FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	BR 2B24(133), ETC.	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 1

STATE OF TEXAS
DEPARTMENT OF TRANSPORTATION

INDEX OF SHEETS

SHEET NO.	DESCRIPTION
1	TITLE SHEET
2	INDEX OF SHEETS

PLANS OF PROPOSED
STATE HIGHWAY IMPROVEMENT

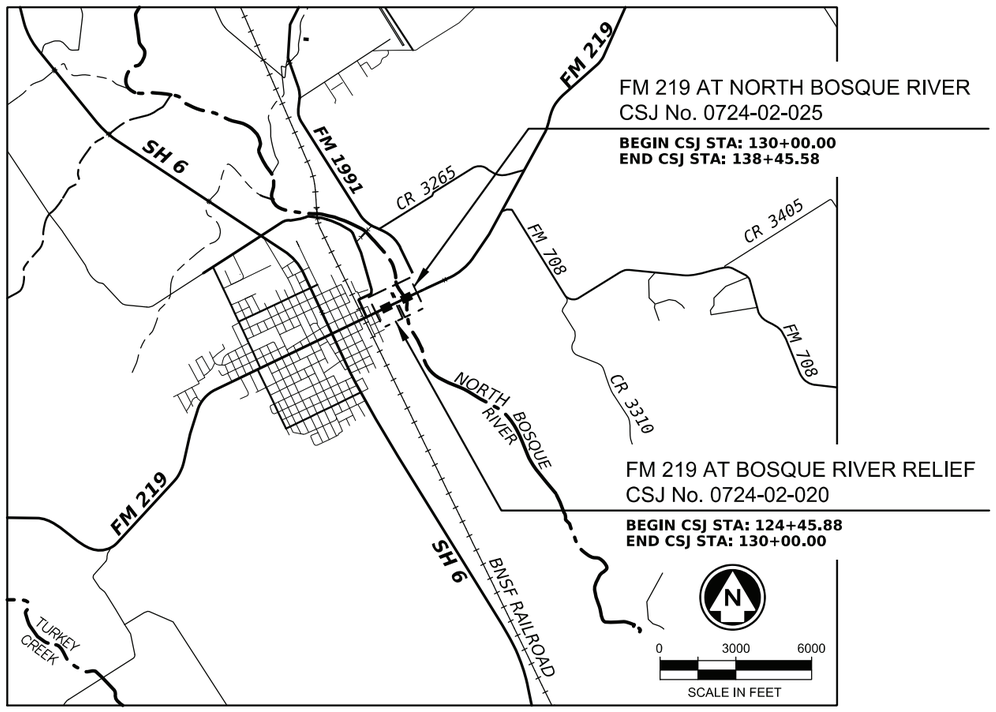
FEDERAL AID PROJECT NUMBER: BR 2B24(133), ETC.
CSJ: 0724-02-020, ETC.

BOSQUE COUNTY
FM 219 AT BOSQUE RIVER RELIEF (STR #016), ETC.

DESIGN SPEED = 45 MPH
AADT (2022) = 2,860 VPD
AADT (2042) = 3,832 VPD

FOR THE CONSTRUCTION OF BRIDGE REPLACEMENTS;
CONSISTS OF REPLACING BRIDGES AND APPROACHES

CSJ No.	HIGHWAY	LOCATION	ROADWAY		BRIDGE		TOTAL LENGTH	
			FEET	MILES	FEET	MILES	FEET	MILES
0724-02-020	FM 219	@ BOSQUE RIVER RELIEF	384.12	0.073	170.00	0.032	554.12	0.105
0724-02-025	FM 219	@ NORTH BOSQUE RIVER	525.58	0.100	320.00	0.061	845.58	0.160
		PROJECT TOTALS	**909.70**	**0.173**	**490.00**	**0.093**	**1399.70**	**0.265**



PROJECT LOCATION MAP

SUBMITTED FOR LETTING: March 4, 2024

JOELLE S. ROSENTSWIEG
TX PE #89451
DESIGN CONSULTANT / PROJECT MANAGER
P.E. STRUCTURAL CONSULTANTS, A HARDESTY & HANOVER, LLC COMPANY
TBPELS FIRM No. F-3379

TEXAS DEPARTMENT OF TRANSPORTATION

RECOMMENDED FOR LETTING: 4/2/2024
DocuSigned by: P.E.
D3F082798B8543C...
AREA ENGINEER

RECOMMENDED FOR LETTING: 4/2/2024
DocuSigned by:
9AD8C743F95E4E3...
DIRECTOR OF TRANSPORTATION PLANNING & DEVELOPMENT

APPROVED FOR LETTING: 4/4/2024
DocuSigned by: Stanley Swiatek
B69BD796DD564C9...
DISTRICT ENGINEER

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

NO EXCEPTIONS
NO EQUATIONS
NO RAILROAD CROSSINGS

CSJ: 0724 02 020, ETC.
FILE LOCATION: ...\5067-WA1.06.GEN.SHT.TTL.01.dgn

INDEX OF SHEETS

STATE OF TEXAS
CRAIG M. WILSON
94710
LICENSED
PROFESSIONAL ENGINEER
3/1/2024

CRAIG WILSON, P.E.
AMERICAN STRUCTUREPOINT, INC.
TBPELS No. F-10069

THE STANDARD SHEETS IDENTIFIED ABOVE WITH (*) HAVE BEEN SELECTED BY ME, OR UNDER MY RESPONSIBLE SUPERVISION, AS BEING APPLICABLE TO THIS PROJECT.

STATE OF TEXAS
JOELLE S. ROSENTSWIEG
89451
LICENSED
PROFESSIONAL ENGINEER
March 4, 2024

JOELLE S. ROSENTSWIEG, P.E.
HARDESTY & HANOVER, LLC
TBPELS No. F-3379

THE STANDARD SHEETS IDENTIFIED ABOVE WITH (**) HAVE BEEN SELECTED BY ME, OR UNDER MY RESPONSIBLE SUPERVISION, AS BEING APPLICABLE TO THIS PROJECT.

STATE OF TEXAS
MARY THERESA CANO
64634
LICENSED
PROFESSIONAL ENGINEER
03/04/2024

MARY THERESA CANO, P.E.
HARDESTY & HANOVER, LLC
TBPELS No. F-3379

THE STANDARD SHEETS IDENTIFIED ABOVE WITH (***) HAVE BEEN SELECTED BY ME, OR UNDER MY RESPONSIBLE SUPERVISION, AS BEING APPLICABLE TO THIS PROJECT.

P.E. Structural Consultants, *a Hardesty & Hanover, LLC Company*

H&H | PESC

8436 Spicewood Springs Road
Austin, Texas 78759
(512) 250-5200
www.HardestyHanover.com

TBPELS Firm No. F-3379

FM 219 BRIDGE REPLACEMENTS

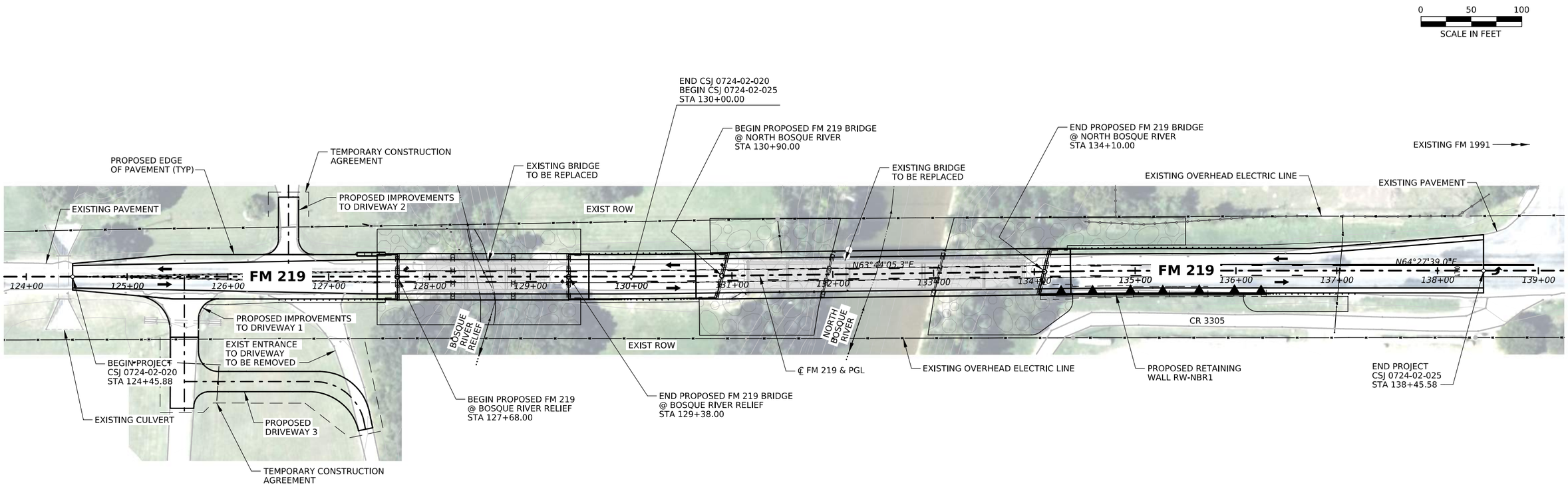
INDEX OF SHEETS

SHEET 1 OF 1

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC / 2

CS: 0724 02 020, ETC.
FILE LOCATION: ...\5067-WA1.06.GEN.SHT.INDX.01.dgn

4/5/2024 10:03:41 AM pw://hardesty-pw.bentley.com:hardesty-pw-01/Documents/TX-Projects/TXDOT/05759.01/03_FM219/4 - Design/Master Design Files/06.Bosque River Relief/H&H/Sheets/5067-WA1.06.GEN.SHT.INDX.01.dgn



FM 219 AT BOSQUE RIVER RELIEF AND NORTH BOSQUE RIVER
PROJECT LAYOUT

PRINT DATE	REVISION DATE
3/4/2024	

STATE OF TEXAS
JOELLE S. ROSENTSWIEG
89451
LICENSED
PROFESSIONAL ENGINEER

March 4, 2024

P.E. Structural Consultants, *a Hardesty & Hanover, LLC Company*

H&H | PESC

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TBPELS Firm No. F-3379

Texas Department of Transportation
Waco District

FM 219 BRIDGE REPLACEMENTS

PROJECT LAYOUT

SHEET 1 OF 1

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 3

CSJ: 0724 02 020, ETC.
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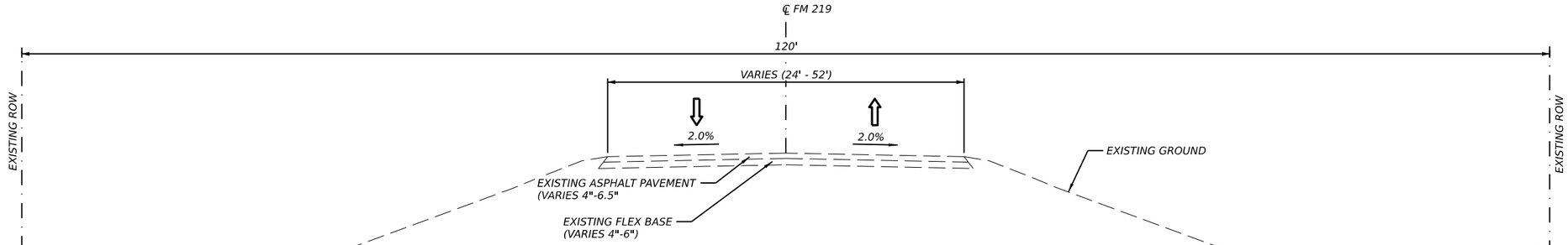

EXISTING TYPICAL SECTION

PRINT DATE	REVISION DATE
3/1/2024	

STATE OF TEXAS
CRAIG M. WILSON
94710
LICENSED
PROFESSIONAL ENGINEER

3/1/2024

AMERICAN STRUCTUREPOINT INC.
3711 SOUTH MOPAC EXPRESSWAY
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Texas Department of Transportation
Waco District

FM 219 BRIDGE REPLACEMENTS

TYPICAL SECTIONS
EXISTING

SHEET 1 OF 4

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219

STATE	DISTRICT	COUNTY	
TEXAS	WACO	BOSQUE	
CONTROL	SECTION	JOB	SHEET NO.
0724	02	020, ETC.	4

CSJ: 0724 02 020, ETC.
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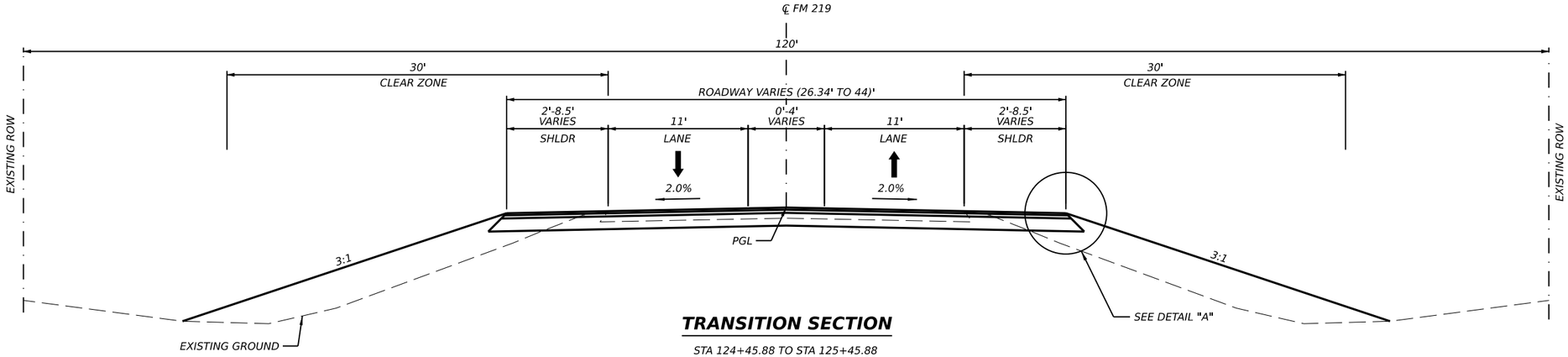
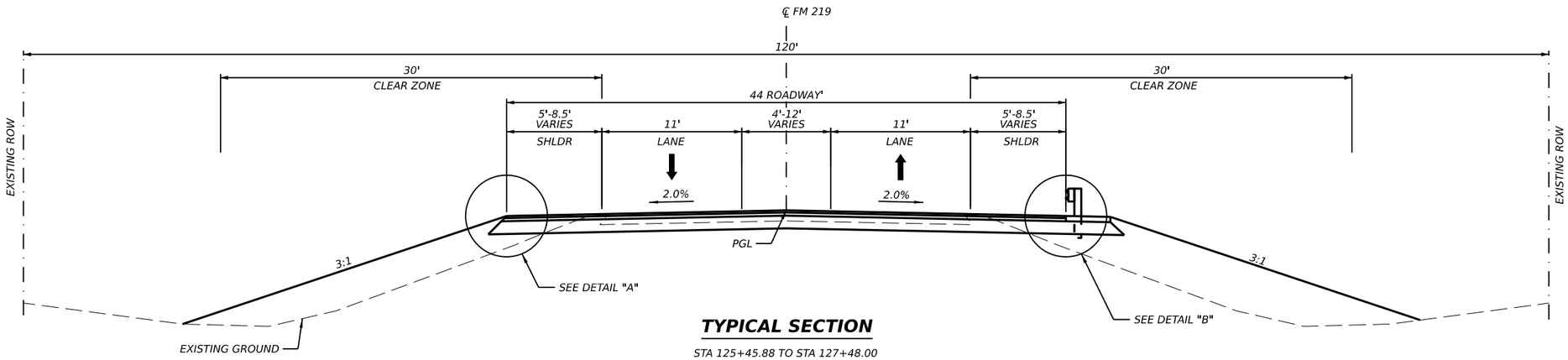


TRANSITION SECTION

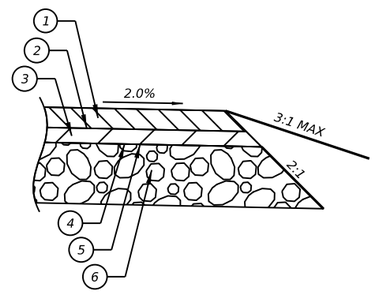
STA 124+45.88 TO STA 125+45.88



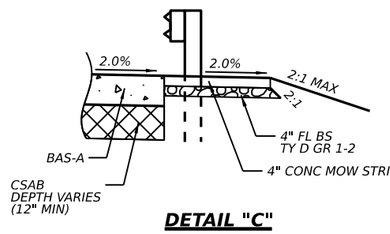
TYPICAL SECTION

STA 125+45.88 TO STA 127+48.00

1. 4" SP MIXES SP-C SAC-B PG 70-22 (EXEMPT)(3077-6081)
2. TACK COAT (0.1 GAL / SY) (3077-6075)
3. 3" D-GR HMA TY-B PG 64-22 (EXEMPT) (3076-6003)
4. ONE-COURSE SURFACE TREATMENT
   ASPH (CRS-2P) (0.6 GAL / SY) (316-6024)
   AGGR GR 3 TY D OR L (1 CY / 95 SY) (316-6453)
5. EMULS ASPH (BS OR SUBGR TRT)(CSS-1H) (0.2 GAL/SY) (314-6005)
6. 12" FL BS TY D GR 1-2 (247-6053)



DETAIL "A"



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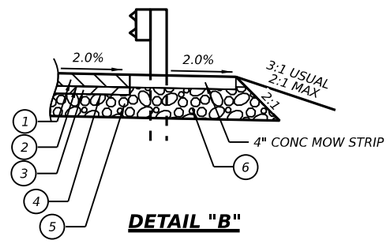

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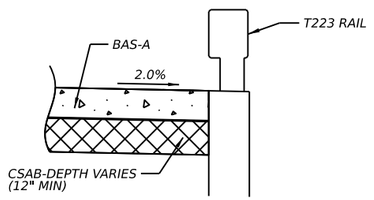

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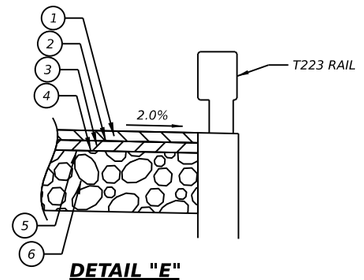

DETAIL "E"

NOTES:

1. REFER TO PLAN & PROFILE SHEETS FOR INTERSECTION AND DRIVEWAY PAVEMENT DESIGN SECTIONS.

PRINT DATE	REVISION DATE
3/1/2024	

STATE OF TEXAS
CRAIG M. WILSON
94710
LICENSED PROFESSIONAL ENGINEER
3/1/2024

AMERICAN STRUCTUREPOINT INC.
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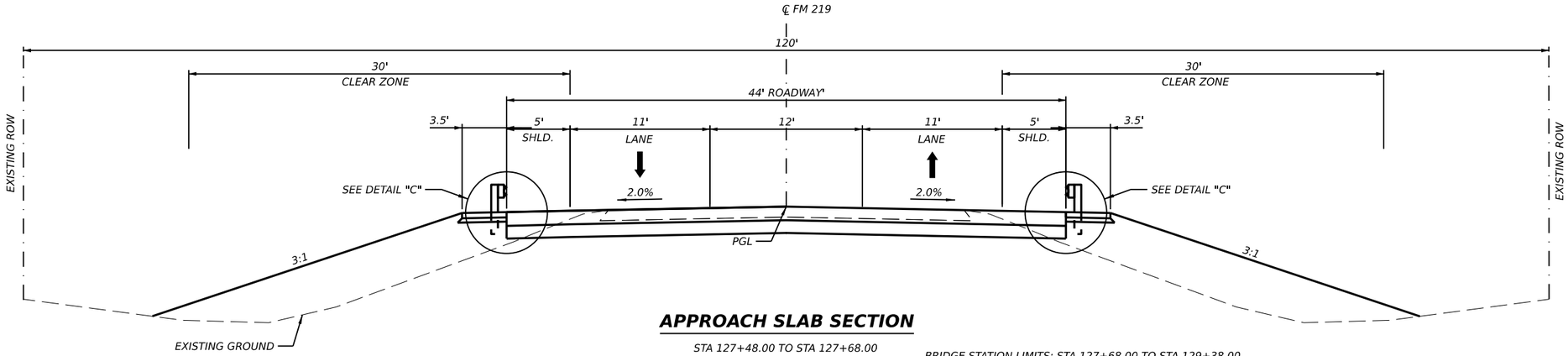
Texas Department of Transportation
Waco District

FM 219 BRIDGE REPLACEMENTS

TYPICAL SECTIONS
PROPOSED

SHEET 2 OF 4

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 5



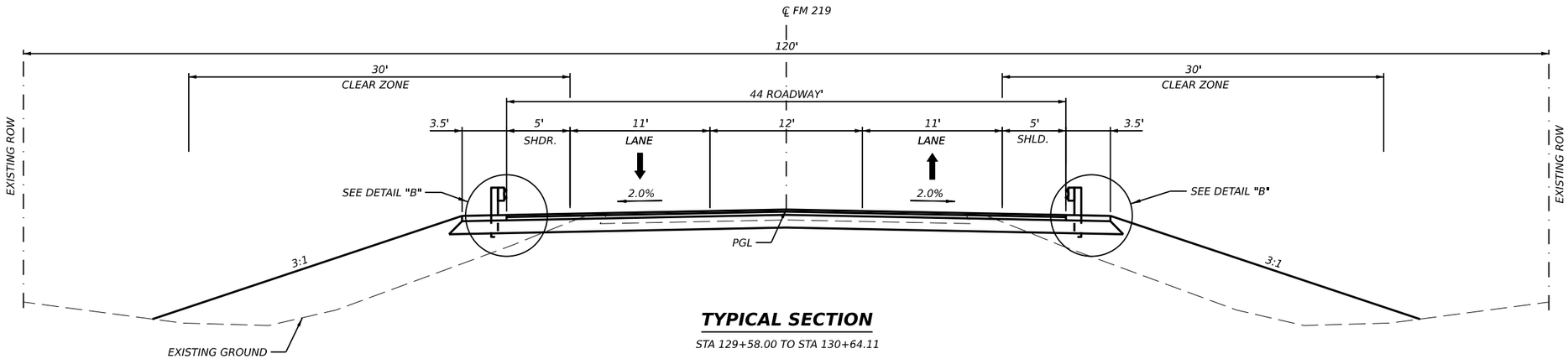
APPROACH SLAB SECTION

STA 127+48.00 TO STA 127+68.00
STA 129+38.00 TO STA 129+58.00
STA 130+64.11 TO STA 130+90.00

BRIDGE STATION LIMITS: STA 127+68.00 TO STA 129+38.00
STA 130+90.00 TO STA 134+10.00

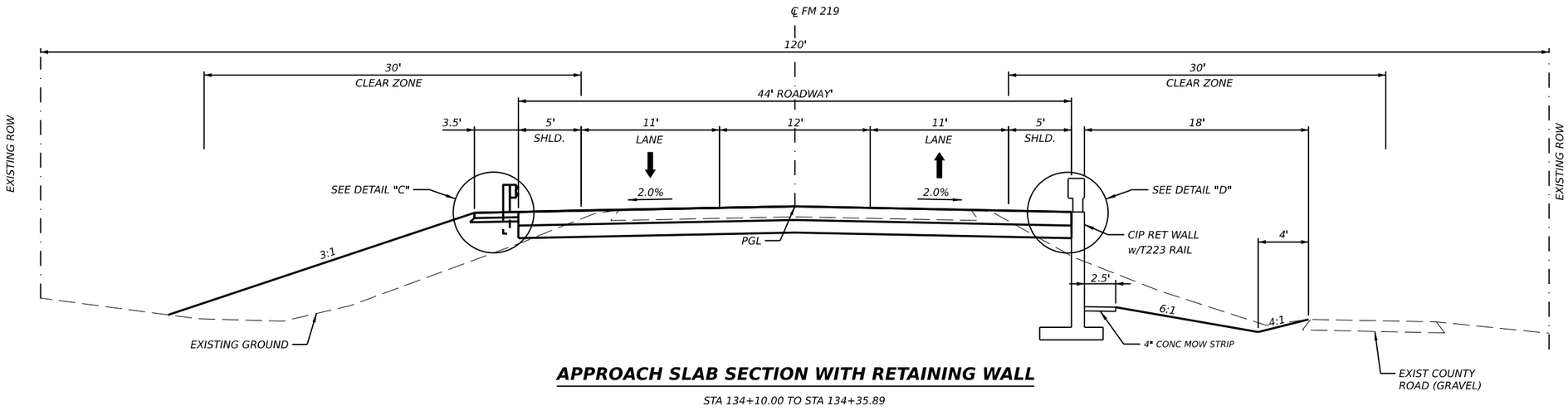
NOTES:

1. REFER TO PLAN & PROFILE SHEETS FOR INTERSECTION AND DRIVEWAY PAVEMENT DESIGN SECTIONS.



TYPICAL SECTION

STA 129+58.00 TO STA 130+64.11



APPROACH SLAB SECTION WITH RETAINING WALL

STA 134+10.00 TO STA 134+35.89

CSJ 0724-02-020 LIMITS
STA 124+45.88 TO STA 130+00.00

CSJ 0724-02-025 LIMITS
STA 130+00.00 TO STA 138+45.58

PRINT DATE	REVISION DATE
3/1/2024	

STATE OF TEXAS
CRAIG M. WILSON
94710
LICENSED PROFESSIONAL ENGINEER
3/1/2024

AMERICAN STRUCTUREPOINT INC.
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Texas Department of Transportation
Waco District

FM 219 BRIDGE REPLACEMENTS

TYPICAL SECTIONS
PROPOSED

SHEET 3 OF 4

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
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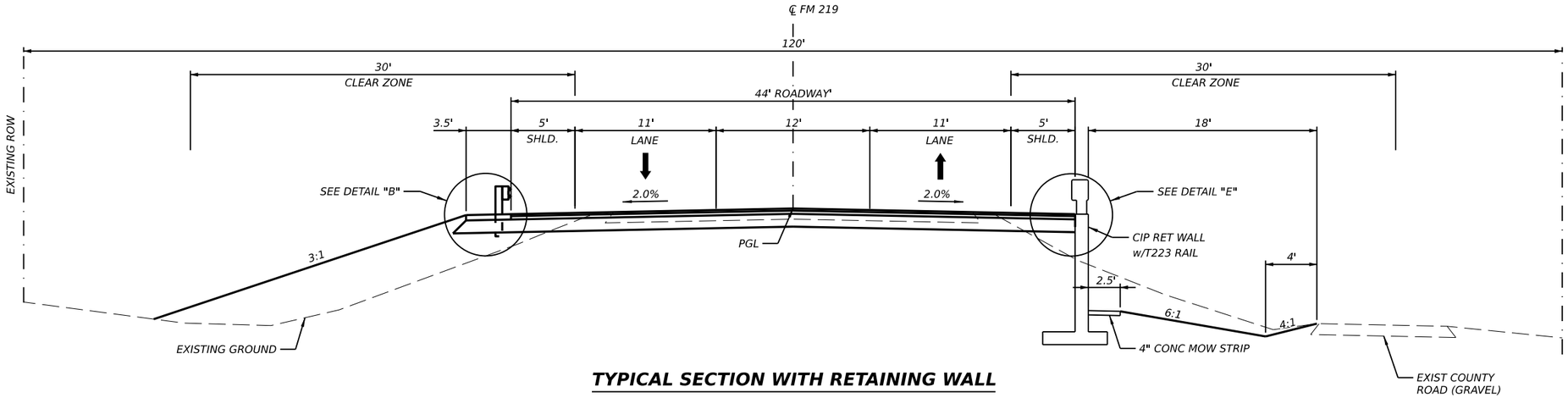
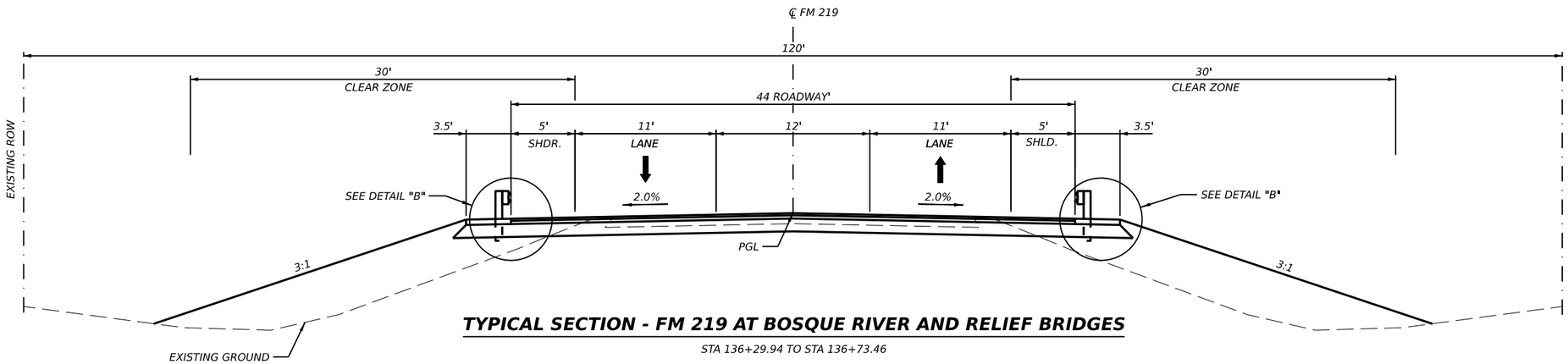


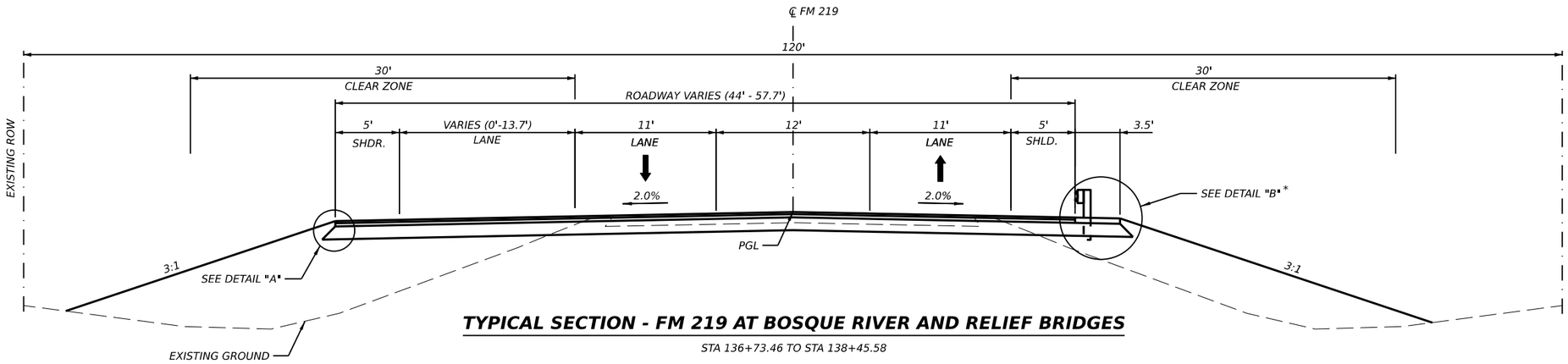
TYPICAL SECTION WITH RETAINING WALL

STA 134+35.89 TO STA 136+29.94



TYPICAL SECTION - FM 219 AT BOSQUE RIVER AND RELIEF BRIDGES

STA 136+29.94 TO STA 136+73.46



TYPICAL SECTION - FM 219 AT BOSQUE RIVER AND RELIEF BRIDGES

STA 136+73.46 TO STA 138+45.58

NOTES:

1. REFER TO PLAN & PROFILE SHEETS FOR INTERSECTION AND DRIVEWAY PAVEMENT DESIGN SECTIONS.

PRINT DATE	REVISION DATE
3/1/2024	

STATE OF TEXAS
CRAIG M. WILSON
94710
LICENSED
PROFESSIONAL ENGINEER

3/1/2024

AMERICAN STRUCTUREPOINT INC.
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FM 219 BRIDGE REPLACEMENTS

TYPICAL SECTIONS
PROPOSED

SHEET 4 OF 4

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 7

CSJ: 0724 02 020, ETC.
FILE LOCATION: ...\2022.05759.06.RD.TY.03.dgn

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	1.97 AC	0.30 TON
	FERTILIZER (20-10-10) (TEMPORARY)	300 LBS / AC	1.97 AC	0.30 TON
168	**VEGETATIVE WATERING**			
	(3 APPLICATIONS - PERM)	13,100 GAL / AC / APP	1.97 AC	39.0 MG
	(3 APPLICATIONS - TEMP)	13,100 GAL / AC / APP	1.97 AC	39.0 MG

** For Contractor's Information Only*

Table 2: Basis of Estimate for Base Work

Item	Description	Rate	Basis	Quantities
247	**FLEXIBLE BASE**			
	(TY D GR 1-2 FNAL POS)	138 LB / CF	42,338 CF	1,569 CY
314**	**EMULSIFIED ASPHALT TREATMENT**			
	EMULS ASPH (5 IN) (BS OR SUBGR TRT) (CSS-1H)	0.20 GAL / SY / IN	4,705 SY	4,705 GAL

*** Rate provided is desired final emulsified product rate not inclusive of mix water*

Table 3: Basis of Estimate for Seal Coats (Construction Projects)

Item	Description	Rate	Basis	Quantities
316	ASPH (CRS-2P)	0.60 GAL / SY	4,705 SY	2,822 GAL
	AGGR (TY D GR 3 OR TY L GR 3)	1 CY / 95 SY	4,705 SY	51.0 CY

Table 4: Basis of Estimate for Asphalt Pavements

Item	Description	Rate	Basis	Quantities
3076	**DENSE-GRADED HOT MIX ASPHALT**			
	TY-B PG64-22 (3 IN)	110 LB / SY / IN	4,057 SY	670 TON
	TY-D PG64-22 (2 IN)	110 LB / SY / IN	10,000 SY	1,100 TON
3077	**SUPERPAVE MIXTURES**			
	TY-C PG70-22 (4 IN)	110 LB / SY / IN	4,039 SY	889 TON
*ALL HOT MIX ITEMS	TACK COAT	0.1 GAL / SY / LIFT OF HMAC	4,057 SY	406 GAL

** Tack Rate for all interlayer tack use*

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.

Total combined disturbed area for project is 2.83 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 one (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 Right-of-Way according to the TDA of the project. When the TDA for the project exceeds one (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 one (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).

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

Bill Compton: Wacoprebid@txdot.gov, (254) 867-2770, 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:Jeff Jackson, P.E. / (254) 865-7115
Assistant Area Engineer: Ben Wilson, P.E. / (254) 865-7115

Contractor questions will be accepted through email, phone, and in person by the above individuals. Questions may also be submitted via the Letting Pre-Bid Q&A web page. This webpage can be accessed from the Notice to Contractors dashboard located at the following Address:

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

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

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

Paper copies of cross-sections may be produced by using the provided .pdf file located on the above FTP Website at the bidders' expense and at copying companies. This data is for non-construction purposes only and it is the responsibility of the prospective bidder to validate the enclosed data with appropriate plans, specifications and estimate for the project(s).

ITEM 5: CONTROL OF THE WORK

Provide the Engineer with a Weekly Work Schedule of planned activities including anticipated quantities of materials to be placed daily (CY of each concrete placement, tons of HMAC to be placed daily, etc.). Schedules will be provided for the following week as part of each week's project meetings or by 5PM on Thursday as approved by the Engineer. Failure to provide notifications may be deemed as insufficient notice per Item 5.10.

Provide the Engineer daily – by 3PM – the planned activities for the following day including location, quantities of materials to be placed, etc. in a format acceptable to the Engineer.

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.

ITEM 6: CONTROL OF MATERIALS

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

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

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

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 two (2) existing bridge structures with surface coatings containing hazardous constituent(s): **Lead Present / No Asbestos**. 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. Provide such proof prior to occupying the site.

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 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. No relief or compensation will be considered for project delays due the Contractors in attention / in action to preventing nesting or for nesting already underway at the commencement of work.

Notify the Engineer in writing a minimum of seven (7) days in advance of opening any bridge structure to public use, to allow the Engineer an opportunity to conduct a safety assessment prior to opening.

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 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 Work Week 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 at the following locations:

From Sta. 124+45.88 to Sta. 130+00.00 (FM 219 @ Bosque River Relief)
From Sta. 130+00.00 to Sta. 138+45.58 (FM 219 @ North Bosque River)

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 within station limits designated for Preparing Right of Way unless designated for preservation or as directed by the Engineer.

Trees to be removed near gas lines shall be cut and ground 1-foot below finished grade.

Preserve trees within temporary construction easements in accordance with Article 100.2, unless otherwise directed.

Prune trees designated for preservation as directed. All work required in preserving and pruning trees will be included in the price bid for Item 100, “Preparing Right of Way”.

The removal of any existing fence will not be paid for directly, but will be considered subsidiary to the bid Item 100, “Preparing Right of Way”.

All trees and brush removed each day will be disposed of within the same day of removal unless otherwise approved. If removed vegetation is burned, ashes from burned vegetation will not be placed or allowed to be transported by storm water into any stream. Burn locations, if approved, will be no closer than 300 feet from a stream. Earth berms must be used around burn areas to keep ash in place.

The Contractor is prohibited from removing grass vegetation throughout the entire project limits and then ceasing construction for long periods, typically over three weeks. The Contractor schedule will be developed based on staged vegetation removal, limiting disturbed soil to no more than 25 percent at one time, unless otherwise approved. Should

the Contractor not be able to adequately control sediment and erosion for areas disturbed, TxDOT will substantially reduce the size of areas that the Contractor may disturb soil. Should the project be evaluated to have sediment control problems as a result of the Contractor disturbing excessive amounts of soil, the Contractor will be required to immediately re-vegetate (seed and water) those disturbed areas at no cost to TxDOT.

The following five (5) notes apply to 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.

Wood chips may be left on the Right of Way no deeper than two (2) inches outside of city limits. Do not trespass on private property while performing 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.

ITEM 105: REMOVING TREATED & UNTREATED BASE AND ASPHALT PAVEMENT

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

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

Properly dispose of unsalvageable material at Contractor’s expense.

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

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 1-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.

The Contractor may modify side slopes from those shown in the cross-section as needed to allow grades to match / tie into fixed features. In no case should slope be modified beyond the maximum grades shown on the typical sections and approved by the Engineer. Additionally slope adjustments will not be allowed simply to reduce work quantities.

ITEM 132: EMBANKMENT

Type C1 Embankment specified for this Project shall comply with Item 132 and meet the following requirements:

Properties	Test Method	Specification Limits
LIQUID LIMITS	TEX-104-E	≤ 55
PLASTICITY INDEX (PI)	TEX-106-E	10 ≤ PI ≤ 30

Type C2 Embankment material is specified for retaining wall backfill and shall be Type DS Select Fill Material complying with the requirements of Item 423.

Cement Stabilized Backfill (CSB) used as embankment and/or backfill material for this Project shall comply with Item 400 and shall be constructed in accordance with Item 276. See Retaining Wall Plans for locations and Item 423 and additional information.

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

Perform Tex-106-E (Plasticity Index) by an approved laboratory on excavated soils from sources outside Right of Way when used in roadway embankment. Provide the test results

at no expense to the Department. The Engineer will sample and test soils produced by the construction project for specification requirements or material sources specified in the plans.

ITEM 160: TOPSOIL

Salvage the existing topsoil from the cut & fill areas. Topsoil not stored in small windrows will be stockpiled in locations with heights no greater than four (4) feet and dumped loose from Contractor equipment. The Contractor will minimize topsoil compaction and limit equipment being driven over stockpiled topsoil.

Avoid topsoil areas that have invasive plant species. Contain / separate topsoil from areas with identified invasive species into separate windrows / piles. Mark topsoil from invasive species areas accordingly and track and return materials to only their original areas or dispose of such materials accordingly. Invasive species will include Giant Cane.

Additional topsoil will come from approved sources outside of the ROW. Topsoil must come from a location within six (6) inches of the natural ground surface to ensure it contains nutrients and is not sterile soil. Off ROW topsoil will contain a minimum organic content of three & one-half percent (3.5%), based on soil test results.

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 247: FLEXIBLE BASE

Construct uniform layer thickness of 6 inches, or less with the required density and moisture content. Do not construct layers less than 3 inches in thickness.

Minimum PI is equal to three (3) for all Grades, or a minimum Bar Linear Shrinkage of 2%.

RAP may not be incorporated into Flex Base Material.

ITEM 314: EMULSIFIED ASPHALT TREATMENT

Treat with CSS-1h. Apply MS-2 or SS-1 as a Prime, dilute the asphalt with base finish water, distribute in successive applications, and work into the top 5" of flex base.

Prior to application, emulsion may be diluted with water up to a maximum dilution of one (1) part emulsion to six (6) parts water (14% diluted emulsion mixture) as directed.

ITEM 316: SEAL COAT

Rates of application and quantities shown on the plans of surface treatment are for estimating purposes only. It will be the Contractor's responsibility to verify all quantities prior to ordering and delivering materials. The asphalt rates will be adjusted as necessary to fit existing field conditions as agreed, upon by the Contractor's designated project superintendent and the Department's designated project manager. For each project, intersections, ramps, and crossovers will be resurfaced prior to resurfacing the roadway unless otherwise authorized. It is TxDOT's intent to seal from edge of pavement to edge of pavement including all transitions and widenings, regardless of plan width, unless otherwise directed.

Protect all existing bridges, curbs, and other exposed concrete surfaces within the limits of these projects from asphalt materials by any method that is approved. Remove any excessive asphalt materials deposited on these surfaces at the Contractor's expense in a manner approved. Stockpile sites for material will be approved and will be located as far as possible from the travel way and in no instance closer than 30-ft measured from pavement edge unless otherwise authorized. They will be kept clear of improved abutting property and, in general, locations at intersections will be avoided in order that sight distance will not be impaired. The Contractor will notify the Engineer at least five (5) days prior to stockpiling of materials closer than 30-ft from the pavement edge provided that adequate barricades and warning signs and devices are provided by the Contractor and approved.

Stockpile sites for material will be leveled and cleared of all vegetation prior to materials being stockpiled. Stockpile sites will be kept clear of debris and vegetative growth in a manner approved.

Stockpile locations will be cleared. Sites will be re-vegetated prior to partial acceptance of individual projects. This work will not be paid for directly, but will be considered subsidiary to the various bid items of the contract.

Unless otherwise approved, seal coat will not be exposed to traffic for more than one (1) calendar day before application of HMAC.

ITEM 320: EQUIPMENT FOR ASPHALT CONCRETE PAVEMENT

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

The use of windrow pick-up equipment is allowed with the exception of windrows to be placed on seal coat surface placed as part of this contract or instances when trackless tacks are used as optional bonding or sealing courses.

ITEM 351: FLEXIBLE PAVEMENT STRUCTURE REPAIR

For this project, a laydown machine will be required during the construction & placement of this item.

Locations and Quantities will vary as directed. The minimum area to be repaired will be 750 SY.

ITEM 354: PLANING AND TEXTURING PAVEMENT

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

To remove dirt and debris, and assure reclaimable material is not contaminated per the specification, blade or otherwise make a neat cut along the existing pavement edge to a depth approx. 1" below the milling limits. This work will be required prior to milling operation and is subsidiary to this item.

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

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

Mill the pavement producing a final pavement surface with transverse pattern of 0.2-inch center to center of each strike area with a difference of no greater than one-sixteenth (1/16) inch between the ridge and valley (RVD) measurement of the final milled surface. The speed of the milling machine and RPMs of the drum will be set to ensure a smooth surface per manufacturer's instructions.

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 for all storm drain installations. In areas requiring Cement Stabilized Backfill, CSB will be used in lieu of Class B materials for bedding.

ITEM 416: DRILLED SHAFT FOUNDATIONS

Provide a minimum of one core per bent, regardless of placement method.

ITEM 420 CONCRETE SUBSTRUCTURES

Form columns down to bottom of proposed stone riprap by an acceptable method. If there is no rock riprap around the column base, form column faces to a minimum of one (1) foot below the finished ground surface. This form work is not paid for directly but is considered subsidiary to this Item.

NATIONAL BRIDGE INVENTORY NUMBERS: Provide signs with the National Bridge Inventory (NBI) numbers on all bridge structures and bridge class culverts. Mount signs on rail or exterior concrete girder near each Bridge Abutment in accordance with the NBIS Bridge Identification Sign Standard and as directed by the Engineer. All labor, equipment, and incidentals required to install the signs are subsidiary to this Item.

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.

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 422: CONCRETE SUPERSTRUCTURES

Provide Carpet Drag, burlap drag or broom finish for bridge deck, approach slabs and direct traffic culvert top slabs.

ITEM 423: RETAINING WALLS

All Retaining Walls will have a uniform texture and appearance. Use 3/4” chamfers at exposed concrete edges.

Retaining Wall is subject to inundation and shall be backfilled with Type DS Select Fill material (Type C2 Embankment) as defined under this Item.

When paid for as embankment, Type DS backfill is Embankment Type C2, as defined under Item 423.2.4.1.

Supply drainage aggregate meeting the requirements of this Item for use as filter material behind the retaining wall. Refer to retaining wall standard details for additional information.

Cement-Stabilized Backfill (CSB) will be used as Embankment beneath stone riprap placed in front of the retaining wall. Use CSB to replace any disturbed or weak in-situ soils below or in front of the wall footings. See Retaining Wall Plans for additional information.

Do not use flowable backfill in areas subject to inundation, especially near the bridge abutment or other locations that could prevent the Type DS backfill and embankment material from freely draining flood waters into the creek channel.

Avoid distinct vertical joints between wall select backfill and other embankment materials as required by Section 423.3.4. Transition between fill material types over a “transition zone” by using alternating and overlapping lifts of the different materials.

Provide six (6) inch dia. perforated pipe underdrains, as detailed on the retaining wall standard details. Pipe shall outfall and be terminated as shown on the Retaining Wall Plans. Pipe underdrains behind retaining walls are subsidiary to Item 423, “Retaining Walls”. Quantities for pipe outfall lengths beyond the limits of the wall are paid under Item 556.

ITEM 427: SURFACE FINISHES FOR CONCRETE

Apply a Rub Finish to all “Surface Area I” within 30 days after form removal unless directed otherwise by the Engineer.

Apply an Ordinary Surface Finish to elements not listed in “Surface Area I”.

Special Surface Finishes listed above will not be paid for directly but are considered subsidiary to various bid items.

Off-the-Form Surface Finish: Supplemented by the following and will apply to Readily Visible Concrete Surfaces only:

- Off-the-Form Finish will have a pleasing appearance with minimal color and texture variations and minimal surface defects when observed at a distance of approximately twenty (20) feet. Provide this finish by using non-staining, non-porous, high-quality forming materials as specified under Item 427.3.5. Use the same type of forming materials for like elements for the entire structure.

- Engineer will determine acceptability of finished surfaces.

- Refurbish or replace forms that have become discolored or cause a variation in the finish.

ITEM 432: RIPRAP

Granular material is required below stone riprap in the channel and in front of retaining walls, and at other locations inside the floodplain limits. See the Stone Riprap Standard for additional information.

ITEM 440: REINFORCEMENT FOR CONCRETE

Fiber Reinforced Concrete (FRC) can be used as a substitute for Non-Structural Class Reinforced Concrete in Mow Strips for MBGF and Sidewalks. FRC may also be used for other Non-Structural Class Reinforced Concrete Items as approved by the Engineer.

For riprap slope protection wire mesh will not be allowed. Rebar reinforcing is required per the TxDOT Standard Plans.

ITEM 450: RAILING

Provide slip formed barrier and cast-in-place barrier uniform in color and texture.

ITEM 496: REMOVING STRUCTURES

Submit to the Engineer for approval a detailed plan for bridge removal including methods, equipment and sequencing.

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.

Install traffic marking signs prior to sealcoat application and remove within three days after placement of traffic markings.

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.

When excavation is required next to a pavement lane carrying traffic and the widening is not completed by the end of the workday, 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 Barricade / long term traffic control signs with driven post / sleeve mount options for all projects with more than nine (9) months of project barricades. Use in-ground mount for project limits signs / long term signs. Upon sign removal, pull sleeve or drive to below ground line.

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 within one (1) hour to respond to emergencies and/or oversee corrective measures as needed, etc.

ITEM 504: FIELD OFFICE

Furnish one Asphalt Mix Control Laboratory (Type D) for this Project.

ITEM 506: TEMPORARY 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-inch 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 SWP3 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 "SWP3" 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. SWP3 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 overflow. 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 540: METAL BEAM GUARD FENCE

Furnish steel posts throughout the project except as specifically noted in the plans.

Wooden block out will not be allowed.

ITEM 544: GUARDRAIL END TREATMENTS

The use of wooden block-outs will not be allowed.

ITEM 585: RIDE QUALITY FOR PAVEMENT SURFACES

Use Surface Test Type A on all intersections and driveways.

Use Surface Test Type B pay adjustment schedule 3 on the travel lanes.

The Contractor will ensure satisfactory profile results in the intermediate paving layers (mixture) to eliminate corrective action for excessive deviations in the final surface layers.

Milling will not be allowed as a corrective action for excessive deviations in the surface layer.

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 a minimum of seven (7) days in advance of anticipated installation. The Engineer will review and approve the final installation locations.

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.

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Stake the location of the new signs a minimum of seven (7) days in advance of anticipated installation. The Engineer will review and approve the final installation locations.

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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.

The Delineator Assembly BRF Class A (D-SW) and (D-SY) are to be single delineators (Class I) attached to a flat, plastic bracket to facilitate the mounting of the delineator on top of the bridge rail at the locations shown on the plans. Submit a sample for approval before ordering materials.

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 at 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 3076: DENSE-GRADED HOT-MIX ASPHALT

Use aggregate that meets the Surface Aggregate Classification (SAC) requirement of Class. B .

Maximum stripping of 0% is required.

ITEM 3077: SUPERPAVE MIXTURES

RAP from Contractor owned sources may be used if the RAP is fractionated.

Use aggregate that meets the Surface Aggregate Classification (SAC) requirement of Class . B .

Superpave gradations will be required to be below the reference zones shown in Table 9 on surface mixes.

Maximum stripping of 0% is required.

ITEM 3096: ASPHALTS, OILS, AND EMULSIONS

Latex additives or modifiers will not be allowed on this project.

ITEM 6001: PORTABLE CHANGEABLE MESSAGE SIGN

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

Furnish 2 Portable Changeable Message Signs. The Portable Changeable Message Signs will be used for all lane closures and freeway closures as shown on the Traffic Control Plan standard sheets.

Supply Portable Changeable Message Signs 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 TMA’s/TA’s used for installation and removal of traffic control for a work area will be subsidiary to the TMA/TA used to perform the work.

The total number of Truck Mounted Attenuators (TMA’s) required when utilizing the Traffic Control Standards are shown below.

TCP 3 Series	Scenario	Required TMA
(3-5)-18	All	1

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.

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 0724-02-020 **DISTRICT** Waco **COUNTY** Bosque
HIGHWAY FM 219, RIVERSIDE

			CONTROL SECTION JOB	**0724-02-020**		**0724-02-025**		**0909-28-036**		TOTAL EST.	TOTAL FINAL
			PROJECT ID	**A00002144**		**A00002149**		**A00205983**			
			COUNTY	**Bosque**		**Bosque**		**Bosque**			
			HIGHWAY	**FM 219**		**FM 219**		**RIVERSIDE**			
ALT	**BID CODE**	**DESCRIPTION**	**UNIT**	EST.	FINAL	EST.	FINAL	EST.	FINAL		
	100-6002	PREPARING ROW	STA	5.540		8.460				14.000	
	104-6009	REMOVING CONC (RIPRAP)	SY	200.000		104.000				304.000	
	105-6008	REMOVING STAB BASE AND ASPH PAV (6")	SY	525.000						525.000	
	105-6033	REMOVING STB BASE AND ASPH PAV(10-14")	SY	1,370.000		2,455.000				3,825.000	
	110-6001	EXCAVATION (ROADWAY)	CY	253.000		717.000				970.000	
	110-6002	EXCAVATION (CHANNEL)	CY	1,162.000		1,657.000				2,819.000	
	132-6047	EMBANKMENT (FINAL)(ORD COMP)(TY C1)	CY	393.000		986.000				1,379.000	
	132-6056	EMBANKMENT (FINAL)(ORD COMP)(TY C2)(DS)	CY			85.000				85.000	
	160-6003	FURNISHING AND PLACING TOPSOIL (4")	SY	2,559.000		2,207.000				4,766.000	
	164-6003	BROADCAST SEED (PERM) (RURAL) (CLAY)	SY	2,559.000		2,207.000				4,766.000	
	164-6009	BROADCAST SEED (TEMP) (WARM)	SY	1,280.000		1,104.000				2,384.000	
	164-6011	BROADCAST SEED (TEMP) (COOL)	SY	1,280.000		1,104.000				2,384.000	
	168-6001	VEGETATIVE WATERING	MG	42.000		36.000				78.000	
	169-6002	SOIL RETENTION BLANKETS (CL 1) (TY B)	SY	100.000		100.000				200.000	
	247-6053	FL BS (CMP IN PLC)(TYD GR1-2)(FNAL POS)	CY	608.000		961.000				1,569.000	
	314-6005	EMULS ASPH (BS OR SUBGR TRT)(CSS-1H)	GAL	1,825.000		2,880.000				4,705.000	
	316-6024	ASPH (CRS-2P)	GAL	1,094.000		1,728.000				2,822.000	
	316-6453	AGGR(TY D GR 3 OR TY L GR 3)	CY	20.000		31.000				51.000	
	351-6004	FLEXIBLE PAVEMENT STRUCTURE REPAIR(8")	SY					1,000.000		1,000.000	
	354-6021	PLANE ASPH CONC PAV(0" TO 2")	SY					10,000.000		10,000.000	
	400-6005	CEM STABIL BKFL	CY	174.000		310.000				484.000	
	403-6001	TEMPORARY SPL SHORING	SF			2,360.000				2,360.000	
	416-6001	DRILL SHAFT (18 IN)	LF			129.000				129.000	
	416-6004	DRILL SHAFT (36 IN)	LF	848.000		415.000				1,263.000	
	416-6005	DRILL SHAFT (42 IN)	LF			176.000				176.000	
	420-6014	CL C CONC (ABUT)(HPC)	CY	53.000		63.900				116.900	
	420-6030	CL C CONC (CAP)(HPC)	CY	41.500		56.000				97.500	
	420-6038	CL C CONC (COLUMN)(HPC)	CY	39.800		184.700				224.500	
	420-6066	CL C CONC (RAIL FOUNDATION)	CY	5.000		5.000				10.000	
	422-6001	REINF CONC SLAB	SF	7,820.000		14,720.000				22,540.000	
	422-6015	APPROACH SLAB	CY	71.000		92.000				163.000	
	423-6005	RETAINING WALL (SPREAD FOOTING)	SF			2,662.000				2,662.000	
	425-6035	PRESTR CONC GIRDER (TX28)	LF	1,011.000						1,011.000	
	425-6038	PRESTR CONC GIRDER (TX46)	LF			1,910.900				1,910.900	
	432-6001	RIPRAP (CONC)(4 IN)	CY			20.000				20.000	
	432-6031	RIPRAP (STONE PROTECTION)(12 IN)	CY	1,350.000						1,350.000	
	432-6033	RIPRAP (STONE PROTECTION)(18 IN)	CY			3,339.000				3,339.000	

Estimate & Quantity Sheet

CONTROLLING PROJECT ID 0724-02-020 **DISTRICT** Waco **COUNTY** Bosque
HIGHWAY FM 219, RIVERSIDE

			CONTROL SECTION JOB	**0724-02-020**		**0724-02-025**		**0909-28-036**		TOTAL EST.	TOTAL FINAL
			PROJECT ID	**A00002144**		**A00002149**		**A00205983**			
			COUNTY	**Bosque**		**Bosque**		**Bosque**			
			HIGHWAY	**FM 219**		**FM 219**		**RIVERSIDE**			
ALT	**BID CODE**	**DESCRIPTION**	**UNIT**	EST.	FINAL	EST.	FINAL	EST.	FINAL		
	432-6045	RIPRAP (MOW STRIP)(4 IN)	CY	19.000		34.300				53.300	
	450-6006	RAIL (TY T223)	LF	419.500		946.900				1,366.400	
	454-6018	SEALED EXPANSION JOINT (4 IN) (SEJ - M)	LF	91.000		94.000				185.000	
	496-6010	REMOV STR (BRIDGE 100 - 499 FT LENGTH)	EA	1.000		1.000				2.000	
	496-6040	REMOV STR (RET WALL)	LF	48.000						48.000	
	500-6001	MOBILIZATION	LS	0.340		0.660				1.000	
	502-6001	BARRICADES, SIGNS AND TRAFFIC HANDLING	MO	5.000		7.000				12.000	
	506-6038	TEMP SEDMT CONT FENCE (INSTALL)	LF	1,025.000		943.000				1,968.000	
	506-6039	TEMP SEDMT CONT FENCE (REMOVE)	LF	1,025.000		943.000				1,968.000	
	530-6005	DRIVEWAYS (ACP)	SY	289.000						289.000	
	530-6016	DRIVEWAYS (BASE)	SY	145.000						145.000	
	540-6002	MTL W-BEAM GD FEN (STEEL POST)	LF	119.000		331.000				450.000	
	540-6006	MTL BEAM GD FEN TRANS (THRIE-BEAM)	EA	3.000		4.000				7.000	
	544-6001	GUARDRAIL END TREATMENT (INSTALL)	EA	1.000		2.000				3.000	
	545-6019	CRASH CUSH ATTEN (INSTL)(S)(N)(TL3)	EA	1.000						1.000	
	556-6006	PIPE UNDERDRAINS (TY 6) (6")	LF			25.000				25.000	
	644-6001	IN SM RD SN SUP&AM TY10BWG(1)SA(P)	EA	6.000		7.000				13.000	
	644-6076	REMOVE SM RD SN SUP&AM	EA	7.000		7.000				14.000	
	658-6014	INSTL DEL ASSM (D-SW)SZ (BRF)CTB (BI)	EA	4.000		10.000				14.000	
	658-6062	INSTL DEL ASSM (D-SW)SZ 1(BRF)GF2(BI)	EA	4.000		5.000				9.000	
	658-6109	INSTL OM ASSM (OM-2Z)(WFLX)SRF(BI)	EA					6.000		6.000	
	666-6036	REFL PAV MRK TY I (W)8"(SLD)(100MIL)	LF			100.000				100.000	
	666-6309	RE PM W/RET REQ TY I (W)6"(SLD)(100MIL)	LF	1,108.000		1,692.000				2,800.000	
	666-6318	RE PM W/RET REQ TY I (Y)6"(BRK)(100MIL)	LF	130.000		340.000				470.000	
	666-6321	RE PM W/RET REQ TY I (Y)6"(SLD)(100MIL)	LF	1,508.000		1,796.000				3,304.000	
	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			6.000				6.000	
	672-6009	REFL PAV MRKR TY II-A-A	EA	68.000		36.000				104.000	
	3076-6003	D-GR HMA TY-B PG64-22 (EXEMPT)	TON	264.000		406.000				670.000	
	3076-6035	D-GR HMA TY-D PG64-22	TON					1,100.000		1,100.000	
	3077-6075	TACK COAT	GAL	160.000		246.000				406.000	
	3077-6081	SP MIXES SP-C SAC-B PG70-22 (EXEMPT)	TON	349.000		540.000				889.000	
	5132-6001	LEAD CONTAINING COATING MANAGEMENT	SF	214.000		256.000				470.000	
	6001-6002	PORTABLE CHANGEABLE MESSAGE SIGN	EA	1.000		1.000				2.000	
	6185-6002	TMA (STATIONARY)	DAY	180.000		180.000				360.000	
	18	SAFETY CONTINGENCY: CONTRACTOR FORCE ACCOUNT WORK (PARTICIPATING)	LS	1.000		1.000				2.000	

Estimate & Quantity Sheet

CONTROLLING PROJECT ID 0724-02-020 **DISTRICT** Waco **COUNTY** Bosque
HIGHWAY FM 219, RIVERSIDE

		CONTROL SECTION JOB		**0724-02-020**		**0724-02-025**		**0909-28-036**		TOTAL EST.	TOTAL FINAL
		PROJECT ID		**A00002144**		**A00002149**		**A00205983**			
		COUNTY		**Bosque**		**Bosque**		**Bosque**			
		HIGHWAY		**FM 219**		**FM 219**		**RIVERSIDE**			
ALT	**BID CODE**	**DESCRIPTION**	**UNIT**	EST.	FINAL	EST.	FINAL	EST.	FINAL		
	18	EROSION CONTROL MAINTENANCE: CONTRACTOR FORCE ACCOUNT WORK (PART)	LS	1.000		1.000				2.000	

SUMMARY OF TRAFFIC CONTROL ITEMS

LOCATION	6001 6002 PORTABLE CHANGEABLE MESSAGE SIGN EA	6185 6002 TMA (STATIONARY) DAY
FM 219 @ BOSQUE RIVER RELIEF	1	180
FM 219 @ NORTH BOSQUE RIVER	1	180
PROJECT TOTALS	2	360

SUMMARY OF REMOVAL ITEMS

LOCATION	100 6002 PREPARING ROW STA	104 6009 REMOVING CONC (RIPRAP) SY	105 6008 REMOVING STAB BASE AND ASPH PAV (6") SY	105 6033 REMOVING STAB BASE AND ASPH PAV (10"-14") SY	496 6010 REMOV STR (BRIDGE 100-499 FT LENGTH) EA	496 6040 REMOV STR (RET WALL) LF	644 6076 REMOVE SM RD SN SUP&AM EA
FM 219 @ BOSQUE RIVER RELIEF	5.54	200	525	1,370	1	48	7
FM 219 @ NORTH BOSQUE RIVER	8.46	104	0	2,455	1	0	7
PROJECT TOTALS	14.00	304	525	3,825	2	48	14

SUMMARY OF DETOUR ITEMS

LOCATION	351 6004 FLEXIBLE PAVEMENT STRUCTURE REPAIR (8") SY	354 6021 PLANE ASPH CONC PAV (0" TO 2") SY	658 6109 INSTL OM ASSM (OM-2Z) (WFLX) SRF (BI) EA	3076 6035 D-GR HMA TY-D PG64-22 TON
FM 219 @ BOSQUE RIVER RELIEF	0	0	0	0
FM 219 @ NORTH BOSQUE RIVER	1,000	10,000	6	1,100
PROJECT TOTALS	1,000	10,000	6	1,100

SUMMARY OF DRIVEWAY ITEMS (FOR CONTRACTOR'S INFORMATION ONLY) (2)

LOCATION	105 **** REMOVING STAB BASE AND ASPH PAV (6") SY	506 **** TEMP SEDMT CONT FENCE (INSTALL) LF	506 **** TEMP SEDMT CONT FENCE (REMOVE) LF
FM 219 @ BOSQUE RIVER RELIEF	263	349	349
FM 219 @ NORTH BOSQUE RIVER	0	0	0
PROJECT TOTALS	263	349	349

(1) PORTIONS OF DRIVEWAYS THAT ARE OUTSIDE THE ROW SHALL BE PAID FOR UNDER ITEM 530-6016 DRIVEWAYS (BASE)

(2) BID ITEMS LISTED IN THIS TABLE ARE FOR CONTRACTORS INFORMATION ONLY. BID ITEMS ARE CONSIDERED SUBSIDIARY TO BID ITEM 530-6016 DRIVEWAYS (BASE)

SUMMARY OF ROADWAY ITEMS

LOCATION	247 6053 FL BS (CMP IN PLC) (TYD GR1-2) (FINAL POS) CY	314 6005 EMULS ASPH (BS OR SUBGR TRT) (CSS-1H) GAL	316 6024 ASPH (CRS-2P) GAL	316 6453 AGGR (TY D GR 3 OR TY L GR 3) CY	420 6066 CL C CONC (RAIL FOUNDATION) CY	432 6001 RIPRAP (CONC) (4 IN) CY	432 6045 RIPRAP (MOW STRIP) (4 IN) CY	450 6006 RAIL (TY T223) LF	530 6005 DRIVEWAYS (ACP) SY	530 6016 DRIVEWAYS (BASE) (1) SY	540 6002 MTL W-BEAM GD FEN (STEEL POST) LF	540 6006 MTL BEAM GD FEN TRANS (THRIE-BEAM) EA	544 6001 GUARDRAIL END TREATMENT (INSTALL) EA	545 6019 CRASH CUSH ATTEN (INSTL) (S) (N) (TL3) EA	3076 6003 D-GR HMA TY-B PG64-22 (EXEMPT) TON	3077 6075 TACK COAT GAL	3077 6081 SP MIXES SP-C SAC-B PG70-22 (EXEMPT) TON
FM 219 @ BOSQUE RIVER RELIEF	608	1,825	1,094	20	5	0	19	31.5	289	145	119	3	1	1	264	160	349
FM 219 @ NORTH BOSQUE RIVER	961	2,880	1,728	31	5	20	29	30.0	0	0	331	4	2	0	406	246	540
PROJECT TOTALS	1,569	4,705	2,822	51	10	20	48	61.5	289	145	450	7	3	1	670	406	889

SUMMARY OF RETAINING WALL ITEMS

LOCATION	400 6005 CEM STABIL BKFL CY	403 6001 TEMPORARY SPL SHORING SF	423 6005 RETAINING WALL (SPREAD FOOTING) SF	432 6045 RIPRAP (MOW STRIP) (4 IN) CY	450 6006 RAIL (TY T223) LF	556 6006 PIPE (3) UNDERDRAINS (TY 6) (6") LF
FM 219 @ BOSQUE RIVER RELIEF	0	0	0	0.0	0.0	0.0
FM 219 @ NORTH BOSQUE RIVER	35	2,360	2,662	5.3	224.0	25.0
PROJECT TOTALS	35	2,360	2,662	5.3	224.0	25.0

(3) UNDERDRAIN QUANTITIES PROVIDED HERE ARE FOR LENGTHS OF PIPE NEEDED TO OUTFALL THE WALL UNDERDRAIN INTO THE CHANNEL. UNDERDRAIN PIPES IMMEDIATELY BEHIND RETAINING WALLS ARE SUBSIDIARY TO ITEM 423.

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Texas Department of Transportation

Waco District

FM 219 BRIDGE REPLACEMENTS

SUMMARY OF QUANTITIES

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 10

SUMMARY OF EARTHWORK ITEMS

LOCATION	110 6001 EXCAVATION (ROADWAY) CY	110 6002 EXCAVATION (CHANNEL) CY	132 6047 EMBANKMENT (FINAL) (ORD COMP) (TY C1) CY	132 6056 EMBANKMENT (FINAL) (ORD COMP) (TY C2) (DS) CY
FM 219 @ BOSQUE RIVER RELIEF	253	1,162	393	0
FM 219 @ NORTH BOSQUE RIVER	717	1,657	986	85
PROJECT TOTALS	970	2,819	1,379	85

EARTHWORK ITEMS BY LOCATION
FM 219 @ BOSQUE RIVER RELIEF

LOCATION	110 6001 EXCAVATION (ROADWAY) CY	110 6002 EXCAVATION (CHANNEL) CY	132 6047 EMBANKMENT (FINAL) (ORD COMP) (TY C1) CY
STA 0124+45.88	-	-	-
STA 0125+00.00	51	-	0
STA 0126+00.00	112	-	19
STA 0127+00.00	74	-	40
STA 0128+00.00	16	-	21
STA 0129+00.00	0	-	0
STA 0130+00.00	0	-	313
CHANNEL	-	1,162	-
PROJECT TOTALS	253	1,162	393

EARTHWORK ITEMS BY LOCATION
FM 219 @ NORTH BOSQUE RIVER

LOCATION	110 6001 EXCAVATION (ROADWAY) CY	110 6002 EXCAVATION (CHANNEL) CY	132 6047 EMBANKMENT (FINAL) (ORD COMP) (TY C1) CY	132 6056 EMBANKMENT (FINAL) (ORD COMP) (TY C2) (DS) CY
STA 0130+00.00	-	-	-	-
STA 0131+00.00	0	-	313	-
STA 0132+00.00	0	-	0	-
STA 0133+00.00	0	-	0	-
STA 0134+00.00	0	-	0	-
STA 0135+00.00	115	-	212	-
STA 0136+00.00	212	-	322	-
STA 0137+00.00	172	-	124	-
STA 0138+00.00	151	-	15	-
STA 0138+45.58	67	-	0	-
CHANNEL	-	1,657	-	-
RET WALL RW-NBR	-	-	-	85
PROJECT TOTALS	717	1,657	986	85

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FM 219 BRIDGE REPLACEMENTS

SUMMARY OF QUANTITIES

SHEET 2 OF 3

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219

STATE	DISTRICT	COUNTY	
TEXAS	WACO	BOSQUE	
CONTROL	SECTION	JOB	SHEET NO.
0724	02	020, ETC.	10A

CSJ: 0724 02 020, ETC.
FILE LOCATION: ...\5067-WA1.06.GEN.SHT.SUMM.03.dgn

SUMMARY OF BRIDGE ITEMS

LOCATION	400 6005 CEM STABIL BKFL CY	416 6001 DRILL SHAFT (18 IN) LF	416 6004 DRILL SHAFT (36 IN) LF	416 6005 DRILL SHAFT (42 IN) LF	420 6014 CL C CONC (ABUT) (HPC) CY	420 6030 CL C CONC (CAP) (HPC) CY	420 6038 CL C CONC (COLUMN) (HPC) CY	422 6001 REINF CONC SLAB SF	422 6015 APPROACH SLAB CY	425 6035 PRESTR CONC GIRDER (TX28) LF	425 6038 PRESTR CONC GIRDER (TX46) LF	432 6031 RIPRAP (STONE PROTECTION) (12 IN) CY	432 6033 RIPRAP (STONE PROTECTION) (18 IN) CY	450 6006 RAIL (TY T223) LF	454 6018 SEALED EXPANSION JOINT (4 IN) (SEJ-M) LF	5132 6001 LEAD CONTAINING COATING MANAGEMENT SF
FM 219 @ BOSQUE RIVER RELIEF	174	0	848	0	53.0	41.5	39.8	7,820	70.7	1,011.00	0.00	1,350	0	388.0	91	214
FM 219 @ NORTH BOSQUE RIVER	275	129	415	176	63.9	56.0	184.7	14,720	91.5	0.00	1,910.90	0	3,339	692.9	94	256
PROJECT TOTALS	**449**	**129**	**1,263**	**176**	**116.9**	**97.5**	**224.5**	**22,540**	**162.2**	**1,011.00**	**1,910.90**	**1,350**	**3,339**	**1,080.9**	**185**	**470**

SUMMARY OF SIGN & PAVEMENT MARKING ITEMS

LOCATION	644 6001 IN SM RD SN SUP&AM TY10BWG (1) SA (P) EA	658 6014 INSTL DEL ASSM (D-SW) SZ (BRF) CTB (BI) EA	658 6062 INSTL DEL ASSM (D-SW) SZ 1 (BRF) GF2 (BI) EA	666 6036 REFL PAV MRK TY I (W) 8" (SLD) (100MIL) LF	666 6309 RE PM W/ RET REQ TY I (W) 6" (SLD) (100MIL) LF	666 6318 RE PM W/ RET REQ TY I (Y) 6" (BRK) (100MIL) LF	666 6321 RE PM W/ RET REQ TY I (Y) 6" (SLD) (100MIL) LF	668 6077 PREFAB PAV MRK TY C (W) (ARROW) EA	668 6085 PREFAB PAV MRK TY C (W) (WORD) EA	672 6007 REFL PAV MRKR TY I-C EA	672 6009 REFL PAV MRKR TY II-A-A EA
FM 219 @ BOSQUE RIVER RELIEF	6	4	4	0	1,108	130	1,508	0	0	0	68
FM 219 @ NORTH BOSQUE RIVER	7	10	5	100	1,692	340	1,796	1	1	6	36
PROJECT TOTALS	**13**	**14**	**9**	**100**	**2,800**	**470**	**3,304**	**1**	**1**	**6**	**104**

SUMMARY OF EROSION CONTROL ITEMS

LOCATION	160 6003 FURNISHING AND PLACING TOPSOIL (4") SY	164 6003 BROADCAST SEED (PERM) (RURAL) (CLAY) SY	164 6009 BROADCAST SEED (TEMP) (WARM) SY	164 6011 BROADCAST SEED (TEMP) (COOL) SY	168 6001 VEGETATIVE WATERING MG	169 6002 SOIL RETENTION BLANKETS (CL 1) (TY B) SY	506 6038 TEMP SEDMT CONT FENCE (INSTALL) LF	506 6039 TEMP SEDMT CONT FENCE (REMOVE) LF
FM 219 @ BOSQUE RIVER RELIEF	2,559	2,559	1,280	1,280	42	100	1,025	1,025
FM 219 @ NORTH BOSQUE RIVER	2,207	2,207	1,104	1,104	36	100	943	943
PROJECT TOTALS	**4,766**	**4,766**	**2,384**	**2,384**	**78**	**200**	**1,968**	**1,968**

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FM 219 BRIDGE REPLACEMENTS

SUMMARY OF QUANTITIES

SHEET 3 OF 3

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	**DISTRICT**	**COUNTY**
TEXAS	WACO	BOSQUE
CONTROL	**SECTION**	**JOB** / **SHEET NO.**
0724	02	020, etc. / 11

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
1	N/A	P&P 1 OF 3	FM 219 AT BOSQUE RIVER RELIEF	127+26.60	TL-3	UNI	CONCRETE	6"		30"	32"		X									
												TOTALS	1									

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/rdwyIse.htm

CRASH CUSHION SUMMARY SHEET

FILE: ccss.dgn	DN: TxDOT	CK:		CK:
© TxDOT	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC	FM 219
	DIST	COUNTY		
	WACO	BOSQUE		
	FEDERAL AID PROJECT			SHEET NO.
				12

SUMMARY OF SMALL SIGNS

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

PLAN SHEET NO.	SIGN NO.	SIGN NOMENCLATURE	SIGN	DIMENSIONS	FLAT ALUMINUM (TYPE A)	EXAL ALUMINUM (TYPE G)	POST TYPE FRP = Fiberglass TWT = Thin-Wall 10BWG = 10 BWG S80 = Sch 80	POSTS 1 or 2	ANCHOR TYPE UA=Universal Conc UB=Universal Bolt SA=Slipbase-Conc SB=Slipbase-Bolt WS=Wedge Steel WP=Wedge Plastic	MOUNTING DESIGNATION PREFABRICATED P = "Plain" T = "T" U = "U"	1EXT or 2EXT = # of Ext BM = Extruded Wind Beam WC = 1.12 #/ft Wing Channel EXAL= Extruded Alum Sign Panels	BRIDGE MOUNT CLEARANCE SIGNS (See Note 2) TY = TYPE TY N TY S
SPM 1 OF 1	1	R1-1	STOP	36X36	X		10BWG	1	SA	P		
SPM 1 OF 1	2	R1-1	STOP	36X36	X		10BWG	1	SA	P		
SPM 1 OF 1	3	M2-1	JCT	21X15	X							
SPM 1 OF 1	3	M1-6F	FARM 1991 ROAD	24X24	X		10BWG	1	SA	P		
SPM 1 OF 1	4	VARIES	NO TRUCK PARKING CITY LIMITS ON HWY 6 & FM 219	VARXVAR	X		10BWG	1	SA	P		
SPM 1 OF 1	5	D14-4T	ADOPT A HIGHWAY NEXT 2 MILES TEXAS-NEW MEXICO POWER CO.	48X48	X		10BWG	1	SA	P		
SPM 1 OF 1	6	D42	SUPERIOR PUBLIC WATER SYSTEM THE STATE OF TEXAS	VARXVAR	X		10BWG	1	SA	P		

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

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

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).

FM 219 BRIDGE REPLACEMENTS
CSJ: 0724-02-020

Texas Department of Transportation

Traffic Operations Division Standard

SUMMARY OF SMALL SIGNS

SOSS

FILE: sums16.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT May 1987	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC.	FM 219
4-16	DIST	COUNTY		SHEET NO.
8-16	WACO	BOSQUE		13

18

DATE: 3/1/2024 10:38:34 AM
FILE: c:\users\eflores\dms58816\2022.05759.06.RD.SOSS.01.dgn

SUMMARY OF SMALL SIGNS

PLAN SHEET NO.	SIGN NO.	SIGN NOMENCLATURE	SIGN	DIMENSIONS	FLAT ALUMINUM (TYPE A)	EXAL ALUMINUM (TYPE G)	SM RD SGN ASSM TY XXXXX (X) XX (X-XXXX) POST TYPE	POSTS	ANCHOR TYPE	MOUNTING DESIGNATION PREFABRICATED	MOUNTING DESIGNATION 1EXT or 2EXT = # of Ext	BRIDGE MOUNT CLEARANCE SIGNS (See Note 2) TY = TYPE
							FRP = Fiberglass TWT = Thin-Wall 10BWG = 10 BWG S80 = Sch 80	1 or 2	UA=Universal Conc UB=Universal Bolt SA=Slipbase-Conc SB=Slipbase-Bolt WS=Wedge Steel WP=Wedge Plastic	P = "Plain" T = "T" U = "U"	BM = Extruded Wind Beam WC = 1.12 #/ft Wing Channel EXAL= Extruded Alum Sign Panels	TY N TY S
SPM 1 OF 1	7	I-3	Bosque River	VARX18	X		10BWG	1	SA	P		
SPM 1 OF 1	8	I-3	Bosque River	VARX18	X		10BWG	1	SA	P		
SPM 1 OF 1	9	R2-1	SPEED LIMIT 50	30X36	X		10BWG	1	SA	P		
SPM 1 OF 1	10	R2-1	SPEED LIMIT 40	30X36	X		10BWG	1	SA	P		
SPM 1 OF 1	11	I-2aT	Clifton CITY LIMIT POP 3465	VARX24	X		10BWG	1	SA	P		
SPM 1 OF 1	12	M3-4	WEST	24X12	X							
SPM 1 OF 1	12	M1-6F	FARM 219 ROAD	24X24	X		10BWG	1	SA	P		
SPM 1 OF 1	13	I-5		36X36	X							
SPM 1 OF 1	13	M6-1G		30X24	X		10BWG	1	SA	P		

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

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

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).

FM 219 BRIDGE REPLACEMENTS
CSJ: 0724-02-025

Texas Department of Transportation

Traffic Operations Division Standard

SUMMARY OF SMALL SIGNS

SOSS

FILE: sums16.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT May 1987	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC.	FM 219
4-16	DIST	COUNTY		SHEET NO.
8-16	WACO	BOSQUE		14

TB

DATE: 3/1/2024 10:39:32 AM
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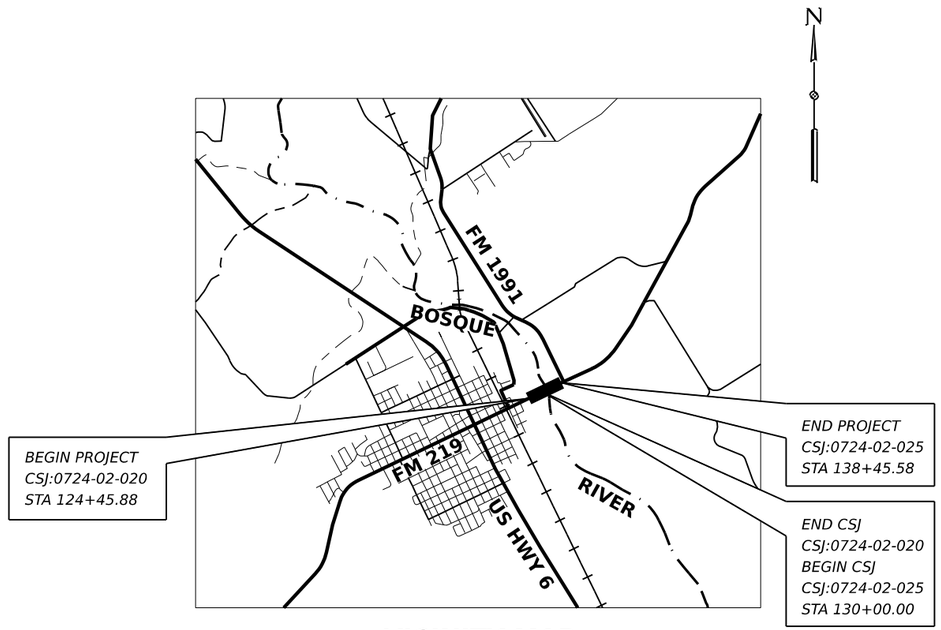

VICINITY MAP

FM 219 AT BOSQUE RIVER RELIEF CHANNEL
AND NORTH BOSQUE RIVER

0 3,000 6,000
SCALE IN FEET

SIGNS G20-10T, G20-5T, G20-6T, G20-2, G20-2bT, CW20-1D, R20-3T, 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.

REFER TO BC STANDARDS FOR SIGN R2-1 PLACEMENT.

SIGNAGE LEGEND
R20-5aTP (36X18) - WHEN WORKERS ARE PRESENT
G20-10T (60X48)- STAY ALERT TALK OR TEXT LATER
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
G20-1a (72X36)- ROAD WORK NEXT X MILES
CW20-1D (48X48)- ROAD WORK AHEAD
R20-5T (36X36)- TRAFFIC FINES DOUBLE
G20-2 (48X24) - END ROAD WORK
R2-1 (24X30) - SPEED LIMIT XX

GENERAL

A. *INSTALL ALL SIGNS, BARRICADES AND TRAFFIC CONTROL DEVICES AS SHOWN AND IN ACCORDANCE WITH STANDARD SHEETS BC(1)-21 THRU BC(12)-21 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 WILL BE CONSIDERED AS SUBSIDIARY TO ITEM 502, "BARRICADES, SIGNS AND TRAFFIC HANDLING".*

C. *WORK SITES WILL 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 TRAFFIC CONTROL SEQUENCE OF WORK AND TRAFFIC CONTROL SHOWN ON THESE PLANS IS A SUGGESTED METHOD OF HANDLING TRAFFIC DURING CONSTRUCTION. SIGNS, BARRICADES, ETC. SHOWN IN THE PLANS ARE CONSIDERED TO BE MINIMUM REQUIRED FOR TRAFFIC HANDLING ON THIS PROJECT.*

E. *ADDITIONAL TRAFFIC CONTROL DEVICES AND SIGNAGE MAY BE REQUIRED BASED ON CONTRACTORS' CONSTRUCTION OR DURING SHORT-TERM OPERATIONS NOT ADDRESSED IN THESE SHEETS.*

F. *THE ENGINEER MAY DIRECT THE CONTRACTOR TO VARY THE NUMBER AND LOCATION OF SIGNS, BARRICADES AND CHANNELIZING DEVICES FROM THOSE INDICATED IN THE PLANS IN ORDER TO MAINTAIN SAFE AND UNITERRUPTED FLOW OF TRAFFIC, PARTICULARLY IN THOSE AREAS OF IMMEDIATE WORK.*

G. *THE CONTRACTOR WILL PROVIDE SAFE ACCESS TO AND FROM ALL PRIVATE PROPERTY AT ALL TIMES AND IN ALL WEATHER CONDITIONS, UNLESS OTHERWISE DIRECTED.*

H. *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.*

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

J. *ANY REQUEST TO ALTER THE SEQUENCE OF OPERATION OR TRAFFIC CONTROL PLAN WILL BE SIGNED AND SEALED BY A PROFESSIONAL ENGINEER AND SUBMITTED TO THE PROJECT ENGINEER FOR THEIR WRITTEN APPROVAL.*

SEQUENCE OF OPERATION

1) *SET PROJECT BARRICADES AND INSTALL TEMPORARY DETOUR SIGNAGE.*
2) *INSTALL SWP3 BMP'S AS SHOWN AND AS DIRECTED.*
3) *UPON APROVAL, CLOSE ROAD TO TRAFFIC.*
4) *REMOVE EXISTING NORTH BOSQUE RELIEF CHANNEL BRIDGE.*
5) *CONSTRUCT REPLACEMENT BRIDGE, RIPRAP, APPROACH TO WEST, AND PARTIAL APPROACH TO EAST.*
6) *REMOVE EXISTING NORTH BOSQUE RIVER BRIDGE.*
7) *CONSTRUCT REPLACEMENT BRIDGE, CHANNEL GRADING, RETAINING WALL AND INSTALL RIPRAP.*
8) *INSTALL REMAINDER OF APPROACHES, COMPLETE GRADING, AND INSTALL REMAINING RIPRAP.*
9) *CONSTRUCT TRAFFIC RAIL, CONCRETE RIPRAP, SIDE SLOPE GRADING, INSTALL MBGF, PAVEMENT MARKINGS, SIGNS AND DELINEATORS.*
10) *INSTALL PERMANENT SEEDING AS SHOWN.*
11) *PERFORM CLEANUP AND PERFORM OTHER WORK AS DIRECTED.*
12) *OPEN ROAD AND BRIDGES TO TRAFFIC AS APPROVED BY THE ENGINEER.*
13) *REPAIR DETOUR ROUTE AS DIRECTED BY THE ENGINEER.*
14) *REMOVE DETOUR SIGNAGE UPON COMPLETION OF CONSTRUCTION OR AS DIRECTED BY THE ENGINEER.*

NOTES

1) *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.*

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

PRINT DATE	REVISION DATE
3/1/2024	

STATE OF TEXAS
CRAIG M. WILSON
94710
LICENSED PROFESSIONAL ENGINEER

3/1/2024

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(512) 250-5200
www.HardestyHanover.com
TBPELS Firm No. F-3379

Texas Department of Transportation
Waco District

FM 219 BRIDGE REPLACEMENTS

SEQUENCE OF WORK

SHEET 1 OF 1

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 15

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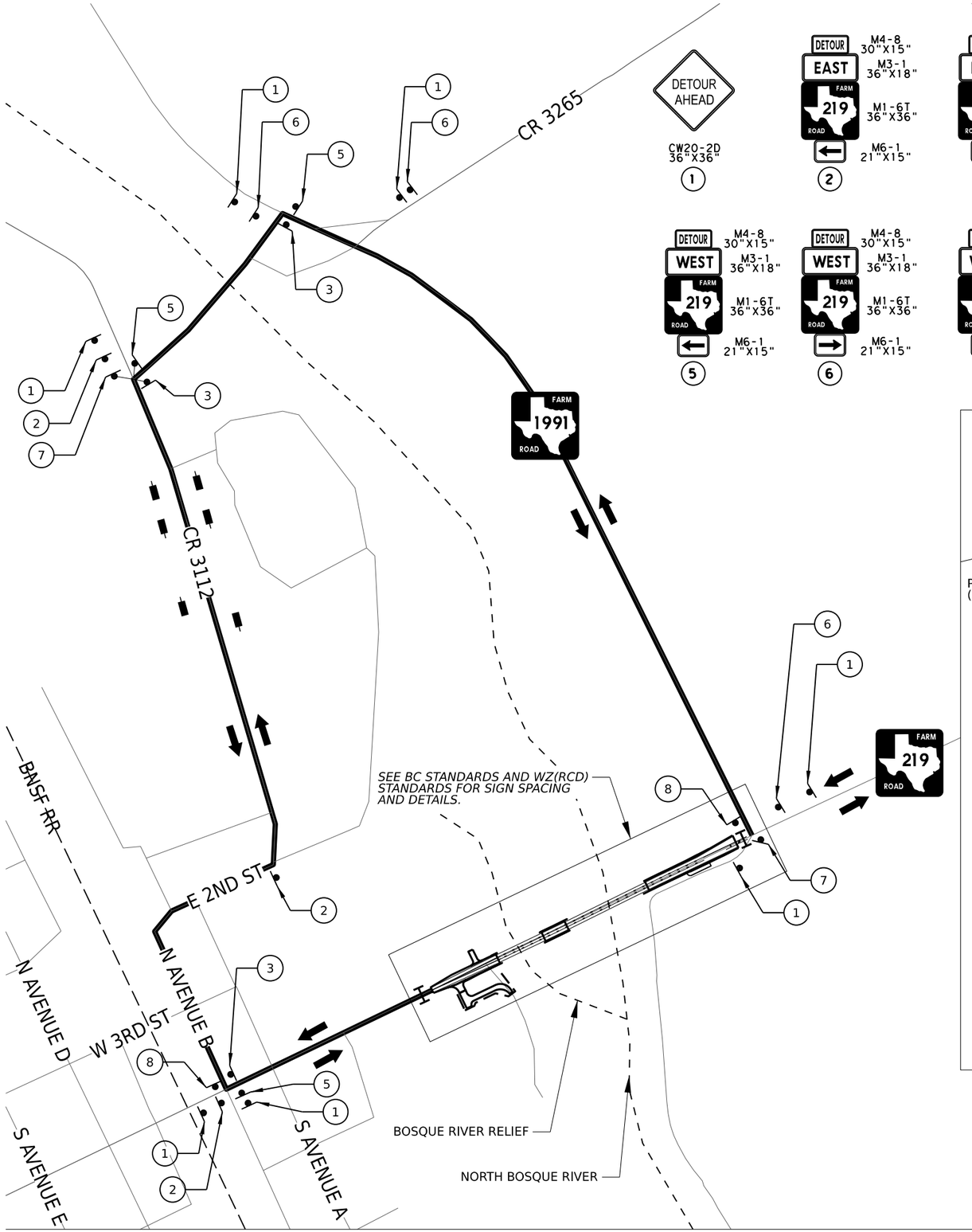
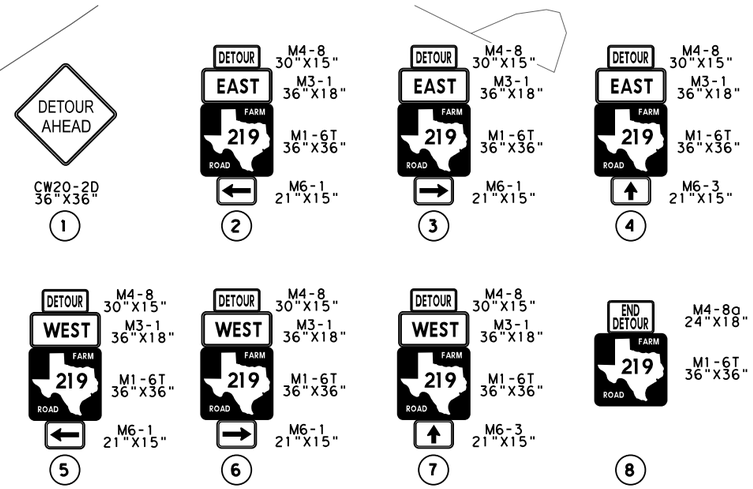
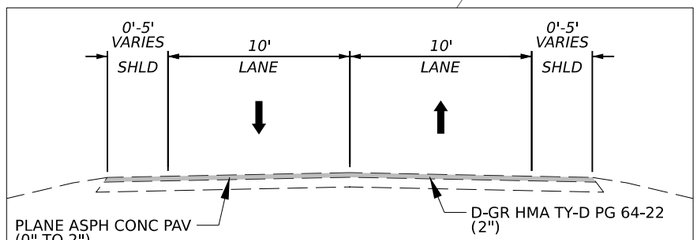
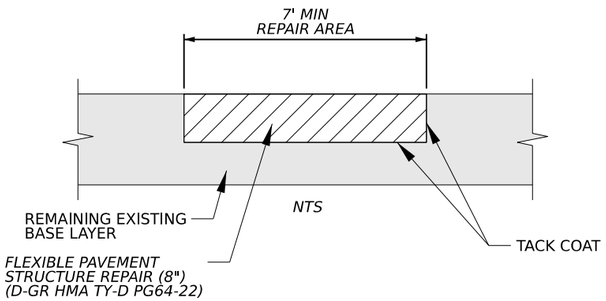






OFF-SYSTEM DETOUR TYPICAL SECTION

NTS



SPOT REPAIR DETAIL

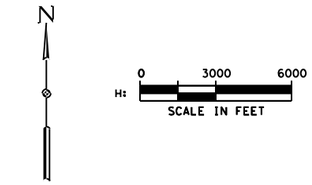
NTS

LOCATION AND SIZE OF SPOT REPAIRS TO BE DETERMINED BY THE ENGINEER. REMOVAL OF EXISTING MATERIAL, D-GR HMA TY-D PG64-22 OR BETTER AS APPROVED, AND PRIME ARE INCLUDED IN THE UNIT BID PRICE FOR 351.

OFF-SYSTEM DETOUR SUMMARY OF QUANTITIES

ITEM	CODE	DESCRIPTION	UNIT	QTY
0351	6004	FLEXIBLE PAVEMENT STRUCTURE REPAIR (8")	SY	1,000
0354	6021	PLANE ASPH CONC PAV (0" TO 2")	SY	10,000
0658	6109	INSTL OM ASSM (OM-2Z)(WFLX)SRF(BI)	EA	6
3076	6035	D-GR HMA TY-D PG 64-22	TON	1,100

** DETOUR ROUTE WILL BE CLEARED.*



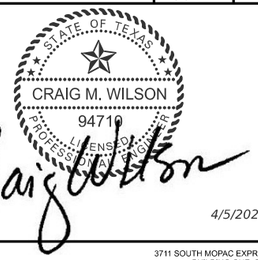
LEGEND:

- DETOUR
- TY 3 BARRICADES
- CONSTRUCTION SIGN
- DIRECTION OF DETOUR TRAFFIC
- OM ASSM (OM-2Z)(WFLX)SRF(BI)

NOTES:

1. REPAIR OFF-SYSTEM DETOUR ROUTE AS DIRECTED BY THE ENGINEER.
2. DETOUR ROUTE WILL BE CLEARED.
3. DETOUR WILL REMAIN IN PLACE THROUGHOUT THE DURATION OF THE CONSTRUCTION.
4. OM ASSM WILL BE PLACED AT CULVERT CROSSING.
5. SEE BC STANDARDS AND WZ (RCD) STANDARD FOR SIGN SPACING, DETAILS AND ADDITIONAL SIGNING NOT SHOWN. SIGNS MAY BE ADJUSTED TO FIT FIELD CONDITIONS OR AS DIRECTED.
6. USE EXISTING SIGNS AT INTERSECTIONS APPLICABLE FOR THIS DETOUR ROUTE. SIGNS THAT ARE IN CONFLICT WITH THESE SIGNS SHALL BE COVERED PER ENGINEER'S DIRECTION.

PRINT DATE	REVISION DATE
4/5/2024	



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TBPELS Firm No. F-3379

FM 219 BRIDGE REPLACEMENTS

DETOUR LAYOUT

SHEET 1 OF 1

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 16

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DATE: 3/1/2024 12:14:46 PM
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BARRICADE AND CONSTRUCTION (BC) STANDARD SHEETS GENERAL NOTES:

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

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

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

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

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

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

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

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

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

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

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

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

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

WORKER SAFETY NOTES:

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

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

COMPLIANT WORKZONE TRAFFIC CONTROL DEVICES

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

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

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

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION GENERAL NOTES AND REQUIREMENTS

BC(1)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS 4-03 7-13 9-07 8-14 5-10 5-21	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		17

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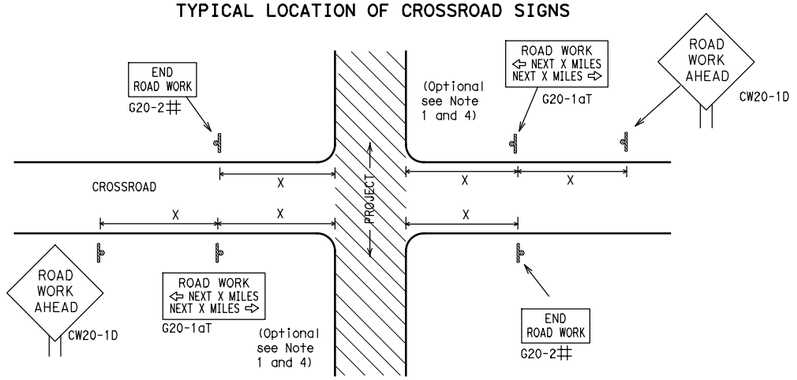
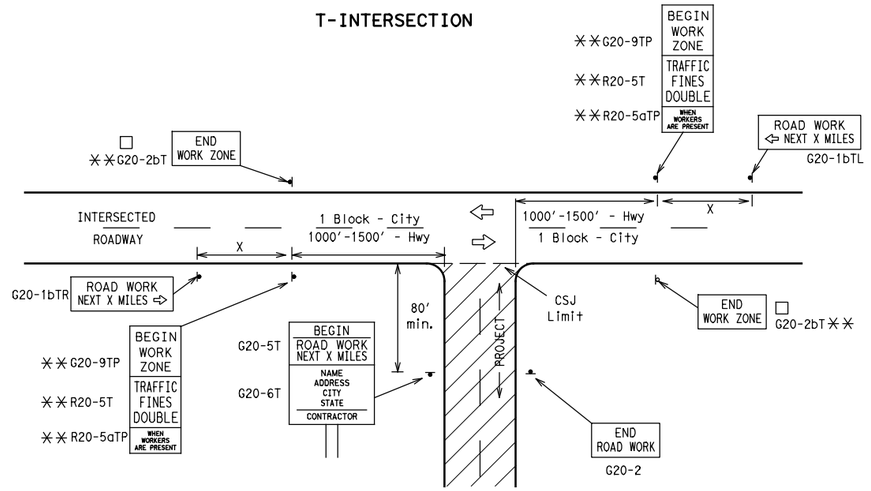
TYPICAL LOCATION OF CROSSROAD SIGNS



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]

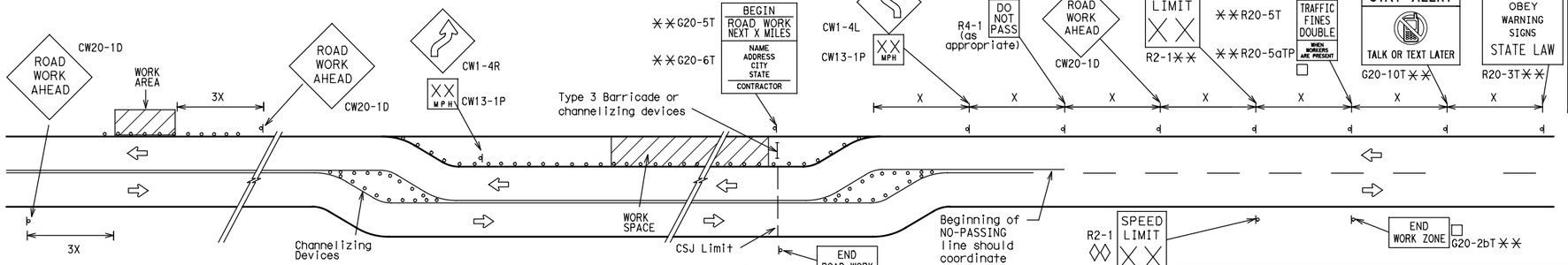
✳ For typical sign spacings on divided highways, expressways and freeways, see Part 6 of the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD) typical application diagrams or TCP Standard Sheets.

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

GENERAL NOTES

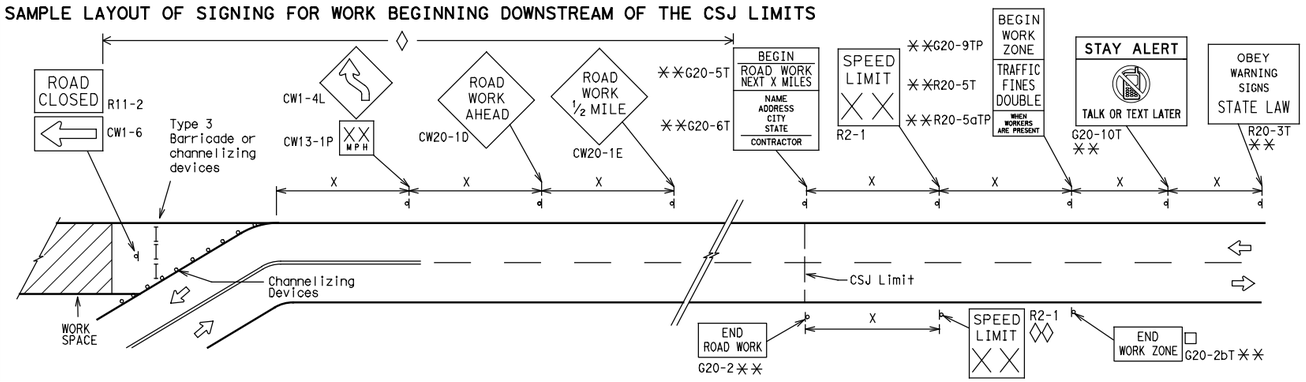
1. Special or larger size signs may be used as necessary.
2. Distance between signs should be increased as required to have 1500 feet advance warning.
3. Distance between signs should be increased as required to have 1/2 mile or more advance warning.
4. 36" x 36" "ROAD WORK AHEAD" (CW20-1D)signs may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



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

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC.	FM 219
9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	WACO	BOSQUE		18

DATE: 3/1/2024 12:14:47 PM
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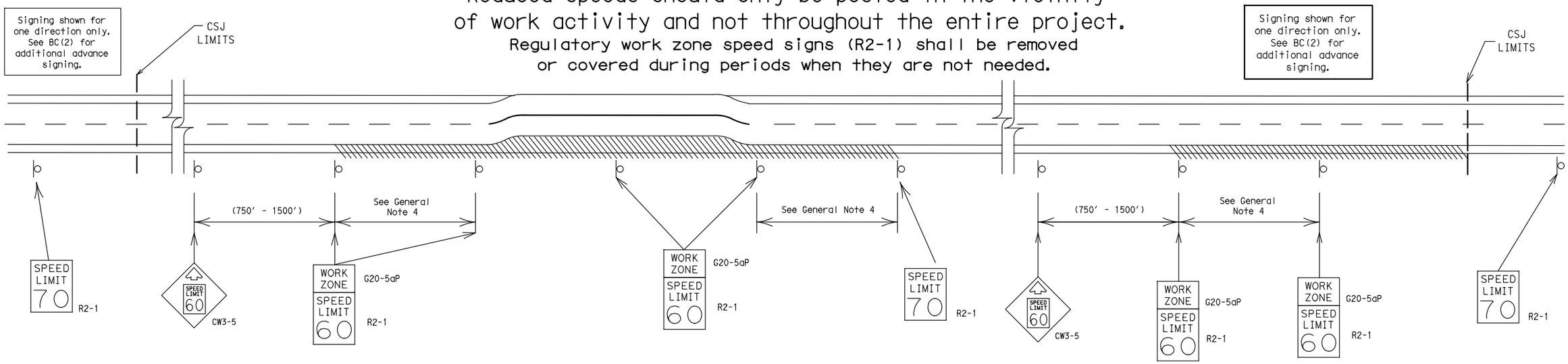
TYPICAL APPLICATION OF WORK ZONE SPEED LIMIT SIGNS

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

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

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



GUIDANCE FOR USE:

LONG/INTERMEDIATE TERM WORK ZONE SPEED LIMITS

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

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

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

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

SHORT TERM WORK ZONE SPEED LIMITS

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

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

GENERAL NOTES

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

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION WORK ZONE SPEED LIMIT

BC(3)-21

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©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS 9-07 8-14 7-13 5-21	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		19

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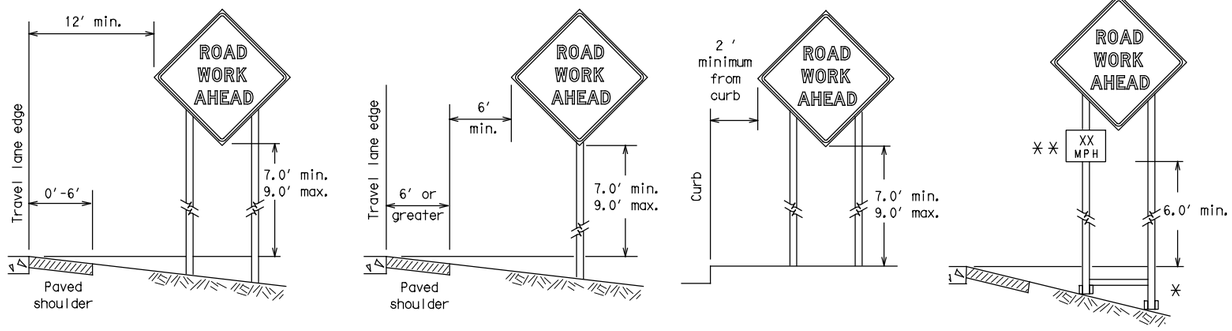
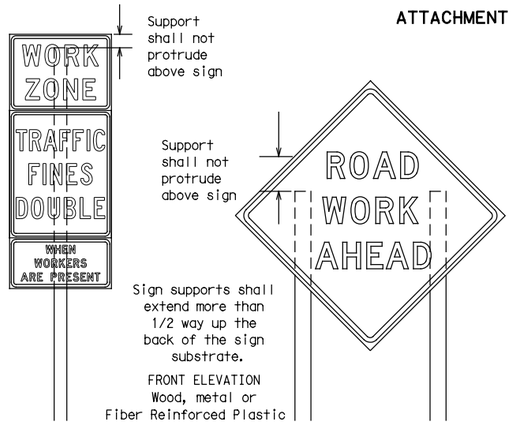
TYPICAL MINIMUM CLEARANCES FOR LONG TERM AND INTERMEDIATE TERM SIGNS

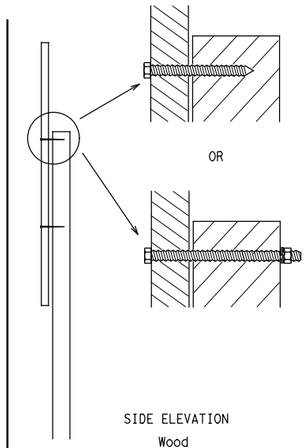


⚹ When placing skid supports on unlevel ground, the leg post lengths must be adjusted so the sign appears straight and plumb. Objects shall NOT be placed under skids as a means of leveling.

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

ATTACHMENT FOR SIGN SUPPORTS





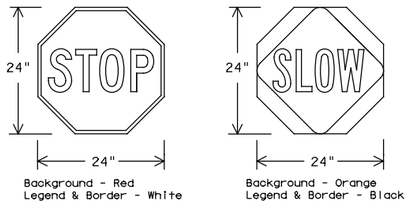
Attachment to wooden supports will be by bolts and nuts or screws. Use TxDOT's or manufacturer's recommended procedures for attaching sign substrates to other types of sign supports

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

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

STOP/SLOW PADDLES

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



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

CONTRACTOR REQUIREMENTS FOR MAINTAINING PERMANENT SIGNS WITHIN THE PROJECT LIMITS

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

GENERAL NOTES FOR WORK ZONE SIGNS

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

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

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

SIGN MOUNTING HEIGHT

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

SIZE OF SIGNS

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

SIGN SUBSTRATES

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

REFLECTIVE SHEETING

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

SIGN LETTERS

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

REMOVING OR COVERING

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

SIGN SUPPORT WEIGHTS

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

FLAGS ON SIGNS

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

Texas Department of Transportation | Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION TEMPORARY SIGN NOTES

BC(4)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
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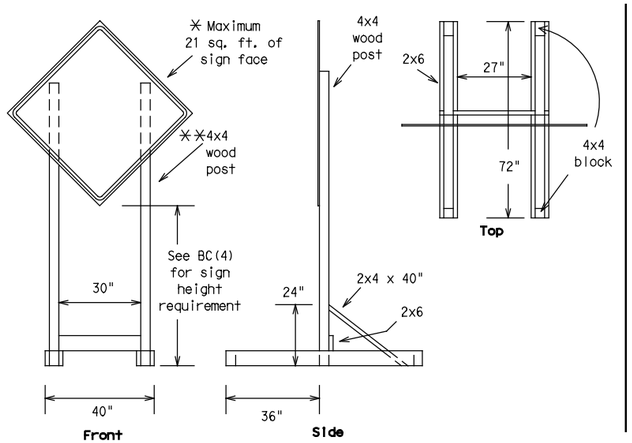
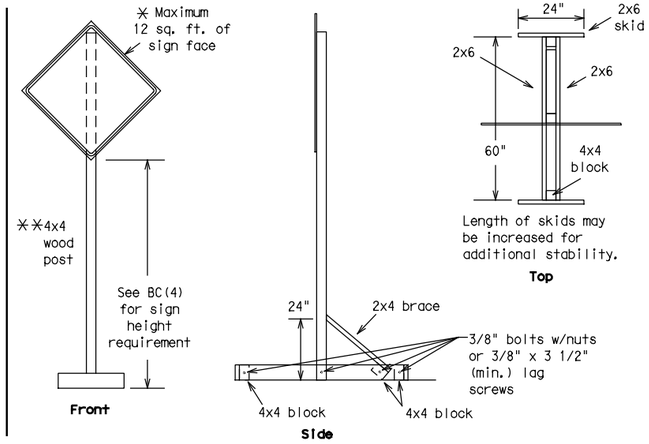
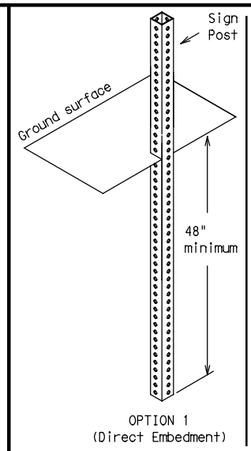
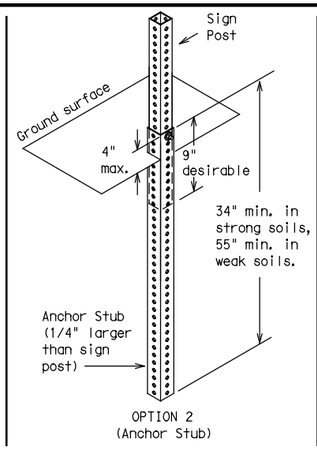


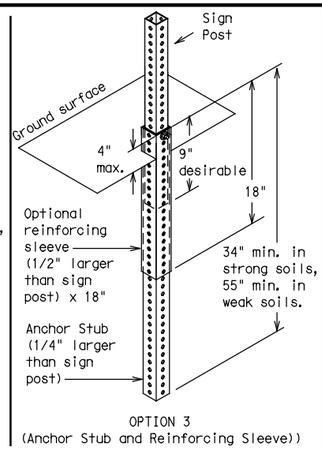


SKID MOUNTED WOOD SIGN SUPPORTS

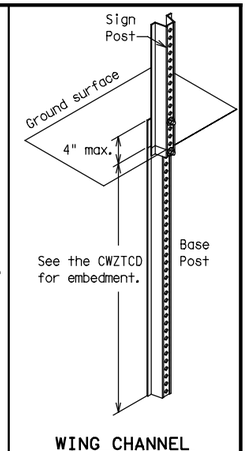
* LONG/INTERMEDIATE TERM STATIONARY - PORTABLE SKID MOUNTED SIGN SUPPORTS







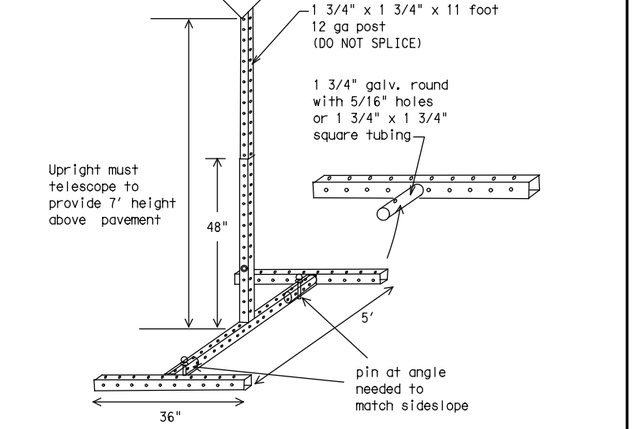
PERFORATED SQUARE METAL TUBING

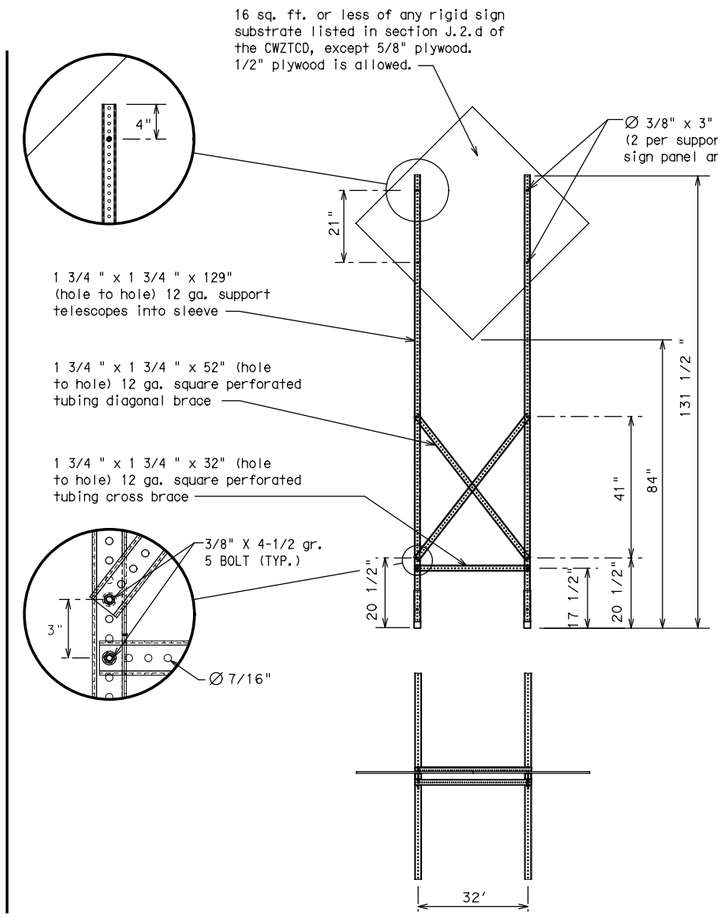


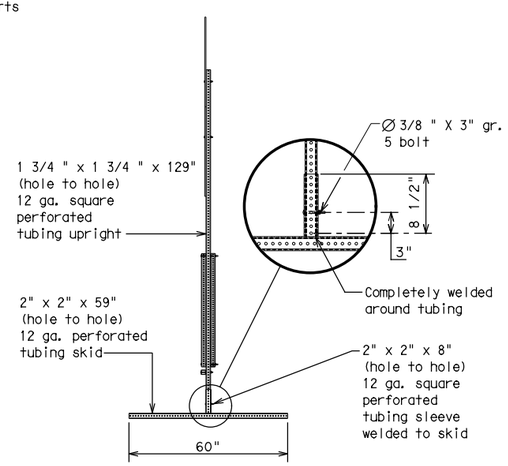
WING CHANNEL
Lap-splice/base bolted anchor

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.

Texas Department of Transportation | Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION TYPICAL SIGN SUPPORT

BC(5)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC.	FM 219
9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	WACO	BOSQUE		21

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

PORTABLE CHANGEABLE MESSAGE SIGNS

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

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

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

RECOMMENDED PHASES AND FORMATS FOR PCMS MESSAGES DURING ROADWORK ACTIVITIES

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

Phase 1: Condition Lists

Road/Lane/Ramp Closure List

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

Other Condition List

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

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

Phase 2: Possible Component Lists

Action to Take/Effect on Travel List

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

Location List

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

Warning List

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

✳✳ Advance Notice List

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

✳✳ See Application Guidelines Note 6.

APPLICATION GUIDELINES

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

WORDING ALTERNATIVES

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

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

FULL MATRIX PCMS SIGNS

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

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PORTABLE CHANGEABLE MESSAGE SIGN (PCMS)

BC(6)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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REVISIONS	0724	02	020, ETC.	FM 219
9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	WACO	BOSQUE		22

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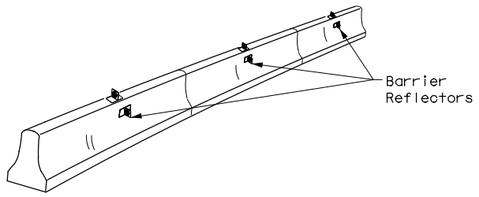
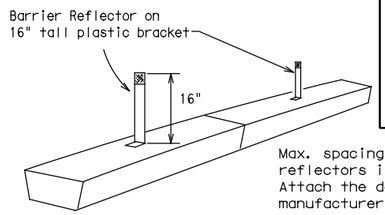
1. Barrier Reflectors shall be pre-qualified, and conform to the color and reflectivity requirements of DMS-8600. A list of prequalified Barrier Reflectors can be found at the Material Producer List web address shown on BC(1).
2. Color of Barrier Reflectors shall be as specified in the TMUTCD. The cost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



CONCRETE TRAFFIC BARRIER (CTB)

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

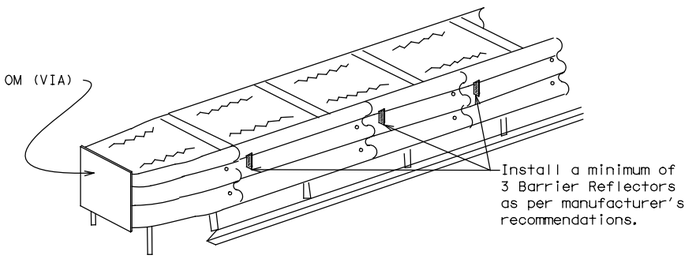


Max. spacing of barrier reflectors is 20 feet. Attach the delineators as per manufacturer's recommendations.

LOW PROFILE CONCRETE BARRIER (LPCB) USED IN WORK ZONES

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

LOW PROFILE CONCRETE BARRIER (LPCB)

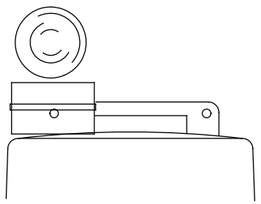


DELINEATION OF END TREATMENTS

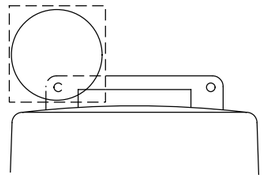
END TREATMENTS FOR CTB'S USED IN WORK ZONES

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

BARRIER REFLECTORS FOR CONCRETE TRAFFIC BARRIER AND ATTENUATORS



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



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

WARNING LIGHTS

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

WARNING LIGHTS MOUNTED ON PLASTIC DRUMS

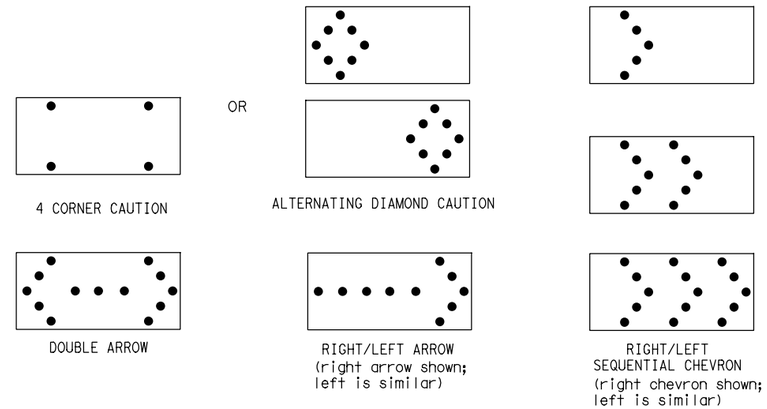
1. Type A flashing warning lights are intended to warn drivers that they are approaching or are in a potentially hazardous area.
2. Type A random flashing warning lights are not intended for delineation and shall not be used in a series.
3. A series of sequential flashing warning lights placed on channelizing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

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

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

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

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



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

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

ATTENTION

Flashing Arrow Boards shall be equipped with automatic dimming devices.

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

FLASHING ARROW BOARDS

TRUCK-MOUNTED ATTENUATORS

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

Texas Department of Transportation

Traffic Safety Division Standard

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

BC(7)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC.	FM 219
9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	WACO	BOSQUE		23

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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:

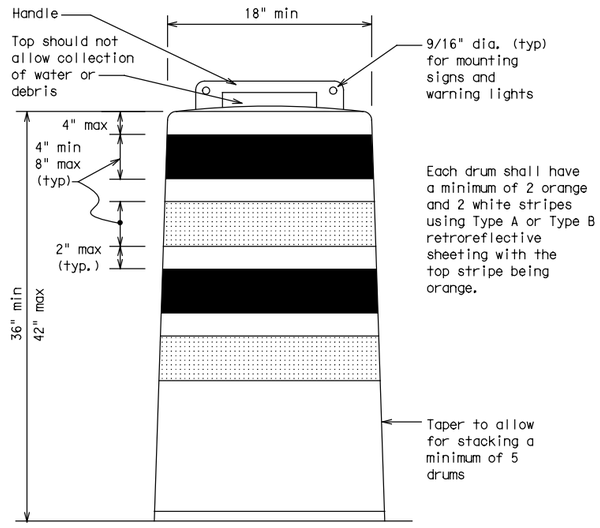
1. Plastic drums shall be a two-piece design; the "body" of the drum shall be the top portion and the "base" shall be the bottom.
2. The body and base shall lock together in such a manner that the body separates from the base when impacted by a vehicle traveling at a speed of 20 MPH or greater but prevents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

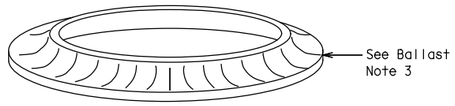
RETROREFLECTIVE SHEETING

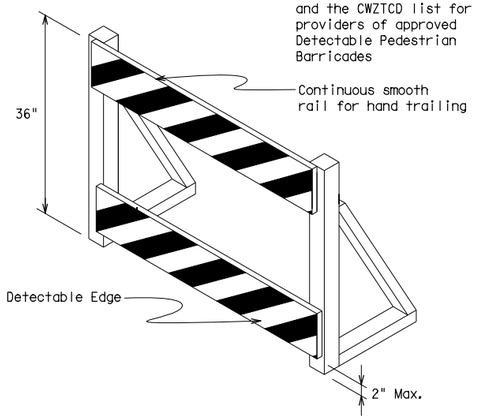
1. The stripes used on drums shall be constructed of sheeting meeting the color and retroreflectivity requirements of Departmental Materials Specification DMS-8300, "Sign Face Materials," Type A or Type B reflective sheeting shall be supplied unless otherwise specified in the plans.
2. The sheeting shall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

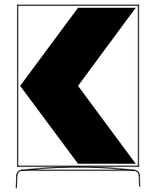




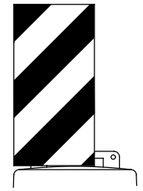


DETECTABLE PEDESTRIAN BARRICADES

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

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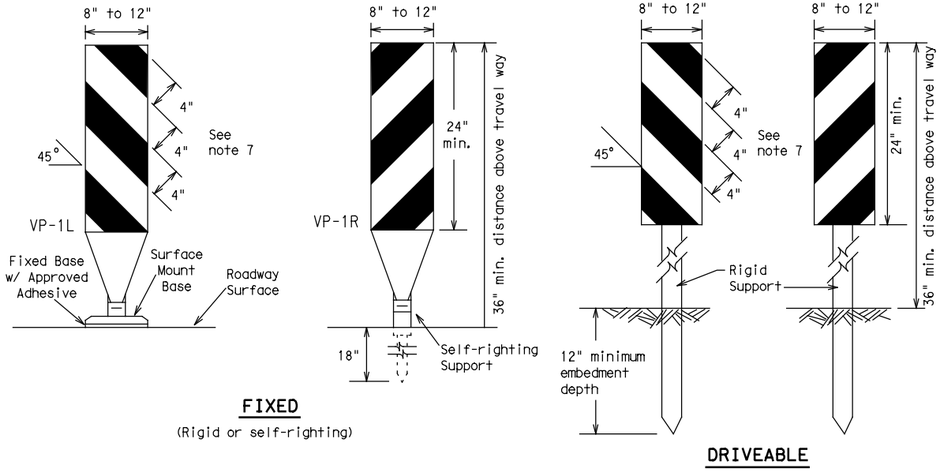
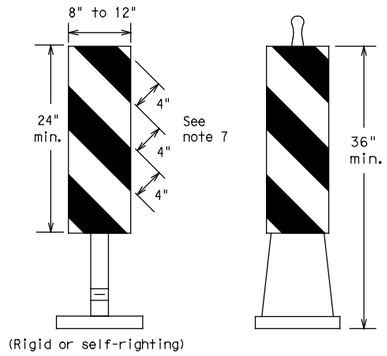


FIXED
(Rigid or self-righting)

DRIVEABLE

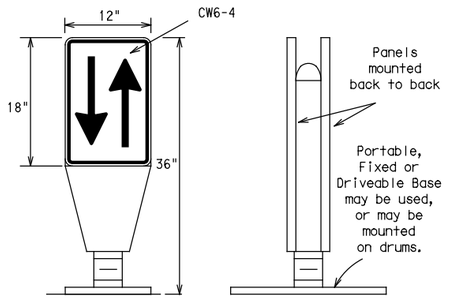


(Rigid or self-righting)

PORTABLE

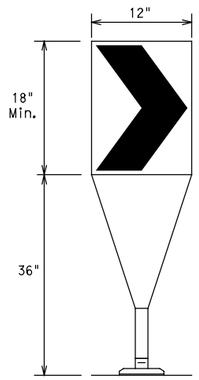
1. Vertical Panels (VP's) are normally used to channelize traffic or divide opposing lanes of traffic.
2. VP's may be used in daytime or nighttime situations. They may be used at the edge of shoulder drop-offs and other areas such as lane transitions where positive daytime and nighttime delineation is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

VERTICAL PANELS (VPs)



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

OPPOSING TRAFFIC LANE DIVIDERS (OTLD)



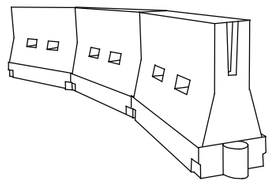
Fixed Base w/ Approved Adhesive (Driveable Base, or Flexible Support can be used)

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

CHEVRONS

GENERAL NOTES

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



LONGITUDINAL CHANNELIZING DEVICES (LCD)

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

WATER BALLASTED SYSTEMS USED AS BARRIERS

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

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

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

Posted Speed	Formula	Minimum Desirable Taper Lengths ✳✳			Suggested Maximum Spacing of Channelizing Devices	
		10′ Offset	11′ Offset	12′ Offset	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

Texas Department of Transportation | Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC(9)-21

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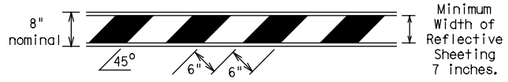
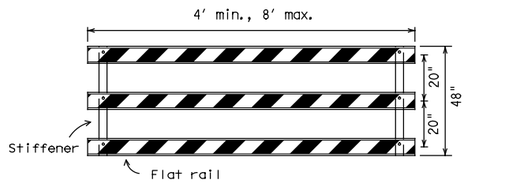
TYPE 3 BARRICADES

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.



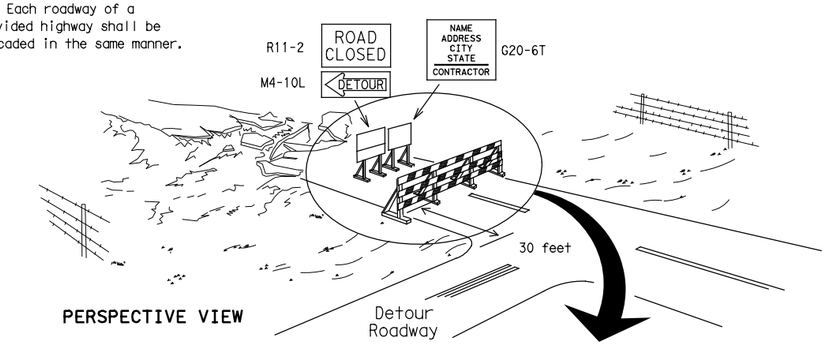
TYPICAL STRIPING DETAIL FOR BARRICADE RAIL



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

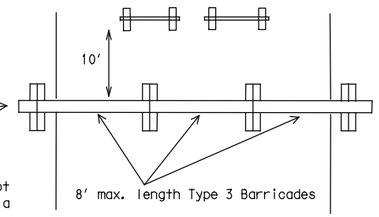
TYPICAL PANEL DETAIL FOR SKID OR POST TYPE BARRICADES

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



PERSPECTIVE VIEW

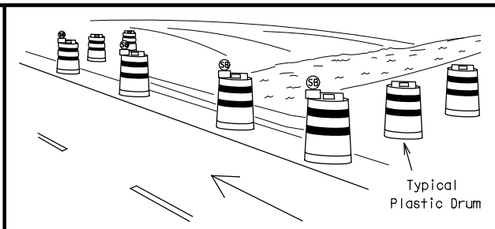
The three rails on Type 3 barricades shall be reflectorized orange and reflective white stripes on one side facing one-way traffic and both sides for two-way traffic.
Barricade striping should slant downward in the direction of detour.



PLAN VIEW

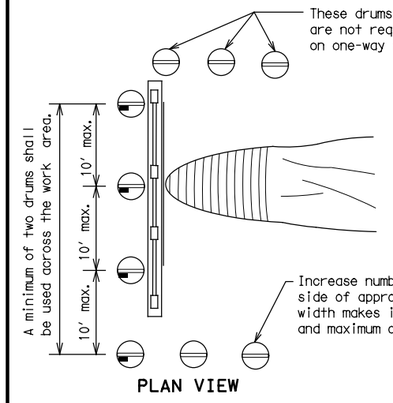
1. Signs should be mounted on independent supports at a 7 foot mounting height in center of roadway. The signs should be a minimum of 10 feet behind Type 3 Barricades.
2. Advance signing shall be as specified elsewhere in the plans.

TYPE 3 BARRICADE (POST AND SKID) TYPICAL APPLICATION



PERSPECTIVE VIEW

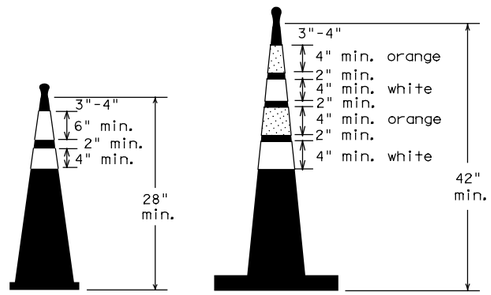
1. Where positive redirectional capability is provided, drums may be omitted.
2. Plastic construction fencing may be used with drums for safety as required in the plans.
3. Vertical Panels on flexible support may be substituted for drums when the shoulder width is less than 4 feet.
4. When the shoulder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



PLAN VIEW

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

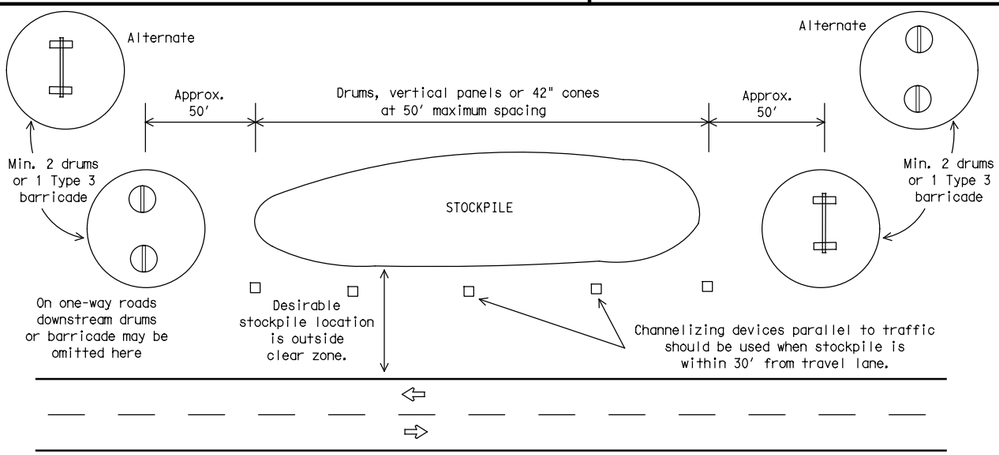
CULVERT WIDENING OR OTHER ISOLATED WORK WITHIN THE PROJECT LIMITS



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

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WORK ZONE PAVEMENT MARKINGS

GENERAL

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

RAISED PAVEMENT MARKERS

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

PREFABRICATED PAVEMENT MARKINGS

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

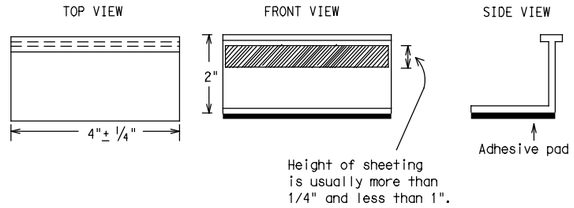
MAINTAINING WORK ZONE PAVEMENT MARKINGS

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

REMOVAL OF PAVEMENT MARKINGS

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

Temporary Flexible-Reflective Roadway Marker Tabs



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

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

RAISED PAVEMENT MARKERS USED AS GUIDEMARKS

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

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

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

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

Texas Department of Transportation | Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PAVEMENT MARKINGS

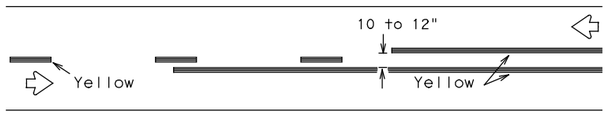
BC(11)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC.	FM 219
2-98 9-07 5-21	DIST	COUNTY		SHEET NO.
1-02 7-13	WACO	BOSQUE		27
11-02 8-14				

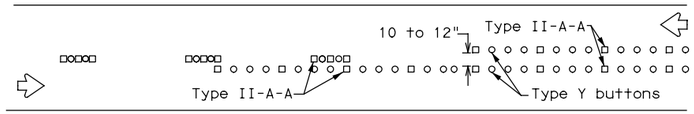
105

DATE: 3/1/2024 12:14:51 PM
FILE: P:\2020\01156\06-Bosque River-0724-02-020\4 - Design\Plan Set\13. Standards\TCP\BC(1) THRU (12)-21.dgn

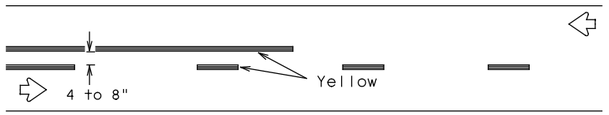
PAVEMENT MARKING PATTERNS



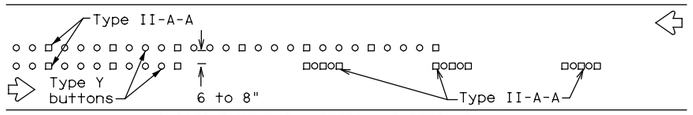
REFLECTORIZED PAVEMENT MARKINGS - PATTERN A



RAISED PAVEMENT MARKERS - PATTERN A



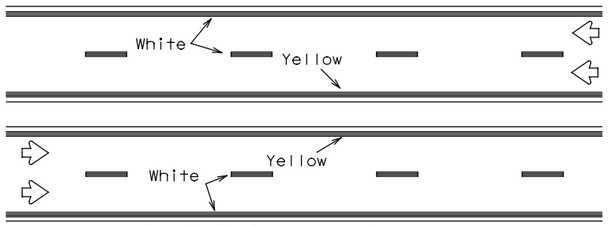
REFLECTORIZED PAVEMENT MARKINGS - PATTERN B



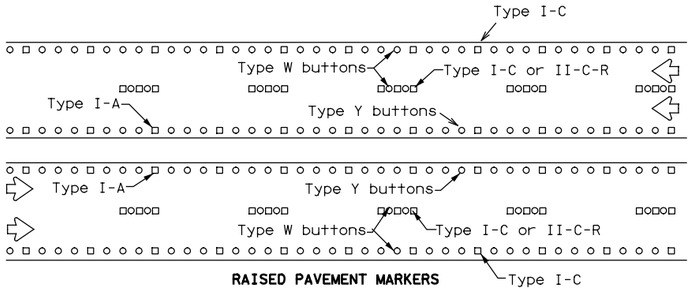
RAISED PAVEMENT MARKERS - PATTERN B

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

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



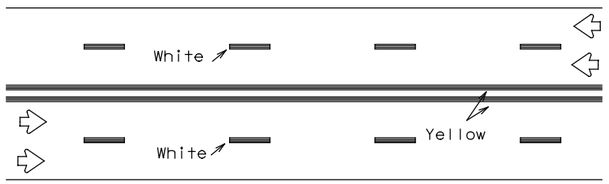
REFLECTORIZED PAVEMENT MARKINGS



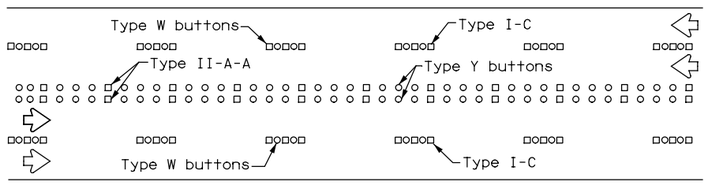
RAISED PAVEMENT MARKERS

Prefabricated markings may be substituted for reflectorized pavement markings.

EDGE & LANE LINES FOR DIVIDED HIGHWAY



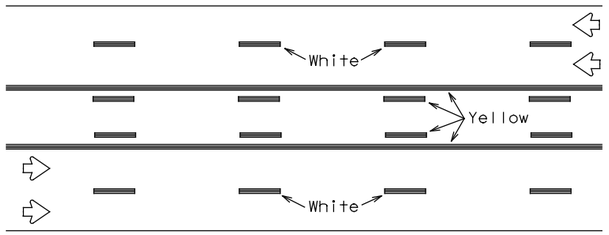
REFLECTORIZED PAVEMENT MARKINGS



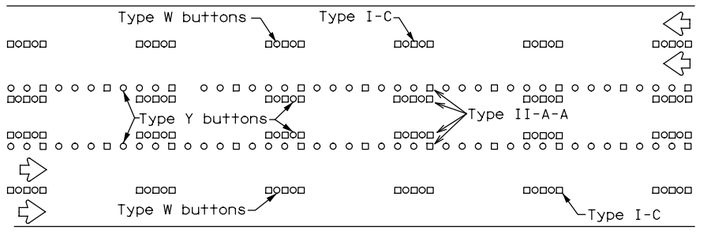
RAISED PAVEMENT MARKERS

Prefabricated markings may be substituted for reflectorized pavement markings.

LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



REFLECTORIZED PAVEMENT MARKINGS



RAISED PAVEMENT MARKERS

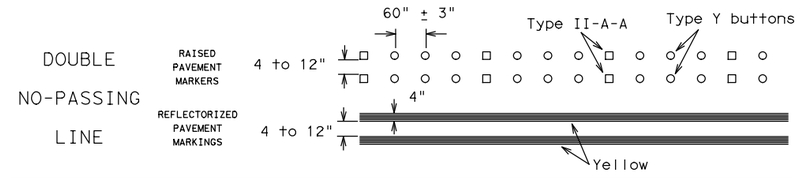
Prefabricated markings may be substituted for reflectorized pavement markings.

