| FED. RD. DIV. NO. | FEDERAL AID PROJECT NO. | | SHEET NO. |
|---|---|---|---|
| | RMC: 643916001 | | 1 |
| STATE | STATE DIST. NO. | COUNTY | |
| TEXAS | 22 | VAL VERDE | |
| CONT. | SECT. | JOB | HIGHWAY NO. |
| 6439 | 16 | 001 | VAR |

# STATE OF TEXAS
## TEXAS DEPARTMENT OF TRANSPORTATION

## PLANS OF PROPOSED
## HIGHWAY ROUTINE MAINTENANCE CONTRACT

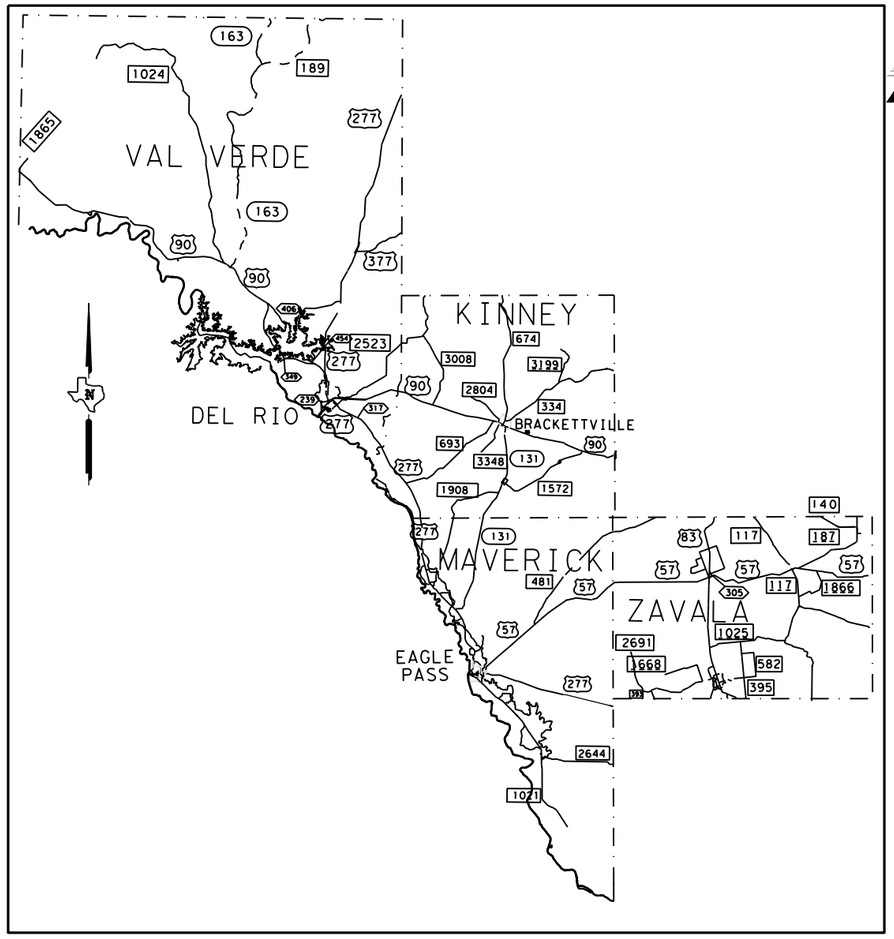
PROJECT NO. RMC: 6439-16-001
PROJECT LENGTH : VARIOUS
PROJECT LIMITS : VARIOUS
COUNTY : VALVERDE, etc.
HIGHWAY : US 277, etc.
CCSJ# 6439-16-001
FOR GUARDRAIL REPAIRS

**FINAL PLANS**

Letting Date :
Work Began :
Date Accepted :
Contractor :
Total Cost :

SHEET NO. | INDEX OF SHEETS DESCRIPTION

SEE SHEET NO. 2




TEXAS DEPARTMENT OF TRANSPORTATION

RECOMMENDED FOR LETTING: 4/20/2023

DocuSigned by:
Vanessa Rosales-Herrera
70CAB6EA8F3B42B...
VANESSA ROSALES-HERRERA, P.E.
AREA ENGINEER

APPROVED FOR LETTING: 4/20/2023

DocuSigned by:
Cynthia M. Saldaña
800D2BE906AC4DD...
CYNTHIA M. SALDAÑA, P.E.
DIRECTOR OF MAINTENANCE

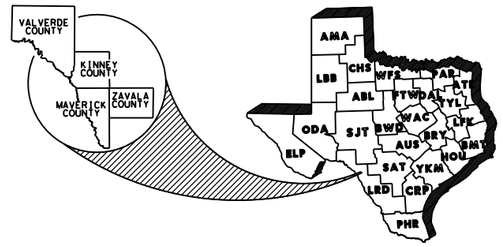
THE STANDARD SHEETS SPECIFICALLY IDENTIFIED WITH A SINGLE ASTERISK(*) HAVE BEEN ISSUED BY ME OR UNDER MY RESPONSIBLE SUPERVISION AS BEING APPLICABLE TO THIS PROJECT.

4/20/2023
DATE

DocuSigned by:
Cynthia M. Saldaña
800D2BE906AC4DD...
CYNTHIA M. SALDAÑA, P.E.

STATE OF TEXAS
CYNTHIA M. SALDANA
104786
LICENSED
PROFESSIONAL ENGINEER

**SPECIFICATIONS ADOPTED BY THE TEXAS DEPARTMENT OF TRANSPORTATION, NOVEMBER 2014 AND SPECIFICATION ITEMS LISTED AND DATED AS FOLLOWS, SHALL GOVERN ON THIS PROJECT.**



# INDEX OF SHEETS





*INDEX OF SHEETS*

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| FED. RD. DIV. NO. | STATE DIST. NO. | COUNTY | CONTROL | SECTION | JOB | HIGHWAY NO. |
| | 22 | VAL VERDE | 6439 | 16 | 001 | US 277 |

**GENERAL NOTES:**

The contract becomes effective upon receipt of the work authorization letter and covers a one (1) year period. Contractor questions on this project are to be addressed to the following individual(s):

Cynthia Saldaña - cynthia.saldana@txdot.gov

Questions may be submitted via the Letting Pre-Bid Q&A webpage. 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 webpage.

The Letting Pre-Bid Q&A webpage 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 windows that pops up.

**This project consists of Guardrail Repair on various roadways in Kinney, Maverick, Val Verde and Zavala.**

Each contract awarded by the Department stands on its own and as such, is separate from other contracts. A contractor awarded multiple contracts, must be capable and sufficiently staffed to concurrently process any or all contracts at the same time.

All work on this contract is callout work and a written work order will be issued as work is needed. A work order will consist of the location(s) of each repair, the bid item for the repairs and the approximate quantity of work to be paid. Each work order is required to be completed with all of its location(s), in order be defined as a completed work order repaired. Any additional work performed not specified in the work order will require prior approval.

When notified by work order of emergency repair, begin physical work within 48 hours of notification and complete within 96 hours, unless otherwise approved.

Notify the maintenance office(s) of cancellation of work activities, and provide a minimum of 48 hours advance notice prior to beginning work.

Remove materials or debris within the construction limits not incorporated in the project.

Liquidated damages will be assessed in accordance with Article 6 "Failure to Complete Work on Time". The working days allowed for each work order shall be as outlined below.

1. When identified as "Emergency Repairs", the work shall be completed within 96 hours.
2. When identified as "Specialty Rail Repairs" the repairs shall be completed within 90 calendar days from the issuance date of the work order.
3. All other work orders, not identified as emergency or specialty, shall be completed within 20 calendar days from the issuance date of the work order.

**SUPERVISION:**

Report each day, prior to the beginning of work, to the Maintenance Supevisor. Discuss times, places, contractor inspections, etc. prior to each day, or as directed by the engineer.

For this project, the Maintenance Supervisors in charge are:

| Kinney County | Maverick County | Val Verde County | Zavala County |
|---|---|---|---|
| Brandon Baxter | Charles Fite | Francis Schell, Jr. | Arnulfo Longoria, Jr. |
| brandon.baxter@txdot.gov | charles.fite@txdot.gov | francis.a.schell@txdot.gov | arnulfo.longoria@txdot.gov |

**ITEM 4 - SCOPE OF WORK:**

If agreed upon in writing by both parties to the Contract, the Contract may be extended for an additional period of time not to exceed the original Contract time period. The extended Contract shall be for the original bid quantities, terms and conditions plus any approved, applicable change orders.

When the Contract is extended by agreement, a performance and/or payment bond, if required shall be executed in the amount of the extension before the additional work begins.

**ITEM 6 - CONTROL OF MATERIALS**

Contractor will furnish all necessary materials and deliver salvageable materials to the designated maintenance office.
Materials that are determined unsalvageable by the Engineer shall become property of the Contractor and shall be disposed in accrdance with federal, state, and local regulations.

**ITEM 7 - LEGAL RELATIONS AND RESPONSIBILITIES**

Roadway closures during the following key dates and/or special events are prohibited; January1, the last Monday in May, July 4, the first Monday in September, the fourth Thursday in November, and December 24 or 25.

**ITEM 8 - PROSECUTION AND PROGRESS**

Working days will be computed and charged in accordance with Article 8.3.1.5 "Calendar Day." Night time work will be allowed as approved by the engineer.
No work will be performed on Saturdays, Sundays, & national holidays, without prior approval.

**ITEM 9 - MEASURMENT AND PAYMENT**

Submit 'Material on Hand' (MOH) payment requests at least 5 working days prior to the end of the month for payment on that month's estimate. For out of town MOH submit requests at least 10 working days prior to the end of the month.

**ITEM 421 -HYDRAULIC CEMENT CONCRETE**

Sulfate resistant concrete shall be used in all situations where structural elements are in contact with the natural ground. These includes, but are not limited to, all reinforced concrete pipe, concrete box culverts, drill shafts, bridge columns, bridge abutments, wing walls, approach slabs, inlets, manholes, junction boxes, ground boxes and all concrete riprap.

**ITEM 432 -RIPRAP**

When placing Concrete Riprap, use Class B Concrete.

**ITEM 451 -RAILING**

Contractor is responsible for field verifying measurements for pedestrian rail in radius. Removal of the existing pedestrian rail shall be subsidiary to Items 0451-6066 and 0451-6067. This work shall be considered as Specialty Rail Repairs.

**ITEM 500 - MOBILIZATION**

"Materials-on-Hand" payments will not be considered in determining percentages used to compute mobilization payments. This item will be paid on an individual work order basis. Only one mobilization item will be paid on each work order.

| Item Code | Item Description | Unit | Work Description |
|---|---|---|---|
| I. 0500 6003 | Mobilization (Callout I) | EA | Work Order performed in Kinney County |
| II. 0500 6004 | Mobilization (Callout 2) | EA | Work Order performed in Maverick County |
| III. 0500 6005 | Mobilization (Callout 3) | EA | Work Order performed in Val Verde County |
| IV. 0500 6006 | Mobilization (Callout 4) | EA | Work Order performed in Zavala County |

**ITEM 502 -BARRICADES, SIGNS AND TRAFFIC HANDLING**

Barricades, signs, and traffic handling (including truck mounted attenuators) shall not be paid for directly but shall be subsidiary to the various bid items of the contract. Furnish and install all signs, barricades and other incidentals necessary for proper traffic control, in accordance the Texas Manual on Uniform Traffic Control Devices, the Department's Compliant Work Zone Traffic Control Device List, and the Department's traffic control standards.

When shadow vehicles are called for in the standards, they shall be equipped with Truck Mounted Attenuators (TMA).
Lane closures will require prior approval from the Department and a minimum of 48 hours of advance notice. Immediately notify th Department of changes in schedule.

Limit lane closures to a maximum of 2 miles. If more than one lane closure location is desired, provide a minimum of a 2 mile pasing zone between locations. Provide a separate sign set up for each location.

When arrow boards are required, provide a standby unit in good working condition at the jobsite ready for immediate use.

Rumble strips shall be required as per standard WZ(RS)-16, unless otherwise directed by the Engineer.

**ITEM 544 -GUARDRAIL END TREATMENTS**

ET-PLUS or X-Lite systems shall not be utilized for new installations, unless otherwise approved by the Engineer.

After installation of new SGT, repair all galvanized parts on which the galvanizing has become scratched, chipped, or otherwise damaged. Repair in accordance with Item 445.3.5, "Repairs". This work is subsidiary to the various bid items of the contract.

Posts height will vary and dimensions will be provided by the Engineer.

**ITEM 545 -CRASH CUSHION ATTENUATORS:**

A MASH compliant crash cushion attenuator is required for every temporary and permanent installation.

**ITEM 658 -DELINEATOR AND OBJECT MARKER ASSEMBLIES:**

Remove damaged delineators and replace with barrier reflector (GF2) delineators or install as directed by the engineer.

Delineators are to be placed at 25 foot spacing on the entire side of the repaired railing. A minimum of 3 delineators are to be installed whenever the approach or departure is less than 100 foot in length.

One delineator per rail is to be installed except on SGT-Railing.



**GENERAL NOTES**

| DN: | | CK: | | DW: | | CK: | | STATE | SHEET NUMBER | | | SHEET NO. |
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| | | | | | | | | TEXAS | | | | |
| FED. RD. DIV. NO. | STATE DIST. NO. | COUNTY | | CONTROL | SECTION | JOB | HIGHWAY NO. | | | | | |
| | 22 | VAL VERDE | | 6439 | 16 | 001 | US 277 | | | | | 3 |

**ITEM 770 -GUARD FENCE REPAIR**

Contractor shall furnish all materials and hardware as per Item 770.

Furnish and place topsoil to repair areas disturbed by construction operations, as approved. The topsoil and placement will notbe paid for directly, but will be considered subsidiary to the various bid items.

After guardrail repair is complete, repair all galvanized parts on which the galvanizing has become scratched, chipped or otherwise damaged. Repair galvanizing in accordance with Item 445.3.D, "Repairs". This work is subsidiary to the various bid items of the contract.

If only the W-beam rail element of a bridge rail is damaged, the rail shall be repaired in accordance with Item 770-6001.

Different terminal connectors are required to attach rail to concrete bridge rail and TxDOT will provide a site specific design for Contractor to install the terminal connection assembly. This work will be subsidiary to the bid item specified.

When repairing rail element attached to a concrete bridge rail, remove expansion anchors and drill holes (to provide a snug fit for 7/8 inch diameter bolts) completely through the parapet wall with a masonry bit or core drill. Do not use percussion drilling in concrete walls. Mount guardrail to the parapet wall with 7/8 inch diameter bolts that extend completely through the parapet wall. This work is subsidiary to these items, depending on type of rail elements used.

When timber or steel posts are encountered in concrete riprap without an existing leave-out, the contractor will remove existing post, saw cut 18"X18" square leave out hole and replace post, backfill, and compact with suitable material to the bottom of existing adjoining riprap and fill leave out area with grout. This work will be subsidiary to pertaining 770 items.

Timber/steel post with concrete foundation will be defined as a post in which the entire foundation is completely encapsulated in concrete. This work will be paid for under this Item 770-6011. All other posts, including those in riprap and mow strip will be paid for under Item 770-6010 "Remove/Replace Timber/Steel Post without Concrete Foundation".

Repair damaged steel post by exposing the post twelve inches below the damaged area. Cut post a minimum of six inches below the damaged area and weld a new post to the existing portion of post using full depth groove weld all the way around the post. Backfill will consist of grout.

When field welding is required, provide a "qualified" person, capable of making welds of sound quality in accordance with Item 448.4.2, "Welder Qualification".

Do not damage existing posts when realigning posts, drill new post holes and reset existing posts as directed.

If an SGT post must be realigned, removal and resetting of supported elements will be necessary to complete the realignment of the post. This removal and resetting of the supporting elements will be subsidiary to Item 770-6017. Concrete/grout work may be necessary to perform the realignment of posts and shall will be subsidiary to this item.

When a curved rail is required to be replaced, the contractor shall field verify radius and provide materials to repair the location. The removal and replacement of the existing rail type will be subsidiary to this item.

**MISCELLANEOUS**

Certain standard sheets in the miscellaneous tab will be used as a guide for retrofitting existing structures with rails listed on those sheets. Details with appropriate notes from these guides should be prepared for the specific application. Dimensions of existing slab thickness, curb widths, heights, etc., should be shown. In some cases, particular care should be taken in identifying the bridge abutment wing wall conditions and providing for proper reinforcement anchorage and approach guard fence post positioning. These sheets may not be used without modification.

The details shown may need to be amended if the exact existing condition is not covered. In all cases, details and notes not required must be crossed out or eliminated, “(MOD)”added, and the phrase “(Not to be used as a standard)” removed, and the sheet signed and sealed.



**GENERAL NOTES**

| DN: | | DW: | STATE | SHEET NUMBER | | | SHEET NO. |
|---|---|---|---|---|---|---|---|
| CK: | | CK: | TEXAS | | | | |
| FED. RD. DIV. NO. | STATE DIST. NO. | COUNTY | CONTROL | SECTION | JOB | HIGHWAY NO. | |
| | 22 | VAL VERDE | 6439 | 16 | 001 | US 277 | 4 |

# Estimate & Quantity Sheet

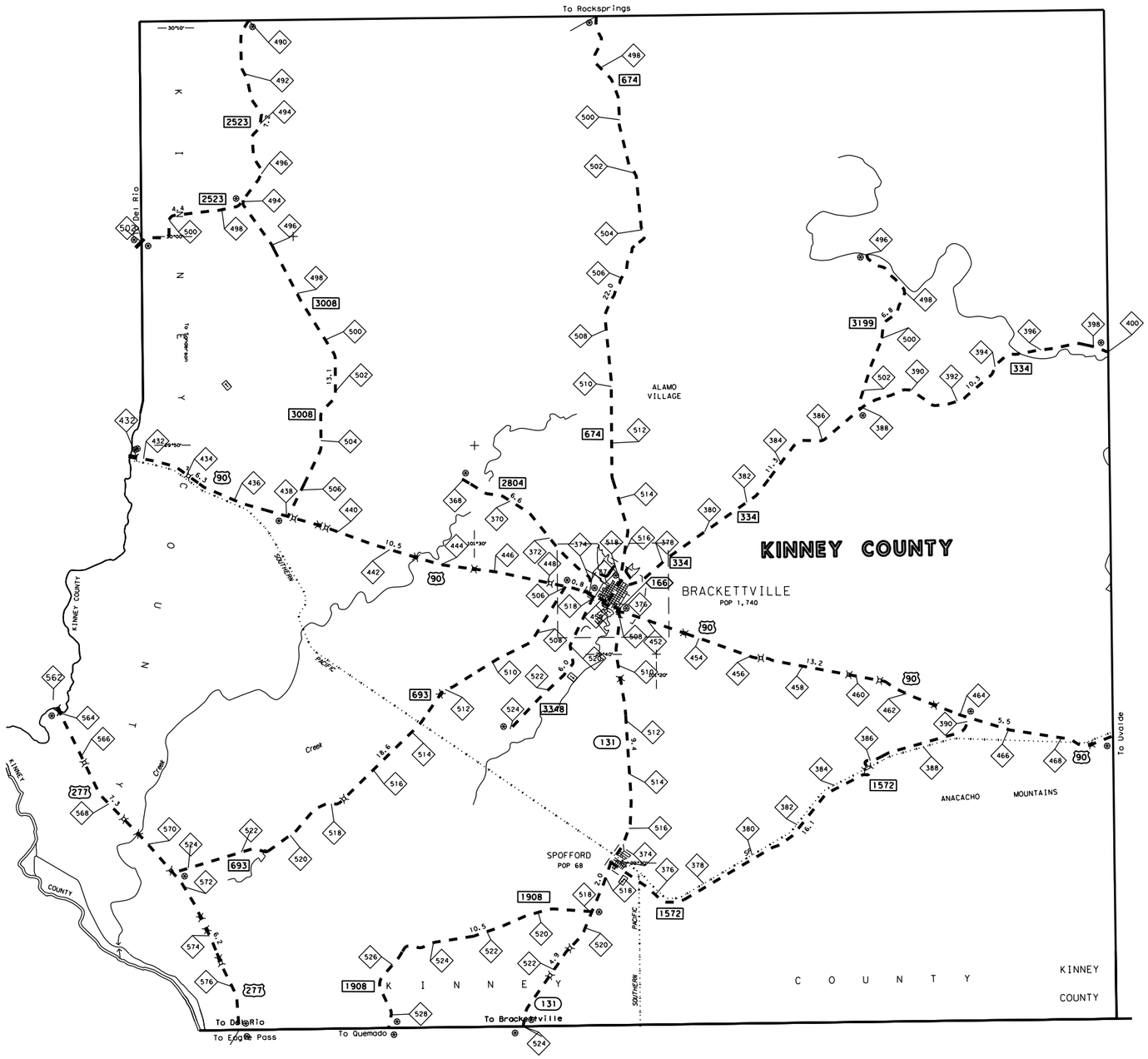
**CONTROLLING PROJECT ID** 6439-16-001 **DISTRICT** Laredo **COUNTY** Val Verde
**HIGHWAY** UP0277

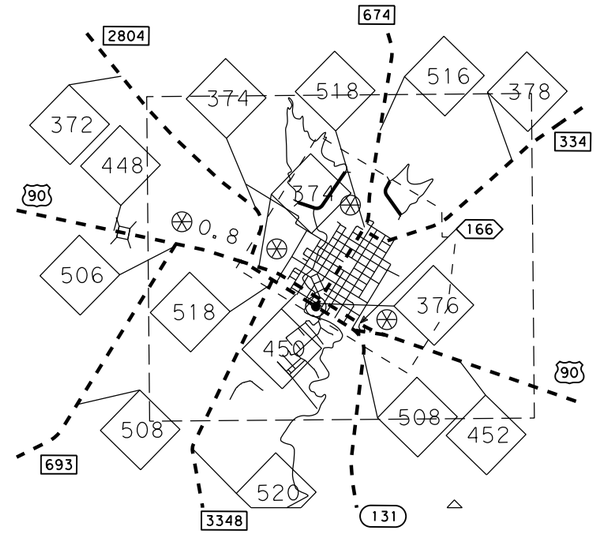
| | | | | | | | TOTAL EST. | TOTAL FINAL |
|---|---|---|---|---|---|---|---|---|
| | | | **CONTROL SECTION JOB** | | **6439-16-001** | | | |
| | | | **PROJECT ID** | | **A00195262** | | | |
| | | | **COUNTY** | | **Val Verde** | | | |
| | | | **HIGHWAY** | | **UP0277** | | | |
| **ALT** | **BID CODE** | **DESCRIPTION** | | **UNIT** | EST. | FINAL | | |
| | 104-6028 | REMOVING CONC (MISC) | | SY | 6.000 | | 6.000 | |
| | 429-6007 | CONC STR REPAIR (VERTICAL & OVERHEAD) | | SF | 10.000 | | 10.000 | |
| | 432-6045 | RIPRAP (MOW STRIP)(4 IN) | | CY | 5.000 | | 5.000 | |
| | 451-6066 | RETROFIT RAIL (TY PR11) | | LF | 25.000 | | 25.000 | |
| | 451-6067 | RETROFIT RAIL (TY PR22) | | LF | 10.000 | | 10.000 | |
| | 500-6003 | MOBILIZATION (CALLOUT 1) | | EA | 3.000 | | 3.000 | |
| | 500-6004 | MOBILIZATION (CALLOUT 2) | | EA | 5.000 | | 5.000 | |
| | 500-6005 | MOBILIZATION (CALLOUT 3) | | EA | 5.000 | | 5.000 | |
| | 500-6006 | MOBILIZATION (CALLOUT 4) | | EA | 3.000 | | 3.000 | |
| | 500-6034 | MOBILIZATION (EMERGENCY) | | EA | 2.000 | | 2.000 | |
| | 510-6002 | ONE-WAY TRAF CONT (PILOT CAR) | | HR | 10.000 | | 10.000 | |
| | 540-6001 | MTL W-BEAM GD FEN (TIM POST) | | LF | 250.000 | | 250.000 | |
| | 540-6016 | DOWNSTREAM ANCHOR TERMINAL SECTION | | EA | 4.000 | | 4.000 | |
| | 540-6017 | MTL BM GD FEN (LONG SPAN SYSTEM) | | LF | 50.000 | | 50.000 | |
| | 540-6035 | MTL BM GD FEN TRANS (31"-28") | | EA | 8.000 | | 8.000 | |
| | 542-6001 | REMOVE METAL BEAM GUARD FENCE | | LF | 100.000 | | 100.000 | |
| | 542-6002 | REMOVE TERMINAL ANCHOR SECTION | | EA | 4.000 | | 4.000 | |
| | 544-6006 | GDRAIL END TRT(INST)(WOOD POST)(TY III) | | EA | 2.000 | | 2.000 | |
| | 658-6061 | INSTL DEL ASSM (D-SW)SZ 1(BRF)GF2 | | EA | 15.000 | | 15.000 | |
| | 658-6062 | INSTL DEL ASSM (D-SW)SZ 1(BRF)GF2(BI) | | EA | 40.000 | | 40.000 | |
| | 658-6064 | INSTL DEL ASSM (D-SY)SZ 1(BRF)GF2 | | EA | 15.000 | | 15.000 | |
| | 770-6001 | REPAIR RAIL ELEMENT (W - BEAM) | | LF | 2,200.000 | | 2,200.000 | |
| | 770-6002 | REPAIR RAIL ELEMENT (THRIE - BEAM) | | LF | 30.000 | | 30.000 | |
| | 770-6003 | REP RAIL ELMNT(THRIE-BM TRANS TO W -BM) | | LF | 6.000 | | 6.000 | |
| | 770-6004 | REPAIR RAIL ELEMENT (CURVED RAIL) | | LF | 100.000 | | 100.000 | |
| | 770-6006 | RAISE RAIL ELEMENT | | LF | 120.000 | | 120.000 | |
| | 770-6010 | REM / REPL TIMBER/STL POST W/O CONC FND | | EA | 170.000 | | 170.000 | |
| | 770-6011 | REM / REPL TIMBER / STL POST W/CONC FND | | EA | 35.000 | | 35.000 | |
| | 770-6017 | REALIGN POSTS | | EA | 70.000 | | 70.000 | |
| | 770-6018 | INSTALL BLOCKOUT (TYPE SPECIFIED) | | EA | 25.000 | | 25.000 | |
| | 770-6019 | REMOVE & REPLACE BLOCKOUT | | EA | 175.000 | | 175.000 | |
| | 770-6021 | REPLACE SINGLE GDRAIL TERMINAL RAIL | | LF | 300.000 | | 300.000 | |
| | 770-6022 | REPLACE SINGLE GDRAIL TERMINAL POST | | EA | 50.000 | | 50.000 | |
| | 770-6023 | REPAIR OF TERMINAL ANCHORS POSTS | | EA | 2.000 | | 2.000 | |
| | 770-6027 | REMOVE GDRAIL END TRT / REPL WITH SGT | | EA | 30.000 | | 30.000 | |
| | 770-6028 | REPL SINGLE GDRAIL TERM IMPACT HEAD | | EA | 12.000 | | 12.000 | |
| | 770-6029 | REM & RESET SGT IMPACT HEAD | | EA | 5.000 | | 5.000 | |

# Estimate & Quantity Sheet

**CONTROLLING PROJECT ID** 6439-16-001 **DISTRICT** Laredo **COUNTY** Val Verde
**HIGHWAY** UP0277

| | | | | | | TOTAL EST. | TOTAL FINAL |
|---|---|---|---|---|---|---|---|
| | | **CONTROL SECTION JOB** | | **6439-16-001** | | | |
| | | **PROJECT ID** | | **A00195262** | | | |
| | | **COUNTY** | | **Val Verde** | | | |
| | | **HIGHWAY** | | **UP0277** | | | |
| **ALT** | **BID CODE** | **DESCRIPTION** | **UNIT** | EST. | FINAL | | |
| | 770-6030 | REPLACE SGT CABLE ASSEMBLY | EA | 12.000 | | 12.000 | |
| | 770-6031 | REPLACE SGT CABLE ANCHOR | EA | 12.000 | | 12.000 | |
| | 770-6032 | REPLACE SGT STRUT | EA | 12.000 | | 12.000 | |
| | 770-6033 | REPLACE SGT OBJECT MARKER | EA | 12.000 | | 12.000 | |
| | 770-6052 | REPAIR STEEL POST WITH BASE PLATE | EA | 2.000 | | 2.000 | |
| | 770-6061 | REPAIR MTL BM GD FEN(LONG SPAN SYS) | LF | 25.000 | | 25.000 | |
| | 771-6001 | REPLACE POSTS (TL-3) | EA | 35.000 | | 35.000 | |
| | 771-6003 | CABLE SPLICE / TURNBUCKLE (TL-3) | EA | 2.000 | | 2.000 | |
| | 771-6007 | REPR OR REPLC CABLE BARR TERM SEC(TL-3) | EA | 2.000 | | 2.000 | |
| | 771-6009 | REPLACE CABLE (TL-3) | LF | 20.000 | | 20.000 | |
| | 771-6011 | CHECK / RE-TENSION CABLE | EA | 5.000 | | 5.000 | |
| | 771-6018 | REPLACE POST HARDWARE (TL-3) | EA | 5.000 | | 5.000 | |
| | 772-6003 | POST AND CABLE FENCE (NEW INSTALLATION) | LF | 20.000 | | 20.000 | |
| | 772-6009 | POST AND CABLE FENCE (REPAIR) | LF | 50.000 | | 50.000 | |
| | 774-6010 | REPAIR (REACT) | EA | 1.000 | | 1.000 | |
| | 774-6058 | REPAIR (BEAT - SSCC) | EA | 1.000 | | 1.000 | |
| | 776-6009 | REPAIR (STL PIPE PEDESTRIAN RAIL - PR1) | LF | 20.000 | | 20.000 | |
| | 776-6011 | REP METAL POST W/ BASE PLATE(T101 RAIL) | EA | 3.000 | | 3.000 | |
| | 776-6035 | REPAIR (W-BEAM - T101 RAIL) | LF | 50.000 | | 50.000 | |
| | 776-6055 | REP METAL PST W/ BASE PLATE (TY T631) | EA | 15.000 | | 15.000 | |
| | 778-6001 | CONCRETE RAIL REPAIR (IN-KIND) | LF | 10.000 | | 10.000 | |
| | 778-6076 | CONCRETE RAIL REPLACEMENT (IN-KIND) | LF | 5.000 | | 5.000 | |
| | 6185-6002 | TMA (STATIONARY) | DAY | 70.000 | | 70.000 | |




CITY OF BRACKETTVILLE

# KINNEY COUNTY



**KINNEY COUNTY**
**LOCATION MAP**

| DN: | | DN: | STATE | SHEET NUMBER | | | SHEET NO. |
|---|---|---|---|---|---|---|---|
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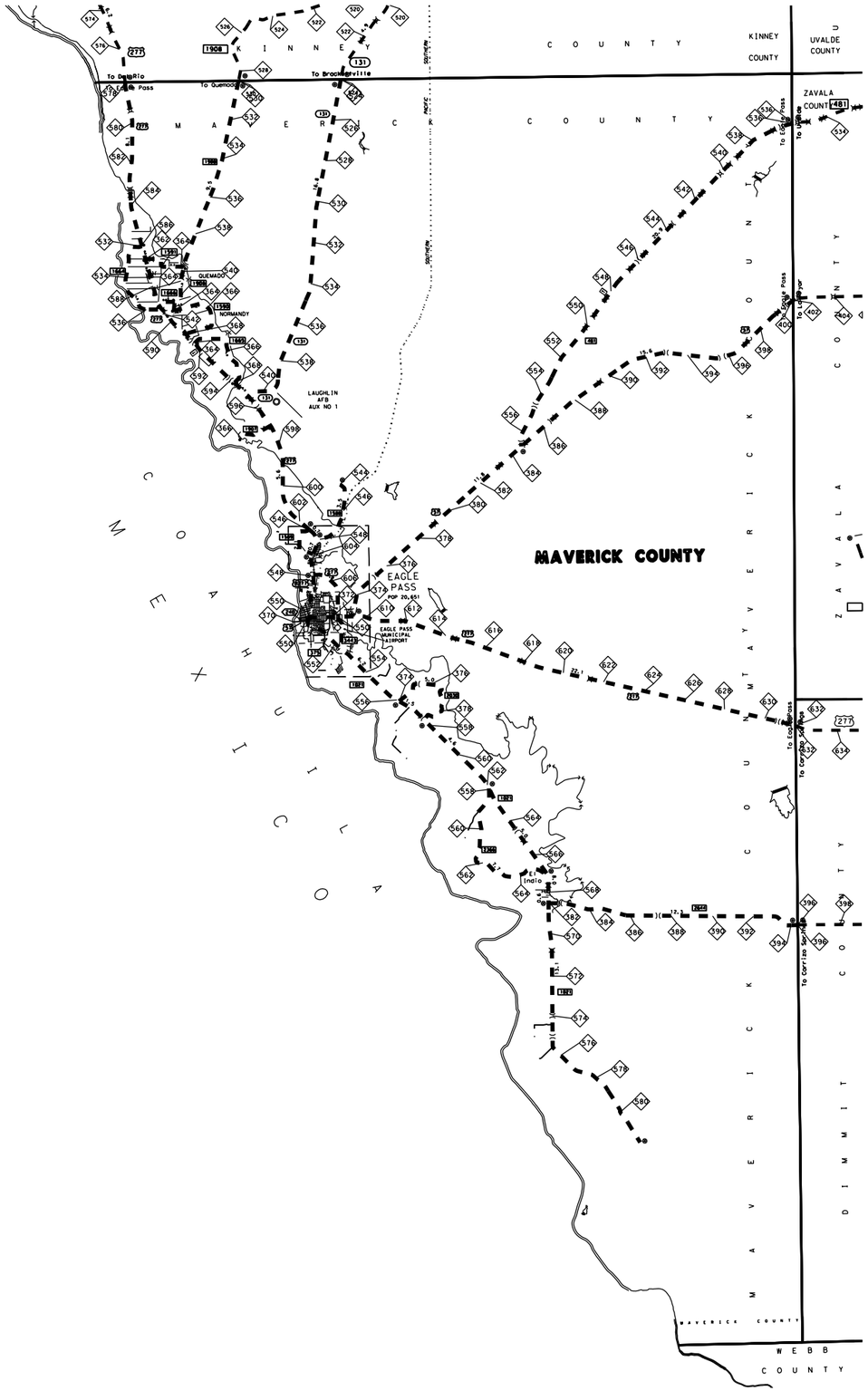
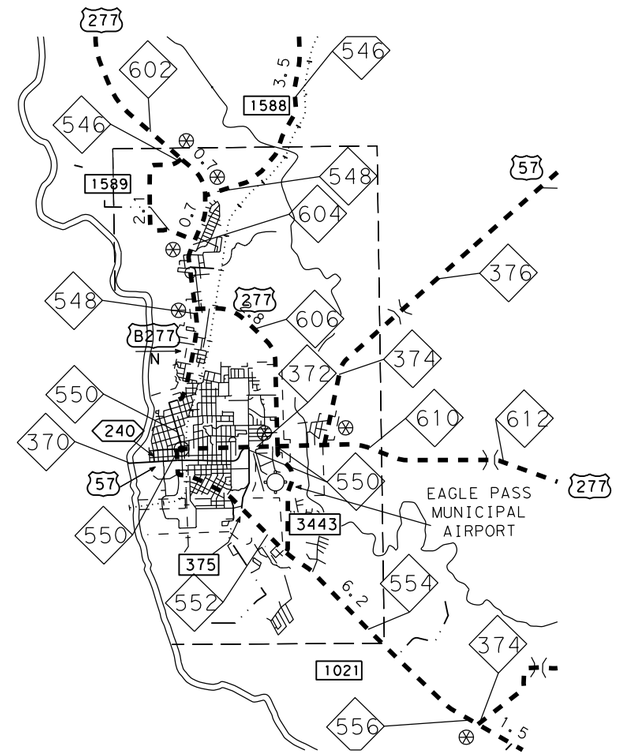
| FED. RD. DIV. NO. | STATE DIST. NO. | COUNTY | CONTROL | SECTION | JOB | HIGHWAY NO. | 7 |
| | 22 | VAL VERDE | 6439 | 16 | 001 | VAR | |




# CITY OF EAGLE PASS

# MAVERICK COUNTY

TEXAS DEPARTMENT OF TRANSPORTATION ®
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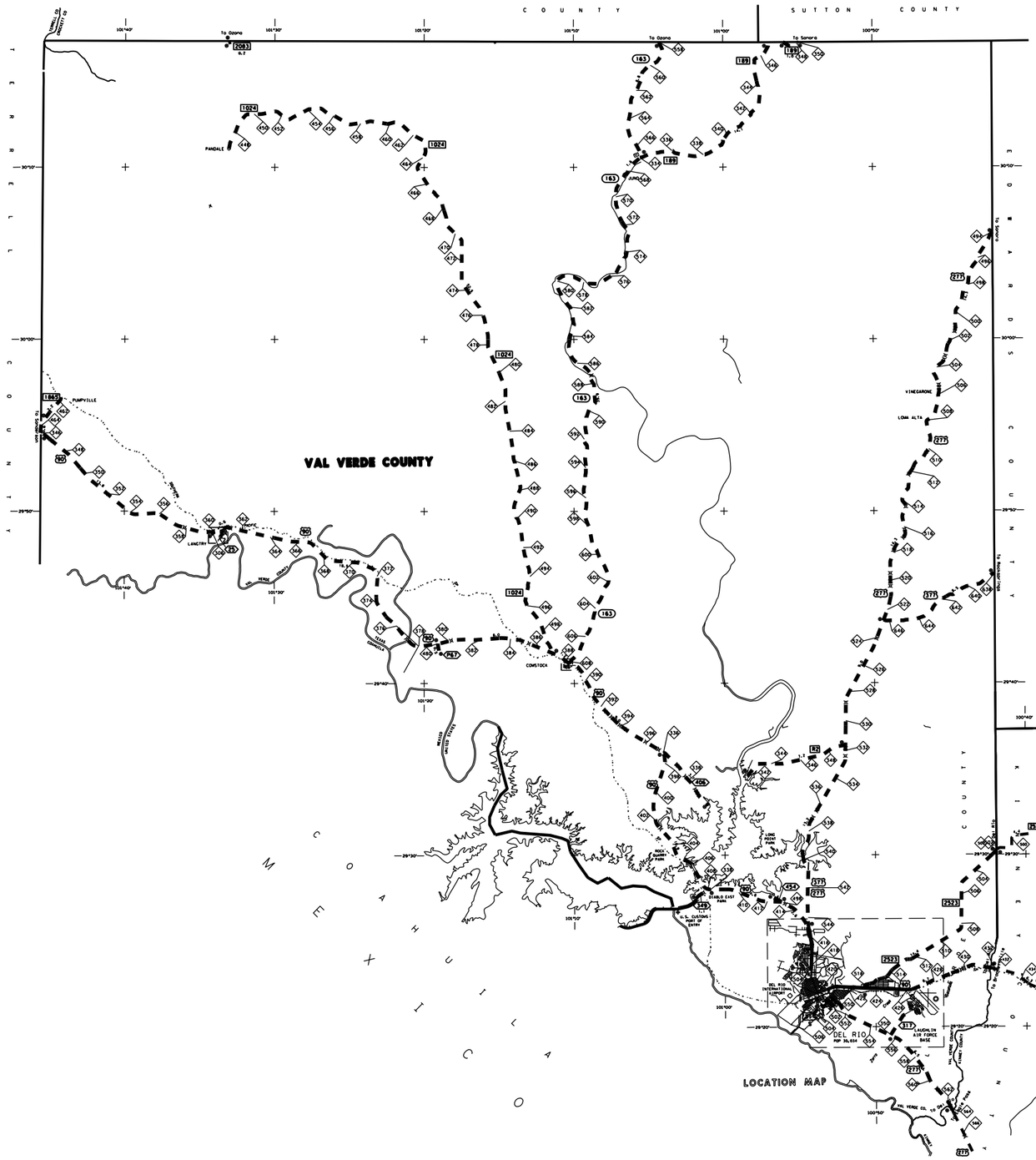
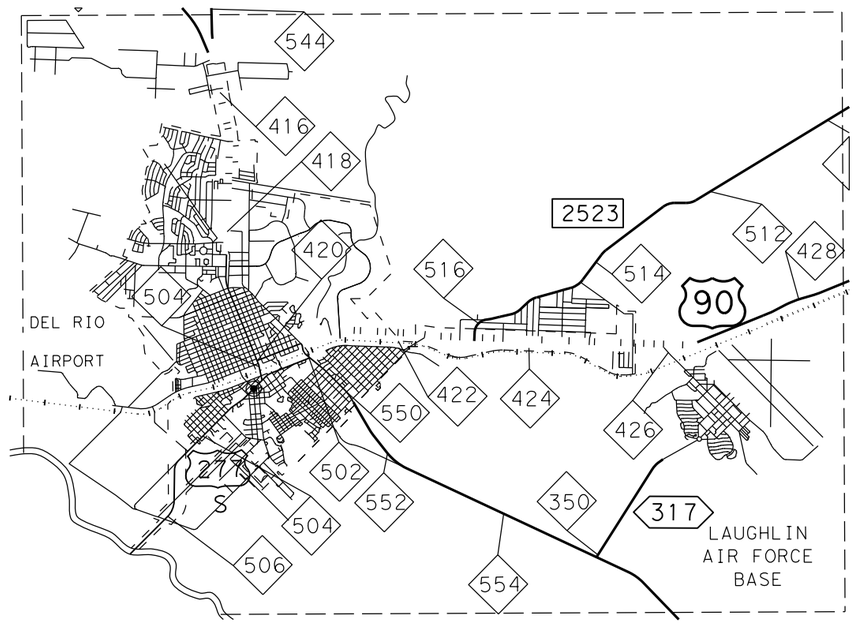
**MAVERICK COUNTY**
**LOCATION MAP**

| DN: | | DW: | STATE | SHEET NUMBER | | | SHEET NO. |
|---|---|---|---|---|---|---|---|
| CK: | | CK: | TEXAS | | | | |
| FED. RD. DIV. NO. | STATE DIST. NO. | COUNTY | CONTROL | SECTION | JOB | HIGHWAY NO. | |
| | 22 | VAL VERDE | 6439 | 16 | 001 | VAR | 8 |




# CITY OF DEL RIO

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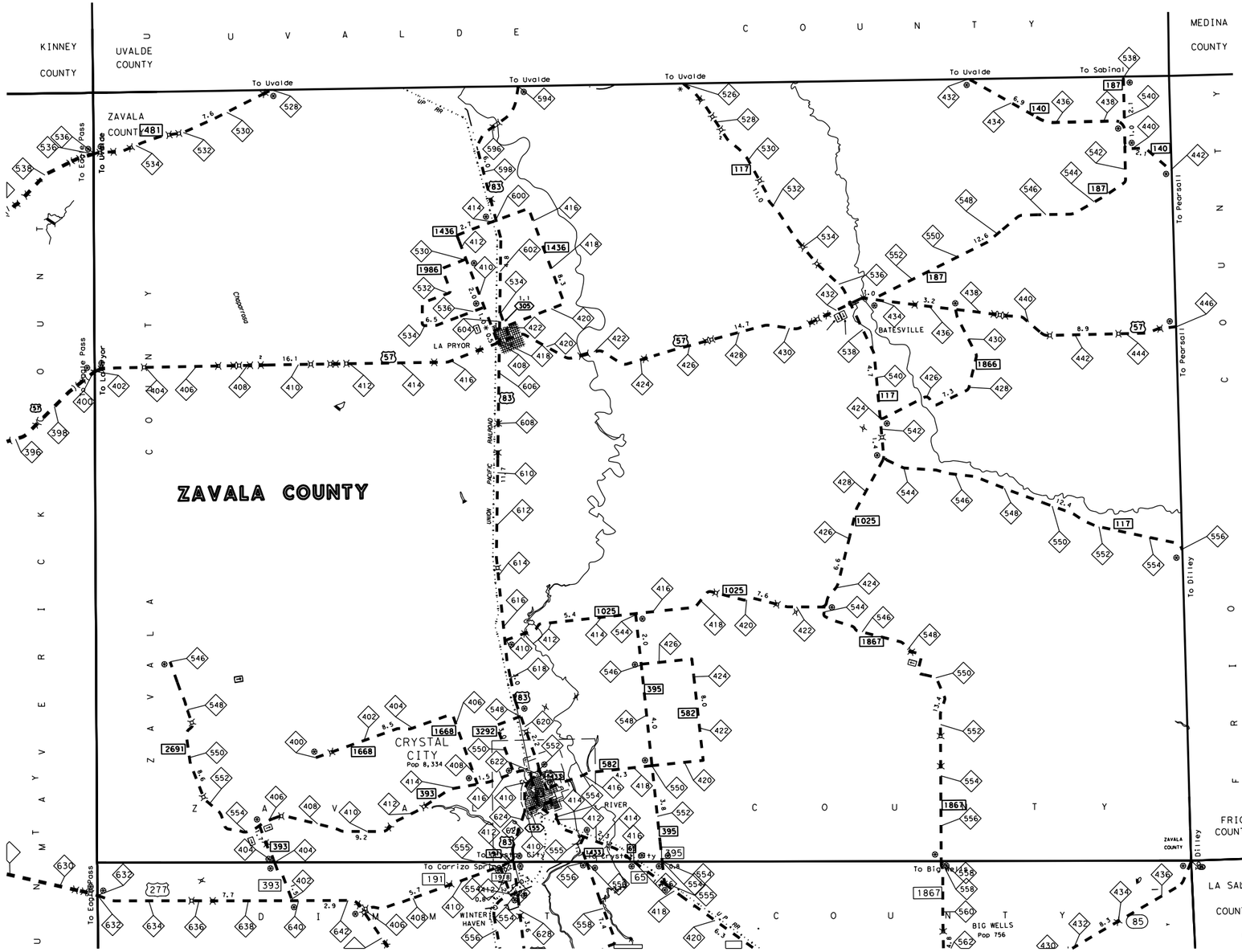
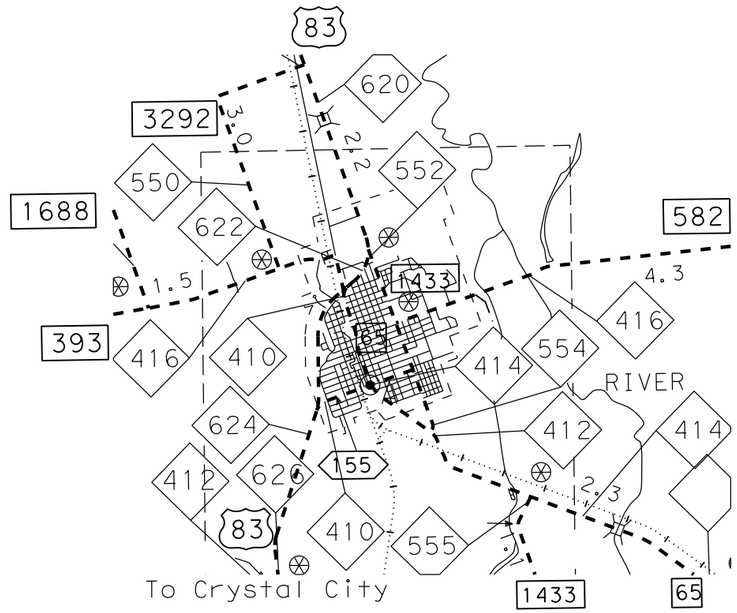
## VAL VERDE COUNTY
## LOCATION MAP

| DN: | DW: | STATE | SHEET NUMBER | | | | SHEET NO. |
|---|---|---|---|---|---|---|---|
| CK: | CK: | TEXAS | | | | | |
| FED. RD. DIV. NO. | STATE DIST. NO. | COUNTY | CONTROL | SECTION | JOB | HIGHWAY NO. | |
| | 22 | VAL VERDE | 6439 | 16 | 001 | VAR | 9 |




# ZAVALA COUNTY



**ZAVALA COUNTY LOCATION MAP**

| DN: | | DW: | STATE | SHEET NUMBER | | | SHEET NO. |
|---|---|---|---|---|---|---|---|
| CK: | | CK: | TEXAS | | | | |
| FED. RD. DIV. NO. | STATE DIST. NO. | COUNTY | CONTROL | SECTION | JOB | HIGHWAY NO. | 10 |
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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. As shown on BC(2), the OBEY WARNING SIGNS STATE LAW sign, STAY ALERT TALK OR TEXT LATER (see Sign Detail G20-10T) and the WORK ZONE TRAFFIC FINES DOUBLE sign with plaque shall be erected in advance of the CSJ limits. However, the TRAFFIC FINES DOUBLE sign will not be required on projects consisting solely of mobile operation work, such as striping or milling edgeline rumble strips. The BEGIN ROAD WORK NEXT X MILES, CONTRACTOR and END ROAD WORK signs shall be erected at or near the CSJ limits.