TWO-WAY LEFT TURN LANE

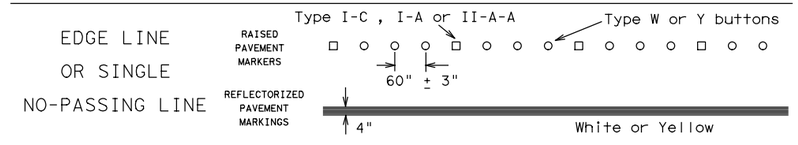
STANDARD WORK ZONE PAVEMENT MARKINGS DETAILS

SOLID LINES

DOUBLE NO-PASSING LINE

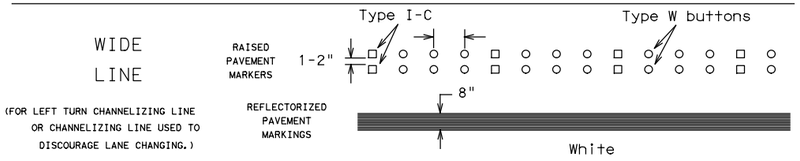


EDGE LINE OR SINGLE NO-PASSING LINE



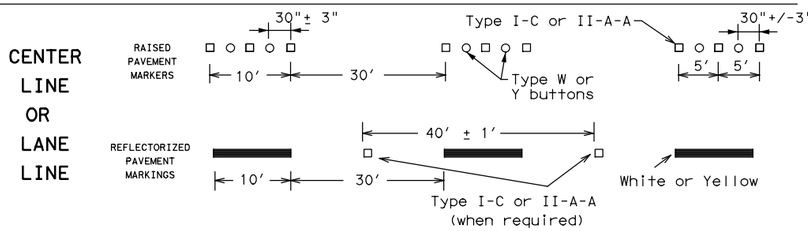
WIDE LINE

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

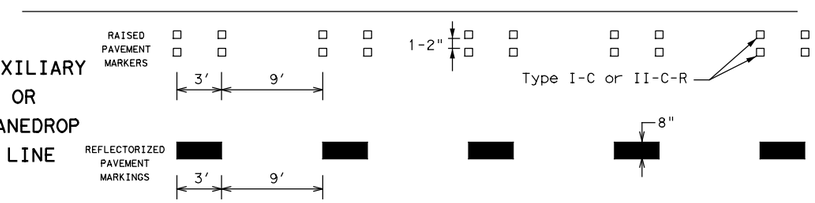


BROKEN LINES

CENTER LINE OR LANE LINE

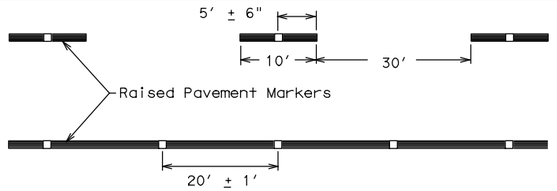


AUXILIARY OR LANEDROP LINE



REMOVABLE MARKINGS WITH RAISED PAVEMENT MARKERS

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



Centerline only - not to be used on edge lines

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

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PAVEMENT MARKING PATTERNS

BC(12)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS 1-97 9-07 5-21 2-98 7-13 11-02 8-14	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		28

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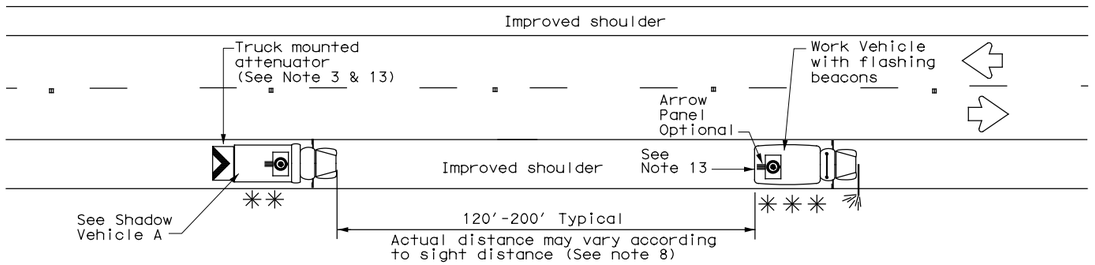
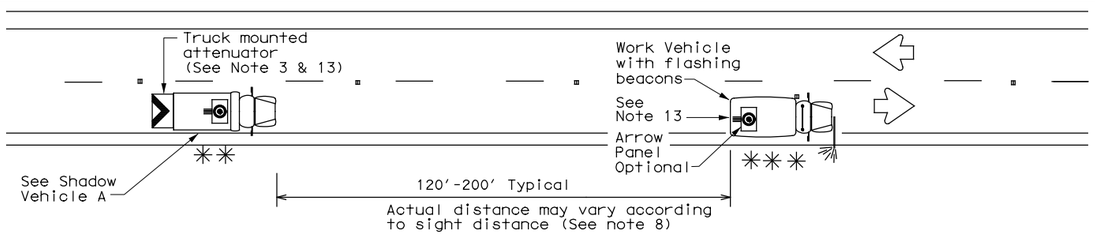
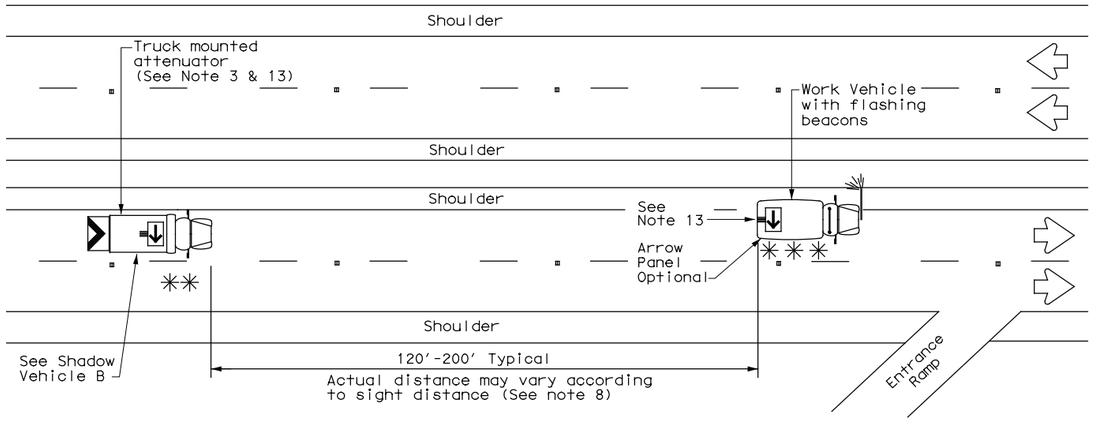


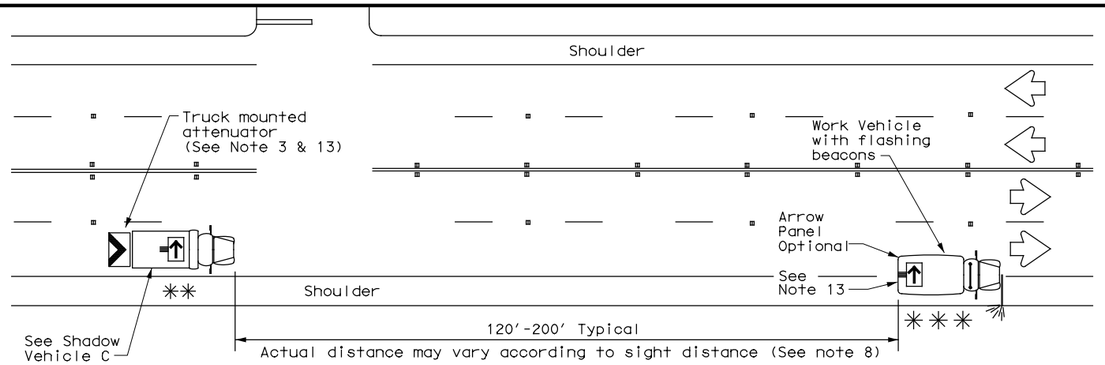
TWO LANE HIGHWAY WITH PAVED SHOULDERS MINIMUM 8'



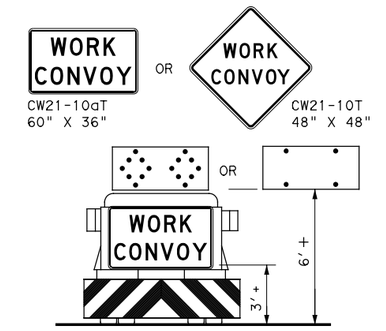
TWO LANE HIGHWAY WITH NO SHOULDER OR NARROW SHOULDER



MULTILANE HIGHWAY

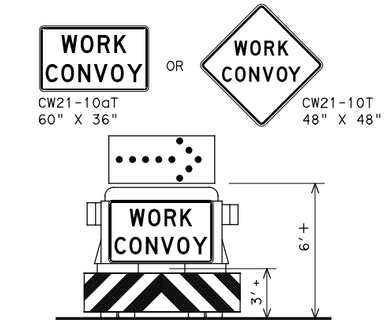


MULTILANE HIGHWAY



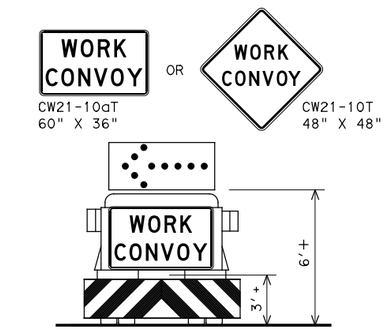
SHADOW VEHICLE A

with Flashing Arrow Board in Caution Mode



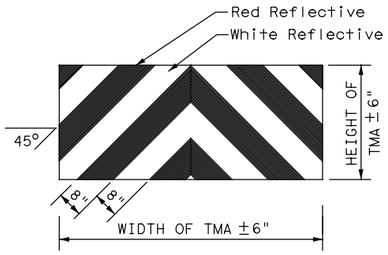
TYPICAL SHADOW VEHICLE B

with RIGHT Directional display
Flashing Arrow Board



TYPICAL SHADOW VEHICLE C

with LEFT Directional display
Flashing Arrow Board



STRIPING FOR TMA

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

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

GENERAL NOTES

1. All traffic control devices shall be in accordance with the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD), latest edition.
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 is required.
4. Striping on the back panel of all TMAs shall be 8" red reflective sheeting with white background, placed in an inverted "V" design. Reflective sheeting shall meet or exceed the reflectivity and color requirements of DEPARTMENTAL MATERIAL SPECIFICATION DMS-8300, TYPE A.
5. Flashing Arrow Panels shall be Type B or Type C as per BC Standards. The panel operation shall be controlled from inside the vehicle.
6. Each vehicle shall have two-way radio communication capability.
7. When the work convoy must change lanes, the Shadow Vehicle should change lanes first to protect the Work Vehicle.
8. Spacing between Shadow and Work Vehicle will vary depending on sight distance restrictions. Motorists approaching the work convoy should be able to see the Shadow Vehicle in time to slow down and/or change lanes as they approach the Work Convoy.
9. Use of an arrow panel on the Work Vehicle is optional except as provided in note 13, but may be required by the Engineer. If an arrow panel is not used, dual flashing beacons, mounted as high and as widely separated as practicable at the rear of the Work Vehicle shall be required.
10. On two-lane two-way roadways, the Work and Shadow Vehicles should pull over periodically to allow motor vehicle traffic to pass.
11. Work and Shadow Vehicles should stay on the shoulder of highways having 8' or wider shoulders when possible.
12. A Trail Vehicle may be added to the operation when approved by the Engineer. See TCP(3) series standards.
13. The shadow vehicle may be omitted on conventional roadways when a TMA or TA and arrow panel is mounted to the herbicide vehicle. A separate shadow vehicle will be required on expressways and Freeways.

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL PLAN MOBILE OPERATIONS HERBICIDE TRUCK OPERATIONS

TCP(3-5)-18

FILE: tcp3-5.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT July 2015	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC.	FM 219
4-18	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		29

DATE: 3/1/2024 12:14:53 PM
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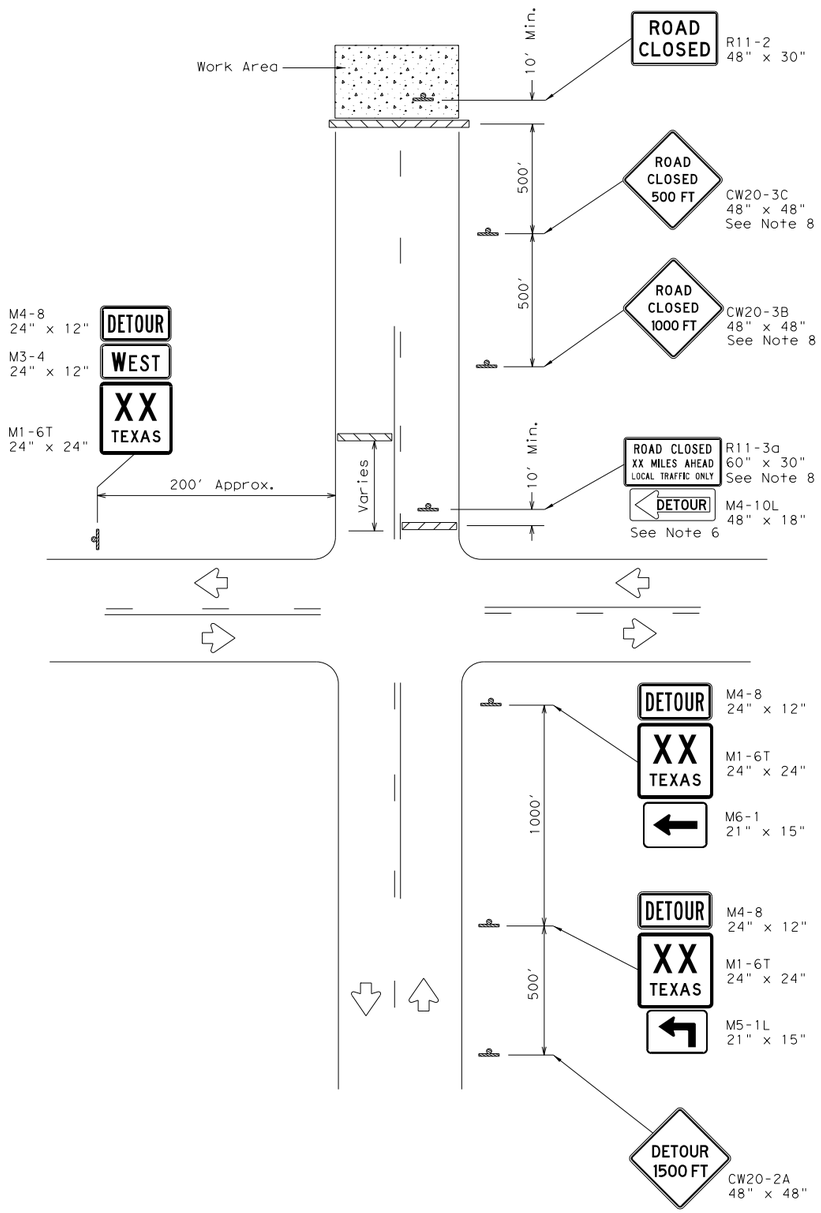
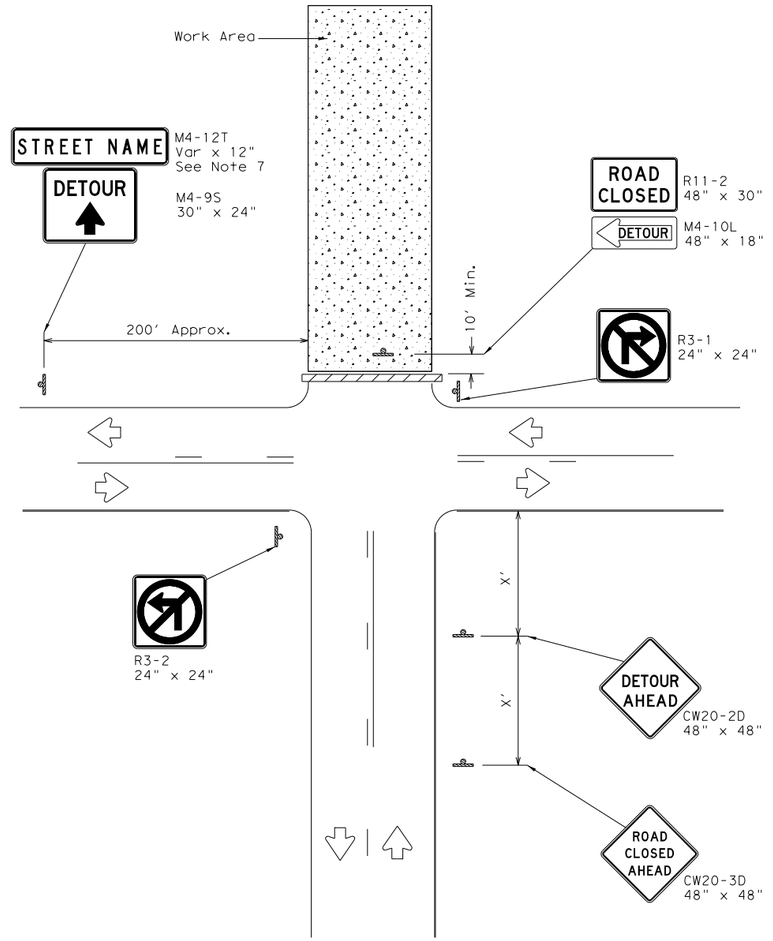


ROAD CLOSURE BEYOND THE INTERSECTION

Signing for a Numbered Route with an Off-Site Detour



ROAD CLOSURE AT THE INTERSECTION

Signing for an Un-numbered Route with an Off-Site Detour

LEGEND	
	Type 3 Barricade
	Sign

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

GENERAL NOTES

1. This sheet is intended to provide details for temporary work zone road closures. For permanent road closure details see the D&OM standards.
2. Barricades used shall meet the requirements shown on Barricade and Construction Standard BC(10) and listed on the Compliant Work Zone Traffic Control Devices list (CWZTCD).
3. Stockpiled materials shall not be placed on the traffic side of barricades.
4. Barricades at the road closure should extend from pavement edge to pavement edge.
5. Detour signing shown is intended to illustrate the type of signing that is appropriate for numbered routes or un-numbered routes as labeled. It does not indicate the full extent of detour signing required. Detour routes should be signed as shown elsewhere in the plans.
6. If the road is open for a significant distance beyond the intersection or there are significant origin/destination points beyond the intersection, the signs and barricades at this location should be located at the edge of the traveled way.
7. The Street Name (M4-12T) sign is to be placed above the DETOUR (M4-9S) sign.
8. For urban areas where there is a shorter distance between the intersection and the actual closure location, the ROAD CLOSED XX MILES AHEAD (R11-3a) sign may be replaced with a ROAD CLOSED TO THRU TRAFFIC (R11-4) sign. If adequate space does not exist between the intersection and the closure a single ROAD CLOSED AHEAD (CW20-3D) sign spaced as per the table above may replace the ROAD CLOSED 1000 FT (CW20-3B) and ROAD CLOSED 500 FT (CW20-3C) signs.
9. Signs and barricades shown shall be subsidiary to Item 502. Locations where these details will be required shall be as shown elsewhere in the plans.

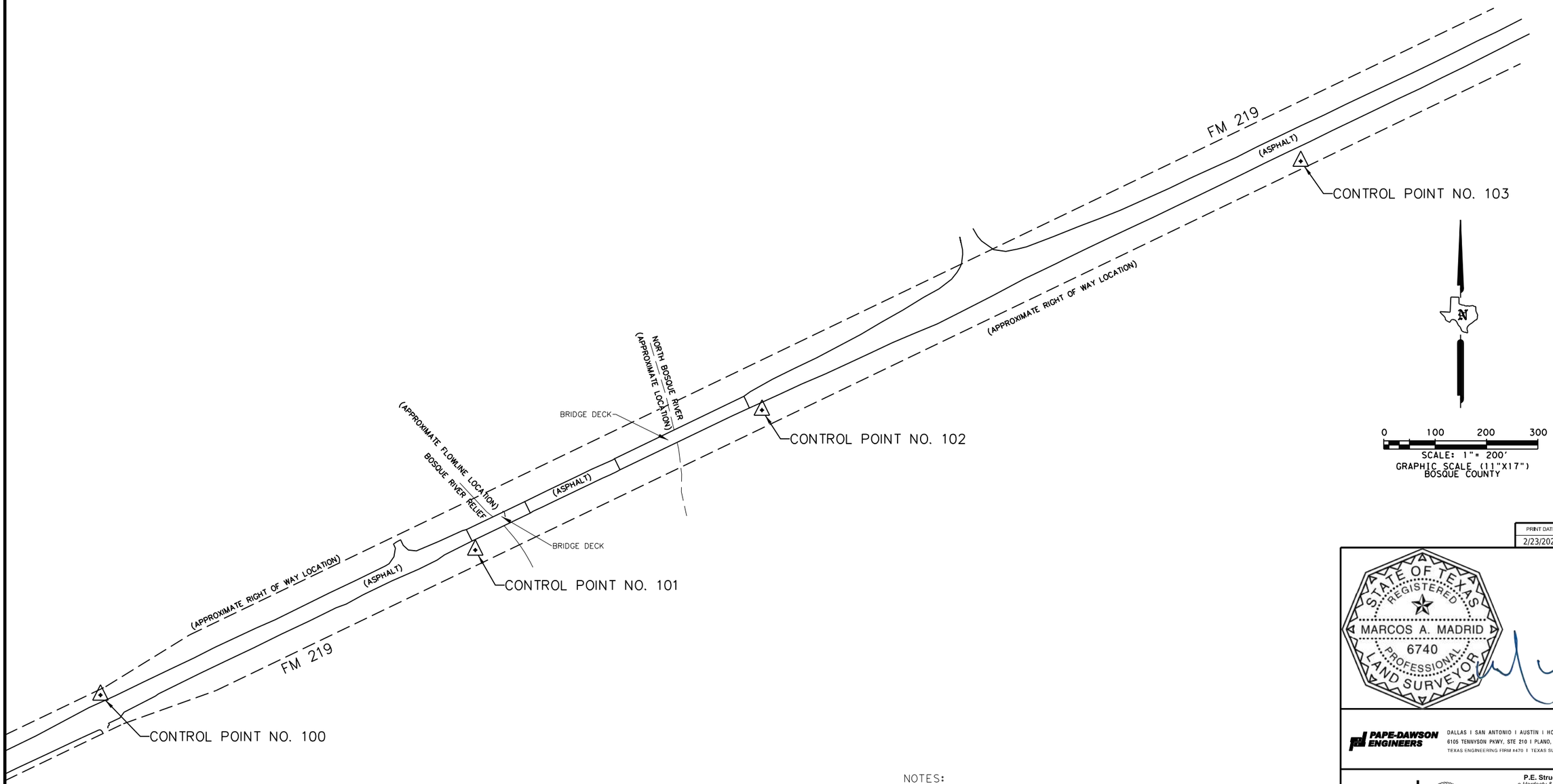
Texas Department of Transportation

Traffic Operations Division Standard

WORK ZONE ROAD CLOSURE DETAILS

WZ(RCD)-13

FILE: wzrcd-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT August 1995	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC.	FM 219
1-97 4-98 7-13	DIST	COUNTY		SHEET NO.
2-98 3-03	WACO	BOSQUE		30



HORIZONTAL AND VERTICAL CONTROL POINTS				
Point #	Northing	Easting	Elevation	Full Description
100	10,623,821.68	3,154,900.37	662.81	5/8" I.R. W/ 3 1/4" ALUMINUM CAP STAMPED "TEXAS DEPT OF TRANSPORTATION/ CONTROL MARK/ PD 100"
101	10,624,104.06	3,155,629.97	638.12	5/8" I.R. W/ 3 1/4" ALUMINUM CAP STAMPED "TEXAS DEPT OF TRANSPORTATION/ CONTROL MARK/ PD 101"
102	10,624,376.64	3,156,187.97	639.64	5/8" I.R. W/ 3 1/4" ALUMINUM CAP STAMPED "TEXAS DEPT OF TRANSPORTATION/ CONTROL MARK/ PD 102"
103	10,624,861.13	3,157,236.80	637.16	5/8" I.R. W/ 3 1/4" ALUMINUM CAP STAMPED "TEXAS DEPT OF TRANSPORTATION/ CONTROL MARK/ PD 103"

NOTES:

1. CONTROL POINTS LISTED HEREON WERE ESTABLISHED BY PAPE-DAWSON ENGINEERS IN SEPTEMBER 2022.

2. UNIT OF MEASUREMENT: U.S. SURVEY FEET.

3. ALL COORDINATES ARE SURFACE AND REFERENCED TO THE TEXAS COORDINATE SYSTEM, TEXAS CENTRAL ZONE (4203), NORTH AMERICAN DATUM OF 1983, 2011 ADJUSTMENT, EPOCH 2010.00, AND BASED ON DATA OBTAINED FROM THE NORTH*VRS*CMR SOLUTION IN THE TXDOT REAL TIME NETWORK (RTN).

4. COORDINATES MAY BE CONVERTED TO GRID BY USING THE TXDOT BOSQUE COUNTY SCALE FACTOR OF 1.00003.

5. VERTICAL VALUES ARE NAVD 88 BASED ON THE TxDOT REAL TIME GPS NETWORK (RTN) WITH THE GEOID 18 APPLIED.

6. THE EXISTING RIGHT OF WAY FOR FM 219 WERE PLACED APPROXIMATELY

PRINT DATE	REVISION DATE
2/23/2024	

STATE OF TEXAS
REGISTERED
MARCOS A. MADRID
6740
PROFESSIONAL
LAND SURVEYOR

PAPE-DAWSON ENGINEERS
DALLAS I SAN ANTONIO I AUSTIN I HOUSTON I FORT WORTH
6105 TENNYSON PKWY, STE 210 I PLANO, TX 75024 I 214.420.8494
TEXAS ENGINEERING FIRM #470 I TEXAS SURVEYING FIRM #10194390

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P.E. Structural Consultants
a Hardesty & Hanover, LLC Company
8436 Spicewood Springs Road
Austin, Texas 78759
(512) 250-5200
www.HardestyHanover.com
TBPELS Firm No. F-3379

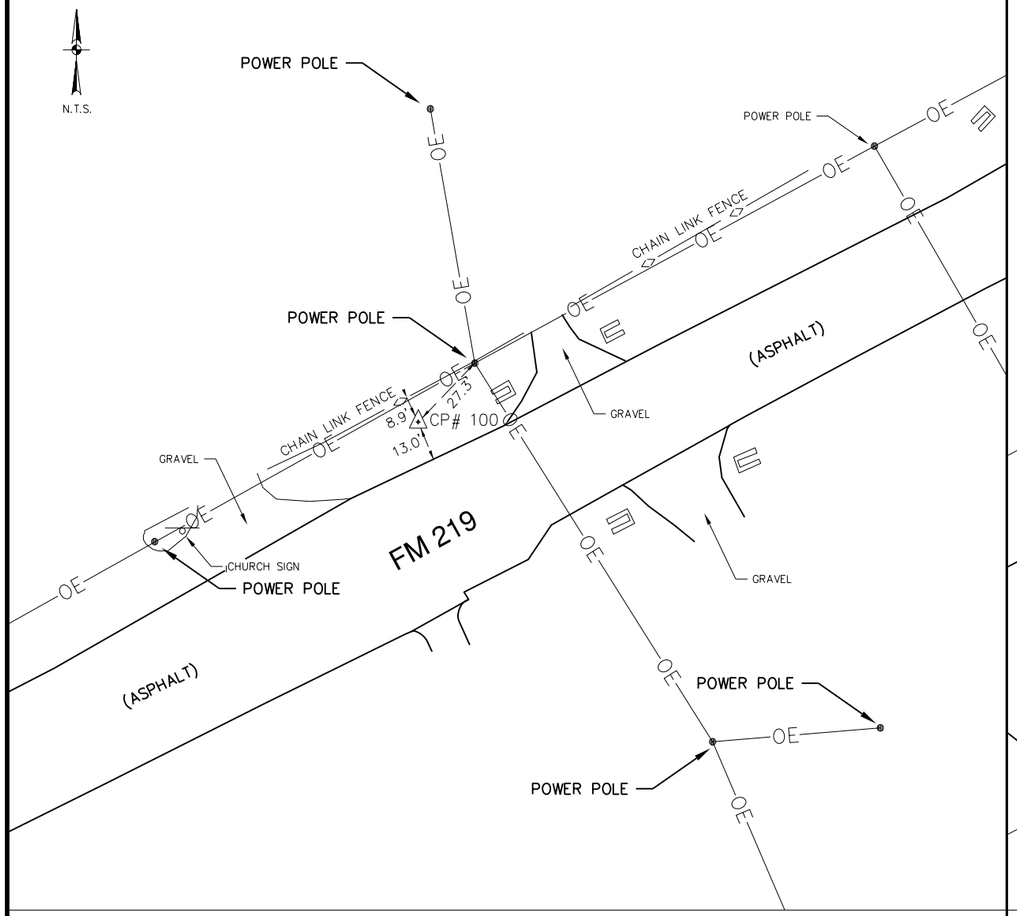
FM 219 BRIDGE REPLACEMENTS

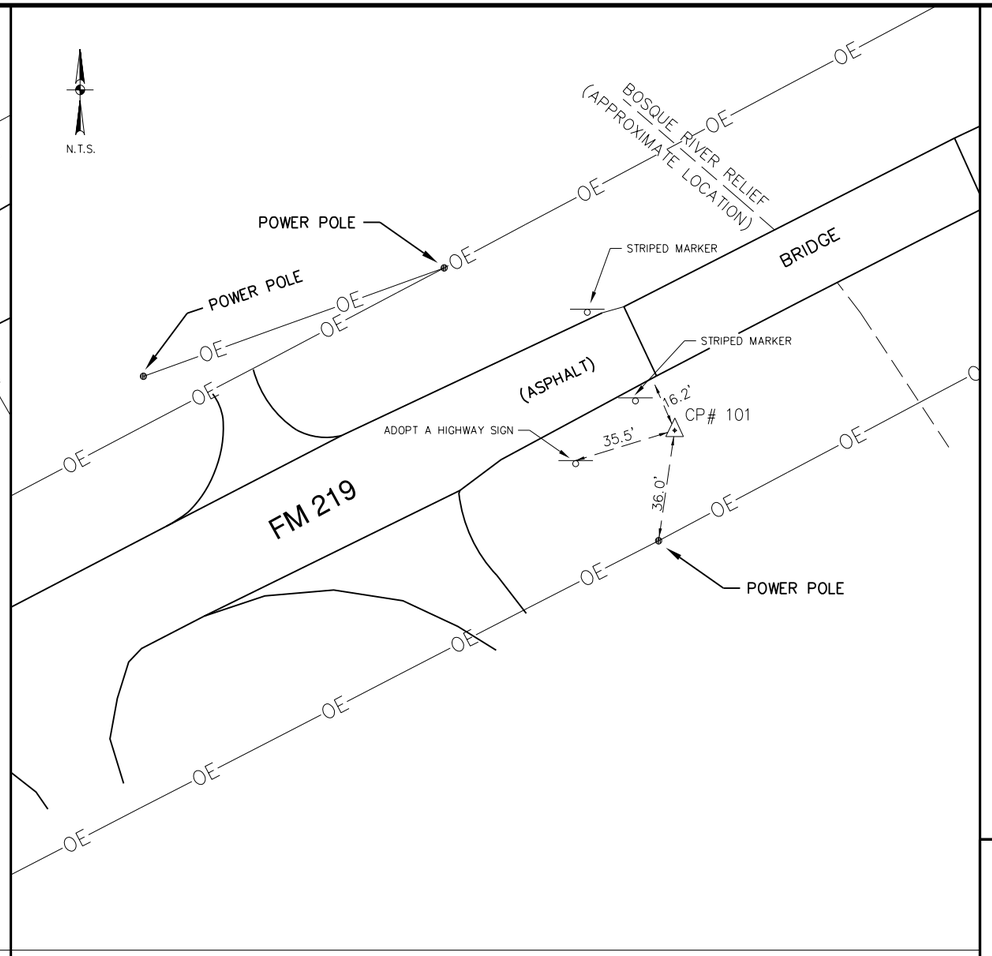
SURVEY CONTROL INDEX

SHEET 1 OF 1

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 31

CSI: 0724 02 020, ETC.
FILE LOCATION: ..\12207-01 BOSQUE CONTROL SHEET INDEX (1)





THE CONTROL POINTS SHOWN HEREON WERE ESTABLISHED BY A SURVEY MADE ON THE GROUND UNDER MY SUPERVISION.

STATE OF TEXAS
REGISTERED
MARCOS A. MADRID
6740
PROFESSIONAL
LAND SURVEYOR

PRINT DATE	REVISION DATE
2/23/2024	

MONUMENT NO. 100

APPROXIMATE LOCATION:

APPROXIMATELY 288 FEET NORTHEAST OF THE INTERSECTION OF AVENUE A AND FM 219, A 5/8" IRON ROD WITH A 3 1/4" ALUMINUM CAP MARKED "TEXAS DEPARTMENT OF TRANSPORTATION/ CONTROL MARK/ PD 100" SET ON THE NORTHWEST SIDE OF FM 219. WHICH IS APPROXIMATELY 27.3 FEET SOUTHEAST OF A POWER POLE AND APPROXIMATELY 13.0 FEET NORTHWEST, PERPENDICULAR ALONG THE NORTHWEST EDGE OF ASPHALT AND APPROXIMATELY 8.9 FEET SOUTHEAST OF A WIRE FENCE LINE PERPENDICULAR WITH FM 219.

US SURVEY FEET
NAVD 88 ELEVATION= 662.81
DATE SET: SEPTEMBER 20, 2022
MONUMENT: 3 1/4" ALUMINUM DISC STAMPED
"TEXAS DEPT OF TRANSPORTATION"/ "CONTROL MARK"/ "PD 100"
BOSQUE COUNTY SCALE FACTOR: 1.00003
SURFACE ENGLISH COORDS.
NORTHING: 10,623,821.68
EASTING: 3,154,900.37
STATE PLANE ENGLISH COORDS.
NORTHING: 10,623,502.98
EASTING: 3,154,805.72
ELEVATIONS ARE NAVD 88 BASED UPON
REAL TIME GPS NETWORK (RTN) WITH GEOID 18 APPLICATION, IN US SURVEY.

MONUMENT NO. 101

APPROXIMATE LOCATION:

APPROXIMATELY 1,061 FEET NORTHEAST OF THE INTERSECTION OF AVENUE A AND FM 219, A 5/8" IRON ROD WITH A 3 1/4" ALUMINUM CAP MARKED "TEXAS DEPARTMENT OF TRANSPORTATION/ CONTROL MARK/ PD 101" SET ON THE SOUTHEAST SIDE OF FM 219. WHICH IS APPROXIMATELY 36.0 FEET NORTHEAST OF A POWER POLE AND APPROXIMATELY 16.2 FEET NORTHWEST, TO THE FACE OF THE BRIDGE AND APPROXIMATELY 35.5 FEET EAST OF A "ADOPT A HIGHWAY" SIGN ALONG THE SOUTHEAST EDGE OF FM 219.

US SURVEY FEET
NAVD 88 ELEVATION= 638.12
DATE SET: SEPTEMBER 20, 2022
MONUMENT: 3 1/4" ALUMINUM DISC STAMPED
"TEXAS DEPT OF TRANSPORTATION"/ "CONTROL MARK"/ "PD 101"
BOSQUE COUNTY SCALE FACTOR: 1.00003
SURFACE ENGLISH COORDS.
NORTHING: 10,624,104.06
EASTING: 3,155,629.97
STATE PLANE ENGLISH COORDS.
NORTHING: 10,623,785.34
EASTING: 3,155,535.31
ELEVATIONS ARE NAVD 88 BASED UPON
REAL TIME GPS NETWORK (RTN) WITH GEOID 18 APPLICATION, IN US SURVEY.

PAPE-DAWSON ENGINEERS
DALLAS I SAN ANTONIO I AUSTIN I HOUSTON I FORT WORTH
6105 TENNYSON PKWY, STE 210 I PLANO, TX 75024 I 214.420.8494
TEXAS ENGINEERING FIRM #470 I TEXAS SURVEYING FIRM #10194390

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P.E. Structural Consultants
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www.HardestyHanover.com
TBPELS Firm No. F-3379

FM 219 BRIDGE REPLACEMENTS

HORIZONTAL & VERTICAL SURVEY CONTROLS

SHEET 1 OF 2

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219

STATE	DISTRICT	COUNTY	
TEXAS	WACO	BOSQUE	
CONTROL	SECTION	JOB	SHEET NO.
0724	02	020, ETC.	32

CSI: 0724 02 020, ETC.
FILE LOCATION: ...\CONTROL SHEETS 100-103.dgn

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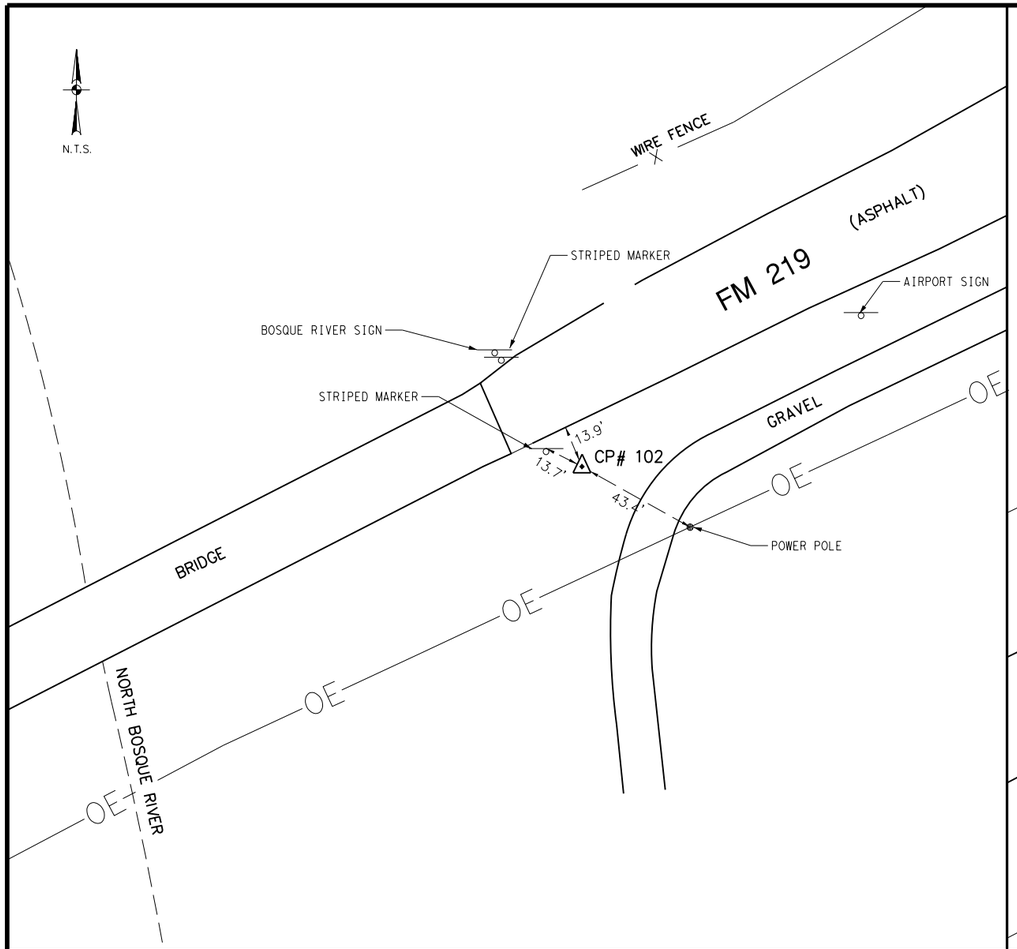

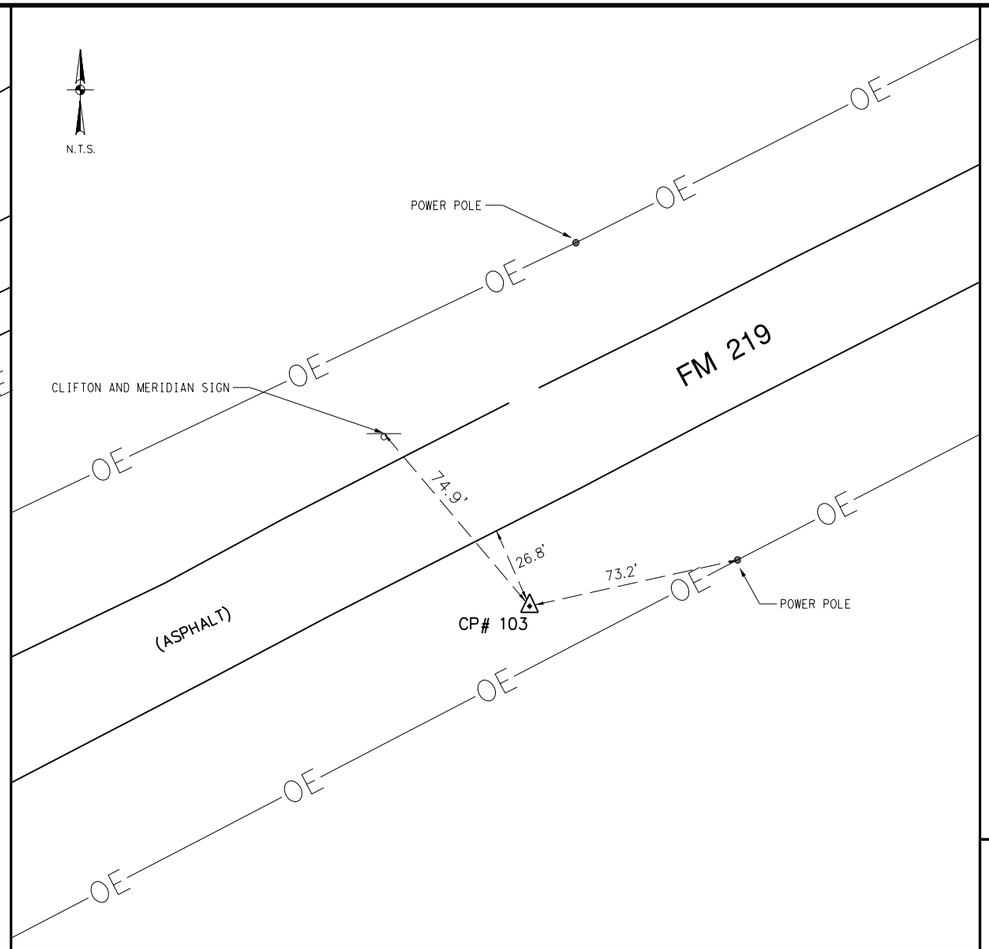

MONUMENT NO. 102

APPROXIMATE LOCATION:

APPROXIMATELY 520 FEET SOUTHWEST OF THE INTERSECTION OF FM 1991 AND FM 219, A 5/8" IRON ROD WITH A 3 1/4" ALUMINUM CAP MARKED "TEXAS DEPARTMENT OF TRANSPORTATION/ CONTROL MARK/ PD 102" SET ON THE SOUTHEAST SIDE OF FM 219. WHICH IS APPROXIMATELY 43.4 FEET NORTHWEST OF A POWER POLE AND APPROXIMATELY 13.9 FEET SOUTHEAST, PERPENDICULAR ALONG THE SOUTHEAST EDGE OF ASPHALT AND APPROXIMATELY 13.7 FEET SOUTHEAST OF A FLASHER SIGN ALONG THE SOUTHEAST SIDE OF FM 219.

US SURVEY FEET
NAVD 88 ELEVATION= 639.64
DATE SET: SEPTEMBER 20, 2022
MONUMENT: 3 1/4" ALUMINUM DISC STAMPED
"TEXAS DEPT OF TRANSPORTATION"/ "CONTROL MARK"/ "PD 102"
BOSQUE COUNTY SCALE FACTOR: 1.00003
SURFACE ENGLISH COORDS.
NORTHING: 10,624,376.64
EASTING: 3,156,187.97
STATE PLANE ENGLISH COORDS.
NORTHING: 10,624,057.92
EASTING: 3,156,093.28
ELEVATIONS ARE NAVD 88 BASED UPON
REAL TIME GPS NETWORK (RTN) WITH GEOID 18 APPLICATION, IN US SURVEY.

MONUMENT NO. 103

APPROXIMATE LOCATION:

APPROXIMATELY 634 FEET NORTHEAST OF THE INTERSECTION OF FM 1991 AND FM 219, A 5/8" IRON ROD WITH A 3 1/4" ALUMINUM CAP MARKED "TEXAS DEPARTMENT OF TRANSPORTATION/ CONTROL MARK/ PD 103" SET ON THE SOUTHEAST SIDE OF FM 219. WHICH IS APPROXIMATELY 74.9 FEET SOUTHEAST OF A CLIFTON AND MERIDIAN SIGN AND APPROXIMATELY 26.8" FEET SOUTHEAST, PERPENDICULAR ALONG THE SOUTHEAST EDGE OF ASPHALT AND APPROXIMATELY 73.2 FEET WEST OF A POWER POLE ALONG A POWER LINE RUNNING PARALLEL WITH THE SOUTHEAST SIDE OF FM 219.

US SURVEY FEET
NAVD 88 ELEVATION= 637.16
DATE SET: SEPTEMBER 20, 2022
MONUMENT: 3 1/4" ALUMINUM DISC STAMPED
"TEXAS DEPT OF TRANSPORTATION"/ "CONTROL MARK"/ "PD 103"
BOSQUE COUNTY SCALE FACTOR: 1.00003
SURFACE ENGLISH COORDS.
NORTHING: 10,624,861.13
EASTING: 3,157,236.80
STATE PLANE ENGLISH COORDS.
NORTHING: 10,624,542.40
EASTING: 3,157,142.09
ELEVATIONS ARE NAVD 88 BASED UPON
REAL TIME GPS NETWORK (RTN) WITH GEOID 18 APPLICATION, IN US SURVEY.

THE CONTROL POINTS SHOWN HEREON WERE ESTABLISHED BY A SURVEY MADE ON THE GROUND UNDER MY SUPERVISION.

STATE OF TEXAS
REGISTERED
MARCOS A. MADRID
6740
PROFESSIONAL
LAND SURVEYOR

PRINT DATE	REVISION DATE
2/23/2024	

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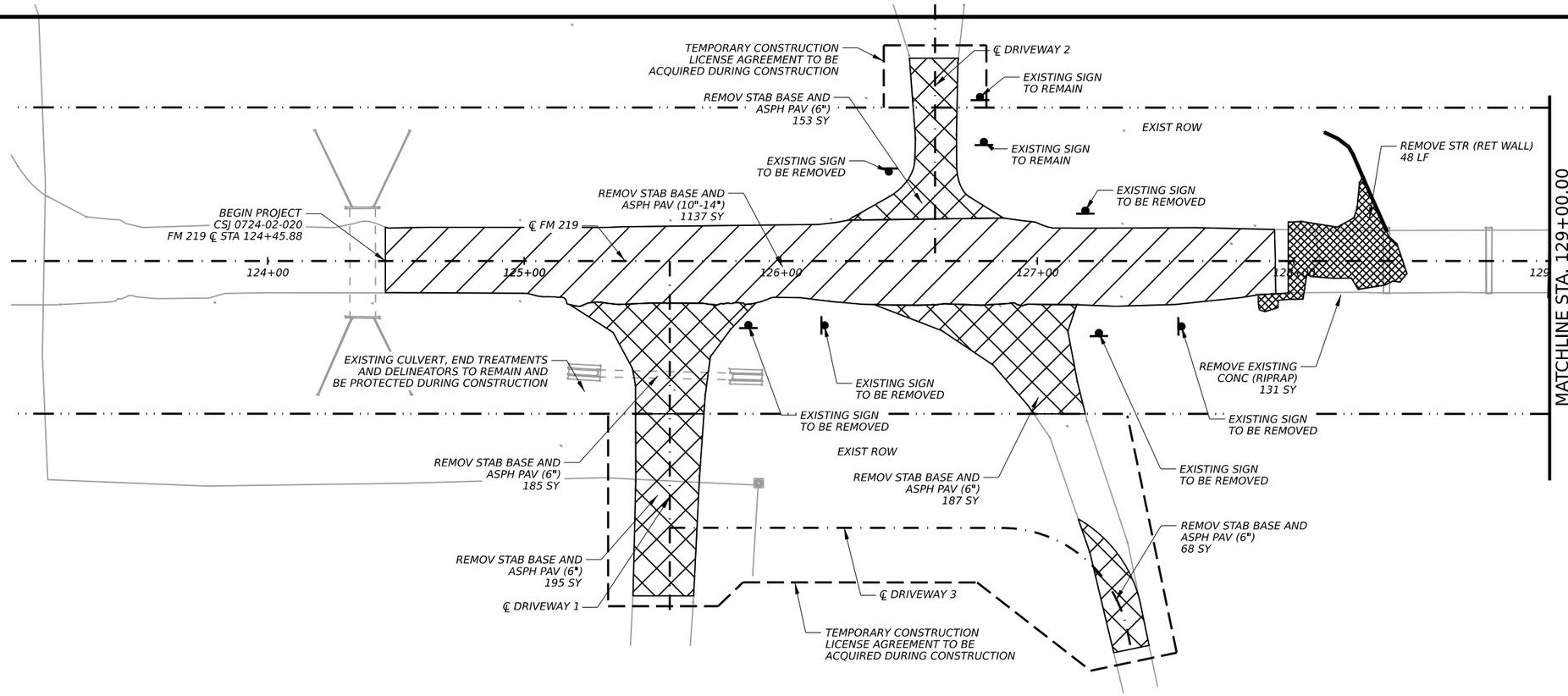
FM 219 BRIDGE REPLACEMENTS

HORIZONTAL & VERTICAL SURVEY CONTROLS

SHEET 2 OF 2

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219

STATE	DISTRICT	COUNTY	
TEXAS	WACO	BOSQUE	
CONTROL	SECTION	JOB	SHEET NO.
0724	02	020, ETC.	33



PRINT DATE	REVISION DATE
3/1/2024	

STATE OF TEXAS
CRAIG M. WILSON
94710
LICENSED PROFESSIONAL ENGINEER
3/1/2024

AMERICAN STRUCTUREPOINT INC.
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www.structurepointLom
TBPELS FIRM NO. F-10069

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Texas Department of Transportation
Waco District

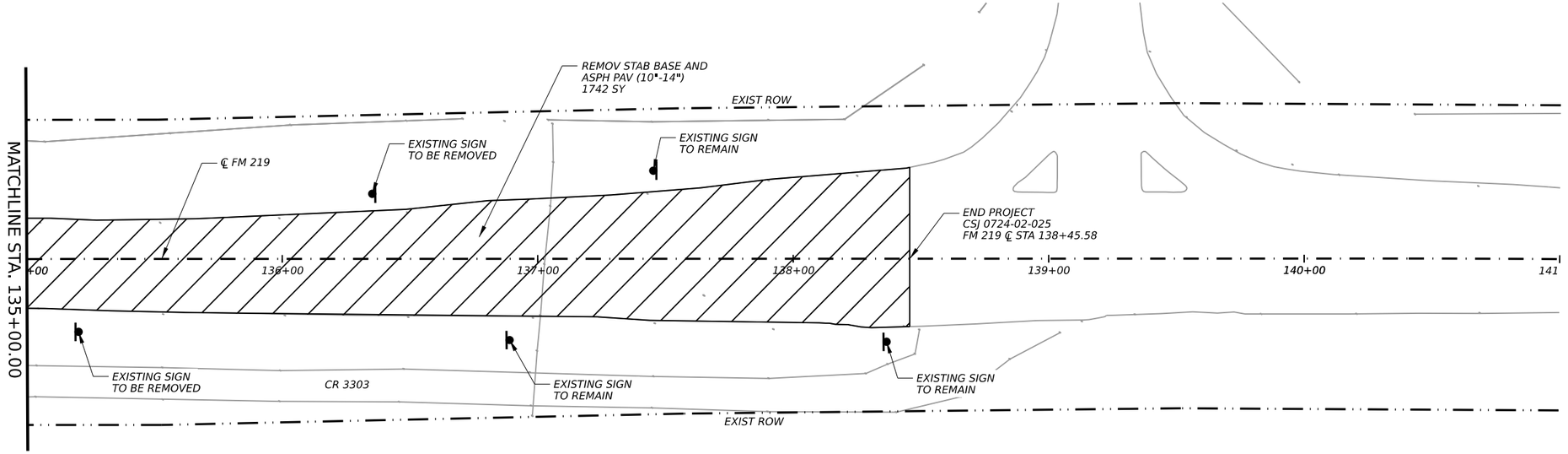
FM 219 BRIDGE REPLACEMENTS

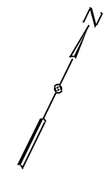
REMOVAL PLAN

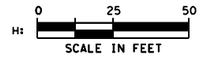
SHEET 1 OF 2

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 34

CSJ: 0724 02 020, ETC.
FILE LOCATION: ...\2022.05759.06.RD.REM.01.dgn







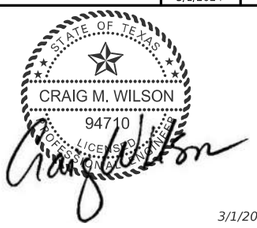
LEGEND:

- REMOVAL OF STAB BASE & ASPH PAV (10"-14")
- REMOVAL OF STAB BASE & ASPH PAV (6")
- REMOVING CONC (RIPRAP)
- EXISTING SIGN

NOTES:

1. ANY ITEMS REQUIRED TO BE REMOVED BUT NOT SHOWN, ARE RESPONSABILITY OF THE CONTRACTOR AND SHALL BESUBSIDIARY TO ITEM 100-6002 PREP ROW.
2. REMOVAL OF EXISTING DRIVEWAYS IS PAID UNDER ITEM 105-6008.
3. DRIVEWAY ACCESS SHOULD BE MAINTAINED AT ALL TIMES DURING CONSTRUCTION.
4. THE THICKNESS OF THE REMOVAL OF STAB BASE & ASPH PAV IS ASSUMED TO TO BE (10"-14") FOR THE MAIN ROAD.
5. THE THICKNESS OF THE REMOVAL OF STAB BASE & ASPH PAV IS ASSUMED TO TO BE (6") FOR THE DRIVEWAYS.
6. DISPOSE OF REMOVED MATERIAL IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL REGULATIONS.

PRINT DATE	REVISION DATE
3/1/2024	



3/1/2024

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Texas Department of Transportation
Waco District

FM 219 BRIDGE REPLACEMENTS

REMOVAL PLAN

SHEET 2 OF 2

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 35

CSJ: 0724 02 020, ETC.
FILE LOCATION: ...\2022.05759.06.RD.REM.02.dgn

℄ FM 219

Alignment name: CL_FM219_01
Alignment description:
Report Created: Friday, January 13, 2023
Time: 10:37:27 AM

	STATION	X	Y
POT	123+00.00 R1	3155173.3837	10623920.5322
PC	129+63.44 R1	3155771.9938	10624206.5571
Tangential Direction:	N64°27'39.01"E		
Tangential Length:	663.43		
PC	129+63.44 R1	3155771.9938	10624206.5571
PI	130+13.30 R1	3155816.9847	10624228.0544
CC		3152379.0167	10631307.5856
PT	130+63.16 R1	3155861.6995	10624250.1200
Radius:	7870.00		
Delta:	00°43'33.7" Left		
Degree of Curvature(Arc):	00°43'40.9"		
Length:	99.72		
Tangent:	49.86		
Chord:	99.72		
Middle Ordinate:	0.16		
External:	0.16		
Tangent Back Direction:	N64°27'39.01"E		
Radial Direction:	S25°32'20.99"E		
Chord Direction:	N64°05'52.17"E		
Radial Direction:	S26°15'54.67"E		
Tangent Ahead Direction:	N63°44'05.33"E		
PT	130+63.16 R1	3155861.6995	10624250.1200
PC	134+36.95 R1	3156196.8989	10624415.5325
Tangential Direction:	N63°44'05.33"E		
Tangential Length:	373.79		
PC	134+36.95 R1	3156196.8989	10624415.5325
PI	134+86.82 R1	3156241.6138	10624437.5982
CC		3159679.5818	10617358.0670
PT	135+36.68 R1	3156286.6046	10624459.0955
Radius:	7870.00		
Delta:	00°43'33.7" Right		
Degree of Curvature(Arc):	00°43'40.9"		
Length:	99.72		
Tangent:	49.86		
Chord:	99.72		
Middle Ordinate:	0.16		
External:	0.16		
Tangent Back Direction:	N63°44'05.33"E		
Radial Direction:	S26°15'54.67"E		
Chord Direction:	N64°05'52.17"E		
Radial Direction:	S25°32'20.99"E		
Tangent Ahead Direction:	N64°27'39.01"E		
PT	135+36.68 R1	3156286.6046	10624459.0955
PC	140+40.89 R1	3156741.5531	10624676.4766
Tangential Direction:	N64°27'39.01"E		
Tangential Length:	504.21		
PC	140+40.89 R1	3156741.5531	10624676.4766
PI	140+94.13 R1	3156789.5886	10624699.4287
CC		3160134.5302	10617575.4481
PT	141+47.37 R1	3156837.9302	10624721.7288
Radius:	7870.00		
Delta:	00°46'30.5" Right		
Degree of Curvature(Arc):	00°43'40.9"		
Length:	106.47		
Tangent:	53.24		
Chord:	106.47		
Middle Ordinate:	0.18		
External:	0.18		
Tangent Back Direction:	N64°27'39.01"E		
Radial Direction:	S25°32'20.99"E		
Chord Direction:	N64°50'54.28"E		
Radial Direction:	S24°45'50.45"E		
Tangent Ahead Direction:	N65°14'09.55"E		
PT	141+47.37 R1	3156837.9302	10624721.7288
PC	142+81.73 R1	3156959.9391	10624778.0119
Tangential Direction:	N65°14'09.55"E		
Tangential Length:	134.37		

℄ FM 219 (CONTINUED)

	STATION	X	Y
PC	142+81.73 R1	3156959.9391	10624778.0119
PI	143+46.15 R1	3157018.4340	10624804.9958
CC		3153663.3391	10631924.2926
PT	144+10.57 R1	3157076.4793	10624832.9335
Radius:	7870.00		
Delta:	00°56'16.6" Left		
Degree of Curvature(Arc):	00°43'40.9"		
Length:	128.83		
Tangent:	64.42		
Chord:	128.83		
Middle Ordinate:	0.26		
External:	0.26		
Tangent Back Direction:	N65°14'09.55"E		
Radial Direction:	S24°45'50.45"E		
Chord Direction:	N64°46'01.24"E		
Radial Direction:	S25°42'07.08"E		
Tangent Ahead Direction:	N64°17'52.92"E		
PT	144+10.57 R1	3157076.4793	10624832.9335
POT	144+60.57 R1	3157121.5324	10624854.6180
Tangential Direction:	N64°17'52.92"E		
Tangential Length:	50.00		

℄ DRIVEWAY 1

Alignment name: DR_1
Alignment description:
Report Created: Friday, August 18, 2023
Time: 12:52:38 PM

	STATION	X	Y
POT	0+00.000 R1	3155405.021	10624031.212
POT	1+39.182 R1	3155465.026	10623905.630
Tangential Direction:	S25.539?E		
Tangential Length:	139.182		

℄ DRIVEWAY 2

Alignment name: DR_2
Alignment description:
Report Created: Wednesday, April 5, 2023
Time: 3:17:57 PM

	STATION	X	Y
POT	0+00.00 R1	3155455.2200	10624166.0268
POT	1+00.00 R1	3155498.3328	10624075.7977
Tangential Direction:	S25°32'20.99"E		
Tangential Length:	100.00		

℄ DRIVEWAY 3

Alignment name: DR_3
Alignment description:
Report Created: Friday, November 10, 2023
Time: 2:02:49 PM

	STATION	X	Y
POT	1+00.00 R1	3155449.849	10623937.395
PC	2+29.32 R1	3155566.555	10623993.101
Tangential Direction:	N64.48°E		
Tangential Length:	129.32		
PC	2+29.32 R1	3155566.555	10623993.101
PI	2+69.94 R1	3155603.216	10624010.601
CC		3155588.093	10623947.978
PT	2+97.55 R1	3155627.851	10623978.299
Radius:	50.0		
Delta:	78.1°Right		
Degree of Curvature(Arc):	114.5°		
Length:	68.23		
Tangent:	40.62		
Chord:	63.05		
Middle Ordinate:	11.19		
External:	14.42		
Tangent Back Direction:	N64.48°E		
Radial Direction:	S25.51°E		
Chord Direction:	S76.42°E		
Radial Direction:	S52.67°W		
Tangent Ahead Direction:	S37.33°E		

℄ DRIVEWAY 3 (CONTINUED)

	STATION	X	Y
PT	2+97.55 R1	3155627.851	10623978.299
POT	3+05.15 R1	3155632.462	10623972.253
Tangential Direction:	S37.33°E		
Tangential Length:	7.60		

PRINT DATE	REVISION DATE
3/1/2024	

STATE OF TEXAS
CRAIG M. WILSON
94710
LICENSED PROFESSIONAL ENGINEER
3/1/2024

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TBPELS Firm No. F-3379

Texas Department of Transportation
Waco District

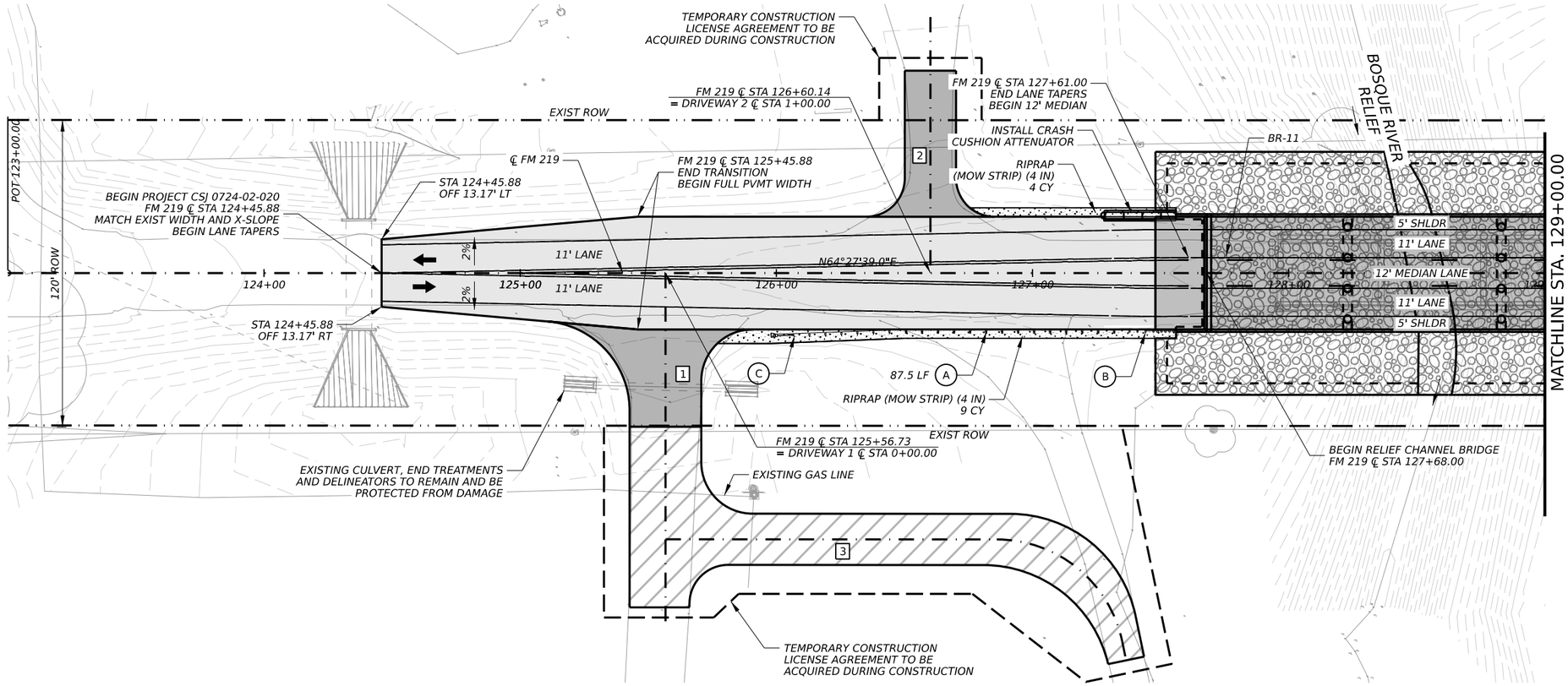
FM 219 BRIDGE REPLACEMENTS

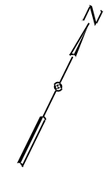
HORIZONTAL ALIGNMENT DATA

SHEET 1 OF 1

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 36

CSJ: 0724 02 020, ETC.
FILE LOCATION: ...\2022.05759.06.RD.HAD.01.dgn





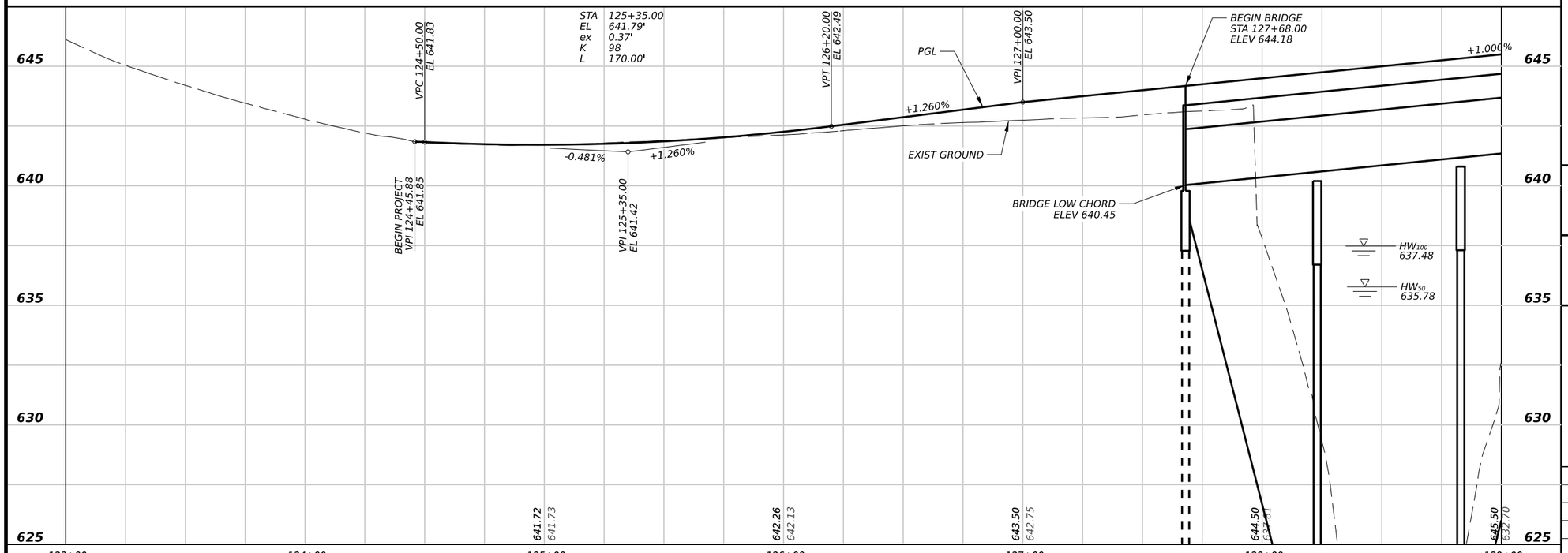
0 25 50
H: SCALE IN FEET
0 2.5 5
V: SCALE IN FEET

LEGEND:

- PROPOSED ROAD
- PROPOSED BRIDGE
- PROPOSED DRIVEWAY
- RIPRAP (MOWSTRIP)(4IN)
- RIPRAP (STONE PROTECTION)
- CONSTRUCTION OUTSIDE OF ROW
- # PROPOSED DRIVEWAY
- (A) MTL W-BEAM GD FEN (STL POST)
- (B) MTL BEAM GF TRANS (THRIE-BEAM)
- (C) INSTALL GUARDRAIL END TREATMENT

NOTES:

1. REFER TO GRADING PLANS FOR MORE DETAILS.



CSJ: 0724 02 020, ETC.
FILE LOCATION: ...\Sheets\2022.05759.06.RD.PP.01

PRINT DATE	REVISION DATE
3/1/2024	

STATE OF TEXAS
CRAIG M. WILSON
94710
LICENSED PROFESSIONAL ENGINEER
3/1/2024

AMERICAN STRUCTUREPOINT INC.
3711 SOUTH MOPAC EXPRESSWAY
BUILDING ONE, SUITE 350
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TBPELS FIRM NO. F-10069

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9020 N. Capital of Texas Hwy.
Bldg 2, Suite 250
Austin, Texas 78759
(512) 250-5200
www.HardestyHanover.com
TBPELS Firm No. F-3379

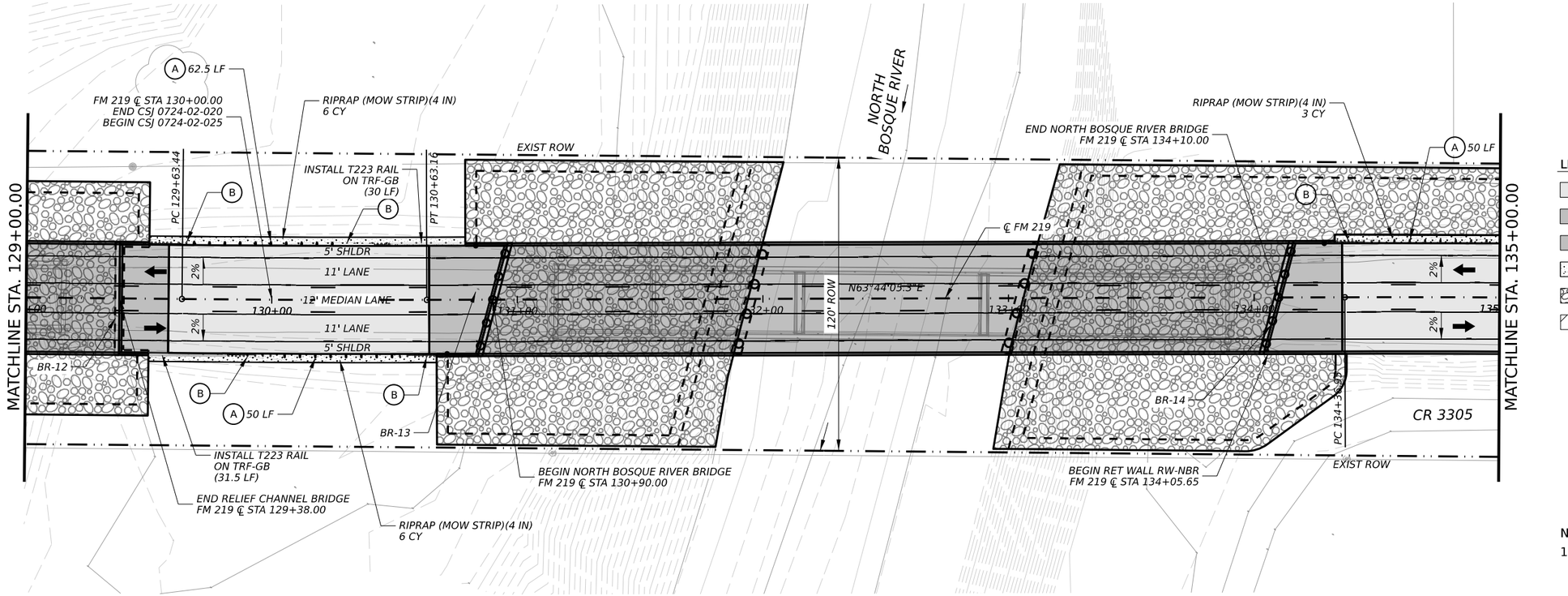
Texas Department of Transportation
Waco District

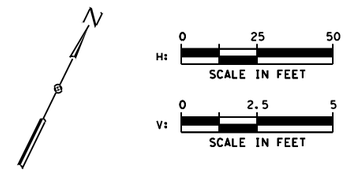
FM 219 BRIDGE REPLACEMENTS

FM 219
PLAN & PROFILE
BEGIN TO STA 129+00

SHEET 1 OF 3

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 37



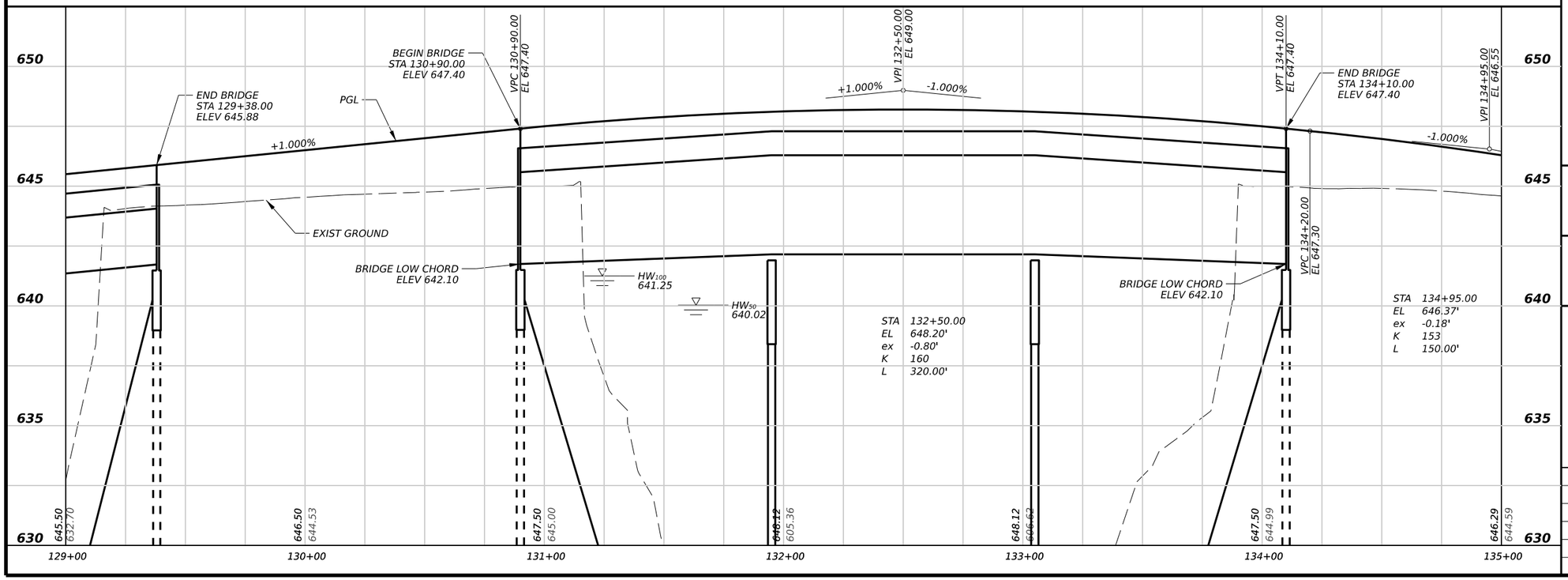


LEGEND:

- PROPOSED ROAD
- PROPOSED BRIDGE
- PROPOSED DRIVEWAY
- RIPRAP (MOWSTRIP)(4IN)
- RIPRAP (STONE PROTECTION)
- CONSTRUCTION OUTSIDE OF ROW
- (#) PROPOSED DRIVEWAY
- (A) MTL W-BEAM GD FEN (STL POST)
- (B) MTL BEAM GF TRANS (THRIE-BEAM)
- (C) INSTALL GUARDRAIL END TREATMENT

NOTES:

1. REFER TO GRADING PLANS FOR MORE DETAILS.



PRINT DATE	REVISION DATE
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Texas Department of Transportation
Waco District

FM 219 BRIDGE REPLACEMENTS

FM 219
PLAN & PROFILE
STA 129+00 TO STA 135+00

SHEET 2 OF 3

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 38

CSJ: 0724 02 020, ETC.
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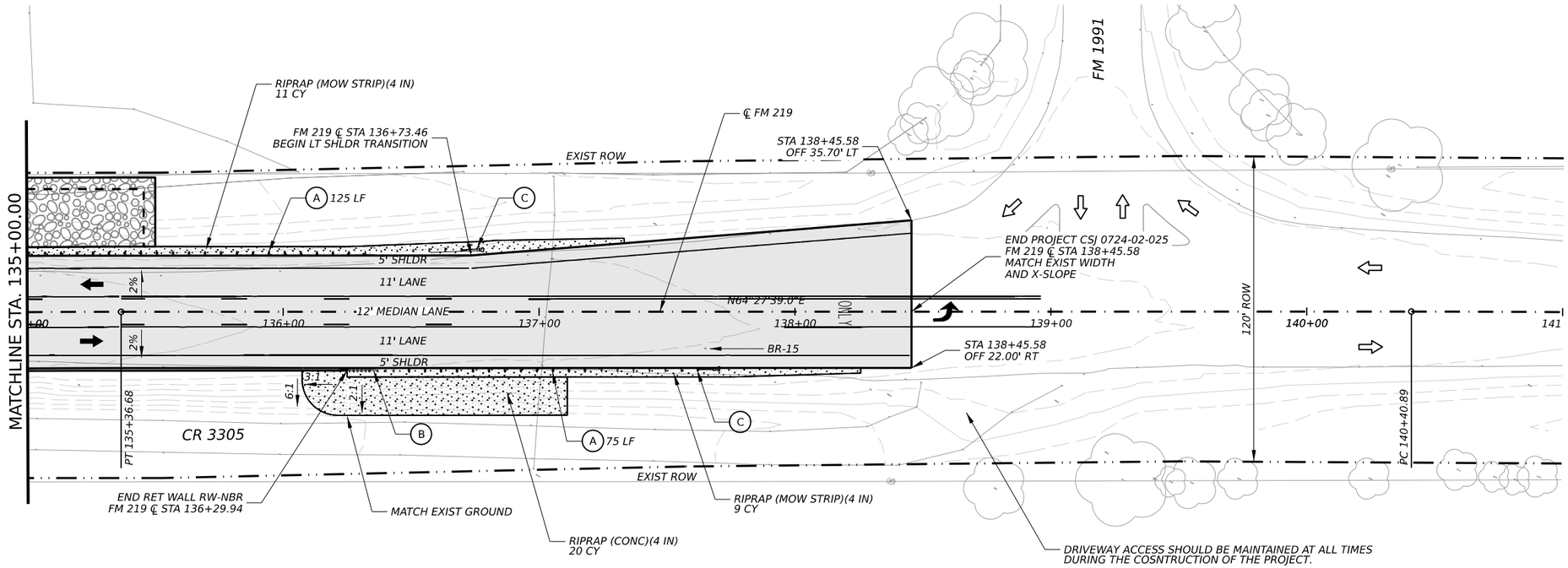

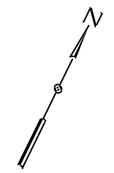

H: 0 25 50 SCALE IN FEET

V: 0 2.5 5 SCALE IN FEET

LEGEND:

- PROPOSED ROAD
- PROPOSED BRIDGE
- PROPOSED DRIVEWAY
- RIPRAP (MOWSTRIP)(4IN)
- RIPRAP (STONE PROTECTION)
- CONSTRUCTION OUTSIDE OF ROW
- [#] PROPOSED DRIVEWAY
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NOTES:

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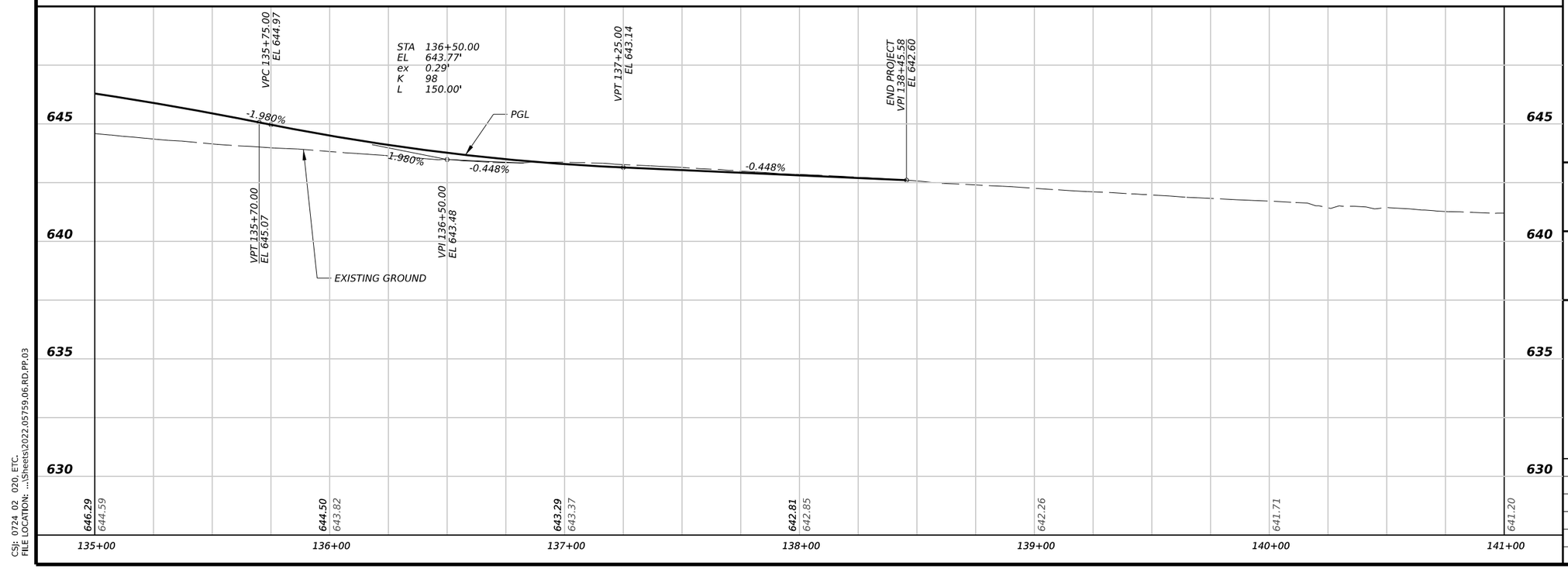

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Texas Department of Transportation
Waco District

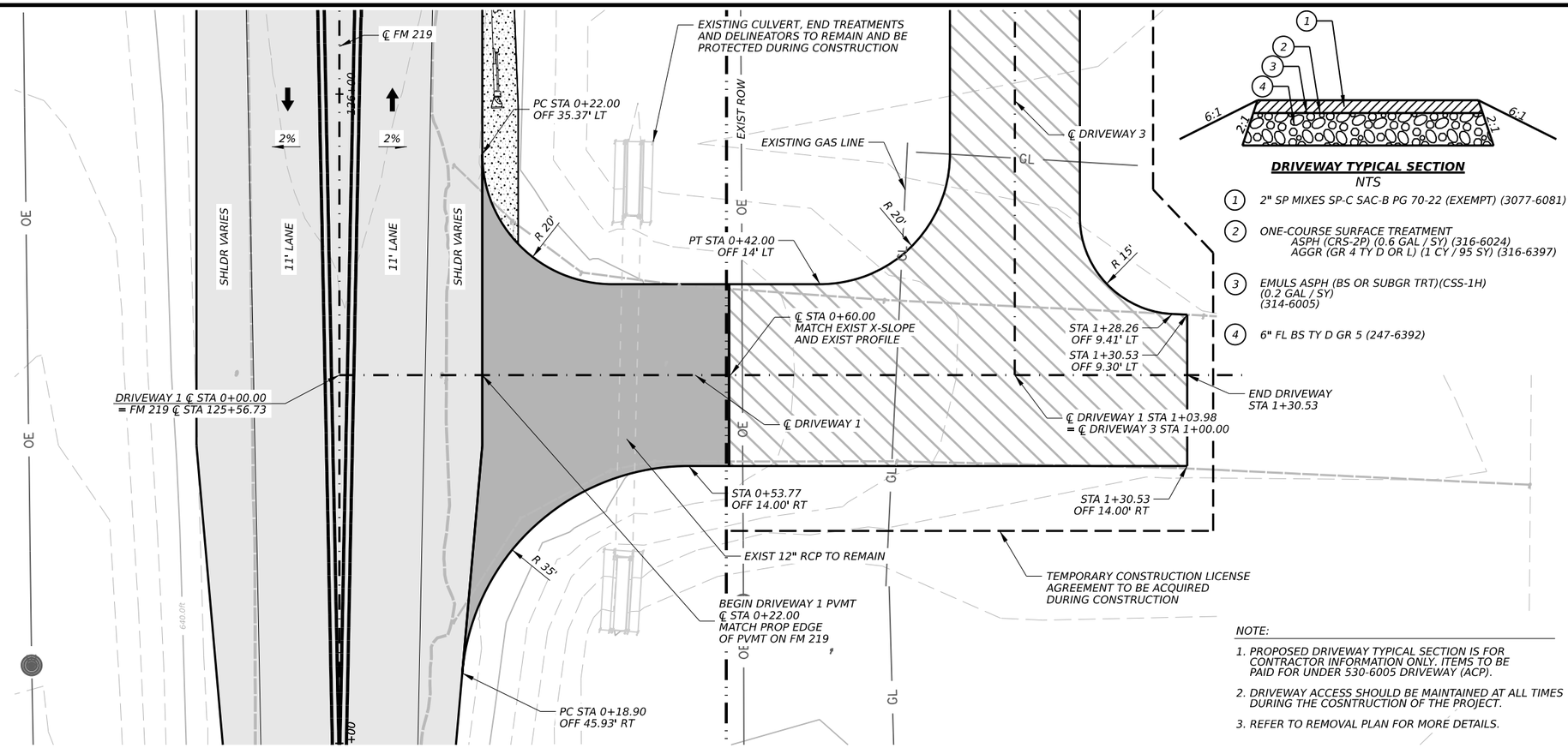
FM 219 BRIDGE REPLACEMENTS

FM 219
PLAN & PROFILE
STA 135+00 TO END

SHEET 3 OF 3

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 39

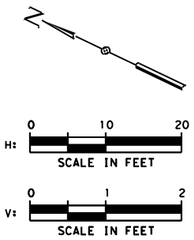
CSJ: 0724 02 020, ETC.
FILE LOCATION: ...\Sheets\2022.05759.06.RD.PP.03



DRIVEWAY TYPICAL SECTION

NTS

1. 2" SP MIXES SP-C SAC-B PG 70-22 (EXEMPT) (3077-6081)
2. ONE-COURSE SURFACE TREATMENT
   ASPH (CRS-2P) (0.6 GAL / SY) (316-6024)
   AGGR (GR 4 TY D OR L) (1 CY / 95 SY) (316-6397)
3. EMULS ASPH (BS OR SUBGR TRT)(CSS-1H) (0.2 GAL / SY) (314-6005)
4. 6" FL BS TY D GR 5 (247-6392)

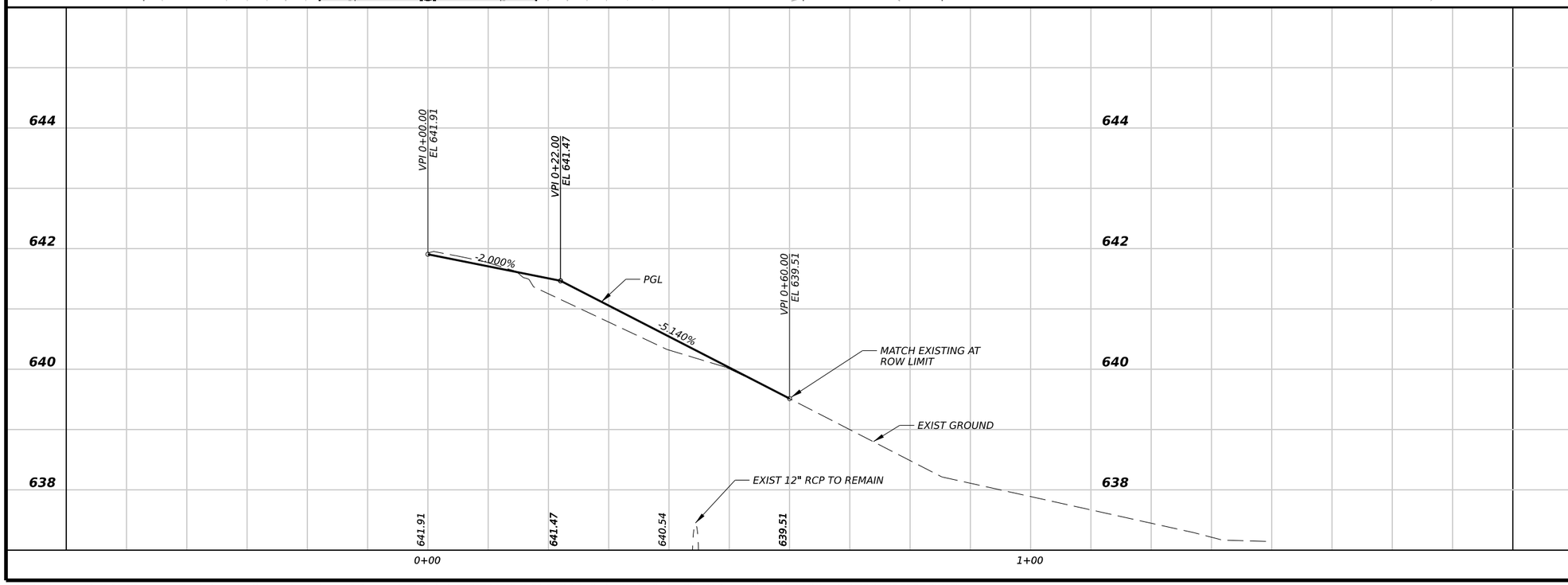


LEGEND:

- PROPOSED ROAD
- PROPOSED BRIDGE
- PROPOSED DRIVEWAY
- RIPRAP (MOWSTRIP)(4IN)
- RIPRAP (STONE PROTECTION)
- CONSTRUCTION OUTSIDE OF ROW
- # PROPOSED DRIVEWAY
- A MTL W-BEAM GD FEN (STL POST)
- B MTL BEAM GF TRANS (THRIE-BEAM)
- C INSTALL GUARDRAIL END TREATMENT

NOTE:

1. PROPOSED DRIVEWAY TYPICAL SECTION IS FOR CONTRACTOR INFORMATION ONLY. ITEMS TO BE PAID FOR UNDER 530-6005 DRIVEWAY (ACP).
2. DRIVEWAY ACCESS SHOULD BE MAINTAINED AT ALL TIMES DURING THE COSNTRUCTION OF THE PROJECT.
3. REFER TO REMOVAL PLAN FOR MORE DETAILS.



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FM 219 BRIDGE REPLACEMENTS

DRIVEWAY 1 PLAN & PROFILE

SHEET 1 OF 1

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219

STATE	DISTRICT	COUNTY	
TEXAS	WACO	BOSQUE	
CONTROL	SECTION	JOB	SHEET NO.
0724	02	020, ETC.	40

CSJ: 0724 02 020, ETC.
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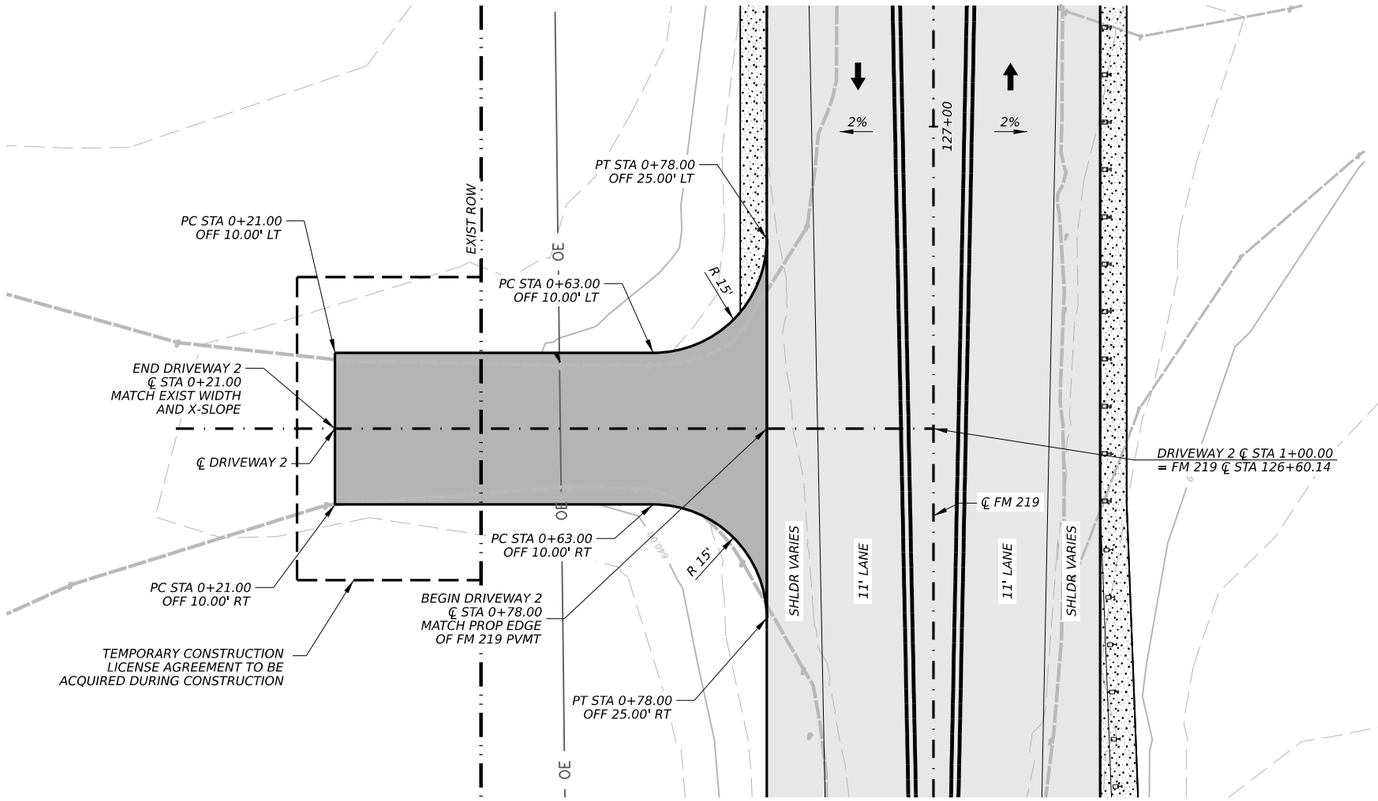

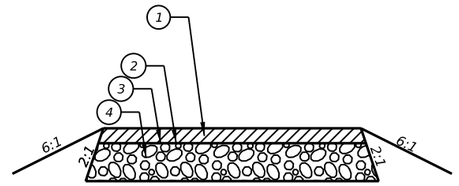

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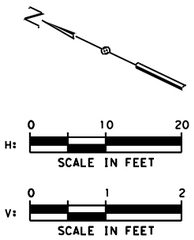

LEGEND:

- PROPOSED ROAD
- PROPOSED BRIDGE
- PROPOSED DRIVEWAY
- RIPRAP (MOWSTRIP)(4IN)
- RIPRAP (STONE PROTECTION)
- CONSTRUCTION OUTSIDE OF ROW
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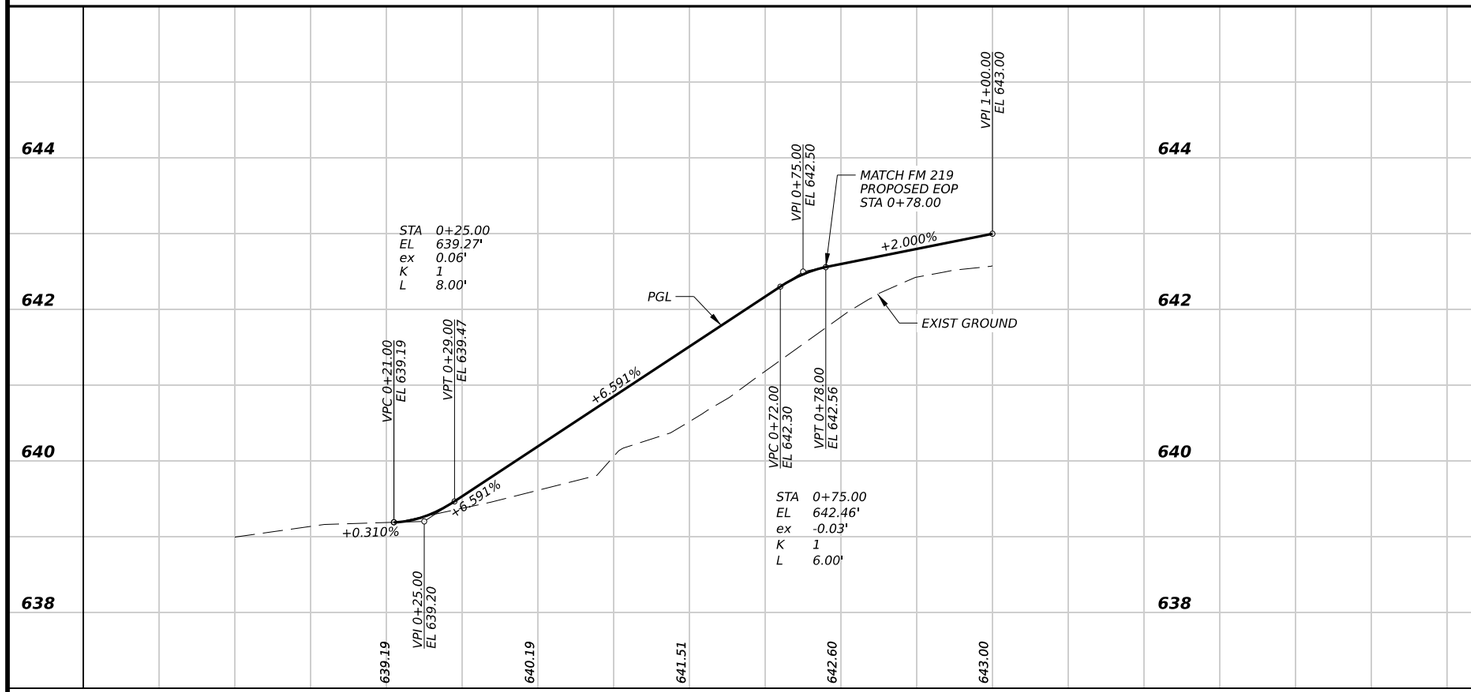

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3/1/2024	

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Texas Department of Transportation
Waco District

FM 219 BRIDGE REPLACEMENTS

DRIVEWAY 2 PLAN & PROFILE

SHEET 1 OF 1

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 41

CSJ: 0724 02 020, ETC.
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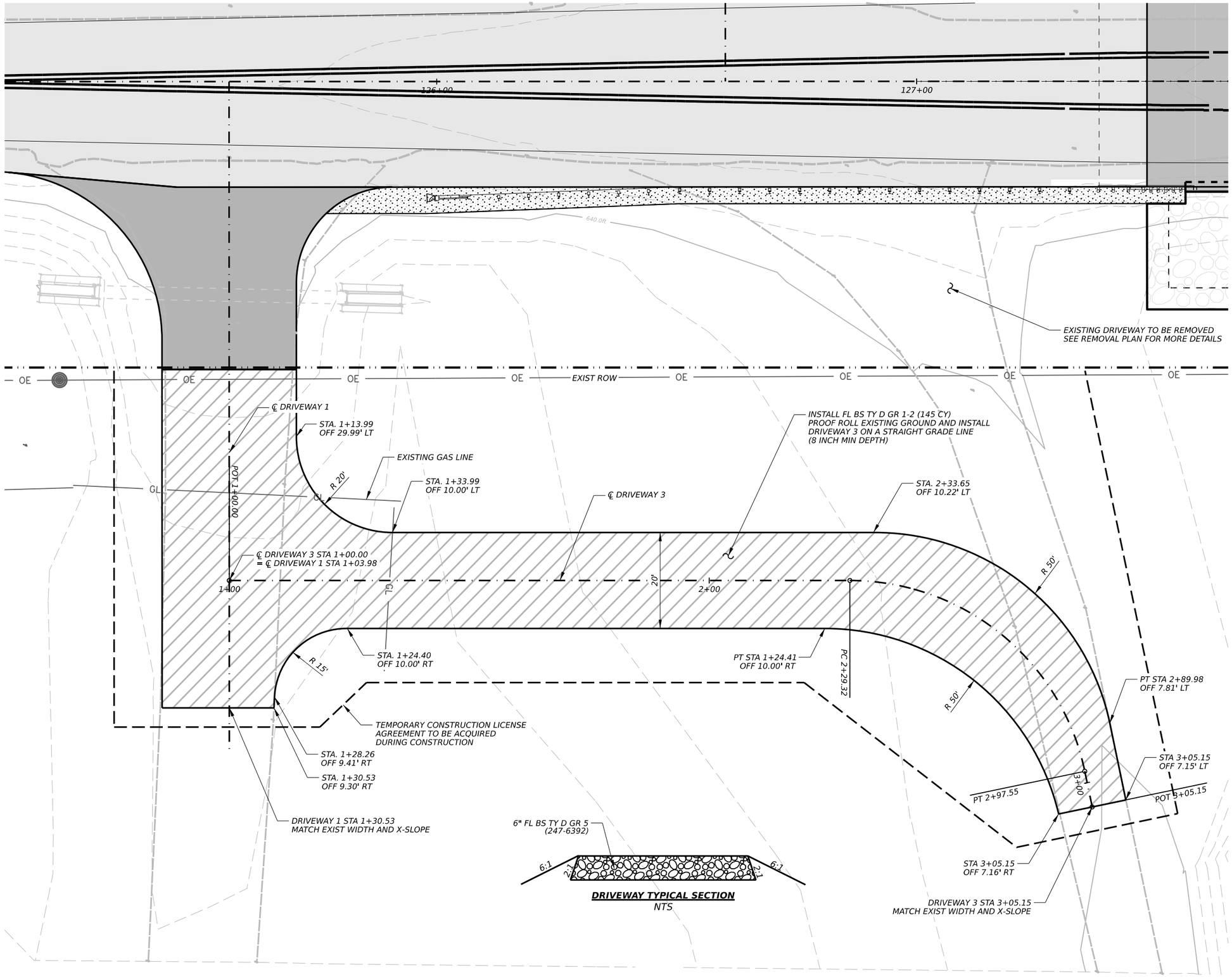

LEGEND:

- PROPOSED ROAD
- PROPOSED BRIDGE
- PROPOSED DRIVEWAY
- RIPRAP (MOWSTRIP)(4IN)
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- CONSTRUCTION OUTSIDE OF ROW
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FM 219 BRIDGE REPLACEMENTS

DRIVEWAY 3 PLAN

SHEET 1 OF 1

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 42

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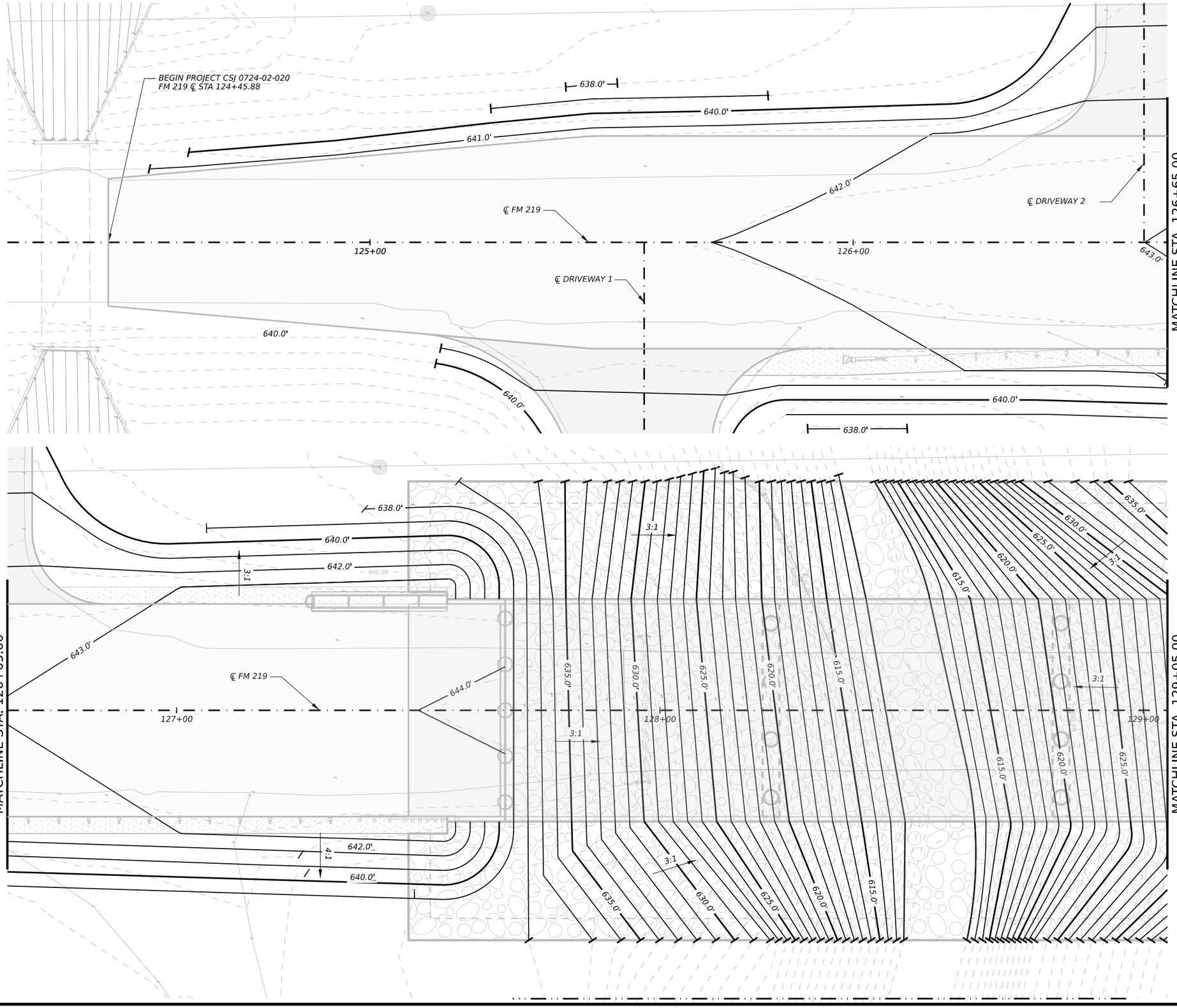

0 10 20
SCALE IN FEET

LEGEND

- *EXIST CONTOURS*
- *PROP CONTOURS*

NOTE

1. *CONTOURS REPRESENTING THE SURFACE OF THE BRIDGE DECK ARE NOT SHOWN.*

PRINT DATE	REVISION DATE
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FM 219 BRIDGE REPLACEMENTS

PROPOSED GRADING PLAN

SHEET 1 OF 3

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 43

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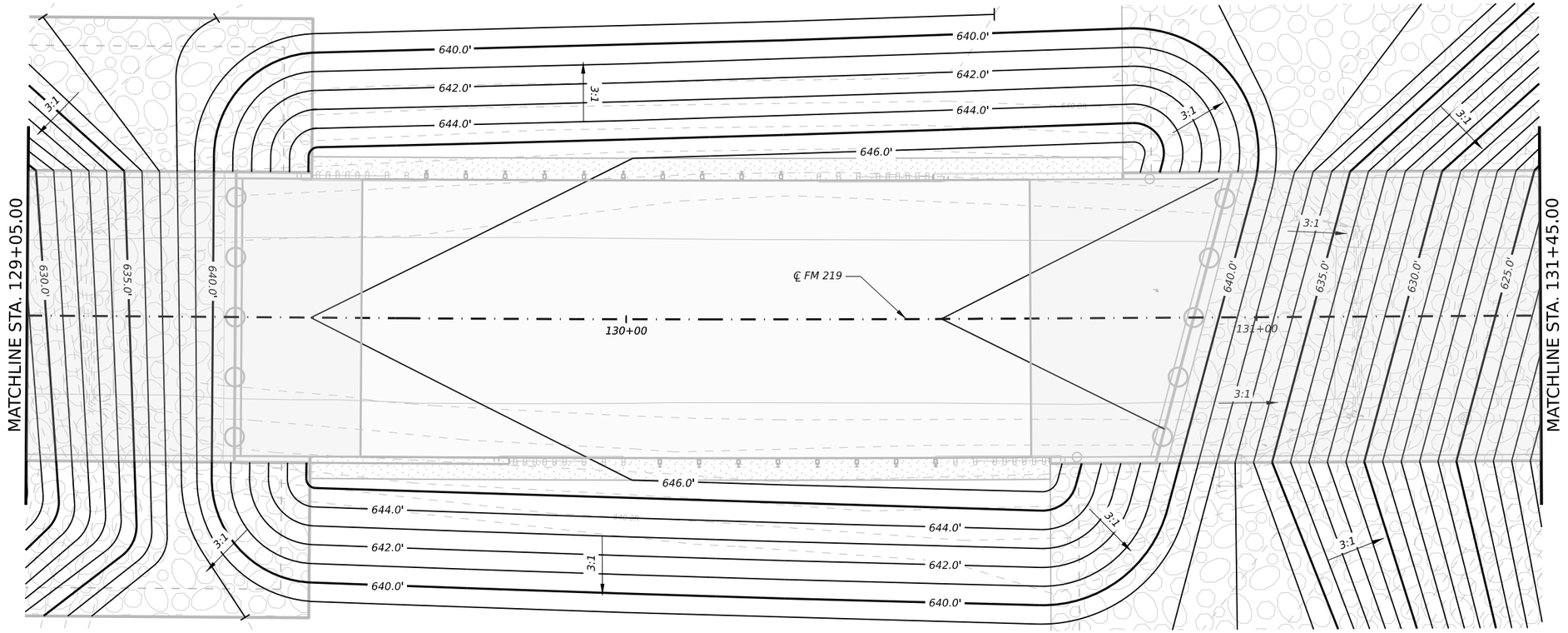

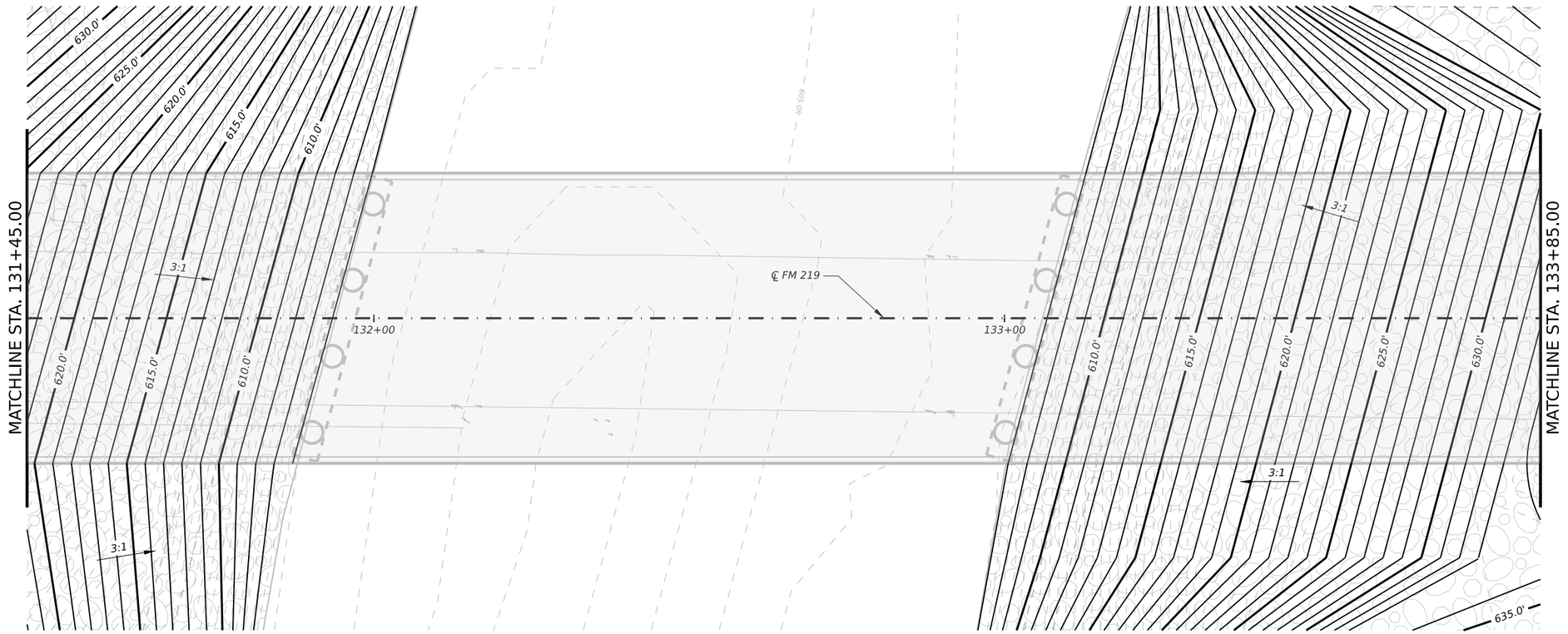

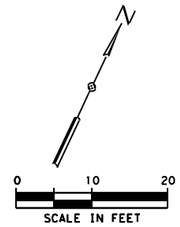

LEGEND

EXIST CONTOURS
PROP CONTOURS

NOTE

1. CONTOURS REPRESENTING THE SURFACE OF THE BRIDGE DECK ARE NOT SHOWN.

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3/1/2024	

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FM 219 BRIDGE REPLACEMENTS

PROPOSED GRADING PLAN

SHEET 2 OF 3

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 44

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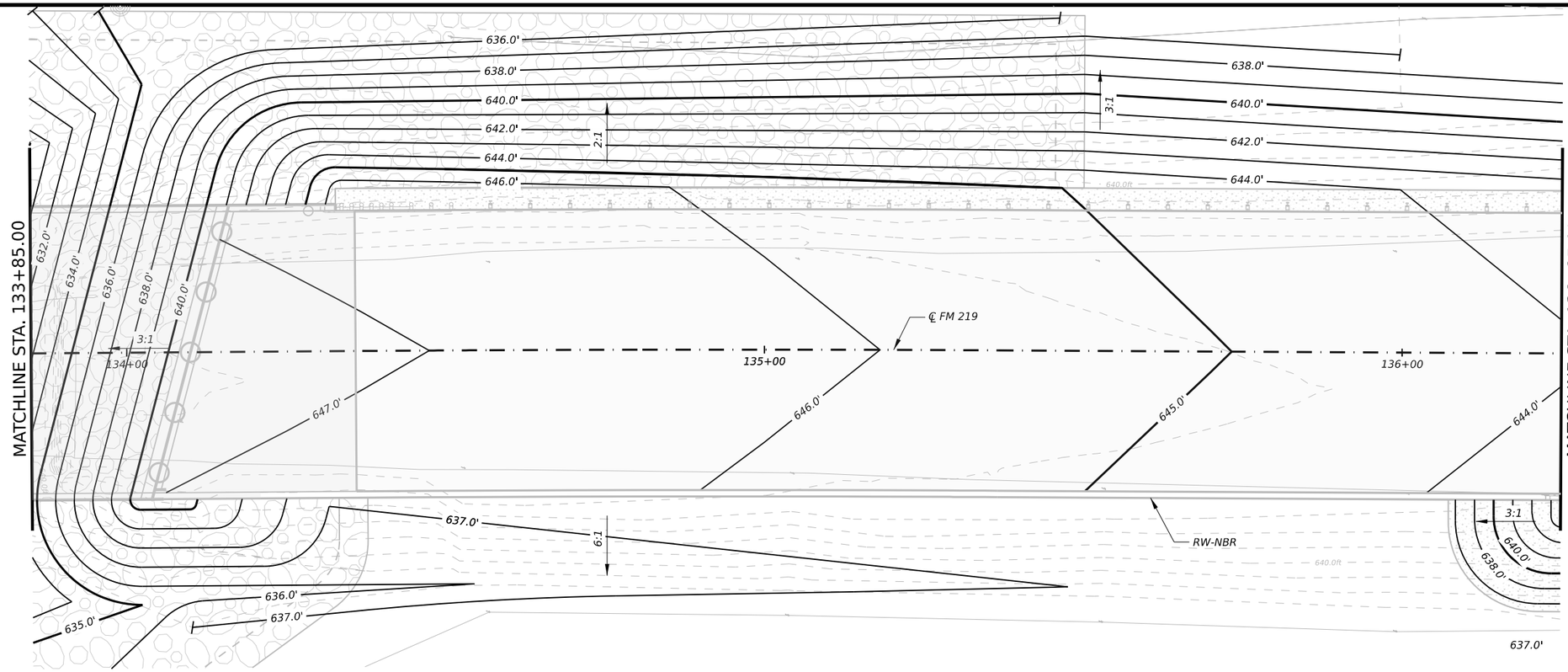

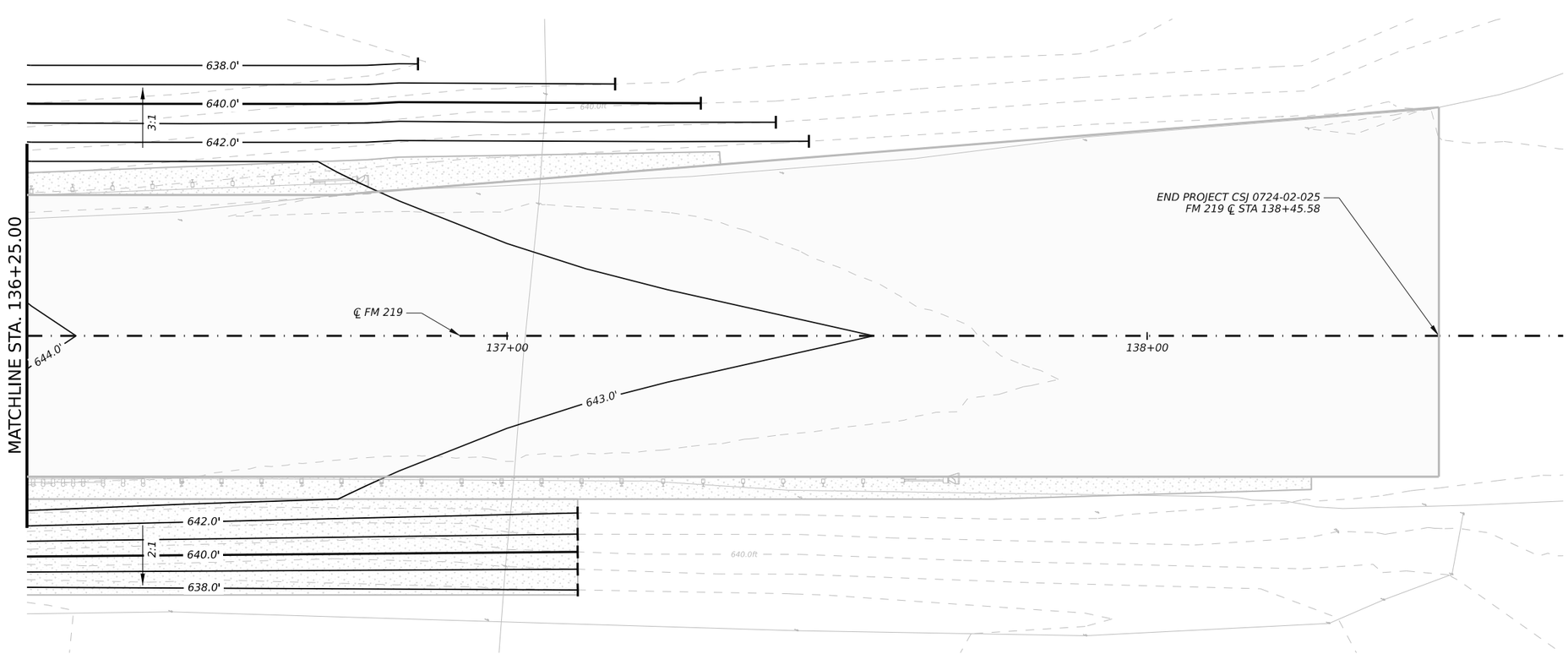

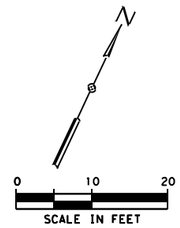

LEGEND

EXIST CONTOURS

PROP CONTOURS

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Waco District

FM 219 BRIDGE REPLACEMENTS

PROPOSED GRADING PLAN

SHEET 3 OF 3

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 45

CSJ: 0724 02 020, ETC.
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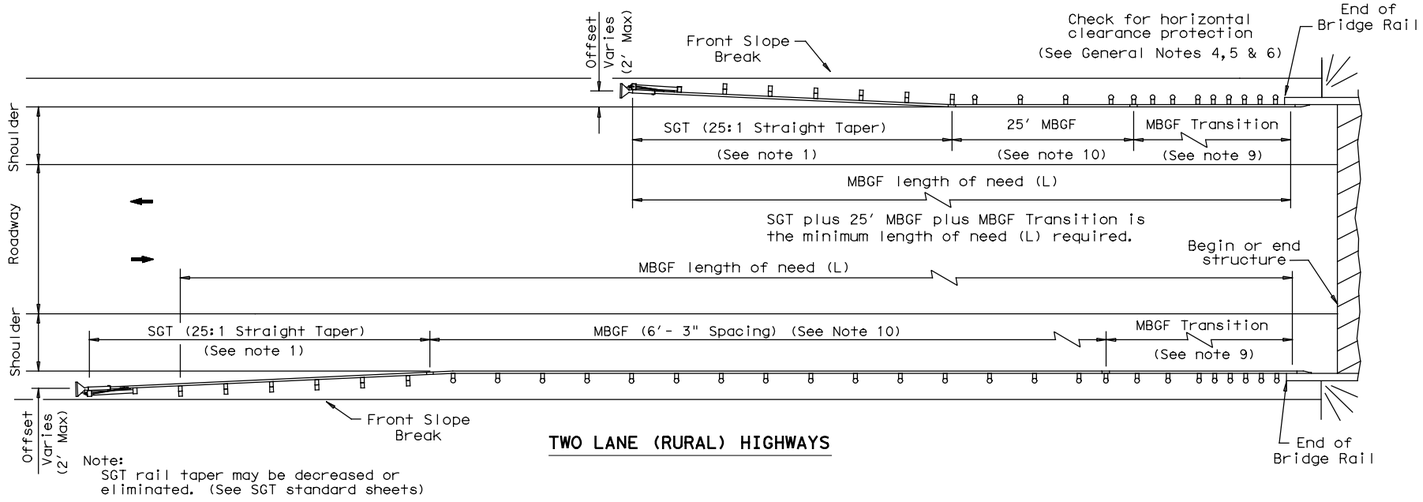
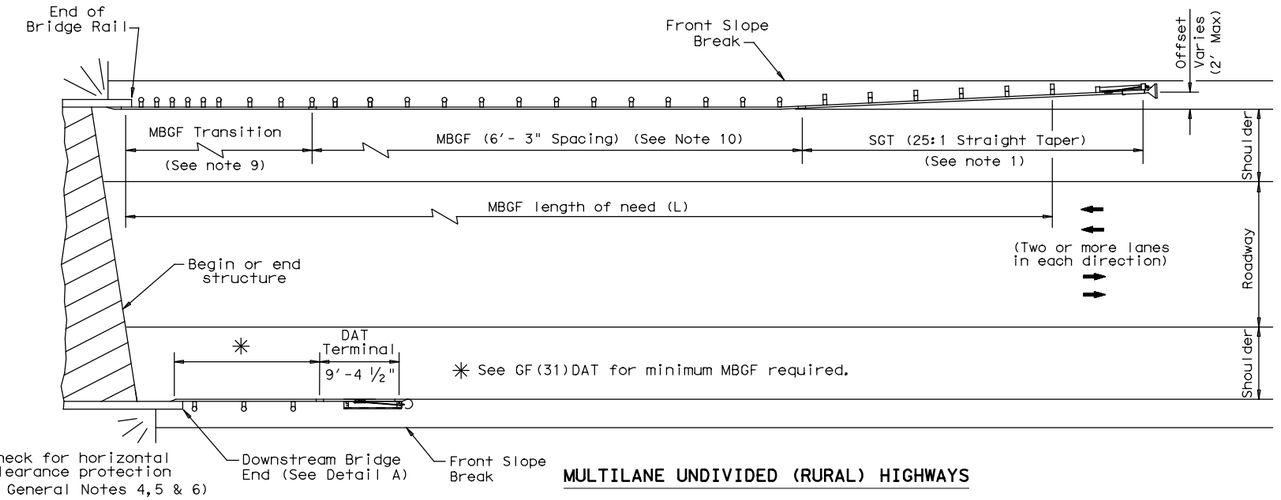
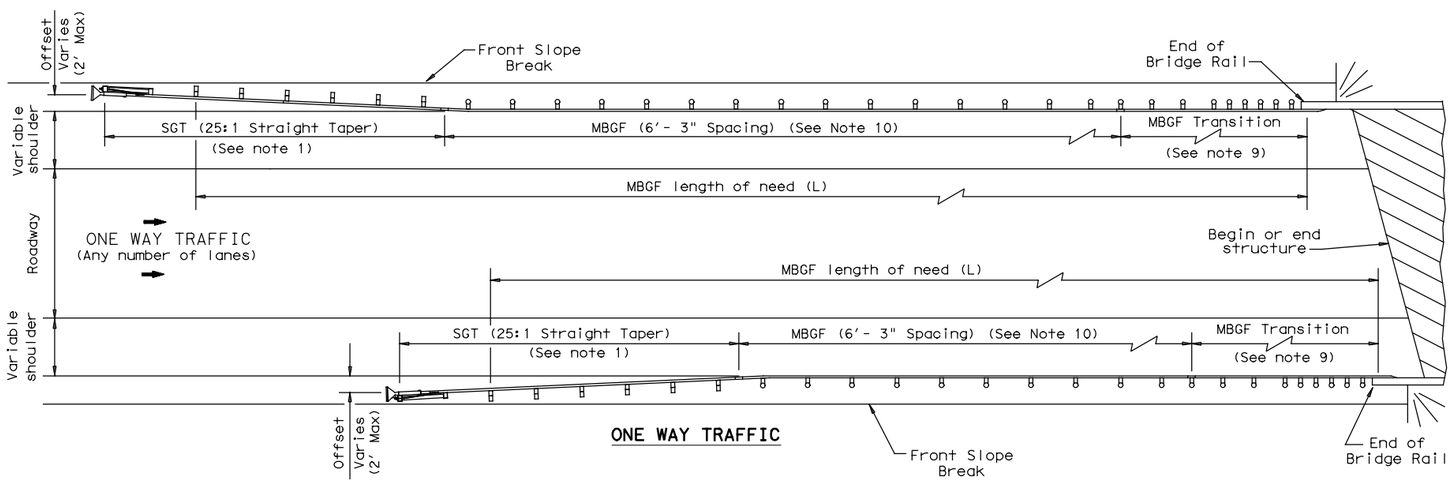


TWO LANE (RURAL) HIGHWAYS

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



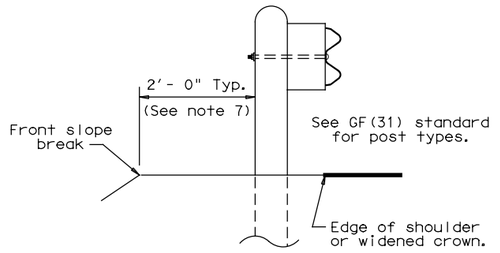
MULTILANE UNDIVIDED (RURAL) HIGHWAYS



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

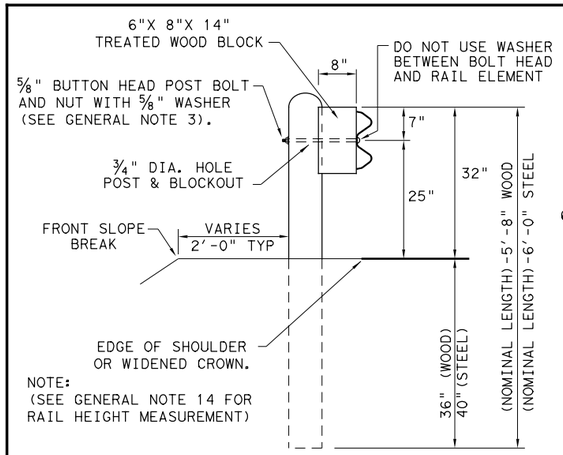
BRIDGE END DETAILS

(METAL BEAM GUARD FENCE APPLICATIONS TO RIGID RAILS)

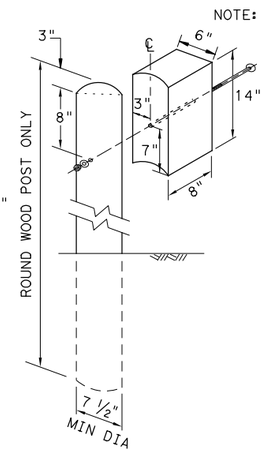
BED-14

FILE: bed14.dgn	DN: TxDOT	CK: AM	DW: BD/VP	CK: CGL
© TxDOT: December 2011	CONT	SECT	JOB	HIGHWAY
REVISIONS REVISED APRIL 2014 SEE (MEMO 0414)	0724	02	020, ETC,	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		46

DATE: 3/1/2024
FILE: P:\2020\01156\06-Bosque River-0724-02-020\4 - Design\Plan Set\13. Standards\Roadway\GF(31)-19.dgn

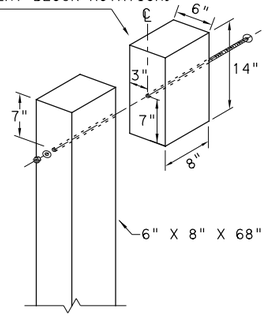


TYPICAL POST PLACEMENT

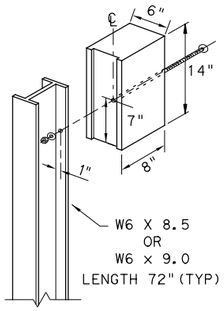


WOOD BLOCK TO ROUND WOOD POST

NOTE: TOENAIL WITH ONE 16D GALV. NAIL TO PREVENT BLOCK ROTATION.

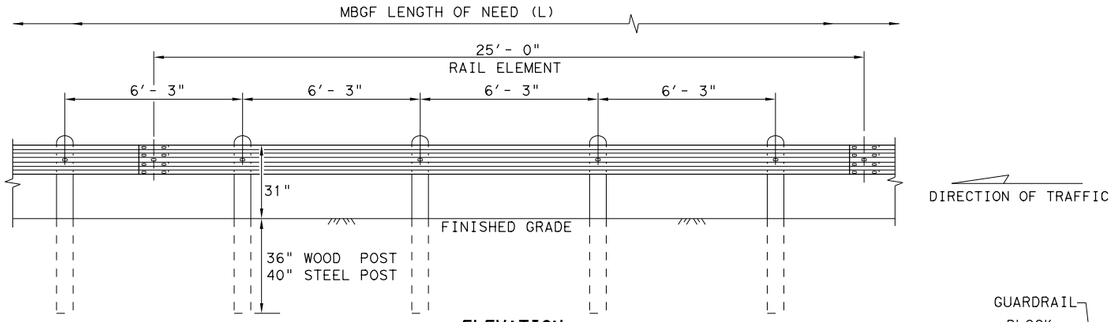


WOOD BLOCK TO RECTANGULAR WOOD POST



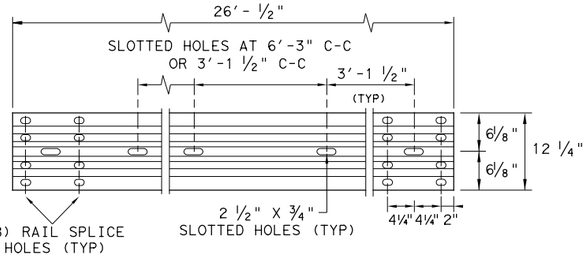
ROUTED WOOD BLOCK TO I-BEAM STEEL POST

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



ELEVATION MID-SPAN RAIL SPLICE

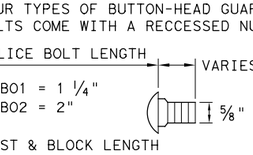
SHOWING A 25'- 0" SECTION OF W-BEAM RAIL. (SEE GENERAL NOTE 2)



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

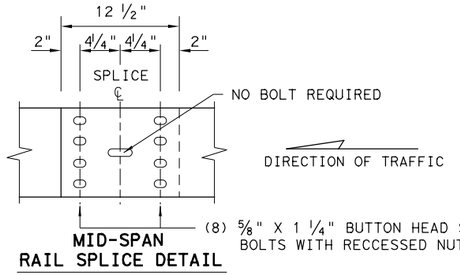
NOTES: SEE GENERAL NOTE 2 FOR ALLOWABLE RAIL TYPES.
SEE RAIL SPLICE DETAIL FOR REQUIRED HARDWARE.

NOTE:
FOUR TYPES OF BUTTON-HEAD GUARD RAIL BOLTS COME WITH A RECCESSED NUT.



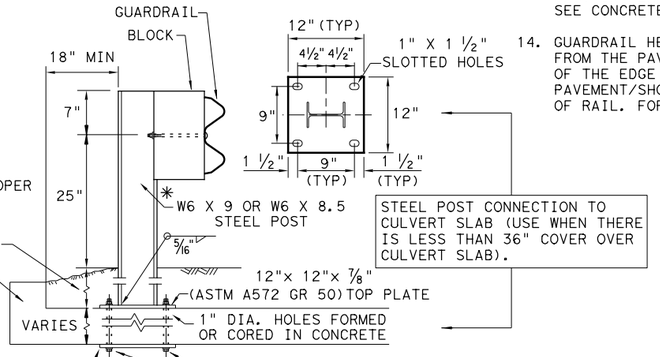
BUTTON HEAD BOLT

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

*POST(S) MAY REQUIRE FIELD MODIFICATION TO ENSURE PROPER GUARDRAIL HEIGHT.

STEEL POST CONNECTION TO CULVERT SLAB (USE WHEN THERE IS LESS THAN 36" COVER OVER CULVERT SLAB).

NOTE: TWO INSTALLATION OPTIONS.

1. BOLT-THROUGH OPTION: REQUIRES A 6" MIN. SLAB THICKNESS. 7/8" DIA (ASTM A449) HEAVY HEX BOLTS WITH TWO HARDENED WASHER EACH AND HEAVY HEX NUTS.
   NOTE: BOLT LENGTH = SLAB PLUS 2 1/4" MIN.

2. EPOXY ANCHOR OPTION: THIS OPTION MAY ONLY BE USED IF THE CULVERT SLAB IS 9" MIN. THICK. THREADED ANCHOR RODS MUST BE 7/8" 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 1/4" 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 1/2" 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 5/8" 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
REVISIONS	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		47

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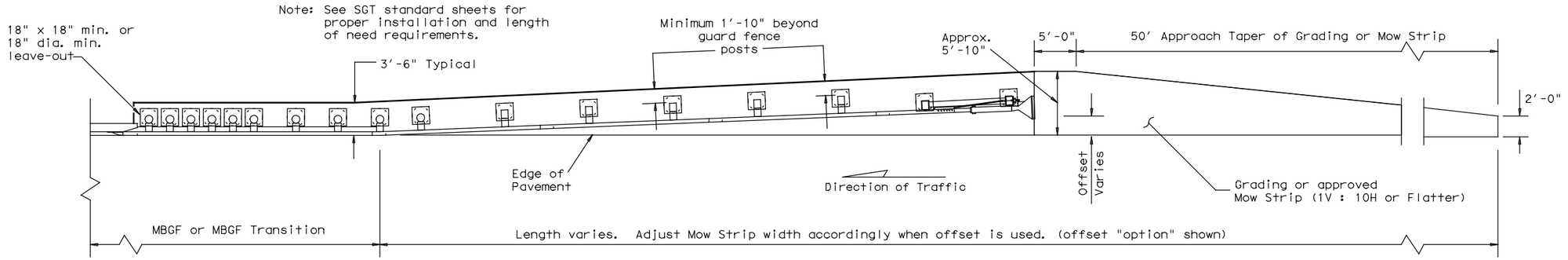
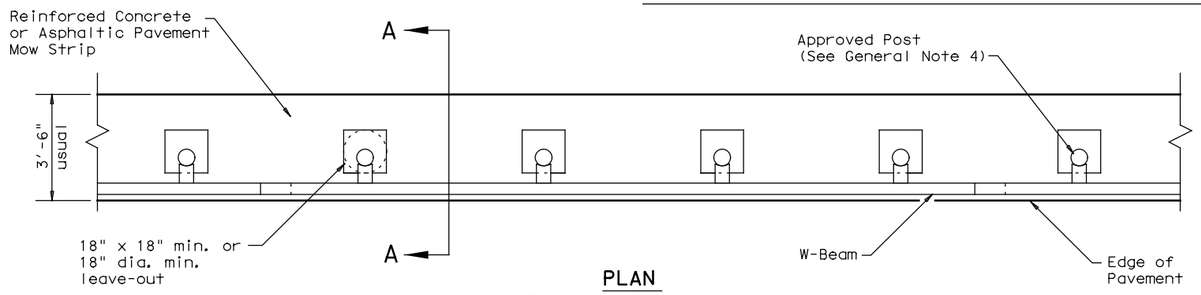


GRADING AND MOW STRIP AT GUARDRAIL END TREATMENTS



PLAN

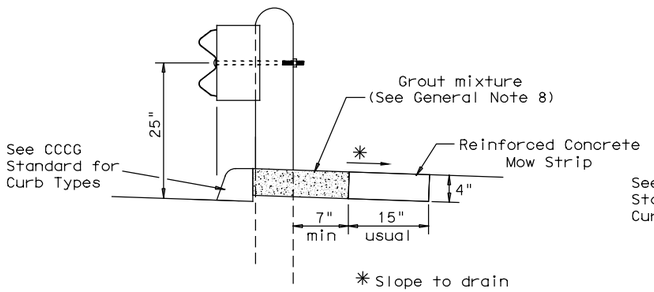
GF(31) shown with Mow Strip
(See GF(31) standard sheet for proper installation)

SECTION A-A

Typical

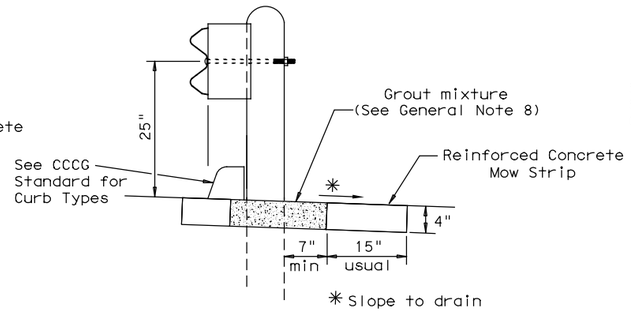
MOW STRIP DETAIL

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



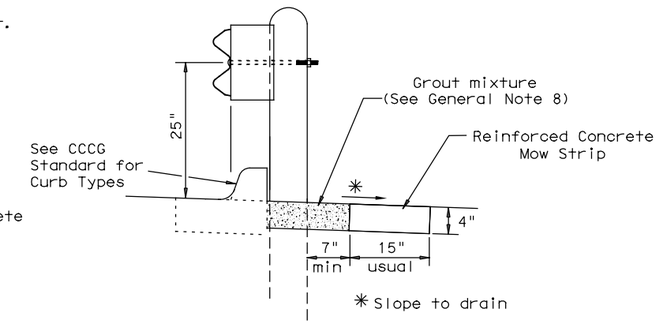
CURB OPTION (1)

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	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
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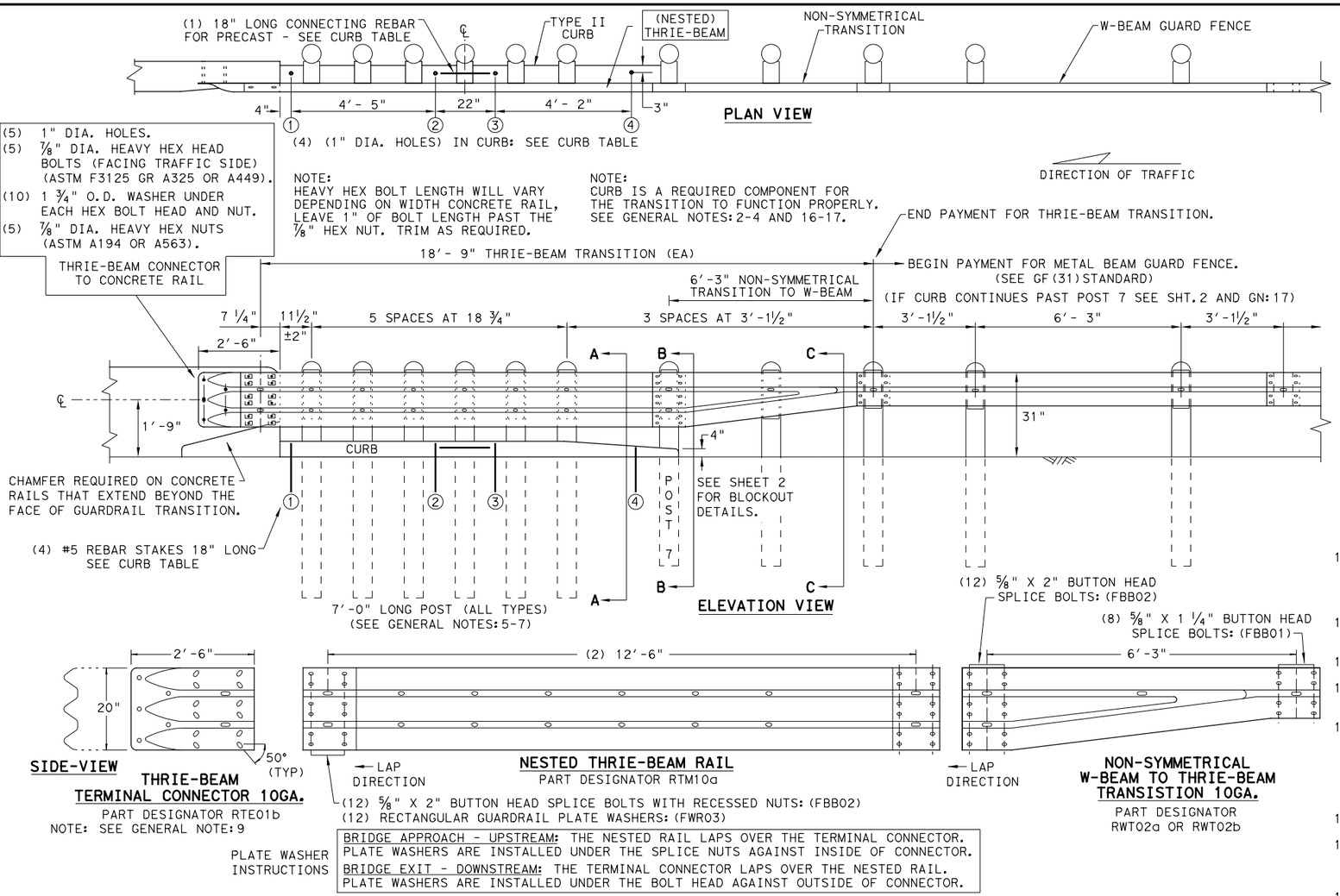
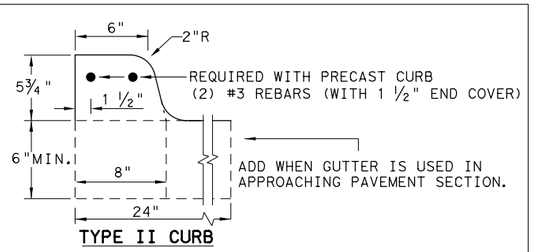


GENERAL NOTES

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.