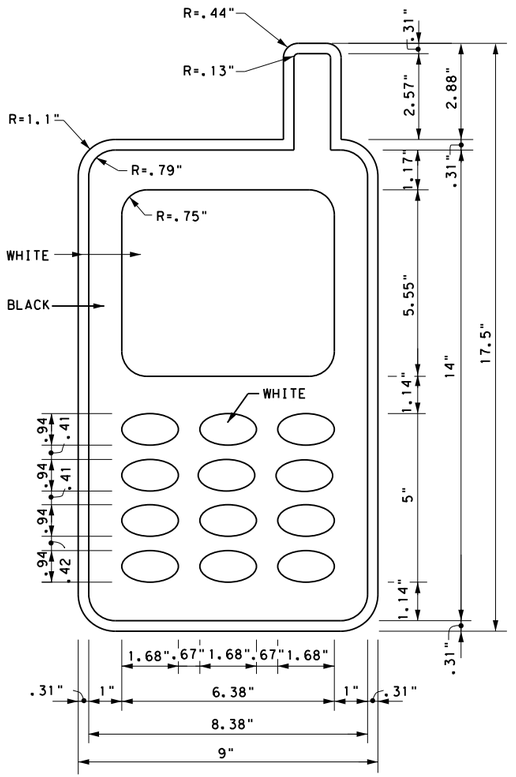
11. Except for devices required by Note 10, traffic control devices should be in place only while work is actually in progress or a definite need exists.

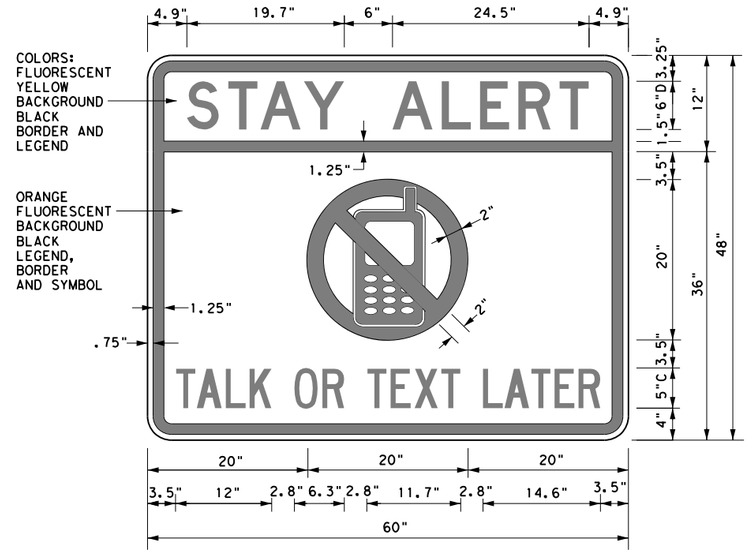
12. The Engineer has the final decision on the location of all traffic control devices.

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 APPAREL 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.




3.0" Radius, 1.25" Border, 0.75" Indent, Black on Yellow;
[STAY ALERT] Font: D
3.0" Radius, 1.25" Border, 0.75" Indent, Black on Orange;
[TALK OR TEXT LATER] Font: C specified length;

## SIGN DETAIL (G20-10T)

Only pre-qualified products shall be used. The "Compliant Work Zone Traffic Control Devices List" (CWZTCD) describes pre-qualified products and their sources and may be found on-line at the web address given below or by contacting:

Texas Department of Transportation
Traffic Operations Division - TE
Phone (512) 416-3118

| 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 Operations Division Standard

# BARRICADE AND CONSTRUCTION GENERAL NOTES AND REQUIREMENTS

# BC(1)-14

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| 4-03 5-10 8-14 | DIST | COUNTY | | SHEET NO. |
| 9-07 7-13 | 22 | VAR | | 11 |



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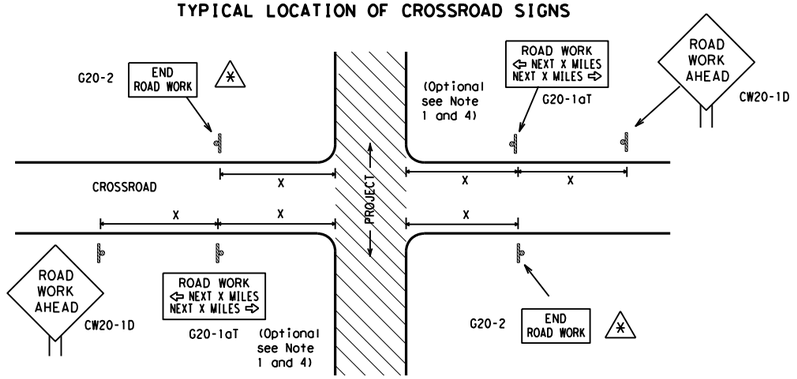
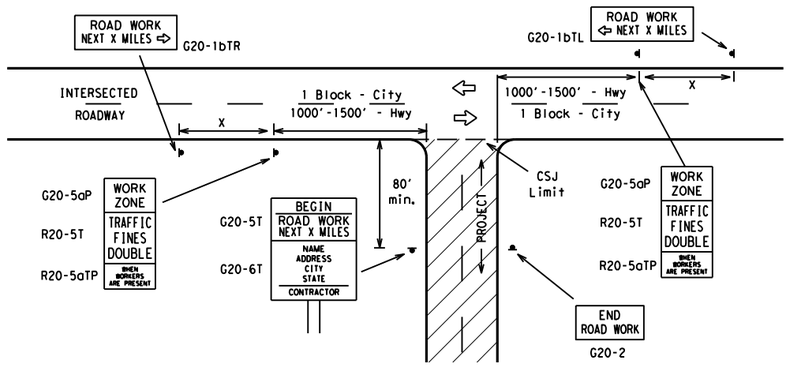
## TYPICAL LOCATION OF CROSSROAD SIGNS




✱ 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. 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 | | | SPACING | |
|---|---|---|---|---|
| Sign Number or Series | Conventional Road | Expressway/ Freeway | Posted Speed | Sign Spacing "X" △ |
| | | | MPH | Feet (Apprx.) |
| CW20[4] CW21 CW22 CW23 CW25 | 48" x 48" | 48" x 48" | 30 | 120 |
| | | | 35 | 160 |
| | | | 40 | 240 |
| | | | 45 | 320 |
| CW1, CW2, CW7, CW8, CW9, CW11, CW14 | 36" x 36" | 48" x 48" | 50 | 400 |
| | | | 55 | 500[2] |
| | | | 60 | 600[2] |
| CW3, CW4, CW5, CW6, CW8-3, CW10, CW12 | 48" x 48" | 48" x 48" | 65 | 700[2] |
| | | | 70 | 800[2] |
| | | | 75 | 900[2] |
| | | | 80 | 1000[2] |
| | | | ✱ | ✱ [3] |

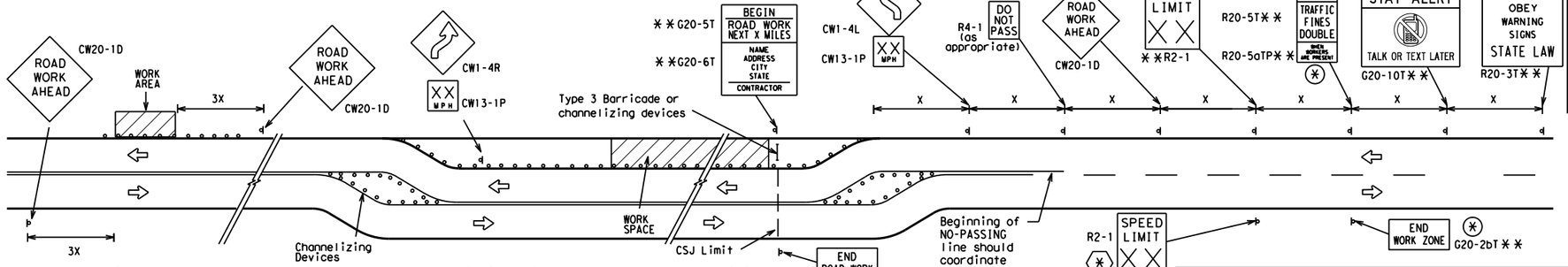
✱ For typical sign spacings on divided highways, expressways and freeways, see Part 6 of the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD) typical application diagrams or TCP Standard Sheets.

△ 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. See Note 2 under "Typical Location of Crossroad Signs".
5. Only diamond shaped warning sign sizes are indicated.
6. See sign size listing in "TMUTCD", Sign Appendix or the "Standard Highway Sign Designs for Texas" manual for complete list of available sign design sizes.

## WORK AREAS IN MULTIPLE LOCATIONS WITHIN CSJ LIMITS

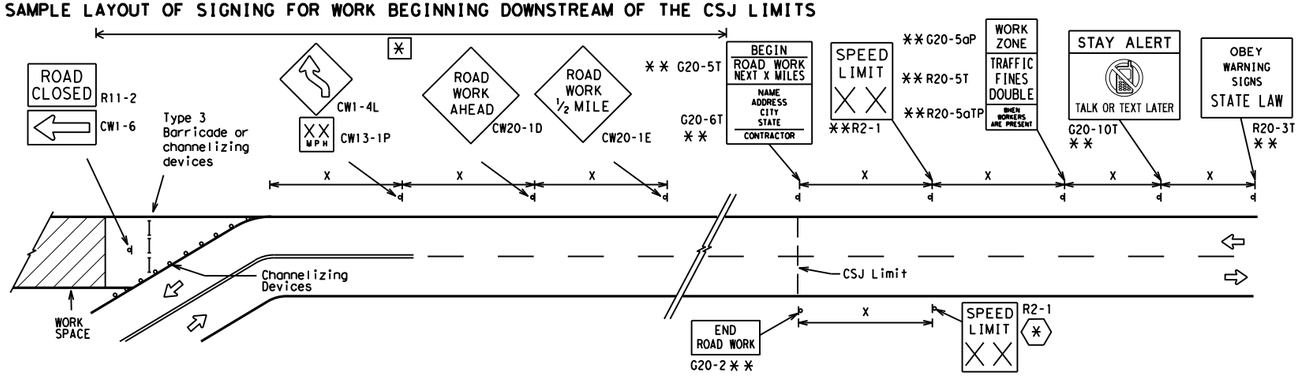



When extended distances occur between minimal work spaces, the Engineer/Inspector should ensure additional "ROAD WORK AHEAD"(CW20-1D)signs are placed in advance of these work areas to remind drivers they are still within the project limits. See the applicable TCP sheets for exact location and spacing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

## SAMPLE LAYOUT OF SIGNING FOR WORK BEGINNING AT THE CSJ LIMITS




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




## NOTES

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

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

✱✱ Required CSJ Limit signing. See Note 10 on BC(1). TRAFFIC FINES DOUBLE signs will not be required on projects consisting solely of mobile operations work.

[✱] 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 Operations Division Standard

# BARRICADE AND CONSTRUCTION PROJECT LIMIT

# BC(2)-14

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| 9-07 8-14 | DIST | COUNTY | | SHEET NO. |
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DATE: 03/20/23 11:30
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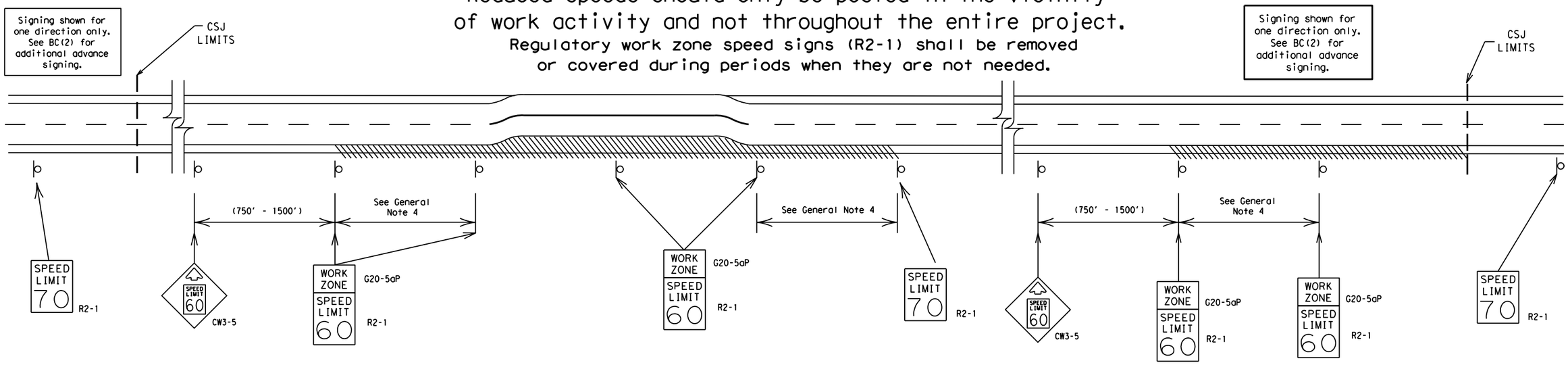
# TYPICAL APPLICATION OF WORK ZONE SPEED LIMIT SIGNS

**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 travelled 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 Operations Division Standard

## BARRICADE AND CONSTRUCTION WORK ZONE SPEED LIMIT

## BC(3)-14

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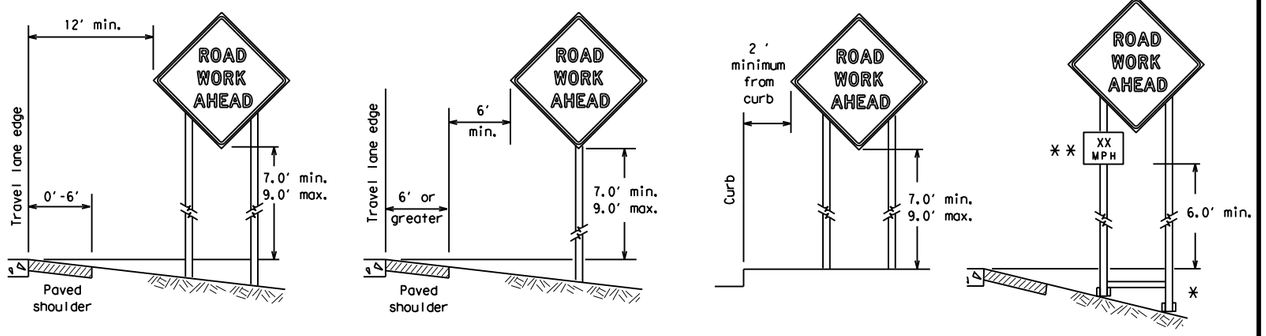
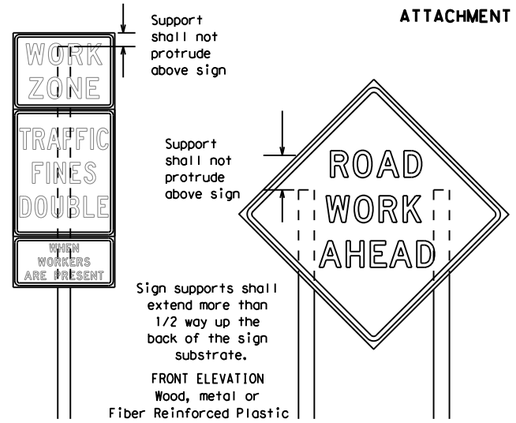
## TYPICAL MINIMUM CLEARANCES FOR LONG TERM AND INTERMEDIATE TERM SIGNS

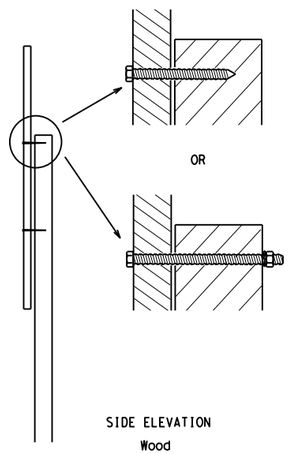



* When placing skid supports on unlevel ground, the leg post lengths must be adjusted so the sign appears straight and plumb. Objects shall NOT be placed under skids as a means of leveling.

** 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



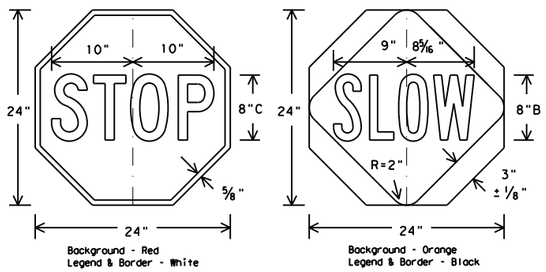

Attachment to wooden supports will be by bolts and nuts or screws. Use TxDOT's or manufacturer's recommended procedures for attaching sign substrates to other types of sign supports

**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" as detailed below.
2. When used at night, the STOP/SLOW paddle shall be retroreflectorized.
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.




## 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, 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.
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 sheets or the CWZTCD. The signs shall meet the required mounting heights shown on the BC Sheets or the SMD Standards 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). The Contractor shall install the sign support in accordance with the manufacturer's recommendations. If there is a question regarding installation procedures, the Contractor shall furnish the Engineer a copy of the manufacturer's installation recommendations so the Engineer can verify the correct procedures are being followed.
7. The Contractor is responsible for installing signs on approved supports and replacing signs with damaged or cracked substrates and/or damaged or marred reflective sheeting as directed by the Engineer/Inspector.
8. Identification markings may be shown only on the back of the sign substrate. The maximum height of letters and/or company logos used for identification shall be 1 inch.
9. The Contractor shall replace damaged wood posts. New or damaged wood sign posts shall not be spliced.

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

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

## SIGN MOUNTING HEIGHT

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

## SIZE OF SIGNS

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

## SIGN SUBSTRATES

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

## REFLECTIVE SHEETING

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

## SIGN LETTERS

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

## REMOVING OR COVERING

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

## SIGN SUPPORT WEIGHTS

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

## FLAGS ON SIGNS

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



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Traffic Operations Division Standard

# BARRICADE AND CONSTRUCTION TEMPORARY SIGN NOTES

# BC(4)-14

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|---|---|---|---|---|
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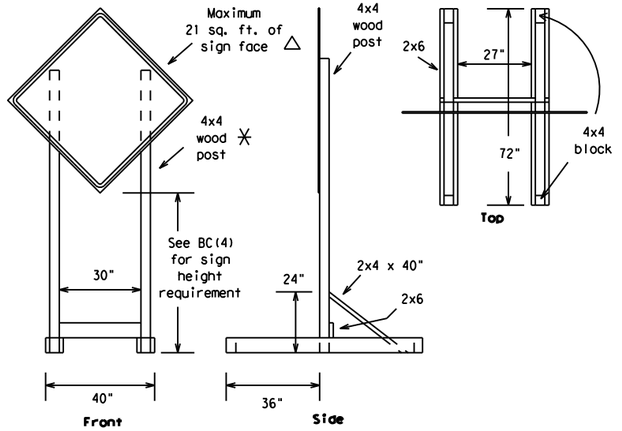
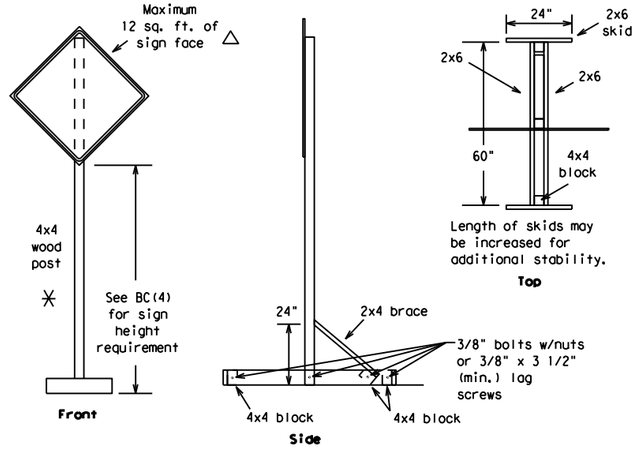
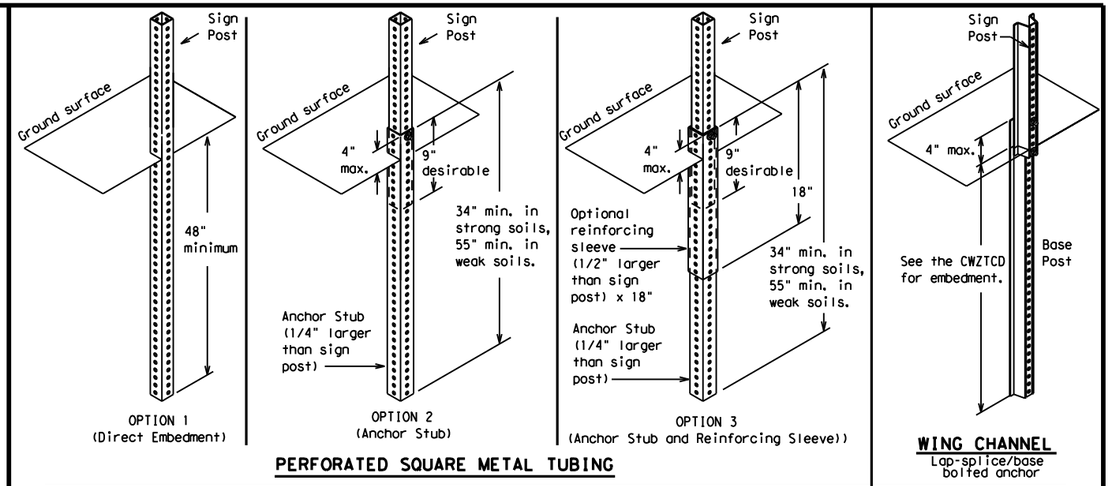



# SKID MOUNTED WOOD SIGN SUPPORTS

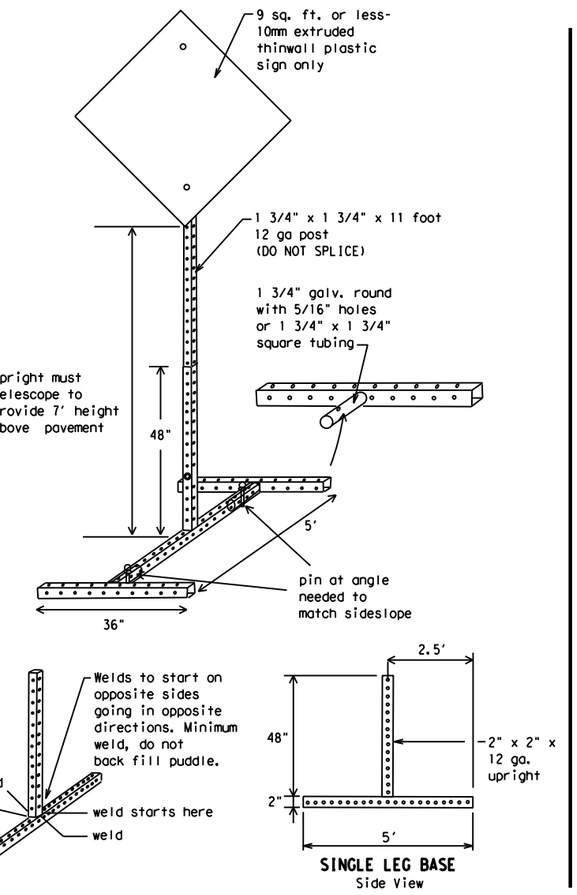
LONG/INTERMEDIATE TERM STATIONARY - PORTABLE SKID MOUNTED SIGN SUPPORTS □

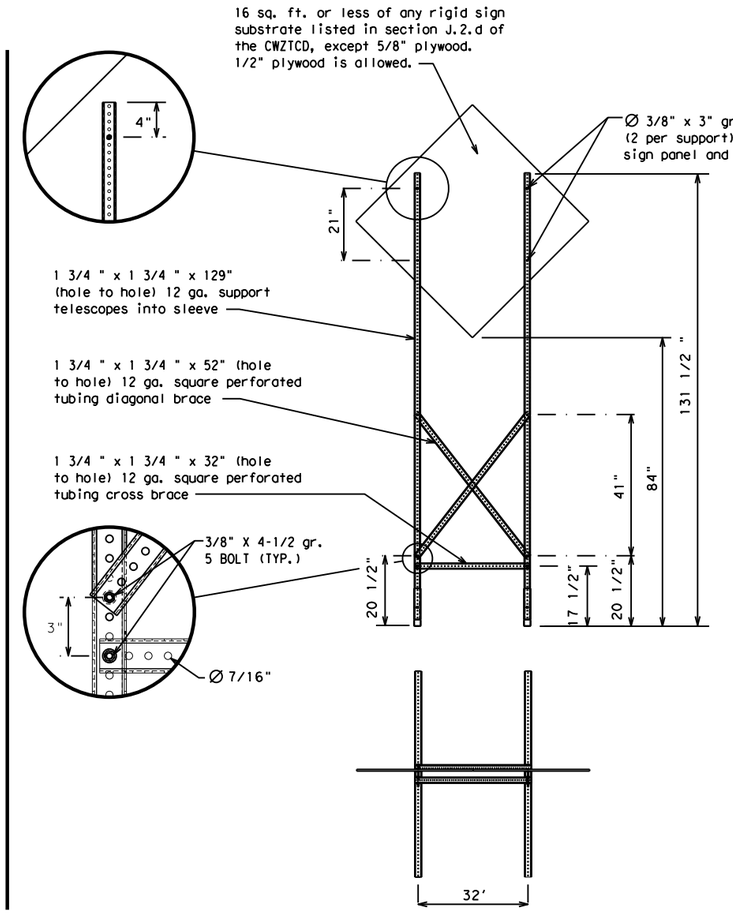


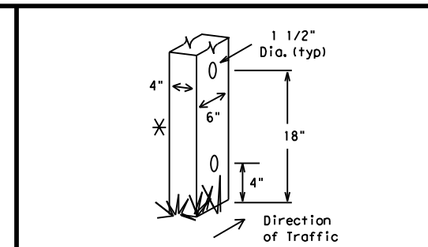

PERFORATED SQUARE METAL TUBING

# GROUND MOUNTED SIGN SUPPORTS

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

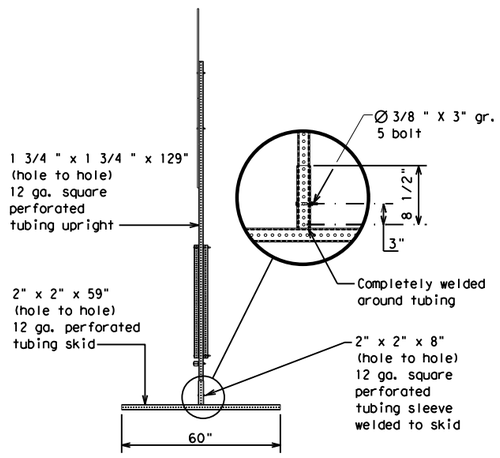



| Nominal Post Size | Number of Posts | Maximum Sq. feet of Sign Face | Minimum Soil Embedment | Drilled Hole(s) Required |
|---|---|---|---|---|
| 4 x 4 | 1 | 12 | 36" | NO |
| 4 x 4 | 2 | 21 | 36" | NO |
| 4 x 6 | 1 | 21 | 36" | YES |
| 4 x 6 | 2 | 36 | 36" | YES |

WOOD POST SYSTEM FOR GROUND 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 Operations Division Standard

# SKID MOUNTED PERFORATED SQUARE STEEL TUBING SIGN SUPPORTS

# BARRICADE AND CONSTRUCTION TYPICAL SIGN SUPPORT

## BC(5)-14

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

## PORTABLE CHANGEABLE MESSAGE SIGNS

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

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

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

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

# RECOMMENDED PHASES AND FORMATS FOR PCMS MESSAGES DURING ROADWORK ACTIVITIES

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

## Phase 1: Condition Lists

### Road/Lane/Ramp Closure List

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

### Other Condition List

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

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

## Phase 2: Possible Component Lists

### Action to Take/Effect on Travel List

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

### Location List

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

### Warning List

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

### ** Advance Notice List

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

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

** 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 Operations Division Standard

# BARRICADE AND CONSTRUCTION PORTABLE CHANGEABLE MESSAGE SIGN (PCMS)

# BC(6)-14

| FILE: bc-14.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT November 2002 | CONT | SECT | JOB | HIGHWAY |
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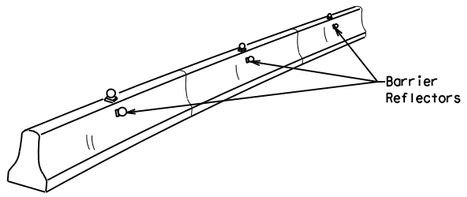
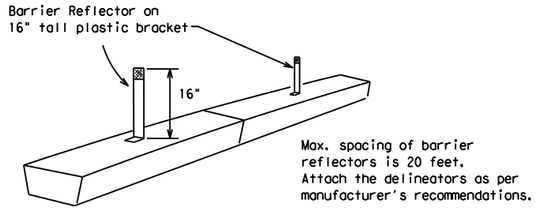
1. Barrier Reflectors shall be pre-qualified, and conform to the color and reflectivity requirements of DMS-8600. A list of prequalified Barrier Reflectors can be found at the Material Producer List web address shown on BC(1).
2. Color of Barrier Reflectors shall be as specified in the TMUTCD. The cost of the reflectors shall be considered subsidiary to Item 512.

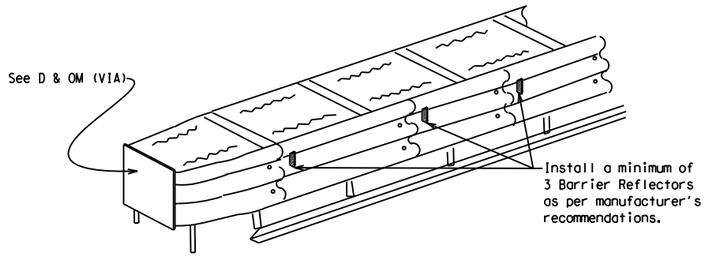



## CONCRETE TRAFFIC BARRIER (CTB)

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.




## LOW PROFILE CONCRETE BARRIER (LPCB)

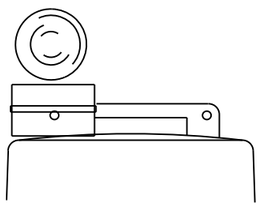



## DELINEATION OF END TREATMENTS

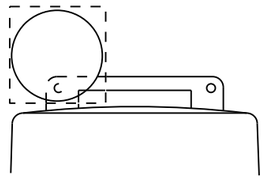
**END TREATMENTS FOR CTB'S USED IN WORK ZONES**

End treatments used on CTB's in work zones shall meet crashworthy standards as defined in the National Cooperative Highway Research Report 350. 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

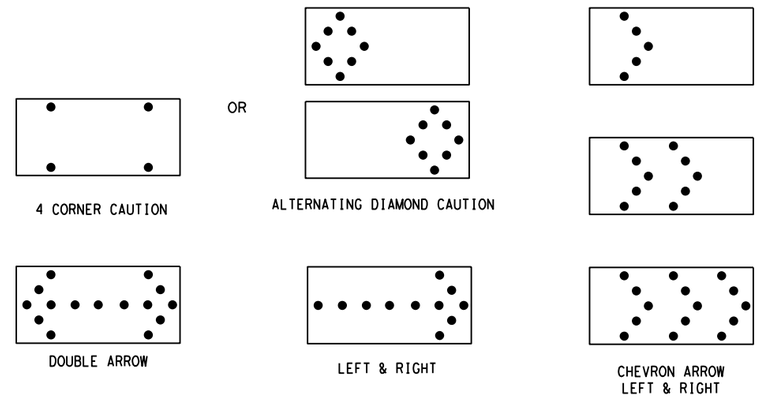
1. Type A flashing warning lights are intended to warn drivers that they are approaching or are in a potentially hazardous area.
2. Type A random flashing warning lights are not intended for delineation and shall not be used in a series.
3. A series of sequential flashing warning lights placed on channelizing 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 National Cooperative Highway Research Report No. 350 (NCHRP 350) or 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 Operations Division Standard*

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

# BC(7)-14

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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:

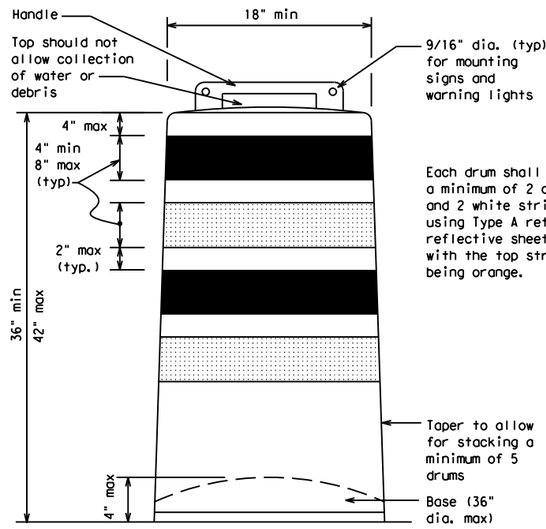
1. Plastic drums shall be a two-piece design; the "body" of the drum shall be the top portion and the "base" shall be the bottom.
2. The body and base shall lock together in such a manner that the body separates from the base when impacted by a vehicle traveling at a speed of 20 MPH or greater but prevents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

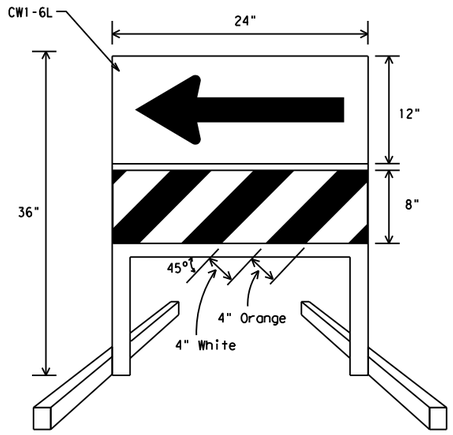
## RETROREFLECTIVE SHEETING

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 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

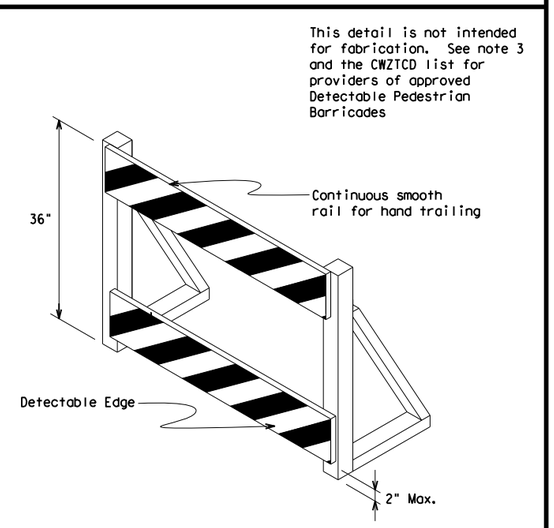
1. Unballasted bases shall be large enough to hold up to 50 lbs. of sand. This base, when filled with the ballast material, should weigh between 35 lbs (minimum) and 50 lbs (maximum). The ballast may be sand in one to three sandbags separate from the base, sand in a sand-filled plastic base, or other 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.



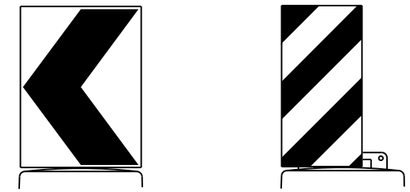

## DIRECTION INDICATOR BARRICADE

1. The Direction Indicator Barricade may be used in tapers, transitions, and other areas where specific directional guidance to drivers is necessary.
2. If used, the Direction Indicator Barricade should be used in series to direct the driver through the transition and into the intended travel lane.
3. The Direction Indicator Barricade shall consist of One-Direction Large Arrow (CW1-6) sign in the size shown with a black arrow on a background of Type $B_{FL}$ or Type $C_{FL}$ Orange retroreflective sheeting above a rail with Type A retroreflective sheeting in alternating 4" white and orange stripes sloping downward at an angle of 45 degrees in the direction road users are to pass. Sheeting types shall be as per DMS 8300.
4. Double arrows on the Direction Indicator Barricade will not be allowed.
5. Approved manufacturers are shown on the CWZTCD List. Ballast shall be as approved by the manufacturers instructions.




## 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.
2. Where pedestrians with visual disabilities normally use the closed sidewalk, a device that is detectable by a person with a visual disability traveling with the aid of a long cane shall be placed across the full width of the closed sidewalk.
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 for Buildings and Facilities (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 may 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 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 Operations Division Standard

# BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

# BC(8)-14

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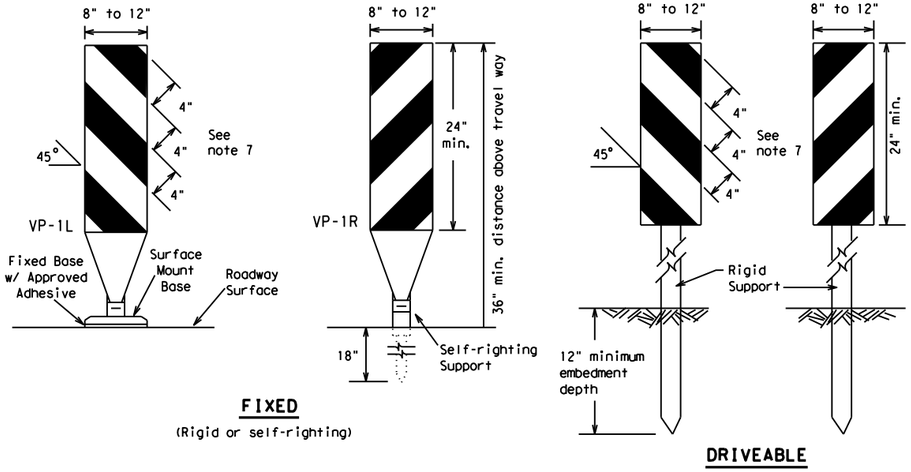
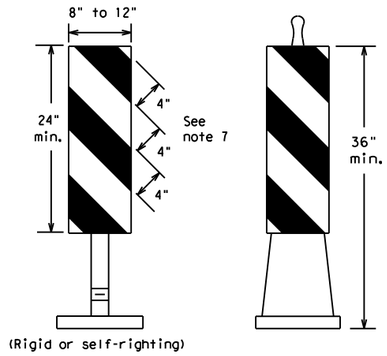



**FIXED**
(Rigid or self-righting)

**DRIVEABLE**

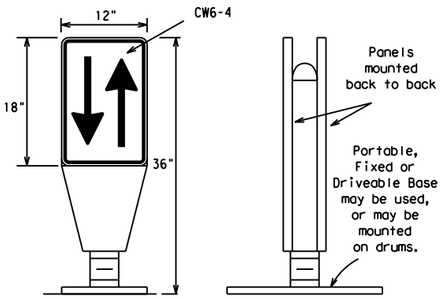



(Rigid or self-righting)

**PORTABLE**

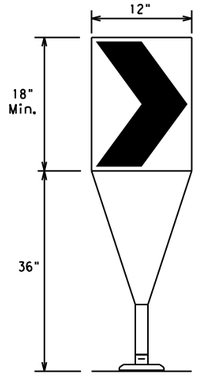
1. Vertical Panels (VP's) are normally used to channelize traffic or divide opposing lanes of traffic.
2. VP's may be used in daytime or nighttime situations. They may be used at the edge of shoulder drop-offs and other areas such as lane transitions where positive daytime and nighttime delineation is required. The Engineer/Inspector shall refer to the Roadway Design Manual Appendix B "Treatment of Pavement Drop-offs in Work Zones" for additional guidelines on the use of 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 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)



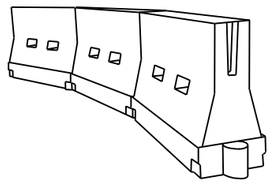

Fixed Base w/ Approved Adhesive (Driveable Base, or Flexible Support can be used)

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) placed 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 NCHRP 350 crashworthiness requirements based on roadway speed and barrier application.
2. Water ballasted systems used to channelize vehicular traffic shall be supplemented with retroreflective delineation or channelizing devices to improve daytime/nighttime visibility. They may also be supplemented with pavement markings.
3. Water ballasted systems used as barriers shall be placed in accordance to application and installation requirements specific to the device, and used only when shown on the CWZTCD list.
4. Water ballasted systems used as barriers should not be used for a merging taper except in low speed (less than 45 MPH) urban areas. When used on a taper in a low speed urban area, the taper shall be delineated and the taper length should be designed to optimize road user operations considering the available geometric conditions.
5. When water ballasted systems used as barriers have blunt ends exposed to traffic, they should be attenuated as per manufacturer recommendations or flared to a point outside the clear zone.