TYPE II CURB

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

* 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 DETAILS

HIGH-SPEED TRANSITION

SHEET 1 OF 2

Texas Department of Transportation — Design Division Standard

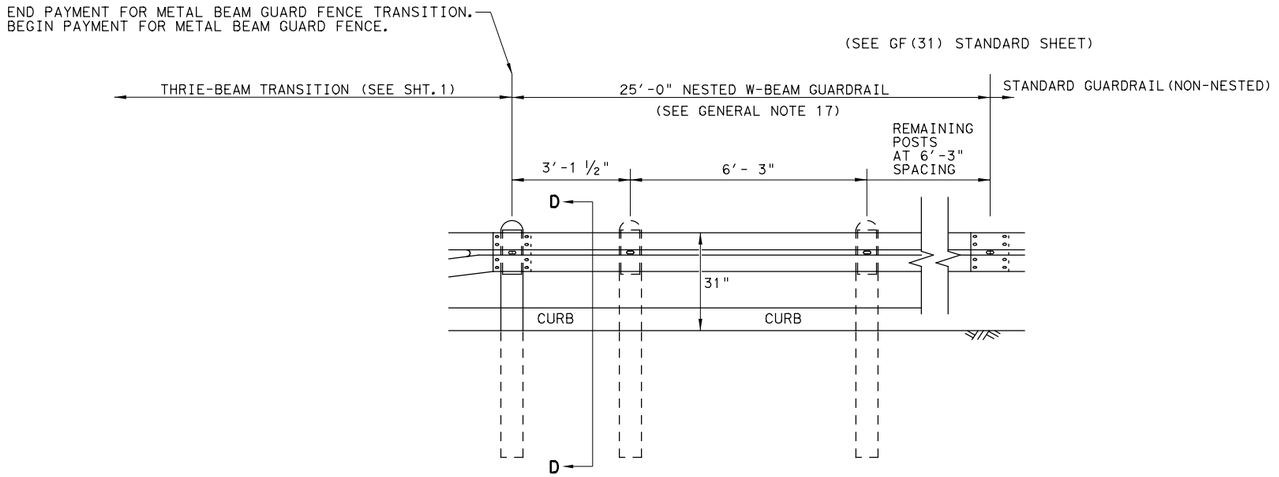
METAL BEAM GUARD FENCE THRIE-BEAM TRANSITION TL-3 MASH COMPLIANT

GF(31)TR TL3-20

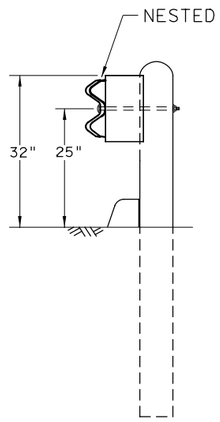
FILE: gf31tr1320.dgn	DN: TxDOT	CK: KM	DW: VP	CK: CGL/AG	
©TxDOT: NOVEMBER 2020	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0724	02	020, ETC,	FM 219	
	DIST	COUNTY		SHEET NO.	
	WACO	BOSQUE		49	

DATE: 3/1/2024
FILE: P:\2020\01156\06-Bosque River-0724-02-020\4 - Design\Plan Set\13. Standards\Roadway\GF(31)TRTL3-20.dgn

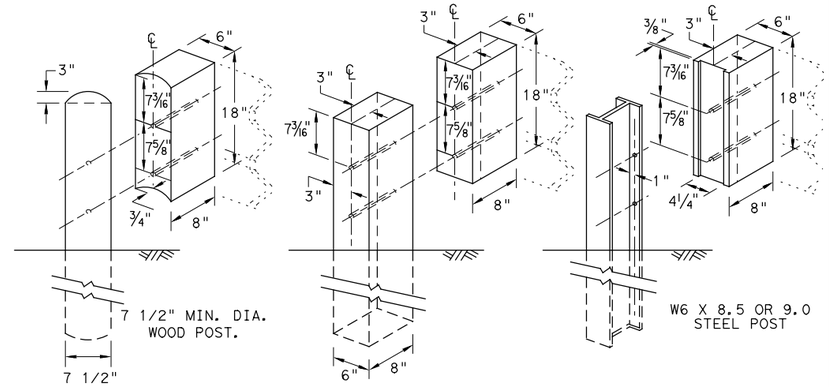
REQUIRED ALTERNATIVE FOR CONTINUOUS CURB EXTENDING PAST POST 7 (SEE SHT. 1 GENERAL NOTE 17)



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: gf31tr1320.dgn	DN: TxDOT	CK: KM	DW: KM	CK: CGL/AG	
©TxDOT: NOVEMBER 2020	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0724	02	020, ETC.	FM 219	
	DIST	COUNTY		SHEET NO.	
	WACO	BOSQUE		50	

DATE: 3/1/2024
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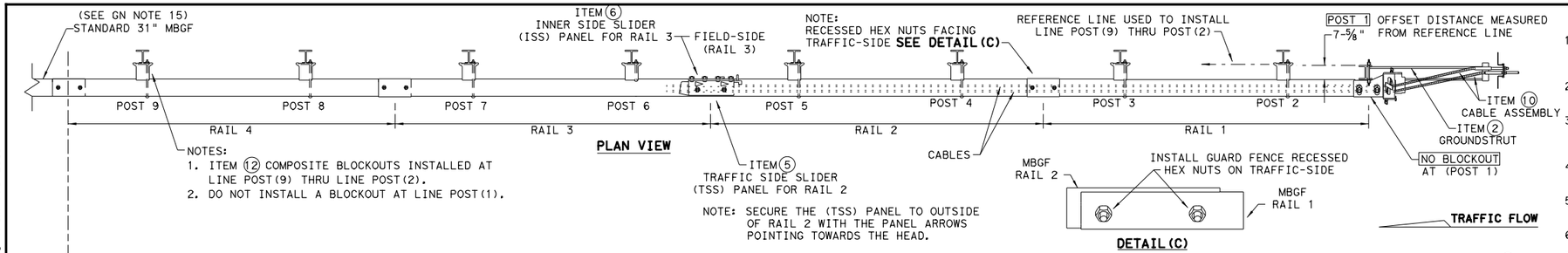

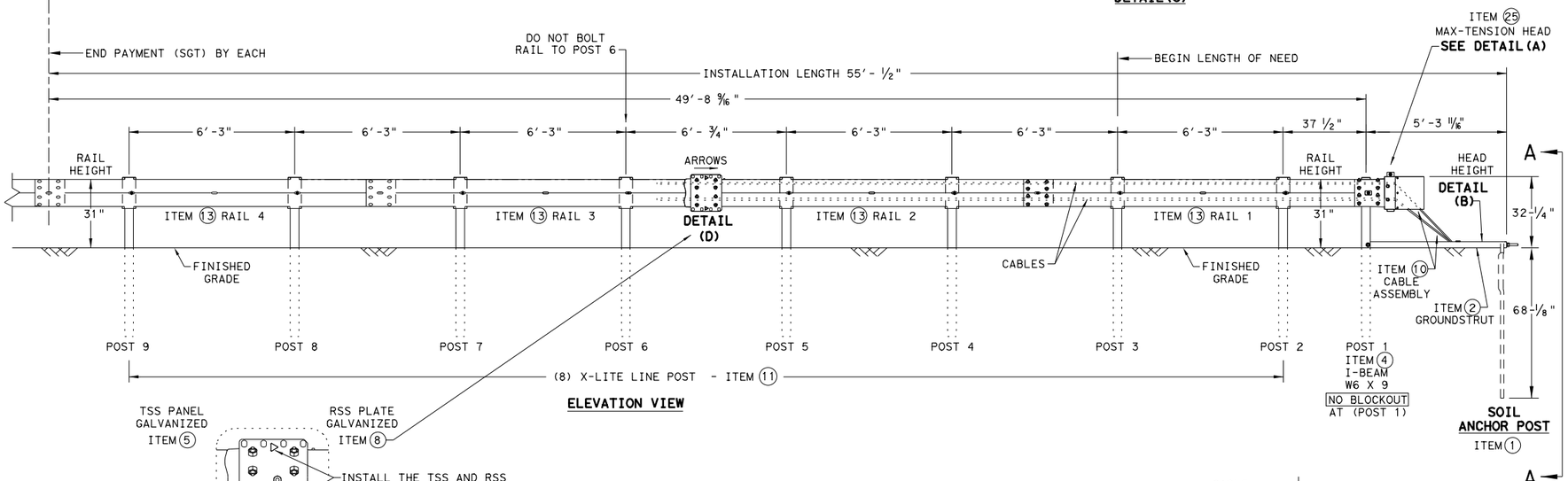

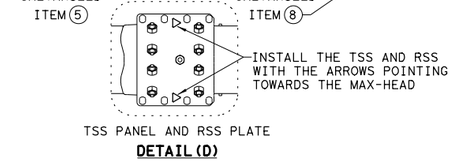

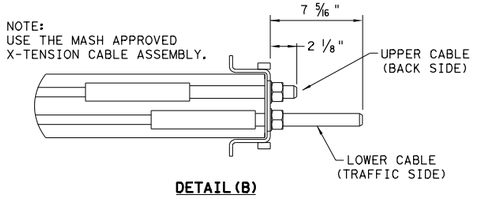

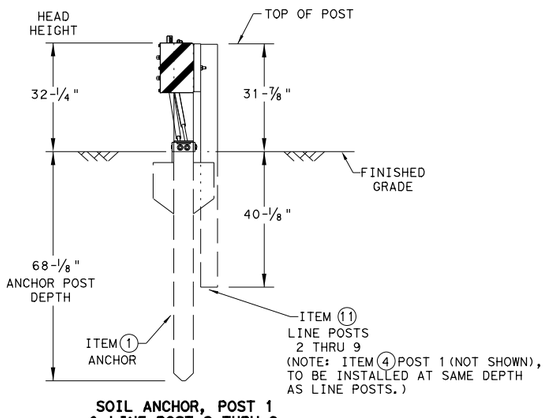

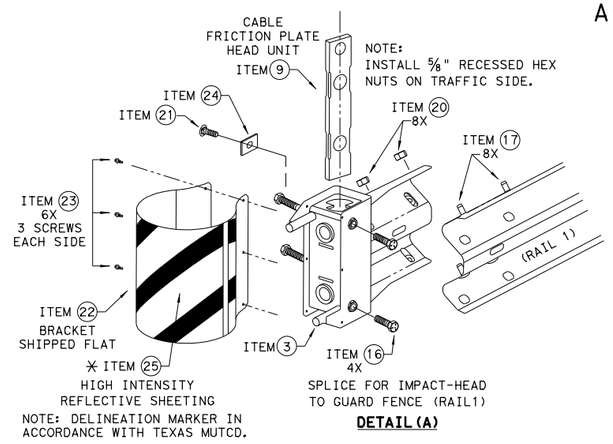

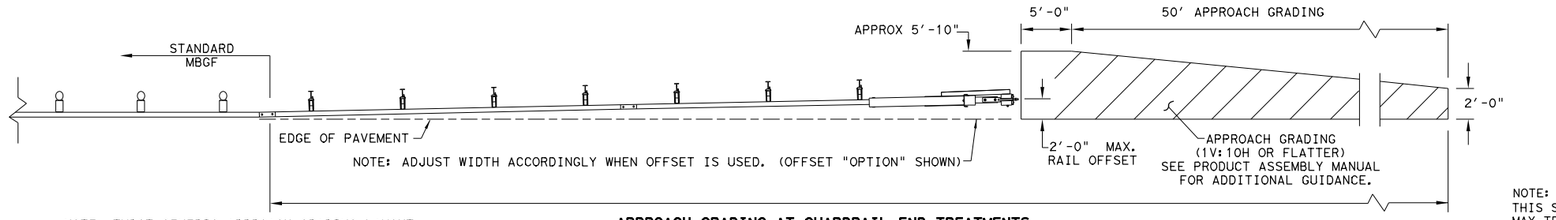

GENERAL NOTES

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	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		51

DATE: 3/1/2024
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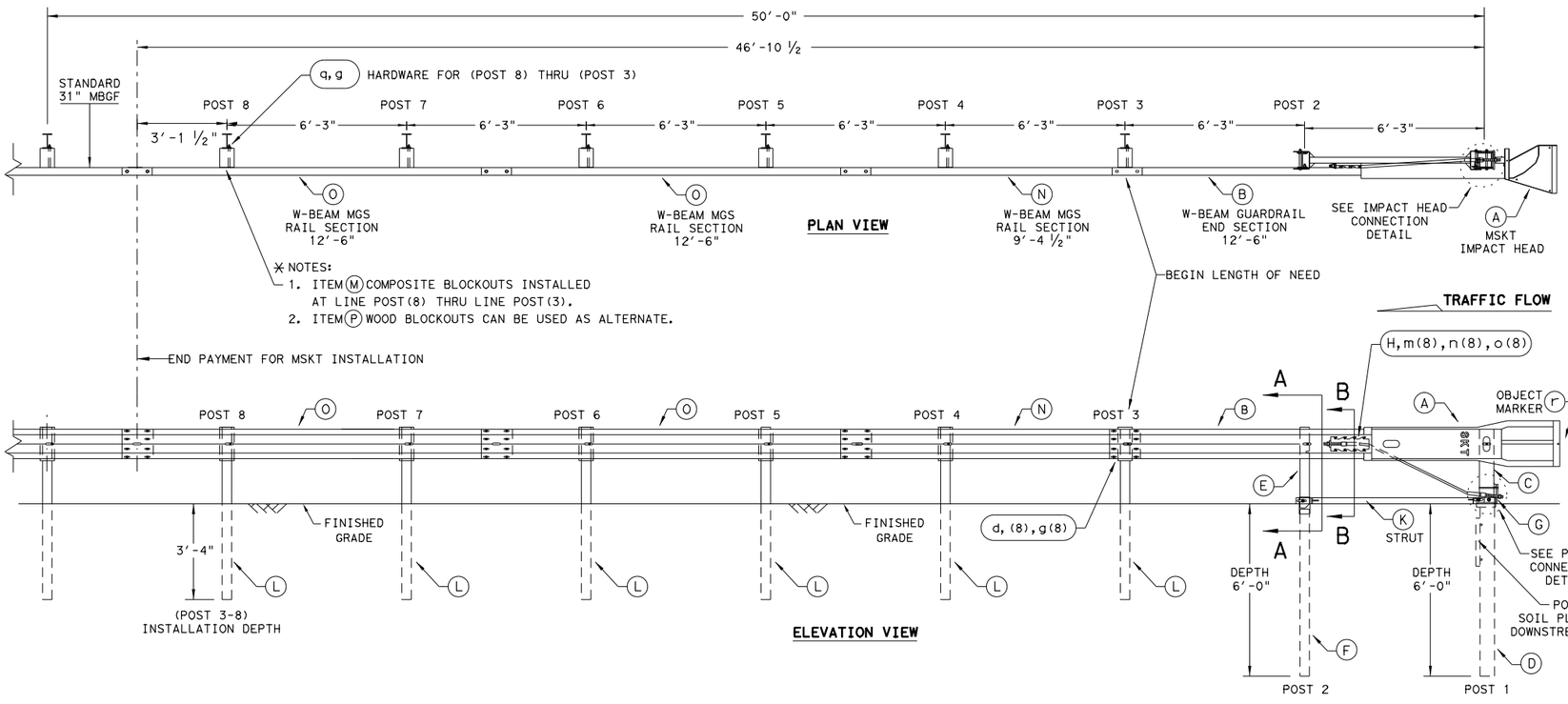


NOTE: SEE (GENERAL NOTE 14) FOR DRIVING CAP INFORMATION.

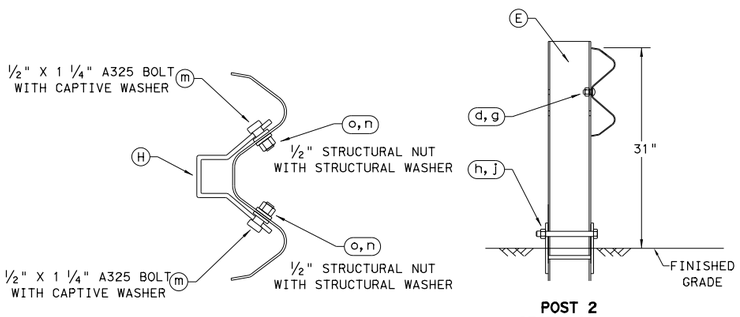
GENERAL NOTES

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.

SEE NOTES: ✳

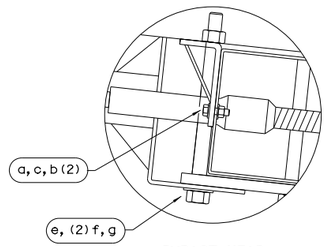
ITEM	QTY	MAIN SYSTEM COMPONENTS	ITEM NUMBERS
A	1	MSKT IMPACT HEAD	MS3000
B	1	W-BEAM GUARDRAIL END SECTION, 12 Ga.	SF1303
C	1	POST 1 - TOP (6" X 6" X 1/8" TUBE)	MTPHP1A
D	1	POST 1 - BOTTOM (6' W6X15)	MTPHP1B
E	1	POST 2 - ASSEMBLY TOP	UHP2A
F	1	POST 2 - ASSEMBLY BOTTOM (6' W6X9)	HP2B
G	1	BEARING PLATE	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 9/16" 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

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

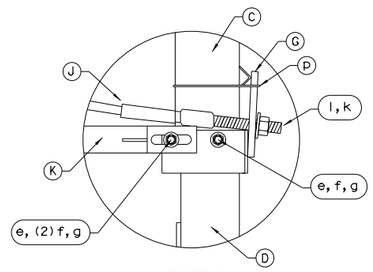


SECTION B-B
ANCHOR BRACKET

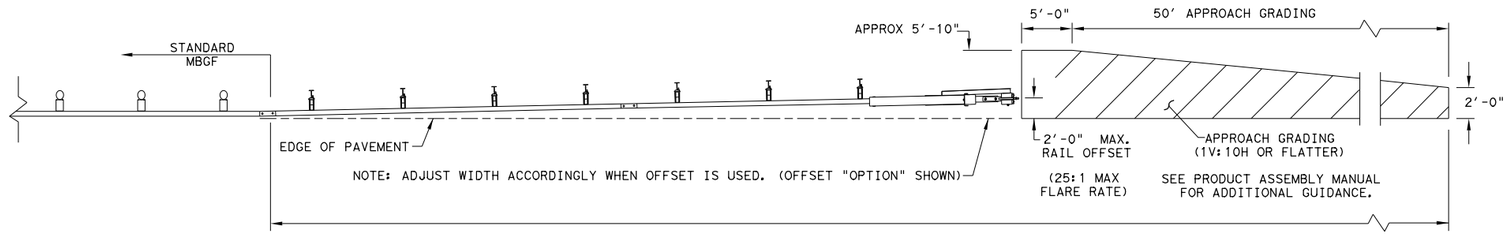
POST 2
SECTION A-A



IMPACT HEAD
CONNECTION DETAIL



POST 1
CONNECTION DETAIL



APPROACH GRADING AT GUARDRAIL END TREATMENTS

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

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	0724	02	020, ETC.		FM 219		
	DIST	COUNTY			SHEET NO.		
	WACO	BOSQUE			52		

DATE: 3/1/2024
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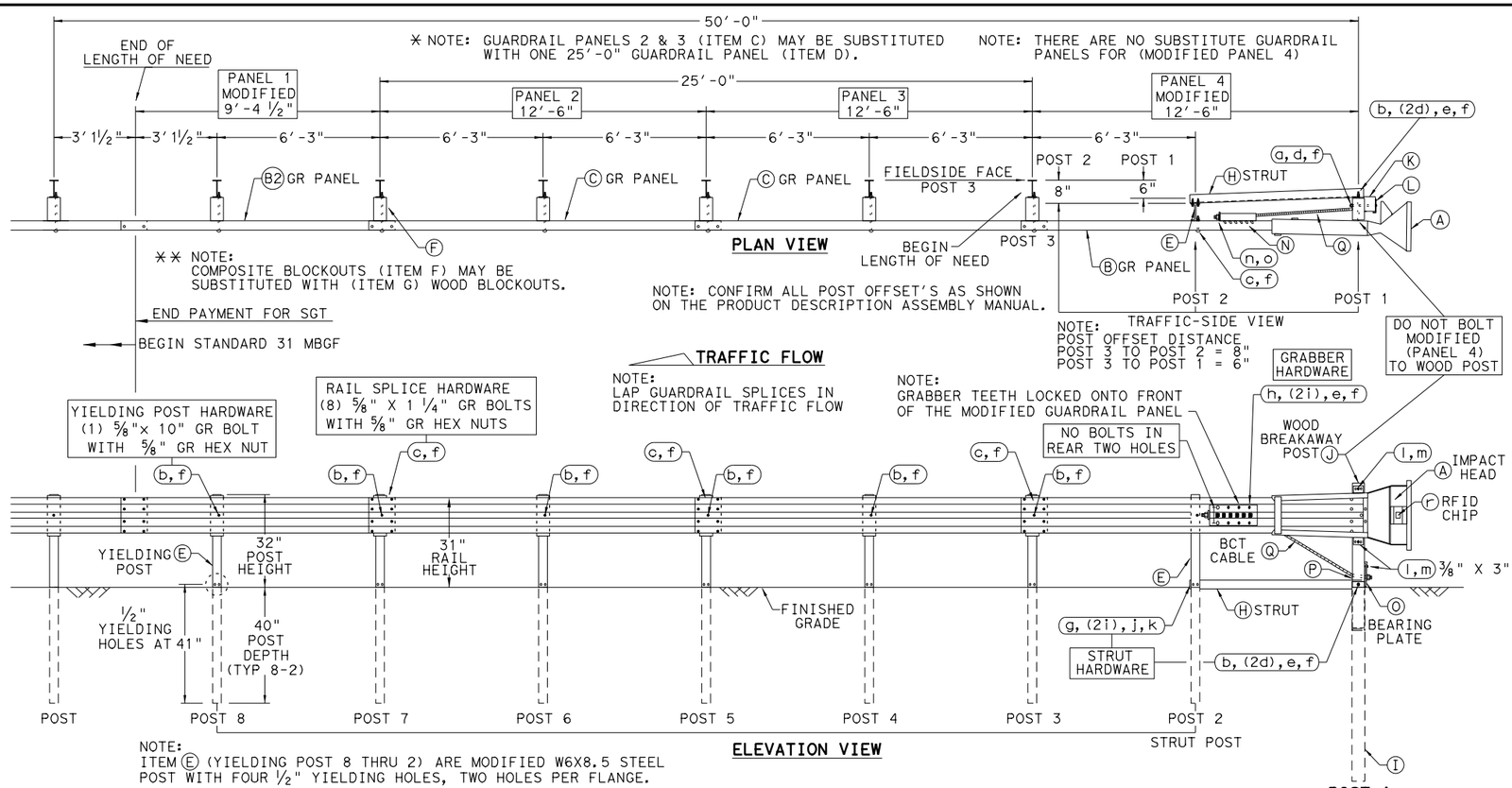
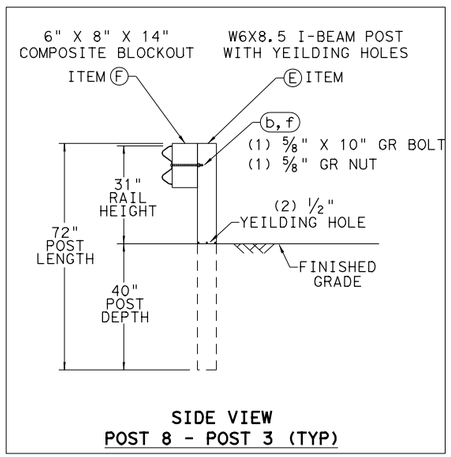


GENERAL NOTES

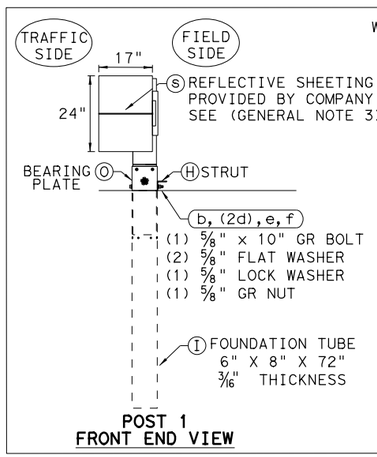
1. FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: SPIG INDUSTRY, INC. AT 1(267) 644-9510. 14675 INDUSTRIAL PARK RD; BRISTOL, VA 24202
2. FOR INSTALLATION, REPAIR AND MAINTENANCE REFER TO THE MANUFACTURER'S; SGET END TERMINAL, PRODUCT DESCRIPTION ASSEMBLY 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

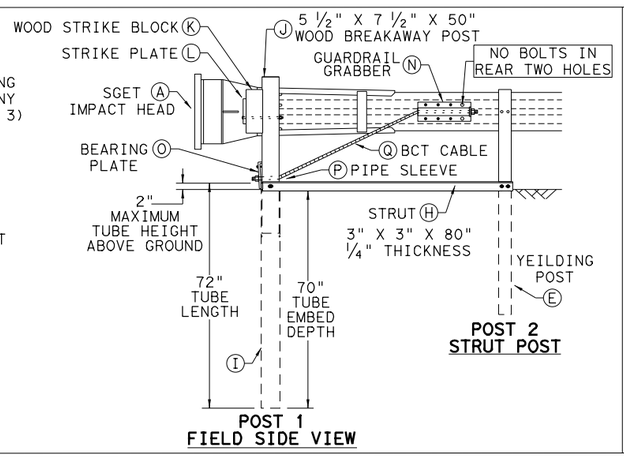
ALTERNATIVE ITEMS
NOTE: SEE PLAN VIEW
* ITEM D
** ITEM G



SIDE VIEW
POST 8 - POST 3 (TYP)

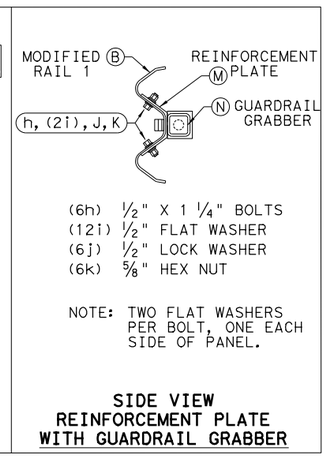


POST 1
FRONT END VIEW

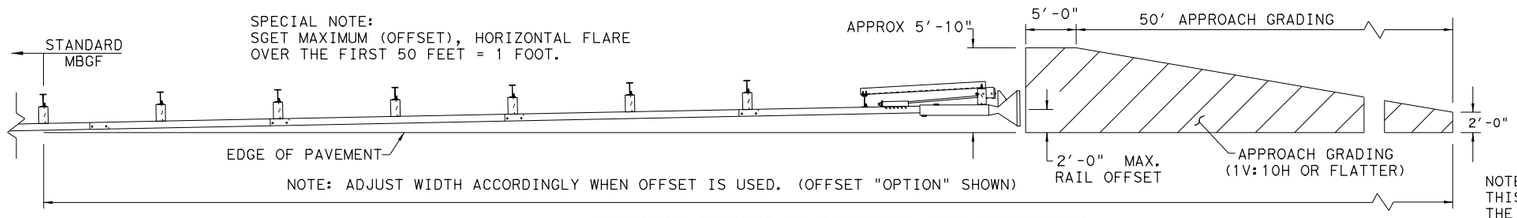


POST 1
FIELD SIDE VIEW

POST 2
STRUT POST



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

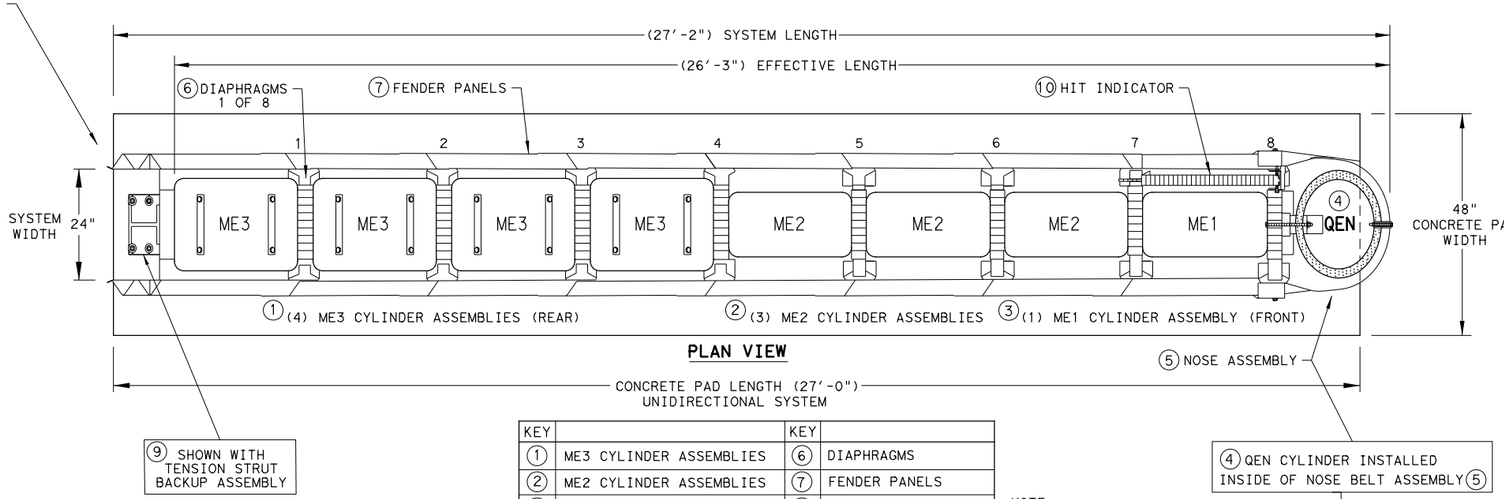
SPIG INDUSTRY, LLC
SINGLE GUARDRAIL TERMINAL
SGET - TL-3 - MASH
SGT(15)31-20

FILE: sgt15320.dgn	DN: TxDOT	CK: KM	DW: VP	CK: VP		
©TxDOT: APRIL 2020	CONT	SECT	JOB	HIGHWAY		
REVISIONS	0724	02	020, ETC.	FM 219		
	DIST	COUNTY		SHEET NO.		
	WACO	BOSQUE		53		

DATE: 3/1/2024
FILE: P:\2020\01156\06-Bosque River-0724-02-020\4 - Design\Plan Set\13. Standards\Roadway\QGELITE(M10)(N)-20.dgn

NOTE:
A TRANSITION MAY BE REQUIRED TO INSTALL THE QUADGUARD ELITE M10 TO THE OBJECT BEING SHIELDED.

QUADGUARD EITE M10 24" WIDE (8 BAY) SYSTEM



PLAN VIEW

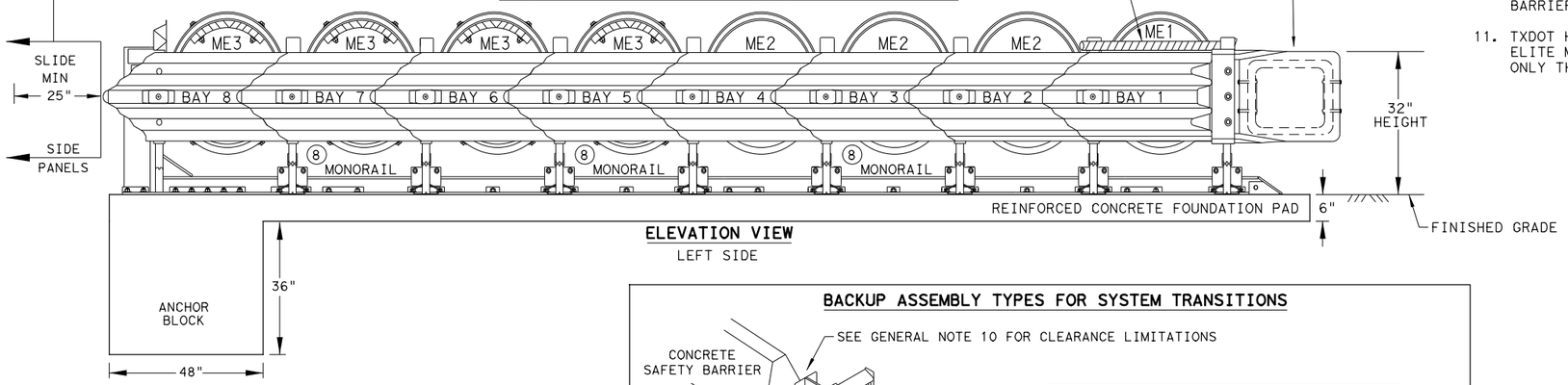
⑨ SHOWN WITH TENSION STRUT BACKUP ASSEMBLY

KEY		KEY	
①	ME3 CYLINDER ASSEMBLIES	⑥	DIAPHRAGMS
②	ME2 CYLINDER ASSEMBLIES	⑦	FENDER PANELS
③	ME1 CYLINDER ASSEMBLY	⑧	MONORAILS
④	QEN CYLINDER	⑨	TYPE OF BACKUP
⑤	NOSE BELT ASSEMBLY	⑩	HIT INDICATOR

④ QEN CYLINDER INSTALLED INSIDE OF NOSE BELT ASSEMBLY ⑤

NOTE:
HIT INDICATOR WILL RAISE UPON IMPACT.
⑩ HIT INDICATOR

NOTE:
PROVISION SHALL BE MADE FOR REAR FENDER SIDE PANELS TO SLIDE REARWARD UPON IMPACT, 25" MIN.



ELEVATION VIEW
LEFT SIDE

NOTES:
CONTACT THE MANUFACTURER WITH SITE SPECIFIC DATA (SSD) FOR CONCRETE PAD AND ANCHOR BLOCK INSTALLATION REQUIREMENTS.

A MANUFACTURER'S DRAWING PACKAGE UNIQUE AND SPECIFIC FOR THE QUADGUARD ELITE M10 FIELD INSTALATION AND INFORMATION REGARDING THE TYPE OF BACKUP ASSEMBLY REQUIRED FOR THE TRANSITION WILL BE PROVIDED BY THE MANUFACTURER TO THE ENGINEER AND INSTALLER.

6" REINFORCED CONCRETE PAD REQUIRES THE INSTALLATION OF AN ANCHOR BLOCK AS SHOWN ON THE MANUFACTURER'S DRAWING PACKAGE.

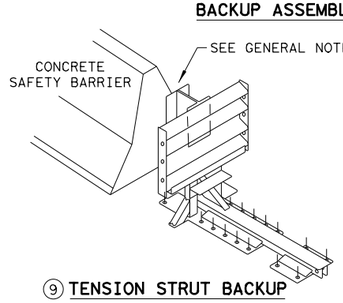
8" NON-REINFORCED CONCRETE PAD MAY NOT REQUIRE AN ANCHOR BLOCK, IF THE PAD IS INSTALLED AGAINST AN IMMOVABLE CONCRETE BACKUP.

CONCRETE PAD AND ANCHOR BLOCK COMBINATIONS SHALL BE CONFIRMED WITH THE MANUFACTURER BASED UPON SITE SPECIFIC DATA (SSD).

NOTE:
THE QUADGUARD ELITE M10 8-BAY, 24" WIDE - NARROW SYSTEM TESTED TO MASH TEST LEVEL 3.

TL-3 MODEL #	QM10024E	CYLINDER TYPES IN BAYS			
BAYS	8	TYPE-ME3	TYPE-ME2	TYPE-ME1	TYPE-QEN
DIAPHRAGMS	8	4	3	1	1
WIDTH	24"	REAR	FRONT		NOSE

BACKUP ASSEMBLY TYPES FOR SYSTEM TRANSITIONS

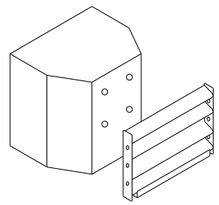


⑨ TENSION STRUT BACKUP

SYSTEM TRANSITIONS TYPES	
1	QUAD-BEAM TO CONCRETE SAFETY BARRIER
2	QUAD-BEAM TO CONCRETE BRIDGE RAIL
3	QUAD-BEAM TO CONCRETE END SHOE
4	QUAD-BEAM TO THRIE-BEAM RAIL
5	QUAD-BEAM TO W-BEAM RAIL

NOTE:
TRANSITION ASSEMBLIES FOR THE QUADGUARD ELITE M10 TO THRIE-BEAM OR W-BEAM FENCE REQUIRES I-BEAM POSTS:

ALL POSTS W6X8.5/9 I-BEAMS (78" LONG).



⑨ CONCRETE BACKUP

NOTES:
CONTACT THE MANUFACTURER WITH SITE SPECIFIC DATA (SSD) FOR THE CORRECT BACKUP ASSEMBLY AND TRANSITION PANELS OR SIDE PANELS USED FOR STANDARD AND BI-DIRECTIONAL INSTALLATIONS: AT DIVIDED-HIGHWAY MEDIANS OR UNDIVIDED ROADWAYS WHERE THE SYSTEM IS EXPOSED TO IMPACTS FROM ONE OR TWO DIFFERENT DIRECTIONS OF TRAFFIC FLOW.

NOTE:
THIS STANDARD IS A BASIC REPRESENTATION OF THE QUADGUARD ELITE M10 SYSTEM AND IS NOT INTENDED TO REPLACE THE PRODUCT DESCRIPTION ASSEMBLY MANUAL.

GENERAL NOTES

1. FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: TRINITY HIGHWAY - ENERGY ABSORPTION INC. AT 1(888)323-6374.
2. SEE THE RECENT QUADGUARD ELITE M10 PRODUCT DESCRIPTION ASSEMBLY MANUAL FOR IMPACT PERFORMANCE CHARACTERISTICS AND DESIGN LIMITATIONS AND THE DRAWING PACKAGE FOR THE NARROW 24" SYSTEM BEFORE INSTALLING THE QUADGUARD ELITE M10 AT ANY GIVEN LOCATION.
3. FOR BI-DIRECTIONAL TRAFFIC: THE LOCATION AND OR WIDTH OF THE QUADGUARD ELITE M10 IS RESTRICTED. AS BI-DIRECTIONAL TRAFFIC APPROACHES THE REAR OF THE QUADGUARD ELITE M10, THE QUADGUARD ELITE M10 SHOULD NOT EXTEND FURTHER INTO THE TRAFFIC-SIDE OF THE BARRIER THAN THE OBSTACLE. ANY TRANSITION INSTALLED MUST EITHER BE TANGENT TO BOTH QUADGUARD ELITE M10 AND OBSTACLE OR MUST ANGLE TOWARD FIELD SIDE OF THE BARRIER.
4. SYSTEM TRANSITION: APPROPRIATE TRANSITION PANELS OR SIDE PANELS WILL BE REQUIRED FOR PROPER IMPACT PERFORMANCE. THE CORRECT PANEL(S) TO USE WILL DEPEND ON THE DIRECTION OF TRAFFIC FLOW AND WHAT TYPE OF BARRIER OR ROAD FEATURE THE QUADGUARD ELITE M10 SYSTEM IS SHIELDING. SEE THE QUADGUARD ELITE M10 PRODUCT DESCRIPTION & ASSEMBLY MANUAL FOR FURTHER DETAILS.
5. COMPONENTS FOR THE QUADGUARD ELITE (M10) BACKUP AND REINFORCING DETAILS ARE SHOWN ON THE QUADGUARD ELITE M10 PRODUCT DESCRIPTION & ASSEMBLY MANUAL.
6. CONCRETE PAD SHALL BE 6" MIN. REINFORCED 28MPa [4,000 PSI] (P.C.) OR 8" MIN. NON-REINFORCED 28MPa [4,000 PSI] CONCRETE ROADWAY MEASURING AT LEAST 12'-0" WIDE BY 50'-0" LONG. ANCHOR BLOCK IS NOT REQUIRED WHEN USING 8" CONCRETE PAD INSTALLED AGAINST AN IMMOVABLE STRUCTURE, E.G. CONCRETE WALL.
7. IF THE CROSS-SLOPE VARIES MORE THAN 2% OVER THE LENGTH OF THE SYSTEM, THE CONCRETE PAD WILL REQUIRE LEVELING. MAXIMUM PERMISSIBLE CROSS-SLOPE IS 8%.
8. THE INSTALLATION AREA SHOULD BE FREE OF CURBS, ELEVATED OBJECTS,OR DEPRESSIONS.
9. THE QUADGUARD ELITE M10 SYSTEM SHOULD BE INSTALLED APPROXIMATELY PARALLEL WITH THE BARRIER.
10. FOR THE TENSION STRUT BACKUP THE DISTANCE BETWEEN THE BACK OF BACKUP AND THE BARRIER WALL SHOULD NOT EXCEED 7" IN ANY CASE.
11. TXDOT HAS ONLY APPROVED THE 24" WIDE QUADGUARD ELITE M10 SYSTEM. THE QUADGUARD ELITE M10 PRODUCT DESCRIPTION AND ASSEMBLY MANUAL INCLUDES SYSTEM WIDTH OF 24". ONLY THE 24" SYSTEM IS ALLOWED TO BE INSTALLED ON TEXAS ROADWAYS.

FOUNDATION & ANCHORING REQUIREMENTS FOUNDATION TYPES: A, B, C, & D	
FOUNDATION TYPE: A	REINFORCED CONCRETE PAD OR ROADWAY
FOUNDATION:	6" MINIMUM DEPTH (P.C.C.)
ANCHORAGE:	7" STUDS EMBEDDED 5 ½" - APPROVED ADHESIVE
FOUNDATION TYPE: B	ASPHALT OVER P.C.C.
FOUNDATION:	3" MIN. (A.C.) OVER 3" MIN. (P.C.C.)
ANCHORAGE:	18" THREADED ROD EMBEDDED 16 ½" - APPROVED ADHESIVE
FOUNDATION TYPE: C	ASPHALT OVER SUBBASE
FOUNDATION:	6" MIN. (A.C.) OVER 6" MIN. (C.S.)
ANCHORAGE:	18" THREADED ROD EMBEDDED 16 ½" - APPROVED ADHESIVE
FOUNDATION TYPE: D	ASPHALT ONLY
FOUNDATION:	8" MIN. (A.C.)
ANCHORAGE:	18" THREADED ROD EMBEDDED 16 ½" - APPROVED ADHESIVE

KEY:
ASPHALT CONCRETE (A.C.)
COMPACTED SUBBASE (C.S.)
PORTLAND CEMENT CONCRETE (P.C.C.)

NOTE: SEE TRINITY'S PRODUCT DESCRIPTION ASSEMBLY MANUAL FOR THE APPROVED ADHESIVE.

IF THE UNIT IS ANCHORED TO ASPHALTIC CONCRETE, IT SHOULD BE RELOCATED TO FRESH, UNDISTURBED ASPHALT AND RE-ANCHORED AFTER EACH IMPACT TO ENSURE ADEQUATE FUTURE PERFORMANCE.

TENSION STRUT BACKUP MAY BE USED IN CONSTRUCTION ZONES ON ASPHALT CONCRETE (A.C.) FOR TEMPORARY USE ONLY.

LOW MAINTENANCE

Texas Department of Transportation
Design Division Standard

TRINITY HIGHWAY ENERGY ABSORPTION QUADGUARD ELITE M10 (MASH TL-3)

QGELITE(M10)(N)-20

FILE: qgelitem10n20.dgn	DN: TxDOT	CK: KM	DW: VP	CK: AG
©TxDOT: NOVEMBER 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		54

DATE: 3/1/2024
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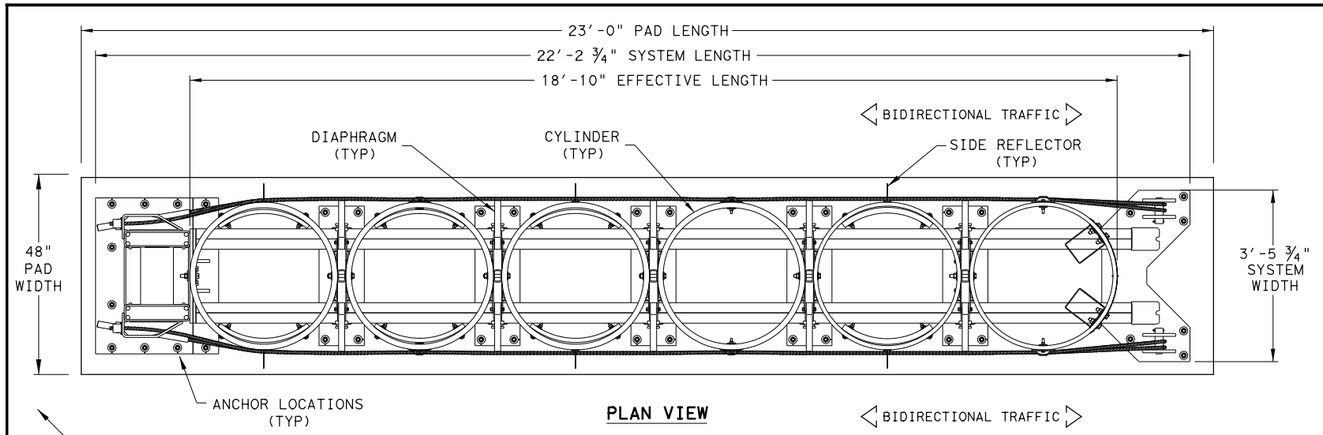
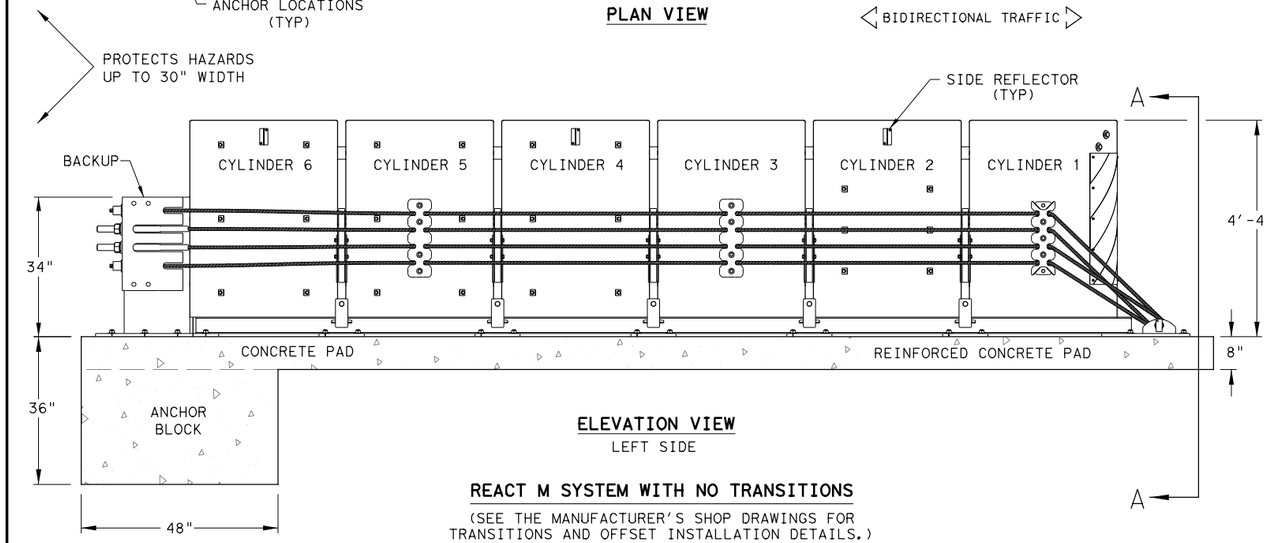


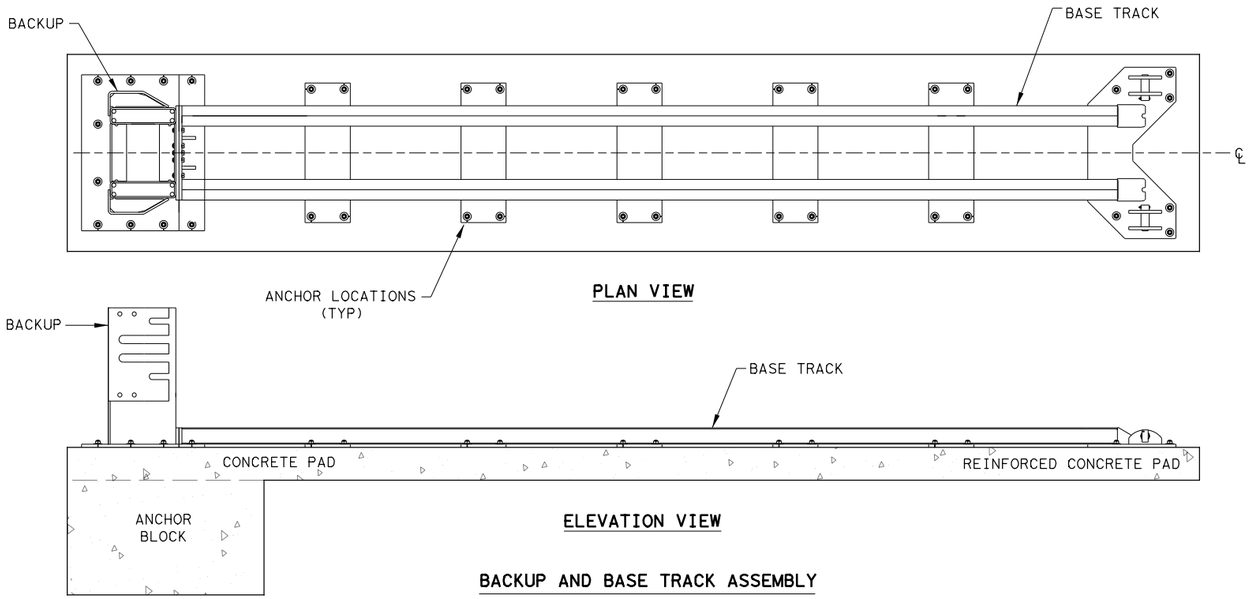
PLAN VIEW



ELEVATION VIEW
LEFT SIDE

REACT M SYSTEM WITH NO TRANSITIONS

(SEE THE MANUFACTURER'S SHOP DRAWINGS FOR TRANSITIONS AND OFFSET INSTALLATION DETAILS.)

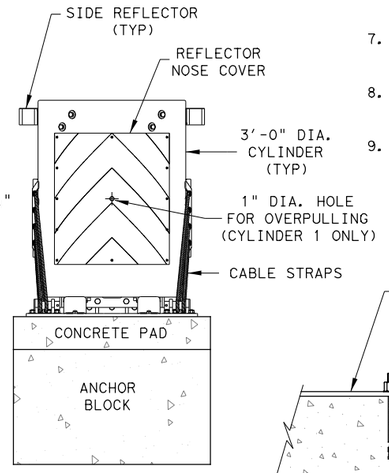


PLAN VIEW

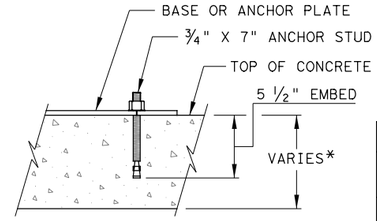
ELEVATION VIEW

BACKUP AND BASE TRACK ASSEMBLY

(SEE THE MANUFACTURER'S SHOP DRAWINGS FOR TRANSITIONS, OFFSETS, BIDIRECTIONAL AND UNIDIRECTIONAL INSTALLATION DETAILS.)

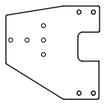


VIEW A-A

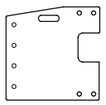


ANCHORING DETAIL
*SEE FOUNDATION TYPES TABLE

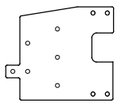
BACKUP ASSEMBLY TYPES FOR SYSTEM TRANSITIONS



SAFETY SHAPE BARRIER TRANSITION (ADAPTER)
TRANSITION PLATE(S) (OPTIONAL)
REQUIRED W/BI-DIRECTIONAL TRAFFIC FLOWS ONLY.



VERTICAL WALL BARRIER TRANSITION (ADAPTER)
TRANSITION PLATE(S) (OPTIONAL)
REQUIRED W/UNIDIRECTIONAL TRAFFIC FLOWS ONLY.



VERTICAL WALL BARRIER TRANSITION (ADAPTER)
TRANSITION PLATE(S) (OPTIONAL)
REQUIRED W/BI-DIRECTIONAL TRAFFIC FLOWS ONLY.

NOTES:
CONTACT THE MANUFACTURER WITH SITE SPECIFIC DATA (SSD) FOR THE CORRECT BACKUP ASSEMBLY AND TRANSITION PANELS OR SIDE PANELS USED FOR STANDARD AND BI-DIRECTIONAL INSTALLATIONS: AT DIVIDED-HIGHWAY MEDIANS OR UNDIVIDED ROADWAYS WHERE THE SYSTEM IS EXPOSED TO IMPACTS FROM ONE OR TWO DIFFERENT DIRECTIONS OF TRAFFIC FLOW.

LOW MAINTENANCE

GENERAL NOTES

1. FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: TRINITY HIGHWAY - ENERGY ABSORPTION AT 1(888)323-6374 OR WEBSITE: www.trinityhighway.com.
2. THE NOSE OF THE REACT M SHALL BE CLAD WITH A PLASTIC WRAP WITH STANDARD DELINEATION ADHERED TO THE WRAP AND SHALL HAVE A SERIES OF SIDE MARKER REFLECTORS ON BOTH SIDES OF THE UNIT. SEE SITE PLAN VIEWS FOR MARKER AND PLASTIC WRAP COLOR ORIENTATION.
3. FOR BI-DIRECTIONAL TRAFFIC, APPROPRIATE TRANSITION DETAILS WILL BE AS SHOWN ON THE MANUFACTURER'S SHOP DRAWINGS.
4. DETAILS OF COMPONENTS FOR THE REACT M, BACKUPS AND REINFORCING DETAILS WILL BE SHOWN ON THE MANUFACTURER'S SHOP DRAWINGS FURNISHED TO THE ENGINEER.
5. IF THE CROSS-SLOPE VARIES MORE THAN 2% OVER THE LENGTH OF THE SYSTEM, THE CONCRETE PAD WILL REQUIRE LEVELING. MAXIMUM PERMISSIBLE CROSS-SLOPE IS 8%.
6. THE INSTALLATION AREA SHOULD BE FREE FROM CURBS, ELEVATED OBJECTS, OR DEPRESSIONS.
7. THE REACT M SYSTEM SHOULD BE APPROXIMATELY PARALLEL WITH THE BARRIER OR CENTERLINE OF MERGING BARRIERS.
8. ALL STEEL COMPONENTS TO BE HOT DIPPED GALVANIZED EXCEPT STAKES, DRIVE SPIKES, THREADED BOLTS IN BACKUP UNIT, AND WEDGE FITTINGS ON CABLES.
9. THIS DRAWING REPRESENTS THE REACT M TL-3 SYSTEM, RE-DIRECTIVE, NON-GATING CRASH CUSHION THAT CAN PROTECT HAZARDS UP TO 30-INCHES IN WIDTH.

DESIGN DATA TABLE FOR REACT M

TEST NUMBER	TEST LEVEL	OVERALL LENGTH	TRANSITION LENGTH	SYSTEM WIDTH
3-30 TO 3-36	TL-3	22′-2 ¾"	-	3′-5 ¾"
3-37A	TL-3	22′-2 ¾"	9′-10 ¾"	3′-5 ¾"
3-38	TL-3	22′-2 ¾"	-	3′-5 ¾"

ANCHOR SYSTEM TYPE

APPROVED ADHESIVE, 7" STUDS, 5.5" EMBEDMENT

FOUNDATION TYPES

MINIMUM 8" REINFORCED PORTLAND CEMENT CONCRETE PAD (REQUIRED REINFORCING STEEL FOR CONCRETE PAD SHALL BE SHOWN ON THE MANUFACTURER'S SHOP DRAWINGS.

MINIMUM 8" NON-REINFORCED PORTLAND CEMENT CONCRETE ROADWAY MEASURING AT LEAST 12′ WIDE BY 50′ LONG)

MINIMUM 7" CONCRETE DECK STRUCTURE, OR MINIMUM 6" REINFORCED CONCRETE ROADWAY

NOTE:
THIS STANDARD IS A BASIC REPRESENTATION OF THE REACT M SYSTEM AND IS NOT INTENDED TO REPLACE THE PRODUCT DESCRIPTION ASSEMBLY MANUAL.

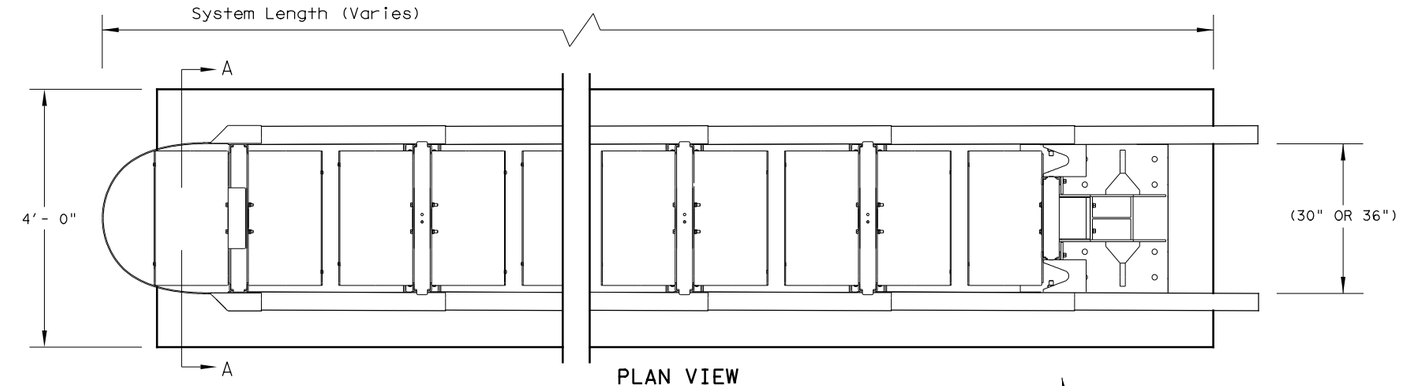
Texas Department of Transportation — Design Division Standard

TRINITY HIGHWAY ENERGY ABSORPTION CRASH CUSHION REACT M (NARROW) (MASH TL-3)

REACT(M)-21

FILE: reactm21.dgn	DN: TXDOT	CK: KM	DW: SS	CK: CL
©TxDOT: JULY 2021	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		55

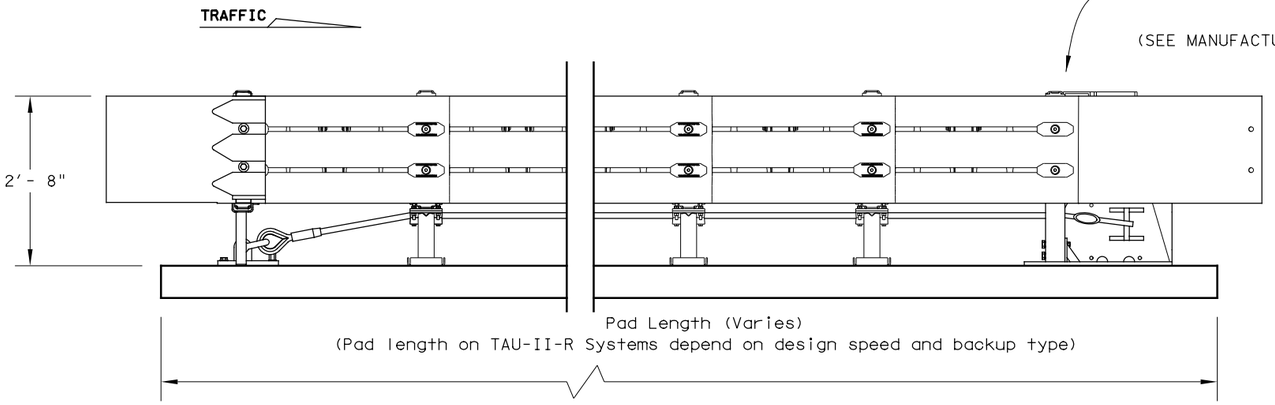
DATE: 3/1/2024
FILE: P:\2020\01156\06-Bosque River-0724-02-020\4 - Design\Plan Set\13. Standards\Roadway\TAU-II-R(N)-16.dgn



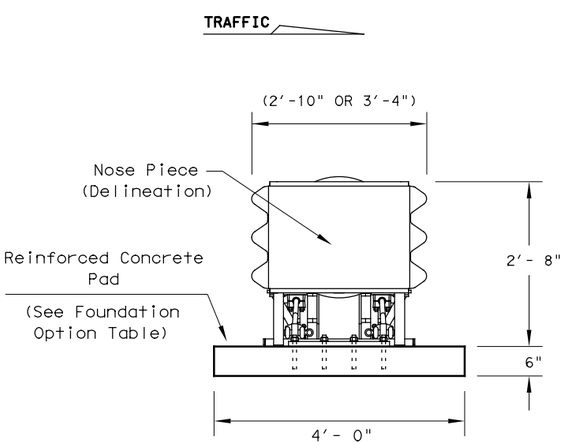
PLAN VIEW

Attachments and transitions to various barrier shapes, barrier railings and bi-directional traffic flows are available.

(SEE MANUFACTURER'S PRODUCT MANUAL)



ELEVATION VIEW



SECTION A-A

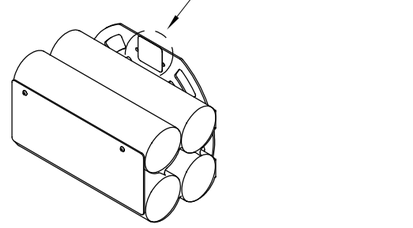
Nose Piece delineation orientation, is shown elsewhere on the plans.

TRANSITION OPTIONS
Vertical Wall
Concrete Traffic Barriers
W-Beam Guardrail
Thrie Beam Guardrail

For bi-directional transition panel and end shoe details.
(See manufacturer's product manual.)

FOUNDATION OPTIONS
6" Reinforced Concrete
8" Unreinforced Concrete
Asphalt over Concrete with Minimum 6" Embedment in Concrete
6" Asphalt over 6" Compact Subbase
8" Minimum Asphalt

For steel placement in concrete foundations.
(See manufacturer's product manual)



ENERGY ABSORBING ELEMENTS (EAE)

BACKUP SUPPORT OPTIONS
Compact (Stand Alone)
Flush Mount
PCB (Concrete Barrier)

TAU-II-R (NARROW) SYSTEM LENGTHS			
BACKSTOP	TL-2	TL-3	70 mph
PCB	13'-7"	27'-10"	30'-7"
Flush Mount	14'-0"	28'-3"	31'-0"
Compact	15'-3"	29'-6"	32'-3"

Backup and Transition types are shown elsewhere on the plans, (i.e. Attenuator location details or in the general notes).

Note: System lengths are ± 2"

GENERAL NOTES

1. For specific information regarding installation and technical guidance of the system, contact: Lindsay Transportation Solutions - Barrier Systems, Inc. at (707) 374-6800. 180 River Road, Rio Vista, CA 94571
2. For bi-directional traffic, appropriate transition panels will be required.
3. Additional details for the backup support option, transition options and foundation option will be shown on the manufacturer's shop drawings furnished to the Engineer.
4. Concrete shall be class "S" with a minimum compressive strength of 4,000 psi.
5. Maximum permissible cross-slope is 8%.
6. The installation area should be free from curbs, elevated objects, or depressions.
7. The TAU-II-R system should be approximately parallel with the barrier or center of merging barriers.
8. Refer to Universal TAU-II-R configuration chart for specific systems configuration number and location of each type of energy absorbing element.
9. 30-inch (30") model shown, also available in 36-inch (36") configuration.

BILL OF MATERIAL

PRODUCT CODE	QTY	DESCRIPTION
B030704	1	Front Support
B030703	TBD	Mid Support
TBD	1	Backstop Assembly (See Table)
TBD	1	Front Cable Anchor
TBD	1	Nose Assembly
B010202	TBD	Sliding Panel
B010659	2	End Panel
K001003	1	Slider Assembly Kit
BSI-1202006-KT	TBD	TAU-II-R Slider Kit
BSI-1107131-KT	TBD	TAU-II-R EAE Mounting Hw Kit
BSI-1012069-00	TBD	Energy Absorbing Element, Type 1
BSI-1012070-00	TBD	Energy Absorbing Element, Type 2
BSI-1012071-00	TBD	Energy Absorbing Element, Type 3
BSI-1110009-00	TBD	Energy Absorbing Element, Type 3N
TBD	TBD	Cable Assembly
K001004	TBD	Cable Guide Kit
K001005	2	Front Support Leg Kit
B010651	4	Pipe Panel Mount
TBD	1	Anchoring Package

(TBD) = To Be Determined, depending on Backup Type and System Length.

(See manufacturer's product manual for details)

LOW MAINTENANCE

Texas Department of Transportation

Design Division Standard

LTS-BARRIER SYSTEMS CRASH CUSHION (R-NARROW)

TAU-II-R(N)-16

FILE: tauiirn16.dgn	DN: TxDOT	CK: KM	DW: VP	CK: CGL
©TxDOT: January 2013	CONT	SECT	JOB	HIGHWAY
REVISIONS REVISED 06,2013 (VP) REVISED 03,2016 (VP)	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		56

DATE: 3/1/2024
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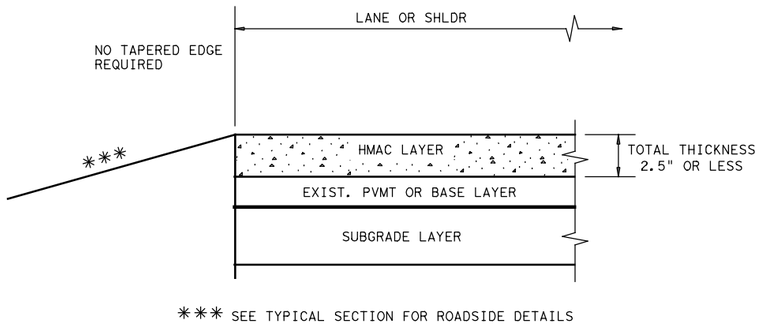
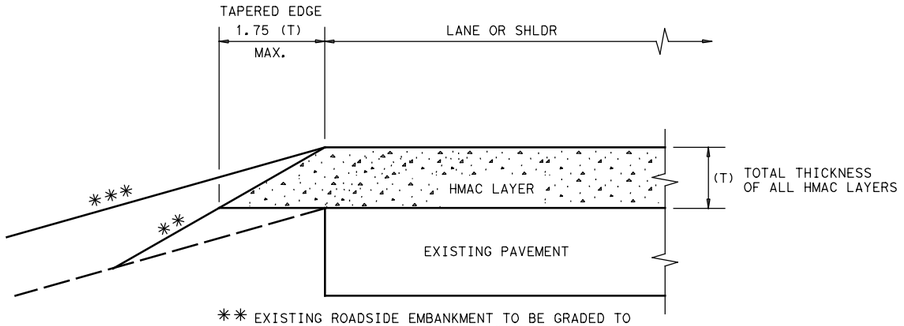


*** SEE TYPICAL SECTION FOR ROADSIDE DETAILS

CONDITION - 1

THIN HMAC SURFACES OR HMAC OVERLAY WITH THICKNESS OF 2.5" OR LESS

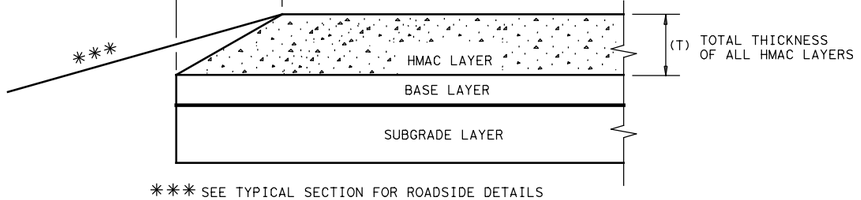


** EXISTING ROADSIDE EMBANKMENT TO BE GRADED TO PRODUCE A SMOOTH LEVEL SURFACE FOR PLACEMENT OF TAPERED EDGE. THIS WORK IS SUBSIDIARY TO THE VARIOUS BID ITEMS.

*** SEE TYPICAL SECTION FOR ROADSIDE DETAILS

CONDITION - 2

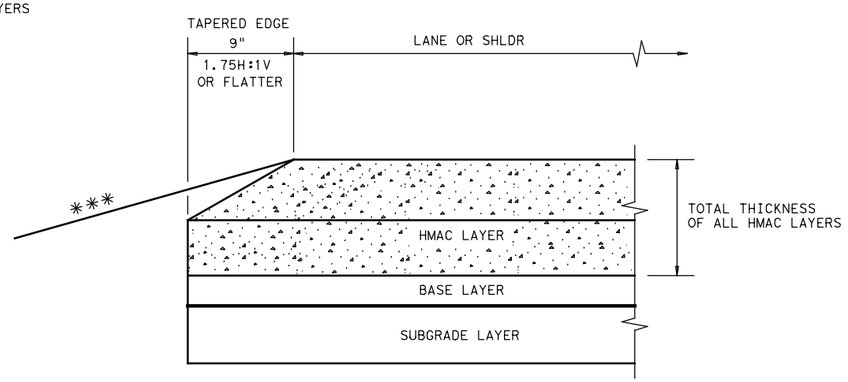
OVERLAY OF EXISTING PAVEMENT HMAC THICKNESS 2.5" TO 5"



*** SEE TYPICAL SECTION FOR ROADSIDE DETAILS

CONDITION - 3

NEW OR RECONSTRUCTED PAVEMENT HMAC THICKNESS 2.5" TO 5"



*** SEE TYPICAL SECTION FOR ROADSIDE DETAILS

CONDITION - 4

NEW OR RECONSTRUCTED PAVEMENT HMAC THICKNESS 5" OR GREATER

GENERAL NOTES

1. UNLESS OTHERWISE SHOWN IN THE PLANS, A VERTICAL EDGE IS PERMISSIBLE FOR HMAC PLACED GREATER THAN 5" BELOW THE EDGE OF PAVEMENT AND FOR THICKNESS OF HMAC LESS THAN 2.5".
2. FOR FURTHER INFORMATION REGARDING THE ROADSIDE AND PAVEMENT DETAILS, SEE TYPICAL SECTIONS.
3. PAYMENT FOR TAPERED EDGE WILL BE IN ACCORDANCE WITH APPLICABLE ITEMS IN THE CONTRACT.
4. THE SLOPE OF THE TAPERED EDGE SHALL BE 1.75H:1V OR FLATTER.
5. THE TAPERED EDGE SHALL BE PRODUCED BY USE OF A SCREED ATTACHMENT CAPABLE OF PRODUCING A SMOOTH COMPACTED SURFACE. ADDITIONAL COMPACTING EFFORT BEHIND THE SCREED IS NOT REQUIRED.

(NOT TO SCALE)

Texas Department of Transportation | Design Division Standard

TAPERED EDGE DETAILS HMAC PAVEMENT

TE(HMAC)-11

FILE: tehmac11.dgn	DN: TxDOT	CK: RL	DW: KB	CK:
©TxDOT January 2011	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC.	FM 219
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	WACO	BOSQUE		57

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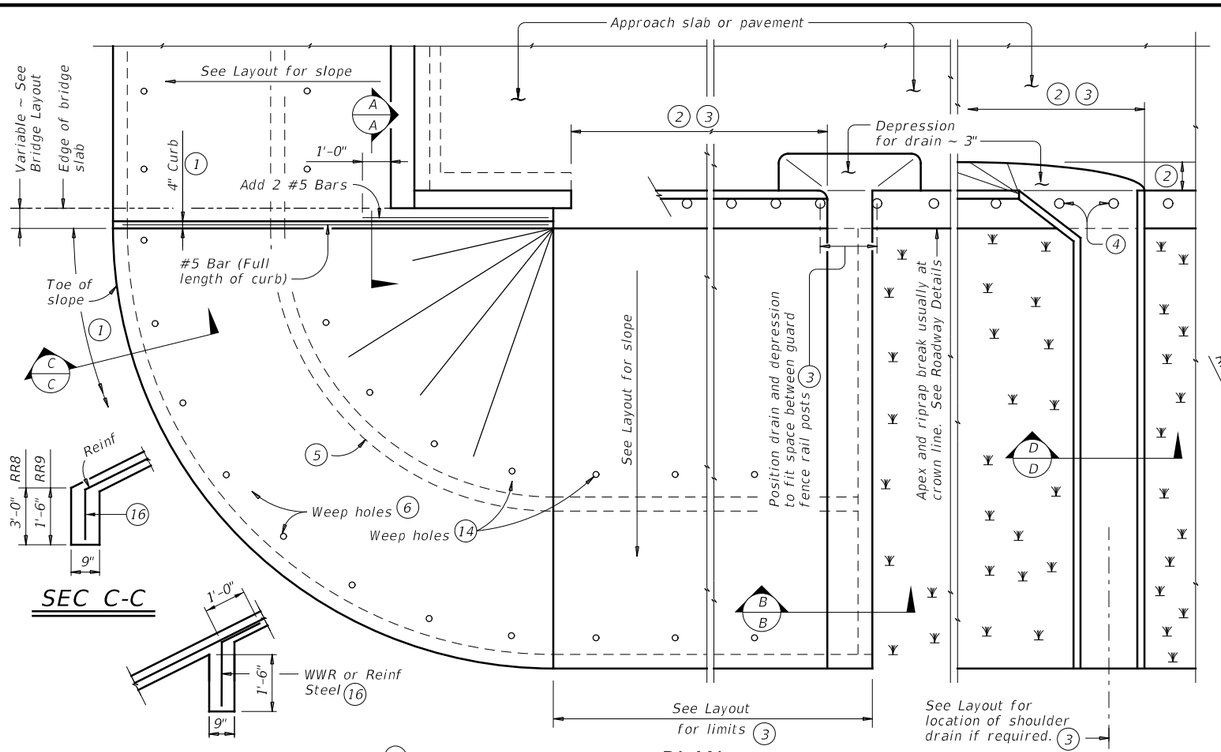
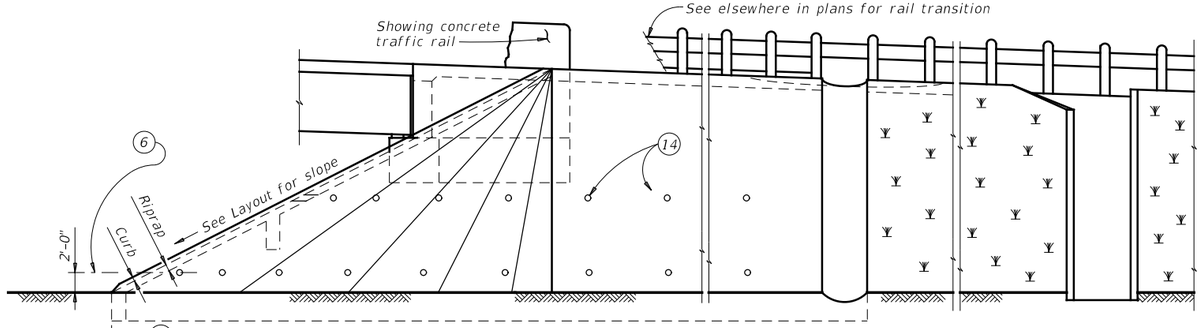


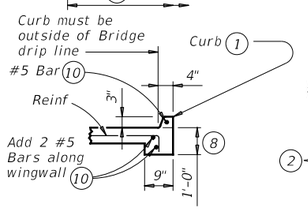
PLAN

SEC C-C

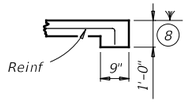
INTERMEDIATE TOEWALL



ELEVATION

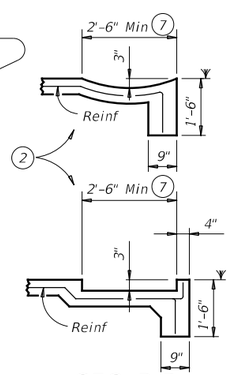


SEC A-A



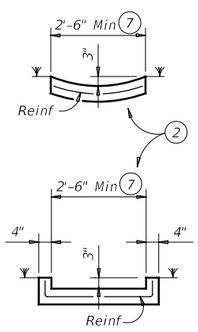
SEC B-B

(No drain)



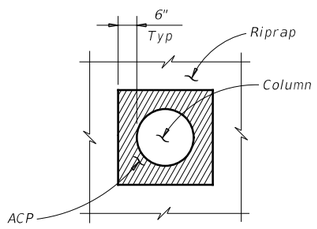
SEC B-B

(Shoulder drain integral with riprap)



SEC D-D

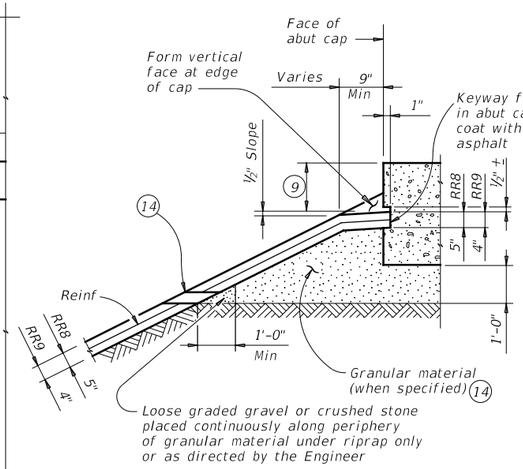
(Shoulder drain)



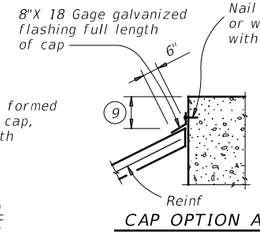
Riprap blockout to be filled with ACP. (Subsidiary to riprap)

RIPRAP DETAIL AT COLUMNS

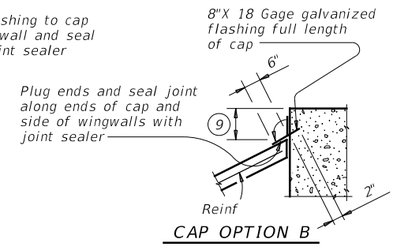
(As directed by the Engineer)



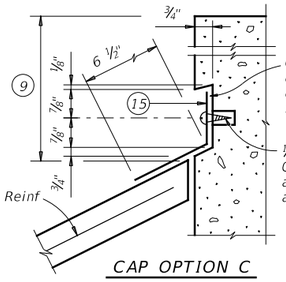
SHOWING KEYWAY OPTION



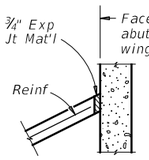
CAP OPTION A



CAP OPTION B

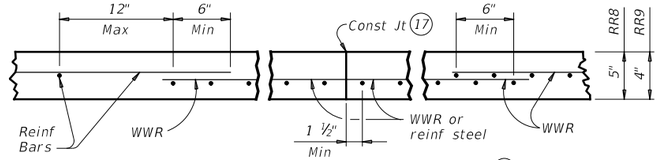


CAP OPTION C



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:	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		58

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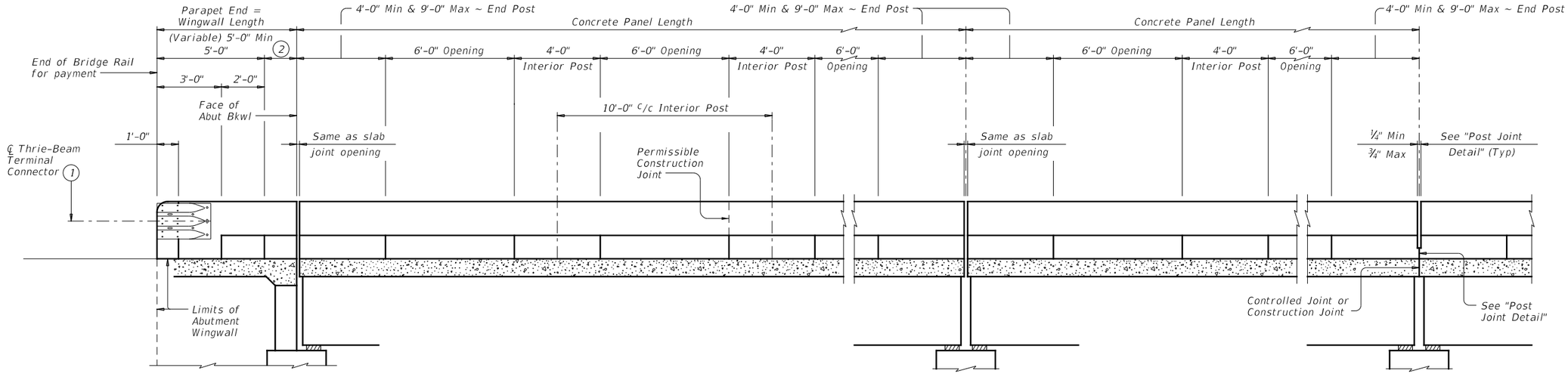
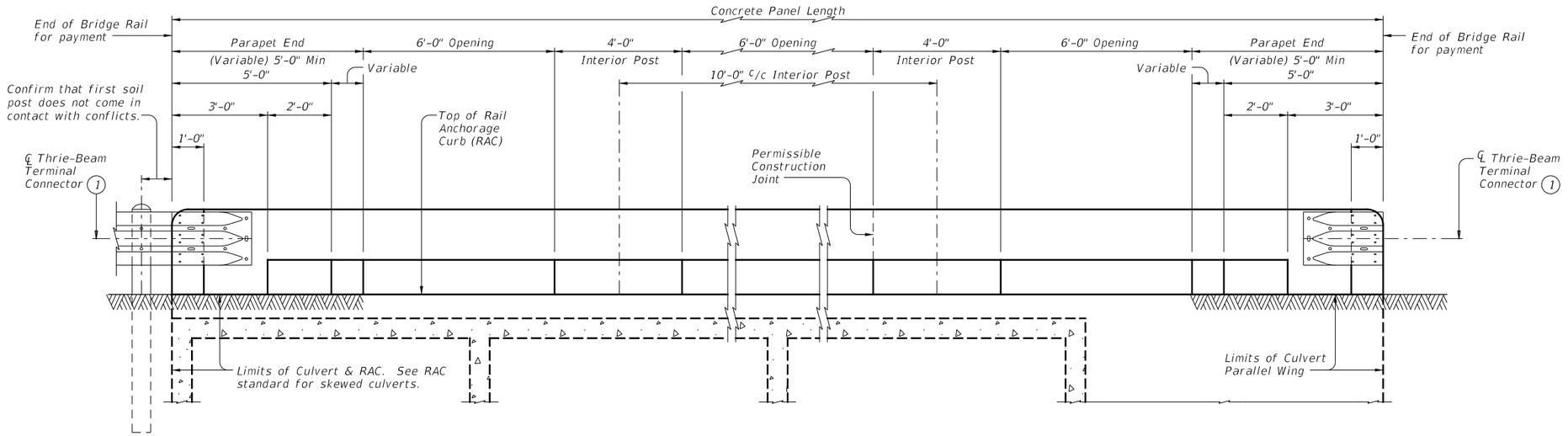


ROADWAY ELEVATION OF RAIL ON BRIDGE



ROADWAY ELEVATION OF RAIL ON BOX CULVERTS

Showing 0° skew culvert. Skewed culverts similar. See RAC standard for details not shown.
Vertical joints in concrete rail are not required, unless shown elsewhere.

(1) Terminal Connectors and associated hardware are to be paid for under the Item "Metal Beam Guard Fence". Attach Metal Beam Guard Fence Transitions to the bridge rail and extend along the embankment unless otherwise shown in the plans.

(2) Wingwall Length minus 5'-0" (Varies)

Texas Department of Transportation

Bridge Division Standard

TRAFFIC RAIL

TYPE T223

FILE:	DN: TxDOT	CK: TxDOT	DW: JTR	CK: AES
©TxDOT September 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		59

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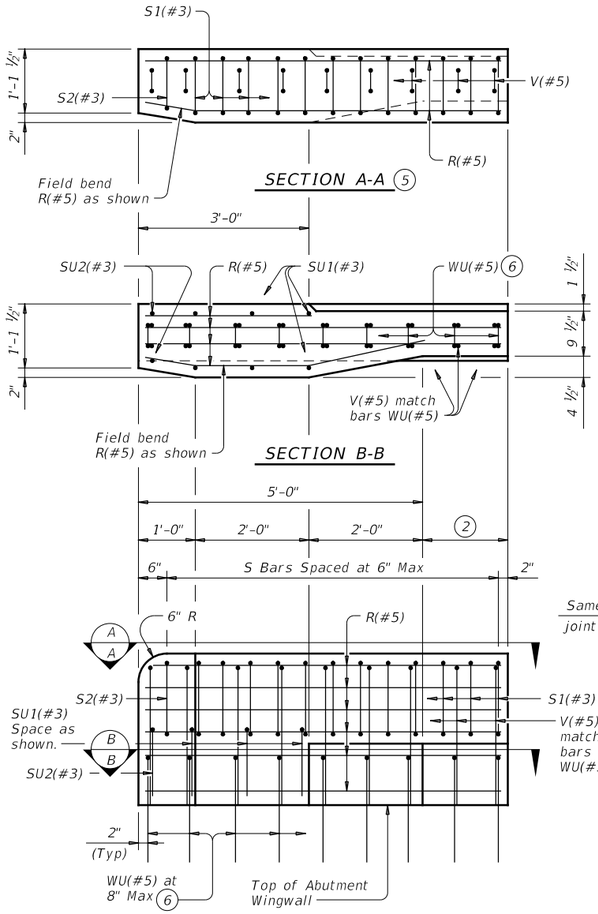
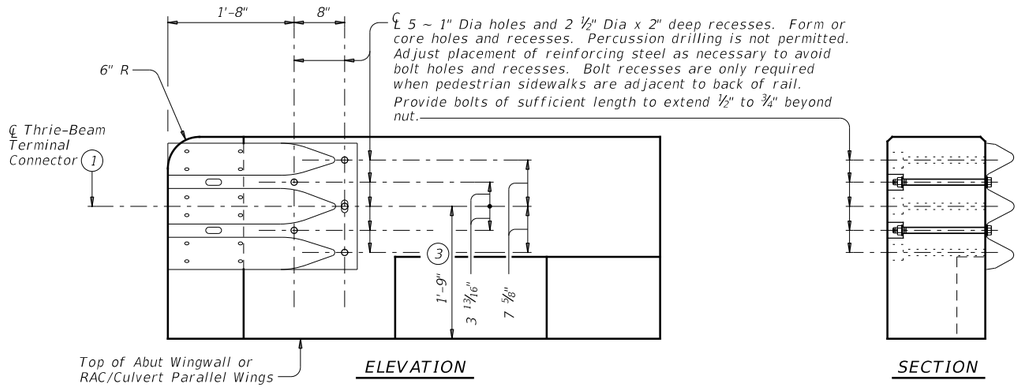
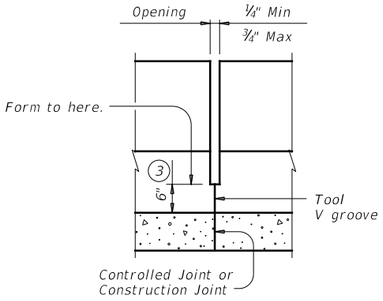


PARAPET END AT ABUT WINGWALL (6)

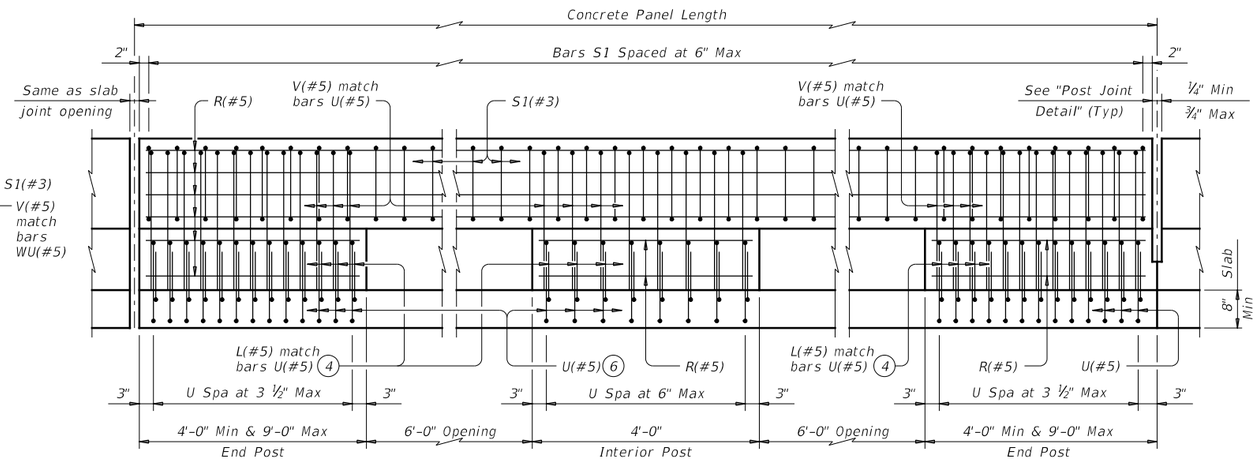


TERMINAL CONNECTION DETAILS



POST JOINT DETAIL

Provide at all interior bents without slab expansion joints.



AT SLAB EXPANSION JOINTS

AT 4' INTERIOR POST

AT BENTS WITHOUT SLAB EXPANSION JOINTS

ELEVATION SHOWING TYPICAL REINFORCING PLACEMENT

Showing rail on slab. Rail on box culvert similar.

(1) Terminal Connectors and associated hardware are to be paid for under the Item "Metal Beam Guard Fence". Attach Metal Beam Guard Fence Transitions to the bridge rail and extend along the embankment unless otherwise shown in the plans.

(2) Wingwall Length minus 5'-0" (Varies)

(3) Increase 2" for structures with overlay.

(4) Bars L(#5) are part of rail reinforcing and are included in unit price bid for railing. Space with Bars U. Bars L match slab bar cover. Bars L may be bundled with top slab reinforcing if spacing is equivalent.

(5) Bars SU1(#3), SU2(#3) and WU(#5) not shown for clarity.

(6) Substitute Bars U(#5) for Bars WU(#5) when parapet end is located on anchorage curb over culvert top slab. Use Bars WU(#5) in culvert parallel wings.

Texas Department of Transportation

Bridge Division Standard

TRAFFIC RAIL

TYPE T223

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©TxDOT September 2019	CONT	SECT	JOB	HIGHWAY
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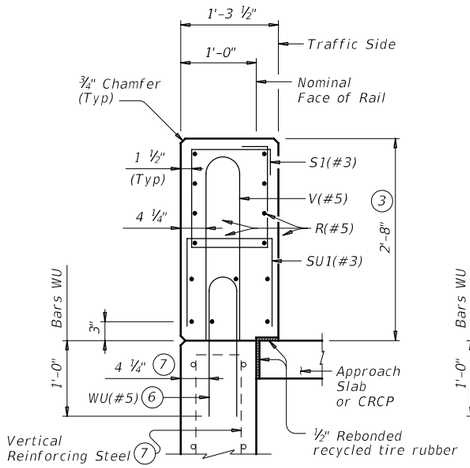
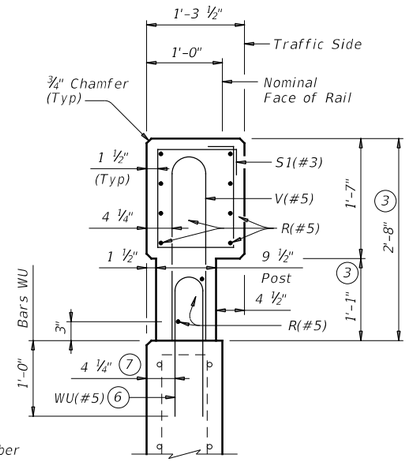
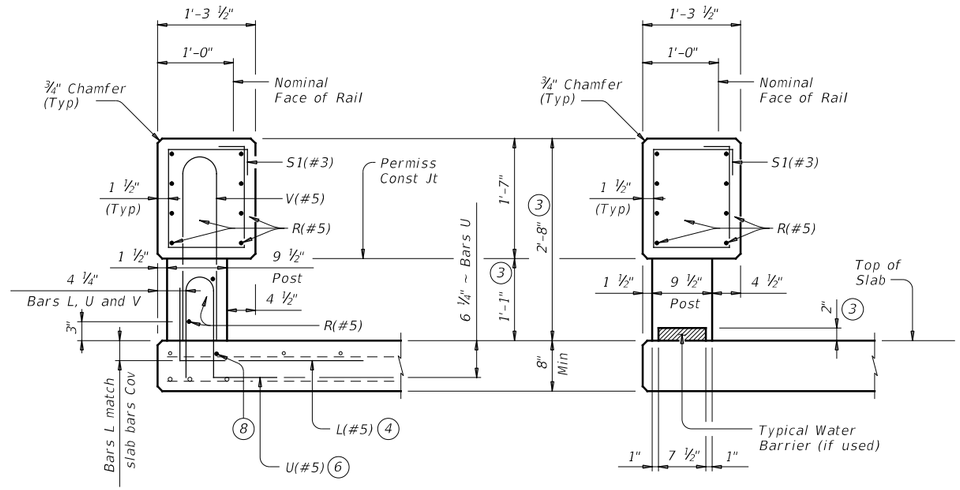


SECTION C-C
ON ABUTMENT WINGWALLS
OR CIP RETAINING WALLS



SECTION D-D
ON ABUTMENT WINGWALLS
OR CIP RETAINING WALLS

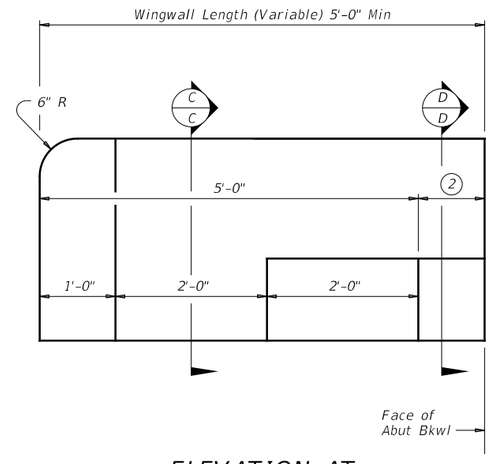


AT POST
ON BRIDGE SLAB

AT OPENING
ON BRIDGE SLAB

SECTIONS THRU RAIL

Sections on box culverts similar.



ELEVATION AT ABUTMENT WINGWALL

Box culvert parallel wings or rail anchorage curb similar.

(2) *Wingwall Length minus 5'-0" (Varies)*

(3) *Increase 2" for structures with overlay.*

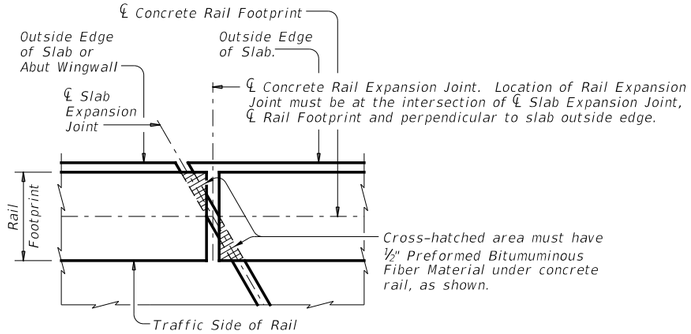
(4) *Bars L(#5) are part of rail reinforcing and are included in unit price bid for railing. Space with Bars U. Bars L match slab bar cover. Bars L may be bundled with top slab reinforcing if spacing is equivalent.*

(6) *Substitute Bars U(#5) for Bars WU(#5) when parapet end is located on anchorage curb over culvert top slab. Use Bars WU(#5) in culvert parallel wings.*

(7) *When vertical reinforcing has closer clear cover over horizontal reinforcing in abutment wingwalls on traffic side of wall, move the horizontal wingwall/retaining wall reinforcing to the inside of Bars WU where bars conflict.*

(8) *Top longitudinal slab bar may be adjusted laterally 3" plus or minus to tie reinforcing.*

(9) *At the Contractor's option, Bars V may be replaced by extending Bars U to 2'-5 ¼" above the roadway surface without overlay.*



PLAN OF RAIL AT EXPANSION JOINTS

Example showing Slab Expansion Joints without breakbacks.

CONSTRUCTION NOTES:

Face of rail and parapet must be vertical transversely unless otherwise shown in the plans or approved by the Engineer.

Provide water barriers at openings draining onto undercrossing roadways and sidewalks. They may be cast-in-place or precast in convenient lengths and bonded to the bridge deck with an approved epoxy cement.

Chamfer all exposed corners.

MATERIAL NOTES:

Provide Class "C" concrete. Provide Class "C" (HPC) if required elsewhere.

Provide Grade 60 reinforcing steel.

Epoxy coat or galvanize all reinforcing steel if slab bars are epoxy coated or galvanized.

Deformed Welded Wire Reinforcing (WWR) (ASTM A1064) of equal size and spacing may be substituted for Bars U, V, and WU unless noted otherwise. Provide the same laps as required for reinforcing bars.

Provide bar laps, where required, as follows:

Uncoated or galvanized ~ #5 = 2'-0"
Epoxy coated ~ #5 = 3'-0"

GENERAL NOTES:

This rail has been evaluated by full-scale crash test to meet MASH TL-3 criteria. This rail can be used for speeds of 50 mph and greater when a TL-3 rated guard fence transition is used. When a TL-2 rated guard fence transition is used, this rail can only be used for speeds of 45 mph and less.

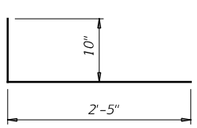
Do not use this railing on bridges with expansion joints providing more than 5" movement.

Rail anchorage details shown on this standard may require modification for select structure types. See appropriate details elsewhere in plans for these modifications.

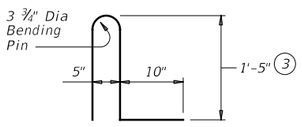
Shop drawings are not required for this rail.

Average weight of railing with no overlay is 358 plf.

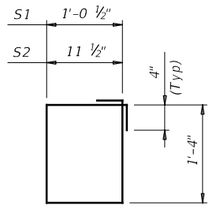
Cover dimensions are clear dimensions, unless noted otherwise. Reinforcing bar dimensions shown are out-to-out of bar.



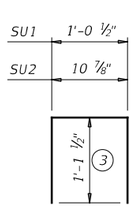
BARS L (#5)



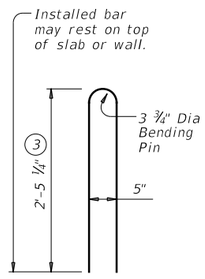
BARS U (#5) 9



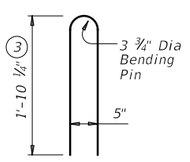
BARS S (#3)



BARS SU (#3)



BARS V (#5) 9



BARS WU (#5)

SHEET 3 OF 3

Texas Department of Transportation

Bridge Division Standard

TRAFFIC RAIL

TYPE T223

FILE:	DN: TxDOT	CK: TxDOT	DW: JTR	CK: AES
©TxDOT September 2019 REVISIONS	CONT	SECT	JOB	HIGHWAY
	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		61

DATE: 3/1/2024 12:16:06 PM
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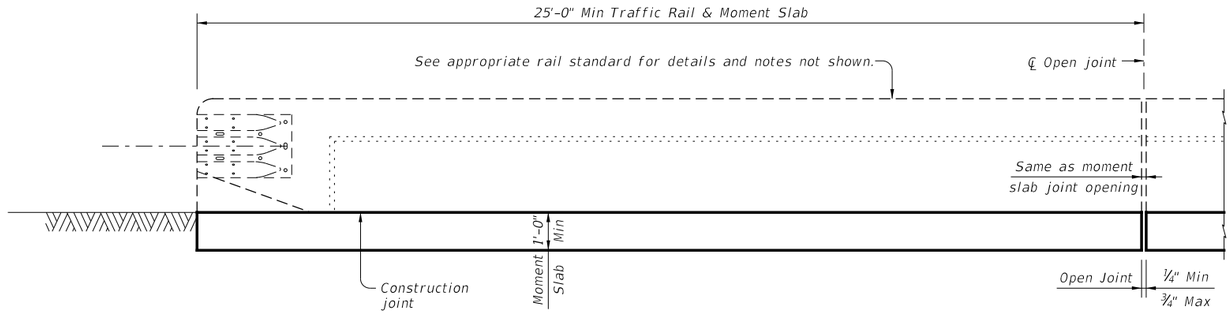
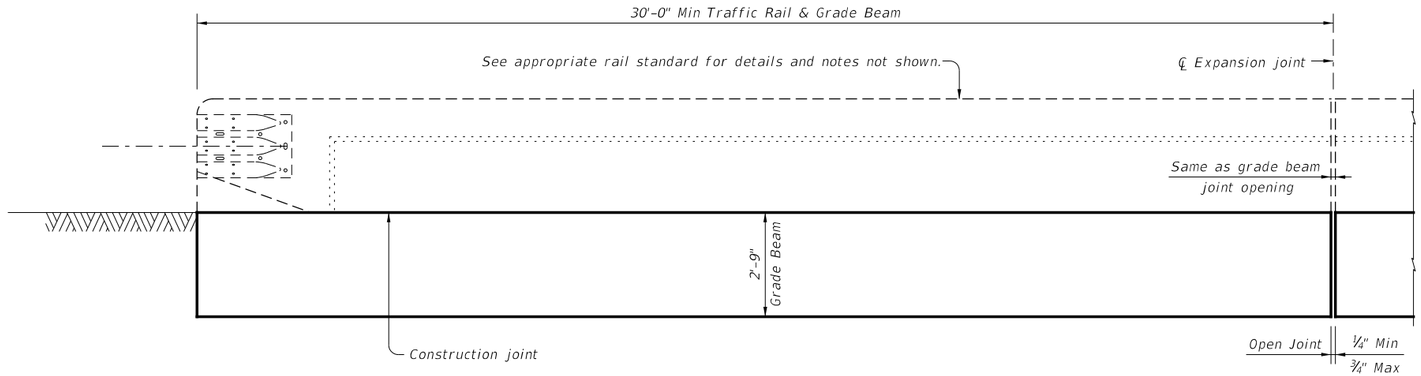


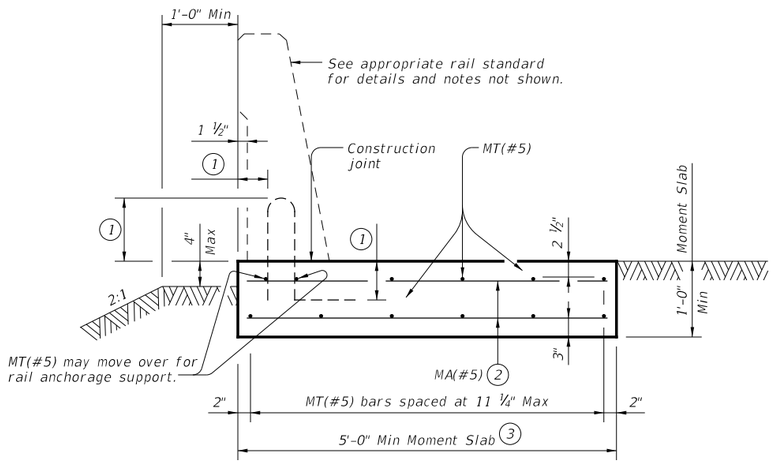
ROADWAY ELEVATION OF TRAFFIC RAIL ON MOMENT SLAB (TRF-MS)

(Showing SSTR rail other rails are similar. Reinforcing not shown for clarity.)



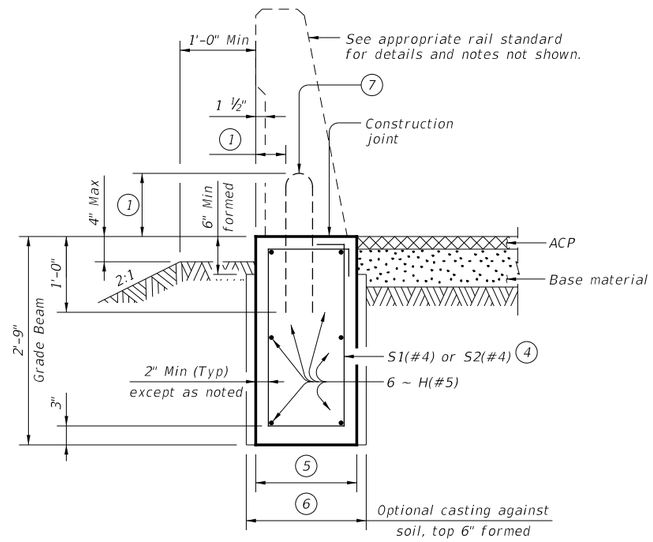
ROADWAY ELEVATION OF TRAFFIC RAIL ON GRADE BEAM (TRF-GB)

(Showing SSTR rail other rails are similar. Reinforcing not shown for clarity.)



SECTION OF TRAFFIC RAIL ON MOMENT SLAB (TRF-MS)

(Showing SSTR rail other rails are similar.)



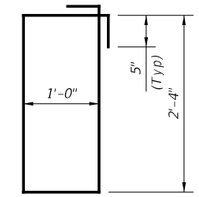
SECTION OF TRAFFIC RAIL ON GRADE BEAM (TRF-GB)

(Showing SSTR rail other rails are similar.)

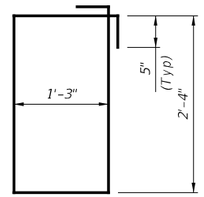
1. See applicable bridge rail standard.
2. MA(#5) space longitudinally along moment slab at 12" Max. (Spaced 2 ½" longitudinally from outside edge of moment slab).
3. Approximate moment slab concrete = 0.19 CY/LF and reinforcement = 22.4 LB/LF.
4. S1(#4) or S2(#4) spaced longitudinally along grade beam at 8" Max. (Spaced 2 ½" longitudinally from outside edge of grade beam).
5. Use bar S1(#4) with 1'-4" grade beam width and bridge rail types: All rails except for T224, C412, T66, C66, T80HT and T80SS.
   Approximate grade beam concrete = 0.14 CY/LF and reinforcement = 13.8 LB/LF.

   Use bar S2(#4) with 1'-7" grade beam width and bridge rail types: T66 and C66.
   Approximate grade beam concrete = 0.16 CY/LF and reinforcement = 14.2 LB/LF.
6. 1'-6" for bridge rail types: All rails except for T224, C412, T66, C66, T80HT and T80SS.

   1'-9" bridge rail types: T66 and C66.
7. Modify reinforcing on standard bridge rail anchorage if necessary by extending rail anchorage 12" Min, vertically into traffic rail



BARS S1(#4)



BARS S2(#4)

CONSTRUCTION NOTES:

Align moment slab (TRF-MS) or grade beam (TRF-GB) open joints with rail open joints maintaining no less than minimum rail length. Provide moment slab (TRF-MS) or grade beam (TRF-GB) with open joints at no greater than 100' spacing unless otherwise shown on the plans or approved by the Engineer.

MATERIAL NOTES:

Provide Class "C" concrete. Provide Class "C" (HPC) if required elsewhere.

Provide Grade 60 reinforcing steel.

Epoxy coat or galvanize all reinforcing steel if required elsewhere.

Deformed Welded Wire Reinforcement (WWR) (ASTM A1064) of equal size and spacing may be substituted for bars S1(#4), S2(#4) and H(#5) unless noted otherwise. Provide the same laps as required for reinforcing bars.

Provide bar laps, where required, as follows:

Uncoated or galvanized ~ #5 = 2'-4"
Epoxy coated ~ #5 = 3'-6"

GENERAL NOTES:

Use of these details will result in a moment slab (TRF-MS) or grade beam (TRF-GB) foundation that is acceptable for traffic rails which are MASH TL-2, TL-3, or TL-4 compliant.

See elsewhere in the plans for selected options between moment slab (TRF-MS) and/or grade beam (TRF-GB).

The foundation design resistance is based on the current AASHTO bridge railing requirements with the assumption of fair to good soil support conditions. Poor soil conditions will require suitably deeper and/or wider foundations.

See appropriate rail standard for details and notes not shown.

This detail is intended for use as a guide to unusual railing anchorage situations but may be included in the plans, modified as necessary to apply to specific installations required on the project.

Payment for moment slab (TRF-MS) and/or grade beam (TRF-GB) will be by Class "C" concrete or Class "C" (HPC) concrete for rail foundations.

The associated bridge railing will be paid for by the linear foot which includes the concrete and reinforcement.

Excavation will be subsidiary to other Items.

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

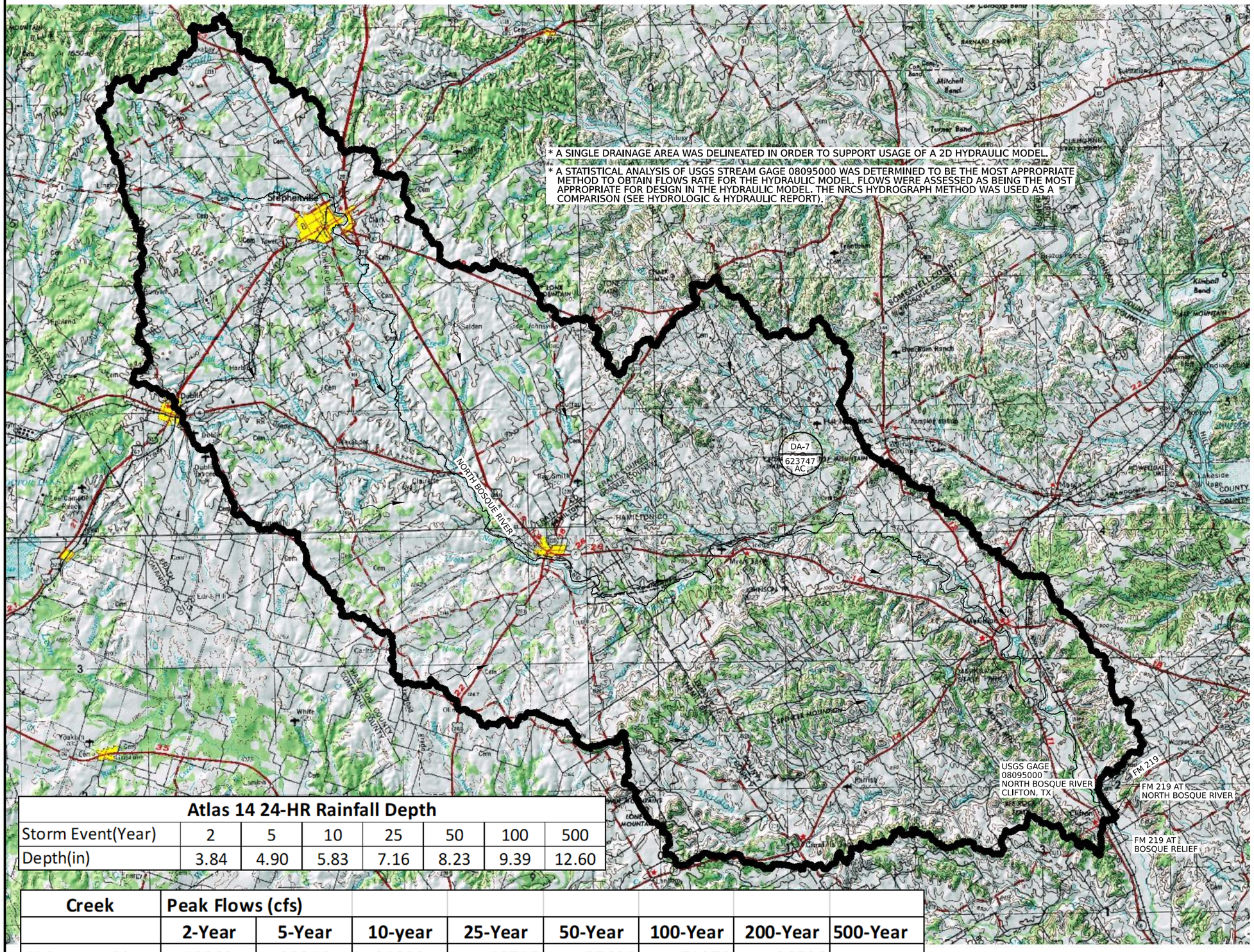
Texas Department of Transportation

Bridge Division Standard

TRAFFIC RAIL FOUNDATIONS
FOR MASH TL-2, TL-3 & TL-4 BRIDGE RAILS

TRF

FILE:	DN: TxDOT	CK: TAR	DW: JTR	CK: TAR
©TxDOT September 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS 07-20: Added moment slab with rail foundation lengths.	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		62



Atlas 14 24-HR Rainfall Depth							
Storm Event(Year)	2	5	10	25	50	100	500
Depth(in)	3.84	4.90	5.83	7.16	8.23	9.39	12.60

Creek	Peak Flows (cfs)							
	2-Year	5-Year	10-year	25-Year	50-Year	100-Year	200-Year	500-Year
N Bosque River	13902	22916	31820	45715	57624	71079	86796	110322

N

LEGEND:

- XX-X / XXXX XX — DA ID / DA ACRES
- FLOW ARROW
- DRAINAGE AREA BOUNDARY
- FLOW CHANNEL
- 5 FT CONTOUR

NOTES:

1. 2018 1-m LIDAR DATA AND ARC GIS WERE USED TO DELINEATE THE DRAINAGE AREA MAP.
2. HYDROLOGIC CALCULATIONS WERE PERFORMED IN ACCORDANCE WITH THE TXDOT HYDRAULIC DESIGN MANUAL, SEPT. 2019 EDITION.
3. RAINFALL DATA WERE OBTAINED FROM NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY ESTIMATES.
4. TIME OF CONCENTRATION AND LAG TIME WERE ESTIMATED USING KERBY-KIRPICH METHOD.
5. THE CN VALUE WAS ADJUSTED BASED ON THE RECOMMENDED AMC II CLIMATIC ADJUSTMENT OF -15 IN ACCORDANCE WITH THE TXDOT HYDRAULIC DESIGN MANUAL, SEPT. 2019 EDITION.
6. HEC-HMS VER. 4.11 SCS METHOD WAS USED TO COMPUTE PEAK DISCHARGE.
7. FEMA EFFECTIVE FIRM PANEL NO. IS 48035C0490C, DATED EFFECTIVE JANUARY 6, 2011 AND IS LOCATED IN ZONE A FLOOD HAZARD AREA.
8. PLANS WILL BE SENT TO THE FLOODPLAIN ADMINISTRATOR ON 2-22-2024.

0 12500 25000 FT

PRINT DATE	REVISION DATE
2/26/2024	

STATE OF TEXAS
JEREMY A. BRANCH
133488
LICENSED PROFESSIONAL ENGINEER
2/26/2024

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Texas Department of Transportation
Waco District

FM 219 BRIDGE REPLACEMENTS

DRAINAGE AREA MAP

SHEET 1 OF 2

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 63

CS: 0724 02 020, ETC.
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USGS PEAK STREAMFLOW DATA

Year	Discharge	Year	Discharge	Year	Discharge
1922	-	1957	37400	1991	6440
1924	14300	1958	32200	1992	200000
1925	7760	1959	6280	1993	7230
1926	10400	1960	92800	1994	32500
1927	15200	1961	16000	1995	29100
1928	12700	1962	25100	1996	17200
1929	26800	1963	11000	1997	36000
1930	18300	1964	19500	1998	137000
1931	25900	1965	38500	1999	1570
1932	24300	1966	22200	2000	24800
1933	21400	1967	3050	2001	16500
1934	12000	1968	33600	2002	19100
1935	38300	1969	19200	2003	8460
1936	32400	1970	12000	2004	38900
1937	16900	1971	2210	2005	28300
1938	38500	1972	36800	2006	6280
1939	24500	1973	18100	2007	46500
1940	4970	1974	5450	2008	7960
1941	36400	1975	14200	2009	2100
1942	27900	1976	12000	2010	35300
1943	20100	1977	36400	2011	147
1944	36000	1978	1250	2012	21300
1945	39000	1979	34300	2013	691
1946	12800	1980	1860	2014	4460
1947	7270	1981	21400	2015	39900
1948	31900	1982	10100	2016	29500
1949	15200	1983	2230	2017	8990
1950	9750	1984	6030	2018	6840
1951	4100	1985	4500	2019	37500
1952	35400	1986	23200	2020	6070
1953	3990	1987	20500	2021	13800
1954	4570	1988	28400	2022	121
1955	21300	1989	37900		
1956	29900	1990	82400		

HIGH OUTLIERS

Year	Discharge
1960	92800
1990	82400
1992	200000
1998	137000

HIGH OUTLIERS

MULTIPLE GRUBBS-BECK TEST WAS PERFORMED TO IDENTIFY INFLUENTIAL HIGH FLOODS IN THE PEAK FLOW DATASET. THE POTENTIALLY INFLUENTIAL HIGH-THRESHOLD WAS CALCULATED AT 80,000 CFS. THE IDENTIFIED HIGH FLOWS WERE REMOVED FROM THE ANALYSIS.

STATISTICAL ANALYSIS OF STREAM GAUGE DATA

EXPECTED MOMENTS ALGORITHM AND LOG-PEARSON TYPE III DISTRIBUTION FITTING PROCEDURE WERE PERFORMED USING PEAKFQ (V.7.4) TO ESTIMATE PEAK FLOWS FOR EVENTS WITH FIFFERENT ANNUAL PROBABILITY OF EXCEEDANCE.

USGS STREAM SITE

USGS 08095000 NORTH BOSQUE RIVER NEAR CLIFTON, TX
LATITUDE 31°47'09", LONGITUDE 97°34'04" NAD27
BOSQUE COUNTY TEXAS HYDROLOGIC UNIT CODE 12060204
DRAINAGE AREA: 968 SQUARE MILES

NOTES:

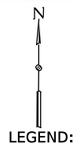
* A SINGLE DRAINAGE AREA WAS DELINEATED IN ORDER TO SUPPORT USAGE OF A 2D HYDRAULIC MODEL.

* A STATISTICAL ANALYSIS OF USGS STREAM GAGE 08095000 WAS DETERMINED TO BE THE MOST APPROPRIATE METHOD TO OBTAIN FLOWS RATE FOR THE HYDRAULIC MODEL. FLOWS WERE ASSESSED AS BEING THE MOST APPROPRIATE FOR DESIGN IN THE HYDRAULIC MODEL. THE NRCS HYDROGRAPH METHOD WAS USED AS A COMPARISON (SEE HYDROLOGIC & HYDRAULIC REPORT).

* A WEIGHTED SKEW WAS USED BASED ON A REGIONAL SKEW OF -0.1 AND A REGIONAL SKEW MSE OF 0.123.

SkewOption	Skew	Mean	StandDev	AtSiteSkew	AtSiteMSEG	AtSiteMSEG GagedOnly	RegSkew	RegMSEG
Weighted	-0.263	4.251	0.271	-1.12	0.254	0.254	-0.1	0.123

Creek Name	Statistical Analysis of Stream Gauge Data-Log Pearson III Distribution (cfs)							
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	200-Year	500-Year
N Bosque River	18330	30370	38940	50210	58810	67520	76380	88320



LEGEND:

DA ID
DA ACRES
FLOW ARROW
DRAINAGE AREA BOUNDARY
FLOW CHANNEL
5 FT CONTOUR

NOTES:

1. 2018 1-m LIDAR DATA AND ARC GIS WERE USED TO DELINEATE THE DRAINAGE AREA MAP.
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7. FEMA EFFECTIVE FIRM PANEL NO. IS 48035C0490C, DATED EFFECTIVE JANUARY 6, 2011 AND IS LOCATED IN ZONE A FLOOD HAZARD AREA.
8. PLANS WILL BE SENT TO THE FLOODPLAIN ADMINISTRATOR ON 2-22-2024.

0 12500 25000 FT

PRINT DATE	REVISION DATE
2/26/2024	

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Texas Department of Transportation
Waco District

FM 219 BRIDGE REPLACEMENTS

DRAINAGE AREA MAP

SHEET 2 OF 2

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 64

CSJ: 0724 02 020, ETC.
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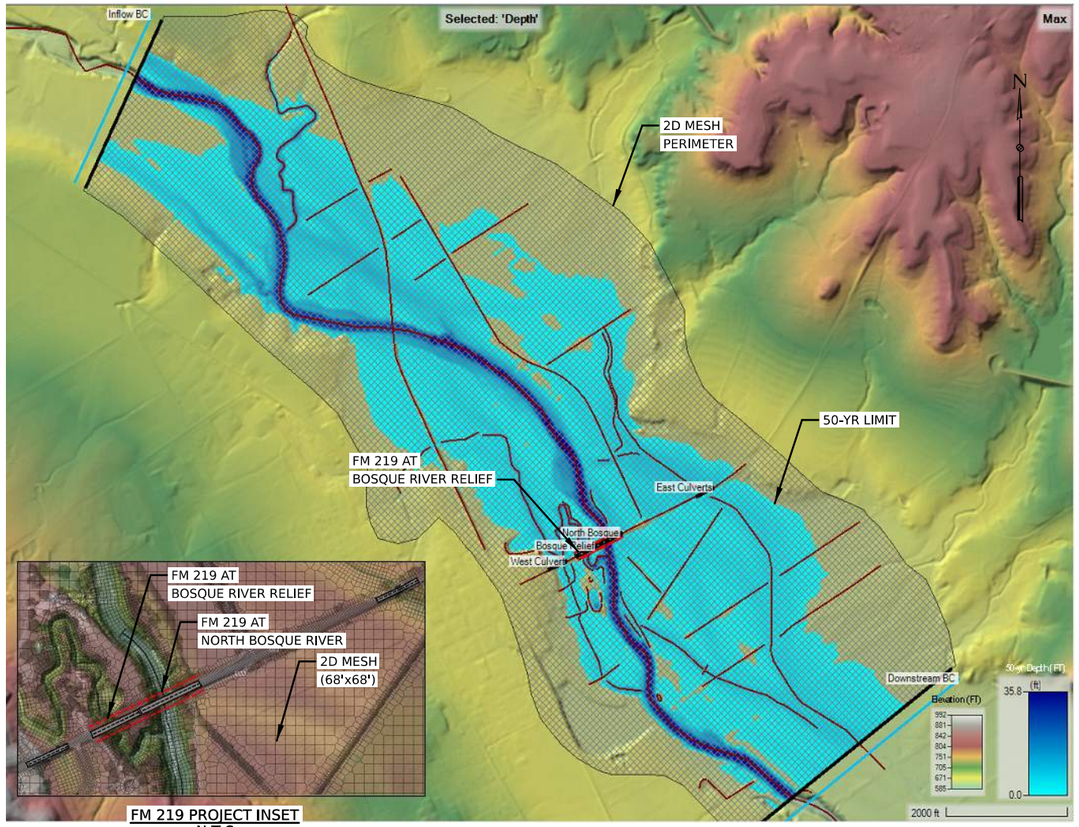

FM 219 PROJECT INSET
N.T.S

HECRAS 2D MODEL LAYOUT AT BOSQUE RIVER RELIEF

NOTES:

1. 2D STEADY STATE HYDRAULIC ANALYSIS WAS COMPUTED USING HEC-RAS VER. 6.4.1.
2. DISCHARGE AT BRIDGE IS OBTAINED FROM 2D MESH USING PROFILE LINES.
3. THE STARTING WATER SURFACE ELEVATION WAS BASED ON NORMAL DEPTH AND BED SLOPE OF 0.0014.
4. THE DESIGN STORM EVENT WAS 50 YR WITH A CHECK FLOOD OF 100 YR EVENT.
5. ALL ELEMENTS ARE BASED ON NORTH AMERICAN VERTICAL DATUM 88 (NAVD88).
6. PROJECT IS LOCATED IN FEMA EFFECTIVE FIRM PANEL NO. 48035C0490C, DATED EFFECTIVE JANUARY 6, 2011 AND IS IN ZONE A FLOOD HAZARD AREA.
7. THE LOCAL FLOODPLAIN ADMINISTRATOR SHALL BE NOTIFIED AND GIVEN AN ELECTRONIC AND HARD COPY VERSION OF THE FINAL DRAINAGE REPORT AS PART OF THE INFORMAL COORDINATION.

Existing Hydraulic Data at Bridge			
Q_{50} (cfs) *	1.79	Q_{100} (cfs)	3631.16
H_{50} (ft)	635.59	H_{100} (ft)	637.45
V_{50} (ft/sec)	0.03	V_{100} (ft/sec)	4.17

Proposed Hydraulic Data at Bridge			
Q_{50} (cfs) *	49.75	Q_{100} (cfs)	4270.20
H_{50} (ft)	635.78	H_{100} (ft)	637.48
V_{50} (ft/sec)	2.45	V_{100} (ft/sec)	3.48

* DURING THE 50 YR EVENT, THE BOSQUE RELIEF CHANNEL EXPERIENCES MULTI-DIRECTIONAL FLOW. THE VALUE SHOWN IN THE TABLE REPRESENTS THE MAXIMUM FLUX.

50-Year Storm Event (Bosque Relief)

Location	Water Surface Elevation, ft		Velocity, ft/sec		Water Surface Differences (Proposed-Existing), ft	Low Chord Elevation, ft	Proposed Freeboard, ft
	Existing	Proposed	Existing	Proposed			
Upstream of Bridge@Convergence of 4200 ft	635.59	635.51	0.00	0.01	-0.09		
Upstream of Bridge@ROW	635.59	635.89	0.00	0.35	0.30		
At the Bridge	635.59	635.78	0.03	2.45	0.18	640.45	4.67
Downstream of Bridge@ROW	635.59	635.77	0.00	1.95	0.17		
Downstream of Bridge@Convergence of 3100 ft	632.15	632.06	15.37	15.34	-0.09		

100-Year Storm Event (Bosque Relief)

Location	Water Surface Elevation, ft		Velocity, ft/sec		Water Surface Differences (Proposed-Existing), ft	Low Chord Elevation, ft	Proposed Freeboard, ft
	Existing	Proposed	Existing	Proposed			
Upstream of Bridge@Convergence of 4200 ft	642.89	642.87	4.20	4.22	-0.02		
Upstream of Bridge@ROW	639.37	639.43	9.41	9.74	0.06		
At the Bridge	637.45	637.48	4.17	3.48	0.02	640.45	2.97
Downstream of Bridge@ROW	636.90	637.09	3.71	4.39	0.18		
Downstream of Bridge@Convergence of 3100 ft	633.37	633.28	15.73	15.70	-0.10		

PRINT DATE	REVISION DATE
2/26/2024	

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FM 219 AT BOSQUE RIVER RELIEF

HYDRAULIC DATA

SHEET 1 OF 2

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 65

REV DATE: 2/26/2024
CSJ: 0724-02-020, ETC.
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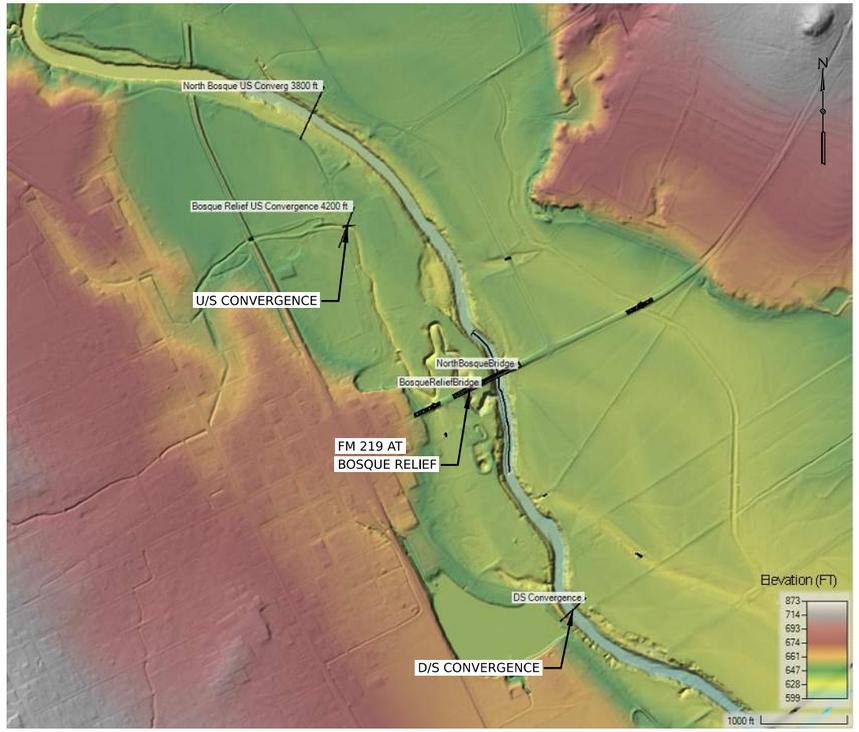
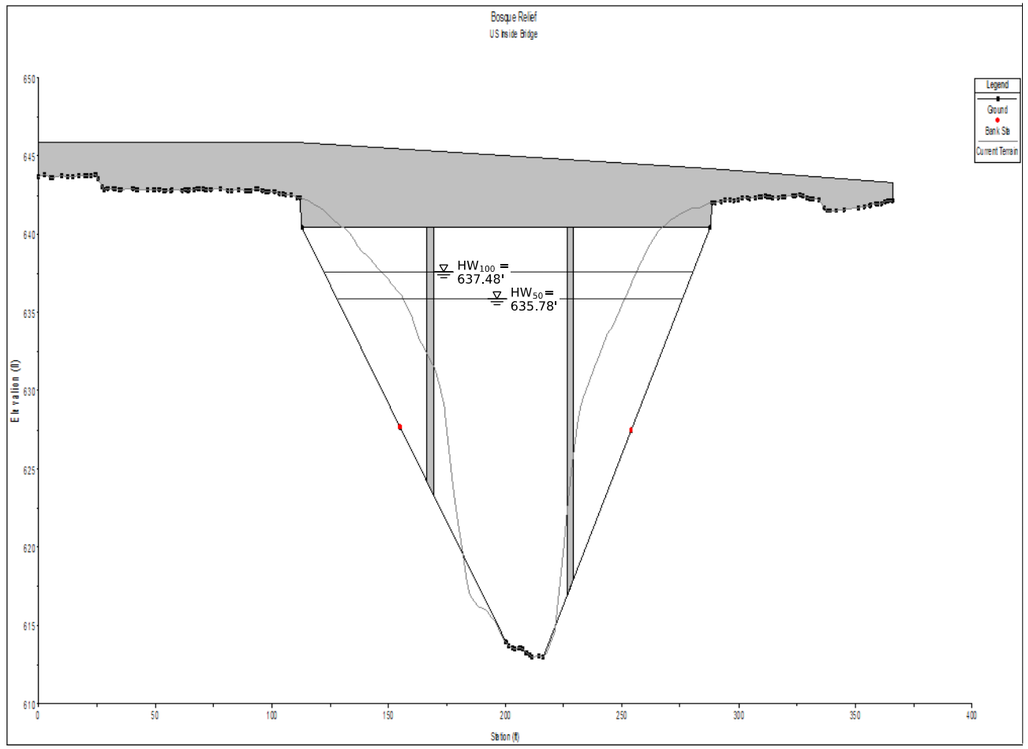


PROFILE CONVERGENCE AT BOSQUE RELIEF
N.T.S

PROFILE LOCATION MAP AT BOSQUE RELIEF
N.T.S



PROPOSED CROSS SECTION AT BOSQUE RELIEF
N.T.S

NOTES:

1. 2D STEADY STATE HYDRAULIC ANALYSIS WAS COMPUTED USING HEC-RAS VER. 6.4.1.
2. DISCHARGE AT THE BRIDGE IS OBTAINED FROM 2D MESH USING PROFILE LINES.
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PRINT DATE	REVISION DATE
2/26/2024	

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2/26/2024

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Austin, Texas 78759
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www.HardestyHanover.com
TBPELS Firm No. F-3379

Texas Department of Transportation
Waco District

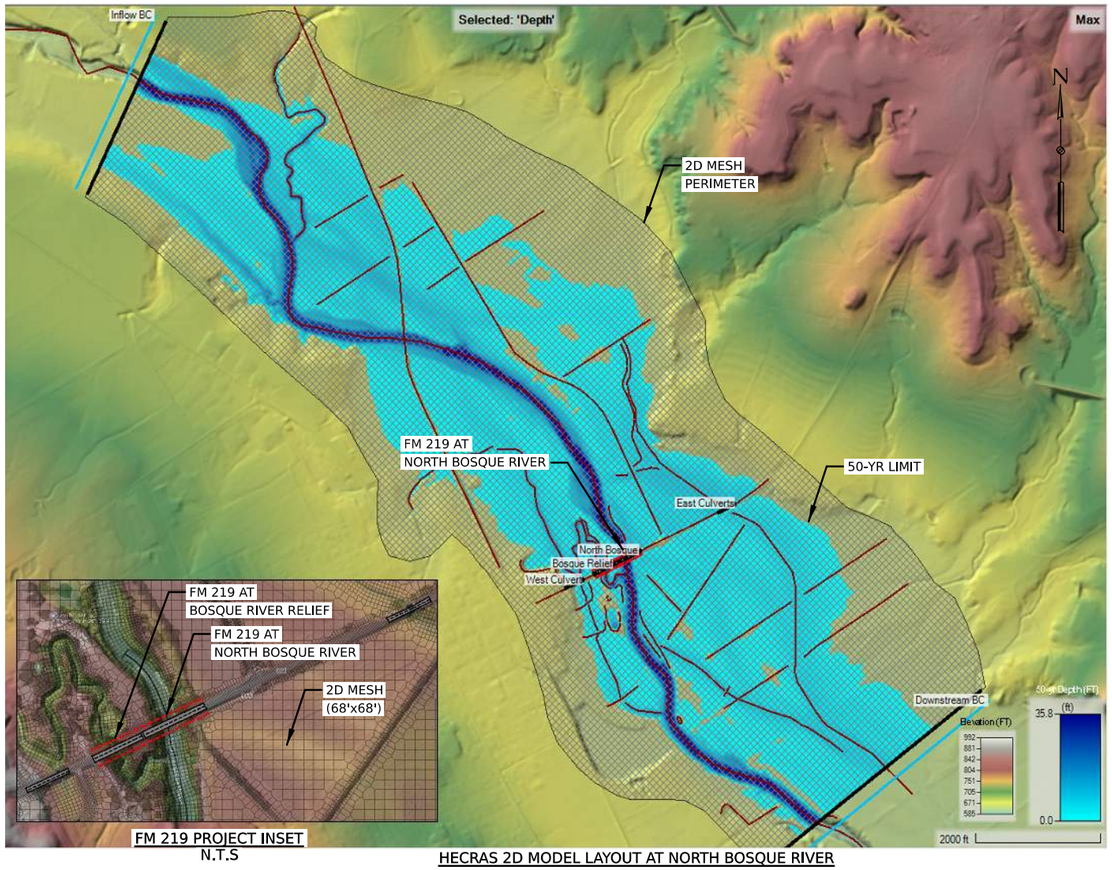
FM 219 AT BOSQUE RIVER RELIEF

HYDRAULIC DATA

SHEET 2 OF 2

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 66

REV DATE: 2/26/2024
CSJ: 0724-02-020, ETC.
FILE LOCATION: ...\5067-WA1.06.HYD.SHT.LAY.02.dgn



FM 219 PROJECT INSET
N.T.S

HECRAS 2D MODEL LAYOUT AT NORTH BOSQUE RIVER

NOTES:

1. 2D STEADY STATE HYDRAULIC ANALYSIS WAS COMPUTED USING HEC-RAS VER. 6.4.1.
2. DISCHARGE AT THE BRIDGE IS OBTAINED FROM 2D MESH USING PROFILE LINES.
3. THE STARTING WATER SURFACE ELEVATION WAS BASED ON NORMAL DEPTH AND BED SLOPE OF 0.0014.
4. THE DESIGN STORM EVENT WAS 50 YR WITH A CHECK FLOOD OF 100 YR EVENT.
5. ALL ELEMENTS ARE BASED ON NORTH AMERICAN VERTICAL DATUM 88 (NAVD88).
6. PROJECT IS LOCATED IN FEMA EFFECTIVE FIRM PANEL NO. 48035C0490C, DATED EFFECTIVE JANUARY 6, 2011 AND IS IN ZONE A FLOOD HAZARD AREA.
7. THE LOCAL FLOODPLAIN ADMINISTRATOR SHALL BE NOTIFIED AND GIVEN AN ELECTRONIC AND HARD COPY VERSION OF THE FINAL DRAINAGE REPORT AS PART OF THE INFORMAL COORDINATION.

Existing Hydraulic Data at Bridge			
Q_{50} (cfs)	58642.66	Q_{100} (cfs)	60661.94
H_{50} (ft)	638.61	H_{100} (ft)	640.53
V_{50} (ft/sec)	15.46	V_{100} (ft/sec)	14.56

Proposed Hydraulic Data at Bridge			
Q_{50} (cfs)	58314.91	Q_{100} (cfs)	59444.60
H_{50} (ft)	640.02	H_{100} (ft)	641.25
V_{50} (ft/sec)	11.94	V_{100} (ft/sec)	11.09

50-Year Storm Event (North Bosque River)

Location	Water Surface Elevation, ft		Velocity, ft/sec		Water Surface Differences (Proposed-Existing), ft	Low Chord Elevation, ft	Proposed Freeboard, ft
	Existing	Proposed	Existing	Proposed			
Upstream of Bridge@Convergence of 3800 ft	642.04	642.44	13.29	12.96	0.40		
Upstream of Bridge@ROW	638.72	639.39	14.40	13.69	0.67		
At the Bridge	638.61	640.02	15.46	11.94	1.41	642.10	2.08
Downstream of Bridge@ROW	636.43	636.99	15.09	14.94	0.56		
Downstream of Bridge@Convergence of 2950 ft	632.15	632.06	15.37	15.34	-0.09		

100-Year Storm Event (North Bosque River)

Location	Water Surface Elevation, ft		Velocity, ft/sec		Water Surface Differences (Proposed-Existing), ft	Low Chord Elevation, ft	Proposed Freeboard, ft
	Existing	Proposed	Existing	Proposed			
Upstream of Bridge@Convergence of 3800 ft	644.11	644.18	13.26	13.19	0.07		
Upstream of Bridge@ROW	641.18	641.32	13.48	12.85	0.14		
At the Bridge	640.53	641.25	14.56	11.09	0.72	642.10	0.85
Downstream of Bridge@ROW	637.12	637.52	14.85	14.45	0.39		
Downstream of Bridge@Convergence of 2950 ft	633.37	633.28	15.73	15.70	-0.10		

PRINT DATE	REVISION DATE
2/26/2024	

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TBPELS Firm No. F-3379

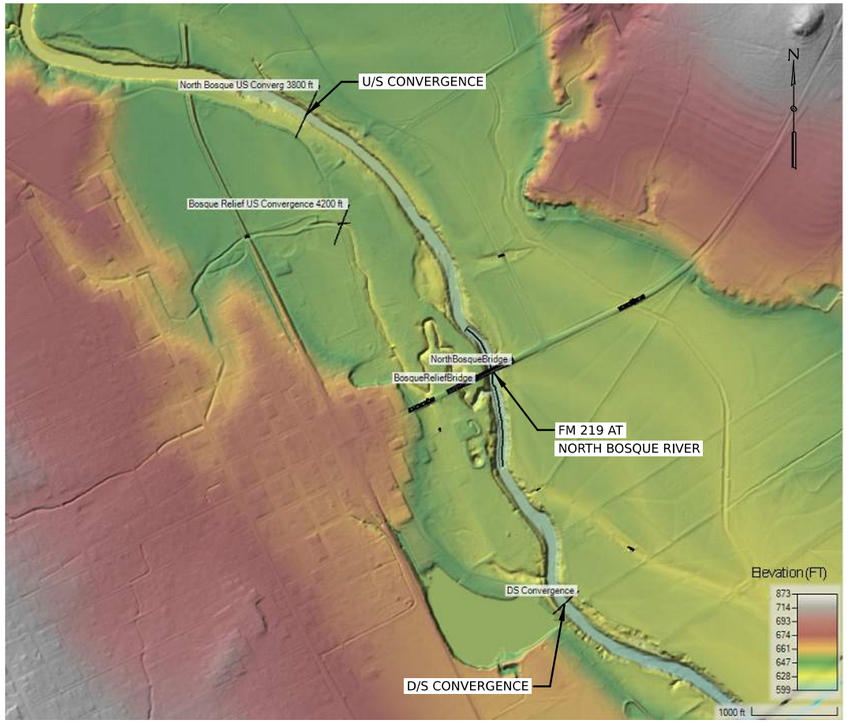
FM 219 AT NORTH BOSQUE RIVER

HYDRAULIC DATA

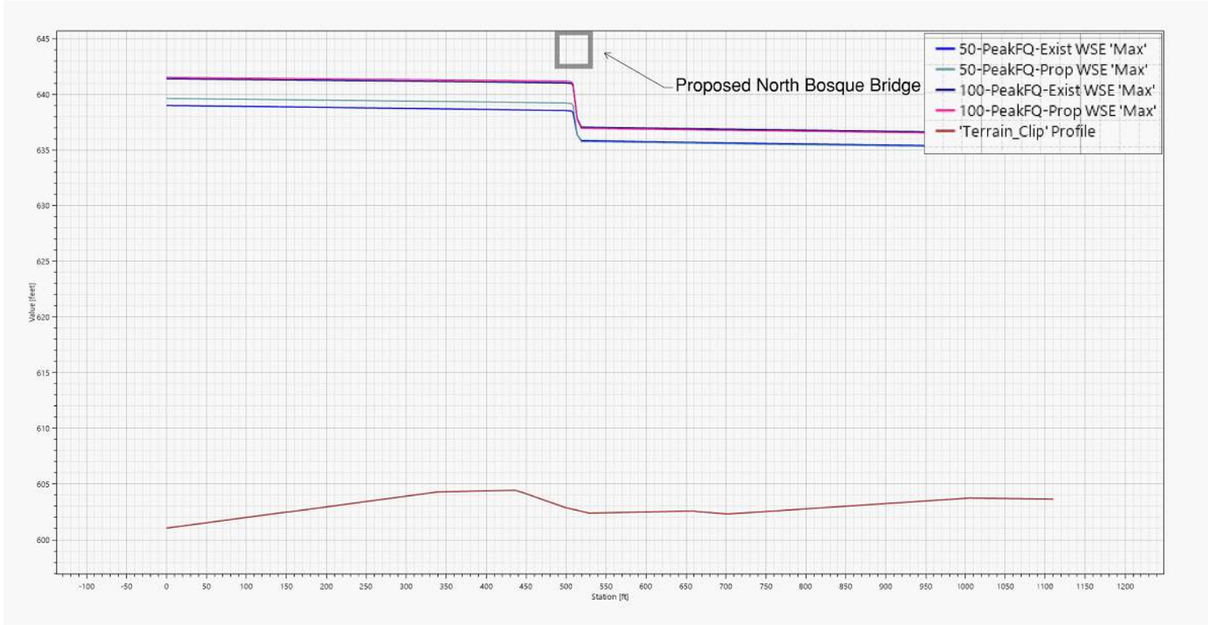
SHEET 1 OF 2

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 67

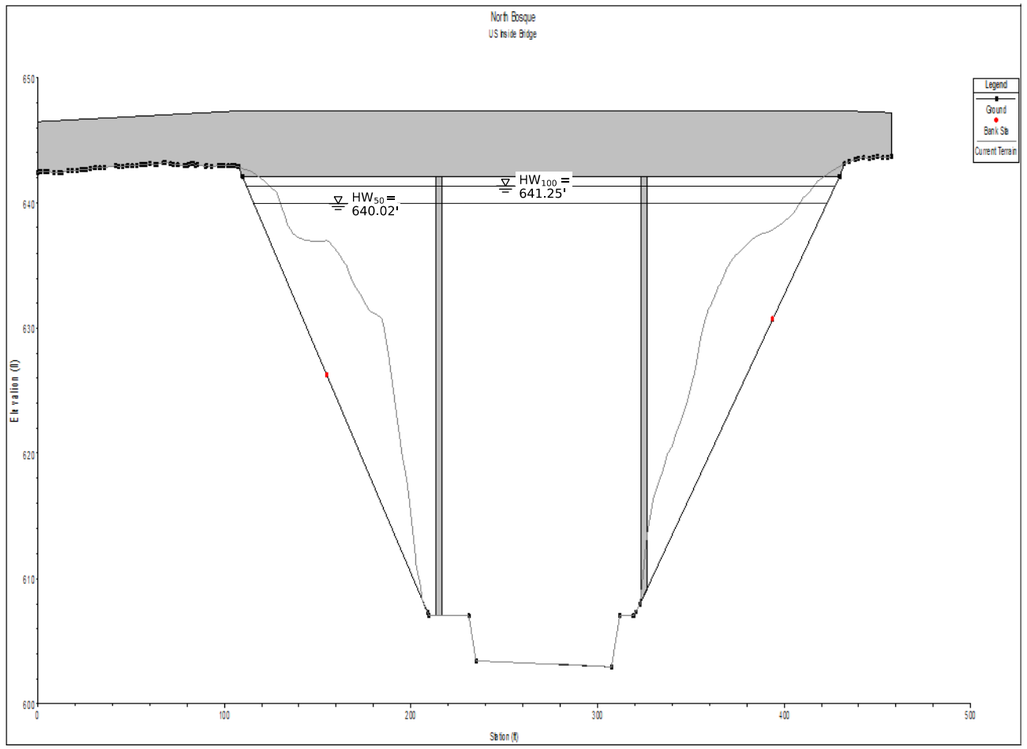
CSJ: 0724 02 020, ETC.
FILE LOCATION: ...\5067-WA1.07.HYD.SHT.LAY.01.dgn



PROFILE CONVERGENCE AT NORTH BOSQUE RIVER
N.T.S



PROFILE LOCATION AT NORTH BOSQUE RIVER
N.T.S



PROPOSED CROSS SECTION AT NORTH BOSQUE RIVER
N.T.S

NOTES:

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4. THE DESIGN STORM EVENT WAS 50 YR WITH A CHECK FLOOD OF 100 YR EVENT.
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PRINT DATE	REVISION DATE
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2/26/2024

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FM 219 AT NORTH BOSQUE RIVER

HYDRAULIC DATA

SHEET 2 OF 2

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 68

CSJ: 0724 02 020, ETC.
FILE LOCATION: ...\5067-WA1.07.HYD.SHT.LAY.02.dgn

DRILLING LOG

WinCore Version 3.3

County	Bosque	Hole	RW-7	District	Waco
Highway	FM 219 at Bosque Rvr Relief	Structure	Retaining Wall	Date	09/12/23
CSJ	0724-02-020	Station	127+75.62	Grnd. Elev.	643.17 ft
		Offset	7.68 LT	GW Elev.	N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	LL	PI	Wet Den. (pcf)	Additional Remarks
642.5			ASPHALT, 7-3/4 inches							
641.9			FLEXIBLE BASE, 7 inches							
		2 (6) 2 (6)	CLAY, very soft to stiff, tan, dry, sandy, with limestone fragments (CL)							
5		11 (6) 12 (6)				15	27	14	133	%Passing #200: 55%
635.7			CLAY, soft, brown to dark brown, moist to dry (CL)							
10		6 (6) 8 (6)								
15		10 (6) 10 (6)		0	106	17	41	24	124	%Passing #200: 89%
623.2	20	10 (6) 9 (6)		0	69	19	48	28	121	
	25									
	30									
	35									
	40									
	45									

Remarks:

The ground water elevation was not determined during the course of this boring.

Driller: Beyond Engineering and Testing, LLC **Logger: Bradley Coffman** **Organization: Raba-Kistner, Inc.**

DRILLING LOG

WinCore Version 3.3

County	Bosque	Hole	RW-8	District	Waco
Highway	FM 219 at Bosque Rvr Relief	Structure	Retaining Wall	Date	09/12/23
CSJ	0724-02-020	Station	129+37.06	Grnd. Elev.	644.19 ft
		Offset	8.23 RT	GW Elev.	N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	LL	PI	Wet Den. (pcf)	Additional Remarks
643.7			ASPHALT, 6-1/2 inches							
643.2			FLEXIBLE BASE, 6 inches							
		5 (6) 6 (6)	CLAY, very soft to soft, tan to brown, dry to moist (CL)			11	26	13	130	%Passing #200: 90%
5		2 (6) 5 (6)								
						13	34	20	120	
634.7			CLAY, stiff, dark brown to brown, moist, with sand (CL)							
10		12 (6) 15 (6)		0	201	15	47	26	123	%Passing 200#: 84%
15		15 (6) 16 (6)				16			128	
624.2	20	11 (6) 12 (6)								
	25									
	30									
	35									
	40									
	45									

Remarks:

The ground water elevation was not determined during the course of this boring.

Driller: Beyond Engineering and Testing, LLC **Logger: Bradley Coffman** **Organization: Raba-Kistner, Inc.**

PRINT DATE	REVISION DATE
2/29/2024	

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3/1/2024

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TBPELS Firm No. F-3379

Texas Department of Transportation
Waco District

FM 219 AT BOSQUE RIVER RELIEF

RET WALL SOIL BORING LOG RW-7 & RW-8

Not To Scale SHEET 1 OF 1

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 69

REV DATE: 2/29/2024
CSJ: 0724-02-020, ETC.
FILE LOCATION: ...\5067-WA1.06.RW.SHT.BOR.01.dgn

DRILLING LOG

WinCore Version 3.0	County	Bosque	Hole	BR-11	District	Waco
	Highway	FM 219 at Bosque Rvr Relief	Structure	Bridge	Date	10/7/22
	CSJ	0724-02-020	Station	127+75.62	Grnd. Elev.	643.17 ft
			Offset	6.68 LT	GW Elev.	N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	LL	PI	Wet Den. (pcf)	Additional Remarks
642.7			ASPHALT, 6 inches							
642.2			BASE, 5 inches			10				pH: 8.6; Sulfate Content: 120 ppm; Resistivity: 998 ohm-cm
641.2			FILL: CLAY, brown, moist, with calcareoud nodules (CL)			14	28	16		%Passing #4, #200: 99%, 78%
5		5 (6) 6 (6)	CLAY, soft, light brown, moist, with sand (CL)							
637.2			CLAY, soft, dark brown to brown, moist, with calcareous deposits (CH)			21				
10		9 (6) 9 (6)				20				
						21	53	34		%Passing #4, #200: 100%, 98%
15		8 (6) 8 (6)								
20		4 (6) 7 (6)				21				
621.2			CLAY, soft, brown, moist, with calcareous deposits (CL)			22	42	25		%Passing #4, #200: 99%, 86%
25		7 (6) 7 (6)								
30		10 (6) 9 (6)				22				
612.2			LIMESTONE, light gray, with clay layers			14				
35		50 (0.5) 50 (0.13)								
						14				RUN: 35'-40'; REC: 75%; RDQ: 32%
40		50 (0.25) 50 (0.13)								RUN: 40'-45'; REC: 32%; RDQ: 7%
45		50 (0.25) 50 (0.13)								

Remarks:
1. Groundwater was not encountered before rock coring during drilling operations. 2. Straight Flight Auger was used from 0-36 ft, and NX Core was used from 36-80 ft. 3. Boring backfilled with bentonite chips and patched with asphalt. (Northing, Easting: 10624131.61, 3155599.643)

The ground water elevation was not determined during the course of this boring.

Driller: Beyond Engineering and Testing, LLC **Logger: Logan Gordon** **Organization: Raba-Kistner, Inc.**

A-: 1a

DRILLING LOG

WinCore Version 3.0	County	Bosque	Hole	BR-11	District	Waco
	Highway	FM 219 at Bosque Rvr Relief	Structure	Bridge	Date	10/7/22
	CSJ	0724-02-020	Station	127+75.62	Grnd. Elev.	643.17 ft
			Offset	6.68 LT	GW Elev.	N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	LL	PI	Wet Den. (pcf)	Additional Remarks
			LIMESTONE, light gray, with clay layers	0	650	7			149	RUN: 45'-50'; REC: 65%; RDQ: 30%
50		50 (2) 50 (4)								
										RUN: 50'-55'; REC: 30%; RDQ: 12%
55		50 (2) 50 (1)								
										RUN: 55'-60'; REC: 55%; RDQ: 43%
60		50 (3) 50 (1)								
										RUN: 60'-65'; REC: 33%; RDQ: 8%
578.2 65		50 (5) 50 (5.5)	LIMESTONE, light gray, with shale layers							
										RUN: 65'-70'; REC: 70%; RDQ: 28%
70		50 (4.5) 50 (3)								
										RUN: 70'-75'; REC: 37%; RDQ: 0%
568.2 75		50 (5) 50 (4.75)	SHALE, dark gray							
										RUN: 75'-80'; REC: 38%; RDQ: 7%
563.2 80		46 (6) 50 (6)								
85										
90										

Remarks:
1. Groundwater was not encountered before rock coring during drilling operations. 2. Straight Flight Auger was used from 0-36 ft, and NX Core was used from 36-80 ft. 3. Boring backfilled with bentonite chips and patched with asphalt. (Northing, Easting: 10624131.61, 3155599.643)

The ground water elevation was not determined during the course of this boring.

Driller: Beyond Engineering and Testing, LLC **Logger: Logan Gordon** **Organization: Raba-Kistner, Inc.**

A-: 1b

PRINT DATE	REVISION DATE
2/26/2024	

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Texas Department of Transportation
Waco District

FM 219 AT BOSQUE RIVER RELIEF

BRIDGE SOIL BORING LOG
BR-11

Not To Scale SHEET 1 OF 1

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 70

REV DATE: 2/26/2024
CSJ: 0724-02-020, ETC.
FILE LOCATION: ...\5067-WA1.06.BRG.SHT.BOR.01.dgn

DRILLING LOG

WinCore Version 3.0

County	Bosque	Hole	BR-12	District	Waco
Highway	FM 219 at Bosque Rvr Relief	Structure	Bridge	Date	10/8/22
CSJ	0724-02-020	Station	129+37.06	Grnd. Elev.	644.19 ft
		Offset	7.23 RT	GW Elev.	601.19 ft

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	LL	PI	Wet Den. (pcf)	Additional Remarks
643.7			ASPHALT, 6 inches							
643.2			BASE, 5 inches			5				
			CLAY, soft, light brown, moist, with calcareous deposits (CL)							
						12				pH: 8.0; Sulfate Content: 160 ppm; Resistivity: 744 ohm-cm
5		8 (6) 9 (6)								
638.2			CLAY, stiff to very stiff, brown, moist, blocky, with calcareous deposits (CH)			19	54	32		%Passing #4, #200: 100%, 93%
						13				
10		21 (6) 19 (6)								
						16				
15		17 (6) 12 (6)								
						13				
624.2		16 (6) 11 (6)								
20			CLAY, stiff, brown, moist, with calcareous deposits (CL)			16	48	29		%Passing #4, #200: 100%, 94%
25		19 (6) 15 (6)								
						14				
30		17 (6) 22 (6)								
						17				
609.2		12 (6) 16 (6)								
35			CLAY, soft to very stiff, brown to light brown, moist to wet, sandy, with ferrous staining (CL)			21	27	12		%Passing #4, #200: 100%, 56%
40		8 (6) 8 (6)								
						18				
45		34 (6) 38 (6)								

Remarks:
1. Groundwater was encountered at about 43 ft before rock coring during drilling operations. 2. Straight Flight Auger was used from 0-48 ft, Mud Rotary was used from 48-60 ft, and NX Core was used from 60-80 ft. 3. Boring backfilled with bentonite chips and patched with asphalt. (Northing, Easting: 10624188.66, 3155751.306)
Any groundwater elevation information provided on this boring log is representative of conditions existing on the day and for the specific location where this information was collected. The actual groundwater elevation may fluctuate due to time, climatic conditions, and/or construction activity.

Driller: Beyond Engineering and Testing, LLC Logger: Logan Gordon Organization: Raba-Kistner, Inc.

A-: 2a

DRILLING LOG

WinCore Version 3.0

County	Bosque	Hole	BR-12	District	Waco
Highway	FM 219 at Bosque Rvr Relief	Structure	Bridge	Date	10/8/22
CSJ	0724-02-020	Station	129+37.06	Grnd. Elev.	644.19 ft
		Offset	7.23 RT	GW Elev.	601.19 ft

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	LL	PI	Wet Den. (pcf)	Additional Remarks
			CLAY, soft to very stiff, brown to light brown, moist to wet, sandy, with ferrous staining (CL)			8				
595.2										
50		50 (2) 50 (1)	GRAVEL, very dense, light brown, wet, clayey (GC)			9				
590.2			SHALE, dark gray, with sand seams							
55		50 (6) 50 (2.5)				21				
		50 (1) 50 (0.13)								
584.2 60			LIMESTONE, gray, with clay layers							RUN: 60'-65'; REC: 18%; RDQ: 0%
65		50 (2) 50 (1.75)								
578.2			SHALE, dark gray, with sand seams							RUN: 65'-70'; REC: 57%; RDQ: 13%
70		50 (3) 50 (5.5)								
573.2			LIMESTONE, light gray, with clay seams	0	10170	1			166	RUN: 70'-75'; REC: 37%; RDQ: 15%
75		50 (4) 50 (3.75)								RUN: 75'-80'; REC: 35%; RDQ: 35%
564.2 80		50 (6) 50 (5)								
85										
90										

Remarks:
1. Groundwater was encountered at about 43 ft before rock coring during drilling operations. 2. Straight Flight Auger was used from 0-48 ft, Mud Rotary was used from 48-60 ft, and NX Core was used from 60-80 ft. 3. Boring backfilled with bentonite chips and patched with asphalt. (Northing, Easting: 10624188.66, 3155751.306)
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Driller: Beyond Engineering and Testing, LLC Logger: Logan Gordon Organization: Raba-Kistner, Inc.

A-: 2b

PRINT DATE	REVISION DATE
2/26/2024	

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3/1/2024

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TBPELS Firm No. F-3379

Texas Department of Transportation
Waco District

FM 219 AT BOSQUE RIVER RELIEF

BRIDGE SOIL BORING LOG BR-12

Not To Scale SHEET 1 OF 1

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 71

REV DATE: 2/26/2024
CSJ: 0724-02-020, ETC.
FILE LOCATION: ...\5067-WA1.06.BRG.SHT.BOR.02.dgn

DRILLING LOG

WinCore Version 3.3

County	Bosque	Hole	RW-09	District	Waco
Highway	FM 219 N Bosque Rvr	Structure	Retaining Wall	Date	09/12/23
CSJ	0724-02-025	Station	130+86.15	Grnd. Elev.	644.94 ft
		Offset	5.28 LT	GW Elev.	N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	LL	PI	Wet Den. (pcf)	Additional Remarks
644.4			ASPHALT, 6 inches							
643.9			FLEXIBLE BASE, 6 inches							
		5 (6) 7 (6)	CLAY, soft, gray, dry to moist, sandy, with limestone fragments (CL)							
639.9	5	8 (6) 6 (6)	CLAY, soft, tan to dark brown, moist (CL)			20	45	24	118	%Passing #200: 89%
635.4	10	4 (6) 4 (6)	CLAY, very soft to soft, dark brown, moist, with sand (CL)							
	15	6 (6) 8 (6)		0	58	17	40	24	136	%Passing #200: 84%
624.9	20	8 (6) 10 (6)		0	99	21	33	18	128	
	25									
	30									
	35									
	40									
	45									

Remarks:

The ground water elevation was not determined during the course of this boring.

Driller: Beyond Engineering and Testing, LLC **Logger: Bradley Coffman** **Organization: Raba-Kistner, Inc.**

DRILLING LOG

WinCore Version 3.3

County	Bosque	Hole	RW-10	District	Waco
Highway	FM 219 N Bosque Rvr	Structure	Retaining Wall	Date	09/12/23
CSJ	0724-02-025	Station	134+08.42	Grnd. Elev.	645.09 ft
		Offset	11.84 RT	GW Elev.	N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	LL	PI	Wet Den. (pcf)	Additional Remarks
644.5			ASPHALT, 7-1/2 inches							
644.0			FLEXIBLE BASE, 6 inches							
		14 (6) 13 (6)	SAND, brown to tan, dry, silty (SM)			5				Non-Plastic
641.6	5	15 (6) 12 (6)	CLAY, stiff to very stiff, tan to dark brown to brown, moist, with sand (CL)							
	10	29 (6) 24 (6)		0	148	13	36	22	136	%Passing #200: 77%
	15	30 (6) 39 (6)				9	31	17		
625.1	20	28 (6) 30 (6)								
	25									
	30									
	35									
	40									
	45									

Remarks:

The ground water elevation was not determined during the course of this boring.

Driller: Beyond Engineering and Testing, LLC **Logger: Bradley Coffman** **Organization: Raba-Kistner, Inc.**

PRINT DATE	REVISION DATE
2/29/2024	

STATE OF TEXAS
SEGU I. IFHAM
106420
LICENSED
PROFESSIONAL ENGINEER

3/1/2024

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TBPELS Firm No. F-3379

Texas Department of Transportation
Waco District

FM 219 AT NORTH BOSQUE RIVER

RET WALL SOIL BORING LOG RW-9 & RW-10

SHEET 1 OF 1

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	**DISTRICT**	**COUNTY**
TEXAS	WACO	BOSQUE
CONTROL	**SECTION**	**JOB** / **SHEET NO.**
0724	02	020, ETC. / 72

REV DATE: 2/29/2024
CSJ: 0724-02-020, ETC.
FILE LOCATION: ...\5067-WA1.07.RW.SHT.BOR.01.dgn

DRILLING LOG

WinCore Version 3.0

County	Bosque	Hole	BR-13	District	Waco
Highway	FM 219 N Bosque Rvr	Structure	Bridge	Date	10/10/22
CSJ	0724-02-025	Station	130+86.15	Grnd. Elev.	644.94 ft
		Offset	4.28 LT	GW Elev.	N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	LL	PI	Wet Den. (pcf)	Additional Remarks
644.6			ASPHALT, 4 inches							
644.1			BASE, 6 inches			16	28	13		%Passing #4, #200: 98%, 67%
			CLAY, very soft, tan, moist, sandy (CL)			17				pH: 8.2; Sulfate Content: 120 ppm; Resistivity: 1,260 ohm-cm
639.9	5	3 (6) 4 (6)	CLAY, very soft to stiff, dark brown, moist, with sand and calcareous deposits (CL)			17				
						20				
	10	5 (6) 4 (6)				18	33	15		%Passing #4, #200: 100%, 71%; Sulfate Content: 113 ppm
	15	5 (6) 5 (6)				17				
	20	8 (6) 7 (6)				15				
	25	12 (6) 11 (6)								
617.9			CLAY, soft to hard, brown to dark gray, moist, sandy (CL)			14	29	16		%Passing #4, #200: 100%, 64%
	30	15 (6) 16 (6)				17				
	35	7 (6) 7 (6)				29				
	40	3 (6) 5 (6)				32	28	11		%Passing #4, #200: 100%, 64%
	45	50 (3) 50 (5)								

Remarks:
1. Groundwater was not encountered before rock coring during drilling operations. 2. Straight Flight Auger was used from 0-50 ft, and NX Core was used from 50-80 ft. 3. Boring backfilled with bentonite chips and patched with asphalt. (Northing, Easting: 10624263.25, 3155878.627)

The ground water elevation was not determined during the course of this boring.

Driller: Beyond Engineering and Testing, LLC **Logger: Logan Gordon** **Organization: Raba-Kistner, Inc.**

A-: 3a

DRILLING LOG

WinCore Version 3.0

County	Bosque	Hole	BR-13	District	Waco
Highway	FM 219 N Bosque Rvr	Structure	Bridge	Date	10/10/22
CSJ	0724-02-025	Station	130+86.15	Grnd. Elev.	644.94 ft
		Offset	4.28 LT	GW Elev.	N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	LL	PI	Wet Den. (pcf)	Additional Remarks
			CLAY, soft to hard, brown to dark gray, moist, sandy (CL)			17				
596.9			LIMESTONE, light gray, with clay seams							
	50	50 (0.25) 50 (0.25)								RUN: 50'-55'; REC: 80%; RDQ: 32%
	55	50 (1) 50 (0.13)								RUN: 55'-60'; REC: 58%; RDQ: 23%
	60	50 (0.25) 50 (0.13)		0	5112	1			162	RUN: 60'-65'; REC: 50%; RDQ: 32%
	65	50 (1) 50 (0.5)								RUN: 65'-70'; REC: 63%; RDQ: 33%
575.9	70	50 (3.25) 50 (0.25)	SHALE, dark gray							RUN: 70'-75'; REC: 50%; RDQ: 33%
570.9	75	50 (2) 50 (0.13)	LIMESTONE, gray							RUN: 75'-80'; REC: 55%; RDQ: 25%
564.9	80	50 (0.5) 50 (0.13)								
	85									
	90									

Remarks:
1. Groundwater was not encountered before rock coring during drilling operations. 2. Straight Flight Auger was used from 0-50 ft, and NX Core was used from 50-80 ft. 3. Boring backfilled with bentonite chips and patched with asphalt. (Northing, Easting: 10624263.25, 3155878.627)

The ground water elevation was not determined during the course of this boring.

Driller: Beyond Engineering and Testing, LLC **Logger: Logan Gordon** **Organization: Raba-Kistner, Inc.**

A-: 3b

PRINT DATE	REVISION DATE
2/26/2024	

STATE OF TEXAS
SEGU I. IFHAM
106420
LICENSED
PROFESSIONAL ENGINEER

3/1/2024

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TBPELS Firm No. F-3379

FM 219 AT NORTH BOSQUE RIVER

BRIDGE SOIL BORING LOG BR-13

SHEET 1 OF 1

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219

STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE

CONTROL	SECTION	JOB	SHEET NO.
0724	02	020, ETC.	73

REV DATE: 2/26/2024
CSJ: 0724-02-020, ETC.
FILE LOCATION: ...\5067-WA1.07.BRG.SHT.BOR.01.dgn

DRILLING LOG

WinCore Version 3.0

County	Bosque	Hole	BR-14	District	Waco
Highway	FM 219 N Bosque Rvr	Structure	Bridge	Date	10/11/22
CSJ	0724-02-025	Station	134+08.42	Grnd. Elev.	645.09 ft
		Offset	10.84 RT	GW Elev.	N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	LL	PI	Wet Den. (pcf)	Additional Remarks
644.6			ASPHALT, 6-1/2 inches			12				pH: 8.2; Sulfate Content: 113 ppm; Resistivity: 780 ohm-cm
644.2			BASE, 4 inches							
642.6			FILL: CLAY, tan, moist, with gravel (CL)			13	35	18		%Passing #4, #200: 98%, 67%
		16 (6) 21 (6)	CLAY, stiff, brown, moist, blocky, sandy, with calcareous deposits (CL)			12				
638.6			CLAY, stiff to soft, brown, moist, with sand and calcareous deposits, sand layer below 18' (CL)			12	33	17		%Passing #4, #200: 100%, 75%
		7 (6) 7 (6)				9				Sulfate Content: 120 ppm
		18 (6) 27 (6)				5				
625.1		40 (6) 50 (5)	CLAY, hard, brown, moist, with sand and calcareous deposits (CL)			14	33	17		%Passing #4, #200: 100%, 73%
		50 (2.5) 50 (5)				13				
615.1		47 (6) 50 (1)	SAND, very dense, brown, moist, clayey, with gravel and ferrous staining (SC)			11				%Passing #4, #200: 66%, 17%
		50 (1) 50 (0.5)								
609.1			LIMESTONE, gray, with clay layers and shale seams			14				
		50 (0.13) 50 (0.13)								RUN: 40'-45'; REC: 85%; RQD: 58%
		50 (0.5) 50 (0.25)								

Remarks:
1. Groundwater was not encountered before rock coring during drilling operations. 2. Straight Flight Auger was used from 0-21.5 ft, Mud Rotary was used from 21.5-40 ft, and NX Core was used from 40-80 ft. 3. Boring backfilled with bentonite chips and patched with asphalt. (Northing, Easting: 10624393.19, 3156176.108)
The ground water elevation was not determined during the course of this boring.

Driller: Beyond Engineering and Testing, LLC **Logger: Logan Gordon** **Organization: Raba-Kistner, Inc.**

A-: 4a

DRILLING LOG

WinCore Version 3.0

County	Bosque	Hole	BR-14	District	Waco
Highway	FM 219 N Bosque Rvr	Structure	Bridge	Date	10/11/22
CSJ	0724-02-025	Station	134+08.42	Grnd. Elev.	645.09 ft
		Offset	10.84 RT	GW Elev.	N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	LL	PI	Wet Den. (pcf)	Additional Remarks
			LIMESTONE, gray, with clay layers and shale seams	0	1185	2			152	RUN: 45'-50'; REC: 60%; RDQ: 43%
		50 (2) 50 (0.5)								RUN: 50'-55'; REC: 85%; RDQ: 37%
		50 (0.5) 50 (2)								RUN: 55'-60'; REC: 55%; RDQ: 33%
		50 (0.13) 50 (0.13)								RUN: 60'-65'; REC: 83%; RDQ: 48%
580.1		50 (4) 50 (3.5)	SHALE, dark gray							RUN: 65'-70'; REC: 70%; RDQ: 58%
		50 (3.5) 50 (3)								RUN: 70'-75'; REC: 72%; RDQ: 48%
570.1		50 (0.5) 50 (0.25)	LIMESTONE, gray, with clay layers							RUN: 75'-80'; REC: 78%; RDQ: 40%
565.1		50 (1) 50 (0.5)								

Remarks:
1. Groundwater was not encountered before rock coring during drilling operations. 2. Straight Flight Auger was used from 0-21.5 ft, Mud Rotary was used from 21.5-40 ft, and NX Core was used from 40-80 ft. 3. Boring backfilled with bentonite chips and patched with asphalt. (Northing, Easting: 10624393.19, 3156176.108)
The ground water elevation was not determined during the course of this boring.

Driller: Beyond Engineering and Testing, LLC **Logger: Logan Gordon** **Organization: Raba-Kistner, Inc.**

A-: 4b

PRINT DATE	REVISION DATE
2/26/2024	

STATE OF TEXAS
SEGU I. IFHAM
106420
LICENSED
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3/1/2024

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TBPELS Firm No. F-3379

Texas Department of Transportation
Waco District

FM 219 AT NORTH BOSQUE RIVER

BRIDGE SOIL BORING LOG BR-14

SHEET 1 OF 1

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 74

REV DATE: 2/26/2024
CSJ: 0724-02-020, ETC.
FILE LOCATION: ..\5067-WA1.07.BRG.SHT.BOR.02.dgn

DRILLING LOG

WinCore Version 3.0

County	Bosque	Hole	BR-15	District	Waco
Highway	FM 219 N Bosque Rvr	Structure	Bridge	Date	10/11/22
CSJ	0724-02-025	Station	137+65.08	Grnd. Elev.	642.96 ft
		Offset	14.41 RT	GW Elev.	N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	LL	PI	Wet Den. (pcf)	Additional Remarks
642.6			ASPHALT, 4 inches							
642.1			BASE, 6 inches			17	33	18		Sulfate Content: 113 ppm
		8 (6) 12 (6)	CLAY, soft to stiff, brown to light brown, moist, sandy, with calcareous deposits (CL)			16				%Passing #4, #200: 92%, 60%
5		14 (6) 8 (6)				16				
						17				
10		10 (6) 12 (6)								
						17				Sulfate Content: 107 ppm
15		3 (6) 5 (6)								
627.0			SAND, compact to very dense, light brown, moist, clayey, with ferrous staining (SC)			4	31	16		%Passing #4, #200: 100%, 35%
20		21 (6) 27 (6)				3				
25		50 (3.5) 50 (2)				8				
30		50 (1) 50 (0.13)				8				
608.0		50 (0.13) 50 (0.13)	LIMESTONE, gray, with shale seams							RUN: 35'-40'; REC: 93%; RDQ: 93%
40		50 (2.5) 50 (1.5)								RUN: 40'-45'; REC: 72%; RDQ: 47%
45		50 (3) 50 (2.75)								

Remarks:
1. Groundwater was not encountered before rock coring during drilling operations. 2. Straight Flight Auger was used from 0-15 ft, Mud Rotary was used from 15-35 ft, and NX Core was used from 35-80 ft. 3. Boring backfilled with bentonite chips and patched with asphalt. (Northing, Easting: 10624544.56, 3156498.899)
The ground water elevation was not determined during the course of this boring.

Driller: Beyond Engineering and Testing, LLC **Logger: Logan Gordon** **Organization: Raba-Kistner, Inc.**

A-: 5a

DRILLING LOG

WinCore Version 3.0

County	Bosque	Hole	BR-15	District	Waco
Highway	FM 219 N Bosque Rvr	Structure	Bridge	Date	10/11/22
CSJ	0724-02-025	Station	137+65.08	Grnd. Elev.	642.96 ft
		Offset	14.41 RT	GW Elev.	N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	LL	PI	Wet Den. (pcf)	Additional Remarks
			LIMESTONE, gray, with shale seams	0	12560	1			165	RUN: 45'-50'; REC: 90%; RDQ: 47%
50		50 (0.25) 50 (0.13)								
										RUN: 50'-55'; REC: 65%; RDQ: 27%
55		50 (0.13) 50 (0.13)								
										RUN: 55'-60'; REC: 85%; RDQ: 23%
60		50 (0.25) 50 (0.13)								
										RUN: 60'-65'; REC: 73%; RDQ: 65%
578.0 65		50 (0.13) 50 (0.13)	SHALE, dark gray							
573.0 70		50 (5) 50 (4.75)	LIMESTONE, gray to dark gray, with shale seams							RUN: 65'-70'; REC: 68%; RDQ: 45%
75		50 (2) 50 (0.75)								RUN: 70'-75'; REC: 62%; RDQ: 30%
563.0 80		50 (1.5) 50 (0.75)								RUN: 75'-80'; REC: 77%; RDQ: 35%
85										
90										

Remarks:
1. Groundwater was not encountered before rock coring during drilling operations. 2. Straight Flight Auger was used from 0-15 ft, Mud Rotary was used from 15-35 ft, and NX Core was used from 35-80 ft. 3. Boring backfilled with bentonite chips and patched with asphalt. (Northing, Easting: 10624544.56, 3156498.899)
The ground water elevation was not determined during the course of this boring.

Driller: Beyond Engineering and Testing, LLC **Logger: Logan Gordon** **Organization: Raba-Kistner, Inc.**

A-: 5b

PRINT DATE	REVISION DATE
2/26/2024	

STATE OF TEXAS
SEGU I. IFHAM
106420
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3/1/2024

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Texas Department of Transportation
Waco District

FM 219 AT NORTH BOSQUE RIVER

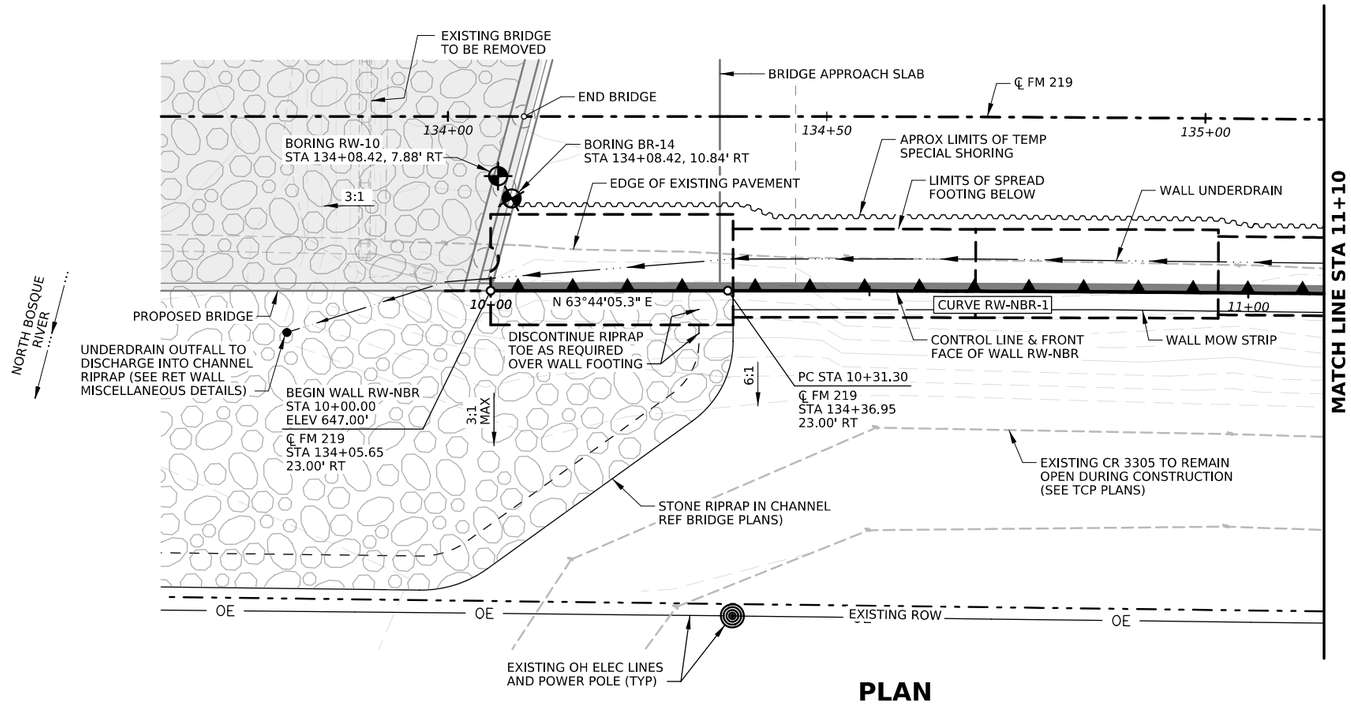
BRIDGE SOIL BORING LOG
BR-15

SHEET 1 OF 1

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219

STATE	DISTRICT	COUNTY	
TEXAS	WACO	BOSQUE	
CONTROL	SECTION	JOB	SHEET NO.
0724	02	020, ETC.	75

REV DATE: 2/26/2024
CSJ: 0724-02-020, ETC.
FILE LOCATION: ...\5067-WA1.07.BRG.SHT.BOR.03.dgn



PLAN

0 10 20
SCALE: 1" = 20' H
1" = 10' V

RETAINING WALL ESTIMATED QUANTITIES

WALL RW-NBR

	ITEM NO.	DESCRIPTION	UNIT	QUANTITY
1	400 6005	CEM STABIL BKFL	CY	35
	403 6001	TEMPORARY SPL SHORING	SF	2,360
	423 6005	RETAINING WALL (SPREAD FOOTING)	SF	2,662
	432 6045	RIPRAP (MOW STRIP) (4 IN)	CY	5.3
	450 6006	RAIL (TY T223)	LF	224.0
	556 6006	PIPE UNDERDRAINS (TY 6) (6")	LF	25

(1) SEE RETAINING WALL TYPICAL SECTIONS FOR LIMITS OF CEMENT STABILIZED BACKFILL.

CURVE RW-NBR-1
HORIZONTAL CURVE DATA

PI Sta. 10+81.02
Δ = 00° 43' 33.7" Rt
D = 00° 43' 48.6"
T = 49.72'
L = 99.43'
PC Sta. 10+31.30
Tangent Brg. @ PC = N 63° 44' 05.3" E
PT Sta. 11+30.74
Tangent Brg. @ PT = N 64° 27' 39.0" E

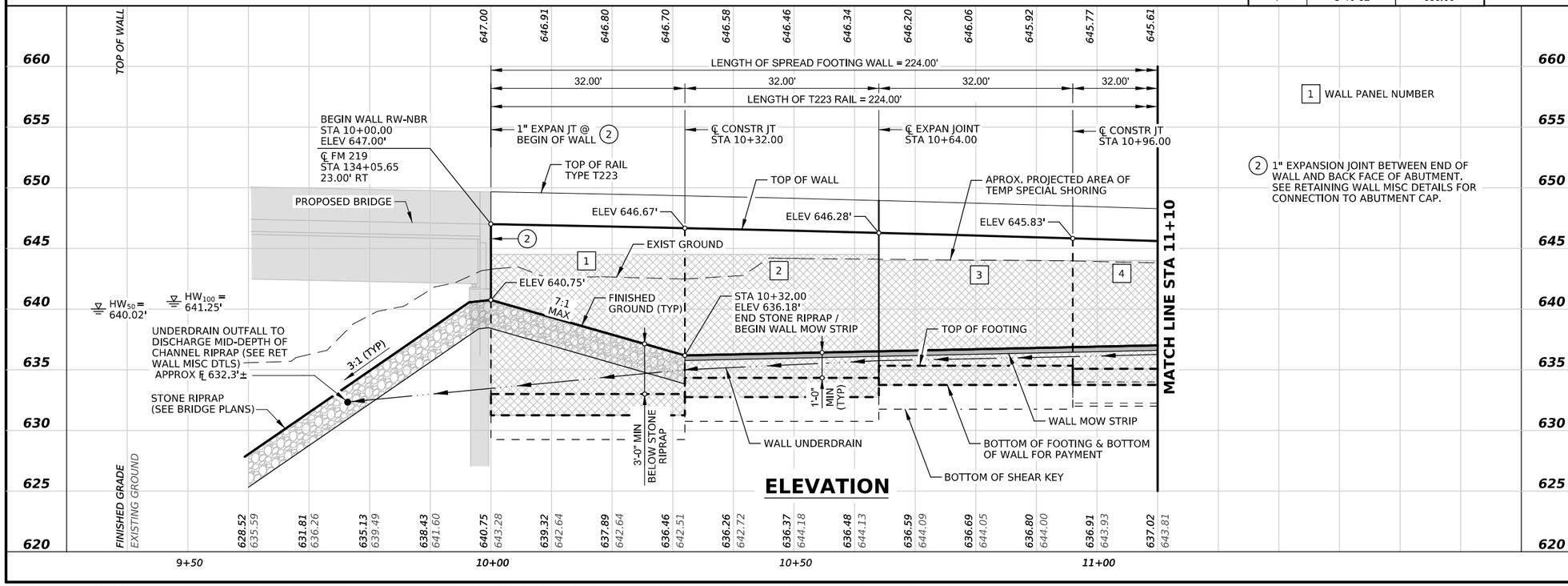
RETAINING WALL & DESIGN SCHEDULE

WALL RW-NBR

PANEL NO.	PANEL DESIGNATION	BOTTOM OF FOOTING ELEV
1	C-16-32	631.25'
2	C-14-32	632.75'
3	C-14-32	633.75'
4	C-12-32	633.75'
5	C-12-32	633.75'
6	C-10-32	635.00'
7	C-10-32	635.00'

GENERAL NOTES:

1. ALL STATIONS AND OFFSETS ARE MEASURED ALONG WALL CONTROL LINE UNLESS NOTED OTHERWISE.
2. REFER TO SOIL BORING LOGS FOR GEOTECHNICAL INFORMATION.
3. CONTRACTOR SHALL PROVIDE POSITIVE DRAINAGE AWAY FROM WALL AT ALL TIMES DURING & POST CONSTRUCTION.
4. CONTRACTOR SHALL VERIFY LOCATIONS OF ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION. NOTIFY ENGINEER OF ANY CONFLICT.
5. TOP OF WALL ELEVATION SHALL MATCH EDGE OF PAVEMENT AS CONSTRUCTED. ELEVATIONS SHOWN MAY NEED ADJUSTMENT.
6. WHERE STONE RIPRAP IS LOCATED IN FRONT OF THE RETAINING WALL, THE TOP OF FOOTING ELEVATION SHALL BE 3 FT MINIMUM BELOW TOP OF GROUND ELEVATION. AT OTHER LOCATIONS, TOP OF FOOTING SHALL BE 1 FT MIN. BELOW TOP OF GROUND.
7. TEMPORARY SPECIAL SHORING SHALL BE PROVIDED FOR ALL WALL EXCAVATIONS WITH A CUT DEPTH DEEPER THAN 5 FT. SHORING MAY BE LAID BACK OR STEPPED AS PERMITTED BY THE GEOTECHNICAL ENGINEER. QUANTITY PROVIDED IS FOR THE VERTICAL PROJECTION OF THE CUT AT BACK OF THE FOOTING.
8. PROPOSED GRADING NOT SHOWN HERE. REFER TO GRADING PLANS FOR FINISHED GROUND.
9. REFER TO SW (SFC), RW(SF) AND RETAINING WALL MISCELLANEOUS DETAILS FOR WALL DESIGN INFORMATION, DETAILS AND OTHER INFORMATION.



ELEVATION

(1) WALL PANEL NUMBER

(2) 1" EXPANSION JOINT BETWEEN END OF WALL AND BACK FACE OF ABUTMENT. SEE RETAINING WALL MISC DETAILS FOR CONNECTION TO ABUTMENT CAP.

HL-93 LOADING

PRINT DATE	REVISION DATE
3/5/2024	

STATE OF TEXAS
JOELLE S. ROSENTSWIEG
89451
LICENSED
PROFESSIONAL ENGINEER
March 4, 2024

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(512) 250-5200
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TBPELS Firm No. F-3379

Waco District

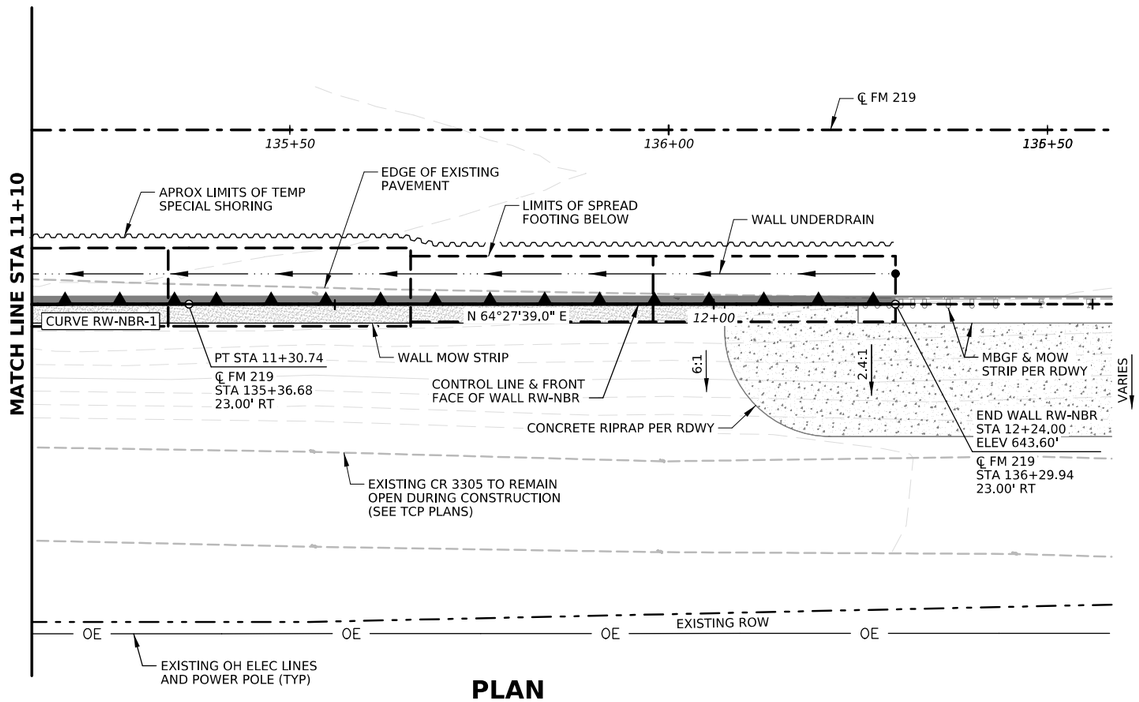
FM 219 AT NORTH BOSQUE RIVER

RW-NBR RETAINING WALL LAYOUT

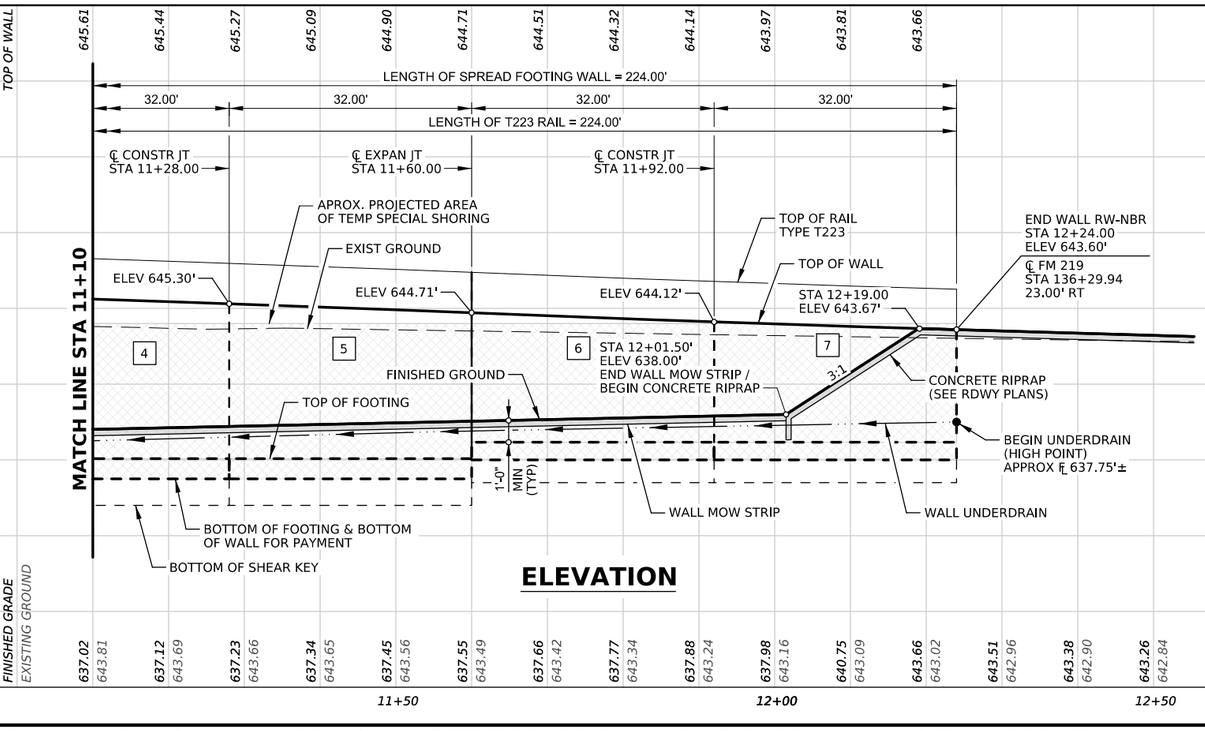
SHEET 1 OF 4

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 76

CS: 0724 02 020, ETC.
FILE LOCATION: ...\5067-WA1.07.RW.SHT.LAY.01.dgn



PLAN



ELEVATION

1 WALL PANEL NUMBER

HL-93 LOADING

PRINT DATE	REVISION DATE
3/5/2024	

STATE OF TEXAS
JOELLE S. ROSENTSWIEG
89451
LICENSED
PROFESSIONAL ENGINEER
March 4, 2024

P.E. Structural Consultants, *a Hardesty & Hanover, LLC Company*

H&H | PESC

9020 N. Capital of Texas Hwy,
Bldg 2, Suite 250
Austin, Texas 78759
(512) 250-5200
www.HardestyHanover.com
TBPELS Firm No. F-3379

FM 219 AT NORTH BOSQUE RIVER
RW-NBR RETAINING WALL LAYOUT

SHEET 2 OF 4

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 77

CSJ: 0724 02 020, ETC.
FILE LOCATION: ...\5067-WA1.07.RW.SHT.LAY.02.dgn

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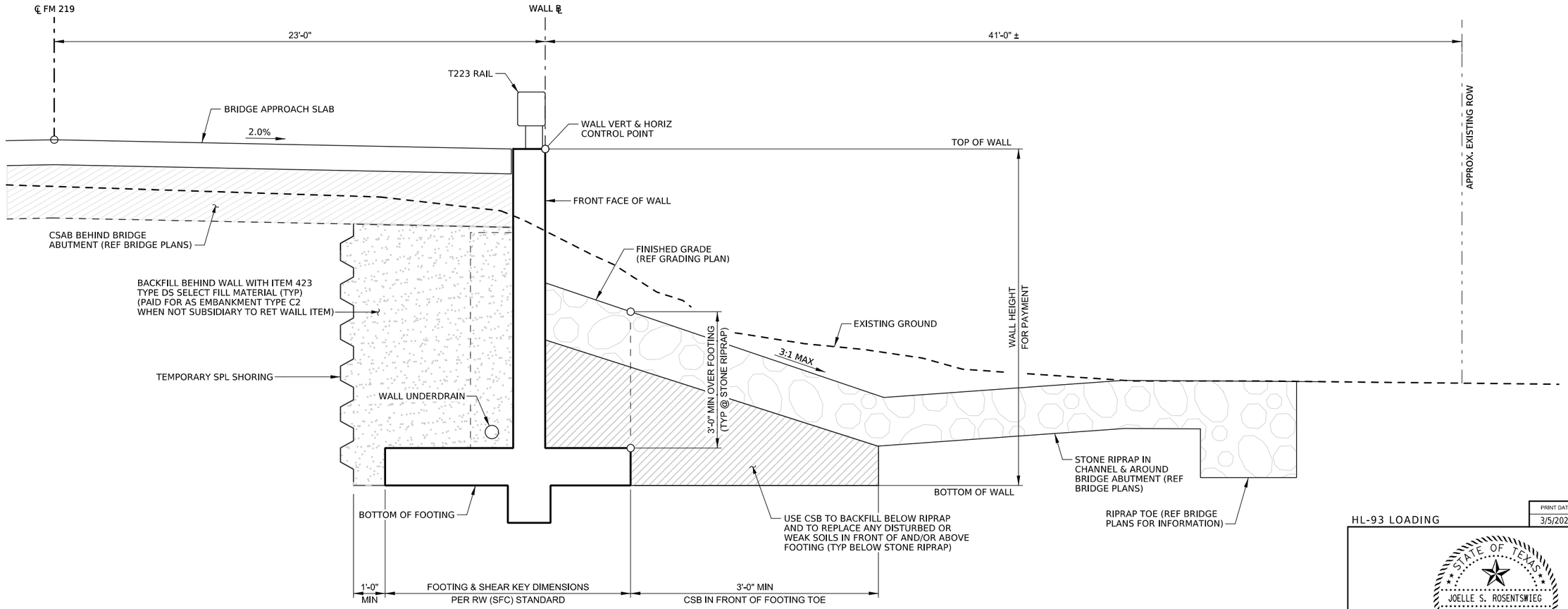

TYPICAL SECTION

WALL RW-NBR, PANEL 1

HL-93 LOADING

PRINT DATE	REVISION DATE
3/5/2024	

STATE OF TEXAS
JOELLE S. ROSENTSWIEG
89451
LICENSED
PROFESSIONAL ENGINEER

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FM 219 AT NORTH BOSQUE RIVER

RW-NBR
RETAINING WALL LAYOUT

SHEET 3 OF 4

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 78

CSJ: 0724 02 020, ETC.
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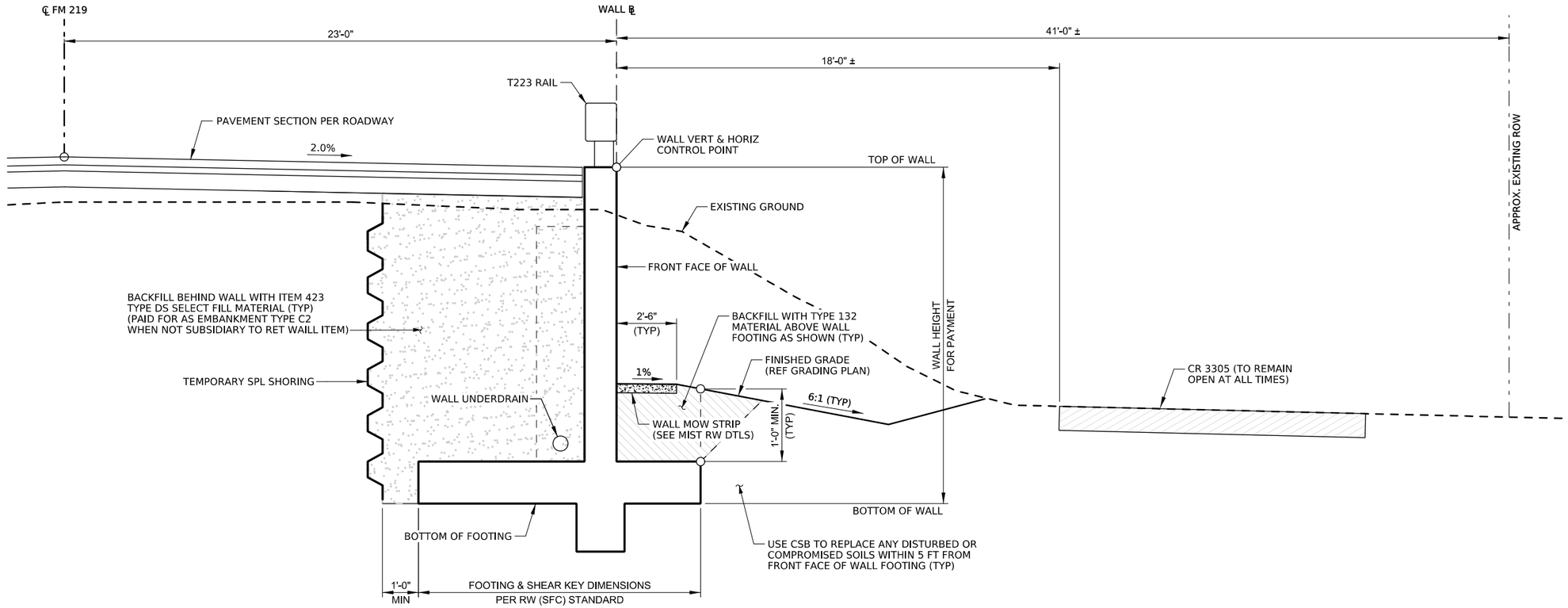
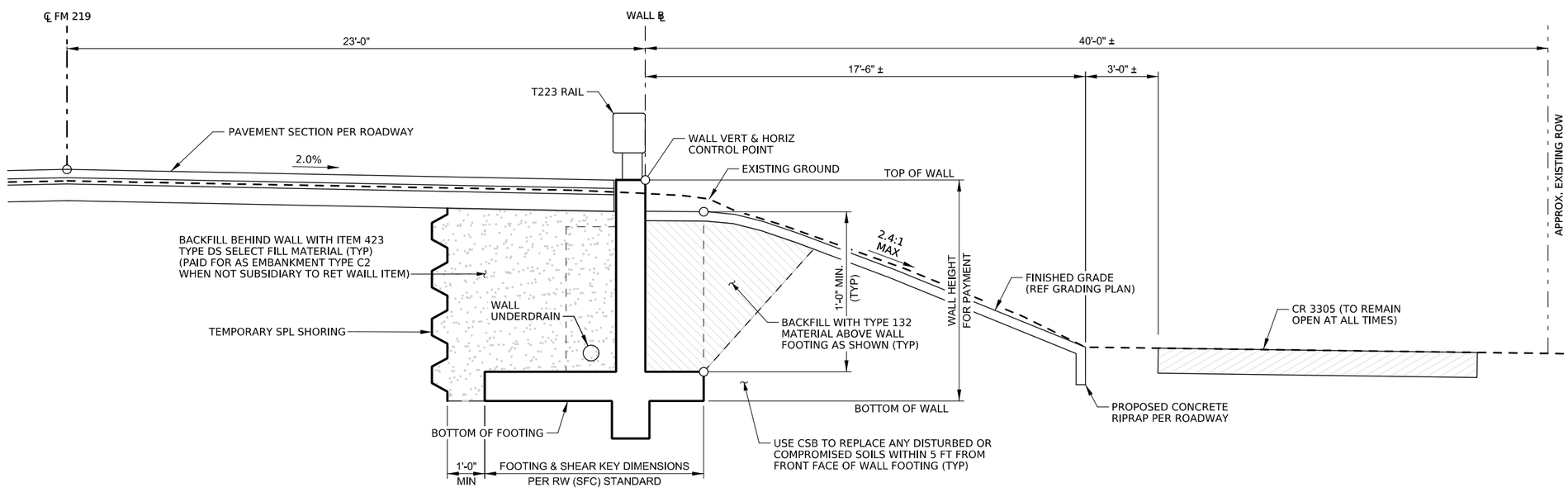


TYPICAL SECTION

WALL RW-NBR, PANELS 2 THRU 6



TYPICAL SECTION

WALL RW-NBR, PANEL 7

HL-93 LOADING

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3/5/2024	

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FM 219 AT NORTH BOSQUE RIVER

RW-NBR RETAINING WALL LAYOUT

SHEET 4 OF 4

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219

STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE

CONTROL	SECTION	JOB	SHEET NO.
0724	02	020, ETC.	78A

CSJ: 0724 02 020, ETC.
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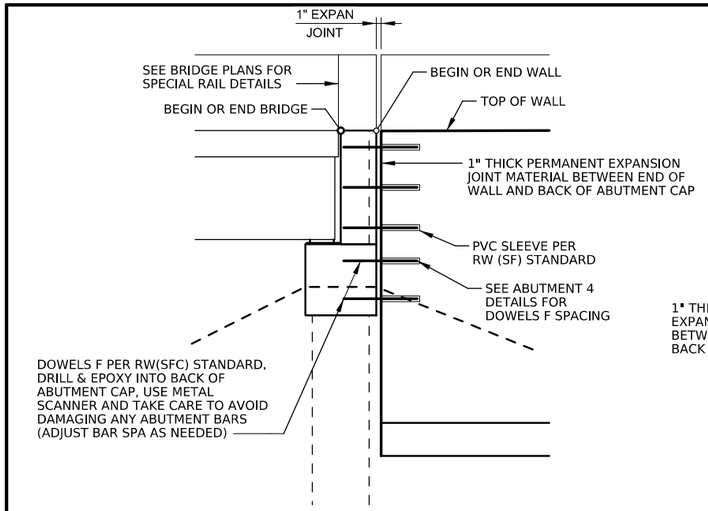
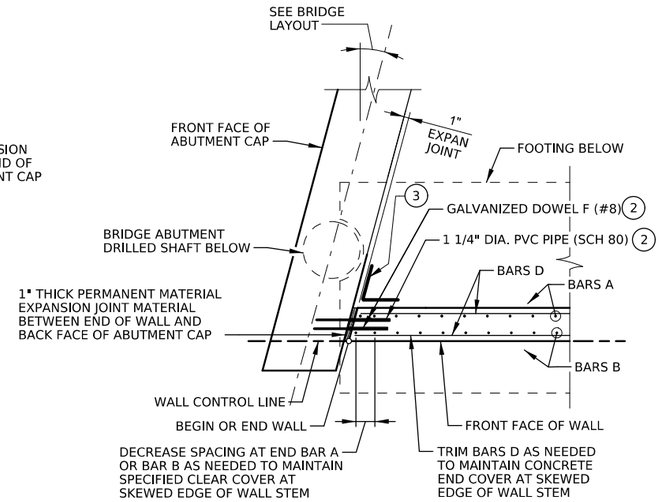
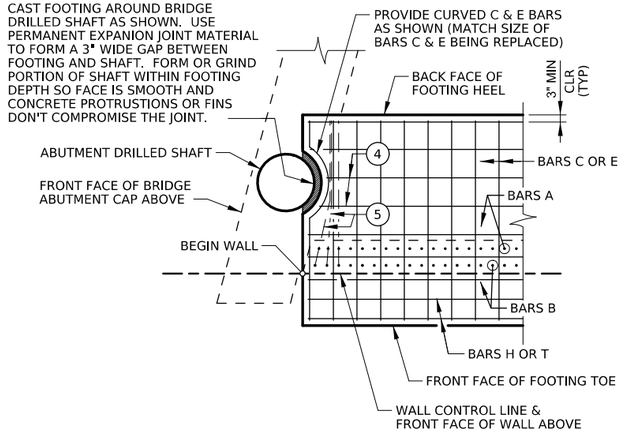


ELEVATION VIEW



PLAN VIEW

END OF WALL AT BRIDGE ABUTMENT

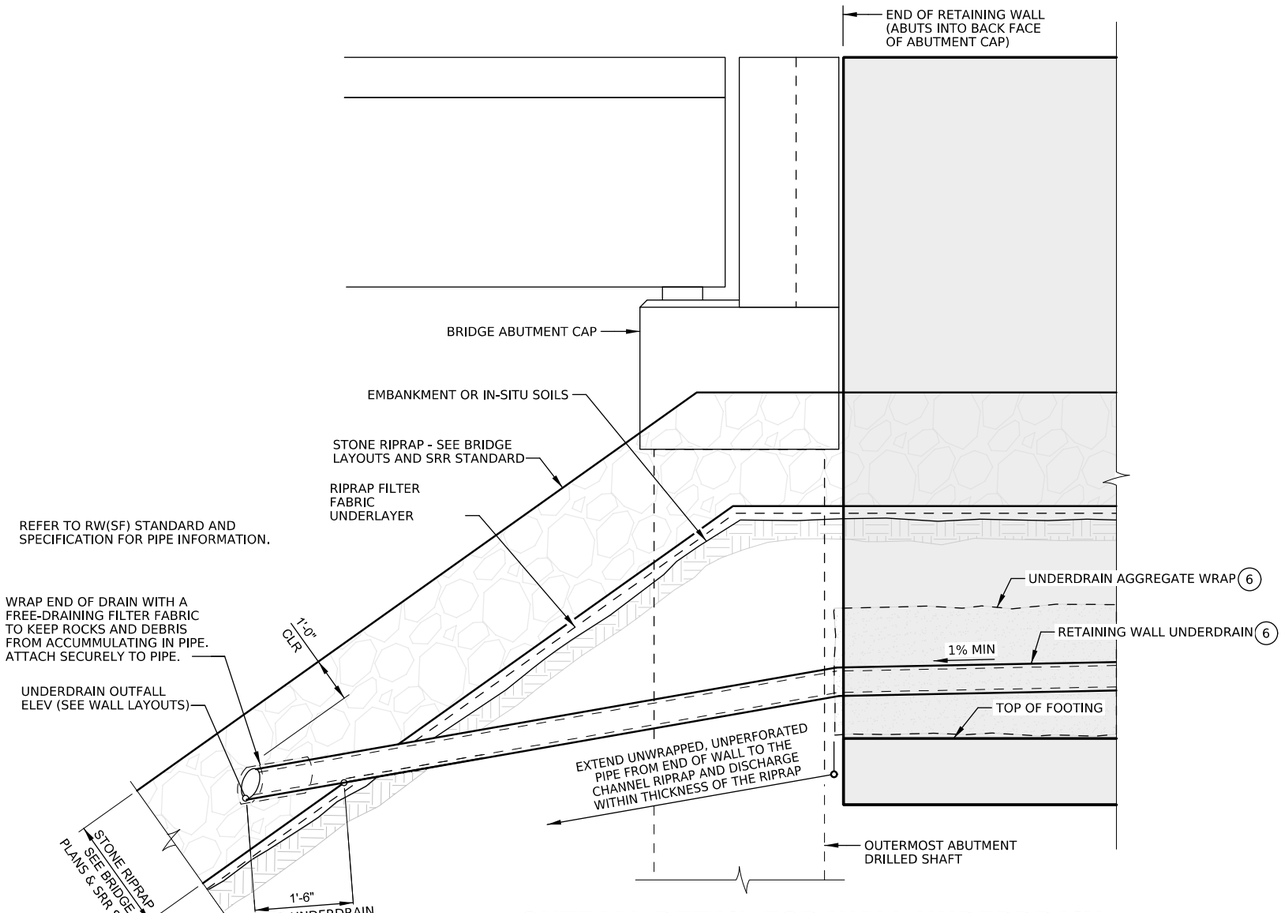


PLAN VIEW

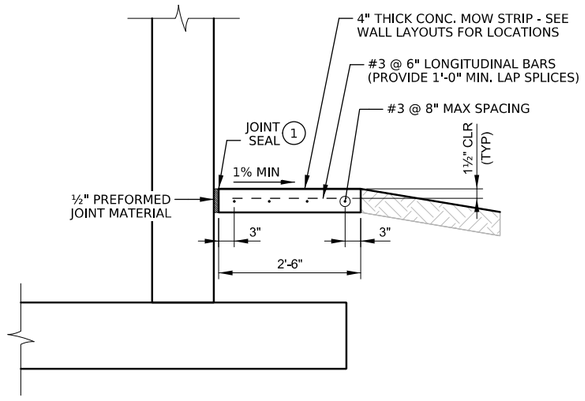
END OF FOOTING AT ABUTMENT SHAFT

REFER TO RW(SFC) STANDARD FOR WALL AND FOOTING GEOMETRY, REINFORCEMENT, AND OTHER INFORMATION.)

1. RECESS TOP OF PREFORMED JOINT MATERIAL 1/2" BELOW TOP OF MOW STRIP AND FILL WITH CLASS 5 JOINT SEALING COMPOUND OR APPROVED ADHESIVE
2. REFER TO THE RW(SF) STANDARD FOR DOWEL INFORMATION.
3. PROVIDE TYPE 10 WATERPROOFING BEHIND JOINT.
4. TRIM BARS AS NEEDED AROUND DRILLED SHAFT NOTCH TO MAINTAIM MIN. CLEAR COVER (TYP).
5. SKEW AND/OR BEND HORIZONTAL LEGS OF WALL BARS A & B AS NEEDED TO CLEAR NOTCH AROUND BRIDGE DRILLED SHAFT AND MAINTAIM MIN. CLEAR COVER.
6. REFER TO RW(SF) STANDARD FOR UNDERDRAIN INFORMATION.



OUTFALL DETAIL FOR WALL UNDERDRAIN



MOW STRIP IN FRONT OF RETAINING WALL

HL-93 LOADING

PRINT DATE	REVISION DATE
3/5/2024	

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FM 219 AT NORTH BOSQUE RIVER

RETAINING WALL MISCELLANEOUS DETAILS

SHEET 1 OF 1

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 79

REV DATE: 3/5/2024
CSJ: 0724-02-020, ETC.
FILE LOCATION: ...\5067-WA1.07.RW.SHT.DTL.01.dgn

3/5/2024 1:34:13 PM pw://hardesty-pw.bentley.com:hardesty-pw-01/Documents/TX-Projects/TXDOT/05759.01/03_FM219/4 - Design/Master Design Files/07.North Bosque River/H&H/Sheets/5067-WA1.07.RW.SHT.DTL.01.dgn

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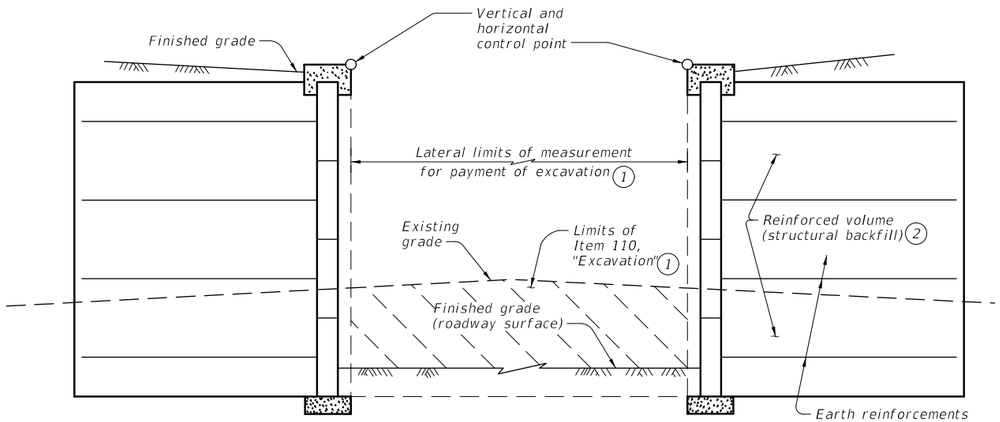
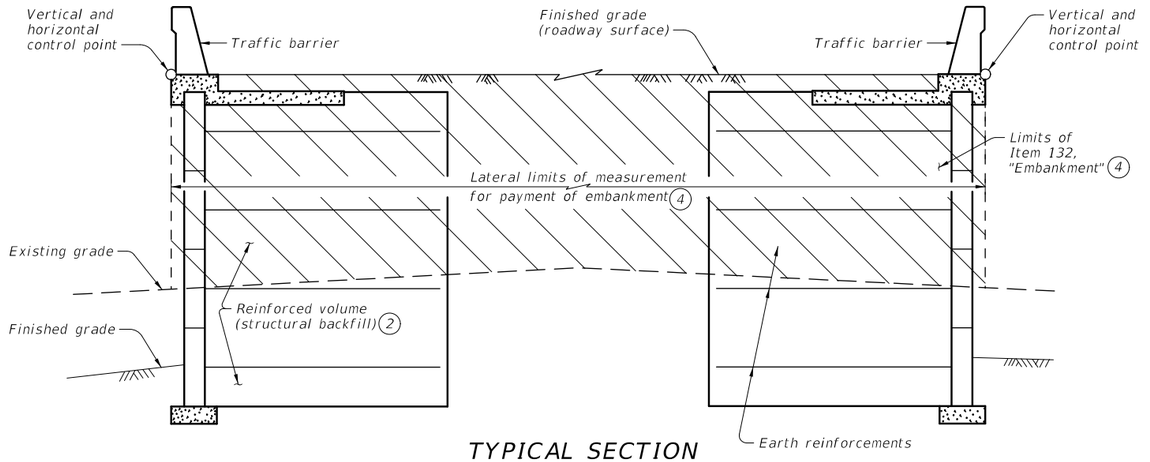
FILE:



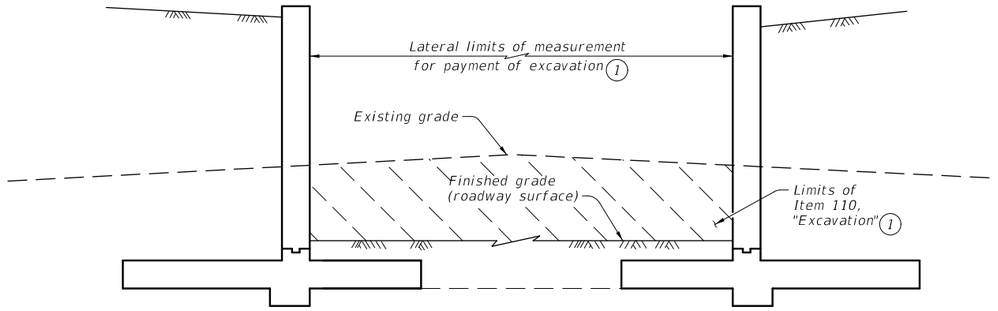
TYPICAL SECTION

(Excavation between MSE retaining walls.) (3)



TYPICAL SECTION

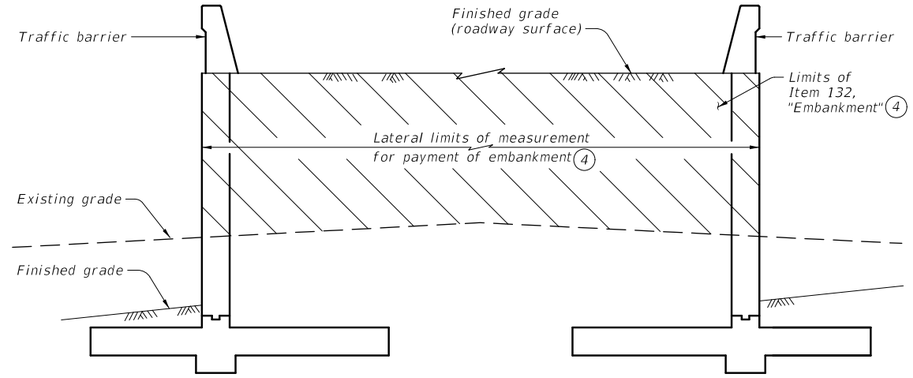
(Embankment between MSE retaining walls.) (3)



TYPICAL SECTION

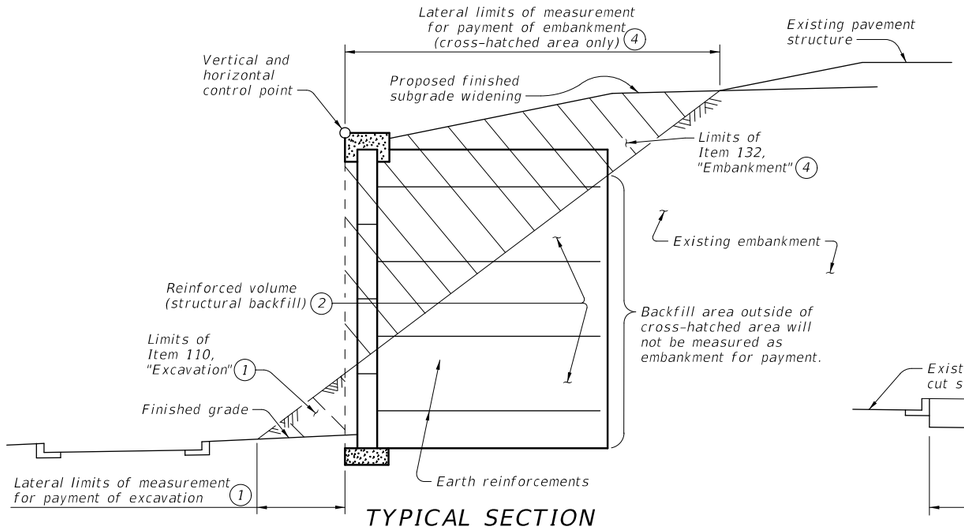
(Excavation between conventional retaining walls.)

1. Only the excavation above the proposed subgrade elevation will be measured for payment.
2. Meeting requirements for Item 423, "Retaining Walls."
3. Earthwork measurement with other retaining wall types will be made to the outside finished face in the same manner.
4. Only the embankment above the existing ground line will be measured for payment.



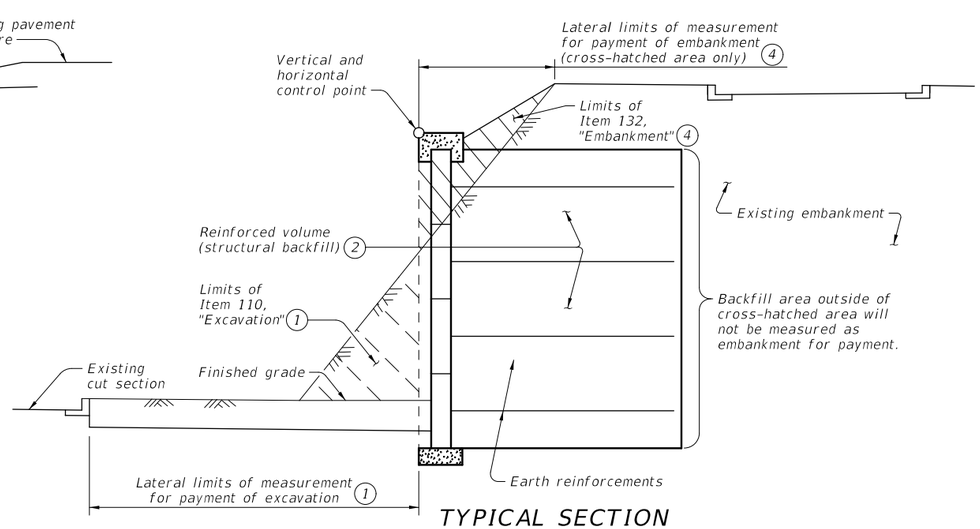
TYPICAL SECTION

(Embankment between conventional retaining walls.)



TYPICAL SECTION

(Widening embankment with MSE retaining walls.) (3)



TYPICAL SECTION

(Widening cut section with MSE retaining walls.) (3)

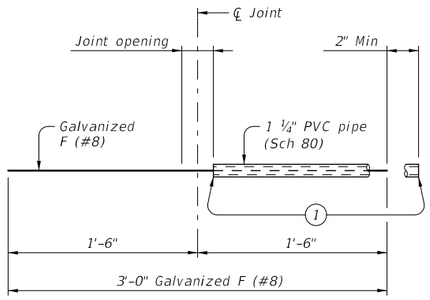
Texas Department of Transportation

Bridge Division Standard

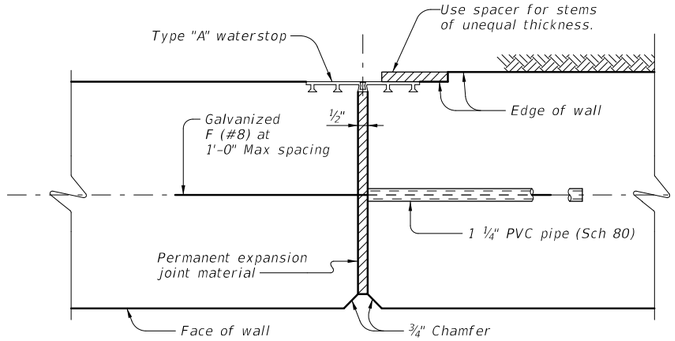
EARTHWORK MEASUREMENT AT RETAINING WALL

RW(EM)

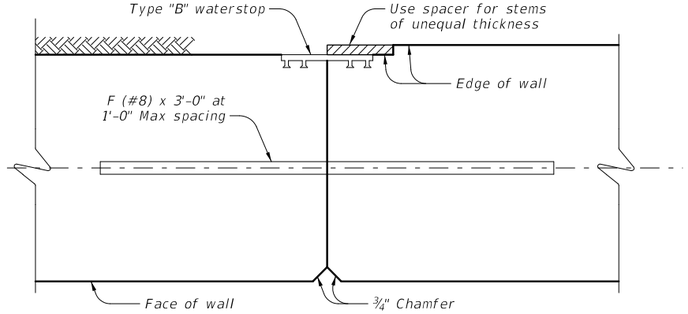
FILE: RW-EM-22.dgn	DN: TxDOT	CK: TxDOT	DW: JER	CK: RLE
©TxDOT June 2022	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		80



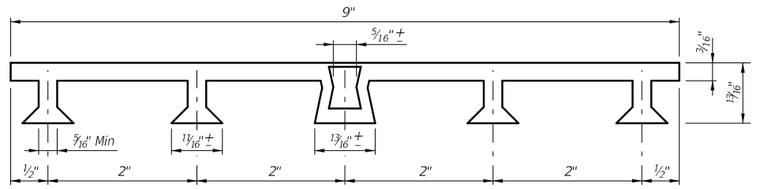
BAR F (#8) ASSEMBLY DETAIL



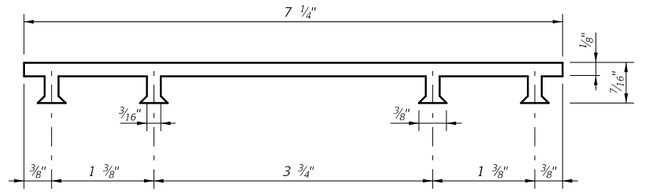
EXPANSION JOINT



CONSTRUCTION JOINT

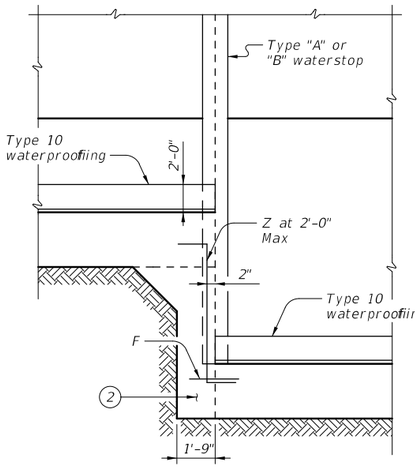


PVC WATERSTOP TYPE "A"

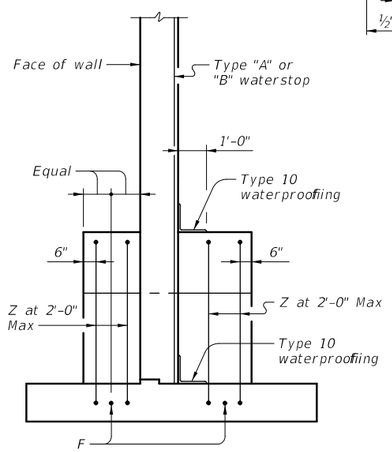


PVC WATERSTOP TYPE "B"

Note: Dimensions and shapes may vary slightly depending on manufacturer.

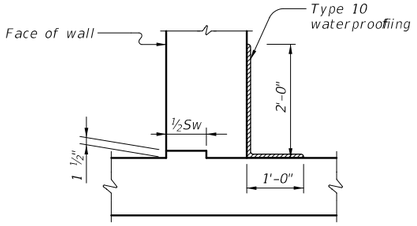


PARTIAL ELEVATION

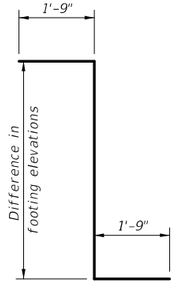


PARTIAL SECTION

SHOWING WATERSTOP AT FOOTING ELEVATION TRANSITION

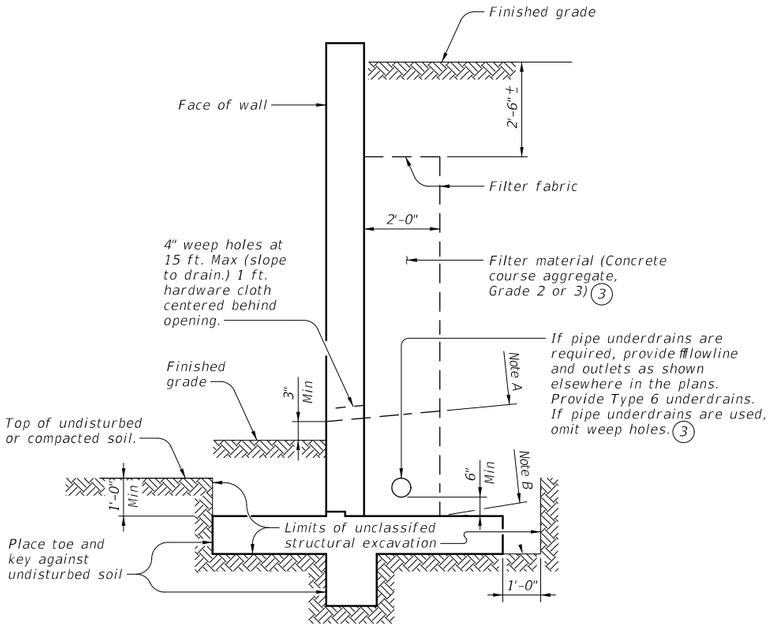


JOINT AND WATERSTOP DETAILS



BARS Z (#5)

(Omit Bars Z when difference in top of footing elevations is less than 2 ft).



DRAINAGE DETAILS AND EXCAVATION DIAGRAM

Note A: Stop coarse aggregate at this level when weep holes are used.

Note B: Use coarse aggregate to here when underdrains are used.

(1) Tape ends of 1 ¼" PVC Schedule 80 to prevent concrete or mortar from seeping in.

(2) Class C unreinforced concrete when difference in top of footing elevations is less than 2 feet. Omit when Dowel Bars F can be placed between adjacent footings with 4-inch cover top and bottom. Footing elevation difference not to exceed 4 feet.

(3) Underdrain pipe to be in accordance with Item 556, "Pipe Underdrains."

MATERIAL NOTES:

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

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.

Walls are designed assuming unit weight of soil = 120 pcf and a friction angle = 30 degrees for foundation and retained soil.

The undisturbed or compacted soil depth in front of walls must not measure less than Kd + Ft + 1 foot as measured upwards from bottom of key.

Retaining walls are detailed to be placed on grades up to 10% with level footing, with no changes in reinforcing steel. Steeper grades can be accommodated by shortening Bars A and Bars B and increasing the length of legs of Bars U by the same amount. No change in quantities will be required.

Retaining walls may be placed on horizontal curves by adjusting lengths of Bars T and Bars H in the footing. Minor revisions to concrete quantities may be required as a result.

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

SPREAD FOOTING RETAINING WALL MISCELLANEOUS DETAILS

RW(SF)

FILE: RW-SF-22.dgn	DN: TAR	CK: RLE	DW: JER	CK: TAR	
©TxDOT June 2022	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0724	02	020, ETC.	FM 219	
8-22: Updated underdrain requirements.	DIST	COUNTY		SHEET NO.	
	WACO	BOSQUE		81	

DATE:
FILE:

PROPERTIES

Wall Height "H" (Ft)	WALL DIMENSIONS Fw	Tw	Sw	Hw	Ft	Kw	Kd	MAX SOIL PRESS T/SF
2	5' - 0"	1' - 0"	1' - 0"	3' - 0"	1' - 0"	1' - 0"	1' - 0"	0.218
4	5' - 0"	1' - 0"	1' - 0"	3' - 0"	1' - 0"	1' - 0"	1' - 0"	0.321
6	5' - 6"	1' - 6"	1' - 0"	3' - 0"	1' - 0"	1' - 0"	1' - 0"	0.395
8	7' - 4"	1' - 9"	1' - 1"	4' - 6"	1' - 0"	1' - 0"	1' - 0"	0.500
10	8' - 8"	2' - 4"	1' - 1"	5' - 3"	1' - 2"	1' - 6"	1' - 6"	0.590
12	10' - 4"	2' - 11"	1' - 2"	6' - 3"	1' - 4"	1' - 9"	1' - 9"	0.684
14	11' - 8"	3' - 6"	1' - 4"	6' - 10"	1' - 7"	2' - 0"	2' - 0"	0.769
16	13' - 1"	4' - 0"	1' - 6"	7' - 7"	1' - 9"	2' - 0"	2' - 0"	0.853
18	14' - 7"	4' - 6"	1' - 8"	8' - 5"	1' - 9"	2' - 0"	2' - 0"	0.937
20	16' - 5"	5' - 0"	1' - 10"	9' - 7"	2' - 0"	2' - 0"	2' - 0"	1.039

REINFORCING STEEL FOR ONE 32' PANEL (DESIGN C)

Wall Height "H" (Ft)	Bars A1 No.	Size	Spa.	Length	Weight	Bars A2 No.	Size	Spa.	Length	Weight	Bars B No.	Size	Spa.	Length	Weight	Bars C No.	Size	Spa.	Length	Weight
2	39	#4	10"	3' - 2"	83	39	#4	10"	3' - 2"	83	39	#4	10"	1' - 11"	50	39	#4	10"	4' - 6"	118
4	39	#4	10"	5' - 2"	135	39	#4	10"	5' - 2"	135	39	#4	10"	3' - 11"	103	39	#4	10"	4' - 6"	118
6	39	#4	10"	7' - 8"	200	39	#4	10"	7' - 8"	200	39	#4	10"	5' - 11"	155	39	#4	10"	5' - 0"	131
8	39	#4	10"	10' - 0"	261	39	#4	10"	10' - 0"	261	39	#4	10"	7' - 11"	207	39	#4	10"	6' - 10"	179
10	39	#5	10"	12' - 7"	512	39	#4	10"	12' - 7"	328	39	#4	10"	9' - 9"	255	39	#5	10"	8' - 2"	333
12	39	#5	10"	15' - 3"	621	39	#4	10"	15' - 3"	398	39	#4	10"	11' - 7"	302	39	#5	10"	9' - 10"	400
14	39	#5	10"	18' - 0"	733	39	#4	10"	18' - 0"	469	39	#4	10"	13' - 4"	348	39	#5	10"	11' - 2"	455
16	39	#5	10"	20' - 8"	841	39	#5	10"	20' - 8"	841	39	#4	10"	15' - 2"	396	39	#6	10"	12' - 7"	738
18	39	#6	10"	23' - 4"	1367	39	#5	10"	23' - 4"	950	39	#4	10"	17' - 2"	448	39	#7	10"	14' - 1"	1124
20	39	#6	10"	26' - 0"	1524	39	#6	10"	26' - 0"	1524	39	#4	10"	18' - 11"	493	39	#7	10"	17' - 11"	1429

Wall Height "H" (Ft)	Bars E No.	Size	Spa.	Length	Weight	Bars K No.	Size	Spa.	Length	Weight	D (#5) at 12" Max. No.	Weight	Dowel F at 12" Max. No.	Weight	H (#5) at 12" Max. No.	Weight	T (#5) at 12" Max. No.	Weight	U ~ 39 #5 at 10" Max Length	Weight	QUANTITY FOR ONE 32' PANEL Conc (CY)	REINF (LB)	Wall Height "H" (Ft)
2	39	#4	10"	4' - 6"	118	39	#4	10"	3' - 10"	100	4	132	8	65	6	198	6	198	2' - 0"	82	8.3	1227	2
4	39	#4	10"	4' - 6"	118	39	#4	10"	3' - 10"	100	8	263	10	81	6	198	6	198	6' - 0"	245	10.7	1694	4
6	39	#4	10"	5' - 0"	131	39	#4	10"	3' - 10"	100	12	395	12	97	6	198	6	198	8' - 5"	343	13.7	2148	6
8	39	#4	10"	6' - 10"	179	39	#4	10"	3' - 10"	100	16	526	16	129	8	263	8	263	8' - 6"	346	18.9	2714	8
10	39	#4	10"	8' - 2"	213	39	#4	10"	5' - 4"	139	20	658	20	161	10	329	10	329	8' - 6"	346	26.0	3603	10
12	39	#4	10"	9' - 10"	257	39	#4	10"	6' - 1"	159	24	789	23	185	11	362	11	362	8' - 7"	350	34.8	4185	12
14	39	#4	10"	11' - 2"	291	39	#4	10"	6' - 10"	179	28	920	27	217	13	428	13	428	8' - 9"	356	46.3	4824	14
16	39	#4	10"	12' - 7"	329	39	#4	10"	6' - 10"	179	32	1052	30	241	14	460	14	460	8' - 11"	363	57.3	5900	16
18	39	#4	10"	14' - 1"	368	39	#4	10"	6' - 10"	179	36	1183	34	273	16	526	16	526	9' - 1"	370	67.1	7314	18
20	39	#4	10"	17' - 11"	467	39	#4	10"	6' - 10"	179	38	1249	36	289	17	559	17	559	9' - 3"	377	82.8	8649	20

SECTION

PARTIAL WALL ELEVATION

(Showing vertical reinforcing pattern in back face.)

H DEFINITION

BARS F ③

BARS D, H, and T

BARS A1 & A2

OPTIONAL BARS A1 ④

OPTIONAL BARS A2 ④

BARS B

OPTIONAL BARS B ④

BARS K

BARS U

① Place vertical bars inside of horizontal bars (Typical both faces).
② Place footing toe against undisturbed soil.
③ See Retaining Wall Miscellaneous Details (RW(SF)) standard for size.
④ Optional bars splices not included in above table.

MATERIAL NOTES:

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

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.

Walls are designed assuming unit weight of soil = 120 pcf and a friction angle = 30 degrees for foundation and retained soil.

See Retaining Wall Miscellaneous Details (RW(SF)) standard for details and notes not shown.

These details provide designs for wall heights of 2 to 20 feet. For heights not shown, round up "H" to determine wall dimensions and reinforcing. (For example, a 9-foot high wall would use the 10-foot high dimensions and reinforcing.)

Quantities are based on "H" being average height of panel.

Retaining walls are designed to be coded as follows on Retaining Wall Layout Sheets:

C - 15 - 32
32 — Panel length ~ 32 ft. is standard; 28 ft. requires special quantities.
15 — Average height (H) of panel.
C — Design A = No surcharge or slope above wall.
Design B = No surcharge; slopes to 3:1.
Design C = Traffic surcharge; no slope above wall.

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

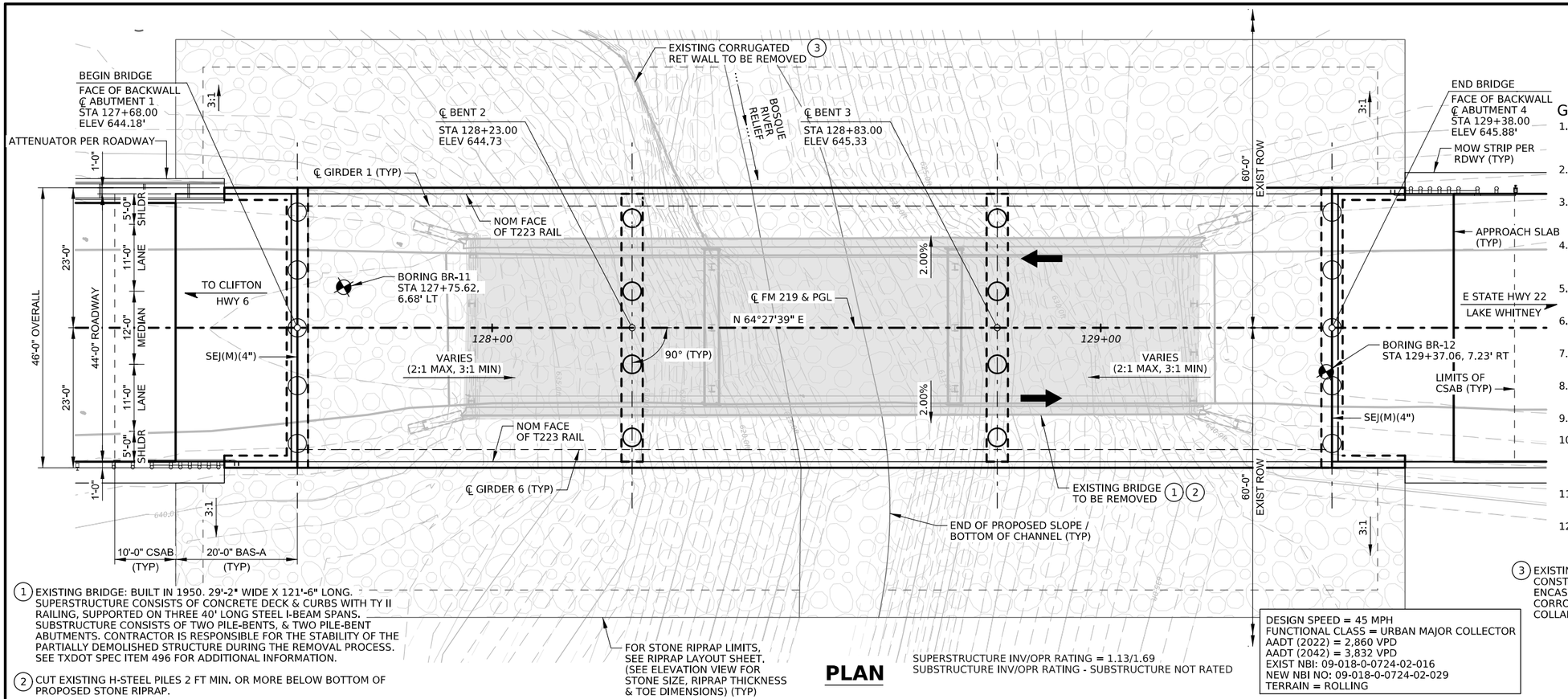
Texas Department of Transportation
Bridge Division Standard

SPREAD FOOTING RETAINING WALL

RW(SFC)

FILE: RW-SFC-22.dgn	DN: TAR	CK: RLE	DW: JER	CK: TAR
©TxDOT June 2022	CONT	SECT	JOB	HIGHWAY
REVISIONS 8-22: Constructability update.	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		82

DATE:
FILE:



0 10 20
SCALE IN FEET

ABUTMENTS AND BENTS ARE ALONG BEARING N 25°32'21" W

GENERAL NOTES:

1. DESIGNED IN ACCORDANCE WITH 2020 AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 9TH EDITION WITH CURRENT INTERIM REVISIONS AND TXDOT BRIDGE DESIGN MANUAL (JAN. 2023).
2. VERIFY ALL DIMENSIONS AND ELEVATIONS PRIOR TO COMMENCING WORK.
3. ALL DIMENSIONS ARE EITHER HORIZONTAL OR VERTICAL AND MUST BE CORRECTED FOR GRADE, CROWN, AND/OR SUPERELEVATION.
4. COLUMN HEIGHTS SHOWN ARE CALCULATED AT THE PROFILE GRADE LINE. ACTUAL COLUMN HEIGHT SHALL BE MEASURED IN THE FIELD PRIOR TO ORDERING MATERIALS.
5. CONTRACTOR SHALL VERIFY LOCATIONS OF ALL UTILITIES PRIOR TO EXCAVATION AND/OR DRILLING.
6. CONTRACTOR TO NOTE THE LOCATIONS OF OVERHEAD ELECTRIC LINES IN VICINITY OF DEMOLITION AND CONSTRUCTION.
7. SEE STANDARD DRAWINGS FOR ABUTMENT, BENT, SHEAR KEY (AT ALL ABUTMENTS AND BENTS), SLAB AND GIRDER DETAILS.
8. SEE CEMENT STABILIZED ABUTMENT BACKFILL DETAILS STANDARD FOR CSAB INFORMATION.
9. SEE SOIL BORING LOG SHEETS FOR BORE HOLE PROFILES.
10. DRILLED SHAFTS HAVE BEEN DESIGNED FOR BOTH END BEARING AND SKIN FRICTION. SHAFTS SHALL BE FOUNDED AT THE LENGTHS SHOWN OR DEEPER AS NECESSARY TO OBTAIN 4 FT MINIMUM EMBEDMENT INTO UNWEATHERED LIMESTONE.
11. SEE GRADING PLAN AND RIPRAP LAYOUT FOR PROPOSED SLOPES AND RIPRAP LIMITS.
12. REFER TO THE NBIS STANDARD FOR BRIDGE INDENTIFICATION SIGN INFORMATION.

(1) EXISTING BRIDGE: BUILT IN 1950. 29'-2" WIDE X 121'-6" LONG. SUPERSTRUCTURE CONSISTS OF CONCRETE DECK & CURBS WITH TY II RAILING, SUPPORTED ON THREE 40' LONG STEEL I-BEAM SPANS. SUBSTRUCTURE CONSISTS OF TWO PILE-BENTS, & TWO PILE-BENT ABUTMENTS. CONTRACTOR IS RESPONSIBLE FOR THE STABILITY OF THE PARTIALLY DEMOLISHED STRUCTURE DURING THE REMOVAL PROCESS. SEE TXDOT SPEC ITEM 496 FOR ADDITIONAL INFORMATION.

(2) CUT EXISTING H-STEEL PILES 2 FT MIN. OR MORE BELOW BOTTOM OF PROPOSED STONE RIPRAP.

(3) EXISTING RET WALL: EMBANKMENT REPAIR (DATE UNKNOWN): RET WALL CONSTRUCTED OF CORRUGATED STEEL LAGGING & TIMBER POSTS ENCASED IN CONCRETE PILES. WALL & PILES ARE IN VARIOUS STAGES OF CORROSION & DECAY. AREAS OF WALL THAT ARE BOWING OR PARTIALLY COLLAPSED, SHALL BE TREATED WITH CAUTION DURING REMOVAL.

FOR STONE RIPRAP LIMITS, SEE RIPRAP LAYOUT SHEET. (SEE ELEVATION VIEW FOR STONE SIZE, RIPRAP THICKNESS & TOE DIMENSIONS) (TYP)

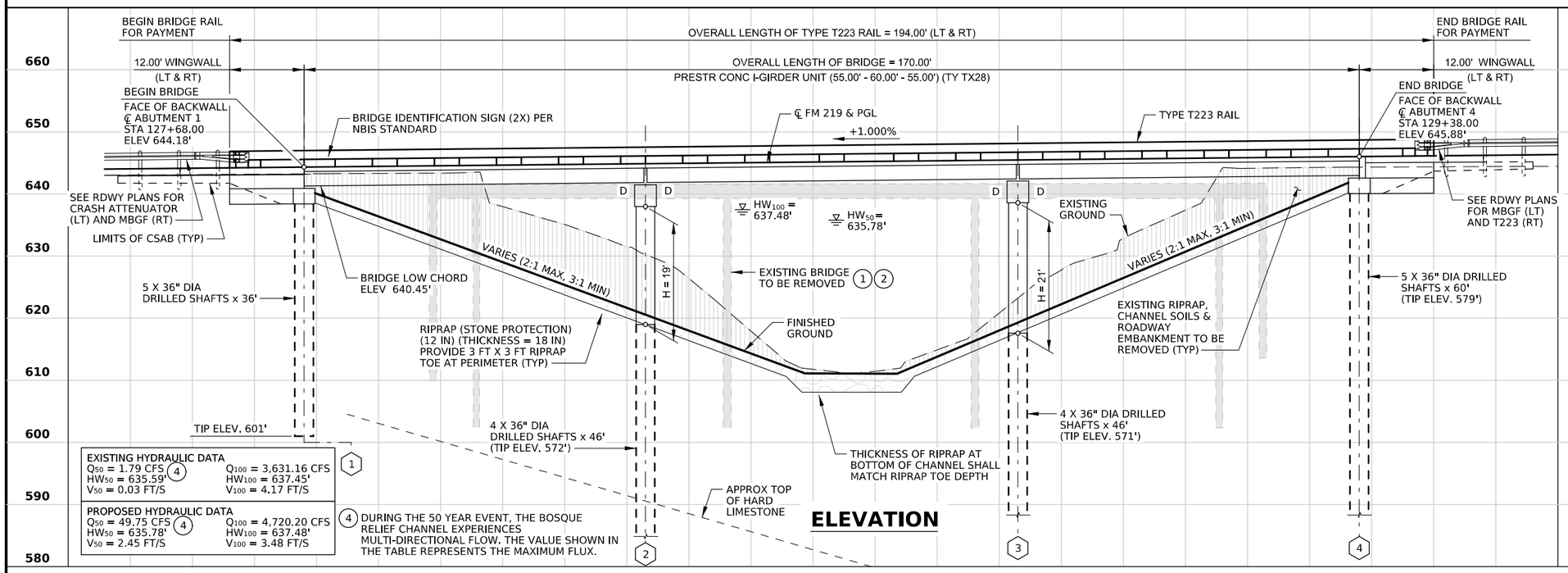
PLAN

SUPERSTRUCTURE INV/OPR RATING = 1.13/1.69
SUBSTRUCTURE INV/OPR RATING - SUBSTRUCTURE NOT RATED

DESIGN SPEED = 45 MPH
FUNCTIONAL CLASS = URBAN MAJOR COLLECTOR
AADT (2022) = 2,860 VPD
AADT (2042) = 3,832 VPD
EXIST NBI: 09-018-0-0724-02-016
NEW NBI NO: 09-018-0-0724-02-029
TERRAIN = ROLLING

HL-93 LOADING

PRINT DATE	REVISION DATE
3/4/2024	



EXISTING HYDRAULIC DATA (4)	
Q_{50} = 1.79 CFS	Q_{100} = 3,631.16 CFS
HW_{50} = 635.59'	HW_{100} = 637.45'
V_{50} = 0.03 FT/S	V_{100} = 4.17 FT/S

PROPOSED HYDRAULIC DATA (4)	
Q_{50} = 49.75 CFS	Q_{100} = 4,720.20 CFS
HW_{50} = 635.78'	HW_{100} = 637.48'
V_{50} = 2.45 FT/S	V_{100} = 3.48 FT/S

(4) DURING THE 50 YEAR EVENT, THE BOSQUE RELIEF CHANNEL EXPERIENCES MULTI-DIRECTIONAL FLOW. THE VALUE SHOWN IN THE TABLE REPRESENTS THE MAXIMUM FLUX.

ELEVATION

STATE OF TEXAS
MARY THERESA CANO
64634
LICENSED
PROFESSIONAL ENGINEER
03/04/2024

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TBPELS Firm No. F-3379

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Waco District

FM 219 AT BOSQUE RIVER RELIEF

BRIDGE LAYOUT
PLAN & ELEVATION

SHEET 1 OF 2

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 83

CSJ: 0724 02 020, ETC.
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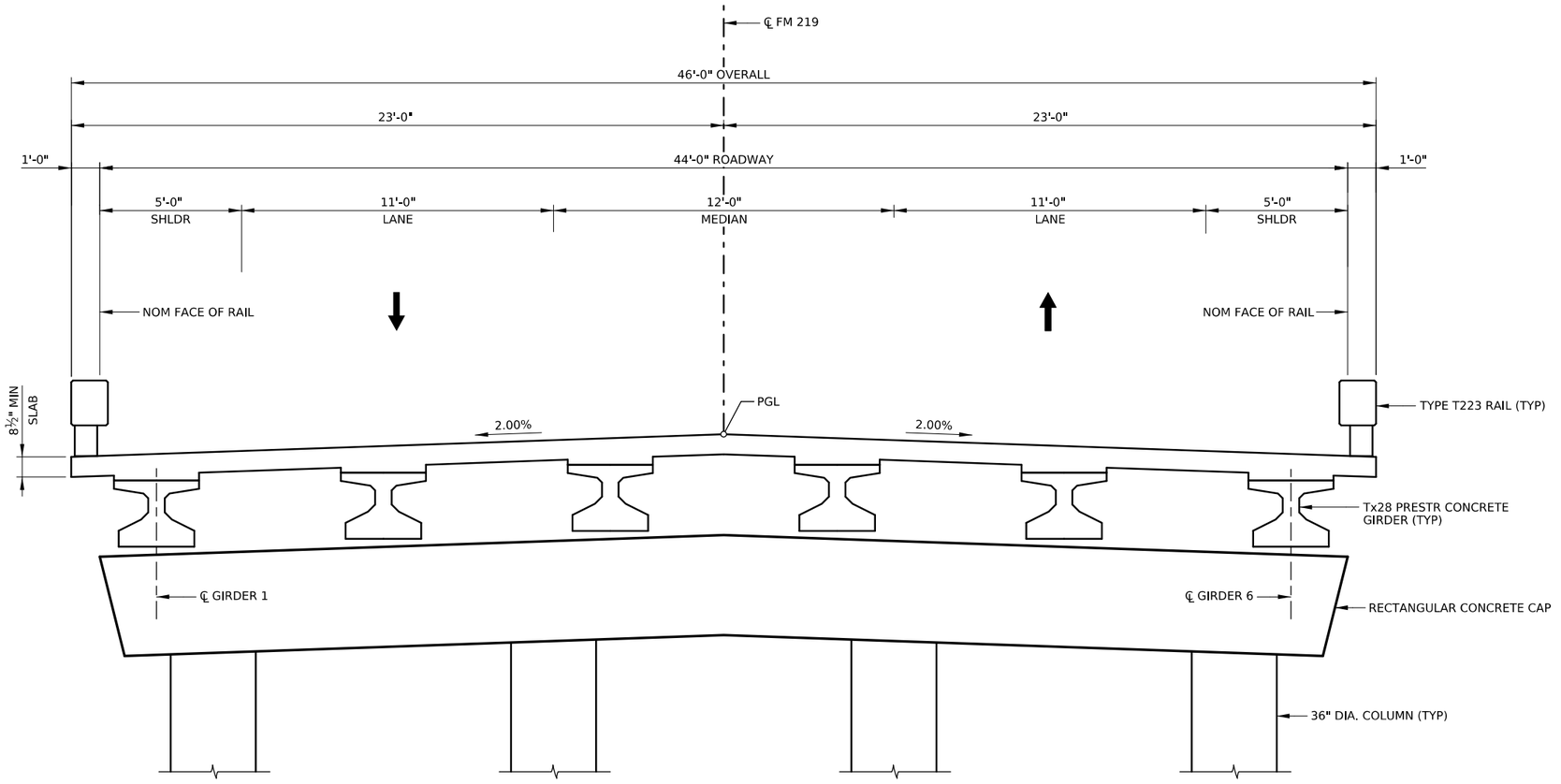

BRIDGE TYPICAL SECTION

HL-93 LOADING

PRINT DATE	REVISION DATE
3/4/2024	

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FM 219 AT BOSQUE RIVER RELIEF

BRIDGE LAYOUT
TYPICAL SECTION

SHEET 2 OF 2

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219

STATE	DISTRICT	COUNTY	
TEXAS	WACO	BOSQUE	
CONTROL	SECTION	JOB	SHEET NO.
0724	02	020, ETC.	84

CSJ: 0724 02 020, ETC.
FILE LOCATION: ...\5067-WA1.06.BRG.SHT.TYP.01.dgn

BRIDGE ESTIMATED QUANTITIES

ITEM	400	416	420	420	420	422	422	425	432	450	454	496	5132
BID CODE	6005	6004	6014	6030	6038	6001	6015	6035	6033	6006	6018	6010	6001
DESCRIPTION / BRIDGE ELEMENT	CEM STABIL BKFL	DRILL SHAFT (36 IN)	(2) CL C CONC (ABUT) (HPC)	(2) CL C CONC (CAP) (HPC)	CL C CONC (COLUMN) (HPC)	REINF CONC SLAB	APPROACH SLAB	(1) PRESTR CONC GIRDER (Tx28)	RIPRAP (STONE PROTECTION) (18 IN)	RAIL (TY T223)	SEALED EXPANSION JOINT (4 IN) (SEJ-M)	REMOV STR (BRIDGE 100 - 499 FT LENGTH)	LEAD CONTAINING COATING MANAGEMENT
UNIT	CY	LF	CY	CY	CY	SF	CY	LF	CY	LF	LF	EA	SF
2 - ABUTMENTS	174	480	53.0				70.7		1,350	48.0			142
2 - INTERIOR BENTS		368		41.5	41.9								72
1 - 170.00' PRESTR CONC I-GIRDER UNIT						7,820		1,011.00		340.0	91	1	
TOTAL	174	848	53.0	41.5	41.9	7,820	70.7	1,011.00	1,350	388.0	91	1	214

(1) BRIDGE IDENTIFICATION SIGN IS SUBSIDIARY TO THE GIRDER BID ITEM. SEE NBIS STANDARD.

(2) SHEAR KEY QUANTITIES ARE INCLUDED IN THE ABUTMENT AND BENT CAP QUANTITIES.

BEARING SEAT ELEVATIONS

	GRDR 1	GRDR 2	GRDR 3	GRDR 4	GRDR 5	GRDR 6
ABUT 1 (FWD)	640.227	640.388	640.547	640.547	640.388	640.227
	GRDR 1	GRDR 2	GRDR 3	GRDR 4	GRDR 5	GRDR 6
BENT 2 (BK)	640.758	640.917	641.078	641.078	640.917	640.758
(FWD)	640.778	640.938	641.098	641.098	640.938	640.778
	GRDR 1	GRDR 2	GRDR 3	GRDR 4	GRDR 5	GRDR 6
BENT 3 (BK)	641.357	641.518	641.677	641.677	641.518	641.357
(FWD)	641.378	641.538	641.698	641.698	641.538	641.378
	GRDR 1	GRDR 2	GRDR 3	GRDR 4	GRDR 5	GRDR 6
ABUT 4 (BK)	641.908	642.068	642.228	642.228	642.068	641.908

PRINT DATE	REVISION DATE
3/4/2024	

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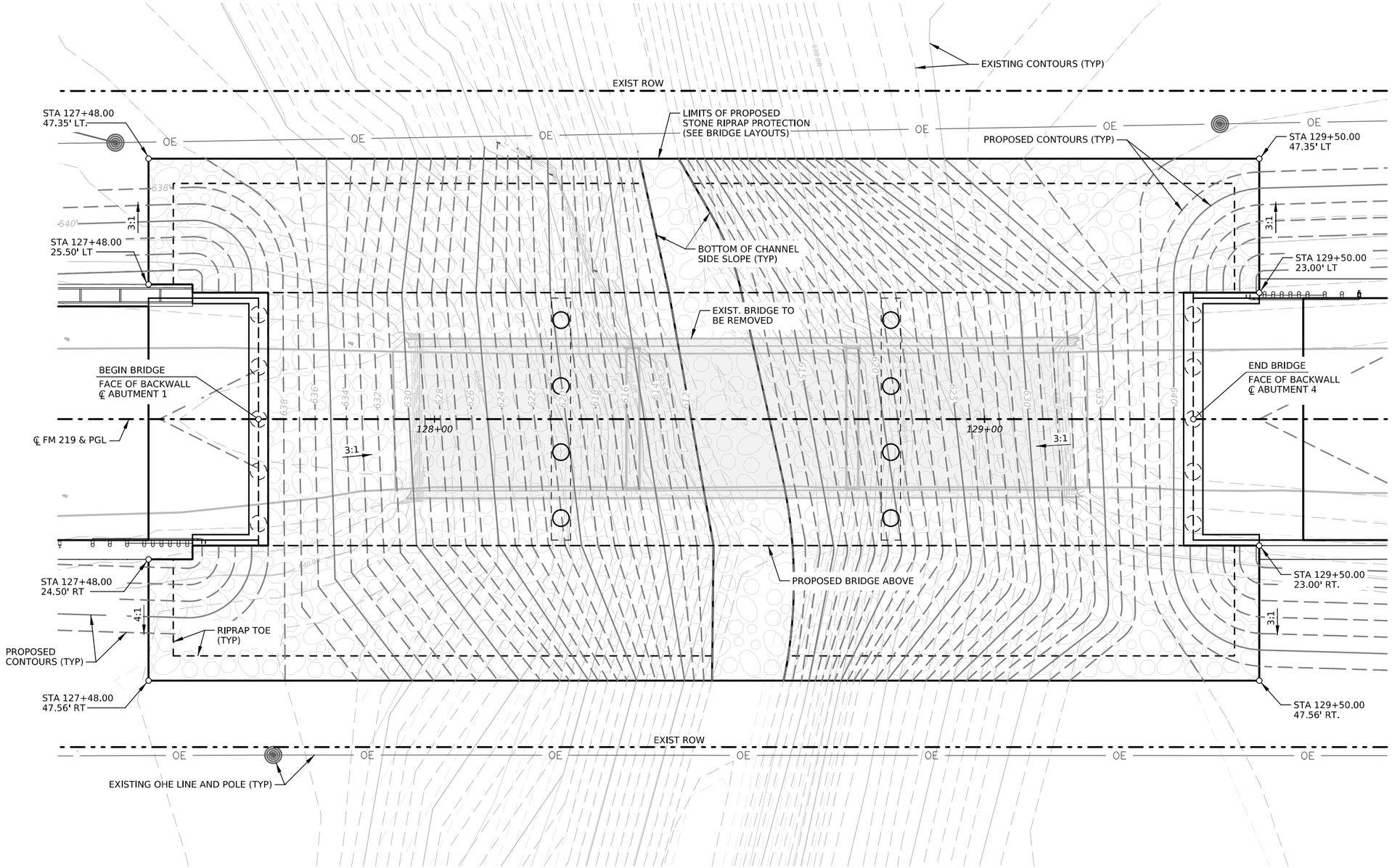
Texas Department of Transportation
Waco District

FM 219 AT BOSQUE RIVER RELIEF

ESTIMATED QUANTITIES & BEARING SEAT ELEV'S

SHEET 1 OF 1

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 85



RIPRAP LAYOUT

0 10 20
SCALE IN FEET

GENERAL NOTES:

1. REFER TO GRADING PLANS FOR FINISHED GROUND INFORMATION.
2. REFER TO BRIDGE LAYOUT FOR PROPOSED RIPRAP ROCK SIZE, THICKNESS AND TOE DIMENSIONS.
3. REFER TO SRR STANDARD FOR STONE RIPRAP INSTALLATION DETAILS.

PRINT DATE	REVISION DATE
3/4/2024	

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Texas Department of Transportation
Waco District

FM 219 AT BOSQUE RIVER RELIEF

RIPRAP LAYOUT

SHEET 1 OF 1

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 86

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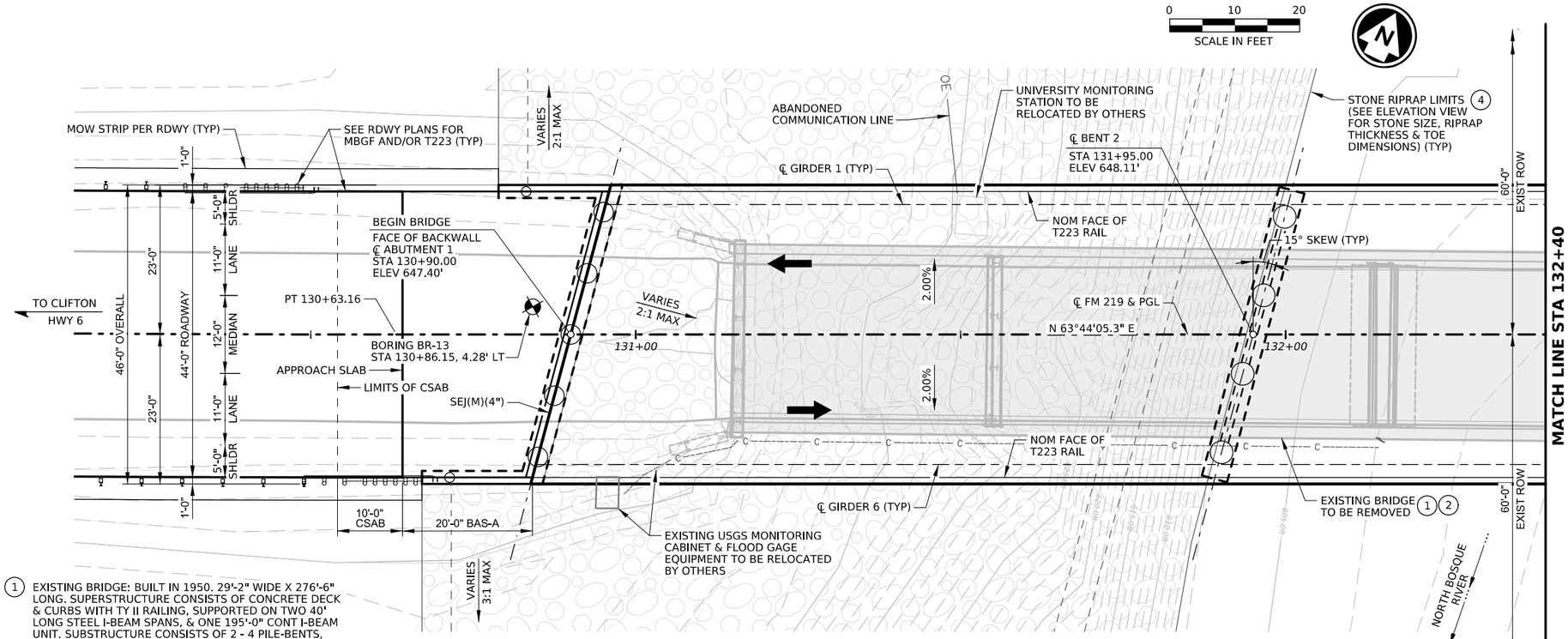
ABUTMENTS AND BENTS ARE ALONG BEARING N 11°15'55" W



(1) EXISTING BRIDGE: BUILT IN 1950. 29'-2" WIDE X 276'-6" LONG. SUPERSTRUCTURE CONSISTS OF CONCRETE DECK & CURBS WITH TY II RAILING, SUPPORTED ON TWO 40' LONG STEEL I-BEAM SPANS, & ONE 195'-0" CONT I-BEAM UNIT. SUBSTRUCTURE CONSISTS OF 2 - 4 PILE-BENTS, TWO VARIABLE DEPTH CONCRETE PIERS ON SPREAD FOOTINGS, & 2 ABUTMENT CAP WITH 4 PILES & 2 FOUNDED WINGWALLS WITH 1 PILE EACH. SEE TXDOT SPEC ITEM 496, UNLESS OTHERWISE NOTED.

(2) CUT EXISTING STEEL H-PILES 2 FT MIN. BOTTOM OF PROPOSED STONE RIPRAP, WHERE STONE PRESENT

(3) EXTEND STONE RIPRAP IN FRONT OF TOE AT A DEPTH OF 2'-3" TO LIMITS SHOWN.

(4) STONE RIPRAP SLOPE VARIES. SEE RIPRAP PLAN FOR ADDITIONAL INFORMATION.

PLAN

(3) SHOWING EASTSIDE ONLY. AT WESTSIDE, SEE ROADWAY PLANS FOR T223 RAIL ON TRF FOUNDATION.

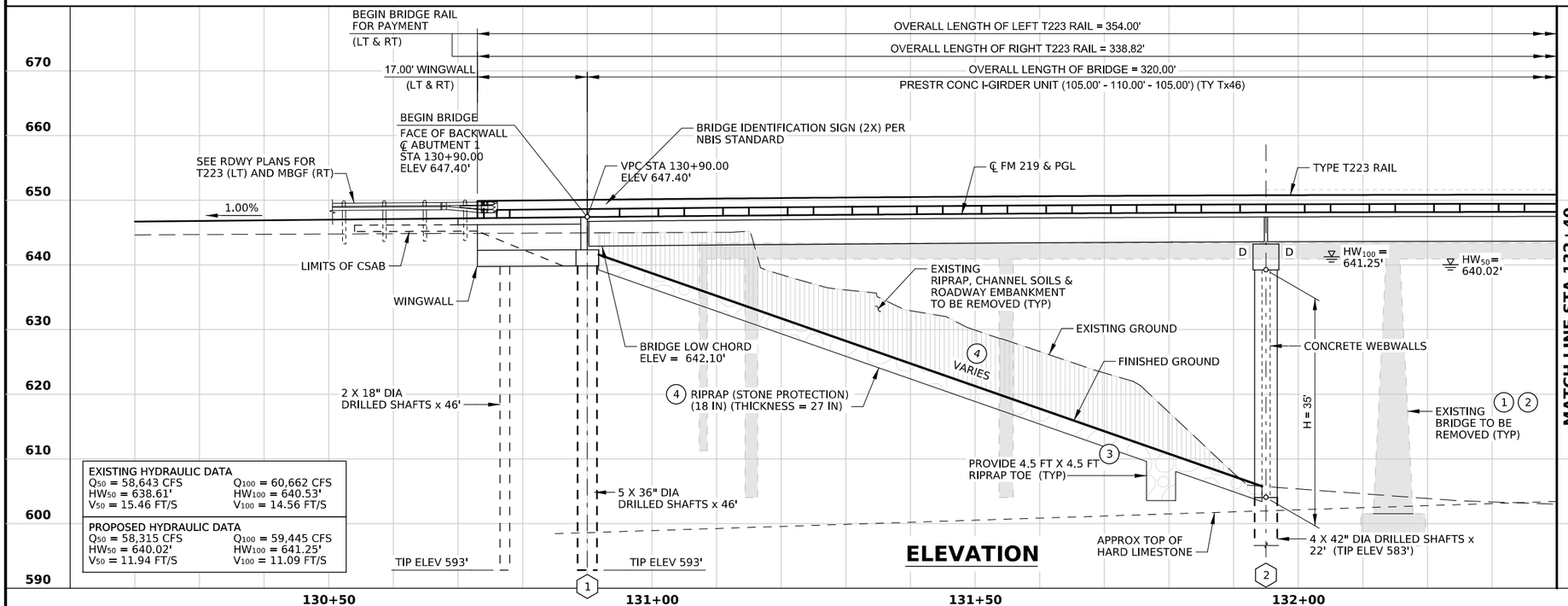
GENERAL NOTES:

1. DESIGNED IN ACCORDANCE WITH 2020 AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 9TH EDITION WITH CURRENT INTERIM REVISIONS AND TXDOT BRIDGE DESIGN MANUAL (JAN. 2023).
2. VERIFY ALL DIMENSIONS AND ELEVATIONS PRIOR TO COMMENCING WORK.
3. ALL DIMENSIONS ARE EITHER HORIZONTAL OR VERTICAL AND MUST BE CORRECTED FOR GRADE, CROWN, AND/OR SUPERELEVATION.
4. COLUMN HEIGHTS SHOWN ARE CALCULATED AT THE PROFILE GRADE LINE. ACTUAL COLUMN HEIGHT SHALL BE MEASURED IN THE FIELD PRIOR TO ORDERING MATERIALS.
5. CONTRACTOR SHALL VERIFY LOCATIONS OF ALL UTILITIES PRIOR TO EXCAVATION AND/OR DRILLING.
6. CONTRACTOR TO NOTE THE LOCATIONS OF OVERHEAD ELECTRIC LINES IN VICINITY OF DEMOLITION AND CONSTRUCTION.
7. SEE STANDARD DRAWINGS FOR ABUTMENT (NO. 1 ONLY), SLAB, SHEAR KEY (AT ALL ABUTMENTS AND BENTS), AND GIRDER DETAILS.
8. SEE CEMENT STABILIZED ABUTMENT BACKFILL DETAILS STANDARD FOR CSAB INFORMATION.
9. SEE SOIL BORING LOG SHEETS FOR BORE HOLE PROFILES.
10. DRILLED SHAFTS HAVE BEEN DESIGNED FOR BOTH END BEARING AND SKIN FRICTION. SHAFTS SHALL BE FOUNDED AT THE LENGTHS SHOWN OR DEEPER AS NECESSARY TO OBTAIN 4 FEET MINIMUM EMBEDMENT INTO UNWEATHERED LIMESTONE.
11. SEE GRADING PLAN AND RIPRAP LAYOUT FOR PROPOSED SLOPES AND RIPRAP LIMITS.
12. SEE RETAINING WALL LAYOUT FOR WALL, FOOTING AND TEMPORARY SPL SHORING INFORMATION.
13. REFER TO THE NBIS STANDARD FOR BRIDGE IDENTIFICATION SIGN INFORMATION.

DESIGN SPEED = 45 MPH
FUNCTIONAL CLASS = URBAN MAJOR COLLECTOR
AADT (2022) = 2,860 VPD
AADT (2042) = 3,832 VPD
EXIST NBI: 09-018-0-0724-02-015
NEW NBI No.: 09-018-0-0724-02-030
TERRAIN = ROLLING

HL-93 LOADING

SUPERSTRUCTURE INV/OPR RATING = 1.05/1.83
SUBSTRUCTURE INV/OPR RATING - SUBSTRUCTURE NOT RATED



ELEVATION

EXISTING HYDRAULIC DATA
Q_{50} = 58,643 CFS Q_{100} = 60,662 CFS
HW_{50} = 638.61' HW_{100} = 640.53'
V_{50} = 15.46 FT/S V_{100} = 14.56 FT/S

PROPOSED HYDRAULIC DATA
Q_{50} = 58,315 CFS Q_{100} = 59,445 CFS
HW_{50} = 640.02' HW_{100} = 641.25'
V_{50} = 11.94 FT/S V_{100} = 11.09 FT/S

PRINT DATE	REVISION DATE
3/4/2024	

STATE OF TEXAS
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03/04/2024

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FM 219 AT NORTH BOSQUE RIVER

BRIDGE LAYOUT
PLAN & ELEVATION

SHEET 1 OF 3

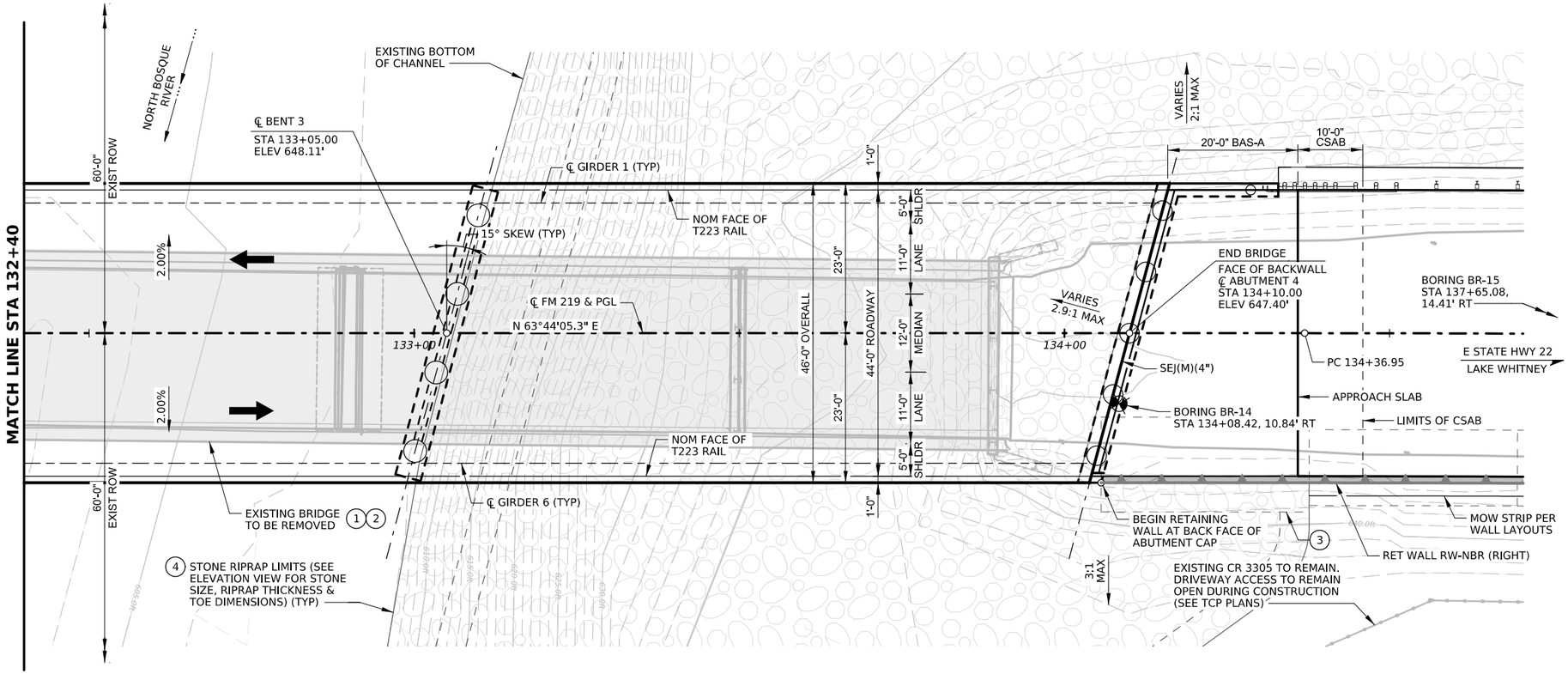
FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 87

CSJ: 0724 02 020, ETC.
FILE LOCATION: ...\5067-WA1.07.BRG.SHT.LAY.01.dgn

ABUTMENTS AND BENTS ARE ALONG BEARING N 11°15'55" W

0 10 20
SCALE IN FEET

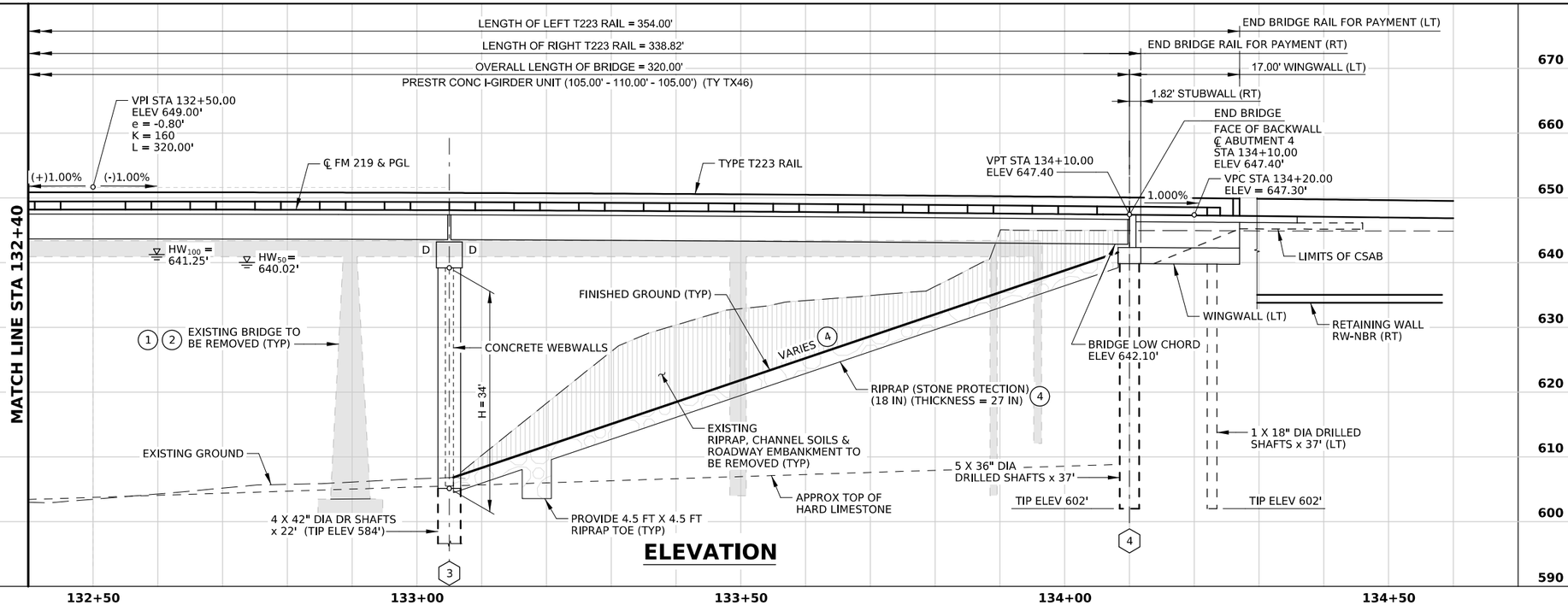
1. EXISTING BRIDGE: BUILT IN 1950. 29'-2" WIDE X 276'-6" LONG. SUPERSTRUCTURE CONSISTS OF CONCRETE DECK & CURBS WITH TY II RAILING, SUPPORTED ON TWO 40' LONG STEEL I-BEAM SPANS, & ONE 195'-0" CONT I-BEAM UNIT. SUBSTRUCTURE CONSISTS OF 2 - 4 PILE-BENTS, TWO VARIABLE DEPTH CONCRETE PIERS ON SPREAD FOOTINGS, & 2 ABUTMENT CAP WITH 4 PILES & 2 FOUNDED WINGWALLS WITH 1 PILE EACH. SEE TXDOT SPEC ITEM 496, UNLESS OTHERWISE NOTED.
2. CUT EXISTING STEEL H-PILES 2 FT MIN. BOTTOM OF PROPOSED STONE RIPRAP, WHERE STONE PRESENT
3. DISCONTINUE RIPRAP TOE AS REQUIRED OVER WALL FOOTING.
4. STONE RIPRAP SLOPE VARIES. SEE RIPRAP PLAN FOR ADDITIONAL INFORMATION.



PLAN

HL-93 LOADING

SUPERSTRUCTURE INV/OPR RATING = 1.05/1.83
SUBSTRUCTURE INV/OPR RATING - SUBSTRUCTURE NOT RATED



ELEVATION

PRINT DATE	REVISION DATE
3/4/2024	

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03/04/2024

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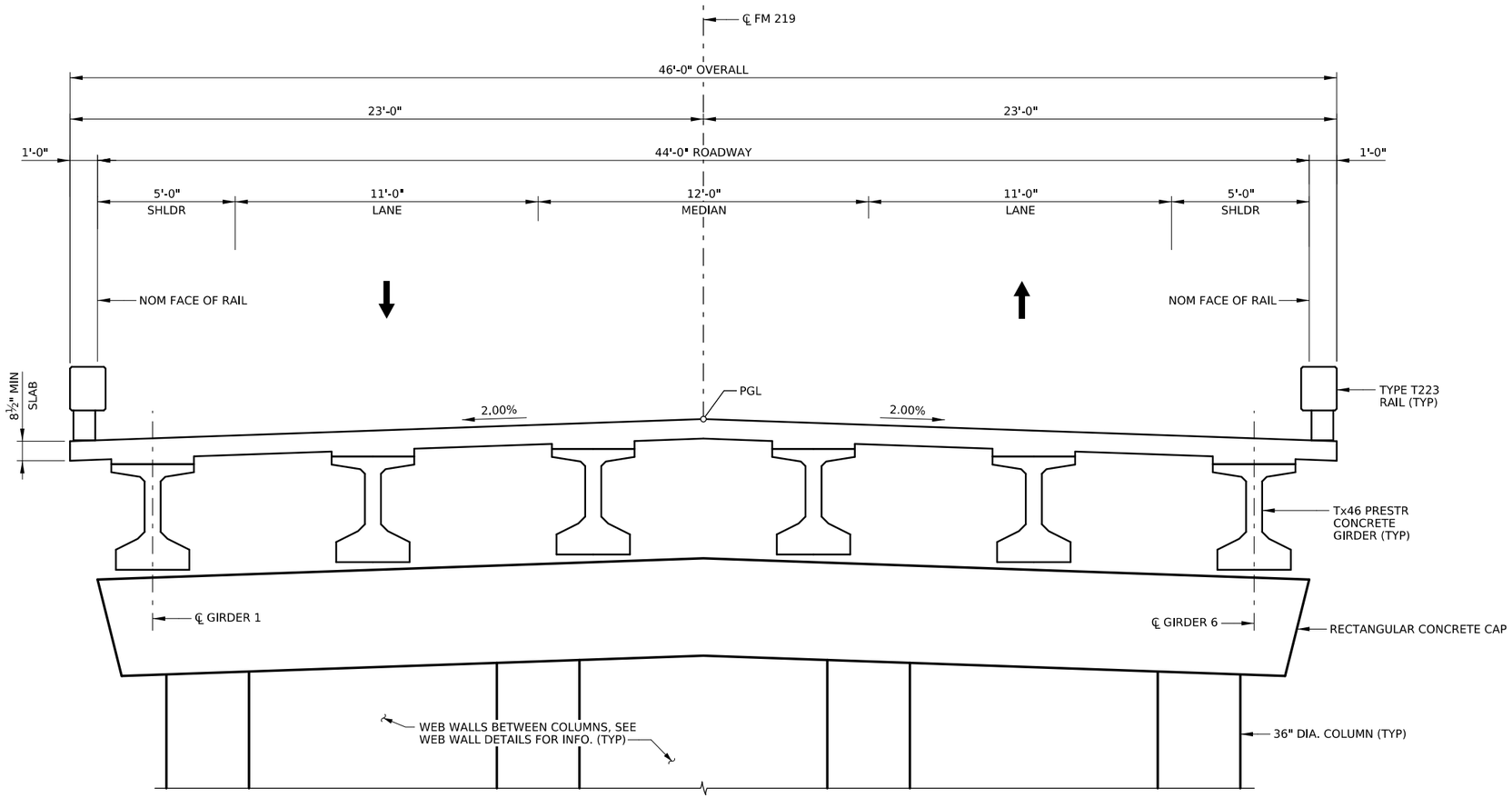
FM 219 AT NORTH BOSQUE RIVER

BRIDGE LAYOUT
PLAN & ELEVATION

SHEET 2 OF 3

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 88



BRIDGE TYPICAL SECTION

(NOT TO SCALE)

HL-93 LOADING

PRINT DATE	REVISION DATE
3/4/2024	

STATE OF TEXAS
MARY THERESA CANO
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03/04/2024

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Texas Department of Transportation
Waco District

FM 219 AT NORTH BOSQUE RIVER

BRIDGE LAYOUT
TYPICAL SECTION

SHEET 3 OF 3

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 89

CSJs: 0724 02 020, ETC.
FILE LOCATION: ...\5067-WA1.07.BRG.SHT.TYP.01.dgn

BRIDGE ESTIMATED QUANTITIES

ITEM	400	416	416	416	420	420	420	422	422	425	432	450	454	496	5132
BID CODE	6005	6001	6004	6005	6014	6030	6038	6001	6015	6038	6033	6006	6018	6010	6001
DESCRIPTION / BRIDGE ELEMENT	CEM STABIL BKFL	DRILL SHAFT (18 IN)	DRILL SHAFT (36 IN)	DRILL SHAFT (42 IN)	(2) CL C CONC (ABUT) (HPC)	(2) CL C CONC (CAP) (HPC)	(3) CL C CONC (COLUMN) (HPC)	REINF CONC SLAB	APPROACH SLAB	(1) PRESTR CONC GIRDER (Tx46)	(4) RIPRAP (STONE PROTECTION) (18 IN)	RAIL (TY T223)	SEALED EXPANSION JOINT (4 IN) (SEJ-M)	REMOV STR (BRIDGE 100 - 499 FT LENGTH)	LEAD CONTAINING COATING MANAGEMENT
UNIT	CY	LF	LF	LF	CY	CY	CY	SF	CY	LF	CY	LF	LF	EA	SF
2 - ABUTMENTS	275	129	415		63.9				91.5		3,339	52.9			142
2 - INTERIOR BENTS				176		56.0	184.7								114
1 - 320.00' PRESTR CONC I-GIRDER UNIT								14,720		1,910.90		640.0	94	1	
TOTAL	275	129	415	176	63.9	56.0	184.7	14,720	91.5	1,910.90	3,339	692.9	94	1	256

(1) BRIDGE IDENTIFICATION SIGN IS SUBSIDIARY TO THE GIRDER BID ITEM. SEE NBIS STANDARD.

(2) SHEAR KEY QUANTITIES ARE INCLUDED IN THE ABUTMENT AND BENT CAP QUANTITIES.

(3) QUANTITY INCLUDES WEB WALLS

(4) APPLIES TO ROCK RIPRAP AROUND ABUTMENTS AND IN THE CHANNEL. SEE ROADWAY PLANS FOR CONCRETE RIPRAP OUTSIDE OF THE CHANNEL.

BEARING SEAT ELEVATIONS

	GRDR 1	GRDR 2	GRDR 3	GRDR 4	GRDR 5	GRDR 6
ABUT 1 (FWD)	642.000	642.139	642.278	642.257	642.076	641.894
	GRDR 1	GRDR 2	GRDR 3	GRDR 4	GRDR 5	GRDR 6
BENT 2 (BK)	642.657	642.810	642.963	642.956	642.788	642.620
(FWD)	642.664	642.817	642.970	642.963	642.795	642.627
	GRDR 1	GRDR 2	GRDR 3	GRDR 4	GRDR 5	GRDR 6
BENT 3 (BK)	642.627	642.795	642.963	642.970	642.817	642.664
(FWD)	642.620	642.788	642.956	642.963	642.810	642.657
	GRDR 1	GRDR 2	GRDR 3	GRDR 4	GRDR 5	GRDR 6
ABUT 4 (BK)	641.894	642.076	642.257	642.278	642.139	642.000

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STATE OF TEXAS
MARY THERESA CANO
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03/04/2024

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Waco District

FM 219 AT NORTH BOSQUE RIVER

ESTIMATED QUANTITIES & BEARING SEAT ELEV'S

SHEET 1 OF 1

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 90

CSJ: 0724 02 020, ETC.
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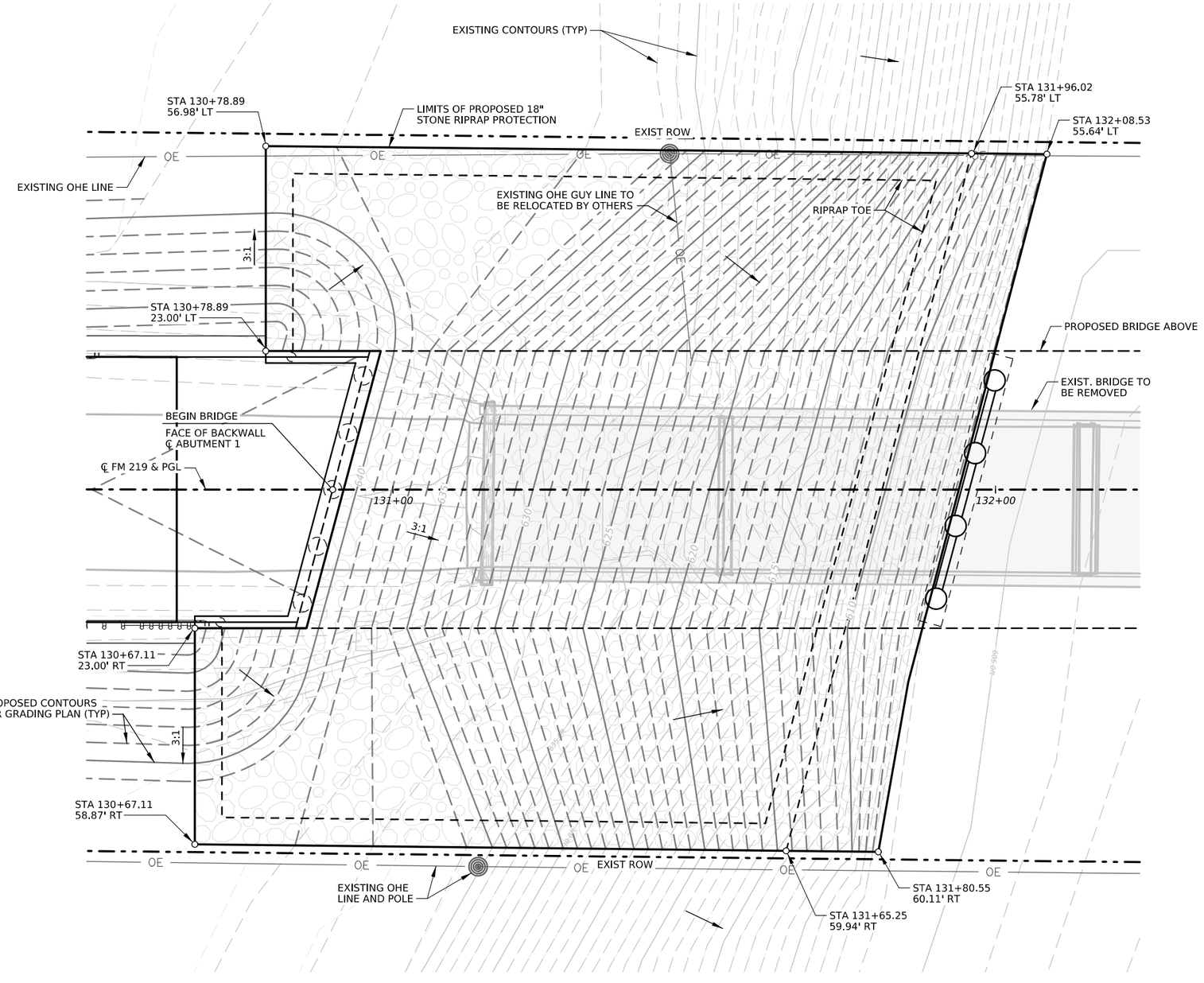

RIPRAP PLAN

0 10 20
SCALE IN FEET

GENERAL NOTES:

1. REFER TO GRADING PLANS FOR FINISHED GROUND INFORMATION.
2. REFER TO BRIDGE LAYOUT FOR PROPOSED RIPRAP ROCK SIZE, THICKNESS AND TOE DIMENSIONS.
3. REFER TO SRR STANDARD FOR STONE RIPRAP INSTALLATION DETAILS.