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

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

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

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

## SUGGESTED MAXIMUM SPACING OF CHANNELIZING DEVICES AND MINIMUM DESIRABLE TAPER LENGTHS



Texas Department of Transportation | Traffic Operations Division Standard

# BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

# BC(9)-14

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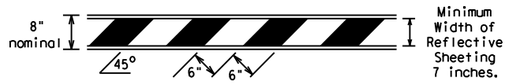
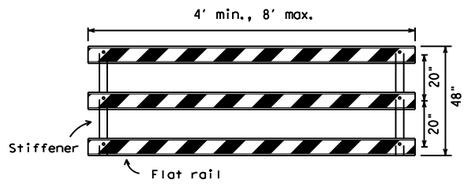
## TYPE 3 BARRICADES

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 conforming to Departmental Material Specification DMS-8300 unless otherwise noted.

Barricades shall NOT be used as a sign support.



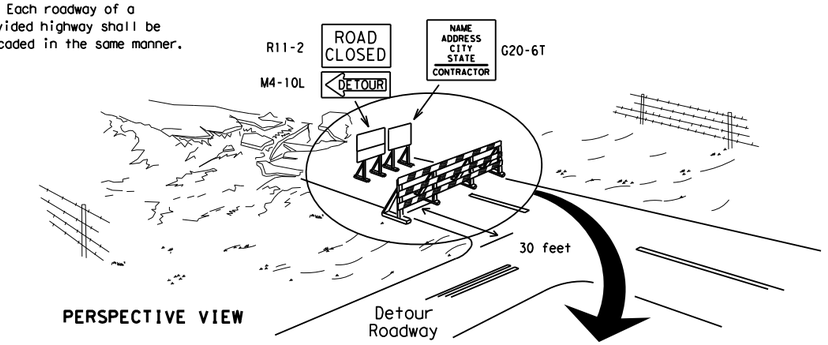

### TYPICAL STRIPING DETAIL FOR BARRICADE RAIL




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

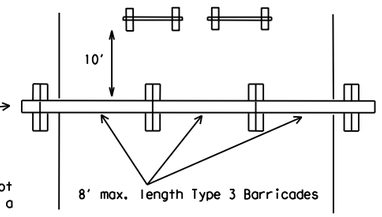
### TYPICAL PANEL DETAIL FOR SKID OR POST TYPE BARRICADES

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




PERSPECTIVE VIEW

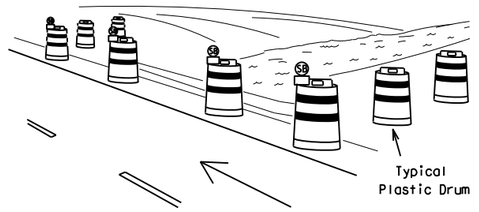
The three rails on Type 3 barricades shall be reflectorized orange and reflective white stripes on one side facing one-way traffic and both sides for two-way traffic.
Barricade striping should slant downward in the direction of detour.




PLAN VIEW

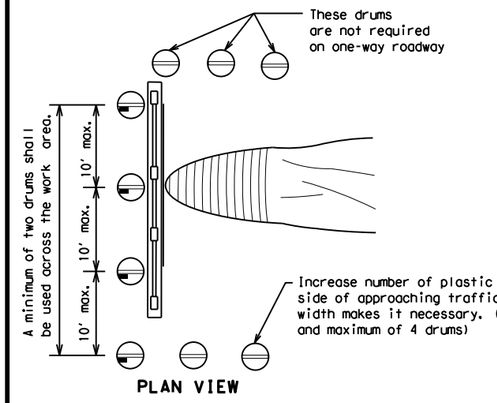
1. Signs should be mounted on independent supports at a 7 foot mounting height in center of roadway. The signs should be a minimum of 10 feet behind Type 3 Barricades.
2. Advance signing shall be as specified elsewhere in the plans.

### TYPE 3 BARRICADE (POST AND SKID) TYPICAL APPLICATION




PERSPECTIVE VIEW

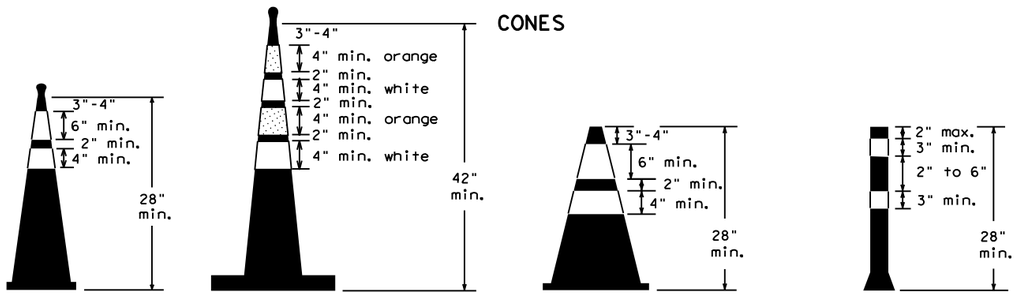
1. Where positive redirectional capability is provided, drums may be omitted.
2. Plastic construction fencing may be used with drums for safety as required in the plans.
3. Vertical Panels on flexible support may be substituted for drums when the shoulder width is less than 4 feet.
4. When the shoulder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




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

PLAN VIEW

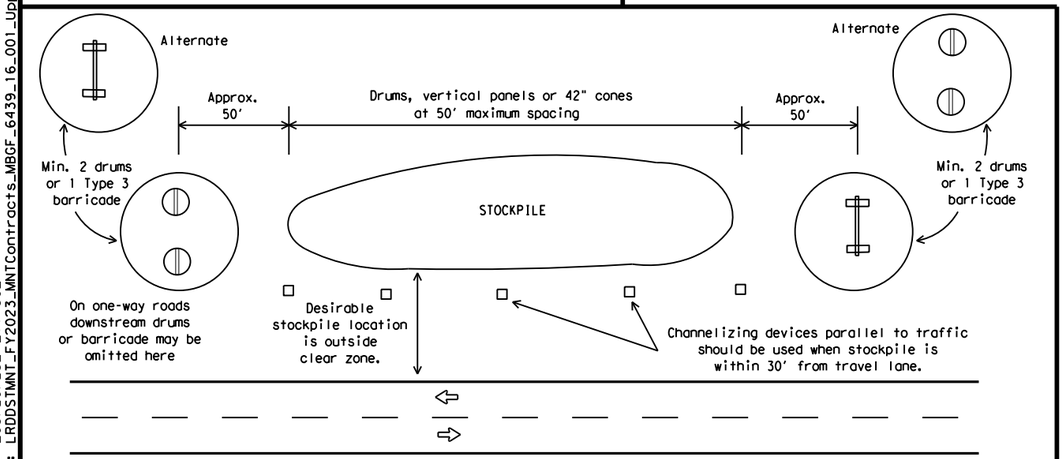
### CULVERT WIDENING OR OTHER ISOLATED WORK WITHIN THE PROJECT LIMITS




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

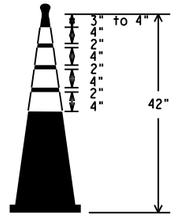
42" 2-piece cones shall have a minimum weight of 30 lbs. including base.

1. Traffic cones and tubular markers shall be predominantly orange, and meet the height and weight requirements shown above.
2. One-piece cones have the body and base of the cone molded in one consolidated unit. Two-piece cones have a cone shaped body and a separate rubber base, or ballast, that is added to keep the device upright and in place.
3. Two-piece cones may have a handle or loop extending up to 8" above the minimum height shown, in order to aid in retrieving the device.
4. Cones or tubular markers used at night 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.
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

THIS DEVICE SHALL NOT BE USED ON PROJECTS LET AFTER MARCH 2014.




EDGELINE CHANNELIZER

1. This device is intended only for use in place of a vertical panel to channelize traffic by indicating the edge of the travel lane. It is not intended to be used in transitions or tapers.
2. This device shall not be used to separate lanes of traffic (opposing or otherwise) or warn of objects.
3. This device is based on a 42 inch, two-piece cone with an alternate striping pattern: four 4 inch retroreflective bands, with an approximate 2 inch gap between bands. The color of the band should correspond to the color of the edgeline (yellow for left edgeline, white for right edgeline) for which the device is substituted or for which it supplements. The reflectorized bands shall be retroreflective Type A conforming to Departmental Material Specification DMS-8300, unless otherwise noted.
4. The base must weigh a minimum of 30 lbs.



Texas Department of Transportation — Traffic Operations Division Standard

# BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

## BC(10)-14

| FILE: bc-14.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| © TxDOT November 2002 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| 9-07 8-14 | DIST | COUNTY | | SHEET NO. |
| 7-13 | 22 | VAR | | 20 |



DATE: _03/20/23_ _11:30_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties

# 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.

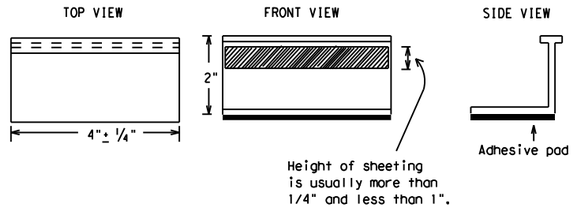
## MAINTAINING WORK ZONE PAVEMENT MARKINGS

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 Operations Division Standard

# BARRICADE AND CONSTRUCTION PAVEMENT MARKINGS

## BC(11)-14

| FILE: bc-14.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT February 1998 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| 2-98 9-07 | DIST | COUNTY | | SHEET NO. |
| 1-02 7-13 | 22 | VAR | | 21 |
| 11-02 8-14 | | | | |

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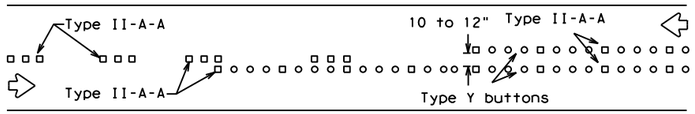
DATE: _03/20/23_ _11:30_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties

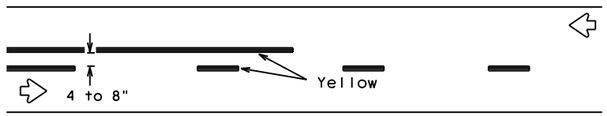
DATE: _03/20/23_ 11:30
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties

# PAVEMENT MARKING PATTERNS

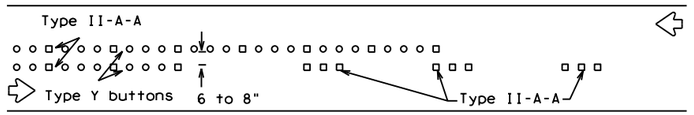

REFLECTORIZED PAVEMENT MARKINGS - PATTERN A




RAISED PAVEMENT MARKERS - PATTERN A



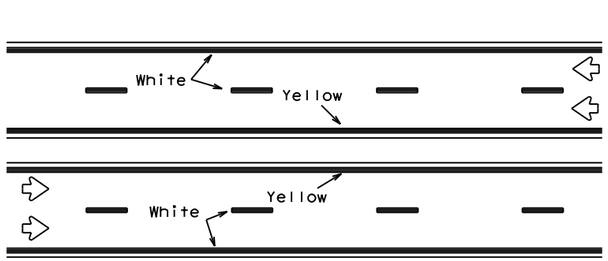

REFLECTORIZED PAVEMENT MARKINGS - PATTERN B



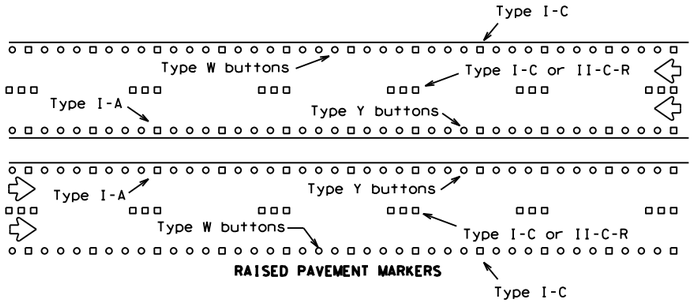

RAISED PAVEMENT MARKERS - PATTERN B

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



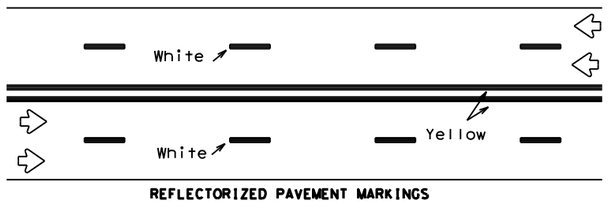

REFLECTORIZED PAVEMENT MARKINGS



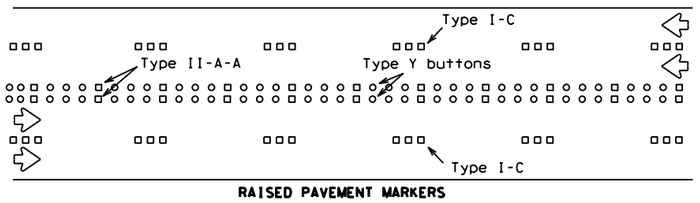

RAISED PAVEMENT MARKERS

Prefabricated markings may be substituted for reflectorized pavement markings.

## EDGE & LANE LINES FOR DIVIDED HIGHWAY



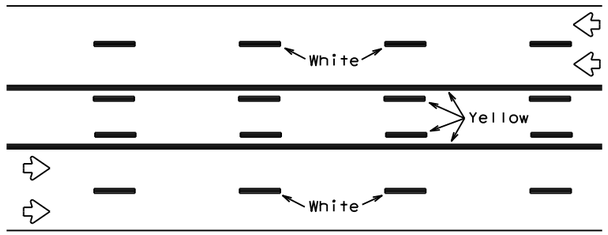

REFLECTORIZED PAVEMENT MARKINGS



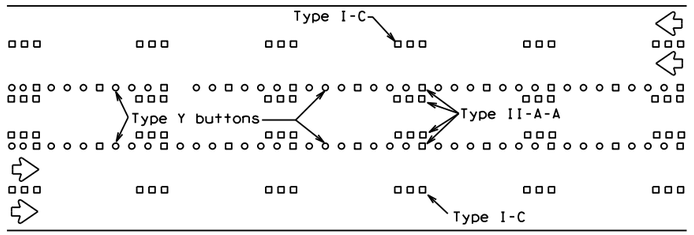

RAISED PAVEMENT MARKERS

Prefabricated markings may be substituted for reflectorized pavement markings.

## LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS




REFLECTORIZED PAVEMENT MARKINGS




RAISED PAVEMENT MARKERS

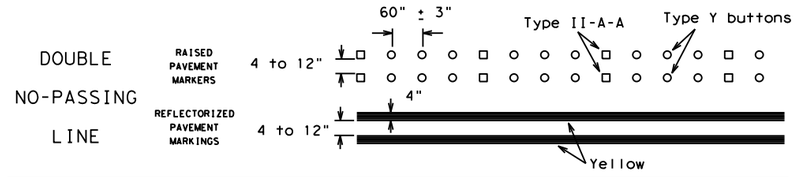
Prefabricated markings may be substituted for reflectorized pavement markings.

## TWO-WAY LEFT TURN LANE

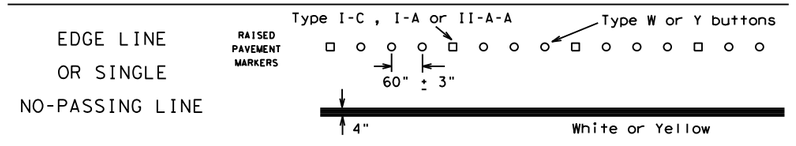
# STANDARD WORK ZONE PAVEMENT MARKINGS DETAILS

## SOLID LINES

### DOUBLE NO-PASSING LINE

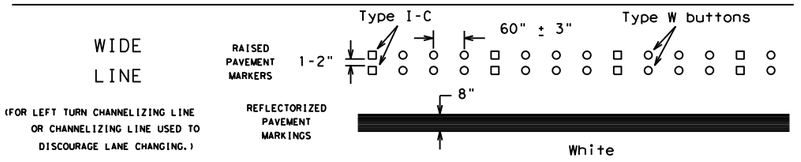



### EDGE LINE OR SINGLE NO-PASSING LINE



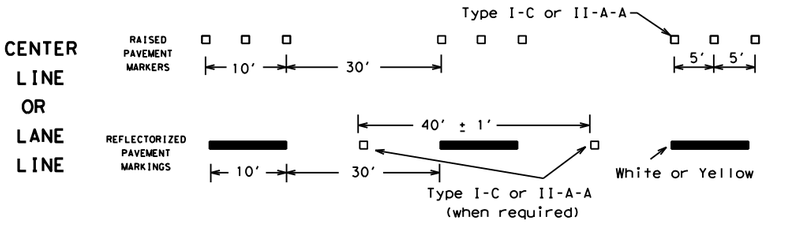

### WIDE LINE

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

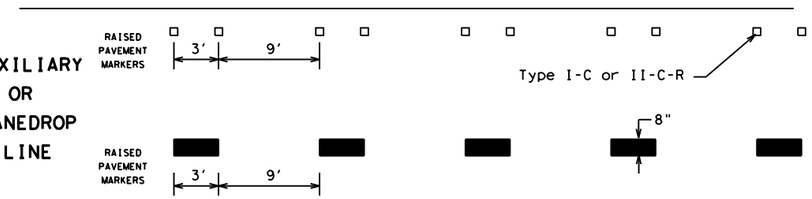



## BROKEN LINES

### CENTER LINE OR LANE LINE

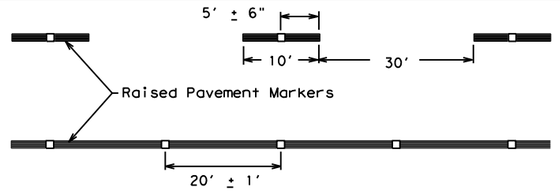



### AUXILIARY OR LANEDROP LINE




### 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

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# BARRICADE AND CONSTRUCTION PAVEMENT MARKING PATTERNS

## BC(12)-14

| FILE: bc-14.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| © TxDOT February 1998 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| 1-97 9-07 | DIST | COUNTY | | SHEET NO. |
| 2-98 7-13 | 22 | VAR | | 22 |
| 11-02 8-14 | | | | |

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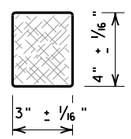
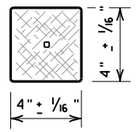
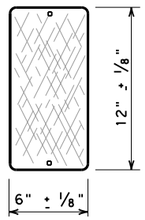
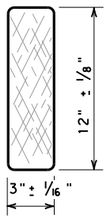
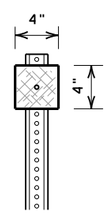
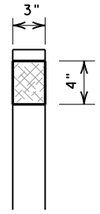
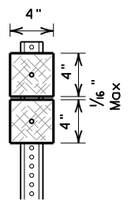
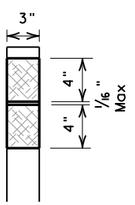
## REFLECTOR UNIT SIZES FOR DELINEATORS AND OBJECT MARKERS

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

## DELINEATORS

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

## D & OM DESCRIPTIVE CODES

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

**NUMBER OF REFLECTORS**
S = Single
D = Double

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

**REFLECTOR UNIT SIZE**
1 or 2

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

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

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

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

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

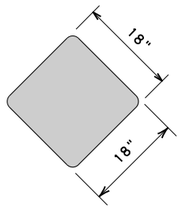
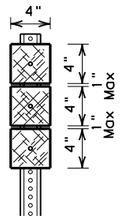
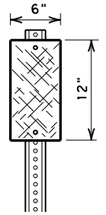
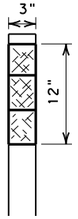
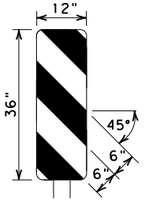
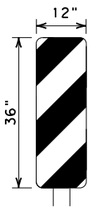
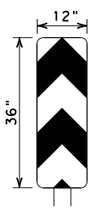
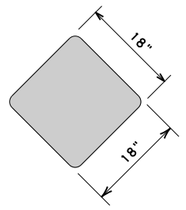
**NUMBER OF REFLECTORS OR DIRECTION**
X = 3-Size 2 reflector units (Type 2 only)
Y = 1-Size 3 reflector unit (Type 2 only)
Z = 3-Size 1 or 1-Size 4 reflector unit(s)(Type 2 only)
L = Left Side (Type 3 Object Marker only)
R = Right Side (Type 3 Object Marker only)
C = Center (Type 3 Object Marker only)

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

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

**DIRECTION**
If Required
BI = Bi-Directional

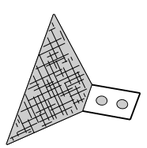
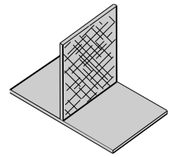
## OBJECT MARKERS

| | Type 1 (OM-1) | Type 2 (OM-2) | | | Type 3 (OM-3) | | | Type 4 (OM-4) |
|---|---|---|---|---|---|---|---|---|
| | OM-1 | OM-2X | OM-2Y | OM-2Z | OM-3L | OM-3R | OM-3C | OM-4 |
| DEVICE |   |   |   |   |   |   |   |   |
| | | 3-Size 2 reflector units | 1-Size 3 reflector unit | 3-Size 1 reflector units or 1-Size 4 reflector unit | | | | |
| SHEETING | Yellow-Type $B_{FL}$ or $C_{FL}$ Sheeting | Yellow - Type B or C Sheeting | | | Alternating acrylic black and retroflective yellow - Type $B_{FL}$ or $C_{FL}$ Sheeting | | | Red -Type $B_{FL}$ or $C_{FL}$ Sheeting |
| POST TYPE | TWT | WC | WC | WFLX | TWT | | | TWT |
| MOUNT TYPE | WAS, WAP | GND | GND | GND, SRF | WAS, WAP | | | WAS, WAP |

## DEPARTMENTAL MATERIAL SPECIFICATIONS

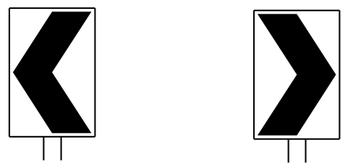
| | |
|---|---|
| FLEXIBLE DELINEATOR & OBJECT MARKER POSTS (EMBEDDED & SURFACE MOUNT TYPES) | DMS-4400 |
| SIGN FACE MATERIALS | DMS-8300 |
| DELINEATORS, OBJECT MARKERS AND BARRIER REFLECTORS | DMS-8600 |

## BARRIER REFLECTORS (BRF)

| | GF1 | GF2 | CTB |
|---|---|---|---|
| DEVICE |  |  |  |
| | 1. Barrier reflectors shall meet the requirements of DMS 8600.<br>2. Approved Barrier Reflectors are listed on the "Barrier Reflectors" Material Producer List at: www.txdot.gov. | | |
| SHEETING | Yellow, White, Red | | |
| NOTE | 1. Reflective sheeting shall have a minimum dimension of 3 inches and minimum surface area of 9 square inches. | | |

## CHEVRONS

DEVICE



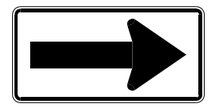
W1-8

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

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

## ONE DIRECTION LARGE ARROW

DEVICE



W1-6

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

## NOTE:

Delineator and object marker substrates and sign substrates shall be 0.080" Aluminum sign blank to conform to ASTM B-209 Alloy 6061-T6 or approved alternative.

Texas Department of Transportation

Traffic Safety Division Standard

# DELINEATOR & OBJECT MARKER MATERIAL DESCRIPTION

# D & OM(1)-20

| FILE: dom1-20.dgn | DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|---|
| ©TxDOT August 2004 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| 10-09 3-15 | DIST | COUNTY | | SHEET NO. |
| 4-10 7-20 | 22 | VAR | | 23 |

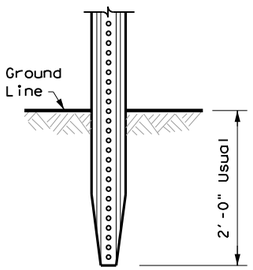
20A

DATE: _03/20/23_ _11:30_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBOF_6439_16_001_UpperCounties

# POST TYPE AND SUPPORT FOUNDATION DETAILS

## WING CHANNEL (WC)

### GND

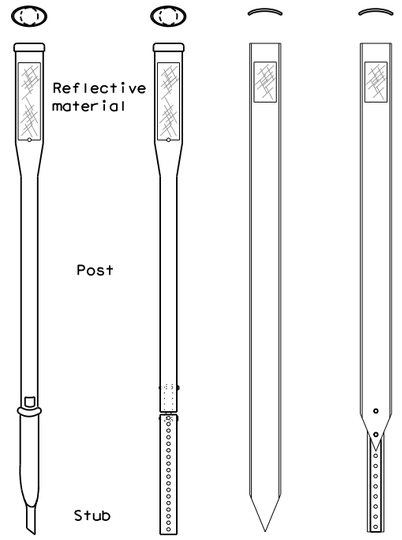



**NOTES**

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

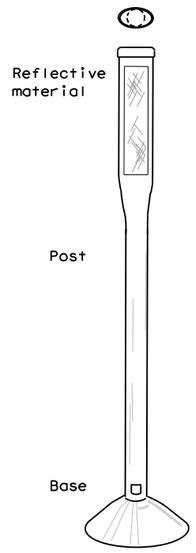
## FLEXIBLE POSTS (YFLX, WFLX)

### GND




EMBEDDED

### SRF



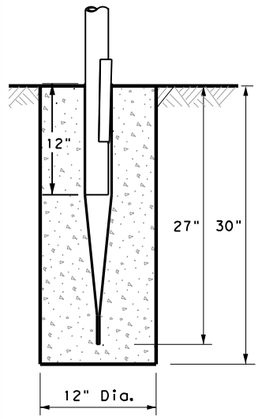

SURFACE MOUNT

**NOTES**

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

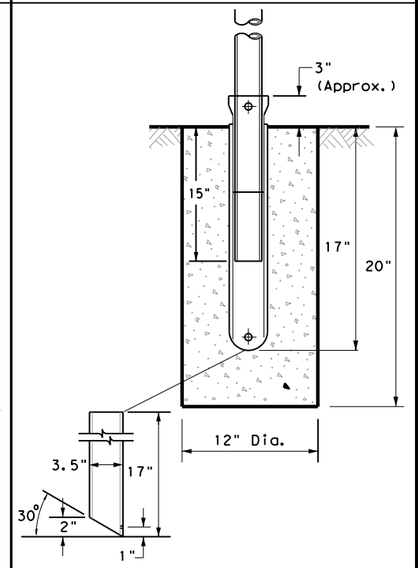
## WEDGE ANCHOR SYSTEMS

### WAS




STEEL

### WAP




PLASTIC

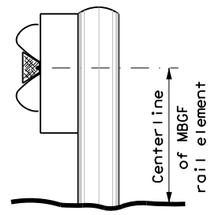
**NOTE**

1. Install per manufacturer's recommendations.

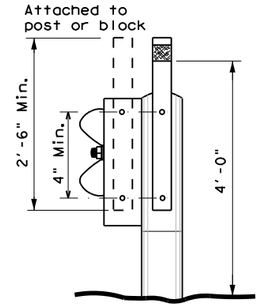
# TYPE OF BARRIER MOUNTS

## GUARD FENCE ATTACHMENT

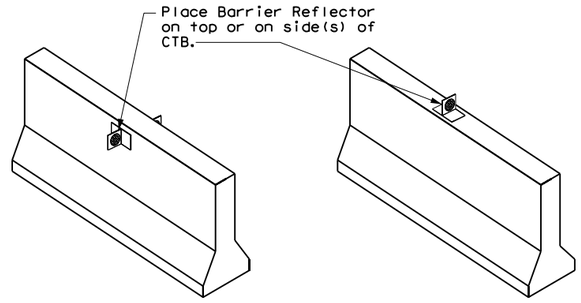
### GF1




### GF2



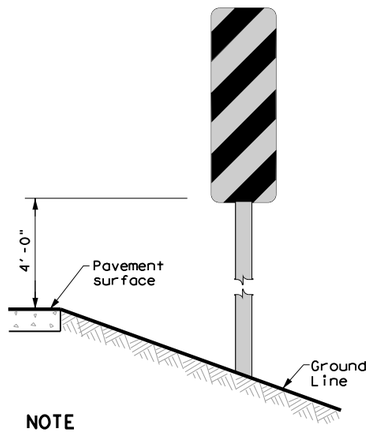

## CONCRETE TRAFFIC BARRIER (CTB)




**GENERAL NOTES**

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

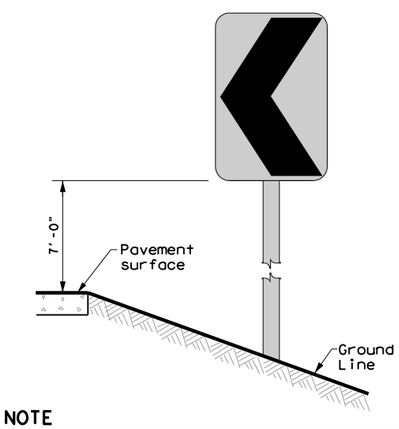
## TYPES 1, 3, AND 4 OBJECT MARKERS AND CHEVRONS




**NOTE**

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

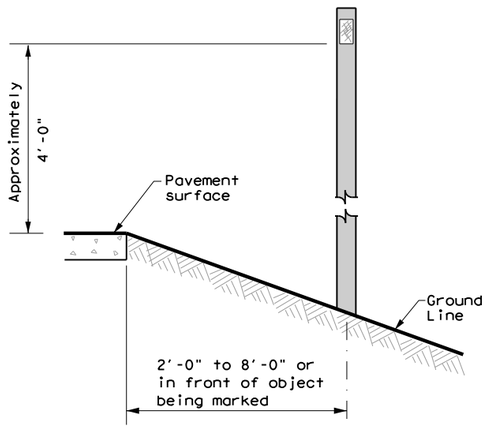
## CHEVRONS AND ONE DIRECTION LARGE ARROW SIGN




**NOTE**

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

## DELINEATORS AND TYPE 2 OBJECT MARKERS




See general notes 1, 2 and 3.

Texas Department of Transportation

*Traffic Safety Division Standard*

# DELINEATOR & OBJECT MARKER INSTALLATION

# D & OM(2)-20

| FILE: dom2-20.dgn | DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|---|
| © TxDOT August 2004 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| 10-09 3-15 | DIST | COUNTY | | SHEET NO. |
| 4-10 7-20 | 22 | VAR | | 24 |

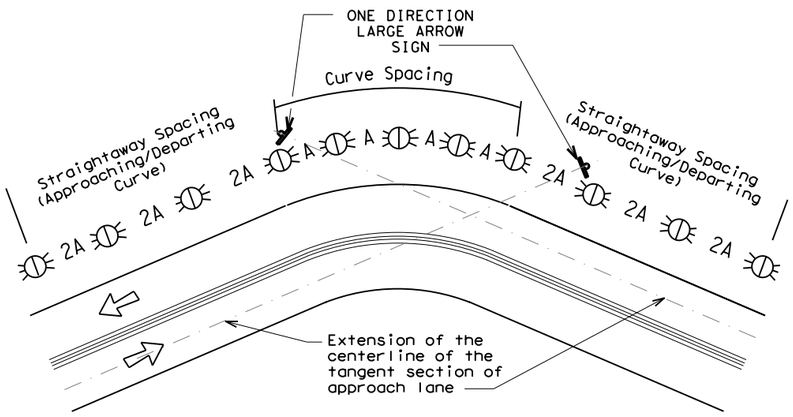
20B

DATE: _03/20/23_ _11:30_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties

## 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<br>• 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<br>• RPMs and One Direction Large Arrow sign where geometric conditions or roadside obstacles prevent the installation of chevrons | • RPMs and Chevrons |

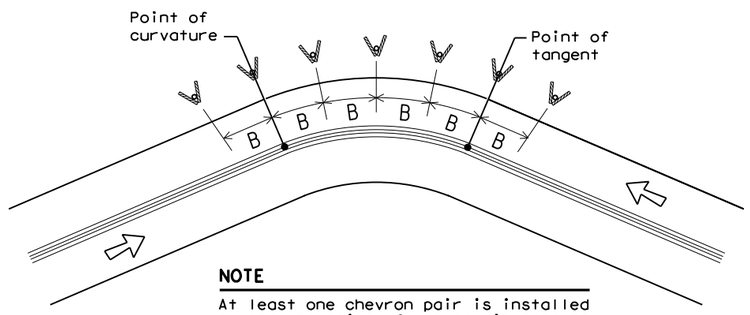
## SUGGESTED SPACING FOR DELINEATORS ON HORIZONTAL CURVES




**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<br>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<br>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<br>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<br>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<br>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

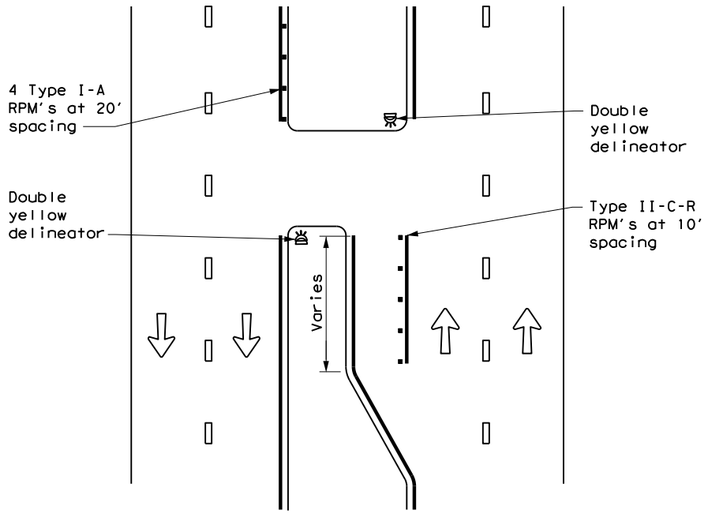
# D & OM(3)-20

| FILE: dom3-20.dgn | DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|---|
| © TxDOT August 2004 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| 3-15 8-15 | DIST | COUNTY | | SHEET NO. |
| 8-15 7-20 | 22 | VAR | | 25 |

20C

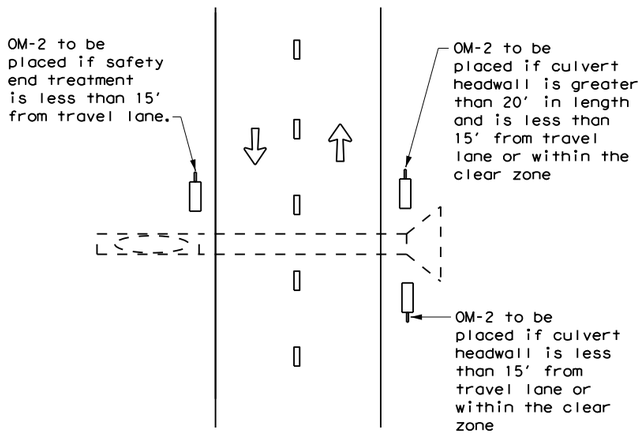
DATE: _03/20/23_ _11:30_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties

## CROSSOVERS



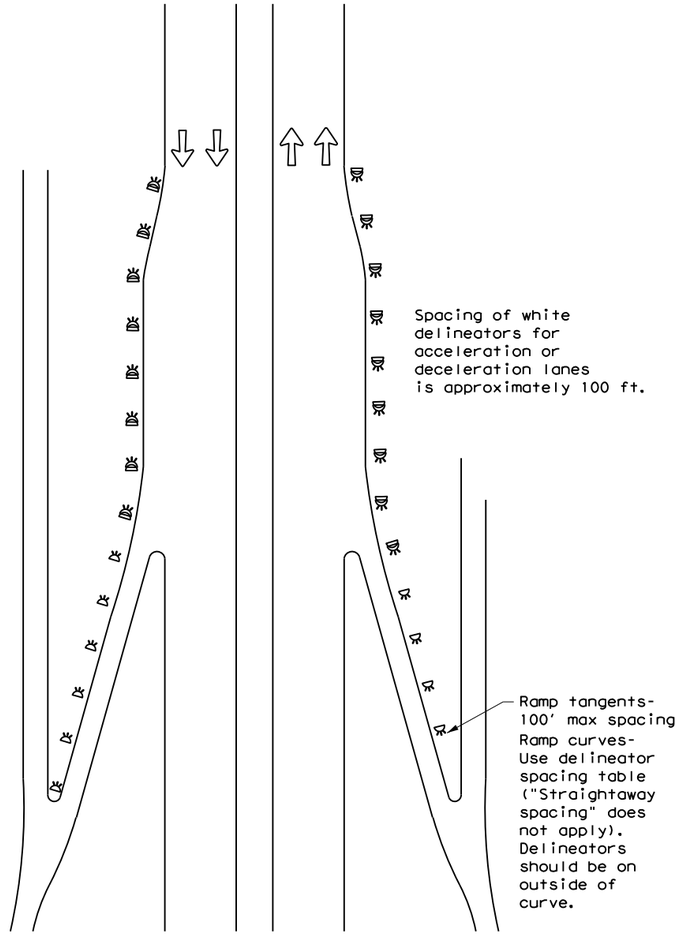

DETAIL 1

## FOR CULVERTS WITHOUT MBGF



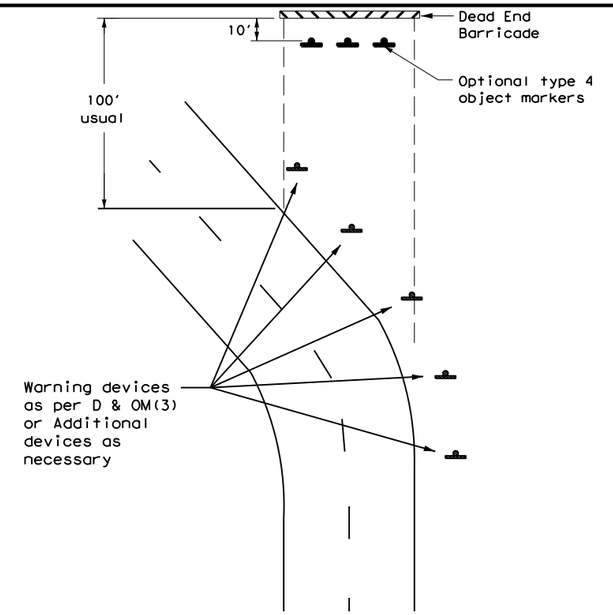

DETAIL 2

## FREEWAY DELINEATION FOR RAMPS AND ACCELERATION/DECELERATION LANES



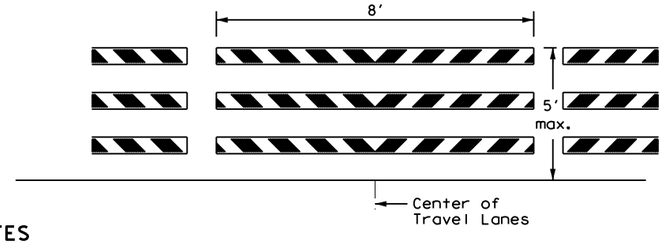

DETAIL 3

## 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

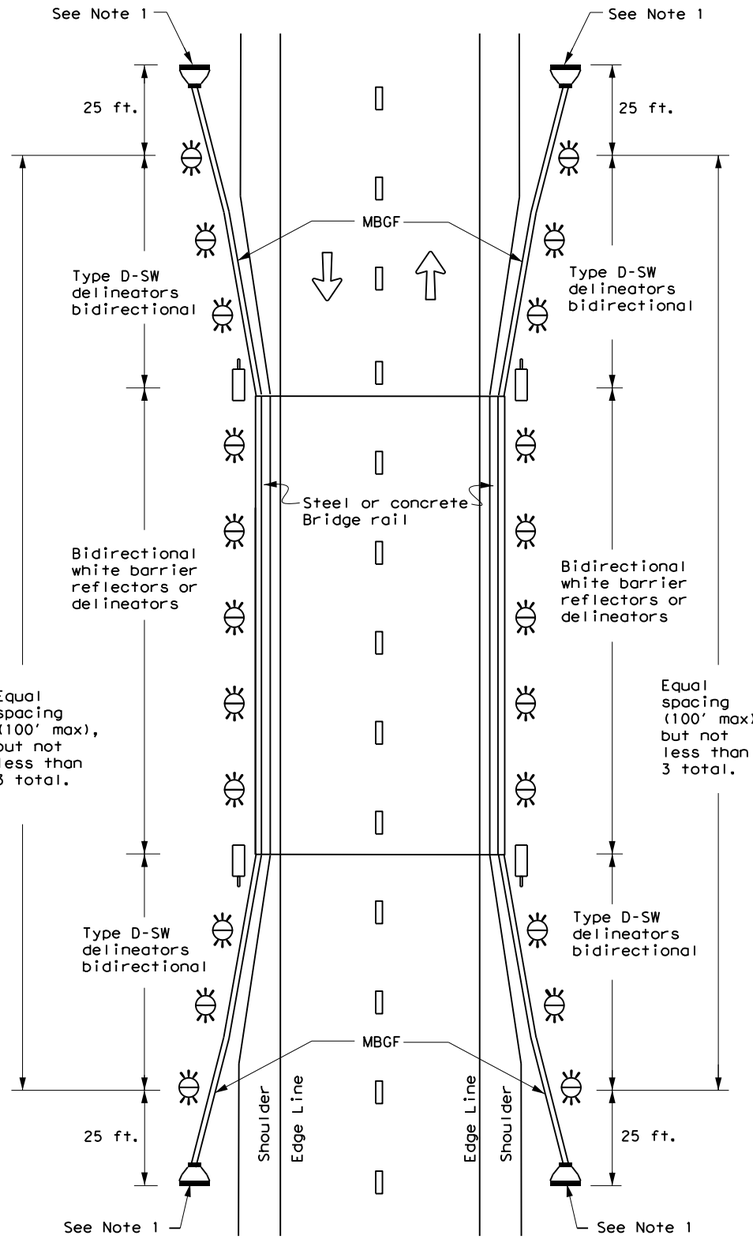
| FILE: dom4-20.dgn | DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|---|
| ©TxDOT August 2004 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| 3-15 | DIST | COUNTY | | SHEET NO. |
| 7-20 | 22 | VAR | | 26 |