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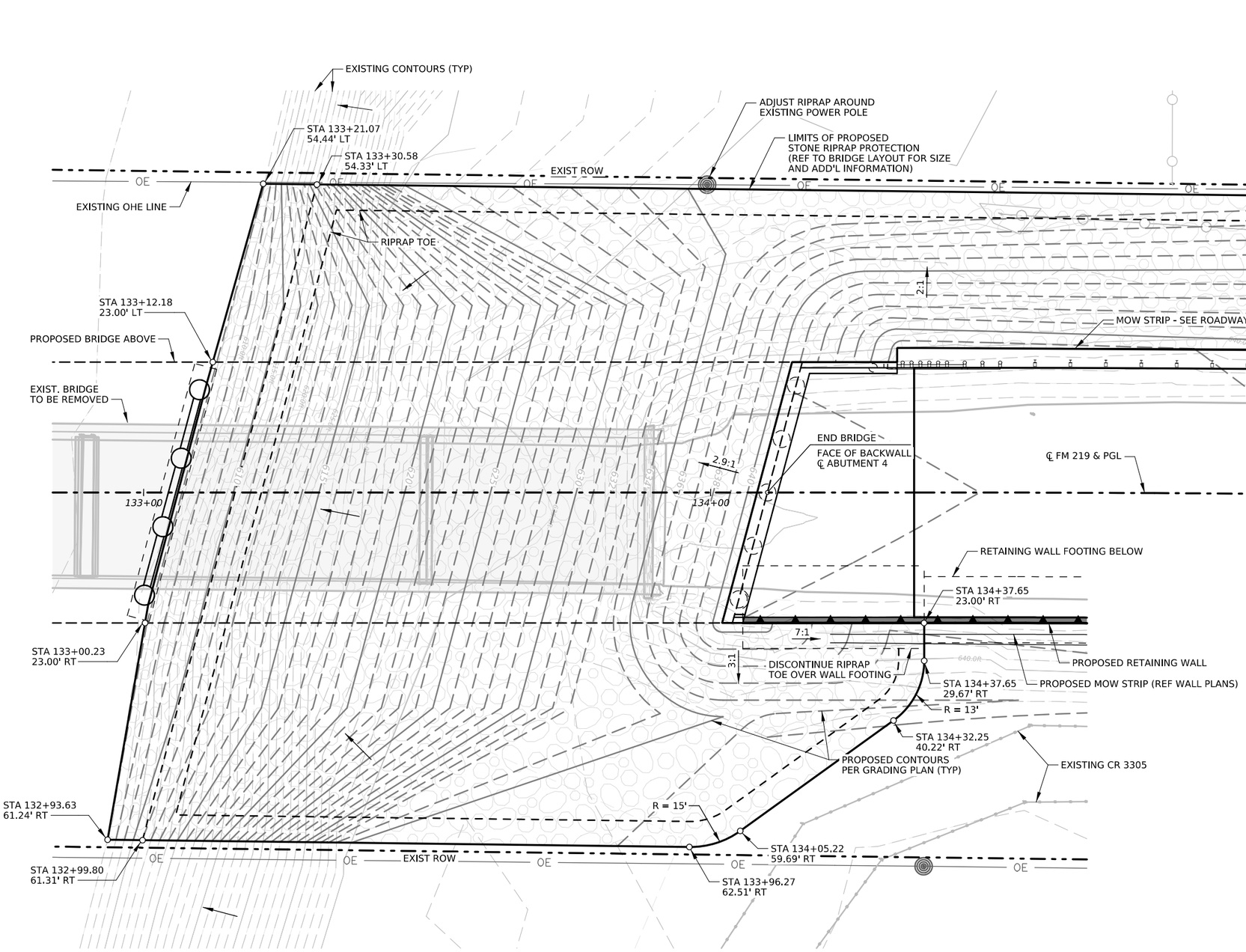
Waco District

FM 219 AT NORTH BOSQUE RIVER

RIPRAP LAYOUT
ABUTMENT 1

SHEET 1 OF 2

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 91



RIPRAP PLAN

PRINT DATE	REVISION DATE
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FM 219 AT NORTH BOSQUE RIVER

RIPRAP LAYOUT
ABUTMENT 4

SHEET 2 OF 2

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219

STATE	DISTRICT	COUNTY	
TEXAS	WACO	BOSQUE	
CONTROL	SECTION	JOB	SHEET NO.
0724	02	020, ETC.	92

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FILE LOCATION: ..\5067-WA1.07.BRG.SHT.RIPRAPLAY.02.dgn

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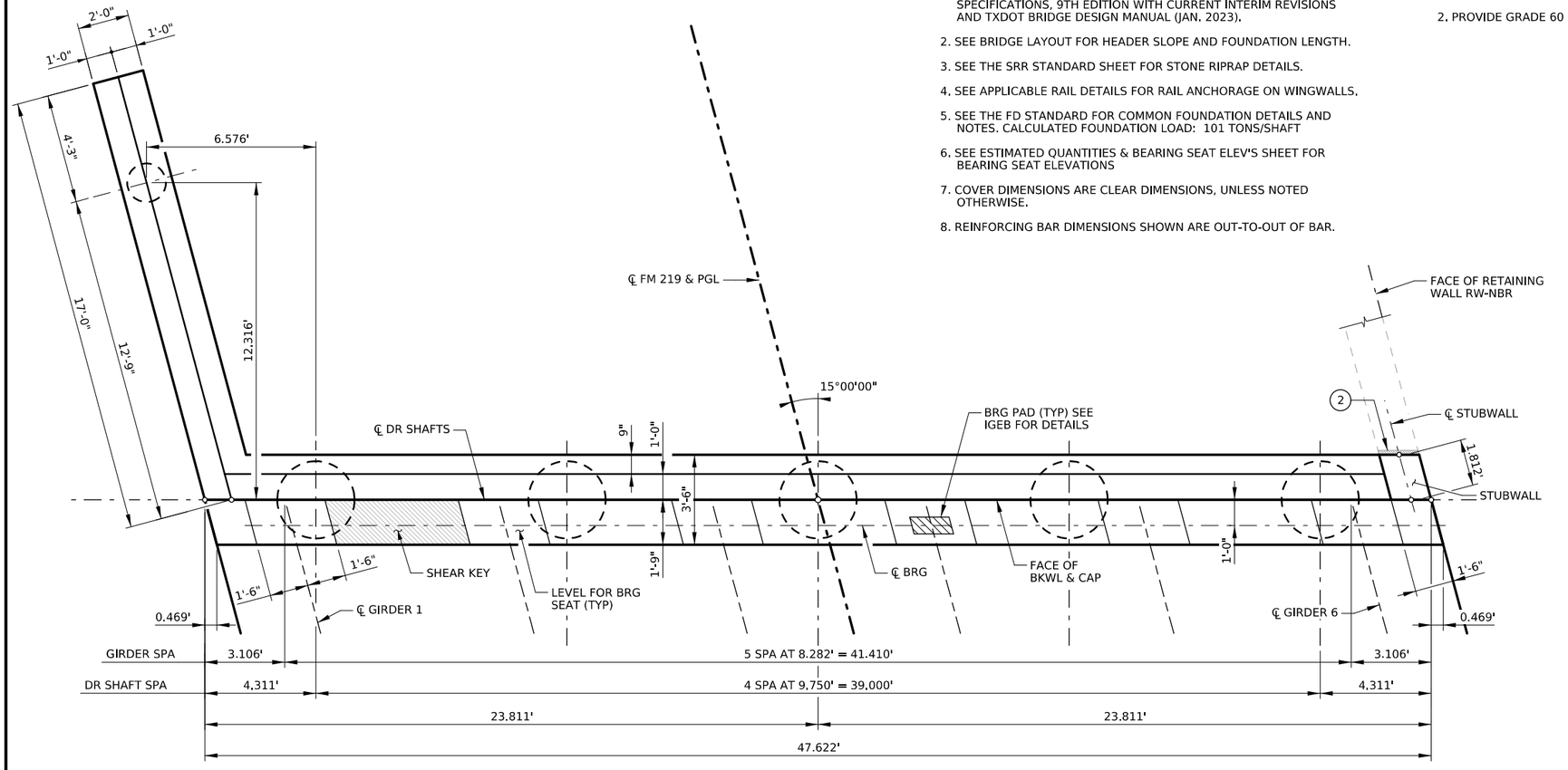
GENERAL NOTES

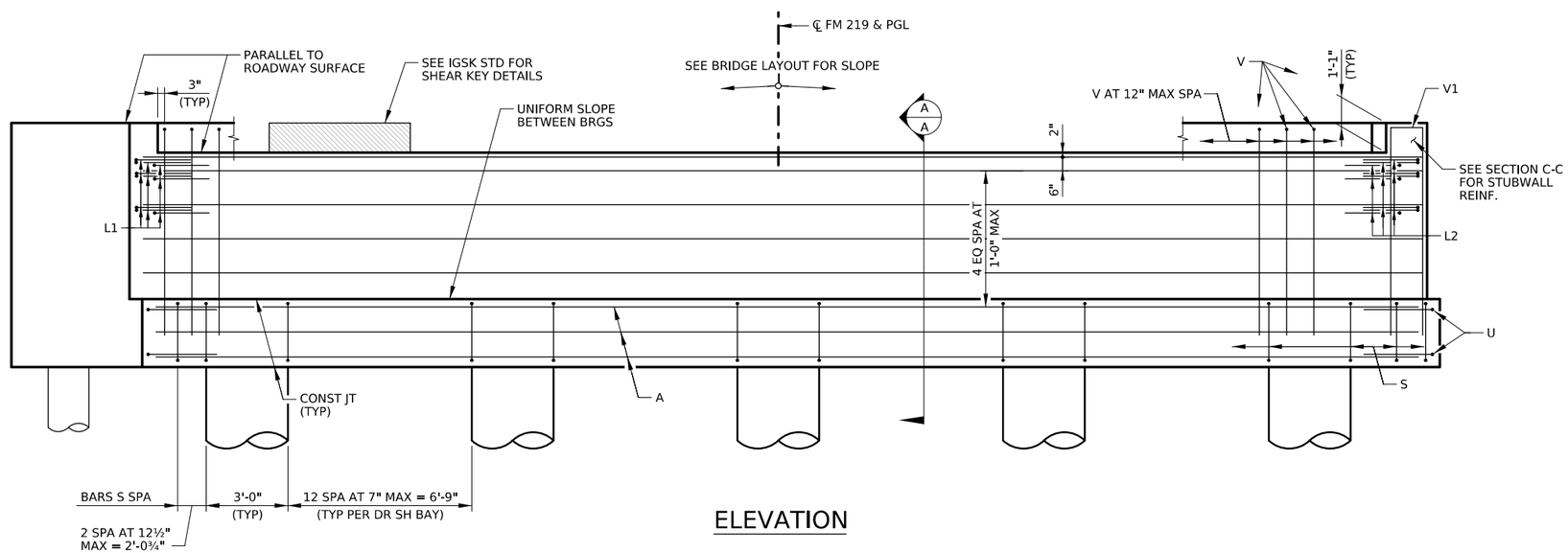
1. DESIGNED IN ACCORDANCE WITH 2020 AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 9TH EDITION WITH CURRENT INTERIM REVISIONS AND TXDOT BRIDGE DESIGN MANUAL (JAN. 2023).
2. SEE BRIDGE LAYOUT FOR HEADER SLOPE AND FOUNDATION LENGTH.
3. SEE THE SRR STANDARD SHEET FOR STONE RIPRAP DETAILS.
4. SEE APPLICABLE RAIL DETAILS FOR RAIL ANCHORAGE ON WINGWALLS.
5. SEE THE FD STANDARD FOR COMMON FOUNDATION DETAILS AND NOTES. CALCULATED FOUNDATION LOAD: 101 TONS/SHAFT
6. SEE ESTIMATED QUANTITIES & BEARING SEAT ELEV'S SHEET FOR BEARING SEAT ELEVATIONS
7. COVER DIMENSIONS ARE CLEAR DIMENSIONS, UNLESS NOTED OTHERWISE.
8. REINFORCING BAR DIMENSIONS SHOWN ARE OUT-TO-OUT OF BAR.

MATERIAL NOTES

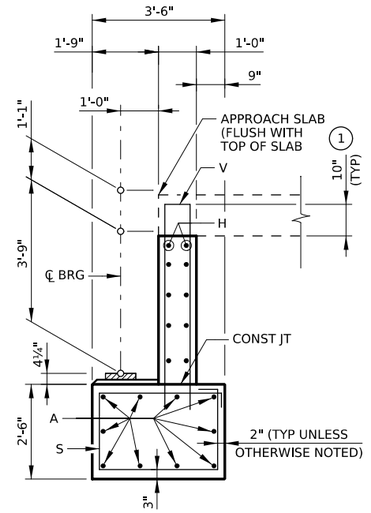
1. PROVIDE CLASS C (HPC) CONCRETE ($f'c$ = 3,600 PSI).
2. PROVIDE GRADE 60 REINFORCING STEEL.



PLAN



ELEVATION



SECTION A-A

1. INCREASE AS REQUIRED TO MAINTAIN 3" FROM FINISHED GRADE.
2. 1" PREFORMED BITUMINOUS FIBER MATERIAL

HL-93 LOADING

PRINT DATE	REVISION DATE
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Waco District

FM 219 AT NORTH BOSQUE RIVER

ABUTMENT 4 DETAILS

SHEET 1 OF 2

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 93

CSJ: 0724 02 020, ETC.
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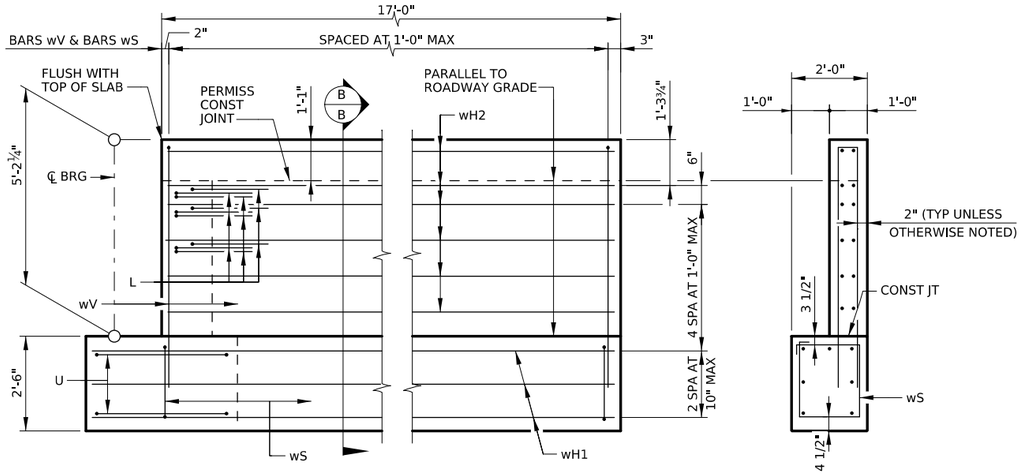
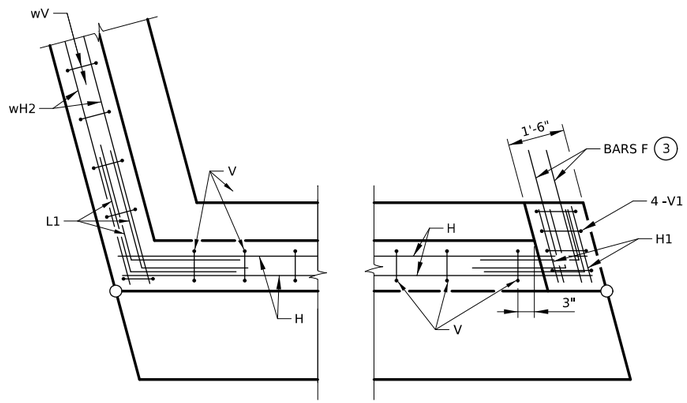


LEFT WINGWALL ELEVATION

SECTION B-B



BACKWALL

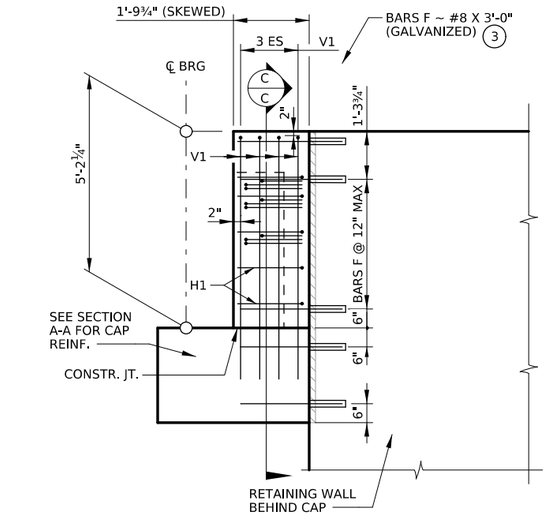
ABUTMENT 4 TABLE OF ESTIMATED QUANTITIES				
BAR	NO.	SIZE	LENGTH	WEIGHT
A	10	#11	46'-7"	2,475
H	10	#6	47'-3"	710
H1	12	#5	1'-8"	21
L1	9	#6	4'-0"	54
L2	9	#6	3'-4"	45
S	58	#5	11'-6"	696
U	4	#6	8'-2"	49
V	47	#5	14'-4"	703
V1	4	#5	14'-4"	60
wH1	7	#6	18'-5"	194
wH2	12	#6	16'-8"	300
wS	18	#4	7'-10"	94
wV	18	#5	14'-4"	269
(2) REINFORCING STEEL			LB	5,669
(1) CLASS C CONC (ABUT) (HPC)			CY	29.1

(1) SHEAR KEY CONCRETE INCLUDED.

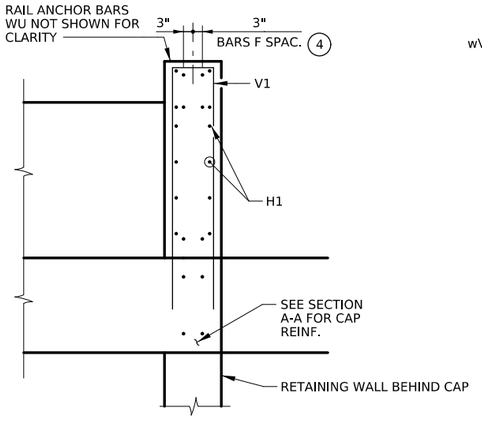
(2) FOR CONTRACTOR'S INFORMATION ONLY.

(3) ADDITIONAL INFORMATION FOR EXPANSION JOINT BETWEEN ABUTMENT AND RETAINING WALL IS SHOWN ON THE RW(SF) STANDARD AND THE RETAINING WALL MISCELLANEOUS DETAILS. EXPANSION JOINT DETAIL BETWEEN ABUTMENT AND WALL SHALL BE SUBSIDARY TO RETAINING WALL ITEM 423.

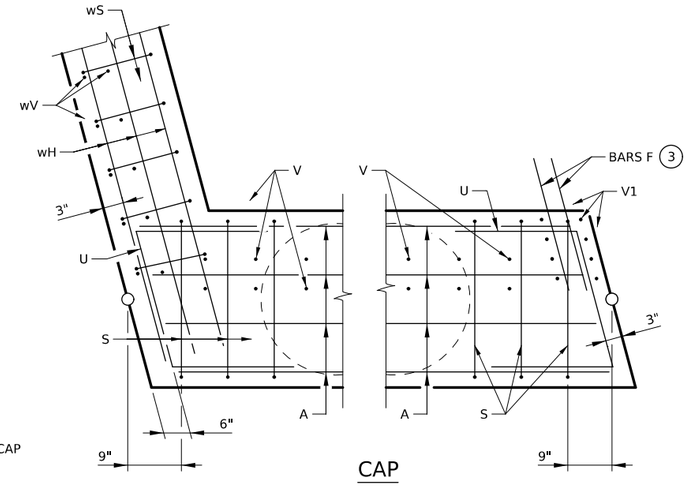
(4) SPACING SHOWN MAY BE ADJUSTED ON FIRST 2 ROWS FROM TOP OF WALL TO CLEAR RAIL ANCHOR BARS WU. FOR LOCATION & SIZE OF BARS WU, SEE T223 RAIL STANDARD. NO SPACING ADJUSTMENTS WILL BE ALLOWED FOR RAIL BARS.



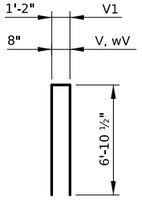
RIGHT STUBWALL ELEVATION



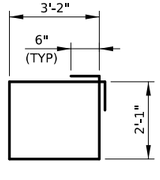
SECTION C-C



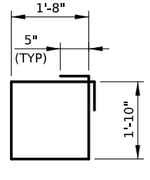
CAP



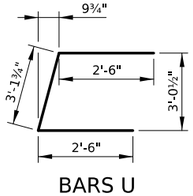
BARS V, wV & V1



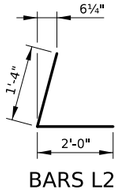
BARS S



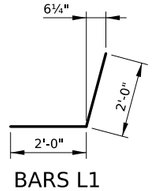
BARS wS



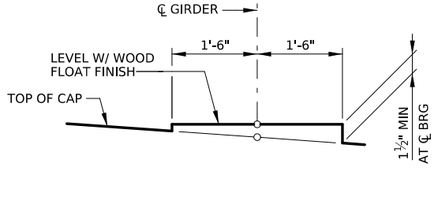
BARS U



BARS L2



BARS L1



BEARING SEAT DETAIL

(BEARING SURFACE MUST BE CLEAN AND FREE OF ALL LOOSE MATERIAL BEFORE PLACING BEARING PAD)

HL-93 LOADING

PRINT DATE	REVISION DATE
3/4/2024	

STATE OF TEXAS
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Texas Department of Transportation

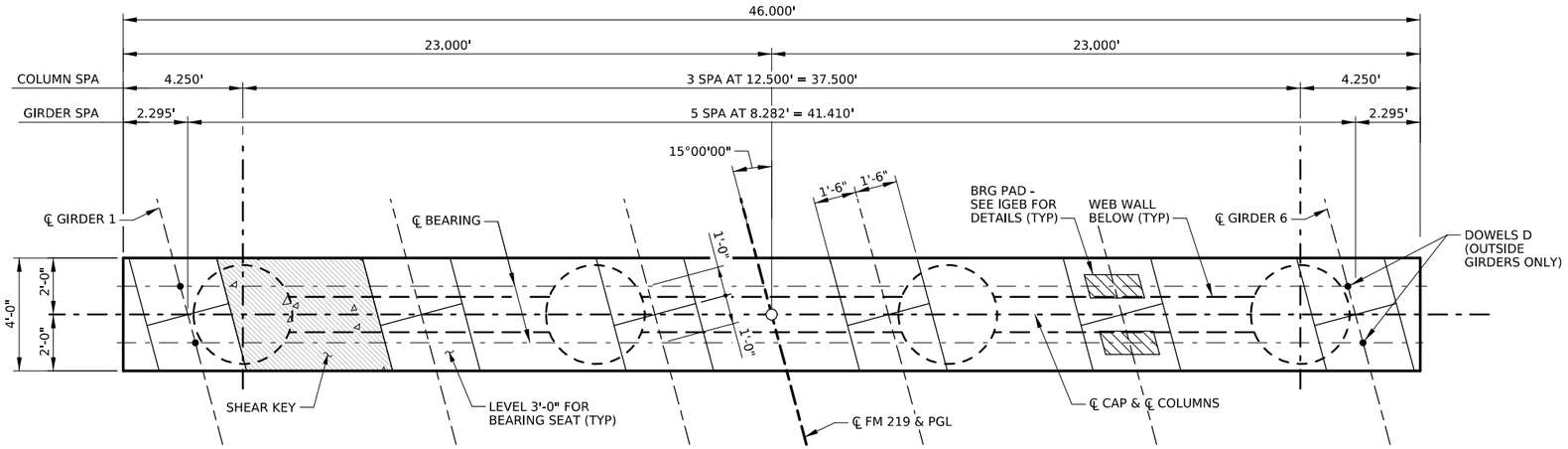
Waco District

FM 219 AT NORTH BOSQUE RIVER

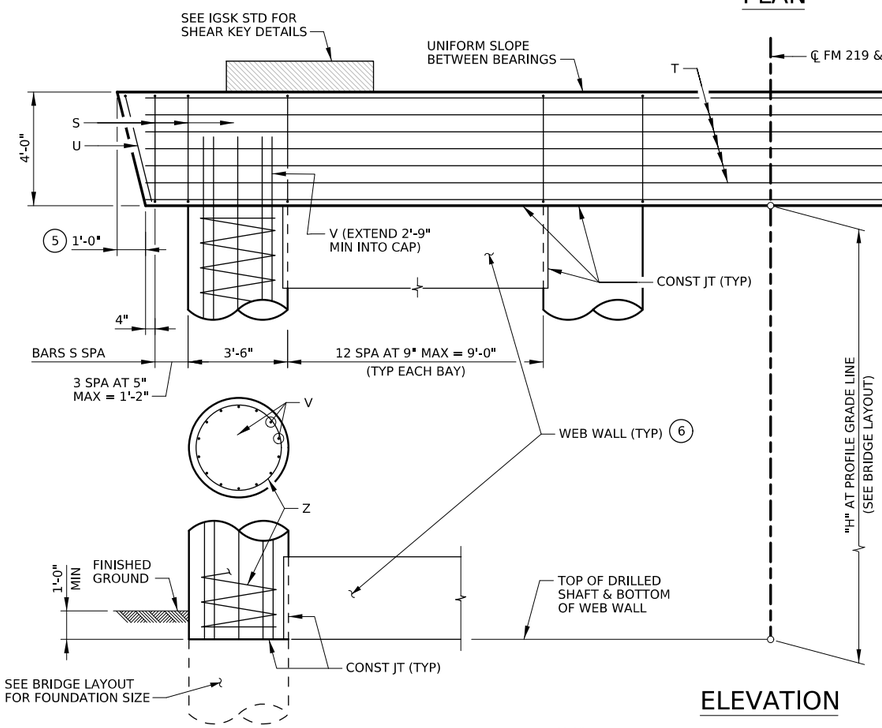
ABUTMENT 4 DETAILS

SHEET 2 OF 2

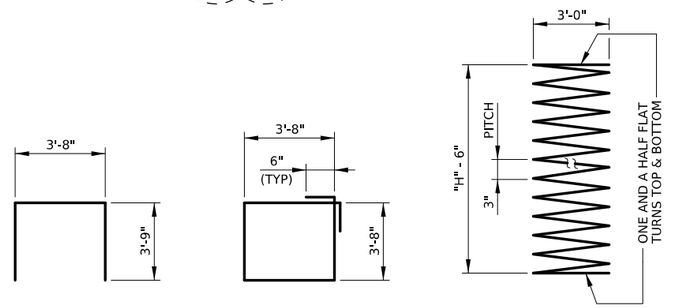
FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 94



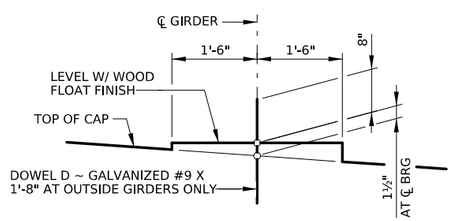
PLAN



ELEVATION

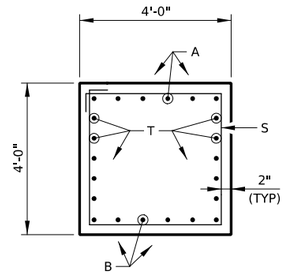


1. QUANTITIES SHOWN ARE BASED ON AN "H" VALUE OF 36'.
2. QUANTITIES SHOWN ARE BASED ON AN "H" VALUE OF 34'.
3. FOR EACH LINEAR FOOT VARIATION IN "H" VALUE, MAKE THE FOLLOWING ADJUSTMENTS:
   BARS V LENGTH: 1'-0"
   BARS Z LENGTH: 37'-9"
   REINFORCING STEEL: 291 LB
   CLASS "C" (HPC) CONC (COL): 1.43 CY
4. QUANTITY INCLUDES SHEAR KEY CONCRETE.
5. MEASURED PARALLEL TO TOP OF CAP CROSS-SLOPE.
6. SEE WEB WALL DETAILS FOR ADDITIONAL INFORMATION.

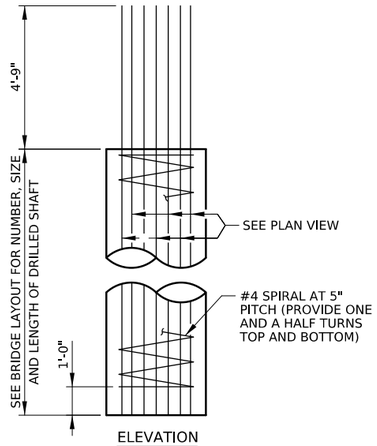


BEARING SEAT DETAIL

(BEARING SURFACE MUST BE CLEAN AND FREE OF ALL LOOSE MATERIAL BEFORE PLACING BEARING PAD)



SECTION A-A



DRILLED SHAFT DETAIL

BENT 2
TABLE OF ESTIMATED QUANTITIES

BAR	NO.	SIZE	LENGTH	WEIGHT
A	6	#11	45'-6"	1,450
B	6	#11	43'-9"	1,395
D	4	#9	1'-8"	23
S	47	#5	15'-8"	768
T	10	#5	43'-9"	456
U	2	#5	11'-2"	23
V	56	#10	37'-9"	9,097
Z	4	#4	1349'-6"	3,606
REINFORCING STEEL			LB	16,818
CLASS C CONC (CAP) (HPC)			CY	28.0
CLASS C CONC (COL) (HPC)			CY	49.9

BENT 3
TABLE OF ESTIMATED QUANTITIES

BAR	NO.	SIZE	LENGTH	WEIGHT
A	6	#11	45'-6"	1,450
B	6	#11	43'-9"	1,395
D	4	#9	1'-8"	23
S	47	#5	15'-8"	768
T	10	#5	43'-9"	456
U	2	#5	11'-2"	23
V	56	#10	36'-9"	8,856
Z	4	#4	1311'-9"	3,505
REINFORCING STEEL			LB	16,476
CLASS C CONC (CAP) (HPC)			CY	28.0
CLASS C CONC (COL) (HPC)			CY	48.5

GENERAL NOTES:

1. DESIGNED IN ACCORDANCE WITH 2020 AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 9TH EDITION WITH CURRENT INTERIM REVISIONS AND TXDOT BRIDGE DESIGN MANUAL (JAN. 2023)
2. SEE BRIDGE LAYOUT FOR DRILLED SHAFT SIZES AND LENGTHS.
3. SEE THE FD STANDARD FOR COMMON FOUNDATION DETAILS AND NOTES NOT SHOWN.
   CALCULATED FOUNDATION LOAD: 270 TONS/SHAFT
4. COVER DIMENSIONS ARE CLEAR DIMENSIONS, UNLESS NOTED OTHERWISE.
5. REINFORCING BAR DIMENSIONS SHOWN ARE OUT-TO-OUT OF BAR.
6. SEE ESTIMATED QUANTITIES & BEARING SEAT ELEV'S SHEET FOR BEARING SEAT ELEVATIONS

MATERIAL NOTES:

1. PROVIDE CLASS C (HPC) CONCRETE ($f'c$ = 3,600 PSI)
2. PROVIDE GRADE 60 REINFORCING STEEL.
3. GALVANIZE DOWEL BARS D.

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INTERIOR BENT DETAILS
BENTS 2 & 3

SHEET 1 OF 1

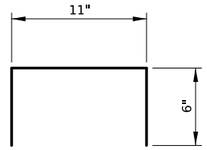
FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 95

BENT 2 WEB WALL
TABLE OF ESTIMATED QUANTITIES

BAR	NO.	SIZE	LENGTH	WEIGHT
WD	144	#6	2'-6"	541
WH	144	#6	8'-8"	1,874
WV	42	#6	36'-3"	2,287
WU	156	#4	1'-11"	200
REINFORCING STEEL			LB	4,902
CLASS C CONC (COL) (HPC)			CY	43.8

BENT 3 WEB WALL
TABLE OF ESTIMATED QUANTITIES

BAR	NO.	SIZE	LENGTH	WEIGHT
WD	144	#6	2'-6"	541
WH	144	#6	8'-8"	1,874
WV	42	#6	35'-3"	2,224
WU	156	#4	1'-11"	200
REINFORCING STEEL			LB	4,839
CLASS C CONC (COL) (HPC)			CY	42.5



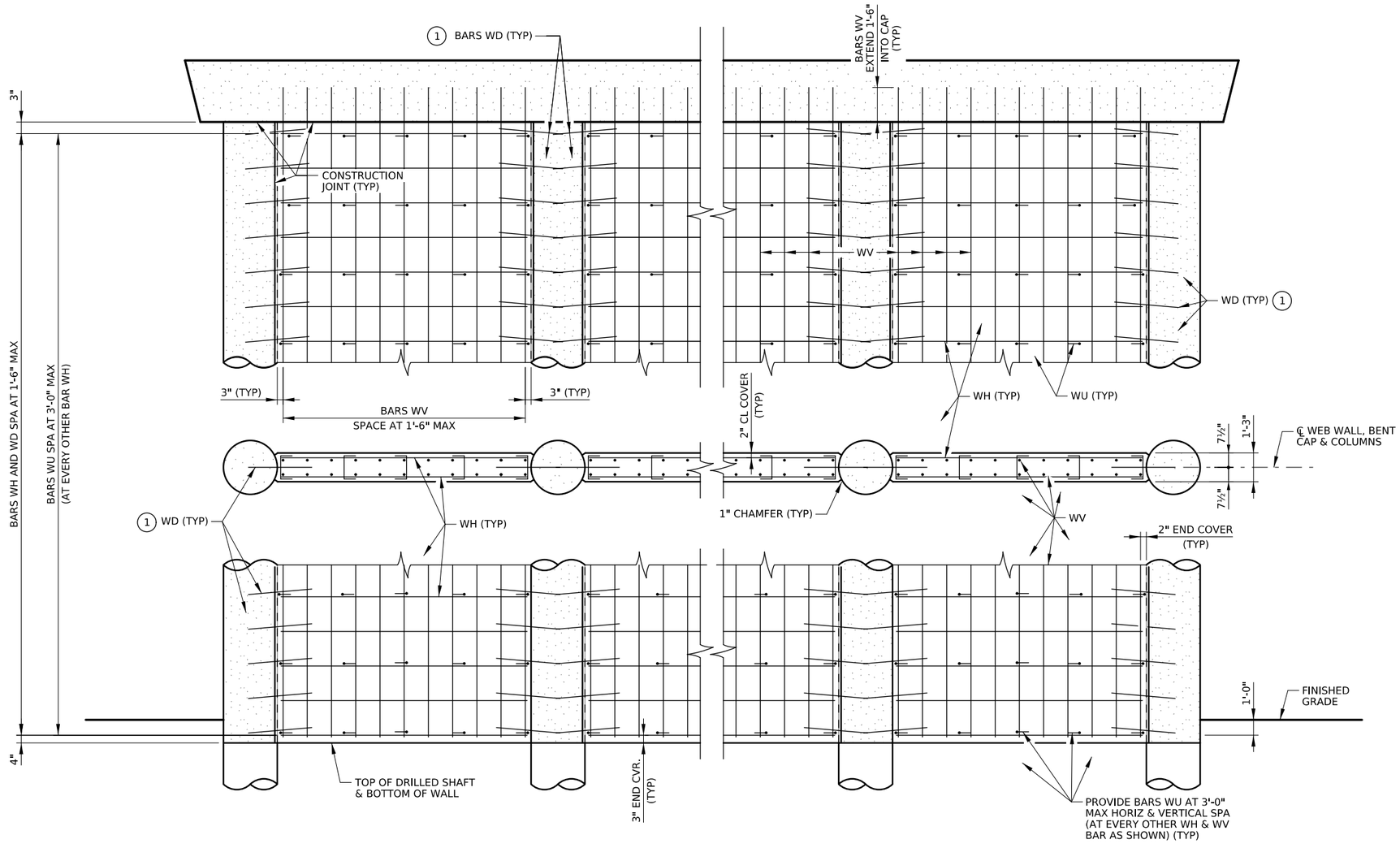
BARS WU

GENERAL NOTES:

1. DESIGNED IN ACCORDANCE WITH 2020 AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 9TH EDITION WITH CURRENT INTERIM REVISIONS AND TXDOT BRIDGE DESIGN MANUAL (JAN. 2023).
2. SEE BRIDGE LAYOUT FOR DRILLED SHAFT SIZES AND LENGTHS.
3. SEE BENT DETAIL SHEETS FOR ALL BENT DETAILS, NOTES AND QUANTITIES NOT SHOWN HERE.
4. SEE THE FD STANDARD FOR COMMON FOUNDATION DETAILS AND NOTES.
5. COVER DIMENSIONS ARE CLEAR DIMENSIONS, UNLESS NOTED OTHERWISE.
6. REINFORCING BAR DIMENSIONS SHOWN ARE OUT-TO-OUT OF BAR.

MATERIAL NOTES:

1. PROVIDE CLASS C (HPC) CONCRETE (f'c = 3,600 PSI).
2. PROVIDE GRADE 60 REINFORCING STEEL.



WEB WALL ELEVATION

(BENT CAP AND COLUMN REINFORCEMENT NOT SHOWN FOR CLARITY)
NTS

1 EMBED WD BARS 1'-3" MIN. INTO COLUMN. AT CONTRACTOR'S OPTION, WD BARS MAY BE PLACED WITH THE COLUMN OR MAY BE INSTALLED USING AN ADHESIVE ANCHORAGE SYSTEM WITH THE ANCHORAGE END SLOPED 1:6 INTO COLUMN. ON INTERIOR COLUMNS, THE CONTRACTOR HAS THE OPTION TO PLACE ONE BAR PASSING THROUGH THE FORM INSTEAD OF A SEPARATE BAR ON EACH SIDE OF THE COLUMN.

HL-93 LOADING

PRINT DATE	REVISION DATE
3/4/2024	

STATE OF TEXAS
MARY THERESA CANO
64634
LICENSED
PROFESSIONAL ENGINEER
Mary Theresa Cano 03/04/2024

P.E. Structural Consultants, *a Hardesty & Hanover, LLC Company*

H&H | PESC

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Bldg 2, Suite 250
Austin, Texas 78759
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www.HardestyHanover.com
TBPELS Firm No. F-3379

Texas Department of Transportation
Waco District

FM 219 AT NORTH BOSQUE RIVER

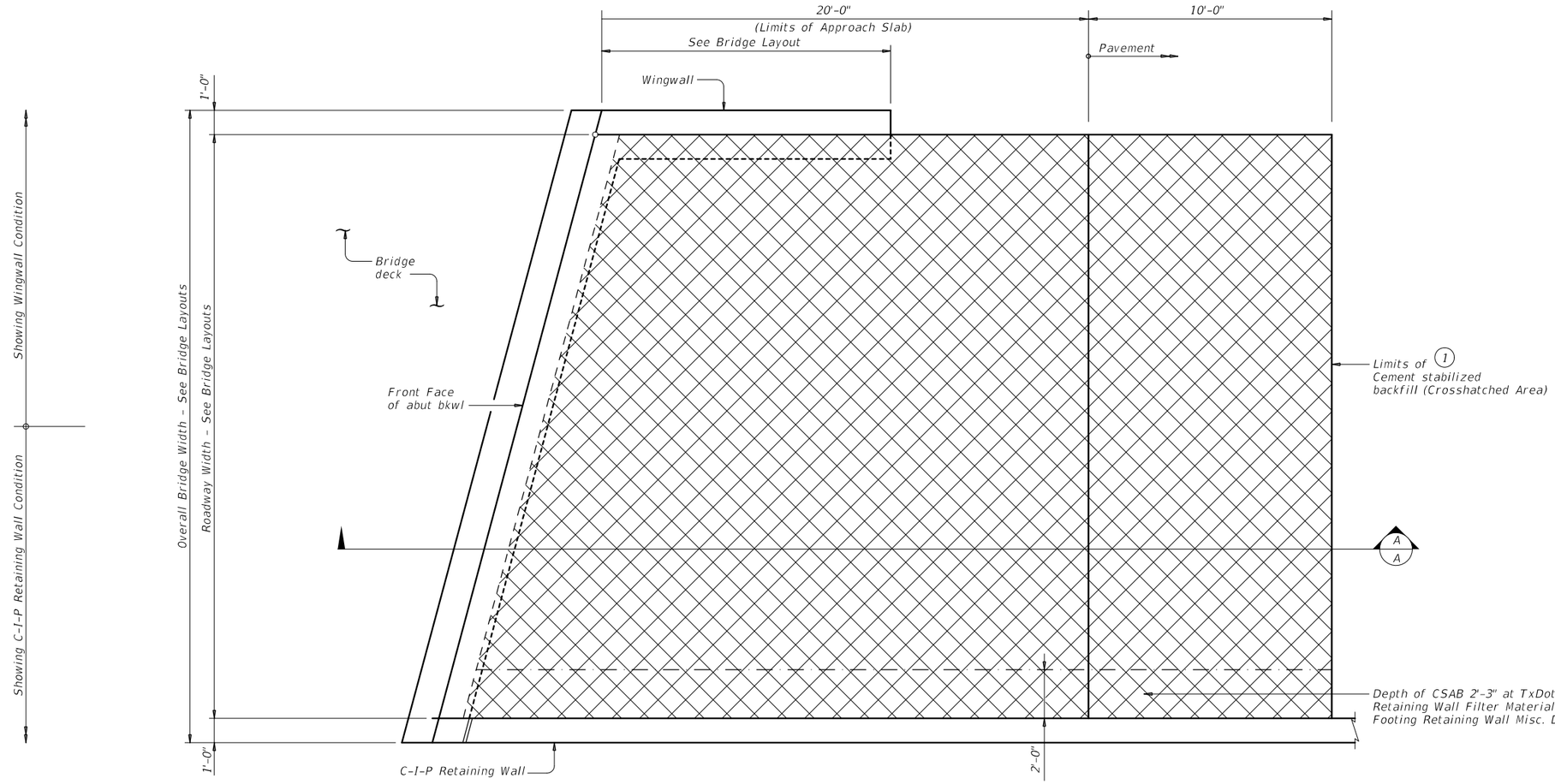
INTERIOR BENT WEB WALL DETAILS
BENTS 2 & 3

SHEET 1 OF 1

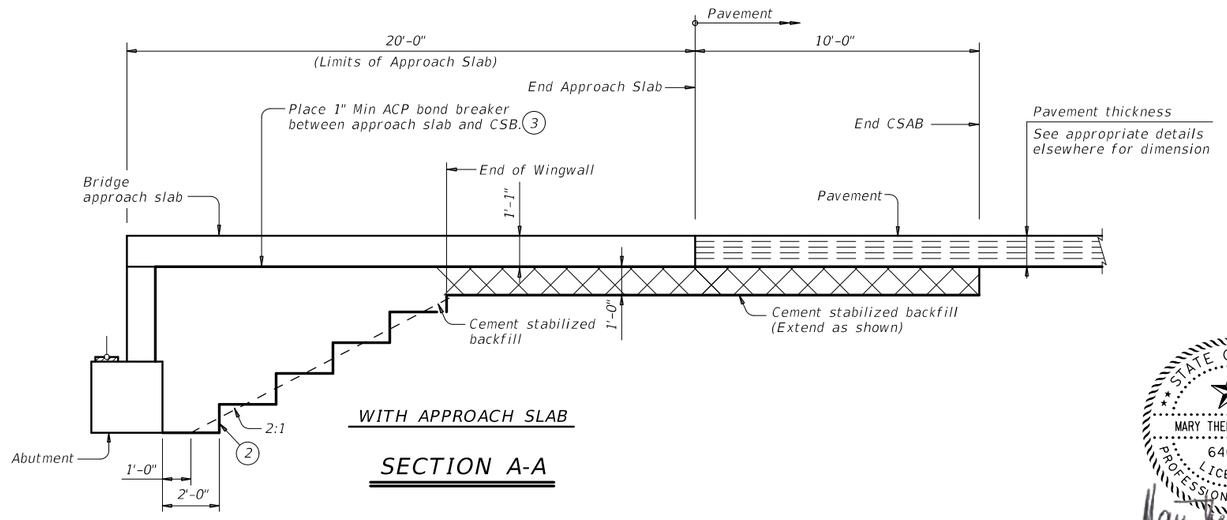
FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 96

CSJ: 0724 02 020, ETC.
FILE LOCATION: ...\5067-WA1.07.BRG.SHT.WEBWALL.01.dgn

3/4/2024 1:58:36 PM pw://hardesty-pw.bentley.com:hardesty-pw-01/Documents/TX-Projects/TXDOT/05759.01/03_FM219/4 - Design/Master Design Files/07.North Bosque River/H&H/Sheets/5067-WA1.07.BRG.SHT.WEBWALL.01.dgn



PLAN SHOWING CSAB CONDITIONS AT WINGWALLS AND RETAINING WALLS



WITH APPROACH SLAB

SECTION A-A

(1) Limits of Cement Stabilized Backfill is 30' from face of backwall. Extend CSB limits as required to maintain a slope no steeper than 1:1 at bottom of backfill.

(2) Bench backfill as shown with 12" (approximate) bench depths.

(3) Other materials can be used as a bond breaker if permitted by the Engineer. 2 layers of 30 Lb roofing felt or 2 layers of heavy mil polyethylene sheeting are examples.

GENERAL NOTES:

Provide Cement Stabilized Backfill (CSB) meeting the requirements of Item 400, "Excavation and Backfill for Structures", to the limits shown at bridge abutments. Paid for as a Bridge Item.

STATE OF TEXAS
MARY THERESA CANO
64634
LICENSED
PROFESSIONAL ENGINEER
03/04/2024

Texas Department of Transportation

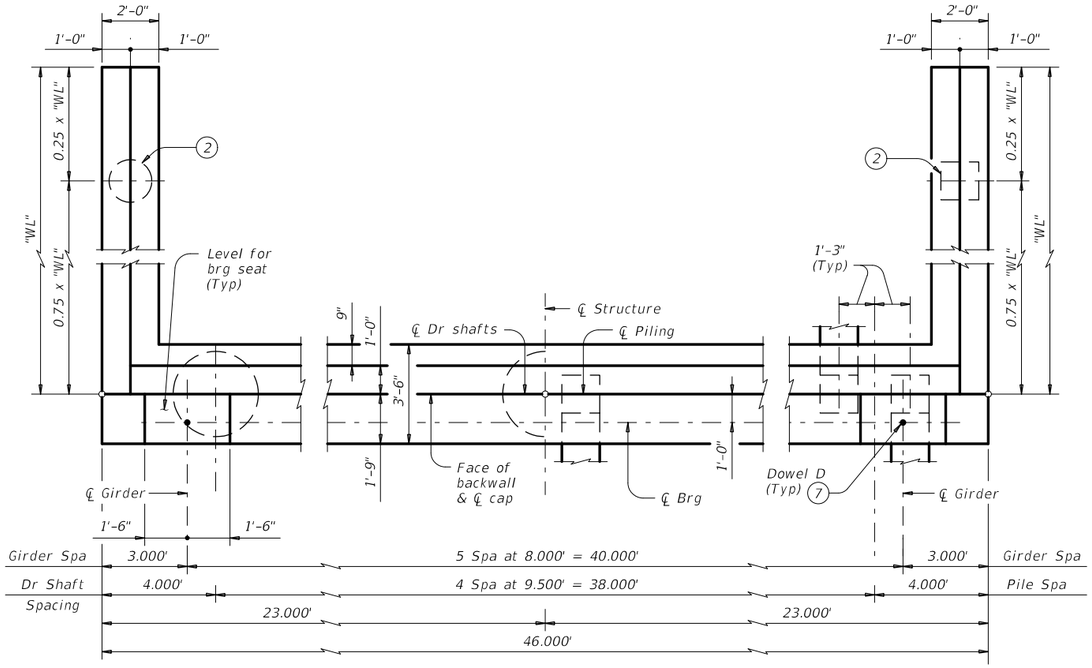
CEMENT STABILIZED ABUTMENT BACKFILL DETAILS

BRIDGE ABUTMENT

FILE: CSABDET.DGN	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT 2022	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		97

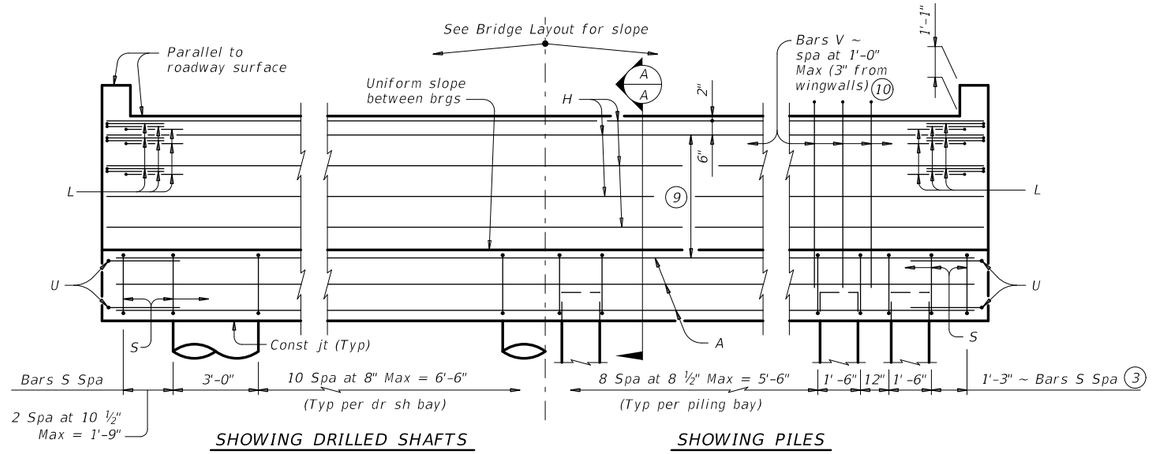
DATE:
FILE:

DATE:
FILE:



SHOWING DRILLED SHAFTS — SHOWING PILES

PLAN (1)

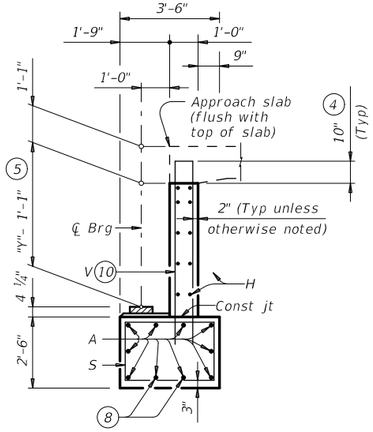


SHOWING DRILLED SHAFTS — SHOWING PILES

ELEVATION

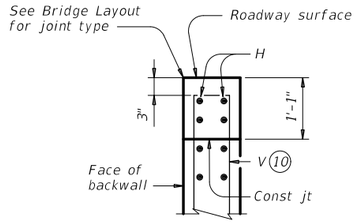
TABLE A

Header Slope	Girder Type	Wingwall Type	Wingwall Lgth "WL"
2:1	Tx28	Cantilevered	8.000'
	Tx34	Cantilevered	9.000'
	Tx40	Cantilevered	10.000'
	Tx46	Cantilevered	11.000'
	Tx54	Cantilevered	12.000'
3:1	Tx28	Cantilevered	12.000'
	Tx34	Founded	13.000'
	Tx40	Founded	15.000'
	Tx46	Founded	16.000'
	Tx54	Founded	18.000'



SECTION A-A

(With approach slab) (6)



BACKWALL DETAIL

(Without approach slab) (6)

TABLE OF FOUNDATION LOADS

Span Length	All Girder Types	
Ft	Tons/Shaft	Tons/Pile
40	55	51
45	59	53
50	63	55
55	66	56
60	70	58
65	73	60
70	77	62
75	80	64
80	84	66
85	87	67
90	91	69
95	94	71
100	98	73
105	101	74
110	104	76
115	108	78
120	111	80
125	114	81

(1) See Table A for variable dimensions based on header slope and girder type.

(2) See Table A to determine if wingwall foundations are required.

(3) For piling larger than 16" adjust Bars S spacing as required to avoid piling.

(4) Increase as required to maintain 3" from finished grade.

(5) See Span details for "Y" value.

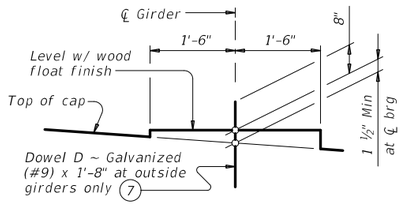
(6) See Bridge Layout to determine if approach slab is present.

(7) Omit Dowels D at end of multi-span unit. Adjust reinforcing steel total accordingly.

(8) With pile foundations, move Bars A shown to clear piles.

(9) Spacing based on girder type:
Tx28 ~ 3 spaces at 1'-0" Max
Tx34 ~ 3 spaces at 1'-0" Max
Tx40 ~ 4 spaces at 1'-0" Max
Tx46 ~ 4 spaces at 1'-0" Max
Tx54 ~ 5 spaces at 1'-0" Max

(10) Field bend as needed to clear piles.



BEARING SEAT DETAIL

(Bearing surface must be clean and free of all loose material before placing bearing pad.)

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.

See Bridge Layout for header slope and foundation type, size and length.

See Common Foundation Details (FD) standard sheet for all foundation details and notes.

See Concrete Riprap (CRR) standard sheet or Stone Riprap (SRR) standard sheet for riprap attachment details, if applicable.

See applicable rail details for rail anchorage in wingwalls.

These abutment details may be used with standard SIG-44 only.

Cover dimensions are clear dimensions, unless noted otherwise.

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

MATERIAL NOTES:

Provide Class C concrete (f'c = 3,600 psi).

Provide Class C (HPC) concrete if shown elsewhere in the plans.

Provide Grade 60 reinforcing steel.

Galvanize dowel bars D.

HL93 LOADING

Texas Department of Transportation

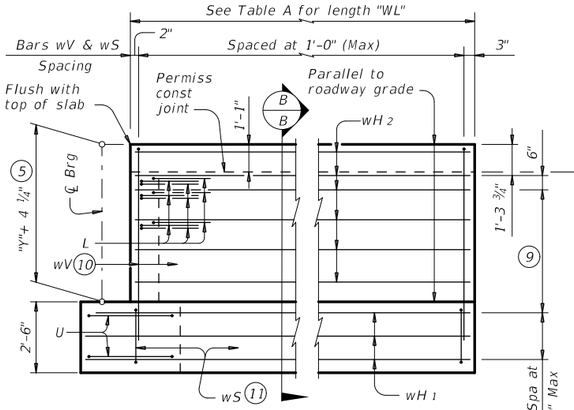
Bridge Division Standard

ABUTMENTS
TYPE TX28 THRU TX54
PRESTR CONC I-GIRDERS
44' ROADWAY

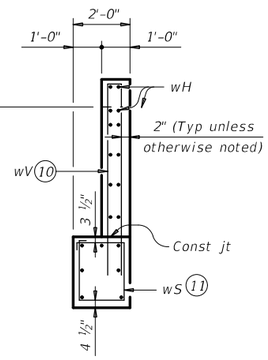
AIG-44

FILE: IG-AIG4400-17.dgn	DN: TAR	CK: KCM	DW: JTR	CK: TAR
©TxDOT August 2017	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		98

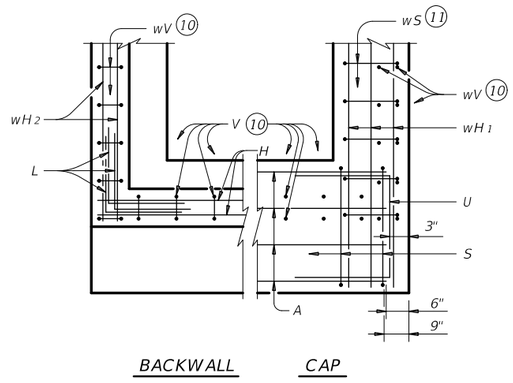
DATE:
FILE:



WINGWALL ELEVATION

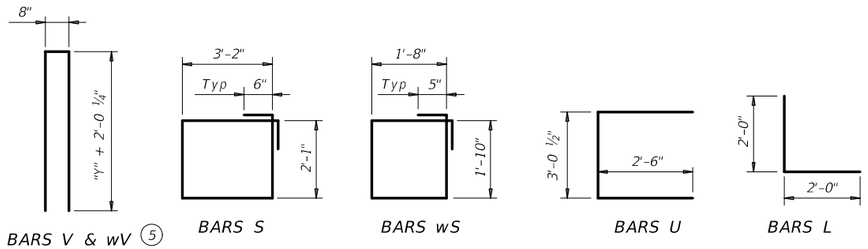


SECTION B-B



BACKWALL CAP

CORNER DETAILS



BARS V & wV (5) BARS S BARS wS BARS U BARS L

(5) See Span details for "Y" value.

(9) Spacing based on girder type:
Tx28 ~ 3 spaces at 1'-0" Max
Tx34 ~ 3 spaces at 1'-0" Max
Tx40 ~ 4 spaces at 1'-0" Max
Tx46 ~ 4 spaces at 1'-0" Max
Tx54 ~ 5 spaces at 1'-0" Max

(10) Field bend as needed to clear piles.

(11) Adjust as required to avoid piling.

HL93 LOADING SHEET 2 OF 3

Texas Department of Transportation

Bridge Division Standard

ABUTMENTS
TYPE TX28 THRU TX54
PRESTR CONC I-GIRDERS
44' ROADWAY

AIG-44

FILE: IG-AIG4400-17.dgn	DN: TAR	CK: KCM	DW: JTR	CK: TAR		
©TxDOT August 2017	CONT	SECT	JOB	HIGHWAY		
REVISIONS	0724	02	020, ETC.	FM 219		
	DIST	COUNTY		SHEET NO.		
	WACO	BOSQUE		99		

DATE:
FILE:

TABLES OF ESTIMATED QUANTITIES WITH 2:1 HEADER SLOPE (12)

TYPE Tx28 Girders

Bar	No.	Size	Length	Weight
A	10	#11	45'-0"	2,391
D (7)	2	#9	1'-8"	11
H	8	#6	45'-8"	549
L	18	#6	4'-0"	108
S	50	#5	11'-6"	600
U	4	#6	8'-1"	49
V	45	#5	11'-4"	532
wH1	14	#6	9'-5"	198
wH2	20	#6	7'-8"	230
wS	18	#4	7'-10"	94
wV	18	#5	11'-4"	213

Reinforcing Steel	Lb	4,975
Class "C" Concrete	CY	23.6

TYPE Tx34 Girders

Bar	No.	Size	Length	Weight
A	10	#11	45'-0"	2,391
D (7)	2	#9	1'-8"	11
H	8	#6	45'-8"	549
L	18	#6	4'-0"	108
S	50	#5	11'-6"	600
U	4	#6	8'-1"	49
V	45	#5	12'-4"	579
wH1	14	#6	10'-5"	219
wH2	20	#6	8'-8"	260
wS	20	#4	7'-10"	105
wV	20	#5	12'-4"	257

Reinforcing Steel	Lb	5,128
Class "C" Concrete	CY	25.4

TYPE Tx40 Girders

Bar	No.	Size	Length	Weight
A	10	#11	45'-0"	2,391
D (7)	2	#9	1'-8"	11
H	10	#6	45'-8"	686
L	18	#6	4'-0"	108
S	50	#5	11'-6"	600
U	4	#6	8'-1"	49
V	45	#5	13'-4"	626
wH1	14	#6	11'-5"	240
wH2	24	#6	9'-8"	348
wS	22	#4	7'-10"	115
wV	22	#5	13'-4"	306

Reinforcing Steel	Lb	5,480
Class "C" Concrete	CY	27.3

TYPE Tx46 Girders

Bar	No.	Size	Length	Weight
A	10	#11	45'-0"	2,391
D (7)	2	#9	1'-8"	11
H	10	#6	45'-8"	686
L	18	#6	4'-0"	108
S	50	#5	11'-6"	600
U	4	#6	8'-1"	49
V	45	#5	14'-4"	673
wH1	14	#6	12'-5"	261
wH2	24	#6	10'-8"	385
wS	24	#4	7'-10"	126
wV	24	#5	14'-4"	359

Reinforcing Steel	Lb	5,649
Class "C" Concrete	CY	29.2

TYPE Tx54 Girders

Bar	No.	Size	Length	Weight
A	10	#11	45'-0"	2,391
D (7)	2	#9	1'-8"	11
H	12	#6	45'-8"	823
L	18	#6	4'-0"	108
S	50	#5	11'-6"	600
U	4	#6	8'-1"	49
V	45	#5	15'-8"	735
wH1	14	#6	13'-5"	282
wH2	28	#6	11'-8"	491
wS	26	#4	7'-10"	136
wV	26	#5	15'-8"	425

Reinforcing Steel	Lb	6,051
Class "C" Concrete	CY	31.7

TABLES OF ESTIMATED QUANTITIES WITH 3:1 HEADER SLOPE (12)

TYPE Tx28 Girders

Bar	No.	Size	Length	Weight
A	10	#11	45'-0"	2,391
D (7)	2	#9	1'-8"	11
H	8	#6	45'-8"	549
L	18	#6	4'-0"	108
S	50	#5	11'-6"	600
U	4	#6	8'-1"	49
V	45	#5	11'-4"	532
wH1	14	#6	13'-5"	282
wH2	20	#6	11'-8"	350
wS	26	#4	7'-10"	136
wV	26	#5	11'-4"	307

Reinforcing Steel	Lb	5,315
Class "C" Concrete	CY	26.2

TYPE Tx34 Girders

Bar	No.	Size	Length	Weight
A	10	#11	45'-0"	2,391
D (7)	2	#9	1'-8"	11
H	8	#6	45'-8"	549
L	18	#6	4'-0"	108
S	50	#5	11'-6"	600
U	4	#6	8'-1"	49
V	45	#5	12'-4"	579
wH1	14	#6	14'-5"	303
wH2	20	#6	12'-8"	381
wS	28	#4	7'-10"	147
wV	28	#5	12'-4"	360

Reinforcing Steel	Lb	5,478
Class "C" Concrete	CY	28.1

TYPE Tx40 Girders

Bar	No.	Size	Length	Weight
A	10	#11	45'-0"	2,391
D (7)	2	#9	1'-8"	11
H	10	#6	45'-8"	686
L	18	#6	4'-0"	108
S	50	#5	11'-6"	600
U	4	#6	8'-1"	49
V	45	#5	13'-4"	626
wH1	14	#6	16'-5"	345
wH2	24	#6	14'-8"	529
wS	32	#4	7'-10"	167
wV	32	#5	13'-4"	445

Reinforcing Steel	Lb	5,957
Class "C" Concrete	CY	30.9

TYPE Tx46 Girders

Bar	No.	Size	Length	Weight
A	10	#11	45'-0"	2,391
D (7)	2	#9	1'-8"	11
H	10	#6	45'-8"	686
L	18	#6	4'-0"	108
S	50	#5	11'-6"	600
U	4	#6	8'-1"	49
V	45	#5	14'-4"	673
wH1	14	#6	17'-5"	366
wH2	24	#6	15'-8"	565
wS	34	#4	7'-10"	178
wV	34	#5	14'-4"	508

Reinforcing Steel	Lb	6,135
Class "C" Concrete	CY	33.0

TYPE Tx54 Girders

Bar	No.	Size	Length	Weight
A	10	#11	45'-0"	2,391
D (7)	2	#9	1'-8"	11
H	12	#6	45'-8"	823
L	18	#6	4'-0"	108
S	50	#5	11'-6"	600
U	4	#6	8'-1"	49
V	45	#5	15'-8"	735
wH1	14	#6	19'-5"	408
wH2	28	#6	17'-8"	743
wS	38	#4	7'-10"	199
wV	38	#5	15'-8"	621

Reinforcing Steel	Lb	6,688
Class "C" Concrete	CY	36.5

(7) Omit Dowels D at end of multi-span unit. Adjust reinforcing steel total accordingly.

(12) Quantities shown are for one abutment only (with approach slab). With no approach slab, add 1.8 CY Class "C" concrete and 274 lbs reinforcing steel for 4 additional Bars H.

HL93 LOADING

Texas Department of Transportation

Bridge Division Standard

ABUTMENTS
TYPE TX28 THRU TX54
PRESTR CONC I-GIRDERS
44' ROADWAY

AIG-44

FILE: IG-AIG4400-17.dgn	DN: TAR	CK: KCM	DW: JTR	CK: TAR		
©TxDOT August 2017	CONT	SECT	JOB	HIGHWAY		
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	WACO	BOSQUE		100		

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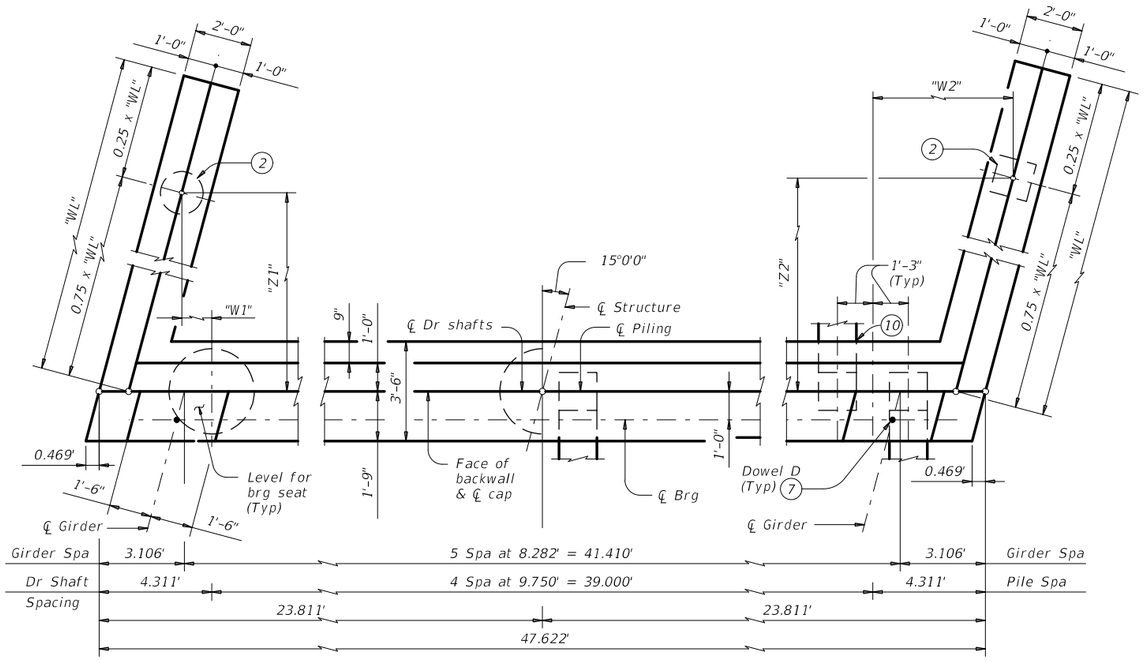
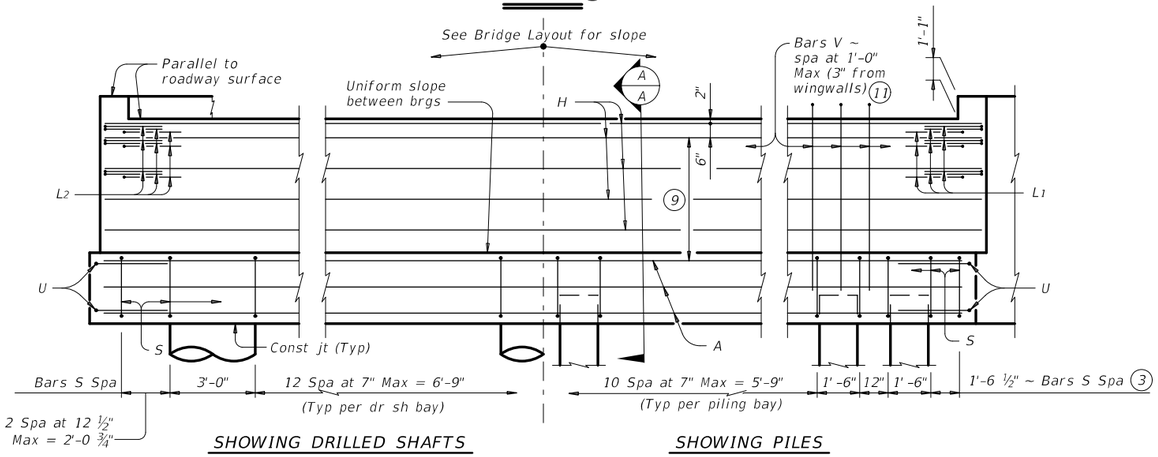


SHOWING DRILLED SHAFTS — SHOWING PILES

PLAN (1)

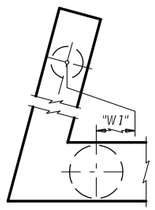


SHOWING DRILLED SHAFTS — SHOWING PILES

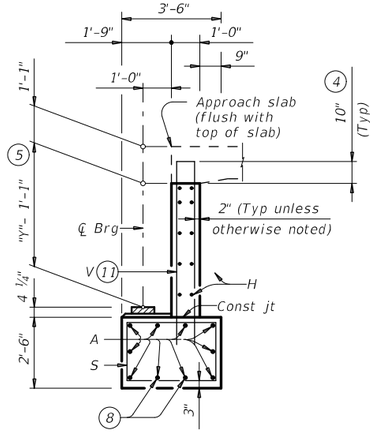
ELEVATION

TABLE A

Header Slope	Girder Type	Wingwall Type	Wingwall Lgth "WL"	"W1" (12)	"Z1"	"W2"	"Z2"
2:1	Tx28	Cantilevered	8.000'	Not Applicable			
	Tx34	Cantilevered	9.000'				
	Tx40	Cantilevered	10.000'				
	Tx46	Cantilevered	11.000'				
	Tx54	Founded	13.000'	0.753'	9.418'	5.800'	9.418'
3:1	Tx28	Cantilevered	12.000'	Not Applicable			
	Tx34	Founded	14.000'	0.558'	10.142'	5.994'	10.142'
	Tx40	Founded	15.000'	0.364'	10.867'	6.188'	10.867'
	Tx46	Founded	17.000'	-0.024'	12.316'	6.576'	12.316'
	Tx54	Founded	19.000'	-0.412'	13.764'	6.964'	13.764'

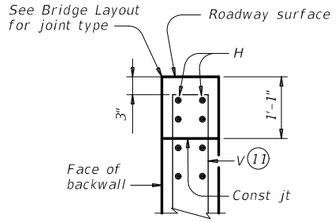


DETAIL A



SECTION A-A

(With approach slab) (6)



BACKWALL DETAIL

(Without approach slab) (6)

(1) See Table A for variable dimensions based on header slope and girder type.

(2) See Table A to determine if wingwall foundations are required.

(3) For piling larger than 16" adjust Bars S spacing as required to avoid piling.

(4) Increase as required to maintain 3" from finished grade.

(5) See Span details for "Y" value.

(6) See Bridge Layout to determine if approach slab is present.

(7) Omit Dowels D at end of multi-span unit. Adjust reinforcing steel total accordingly.

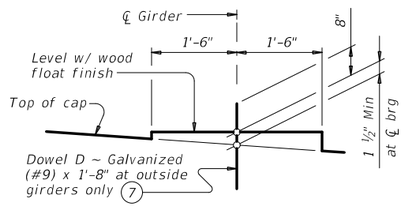
(8) With pile foundations, move Bars A shown to clear piles.

(9) Spacing based on girder type:
Tx28 ~ 3 spaces at 1'-0" Max
Tx34 ~ 3 spaces at 1'-0" Max
Tx40 ~ 4 spaces at 1'-0" Max
Tx46 ~ 4 spaces at 1'-0" Max
Tx54 ~ 5 spaces at 1'-0" Max

(10) See Detail A on FD standard.

(11) Field bend as needed to clear piles.

(12) Negative values for the "W1" dimension indicates a wingwall foundation on the other side of the cap foundation from what is shown in plan view. See Detail A.



BEARING SEAT DETAIL

(Bearing surface must be clean and free of all loose material before placing bearing pad.)

TABLE OF FOUNDATION LOADS

Span Length	All Girder Types	
Ft	Tons/Shaft	Tons/Pile
40	55	51
45	59	53
50	63	55
55	67	57
60	70	59
65	74	61
70	77	63
75	81	65
80	84	66
85	88	68
90	91	70
95	94	72
100	98	73
105	101	75
110	105	77
115	108	79
120	111	80
125	115	82

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.

See Bridge Layout for header slope and foundation type, size and length.

See Common Foundation Details (FD) standard sheet for all foundation details and notes.

See Concrete Riprap (CRR) standard sheet or Stone Riprap (SRR) standard sheet for riprap attachment details, if applicable.

See applicable rail details for rail anchorage in wingwalls.

Details are drawn showing right forward skew. See Bridge Layout for actual skew direction.

These abutment details may be used with standard SIG-44-15 only.

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

MATERIAL NOTES:

Provide Class C concrete (f'c = 3,600 psi).
Provide Class C (HPC) concrete if shown elsewhere in the plans.
Provide Grade 60 reinforcing steel.
Galvanize dowel bars D.

HL93 LOADING — SHEET 1 OF 3

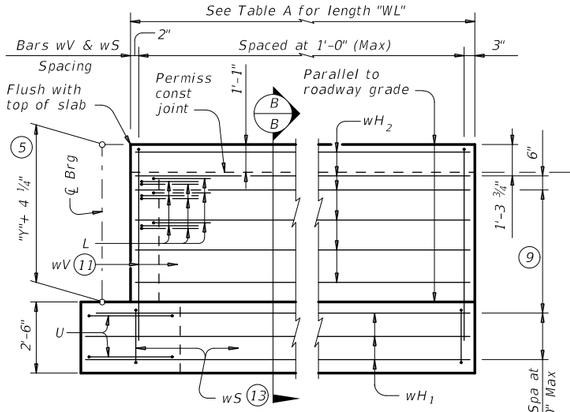
Texas Department of Transportation — Bridge Division Standard

ABUTMENTS
TYPE TX28 THRU TX54
PRESTR CONC I-GIRDERS
44' ROADWAY 15° SKEW

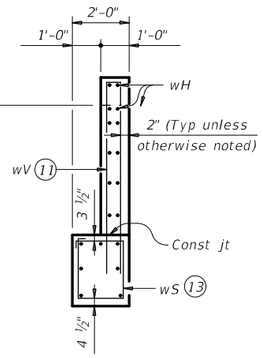
AIG-44-15

FILE: IG-AIG4415-17.dgn	DN: TAR	CK: KCM	DW: JTR	CK: TAR
©TxDOT August 2017	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		101

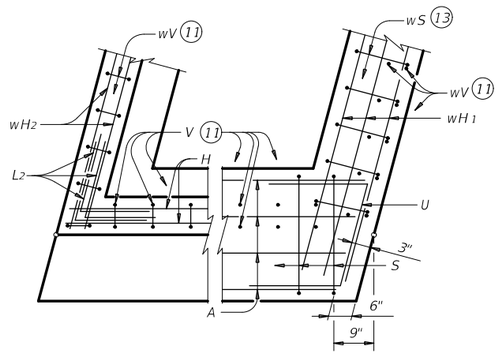
DATE:
FILE:



WINGWALL ELEVATION

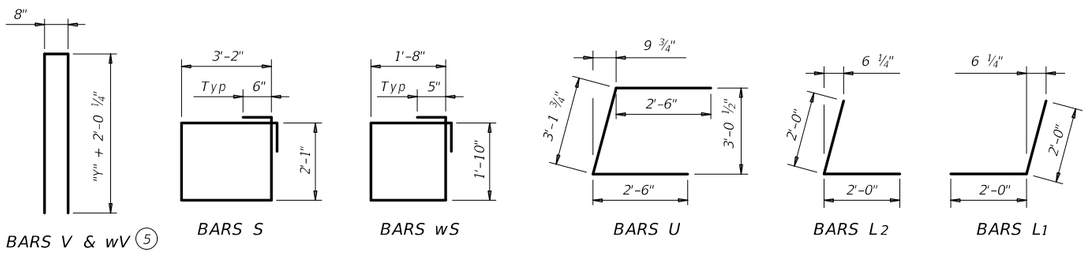


SECTION B-B



BACKWALL CAP

CORNER DETAILS



(5) See Span details for "Y" value.

(9) Spacing based on girder type:
Tx28 ~ 3 spaces at 1'-0" Max
Tx34 ~ 3 spaces at 1'-0" Max
Tx40 ~ 4 spaces at 1'-0" Max
Tx46 ~ 4 spaces at 1'-0" Max
Tx54 ~ 5 spaces at 1'-0" Max

(11) Field bend as needed to clear piles.

(13) Adjust as required to avoid piling.

HL93 LOADING

Texas Department of Transportation

Bridge Division Standard

ABUTMENTS

TYPE TX28 THRU TX54
PRESTR CONC I-GIRDERS
44' ROADWAY 15° SKEW

AIG-44-15

FILE: IG-AIG4415-17.dgn	DN: TAR	CK: KCM	DW: JTR	CK: TAR			
©TxDOT August 2017	CONT	SECT	JOB		HIGHWAY		
REVISIONS	0724	02	020, ETC.		FM 219		
	DIST	COUNTY			SHEET NO.		
	WACO	BOSQUE			102		

DATE:
FILE:

TABLES OF ESTIMATED QUANTITIES WITH 2:1 HEADER SLOPE (14)

TYPE Tx28 Girders

Bar	No.	Size	Length	Weight
A	10	#11	46'-7"	2,475
D (7)	2	#9	1'-8"	11
H	8	#6	47'-3"	568
L1	9	#6	4'-0"	54
L2	9	#6	4'-0"	54
S	58	#5	11'-6"	696
U	4	#6	8'-2"	49
V	47	#5	11'-4"	556
wH1	14	#6	9'-5"	198
wH2	20	#6	7'-8"	230
wS	18	#4	7'-10"	94
wV	18	#5	11'-4"	213

Reinforcing Steel	Lb	5,198
Class "C" Concrete	CY	24.3

TYPE Tx34 Girders

Bar	No.	Size	Length	Weight
A	10	#11	46'-7"	2,475
D (7)	2	#9	1'-8"	11
H	8	#6	47'-3"	568
L1	9	#6	4'-0"	54
L2	9	#6	4'-0"	54
S	58	#5	11'-6"	696
U	4	#6	8'-2"	49
V	47	#5	12'-4"	605
wH1	14	#6	10'-5"	219
wH2	20	#6	8'-8"	260
wS	20	#4	7'-10"	105
wV	20	#5	12'-4"	257

Reinforcing Steel	Lb	5,353
Class "C" Concrete	CY	26.1

TYPE Tx40 Girders

Bar	No.	Size	Length	Weight
A	10	#11	46'-7"	2,475
D (7)	2	#9	1'-8"	11
H	10	#6	47'-3"	710
L1	9	#6	4'-0"	54
L2	9	#6	4'-0"	54
S	58	#5	11'-6"	696
U	4	#6	8'-2"	49
V	47	#5	13'-4"	654
wH1	14	#6	11'-5"	240
wH2	24	#6	9'-8"	348
wS	22	#4	7'-10"	115
wV	22	#5	13'-4"	306

Reinforcing Steel	Lb	5,712
Class "C" Concrete	CY	28.0

TYPE Tx46 Girders

Bar	No.	Size	Length	Weight
A	10	#11	46'-7"	2,475
D (7)	2	#9	1'-8"	11
H	10	#6	47'-3"	710
L1	9	#6	4'-0"	54
L2	9	#6	4'-0"	54
S	58	#5	11'-6"	696
U	4	#6	8'-2"	49
V	47	#5	14'-4"	703
wH1	14	#6	12'-5"	261
wH2	24	#6	10'-8"	385
wS	24	#4	7'-10"	126
wV	24	#5	14'-4"	359

Reinforcing Steel	Lb	5,883
Class "C" Concrete	CY	30.0

TYPE Tx54 Girders

Bar	No.	Size	Length	Weight
A	10	#11	46'-7"	2,475
D (7)	2	#9	1'-8"	11
H	12	#6	47'-3"	852
L1	9	#6	4'-0"	54
L2	9	#6	4'-0"	54
S	58	#5	11'-6"	696
U	4	#6	8'-2"	49
V	47	#5	15'-8"	768
wH1	14	#6	14'-5"	303
wH2	28	#6	12'-8"	533
wS	28	#4	7'-10"	147
wV	28	#5	15'-8"	458

Reinforcing Steel	Lb	6,400
Class "C" Concrete	CY	33.3

TABLES OF ESTIMATED QUANTITIES WITH 3:1 HEADER SLOPE (14)

TYPE Tx28 Girders

Bar	No.	Size	Length	Weight
A	10	#11	46'-7"	2,475
D (7)	2	#9	1'-8"	11
H	8	#6	47'-3"	568
L1	9	#6	4'-0"	54
L2	9	#6	4'-0"	54
S	58	#5	11'-6"	696
U	4	#6	8'-2"	49
V	47	#5	11'-4"	556
wH1	14	#6	13'-5"	282
wH2	20	#6	11'-8"	350
wS	26	#4	7'-10"	136
wV	26	#5	11'-4"	307

Reinforcing Steel	Lb	5,538
Class "C" Concrete	CY	26.9

TYPE Tx34 Girders

Bar	No.	Size	Length	Weight
A	10	#11	46'-7"	2,475
D (7)	2	#9	1'-8"	11
H	8	#6	47'-3"	568
L1	9	#6	4'-0"	54
L2	9	#6	4'-0"	54
S	58	#5	11'-6"	696
U	4	#6	8'-2"	49
V	47	#5	12'-4"	605
wH1	14	#6	15'-5"	324
wH2	20	#6	13'-8"	411
wS	30	#4	7'-10"	157
wV	30	#5	12'-4"	386

Reinforcing Steel	Lb	5,790
Class "C" Concrete	CY	29.5

TYPE Tx40 Girders

Bar	No.	Size	Length	Weight
A	10	#11	46'-7"	2,475
D (7)	2	#9	1'-8"	11
H	10	#6	47'-3"	710
L1	9	#6	4'-0"	54
L2	9	#6	4'-0"	54
S	58	#5	11'-6"	696
U	4	#6	8'-2"	49
V	47	#5	13'-4"	654
wH1	14	#6	16'-5"	345
wH2	24	#6	14'-8"	529
wS	32	#4	7'-10"	167
wV	32	#5	13'-4"	445

Reinforcing Steel	Lb	6,189
Class "C" Concrete	CY	31.6

TYPE Tx46 Girders

Bar	No.	Size	Length	Weight
A	10	#11	46'-7"	2,475
D (7)	2	#9	1'-8"	11
H	10	#6	47'-3"	710
L1	9	#6	4'-0"	54
L2	9	#6	4'-0"	54
S	58	#5	11'-6"	696
U	4	#6	8'-2"	49
V	47	#5	14'-4"	703
wH1	14	#6	18'-5"	387
wH2	24	#6	16'-8"	601
wS	36	#4	7'-10"	188
wV	36	#5	14'-4"	538

Reinforcing Steel	Lb	6,466
Class "C" Concrete	CY	34.5

TYPE Tx54 Girders

Bar	No.	Size	Length	Weight
A	10	#11	46'-7"	2,475
D (7)	2	#9	1'-8"	11
H	12	#6	47'-3"	852
L1	9	#6	4'-0"	54
L2	9	#6	4'-0"	54
S	58	#5	11'-6"	696
U	4	#6	8'-2"	49
V	47	#5	15'-8"	768
wH1	14	#6	20'-5"	429
wH2	28	#6	18'-8"	785
wS	40	#4	7'-10"	209
wV	40	#5	15'-8"	654

Reinforcing Steel	Lb	7,036
Class "C" Concrete	CY	38.1

(7) Omit Dowels D at end of multi-span unit. Adjust reinforcing steel total accordingly.

(14) Quantities shown are for one abutment only (with approach slab). With no approach slab, add 1.8 CY Class "C" concrete and 284 lbs reinforcing steel for 4 additional Bars H.

HL93 LOADING

Texas Department of Transportation

Bridge Division Standard

ABUTMENTS

TYPE TX28 THRU TX54

PRESTR CONC I-GIRDERS

44' ROADWAY 15° SKEW

AIG-44-15

FILE: IG-AIG4415-17.dgn	DN: TAR		CK: KCM	DW: JTR		CK: TAR	
©TxDOT August 2017	CONT	SECT	JOB		HIGHWAY		
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DATE:
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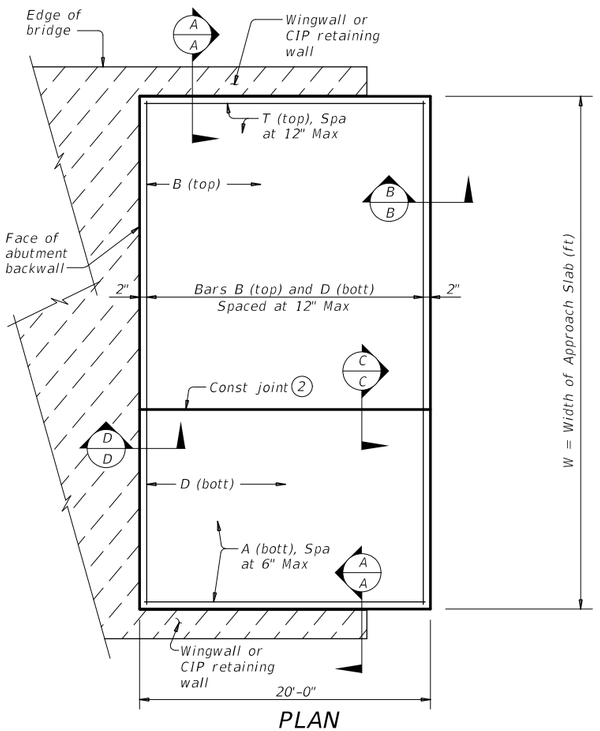
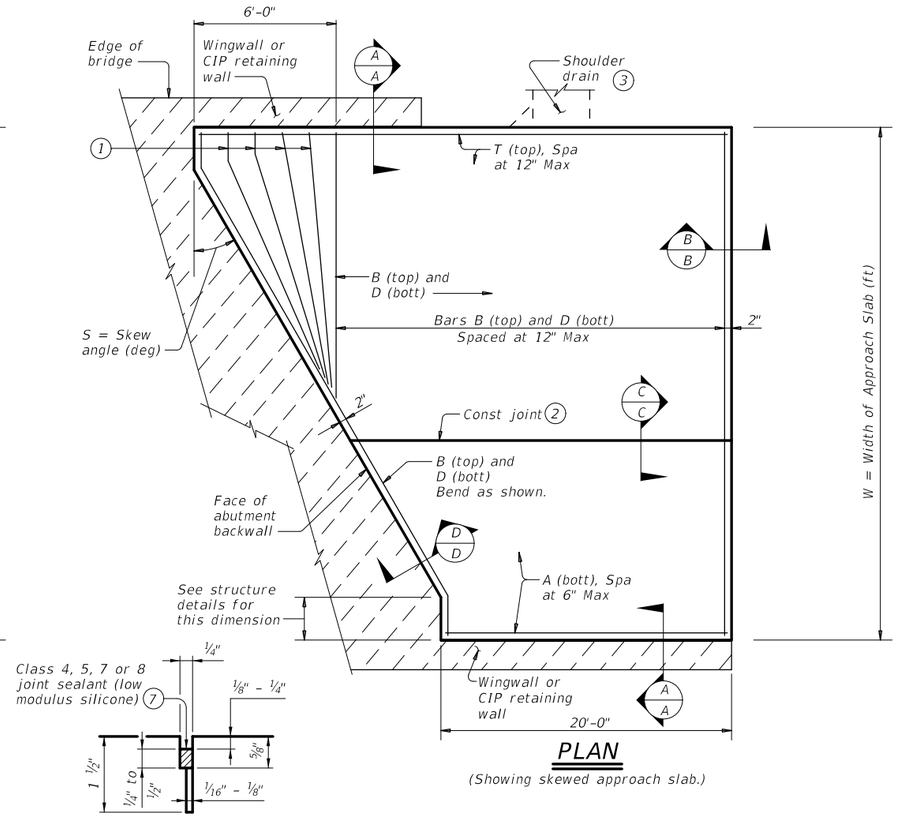


PLAN

(Showing non-skewed approach slab.)



PLAN

(Showing skewed approach slab.)

LONGITUDINAL SAW CUT JOINT DETAIL

BAR TABLE	
BAR	SIZE
A	#8
B	#5
D	#5
T	#5

APPROXIMATE QUANTITIES (4)

Reinf steel weight = 8.5 Lbs/SF of Approach Slab

Volume of Appr Slab Conc (CY) = $0.802W + 0.02W^2 \tan S$

W = Width of Approach Slab (ft)

S = Skew Angle (deg)

(1) Flare Bars B and D in this region (1'-6" Max Spa, 3" Min Spa). Minimum flared bar length = 2'-6". Bend bars as necessary.

(2) Provide longitudinal construction joints that align with longitudinal construction joints in the bridge slab with bridges built in stages. Other longitudinal construction joints must receive approval of the Engineer.

(3) See details elsewhere in plans for shoulder drain location and details.

(4) For Contractor's information only. Quantities shown are for one approach slab.

(5) Multiple piece tie bars are acceptable at longitudinal construction joints provided minimum laps shown are achieved.

(6) See details elsewhere in plans for required cross-slope.

(7) Place in accordance with Item 438.

(8) Provide backer rod that is 25% larger than joint opening and compatible with the sealant.

(9) If bridge rail is present at the wingwall or CIP retaining wall, place ½" rebonded recycled tire rubber between concrete railing and top of approach slab as shown when concrete railing projects over the approach slab.

GENERAL NOTES:

Construct approach slab in accordance with Item 422.

Provide Class "S" concrete with a minimum compressive strength of 4,000 psi.

Provide Grade 60 reinforcing steel.

Provide longitudinal joints as shown on the Longitudinal Saw Cut Joint Detail at lane lines and shoulders when width between longitudinal construction joints or edges of approach slab exceeds 16 feet. Saw cut joints within 24 hours of concrete placement to a depth of 1 ½" and seal in accordance with Item 438. Alternately, provide a controlled joint consisting of 1 ½" vinyl or plastic joint former (Stress Cap, Zip Strip, Stress Lock, or equal as approved by the Engineer.)

Provide rebonded recycled tire rubber joint filler that meets the requirements of DMS-6310. "Joint Sealants and Fillers."

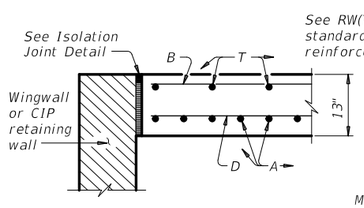
Construct the subgrade or subbase away from the bridge for a minimum distance of 100 feet prior to the approach slab, unless otherwise indicated on the plans.

Compact and finish the subgrade or foundation for the approach slab to the typical cross-section and to the lines and grades shown on the plans.

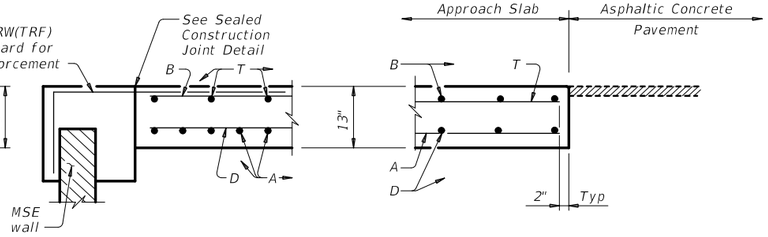
Cure for 4 days using water or membrane curing per Item 422.

All details shown herein are subsidiary to bridge approach slab.

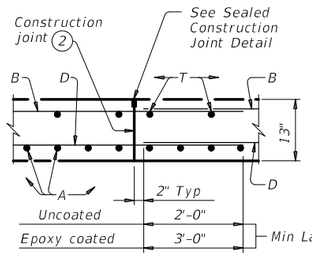
Cover dimensions are clear dimensions, unless noted otherwise.



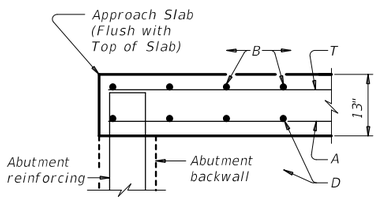
SHOWING WINGWALL OR CIP RETAINING WALL



SHOWING MSE WALL



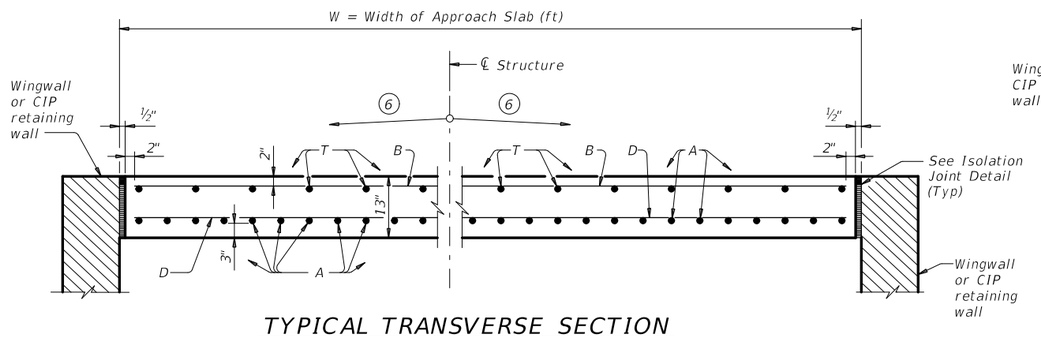
SECTION C-C (5)



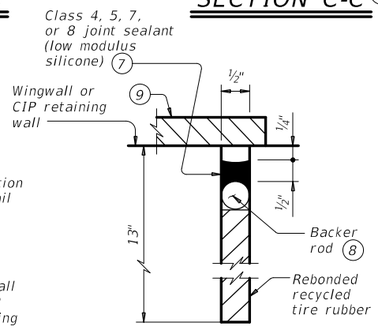
SECTION D-D

SECTION A-A

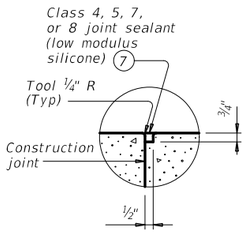
SECTION B-B



TYPICAL TRANSVERSE SECTION



ISOLATION JOINT DETAIL



SEALED CONSTRUCTION JOINT DETAIL

Texas Department of Transportation

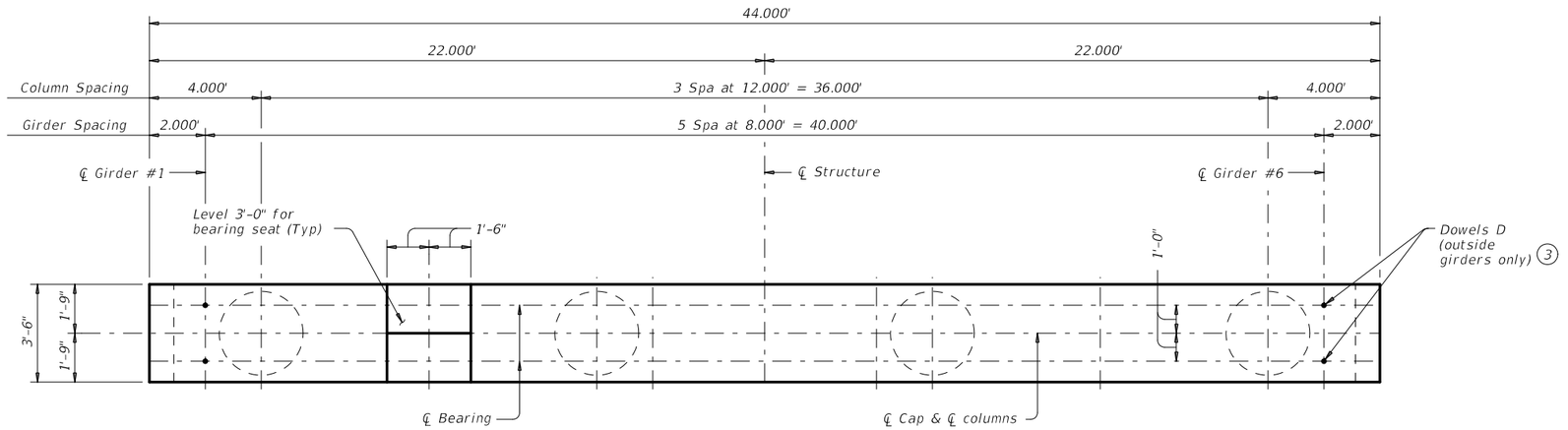
Bridge Division Standard

BRIDGE APPROACH SLAB
ASPHALTIC CONCRETE PAVEMENT

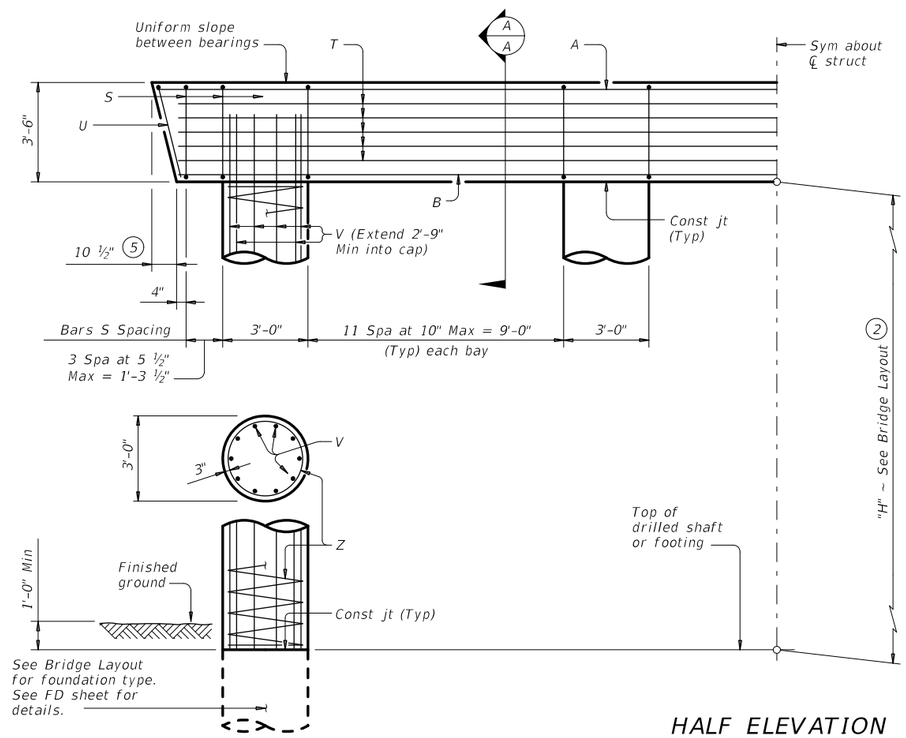
BAS-A

FILE: MS-BAS-A-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC.	FM 219
02-20: Removed stress relieving pad.	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		104

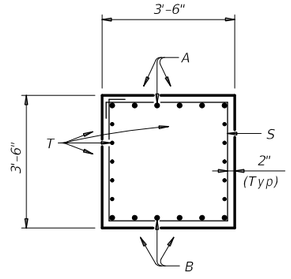
DATE:
FILE:



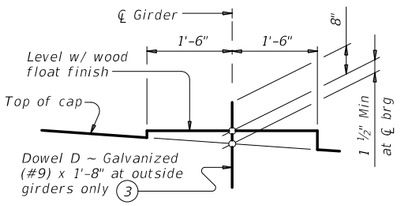
PLAN



HALF ELEVATION



SECTION A-A



BEARING SEAT DETAIL

(Bearing surface must be clean and free of all loose material before placing bearing pad.)

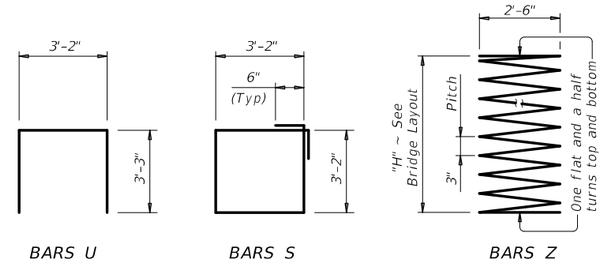


TABLE OF ESTIMATED QUANTITIES (1)

Bar	No.	Size	Length	Weight
A	6	#11	43'- 6"	1,387
B	6	#11	42'- 0"	1,339
D (3)	4	#9	1'- 8"	23
S	44	#5	13'- 8"	627
T	10	#5	42'- 0"	438
U	2	#5	9'- 8"	20
V	40	#9	38'- 9"	5,270
Z	4	#4	1,154'- 7"	3,085
Reinforcing Steel			Lb	12,189
Class "C" Concrete (Cap)			CY	19.9
Class "C" Concrete (Col)			CY	37.7

FOUNDATION LOADS (4)

Span Average	Drilled Shaft Loads	Pile Load (Tons/Pile)		
		3 Pile Ftg	4 Pile Ftg	5 Pile Ftg
Ft	Tons/Shaft			
40	114	41	32	26
45	123	44	34	28
50	131	47	36	29
55	140	50	38	31
60	149	53	40	33
65	157	56	42	35
70	166	59	45	36
75	174	61	47	38
80	183	64	49	40
85	191	67	51	41
90	199	70	53	43
95	208	73	55	45
100	216	75	57	46
105	225	78	59	48
110	233	81	61	50
115	241	84	63	51
120	250	87	66	53
125	258	89	68	55

(1) Quantities shown are based on an "H" value of 36'. For each linear foot variation in "H" value, make the following adjustments:
Bars V length, 1'-0"
Bars Z length, 31'-5"
Reinforcing steel, 220 Lb
Class "C" conc (col), 1.05 CY

(2) This standard may not be used for "H" heights exceeding 36'. In areas of very soft soil or where scour is anticipated, allowable "H" heights must be evaluated by the Engineer prior to the use of this standard.

(3) Omit Dowels D at end of multi-span units. Adjust reinforcing steel total accordingly.

(4) Foundation Loads based on "H" = 36'.

(5) Measured parallel to top of cap cross-slope.

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.
See Bridge Layout for foundation type, size and length.
See Common Foundation Details (FD) standard sheet for all foundation details and notes.
See Shear Key (IGSK) standard sheet for all shear key details and notes, if applicable.
Bent selected must be based on the average span length rounded up to the next 5 ft increment.
These bent details may be used with standard SIG-44 only.

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

MATERIAL NOTES:

Provide Class C concrete (f'c = 3,600 psi).
Provide Class C (HPC) concrete if shown elsewhere in the plans.
Provide Grade 60 reinforcing steel.
Galvanize dowel bars D.

HL93 LOADING

Texas Department of Transportation

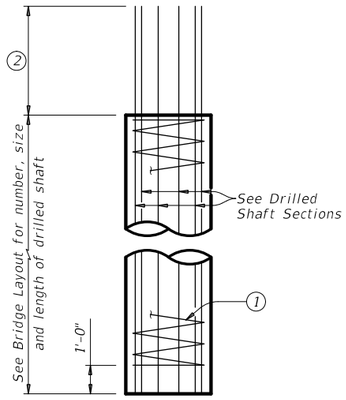
Bridge Division Standard

INTERIOR BENTS
TYPE TX28 THRU TX54
PRESTR CONC I-GIRDERS
44' ROADWAY

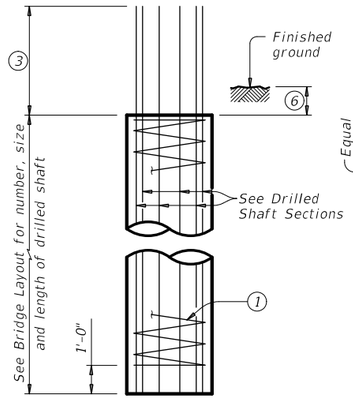
BIG-44

FILE: IG-BIG4400-17.dgn	DN: TAR	CK: SDB	DW: JTR	CK: TAR
©TxDOT August 2017	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		105

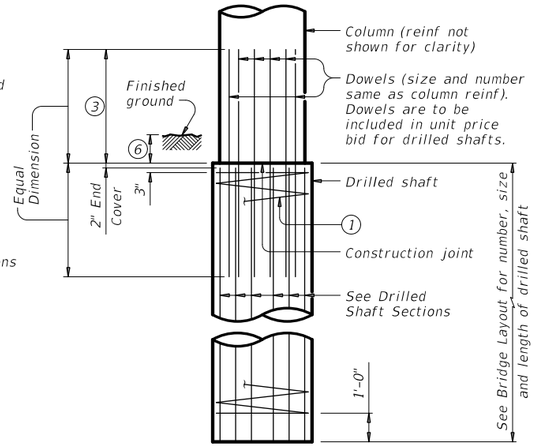
DATE:
FILE:



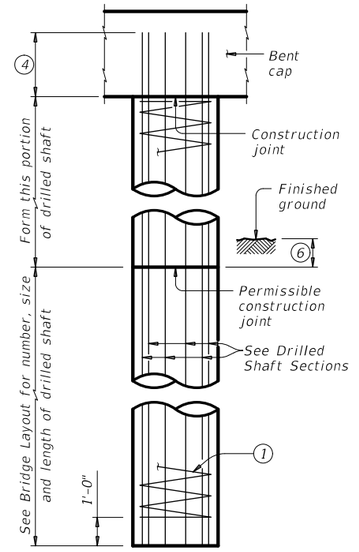
ABUTMENTS, WINGWALLS AND MULTI-DRILLED SHAFT FOOTINGS



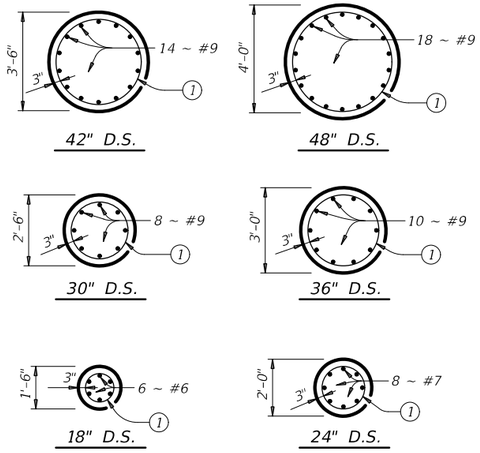
INTERIOR BENTS DRILLED SHAFT DIA EQUAL TO COLUMN DIA



INTERIOR BENTS DRILLED SHAFT DIA GREATER THAN COLUMN DIA



OPTIONAL INTERIOR BENT DRILLED SHAFT DETAIL (5)

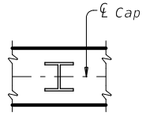


DRILLED SHAFT SECTIONS

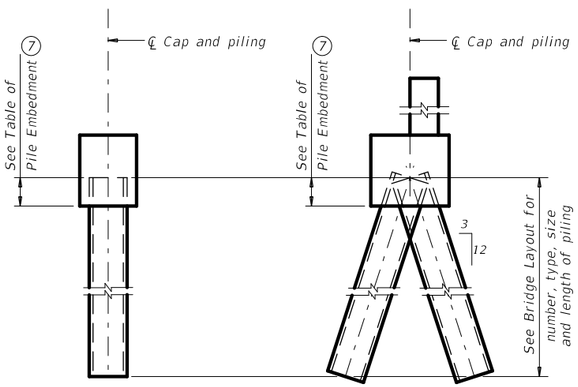
DRILLED SHAFT DETAILS

TABLE OF PILE EMBEDMENT	
Pile Type	Embedment Depth (Ft)
16" Sq Concrete 18" Sq Concrete HP14 Steel HP16 Steel	1'-0"
20" Sq Concrete 24" Sq Concrete HP18 Steel	1'-6"

See Prestressed Concrete Piling (CP) standard for additional details on concrete pile embedment.



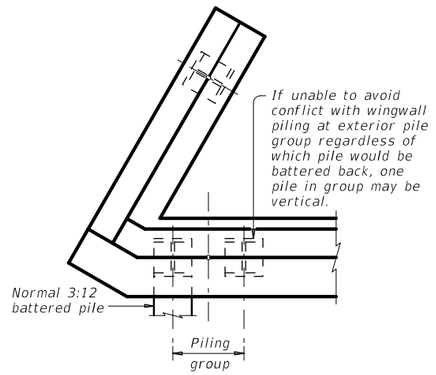
ORIENTATION OF STEEL H-PILING



VERTICAL PILE BATTERED PILE

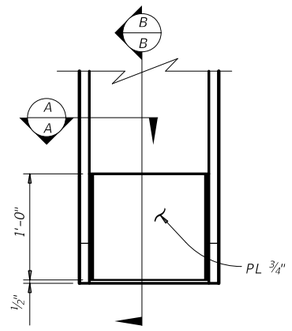
PILING DETAILS

(Concrete or steel H)

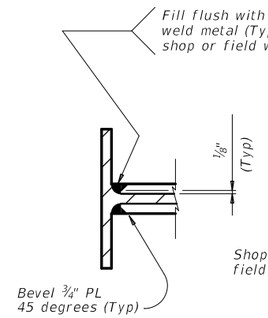


DETAIL "A"

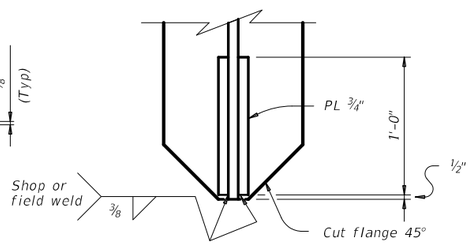
(Showing plan view of a 30° skewed abutment)



ELEVATION



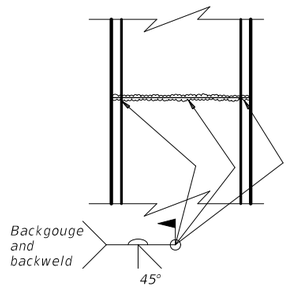
SECTION A-A

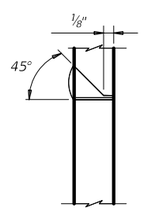


SECTION B-B

STEEL H-PILE TIP REINFORCEMENT

See Item 407 "Steel Piling" to determine when tip reinforcement is required and for options to the details shown.





SECTION THRU FLANGE OR WEB

STEEL H-PILE SPLICE DETAIL

Use when required.

(1) #3 spiral at 6" pitch (one and a half flat turns top and bottom).

(2) Min extension into supported element:
#6 Bars = 1'-11"
#7 Bars = 2'-0"
#9 Bars = 2'-3"

(3) Min lap with column reinf:
#7 Bars = 2'-11"
#9 Bars = 3'-9"
#11 Bars = 4'-8"

(4) Min extension into supported element:
#6 Bars = 1'-11"
#7 Bars = 2'-3"
#9 Bars = 2'-9"

(5) Drilled shafts may extend to the bottom of bent caps for "H" heights of 6 ft and less (as shown on the Bridge Layout), if approved. This option can only be used when the drilled shaft diameter equals the column diameter. Obtain approval of the forming method above the ground line prior to construction. No adjustments in payment will be made if this option is used.

(6) 1'-0" Min, unless shown otherwise on plans.

(7) Or as shown on plans.

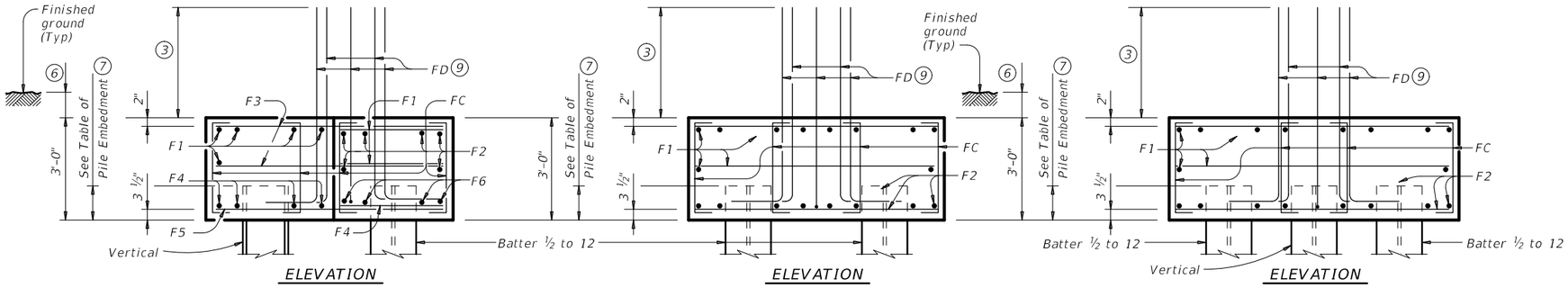
Texas Department of Transportation

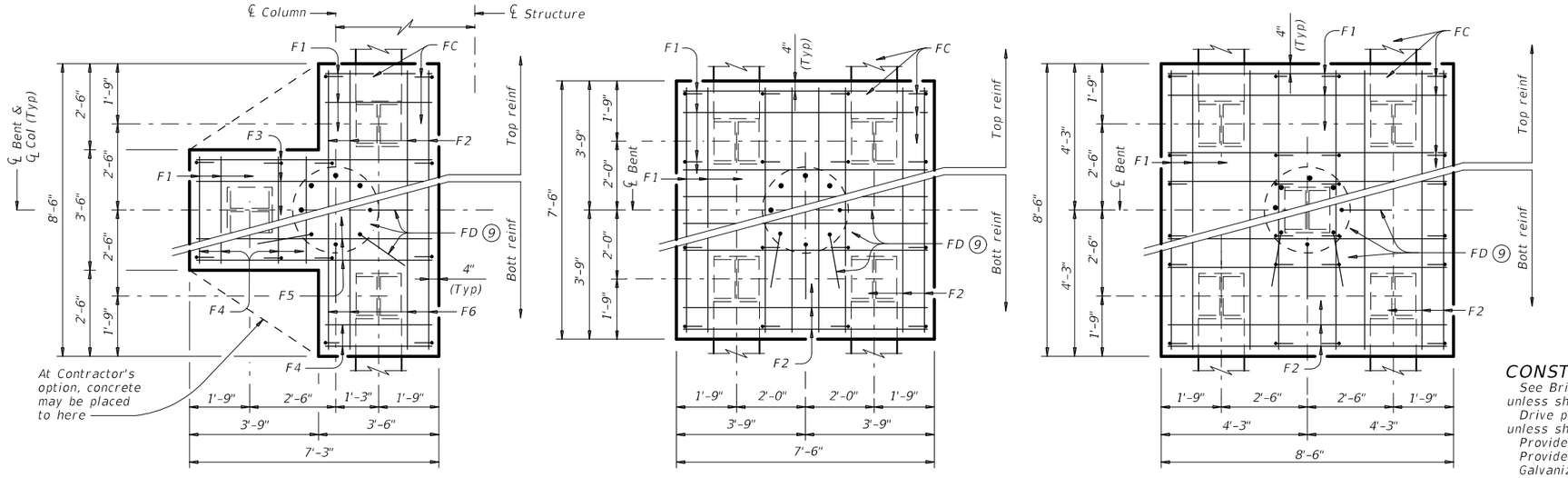
Bridge Division Standard

COMMON FOUNDATION DETAILS

FD

FILE: MS-FD-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC.	FM 219
01-20: Added #11 bars to the FD bars.	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		106





THREE PILE FOOTING (8)

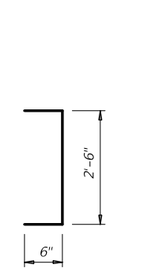
For 36" Dia and smaller columns.

FOUR PILE FOOTING (8)

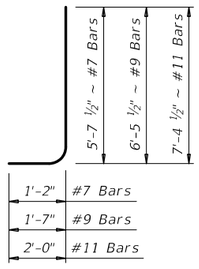
For 42" Dia and smaller columns.

FIVE PILE FOOTING (8)

For 42" Dia and smaller columns.



BARS FC



BARS FD (9)

(3) Min lap with column reinforcing:
#7 Bars = 2'-11"
#9 Bars = 3'-9"
#11 Bars = 4'-8"

(6) 1'-0" Min, unless shown otherwise on plans.

(7) Or as shown on plans.

(8) See Bridge Layout for type, size and length of piling.

(9) Number and size of FD bars must match column reinforcing. Tie FD bars to the top of the bottom reinforcing mat.

(10) Adjust FD quantity, size and weight as needed to match column reinforcing.

TABLE OF FOOTING QUANTITIES FOR 30" COLUMNS

ONE 3 PILE FOOTING

Bar	No.	Size	Length	Weight
F1	11	#4	3'- 2"	23
F2	6	#4	8'- 2"	33
F3	6	#4	6'- 11"	28
F4	8	#9	3'- 2"	86
F5	4	#9	6'- 11"	94
F6	4	#9	8'- 2"	111
FC	12	#4	3'- 6"	28
FD (10)	8	#9	8'- 1"	220
Reinforcing Steel			Lb	623
Class "C" Concrete			CY	4.8

ONE 4 PILE FOOTING

Bar	No.	Size	Length	Weight
F1	20	#4	7'- 2"	96
F2	16	#8	7'- 2"	306
FC	16	#4	3'- 6"	37
FD (10)	8	#9	8'- 1"	220
Reinforcing Steel			Lb	659
Class "C" Concrete			CY	6.3

ONE 5 PILE FOOTING

Bar	No.	Size	Length	Weight
F1	20	#4	8'- 2"	109
F2	16	#9	8'- 2"	444
FC	24	#4	3'- 6"	56
FD (10)	8	#9	8'- 1"	220
Reinforcing Steel			Lb	829
Class "C" Concrete			CY	8.0

CONSTRUCTION NOTES:

See Bridge Layout for foundation type required. Use these foundation details unless shown otherwise.

Drive piling under abutment wingwalls to a minimum resistance of 10 Tons/Pile unless shown otherwise.

Provide Class C Concrete (f'c = 3,600 psi), unless shown otherwise.

Provide Grade 60 reinforcing steel.

Galvanize reinforcing if shown elsewhere in the plans.

Provide bar laps for drilled shaft reinforcing, where required, as follows:

Uncoated or galvanized (#6) ~ 2'-6"
Uncoated or galvanized (#7) ~ 2'-11"
Uncoated or galvanized (#9) ~ 3'-9"

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.

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

DESIGNER NOTES:

Do not use the drilled shaft details shown on this standard for retaining wall, noise wall, barrier, or sign foundations without structural evaluation.

Do not use the footings shown on this standard in direct contact with salt water or exposed to salt water spray.

Maximum allowable pile loads for the footings shown are:

72 Tons/Pile with 24" Dia Columns
80 Tons/Pile with 30" Dia Columns
100 Tons/Pile with 36" Dia Columns
120 Tons/Pile with 42" Dia Columns

Texas Department of Transportation

Bridge Division Standard

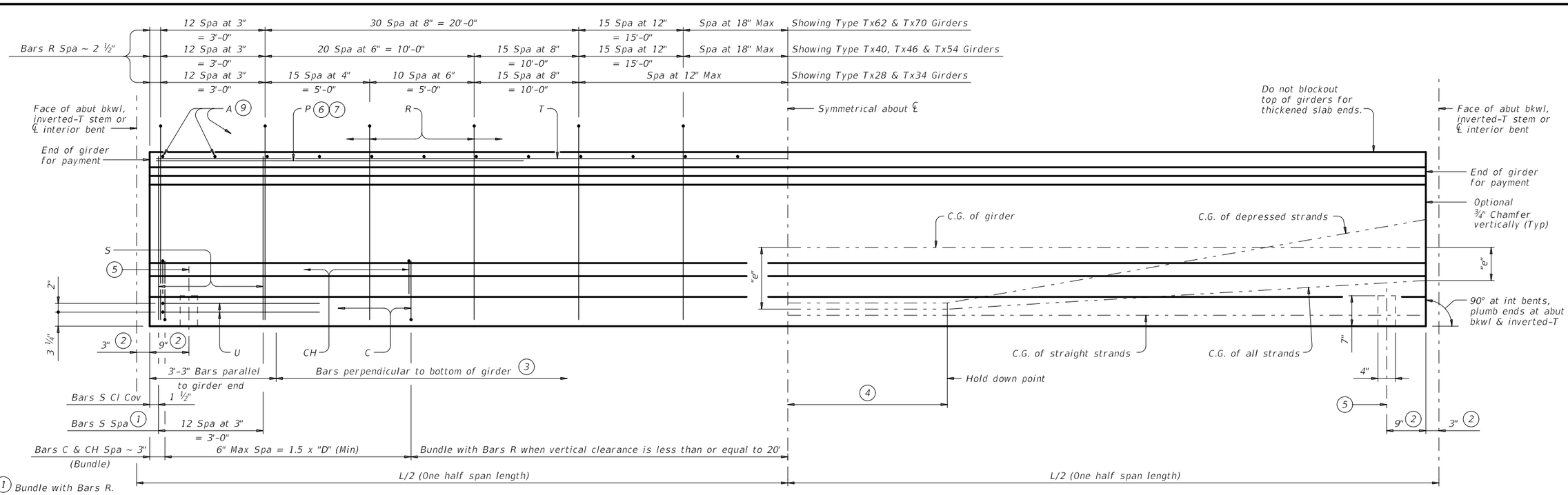
COMMON FOUNDATION DETAILS

FD

FILE: MS-FD-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT		
©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY		
REVISIONS	0724	02	020, ETC.	FM 219		
01-20: Added #11 bars to the FD bars.	DIST	COUNTY		SHEET NO.		
	WACO	BOSQUE		107		

DATE:
FILE:

DATE:
FILE:



(1) Bundle with Bars R.

(2) Measured along ℄ Girder at interior bents; perpendicular to abutment bkwl or inverted-T stem.

(3) The average of the top and bottom spacing of Bars R cannot exceed the required spacing.

(4) L/20, but not less than 5'-0" (-0,+2').

(5) ℄ 4" x 1 ½" Vertical Slotted Hole at doweled girder end [labeled (D) on Bridge Layout]. Required for outside girder only or as shown on substructure details. Anchorage holes may be tapered (4 ¾" x 1 ⅝") at base. If holes are formed with sheet metal, forms may be left in place.

GIRDER ELEVATION

(6) Bars P (#6 x 15'-0") required in Tx62 and Tx70 girders. At the fabricator's option bars larger than #6 may be used. When L is less than 50 ft, Bars P are to be the same length as Bars T.

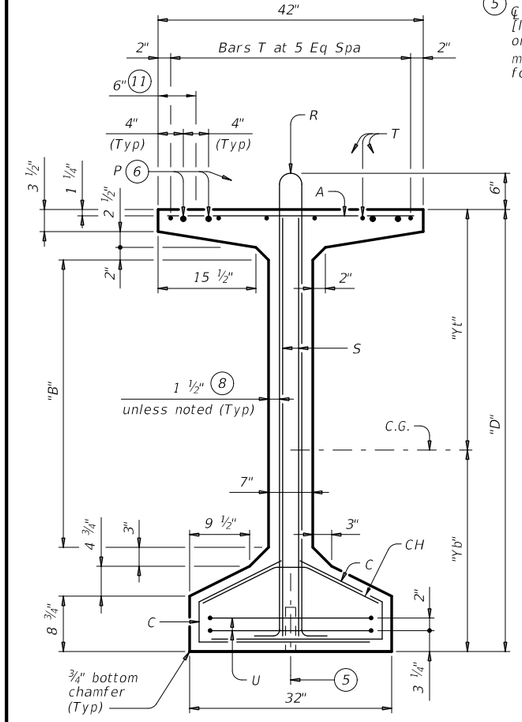
(7) Bars P (#6 x 15'-0") are only required in Tx28, Tx34, Tx40, Tx46, and Tx54 girders when "e" at girder ends exceeds 0.25 x "D". At the fabricator's option bars larger than #6 may be used. When L is less than 50 ft, Bars P are to be the same length as Bars T.

(8) 1 ⅜" Clear Cover to Bars S.

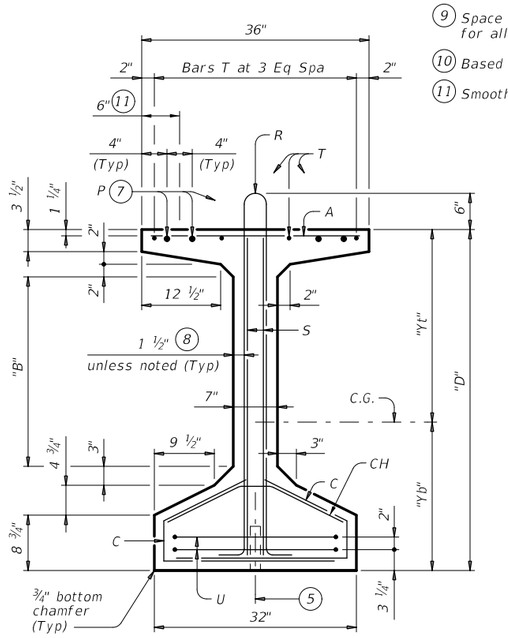
(9) Space Bars A at 6" Max for girders requiring overhang bracket hangers. Space at 12" Max for all other girders. Tie to Bars R as necessary. See standard IGMS for "Deck Forming Notes".

(10) Based on 155 pcf total weight of concrete and reinforcing steel.

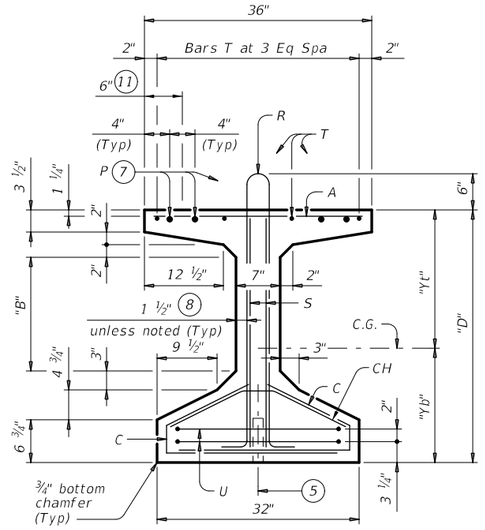
(11) Smooth trowel finish on the slab overhang side of exterior girder.



TYPE Tx62 & Tx70



TYPE Tx46 & Tx54



TYPE Tx28, Tx34 & Tx40

GIRDER DIMENSIONS AND SECTION PROPERTIES

Girder Type	"D" (in.)	"B" (in.)	"Yt" (in.)	"Yb" (in.)	Area (in.²)	"Ix" (in.⁴)	"Iy" (in.⁴)	Weight (10) (plf)
Tx28	28	6	15.02	12.98	585	52,772	40,559	630
Tx34	34	12	18.49	15.51	627	88,355	40,731	675
Tx40	40	18	21.90	18.10	669	134,990	40,902	720
Tx46	46	22	25.90	20.10	761	198,089	46,478	819
Tx54	54	30	30.49	23.51	817	299,740	46,707	880
Tx62	62	37 ½"	33.72	28.28	910	463,072	57,351	980
Tx70	70	45 ½"	38.09	31.91	966	628,747	57,579	1,040

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.
Provide Class H concrete.
Provide Grade 60 reinforcing steel.
An equal area of deformed Welded Wire Reinforcement (WWR) (ASTM A1064) may be substituted for Bars A, C, R or T unless otherwise noted.
It is permissible for bars or strands to come in contact with materials used in forming anchor holes.
When vertical clearance of the span is less than or equal to 20', provide additional Bars C and CH in every girder of that span.

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

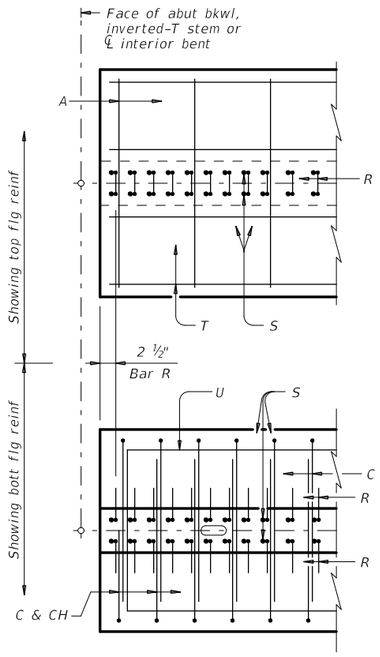
Bridge Division Standard

PRESTRESSED CONCRETE I-GIRDER DETAILS

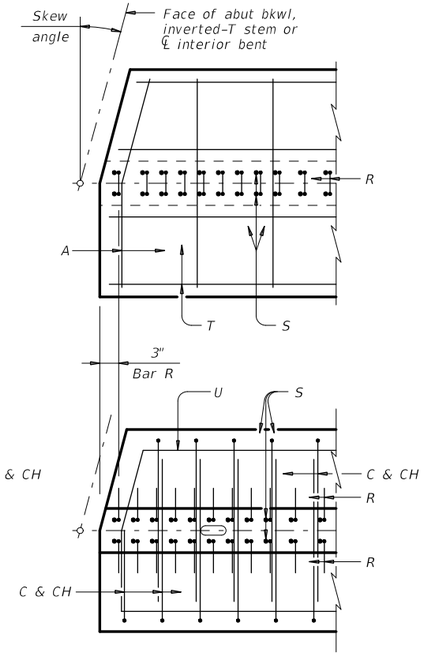
IGD

FILE: IG-IGD-23.dgn	DN: TxDOT	CK: JMH	DW: JTR	CK: TAR
©TxDOT August 2017	CONT	SECT	JOB	HIGHWAY
REVISIONS 10-19: Added Bars C and CH full length for VC<= 20' 3-23: Clarified C and CH requirement	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		108

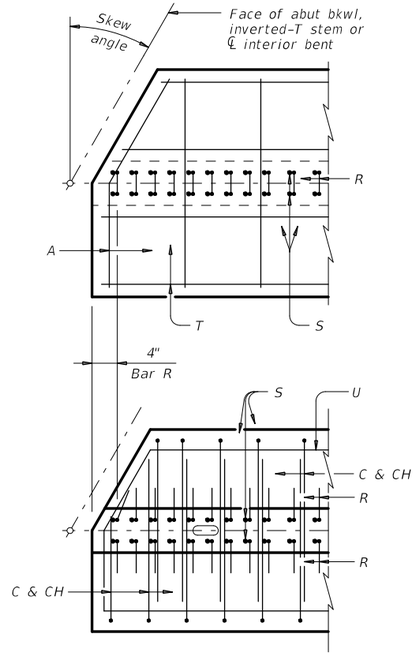
DATE:
FILE:



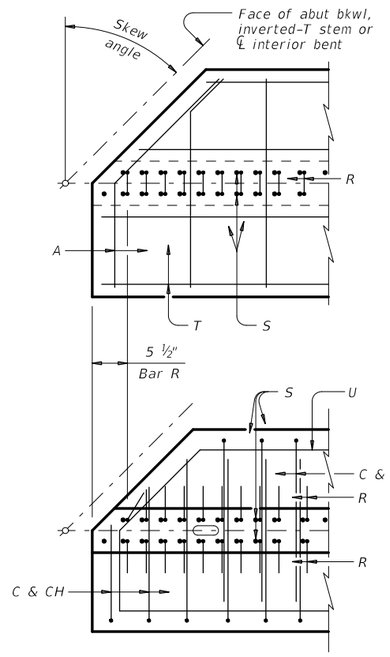
0° SKEW



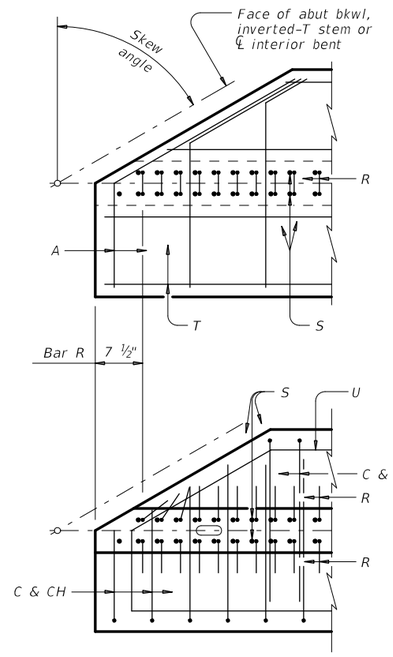
15° SKEW



30° SKEW



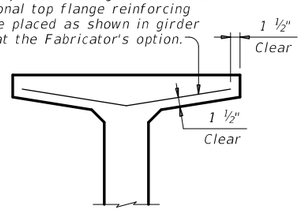
45° SKEW



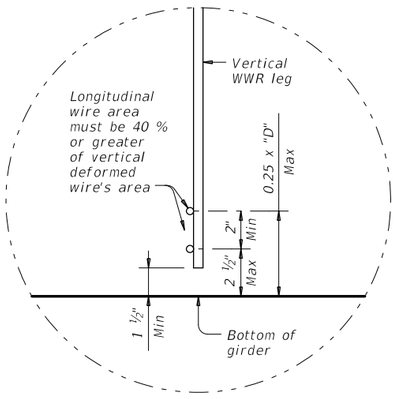
60° SKEW

PLAN OF GIRDER ENDS (12)

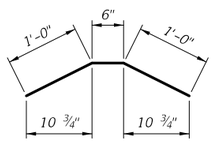
To control top flange cracking that may occur during form removal, additional top flange reinforcing may be placed as shown in girder ends at the Fabricator's option.



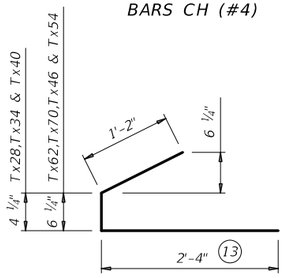
OPTIONAL TOP FLANGE REINFORCING DETAIL



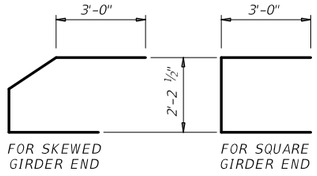
OPTIONAL WELDED WIRE REINFORCEMENT (WWR) DETAIL



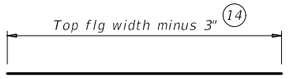
BARS CH (#4)



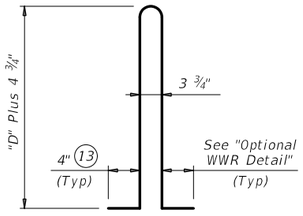
BARS C (#4)



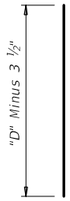
BARS U (#5)



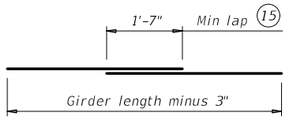
BARS A (#3)



BARS R (#4) (16)



BARS S (#6)



BARS T (#4)

(12) Reinforcing patterns shown are provided as guides to determine reinforcement placement in skewed ends. Place Bars S as close to girder end as cover requirements permit, which may prevent them to be bundled with Bars R.

(13) Bars may be cut or bent at skewed end as required.

(14) Increase as necessary for bars at skewed end.

(15) No portion of bar less than 10 ft.

(16) For Welded Wire Reinforcement (WWR) option, area of Bars R may be reduced in proportion to the increase in reinforcement yield strength over 60 ksi. Yield strength of WWR is limited to 75 ksi.

HL93 LOADING

SHEET 2 OF 2

Texas Department of Transportation

Bridge Division Standard

PRESTRESSED CONCRETE I-GIRDER DETAILS

IGD

FILE: IG-IGD-23.dgn	DN: TxDOT	CK: JMH	DW: JTR	CK: TAR
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REVISIONS 10-19: Added Bars C and CH full length for VC<= 20' 3-23: Clarifed C and CH requirement	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		109

DATE:
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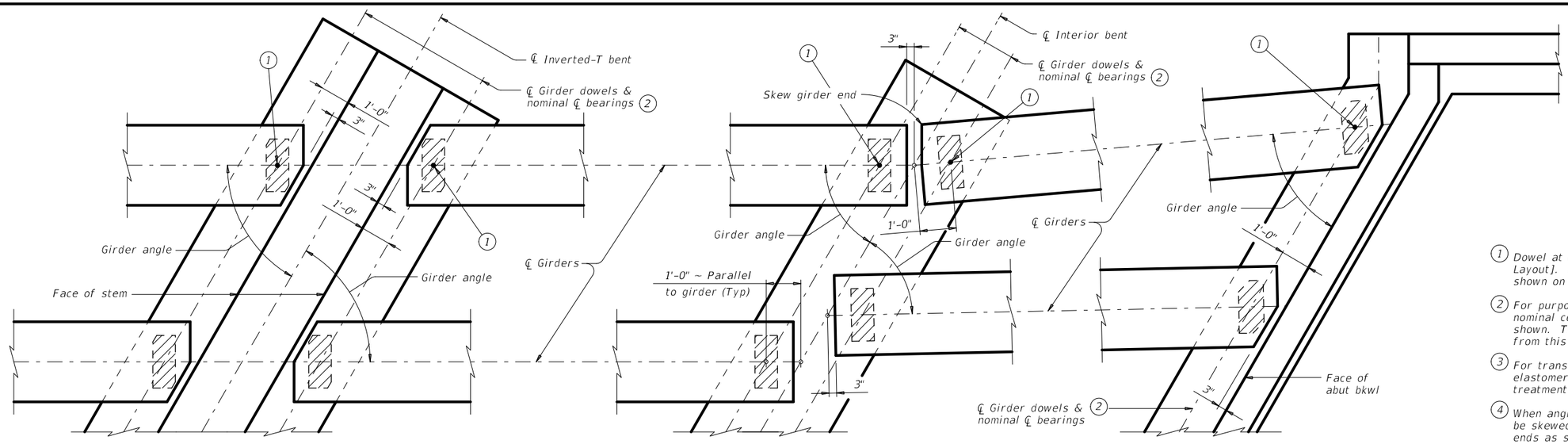


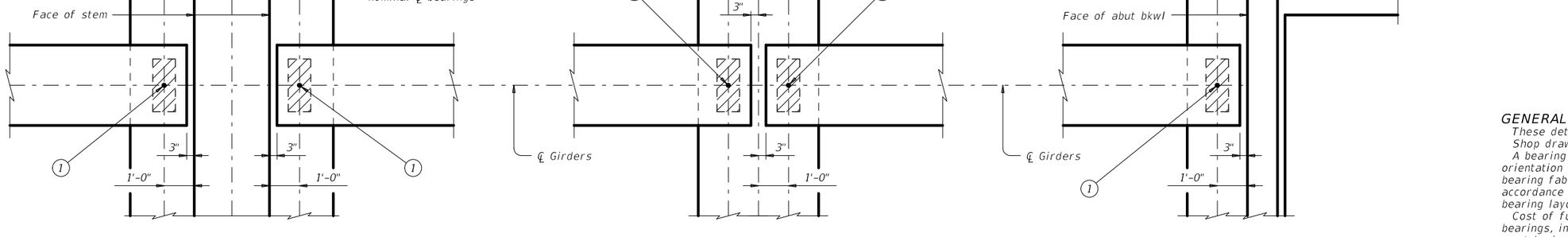
(1) Dowel at doweled girder end [labeled (D) on Bridge Layout]. Required for outside girder only or as shown on substructure details.

(2) For purposes of computing bearing seat elevations, nominal centerline of bearing must be defined as shown. The actual center of bearing pad may vary from this line.

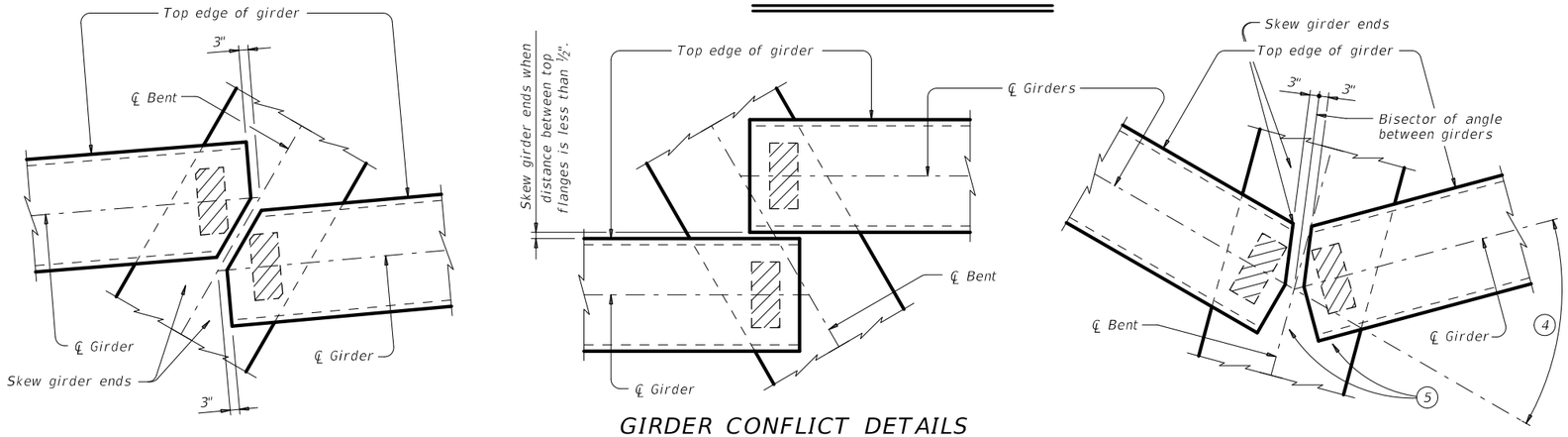
(3) For transition bents with backwall, girder and elastomeric bearings must receive the same treatment as shown for abutments.

(4) When angle exceeds 0°, one or both girders ends must be skewed to maintain the clearance between girder ends as shown in view.

(5) See Table of Bearing Pad Dimensions for bearing size. Girder end skew angles in Table not applicable for this situation. Table reflects girder conflicts of this type on radial bents only.



GIRDER END DETAILS



GIRDER CONFLICT DETAILS

GENERAL NOTES:

These details accommodate skew angles up to 60°.
Shop drawings for approval are required.
A bearing layout which identifies location and orientation of all bearings must be developed by the bearing fabricator. Permanently mark each bearing in accordance with the bearing layout. A copy of the bearing layout is to be provided to the Engineer.
Cost of furnishing and installing elastomeric bearings, including beveled and embedded steel plates, must be included in unit price bid for "Prestressed Concrete Girders".