20D

DATE: _03/20/23_ 11:30_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties

DATE: _03/20/23_ 11:30_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties

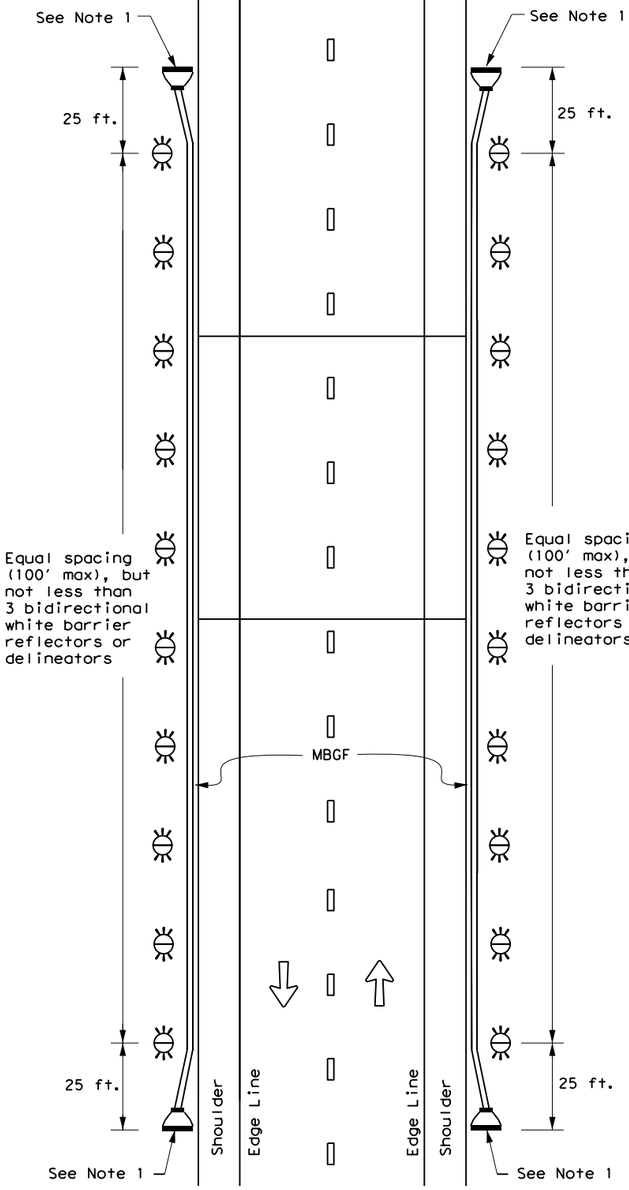
## TWO-WAY, TWO LANE ROADWAY WITH REDUCED WIDTH APPROACH RAIL




**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.

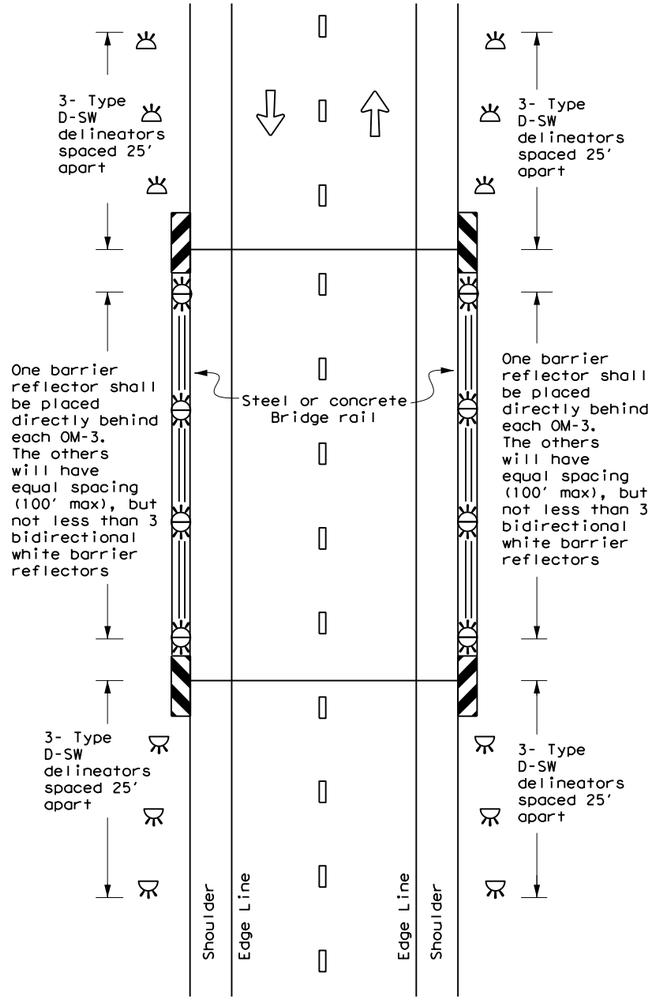
## TWO-WAY, TWO LANE ROADWAY WITH METAL BEAM GUARD FENCE (MBGF)




**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

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# DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

# D & OM(5)-20

| FILE: dom5-20.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| © TxDOT August 2015 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| 7-20 | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 27 |

20E

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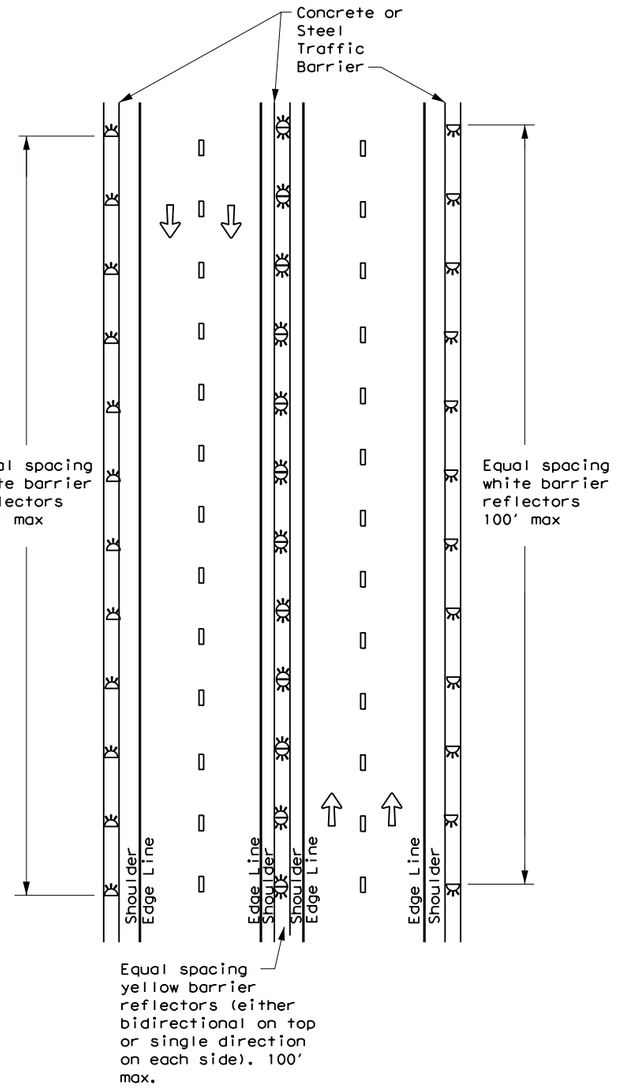
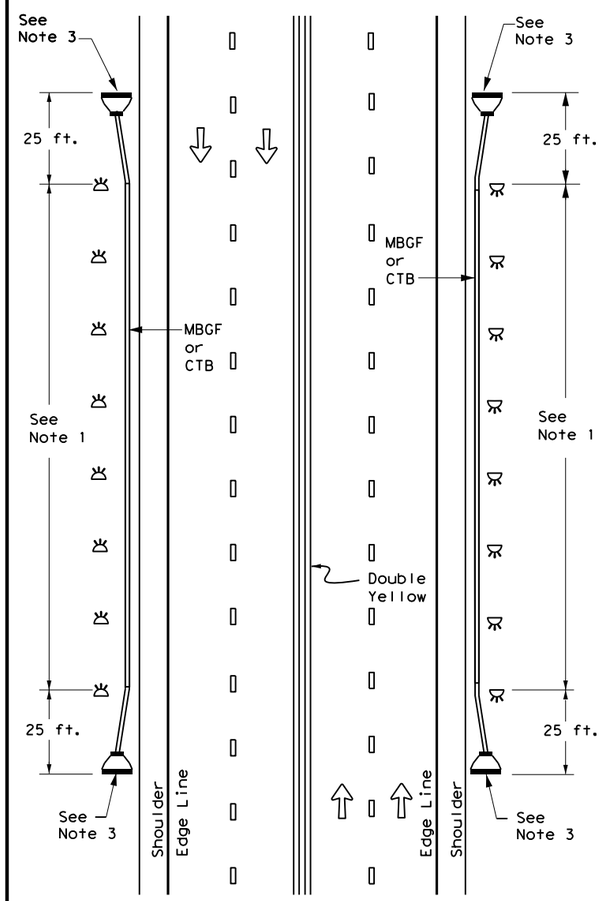
DATE: _03/20/23_ _11:30_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties

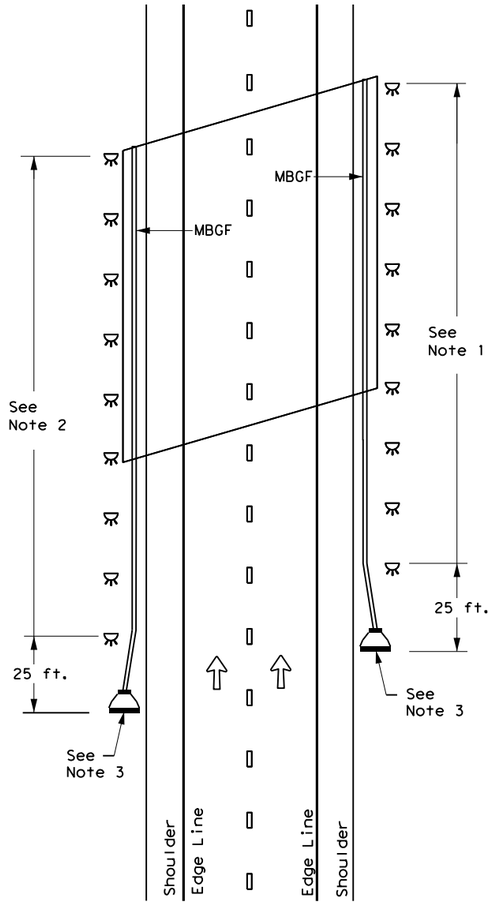
## CONTINUOUS CONCRETE OR STEEL BARRIER



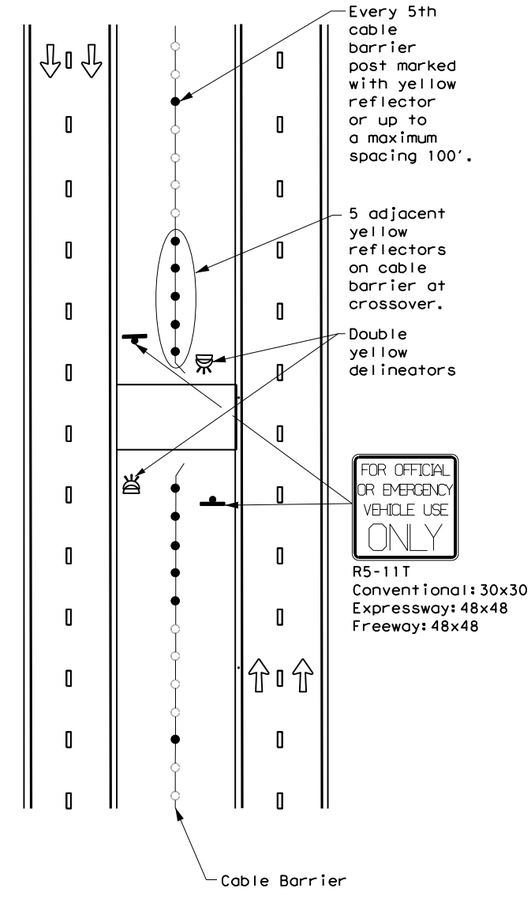

## MULTI-LANE UNDIVIDED, TWO-WAY ROADWAY WITH METAL BEAM GUARD FENCE (MBGF)




## DIVIDED ROADWAY WITH METAL BEAM GUARD FENCE (MBGF)




## EMERGENCY CROSSOVER




## NOTES

1. Equal spacing (100' max), but not less than 3 single directional white barrier reflectors or delineators. On Continuos Barrier, equal spacing (100' max.)
2. Equal spacing (100' max), but not less than 3 single directional yellow barrier reflectors or delineators.
3. Terminal ends require reflective sheeting provided by manufacturer per D & OM (VIA) or a Type 3 Object Marker (OM-3)in front of the terminal end.

## LEGEND

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

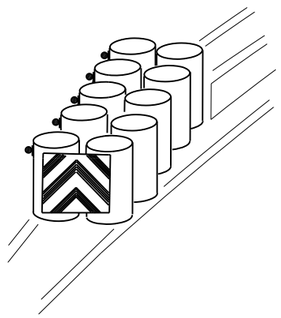
Texas Department of Transportation

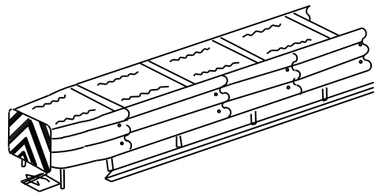
Traffic Safety Division Standard

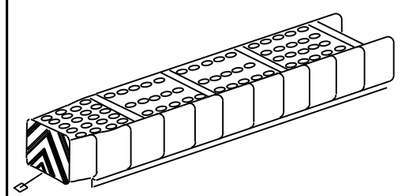
# DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

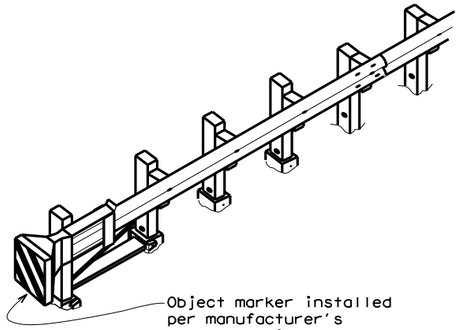
# D & OM(6)-20

| FILE: dom6-20.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT August 2015 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| 7-20 | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 28 |

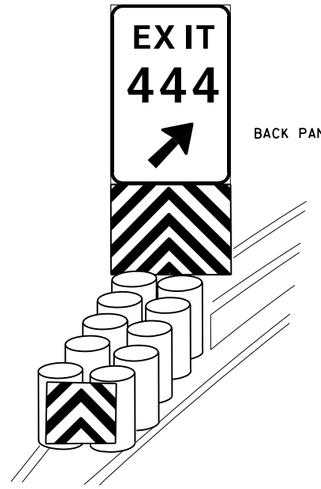




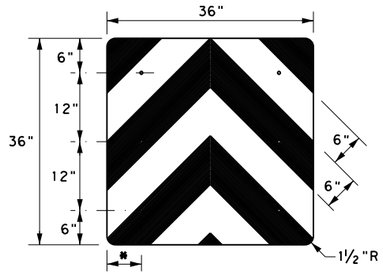


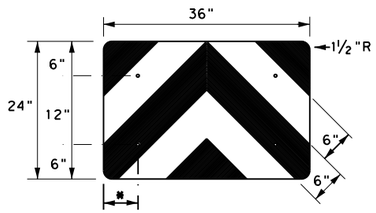


Object marker installed per manufacturer's recommendations.

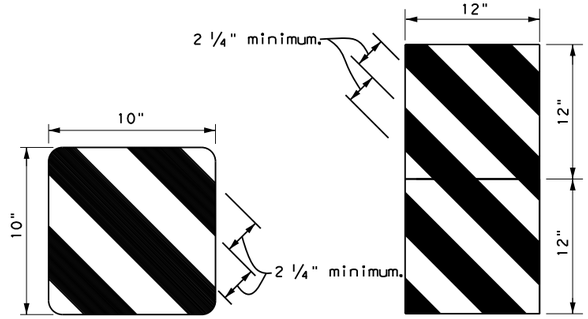



BACK PANEL (OPTIONAL)

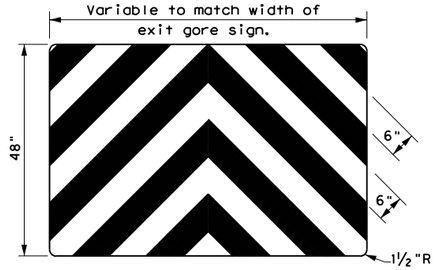


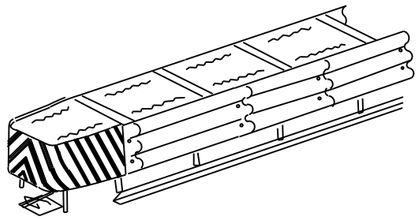



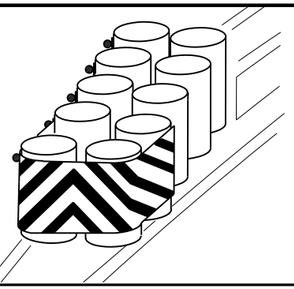

* Adjust to fit attenuator per manufacturer's recommendation, or as directed by the Engineer

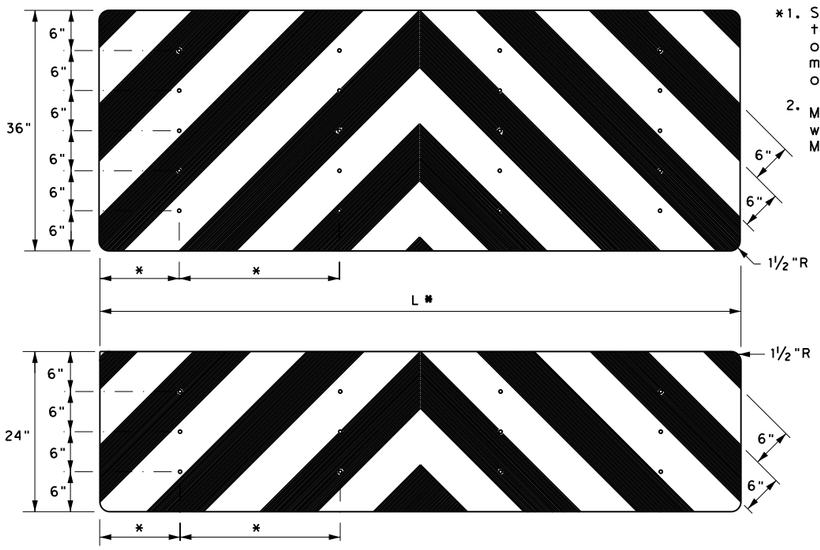



OBJECT MARKERS SMALLER THAN 3 FT$^2$








## NOTES

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

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

## NOTES

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

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

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

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

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

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

Texas Department of Transportation

Traffic Safety Division Standard

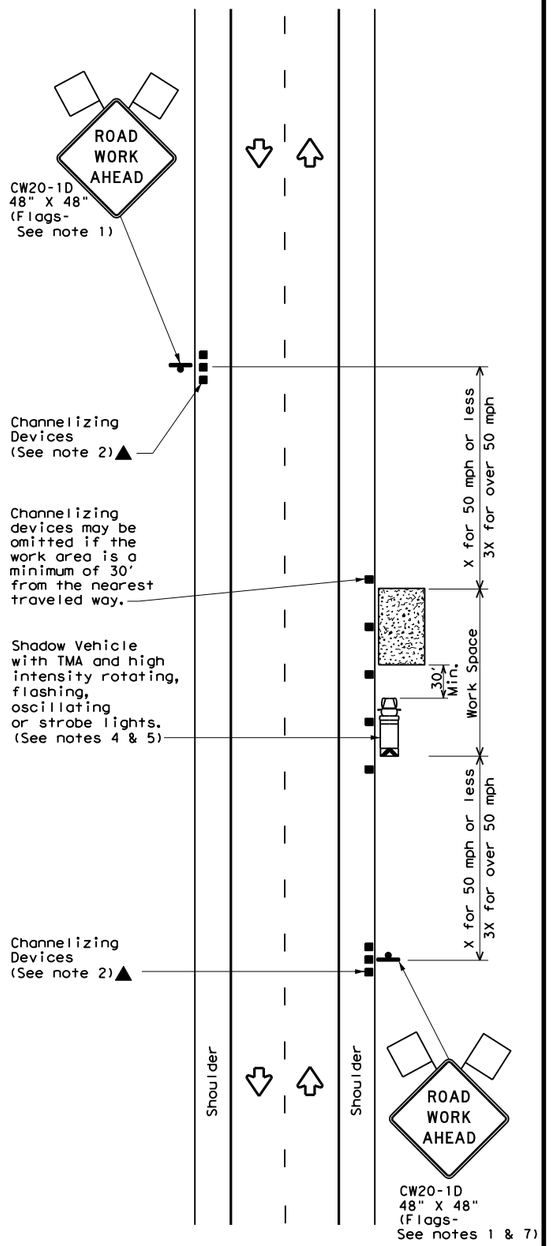
# DELINEATOR & OBJECT MARKER FOR VEHICLE IMPACT ATTENUATORS

# D & OM(VIA)-20

| FILE: domvia20.dgn | DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|---|
| © TxDOT December 1989 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| 4-92 8-04 | DIST | COUNTY | | SHEET NO. |
| 8-95 3-15 | 22 | VAR | | 29 |
| 4-98 7-20 | | | | |

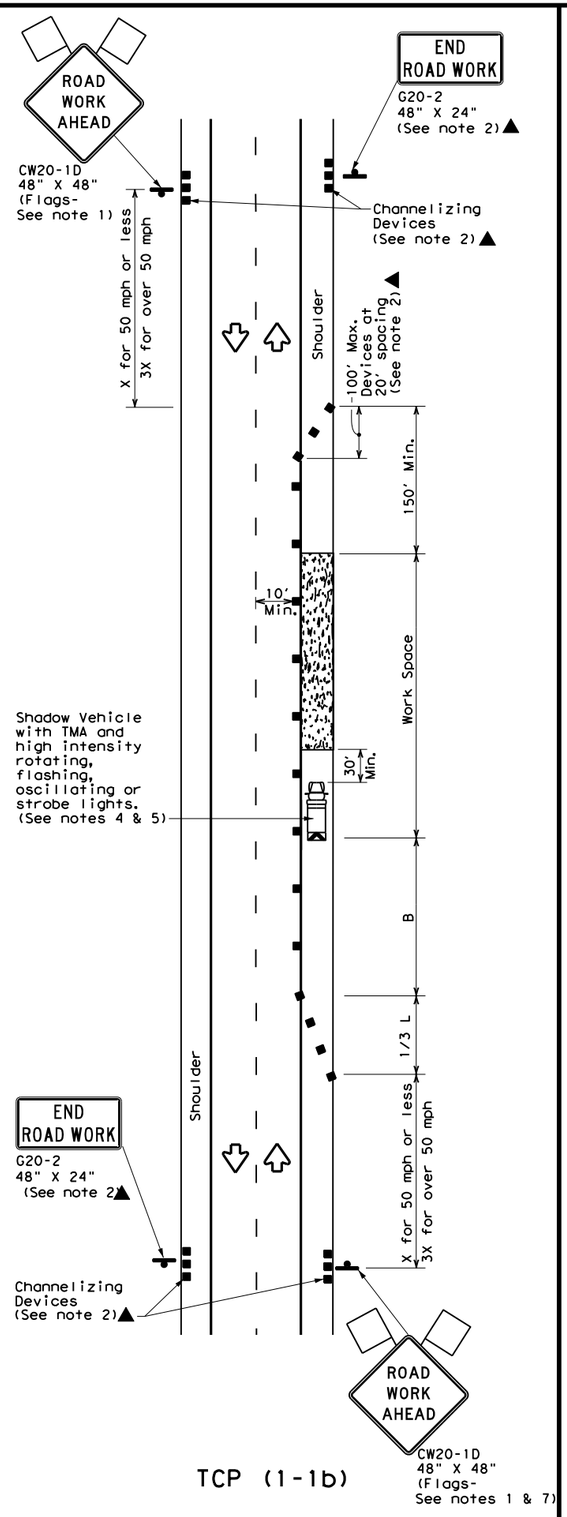
20G

DATE: _03/20/23_ _11:30_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties



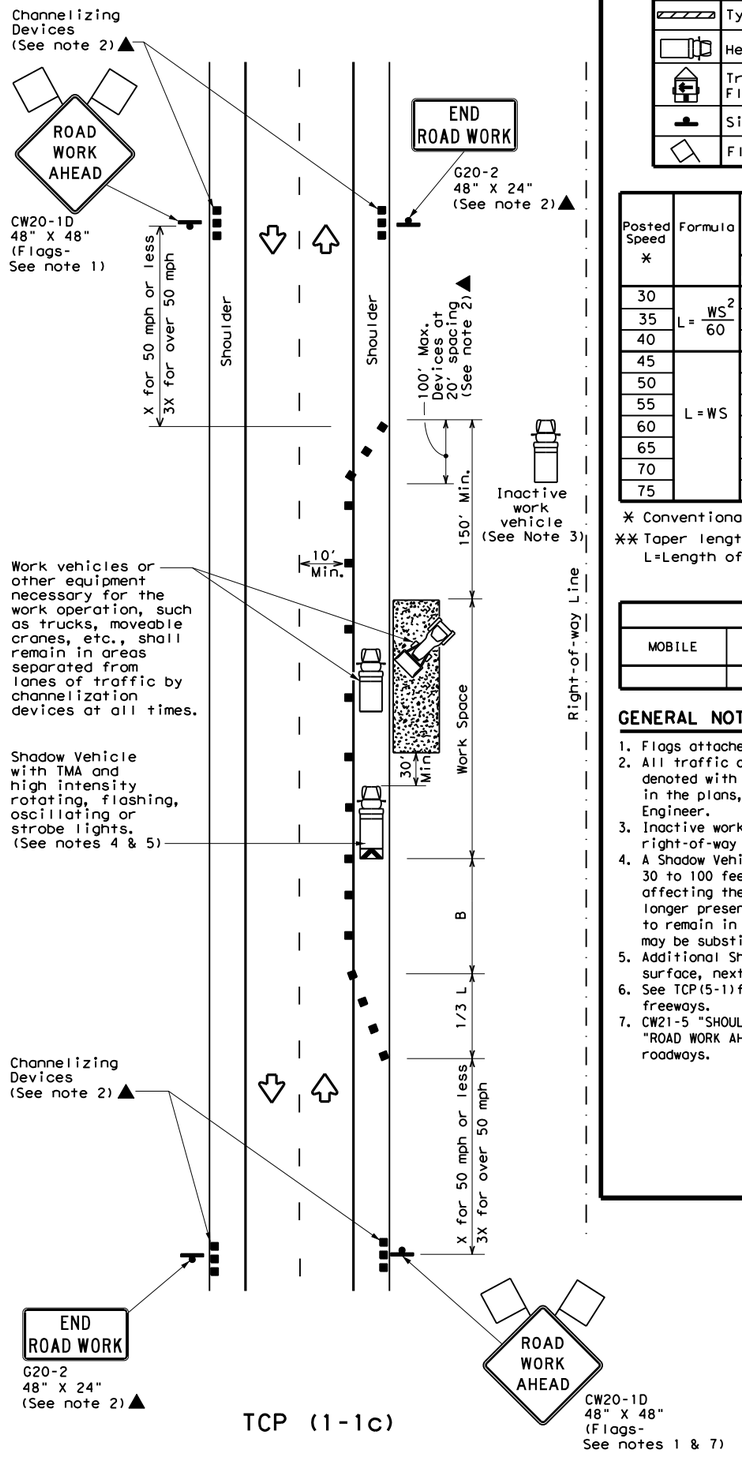

TCP (1-1a)

## WORK SPACE NEAR SHOULDER
Conventional Roads




TCP (1-1b)

## WORK SPACE ON SHOULDER
Conventional Roads




TCP (1-1c)

## WORK VEHICLES ON SHOULDER
Conventional Roads

| LEGEND | | | |
|---|---|---|---|
| | Type 3 Barricade | | Channelizing Devices |
| | Heavy Work Vehicle | | Truck Mounted Attenuator (TMA) |
| | Trailer Mounted Flashing Arrow Board | M | Portable Changeable Message Sign (PCMS) |
| | Sign | | Traffic Flow |
| | Flag | | Flagger |

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

* Conventional Roads Only

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

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

## GENERAL NOTES

1. Flags attached to signs where shown are REQUIRED.
2. All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated elsewhere in the plans, or for routine maintenance work, when approved by the Engineer.
3. Inactive work vehicles or other equipment should be parked near the right-of-way line and not parked on the paved shoulder.
4. A Shadow Vehicle with a TMA should be used anytime it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the performance or quality of the work. If workers are no longer present but road or work conditions require the traffic control to remain in place, Type 3 Barricades or other channelizing devices may be substituted for the Shadow Vehicle and TMA.
5. Additional Shadow Vehicles with TMAs may be positioned off the paved surface, next to those shown in order to protect wider work spaces.
6. See TCP(5-1)for shoulder work on divided highways, expressways and freeways.
7. CW21-5 "SHOULDER WORK" signs may be used in place of CW20-1D "ROAD WORK AHEAD" signs for shoulder work on conventional roadways.

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Traffic Operations Division Standard

# TRAFFIC CONTROL PLAN CONVENTIONAL ROAD SHOULDER WORK

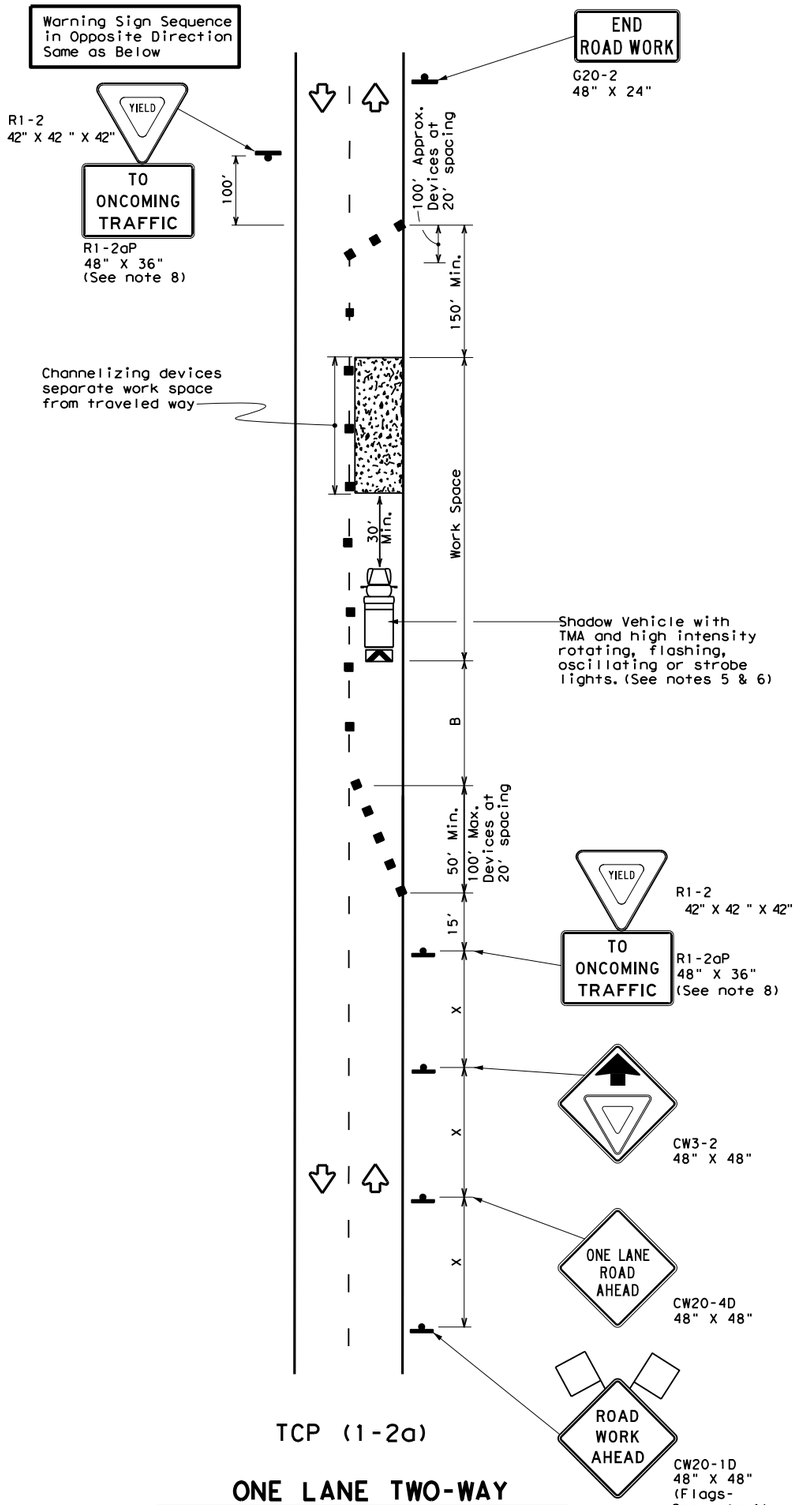
# TCP(1-1)-18

| FILE: tcp1-1-18.dgn | DN: | CK: | DW: | CK: |
|---|---|---|---|---|
| ©TxDOT December 1985 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS 2-94 4-98 | 6439 | 16 | 001 | VAR |
| 8-95 2-12 | DIST | COUNTY | | SHEET NO. |
| 1-97 2-18 | 22 | VAR | | 30 |

151

DATE: _03/20/23_ _11:30_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties

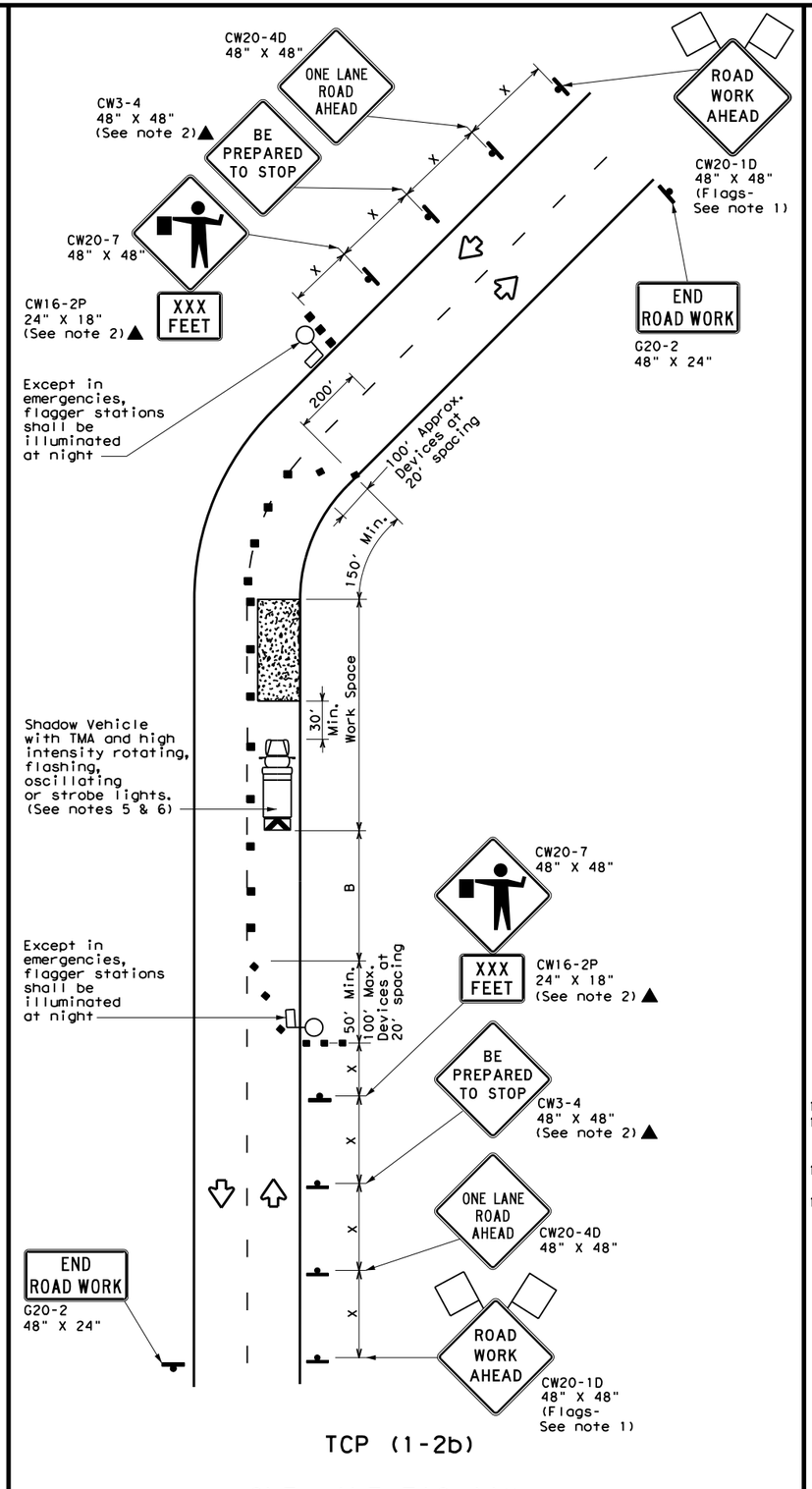
DATE: _03/20/23_ _11:30_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties




TCP (1-2a)

## ONE LANE TWO-WAY CONTROL WITH YIELD SIGNS

(Less than 2000 ADT - See note 7)




TCP (1-2b)

## ONE LANE TWO-WAY CONTROL WITH FLAGGERS

### LEGEND

| | | | |
|---|---|---|---|
| | Type 3 Barricade | | Channelizing Devices |
| | Heavy Work Vehicle | | Truck Mounted Attenuator (TMA) |
| | Trailer Mounted Flashing Arrow Board | M | Portable Changeable Message Sign (PCMS) |
| | Sign | | Traffic Flow |
| | Flag | | Flagger |

| Posted Speed * | Formula | Minimum Desirable Taper Lengths ** 10' Offset | 11' Offset | 12' Offset | Suggested Maximum Spacing of Channelizing Devices: On a Taper | On a Tangent | Minimum Sign Spacing "X" Distance | Suggested Longitudinal Buffer Space "B" | Stopping Sight Distance |
|---|---|---|---|---|---|---|---|---|---|
| 30 | $L = \frac{WS^2}{60}$ | 150' | 165' | 180' | 30' | 60' | 120' | 90' | 200' |
| 35 | | 205' | 225' | 245' | 35' | 70' | 160' | 120' | 250' |
| 40 | | 265' | 295' | 320' | 40' | 80' | 240' | 155' | 305' |
| 45 | L = WS | 450' | 495' | 540' | 45' | 90' | 320' | 195' | 360' |
| 50 | | 500' | 550' | 600' | 50' | 100' | 400' | 240' | 425' |
| 55 | | 550' | 605' | 660' | 55' | 110' | 500' | 295' | 495' |
| 60 | | 600' | 660' | 720' | 60' | 120' | 600' | 350' | 570' |
| 65 | | 650' | 715' | 780' | 65' | 130' | 700' | 410' | 645' |
| 70 | | 700' | 770' | 840' | 70' | 140' | 800' | 475' | 730' |
| 75 | | 750' | 825' | 900' | 75' | 150' | 900' | 540' | 820' |

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

### TYPICAL USAGE

| MOBILE | SHORT DURATION | SHORT TERM STATIONARY | INTERMEDIATE TERM STATIONARY | LONG TERM STATIONARY |
|---|---|---|---|---|
| | ✓ | ✓ | | |

### GENERAL NOTES

1. Flags attached to signs where shown are REQUIRED.
2. All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated elsewhere in the plans, or for routine maintenance work, when approved by the Engineer.
3. The CW3-4 "BE PREPARED TO STOP" sign may be installed after the CW20-4D "ONE LANE ROAD AHEAD" sign, but proper sign spacing shall be maintained.
4. Sign spacing may be increased or an additional CW20-1D "ROAD WORK AHEAD" sign may be used if advance warning ahead of the flagger or R1-2 "YIELD" sign is less than 1500 feet.
5. A Shadow Vehicle with a TMA should be used anytime it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the performance or quality of the work. If workers are no longer present but road or work conditions require the traffic control to remain in place, Type 3 Barricades or other channelizing devices may be substituted for the Shadow Vehicle and TMA.
6. Additional Shadow Vehicles with TMAs may be positioned off the paved surface, next to those shown in order to protect wider work spaces.