HL93 LOADING SHEET 1 OF 3

Texas Department of Transportation

Bridge Division Standard

ELASTOMERIC BEARING AND GIRDER END DETAILS
PRESTR CONCRETE I-GIRDERS

IGEB

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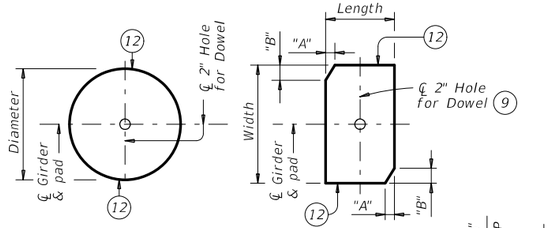
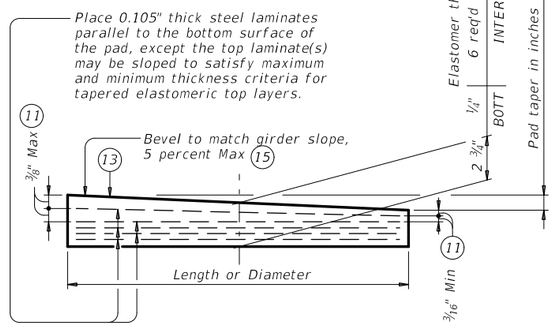
REVISIONS	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		110

DATE:
FILE:



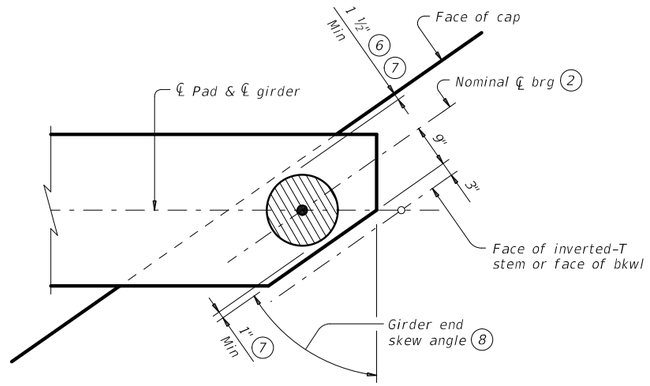
PLANS (10)



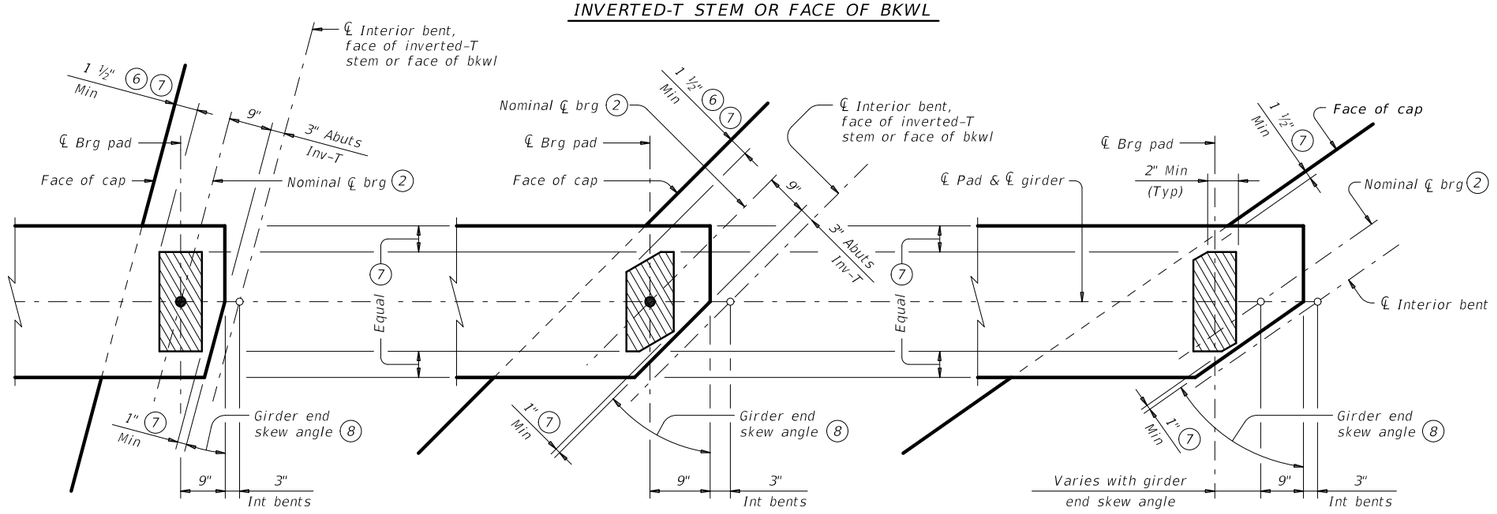
ELEVATION

LAMINATED ELASTOMERIC BEARING PAD

(50 DUROMETER)



ROUND BEARINGS FOR SKEWED GIRDER ENDS AT FACE OF INVERTED-T STEM OR FACE OF BKWL



SKEWED GIRDER ENDS AT INT BENTS, FACE OF INVERTED-T STEM OR FACE OF BKWL

SKEWED GIRDER ENDS AT CONVENTIONAL INTERIOR BENTS (16)

(NO GIRDER DOWELS)

BEARING PAD PLACEMENT DIAGRAMS

TABLE OF MINIMUM SUBSTRUCTURE DIMENSIONS (14)

Girder Type	Abutments: Face of Bkwl to Face of Cap	Int Bents: Overall Cap Width	Inv-T Bents: Corbel Width
Tx28 thru Tx54	1'-9"	3'-6"	1'-10 ½"
Tx62 & Tx70	2'-0"	4'-0"	2'-1 ½"

TABLE OF BEARING PAD DIMENSIONS

Bent Type	Girder Type	Bearing Type (13)	Girder End Skew Angle Range	Pad Size Lgth x Width	Pad Clip Dimensions "A"	Pad Clip Dimensions "B"
ABUTMENTS, INVERTED-T AND TRANSITION BENTS WITH BACKWALLS	Tx28,Tx34, Tx40,Tx46 & Tx54	G-1-"N"	0° thru 21°	8" x 21"	---	---
		G-2-"N"	21°+ thru 30°	8" x 21"	1 ½"	2 ½"
		G-3-"N"	30°+ thru 45°	9" x 21"	4 ½"	4 ½"
		G-4-"N"	45°+ thru 60°	15" Dia	---	---
	Tx62 & Tx70	G-5-"N"	0° thru 21°	9" x 21"	---	---
		G-6-"N"	21°+ thru 30°	9" x 21"	1 ½"	2 ½"
		G-7-"N"	30°+ thru 45°	10" x 21"	4 ½"	4 ½"
		G-8-"N"	45°+ thru 60°	10" x 21"	7 ¼"	4 ¼"
CONVENTIONAL INTERIOR BENTS	Tx28,Tx34, Tx40,Tx46 & Tx54	---	---	---	---	---
		---	---	---	---	---
		G-1-"N"	0° thru 60°	8" x 21"	---	---
	Tx62 & Tx70	G-5-"N"	0° thru 60°	9" x 21"	---	---
CONVENTIONAL INTERIOR BENTS WITH SKEWED GIRDER ENDS (GIRDER CONFLICTS) (16)	Tx28,Tx34, Tx40,Tx46 & Tx54	G-1-"N"	0° thru 18°	8" x 21"	---	---
		G-2-"N"	18°+ thru 30°	8" x 21"	1 ½"	2 ½"
		G-9-"N"	30°+ thru 45°	8" x 21"	3"	3"
		G-10-"N"	45°+ thru 60°	9" x 21"	6"	3 ½"
	Tx62 & Tx70	G-5-"N"	0° thru 18°	9" x 21"	---	---
		G-5-"N"	18°+ thru 30°	9" x 21"	---	---
		G-11-"N"	30°+ thru 45°	9" x 21"	1 ½"	1 ½"
		G-12-"N"	45°+ thru 60°	9" x 21"	3"	1 ¾"

(2) For purposes of computing bearing seat elevations, nominal centerline of bearing must be defined as shown. The actual center of bearing pad may vary from this line.

(6) 3" for inverted-T.

(7) Place centerline pad as near nominal centerline bearing as possible between limits shown.

(8) Girder end skew angle is equal to 90° minus the girder angle except at some conflicting girders.

(9) Provide 2" dia hole only at locations required. See Substructure details for location.

(10) See Table of Bearing Pad Dimensions for dimensions.

(11) Maximum and minimum layer thicknesses shown are for elastomer only, on tapered layers.

(12) Locate Permanent Mark here.

(13) Indicate BEARING TYPE on all pads. For tapered pads, locate BEARING TYPE on the high side. The Fabricator must include the value of "N" (amount of taper in ⅛" increments) in this mark.
Examples: N=0, (for 0" taper)
N=1, (for ⅛" taper)
N=2, (for ¼" taper)
(etc.)
Fabricated pad top surface slope must not vary from plan girder slope by more than $\left(\frac{0.0625"}{\text{Length or Dia}}\right)$ IN/IN.

(14) Substructure dimensions must satisfy the minimums provided to accommodate the elastomeric bearings shown on this standard.

(15) See sheet 3 of 3 for beveled plate use when slopes exceed 5 percent.

(16) If girder end is skewed for a girder conflict at an interior bent and a beveled sole plate is required, use bearing type for abutments at this location. Location of bearing centerline is to be set as for abutments in this case.

HL93 LOADING SHEET 2 OF 3

Texas Department of Transportation

Bridge Division Standard

ELASTOMERIC BEARING AND GIRDER END DETAILS

PRESTR CONCRETE I-GIRDERS

IGEB

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	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		111

DATE:
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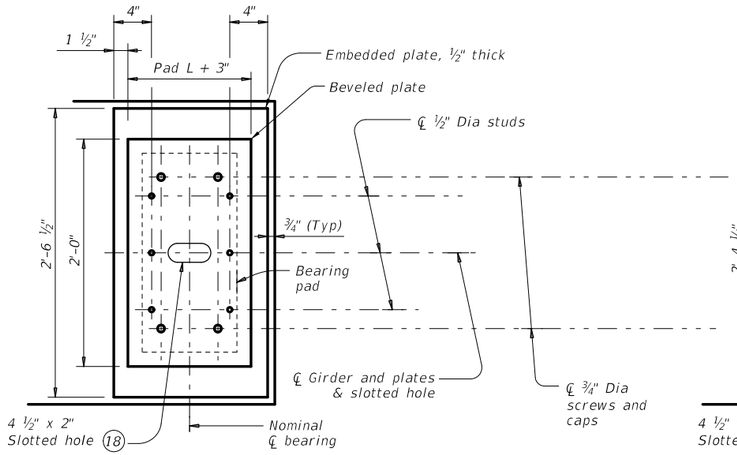
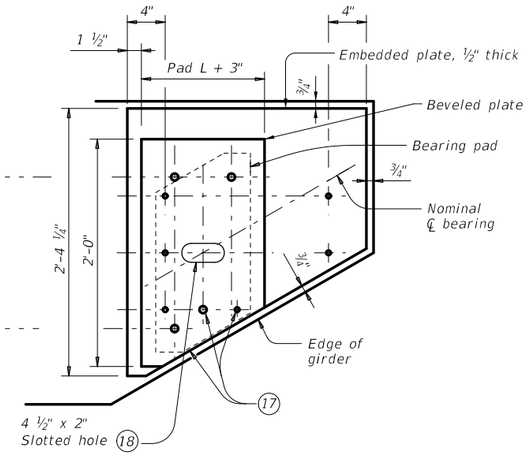
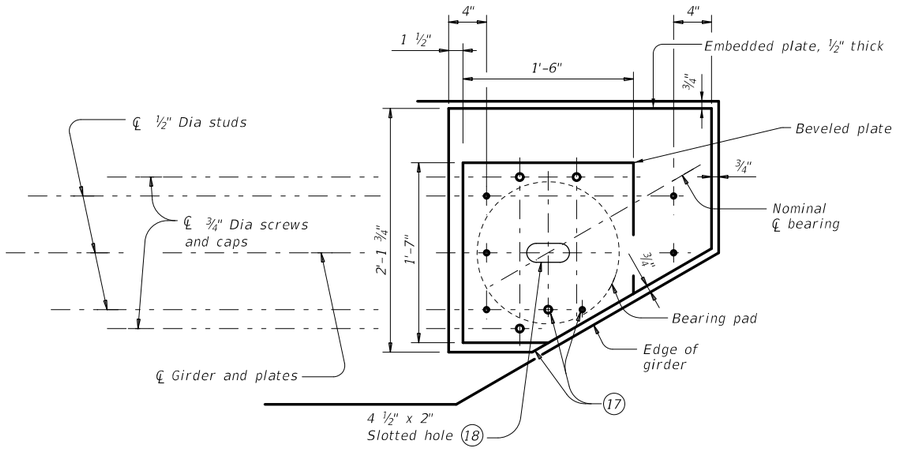


NORMAL GIRDER END
RECTANGULAR BEARING PAD

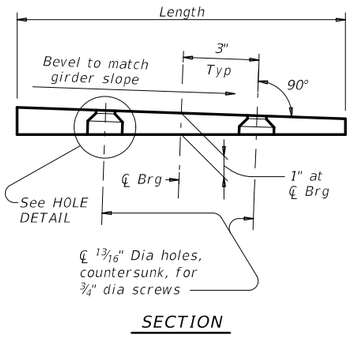


SKEWED GIRDER END
CLIPPED RECTANGULAR BEARING PAD

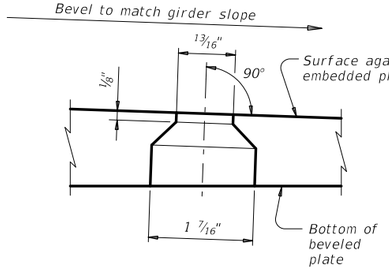


SKEWED GIRDER END
15" DIA BEARING PAD

PLAN VIEW OF SOLE PLATE DETAILS



SECTION



HOLE DETAIL

(17) Cut beveled and embedded plates to match girder end skew. Adjust location of screw and stud as shown when necessary.

(18) Slotted hole is required at doweled girder end locations.

SOLE PLATE NOTES:

Provide constant thickness elastomeric bearings with beveled and embedded steel sole plates in accordance with these details when the girder slope exceeds 5 percent or if otherwise required in the plans. Provide for all girders in the span.

On the shop drawings, dimension sole plates to the nearest 1/16" based on required thickness at centerline of bearing and slope of girder. Thickness tolerance variation from the approved shop drawings is 1/16"+/-, except variation from a plane parallel to the theoretical top surface can not exceed 1/16" total. Bearing surface tolerances listed in Item 424 apply to embedded and beveled plates.

Steel plate must conform to ASTM A36, A572 Gr 50, or A709 Gr 36 or Gr 50. Hot dip galvanize both the embedded plate and beveled sole plate after fabrication. Seal weld caps to embedded plate before galvanizing.

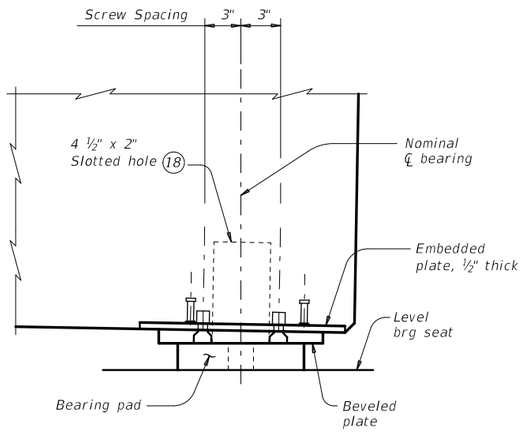
When determining if relocation of screw holes and studs are necessary for skewed girder ends, minimum clearance from screw or stud centerline to plate edge is 1.25".

Tap threads in the embedded plate only. Drill and tap prior to galvanizing.

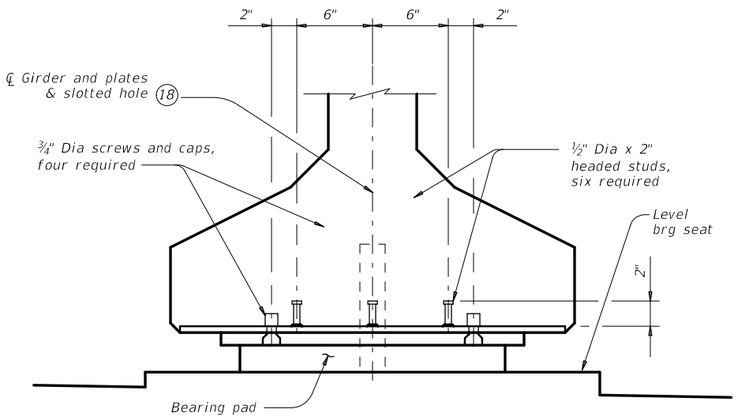
¾" Dia screws must be electroplated, socket flat head countersunk cap screws conforming to ASTM F835. Electroplating must conform to ASTM B633, SC 2, Type I. Provide screws long enough to maintain a ¾" minimum embedment into the embedded plate and galvanized cap. Provide galvanized steel caps (16 ga Min) with a nominal 1" inside diameter and deep enough to accommodate the screws, but not less than ½" deep or deeper than 1".

Install beveled sole plates prior to shipping girders. Installed screw heads must not protrude below the bottom of the beveled plate.

BEVELED PLATE DETAILS



SIDE ELEVATION



END ELEVATION
Showing normal girder end.

GIRDER DETAILS

HL93 LOADING SHEET 3 OF 3

Texas Department of Transportation

Bridge Division Standard

ELASTOMERIC BEARING AND GIRDER END DETAILS
PRESTR CONCRETE I-GIRDERS

IGEB

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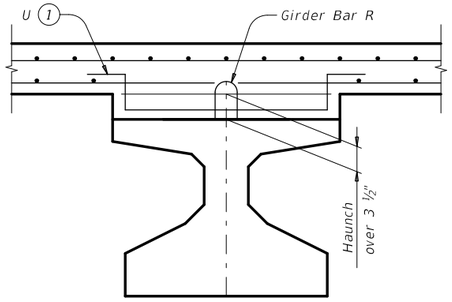
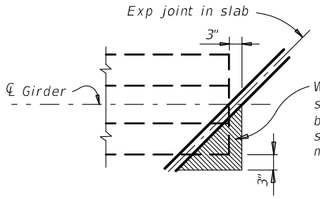
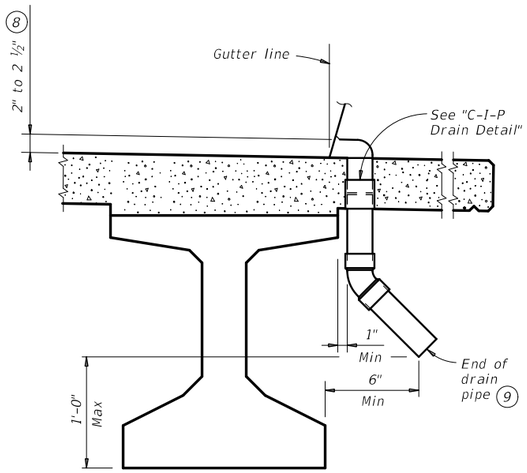


HAUNCH REINFORCING DETAIL

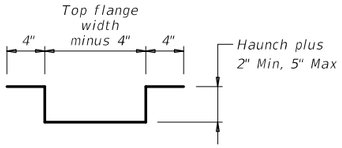


Where flanges project under slab of adjacent span, provide a minimum of ½" clearance between top of girder and bottom of adjacent slab. Polystyrene or other suitable compressible material may be used as a filler.

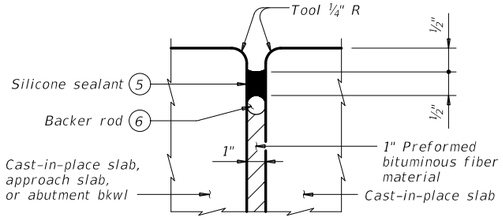
TREATMENT AT GIRDER END FOR SKEWED SPANS



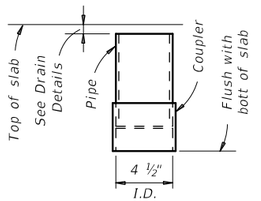
DRAIN DETAIL (10)



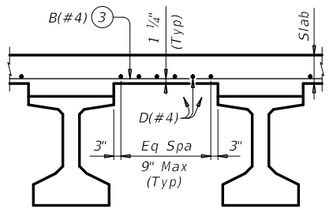
BARS U (#4)



TYPE A JOINT DETAIL (7)



C-I-P DRAIN DETAIL (2)



TYPICAL PART TRANSVERSE SLAB SECTION WITHOUT PCP (4)

Top reinforcing steel not shown for clarity.

(1) Space Bars U with girder Bars R in all areas where measured haunch exceeds 3 ½".

(2) Roughen outside of PVC with coarse rasp or equal to ensure bond with cast-in-place concrete.

(3) Bars B(#4) spaced at 9" Max with 2" end cover. Overhang option, Contractor's may end alternating bars B(#4) at centerline outside girder.

(4) Provide Grade 60 reinforcing steel. Provide bar laps, where required, as follows:
Uncoated ~ #4 = 1'-7"
Epoxy coated ~ #4 = 2'-5"

(5) Class 7 silicone sealant that conforms to DMS-6310. Install when ambient temperature is between 55°F and 85°F and rising. Engineer to determine allowable hours for sealant application.

(6) 1 ¼" backer rod must be compatible with joint sealant. Use of multiple pieces to create a backer rod cross section is not permitted. Top of backer rod must be convex as shown.

(7) The maximum distance between Type A expansion joints is 100'. See Bridge Layout for location of joints.

(8) Drain entrance formed in rail or sidewalk.

(9) Water may not be discharged onto girders.

(10) All drain pipe and fittings to be 4" diameter (Sch 40) PVC. See Item 481 "Pipe for Drains" for pipe, connections and solvent welding. Bend reinforcing steel to clear PVC 1". Drain length and location is as directed by the Engineer. Drains are not permitted over roadways or railways, or within 10'-0" of bent caps. Degrease outside of exposed PVC, apply acrylic water base primer, then coat with same surface finishing material as used for outside girder face. Variations of the above designs, as required for the type of rail used and its location on the structure, may be installed with the approval and direction of the Engineer.

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.

Payment for Type A joint will be as per Item 454, "Bridge Expansion Joints."

All other items (reinforcing steel, drains, etc.) shown on this sheet are subsidiary to other bid items.

Cover dimensions are clear dimensions, unless noted otherwise.

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

DECK FORMWORK NOTES:

Overhang bracket hangers are limited to a safe working load of 3,600 lbs, applied to and along the axis of a coil rod at 45 degrees from vertical, regardless of higher loads permitted by hanger manufacturers. Do not place a hanger less than 12" from girder end. Space hangers accordingly.

Texas Department of Transportation

Bridge Division Standard

MISCELLANEOUS SLAB DETAILS

PRESTR CONCRETE I-GIRDERS

IGMS

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REVISIONS	0724	02	020, ETC.		FM 219	
10-19: Modified Note 7. Type A now a pay item.	DIST	COUNTY			SHEET NO.	
	WACO	BOSQUE			113	

DATE:
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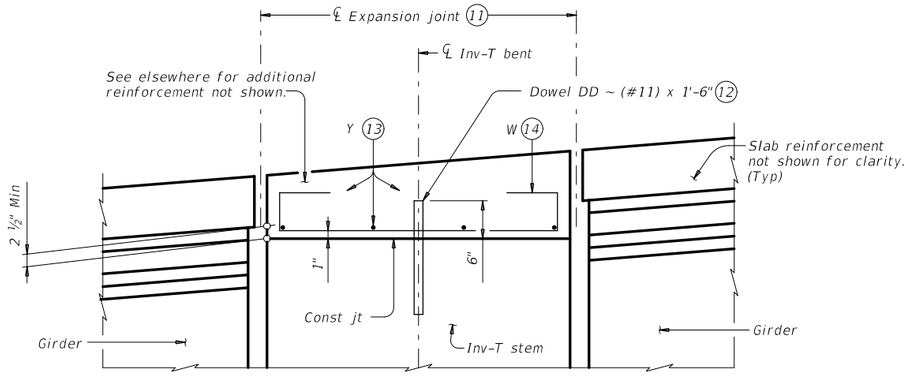
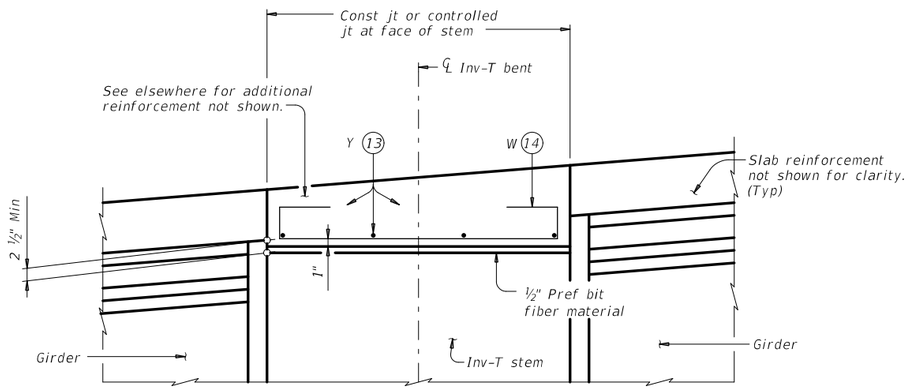
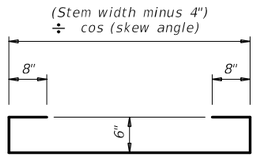


SHOWING EXPANSION JOINTS

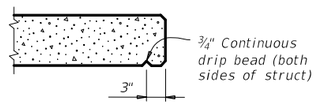


SHOWING CONST JTS OR CONTROLLED JTS

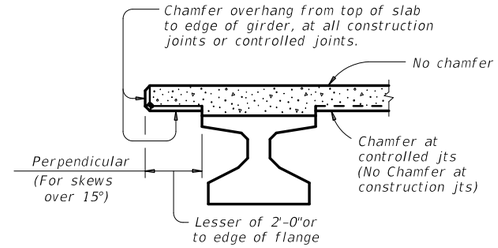
REINFORCEMENT OVER INV-T BENTS



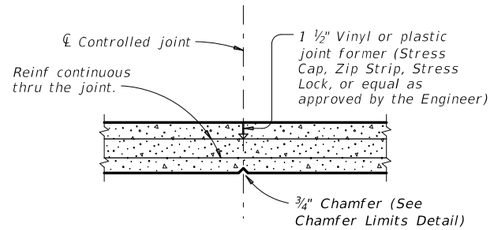
BARS W (#4)



DRIP BEAD DETAIL



CHAMFER LIMITS DETAIL (15)



CONTROLLED JOINT DETAIL

(Saw-cutting is not allowed)

(11) See Layout for joint type.

(12) Dowels DD (#11) spaced at 5 Ft Max. See Inv-T bents for quantity and location.

(13) Space Bars Y (#4) at 12" Max. Use 2" end cover. Number of Bars Y must satisfy spacing limit. Place parallel to bent.

(14) Space Bars W at 12" Max (3" from end of cap). Tilt if necessary to maintain cover requirements. Place parallel to longitudinal slab reinforcement.

(15) See Span details for type of joint and joint locations.

Texas Department of Transportation

Bridge Division Standard

MISCELLANEOUS SLAB DETAILS

PRESTR CONCRETE I-GIRDERS

IGMS

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10-19: Modified Note 7. Type A now a pay item.		DIST	COUNTY			SHEET NO.	
		WACO	BOSQUE			114	

STRUCTURE	DESIGNED GIRDERS									DEPRESSED STRAND PATTERN		CONCRETE		OPTIONAL DESIGN					LOAD RATING FACTORS			
	SPAN NO.	GIRDER NO.	GIRDER TYPE	PRESTRESSING STRANDS						NO.	TO END (in)	RELEASE STRGTH (1) f'ci (ksi)	MINIMUM 28 DAY COMP STRGTH f'c (ksi)	DESIGN LOAD COMP STRESS (TOP ℄) (SERVICE I) fct(ksi)	DESIGN LOAD TENSILE STRESS (BOTT ℄) (SERVICE III) fcb(ksi)	REQUIRED MINIMUM ULTIMATE MOMENT CAPACITY (STRENGTH I) (kip-ft)	LIVE LOAD DISTRIBUTION FACTOR (2)		STRENGTH I		SERVICE III
				NON-STD STRAND PATTERN	TOTAL NO.	SIZE (in)	STRGTH fpu (ksi)	"e" ℄ (in)	"e" END (in)								Moment	Shear	Inv	Opr	Inv
Type Tx28 Girders 44' Roadway 8.5" Slab	40	ALL	Tx28		12	0.6	270	10.48	10.48			4.700	5.000	1.118	-1.542	1586	0.760	0.960	1.71	2.22	2.09
	45	ALL	Tx28		12	0.6	270	10.48	10.48			4.500	5.500	1.403	-1.879	1555	0.740	0.970	1.39	1.80	1.53
	50	ALL	Tx28		14	0.6	270	10.48	9.62	2	8.5	4.000	5.200	1.733	-2.266	1813	0.710	0.970	1.37	1.78	1.34
	55	ALL	Tx28		16	0.6	270	10.23	9.23	4	8.5	4.000	5.600	2.083	-2.688	2121	0.700	0.980	1.31	1.69	1.13
	60	ALL	Tx28		20	0.6	270	9.88	6.28	4	22.5	4.000	6.300	2.478	-3.135	2424	0.680	0.980	1.60	2.07	1.30
	65	ALL	Tx28		24	0.6	270	9.65	6.31	4	24.5	4.700	6.500	2.879	-3.586	2725	0.660	0.980	1.45	1.94	1.12
	70	ALL	Tx28		28	0.6	270	9.48	6.62	4	24.5	5.600	7.000	3.340	-4.101	3068	0.650	0.990	1.28	1.82	1.11
Type Tx34 Girders 44' Roadway 8.5" Slab	40	ALL	Tx34		12	0.6	270	13.01	13.01			4.000	5.000	0.881	-1.184	1785	0.790	0.940	2.01	2.60	2.70
	45	ALL	Tx34		12	0.6	270	13.01	13.01			4.000	5.000	1.110	-1.440	1920	0.760	0.950	1.66	2.15	2.10
	50	ALL	Tx34		14	0.6	270	13.01	13.01			5.100	6.100	1.359	-1.735	2194	0.740	0.950	1.63	2.12	1.87
	55	ALL	Tx34		14	0.6	270	13.01	13.01			4.900	5.900	1.642	-2.056	2186	0.720	0.960	1.34	1.74	1.40
	60	ALL	Tx34		16	0.6	270	12.76	11.76	4	8.5	4.000	5.000	1.934	-2.383	2493	0.700	0.960	1.33	1.73	1.24
	65	ALL	Tx34		18	0.6	270	12.57	11.23	4	10.5	4.000	5.200	2.267	-2.754	2839	0.690	0.960	1.21	1.68	1.07
	70	ALL	Tx34		22	0.6	270	12.28	7.92	4	28.5	4.000	5.700	2.604	-3.128	3186	0.680	0.970	1.44	1.86	1.09
	75	ALL	Tx34		26	0.6	270	12.09	8.40	4	28.5	4.800	6.000	2.980	-3.521	3523	0.660	0.970	1.55	2.01	1.14
	80	ALL	Tx34		30	0.6	270	11.81	7.41	6	28.5	5.200	6.200	3.356	-3.927	3886	0.650	0.970	1.37	2.01	1.10
	85	ALL	Tx34		34	0.6	270	11.48	7.60	6	28.5	5.900	6.600	3.782	-4.375	4273	0.640	0.980	1.37	1.75	1.06
Type Tx40 Girders 44' Roadway 8.5" Slab	40	ALL	Tx40		10	0.6	270	15.60	15.60			4.000	5.000	0.727	-0.959	1847	0.820	0.930	1.84	2.39	2.77
	45	ALL	Tx40		12	0.6	270	15.60	15.60			4.000	5.000	0.913	-1.165	2181	0.790	0.930	1.90	2.47	2.61
	50	ALL	Tx40		14	0.6	270	15.60	15.60			4.500	5.500	1.125	-1.410	2588	0.770	0.940	1.87	2.42	2.34
	55	ALL	Tx40		14	0.6	270	15.60	15.60			4.300	5.300	1.347	-1.662	2519	0.750	0.940	1.55	2.01	1.84
	60	ALL	Tx40		16	0.6	270	15.35	14.35	4	8.5	4.000	5.000	1.598	-1.935	2633	0.730	0.950	1.54	2.00	1.66
	65	ALL	Tx40		16	0.6	270	15.35	14.35	4	8.5	4.000	5.000	1.868	-2.224	2927	0.710	0.950	1.31	1.70	1.29
	70	ALL	Tx40		18	0.6	270	15.16	14.27	4	8.5	4.000	5.000	2.144	-2.525	3287	0.700	0.950	1.30	1.69	1.16
	75	ALL	Tx40		20	0.6	270	15.00	13.40	4	12.5	4.000	5.000	2.451	-2.841	3637	0.680	0.950	1.31	1.76	1.03
	80	ALL	Tx40		24	0.6	270	14.77	9.43	4	36.5	4.000	5.400	2.758	-3.168	4013	0.670	0.960	1.31	1.89	1.09
	85	ALL	Tx40		28	0.6	270	14.60	10.03	4	36.5	4.800	5.600	3.106	-3.529	4415	0.660	0.960	1.42	2.03	1.12
	90	ALL	Tx40		32	0.6	270	14.23	8.60	6	36.5	5.100	5.700	3.445	-3.881	4809	0.650	0.960	1.51	2.11	1.11
	95	ALL	Tx40		34	0.6	270	14.07	10.19	6	28.5	5.800	6.800	3.829	-4.272	5232	0.640	0.970	1.40	1.85	1.02
Type Tx46 Girders 44' Roadway 8.5" Slab	40	ALL	Tx46		10	0.6	270	17.60	17.60			4.000	5.000	0.638	-0.765	1924	0.850	0.920	2.04	2.65	3.31
	45	ALL	Tx46		12	0.6	270	17.60	17.60			4.000	5.000	0.800	-0.930	2275	0.820	0.920	2.11	2.74	3.13
	50	ALL	Tx46		12	0.6	270	17.60	17.60			4.000	5.000	0.983	-1.120	2688	0.790	0.920	1.73	2.25	2.47
	55	ALL	Tx46		14	0.6	270	17.60	17.60			4.000	5.000	1.184	-1.328	3015	0.770	0.930	1.75	2.27	2.28
	60	ALL	Tx46		14	0.6	270	17.60	17.60			4.000	5.000	1.406	-1.555	2964	0.760	0.930	1.45	1.88	1.78
	65	ALL	Tx46		16	0.6	270	17.35	16.35	4	8.5	4.000	5.000	1.629	-1.779	3161	0.740	0.930	1.47	1.91	1.66
	70	ALL	Tx46		16	0.6	270	17.35	16.85	4	6.5	4.000	5.000	1.880	-2.022	3426	0.720	0.940	1.26	1.63	1.30
	75	ALL	Tx46		18	0.6	270	17.16	15.83	4	10.5	4.000	5.000	2.151	-2.287	3827	0.710	0.940	1.27	1.64	1.18
	80	ALL	Tx46		20	0.6	270	17.00	15.40	4	12.5	4.000	5.000	2.422	-2.552	4226	0.700	0.940	1.26	1.65	1.07
	85	ALL	Tx46		24	0.6	270	16.77	14.10	4	20.5	4.000	5.000	2.725	-2.843	4652	0.690	0.940	1.43	1.86	1.11
	90	ALL	Tx46		28	0.6	270	16.60	11.46	4	40.5	4.200	5.100	3.022	-3.129	5071	0.680	0.950	1.55	2.03	1.15
	95	ALL	Tx46		32	0.6	270	16.23	9.48	6	42.5	4.400	5.300	3.358	-3.445	5521	0.670	0.950	1.62	2.15	1.13
	100	ALL	Tx46		34	0.6	270	16.07	10.43	6	38.5	4.900	5.600	3.710	-3.774	5983	0.660	0.950	1.43	2.07	1.03
	105	ALL	Tx46		38	0.6	270	15.81	10.76	6	38.5	5.500	6.300	4.063	-4.103	6444	0.650	0.950	1.52	2.14	1.05
	110	ALL	Tx46		42	0.6	270	15.60	10.75	6	40.5	6.000	6.900	4.429	-4.443	6915	0.640	0.950	1.58	1.83	1.06

NON-STANDARD STRAND PATTERNS

PATTERN	STRAND ARRANGEMENT AT ℄ OF GIRDER

(1) Based on the following allowable stresses (ksi):

Compression = 0.65 f'ci

Tension = $0.24\sqrt{f'ci}$

Optional designs must likewise conform.

(2) Portion of full HL93.

DESIGN NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications. Load rated using Load and Resistance Factor Rating according to AASHTO Manual for Bridge Evaluation.

Optional designs for girders 120 feet or longer must have a calculated residual camber equal to or greater than that of the designed girder.

Prestress losses for the designed girders have been calculated for a relative humidity of 60 percent. Optional designs must likewise conform.

FABRICATION NOTES:

Provide Class H concrete.

Provide Grade 60 reinforcing steel bars.

Use low relaxation strands, each pretensioned to 75 percent of fpu.

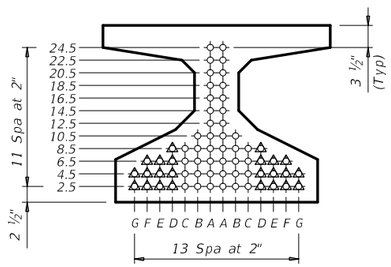
Strand debonding must comply with Item 424.4.2.2.2.4. Full-length debonded strands are only permitted in positions marked △. Double wrap full-length debonded strands in outer most position of each row.

When shown on this sheet, the Fabricator has the option of furnishing either the designed girder or an approved optional design. All optional design submittals must be signed, sealed and dated by a Professional Engineer registered in the State of Texas.

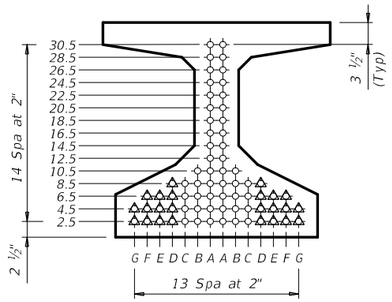
Seal cracks in girder ends exceeding 0.005" in width as directed by the Engineer. The fabricator is permitted to decrease the spacing of Bars R and S by providing additional bars to help limit crack width provided the decreased spacing results in no less than 1" clear between bars. The fabricator must take an approved corrective action if cracks greater than 0.005" form on a repetitive basis.

DEPRESSED STRAND DESIGNS:

Locate strands for the designed girder as low as possible on the 2" grid system unless a non-standard strand pattern is indicated. Fill row "2.5", then row "4.5", then row "6.5", etc., beginning each row in the "A" position and working outward until the required number of strands is reached. All strands in the "A" position must be depressed, maintaining the 2" spacing so that, at the girder ends, the upper two strands are in the position shown in the table.



TYPE Tx28



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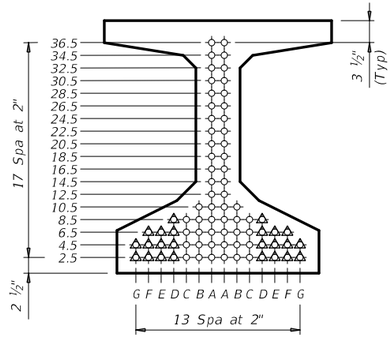

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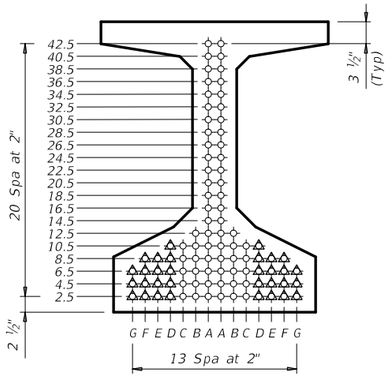


TYPE Tx46

HL93 LOADING

SHEET 1 OF 2

Texas Department of Transportation

Bridge Division Standard

PRESTRESSED CONCRETE I-GIRDER STANDARD DESIGNS

44' ROADWAY

IGSD-44

FILE: IG-IGSD44-21.dgn	DN: EFC	CK: AJF	DW: EFC	CK: TAR
©TxDOT August 2017	CONT	SECT	JOB	HIGHWAY
REVISIONS 10-19: Redesigned girders. 1-21: Added load rating.	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		115

DATE:
FILE:

DATE:
FILE:

STRUCTURE	DESIGNED GIRDERS									DEPRESSED STRAND PATTERN		CONCRETE		OPTIONAL DESIGN					LOAD RATING FACTORS			
	SPAN NO.	GIRDER NO.	GIRDER TYPE	PRESTRESSING STRANDS						NO.	TO END (in)	RELEASE STRGTH (1) f'ci (ksi)	MINIMUM 28 DAY COMP STRGTH f'c (ksi)	DESIGN LOAD COMP STRESS (TOP ℄) (SERVICE I) fct(ksi)	DESIGN LOAD TENSILE STRESS (BOTT ℄) (SERVICE III) fcb(ksi)	REQUIRED MINIMUM ULTIMATE MOMENT CAPACITY (STRENGTH I) (kip-ft)	LIVE LOAD DISTRIBUTION FACTOR (2)		STRENGTH I		SERVICE III
				NON-STD STRAND PATTERN	TOTAL NO.	SIZE (in)	STRGTH fpu (ksi)	"e" ℄ (in)	"e" END (in)								Moment	Shear	Inv	Opr	Inv
Type Tx54 Girders 44' Roadway 8.5" Slab	40	ALL	Tx54		10	0.6	270	21.01	21.01			4.000	5.000	0.530	-0.623	1989	0.880	0.910	2.33	3.03	3.97
	45	ALL	Tx54		12	0.6	270	21.01	21.01			4.000	5.000	0.662	-0.758	2354	0.850	0.910	2.42	3.13	3.78
	50	ALL	Tx54		12	0.6	270	21.01	21.01			4.000	5.000	0.812	-0.912	2784	0.820	0.910	2.00	2.59	3.04
	55	ALL	Tx54		14	0.6	270	21.01	21.01			4.000	5.000	0.978	-1.081	3245	0.800	0.920	2.02	2.61	2.83
	60	ALL	Tx54		14	0.6	270	21.01	21.01			4.000	5.000	1.157	-1.259	3617	0.780	0.920	1.71	2.21	2.31
	65	ALL	Tx54		16	0.6	270	20.76	20.26	4	6.5	4.000	5.000	1.350	-1.447	3859	0.760	0.920	1.73	2.25	2.17
	70	ALL	Tx54		16	0.6	270	20.76	20.26	4	6.5	4.000	5.000	1.548	-1.644	3811	0.750	0.920	1.48	1.92	1.76
	75	ALL	Tx54		18	0.6	270	20.56	19.67	4	8.5	4.000	5.000	1.766	-1.851	4040	0.730	0.930	1.51	1.96	1.66
	80	ALL	Tx54		18	0.6	270	20.56	19.67	4	8.5	4.000	5.000	2.002	-2.076	4367	0.720	0.930	1.30	1.69	1.31
	85	ALL	Tx54		20	0.6	270	20.41	18.81	4	12.5	4.000	5.000	2.251	-2.312	4809	0.710	0.930	1.12	1.45	1.01
	90	ALL	Tx54		22	0.6	270	20.28	18.46	4	14.5	4.000	5.000	2.496	-2.545	5246	0.700	0.930	1.33	1.73	1.13
	95	ALL	Tx54		24	0.6	270	20.17	17.84	4	18.5	4.000	5.000	2.771	-2.802	5712	0.690	0.930	1.33	1.73	1.02
	100	ALL	Tx54		28	0.6	270	20.01	14.29	4	44.5	4.000	5.000	3.060	-3.069	6192	0.680	0.940	1.48	1.93	1.05
	105	ALL	Tx54		32	0.6	270	19.63	11.38	6	50.5	4.100	5.000	3.338	-3.327	6660	0.670	0.940	1.61	2.09	1.07
	110	ALL	Tx54		36	0.6	270	19.34	12.01	6	50.5	4.700	5.400	3.652	-3.613	7163	0.660	0.940	1.53	2.04	1.02
	115	ALL	Tx54		38	0.6	270	19.22	12.27	6	50.5	5.000	5.900	3.980	-3.910	7680	0.650	0.940	1.49	2.00	1.04
	120	ALL	Tx54		42	0.6	270	19.01	12.72	6	50.5	5.600	6.500	4.311	-4.222	8253	0.650	0.940	1.50	2.01	1.07
	125	ALL	Tx54		46	0.6	270	18.66	11.36	8	50.5	5.800	7.100	4.665	-4.539	8796	0.640	0.940	1.45	1.87	1.04
Type Tx62 Girders 44' Roadway 8.5" Slab	60	ALL	Tx62		14	0.6	270	25.78	25.78			4.000	5.000	0.911	-1.054	3863	0.800	0.910	1.93	2.51	2.79
	65	ALL	Tx62		14	0.6	270	25.78	25.78			4.000	5.000	1.063	-1.217	4246	0.790	0.910	1.63	2.12	2.28
	70	ALL	Tx62		16	0.6	270	25.53	25.53			4.000	5.000	1.224	-1.383	4540	0.770	0.910	1.68	2.18	2.18
	75	ALL	Tx62		16	0.6	270	25.53	25.53			4.000	5.000	1.398	-1.564	4494	0.760	0.920	1.44	1.87	1.78
	80	ALL	Tx62		18	0.6	270	25.33	25.33			4.000	5.000	1.567	-1.736	4780	0.740	0.920	1.50	1.94	1.73
	85	ALL	Tx62		18	0.6	270	25.33	25.33			4.000	5.000	1.760	-1.933	5010	0.730	0.920	1.30	1.68	1.40
	90	ALL	Tx62		18	0.6	270	25.33	25.33			4.000	5.000	1.965	-2.140	5488	0.720	0.920	1.12	1.45	1.10
	95	ALL	Tx62		20	0.6	270	25.18	24.78	4	6.5	4.000	5.000	2.179	-2.355	5980	0.710	0.920	1.15	1.49	1.04
	100	ALL	Tx62		24	0.6	270	24.94	23.28	4	14.5	4.000	5.000	2.405	-2.579	6487	0.700	0.920	1.36	1.76	1.14
	105	ALL	Tx62		26	0.6	270	24.85	22.70	4	18.5	4.000	5.000	2.620	-2.795	6978	0.690	0.930	1.37	1.78	1.07
	110	ALL	Tx62		30	0.6	270	24.58	17.78	6	40.5	4.000	5.000	2.864	-3.035	7510	0.680	0.930	1.52	1.97	1.10
	115	ALL	Tx62		34	0.6	270	24.25	15.42	6	56.5	4.200	5.000	3.119	-3.284	8055	0.670	0.930	1.50	1.95	1.00
	120	ALL	Tx62		36	0.6	270	24.11	15.78	6	56.5	4.500	5.300	3.357	-3.518	8575	0.660	0.930	1.63	2.11	1.07
	125	ALL	Tx62		40	0.6	270	23.88	16.08	6	58.5	5.000	5.900	3.637	-3.798	9210	0.660	0.930	1.58	2.04	1.02
	130	ALL	Tx62		42	0.6	270	23.78	16.35	6	58.5	5.300	6.200	3.888	-4.044	9750	0.650	0.930	1.40	2.16	1.05
	135	ALL	Tx62		46	0.6	270	23.43	14.73	8	58.5	5.500	6.400	4.180	-4.324	10345	0.640	0.940	1.46	1.90	1.05

NON-STANDARD STRAND PATTERNS

PATTERN	STRAND ARRANGEMENT AT ℄ OF GIRDER

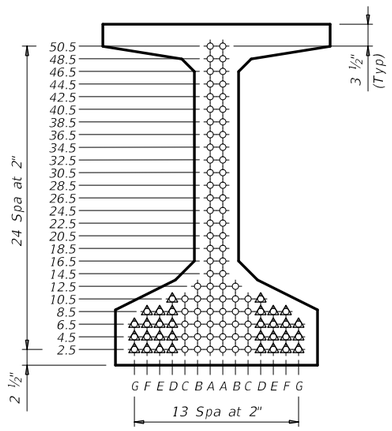
(1) Based on the following allowable stresses (ksi):

Compression = 0.65 f'ci

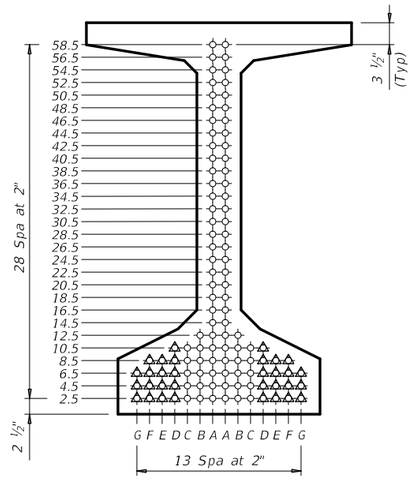
Tension = $0.24\sqrt{f'ci}$

Optional designs must likewise conform.

(2) Portion of full HL93.



TYPE Tx54



TYPE Tx62

HL93 LOADING

SHEET 2 OF 2

Texas Department of Transportation

Bridge Division Standard

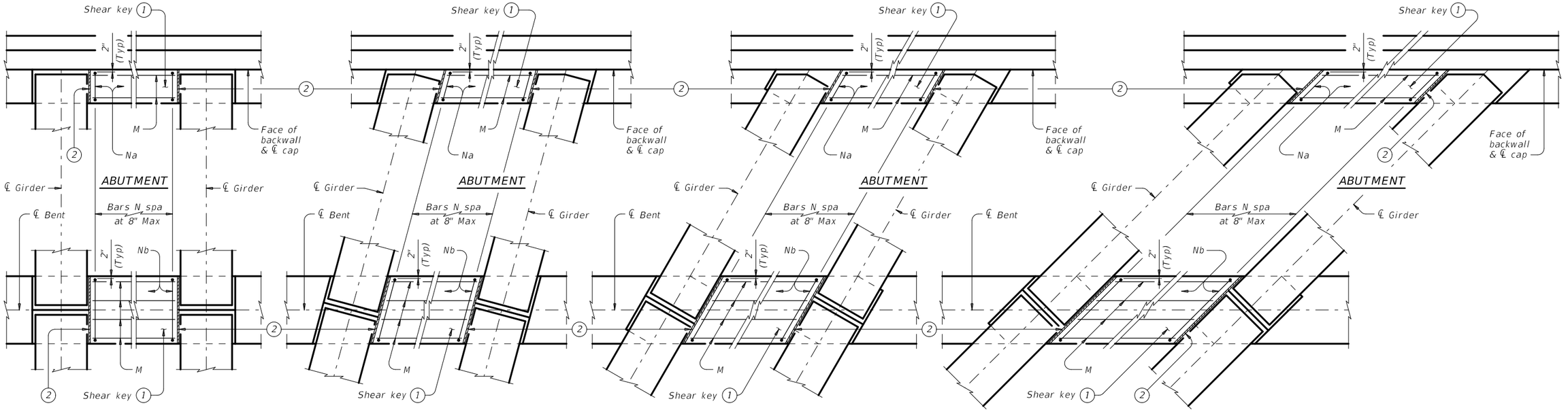
PRESTRESSED CONCRETE I-GIRDER STANDARD DESIGNS

44' ROADWAY

IGSD-44

FILE: IG-IGSD44-21.dgn	DN: EFC	CK: AJF	DW: EFC	CK: TAR
©TxDOT August 2017	CONT	SECT	JOB	HIGHWAY
REVISIONS 10-19: Redesigned girders. 1-21: Added load rating.	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		116

DATE:
FILE:



PARTIAL PLANS WITH NO SKEW

Showing shear keys on 3'-6" wide caps. 4'-0" caps similar.

PARTIAL PLANS WITH 15° SKEW

Showing shear keys on 3'-6" wide caps. 4'-0" caps similar.

PARTIAL PLANS WITH 30° SKEW

Showing shear keys on 3'-6" wide caps. 4'-0" caps similar.

PARTIAL PLANS WITH 45° SKEW

Showing shear keys on 3'-6" wide caps. 4'-0" caps similar.

(1) Place shear keys on the upstream side of structure between outside girder and next adjacent girder, unless shown otherwise on plans.

(2) UHMW polyethylene wear pad. (Typ)

(3) Leave a ¼" gap plus or minus between girder and face of wear pad. Cast wear pad with shear key, smooth side facing girder. Care must be taken to keep concrete from flowing under girder. Slope top of shear keys in accordance with Item 420.4.9, "Treatment and Finishing of Horizontal Surfaces."

(4) Measure at higher bearing seat elevation forward or back. Dimension based on typical bearing pad and bearing seat. Increase as necessary to maintain 5" overlap.

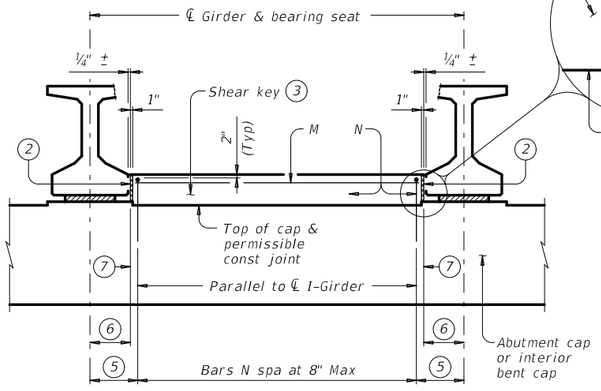
(5) With No Skew = 1'-8 ¼", measured along ℄ cap.
With Skew = 1'-8 ¼" ± Cos Skew, measured along ℄ cap.

(6) With No Skew = 1'-4 ¼", measured along ℄ cap.
With Skew = 1'-4 ¼" ± Cos Skew, measured along ℄ cap.

(7) Face of UHMW polyethylene wear pad. Smooth side of pad facing girder.

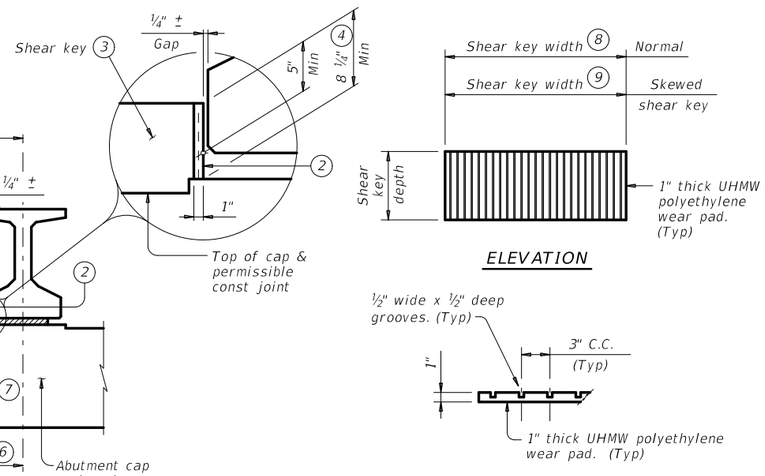
(8) Abutments = ½ Cap width.
Interior bents = Cap width.

(9) Abutments = ½ Cap width ± Cos Skew.
Interior bents = Cap width ± Cos Skew.



PARTIAL ELEVATION OF ABUTMENT OR INTERIOR BENT CAP (1)

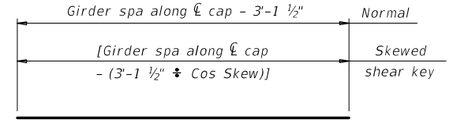
Showing shear key with girder Type Tx46.
Other I-Girder types similar.



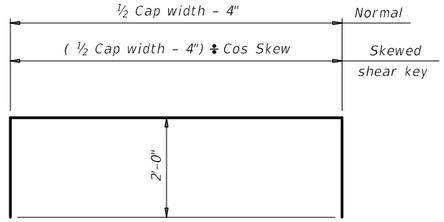
ELEVATION

PART SECTION

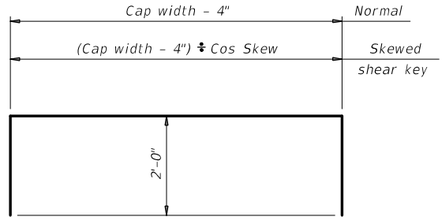
ULTRA HIGH MOLECULAR WEIGHT (UHMW) POLYETHYLENE WEAR PAD DETAILS



BARS M (#5)



BARS Na (#5)
(For abutments)



BARS Nb (#5)
(For interior bents)

CONSTRUCTION NOTES:

Provide Class "C" concrete (f'c = 3,600 psi). Provide Class "C" (HPC) if shown elsewhere on the plans.
Provide Grade 60 reinforcing steel.
Provide epoxy coated reinforcing steel for shear key if abutment or interior bent reinforcing steel is epoxy coated.
Provide Ultra High Molecular Weight (UHMW) polyethylene wear pads in accordance with ASTM D6712.

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.
Details showing skew are drawn showing right forward skew. See Bridge Layout for actual skew direction.
These details are limited to bridges skewed 45 degrees and less.
This standard is only applicable for I-Girders.
Modify details for bearing conditions, and girder spacing not shown on this standard. Details do not account for sole plate or pedestal bearing seat.
Include shear key concrete in abutment or bent concrete for payment.
UHMW polyethylene wear pads are subsidiary to Class "C" concrete.

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

Texas Department of Transportation

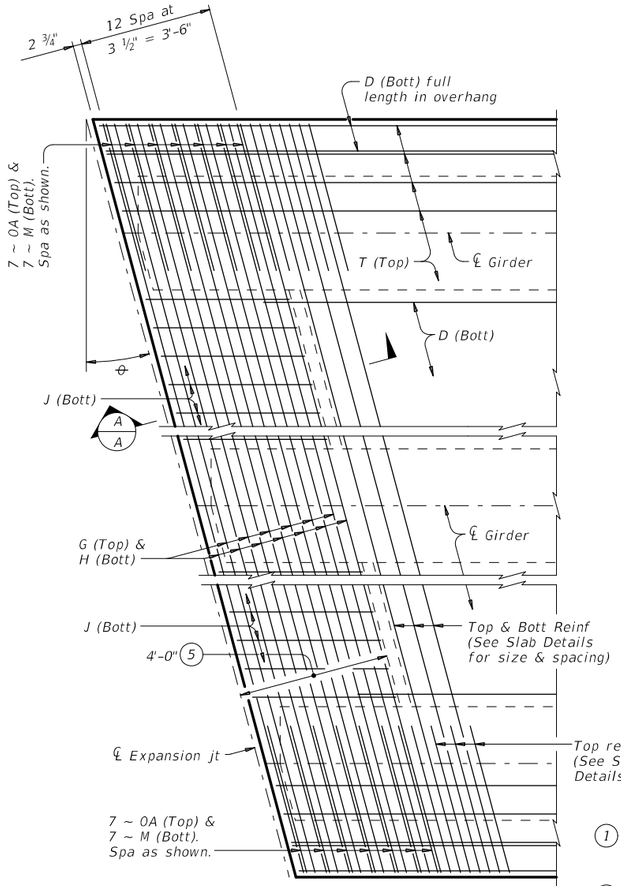
Bridge Division Standard

SHEAR KEY DETAILS
PRESTR CONCRETE I-GIRDERS

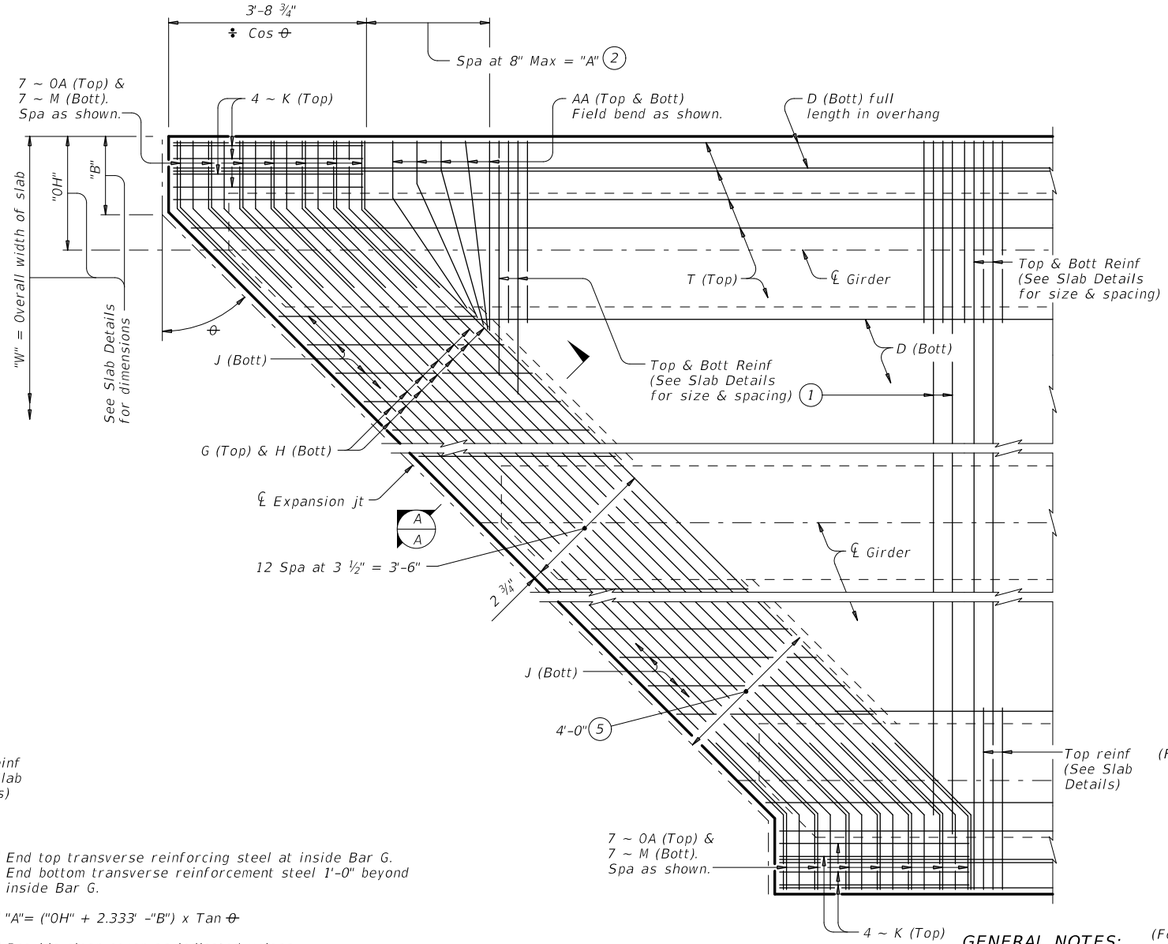
IGSK

FILE: IG-IGSK-17.dgn		DN: TxDOT	CK: TxDOT	DW: JTR		CK: AES	
©TxDOT August 2017		CONT	SECT	JOB		HIGHWAY	
REVISIONS		0724	02	020, ETC.		FM 219	
		DIST	COUNTY			SHEET NO.	
		WACO	BOSQUE			117	

DATE:
FILE:



PARTIAL PLAN FOR SLABS WITHOUT BREAKBACK



PARTIAL PLAN FOR SLABS WITH BREAKBACK

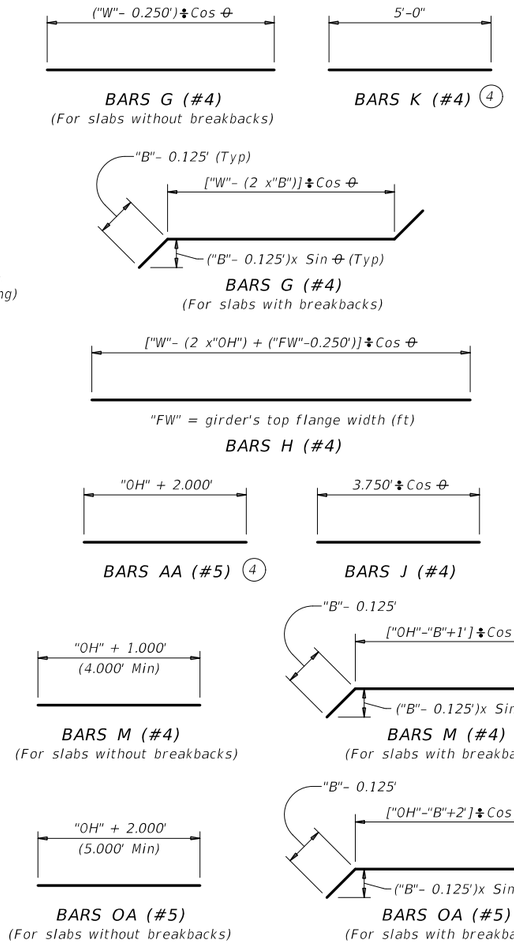
(1) End top transverse reinforcing steel at inside Bar G. End bottom transverse reinforcement steel 1'-0" beyond inside Bar G.

(2) "A"= ("0H" + 2.333' -"B") x Tan θ

(3) Provide clear cover as indicated unless otherwise shown on Span Details.

(4) Only required on slabs with breakbacks.

(5) Thickened slab end dimensioned perpendicular to face of bkwl, centerline interior bent or face of inverted-T stem.



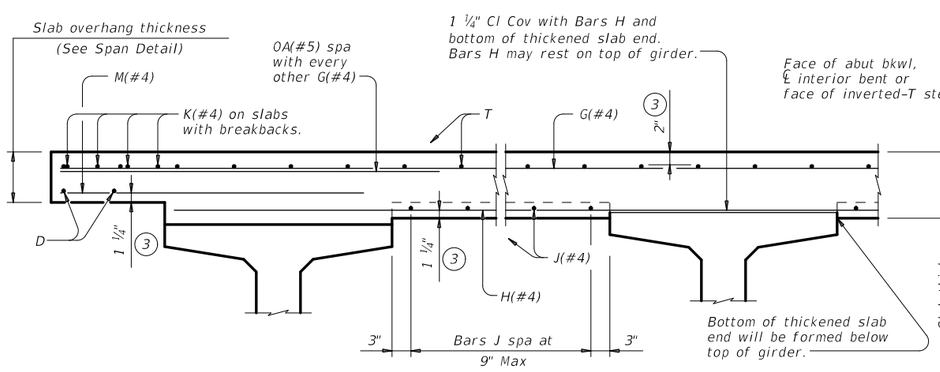
GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.
These details are restricted to Prestressed Concrete I-Girder Spans.
These details are to be used in conjunction with the Span Details and PCP standard (if prestressed concrete panels are used).
When Option 2 from PCP standard is used, provide Bars AA, G, K and OA in the slab.

MATERIAL NOTES:

Provide Grade 60 reinforcing steel.
If slab reinforcing steel is shown on the Slab Details to be epoxy coated, then Bars AA, G, K, H, J, M and OA must be epoxy coated.
Provide bar laps, where required, as follows:
Uncoated ~ #4 = 1'-7"
Epoxy Coated ~ #4 = 2'-5"

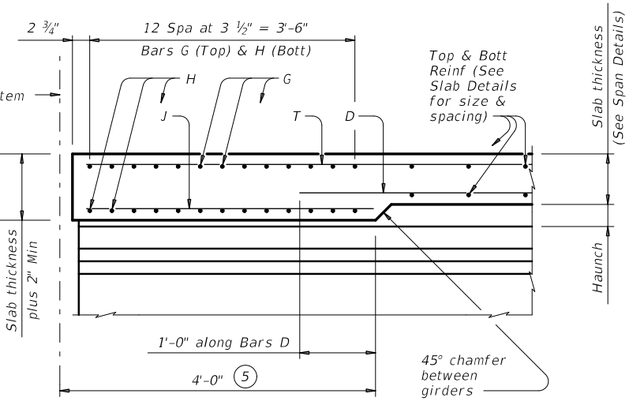
Cover dimensions are clear dimensions, unless noted otherwise.
Reinforcing bar dimensions shown are out-to-out of bar.



2" AND MORE OF HAUNCH — LESS THAN 2" OF HAUNCH

TYPICAL TRANSVERSE SECTION

(Showing Prestressed Conc I-Girders at ℄ Brg)



SECTION A-A

(Showing with 2" and more of haunch)

HL93 LOADING

Texas Department of Transportation — Bridge Division Standard

THICKENED SLAB END DETAILS
PRESTRESSED CONCRETE I-GIRDER SPANS

IGTS

FILE: IG-IGTS-17.dgn	DN: TxDOT	CK: TxDOT	DW: JTR	CK: TxDOT
©TxDOT August 2017 REVISIONS	CONT	SECT	JOB	HIGHWAY
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	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		118

DATE:
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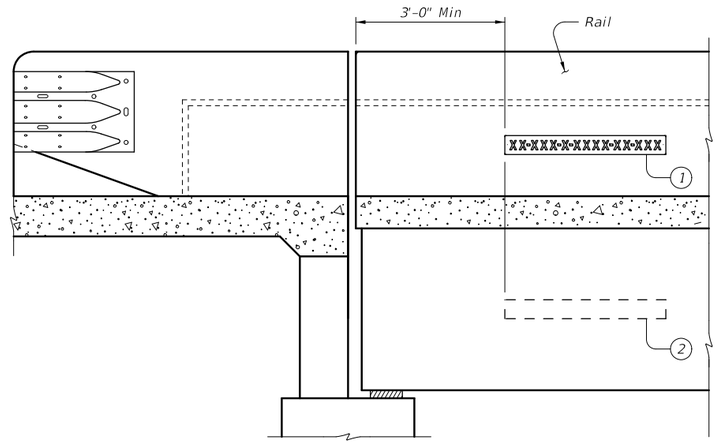
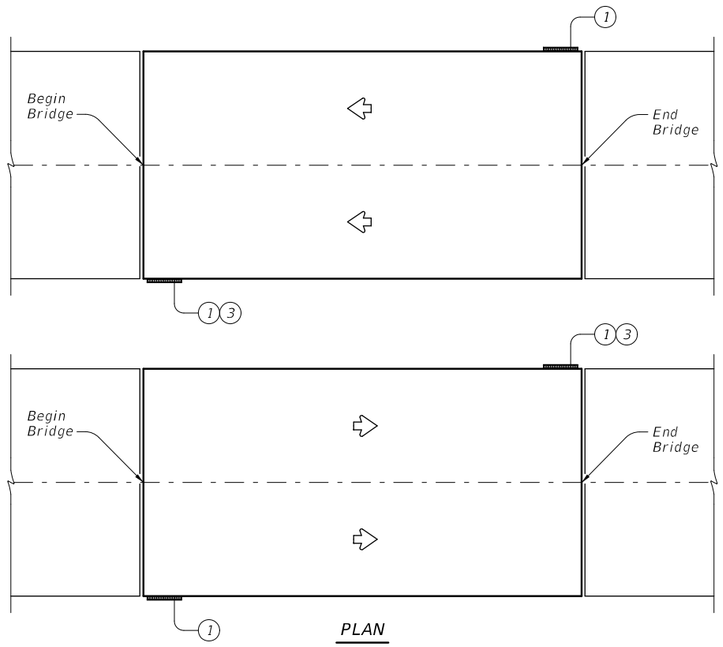
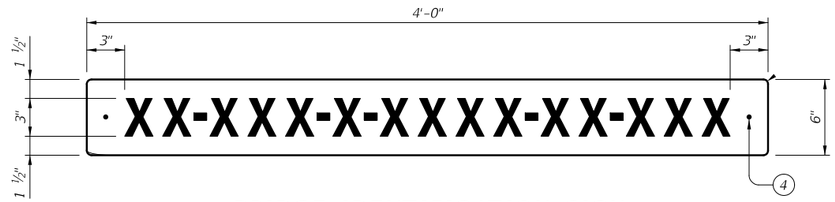


ELEVATION

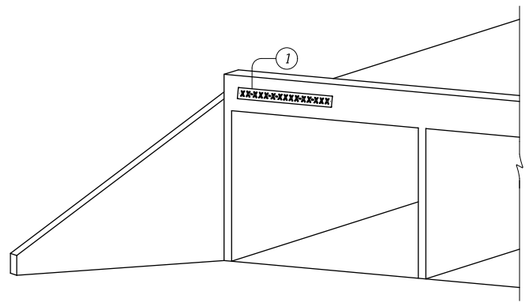


PLAN

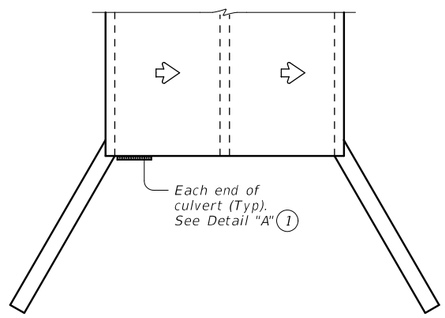
BRIDGE SIGN LOCATIONS



BRIDGE IDENTIFICATION SIGN

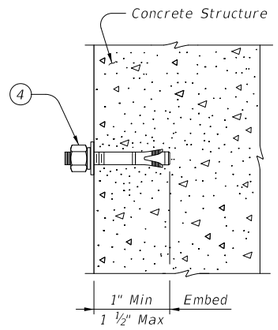


DETAIL "A"



PLAN

BRIDGE CLASS CULVERT SIGN PLACEMENT



ANCHOR DETAIL

SHEETING REQUIREMENTS		
Usage	Color	Sign Face Material
Background	White	Type B or C Sheeting
Letters and Symbols	Black	Type B or C Sheeting

(1) Bridge identification sign location

(2) Alternate sign placement location for exterior concrete beams.

(3) If adjacent bridges are less than 2 feet apart, these signs may be omitted.

(4) ¼" Diameter stainless steel expansion anchor with hex nut, washer, and spring-lock washer.

SIGN NOTES:

Standard sign designs can be found in the Standard Highway Sign Designs for Texas (SHSD).

Use the Clearview Alphabet CV-2W for the letters and symbols.

MATERIAL NOTES:

Provide lateral spacing between letters and numerals conforming with the SHSD, and any approved changes thereto. Provide a balanced appearance when spacing is not shown.

Provide aluminum sign blanks with a minimum thickness of 0.080" that meet the requirements of DMS-7110.

Provide sign face materials that meet the requirements of DMS-8300 and the sheeting requirements shown in the table.

Provide ¼" diameter stainless steel expansion anchors with one hex head nut, one flat washer, and one helical spring-lock washer each.

Use torque controlled mechanical expansion anchors that are approved for use in cracked concrete by the International Code Council, Evaluation Service (ICC-ES). Provide anchor products that have a designated ICC-ES Evaluation Report number. The approval status must be maintained on the ICC-ES website under Division 031600 for Concrete Anchors.

Unless otherwise approved by the Engineer: do not use adhesive anchors; do not use expansion anchors that are not included in the ICC-ES approval list; and do not use expansion anchors that are only approved for use in uncracked concrete.

Use anchors manufactured with stainless steel expansion wedges. Anchors manufactured with carbon steel expansion wedges are not allowed. Anchor bodies can be either zinc-plated carbon steel or stainless steel. For application in marine environments, provide both stainless steel anchor bodies and expansion wedges.

GENERAL NOTES:

Prior to hole drilling, locate rebar to ensure clearing of existing reinforcement and/or strands.

Prior to installation, obtain approval of sign locations from the Engineer. Avoid placement of sign over travel lanes and pedestrian walkways. Submit proposed installation method to Engineer prior to beginning work. Install anchors as shown on plans and in accordance with the anchor manufacturer's published installation instructions.

Do not install anchors sections of members under tension.

For new construction, the signs and anchors are subsidiary to the bridge. For installations on existing structures, the signs and anchors are paid under Item 442, "Metal for Structures." Each sign weighs 28 lbs.

Texas Department of Transportation

Bridge Division Standard

NBIS BRIDGE IDENTIFICATION SIGN STANDARD

NBIS

FILE: MS-NBIS-23.dgn	DN: TAR	CK: TxDOT	DW: JER	CK: TAR
©TxDOT March 2023 REVISIONS	CONT	SECT	JOB	HIGHWAY
	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		119

DATE:
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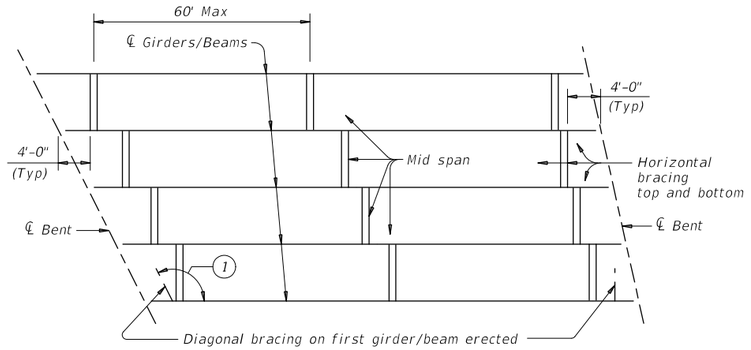
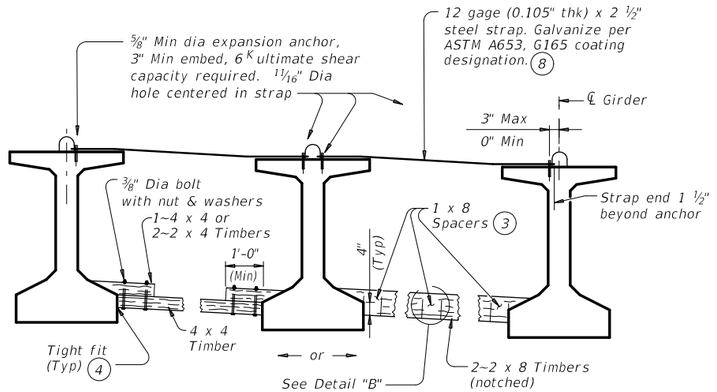
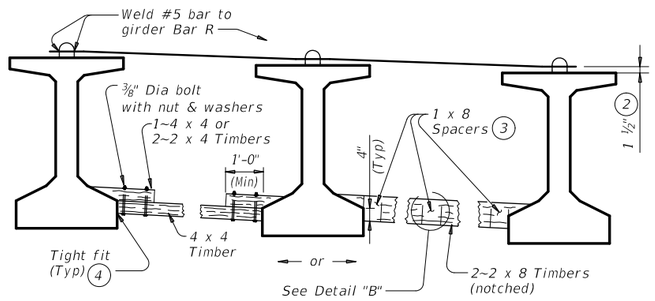


ERECTION BRACING



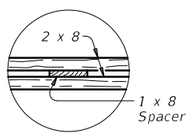
FOR ERECTION BRACING, OPTION 1

(This option is not allowed when slab is formed with PMDF or plywood.)



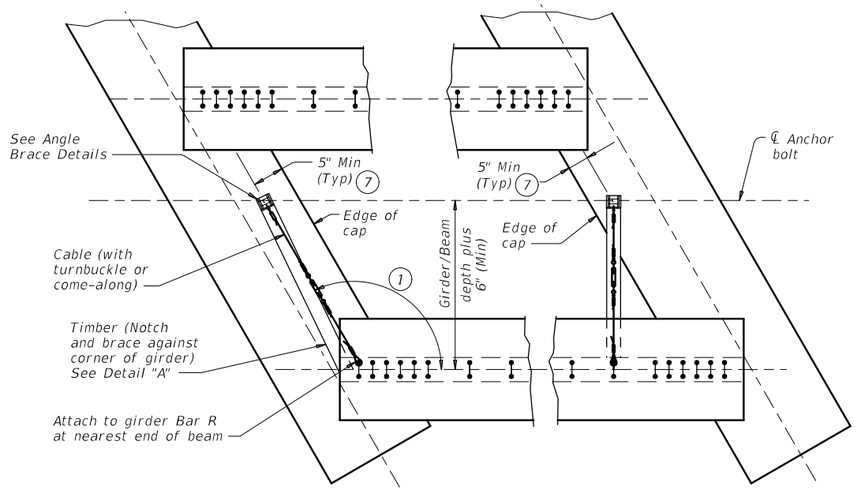
FOR ERECTION BRACING, OPTION 2

HORIZONTAL BRACING DETAILS (5)

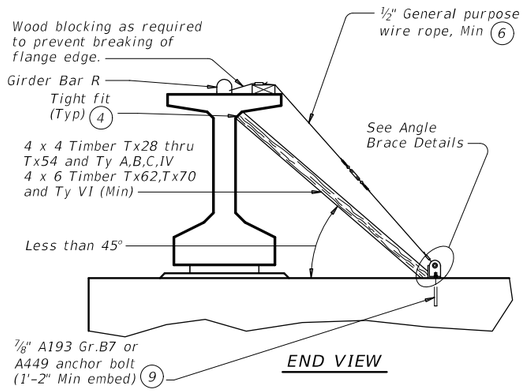


PLAN

DETAIL "B"



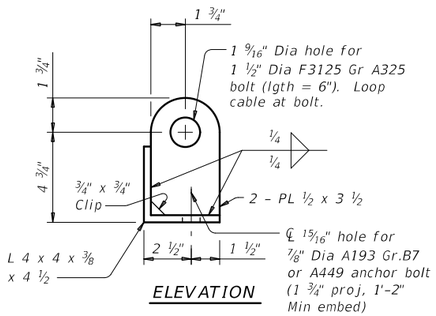
PLAN



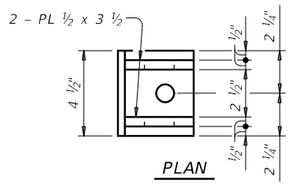
END VIEW

DIAGONAL BRACING DETAILS (5)

(To be used on both ends of the first girder/beam erected in the span in each phase.)



ELEVATION



PLAN

ANGLE BRACE DETAILS

HAULING & ERECTION:

The Contractor's attention is directed to the possible lateral instability of prestressed concrete girders and beams over 130' long, especially during hauling and erection. The use of the following methods to improve stability is encouraged: Locate lifting devices at the maximum practical distance from girder ends; use external lateral stiffening devices during hauling and erection; lift with vertical lines using two machines; and take care in handling to minimize inertial and impact forces.

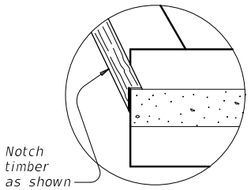
ERECTION BRACING:

Erection bracing details shown are considered the minimum for fulfilling the bracing requirements of Item 425.

Required erection bracing must be placed immediately after erection of each girder and remain in place until additional bracing as required for slab placement is in place. This standard is needed in all cases to meet requirements for Slab Placement Bracing.

PHASED CONSTRUCTION:

Place erection and slab placement bracing for all girders in a phase as shown in these details. For phases after first, also place erection and slab placement bracing between outer girder of completed phase and adjacent girder of current phase. When the phase construction joint is between girders, top bracing can be omitted.



DETAIL "A"

(1) If angle shown exceeds 120 degrees, move diagonal brace to other side of girder/beam and place square to girder/beam. This may prevent exterior girder from being erected first.

(2) Place and weld #5 bars as shown during erection. If forming deck with prestressed panels, bars can be temporarily removed, one at a time, during panel erection. Re-install bar prior to additional panel erection. Bars can rest on panels and be bent down and welded to girder Bars R (See Sheet 2 of 2).

(3) Clear distance between spacers must not exceed 3'. Nail together with 16d nails.

(4) Use wedges as necessary to obtain tight fit. Nail wedges to timbers.

(5) Pressure treated landscape timbers can not be used.

(6) All hardware used with cable must be able to develop a minimum 25 kips breaking strength. Use thimbles at all loops in cable. Install cable clamps with saddles bearing against the live end and U-bolts bearing aginst the dead end.

(7) It is acceptable to tie anchor bolts to cap reinforcement.

(8) Prior to installing, field bend strap to lay flush on both girders' top flange and slope between flange tips.

(9) Anchor bolt may be drilled and epoxied in place. Provide 25k minimum pullout. Core drill hole.

Texas Department of Transportation

Bridge Division Standard

MINIMUM ERECTION AND BRACING REQUIREMENTS

PRESTRESSED CONCRETE I-GIRDERS AND I-BEAMS

MEBR(C)

FILE: IG-MEBR(C)-17.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT August 2017 REVISIONS	CONT	SECT	JOB	HIGHWAY
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	WACO	BOSQUE		120

DATE:
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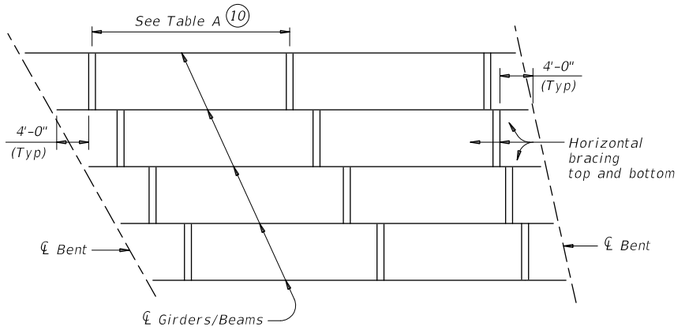


SLAB PLACEMENT BRACING

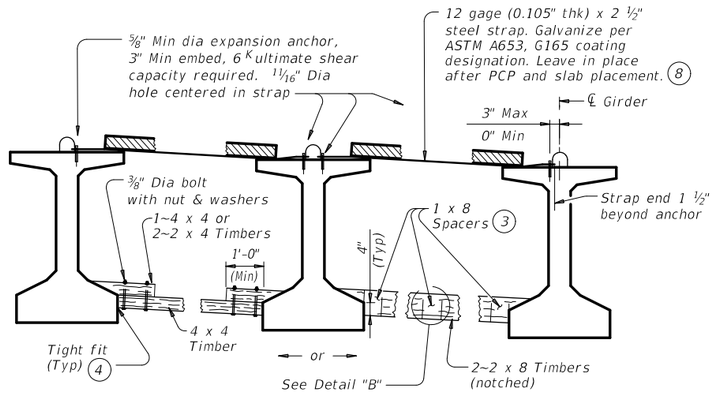
TABLE A

OPTION 1-RIGID BRACING (STEEL STRAP)

Girder or Beam Type	Maximum Bracing Spacing	
	Slab Overhang less than 4'-0" (11)	Slab Overhang 4'-0" and greater (11)
Tx28	¼ points	¼ points
Tx34	¼ points	¼ points
Tx40	¼ points	⅛ points
Tx46	¼ points	⅛ points
Tx54	¼ points	⅛ points
Tx62	¼ points	⅛ points
Tx70	¼ points	⅛ points
A	⅛ points	⅛ points
B	⅛ points	⅛ points
C	⅛ points	⅛ points
IV	¼ points	⅛ points
VI	¼ points	⅛ points

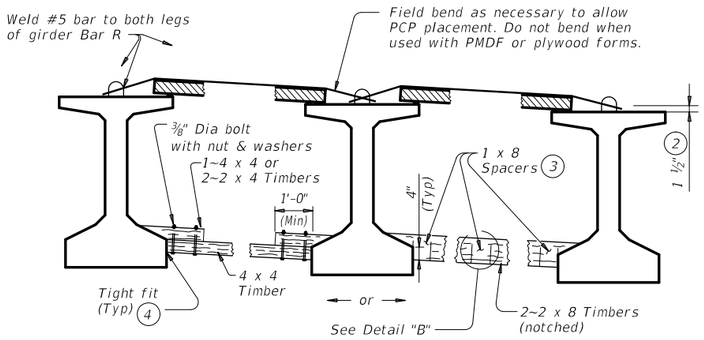
OPTION 2-FLEXIBLE BRACING (NO. 5 OVER PCP)

Girder or Beam Type	Maximum Bracing Spacing	
	Slab Overhang less than 4'-0" (11)	Slab Overhang 4'-0" and greater (11)
Tx28	¼ points	⅛ points
Tx34	¼ points	⅛ points
Tx40	¼ points	⅛ points
Tx46	¼ points	⅛ points
Tx54	¼ points	⅛ points
Tx62	¼ points	⅛ points
Tx70	¼ points	⅛ points
A	2.0 ft	1.5 ft
B	3.0 ft	2.0 ft
C	4.5 ft	2.0 ft
IV	¼ points	4.0 ft
VI	¼ points	4.0 ft



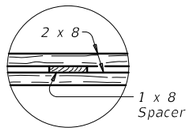
FOR SLAB PLACEMENT BRACING, OPTION 1 - RIGID

(Showing slab formed with PCP. This option is not allowed when slab is formed with PMDF or plywood.)



FOR SLAB PLACEMENT BRACING, OPTION 2 - FLEXIBLE

(Showing slab formed with PCP.)



PLAN

DETAIL "B"

HORIZONTAL BRACING DETAILS (5)

(2) Place and weld #5 bars as shown during erection. If forming deck with prestressed panels, bars can be temporarily removed, one at a time, during panel erection. Re-install bar prior to additional panel erection. Bars can rest on panels and be bent down and welded to girder Bars R.

(3) Clear distance between spacers must not exceed 3'. Nail together with 16d nails.

(4) Use wedges as necessary to obtain tight fit. Nail wedges to timbers.

(5) Pressure treated landscape timbers can not be used.

(8) Prior to installing, field bend strap to lay flush on both girders' top flange and slope between flange tips.

(10) Bracing spacing (¼ and ⅛ points) measured between first and last typical brace location.

(11) Measure slab overhang from centerline of girder or beam. When overhang varies in span, determine bracing spacing based on largest overhang.

SLAB PLACEMENT BRACING:

The details for slab placement bracing are considered minimum for fulfilling the requirements of Specification Items 422 and 425.

Required slab placement bracing must remain in place until slab concrete has attained a compressive strength of 3000 psi.

GENERAL NOTES:

Bracing details for spans longer than 150' are not provided. The Contractor must submit proposed bracing details for such conditions to the Engineer for approval prior to erection.

Systems equal to or better than those shown may be used provided details of such systems are submitted to and approved by the Engineer prior to erection.

Use of these systems or details does not relieve the Contractor of the responsibility for the adequacy of the bracing and the safety of the structure.

Removal of bracing for short periods of time to align girders and beams is permissible.

All turn-buckles, come-alongs, anchors and other connections must be capable of developing the full strength of the cable shown.

Furnish anchor bolts and nuts in accordance with Item 449, "Anchor Bolts".

Texas Department of Transportation

Bridge Division Standard

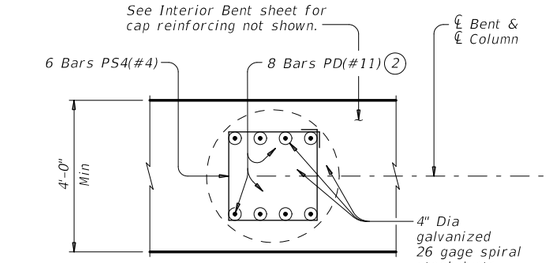
MINIMUM ERECTION AND BRACING REQUIREMENTS

PRESTRESSED CONCRETE I-GIRDERS AND I-BEAMS

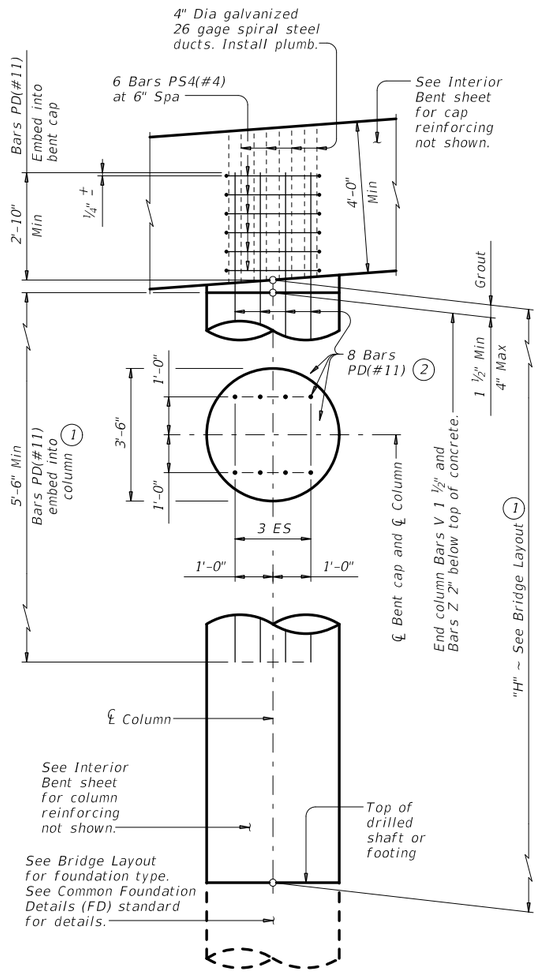
MEBR(C)

FILE: IG-MEBR(C)-17.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT August 2017	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		121

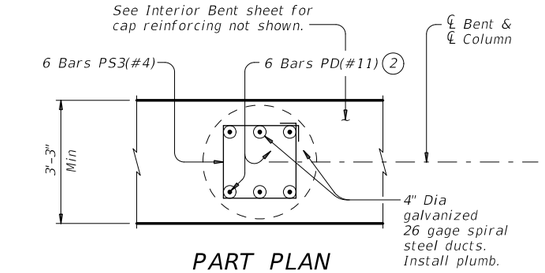
DATE:
FILE:



PART PLAN
(42" Dia Column)



PART ELEVATION
(42" Dia Column)



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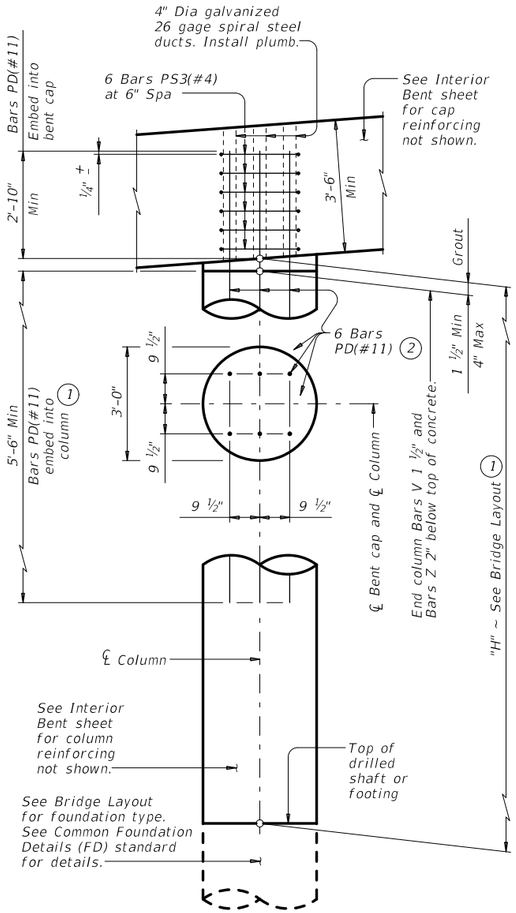
(36" Dia Column)



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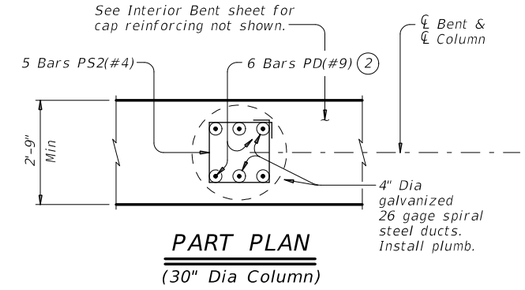
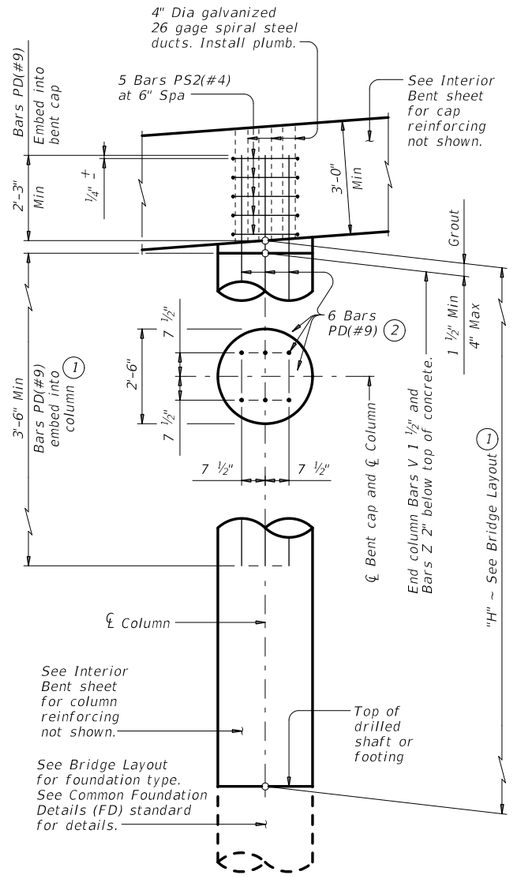
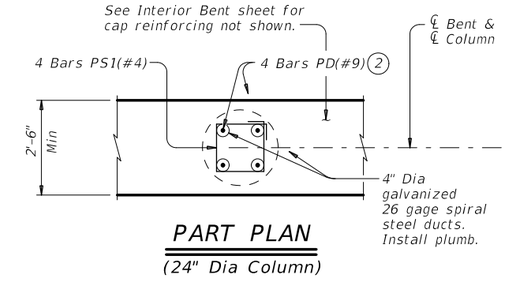


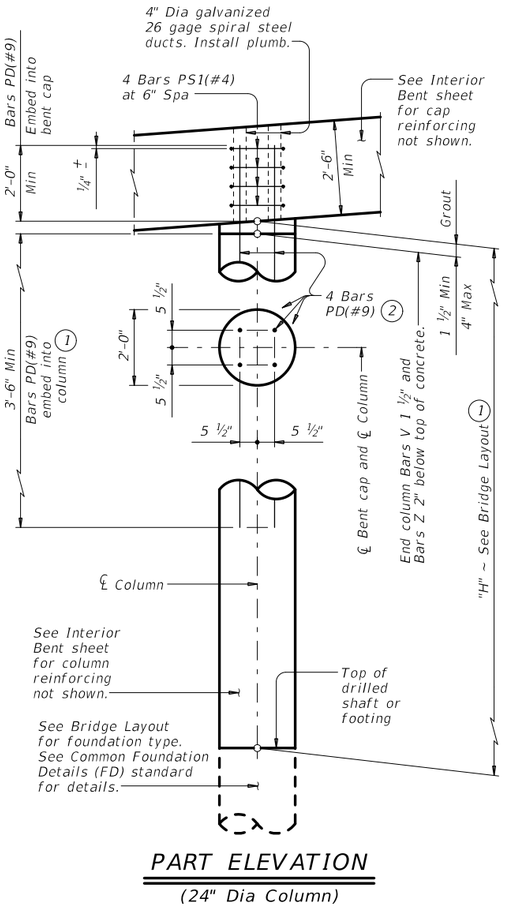
PART PLAN
(30" Dia Column)



PART ELEVATION
(30" Dia Column)

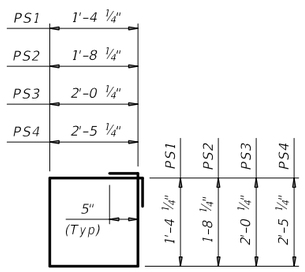


PART PLAN
(24" Dia Column)



PART ELEVATION
(24" Dia Column)

PS1	1'-4 ¼"
PS2	1'-8 ¼"
PS3	2'-0 ¼"
PS4	2'-5 ¼"



BARS PS (#4)

(1) Bars PD may need to be embedded in footing or drilled shaft for short columns.

(2) Location tolerance of dowels in columns/drilled shafts is ¼" from plan location, transversely and longitudinally.

HL93 LOADING

SHEET 1 OF 2

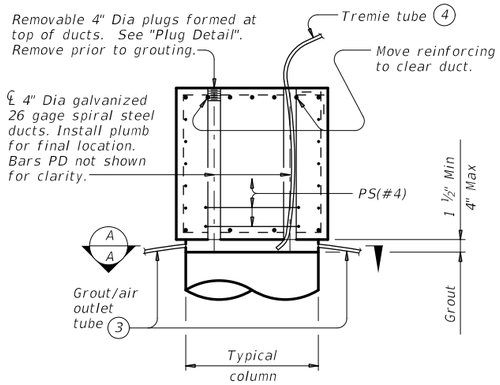
Texas Department of Transportation

Bridge Division Standard

PRECAST CONCRETE BENT CAP OPTION FOR ROUND COLUMNS

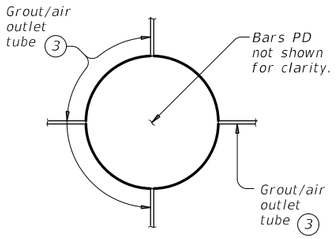
PBC-RC

FILE:	DN: TxDOT	CK: JMH	DW: JTR	CK: TxDOT
©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS 12-21: General Notes	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		122

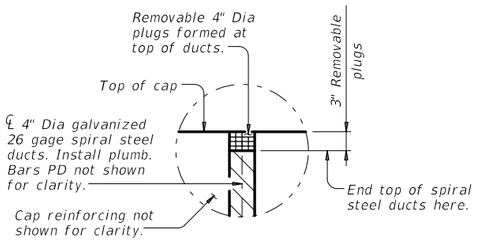


TYPICAL SECTION THRU CAP

(Showing example of ducts and cap reinforcing.)

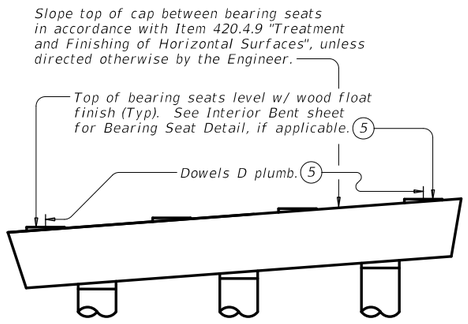


SECTION A-A

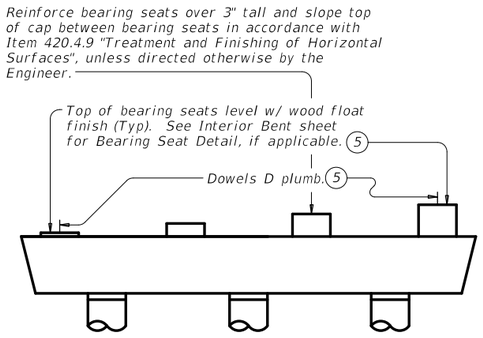


PLUG DETAIL

(Plug is used to keep concrete out of ducts during concrete placement. Remove prior to grouting)



CAP SET AT SLOPE



CAP SET LEVEL

EXAMPLES OF PRECAST BENTS WITH DOWELS D

(3) Provide at least 4 grout/air outlet tubes equally spaced around the perimeter of the column. Install at bottom of cap to avoid air entrapment. Seal off tubes sequentially when a steady flow of grout without air occurs. Secondary tubes to help drain water, located at top of column, may also be installed.

(4) Continuous gravity-flow grouting through a tremie tube is recommended. With this method, lower a flexible tremie tube through one of the vertical ducts to the bottom of the bedding layer and fill the connection from the bottom upward with a continuous flow of grout. This method requires a sufficient amount of grout to be mixed prior to grouting and that the funnel connected to the tremie tube have adequate volume capacity (4 quarts Min is recommended). A valve may be used to stop the flow during grouting to allow refilling the funnel or to tamp the grout. The tube should remain within the grout and gradually withdrawn as the level of the grout rises in the ducts. It is critical to ensure a continuous flow of grout to avoid air entrapment. Alternative methods, including pressure grouting with low pressure pumps, may be used provided they are proved effective in providing void-free connections during the mock-up phase.

(5) Unless otherwise shown.

CONSTRUCTION NOTES:

Cap Fabrication:

Construct and cure cap in accordance with Item 420, "Concrete Substructures". If fabricated at an offsite location, construct and cure cap in accordance with Item 424, "Precast Concrete Structural Members (Fabrication)". Secure ducts to prevent their movement during concrete placement. Location tolerance of ducts is ¼" from plan location, transversely and longitudinally. Seal ducts to prevent intrusion of concrete.

Bearing seats may be precast with the cap. Bearing seats over 3" in height must be reinforced as per Item 420.4.9. Do not locate lift points at bearing seats if bearing seats are precast.

Cap concrete must achieve a compressive strength of 2,500 psi prior to lifting. Limit flexural stress in cap to 250 psi during handling and storage. Store and handle caps in accordance with Item 424, "Precast Concrete Structural Members (Fabrication)". Do not stack caps. Caps that become cracked or otherwise damaged may be rejected.

Cap-to-Column Connection:

Make a trial batch of grout using the same material, equipment and personnel to be used for actual grouting operations and grout a mock-up of the connection at least one week before grouting and in the presence of the Engineer. This mock-up test must demonstrate the reliability of the Contractor's grouting procedures to provide a connection free of voids. Field test the trial batch grout to the same level required for the actual grouting.

Caps may be placed on columns/drilled shafts after column/drilled shaft concrete has achieved a flexural stress of 355 psi (or 2,500 psi compressive strength). Use plastic shims or friction collars to support the cap at the proper elevation prior to grouting. Total area of plastic shims used on top of each column may not exceed 6 percent of the column area. Column/drilled shaft curing may be interrupted a maximum of 2 hours for placement of plastic shims or friction collars and cap placement.

Surfaces in contact with grout must be clean and in a saturated, surface-dry condition, immediately prior to grouting. Provide water tight forms. Fill the forms with water and drain just prior to grouting. Ponding or free-standing water is not permitted. Use compressed air to blow out excess water.

Mix grout in accordance with the manufacturer's directions. Evidence of frothing, foaming, or segregation is cause for rejection. Transport grout from mixer to final location by wheel barrow, bucket or pumping.

Perform sampling and testing of grout by trained personnel at the Contractor's expense and while witnessed by the Engineer. Grouted connections must be free of voids.

Trowel finish top surface of cap anchorage ducts flush with top of cap. Wet mat cure these locations for at least 48 hours. Recess lifting loops 1-inch minimum using exothermic cutting rods. Do not overheat or damage the surrounding concrete. Abrade the concrete surfaces of excavation and end of the lifting loop to remove all slag with a needle gun, steel brush, or other suitable means. Coat the inside of the recessed area, including the lifting loops, with 10 mils (minimum) of neat, Type VIII epoxy and patch the recess with epoxy mortar.

Friction collars may be removed, if used, and beams placed on the cap after the grout obtains a compressive strength of 2,500 psi. Subsequent loading can occur when the grout reaches its final required 28 day compressive strength.

MATERIAL NOTES:

Provide a pre-qualified grout from TxDOT's Material Producer List "Cementitious Grouts and Mortars for Miscellaneous Applications", conforming to DMS-4675.

Provide semi-rigid spirally crimped, corrugated duct of galvanized, cold rolled steel conforming to ASTM A653. Corrugations must have a minimum amplitude of 0.094".

Grout tubes and forms must be approved prior to grouting.

Provide Grade 60 reinforcing steel. Epoxy coat or galvanize all reinforcement if column reinforcement is epoxy coated or galvanized.

GENERAL NOTES:

Designed in accordance with AASHTO LRFD Bridge Design Specifications.

The Contractor has the option to provide precast bent caps in accordance with the details shown. No additional payment will be made if the Contractor uses precast caps.

Submit shop drawings of precast caps for approval prior to construction. Indicate lifting attachments and locations on the shop drawings.

Precast Concrete Bent Cap Option shown on this standard may require modification for select structure types. See appropriate details elsewhere in plans for these modifications.

See Interior Bent sheet for details and notes not shown.

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

HL93 LOADING

Texas Department of Transportation

Bridge Division Standard

PRECAST CONCRETE BENT CAP OPTION FOR ROUND COLUMNS

PBC-RC

FILE:	DN: TxDOT	CK: JMH	DW: JTR	CK: TxDOT
©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS 12-21: General Notes	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		123

DATE:
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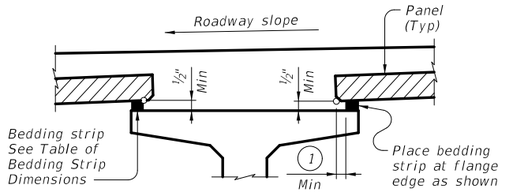
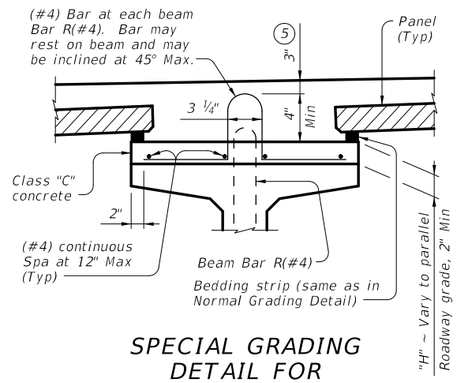


NORMAL GRADING DETAIL (3)

Showing prestressed concrete I-girders.
(Other beam types similar)



SPECIAL GRADING DETAIL FOR CONCRETE BEAMS

Showing prestressed concrete I-girders.
(Other beam types similar)

TABLE OF BEDDING STRIP DIMENSIONS		
WIDTH	HEIGHT (4)	
	Min	Max
1" (Min)	½"	2"
1 ¼"	½"	2 ½"
1 ½"	½"	3"
1 ¾"	½"	3 ½"
2"	½"	4"
2 ¼"	½"	4 ½" (2)
2 ½"	½"	5" (2)
2 ¾"	½"	5 ½" (2)
3" (Max)	½"	6" (2)

(1) 2" Min for I-girders, 1 ½" Min for all other beam types.

(2) Allowed for prestressed concrete I-girders, not allowed on other beam types.

(3) To reduce the quantity of cast-in-place concrete, bedding strip thickness may be increased in ¼" increments. Bedding strips must be comprised of one layer. Bond bedding strips to the beams with an adhesive compatible with bedding strips. Bedding strips over 2.5" high may need to be bonded to panels. The same thickness strip must be used under any one panel edge and the maximum change in thickness between adjacent panels is ¼". Alternatively, bedding strips may be cut to grade. Panels may be supported by an alternate method, using a commercial product, if approved by the Engineer of Bridge Design, Bridge Division. If bedding strips exceed 6" high for I-Girders, 4" high for all other beam types, use Special Grading Detail for Concrete Beams or submit an alternate method to the Bridge Division for approval.

(4) Height must not exceed twice the width.

(5) Provide clear cover as indicated unless otherwise shown on Span Details.

(6) See Span Details and Thickened Slab End Details for top slab reinforcement and clear cover. Transverse top slab reinforcement may rest on top of prestressed concrete panels if necessary to maintain clear cover.

(7) Space Bars UP(#4) with Beam Bars R(#4) in all areas where measured haunch exceeds 3 ½" with I-girders, and 3" for all other beam types. Epoxy coating for Bars UP is not required.

(8) Do not locate construction joints on top of a panel.

(9) Butt adjacent bedding strips together with adhesive. Cut v-notches, approx ¼" deep, in the top of the bedding strips at 8' o.c..

CONSTRUCTION NOTES:

Erected panels must bear uniformly on bedding strips of extruded polystyrene placed along top flange edges.

Placing panels to minimize joint openings is recommended.

If additional blocking is needed, special grading details for supporting the panels and extra reinforcing between beam and slab will be considered subsidiary to deck construction.

Bars U, shown on PCP-FAB, may be bent over or cut off if necessary.

Care must be taken to ensure proper cleaning of construction debris and consolidation of concrete material under the edges of the panels. Bedding strips must be placed at beam flange edges so that adequate space is provided for the mortar to flow a minimum of 1 ½" under the panels as the slab concrete is placed.

To allow the proper amount of mortar to flow between beam and panel, the minimum vertical opening must be at least ½". Roadway cross-slope reduces the opening available for entry of the mortar. Bedding strips varying in thickness across the beam are therefore required.

For clear span between U-beams less than or equal to 18", see Permissible Slab Forming Detail on Miscellaneous Slab Detail sheets, UBMS.

MATERIAL NOTES:

Provide Grade 60 reinforcing steel in the cast-in-place slab. See Table of Reinforcing Steel for size and spacing of reinforcement.

If the top and bottom layer of reinforcing steel is shown on the Span Details to be epoxy coated, then the D, E, P, & Z bars must be epoxy coated.

Provide bar Laps, where required, as follows:

Uncoated ~ #4 = 1'-7"
Epoxy Coated ~ #4 = 2'-5"

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.

Panel placement may follow either Option 1 or Option 2 except Option 1 must be used if the skew exceeds 45 degrees.

Use of Prestressed Concrete Panels is not permitted for horizontally curved steel plate or tub girders. See Span Details for other possible restrictions on their use.

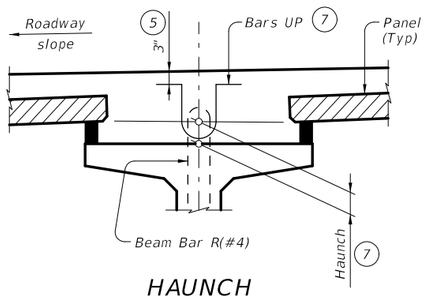
These details are to be used in conjunction with the Span Details, PCP-FAB and other applicable standard drawings.

When panel support (bedding strips) deviates from what is shown herein, provide details signed and sealed by a professional Engineer.

Any additional reinforcement or concrete required on this standard is considered subsidiary to the bid Item "Reinforced Concrete Slab".

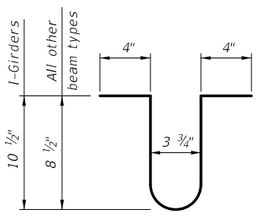
Cover dimensions are clear dimensions, unless noted otherwise.

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

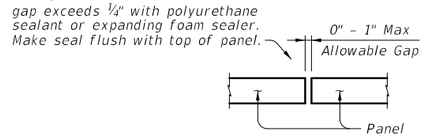


HAUNCH REINFORCING DETAIL

Showing prestressed concrete I-girders.
(Other beam types similar)

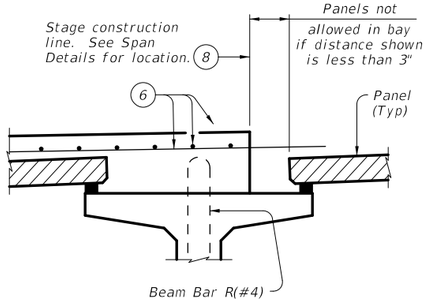


BARS UP (#4) (7)

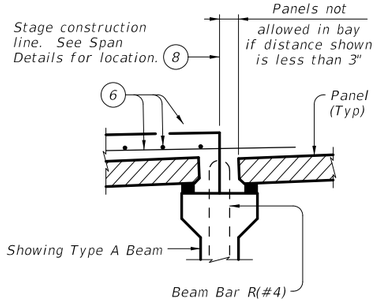


PANEL JOINTS

(Panel reinforcing not shown for clarity.
The gap cannot be considered as a panel fabrication tolerance. Adjust panel placement to minimize joint openings.)



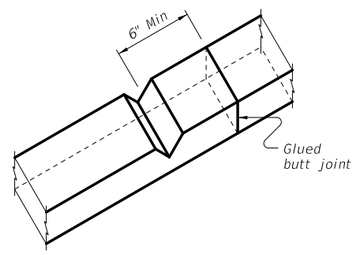
PRESTR CONC I-GIRDERS



PRESTR CONC I-BEAMS

STAGE CONSTRUCTION LIMITATIONS

(Other beam types similar)



BEDDING STRIP DETAIL (9)

HL93 LOADING SHEET 1 OF 4

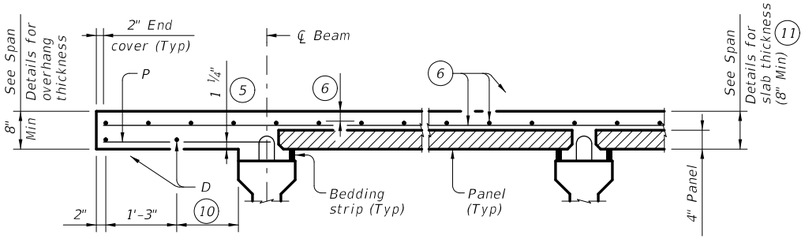
Texas Department of Transportation — Bridge Division Standard

PRESTRESSED CONCRETE PANELS
DECK DETAILS

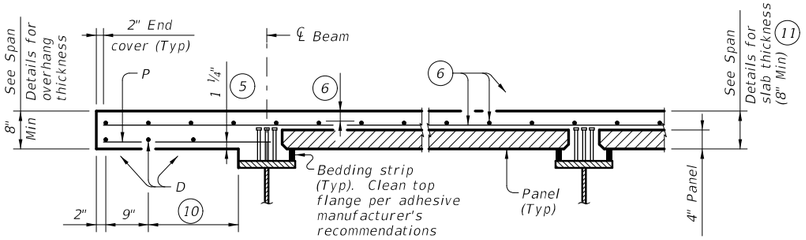
PCP

FILE: MS-PCP-23.dgn	DN: TxDOT	CK: TxDOT	DW: JTR	CK: JMH		
©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY		
REVISIONS	0724	02	020, ETC.	FM 219		
3/2023: Removed top flange tension limit.	DIST	COUNTY		SHEET NO.		
	WACO	BOSQUE		124		

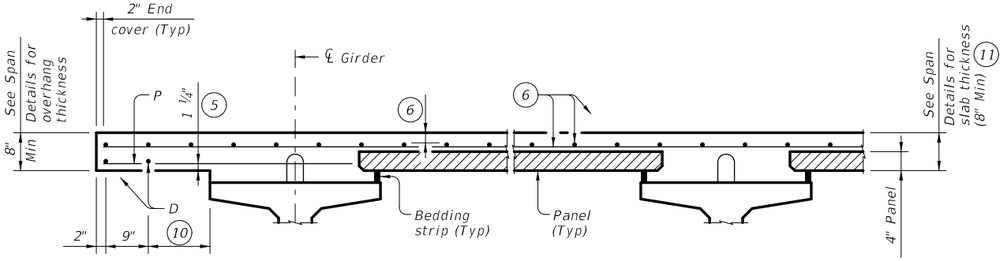
DATE:
FILE:



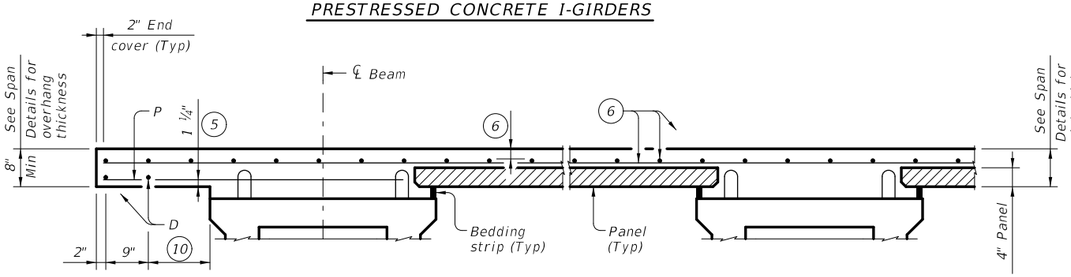
PRESTRESSED CONCRETE I-BEAMS



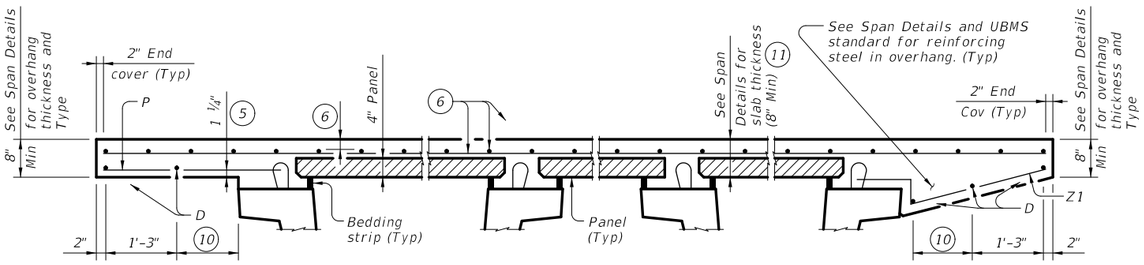
STEEL BEAMS (13)



PRESTRESSED CONCRETE I-GIRDERS



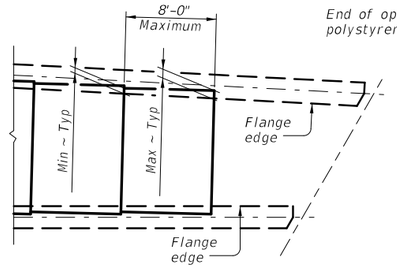
PRESTRESSED CONCRETE X-BEAMS



NORMAL OVERHANG WITH PRESTR CONC U-BEAMS

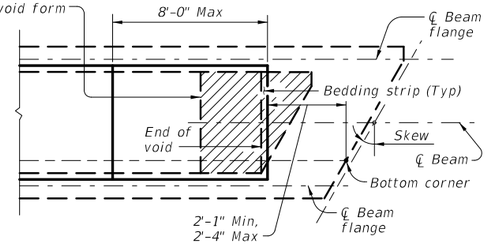
SLOPED OVERHANG WITH PRESTR CONC U-BEAMS

TYPICAL PART TRANSVERSE SECTIONS



AT FLARED BEAMS OR GIRDERS

See PCP-FAB standard for Min and Max dimensions based on beam/girder type.



OVER CONC U-BEAMS

PART PLANS OF PANEL PLACEMENT

(5) Provide clear cover as indicated unless otherwise shown on Span Details.

(6) See Span Details and Thickened Slab End Details for top slab reinforcement and clear cover. Transverse top slab reinforcement may rest on top of prestressed concrete panels if necessary to maintain clear cover.

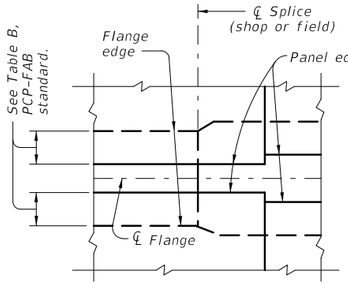
(9) Butt adjacent bedding strips together with adhesive. Cut v-notches, approx ¼" deep, in the top of the bedding strips at 8' o.c..

(10) Equally space additional bar if more than 1'-3" Max.

(11) The actual thickness constructed may exceed the slab thickness shown on the Span Details but the extra thickness may be no more than 2" (1" for prestressed concrete U-beams and steel beams). Bearing seat elevations or finished grade may be adjusted.

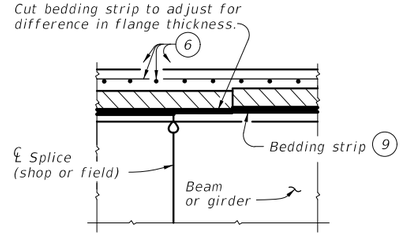
(12) Field adjust Bars Z1(#4) to match actual slope of slab overhangs. Width of slab overhang will vary along span with curved slab edges. Adjust Bar Z1(#4) dimensions to maintain proper cover. Bars Z2(#4) are located at Inverted-Tee stems only.

(13) Panels are allowed over top tension flanges, as approved by the Engineer. See Span Details for additional top mat reinforcement required in tension zones. Location of concrete placement sequence boundaries and bolted field splices should be considered by the contractor in determining panel limits.



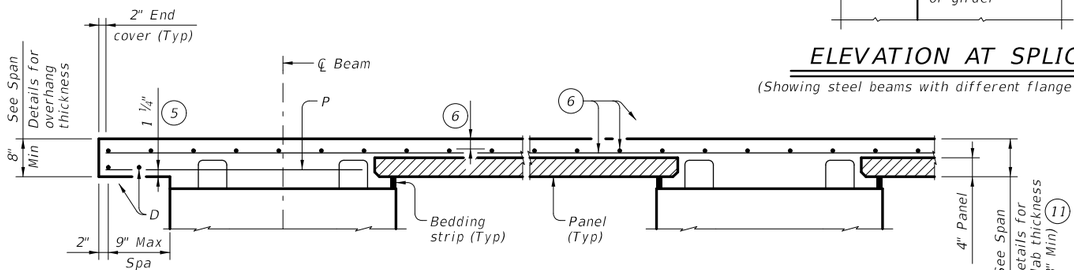
PLAN AT SPLICE

(Showing steel beams with flange width transition)



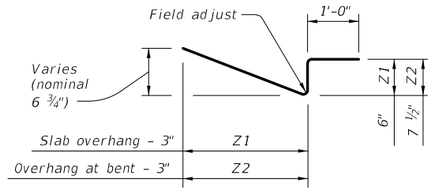
ELEVATION AT SPLICE

(Showing steel beams with different flange thickness)



PRESTRESSED CONCRETE SPREAD SLAB BEAMS

Bars P over exterior beams are still required when no overhang is used. In this case, only one Bar D, 2" from slab edge, is required.



BARS Z (#4) (12)

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Texas Department of Transportation

Bridge Division Standard

PRESTRESSED CONCRETE PANELS
DECK DETAILS

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DATE:
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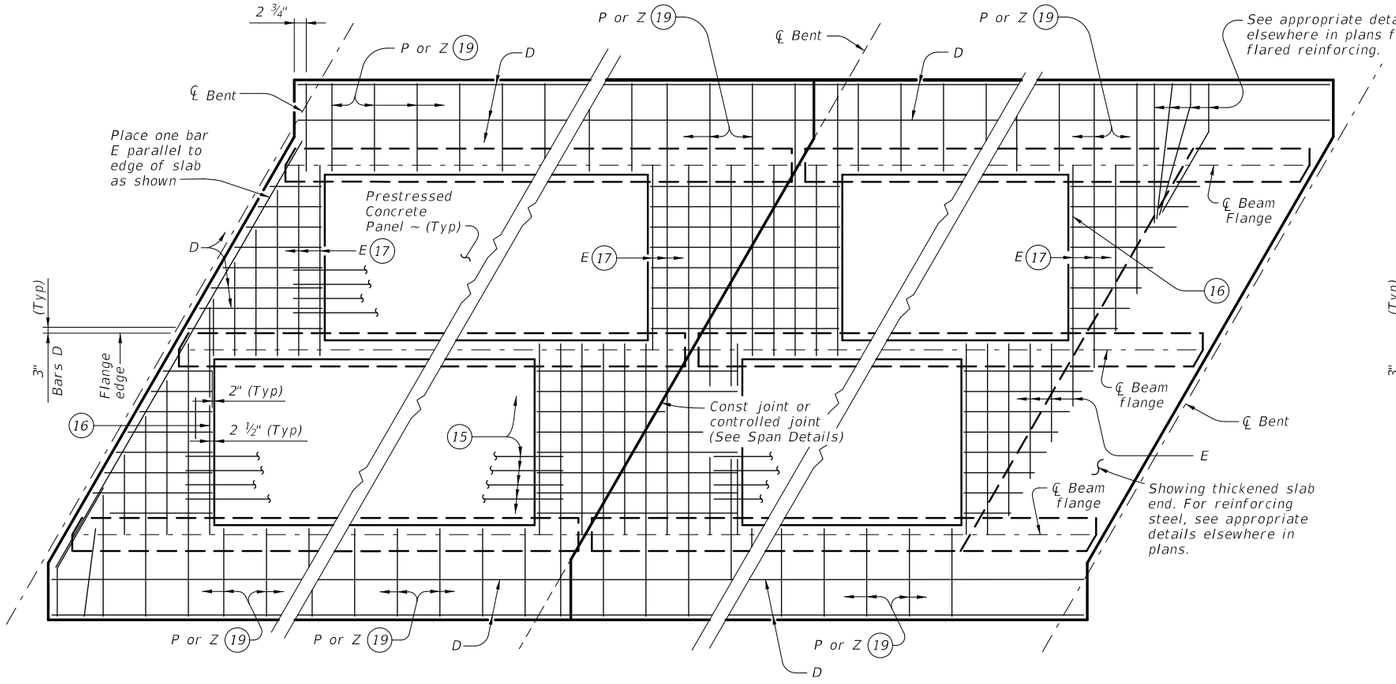
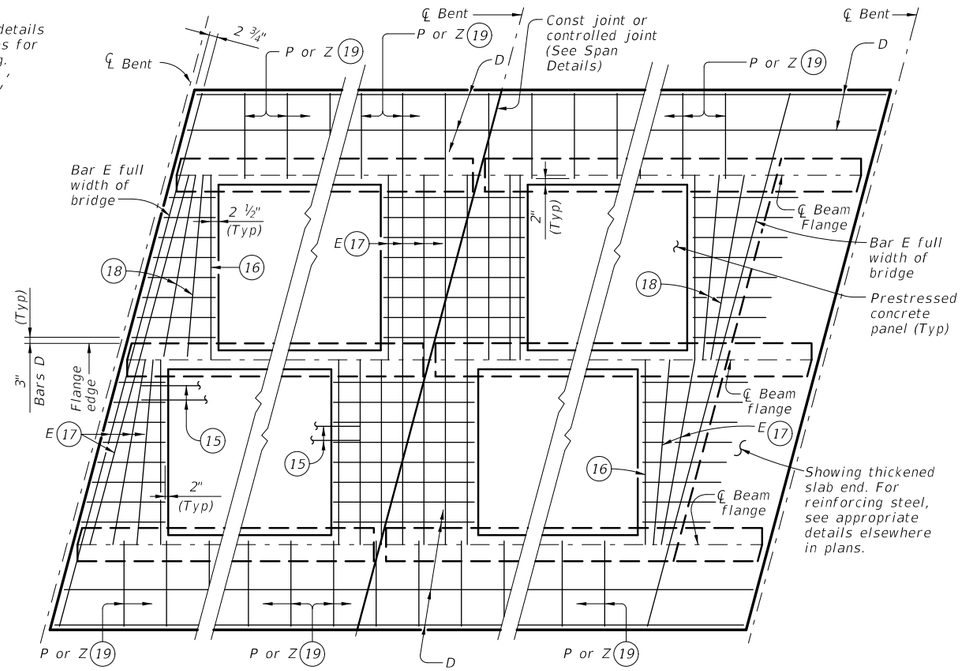


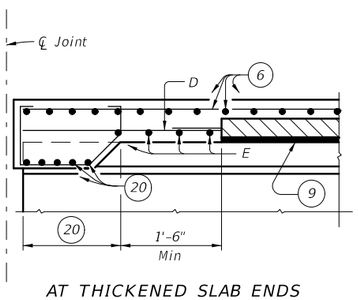
AT ALL SPAN ENDS UNLESS NOTED OTHERWISE | AT INTERIOR BENTS | AT THICKENED END SLABS

OPTION 1 ~ PLAN OF SLABS WITH NORMAL REINFORCEMENT

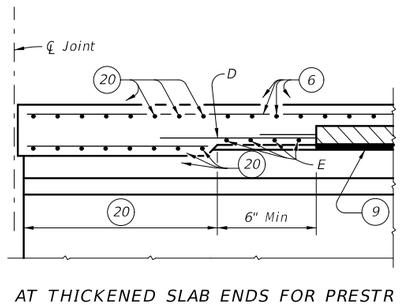


AT ALL SPAN ENDS UNLESS NOTED OTHERWISE | AT INTERIOR BENTS | AT THICKENED END SLABS

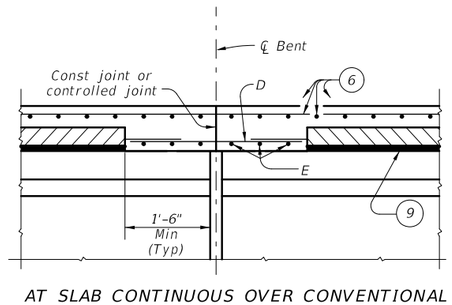
OPTION 1 ~ PLAN OF SLABS WITH SKEWED REINFORCEMENT



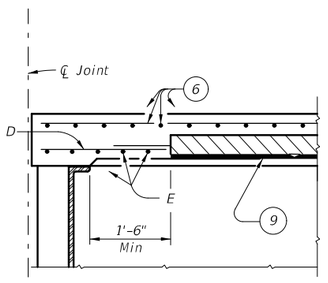
AT THICKENED SLAB ENDS FOR PRESTR CONCRETE U-BEAMS



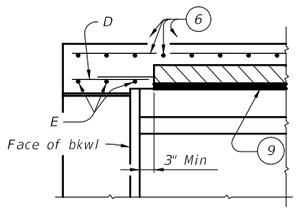
AT THICKENED SLAB ENDS FOR PRESTR CONCRETE I-BEAMS AND STEEL BEAMS



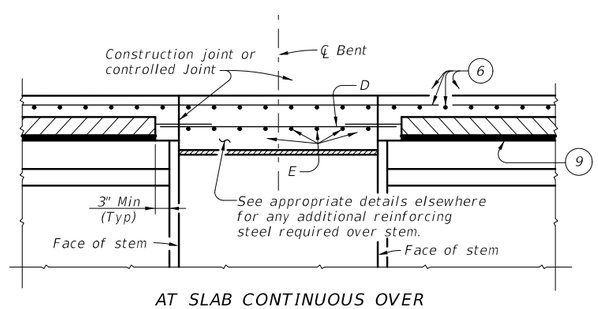
AT SLAB CONTINUOUS OVER CONVENTIONAL INTERIOR BENTS FOR ALL SIMPLE SPAN BEAMS



AT CONVENTIONAL END DIAPHRAGMS FOR STEEL BEAMS



AT SLAB OVER ABUTMENT BACKWALL FOR ALL BEAMS



AT SLAB CONTINUOUS OVER INVERTED-T BENTS FOR ALL BEAMS

OPTION 1 ~ ELEVATIONS AT BEAM ENDS

(6) See Span Details and Thickened Slab End Details for top slab reinforcement and clear cover. Transverse top slab reinforcement may rest on top of prestressed concrete panels if necessary to maintain clear cover.

(9) Butt adjacent bedding strips together with adhesive. Cut v-notches, approx ¼" deep, in the top of the bedding strips at 8' o.c.

(14) Max Spacing as listed unless otherwise shown.

(15) At connection with cast-in-place slab, extend longitudinal panel reinforcement. See PCP-FAB for details.

(16) Maintain one Bar E(#4) parallel to panel ends (Typ).

(17) Bars E(#4) not continuous over beam flanges must overlap beam flange 6" Min.

(18) Add flared Bars E(#4) (Min Spa = 6", Max Spa = 12") as required at panel ends.

(19) Where possible, Bars E(#4) may be extended into overhangs to replace Bars P(#4). Bars Z(#4) are required for sloped overhangs with U-Beams.

(20) See appropriate thickened slab end details for reinforcing and limits of thickened slab end.

TABLE OF REINFORCING STEEL (14)

BAR	SIZE	Max Spa (in.)
D	#4	9
E	#4	9
P	#4	18
UP	#4	~
Z	#4	18

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Texas Department of Transportation

Bridge Division Standard

PRESTRESSED CONCRETE PANELS
DECK DETAILS

PCP

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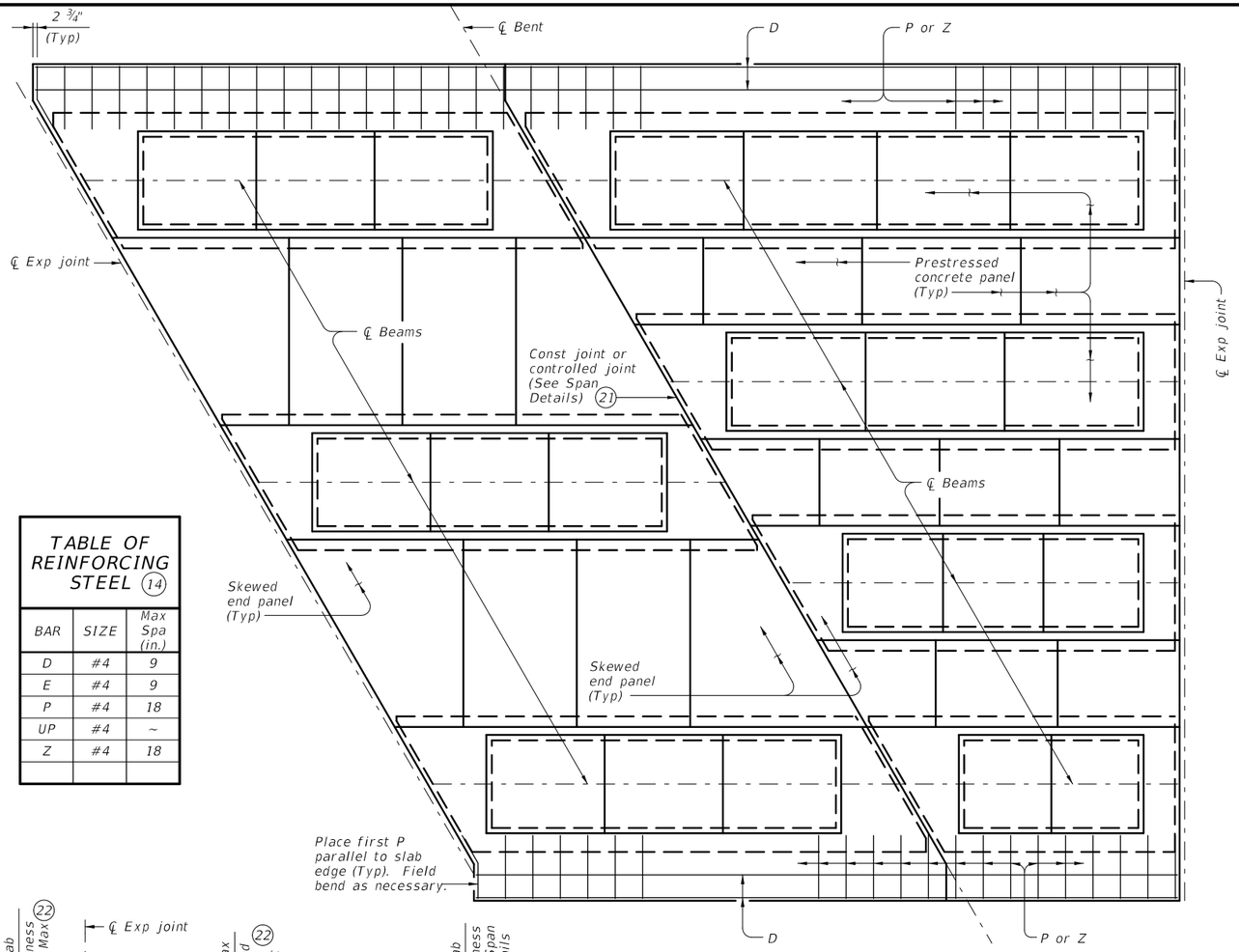
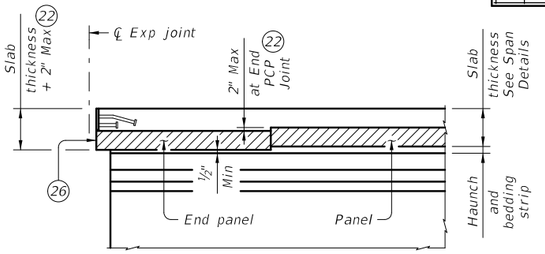


OPTION 2 ~ PLAN OF SLAB

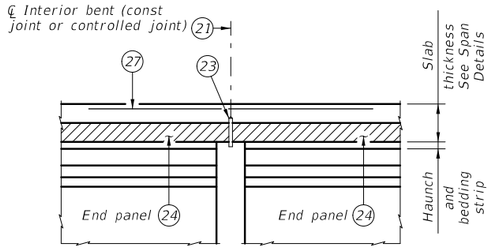
(Showing U-Beams; other beams similar)

TABLE OF REINFORCING STEEL (14)		
BAR	SIZE	Max Spa (in.)
D	#4	9
E	#4	9
P	#4	18
UP	#4	~
Z	#4	18



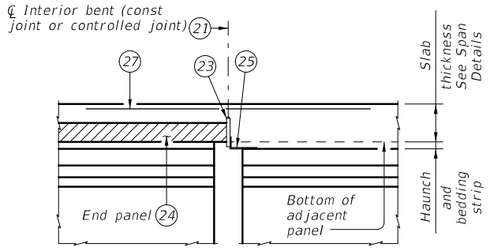
JOINTS (BETWEEN BEAMS/GIRDERS OR AT INV-T STEM)

For SEJ-B, SEJ-M, SEJ-S(0), AJ, and Type A expansion joints only.



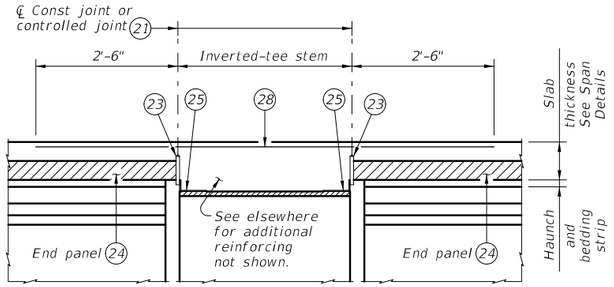
CONVENTIONAL INTERIOR BENT

Panel against panel between beams/girders.



CONVENTIONAL INTERIOR BENT

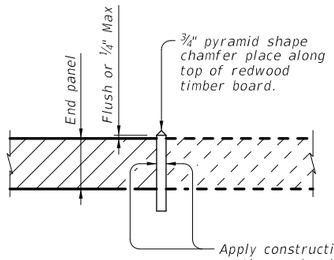
Panel against beam/girder end in adjacent span.



INVERTED-T BENT

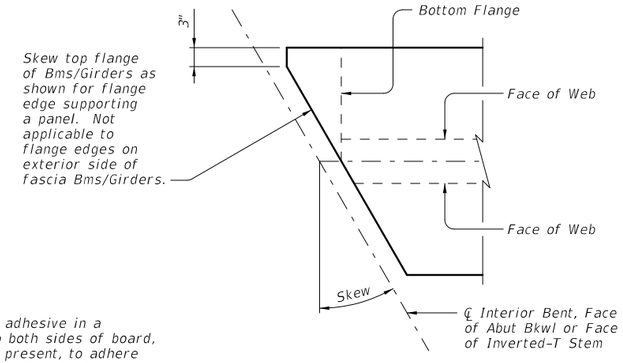
Panels against inverted-tee stem

OPTION 2 ~ ELEVATIONS AT BEAM ENDS (6)



ELEVATION EXAMPLE OF END PANEL AND TIMBER BOARD (23)

See "Option 2 ~ Elevation At Beam Ends".



OPTION 2 ~ SHOWING MODIFICATION TO BEAM/GIRDER TOP FLANGE FOR SKEWS OVER 5°

Showing I-Beam/I-Girder, U-Beams and Steel Beams similar.

(6) See Span Details and Thickened Slab End Details for top slab reinforcement and clear cover. Transverse top slab reinforcement may rest on top of prestressed concrete panels if necessary to maintain clear cover.

(14) Max Spacing as listed unless otherwise shown.

(21) 1 ½" Vinyl or plastic joint former at controlled joints (Stress Cap, Zip Strip, Stress Lock, or equal as approved by the Engineer.)

(22) End panel may be set up to 2" lower to accommodate expansion joint hardware, provided bedding strip is not less than ½" thick.

(23) ¾" thick redwood timber board, leave in place. Redwood timber board placed flush with top of panel or within ¼" Max above panel. Place ¾" pyramid shape chamfer along top of timber board. See "Elevation Example of End Panel and Timber Board". Place straight, within ¼" of centerline of bent or face of inverted-tee, across bridge width and end board at exterior flange edge of fascia beams/girders. Do not extend into overhang.

(24) Place panel within ½" of ¾" thick board.

(25) Permanent galvanized steel sheet form. Removable formwork is acceptable.

(26) Place end panel within ½" of expansion joint opening. End panel cannot encroach on required expansion joint opening.

(27) Place additional (#4) bar 5'-0" in length between every slab Bars T. Center (#4) bar on Joint.

(28) Place additional (#4) bar continuous 2'-6" beyond each side of Inverted-T Stem between every slab bars T.

SPECIAL OPTION 2 CONSTRUCTION NOTES:

When Option 2 is chosen bottom mat of thickened end slab reinforcing is not required. Use the same top mat as shown on the Thickened Slab End Details sheet.

Placing panels adjacent to expansion joints and bent centerlines prior to completing interior panel placement is recommended. Saw cutting panels to fit is acceptable when approved by the Engineer. Minimum distance from a saw cut edge to a panel strand is 1 ½".

Do not extend the longitudinal panel reinforcement into the cast-in-place slab.

Top flanges of beams and girders on skewed bridges must be modified as shown on this drawing. The Contractor is responsible for coordinating this modification with the beam fabricator prior to submitting shop drawings for approval.

Fabricator may optionally skew the whole end. When electing to skew whole end, girder end details and bearing type at conventional interior bent must be changed to use condition at abutment. Fabricator must coordinate change in bearing type, bearing centerline location, and dowel location with Engineer and Contractor. Show appropriate changes on girder and bearing shop drawings.

Bending of anchor studs of expansion joints shown on standards AJ, SEJ-B, SEJ-M, and SEJ-S(0) is permissible if necessary to clear top of end panels. The Contractor is responsible for coordinating modifications with the joint fabricator. Submit shop drawings for approval when modifications to expansion joint hardware are made.

Bedding strips under skewed end panels must conform to the requirements of Item 422 except their minimum compressive strength must be 60 psi.

Provide Bars AA, G, K and OA from standard IGTS in the slab.

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Texas Department of Transportation — Bridge Division Standard

PRESTRESSED CONCRETE PANELS
DECK DETAILS

PCP

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DATE:
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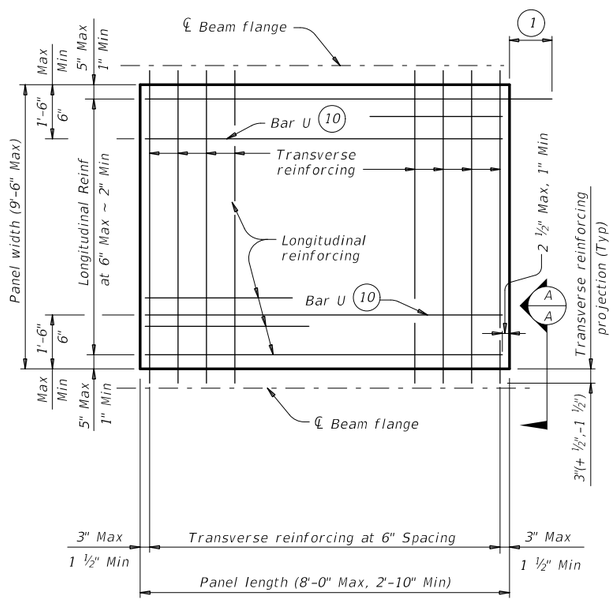
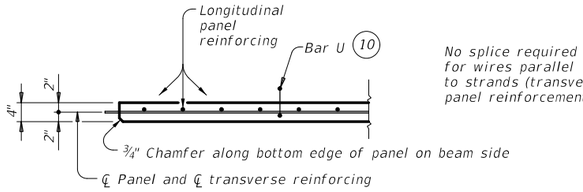
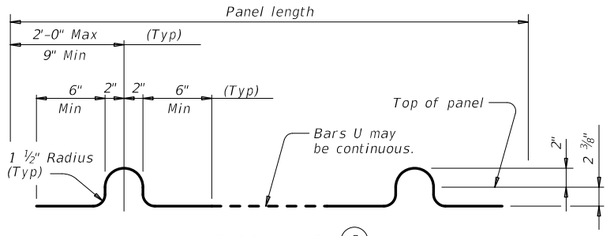


TYPICAL NON-SKEWED PANEL PLAN

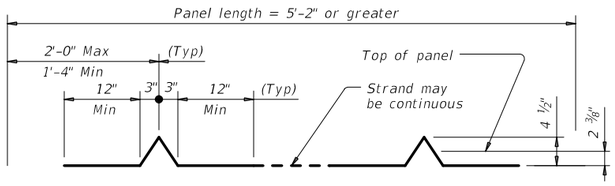


SECTION A-A

(Not showing supplemental #4 bars for skewed end panels.)



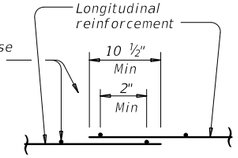
BARS U (#3) (2)



OPTIONAL STRAND FOR BARS U (3)

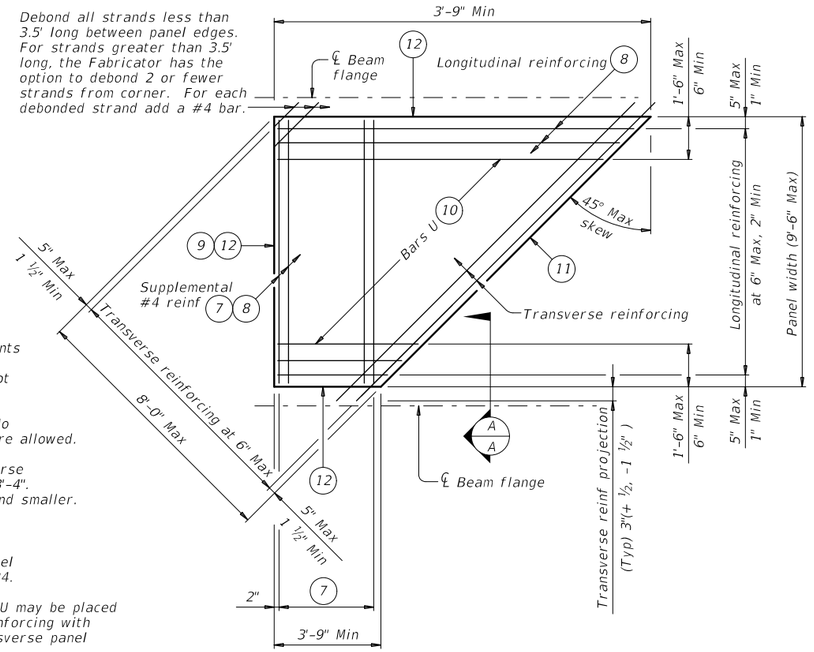
1. At connection with cast-in-place slab, extend longitudinal panel reinforcement 1'-0" (+2",-0") past panel end. Alternatively, provide (#3) x 2'-0" dowels at 6" Max Spacing and extend dowels 1'-0" past panel end.
2. Four loops required per panel.
3. Four loops required per panel. ⅜" or ½" strands may be used.
4. Normal dimensions must be used on spans with parallel beams. Maximum and Minimum dimensions apply only to spans with flared beams.
5. See Normal Grading Detail on PCP standard for lap requirements and bedding strip dimensions. Some laps shown in tables cannot utilize all bedding strip widths.
6. One Splice allowed per panel. No more than two sheets of WWR are allowed.
7. Provide (#4) bars under transverse reinforcing, 10 Spaces at 4" = 3'-4". Omit for 5 degree (1:12) skew and smaller.
8. End Cover 2 ½" Max, 1" Min.
9. Recess strands on indicated panel edge in accordance with Item 424.
10. At the fabricator's option, Bars U may be placed parallel to transverse panel reinforcing with horizontal legs in plane of transverse panel reinforcing.
11. Use length of indicated panel edge as panel width for purpose of determining type of transverse reinforcing.
12. Timber form work permissible this edge.

No splice required for wires parallel to strands (transverse panel reinforcement)



WELDED WIRE REINFORCEMENT (WWR) SPLICE DETAIL (6)

Debond all strands less than 3.5' long between panel edges. For strands greater than 3.5' long, the Fabricator has the option to debond 2 or fewer strands from corner. For each debonded strand add a #4 bar.

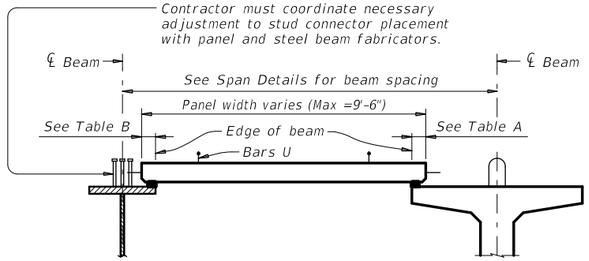


TYPICAL SKEWED END PANEL PLAN

(Only to be used with details shown elsewhere in the plans.)

TABLE A (4) (5)			
Beam Type	Normal (In.)	Min (In.)	Max (In.)
A	3	2 ½	3 ½
B	3	2 ½	3 ½
C	4	3	4 ½
IV	6	4	7 ½
VI	6 ½	4 ½"	8 ½
U40 – 54	5 ½	5 ½	7
Tx28–70	6	5	7 ½
XB20 – 40	4	3	4 ½
XSB12 – 15	4	3	4 ½

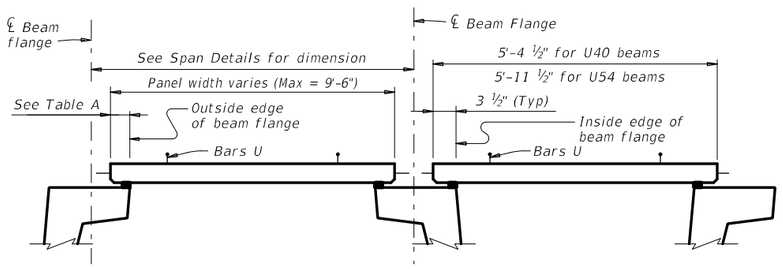
TABLE B (4) (5)			
Top Flange Width	Normal (In.)	Min (In.)	Max (In.)
11" to 12"	2 ¾	2 ½	2 ¾
Over 12" to 15"	3 ¼	3	3 ¼
Over 15" to 18"	4	3	4 ¾
Over 18"	5	3 ½	6 ¼



STEEL BEAMS

PRESTRESSED CONCRETE BEAMS OR GIRDERS

Typ unless noted otherwise



PRESTRESSED CONCRETE U-BEAMS

TYPICAL SECTIONS FOR DETERMINING PANEL WIDTH

GENERAL NOTES:

Provide Class H concrete for panels. Release strength f'ci=3,500 psi. Minimum 28 day strength f'c=5,000 psi.

Provide ¾" chamfer along bottom edge of panel on beam side.

Do not use epoxy-coated reinforcing steel bar or strand in panels.

Remove laitance from top panel surface.

Finish top of panel to a roughness between a No. 6 and No. 9 concrete surface profile, inclusive, as specified by the International Concrete Repair Institute (ICRI).

Shop drawings for the fabrication of panels will not require the Engineer's approval if fabrication is in accordance with the details shown on this standard.

A panel layout which identifies location of each panel must be developed by the Fabricator. Permanently mark each panel in accordance with the panel layout. A copy of the layout is to be provided to the Engineer.

TRANSVERSE PANEL REINFORCEMENT:

For panel widths over 5', use ⅜" or ½" Dia (270k) prestressing strands with a tension of 14.4 kips per strand.

For panel widths over 3'-6" up to and including 5', use ⅜" or ½" Dia (270k) prestressing strands with a tension of 14.4 kip per strand. Optionally, (#4) Grade 60 reinforcing bars may be used in lieu of prestressed strands.

For panel widths up to 3'-6", use (#4) Grade 60 reinforcing bars (prestressed strands alone are not allowed).

Place transverse panel reinforcement at panel centroid and space at 6" Max.

LONGITUDINAL PANEL REINFORCEMENT:

Any of the following options may be used for longitudinal panel reinforcement:

1. (#3) Grade 60 reinforcing steel at 6" Max Spacing. No splices allowed.
2. ⅜" Dia prestressing strands at 4 ½" Max Spacing (unstressed). No splices allowed.
3. ½" Dia prestressing strands at 6" Max Spacing (unstressed). No splices allowed.
4. Deformed Welded Wire Reinforcement (WWR) (ASTM A1064) providing 0.22 sq in per foot of panel width. Wires larger than D11 not permitted. Provide transverse wires to ensure proper handling of reinforcing. One splice per panel is allowed. See WWR Splice Detail.

No combination of longitudinal reinforcement options in a panel is allowed.

Place longitudinal panel reinforcement above or below transverse panel reinforcement. Must be placed above transverse panel reinforcement for skewed end panels with supplemental (#4) reinforcement.

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PRESTRESSED CONCRETE PANEL FABRICATION DETAILS

PCP-FAB

FILE: MS-PCP-FAB-19.dgn	DN: TxDOT	CK: TxDOT	DW: JTR	CK: AES
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	WACO	BOSQUE		128

DATE:
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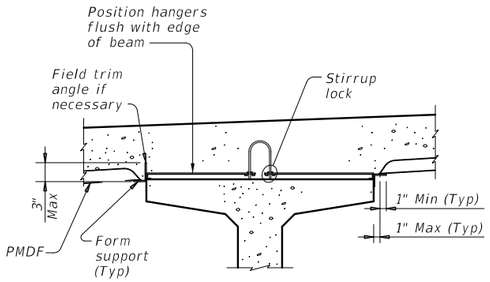
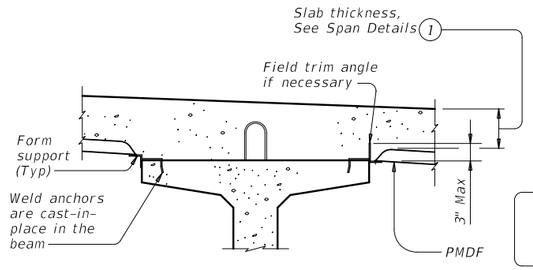
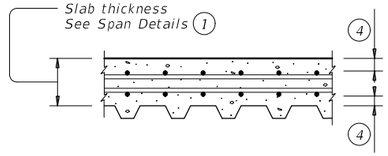


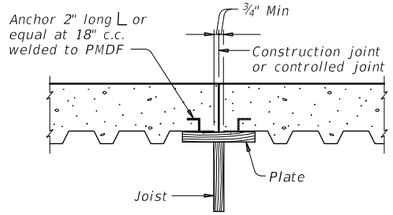
PRESTR CONC I-BEAMS AND I-GIRDERS WITH STIRRUP LOCKS



PRESTR CONC I-BEAMS AND I-GIRDERS WITH WELD ANCHORS

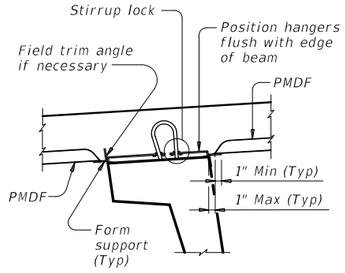


TYP LONGITUDINAL SLAB SECTION

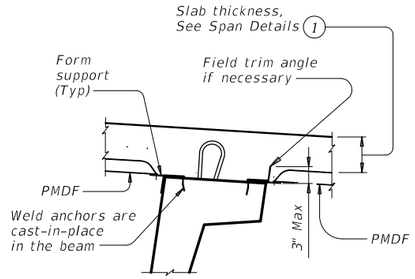


Note: In spans where PMD forms are used, timber forms must be used at construction joints. Adequate provision must be made to support edge of metal form and to provide anchorage of metal form to slab concrete where joined to wood forms.

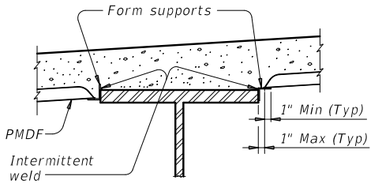
SECTION THRU CONSTRUCTION JOINT



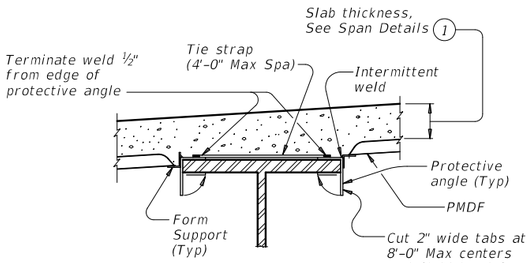
U-BEAMS WITH STIRRUP LOCKS



U-BEAMS WITH WELD ANCHORS

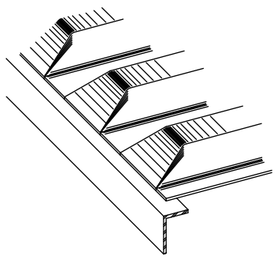


STEEL BEAMS AT COMPRESSION FLANGES

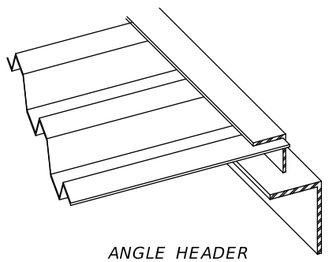


STEEL BEAMS AT TENSION FLANGES (2)

TYPICAL TRANSVERSE SECTIONS



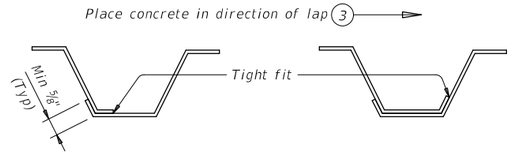
PRECLOSED



ANGLE HEADER

NOTE: This type is to be used for skewed ends only.

TYPES OF END CLOSURES



SIDE LAP DETAILS

(1) Slab thickness minus 5/8" if corrugations match reinforcing bars.

(2) Welding of form supports to tension flanges will not be permitted. Other methods of providing wind hold down resistance for PMDF in tension flange zones will be considered. At least one layer of sheet metal must be provided between the flange and the weld joint.

(3) The direction of concrete placement will be such that the upper layer of the form overlap is loaded first.

(4) See Span details for cover requirements.

FOR PRESTR CONC U-BEAM AND STEEL GIRDER BRIDGES:
Unless shown elsewhere in the plans, size, spacing, and orientation of bottom mat of slab reinforcement must match the top mat of reinforcing shown on the span details except all bottom mat bars are to be #5. Bottom mat reinforcement and additional concrete is subsidiary to Item 422 "Concrete Superstructures."

FOR PRESTR CONC TX-GIRDER BRIDGES:
See Miscellaneous Slab Details, Prestr Concrete I-Girders (IGMS) standard sheet for bottom mat reinforcing.

GENERAL NOTES:

Steel for Permanent Metal Deck Forms (PMDF) and support angles shall conform to ASTM A653, structural steel (SS), with coating designation G165. Steel must have a minimum yield strength of 33 ksi. Minimum thickness of PMDF is 20 gage and that of support angles and protective angles is 12 gage.

Submit two copies of forming plans for PMDF to the Engineer. These plans must show all essential details of proposed form sheets, closures, fasteners, supports, connectors, special conditions and size and location of welds. These plans must clearly show areas of tension flanges for steel beams and provisions for protecting the tension flanges from welding notch effects by inclusion of separating sheet metal or other positive method. These plans must be designed, signed, and sealed by a licensed professional engineer. Department approval of these plans is not required, but the Department reserves the right to require modifications to the plans. The Contractor is responsible for the adequacy of these plans.

The details and notes shown on this standard are to be used as a guide in preparation of the forming plans.

All material, labor, tools and incidentals necessary to form a bridge deck with Permanent Metal Deck Forms is considered subsidiary to Item 422, "Concrete Superstructures".

DESIGN NOTES:

As a minimum, PMDF and support angles must be designed for the dead load of the form, reinforcement and concrete plus 50 psf for construction loads. Flexural stresses due to these design loads must not exceed 75 percent of the yield strength of the steel. Allowable stress for weld metal must be 12,400 psi.

Maximum deflection under the weight of forms, reinforcement and concrete or 120 psf, whichever is greater, shall not exceed the following:

1/180 of the form design span, but not more than 0.50", for design spans of 10' or less.

1/240 of the form design span, but not more than 0.75", for design spans greater than 10'.

1/240 of the form design span, but not more than 0.75", for all design spans of railroad overpass bridge spans fully or partially over railroad right-of-way, and for all bridge spans of railroad underpass structures.

The form design span must not be less than the clear distance between beam flanges, measured parallel to the form flutes, minus 2".

CONSTRUCTION NOTES:

Form sheets must not be permitted to rest directly on the top of beam flanges. Form sheets must be securely fastened to form supports and must have a minimum bearing length of one inch at each end. Form supports must be placed in direct contact with beam flanges.

All attachments must be made by permissible welds, screws, bolts, clips or other means shown on the forming plans. All sheet metal assembly screws must be installed with torque-limiting devices to prevent stripping. Only welds or bolts must be used to support vertical loads.

Welding and welds must be in accordance with the provisions of Item 448, "Structural Field Welding", pertaining to fillet welds. All welds must be made by a qualified welder in accordance with Item 448.

All permanently exposed form metal, where the galvanized coating has been damaged, must be thoroughly cleaned and repaired in accordance with Item 445, "Galvanizing". Minor heat discoloration in areas of welds need not be touched up.

Flutes must line up uniformly across the entire width of the structure where main reinforcing steel is located in the flute.

Construction joints will not be permitted unless shown on the plans. The location of and forming details for any construction joint used must be shown on the forming plans. Forms below a construction joint must be removed after curing of the slab.

A sequence for uniform vibration of concrete must be approved by the Engineer prior to concrete placement. Attention must be given to prevent damage to the forms, yet provide proper vibration to prevent voids or honeycomb in the flutes and at headers and/or construction joints.

Texas Department of Transportation

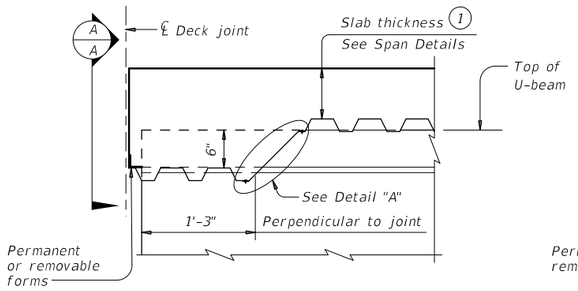
Bridge Division Standard

PERMANENT METAL DECK FORMS

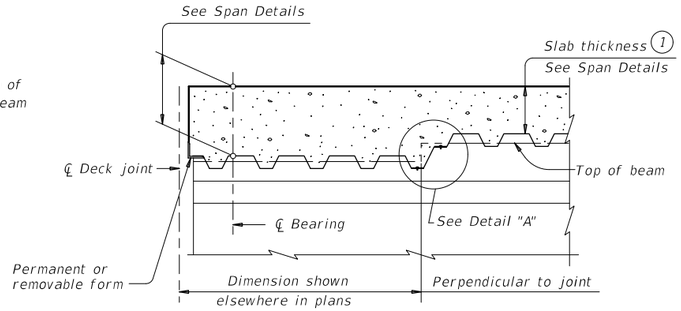
PMDF

FILE: MS-PMDF-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC.	FM 219
02-20: Modified box note by adding steel beams/girders and subsidiary. 12-21: Updated max deflection for RR.	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		129

DATE:
FILE:

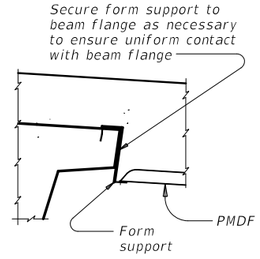


AT THICKENED SLAB END FOR U-BEAMS

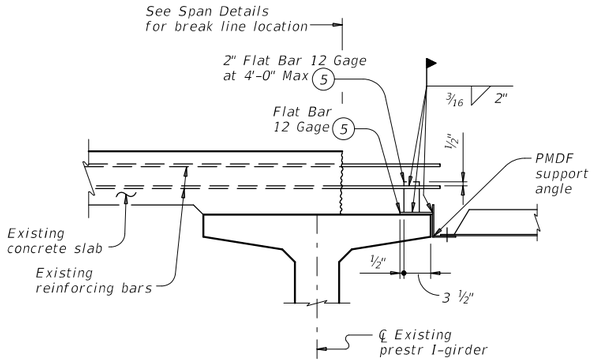


AT THICKENED SLAB END FOR PRESTRESSED I-BEAMS, I-GIRDERS AND STEEL BEAMS

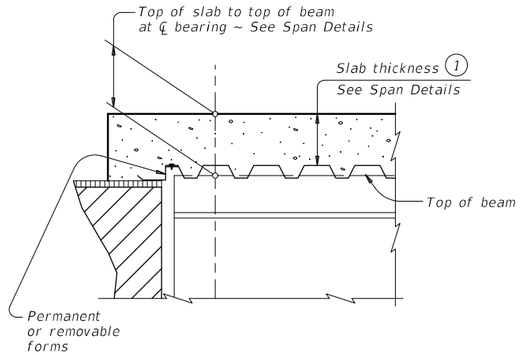
Showing I-beam block-out. No block-out for I-girders or steel beams.



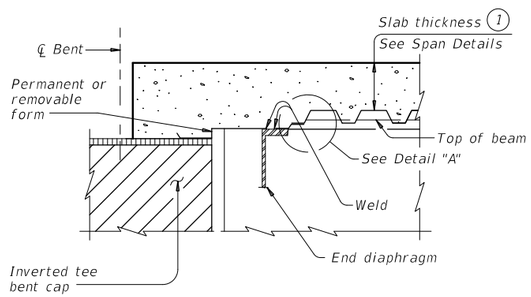
SECTION A-A



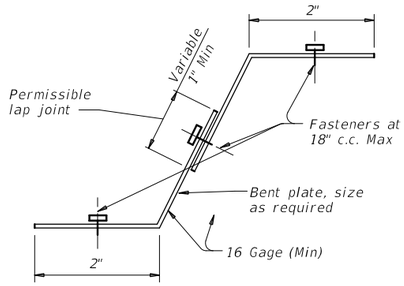
SHOWING PRESTRESSED CONCRETE I-BEAMS, I-GIRDERS AND U-BEAMS



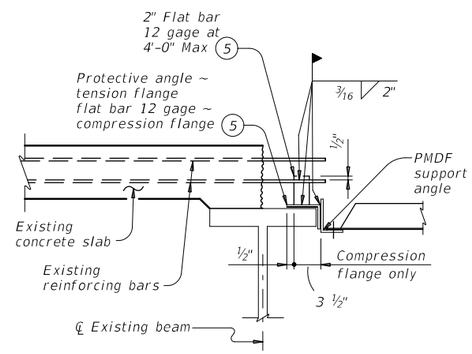
AT SLAB OVER ABUTMENT BACKWALL OR INVERTED-T STEM FOR CONCRETE BEAMS WITHOUT THICKENED SLAB END



AT SLAB OVER INVERTED-T STEM FOR STEEL BEAMS WITHOUT THICKENED SLAB END

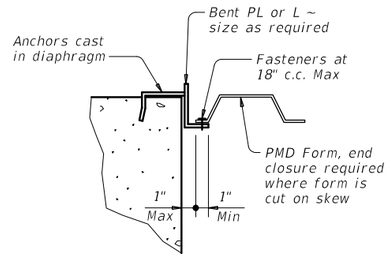


DETAIL "A"

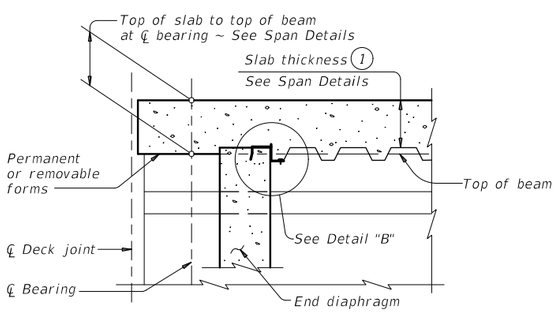


SHOWING STEEL BEAMS

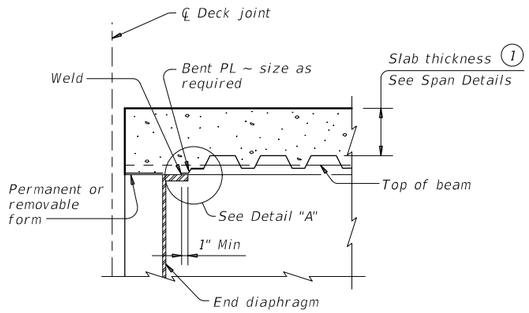
WIDENING DETAILS



DETAIL "B"



AT CONCRETE END DIAPHRAGM FOR PRESTRESSED I-BEAMS AND STEEL BEAMS



AT END DIAPHRAGM FOR STEEL BEAMS WITHOUT THICKENED SLAB END

(1) Slab thickness minus 5/8" if corrugations match reinforcing bars

(5) Minimum yield stress of 12 gage bars shall be 40 ksi

DETAILS AT ENDS OF BEAMS

SHEET 2 OF 2

Texas Department of Transportation

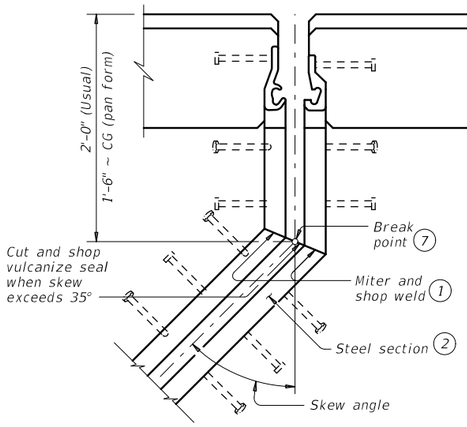
Bridge Division Standard

PERMANENT METAL DECK FORMS

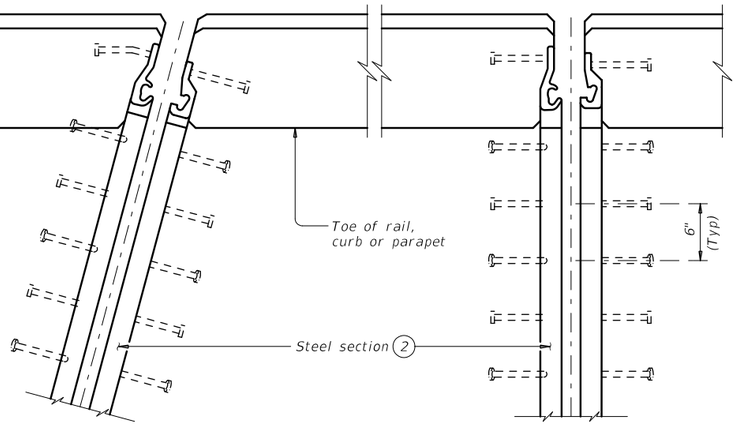
PMDF

FILE: MS-PMDF-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC.	FM 219
02-20: Modified box note by adding steel beams/girders and subsidiary.	DIST	COUNTY		SHEET NO.
12-21: Updated max deflection for RR.	WACO	BOSQUE		130

DATE:
FILE:



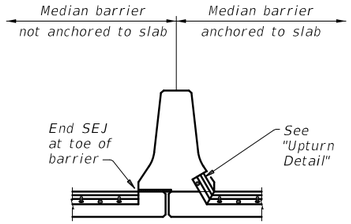
SHOWING SKEWS WITH SLAB BREAKBACKS



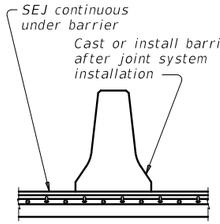
SHOWING SKEWS WITHOUT SLAB BREAKBACKS

SHOWING WITHOUT SKEWS AND SLAB BREAKBACKS

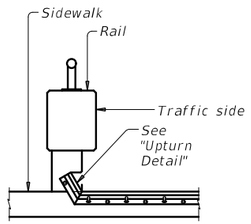
PLANS OF END CONDITIONS



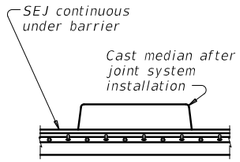
WITH OPEN DECK JOINT BELOW MEDIAN BARRIER



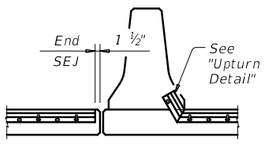
AT MEDIAN BARRIER



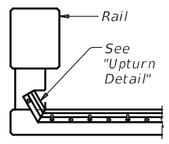
AT SIDEWALK BEHIND BRIDGE RAIL



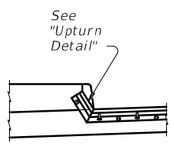
AT RAISED MEDIAN



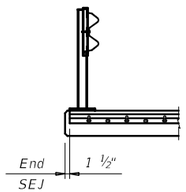
WITH OPEN DECK JOINT ADJACENT TO MEDIAN BARRIER



AT CONCRETE BRIDGE RAIL

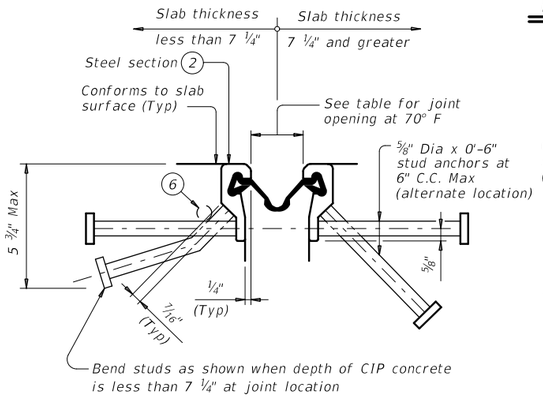


AT SIDEWALK

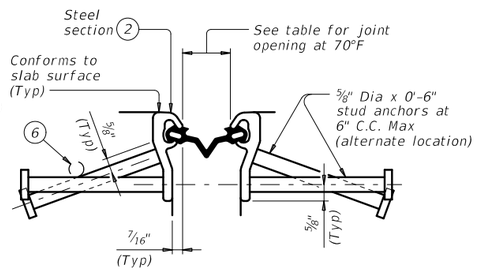


AT STEEL POST BRIDGE RAIL

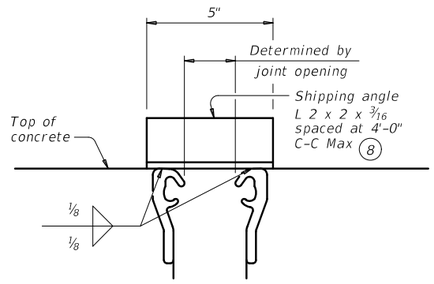
TYPICAL SECTIONS (5)



SECTION THRU WATSON BOWMAN ACME (SE-400 OR SE-500) JOINTS



SECTION THRU D.S. BROWN (A2R-400 OR A2R-XTRA) JOINTS



SHOWING D.S. BROWN (Ty SSCM2)
(All joints are similar.) (Studs are not shown for clarity.)

SHIPPING ANGLE

An alternate method of securing joint sections may be used if approved by the Bridge Division. Erection bolts are not allowed.

TABLE OF SEALED EXPANSION JOINT INFORMATION

MANUFACTURER	STEEL SECTION (2)	STRIP SEAL			
		4" JOINT		5" JOINT	
		Seal Type	Joint Opening (3)	Seal Type	Joint Opening (3)
D.S. Brown	Type SSCM2	A2R-400	1 ¾"	A2R-XTRA	2"
Watson Bowman Acme	Type R	SE-400	1 ¾"	SE-500	2"

REDUCED LONGITUDINAL MOVEMENT RANGE

SKEW (deg)	JOINT SIZE	
	4"	5"
0	4.0"	5.0"
15	4.0"	5.0"
30	3.5"	4.3"
45	2.8"	3.5"

DESIGN NOTES:

Joints installed on a skew have reduced ability to accommodate longitudinal movement. Use table values to determine the correct joint size for skewed installations.

For other skews over 25 degrees, calculate reduced movement range by multiplying joint size by cosine (skew).

(1) Remove all burrs which will be in contact with seal prior to making splice.

(2) Shape of steel section shown is typical. Variations in sections must be approved by the Engineer.

(3) These openings are also the recommended minimum installation openings.

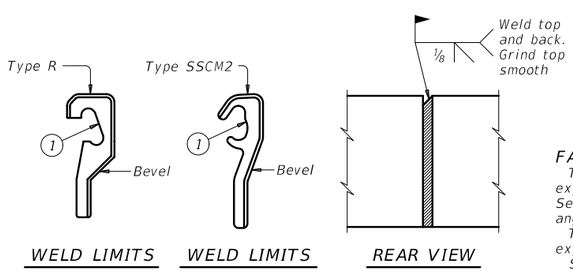
(4) Reduce for sidewalk or parapet heights less than 6".

(5) Other conditions affecting the joint profile should be noted elsewhere.

(6) Move transverse bars that are in conflict with SEJ studs, in either the bridge slab or approach slab, to rest at the junction of the studs.

(7) See Span details for location of break point.

(8) Align shipping angle perpendicular to joint.



WELD LIMITS WELD LIMITS REAR VIEW

FIELD SPLICE DETAIL

FABRICATION NOTES:

Temporarily shop assemble corresponding sections of sealed expansion joints (SEJ), check for fit, and match mark for shipment. Secure corresponding sections together for shipment with shipping angle. Do not use erection bolts.

The seal must be continuous and included in the price bid for sealed expansion joint.

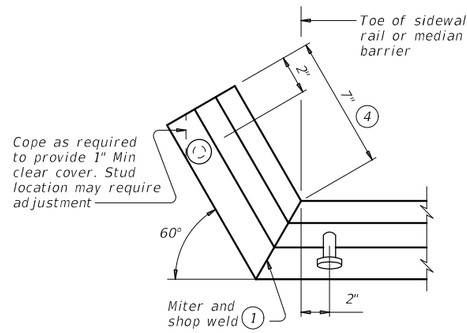
Ship steel sections in convenient lengths of 10'-0" Min and 24'-0" Max unless necessary for staged construction or widenings. One shop splice is permitted in each shipping length provided no piece is less than 2'-0" long and sufficient studs are added to limit the stud to shop splice distance to 2" Min and 4" Max.

Weld studs in accordance with AWS D1.1.

Butt weld all shop and field splices and grind smooth areas in contact with seal. Make all necessary field splice joint preparations in the shop.

Paint the entire steel section with System II or IV primer in accordance with Item 446, "Field Cleaning and Painting Steel", unless required to galvanize when shown in the plans. Provide galvanizing in accordance with Item 445, "Galvanizing". Provide paints in accordance with Item 446.2. Prepare steel and apply paint in accordance with Item 446.4.7.3 and 446.4.7.4.

Shop drawings for the fabrication of sealed expansion joints will not require the Engineer's approval if fabrication is in accordance with the details shown on this standard.



UPTURN DETAIL

CONSTRUCTION NOTES:

Secure the sealed expansion joint in position and place to the proper grade and alignment by welding braces to adjacent reinforcing steel, to prestressed beam stirrups, or to anchors cast in concrete diaphragms. Include cost of temporary bracing in the price bid for sealed expansion joint.

Remove shipping angle immediately after each joint half is secured in place. Grind smooth, and touch up with organic zinc-rich paint.

Clean and prepare seal cavity for seal installation as per the Manufacturer's installation procedures.

GENERAL NOTES:

Provide sealed expansion joints in the size and at locations shown on the plans.

Minimum slab and overhang thickness required for the use of SEJ-M is 6 ½".

Texas Department of Transportation

Bridge Division Standard

SEALED EXPANSION JOINT TYPE M

WITHOUT OVERLAY

SEJ-M

FILE: MS-SEJ-M-19.dgn	DN: TxDOT	CK: TxDOT	DW: JTR	CK: JMH
©TxDOT April 2019 REVISIONS	CONT	SECT	JOB	HIGHWAY
	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		131

DATE:
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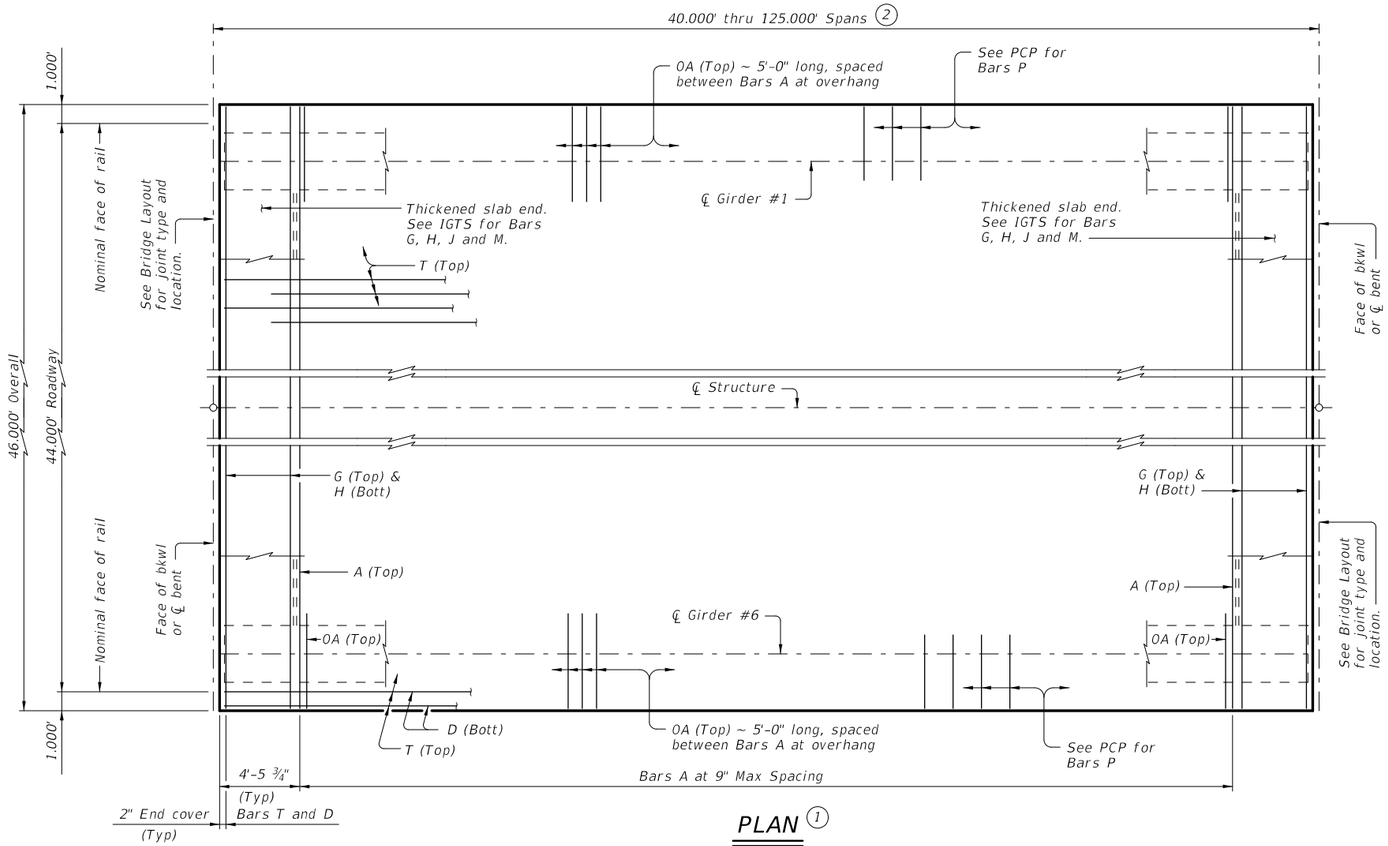
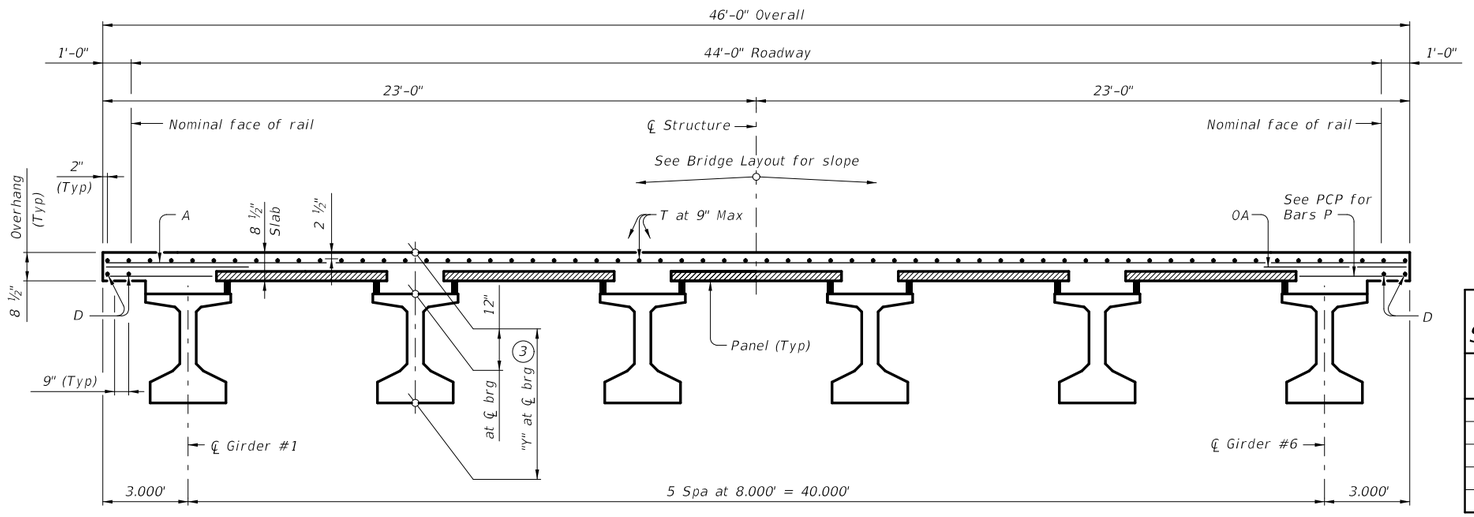


PLAN (1)



TYPICAL TRANSVERSE SECTION

(Showing girder type Tx46)

BAR TABLE	
BAR	SIZE
A	#4
D	#4
G	#4
H	#4
J	#4
M	#4
0A	#5
P	#4
T	#4

TABLE OF SECTION DEPTHS	
GIRDER TYPE	"Y" AT ℄ BRG (3)
	Ft/In
Tx28	3'-4"
Tx34	3'-10"
Tx40	4'-4"
Tx46	4'-10"
Tx54	5'-6"

(1) If multi-span units (with slab continuous over interior bents) are indicated on the Bridge Layout, see standard IGCS for adjustment to slab reinforcement and quantities.

(2) Span lengths for prestressed concrete I-Girder type:
Type Tx28 for spans lengths 40.000' thru 70.000'.
Type Tx34 for spans lengths 40.000' thru 85.000'.
Type Tx40 for spans lengths 40.000' thru 95.000'.
Type Tx46 for spans lengths 40.000' thru 110.000'.
Type Tx54 for spans lengths 40.000' thru 125.000'.

(3) "Y" value shown is based on theoretical girder camber, dead load deflection from an 8 ½" concrete slab, a constant roadway grade, and using precast panels (PCP). The Contractor will adjust this value as necessary for any roadway vertical curve.

HL93 LOADING SHEET 1 OF 2

Texas Department of Transportation

Bridge Division Standard

PRESTRESSED CONCRETE I-GIRDER SPANS (TYPE Tx28 THRU Tx54)

44' ROADWAY

SIG-44

FILE: IG-SIG4400-23.dgn	DN: JMH	CK: NRN	DW: JTR	CK: TAR
©TxDOT August 2017	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC.	FM 219
10-19: Increased "X" and "Y" Values. 01-23: Removed PCP(0) reference.	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		132

DATE:
FILE:

TABLE OF DEAD LOAD DEFLECTIONS

TYPE Tx28 GIRDERS

SPAN LENGTH	"A"	"B"
Ft	Ft	Ft
40	0.009	0.013
45	0.015	0.021
50	0.023	0.032
55	0.034	0.048
60	0.048	0.068
65	0.068	0.095
70	0.092	0.129

TYPE Tx34 GIRDERS

SPAN LENGTH	"A"	"B"
Ft	Ft	Ft
40	0.006	0.008
45	0.009	0.012
50	0.014	0.019
55	0.020	0.028
60	0.029	0.041
65	0.041	0.057
70	0.055	0.077
75	0.073	0.102
80	0.095	0.134
85	0.122	0.171

TYPE Tx40 GIRDERS

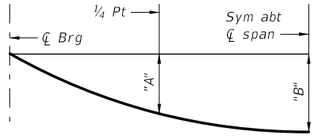
SPAN LENGTH	"A"	"B"
Ft	Ft	Ft
40	0.004	0.005
45	0.006	0.008
50	0.009	0.013
55	0.014	0.019
60	0.019	0.027
65	0.026	0.037
70	0.036	0.050
75	0.048	0.067
80	0.062	0.087
85	0.080	0.112
90	0.101	0.142
95	0.126	0.177

TYPE Tx46 GIRDERS

SPAN LENGTH	"A"	"B"
Ft	Ft	Ft
40	0.002	0.003
45	0.004	0.006
50	0.006	0.009
55	0.009	0.013
60	0.013	0.018
65	0.018	0.025
70	0.024	0.034
75	0.033	0.046
80	0.043	0.060
85	0.054	0.076
90	0.068	0.096
95	0.085	0.120
100	0.105	0.148
105	0.129	0.181
110	0.156	0.219

TYPE Tx54 GIRDERS

SPAN LENGTH	"A"	"B"
Ft	Ft	Ft
40	0.001	0.002
45	0.003	0.004
50	0.004	0.006
55	0.006	0.008
60	0.009	0.012
65	0.012	0.017
70	0.016	0.023
75	0.021	0.030
80	0.028	0.039
85	0.036	0.050
90	0.046	0.064
95	0.057	0.080
100	0.070	0.098
105	0.085	0.120
110	0.103	0.145
115	0.123	0.173
120	0.147	0.206
125	0.173	0.243



DEAD LOAD DEFLECTION DIAGRAM

Calculated deflections shown are due to the concrete slab on interior girders only (Ec = 5000 ksi). Adjust values as required for exterior girders and if optional slab forming is used. These values may require field verification.

TABLE OF ESTIMATED QUANTITIES

SPAN LENGTH	REINF CONCRETE SLAB	Prestressed Concrete Girders			TOTAL REINF STEEL (5)
		ABUT TO INT BT (4)	INT BT TO INT BT (4)	ABUT TO ABUT (4)	
Ft	SF	LF	LF	LF	Lb
40	1,840	237.00	237.00	237.00	4,232
45	2,070	267.00	267.00	267.00	4,761
50	2,300	297.00	297.00	297.00	5,290
55	2,530	327.00	327.00	327.00	5,819
60	2,760	357.00	357.00	357.00	6,348
65	2,990	387.00	387.00	387.00	6,877
70	3,220	417.00	417.00	417.00	7,406
75	3,450	447.00	447.00	447.00	7,935
80	3,680	477.00	477.00	477.00	8,464
85	3,910	507.00	507.00	507.00	8,993
90	4,140	537.00	537.00	537.00	9,522
95	4,370	567.00	567.00	567.00	10,051
100	4,600	597.00	597.00	597.00	10,580
105	4,830	627.00	627.00	627.00	11,109
110	5,060	657.00	657.00	657.00	11,638
115	5,290	687.00	687.00	687.00	12,167
120	5,520	717.00	717.00	717.00	12,696
125	5,750	747.00	747.00	747.00	13,225

(4) Fabricator will adjust lengths for girder slopes as required.

(5) Reinforcing steel weight is calculated using an approximate factor of 2.3 lbs/SF.

MATERIAL NOTES:

Provide Class S concrete (f'c = 4,000 psi).
Provide Class S (HPC) concrete if shown elsewhere in the plans.
Provide Grade 60 reinforcing steel.
Provide bar laps, where required, as follows:
Uncoated ~ #4 = 1'-7"
Epoxy coated ~ #4 = 2'-5"
Deformed welded wire reinforcement (WWR) (ASTM A1064) of equal size and spacing may be substituted for Bars A, D, OA, P or T unless noted otherwise.

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.
Multi-span units, with slab continuous over interior bents, may be formed with the details shown on this sheet and the I-Girder Continuous Slab Detail (IGCS) standard.
See I-Girder Thickened Slab End Details (IGTS) standard for details and quantity adjustments.
See Prestressed Concrete Panels (PCP) standard and Prestressed Concrete Panel Fabrication Details (PCP-FAB) standard for panel details not shown.
See I-Girder Miscellaneous Slab Details (IGMS) standard for miscellaneous details.
See applicable rail details for rail anchorage in slab.
See Permanent Metal Deck Forms (PMDF) standard for details and quantity adjustments if this option is used.
This standard does not support the use of transition bents.

Cover dimensions are clear dimensions, unless noted otherwise.

HL93 LOADING

Texas Department of Transportation

Bridge Division Standard

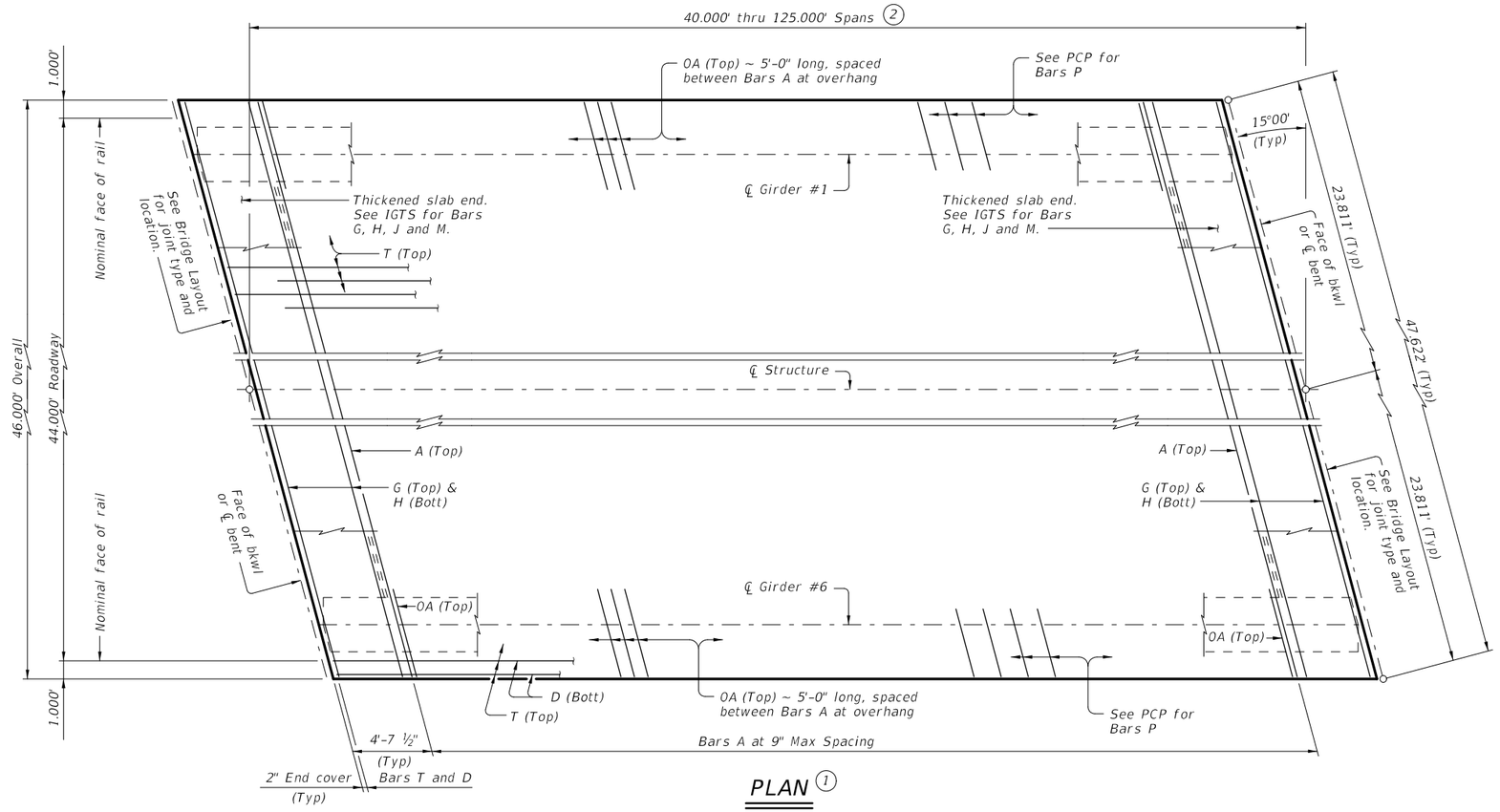
PRESTRESSED CONCRETE I-GIRDER SPANS (TYPE Tx28 THRU Tx54)

44' ROADWAY

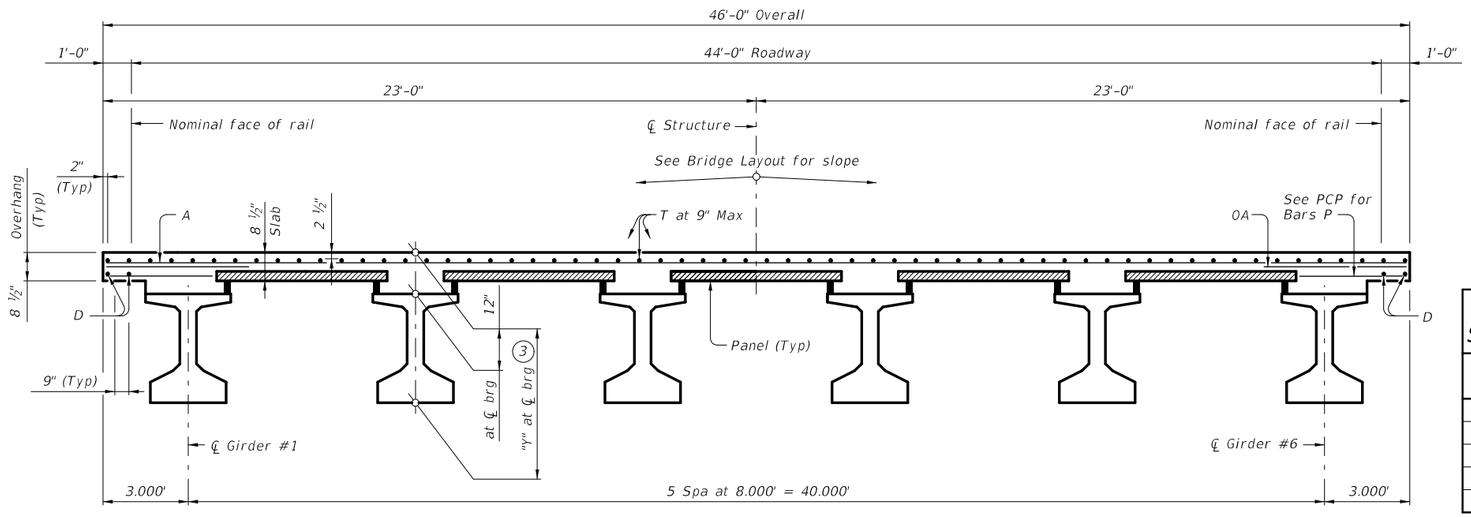
SIG-44

FILE: IG-SIG4400-23.dgn	DN: JMH	CK: NRN	DW: JTR	CK: TAR
©TxDOT August 2017	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC.	FM 219
10-19: Increased "X" and "Y" Values. 01-23: Removed PCP(0) reference.	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		133

DATE:
FILE:



PLAN (1)



TYPICAL TRANSVERSE SECTION

(Showing girder type Tx46)

BAR TABLE	
BAR	SIZE
A	#4
D	#4
G	#4
H	#4
J	#4
M	#4
0A	#5
P	#4
T	#4

TABLE OF SECTION DEPTHS	
GIRDER TYPE	"Y" AT ℄ BRG (3)
	Ft/In
Tx28	3'-4"
Tx34	3'-10"
Tx40	4'-4"
Tx46	4'-10"
Tx54	5'-6"

(1) If multi-span units (with slab continuous over interior bents) are indicated on the Bridge Layout, see standard IGCS for adjustment to slab reinforcement and quantities.

(2) Span lengths for prestressed concrete I-Girder type:
Type Tx28 for spans lengths 40.000' thru 70.000'.
Type Tx34 for spans lengths 40.000' thru 85.000'.
Type Tx40 for spans lengths 40.000' thru 95.000'.
Type Tx46 for spans lengths 40.000' thru 110.000'.
Type Tx54 for spans lengths 40.000' thru 125.000'.

(3) "Y" value shown is based on theoretical girder camber, dead load deflection from an 8 ½" concrete slab, a constant roadway grade, and using precast panels (PCP). The Contractor will adjust this value as necessary for any roadway vertical curve.

HL93 LOADING SHEET 1 OF 2

Texas Department of Transportation

Bridge Division Standard

PRESTRESSED CONCRETE I-GIRDER SPANS (TYPE Tx28 THRU Tx54)

44' ROADWAY 15° SKEW

SIG-44-15

FILE: IG-SIG4400-23.dgn	DN: JMH	CK: NRN	DW: JTR	CK: TAR
©TxDOT August 2017	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC.	FM 219
10-19: Increased "X" and "Y" Values. 01-23: Removed PCP(0) reference.	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		134

DATE:
FILE:

TABLE OF DEAD LOAD DEFLECTIONS

TYPE Tx28 GIRDERS

SPAN LENGTH	"A"	"B"
Ft	Ft	Ft
40	0.009	0.013
45	0.015	0.021
50	0.023	0.032
55	0.034	0.048
60	0.048	0.068
65	0.068	0.095
70	0.092	0.129

TYPE Tx34 GIRDERS

SPAN LENGTH	"A"	"B"
Ft	Ft	Ft
40	0.006	0.008
45	0.009	0.012
50	0.014	0.019
55	0.020	0.028
60	0.029	0.041
65	0.041	0.057
70	0.055	0.077
75	0.073	0.102
80	0.095	0.134
85	0.122	0.171

TYPE Tx40 GIRDERS

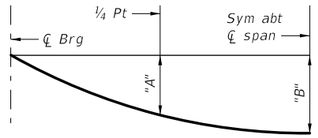
SPAN LENGTH	"A"	"B"
Ft	Ft	Ft
40	0.004	0.005
45	0.006	0.008
50	0.009	0.013
55	0.014	0.019
60	0.019	0.027
65	0.026	0.037
70	0.036	0.050
75	0.048	0.067
80	0.062	0.087
85	0.080	0.112
90	0.101	0.142
95	0.126	0.177

TYPE Tx46 GIRDERS

SPAN LENGTH	"A"	"B"
Ft	Ft	Ft
40	0.002	0.003
45	0.004	0.006
50	0.006	0.009
55	0.009	0.013
60	0.013	0.018
65	0.018	0.025
70	0.024	0.034
75	0.033	0.046
80	0.043	0.060
85	0.054	0.076
90	0.068	0.096
95	0.085	0.120
100	0.105	0.148
105	0.129	0.181
110	0.156	0.219

TYPE Tx54 GIRDERS

SPAN LENGTH	"A"	"B"
Ft	Ft	Ft
40	0.001	0.002
45	0.003	0.004
50	0.004	0.006
55	0.006	0.008
60	0.009	0.012
65	0.012	0.017
70	0.016	0.023
75	0.021	0.030
80	0.028	0.039
85	0.036	0.050
90	0.046	0.064
95	0.057	0.080
100	0.070	0.098
105	0.085	0.120
110	0.103	0.145
115	0.123	0.173
120	0.147	0.206
125	0.173	0.243



DEAD LOAD DEFLECTION DIAGRAM

Calculated deflections shown are due to the concrete slab on interior girders only (Ec = 5000 ksi). Adjust values as required for exterior girders and if optional slab forming is used. These values may require field verification.

TABLE OF ESTIMATED QUANTITIES

SPAN LENGTH	REINF CONCRETE SLAB	Prestressed Concrete Girders			TOTAL REINF STEEL (5)
		ABUT TO INT BT (4)	INT BT TO INT BT (4)	ABUT TO ABUT (4)	
Ft	SF	LF	LF	LF	Lb
40	1,840	236.95	237.00	236.89	4,232
45	2,070	266.95	267.00	266.89	4,761
50	2,300	296.95	297.00	296.89	5,290
55	2,530	326.95	327.00	326.89	5,819
60	2,760	356.95	357.00	356.89	6,348
65	2,990	386.95	387.00	386.89	6,877
70	3,220	416.95	417.00	416.89	7,406
75	3,450	446.95	447.00	446.89	7,935
80	3,680	476.95	477.00	476.89	8,464
85	3,910	506.95	507.00	506.89	8,993
90	4,140	536.95	537.00	536.89	9,522
95	4,370	566.95	567.00	566.89	10,051
100	4,600	596.95	597.00	596.89	10,580
105	4,830	626.95	627.00	626.89	11,109
110	5,060	656.95	657.00	656.89	11,638
115	5,290	686.95	687.00	686.89	12,167
120	5,520	716.95	717.00	716.89	12,696
125	5,750	746.95	747.00	746.89	13,225

(4) Fabricator will adjust lengths for girder slopes as required.

(5) Reinforcing steel weight is calculated using an approximate factor of 2.3 lbs/SF.

MATERIAL NOTES:

Provide Class S concrete (f'c = 4,000 psi).
Provide Class S (HPC) concrete if shown elsewhere in the plans.
Provide Grade 60 reinforcing steel.
Provide bar laps, where required, as follows:
Uncoated ~ #4 = 1'-7"
Epoxy coated ~ #4 = 2'-5"
Deformed welded wire reinforcement (WWR) (ASTM A1064) of equal size and spacing may be substituted for Bars A, AA, D, OA, P or T unless noted otherwise.

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.
Multi-span units, with slab continuous over interior bents, may be formed with the details shown on this sheet and the I-Girder Continuous Slab Detail (IGCS) standard.
See I-Girder Thickened Slab End Details (IGTS) standard for details and quantity adjustments.
See Prestressed Concrete Panels (PCP) standard and Prestressed Concrete Panel Fabrication Details (PCP-FAB) standard for panel details not shown.
See I-Girder Miscellaneous Slab Details (IGMS) standard for miscellaneous details.
See applicable rail details for rail anchorage in slab.
See Permanent Metal Deck Forms (PMDF) standard for details and quantity adjustments if this option is used.
This standard is drawn showing right forward skew.
See Bridge Layout for actual skew direction.
This standard does not support the use of transition bents.

Cover dimensions are clear dimensions, unless noted otherwise.

HL93 LOADING

Texas Department of Transportation

Bridge Division Standard

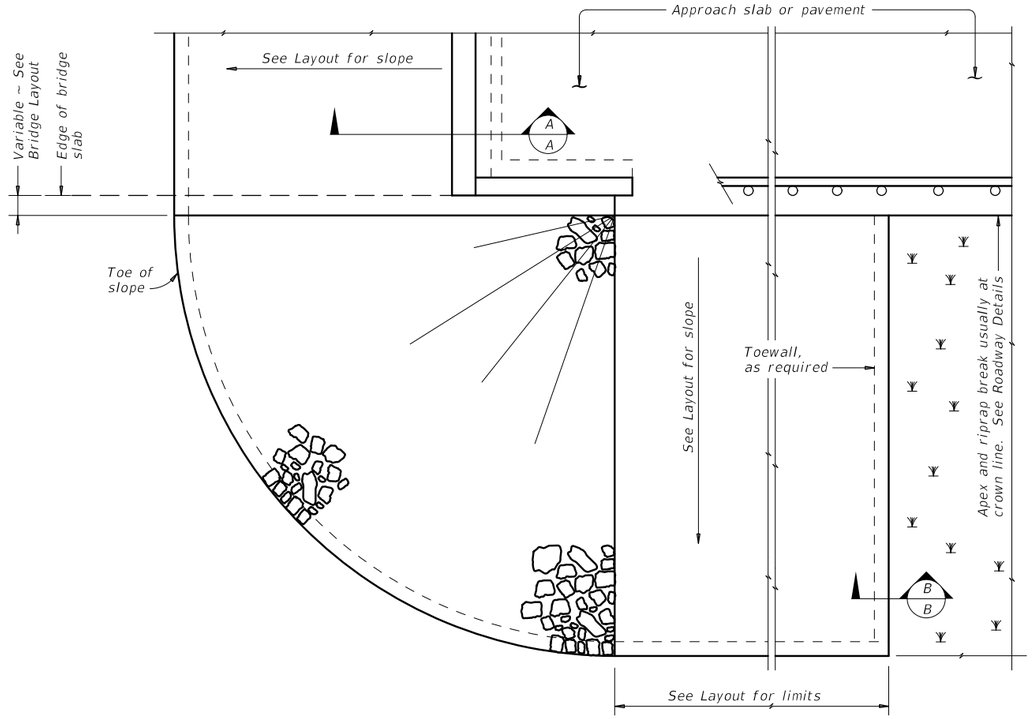
PRESTRESSED CONCRETE I-GIRDER SPANS (TYPE Tx28 THRU Tx54)

44' ROADWAY 15° SKEW

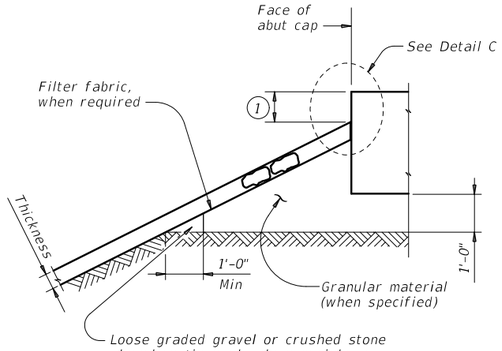
SIG-44-15

FILE: IG-SIG4400-23.dgn	DN: JMH	CK: NRN	DW: JTR	CK: TAR
©TxDOT August 2017	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC.	FM 219
10-19: Increased "X" and "Y" Values. 01-23: Removed PCP(0) reference.	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		135

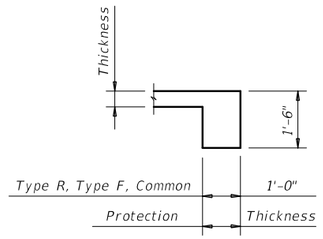
DATE:
FILE:



PLAN

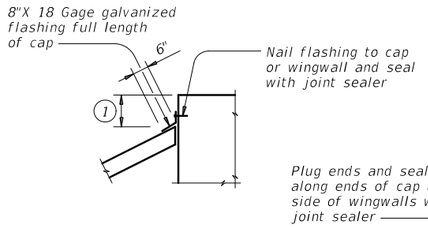


SECTION A-A AT CAP

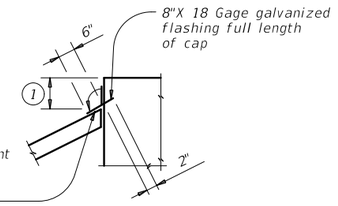


SECTION B-B

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

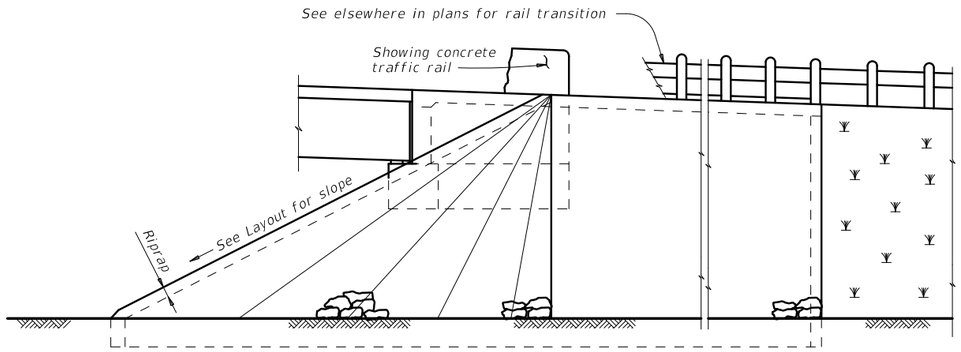


CAP OPTION A



CAP OPTION B

DETAIL C



ELEVATION

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

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

Texas Department of Transportation

Bridge Division Standard

STONE RIPRAP

SRR

FILE: MS-SRR-19.dgn	DN: AES	CK: JGD	DW: BWH	CK: AES
©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		136

DATE:
FILE:

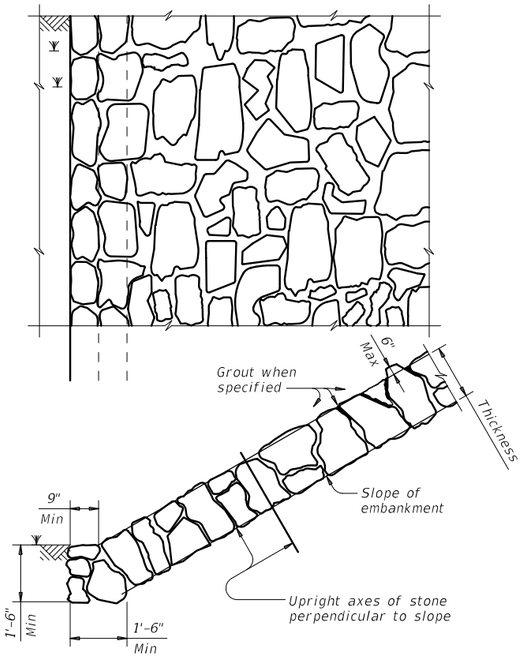


FIGURE 1 ~ TYPE R STONE RIPRAP

dry or grouted

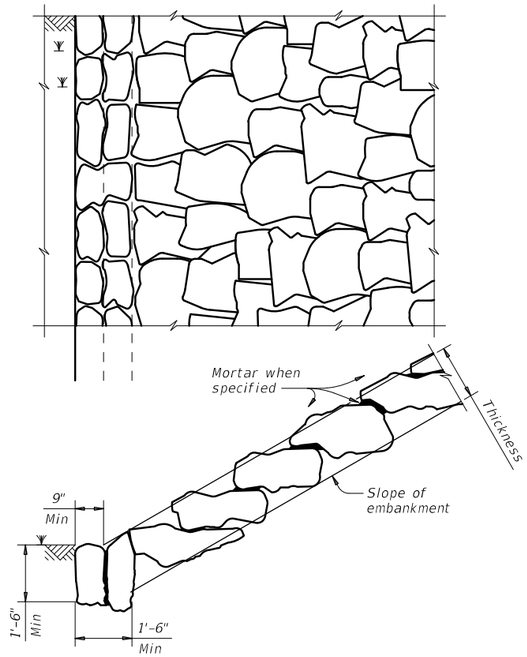


FIGURE 2 ~ TYPE F STONE RIPRAP

dry or mortared

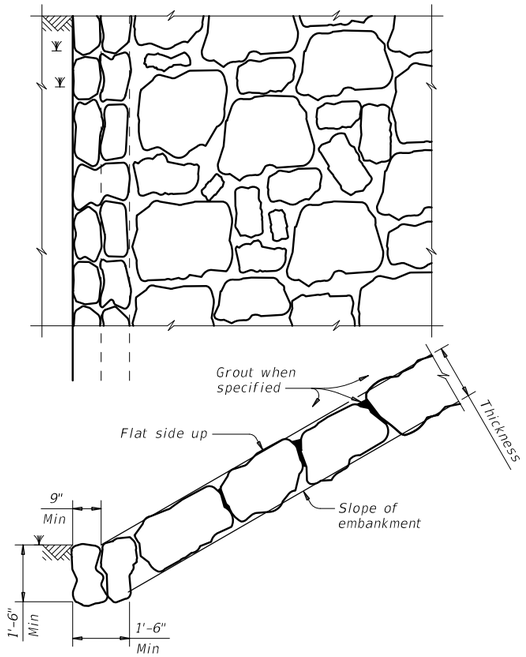


FIGURE 3 ~ TYPE F STONE RIPRAP

grouted

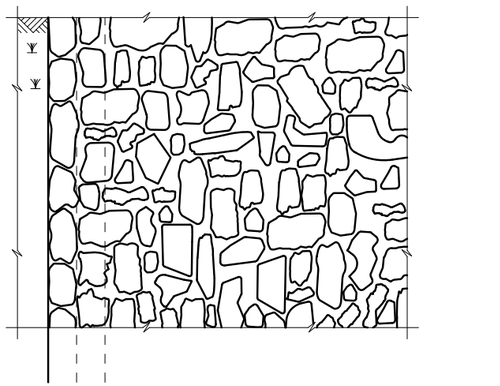


FIGURE 4 ~ COMMON STONE RIPRAP

dry or grouted

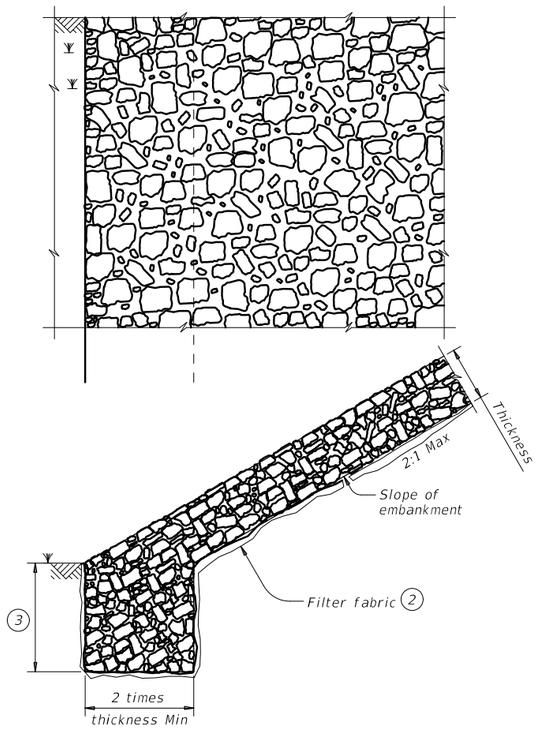


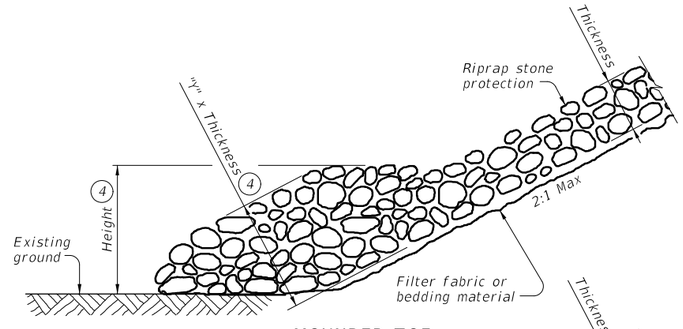
FIGURE 5 ~ PROTECTION STONE RIPRAP (5)

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

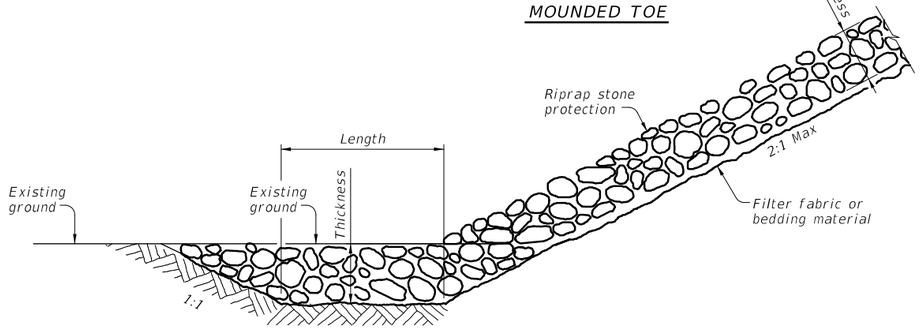
(3) Minimum toe depth is the larger of the maximum scour depth or 2 times the riprap thickness.

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

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



MOUNDED TOE



EXTENDED ROCK FILLED TRENCH

PROTECTION STONE RIPRAP TOE OPTIONS (5)

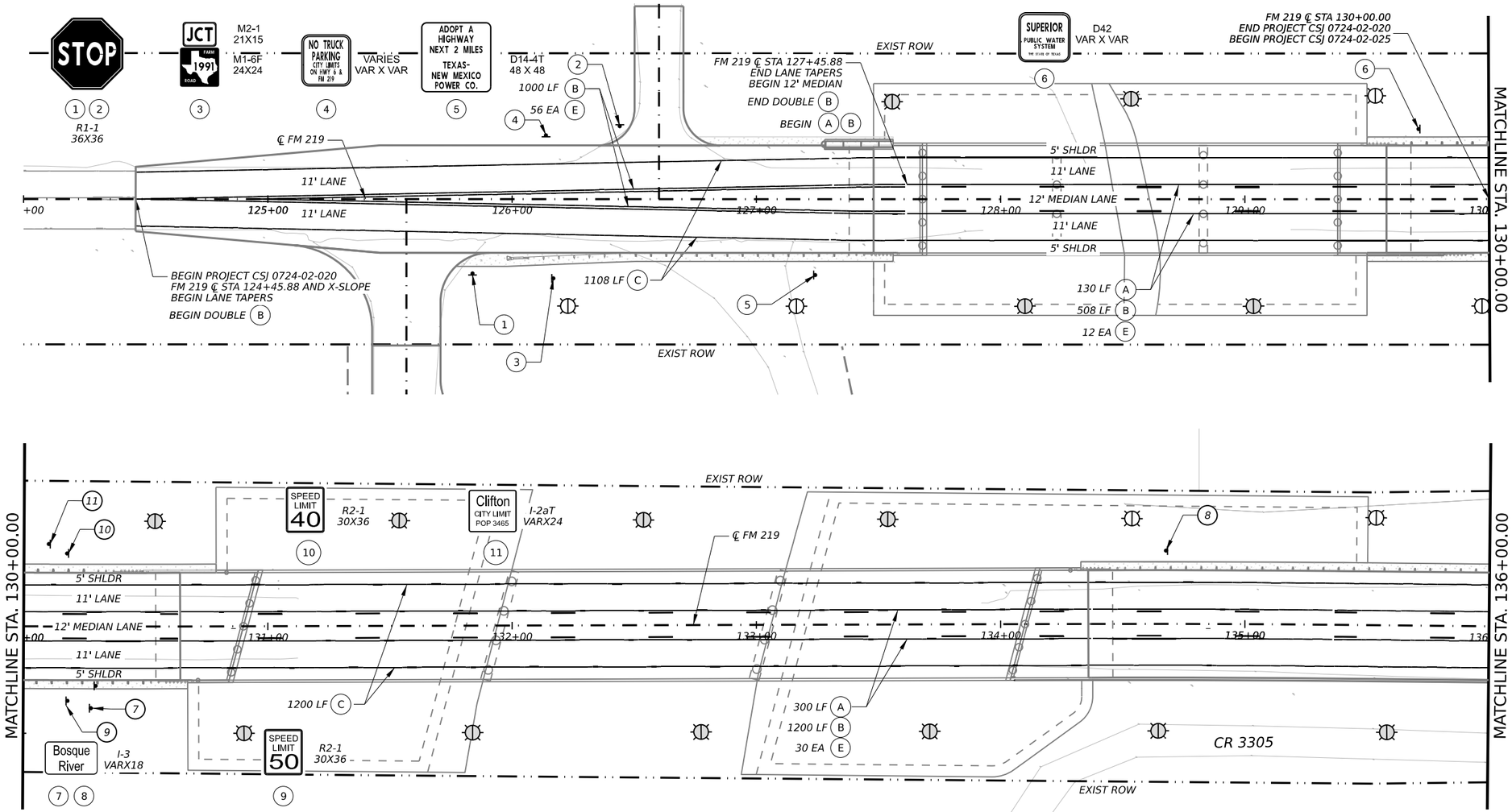
Texas Department of Transportation

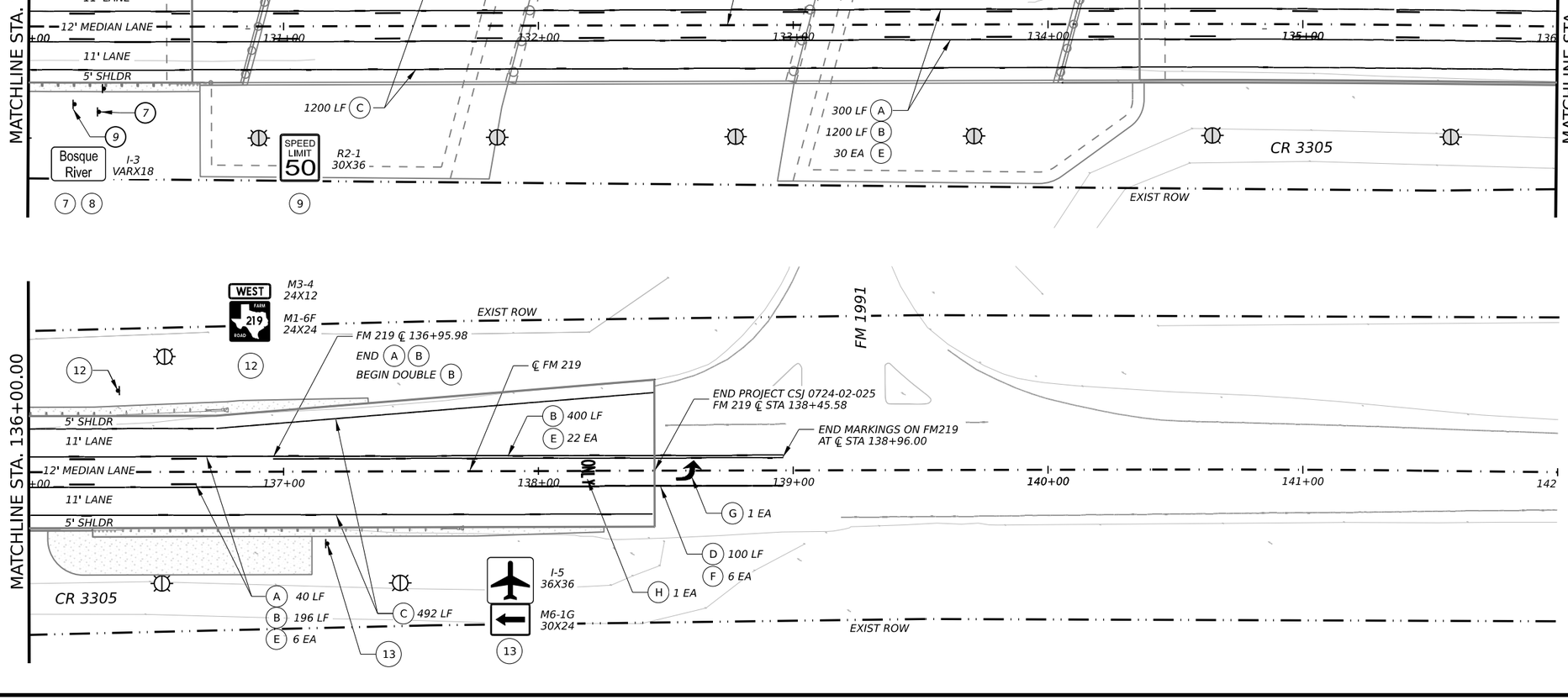
Bridge Division Standard

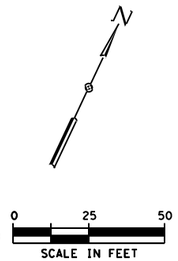
STONE RIPRAP

SRR

FILE: MS-SRR-19.dgn		DN: AES	CK: JGD	DW: BWH	CK: AES		
©TxDOT April 2019		CONT	SECT	JOB		HIGHWAY	
REVISIONS		0724	02	020, ETC.		FM 219	
		DIST	COUNTY			SHEET NO.	
		WACO	BOSQUE			137	







LEGEND:

A	RE PM W/RET REQ TY I(Y) 6" (BRK)(100MIL)
B	RE PM W/RET REQ TY I(Y) 6" (SLD)(100MIL)
C	RE PM W/RET REQ TY I(W) 6" (SLD)(100MIL)
D	RE PM W/RET REQ TY I(W) 8" (SLD)(100MIL)
E	REFL PAV MRKR TY II-A-A
F	REFL PAV MRKR TY I-C
G	REFL PAV MRK TY I (W)(ARROW)(100MIL)
H	REFL PAV MRK TY I (W)(WORD)(100MIL)
	DEL ASSM (D-SW) SZ 1(BRF) GF2 (BI)
	DEL ASSM (D-SW) SZ 1(BRF) CTB (BI)

PRINT DATE	REVISION DATE
3/1/2024	

STATE OF TEXAS
CRAIG M. WILSON
94710
LICENSED PROFESSIONAL ENGINEER

3/1/2024

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a Hardesty & Hanover, LLC Company
9020 N. Capital of Texas Hwy,
Bldg 2, Suite 250
Austin, Texas 78759
(512) 250-5200
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Texas Department of Transportation
Waco District

FM 219 BRIDGE REPLACEMENTS

SIGN & PAVEMENT MARKING LAYOUT

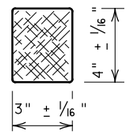
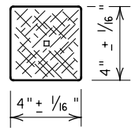
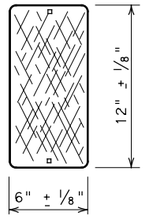
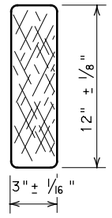
SHEET 1 OF 1

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 138

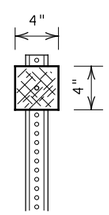
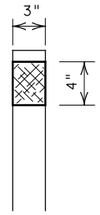
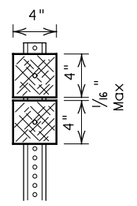
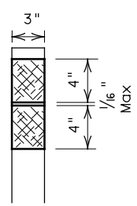
CSJ: 0724 02 020, ETC.
FILE LOCATION: ...\2022.05759.06.RD.PM.01.dgn

DATE: 3/1/2024 12:16:30 PM
FILE: P:\2020\01156\06-Bosque River-0724-02-020\4 - Design\Plan Set\13. Standards\dom1-20.dgn

REFLECTOR UNIT SIZES FOR DELINEATORS AND OBJECT MARKERS

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

DELINEATORS

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

D & OM DESCRIPTIVE CODES

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

NUMBER OF REFLECTORS
S = Single
D = Double

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

REFLECTOR UNIT SIZE
1 or 2

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

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

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

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

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

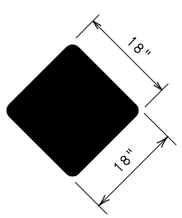
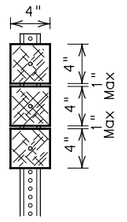
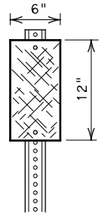
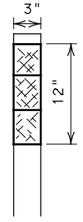
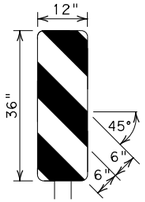
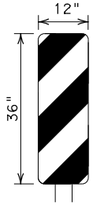
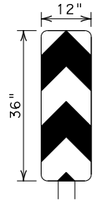
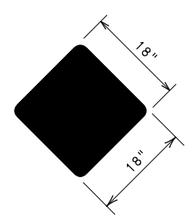
NUMBER OF REFLECTORS OR DIRECTION
X = 3-Size 2 reflector units (Type 2 only)
Y = 1-Size 3 reflector unit (Type 2 only)
Z = 3-Size 1 or 1-Size 4 reflector unit(s)(Type 2 only)
L = Left Side (Type 3 Object Marker only)
R = Right Side (Type 3 Object Marker only)
C = Center (Type 3 Object Marker only)

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

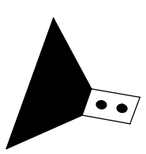
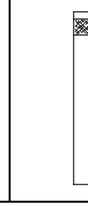
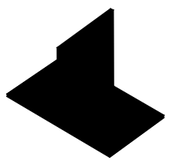
TYPE OF MOUNT
GND = Embedded (drivable)
SRF = Surface Mount
WAS = Wedge Anchor Steel
WAP = Wedge Anchor Plastic

DIRECTION
If Required
BI = Bi-Directional

OBJECT MARKERS

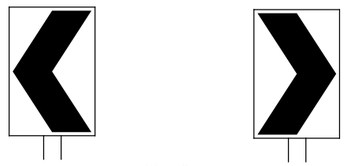
	Type 1 (OM-1)	Type 2 (OM-2)			Type 3 (OM-3)			Type 4 (OM-4)
	OM-1	OM-2X	OM-2Y	OM-2Z	OM-3L	OM-3R	OM-3C	OM-4
DEVICE								
		3-Size 2 reflector units	1-Size 3 reflector unit	3-Size 1 reflector units or 1-Size 4 reflector unit				
SHEETING	Yellow-Type B_{FL} or C_{FL} Sheeting	Yellow - Type B or C Sheeting			Alternating acrylic black and retroflective yellow - Type B_{FL} or C_{FL} Sheeting			Red -Type B_{FL} or C_{FL} Sheeting
POST TYPE	TWT	WC	WC	WFLX	TWT			TWT
MOUNT TYPE	WAS, WAP	GND	GND	GND, SRF	WAS, WAP			WAS, WAP

BARRIER REFLECTORS (BRF)

	GF1	GF2	CTB
DEVICE			
	1. Barrier reflectors shall meet the requirements of DMS 8600. 2. Approved Barrier Reflectors are listed on the "Barrier Reflectors" Material Producer List at: www.txdot.gov.		
SHEETING	Yellow, White, Red		
NOTE	1. Reflective sheeting shall have a minimum dimension of 3 inches and minimum surface area of 9 square inches.		

CHEVRONS

DEVICE



W1-8

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

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

ONE DIRECTION LARGE ARROW

DEVICE

W1-6

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

NOTE:

Delineator and object marker substrates and sign substrates shall be 0.080" Aluminum sign blank to conform to ASTM B-209 Alloy 6061-T6 or approved alternative.

DEPARTMENTAL MATERIAL SPECIFICATIONS

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

Texas Department of Transportation — Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER MATERIAL DESCRIPTION

D & OM(1)-20

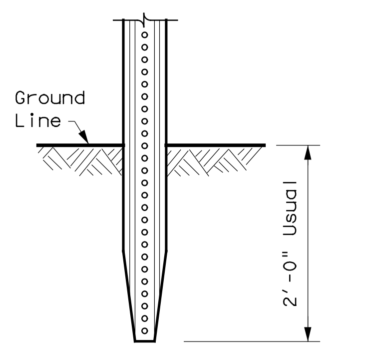
FILE: dom1-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
©TxDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC.	FM 219
10-09 3-15	DIST	COUNTY		SHEET NO.
4-10 7-20	WACO	BOSQUE		139

20A

POST TYPE AND SUPPORT FOUNDATION DETAILS

WING CHANNEL (WC)

GND



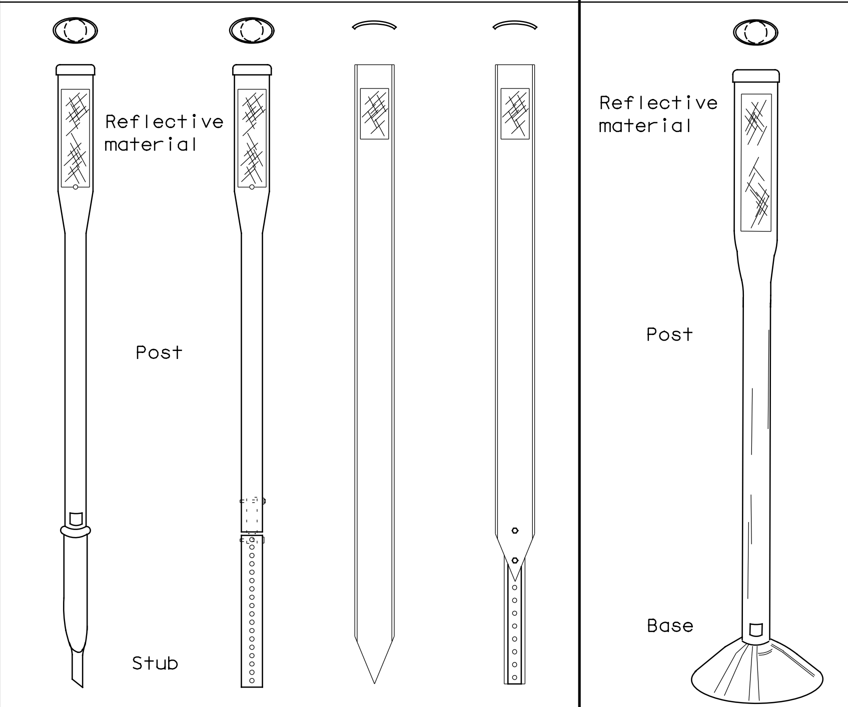
NOTES

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



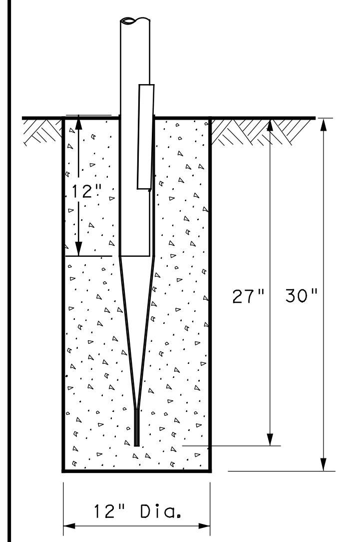
EMBEDDED | SURFACE MOUNT

NOTES

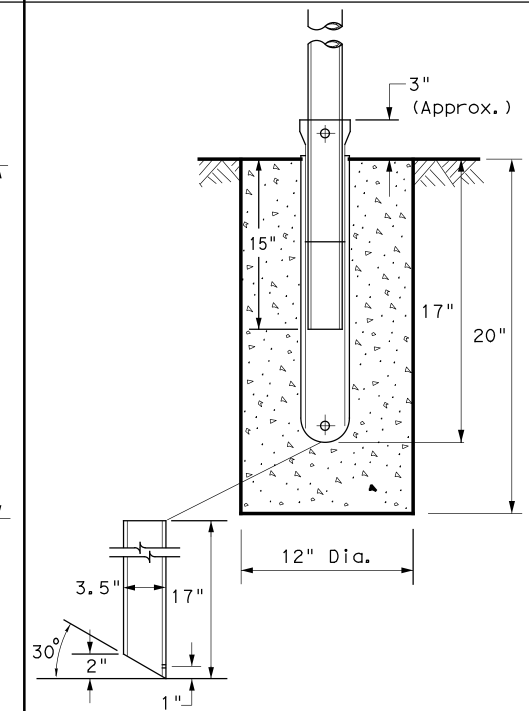
1. See "Flexible Delineator and Object Marker Posts" Material Producer List for approved devices.
2. Install per manufacturer's recommendations.
3. Post length may vary to meet field conditions.
4. When using yellow delineators with flexible posts to separate opposing direction of travel, such as centerline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

WEDGE ANCHOR SYSTEMS

WAS — STEEL



WAP — PLASTIC



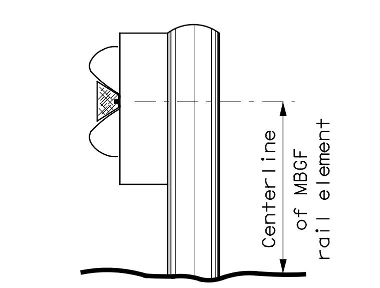
NOTE

1. Install per manufacturer's recommendations.

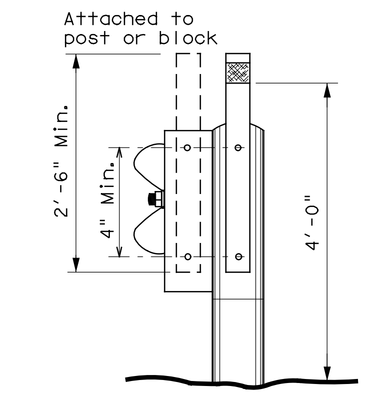
TYPE OF BARRIER MOUNTS

GUARD FENCE ATTACHMENT

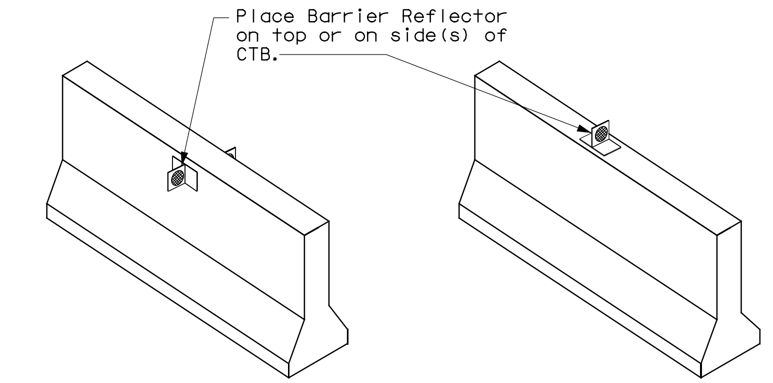
GF1



GF2



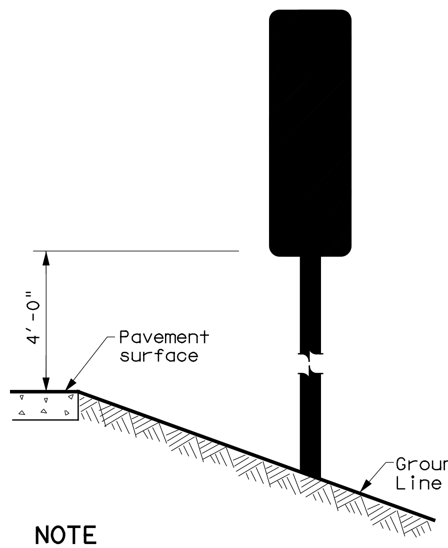
CONCRETE TRAFFIC BARRIER (CTB)



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.

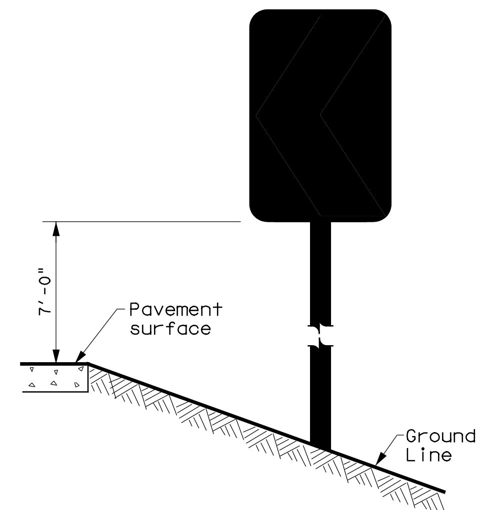
TYPES 1, 3, AND 4 OBJECT MARKERS AND CHEVRONS



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)

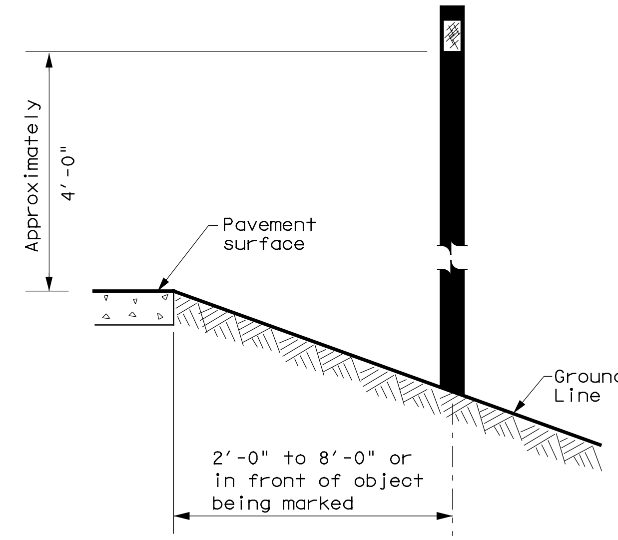
CHEVRONS AND ONE DIRECTION LARGE ARROW SIGN



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 0724	SECT 02	JOB 020, ETC.	HIGHWAY FM 219
REVISIONS 10-09 3-15 4-10 7-20	DIST WACO		COUNTY BOSQUE	SHEET NO. 140

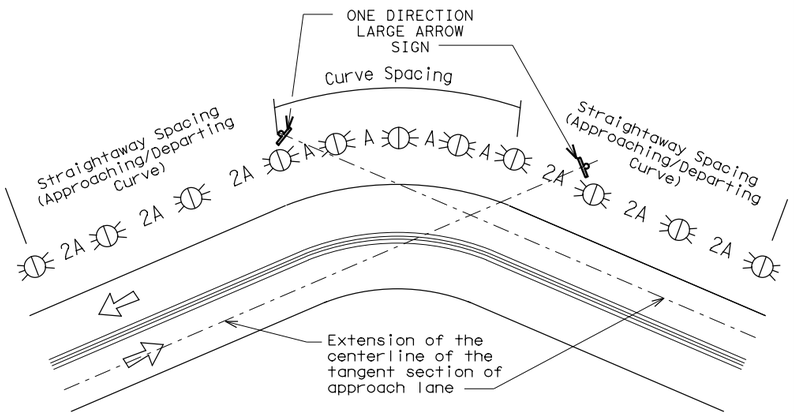
20B

DATE: 3/1/2024 12:16:36 PM
FILE: P:\2020\01156\06-Bosque River-0724-02-020\4 - Design\Plan Set\13. Standards\SMW\dom3-20.dgn

MINIMUM WARNING DEVICES AT CURVES WITH ADVISORY SPEEDS

Amount by which Advisory Speed is less than Posted Speed	Curve Advisory Speed	
	Turn (30 MPH or less)	Curve (35 MPH or more)
5 MPH & 10 MPH	• RPMs	• RPMs
15 MPH & 20 MPH	• RPMs and One Direction Large Arrow sign	• RPMs and Chevrons; or • RPMs and One Direction Large Arrow sign where geometric conditions or roadside obstacles prevent the installation of chevrons.
25 MPH & more	• RPMs and Chevrons; or • RPMs and One Direction Large Arrow sign where geometric conditions or roadside obstacles prevent the installation of chevrons	• RPMs and Chevrons

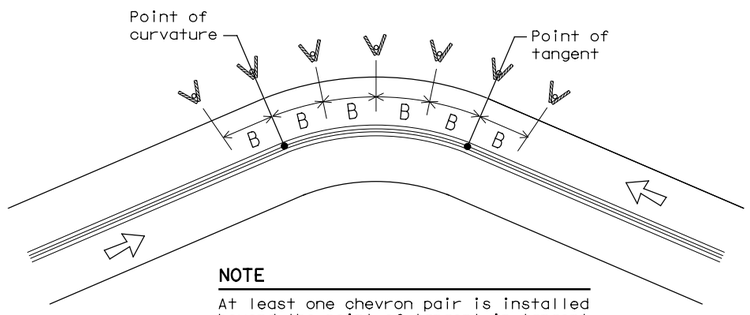
SUGGESTED SPACING FOR DELINEATORS ON HORIZONTAL CURVES



NOTE

ONE DIRECTION LARGE ARROW (W1-6) sign should be located at approximately and perpendicular to the extension of the centerline of the tangent section of approach lane.

SUGGESTED SPACING FOR CHEVRONS ON HORIZONTAL CURVES



NOTE

At least one chevron pair is installed beyond the point of tangent in tangent section.

DELINEATOR AND CHEVRON SPACING

WHEN DEGREE OF CURVE OR RADIUS IS KNOWN

Degree of Curve	FEET			
	Radius of Curve	Spacing in Curve	Spacing in Straightaway	Chevron Spacing in Curve
		A	2A	B
1	5730	225	450	——
2	2865	160	320	——
3	1910	130	260	200
4	1433	110	220	160
5	1146	100	200	160
6	955	90	180	160
7	819	85	170	160
8	716	75	150	160
9	637	75	150	120
10	573	70	140	120
11	521	65	130	120
12	478	60	120	120
13	441	60	120	120
14	409	55	110	80
15	382	55	110	80
16	358	55	110	80
19	302	50	100	80
23	249	40	80	80
29	198	35	70	40
38	151	30	60	40
57	101	20	40	40

Curve delineator approach and departure spacing should include 3 delineators spaced at 2A. This spacing should be used during design preparation or when the degree of curve is known.

DELINEATOR AND CHEVRON SPACING

WHEN DEGREE OF CURVE OR RADIUS IS NOT KNOWN

Advisory Speed (MPH)	Spacing in Curve	Spacing in Straightaway	Chevron Spacing in Curve
	A	2xA	B
65	130	260	200
60	110	220	160
55	100	200	160
50	85	170	160
45	75	150	120
40	70	140	120
35	60	120	120
30	55	110	80
25	50	100	80
20	40	80	80
15	35	70	40

If the degree of curve is not known, delineator spacing may be determined based on the Advisory Speed of the curve. Use the delineator curve spacing for each Advisory Speed (MPH).

DELINEATOR AND OBJECT MARKER APPLICATION AND SPACING

CONDITION	REQUIRED TREATMENT	MINIMUM SPACING
Frwy./Exp. Tangent	RPMs	See PM-series and FPM-series standard sheets
Frwy./Exp. Curve	Single delineators on right side	See delineator spacing table
Frwy/Exp.Ramp	Single delineators on at least one side of ramp (should be on outside of curves) (see Detail 3 on D&OM(4))	100 feet on ramp tangents Use delineator spacing table for ramp curves ("straightway spacing" does not apply to ramp curves)
Acceleration/Deceleration Lane	Double delineators (see Detail 3 on D&OM(4))	100 feet (See Detail 3 on D & OM (4))
Truck Escape Ramp	Single red delineators on both sides	50 feet
Bridge Rail (steel or concrete)and Metal Beam Guard Fence	Bi-Directional Delineators when undivided with one lane each direction Single Delineators when multiple lanes each direction	Equal spacing (100'max) but not less than 3 delineators
Concrete Traffic Barrier (CTB) or Steel Traffic Barrier	Barrier reflectors matching the color of the edge line	Equal spacing 100' max
Cable Barrier	Reflectors matching the color of the edge line	Every 5th cable barrier post (up to 100'max)
Guard Rail Terminus/Impact Head	Divided highway - Object marker on approach end Undivided 2-lane highways - Object marker on approach and departure end	Requires reflective sheeting provided by manufacturer per D & OM (VIA) or a Type 3 Object Marker (OM-3) in front of the terminal end See D & OM (5) and D & OM (6)
Bridges with no Approach Rail	Type 3 Object Marker (OM-3) at end of rail and 3 single delineators approaching rail	See D & OM(5)
Reduced Width Approaches to Bridge Rail	Type 2 and Type 3 Object Markers (OM-3) and 3 single delineators approaching bridge	Requires reflective sheeting provided by manufacturer per D & OM (VIA) or a Type 3 Object Marker (OM-3) in front of the terminal end See D & OM (5)
Culverts without MBGF	Type 2 Object Markers	See Detail 2 on D & OM(4)
Crossovers	Double yellow delineators and RPMs	See Detail 1 on D & OM (4)
Pavement Narrowing (lane merge) on Freeways/Expressway	Single delineators adjacent to affected lane for full length of transition	100 feet

NOTES

1. Unless indicated otherwise, the delineator or barrier reflector color shall conform to the color of the pavement edge line on the side of the road where the delineators or barrier reflectors are placed.
2. Barrier reflectors may be used to replace required delineators.
3. Single red delineators may be mounted on the back side of delineator posts for wrong way driver applications

LEGEND	
	Bi-directional Delineator
	Delineator
	Sign

Texas Department of Transportation

Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

D & OM(3)-20

FILE: dom3-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
©TxDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC.	FM 219
3-15 8-15	DIST	COUNTY		SHEET NO.
8-15 7-20	WACO	BOSQUE		141

20C

DATE: 3/1/2024 12:16:37 PM
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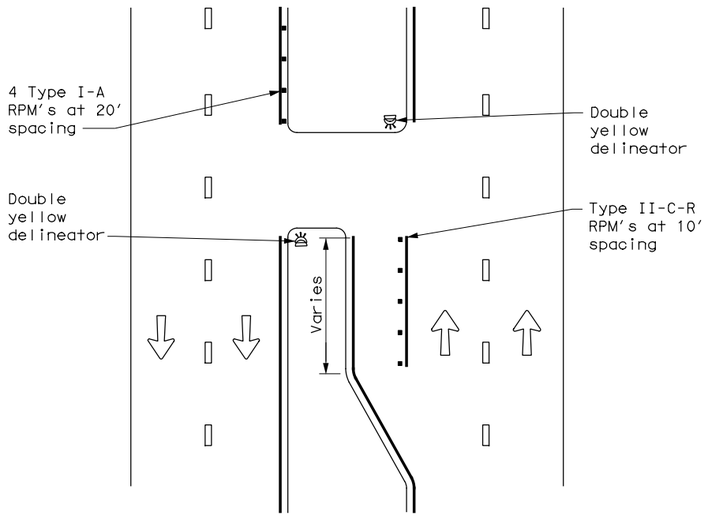
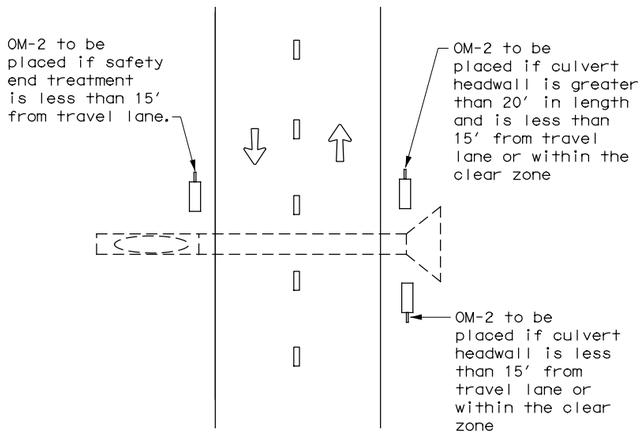
CROSSOVERS



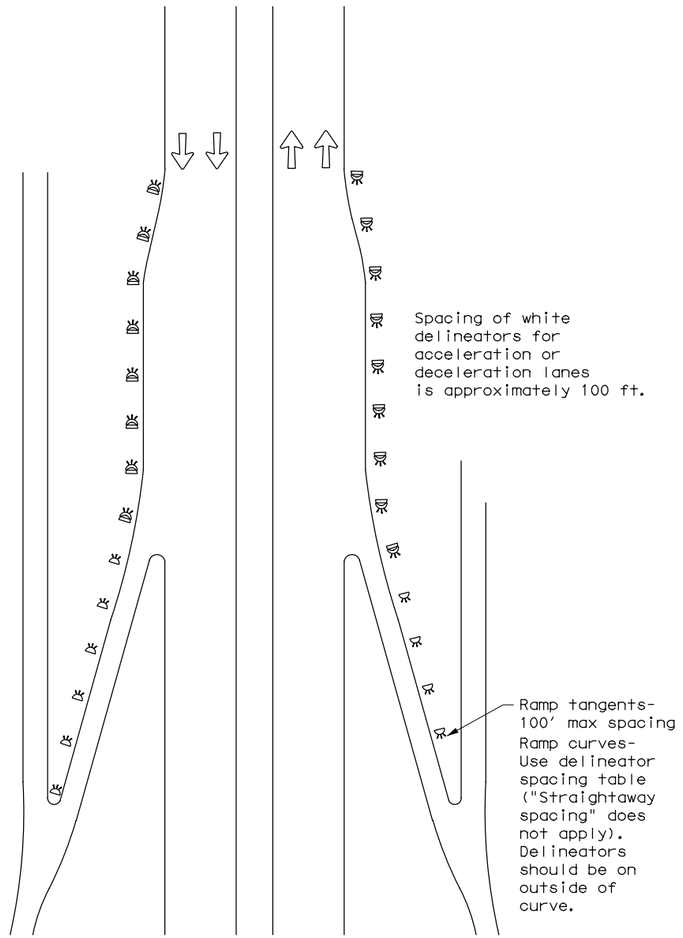
DETAIL 1

FOR CULVERTS WITHOUT MBGF



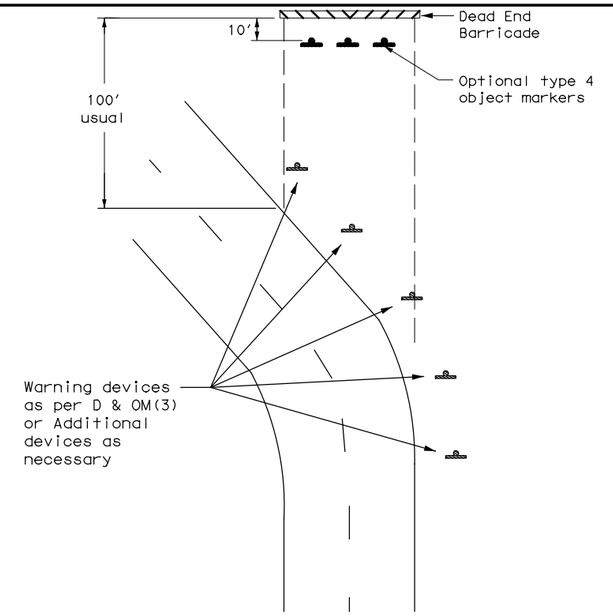
DETAIL 2

FREEWAY DELINEATION FOR RAMPS AND ACCELERATION/DECELERATION LANES



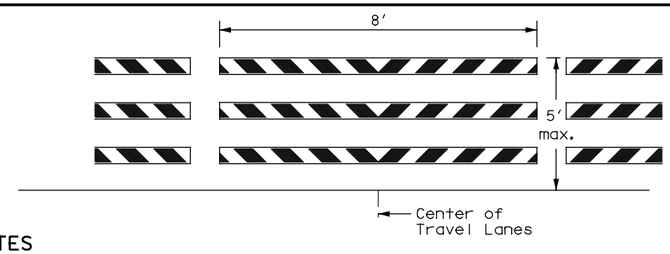
DETAIL 3

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

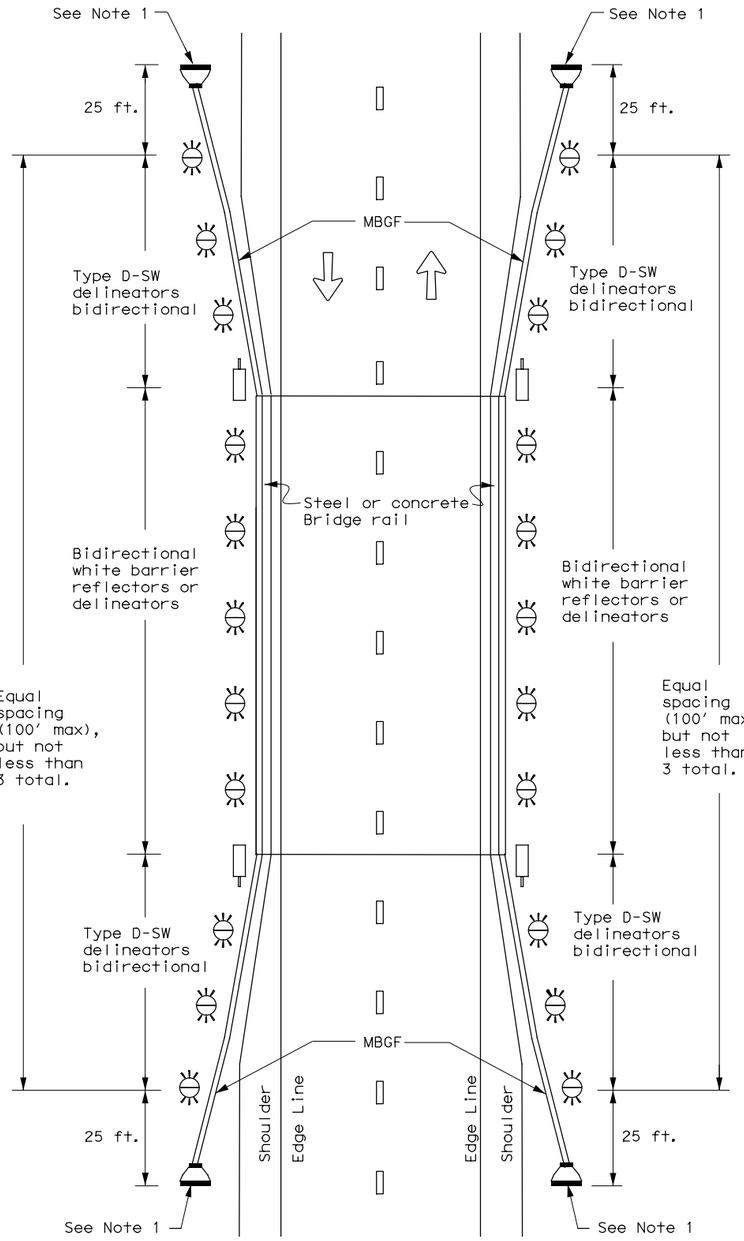
D & OM(4)-20

FILE: dom4-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
©TxDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC,	FM 219
3-15	DIST	COUNTY		SHEET NO.
7-20	WACO	BOSQUE		142

20D

DATE: 3/1/2024 12:16:39 PM
FILE: P:\2020\01156\06-Bosque River-0724-02-020\4 - Design\Plan Set\13. Standards\DOM5-20.dgn

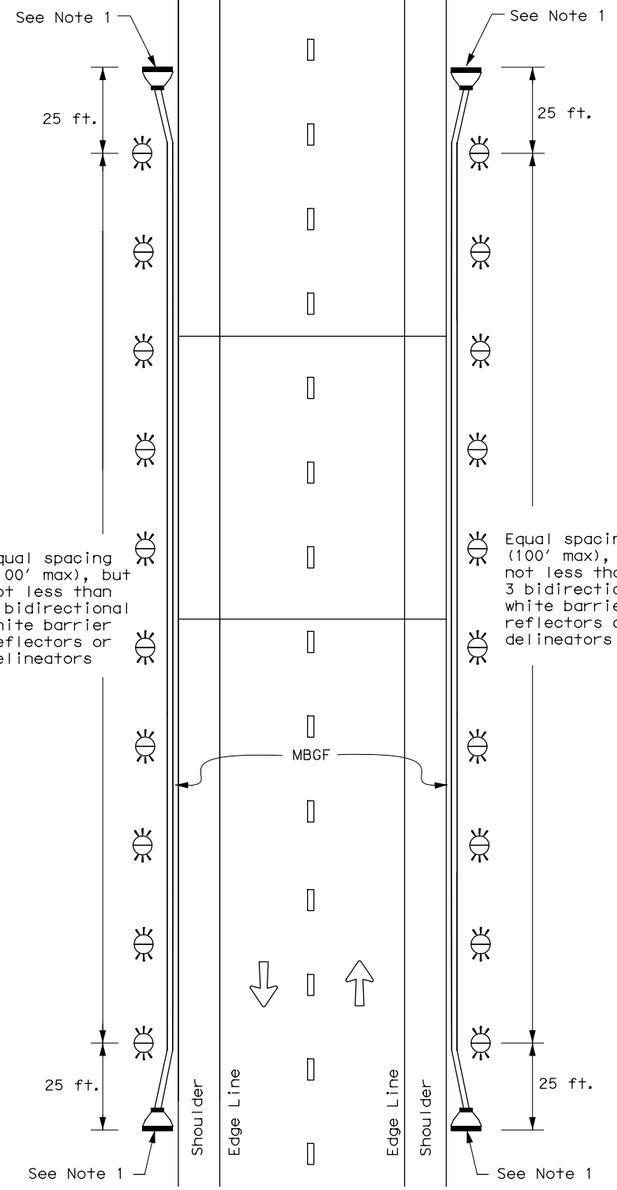
TWO-WAY, TWO LANE ROADWAY WITH REDUCED WIDTH APPROACH RAIL



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.

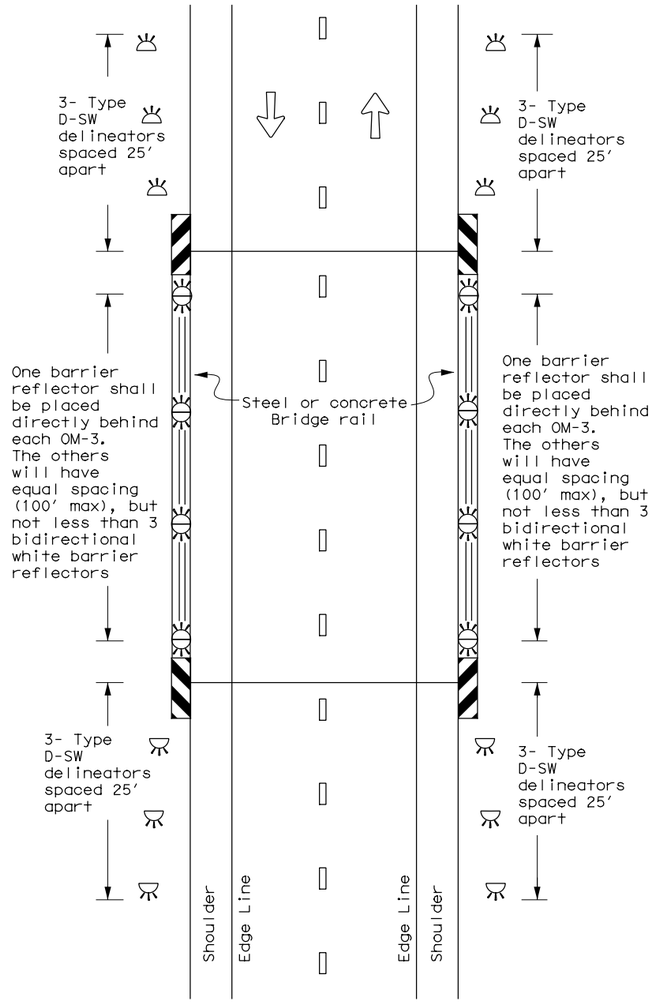
TWO-WAY, TWO LANE ROADWAY WITH METAL BEAM GUARD FENCE (MBGF)



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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7-20	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		143

20E

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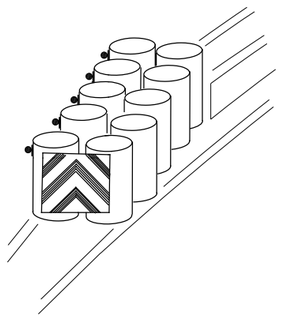
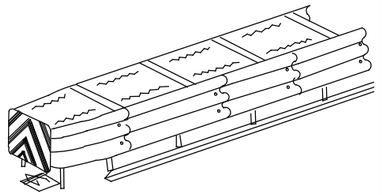
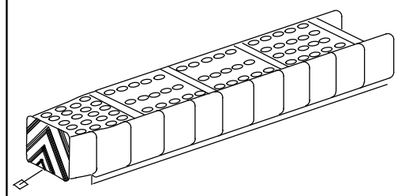
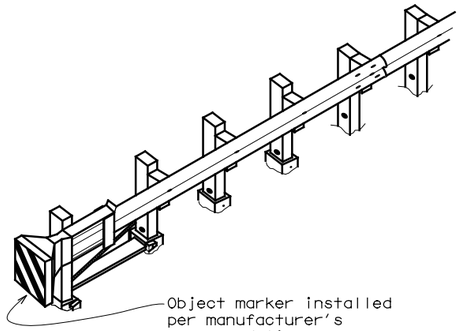
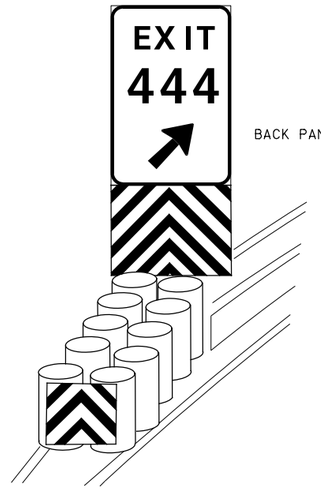
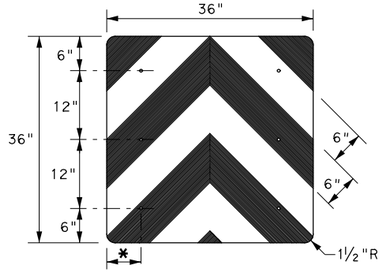


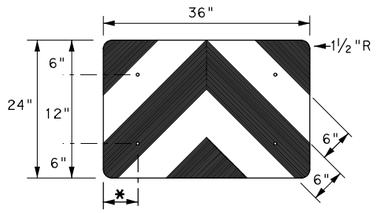




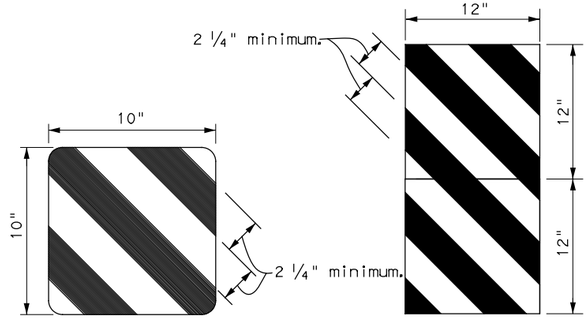




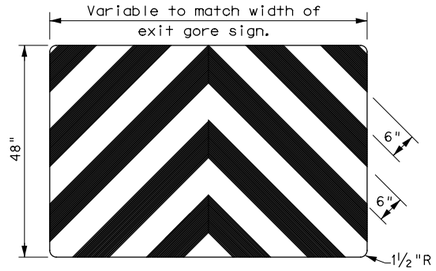


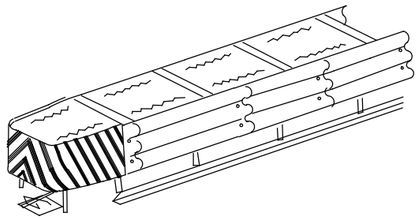


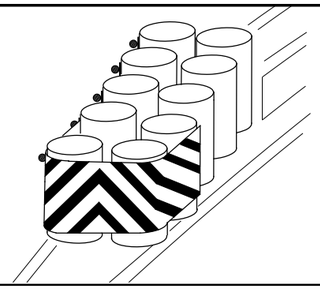
* Adjust to fit attenuator per manufacturer's recommendation, or as directed by the Engineer

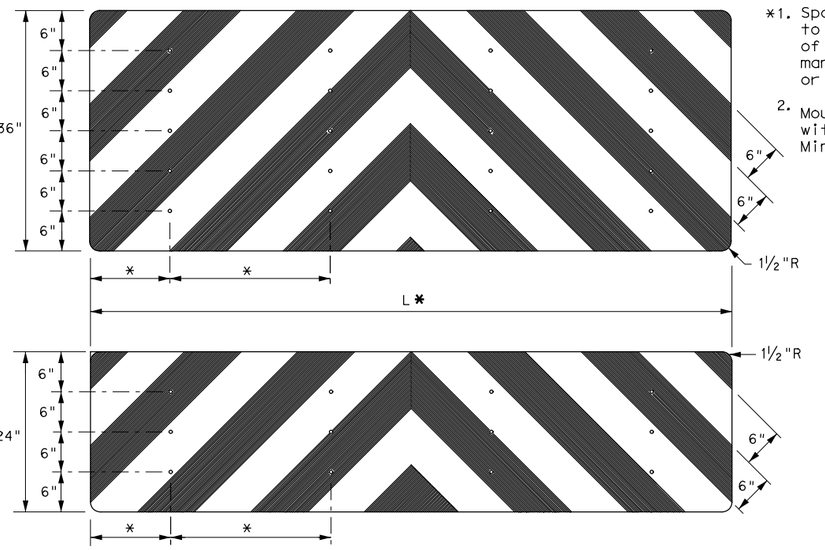


OBJECT MARKERS SMALLER THAN 3 FT^2









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
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4-92 8-04	DIST	COUNTY		SHEET NO.
8-95 3-15	WACO	BOSQUE		144
4-98 7-20				
20G				

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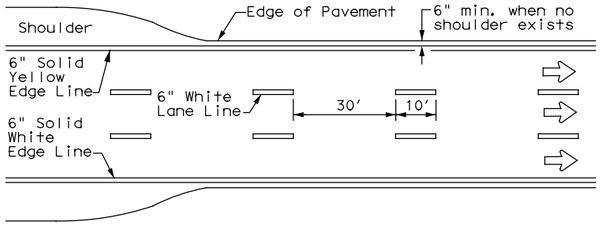
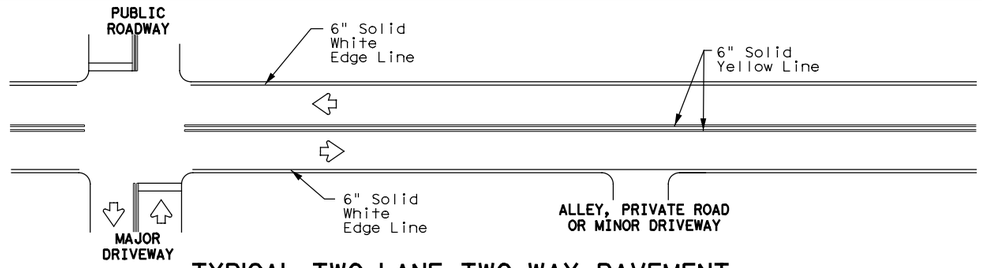
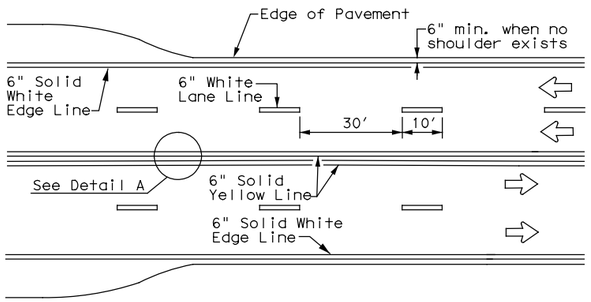
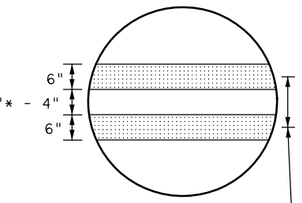


EDGE LINE AND LANE LINES ONE-WAY ROADWAY WITH OR WITHOUT SHOULDERS



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





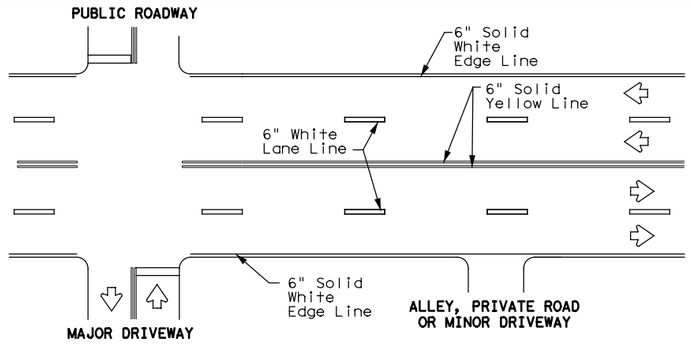
DETAIL "A"

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

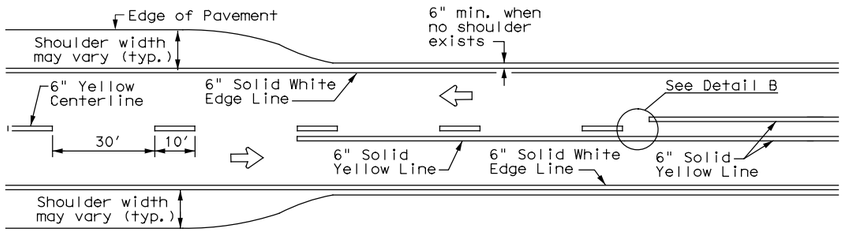
CENTERLINE AND LANE LINES FOUR LANE TWO-WAY ROADWAY WITH OR WITHOUT SHOULDERS

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

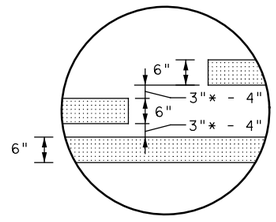
** 8" minimum for restripe projects when approved by the Engineer.



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



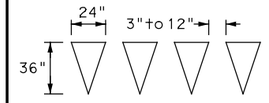
TWO LANE TWO-WAY ROADWAY WITH OR WITHOUT SHOULDERS



18" min. - 20" max.
(16" minimum for restripe projects when approved by the Engineer.)

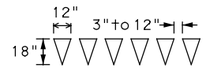
DETAIL "B"

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

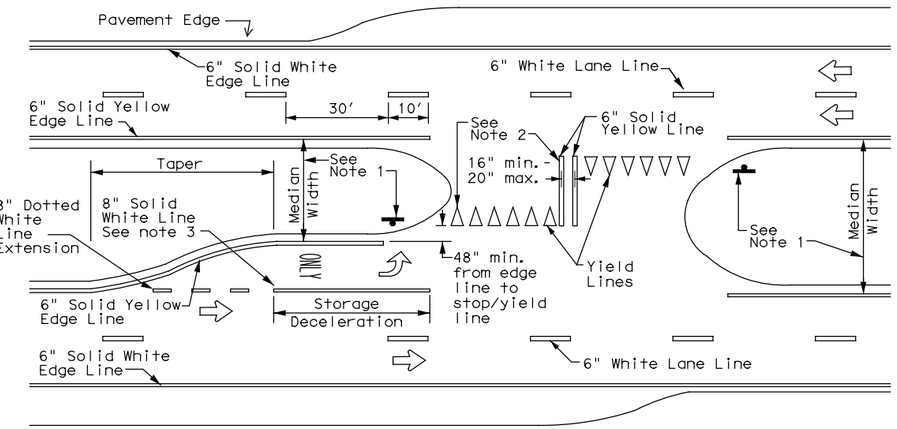


For posted speed on road being marked equal to or greater than 45 MPH.

YIELD LINES



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



FOUR LANE DIVIDED ROADWAY CROSSOVERS

NOTES

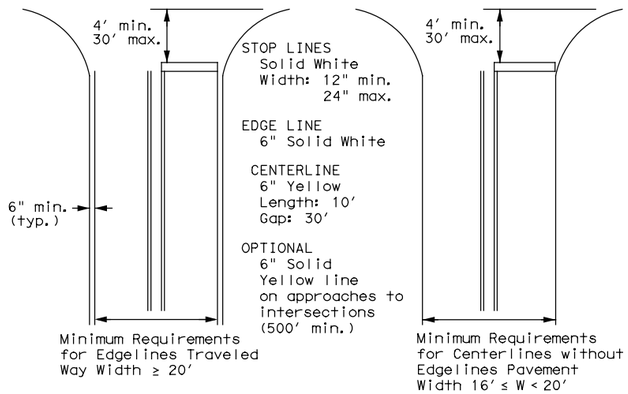
1. Where divided highways are separated by median widths at the median opening itself of 30 feet or more, median openings shall be signed as two separate intersections. Each median opening has two width measurements, with one measurement for each approach. The narrow median width will be the controlling width to determine if signs are required. Yield signs are the typical intersection control. Stop signs and stop bars are optional as determined by the Engineer.
2. Install median striping (double yellow centerlines and stop lines/yield lines) when a 50′ or greater median centerline can be placed. Stop lines shall only be used with stop signs. Yield lines shall only be used with yield signs.
3. Length of turn bays, including taper, deceleration, and storage lengths shall be as shown on the plans or as directed by the Engineer.

GENERAL NOTES

1. Edge line striping shall be as shown in the plans or as directed by the Engineer. The edge line should not be placed less than 6 inches from the edge of pavement. This distance may vary due to pavement raveling or other conditions. Edge lines are not required in curb and gutter sections of roadways.
2. The traveled way includes only that portion of the roadway used for vehicular travel. It does not include the parking lanes, sidewalks, berms and shoulders. The traveled ways shall be measured from the center of edge line to the center of edge line of a two lane roadway.

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

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



NOTE: Traveled way is exclusive of shoulder widths. Refer to General Note 2 for additional details.

GUIDE FOR PLACEMENT OF STOP LINES, EDGE LINE & CENTERLINE

Based on Traveled Way and Pavement Widths for Undivided Roadways

Texas Department of Transportation

Traffic Safety Division Standard

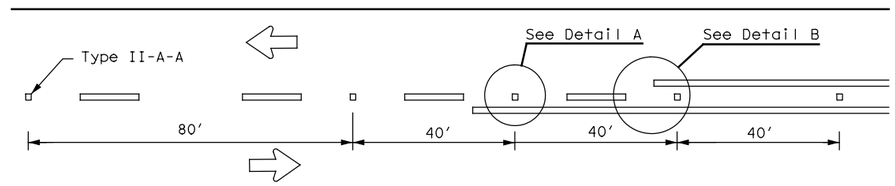
TYPICAL STANDARD PAVEMENT MARKINGS

PM(1)-22

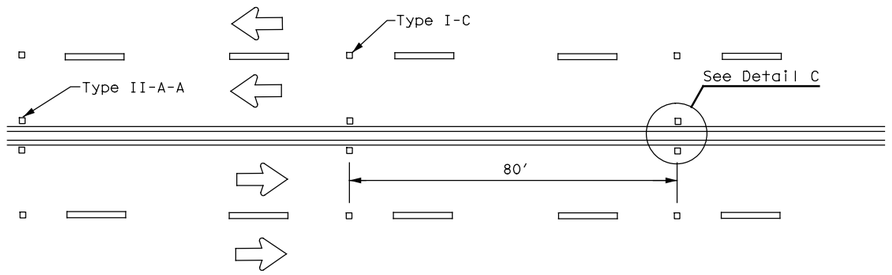
FILE: pm1-22.dgn	DN:	CK:	DW:	CK:
© TxDOT December 2022	CONT	SECT	JOB	HIGHWAY
REVISIONS 11-78 8-00 6-20 8-95 3-03 12-22 5-00 2-12	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		145

22A

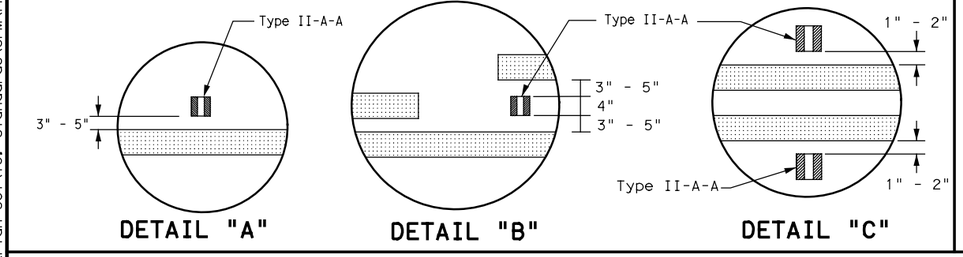
REFLECTIVE RAISED PAVEMENT MARKERS FOR VEHICLE POSITIONING GUIDANCE

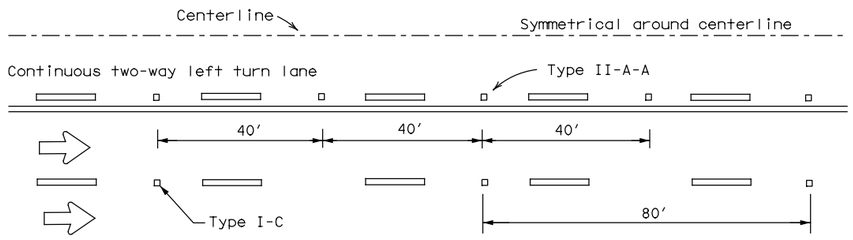


CENTERLINE FOR ALL TWO LANE TWO-WAY ROADWAYS

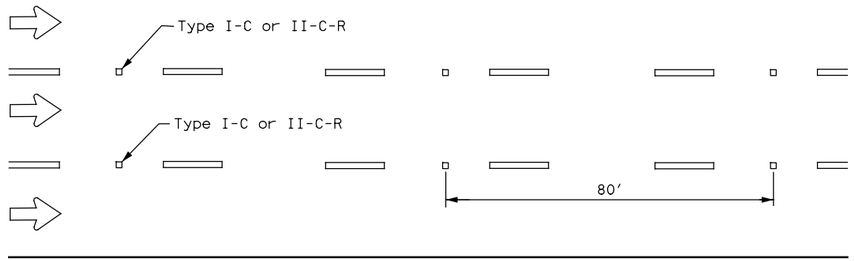


CENTERLINE & LANE LINES FOR FOUR LANE TWO-WAY ROADWAYS





CENTERLINE AND LANE LINES FOR TWO-WAY LEFT TURN LANE



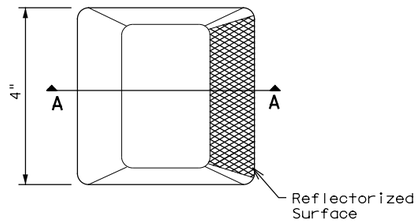
LANE LINES FOR ONE-WAY ROADWAY (NON-FREEWAY FACILITIES)

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

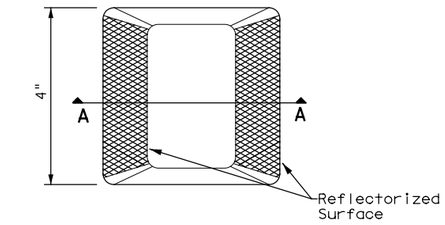
See Note 3.