### TCP (1-2a)

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

### TCP (1-2b)

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

Texas Department of Transportation

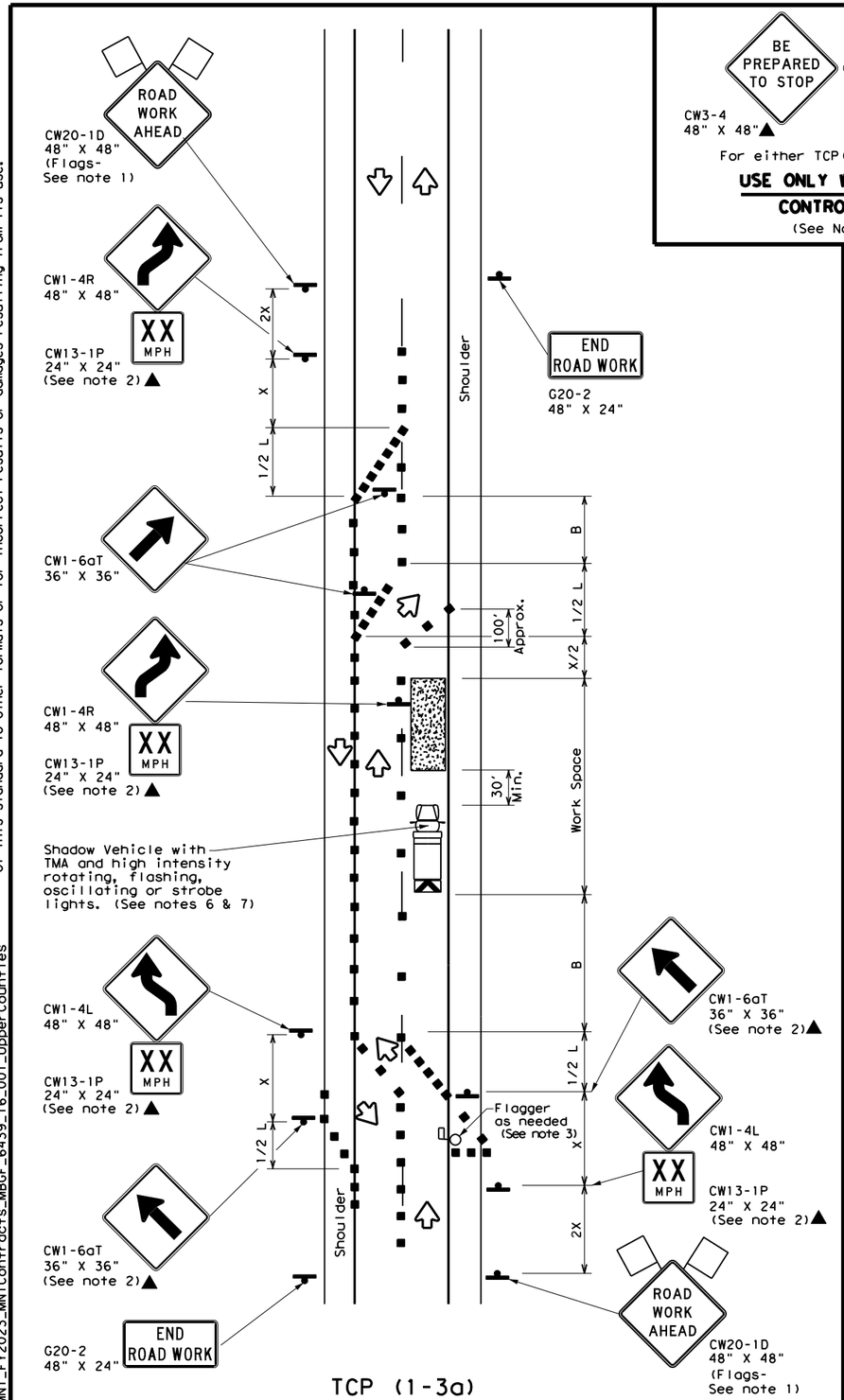
Traffic Operations Division Standard

# TRAFFIC CONTROL PLAN ONE-LANE TWO-WAY TRAFFIC CONTROL

# TCP(1-2)-18

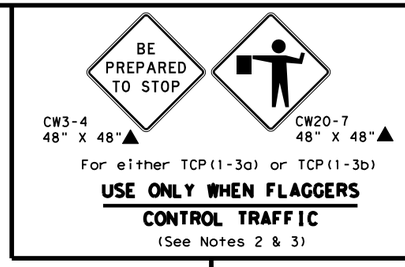
| FILE: tcp1-2-18.dgn | DN: | CK: | DW: | CK: |
|---|---|---|---|---|
| © TxDOT December 1985 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS 4-90 4-98 | 6439 | 16 | 001 | VAR |
| 2-94 2-12 | DIST | COUNTY | | SHEET NO. |
| 1-97 2-18 | 22 | VAR | | 31 |

DATE: 03/20/23 11:30
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties




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

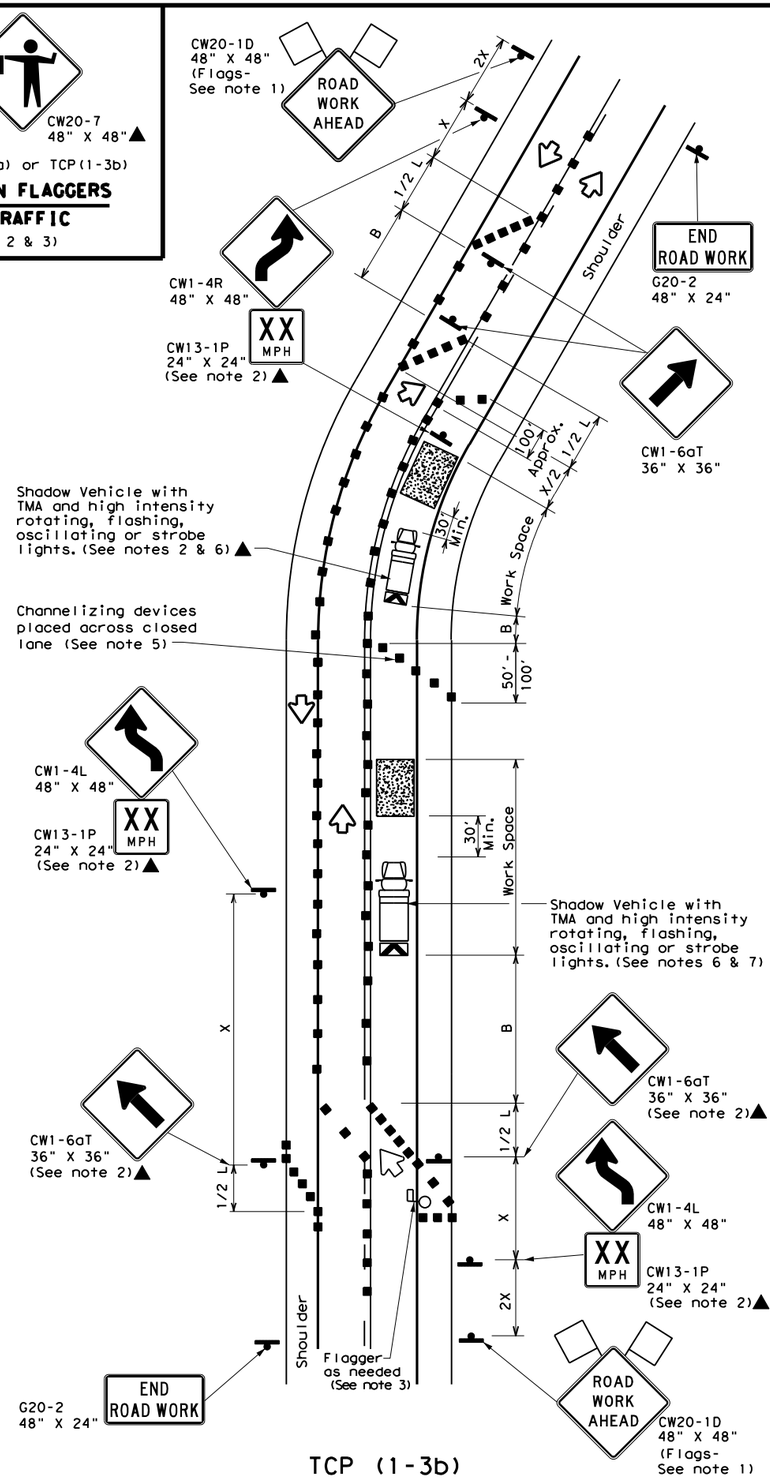
**ONE LANE CLOSED**
**ADEQUATE FIELD OF VIEW**




For either TCP(1-3a) or TCP(1-3b)

**USE ONLY WHEN FLAGGERS CONTROL TRAFFIC**

(See Notes 2 & 3)




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

**ONE LANE CLOSED**
**INADEQUATE FIELD OF VIEW**

| LEGEND | | | |
|---|---|---|---|
| | Type 3 Barricade | | Channelizing Devices |
| | Heavy Work Vehicle | | Truck Mounted Attenuator (TMA) |
| | Trailer Mounted Flashing Arrow Board | M | Portable Changeable Message Sign (PCMS) |
| | Sign | | Traffic Flow |
| | Flag | | Flagger |

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

* Conventional Roads Only

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

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

## GENERAL NOTES

1. Flags attached to signs where shown are REQUIRED.
2. All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated elsewhere in the plans, or for routine maintenance work, when approved by the Engineer.
3. Flagger control should NOT be used unless roadway conditions or heavy traffic volume require additional emphasis to safely control traffic. Additional flaggers may be positioned in advance of traffic queues to alert traffic to reduce speed.
4. DO NOT PASS, PASS WITH CARE and construction regulatory speed zone signs may be installed downstream of the ROAD WORK AHEAD signs.
5. When the work zone is made up of several work spaces, channelizing devices should be placed laterally across the closed lane to re-emphasize closure. Laterally placed channelizing devices should be repeated every 500 to 1000 feet in urban areas and every 1/4 to 1/2 mile in rural areas.
6. A Shadow Vehicle with a TMA should be used anytime it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the performance or quality of the work. If workers are no longer present but road or work conditions require the traffic control to remain in place, Type 3 Barricades or other channelizing devices may be substituted for the Shadow Vehicle and TMA.
7. Additional Shadow Vehicles with TMAs may be positioned off the paved surface, next to those shown in order to protect wider work spaces.
8. Where traffic is directed over a yellow centerline, channelizing devices which separate two-way traffic should be spaced on tapers at 20', or 15' if posted speed are 35 mph or slower, and for tangent sections, at 1/2S where S is the speed in mph. This tighter device spacing is intended for the area of conflicting markings not the entire work zone.

Texas Department of Transportation

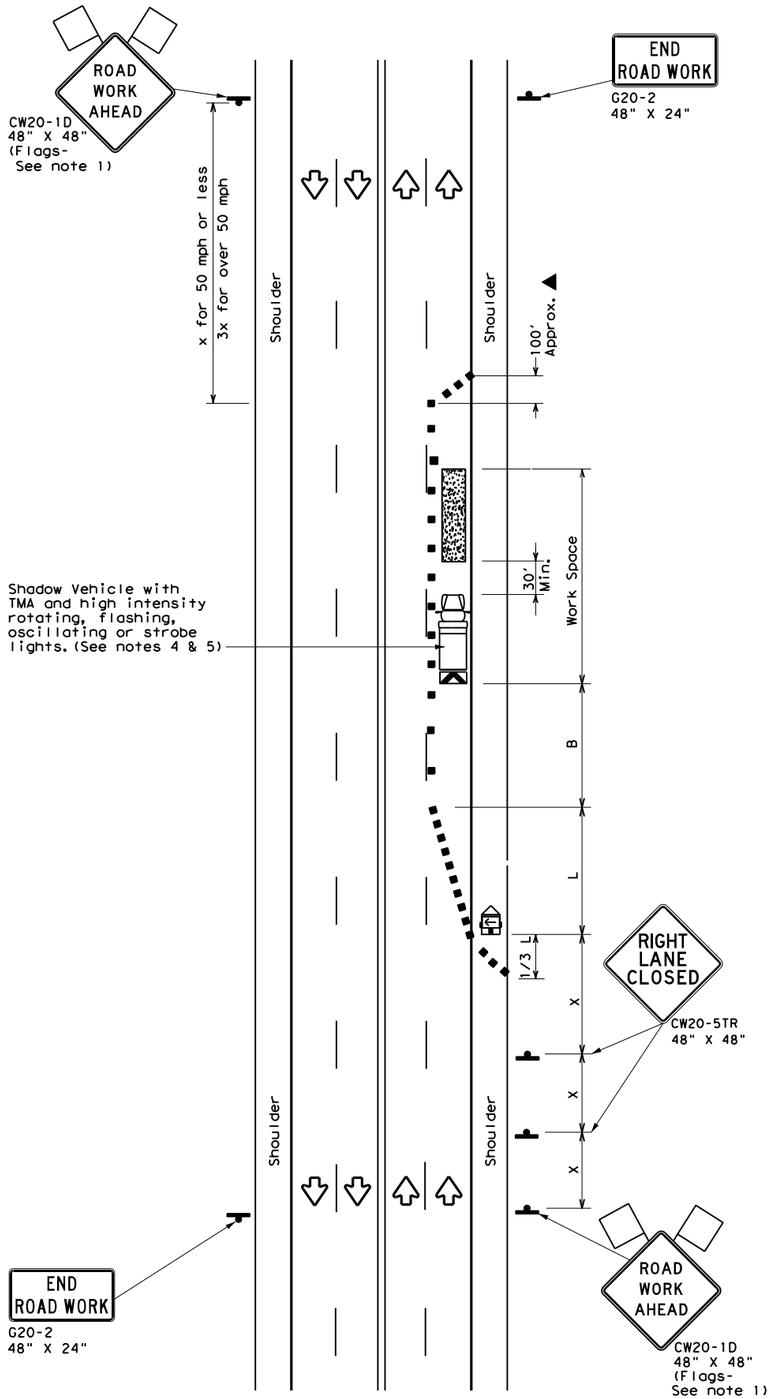
*Traffic Operations Division Standard*

# TRAFFIC CONTROL PLAN TRAFFIC SHIFTS ON TWO LANE ROADS

## TCP(1-3)-18

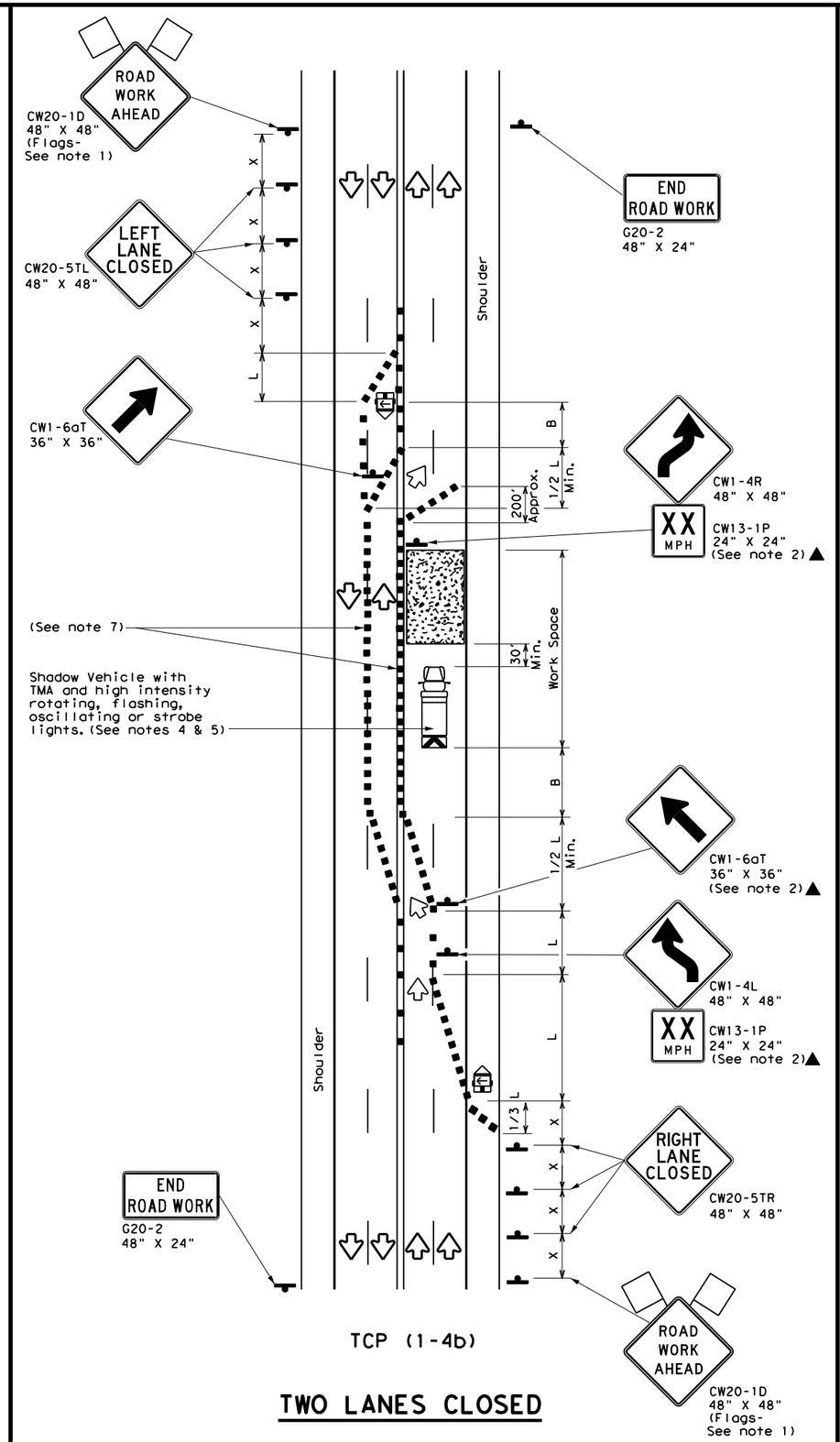
| FILE: tcp1-3-18.dgn | DN: | CK: | DW: | CK: |
|---|---|---|---|---|
| © TxDOT December 1985 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| 2-94 4-98 | DIST | COUNTY | | SHEET NO. |
| 8-95 2-12 | 22 | VAR | | 32 |
| 1-97 2-18 | | | | |

DATE: _03/20/23_ _11:30_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties_TCP1-4R




TCP (1-4a)

## ONE LANE CLOSED




TCP (1-4b)

## TWO LANES CLOSED

| LEGEND | | | |
|---|---|---|---|
| | Type 3 Barricade | | Channelizing Devices |
| | Heavy Work Vehicle | | Truck Mounted Attenuator (TMA) |
| | Trailer Mounted Flashing Arrow Board | M | Portable Changeable Message Sign (PCMS) |
| | Sign | | Traffic Flow |
| | Flag | | Flagger |

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

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

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

## GENERAL NOTES

1. Flags attached to signs where shown are REQUIRED.
2. All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated elsewhere in the plans, or for routine maintenance work, when approved by the Engineer.
3. The CW20-1D "ROAD WORK AHEAD" sign may be repeated if the visibility of the work zone is less than 1500 feet.
4. A Shadow Vehicle with a TMA should be used anytime it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the performance or quality of the work. If workers are no longer present but road or work conditions require the traffic control to remain in place, Type 3 Barricades or other channelizing devices may be substituted for the Shadow Vehicle and TMA.
5. Additional Shadow Vehicles with TMAs may be positioned off the paved surface, next to those shown in order to protect wider work spaces.

### TCP (1-4a)

6. If this TCP is used for a left lane closure , CW20-5TL "LEFT LANE CLOSED" signs shall be used and channelizing devices shall be placed on the centerline where needed to protect the work space from opposing traffic with the arrow panel placed in the closed lane near the end of the merging taper.

### TCP (1-4b)

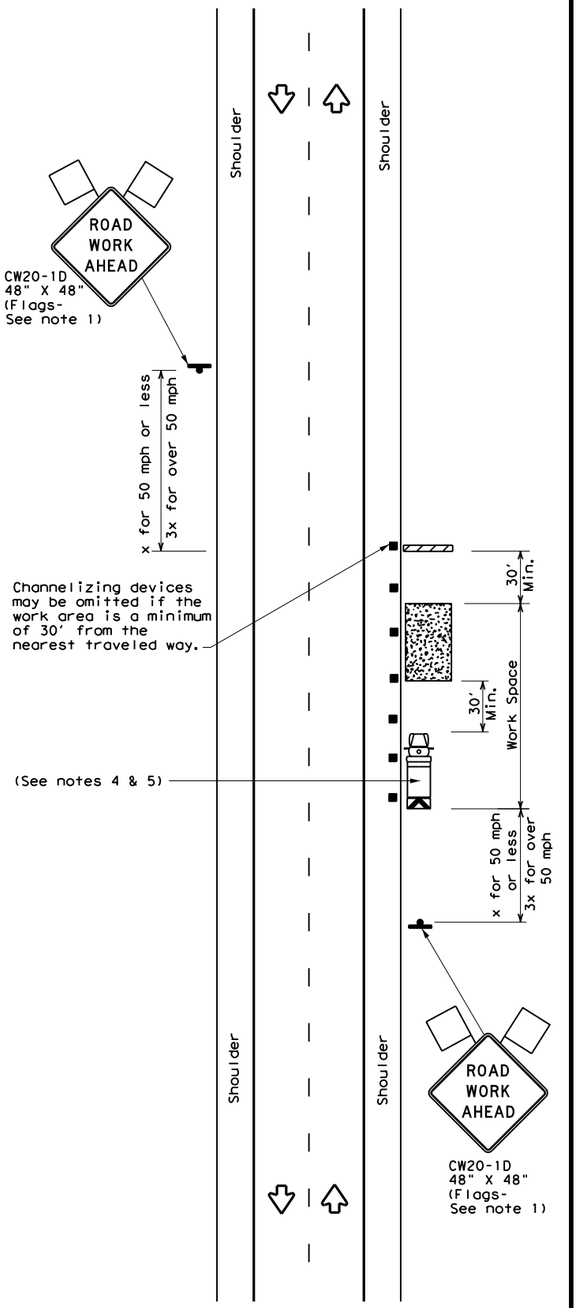
7. Where traffic is directed over a yellow centerline, channelizing devices which separate two-way traffic should be spaced on tapers at 20' or 15' if posted speeds are 35 mph or slower, and for tangent sections, at 1/2S where S is the speed in mph. This tighter device spacing is intended for the areas of conflicting markings, not the entire work zone.

Texas Department of Transportation — Traffic Operations Division Standard

# TRAFFIC CONTROL PLAN LANE CLOSURES ON MULTILANE CONVENTIONAL ROADS

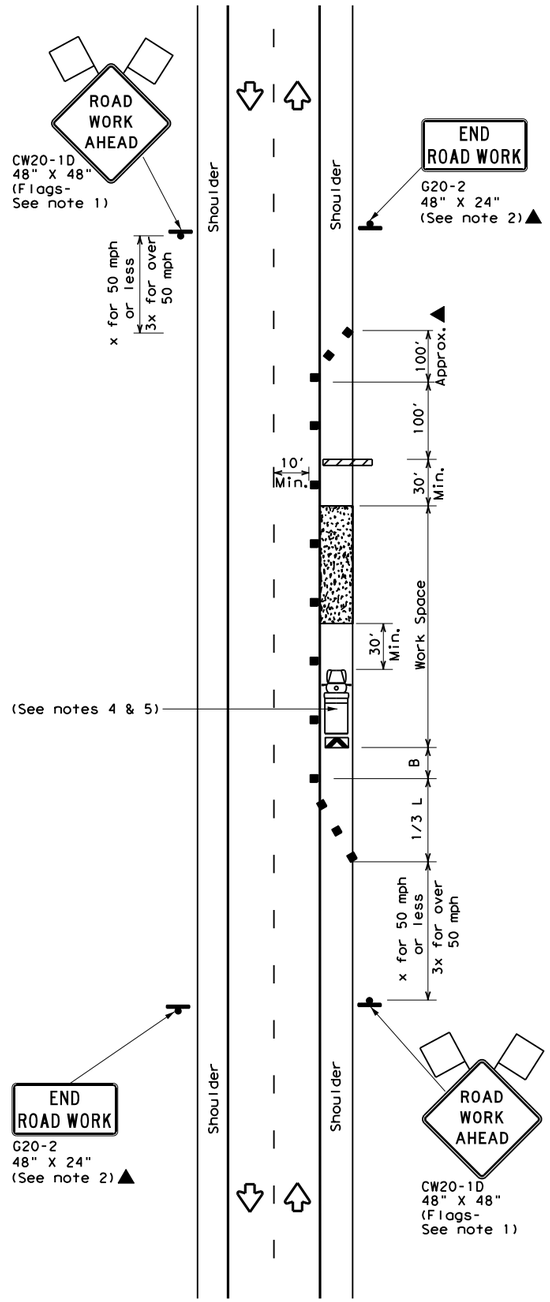
# TCP(1-4)-18

| FILE: tcp1-4-18.dgn | DN: | CK: | DW: | CK: |
|---|---|---|---|---|
| © TxDOT December 1985 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| 2-94 4-98 | DIST | COUNTY | | SHEET NO. |
| 8-95 2-12 | 22 | VAR | | 33 |
| 1-97 2-18 | | | | |



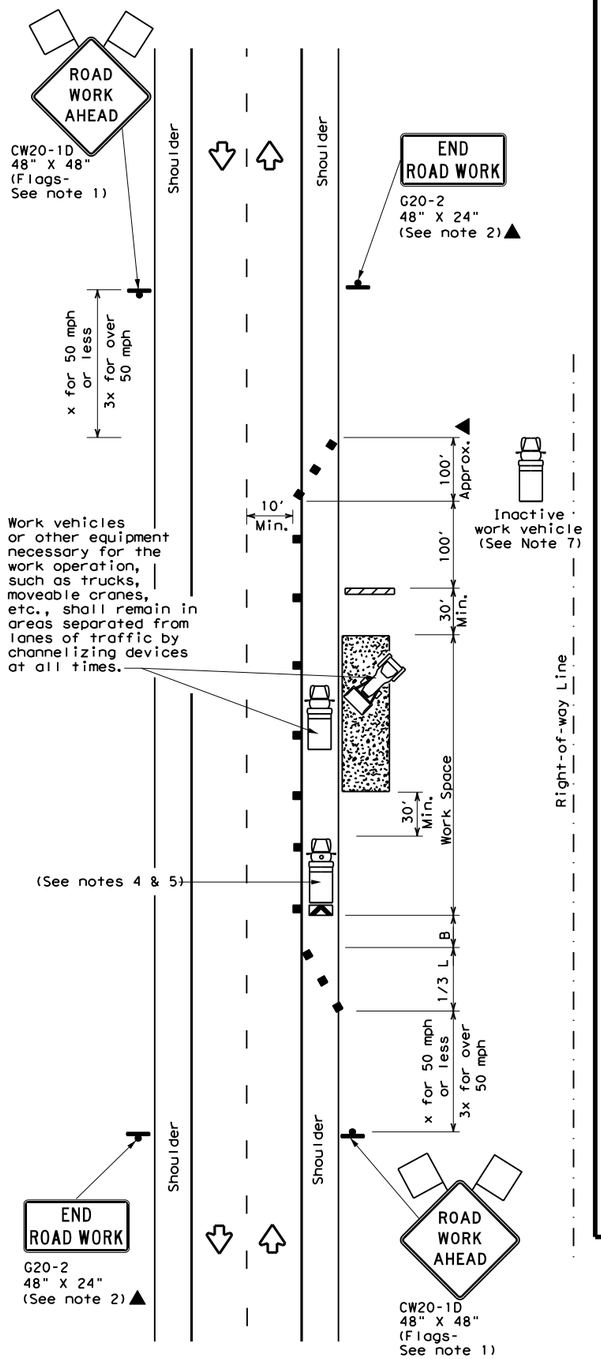

TCP (2-1a)

## WORK SPACE NEAR SHOULDER
Conventional Roads




TCP (2-1b)

## WORK SPACE ON SHOULDER
Conventional Roads




TCP (2-1c)

## WORK VEHICLES ON SHOULDER
Conventional Roads

| LEGEND | | | |
|---|---|---|---|
| | Type 3 Barricade | | Channelizing Devices |
| | Heavy Work Vehicle | | Truck Mounted Attenuator (TMA) |
| | Trailer Mounted Flashing Arrow Board | M | Portable Changeable Message Sign (PCMS) |
| | Sign | | Traffic Flow |
| | Flag | | Flagger |

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

* Conventional Roads Only

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

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

## GENERAL NOTES

1. Flags attached to signs where shown, are REQUIRED.
2. All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated in the plans, or for routine maintenance work, when approved by the Engineer.
3. Stockpiled material should be placed a minimum of 30 feet from nearest traveled way.
4. Shadow Vehicle with TMA and high intensity rotating, flashing, oscillating or strobe lights. A Shadow Vehicle with a TMA should be used anytime it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the performance or quality of the work. If workers are no longer present but road or work conditions require the traffic control to remain in place, Type 3 Barricades or other channelizing devices may be substituted for the Shadow Vehicle and TMA.
5. Additional Shadow Vehicles with TMAs may be positioned off the paved surface, next to those shown in order to protect a wider work space.
6. See TCP(5-1) for shoulder work on divided highways, expressways and freeways.
7. Inactive work vehicles or other equipment should be parked near the right-of-way line and not parked on the paved shoulder.
8. CW21-5 "SHOULDER WORK" signs may be used in place of CW20-1D "ROAD WORK AHEAD" signs for shoulder work on conventional roadways.

Texas Department of Transportation

Traffic Operations Division Standard

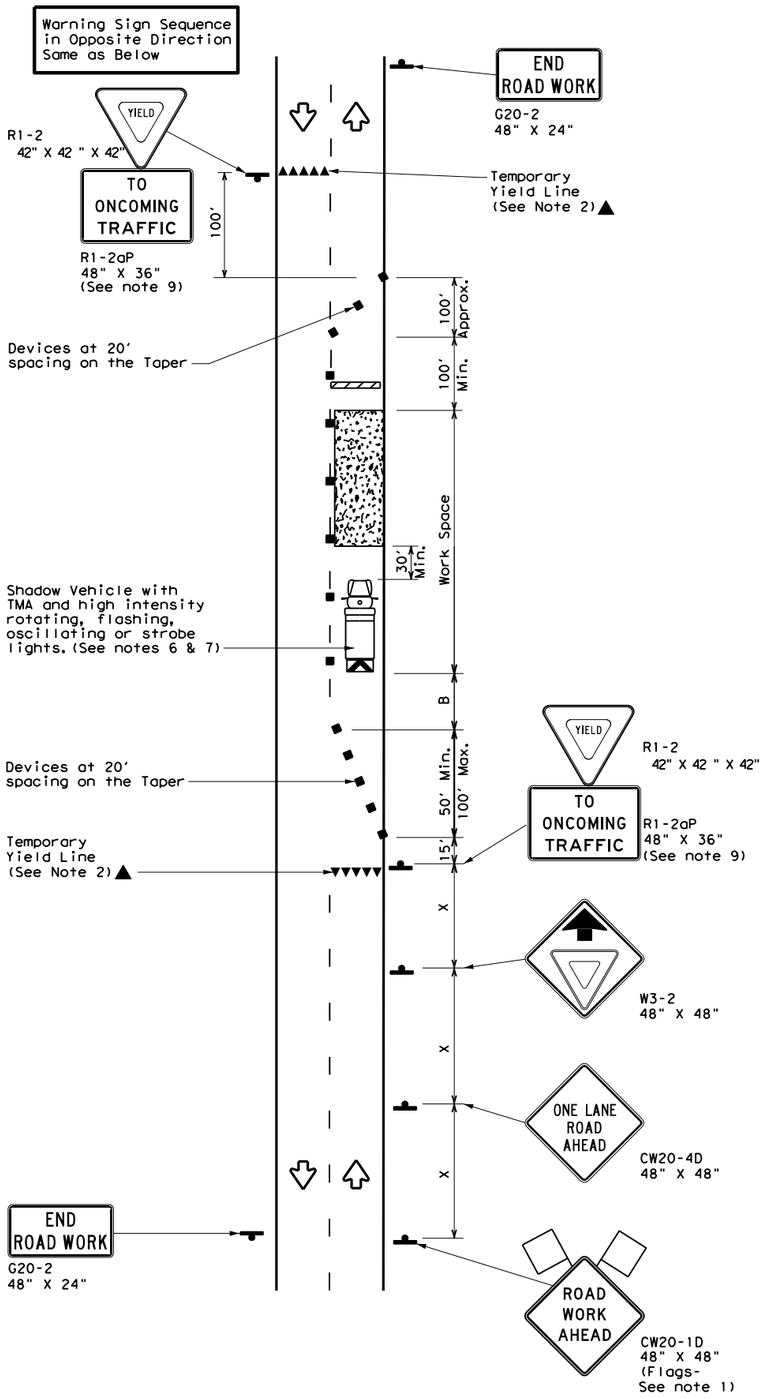
# TRAFFIC CONTROL PLAN CONVENTIONAL ROAD SHOULDER WORK

# TCP(2-1)-18

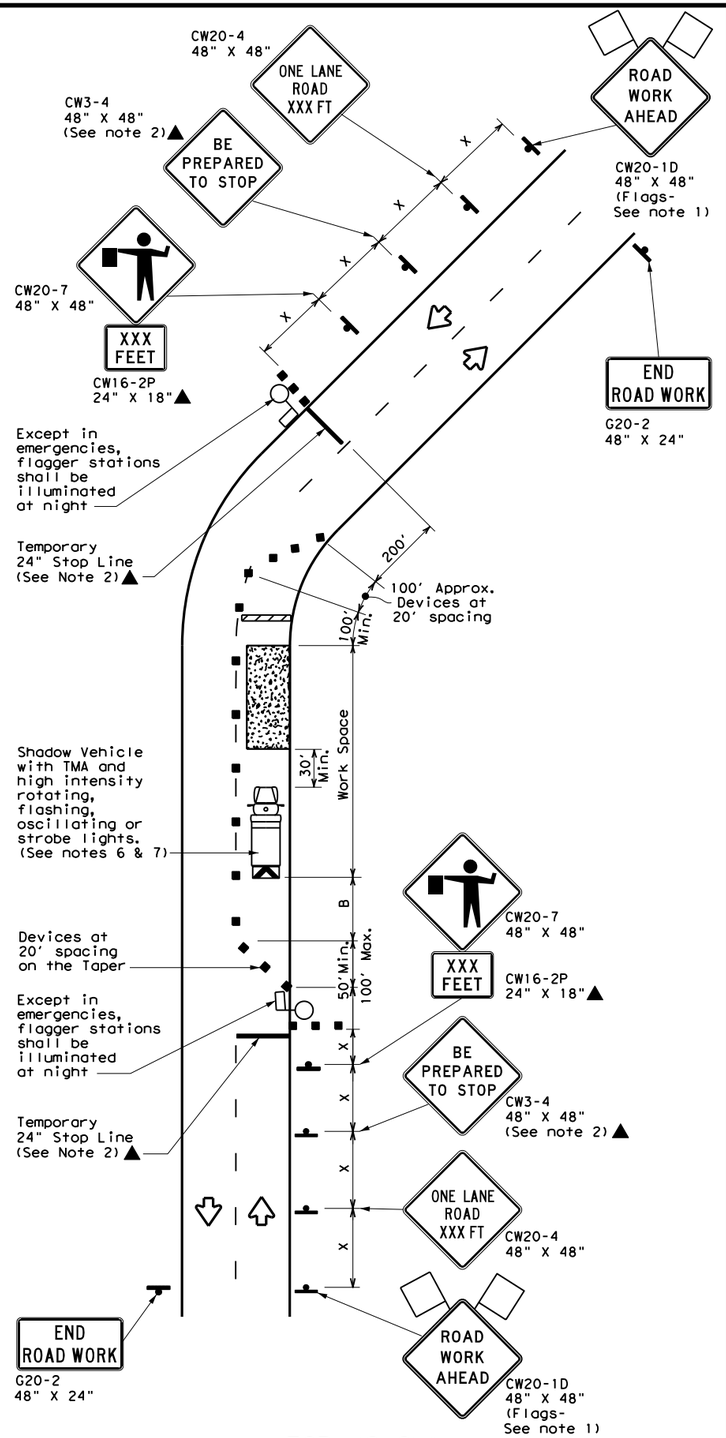
| FILE: tcp2-1-18.dgn | DN: | CK: | DW: | CK: |
|---|---|---|---|---|
| © TxDOT December 1985 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| 2-94 4-98 | DIST | COUNTY | | SHEET NO. |
| 8-95 2-12 | 22 | VAR | | 34 |
| 1-97 2-18 | | | | |



DATE: _03/20/23_ _11:30_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties




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




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

| LEGEND | | | |
|---|---|---|---|
| | Type 3 Barricade | | Channelizing Devices |
| | Heavy Work Vehicle | | Truck Mounted Attenuator (TMA) |
| | Trailer Mounted Flashing Arrow Board | M | Portable Changeable Message Sign (PCMS) |
| | Sign | | Traffic Flow |
| | Flag | | Flagger |

| Posted Speed * | Formula | Minimum Desirable Taper Lengths ** 10' Offset | 11' Offset | 12' Offset | Suggested Maximum Spacing of Channelizing Devices: On a Taper | On a Tangent | Minimum Sign Spacing "X" Distance | Suggested Longitudinal Buffer Space "B" | Stopping Sight Distance |
|---|---|---|---|---|---|---|---|---|---|
| 30 | $L=\frac{WS^2}{60}$ | 150' | 165' | 180' | 30' | 60' | 120' | 90' | 200' |
| 35 | | 205' | 225' | 245' | 35' | 70' | 160' | 120' | 250' |
| 40 | | 265' | 295' | 320' | 40' | 80' | 240' | 155' | 305' |
| 45 | L=WS | 450' | 495' | 540' | 45' | 90' | 320' | 195' | 360' |
| 50 | | 500' | 550' | 600' | 50' | 100' | 400' | 240' | 425' |
| 55 | | 550' | 605' | 660' | 55' | 110' | 500' | 295' | 495' |
| 60 | | 600' | 660' | 720' | 60' | 120' | 600' | 350' | 570' |
| 65 | | 650' | 715' | 780' | 65' | 130' | 700' | 410' | 645' |
| 70 | | 700' | 770' | 840' | 70' | 140' | 800' | 475' | 730' |
| 75 | | 750' | 825' | 900' | 75' | 150' | 900' | 540' | 820' |

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

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

## GENERAL NOTES

1. Flags attached to signs where shown, are REQUIRED.
2. All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated elsewhere in the plans, or for routine maintenance work, when approved by the Engineer.
3. The CW3-4 "BE PREPARED TO STOP" sign may be installed after the CW20-4 "ONE LANE ROAD XXX FT" sign, but proper sign spacing shall be maintained.
4. Flaggers should use two-way radios or other methods of communication to control traffic.
5. Length of work space should be based on the ability of flaggers to communicate.
6. A Shadow Vehicle with a TMA should be used anytime it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the performance or quality of the work. If workers are no longer present but road or work conditions require the traffic control to remain in place, Type 3 Barricades or other channelizing devices may be substituted for the Shadow Vehicle and TMA.
7. Additional Shadow Vehicles with TMAs may be positioned off the paved surface, next to those shown in order to protect a wider work space.

### TCP (2-2a)

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

### TCP (2-2b)

10. Channelizing devices on the center line may be omitted when a pilot car is leading traffic and approved by the Engineer.
11. If the work space is located near a horizontal or vertical curve, the buffer distances should be increased in order to maintain stopping sight distance to the flagger and a queue of stopped vehicles. (See table above).
12. Flaggers should use 24" STOP/SLOW paddles to control traffic. Flags should be limited to emergency situtations.

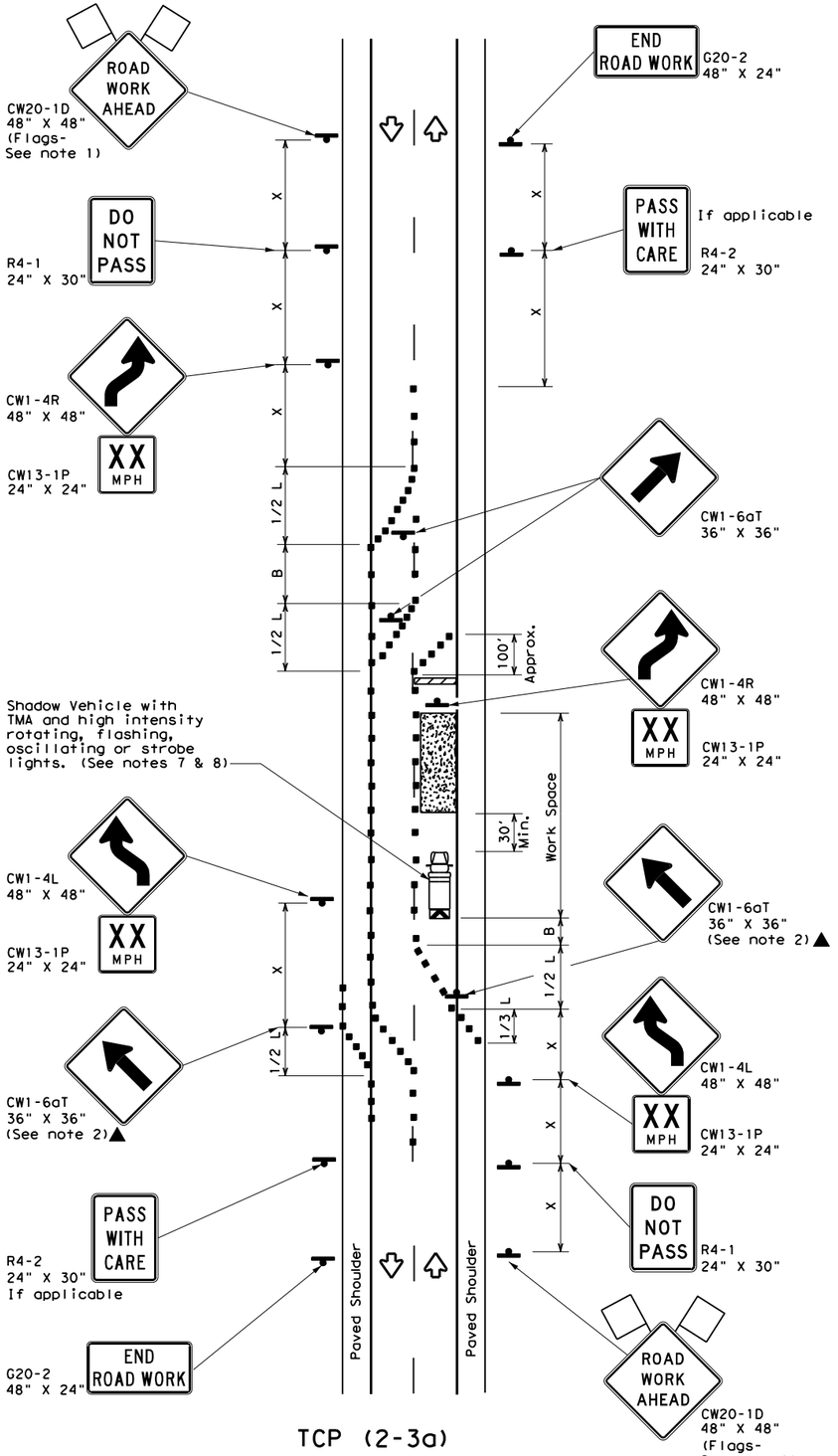
Texas Department of Transportation
*Traffic Operations Division Standard*

# TRAFFIC CONTROL PLAN
# ONE-LANE TWO-WAY
# TRAFFIC CONTROL

## TCP(2-2)-18

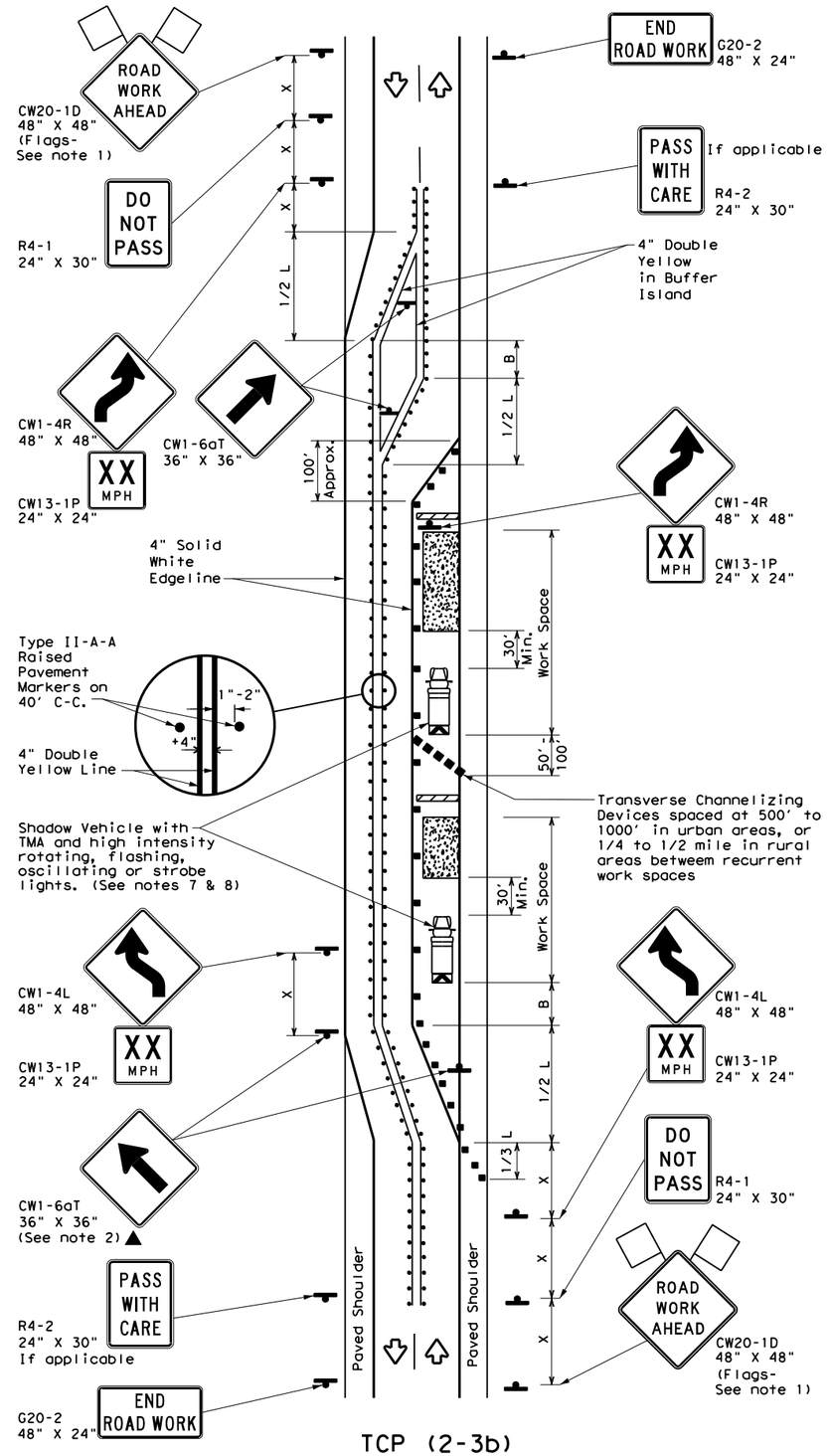
| FILE: tcp2-2-18.dgn | DN: | CK: | DW: | CK: |
|---|---|---|---|---|
| ©TxDOT December 1985 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| 8-95 3-03 | DIST | COUNTY | | SHEET NO. |
| 1-97 2-12 | 22 | VAR | | 35 |
| 4-98 2-18 | | | | |