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

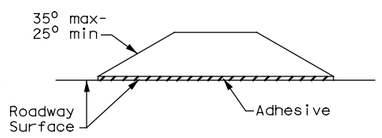
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



Type I (Top View)

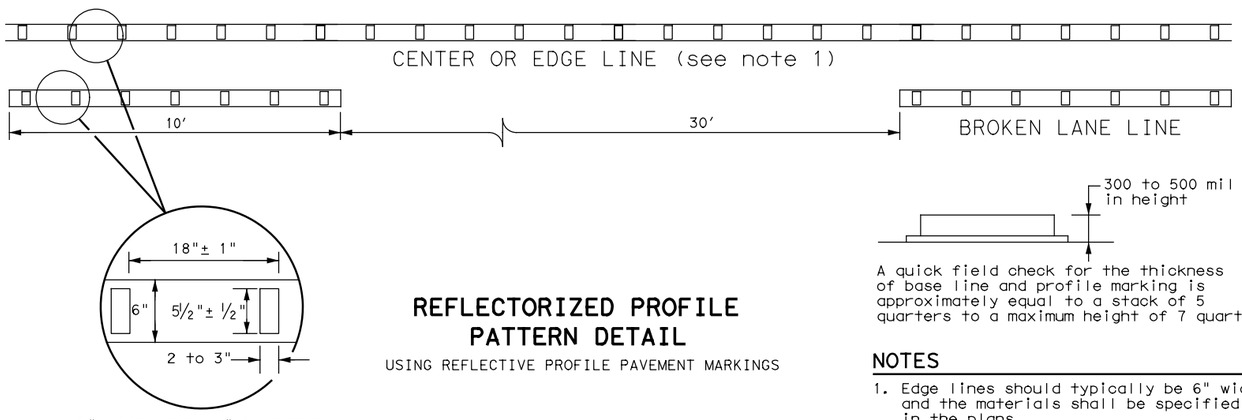


Type II (Top View)



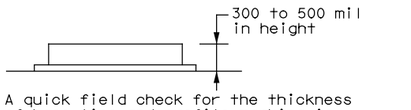
SECTION A

RAISED PAVEMENT MARKERS



REFLECTORIZED PROFILE PATTERN DETAIL

USING REFLECTIVE PROFILE PAVEMENT MARKINGS



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.

NOTES

1. Edge lines should typically be 6" wide and the materials shall be specified in the plans.
2. Profile markings shall not be placed on roadways with a posted speed limit of 45 MPH or less.

GENERAL NOTES

1. All raised pavement markers placed along broken lines shall be placed in line with and midway between the stripes.
2. On concrete pavements the raised pavement markers should be placed to one side of the longitudinal joints.
3. Use raised pavement marker Type I-C with undivided roadways, flush medians and two way left turn lanes. Use raised pavement marker Type II-C-R with divided highways and raised medians.

Texas Department of Transportation

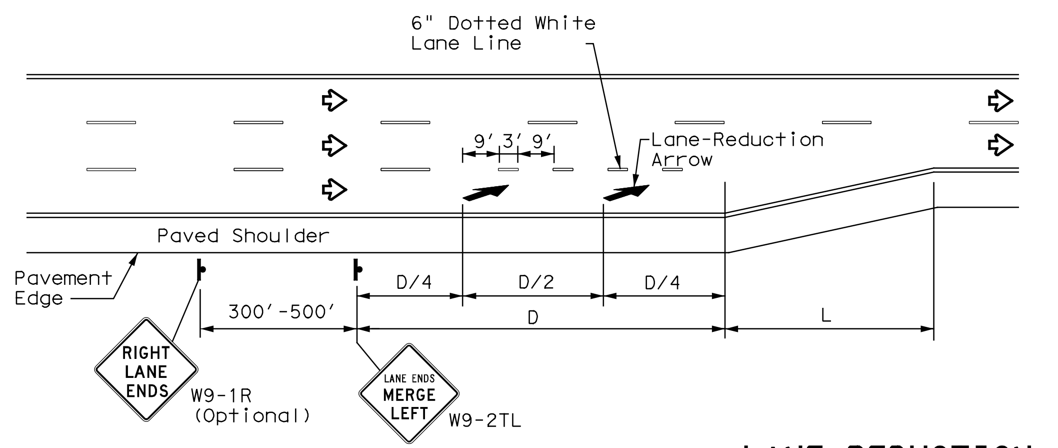
Traffic Safety Division Standard

POSITION GUIDANCE USING RAISED MARKERS RELECTORIZED PROFILE MARKINGS PM(2)-22

FILE: pm2-22.dgn	DN:	CK:	DW:	CK:
© TxDOT December 2022	CONT	SECT	JOB	HIGHWAY
REVISIONS 4-77 8-00 6-20 4-92 2-10 12-22 5-00 2-12	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		146

22B

DATE: 3/1/2024 12:16:44 PM
FILE: P:\2020\01156\06-Bosque River-0724-02-020\4 - Design\Plan Set\13. Standards\PM2(2)-22.dgn



LANE REDUCTION

NOTES

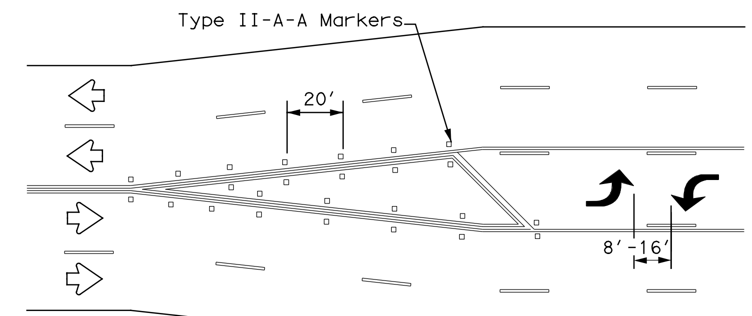
1. Lane reduction pavement markings are used where the number of through lanes is reduced because of narrowing of the roadway or because of a section of on-street parking in what would otherwise be a through lane. For Texas Super 2 Passing Lanes, see TS2(PL) standard sheets.
2. On divided highways, an additional RIGHT LANE ENDS (W9-1R) sign may be installed in the median aligned with the W9-1R sign on the right side of the highway.
3. Lane reduction arrows are required for speeds of 45 mph or greater. An optional third lane reduction arrow may be added based on engineering judgement. If used, the optional third lane reduction arrow should be centered between the first and last lane reduction arrows.
4. For lane reductions on Freeways and Expressways, signing shall conform to the TxDOT Freeway Signing Handbook.

ADVANCED WARNING SIGN DISTANCE (D)

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

GENERAL NOTES

1. Lane use word and arrow markings shall be used where through lanes approaching an intersection become mandatory turn lanes. Lane use word and arrow markings should be used in auxiliary lanes of substantial length. Lane use arrow markings or word and arrow markings may be used in other lanes and turn bays for emphasis. Details for words and arrows are as shown in the Standard Highway Sign Designs for Texas.
2. When lane-use words and arrow markings are used, two sets of arrows should be used if the length of the bay is greater than 180 feet. When a single lane use arrow or word and arrow marking is used for a short turn lane, it should be located at or near the upstream end of the full-width turn lane.
3. Use raised pavement marker Type I-C with undivided highways, flush medians and two way left turn lanes. Use raised pavement marker Type II-C-R with divided highways and raised medians.
4. Length of turn bays, including taper, deceleration, and storage lengths shall be as shown on the plans or as directed by the Engineer. See Chapter 3 of the Roadway Design Manual for additional information on turning lanes or storage lengths.



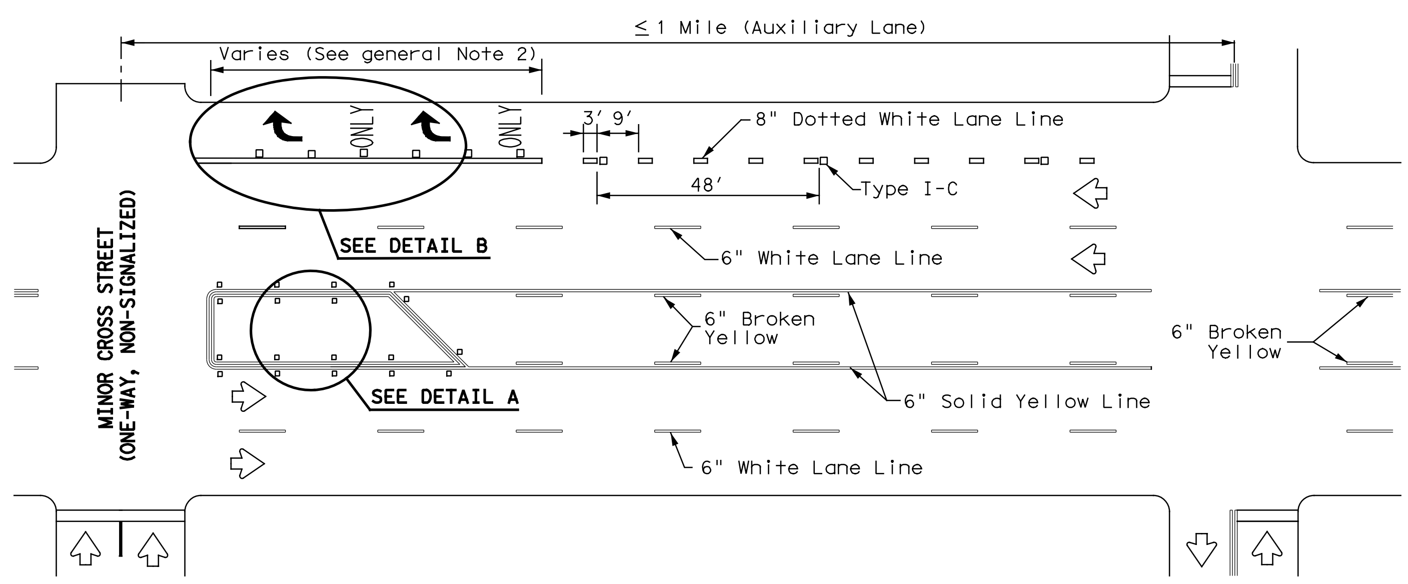
A two-way left-turn (TWLT) lane-use arrow pavement marking should be used at or just downstream from the beginning of a two-way left-turn lane within a corridor. Repeating the marking after each intersection or dedicated turn bay is not required unless stated elsewhere in the plans.

TYPICAL TRANSITION FOR TWLTL AND DIVIDED HIGHWAY

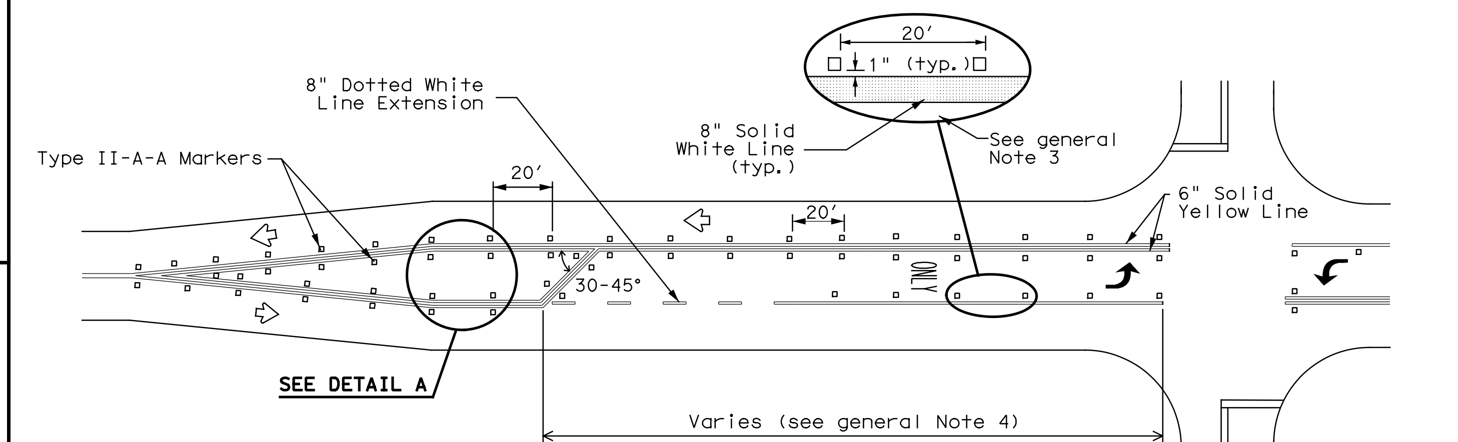
MATERIAL SPECIFICATIONS

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

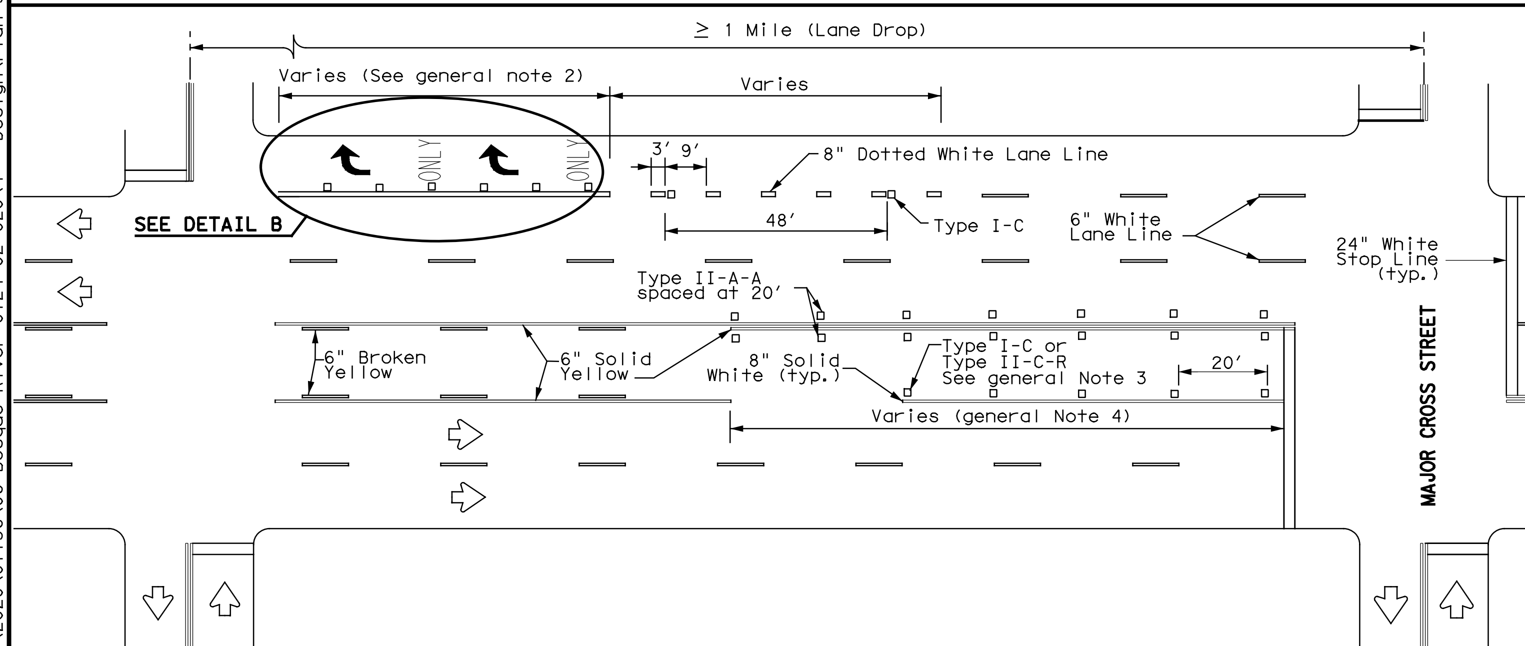
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



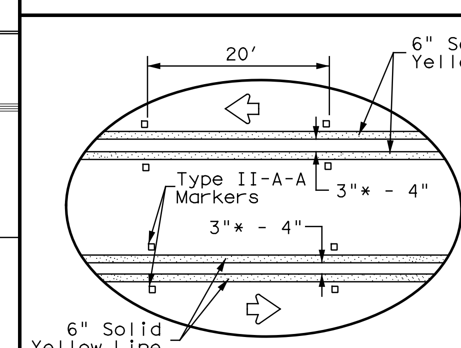
TYPICAL TWLTL AT ONE-WAY STREET AND RIGHT TURN AUXILIARY LANE



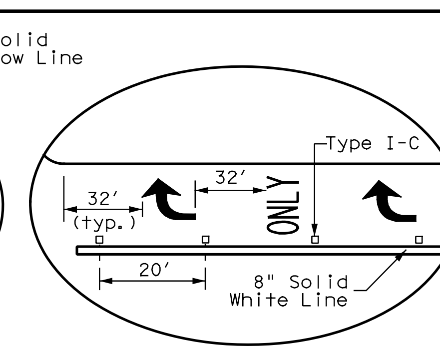
TYPICAL TWO-LANE ROADWAY INTERSECTION WITH LEFT TURN BAYS



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



DETAIL A



DETAIL B

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

Texas Department of Transportation

Traffic Safety Division Standard

TWO-WAY LEFT TURN LANES, RURAL LEFT TURN BAYS, AND LANE REDUCTION PAVEMENT MARKINGS

PM(3)-22

FILE: pm3-22.dgn	DN:	CK:	DW:	CK:
©TxDOT December 2022	CONT 0724	SECT 02	JOB 020, ETC.	HIGHWAY FM 219
REVISIONS 4-98 3-03 6-20; 5-00 2-10 12-22; 8-00 2-12	DIST WACO		COUNTY BOSQUE	SHEET NO. 147

22C

DATE: 3/1/2024 12:16:46 PM
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SIGN SUPPORT DESCRIPTIVE CODES

(Descriptive Codes correspond to project estimate and quantities sheets)

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

Post Type

FRP = Fiberglass Reinforced Plastic Pipe (see SMD(FRP))
TWT = Thin-Walled Tubing (see SMD(TWT))
10BWG = 10 BWG Tubing (see SMD(SLIP-1) to (SLIP-3))
S80 = Schedule 80 Pipe (see SMD(SLIP-1) to (SLIP-3))

Number of Posts (1 or 2)

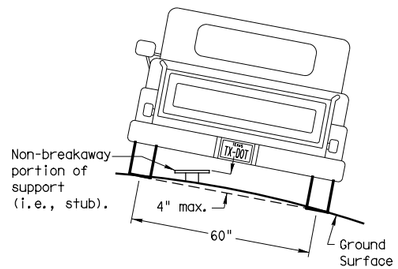
Anchor Type

UA = Universal Anchor - Concreted (see SMD(FRP) and (TWT))
UB = Universal Anchor - Bolted down (see SMD(FRP) and (TWT))
WS = Wedge Anchor Steel - (see SMD(TWT))
WP = Wedge Anchor Plastic (see SMD(TWT))
SA = Slipbase - Concreted (see SMD(SLIP-1) to (SLIP-3))
SB = Slipbase - Bolted Down (see SMD(SLIP-1) to (SLIP-3))

Sign Mounting Designation

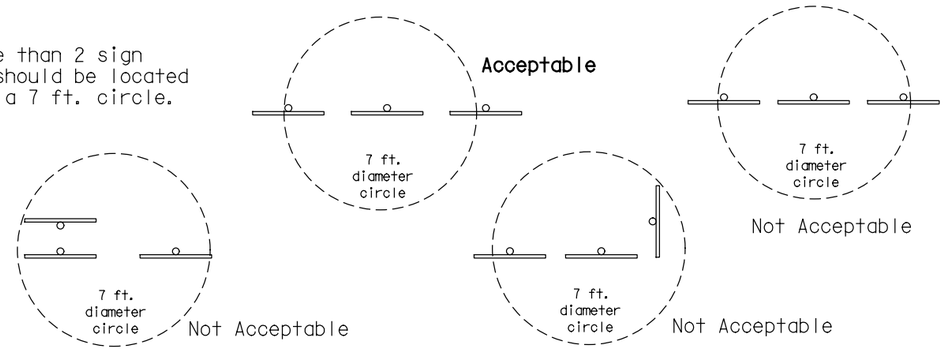
P = Prefab. "Plain" (see SMD(SLIP-1) to (SLIP-3), (TWT), (FRP))
T = Prefab. "T" (see SMD(SLIP-1) to (SLIP-3), (TWT))
U = Prefab. "U" (see SMD(SLIP-1) to (SLIP-3))
IF REQUIRED
1EXT or 2EXT = Number of Extensions (see SMD(SLIP-1) to (SLIP-3), (TWT))
BM = Extruded Wind Beam (see SMD(SLIP-1) to (SLIP-3))
WC = 1.12 #/ft Wing Channel (see SMD(SLIP-1) to (SLIP-3))
EXAL = Extruded Aluminum Sign Panels (see SMD(SLIP-1))

REQUIRED CLEARANCE FOR BREAKAWAY SUPPORT



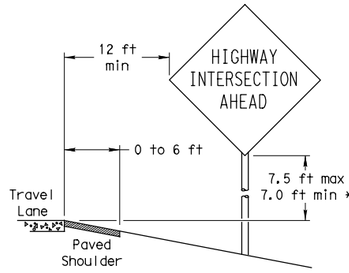
To avoid vehicle undercarriage snagging, any substantial remains of a breakaway support, when it is broken away, should not project more than 4 inches above a 60-inch chord (i.e., typical space between wheel paths).

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



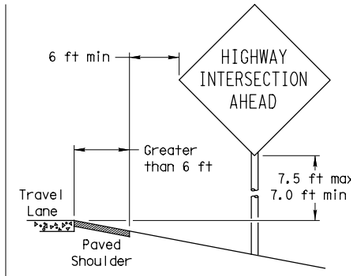
SIGN LOCATION

PAVED SHOULDERS



LESS THAN 6 FT. WIDE

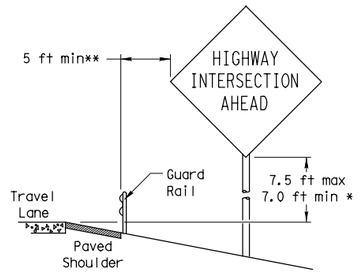
When the shoulder is 6 ft. or less in width, the sign must be placed at least 12 ft. from the edge of the travel lane.



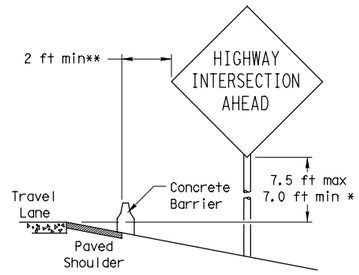
GREATER THAN 6 FT. WIDE

When the shoulder is greater than 6 ft in width, the sign must be placed at least 6 ft. from the edge of the shoulder.

BEHIND BARRIER



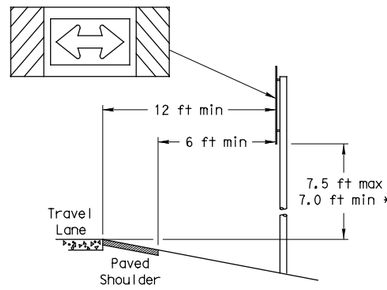
BEHIND GUARDRAIL



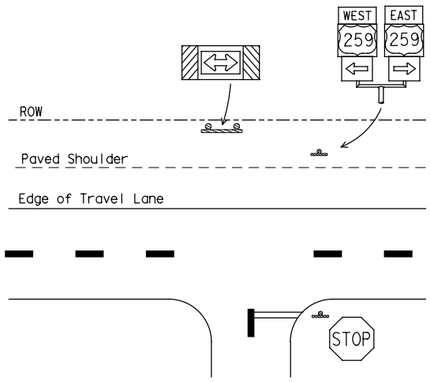
BEHIND CONCRETE BARRIER

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

T-INTERSECTION



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



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

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

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

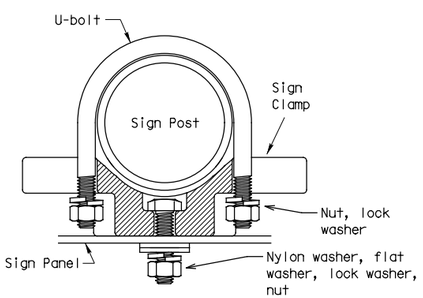
The maximum values may be increased when directed by the Engineer.

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

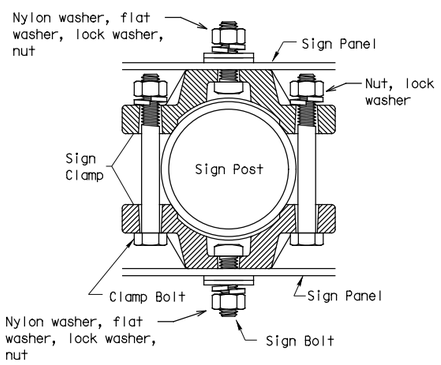
The website address is:
http://www.txdot.gov/publications/traffic.htm

TYPICAL SIGN ATTACHMENT DETAIL

Single Signs



Back-to-Back Signs



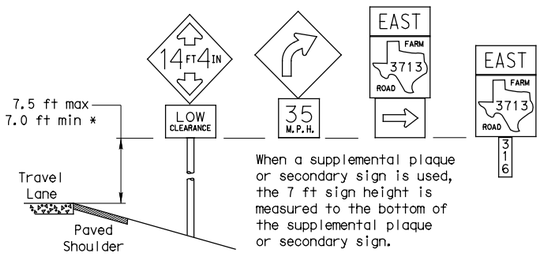
Bolts used to mount sign panels to the clamp are 5/16-18 UNC galvanized square head with nut, nylon washer, flat washer and lock washer. The bolt length is 1 inch for aluminum.

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.

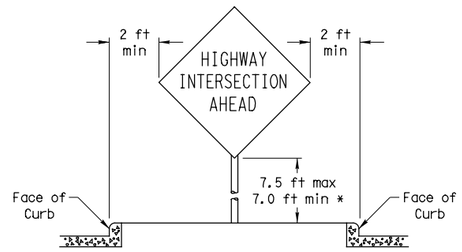
Pipe Diameter	Approximate Bolt Length	
	Specific Clamp	Universal Clamp
2" nominal	3"	3 or 3 1/2"
2 1/2" nominal	3 or 3 1/2"	3 1/2 or 4"
3" nominal	3 1/2 or 4"	4 1/2"

SIGNS WITH PLAQUES



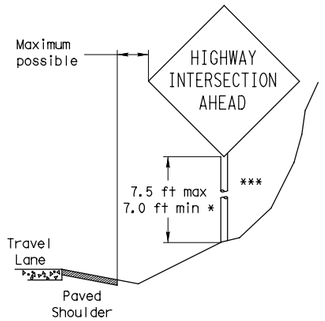
When a supplemental plaque or secondary sign is used, the 7 ft sign height is measured to the bottom of the supplemental plaque or secondary sign.

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

REVISIONS	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
9-08	CONT	SECT	JOB	HIGHWAY
	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		148

DATE: 3/1/2024 12:16:49 PM
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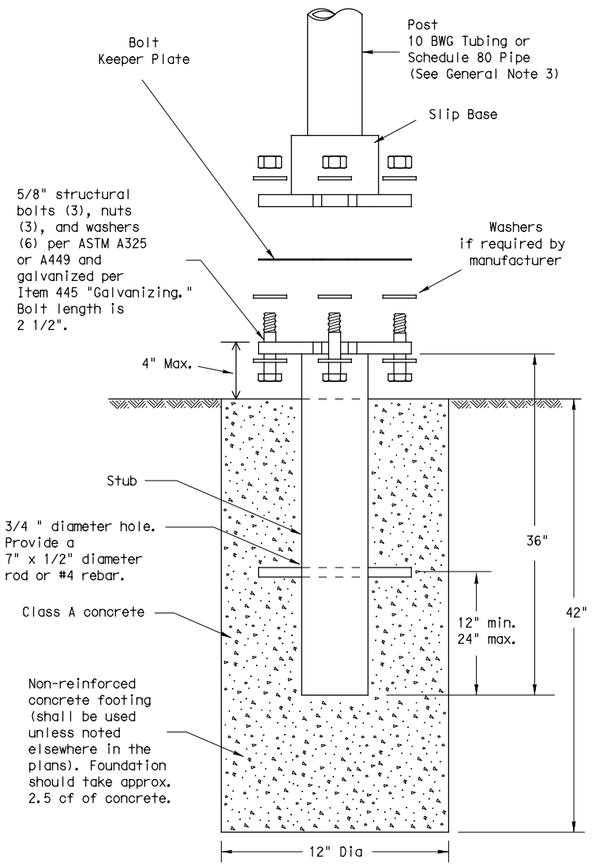
TRIANGULAR SLIPBASE INSTALLATION GENERAL REQUIREMENTS



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:

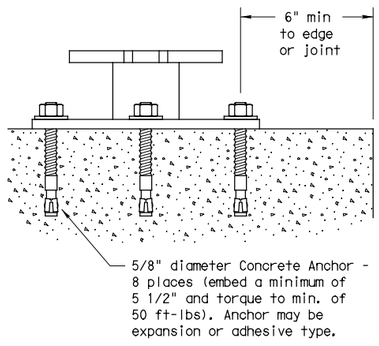
1. Slip base shall be permanently marked to indicate manufacturer. Method, design, and location of marking are subject to approval of the TxDOT Traffic Standards Engineer.
2. Material used as post with this system shall conform to the following specifications:
   10 BWG Tubing (2.875" outside diameter)
   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

REVISIONS	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
9-08	CONT	SECT	JOB	HIGHWAY
	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		149

DATE: 3/1/2024 12:16:51 PM
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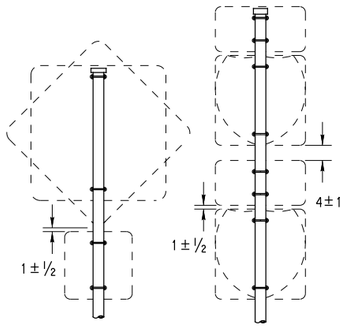
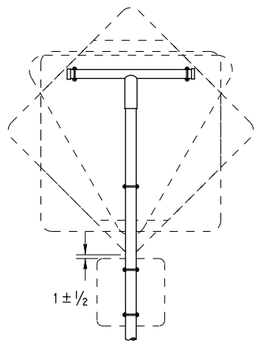
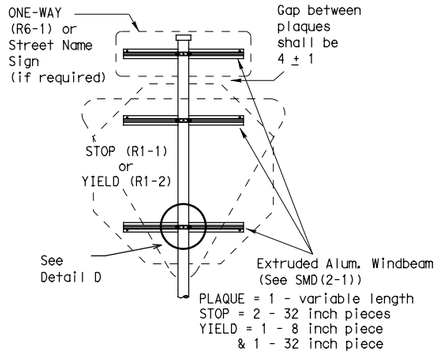


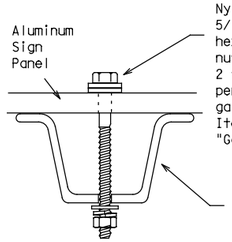
SM RD SGN ASSM TY XXXXX(1)XX(P)



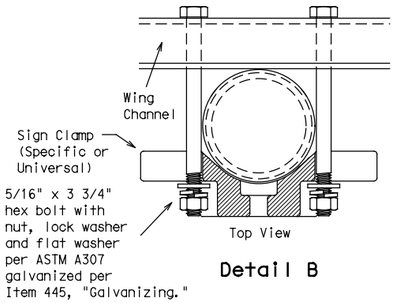
SM RD SGN ASSM TY XXXXX(1)XX(T)



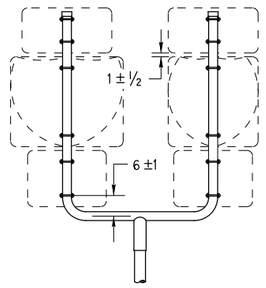
SM RD SGN ASSM TY XXXXX(1)XX(P-BM)



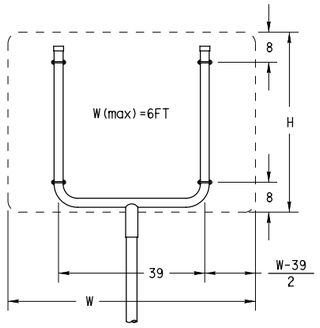
Detail A



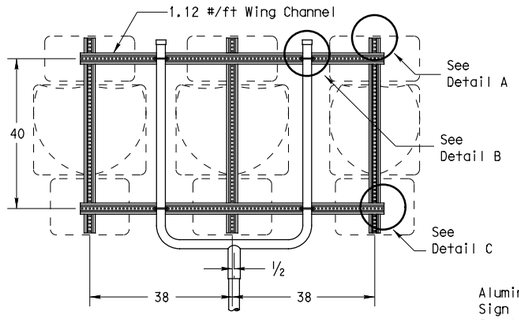
Detail B



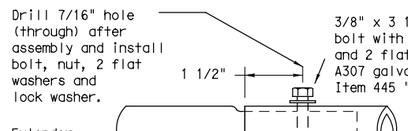
SM RD SGN ASSM TY XXXXX(1)XX(U)



SM RD SGN ASSM TY XXXXX(1)XX(U)

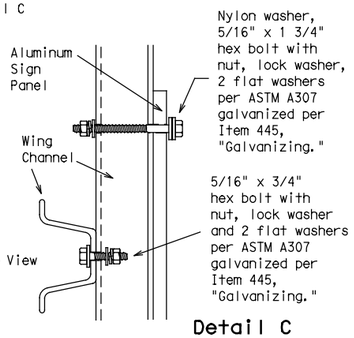


SM RD SGN ASSM TY XXXXX(1)XX(U-WC)
(See Note 11)

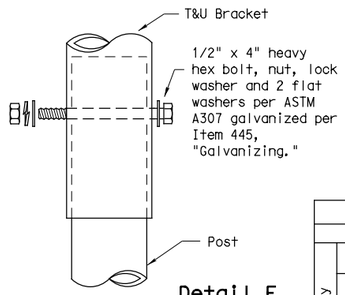


Detail F

Splices shall only be allowed behind the sign substrate.



Detail C



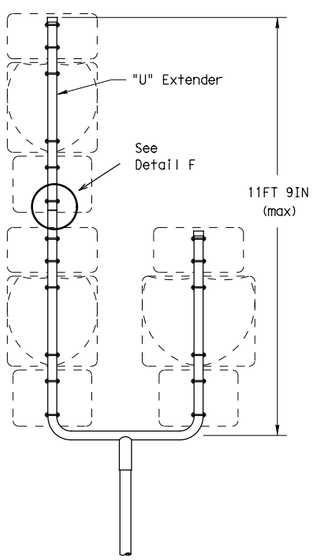
Detail E

GENERAL NOTES:

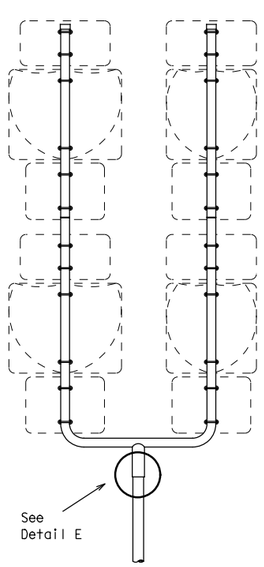
1.

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

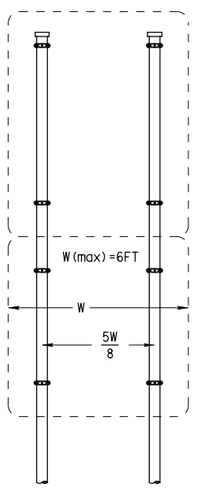
2. The Engineer may require that a Schedule 80 post be used in place of a 10 BWG where a sign height is abnormally high due to a fill slope.
3. Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.
4. Aluminum sign blanks shall conform to Departmental Material 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)

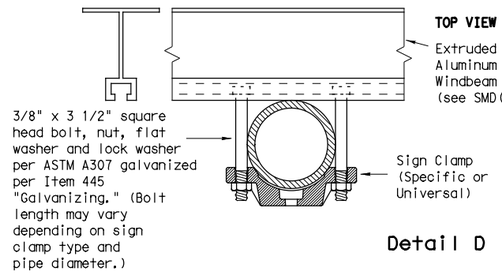


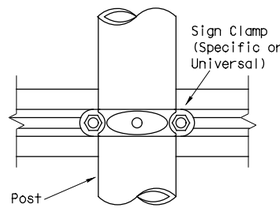
SM RD SGN ASSM TY S80(1)XX(U-2EXT)



SM RD SGN ASSYM TY XXXXX(2)XX(P)

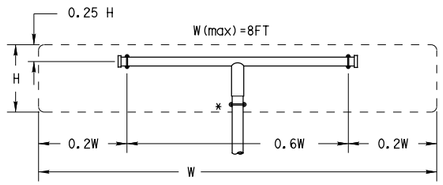
SIDE VIEW





Detail D

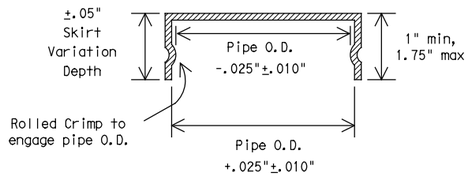
REQUIRED SUPPORT		
	SIGN DESCRIPTION	SUPPORT
Regulatory	48-inch STOP sign (R1-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	60-inch YIELD sign (R1-2)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	48x16-inch ONE-WAY sign (R6-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	36x48, 48x36, and 48x48-inch signs	TY 10BWG(1)XX(T)
	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)



SM RD SGN ASSM TY XXXXX(1)XX(T)
(* - See Note 12)

All dimensions are in english unless detailed otherwise.

FRICTION CAP DETAIL



Friction caps may be manufactured from hot rolled or cold rolled steel sheets. The minimum sheet metal thickness shall be 24 gauge for all cap sizes.

The rim edges shall be reasonably straight and smooth. Caps shall be sized and formed in such a manner as to produce a drive-on friction fit and have no tendency to rock when seated on the pipe. The depth shall be sufficient to give positive protection against entrance of rainwater. They shall be free of sharp creases or indentations and show no evidence of metal fracture.

Caps shall have an electrodeposited coating of zinc in accordance with the requirements of ASTM B633 Class FE/ZN 8.

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

REVISIONS	CONT	SECT	JOB	HIGHWAY
9-08	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		150

DATE: 3/1/2024 12:16:53 PM
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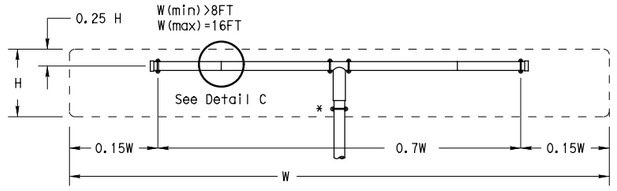
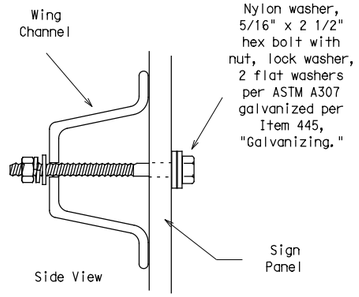
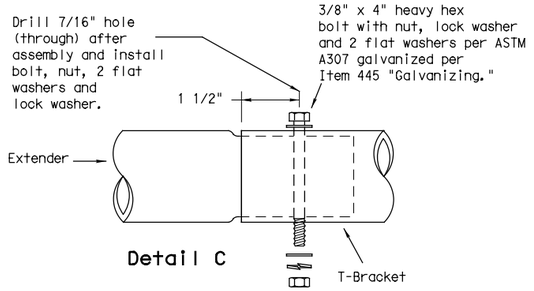


SM RD SGN ASSM TY XXXXX(1)XX(T-2EXT)
(* - See Note 12)



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

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.
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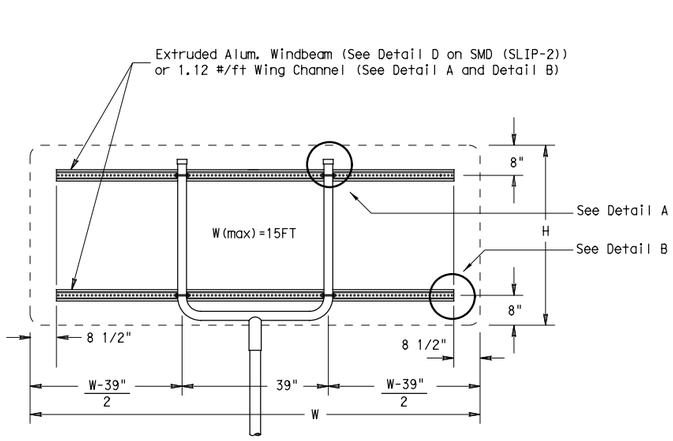
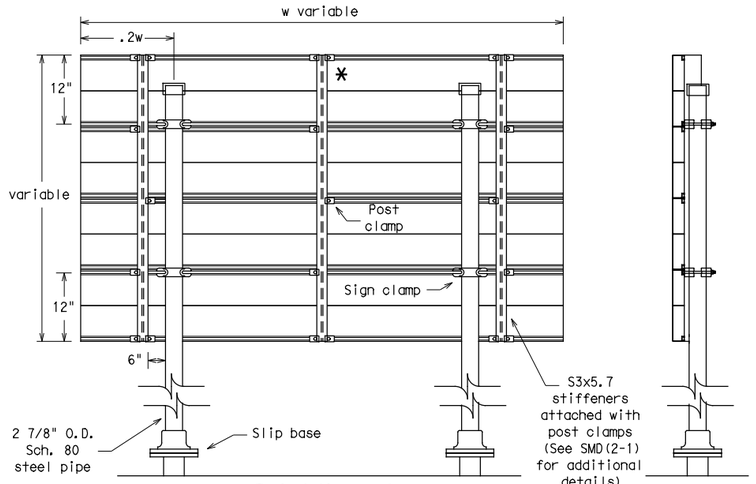
7. When two triangular slipbase supports are used to support a single sign, they shall not be "rigidly" connected to each other except through the sign panel. This will allow each support to act independently when impacted by an errant vehicle.
8. Wing channel shall meet ASTM A 1011 SS Gr 50 and be galvanized per ASTM A 123.
9. Excess pipe, wing channel, or windbeam shall be cut off so that it does not extend beyond the sign panel (i.e., excess support shall not be visible when the sign is viewed from the front.) Repair galvanized coating at cut support ends per Item 445, "Galvanizing."
10. Sign blanks shall be the sizes and shapes shown on the plans.
11. Additional sign clamp required on the "T-bracket" post for 24 inch high signs. Place the clamp 3 inches above bottom of sign when possible.
12. Post open ends shall be fitted with Friction Caps.



SM RD SGN ASSM TY XXXXX(1)XX(U-XX)

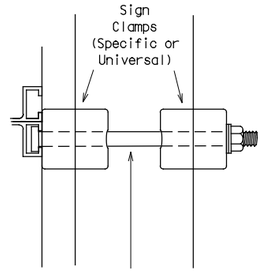


Typical Sign Mount

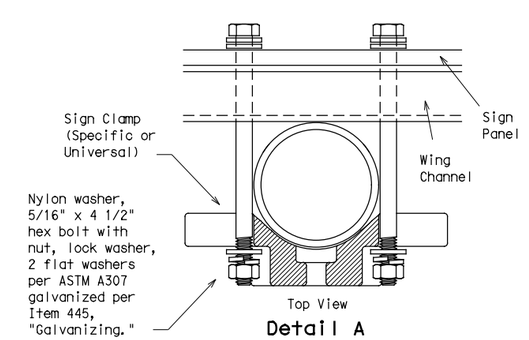
SM RD SGN ASSM TY S80(2)XX(P-EXAL)

* Additional stiffener placed at approximate center of signs when sign width is greater than 10'.

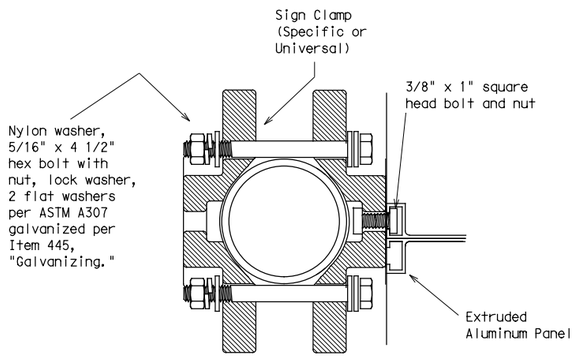
See Detail E
for clamp installation



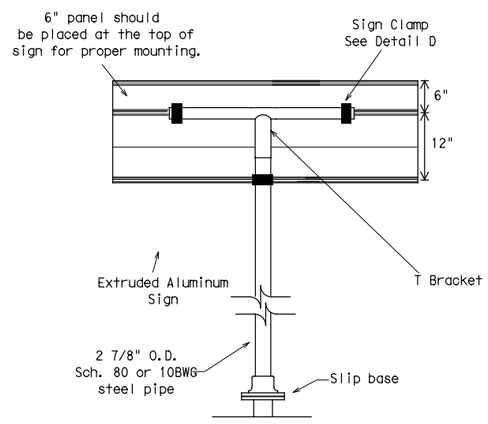
Detail E



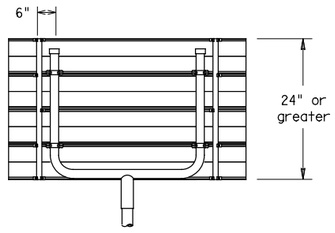
Detail A



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)

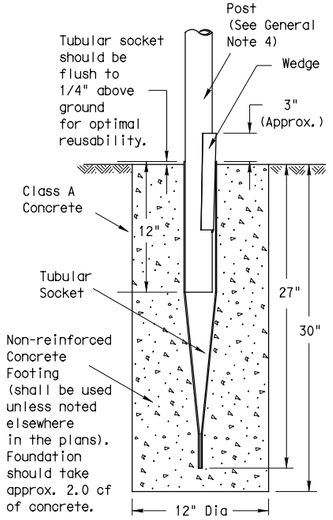
Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS TRIANGULAR SLIPBASE SYSTEM

SMD(SLIP-3)-08

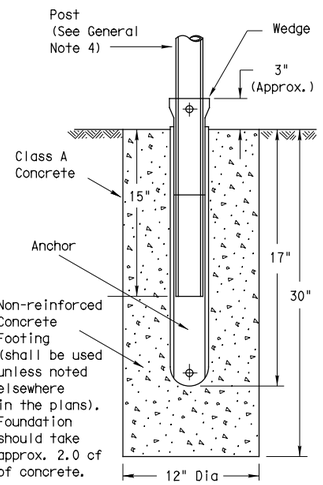
REVISIONS	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
9-08	CONT	SECT	JOB	HIGHWAY
	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		151

Wedge Anchor Steel System



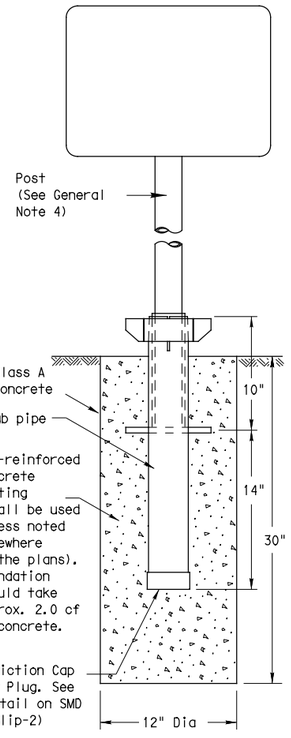
SM RD SGN ASSM TY TWT(X)WS(X)

Wedge Anchor High Density Polyethylene (HDPE) System

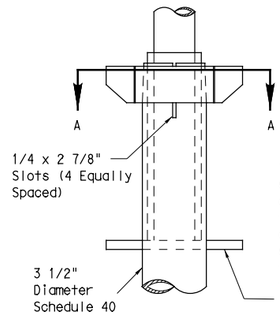


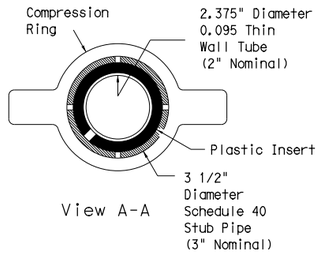
SMD RD SGN ASSM TY TWT(X)WP(X)

Universal Anchor System with Thin-Walled Tubing Post

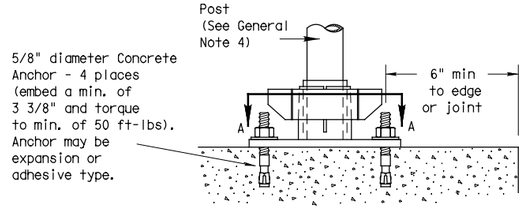


SM RD SGN ASSM TY TWT(X)UA(P)

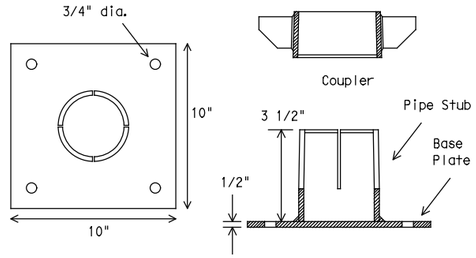




Plastic insert must be used when using the TWT with either the Universal Anchor System or the Bolt Down Universal Anchor System. The insert should be approx. 10" long and cover the tubing from just above the top of the stub pipe to the bottom of the sign post when using the Universal Anchor System. The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

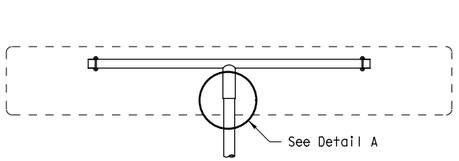


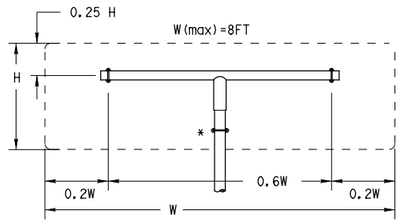
Concrete anchor consists of 5/8" diameter stud bolt with UNC series bolt threads on the upper end. A heavy hex nut per ASTM A563 and hardened washer per ASTM F436. The stud bolt shall have minimum yield and ultimate tensile strengths of 50 and 75 ksi, respectively. Nuts, bolts and washers shall be galvanized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



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

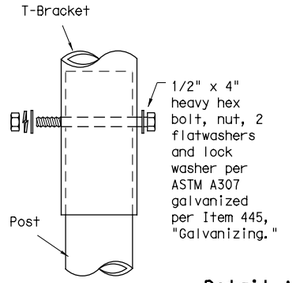
Sign Installation Using a Prefabricated T-Bracket for Thin-Wall Tubing Post





SM RD SGN ASSM TY TWT(X)XX(T)

(* - See General Note 6)



Detail A

9/16" hole may need to be drilled through post to accommodate bolt.

NOTE

The devices shall be installed per manufacturer's recommendations.
Installation procedures shall be provided to the Engineer by Contractor.

GENERAL NOTES:

1. The Wedge Anchor System and the Universal Anchor System with thin wall tubing post may be used to support up to 10 square feet of sign area.
2. The tubular socket, wedge and prefabricated T-bracket shall be permanently marked to indicate manufacturer. Method, design, and location of marking are subject to the approval of the TxDOT Traffic Standards Engineer.
3. Except for posts (13 BWG Tubing), clamps, nuts and bolts, all components shall be prequalified. A list of prequalified vendors may be obtained from the Material Producer List web page. The website address is: http://www.txdot.gov/business/producer list.htm
4. Material used as post with this system shall conform to the following specifications:
   13 BWG Tubing (2.375" outside diameter) (TWT)
   0.095" nominal wall thickness
   Seamless or electric-resistance welded steel tubing
   Steel shall be HSLAS Gr 55 per ASTM A1011 or ASTM A1008
   Other steels may be used if they meet the following:
   55,000 PSI minimum yield strength
   70,000 PSI minimum tensile strength
   18% minimum elongation in 2"
   Wall thickness (uncoated) shall be within the range of .083" to .099"
   Outside diameter (uncoated) shall be within the range of 2.369" to 2.381"
   Galvanization per ASTM 123 or ASTM A653 G210. For precoated steel tubing (ASTM A653), recoat tube outside diameter weld seam by metallizing with zinc wire per ASTM B833.
5. Sign blanks shall be the sizes and shapes shown on the plans.
6. Additional sign clamp required on the "T-bracket" post for 24" high signs. Place clamp at least 3" above bottom of sign when possible.
7. Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.
8. See the Traffic Operations Division website for detailed drawings of sign clamps and Wedge Anchor System components. The website address is: http://www.txdot.gov/publications/traffic.htm

WEDGE ANCHOR SYSTEM INSTALLATION PROCEDURE

1. Dig foundation hole. Where solid rock is encountered at ground level, the foundation shall be a minimum depth of 18". When solid rock is encountered below ground level, the foundation shall extend in the solid rock a minimum depth of 18" or provide a minimum foundation depth of 30". If solid rock is encountered, the socket/stub may be reduced in length as required to a minimum length of 18". Any material removed from the socket/stub shall be from the bottom and the clearance requirements given on SMD(GEN) must be followed. The inner surfaces of the socket/stub must remain free of concrete or other debris.
2. The Engineer may permit batches of concrete less than 2 cubic yards to be mixed with a portable, motor driven concrete mixer. For small placements less than 0.5 cubic yards, hand mixing in a suitable container may be allowed by Engineer. Place concrete into hole until it is approximately flush with the ground. Concrete shall be Class A.
3. Insert tubular socket into concrete until top of socket is approximaely 1/4 " above the concrete footing.
4. Plumb the socket. Allow a minimum 4 days for concrete to set, unless otherwise directed by Engineer..
5. Attach the sign to the sign post.
6. Insert the sign post into socket and align sign face with roadway.
7. Drive the wedge into the socket to secure post. This will leave approximately 3 inches of the wedge exposed.

UNIVERSAL ANCHOR SYSTEM INSTALLATION PROCEDURE

1. Dig foundation hole. Where solid rock is encountered at ground level, the foundation shall be a minimum depth of 18". When solid rock is encountered below ground level, the foundation shall extend in the solid rock a minimum depth of 18" or provide a minimum foundation depth of 30". If solid rock is encountered, the socket/stub may be reduced in length as required to a minimum length of 18". Any material removed from the socket/stub shall be from the bottom and the clearance requirements given on SMD(GEN) must be followed. The inner surfaces of the socket/stub must remain free of concrete or other debris.
2. Insert base post in hole to depths shown and backfill hole with concrete.
3. Level and plumb the base post using a torpedo level and allow concrete adequate time to set. The bottom of the slots provided in the stub pipe shall remain above the top of the concrete foundation.
4. Attach the sign to the sign post.
5. Install plastic insert around bottom of post.
6. Insert sign post into base post. Lower until the post comes to rest on steel rod.
7. Seat compression ring using a hammer. Typically, the top of compression ring will be approximately level with top of stub post when optimally installed.
8. Check sign post by hand to ensure it is unable to turn. If loose, increase the tightening of the compression ring.

Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS WEDGE & UNIVERSAL ANCHOR WITH THIN WALL TUBING POST

SMD(TWT)-08

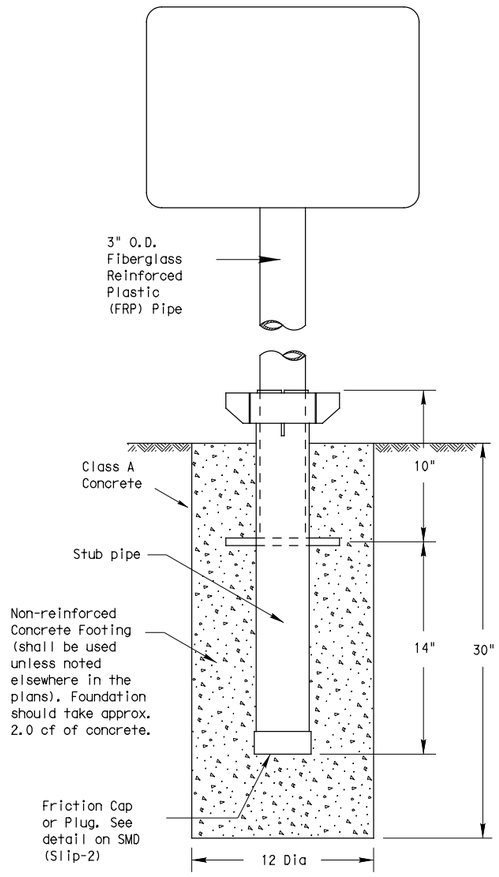
DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

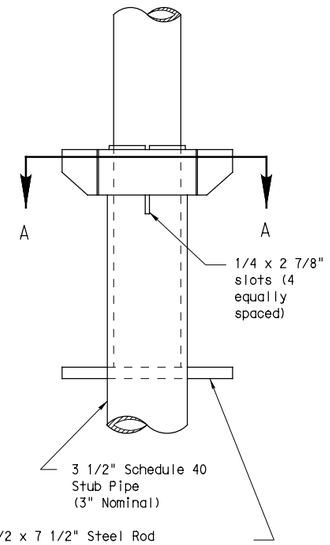
REVISIONS	CONT	SECT	JOB	HIGHWAY
9-08	0724	02	020, ETC,	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		152

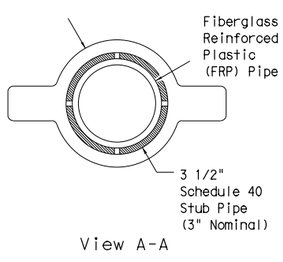
DATE:
FILE:

26E

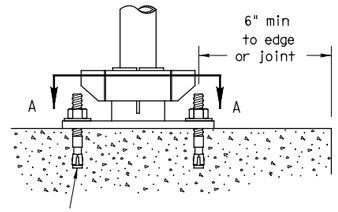
Universal Anchor System with Fiberglass Reinforced Plastic (FRP) Post







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



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

BOLT-DOWN DETAILS

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

GENERAL NOTES:

1. FRP sign supports for a single type sign support may be used for signs up to and including 16 square feet. Dual post installation may be used for signs up to and including 32 square feet.
2. All nuts, bolts and washers shall be galvanized per Item 445, "Galvanizing."
3. See the Traffic Operations Division website for detailed drawings of sign clamps. The website address is: http://www.txdot.gov/publications/traffic.htm

FRP POST REQUIREMENTS

1. Materials shall conform to the requirements of Departmental Material Specification DMS-4410 and will be furnished in a yellow or gray color as specified elsewhere in the plans.
2. Thickness of FRP sign support is 0.125" + 0.031", - 0.0".
3. FRP sign supports are prequalified by the Traffic Operations Division. Prequalification procedures are obtained by writing:
   Texas Department of Transportation
   Traffic Operations Division
   125 East 11th Street
   Austin, Texas 78701-2483

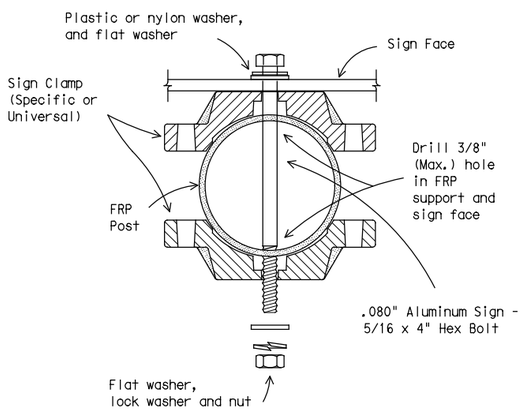
UNIVERSAL ANCHOR SYSTEM INSTALLATION PROCEDURES

1. Dig foundation hole. Where solid rock is encountered at ground level, the foundation shall be a minimum depth of 18". When solid rock is encountered below ground level, the foundation shall extend in the solid rock a minimum depth of 18" or provide a minimum foundation depth of 30". If solid rock is encountered, the socket/stub may be reduced in length as required to a minimum length of 18". Any material removed from the socket/stub shall be from the bottom and the clearance requirements given on SMD(GEN) must be followed. The inner surfaces of the socket/stub must remain free of concrete or other debris.
2. The Engineer may permit batches of concrete less than 2 cubic yards to be mixed with a portable, motor driven concrete mixer. For small placements less than 0.5 cubic yards, hand mixing in a suitable container may be allowed by Engineer. Concrete shall be Class A.
3. Insert base post in foundation hole to depths shown and fill hole with concrete. Cut base post from bottom and ensure a minimum of 18" embedment if installed in solid rock.
4. Level and plumb the base post with coupler using a torpedo level and let concrete set a minimum of 4 days, unless otherwise directed by Engineer. Bottom of base post slots shall be above the concrete footing.
5. Attach sign to FRP post.
6. Insert sign post into base post. Lower until the post comes to rest on the steel rod.
7. Use hammer to ensure the coupler is firmly seated. Top of coupler should be level with top of base post in most instances.
8. Check sign to ensure there is no twist. If loose, increase the tightening of coupler.

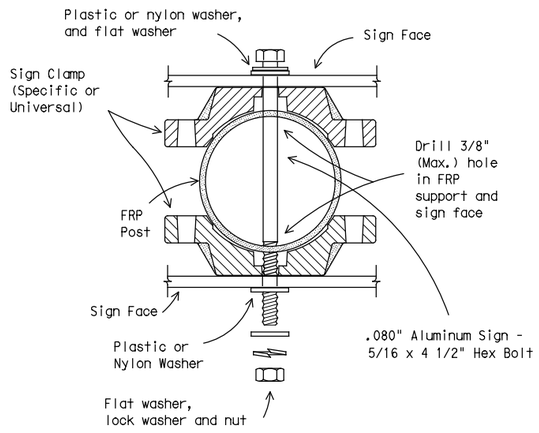
BOLT DOWN SIGN SUPPORT

1. Position base plate with coupler on existing concrete.
2. Drill holes into concrete and insert the 5/8" diameter bolts with wedge anchors, and tighten nuts.
3. Attach sign to FRP post.
4. Insert bottom of sign post into pipe stub.
5. Use hammer to ensure the coupler is firmly seated. Top of coupler should be level with top of base post in most instances.
6. Check sign to ensure there is no twist. If loose, increase the tightening of coupler.

Typical Sign Mounting Detail for FRP Support with Single Sign



Typical Sign Mounting Detail for FRP Support with Back-to-Back Signs



Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS UNIVERSAL ANCHOR SYSTEM WITH FRP POST

SMD(FRP)-08

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

CONT	SECT	JOB	HIGHWAY
0724	02	020, ETC.	FM 219

DIST	COUNTY	SHEET NO.
WACO	BOSQUE	153

REVISIONS
9-08

DATE:3/1/2024 12:16:56 PM
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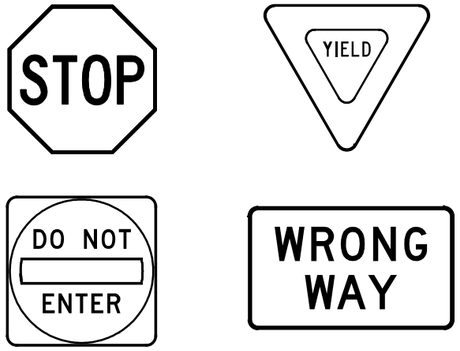
DATE: 3/1/2024 12:16:58 PM
FILE: P:\2020\01156\06-Bosque River-0724-02-020\4 - Design\Plan Set\13. Standards\TSR(4)-13.dgn

REQUIREMENTS FOR RED BACKGROUND REGULATORY SIGNS

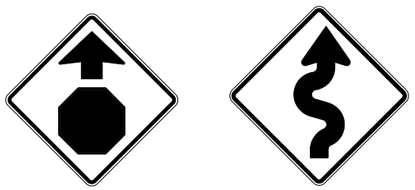
(STOP, YIELD, DO NOT ENTER AND WRONG WAY SIGNS)



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 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 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 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 12-03 7-13 9-08	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		154

4

DATE:
FILE:

I. STORMWATER POLLUTION PREVENTION-CLEAN WATER ACT SECTION 402

TPDES TXR 150000: Stormwater Discharge Permit or Construction General Permit required for projects with 1 or more acres disturbed soil. Projects with any disturbed soil must protect for erosion and sedimentation in accordance with Item 506.

List MS4 Operator(s) that may receive discharges from this project. They may need to be notified prior to construction activities.

1.

2.

☐ No Action Required ☒ Required Action

Action No.

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

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

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

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

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

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

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

☐ No Permit Required

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

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

☐ Individual 404 Permit Required

☐ Other Nationwide Permit Required: NWP# _____

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

1. North Bosque River
2. Bosque River Relief

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

2.

IV. VEGETATION RESOURCES

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

☐ No Action Required ☒ Required Action

Action No.

1. SEE STATEMENT ABOVE

2. Trees and brush trimming and removal need to occur between September 1 and February 28..

3.

4.

☐ No Action Required ☒ Required Action

Action No.

1. Comply with Migratory Bird Treaty Act (MBTA)

2.

3.

4.

5. 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.

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	0724	02	020,etc.	FM 219	
12-12-2011 (DS)	DIST	COUNTY		SHEET NO.	
05-07-14 ADDED NOTE SECTION IV.	09	Bosque		155	
01-23-2015 SECTION I (CHANGED ITEM 1122 TO ITEM 506, ADDED GRASSY SWALES.					

STORMWATER POLLUTION PREVENTION PLAN (SWP3):

This SWP3 has been developed in accordance with the TPDES Construction General Permit TXR150000 (CGP). The Texas Department of Transportation (TxDOT) ensures that project specifications include adequate best management practices (BMPs) for this project.

This SWP3 is consistent with requirements specified in applicable stormwater plans and the projects environmental permits, issues, and commitments (EPICs). A copy of the CGP is included in Attachment 2.12 of the SWP3 binder.

1.0 SITE/PROJECT DESCRIPTION

1.1 PROJECT CONTROL SECTION JOB (CSJ):
CSJ: 0724-02-020

1.2 PROJECT LIMITS:
From: FM 219 @ BOSQUE RELIEFE AND NORTH BOSQUE RIVER

To:

1.3 PROJECT COORDINATES:
BEGIN: (Lat) 31°47'06.4"N ,(Long) 97°34'11.2"W

END: (Lat) 31°47'12.1"N ,(Long) 97°33'56.4"W

1.4 TOTAL PROJECT AREA (Acres): 4.07 AC

1.5 TOTAL AREA TO BE DISTURBED (Acres): 2.83 AC

1.6 NATURE OF CONSTRUCTION ACTIVITY:
EXCAVATION, EMBANKMENT, GRADING OF ROADSIDE DITCHES, CHANNEL SIDE SLOPES AND CONSTRUCTION OF PROPOSED BRIDGES AND APPROACHES.

1.7 MAJOR SOIL TYPES:

Soil Type	Description
CLAY	LIGHT BROWN TO BROWN AND TAN, SOFT TO VERY SOFT, MOIST, SANDY WITH CALCAREOUD NODULES AND CALCAREOUS DEPOSITS.
SAND	COMPACT TO VERY DENSE, LIGHT BROWN TO BROWN, MOIST, CLAYEY, WITH GRAVEL AND FERROUS STAINING.
LIMESTONE	LIGTH GRAY TO GRAY, WITH CLAY LAYERS AND SHALE SEAMS.

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

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

Type	Sheet #s

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

1.9 CONSTRUCTION ACTIVITIES:
(Use the following list as a starting point when developing the Construction Activity Schedule and Ceasing Record in Attachment 2.5.)

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

1.10 POTENTIAL POLLUTANTS AND SOURCES:

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

1.11 RECEIVING WATERS:
Receiving waters must be depicted on the Environmental Layout Sheets in Attachment 1.2 of this SWP3. Include Segment # for receiving waters.

Tributaries	Classified Waterbody
NORTH BOSQUE RIVER	SEGMENT ID 1226 OF NORTH BOSQUE RIVER

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

1.12 ROLES AND RESPONSIBILITIES: TxDOT

- ☒ Development of plans and specifications
- ☒ Submit Notice of Intent (NOI) to TCEQ (≥5 acres)
- ☒ Post Construction Site Notice
- ☒ Submit NOI/CSN to local MS4
- ☒ Perform SWP3 inspections
- ☒ Maintain SWP3 records and update to reflect daily operations
- ☒ Complete and submit Notice of Termination to TCEQ
- ☒ Maintain SWP3 records for 3 years
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

1.13 ROLES AND RESPONSIBILITIES: CONTRACTOR

- ☒ Day To Day Operational Control
- ☒ Submit Notice of Intent (NOI) to TCEQ (≥5 acres)
- ☒ Post Construction Site Notice
- ☒ Submit NOI/CSN to local MS4
- ☒ Maintain schedule of major construction activities
- ☒ Install, maintain and modify BMPs
- ☒ Complete and submit Notice of Termination to TCEQ
- ☒ Maintain SWP3 records for 3 years
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

1.14 LOCAL MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4) OPERATOR COORDINATION:

MS4 Entity

STATE OF TEXAS
CRAIG M. WILSON
94710
LICENSED
PROFESSIONAL ENGINEER

3/1/2024

STORMWATER POLLUTION PREVENTION PLAN (SWP3)

July 2023 Sheet 1 of 2

Texas Department of Transportation

FED. RD. DIV. NO.	PROJECT NO.		SHEET NO.
6	SEE TITLE SHEET		156
STATE	STATE DIST.	COUNTY	
TEXAS	WACO	BOSQUE	
CONT.	SECT.	JOB	HIGHWAY NO.
0724	02	020, ETC.	FM 219

STORMWATER POLLUTION PREVENTION PLAN (SWP3):

2.0 BEST MANAGEMENT PRACTICES (BMPs) AND CONTROLS, INSPECTION, AND MAINTENANCE

The Contractor shall be the responsible party for implementing the BMPs described herein and for complying with the SWP3 for control of erosion and sedimentation during day-to-day operations. The Contractor shall implement changes to this SWP3 approved by TxDOT within the times specified in this SWP3 or the CGP.

2.1 EROSION CONTROL AND SOIL STABILIZATION BMPs:

T / P

- ☐ ☐ Protection of Existing Vegetation
- ☐ ☐ Vegetated Buffer Zones
- ☐ ☐ Soil Retention Blankets
- ☐ ☐ Geotextiles
- ☐ ☐ Mulching/ Hydromulching
- ☐ ☐ Soil Surface Treatments
- X ☐ Temporary Seeding
- ☐ X Permanent Planting, Sodding or Seeding
- ☐ ☐ Biodegradable Erosion Control Logs
- X ☐ Rock Filter Dams/ Rock Check Dams
- ☐ ☐ Vertical Tracking
- ☐ ☐ Interceptor Swale
- ☐ ☐ Riprap
- ☐ ☐ Diversion Dike
- ☐ ☐ Temporary Pipe Slope Drain
- ☐ ☐ Embankment for Erosion Control
- ☐ ☐ Paved Flumes
- ☐ ☐ Other: _____
- ☐ ☐ Other: _____
- ☐ ☐ Other: _____
- ☐ ☐ Other: _____

2.2 SEDIMENT CONTROL BMPs:

T / P

- ☐ ☐ Biodegradable Erosion Control Logs
- ☐ ☐ Dewatering Controls
- ☐ ☐ Inlet Protection
- X ☐ Rock Filter Dams/ Rock Check Dams
- ☐ ☐ Sandbag Berms
- X ☐ Sediment Control Fence
- ☐ ☐ Stabilized Construction Exit
- ☐ ☐ Floating Turbidity Barrier
- ☐ ☐ Vegetated Buffer Zones
- ☐ ☐ Vegetated Filter Strips
- ☐ ☐ Other: _____
- ☐ ☐ Other: _____
- ☐ ☐ Other: _____
- ☐ ☐ Other: _____

Refer to the Environmental Layout Sheets/ SWP3 Layout Sheets located in Attachment 1.2 of this SWP3

Sediment control BMPs requiring design capacity calculations (See SWP3 Attachment 1.3.):

T / P

- ☐ ☐ Sediment Trap
  - ☐ Calculated volume runoff from 2-year, 24-hour storm for each acre of disturbed area
  - ☐ 3,600 cubic feet of storage per acre drained
- ☐ ☐ Sedimentation Basin
  - ☐ Not required (<10 acres disturbed)
  - ☐ Required (>10 acres) and implemented.
    - ☐ Calculated volume runoff from 2-year, 24-hour storm for each acre of disturbed area
    - ☐ 3,600 cubic feet of storage per acre drained
  - ☐ Required (>10 acres), but not feasible due to:
    - ☐ Available area/Site geometry
    - ☐ Site slope/Drainage patterns
    - ☐ Site soils/Geotechnical factors
    - ☐ Public safety
    - ☐ Other: _____

2.3 PERMANENT CONTROLS:

(Coordinate post-construction BMPs with appropriate TxDOT maintenance sections.)

BMPs To Be Left In Place Post Construction:

Type	Stationing	
	From	To
SEEDING	124+45.88	138+45.58

Refer to the Environmental Layout Sheets/ SWP3 Layout Sheets located in Attachment 1.2 of this SWP3

2.4 OFFSITE VEHICLE TRACKING CONTROLS:

- ☐ Excess dirt/mud on road removed daily
- ☐ Haul roads dampened for dust control
- X Loaded haul trucks to be covered with tarpaulin
- ☐ Stabilized construction exit
- ☐ Daily street sweeping
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

2.5 POLLUTION PREVENTION MEASURES:

- ☐ Chemical Management
- X Concrete and Materials Waste Management
- X Debris and Trash Management
- X Dust Control
- X Sanitary Facilities
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

2.6 VEGETATED BUFFER ZONES:

Natural vegetated buffers shall be maintained as feasible to protect adjacent surface waters. If vegetated natural buffer zones are not feasible due to site geometry, the appropriate additional sediment control measures have been incorporated into this SWP3.

Type	Stationing	
	From	To

Refer to the Environmental Layout Sheets/ SWP3 Layout Sheets located in Attachment 1.2 of this SWP3

2.7 ALLOWABLE NON-STORMWATER DISCHARGES:

- X Fire hydrant flushings
- X Irrigation drainage
- X Pavement washwater (where spills or leaks have not occurred, and detergents are not used)
- X Potable water sources
- X Springs
- X Uncontaminated groundwater
- X Water used to wash vehicles or control dust
- X Other allowable non-stormwater discharges as allowed by TPDES GP TXR150000.

2.8 DEWATERING:

Dewatering discharges of accumulated stormwater, groundwater, and surface water including discharges from dewatering of trenches, excavations, foundations, vaults, and other points of accumulation are prohibited unless managed by appropriate controls to prevent and minimize the offsite discharge of sediment and other pollutants.

2.9 INSPECTIONS:

All disturbed areas and erosion and sediment control devices shall be inspected at least once every seven (7) days. Inspections shall be performed by TxDOT as indicated on the Field Inspection and Maintenance Report Form 2118 and retained in Attachment 2.5 of this SWP3.

When dewatering activities are present, a daily inspection will be conducted once per day during those activities and documented in accordance with CGP and TxDOT requirements.

2.10 MAINTENANCE:

Control measures shall be properly installed according to specifications. If it is determined that a BMP or control measure is not operating effectively, maintenance must be accomplished as soon as possible and before the next anticipated rain event, but in no case later than 7 calendar days after being able to access the site. Maintenance shall be performed by the Contractor as indicated on the Field Inspection and Maintenance Report Form 2118 and retained in Attachment 2.5 of this SWP3.

STATE OF TEXAS
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LICENSED
PROFESSIONAL ENGINEER

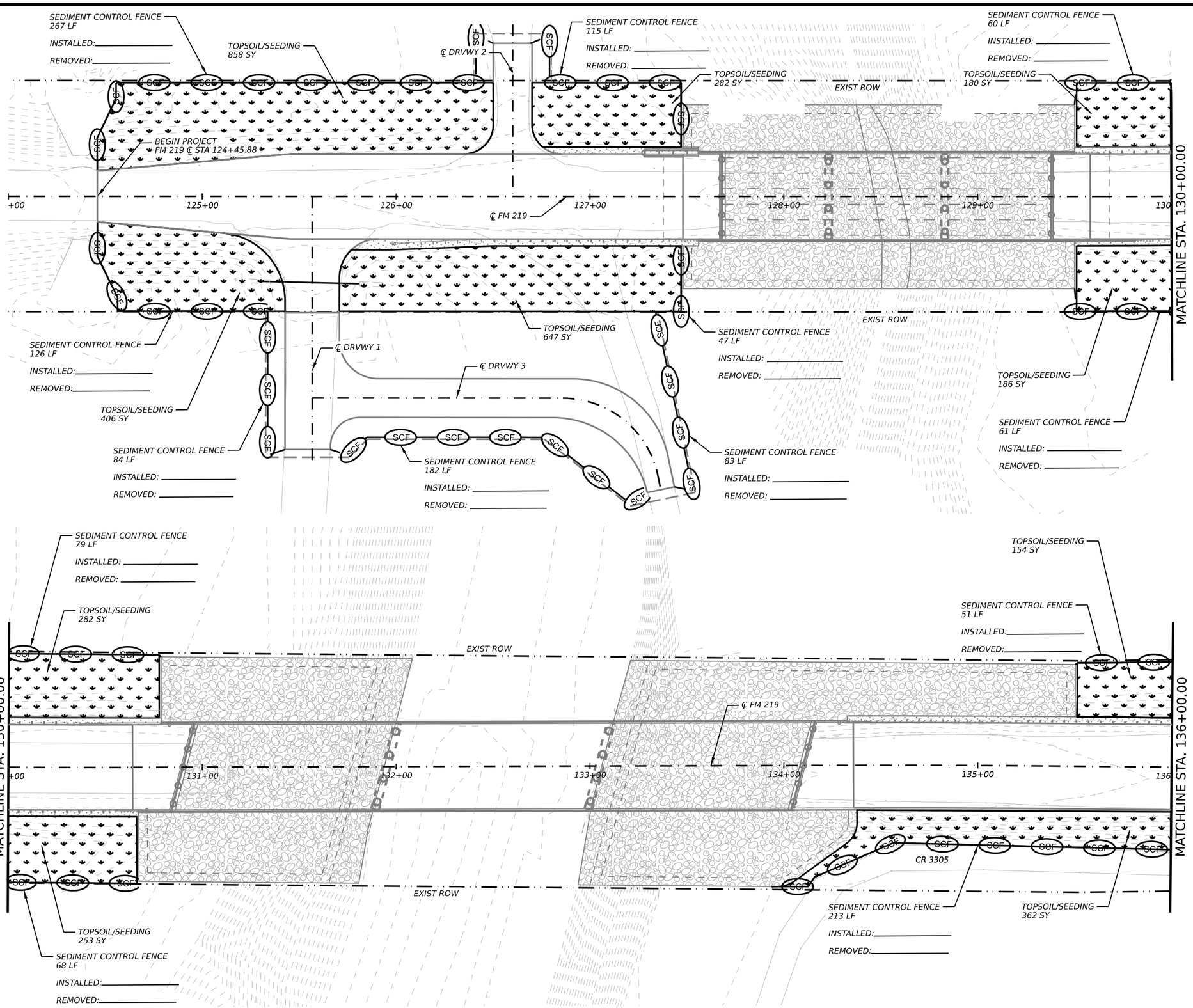
3/1/2024

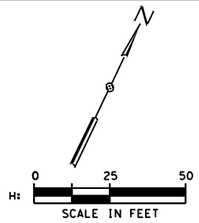
STORMWATER POLLUTION PREVENTION PLAN (SWP3)

July 2023 Sheet 2 of 2

Texas Department of Transportation

FED. RD. DIV. NO.	PROJECT NO.		SHEET NO.
6	SEE TITLE SHEET		157
STATE	STATE DIST.	COUNTY	
TEXAS	WACO	BOSQUE	
CONT.	SECT.	JOB	HIGHWAY NO.
0724	02	020, ETC.	FM 219





LEGEND:

TOPSOIL/SEEDING

SCF SEDIMENT CONTROL FENCE

NOTES:

1. SWP3 ITEMS SHOULD BE ADJUSTED TO ACCOMODATE ACTUAL FIELD CONDITIONS OR AS DIRECTED BY THE ENGINEER.
2. QUANTITY INSTALLATION OF SOIL RETENTION BLANKETS HAS BEEN INCLUDED IN THE PROJECT BUT NOT SHOWN ON THE SWP3 LAYOUT. USE AND PLACEMENT WILL BE AS DIRECTED BY THE ENGINEER.

PRINT DATE	REVISION DATE
3/1/2024	

STATE OF TEXAS
CRAIG M. WILSON
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3/1/2024

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TBPELS Firm No. F-3379

Texas Department of Transportation
Waco District

FM 219 BRIDGE REPLACEMENTS

SWP3 LAYOUT

SHEET 1 OF 2

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 158

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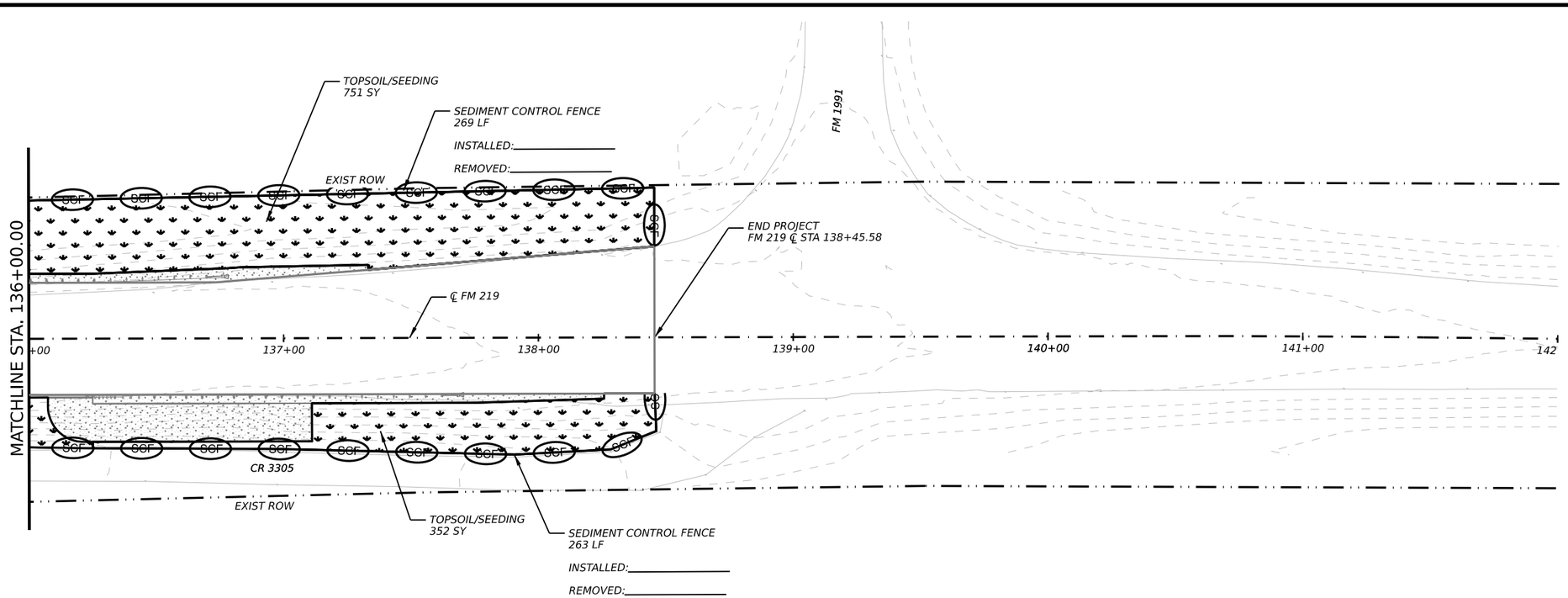

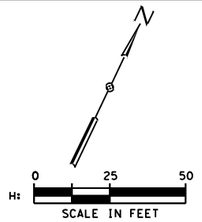

LEGEND:

- TOPSOIL/SEEDING
- SOIL RETENTION BLANKETS (CL 1)(TY B)
- SF SEDIMENT CONTROL FENCE

1. SWP3 ITEMS SHOULD BE ADJUSTED TO ACCOMODATE ACTUAL FIELD CONDITIONS OR AS DIRECTED BY THE ENGINEER.
2. QUANTITY INSTALLATION OF SOIL RETENTION BLANKETS HAS BEEN INCLUDED IN THE PROJECT BUT NOT SHOWN ON THE SWP3 LAYOUT. USE AND PLACEMENT WILL BE AS DIRECTED BY THE ENGINEER.

PRINT DATE	REVISION DATE
4/5/2024	

STATE OF TEXAS
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4/5/2024

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Texas Department of Transportation
Waco District

FM 219 BRIDGE REPLACEMENTS

SWP3 LAYOUT

SHEET 2 OF 2

FED. RD. DIV. NO.	PROJECT NUMBER	HIGHWAY NUMBER
6	SEE TITLE SHEET	FM 219
STATE	DISTRICT	COUNTY
TEXAS	WACO	BOSQUE
CONTROL	SECTION	JOB / SHEET NO.
0724	02	020, ETC. / 159

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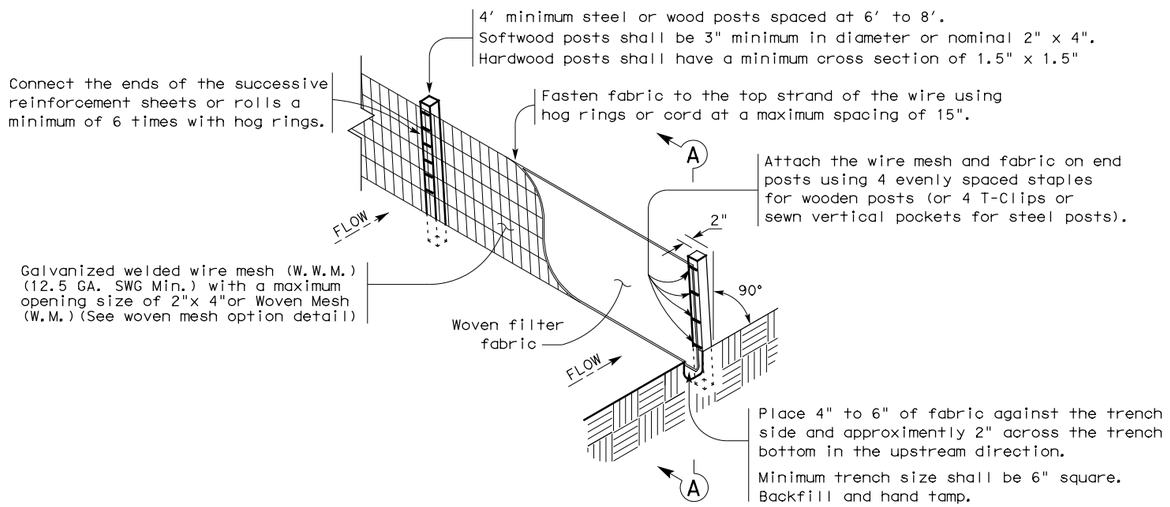
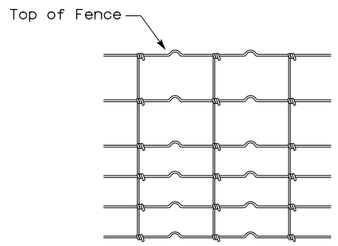
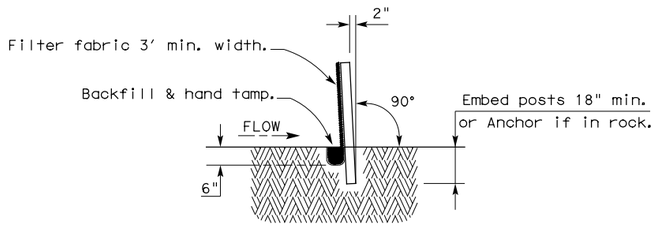


TEMPORARY SEDIMENT CONTROL FENCE

SCF





SECTION A-A

HINGE JOINT KNOT WOVEN MESH (OPTION) DETAIL

Galvanized hinge joint knot woven mesh (12.5 GA.SWG Min.) requires a minimum of five horizontal wires spaced at a maximum of 12 inches apart and all vertical wires spaced at a maximum of 12 inches apart.

SEDIMENT CONTROL FENCE USAGE GUIDELINES

A sediment control fence may be constructed near the downstream perimeter of a disturbed area along a contour to intercept sediment from overland runoff. A 2 year storm frequency may be used to calculate the flow rate to be filtered.

Sediment control fence should be sized to filter a maximum flow through rate of 100 GPM/FT^2. Sediment control fence is not recommended to control erosion from a drainage area larger than 2 acres.

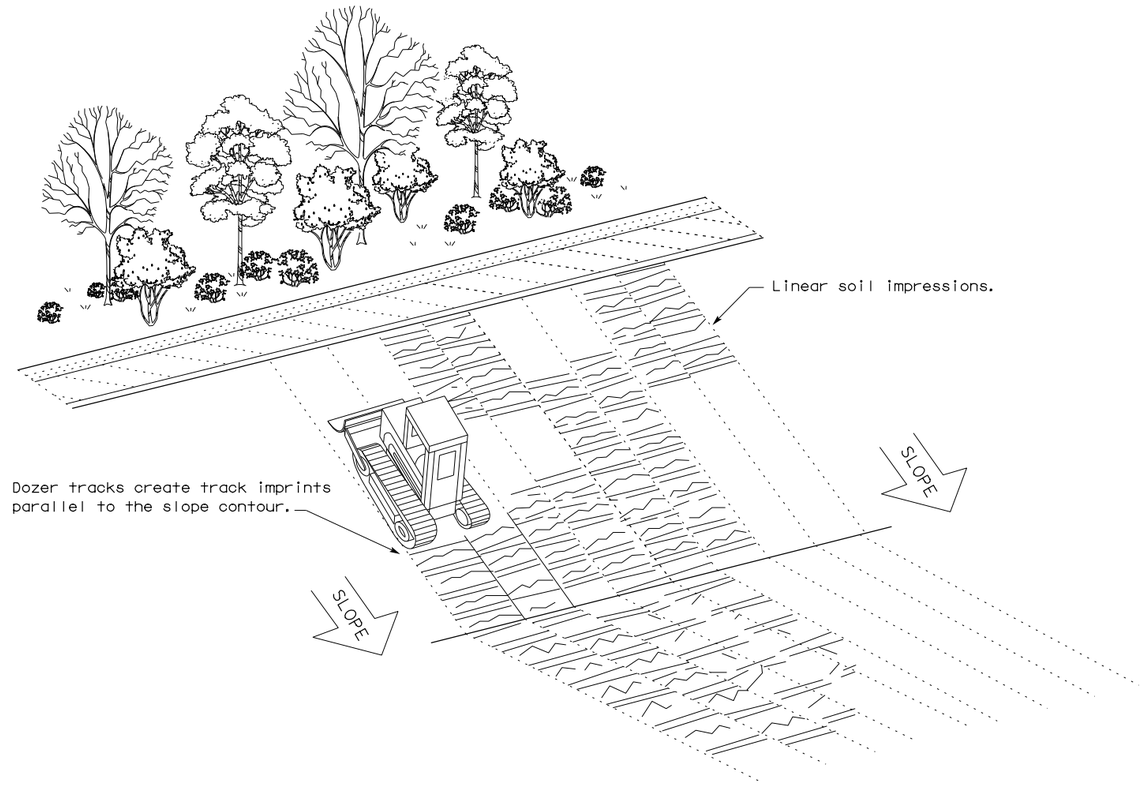
LEGEND

Sediment Control Fence

SCF

GENERAL NOTES

1. Vertical tracking is required on projects where soil distributing activities have occurred unless otherwise approved.
2. Perform vertical tracking on slopes to temporarily stabilize soil.
3. Provide equipment with a track undercarriage capable of producing linear soil impressions measuring a minimum of 12" in length by 2" to 4" in width by 1/2" to 2" in depth.
4. Do not exceed 12" between track impressions.
5. Install continous linear track impressions where the minimum 12" length impressions are perpendicular to the slope or direction of water flow.



VERTICAL TRACKING

Texas Department of Transportation

Design Division Standard

TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

FENCE & VERTICAL TRACKING

EC(1)-16

FILE: ec116	DN: TxDOT	CK: KM	DW: VP	DN/CK: LS
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		160

DATE: 3/1/2024
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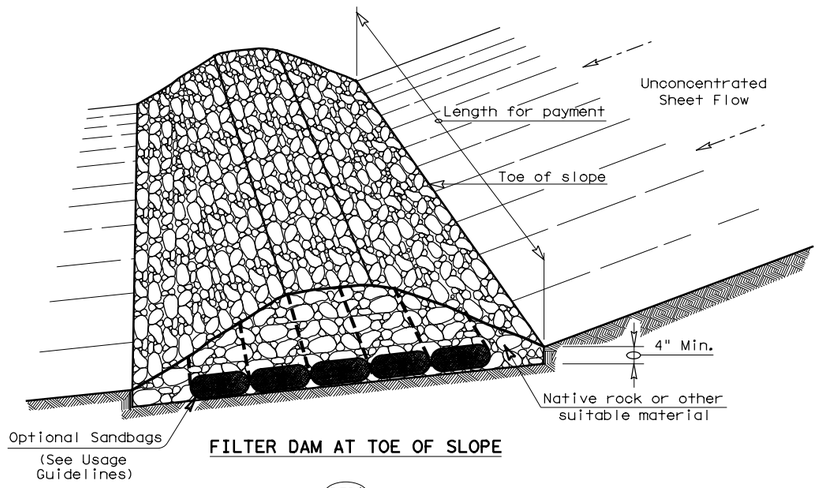
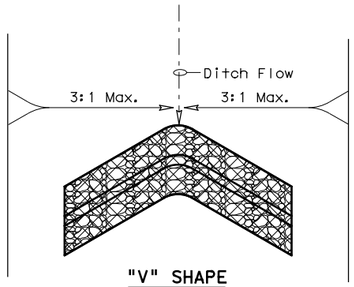
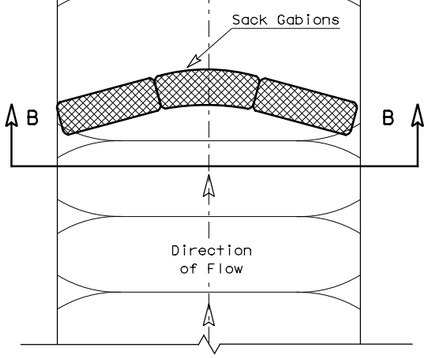


FILTER DAM AT TOE OF SLOPE

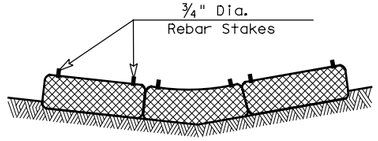
RFD1



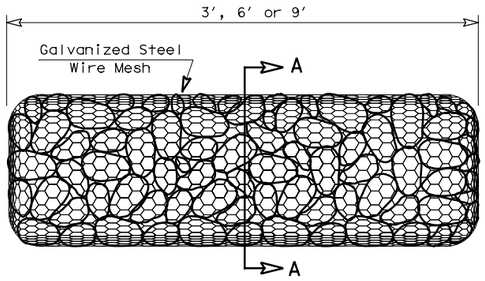
"V" SHAPE PLAN VIEW



PLAN VIEW

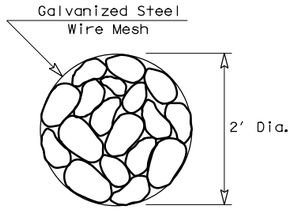


SECTION B-B

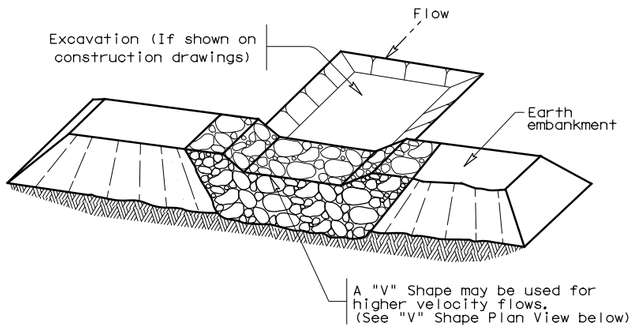


TYPE 4 (SACK GABIONS)

RFD4

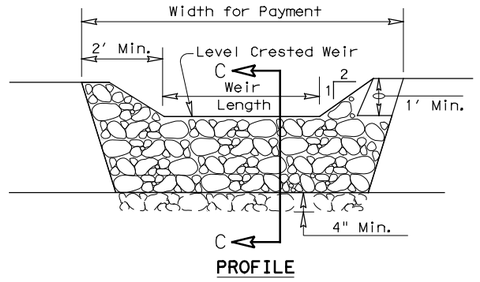


SECTION A-A

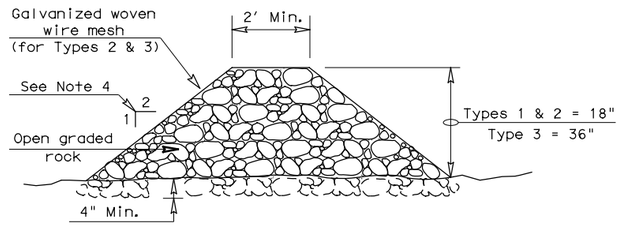


FILTER DAM AT SEDIMENT TRAP

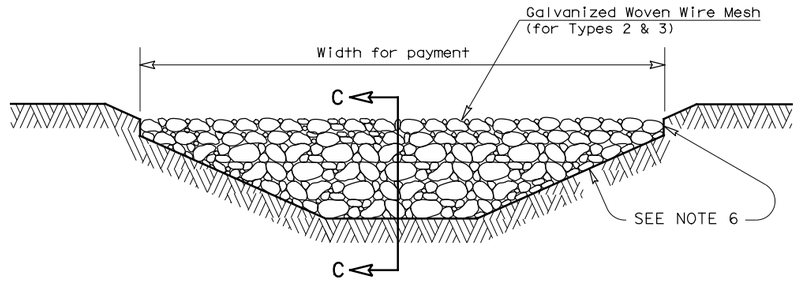
RFD1 — OR — RFD2



PROFILE



SECTION C-C



FILTER DAM AT CHANNEL SECTIONS

RFD1 — OR — RFD2 — OR — RFD3

ROCK FILTER DAM USAGE GUIDELINES

Rock Filter Dams should be constructed downstream from disturbed areas to intercept sediment from overland runoff and/or concentrated flow. The dams should be sized to filter a maximum flow through rate of 60 GPM/FT^2 of cross sectional area. A 2 year storm frequency may be used to calculate the flow rate.

Type 1 (18" high with no wire mesh) (3" to 6" aggregate): Type 1 may be used at the toe of slopes, around inlets, in small ditches, and at dike or swale outlets. This type of dam is recommended to control erosion from a drainage area of 5 acres or less. Type 1 may not be used in concentrated high velocity flows (approximently 8 Ft/Sec or more) in which aggregate wash out may occur. Sandbags may be used at the embedded foundation (4" deep min.) for better filtering efficiency of low flows if called for on the plans or directed by the Engineer.

Type 2 (18" high with wire mesh) (3" to 6" aggregate): Type 2 may be used in ditches and at dike or swale outlets.

Type 3 (36" high with wire mesh) (4" to 8" aggregate): Type 3 may be used in stream flow and should be secured to the stream bed.

Type 4 (Sack gabions) (3" to 6" aggregate): Type 4 May be used in ditches and smaller channels to form an erosion control dam.

Type 5: Provide rock filter dams as shown on plans.

GENERAL NOTES

1. If shown on the plans or directed by the Engineer, filter dams should be placed near the toe of slopes where erosion is anticipated, upstream and/or downstream at drainage structures, and in roadway ditches and channels to collect sediment.
2. Materials (aggregate, wire mesh, sandbags, etc.) shall be as indicated by the specification for "Rock Filter Dams for Erosion and Sedimentation Control".
3. The rock filter dam dimensions shall be as indicated on the SW3P plans.
4. Side slopes should be 2:1 or flatter. Dams within the safety zone shall have sideslopes of 6:1 or flatter.
5. Maintain a minimum of 1' between top of rock filter dam weir and top of embankment for filter dams at sediment traps.
6. Filter dams should be embedded a minimum of 4" into existing ground.
7. The sediment trap for ponding of sediment laden runoff shall be of the dimensions shown on the plans.
8. Rock filter dam types 2 & 3 shall be secured with 20 gauge galvanized woven wire mesh with 1" diameter hexagonal openings. The aggregate shall be placed on the mesh to the height & slopes specified. The mesh shall be folded at the upstream side over the aggregate and tightly secured to itself on the downstream side using wire ties or hog rings. For in stream use, the mesh should be secured or staked to the stream bed prior to aggregate placement.
9. Sack Gabions should be staked down with 3/4" dia. rebar stakes, and have a double-twisted hexagonal weave with a nominal mesh opening of 2 1/2" x 3 1/4"
10. Flow outlet should be onto a stabilized area (vegetation, rock, etc.).
11. The guidelines shown hereon are suggestions only and may be modified by the Engineer.

PLAN SHEET LEGEND

Type 1 Rock Filter Dam	RFD1
Type 2 Rock Filter Dam	RFD2
Type 3 Rock Filter Dam	RFD3
Type 4 Rock Filter Dam	RFD4

Texas Department of Transportation

Design Division Standard

TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

ROCK FILTER DAMS

EC(2)-16

FILE: ec216	DN: TxDOT	CK: KM	DW: VP	DN/CK: LS
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY
REVISIONS	0724	02	020, ETC.	FM 219
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		161

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.

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TYPICAL APPLICATIONS FOR BEST MANAGEMENT PRACTICES

TA-BMP

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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.

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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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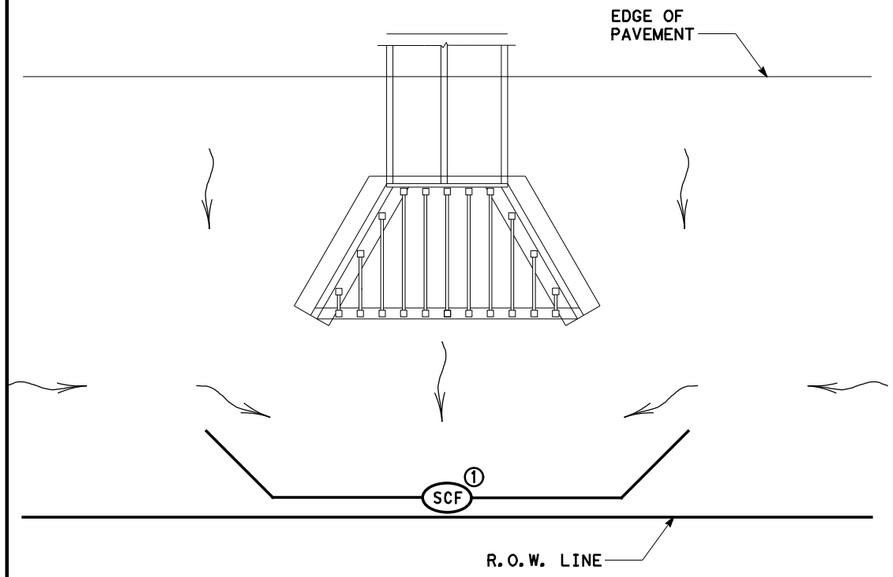
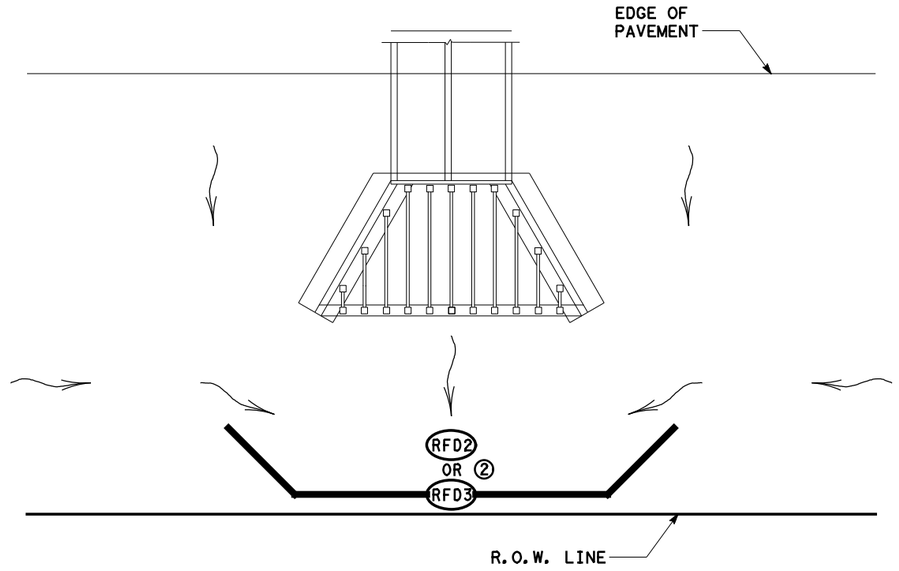


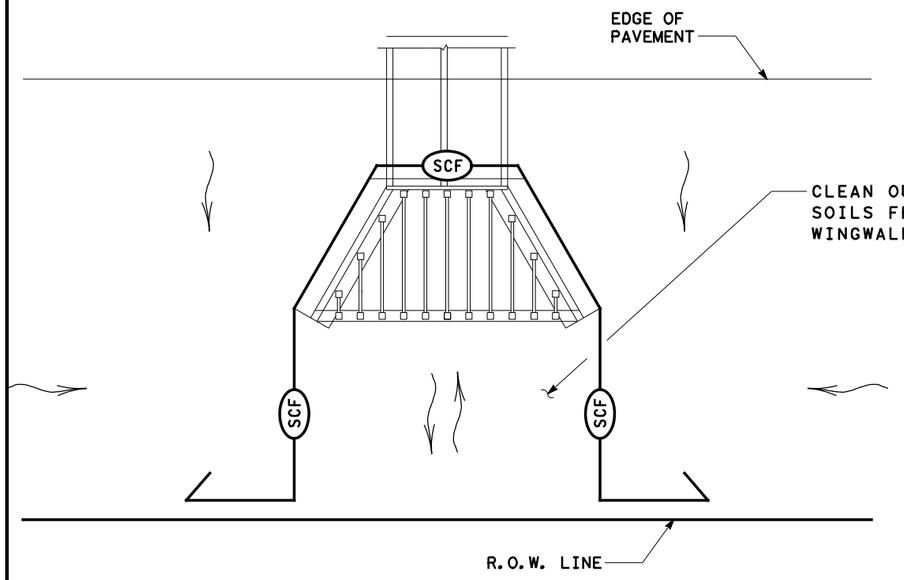
BEST MANAGEMENT PRACTICE (BMP) #1

FOR NON-404 STREAMS ONLY ~ SEDIMENT CONTROL AT EXIT OF CULVERT



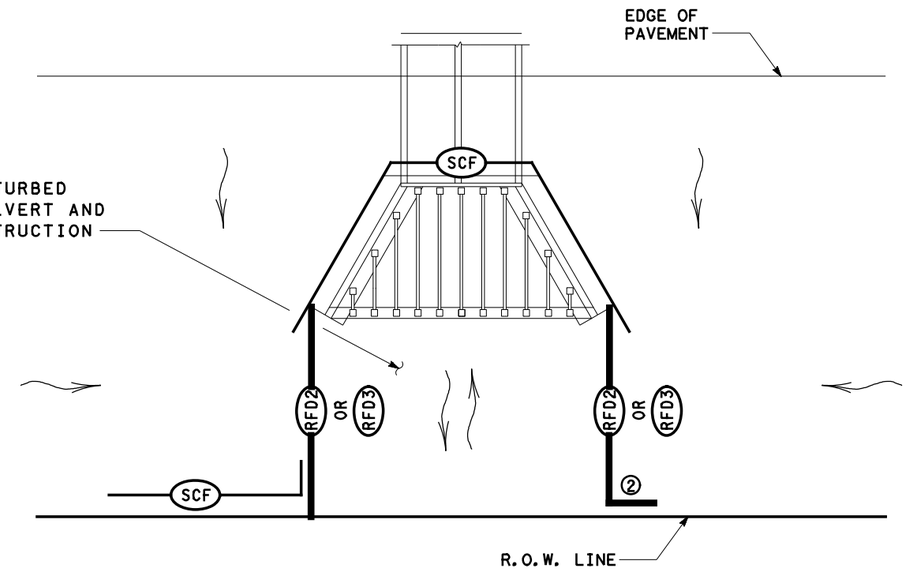
BEST MANAGEMENT PRACTICE (BMP) #2

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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TYPICAL APPLICATIONS FOR BEST MANAGEMENT PRACTICES

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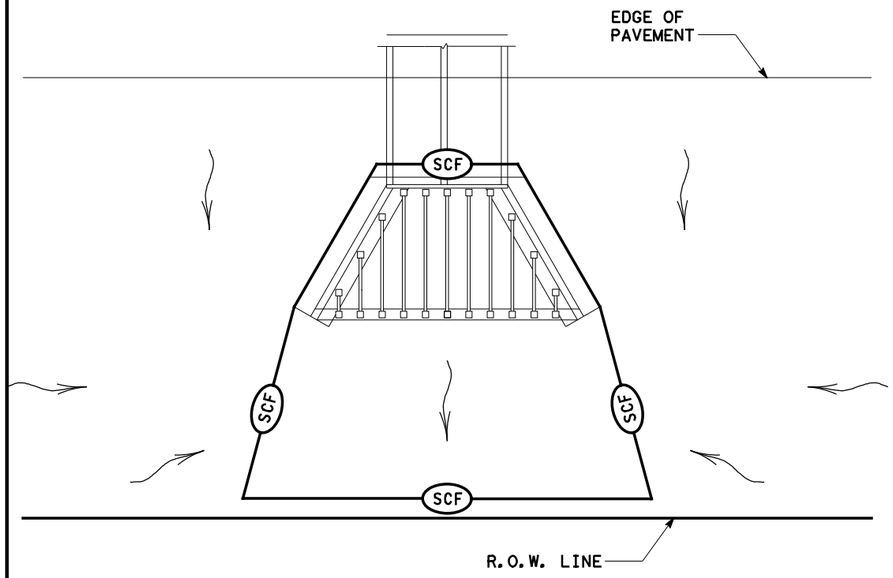
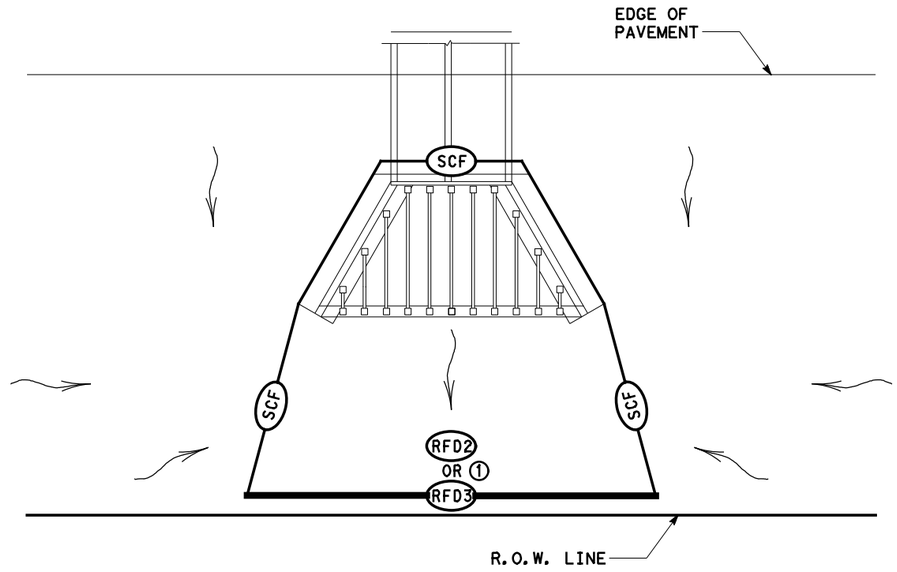


BEST MANAGEMENT PRACTICE (BMP) #5

FOR NON-404 STREAMS ONLY ~ SEDIMENT CONTROL AT EXIT OF CULVERT



BEST MANAGEMENT PRACTICE (BMP) #6

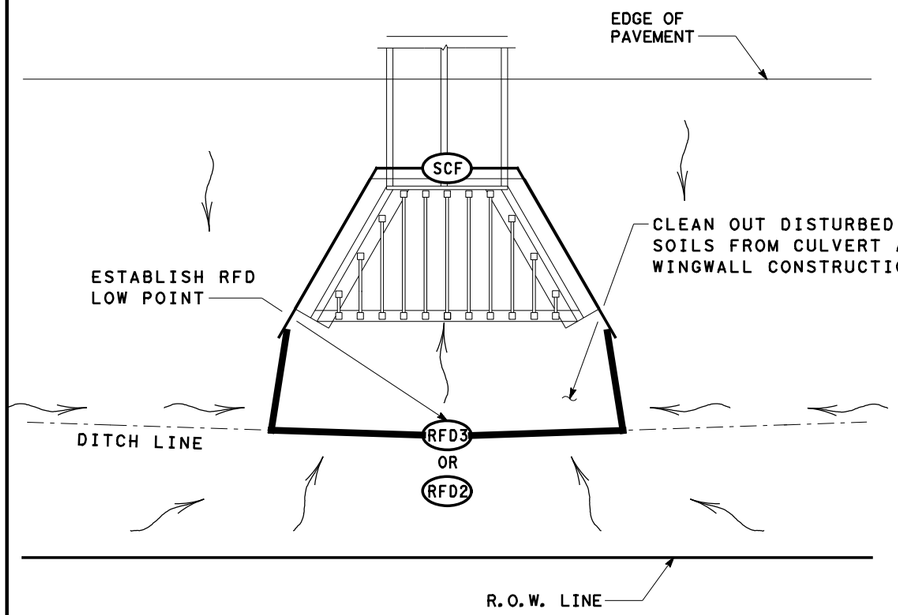
FOR NON-404 STREAMS ONLY ~ SEDIMENT CONTROL AT EXIT OF CULVERT

SCF	SEDIMENT CONTROL FENCE
RFD2	ROCK FILTER DAM (TY 2)
RFD3	ROCK FILTER DAM (TY 3)
	DIRECTION OF FLOW

NOTES:

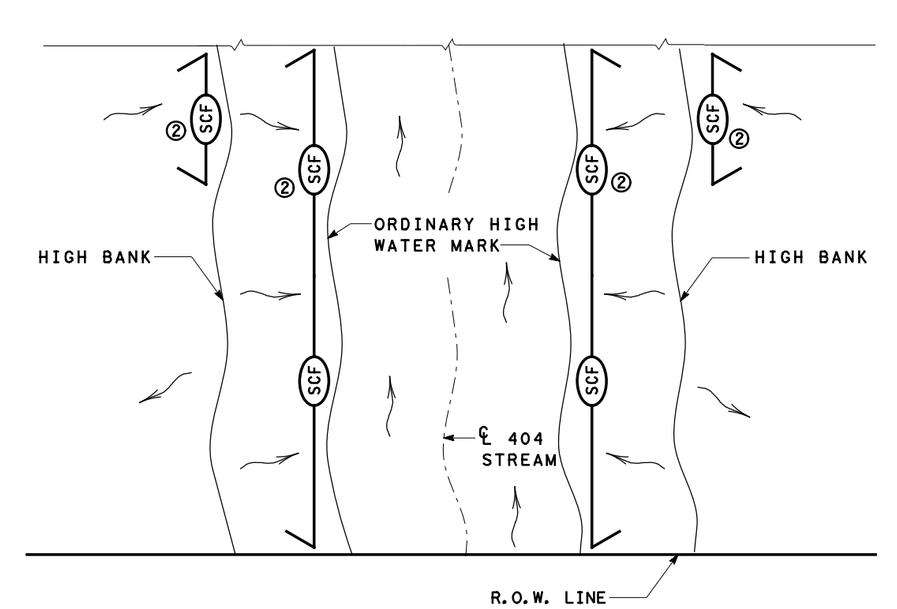
① PROVIDE OVERLAP OF SILT FENCE WITH ROCK FILTER DAM.

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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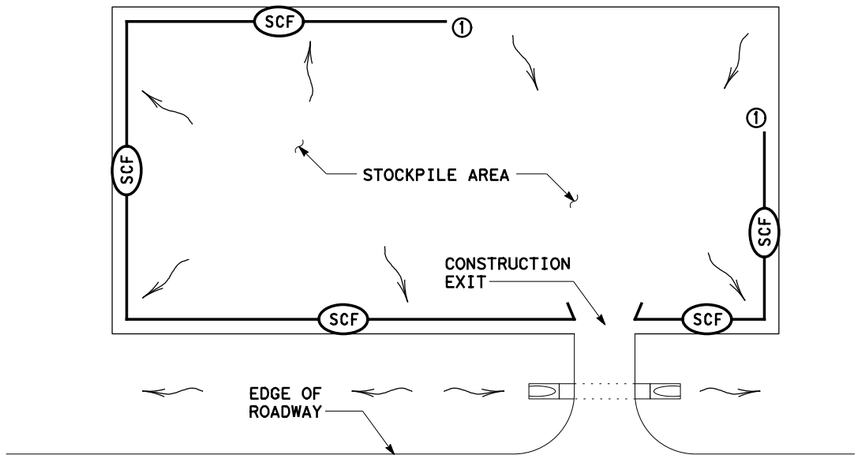
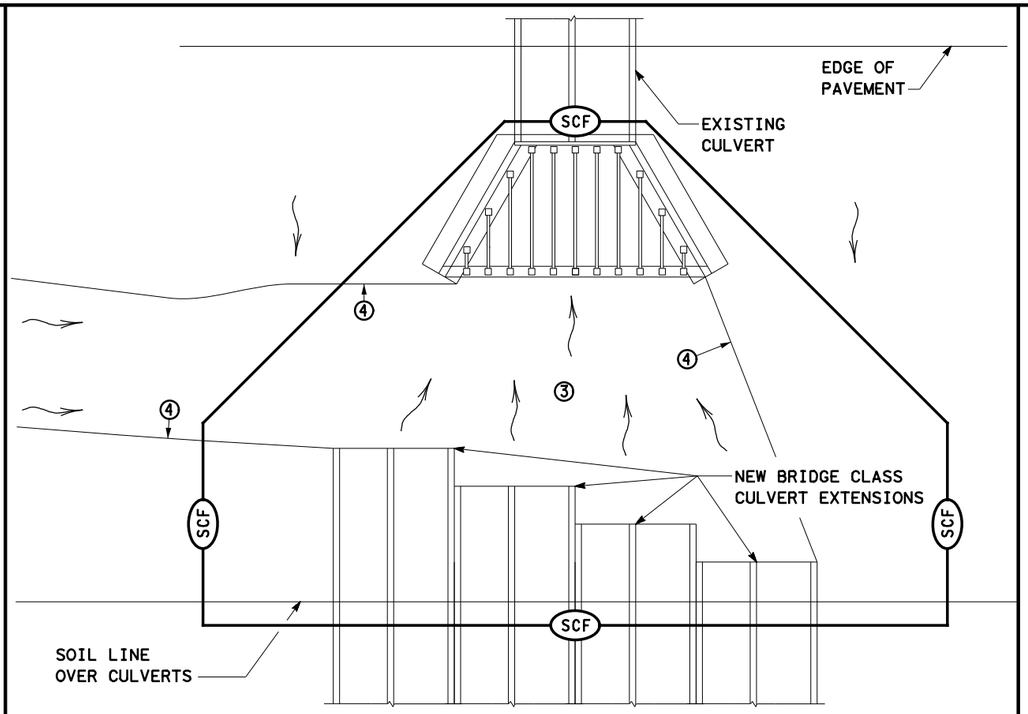


BEST MANAGEMENT PRACTICE (BMP) #9

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

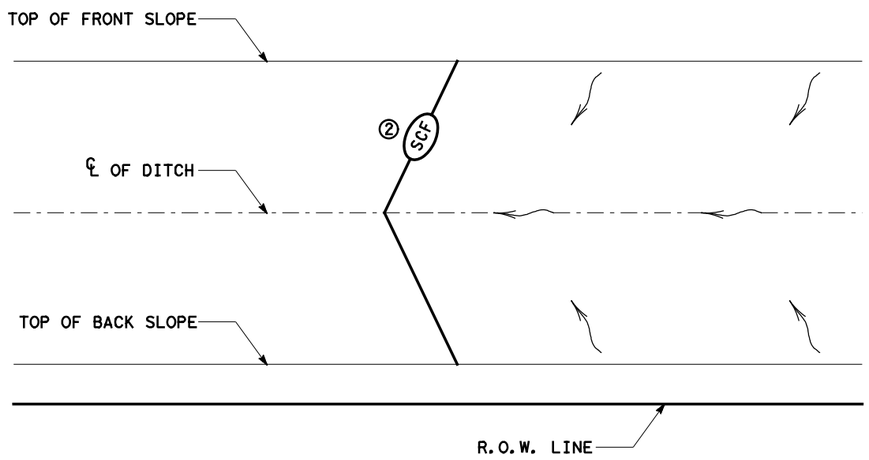
NOTES:

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.

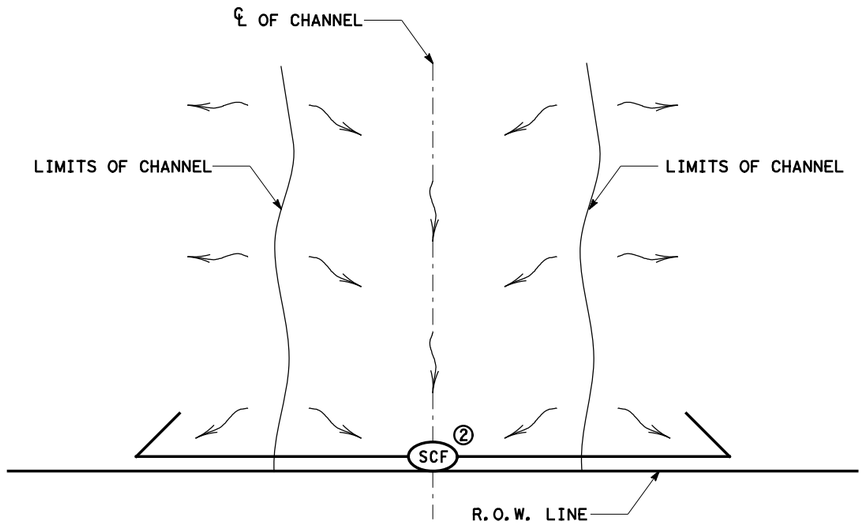
③ PROVIDE A SMOOTH TRANSITION FROM THE INVERT ELEVATIONS BETWEEN CULVERTS. REMOVE LOOSE SOIL FROM EXCAVATED AREA BETWEEN CULVERTS.

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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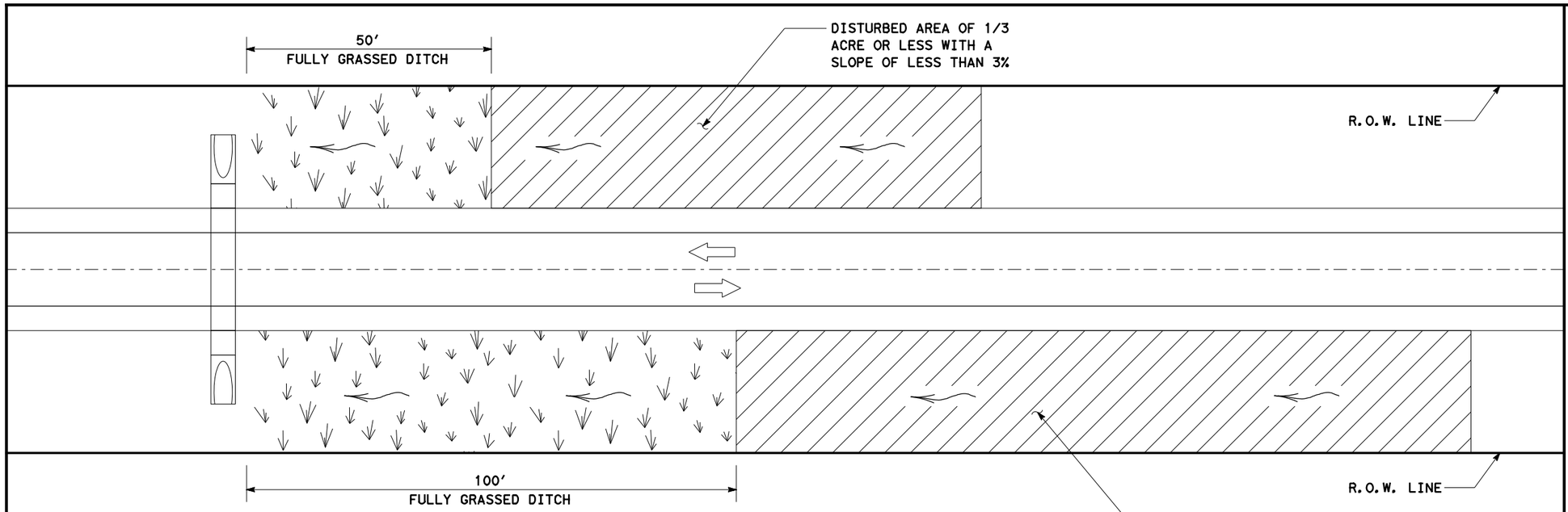
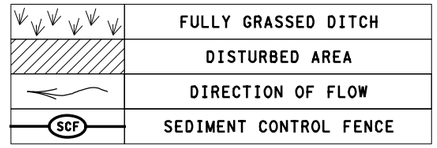


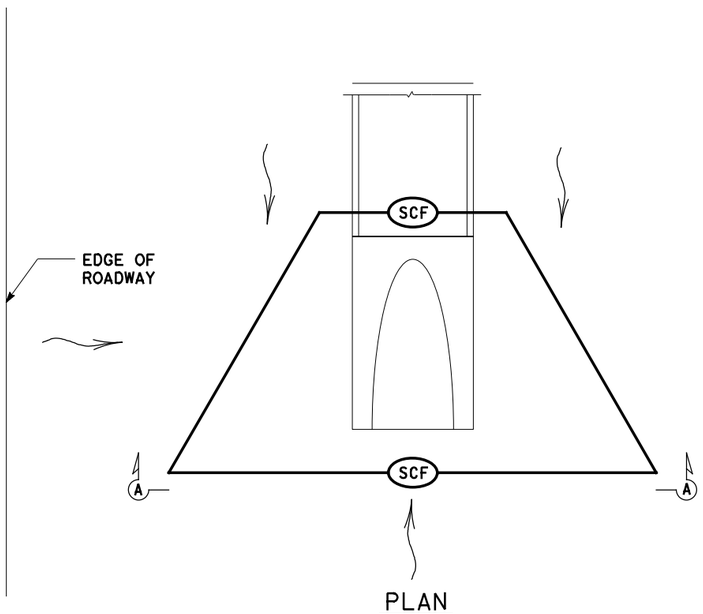
BEST MANAGEMENT PRACTICE (BMP) #13

USE OF VEGETATIVE BUFFERS IN PLACE OF TEMPORARY SEDIMENT CONTROLS SUCH AS SILT FENCE AND ROCK FILTER DAMS

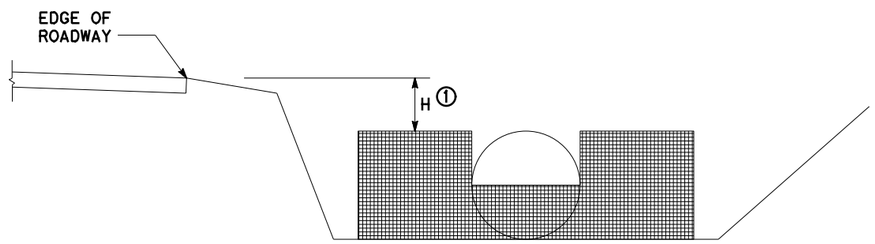


① FOR H DIMENSIONS LESS THAN 1.5′ SILT FENCE MAY NEED TO BE NOTCHED AS SHOWN IN VIEW A-A. ADD EXTRA POSTS AT NOTCH.

② BMP #14 MAY BE USED AT CROSS DRAINAGE STRUCTURES AS DIRECTED.



PLAN



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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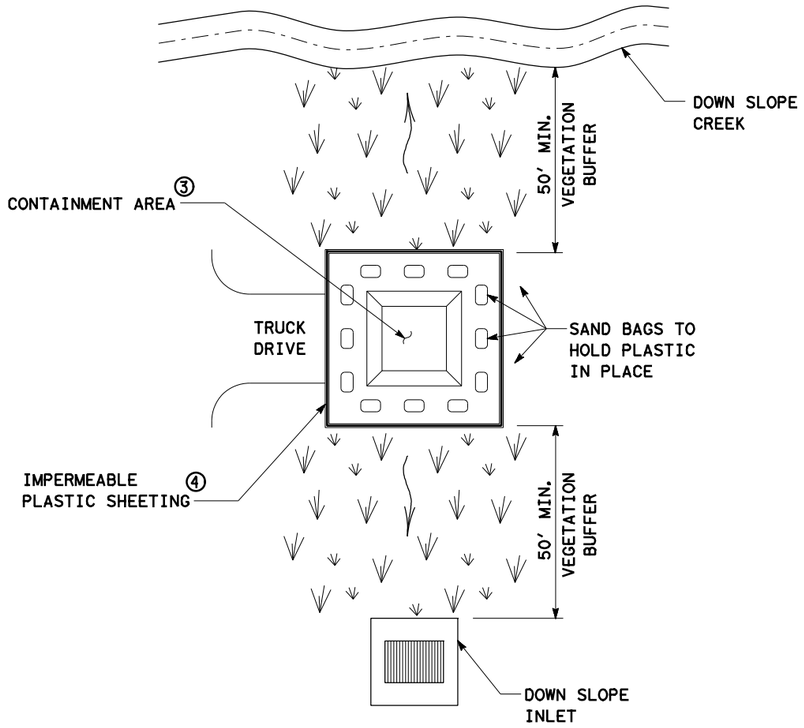
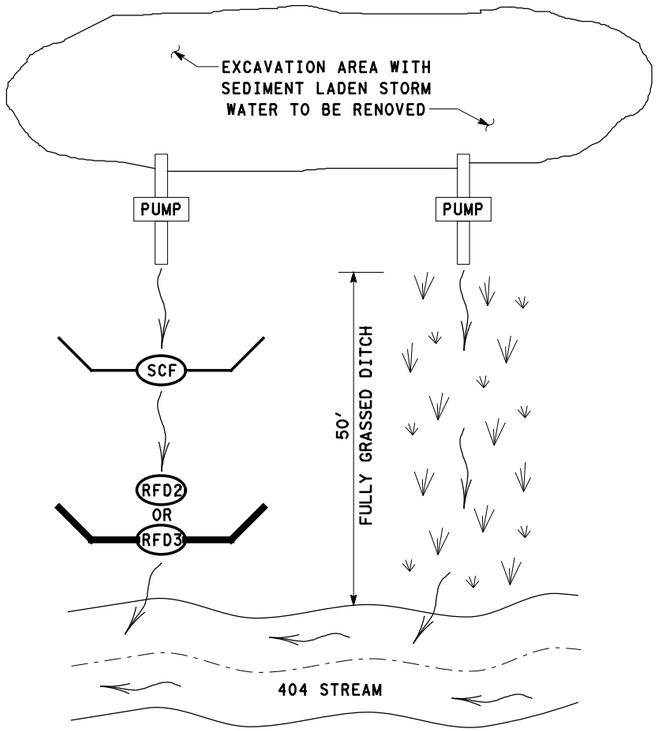
	DIST	COUNTY		SHEET NO.
	WACO	BOSQUE		169



BEST MANAGEMENT PRACTICE (BMP) #15

CONCRETE TRUCK WASHOUT AREA



BEST MANAGEMENT PRACTICE (BMP) #16

PUMPED STORM WATER SEDIMENT CONTROLS ①

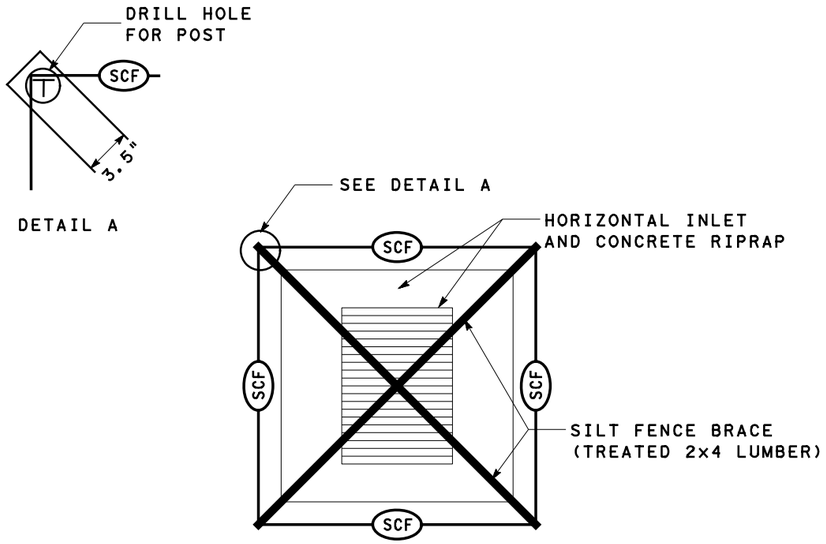
	FULLY GRASSED DITCH
	DIRECTION OF FLOW
SCF	SEDIMENT CONTROL FENCE
RFD2	ROCK FILTER DAM (TY 2)
RFD3	ROCK FILTER DAM (TY 3)

① PUMPED STORM 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.

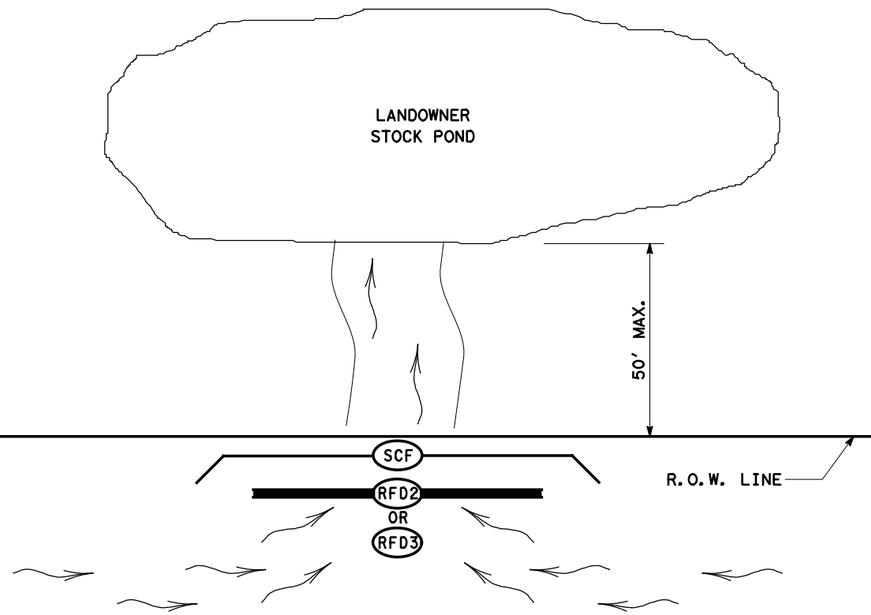
③ WHEN CONTAINMENT AREA REACHES 1' FREEBOARD, DISCONTINUE WASHOUT PLACEMENT AND REMOVE MATERIAL UPON SOLIDIFICATION.

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

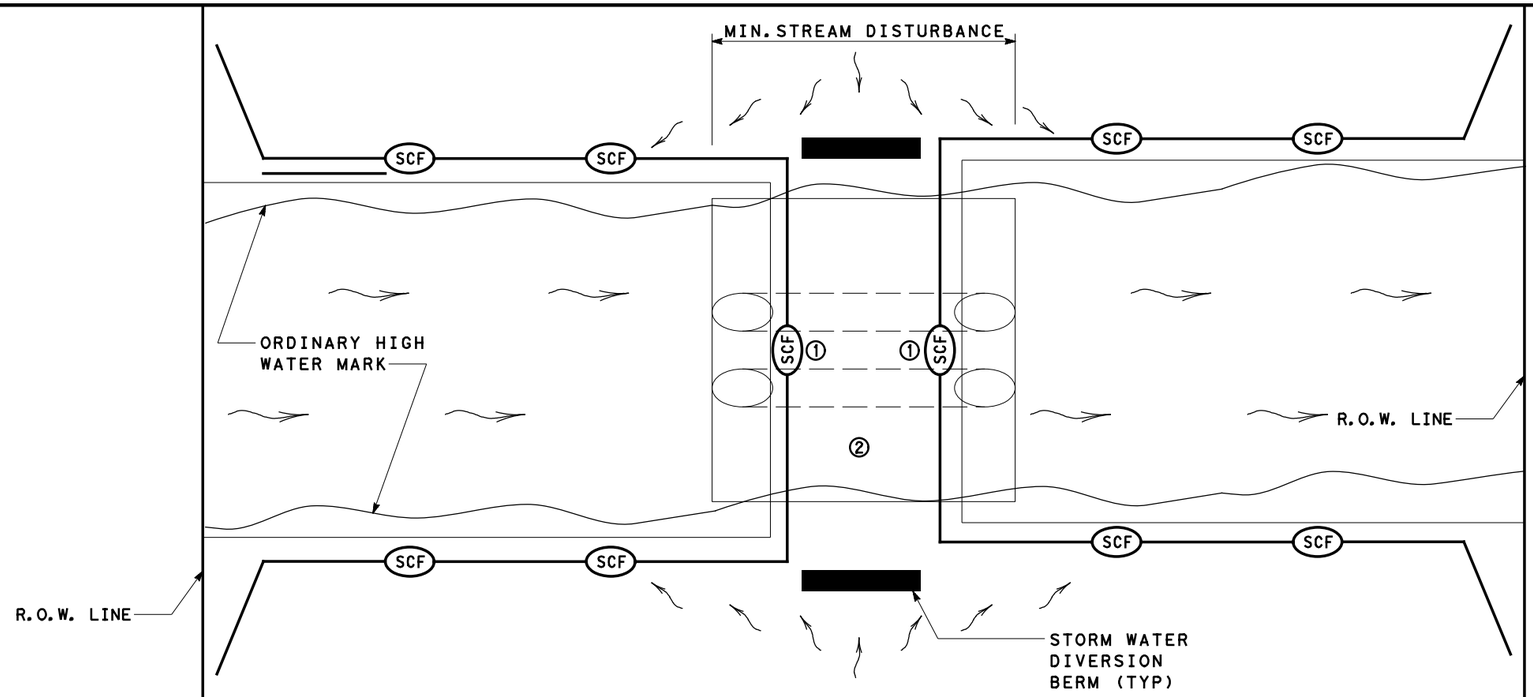
SCALE = NTS SHEET 9 OF 10

Texas Department of Transportation
Waco District Standard

TYPICAL APPLICATIONS FOR BEST MANAGEMENT PRACTICES

TA-BMP

FILE: BMPLAYOUTS.dgn		DN: TXDOT		CK: TXDOT	DW: TXDOT		CK: TXDOT
© TxDOT 2009		CONT	SECT	JOB		HIGHWAY	
REVISIONS		0724	02	020, ETC.		FM 219	
DEC 2013		DIST		COUNTY			SHEET NO.
FEB 2015		WACO		BOSQUE			170



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

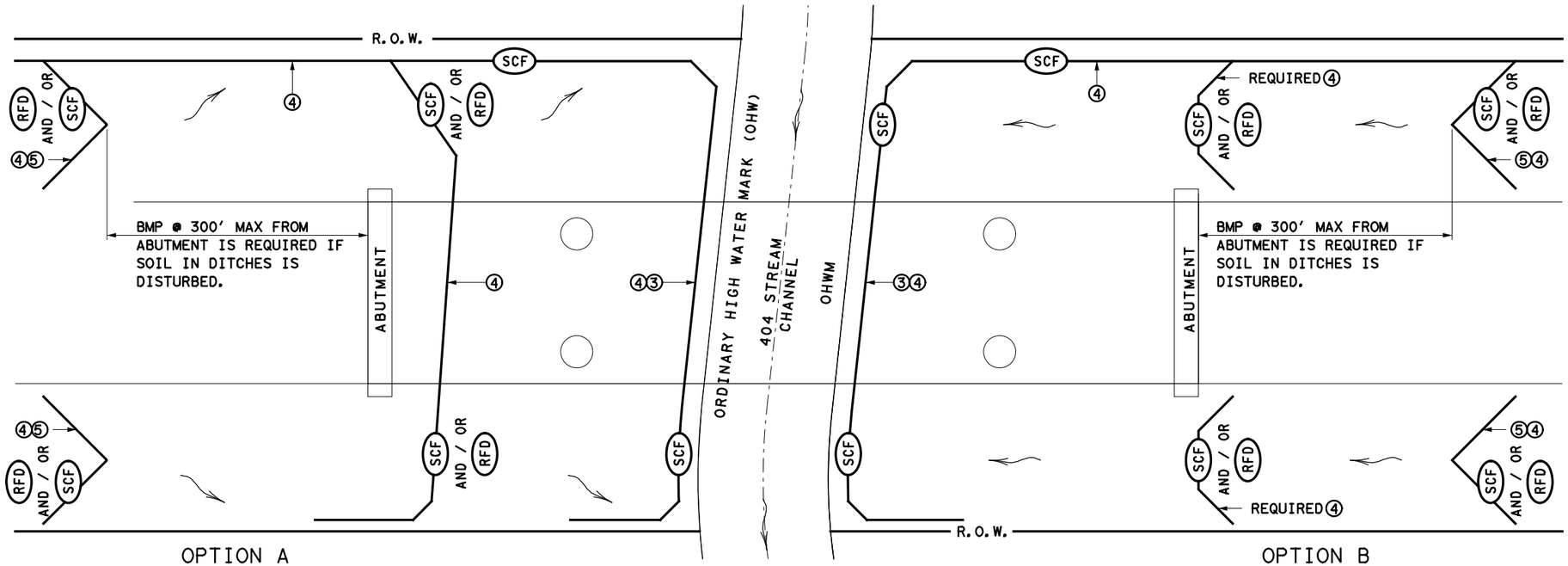
① HAY BALES MAY BE SUBSTITUTED FOR SILT FENCE OVER THE STREAM CROSSING.

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.



OPTION A

OPTION B

BEST MANAGEMENT PRACTICE (BMP) #20

FOR 404 STREAMS ~ BMP'S AT BRIDGES

SCALE = NTS SHEET 10 OF 10

Texas Department of Transportation
Waco District Standard

TYPICAL APPLICATIONS FOR BEST MANAGEMENT PRACTICES

TA-BMP

FILE: BMPLAYOUTS.dgn	DN: TXDOT		CK: TXDOT	DW: TXDOT		CK: TXDOT
© TxDOT 2009	CONT	SECT	JOB		HIGHWAY	
REVISIONS DEC 2013 FEB 2015	0724	02	020, ETC.		FM 219	
	DIST	COUNTY			SHEET NO.	
	WACO	BOSQUE			171	