DATE: _03/20/23_ _11:30_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBOF_6439_16_001_UpperCounties




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

**ONE LANE CLOSED**
**ADEQUATE FIELD OF VIEW**




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

**ONE LANE CLOSED**
**INADEQUATE FIELD OF VIEW**

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

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

* Conventional Roads Only

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

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

## GENERAL NOTES

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

## TCP (2-3a)

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

Texas Department of Transportation — Traffic Operations Division Standard

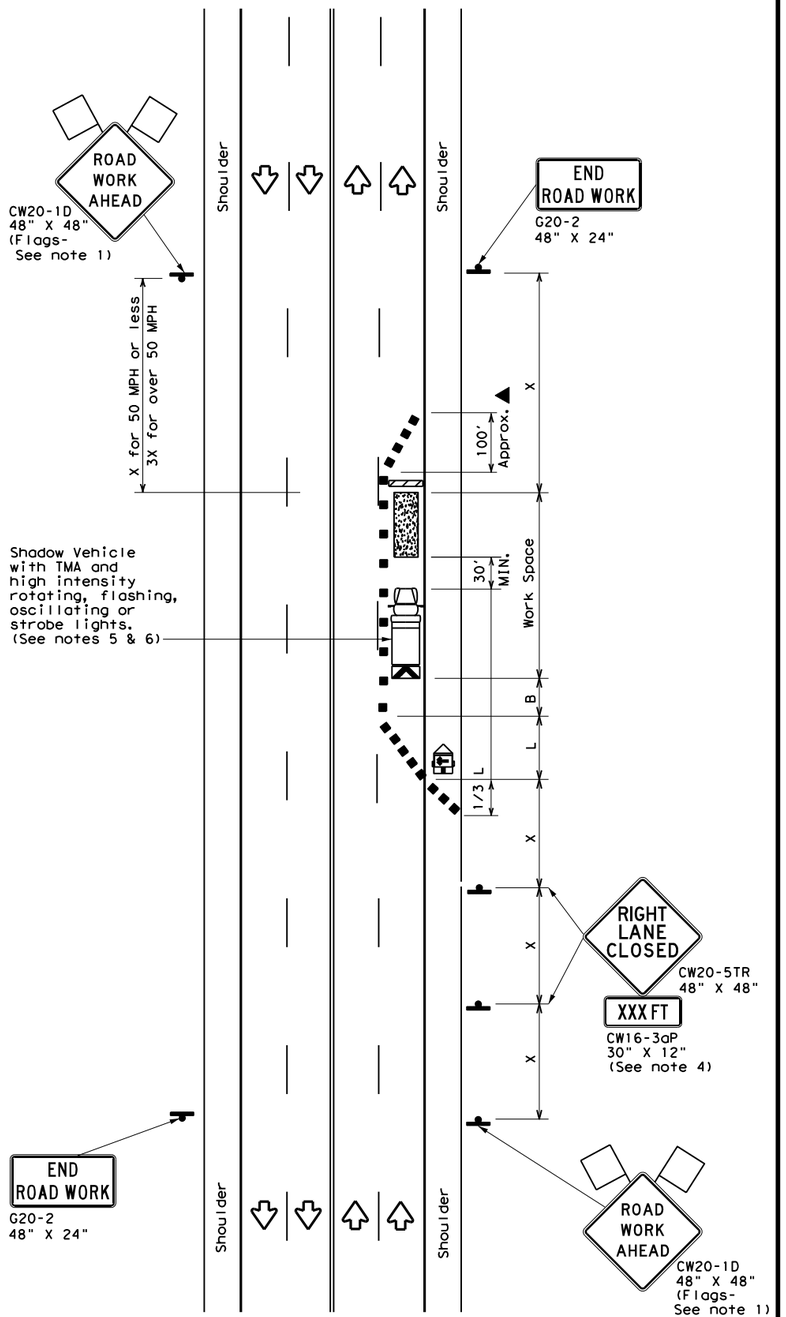
# TRAFFIC CONTROL PLAN TRAFFIC SHIFTS ON TWO-LANE ROADS

## TCP(2-3)-18

| FILE: tcp(2-3)-18.dgn | DN: | CK: | DW: | CK: |
|---|---|---|---|---|
| © TxDOT December 1985 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| 8-95 3-03 | DIST | COUNTY | | SHEET NO. |
| 1-97 2-12 | 22 | VAR | | 36 |
| 4-98 2-18 | | | | |

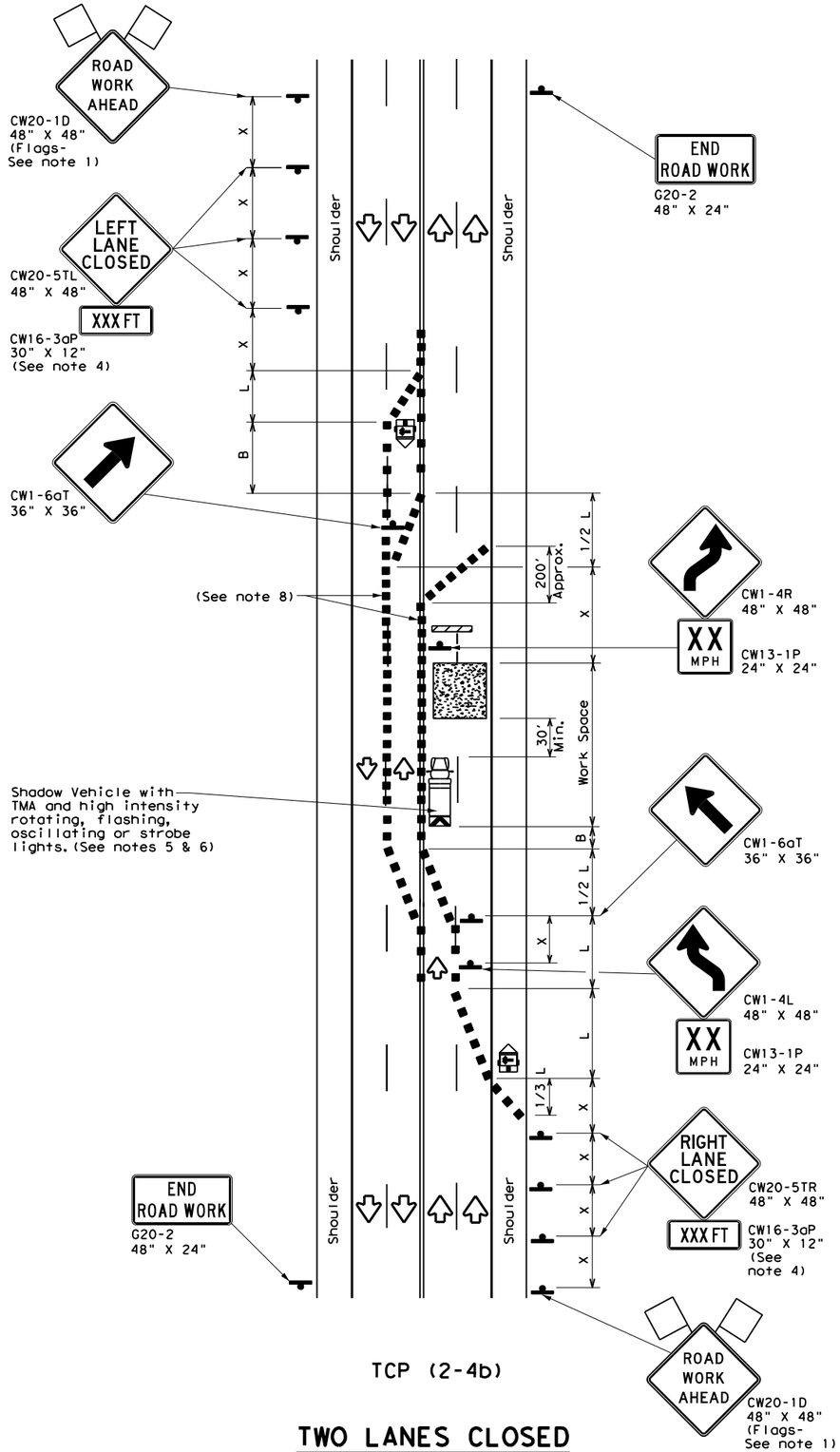


DATE: _03/20/23_ _11:30_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties




TCP (2-4a)

## ONE LANE CLOSED




TCP (2-4b)

## TWO LANES CLOSED

| LEGEND | | | |
|---|---|---|---|
| | Type 3 Barricade | | Channelizing Devices |
| | Heavy Work Vehicle | | Truck Mounted Attenuator (TMA) |
| | Trailer Mounted Flashing Arrow Board | M | Portable Changeable Message Sign (PCMS) |
| | Sign | | Traffic Flow |
| | Flag | | Flagger |

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

* Conventional Roads Only

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

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

## GENERAL NOTES

1. Flags attached to signs where shown, are REQUIRED.
2. All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated elsewhere in the plans, or for routine maintenance work, when approved by the Engineer.
3. The downstream taper is optional. When used, it should be 100 feet minimum length per lane.
4. For short term applications, when post mounted signs are not used, the distance legend may be shown on the sign face rather than on a CW16-3aP supplemental plaque.
5. A Shadow Vehicle with a TMA should be used anytime it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the performance or quality of the work. If workers are no longer present but road or work conditions require the traffic control to remain in place, Type 3 Barricades or other channelizing devices may be substituted for the Shadow Vehicle and TMA.
6. Additional Shadow Vehicles with TMAs may be positioned in each closed lane, on the shoulder or off the paved surface, next to those shown in order to protect a wider work space.

### TCP (2-4a)

7. If this TCP is used for a left lane closure, CW20-5TL "LEFT LANE CLOSED"signs shall be used and channelizing devices shall be placed on the centerline to protect the work space from opposing traffic with the arrow board placed in the closed lane near the end of the merging taper.

### TCP (2-4b)

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

Texas Department of Transportation | Traffic Operations Division Standard

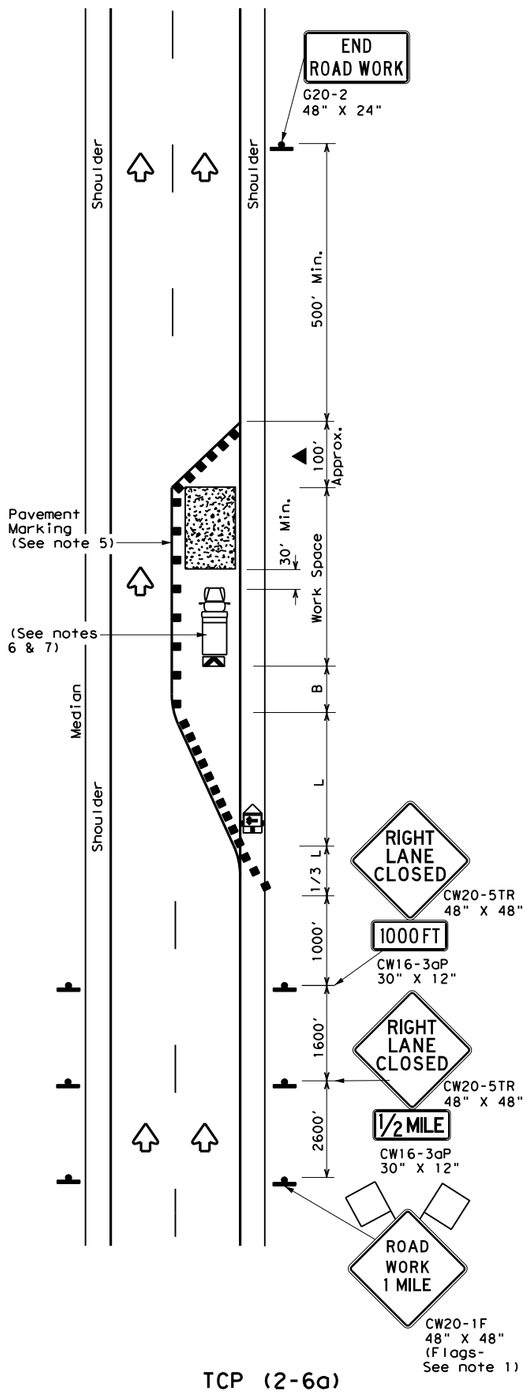
# TRAFFIC CONTROL PLAN LANE CLOSURES ON MULTILANE CONVENTIONAL ROADS

# TCP(2-4)-18

| FILE: tcp2-4-18.dgn | DN: | CK: | DW: | CK: |
|---|---|---|---|---|
| © TxDOT December 1985 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| 8-95 3-03 | DIST | COUNTY | | SHEET NO. |
| 1-97 2-12 | 22 | VAR | | 37 |
| 4-98 2-18 | | | | |

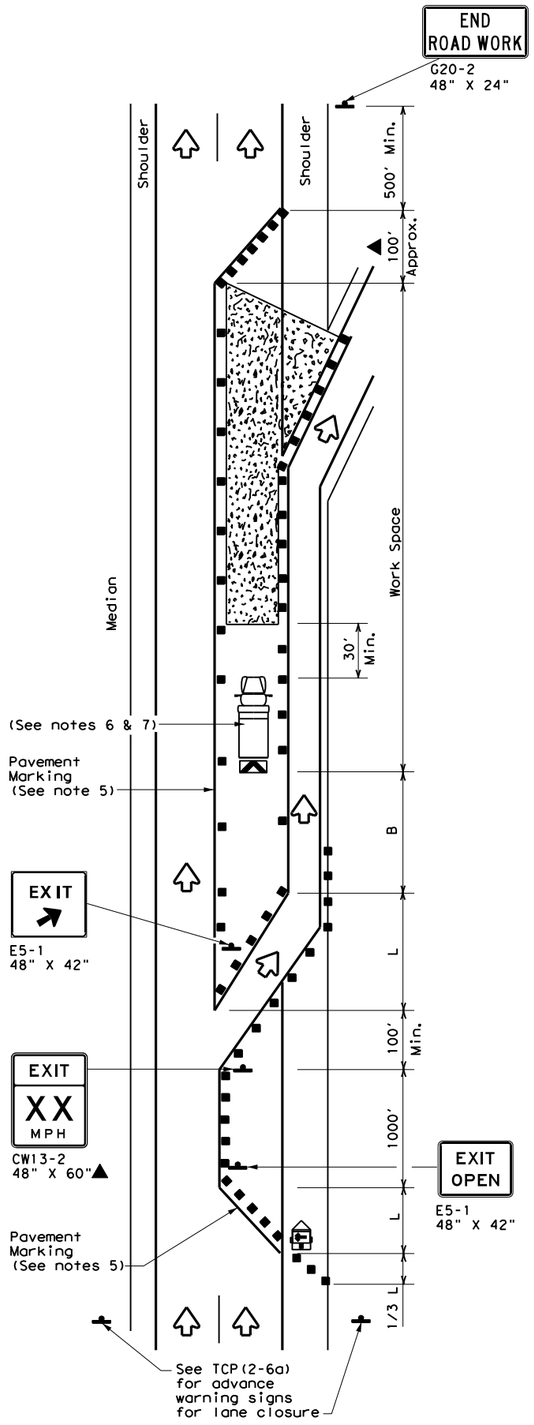


DATE: _03/20/23_ 11:30
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties



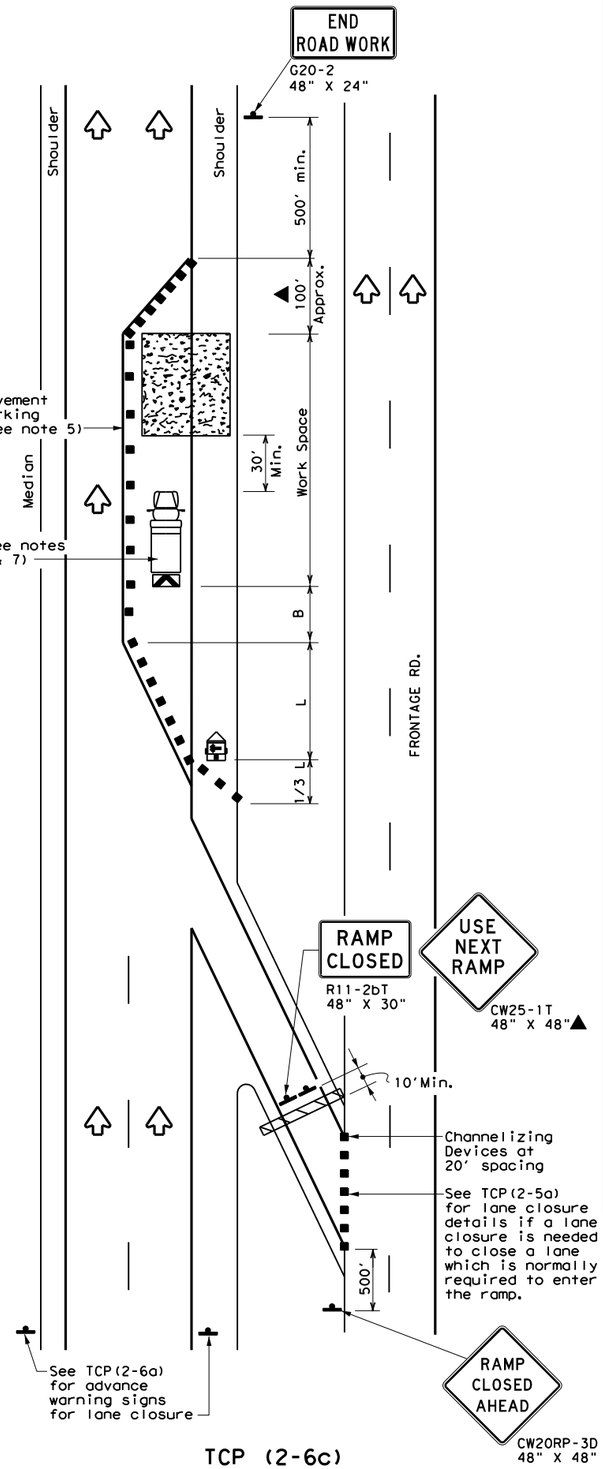

TCP (2-6a)

## ONE LANE CLOSURE




TCP (2-6b)

## LANE CLOSURE NEAR EXIT RAMPS




TCP (2-6c)

## LANE CLOSURE NEAR ENTRANCE RAMPS

| LEGEND | | | |
|---|---|---|---|
| | Type 3 Barricade | | Channelizing Devices |
| | Heavy Work Vehicle | | Truck Mounted Attenuator (TMA) |
| | Trailer Mounted Flashing Arrow Board | M | Portable Changeable Message Sign (PCMS) |
| | Sign | | Traffic Flow |
| | Flag | | Flagger |

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

* Conventional Roads Only

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

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

## GENERAL NOTES

1. Flags attached to signs where shown, are REQUIRED.
2. All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated elsewhere in the plans, or for routine maintenance work, when approved by the Engineer.
3. Channelizing devices used to close lanes may be supplemented with the Chevron Alignment Sign placed on every other channelizing device. Chevrons may be attached to plastic drums as per BC Standards.
4. Channelizing devices used along the work space or along tangent sections may be supplemented with vertical panels (VP) placed on everyother channelizing device. If night time conditions make it difficult to see at least two VPs, the VPs may be placed on each channelizing device.
5. The placement of pavement markings may be omitted on Intermediate-term stationary work zones with the approval of the Engineer.
6. Shadow Vehicle with TMA and high intensity rotating, flashing,oscillating or strobe lights. Shadow Vehicle with TMA and high intensity rotating, flashing, oscillating or strobe lights. A Shadow Vehicle with a TMA should be used anytime it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the performance or quality of the work. If workers are no longer present but road or work conditions require the traffic control to remain in place, Type 3 Barricades or other channelizing devices may be substituted for the Shadow Vehicle and TMA.
7. Additional Shadow Vehicles with TMAs may be positioned in each closed lane, on the shoulder or off the paved surface, next to those shown in order to protect a wider work space.

Texas Department of Transportation

*Traffic Operations Division Standard*

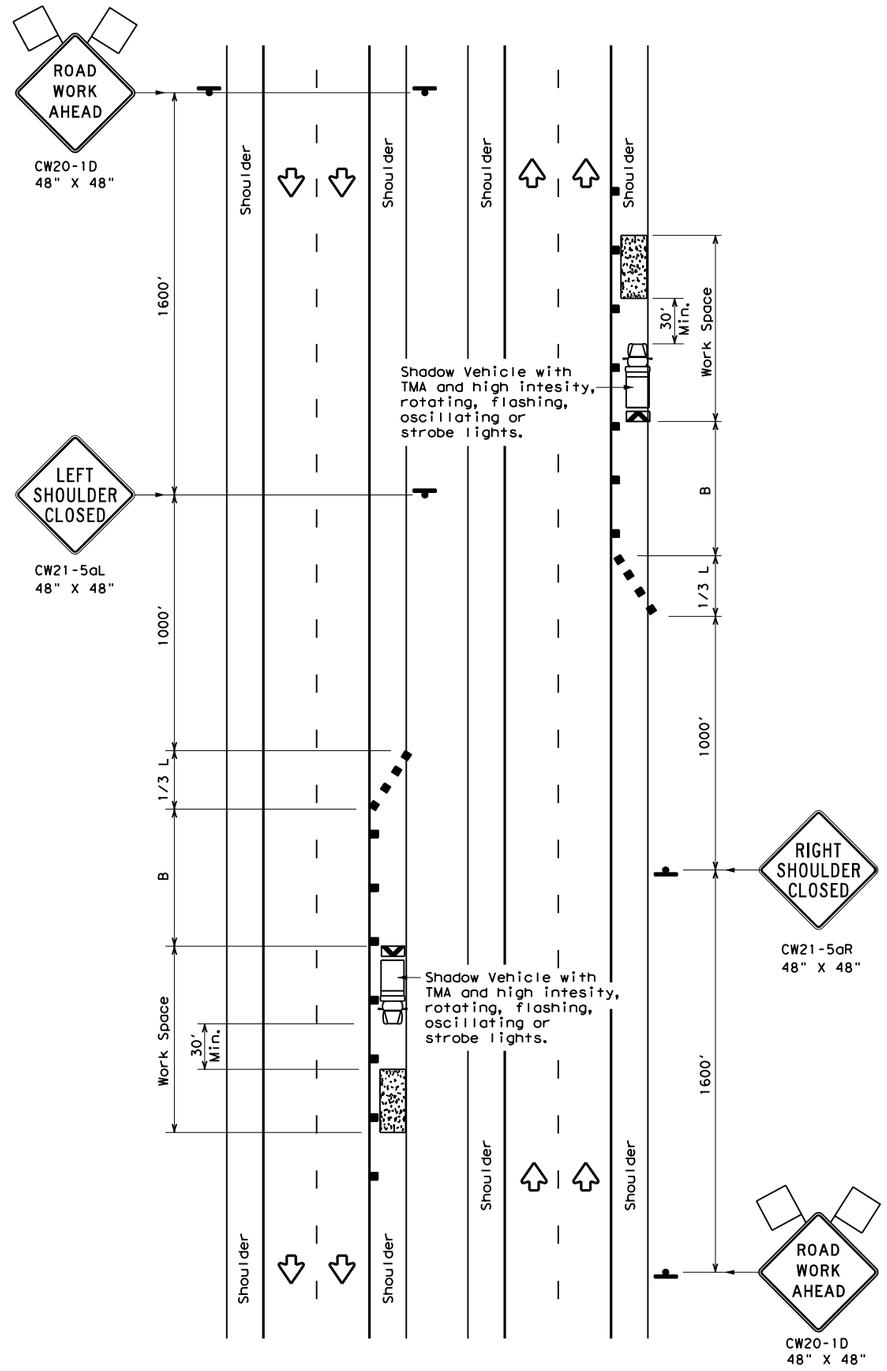
# TRAFFIC CONTROL PLAN LANE CLOSURES ON DIVIDED HIGHWAYS

# TCP(2-6)-18

| FILE: tcp2-6-18.dgn | DN: | CK: | DW: | CK: |
|---|---|---|---|---|
| © TxDOT December 1985 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| 2-94 4-98 | DIST | COUNTY | | SHEET NO. |
| 8-95 2-12 | 22 | VAR | | 38 |
| 1-97 2-18 | | | | |

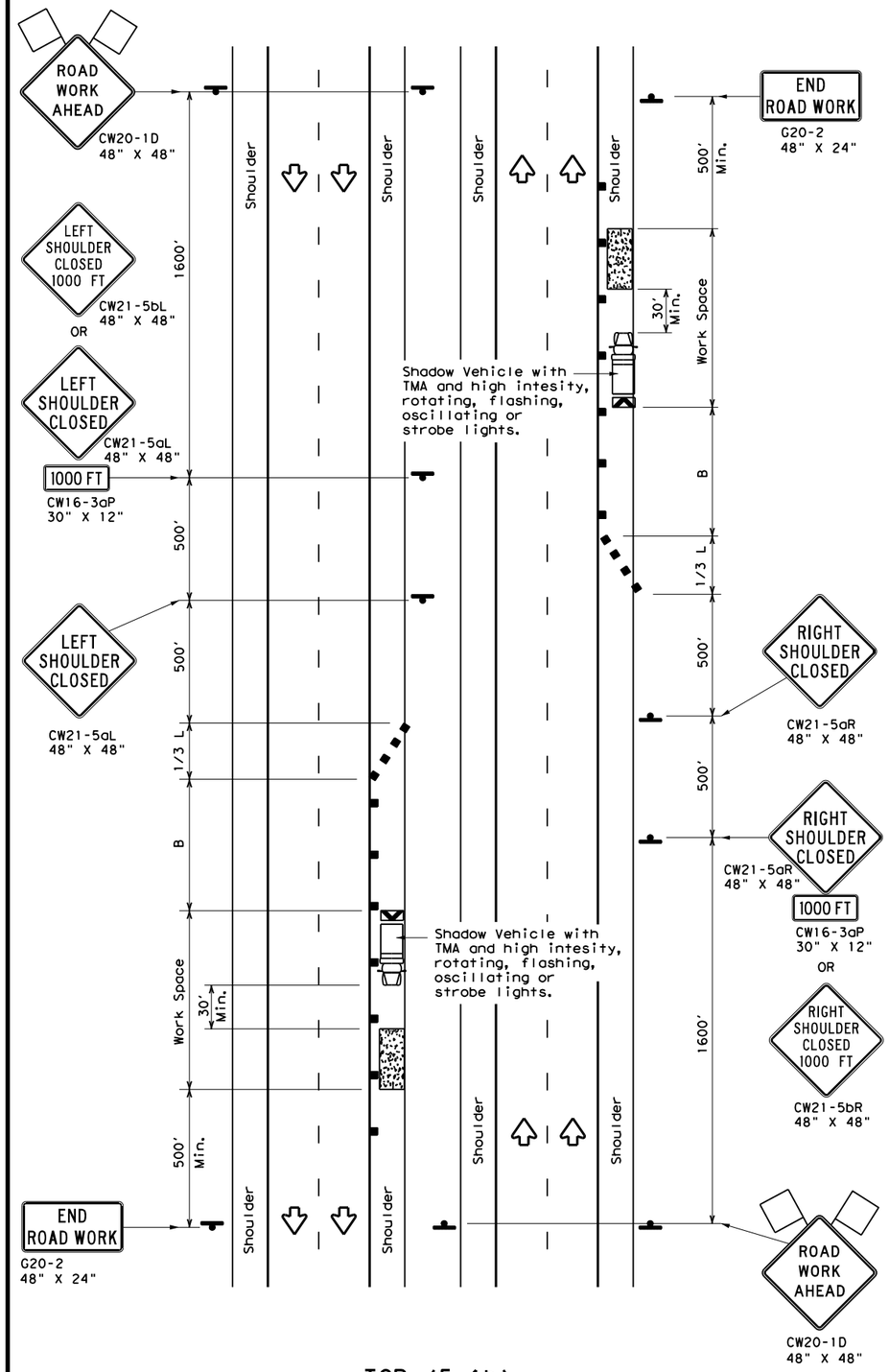


DATE: _03/20/23_ 11:30_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties




TCP (5-1a)

## WORK AREA ON SHOULDER




TCP (5-1b)

## WORK AREA ON SHOULDER

### LEGEND

| | | | |
|---|---|---|---|
| | Type 3 Barricade | | Channelizing Devices |
| | Heavy Work Vehicle | | Truck Mounted Attenuator (TMA) |
| | Trailer Mounted Flashing Arrow Board | M | Portable Changeable Message Sign (PCMS) |
| | Sign | | Traffic Flow |
| | Flag | | Flagger |

| Posted Speed * | Formula | Minimum Desirable Taper Lengths ** 10' Offset | 11' Offset | 12' Offset | Suggested Maximum Spacing of Channelizing Devices On a Taper | On a Tangent | Suggested Longitudinal Buffer Space "B" |
|---|---|---|---|---|---|---|---|
| 30 | $L=\frac{WS^2}{60}$ | 150' | 165' | 180' | 30' | 60' | 90' |
| 35 | | 205' | 225' | 245' | 35' | 70' | 120' |
| 40 | | 265' | 295' | 320' | 40' | 80' | 155' |
| 45 | L=WS | 450' | 495' | 540' | 45' | 90' | 195' |
| 50 | | 500' | 550' | 600' | 50' | 100' | 240' |
| 55 | | 550' | 605' | 660' | 55' | 110' | 295' |
| 60 | | 600' | 660' | 720' | 60' | 120' | 350' |
| 65 | | 650' | 715' | 780' | 65' | 130' | 410' |
| 70 | | 700' | 770' | 840' | 70' | 140' | 475' |
| 75 | | 750' | 825' | 900' | 75' | 150' | 540' |
| 80 | | 800' | 880' | 960' | 80' | 160' | 615' |

* Conventional Roads Only

** Taper lengths have been rounded off.

L=Length of Taper(FT) W=Width of Offset(FT) S=Posted Speed(MPH)

### TYPICAL USAGE

| MOBILE | SHORT DURATION | SHORT TERM STATIONARY | INTERMEDIATE TERM STATIONARY | LONG TERM STATIONARY |
|---|---|---|---|---|
| | TCP(5-1a) | TCP(5-1b) | TCP(5-1b) | |

### GENERAL NOTES

1. A Shadow Vehicle with a TMA should be used anytime it can be positioned 30' to 100' in advance of the area of crew exposure without adversely effecting the performance or quality of the work. Type 3 barricades or drums may be substituted when workers on foot are no longer present when approved by the Engineer.
2. 28" tall or taller one-piece cones will be allowed only for Short Duration or Short Term stationary operations when workers are present to maintain the devices upright and in proper location. Intermediate Term stationary work areas should use Drums, Vertical Panels or 42" tall two-piece cones.

Texas Department of Transportation

Traffic Operations Division Standard

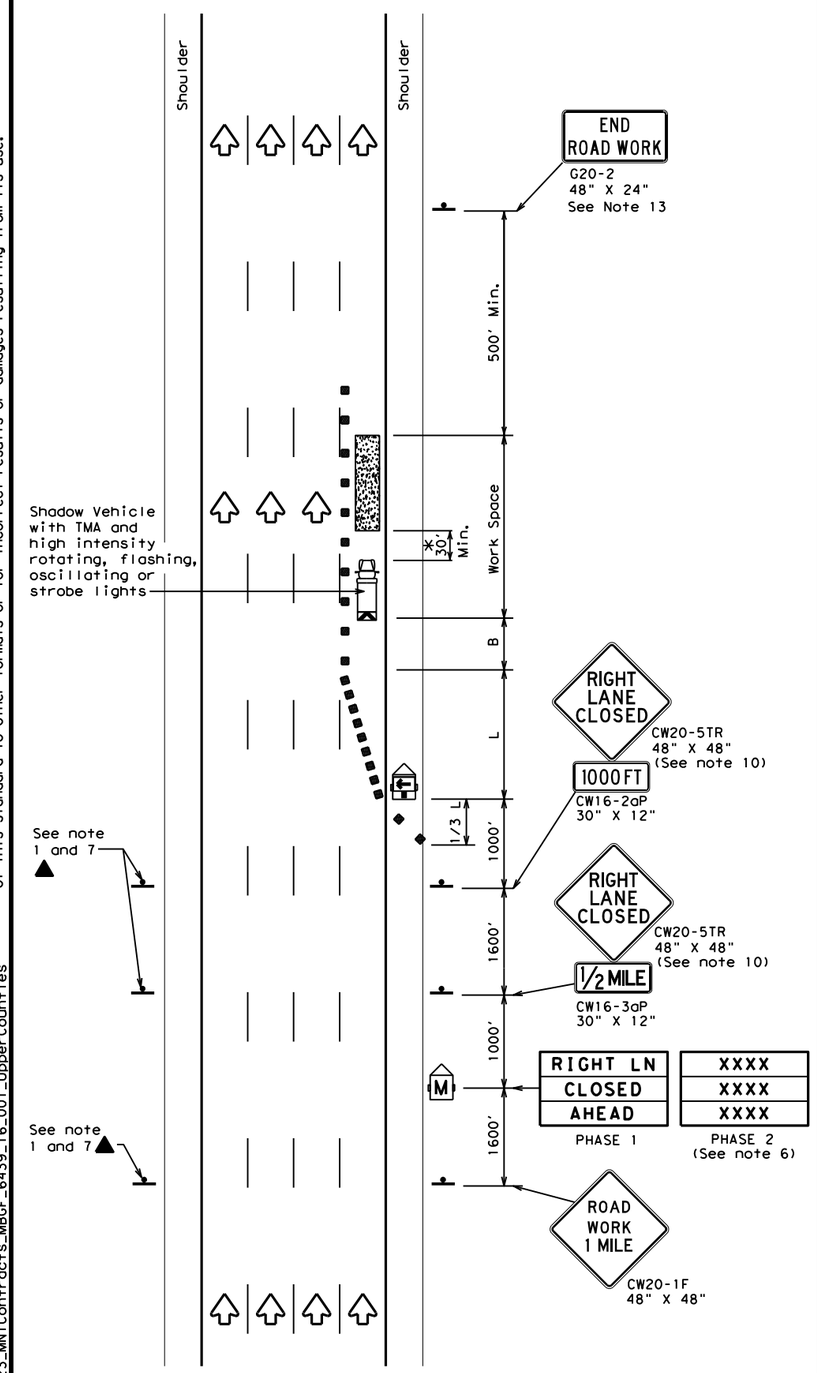
# TRAFFIC CONTROL PLAN SHOULDER WORK FOR FREEWAYS / EXPRESSWAYS

# TCP(5-1)-18

| FILE: tcp5-1-18.dgn | DN: | CK: | DW: | CK: |
|---|---|---|---|---|
| ©TxDOT February 2012 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS 2-18 | 6439 | 16 | 001 | VAR |
| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 39 |

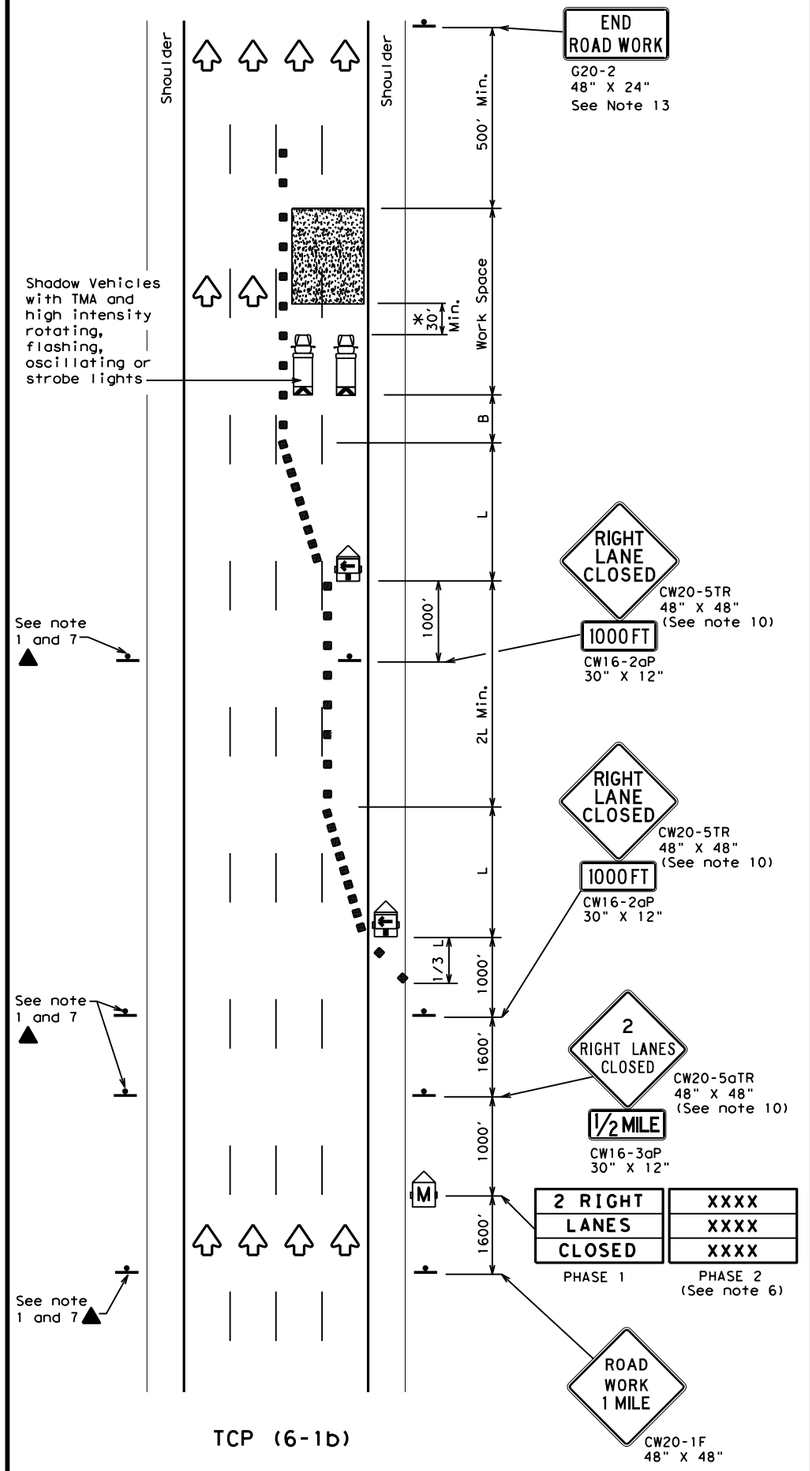


DATE: _03/20/23_ _11:30_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBOF_6439_16_001_UpperCounties




TCP (6-1a)

## TYPICAL FREEWAY ONE LANE CLOSURE




TCP (6-1b)

## TYPICAL FREEWAY TWO LANE CLOSURE

| LEGEND | | | |
|---|---|---|---|
| | Type 3 Barricade | | Channelizing Devices |
| | Heavy Work Vehicle | | Truck Mounted Attenuator (TMA) |
| | Trailer Mounted Flashing Arrow Board | M | Portable Changeable Message Sign (PCMS) |
| | Sign | | Traffic Flow |
| | Flag | | Flagger |

| Posted Speed | Formula | Minimum Desirable Taper Lengths "L" ** 10' Offset | 11' Offset | 12' Offset | Suggested Maximum Spacing of Channelizing Devices On a Taper | On a Tangent | Suggested Longitudinal Buffer Space "B" |
|---|---|---|---|---|---|---|---|
| 45 | L=WS | 450' | 495' | 540' | 45' | 90' | 195' |
| 50 | | 500' | 550' | 600' | 50' | 100' | 240' |
| 55 | | 550' | 605' | 660' | 55' | 110' | 295' |
| 60 | | 600' | 660' | 720' | 60' | 120' | 350' |
| 65 | | 650' | 715' | 780' | 65' | 130' | 410' |
| 70 | | 700' | 770' | 840' | 70' | 140' | 475' |
| 75 | | 750' | 825' | 900' | 75' | 150' | 540' |
| 80 | | 800' | 880' | 960' | 80' | 160' | 615' |

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

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

## GENERAL NOTES

1. All traffic control devices illustrated are REQUIRED. Devices denoted with the triangle symbol may be omitted when stated elsewhere in the plans.
2. Drums or 42"cones are the typical channelizing devices. For Intermediate Term Stationary work, drums shall be used on tapers with drums or 42" cones used on tangent sections. Other channelizing devices may be used as directed by the Engineer.
3. All construction signs and barricades placed during any phase of work shall remain in place until removal is approved by the Engineer.
4. The Engineer may direct the Contractor to furnish additional signs and barricades as required to maintain traffic flow, detours and motorist safety during construction.
5. Static message boards or changeable message signs stating the date and duration of ramp or freeway lane closures shall be placed a minimum of seven (7) calendar days in advance of the actual closure.
6. Phase 2 of the PCMS message should include appropriate information formatted as shown on BC(6), such as "MERGE LEFT," recommended advisory speed, delay information, or other specific warnings.
7. Duplicate construction warning signs should be erected on the medians side of freeways where median width will permit and traffic volume justifies the signing.
8. The number of closed lanes may be increased provided the spacing of traffic control devices, taper lengths and tangent lengths meet the requirements of the TMUTCD.
9. Warning signs for intermediate term stationary work should be mounted at 7' to the bottom of the sign.
10. Warning signs shown shall be appropriately altered for left lane closures. When signs are mounted at 1' height for short term stationary or short duration work, sign versions shown in the SHSD for Texas with distances on the sign face rather than mounted on a plaque below the sign may be used.
11. When possible, PCMS units should be located in advance of the last available exit ramp prior to the lane closure to allow motorists an alternate route. They may also be relocated to improve advance warning in case of unanticipated queuing or congestion.
12. For Intermediate Term Stationary work at night, floodlights should be used to illuminate the work area and equipment crossings. Floodlights shall not produce a disabling glare condition for road users or workers.
13. The END ROAD WORK (G20-2) sign may be omitted when it conflicts with G20-2 signs already in place on the project.

* A shadow vehicle equipped with a Truck Mounted Attenuator is typically required. A shadow vehicle equipped with a TMA shall be used if it can be positioned 30' to 100' in advance of the area of crew exposure without adversely affecting the work performance.

*Texas Department of Transportation*
*Traffic Operations Division Standard*

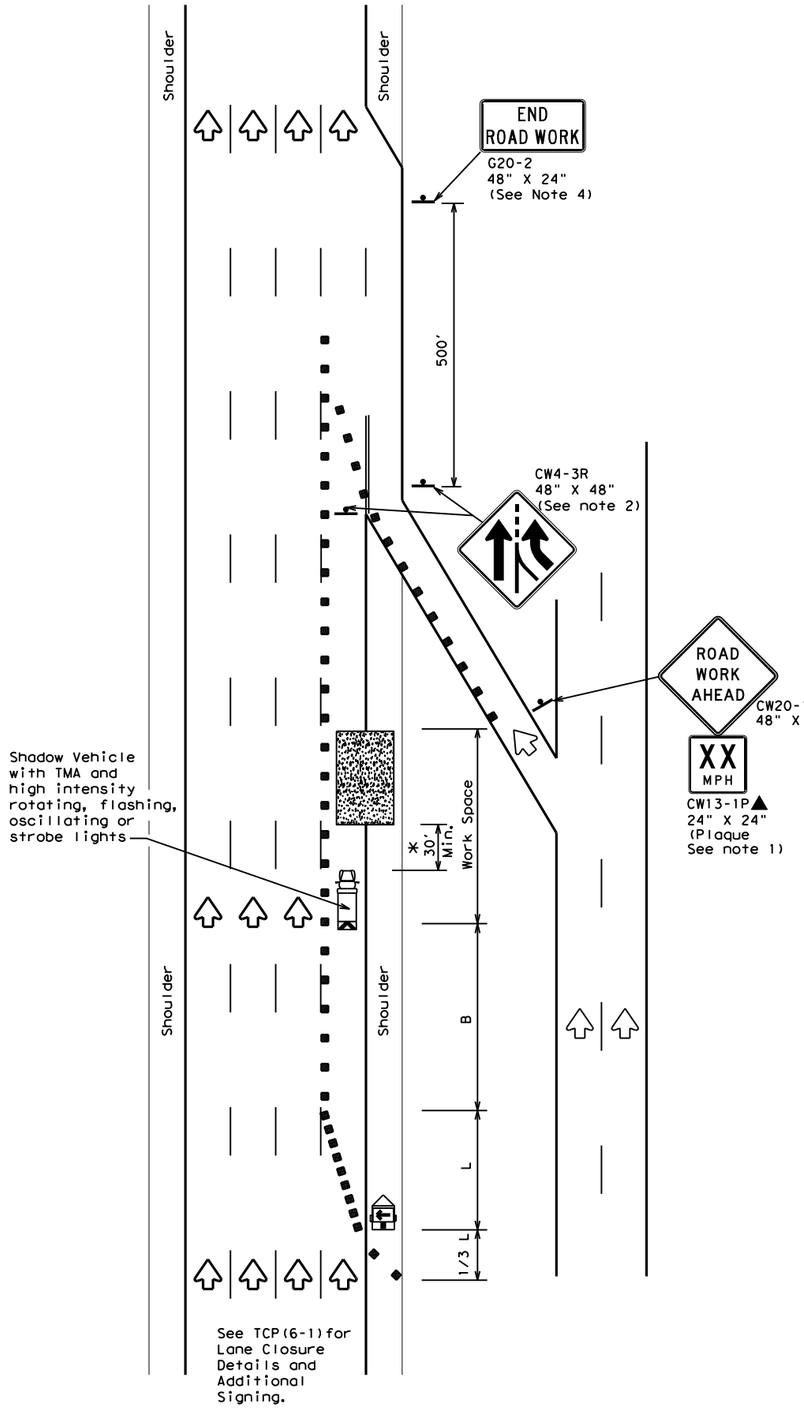
# TRAFFIC CONTROL PLAN FREEWAY LANE CLOSURES

## TCP(6-1)-12

| FILE: tcp6-1.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT February 1998 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| 8-12 | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 40 |

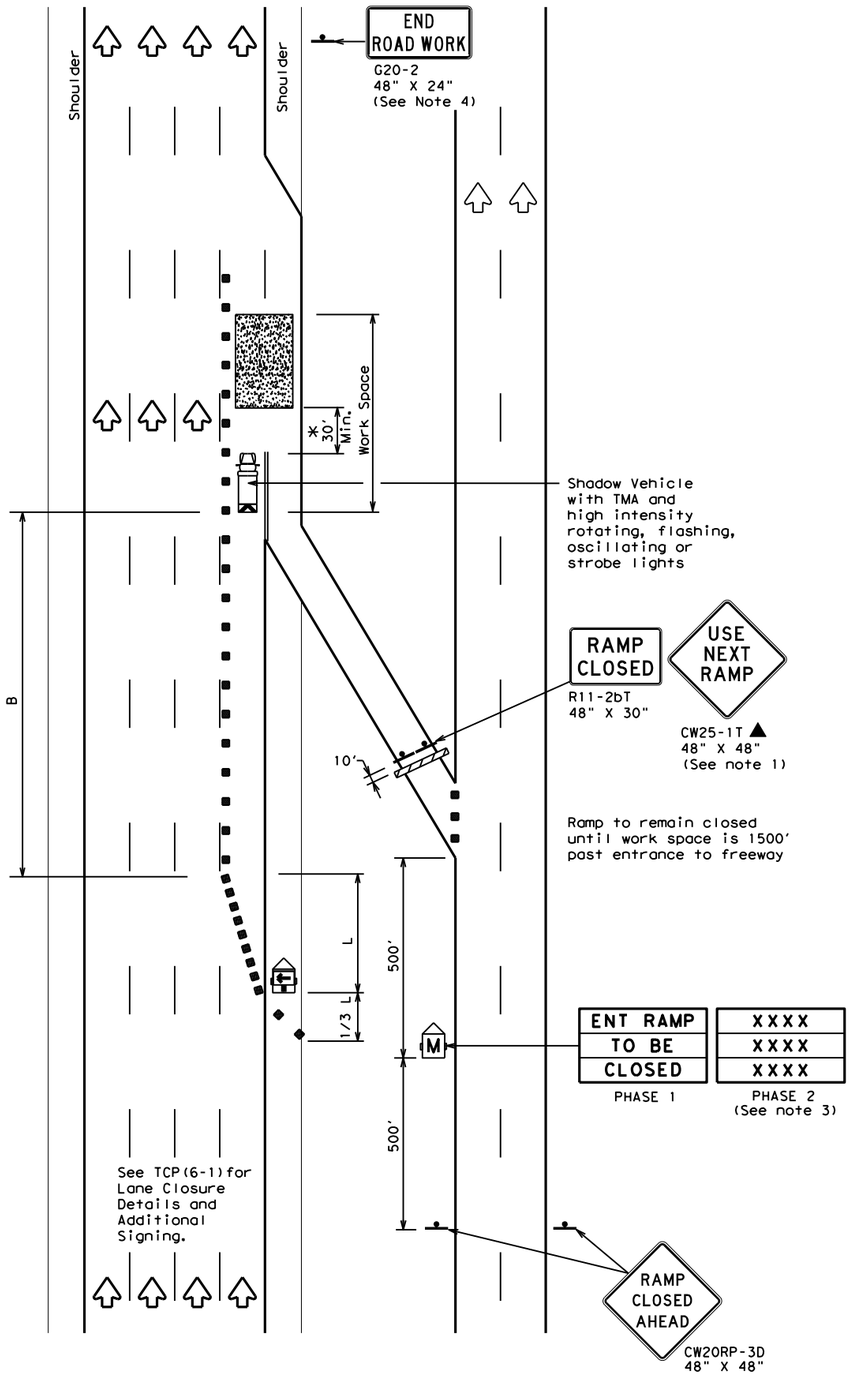
201

DATE: _03/20/23_ _11:30_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties




TCP (6-2a)

## ENTRANCE RAMP OPEN
## WORK WITHIN 500' OF RAMP




TCP (6-2b)

## ENTRANCE RAMP CLOSED

| LEGEND | | | |
|---|---|---|---|
| | Type 3 Barricade | | Channelizing Devices |
| | Heavy Work Vehicle | | Truck Mounted Attenuator (TMA) |
| | Trailer Mounted Flashing Arrow Board | M | Portable Changeable Message Sign (PCMS) |
| | Sign | | Traffic Flow |
| | Flag | | Flagger |

| Posted Speed | Formula | Minimum Desirable Taper Lengths "L" ** | | | Suggested Maximum Spacing of Channelizing Devices | | Suggested Longitudinal Buffer Space "B" |
|---|---|---|---|---|---|---|---|
| | | 10' Offset | 11' Offset | 12' Offset | On a Taper | On a Tangent | |
| 45 | L=WS | 450' | 495' | 540' | 45' | 90' | 195' |
| 50 | | 500' | 550' | 600' | 50' | 100' | 240' |
| 55 | | 550' | 605' | 660' | 55' | 110' | 295' |
| 60 | | 600' | 660' | 720' | 60' | 120' | 350' |
| 65 | | 650' | 715' | 780' | 65' | 130' | 410' |
| 70 | | 700' | 770' | 840' | 70' | 140' | 475' |
| 75 | | 750' | 825' | 900' | 75' | 150' | 540' |
| 80 | | 800' | 880' | 960' | 80' | 160' | 615' |

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

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

## GENERAL NOTES

1. All traffic control devices illustrated are REQUIRED. Devices denoted with the triangle symbol may be omitted when stated elsewhere in the plans.
2. ADDED LANE Symbol (CW4-3) sign may be omitted when sign between ramp and mainlane can be seen from both roadways.
3. See "Advance Notice List" on BC(6) for recommended date and time formatting options for PCMS Phase 2 message.
4. The END ROAD WORK (G20-2) sign may be omitted when it conflicts with G20-2 signs already in place on the project.

*A shadow vehicle equipped with a Truck Mounted Attenuator is typically required. A shadow vehicle equipped with a TMA shall be used if it can be positioned 30' to 100' in advance of the area of crew exposure without adversely affecting the work performance.

Additional requirements for lane closures and advance signing shall be as shown on TCP (6-1) or as directed by the Engineer.

*Texas Department of Transportation*
*Traffic Operations Division Standard*

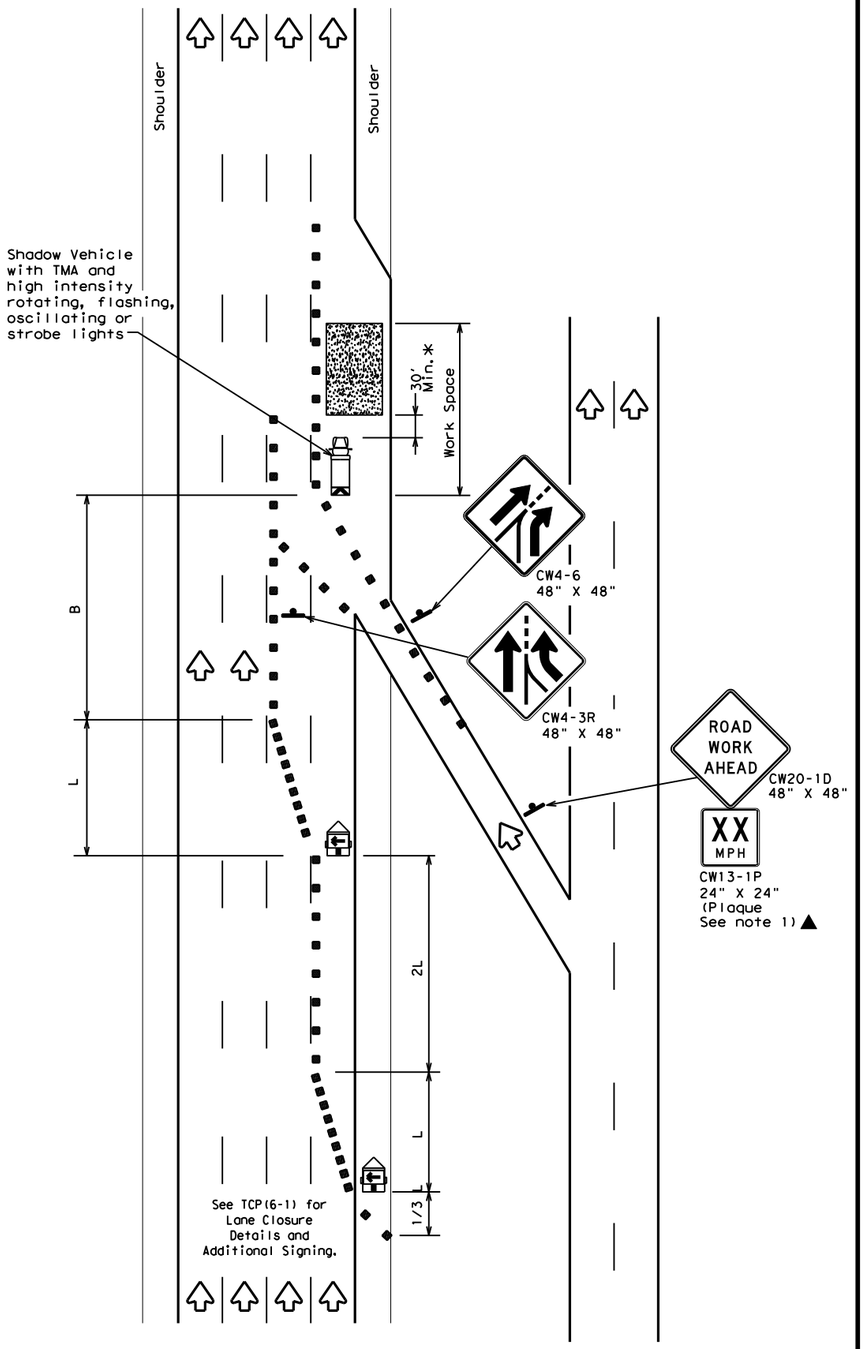
# TRAFFIC CONTROL PLAN
# WORK AREA NEAR RAMP

## TCP(6-2)-12

| FILE: tcp6-2.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT February 1994 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| 1-97 8-98 | DIST | COUNTY | | SHEET NO. |
| 4-98 8-12 | 22 | VAR | | 41 |

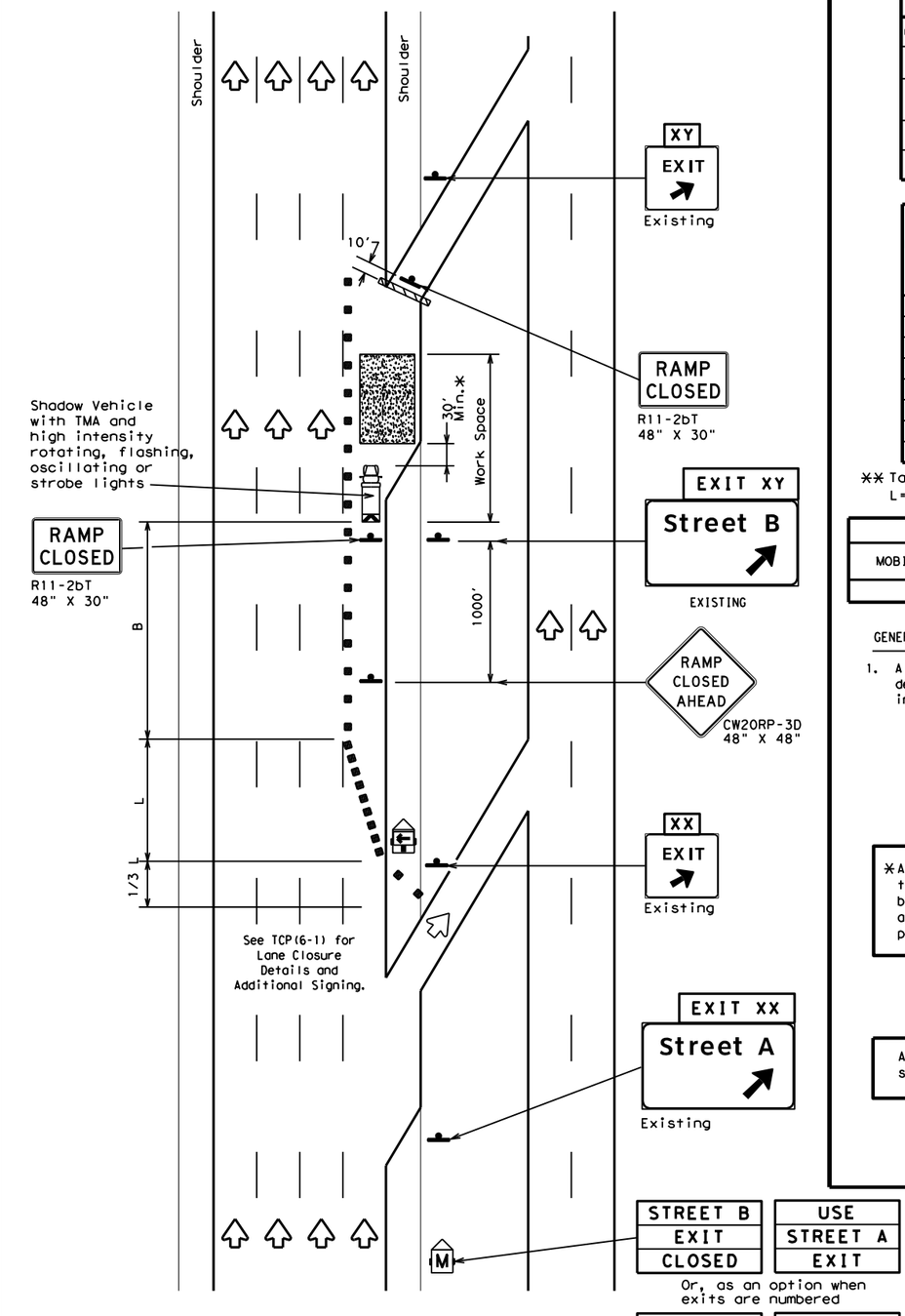
202

DATE: _03/20/23_-_11:30_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties




TCP (6-3a)

## ENTRANCE RAMP OPEN




| STREET B | USE |
|---|---|
| EXIT | STREET A |
| CLOSED | EXIT |

Or, as an option when exits are numbered

| EXIT XY | USE |
|---|---|
| CLOSED | EXIT XX |
| | |

Place 1 mile (approx.) in advance of Street A exit.

TCP (6-3b)

## EXIT RAMP CLOSED
## TRAFFIC EXITS PRIOR TO CLOSED RAMP

| LEGEND | | | |
|---|---|---|---|
| | Type 3 Barricade | | Channelizing Devices |
| | Heavy Work Vehicle | | Truck Mounted Attenuator (TMA) |
| | Trailer Mounted Flashing Arrow Board | M | Portable Changeable Message Sign (PCMS) |
| | Sign | | Traffic Flow |
| | Flag | | Flagger |

| Posted Speed | Formula | Minimum Desirable Taper Lengths "L" ** 10' Offset | 11' Offset | 12' Offset | Suggested Maximum Spacing of Channelizing Devices: On a Taper | On a Tangent | Suggested Longitudinal Buffer Space "B" |
|---|---|---|---|---|---|---|---|
| 45 | L=WS | 450' | 495' | 540' | 45' | 90' | 195' |
| 50 | | 500' | 550' | 600' | 50' | 100' | 240' |
| 55 | | 550' | 605' | 660' | 55' | 110' | 295' |
| 60 | | 600' | 660' | 720' | 60' | 120' | 350' |
| 65 | | 650' | 715' | 780' | 65' | 130' | 410' |
| 70 | | 700' | 770' | 840' | 70' | 140' | 475' |
| 75 | | 750' | 825' | 900' | 75' | 150' | 540' |
| 80 | | 800' | 880' | 960' | 80' | 160' | 615' |

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

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

GENERAL NOTES:

1. All traffic control devices illustrated are REQUIRED. Devices denoted with the triangle symbol may be omitted when stated elsewhere in the plans.

*A shadow vehicle equipped with a Truck Mounted Attenuator is typically required. A shadow vehicle equipped with a TMA shall be used if it can be positioned 30' to 100' in advance of the area of crew exposure without adversely affecting the work performance.

Additional requirements for lane closures and advance signing shall be as shown on TCP (6-1) or as directed by the Engineer.

Texas Department of Transportation
Traffic Operations Division Standard

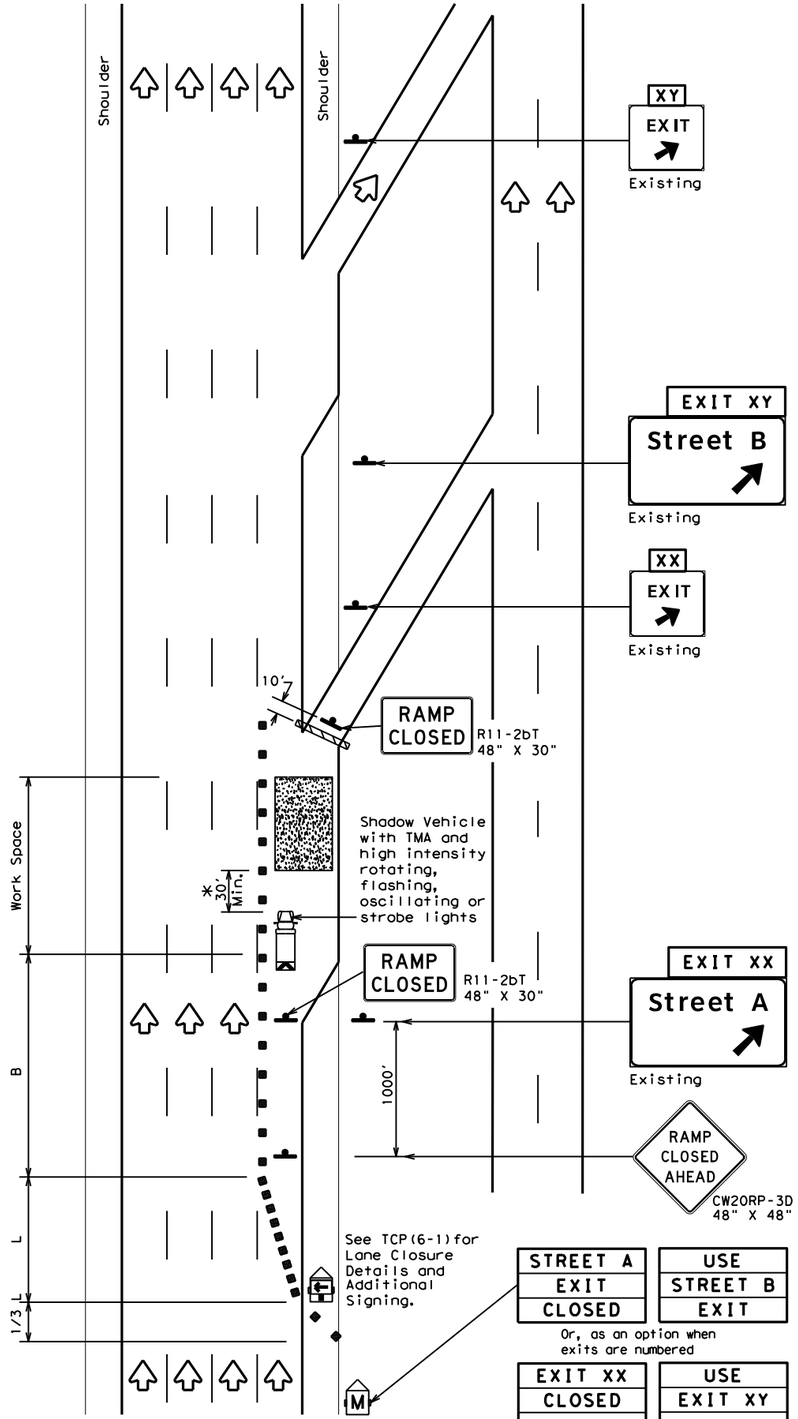
# TRAFFIC CONTROL PLAN
# WORK AREA BEYOND RAMP

## TCP(6-3)-12

| FILE: tcp6-3.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT February 1994 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| 1-97 8-98 | DIST | COUNTY | | SHEET NO. |
| 4-98 8-12 | 22 | VAR | | 42 |

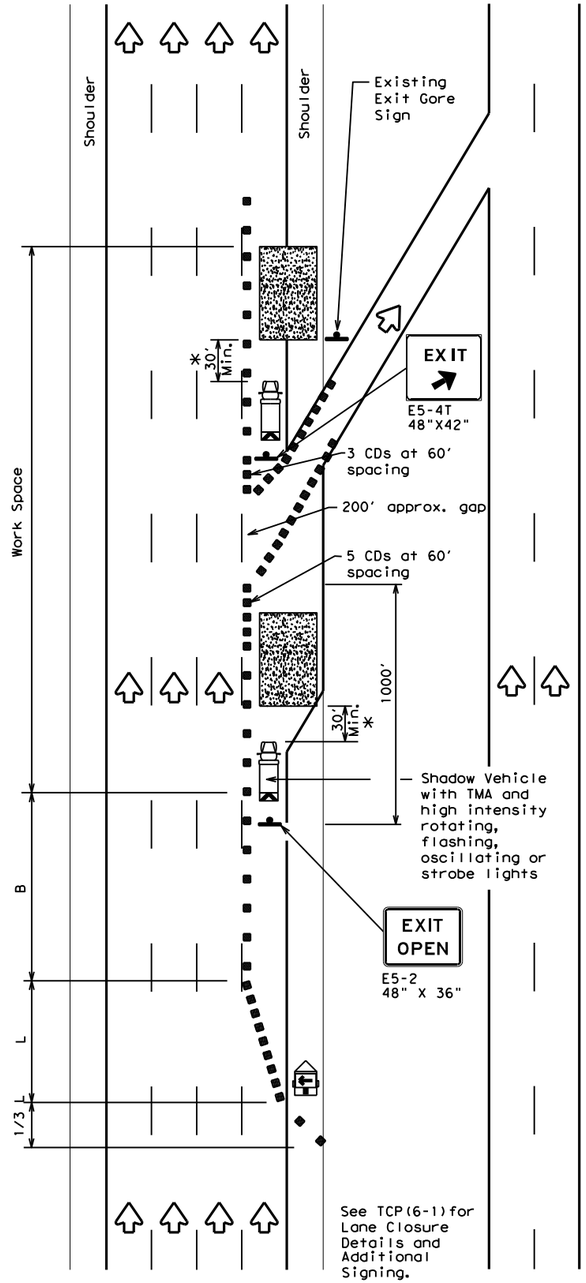


DATE: _03/20/23_ _11:30_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties




TCP (6-4a)

## EXIT RAMP CLOSED
## TRAFFIC EXITS PAST CLOSED RAMP




TCP (6-4b)

## EXIT RAMP OPEN

### LEGEND

| | | | |
|---|---|---|---|
| | Type 3 Barricade | | Channelizing Devices (CDs) |
| | Heavy Work Vehicle | | Truck Mounted Attenuator (TMA) |
| | Trailer Mounted Flashing Arrow Board | M | Portable Changeable Message Sign (PCMS) |
| | Sign | | Traffic Flow |
| | Flag | | Flagger |

| Posted Speed | Formula | Minimum Desirable Taper Lengths "L" ** 10' Offset | 11' Offset | 12' Offset | Suggested Maximum Spacing of Channelizing Devices: On a Taper | On a Tangent | Suggested Longitudinal Buffer Space "B" |
|---|---|---|---|---|---|---|---|
| 45 | L=WS | 450' | 495' | 540' | 45' | 90' | 195' |
| 50 | | 500' | 550' | 600' | 50' | 100' | 240' |
| 55 | | 550' | 605' | 660' | 55' | 110' | 295' |
| 60 | | 600' | 660' | 720' | 60' | 120' | 350' |
| 65 | | 650' | 715' | 780' | 65' | 130' | 410' |
| 70 | | 700' | 770' | 840' | 70' | 140' | 475' |
| 75 | | 750' | 825' | 900' | 75' | 150' | 540' |
| 80 | | 800' | 880' | 960' | 80' | 160' | 615' |

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

### TYPICAL USAGE

| MOBILE | SHORT DURATION | SHORT TERM STATIONARY | INTERMEDIATE TERM STATIONARY | LONG TERM STATIONARY |
|---|---|---|---|---|
| | ✓ | ✓ | ✓ | |

### GENERAL NOTES

1. All traffic control devices illustrated are REQUIRED. Devices denoted with the triangle symbol may be omitted when stated elsewhere in the plans.
2. See BC Standards for sign details.

*A shadow vehicle equipped with a Truck Mounted Attenuator is typically required. A shadow vehicle equipped with a TMA shall be used if it can be positioned 30' to 100' in advance of the area of crew exposure without adversely affecting the work performance.

Additional requirements for lane closures and advance signing shall be as shown on TCP (6-1) or as directed by the Engineer.

Texas Department of Transportation
*Traffic Operations Division Standard*

# TRAFFIC CONTROL PLAN
# WORK AREA AT EXIT RAMP

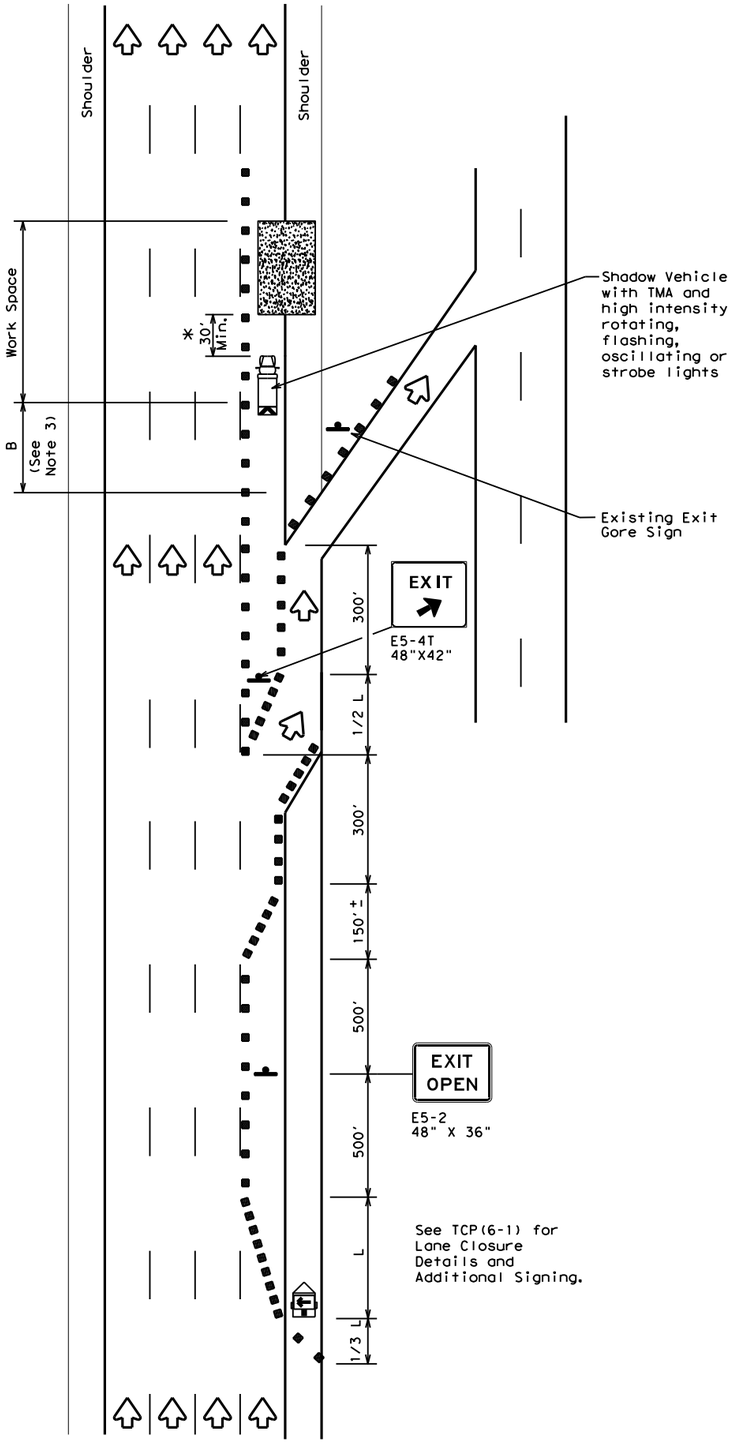
## TCP(6-4)-12

| FILE: tcp6-4.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT Feburary 1994 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| 1-97 8-98 | DIST | COUNTY | | SHEET NO. |
| 4-98 8-12 | 22 | VAR | | 43 |



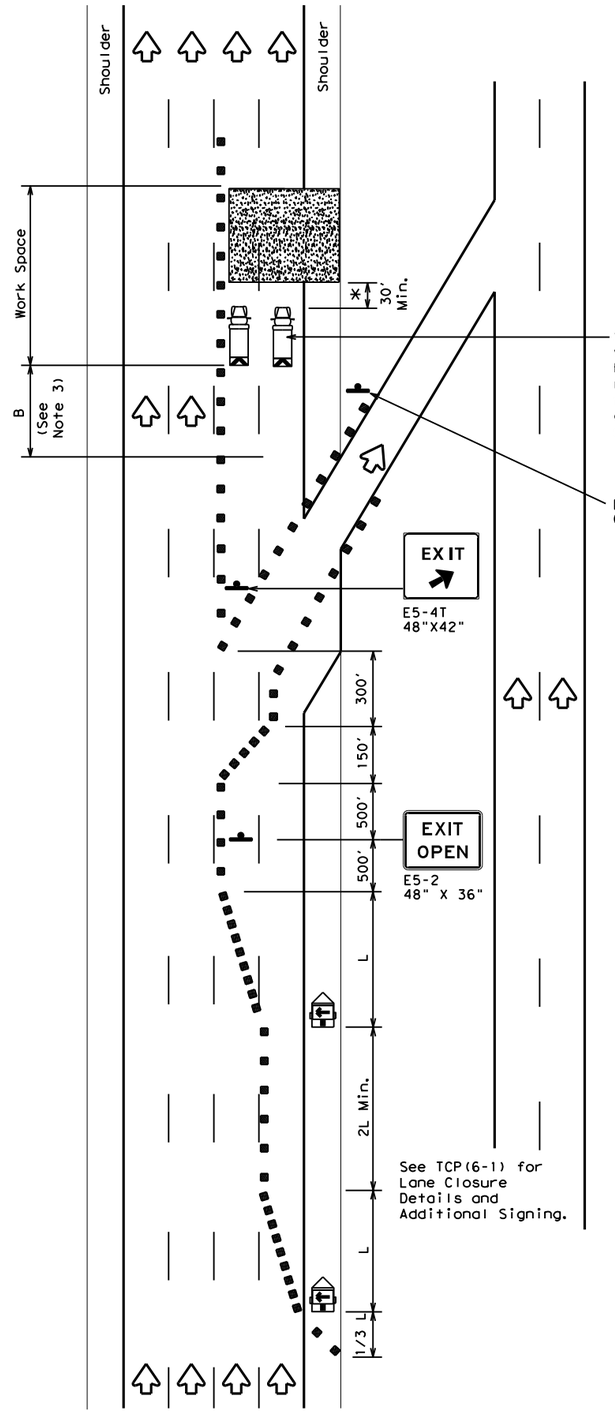
DATE: _03/20/23_ 11:30
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties

DATE: _03/20/23_ _11:30_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties




TCP (6-5a)

## EXIT RAMP OPEN




TCP (6-5b)

## EXIT RAMP OPEN
## TWO LANE CLOSURE WITHIN 1500' PAST EXIT RAMP

| LEGEND | | | |
|---|---|---|---|
| | Type 3 Barricade | | Channelizing Devices |
| | Heavy Work Vehicle | | Truck Mounted Attenuator (TMA) |
| | Trailer Mounted Flashing Arrow Board | M | Portable Changeable Message Sign (PCMS) |
| | Sign | | Traffic Flow |
| | Flag | | Flagger |

| Posted Speed | Formula | Minimum Desirable Taper Lengths "L" ** 10' Offset | 11' Offset | 12' Offset | Suggested Maximum Spacing of Channelizing Devices: On a Taper | On a Tangent | Suggested Longitudinal Buffer Space "B" |
|---|---|---|---|---|---|---|---|
| 45 | L=WS | 450' | 495' | 540' | 45' | 90' | 195' |
| 50 | | 500' | 550' | 600' | 50' | 100' | 240' |
| 55 | | 550' | 605' | 660' | 55' | 110' | 295' |
| 60 | | 600' | 660' | 720' | 60' | 120' | 350' |
| 65 | | 650' | 715' | 780' | 65' | 130' | 410' |
| 70 | | 700' | 770' | 840' | 70' | 140' | 475' |
| 75 | | 750' | 825' | 900' | 75' | 150' | 540' |
| 80 | | 800' | 880' | 960' | 80' | 160' | 615' |

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

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

## GENERAL NOTES

1. All traffic control devices illustrated are REQUIRED. Devices denoted with the triangle symbol may be omitted when stated elsewhere in the plans.
2. See BC standards for sign details.
3. If adequate longitudinal buffer length "B" does not exist between the work space and the exit ramp, consideration should be given to closing the ramp.

*A shadow vehicle equipped with a Truck Mounted Attenuator is typically required. A shadow vehicle equipped with a TMA shall be used if it can be positioned 30' to 100' in advance of the area of crew exposure without adversely affecting the work performance.

Additional requirements for lane closures and advance signing shall be as shown on TCP (6-1) or as directed by the Engineer.

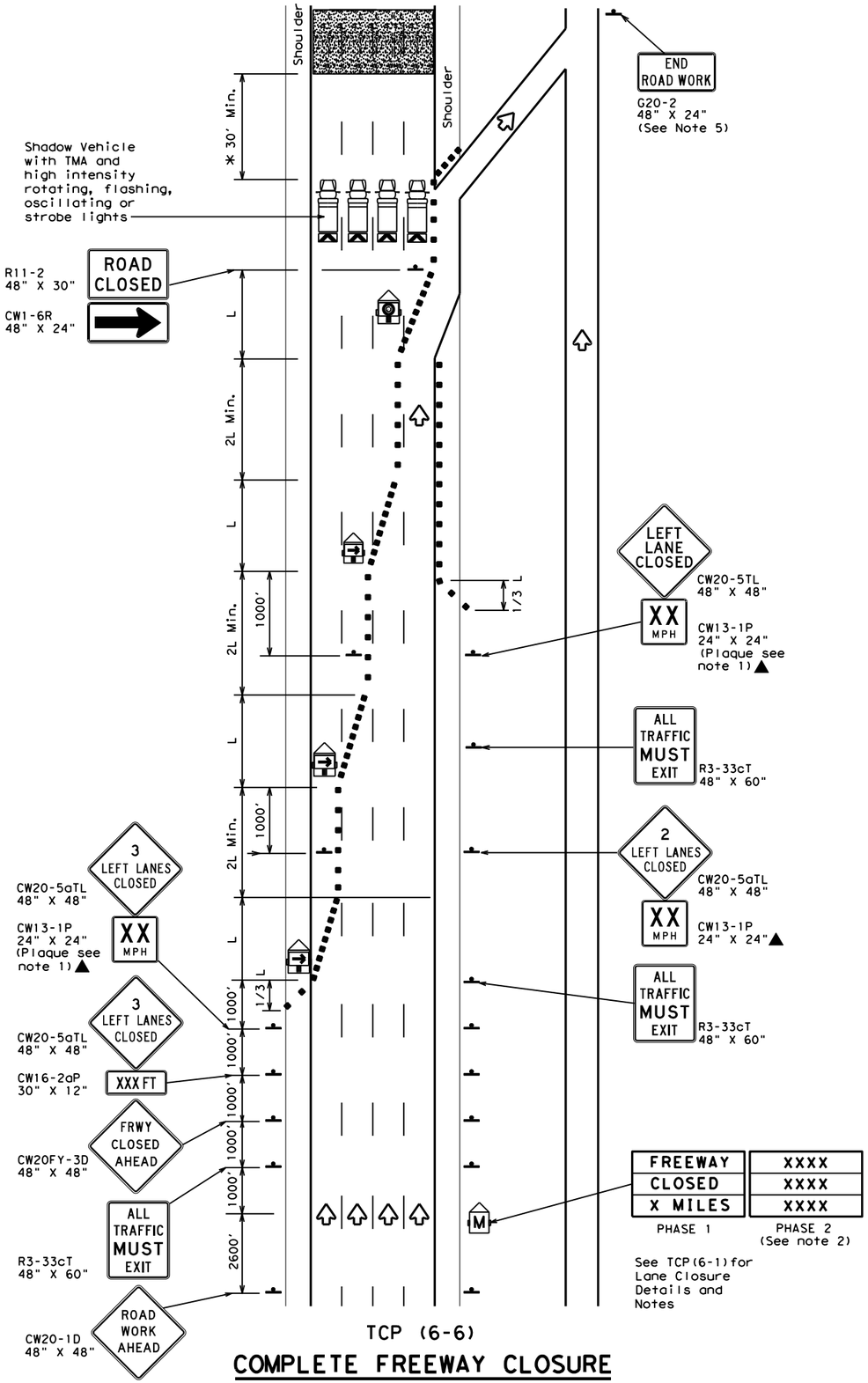
*Texas Department of Transportation*
*Traffic Operations Division Standard*

# TRAFFIC CONTROL PLAN
# WORK AREA BEYOND EXIT RAMP

## TCP(6-5)-12

| FILE: tcp6-5.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT Feburary 1998 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| 1-97 8-98 | DIST | COUNTY | | SHEET NO. |
| 4-98 8-12 | 22 | VAR | | 44 |

DATE: _03/20/23_ 11:30_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties




TCP (6-6)

## COMPLETE FREEWAY CLOSURE

| LEGEND | | | |
|---|---|---|---|
| | Type 3 Barricade | | Channelizing Devices |
| | Heavy Work Vehicle | | Truck Mounted Attenuator (TMA) |
| | Trailer Mounted Flashing Arrow Board | M | Portable Changeable Message Sign (PCMS) |
| | Flashing Arrow Board in Caution Mode | | Traffic Flow |
| | Sign | | |

| Posted Speed | Formula | Minimum Desirable Taper Lengths "L" ** 10' Offset | 11' Offset | 12' Offset | Suggested Maximum Spacing of Channelizing Devices: On a Taper | On a Tangent | Suggested Longitudinal Buffer Space "B" |
|---|---|---|---|---|---|---|---|
| 45 | L=WS | 450' | 495' | 540' | 45' | 90' | 195' |
| 50 | | 500' | 550' | 600' | 50' | 100' | 240' |
| 55 | | 550' | 605' | 660' | 55' | 110' | 295' |
| 60 | | 600' | 660' | 720' | 60' | 120' | 350' |
| 65 | | 650' | 715' | 780' | 65' | 130' | 410' |
| 70 | | 700' | 770' | 840' | 70' | 140' | 475' |
| 75 | | 750' | 825' | 900' | 75' | 150' | 540' |
| 80 | | 800' | 880' | 960' | 80' | 160' | 615' |

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

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

## GENERAL NOTES

1. All traffic control devices illustrated are REQUIRED. Devices denoted with the triangle symbol may be omitted when stated elsewhere in the plans.
2. Phase 2 of the PCMS message should include appropriate information formatted as shown on BC(6), such as "MERGE RIGHT," recommended speed, delay, exit information, or other specific warnings.
3. Where queuing is anticipated beyond signing shown, additional PCMS signs, other warning signs, devices or Law Enforcement Officers should be available to warn approaching high speed traffic of the end of the queue, as directed by the Engineer.
4. Entrance ramps located from the advance warning area to the exit ramp should be closed whenever possible.
5. The END ROAD WORK (G20-2) sign may be omitted when it conflicts with G20-2 signs already in place on the project.

* A shadow vehicle equipped with a Truck Mounted Attenuator is typically required. A shadow vehicle equipped with a TMA shall be used if it can be positioned 30' to 100' in advance of the area of crew exposure without adversely affecting the work performance.

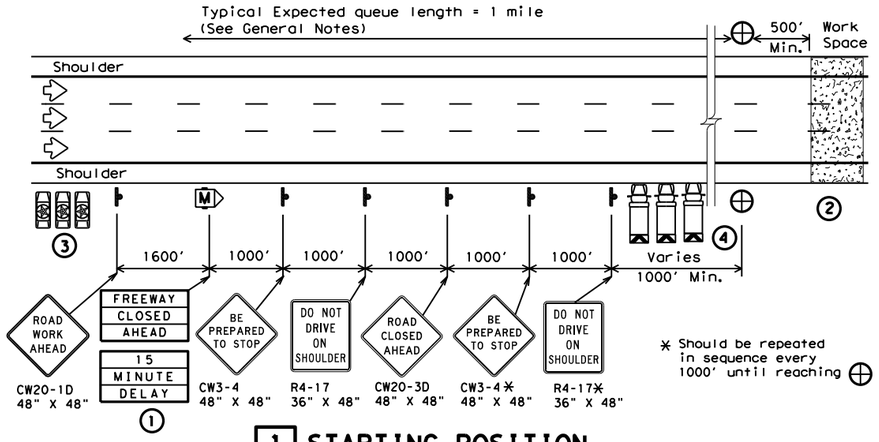
Additional requirements for lane closures and advance signing shall be as shown on TCP (6-1) or as directed by the Engineer.

*Texas Department of Transportation*
*Traffic Operations Division Standard*

# TRAFFIC CONTROL PLAN FREEWAY CLOSURE

## TCP(6-6)-12

| FILE: tcp6-6.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT February 1994 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| 1-97 8-98 | DIST | COUNTY | | SHEET NO. |
| 4-98 8-12 | 22 | VAR | | 45 |



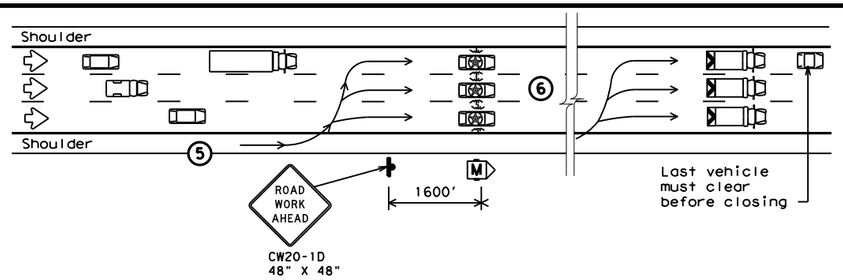

## 1 STARTING POSITION

(1) Traffic control devices should be installed or located near their intended position prior to beginning temporary roadway closure sequence. Duplicate signs should be erected on the median side of the roadway when median width permits. Warning signs should not be placed on the paved shoulders that will be used by the WARNING LEOV, or where movement of the LEOVs or barrier vehicles will be impeded.

(2) Prior to beginning the roadway closure sequence, all equipment, materials, personnel, and other items necessary to complete the work should be gathered near the work area. Entrance ramps located in the area where a queue is expected to build should be closed.

(3) There should be one LEOV for every lane to be controlled, plus a minimum of one to warn traffic approaching a queue. An additional lead law enforcement officer is desirable to remain with the Engineer's or Contractor's point of contact (POC) during the operation in order to improve communication with all LEOVs involved.

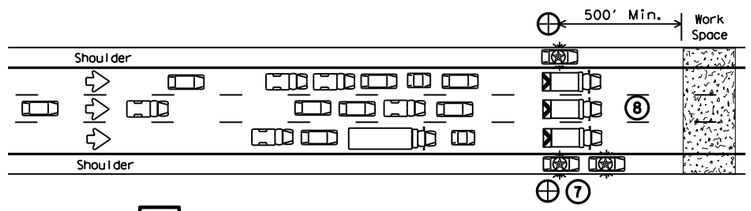
(4) One barrier vehicle with a Truck Mounted Attenuator and amber or blue and amber high intensity flashing/oscillating/strobe lighting shall be used for each lane to be closed.




## 2 REDUCING SPEED OPERATION

(5) Starting position of the LEOVs should be in advance of the most distant warning signs.

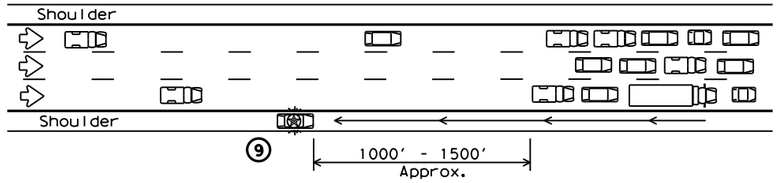
(6) Once the LEOVs have achieved an abreast blocking formation while traveling toward the CP, emergency lights and headlights should be turned "ON". The LEOVs should maintain formation, not allow traffic to pass, and begin to decelerate. The LEOVs should continue to decelerate, giving the barrier vehicles opportunity to be staged upstream of the work space after traffic has cleared. The LEOVs should then continue to decelerate slowly until bringing traffic to a stop near the barrier vehicles.




## 3 ALL TRAFFIC STOPPED AT CP

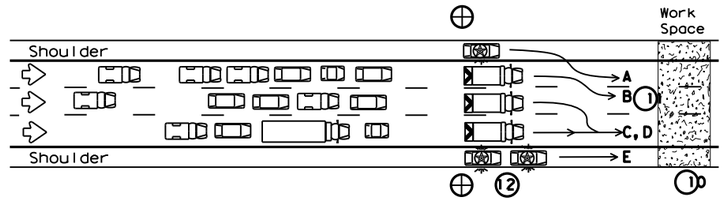
(7) Once traffic is stopped the LEOVs should park on the shoulders with emergency lighting "ON" in order to provide law enforcement presence at the closure and keep shoulders blocked ahead of the work space. They should stay in radio contact with the WARNING LEOV.

(8) The barrier vehicles should be parked, one in each lane, the parking brake set, with the high visibility flashing/oscillating/strobe lighting "ON," and the transmission in gear.




## 4 WARNING THE TRAFFIC QUEUE

(9) The WARNING LEOV should proceed to the right shoulder of the roadway, with emergency lights on approximately 1000' in advance of the traffic queue (stopped traffic) as the queue develops. When determined that limited sight distance situations (crest of hills, sharp roadway curvature, etc.) may occur to motorists approaching the queue, the WARNING LEOV may proceed 1/4 mile or more in advance of the queue.




## 5 RELEASING STOPPED TRAFFIC

(10) All equipment, materials, personnel, and other items should be removed from the roadway and maintain an adequate clear zone.

(11) When the roadway is clear for traffic, the LEOV should proceed forward from the left shoulder followed by the barrier vehicles, from left to right, as shown alphabetically in the plan view.

(12) The LEOV or LEOVs on the right shoulder may remain on the shoulder until satisfied that traffic is moving satisfactorily before merging or proceeding.

(13) LEOVs and barrier vehicles should re-group at their respective starting positions if necessary.

| LEGEND | | | |
|---|---|---|---|
| ■ ■ | Channelizing Devices | ⊕ | Control Position (CP) |
| (M) | Portable Changeable Message Sign (PCMS) | | Barrier Vehicle with Truck Mounted Attenuator |
| | Law Enforcement Officer's Vehicle(LEOV) | | Traffic Flow |

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

## GENERAL NOTES

1. All traffic control devices shall conform with the latest edition of the Texas Manual on Uniform Traffic Control Devices (TMUTCD). Additional guidelines for traffic control devices may be found in the TMUTCD. Signs conflicting with the roadway closure sequence should be completely removed or covered. Additional traffic control devices may be required for closure of access roads, cross streets, exit and entrance ramps as directed by the Engineer.

2. Law enforcement officers and all workers involved should review and understand all procedures before the roadway closure sequence begins. Pre-work meetings may be held for this purpose. Local emergency services and media should have advance notification of roadway closure, expected dates and approximate times of closures.

3. Law enforcement officers shall be in uniform and have jurisdiction in the locale of the work area. An additional WARNING Law Enforcement Officer's Vehicle (LEOV) may be used on the median side of the roadway where median shoulder width permits (See sequence #9 ).

4. The roadway closure should be during off-peak hours, as shown in the plans, or as directed by the Engineer.

5. Work should be limited to approximately 15 minutes maximum duration unless otherwise directed by the Engineer based on existing roadway conditions. If the work is not complete within 15 minutes, or if the end of the traffic queue extends past the most distant advance warning signs, the work area should be cleared of all equipment, materials, personnel, and other items, and the roadway reopened. When the queue has dissipated and the traffic flow appears normal the roadway closure sequence may be repeated.

6. For traffic volumes greater than 1000 Passenger Cars Per Hour Per Lane (PCPHPL), or for roadway closures that exceed 15 minutes, see details elsewhere in the plan.

7. If traffic queues beyond the advance warning signs during one road closure sequence, the advance warning should be extended prior to repeating the road closure sequence. When possible, PCMS signs should be located in advance of the last available exit prior to the closure to allow motorists the choice of an alternate route.

THIS PLAN IS INTENDED TO BE USED AT LOCATIONS/TIMES WHEN TRAFFIC VOLUMES ARE LESS THAN 1000 PASSENGER CARS PER HOUR PER LANE.

*Texas Department of Transportation*
*Traffic Operations Division Standard*

# TRAFFIC CONTROL PLAN SHORT DURATION FREEWAY CLOSURE SEQUENCE

# TCP(6-7)-12

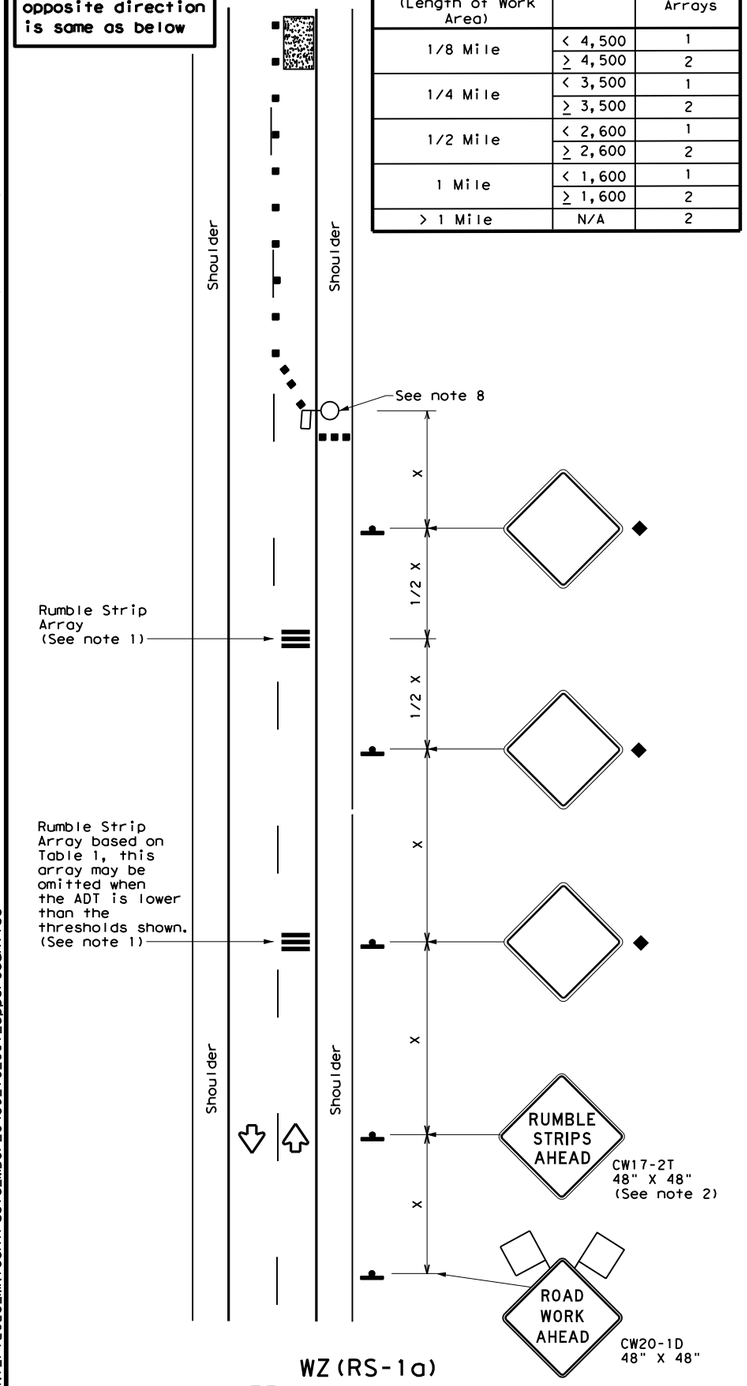
| FILE: tcp6-7.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT February 1998 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| 1-97 8-12 | DIST | COUNTY | | SHEET NO. |
| 4-98 | 22 | VAR | | 46 |



DATE: _03/20/23_ _11:30_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties

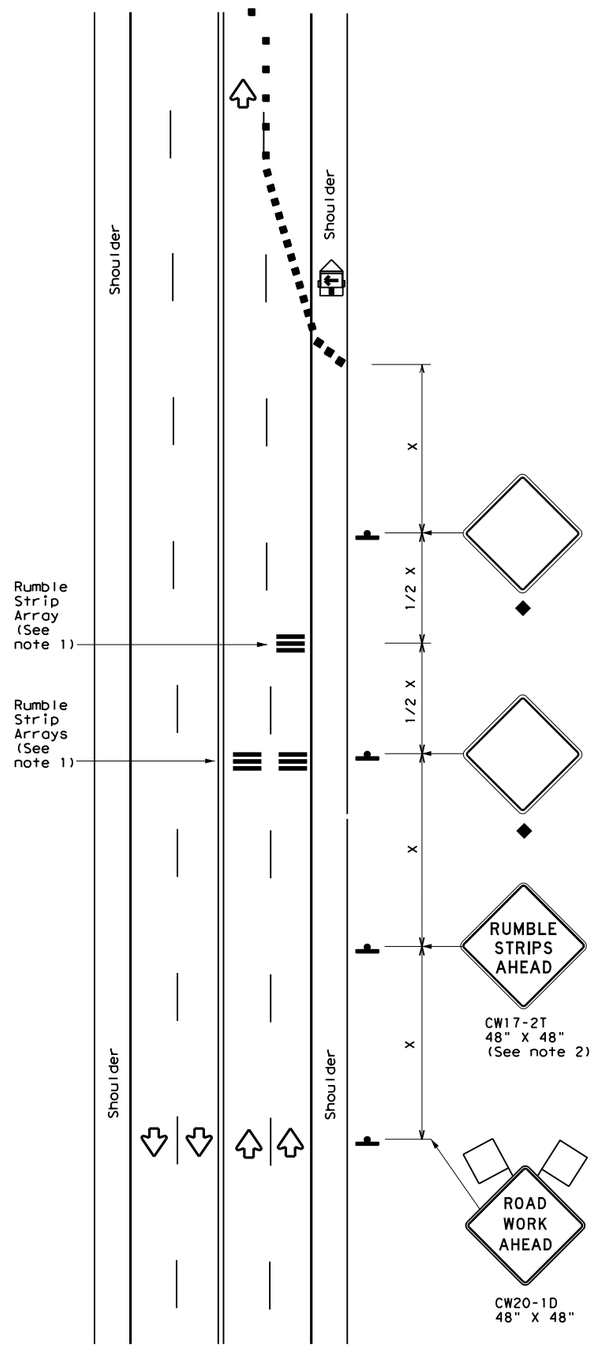
**Warning sign and rumble strip sequence in opposite direction is same as below**

| TABLE 1 | | |
|---|---|---|
| Flagger to Flagger (Length of Work Area) | ADT | # of Rumble Strip Arrays |
| 1/8 Mile | < 4,500 | 1 |
| | ≥ 4,500 | 2 |
| 1/4 Mile | < 3,500 | 1 |
| | ≥ 3,500 | 2 |
| 1/2 Mile | < 2,600 | 1 |
| | ≥ 2,600 | 2 |
| 1 Mile | < 1,600 | 1 |
| | ≥ 1,600 | 2 |
| > 1 Mile | N/A | 2 |




WZ(RS-1a)
75 mph or Less

## RUMBLE STRIPS ON ONE-LANE TWO-WAY APPLICATION




WZ(RS-1b)
75 mph or Less

## RUMBLE STRIPS FOR LANE CLOSURE ON CONVENTIONAL ROADWAY

## GENERAL NOTES

1. Each Rumble Strip Array should consist of three rumble strips spaced center to center at the spacing shown in Table 2, placed transverse across the lane at locations shown.
2. The CW17-2T "RUMBLE STRIPS AHEAD" sign should be located after the CW20-1D "ROAD WORK AHEAD sign and spaced as shown. If traffic is observed to be queuing, or is expected to queue beyond the Rumble Strips, the CW17-2T sign and the first Rumble Strip Array may be located upstream of the CW20-1D sign as necessary to provide needed warning.
3. Temporary Rumble Strips will be considered subsidiary to Item 502, and shall be a product listed on the Compliant Work Zone Traffic Control Devices.
4. Removal of the Temporary Rumble Strips should be accomplished before removing the advance warning signs.
5. Temporary Rumble Strips should not be used on horizontal curves, loose gravel, soft or bleeding asphalt, heavily rutted pavements or unpaved surfaces.
6. Temporary Rumble Strips shall be installed and maintained as per manufacturer's recommendations.
7. This standard sheet shall be used in conjunction with other appropriate TCP standard, TMUTCD typical application or project specific detail for the project.
8. The one-lane two-way application may utilize a flagger, an AFAD or a portable traffic signal.
9. Temporary Rumble Strips may be used on freeways or expressways based on engineering judgment.

| LEGEND | | | |
|---|---|---|---|
| | Type 3 Barricade | | Channelizing Devices |
| | Heavy Work Vehicle | | Truck Mounted Attenuator (TMA) |
| | Trailer Mounted Flashing Arrow Panel | M | Portable Changeable Message Sign (PCMS) |
| | Sign | | Traffic Flow |
| | Flag | | Flagger |

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

* Conventional Roads Only

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

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

◆ **Signs are for illustrative purposes only. Signs required may vary depending on the TCP, TMUTCD Typical Application, or project specific details for the project.**

| TABLE 2 | |
|---|---|
| Speed | Approximate distance between strips in an Array |
| ≤ 40 MPH | 10' |
| > 40 MPH & ≤ 55 MPH | 15' |
| > 55 MPH | 20' |

Texas Department of Transportation — Traffic Operations Division Standard

# TEMPORARY RUMBLE STRIPS

## WZ(RS)-16

| FILE: wzrs16.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT November 2012 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| 2-14 | DIST | COUNTY | | SHEET NO. |
| 4-16 | 22 | VAR | | 47 |



DATE: _03/20/23_ 11:30_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties

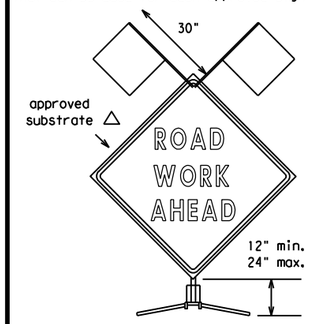
LEVELS DISPLAYED

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | |
| 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | |
| 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | | |

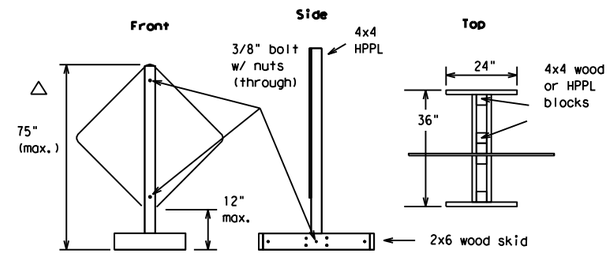
△ See the CWZTCD for the type of sign substrate that can be used for each approved sign support.

# EXAMPLES OF SIGN SUPPORTS

## SHORT TERM DURATION, DAYTIME USE ONLY PORTABLE SIGN SUPPORTS




Flags as required by Engineer or as shown on plans




The upright SHALL be made of hollow-profile plastic lumber (HPPL). Wood or metal shall NOT be used.

1 Foot Mounting Height

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 will NOT be allowed.**

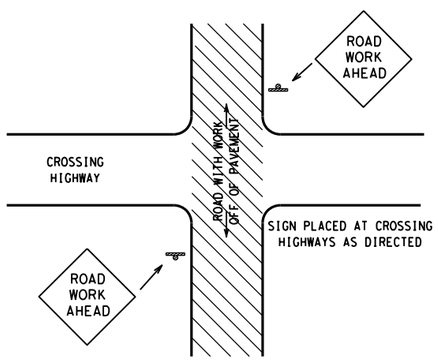

**SIGN IN ACCORDANCE WITH THE TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS**

**MOWERS AHEAD SIGNS ARE USED FOR MOWING OPERATIONS.**

**LITTER PICKUP AHEAD, ROAD WORK AHEAD AND WORKER AHEAD SIGNS ARE USED AS DIRECTED FOR OTHER MAINTENANCE OPERATIONS WHEN ALL WORK OCCURS OFF OF THE PAVED HIGHWAY SURFACE.**

**ROLL-UP SIGNS CONFORMING TO DMS-8310 AND THE CWZTCD ALLOWED**

*Letter dimensions and spacing for "CW21-SPECIAL" is the same as C20-1D>




**TYPICAL LOCATION OF SIGNS AT HIGHWAY CROSSING**

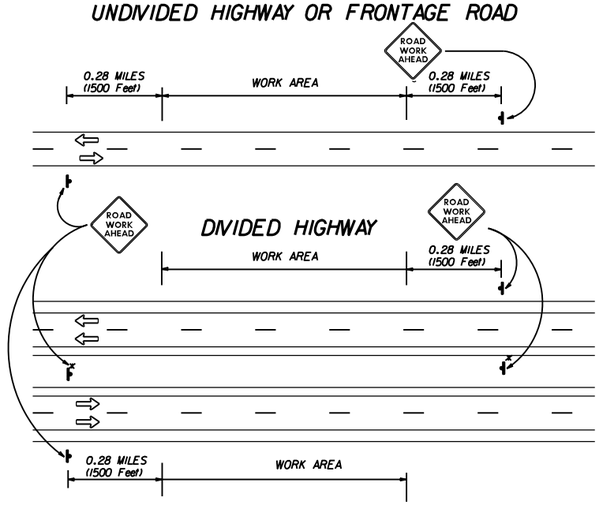
*WORK AREA IS A MAXIMUM OF 2.0 MILES UNLESS OTHERWISE DIRECTED.*
*SIGNS MAY REMAIN IN PLACE ONLY DURING DAYLIGHT HOURS.*

*SIGNS ARE TO BE PLACED 6' TO 12' OFF OF THE PAVED SURFACE UNLESS OTHERWISE DIRECTED.*

*ROAD WORK AHEAD SIGNS SHOWN AS EXAMPLES, ONE OF THE FOUR TYPE SIGNS WILL BE USED AS DIRECTED.*

* *SIGNS IN THE MEDIAN ARE REQUIRED WHEN WORK OCCURS IN MEDIAN*

*UNDIVIDED HIGHWAY OR FRONTAGE ROAD*




*TRAFFIC CONTROL PLAN FOR WORK OFF OF THE PAVED SURFACE.*

**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. Nails shall NOT be used to attach signs to any support.
5. 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.
6. 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. The additional signs requested by the Engineer/Inspector shall not be subsidiary.
7. The Contractor shall furnish sign supports listed in the "Compliant Work Zone Traffic Control Device List" (CWZTCD). 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 that the Engineer can verify the correct procedures are being followed.
8. The Contractor is responsible for sign installations and replacing signs with damaged or cracked substrates and/or damaged or marred reflective sheeting as directed by the Engineer/Inspector.
9. 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".
10. 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 VI)**

1. The Contractor is responsible for ensuring the sign support and substrate meets crashworthiness. For mowing operation all signs and supportS are Short-term Duration for daytime work.
2. The Contractor shall furnish the sign sizes shown on this sheet or as directed by the Engineer.

**SIGN SUBSTRATES**

1. The Contractor shall ensure that the sign substrate is allowed 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.
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 faces.

**REFLECTIVE SHEETING**

1. Reflectorized signs shall be constructed of sheeting meeting the color and retro-reflectivity requirements of DMS-8300 or DMS-8310. The DMS specifications can be accessed from the following web address:
   http://manuals.dot.state.tx.us:80/dynaweb/colmates/@Generic__CollectionView;cs=default;ts=default
2. White sheeting, meeting the requirements of DMS-8300 Type C (High Specific Intensity), shall be used for signs with white background and channelizing devices.
3. Orange sheeting, meeting the requirements of DMS-8300 Type E (Fluorescent Prismatic), shall be used for 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. Signs should be removed or completely covered when not mowing.
2. Duct tape or other adhesive material shall NOT be affixed to a sign face.
3. Signs and supports shall be removed by the end of the day.

**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 is recommended.
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 will 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.
6. Rubber (such as tire inner tubes) shall NOT be used for sandbags.
7. Rubber ballasts (such as those used with cones or edgeline channelizers) shall NOT be used as sign support weights.
8. 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 supports.
9. Sandbags shall NOT be placed under the skid and shall not be used to level sign supports placed on slopes.

## CONTRACTOR REQUIREMENTS FOR MAINTAINING PERMANENT SIGNS WITHIN THE PROJECT LIMITS

Any sign, sign support or traffic control device that is struck or damaged by the Contractor or his/her construction equipment shall be replaced or repaired as soon as possible by the Contractor at the Contractor's expense.

**Only pre-qualified products shall be used. A copy of the "Compliant Work Zone Traffic Control Devices List" (CWZTCD) describes pre-qualified products and their sources and may be obtained by contacting:**

**Standards Engineer**
**Traffic Operations Division - TE**
**Texas Department of Transportation**
**125 East 11th Street**
**Austin, Texas 78701-2483**
**Phone (512) 416-3120**
**Fax (512) 416-3299**

**Instructions to locate the "CWZTCD" on TxDOT website are:**

**Start at website - www.dot.state.tx.us**
**Click on "About TxDOT",**
**Click on "Organizational Chart",**
**Click on Traffic Operations Box,**
**Click on "Compliant Work Zone Traffic Control Devices",**
**Click on "View PDF".**
**This site is printable.**

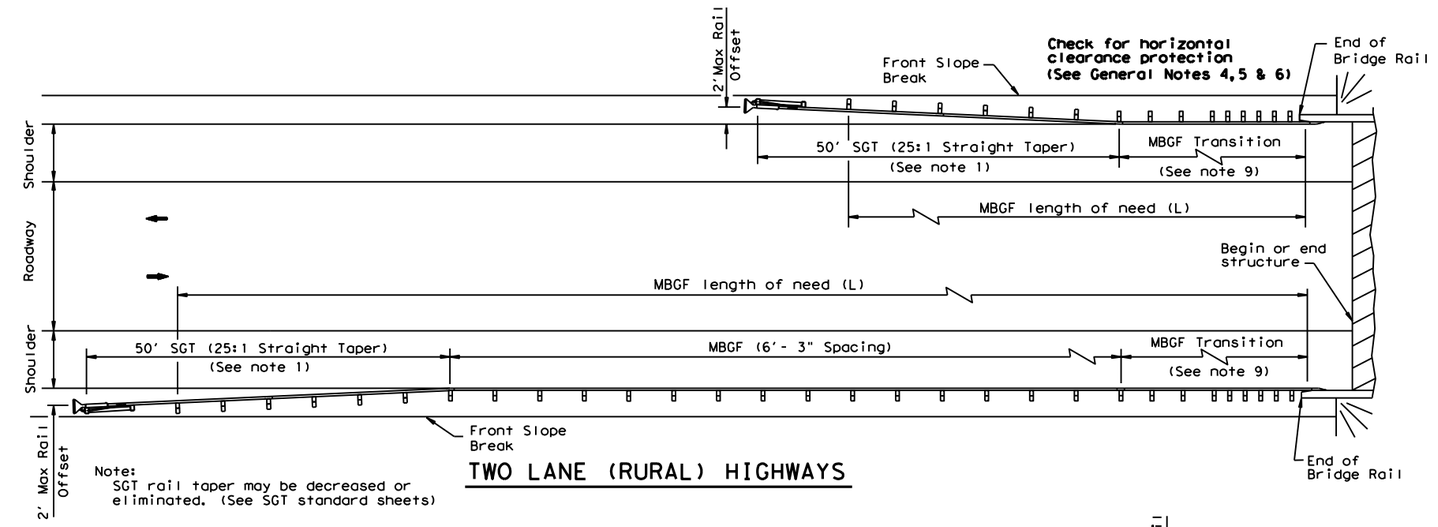
*Texas Department of Transportation*
*Maintenance Division*
*Standard Plans*

# ROADSIDE TRAFFIC CONTROL PLAN

SHEET 1 OF 1 — RS-TCP-05 — NOT TO SCALE

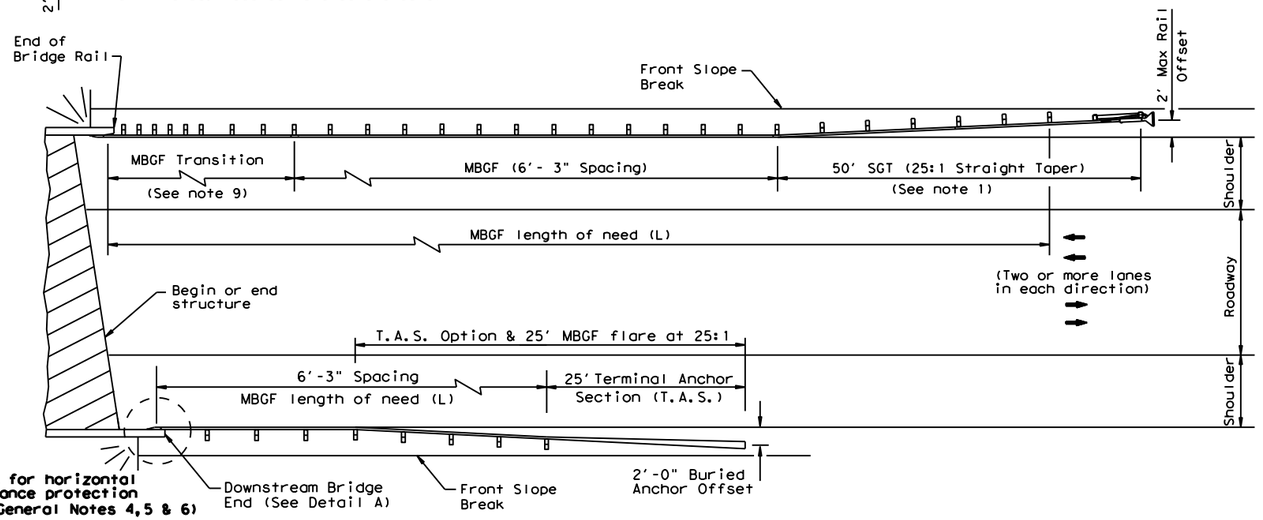
| FILE: RSTCP05.DGN | DN: LJB | CK: JG | DW: JR | CK: LC | NEG NO.: | |
|---|---|---|---|---|---|---|
| ©TxDOT FEBRUARY 2005 | STATE DISTRICT | FEDERAL REGION | FEDERAL AID PROJECT | | | SHEET |
| REVISED: September 17, 2004 | 22 | | | | | 48 |
| REVISED: FEBRUARY 2, 2005 Sign placement in TCP | COUNTY | | | CONTROL | SECTION | JOB | HIGHWAY |
| REVISED: | VAR | | | 6439 | 16 | 001 | VAR |

DATE: _03/20/23_ _11:30_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties

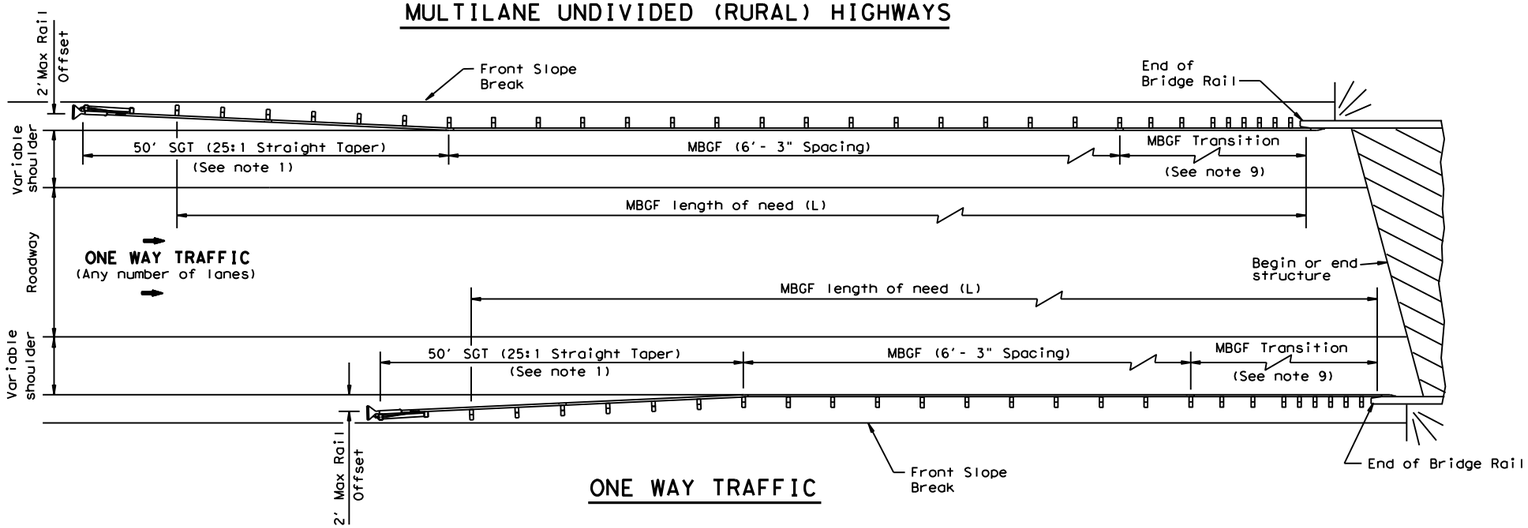



Note:
SGT rail taper may be decreased or eliminated. (See SGT standard sheets)

## TWO LANE (RURAL) HIGHWAYS



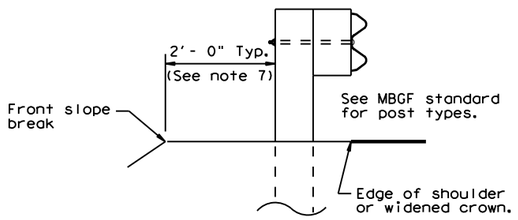

## MULTILANE UNDIVIDED (RURAL) HIGHWAYS



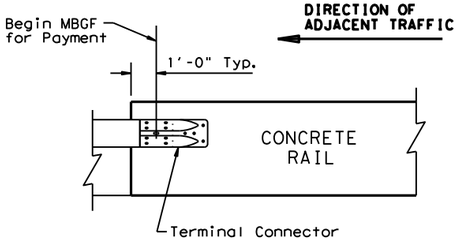

## ONE WAY TRAFFIC

## GENERAL NOTES

1. For more detail: See MBGF, SGT, and MBGF Transition standard sheets.
2. Quantities of metal beam guard fence (MBGF) at individual bridge ends are shown elsewhere in 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. Terminal anchor sections (TAS) are only for downstream end anchorage use, outside the horizontal clearance area of opposing traffic.
6. Direct connection of MBGF (at 6'-3" post spacing without transition) to concrete rail are only for downstream rail connections outside the horizontal clearance area of opposing traffic. (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.
9. Transition length and post spacing will vary depending on the transition type. Transition type will be shown elsewhere in the plans.




## TYPICAL CROSS SECTION AT MBGF




## DETAIL A

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

**ONLY FOR USE IN MAINTENANCE REPAIRS.**

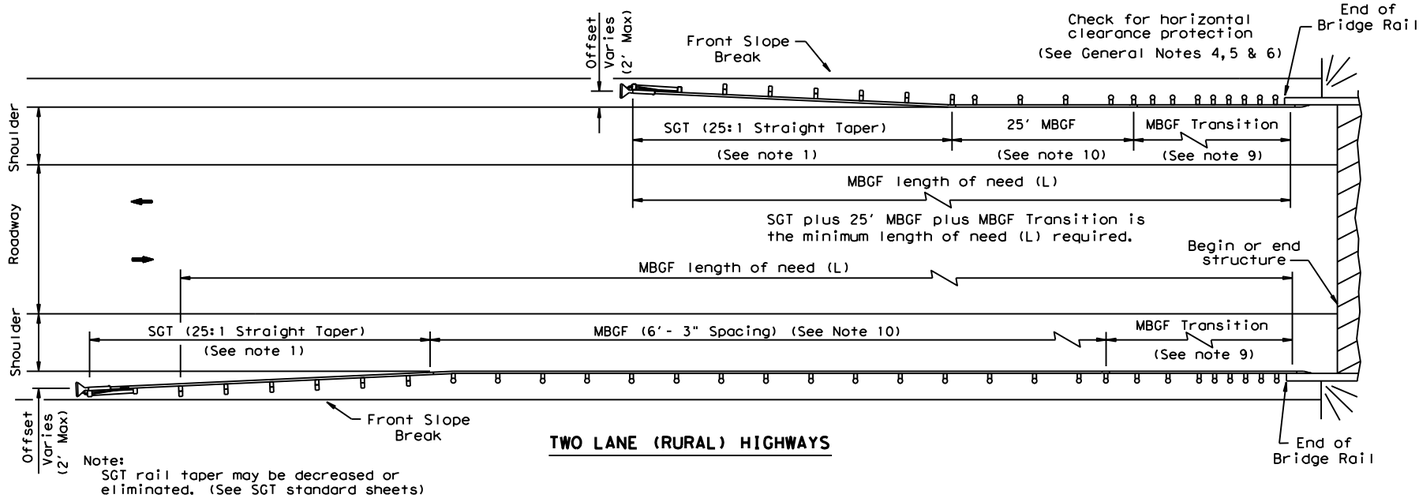
Texas Department of Transportation

Design Division Standard

# BRIDGE END DETAILS
## (28" METAL BEAM GUARD FENCE APPLICATIONS TO RIGID RAILS)

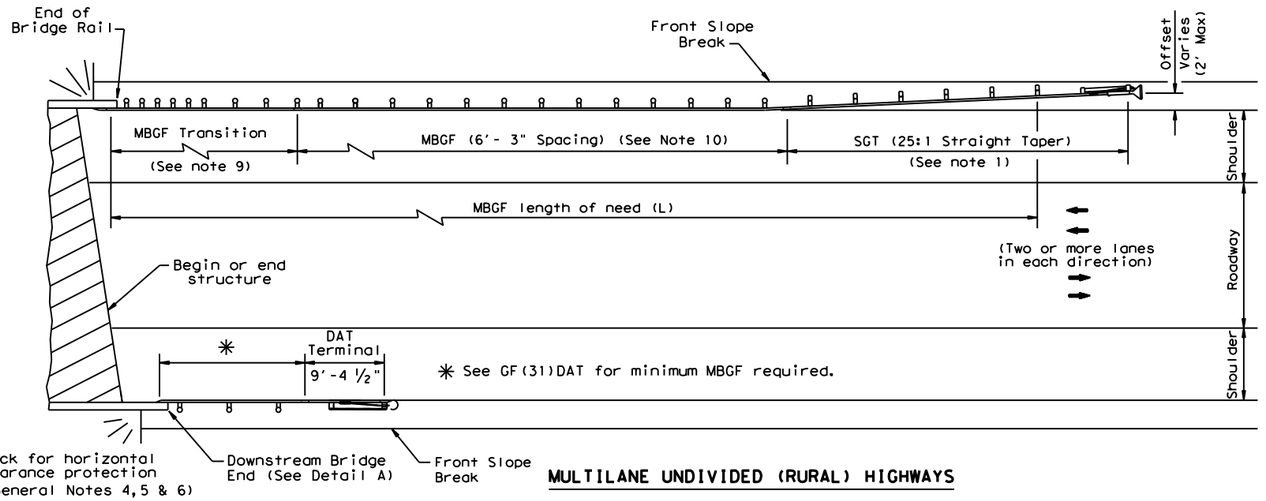
# BED(28)-19

| FILE: bed2819.dgn | DN: TxDOT | CK: KM | DW: BD | CK: VP |
|---|---|---|---|---|
| © TxDOT NOVEMBER 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 49 |

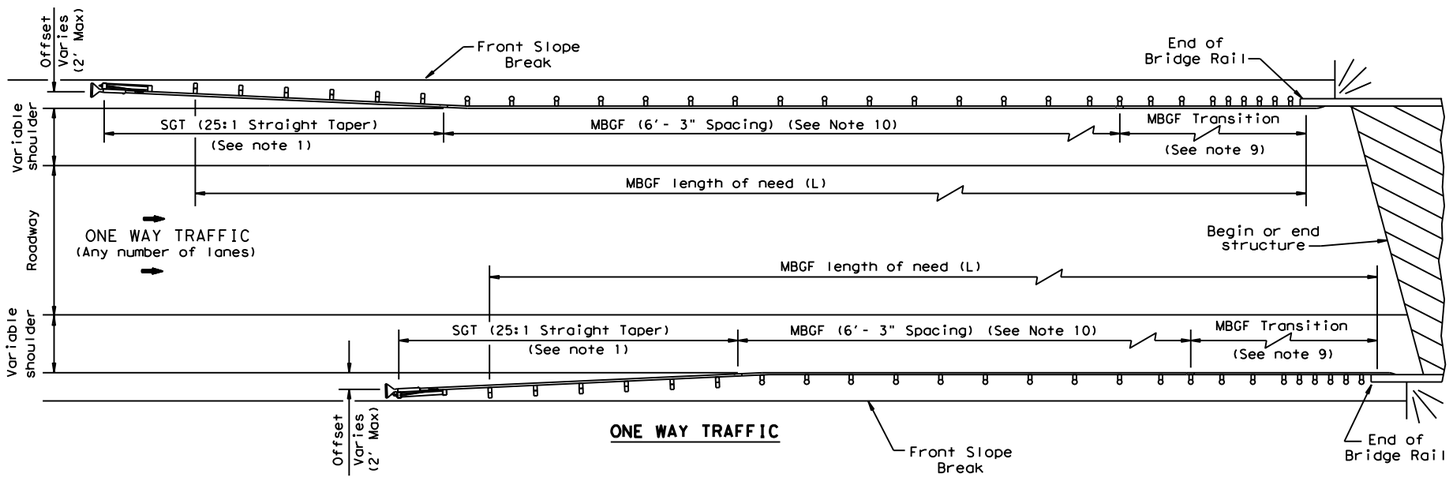



Note:
SGT rail taper may be decreased or eliminated. (See SGT standard sheets)

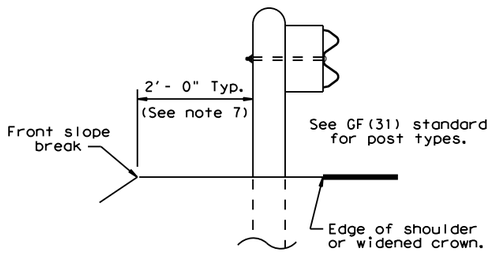
## TWO LANE (RURAL) HIGHWAYS




## MULTILANE UNDIVIDED (RURAL) HIGHWAYS



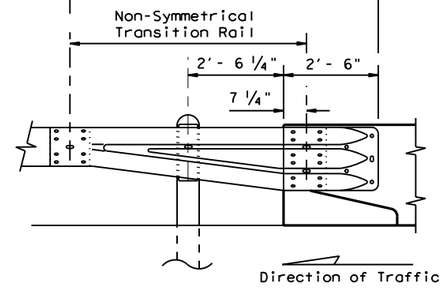

## ONE WAY TRAFFIC




## TYPICAL CROSS SECTION AT MBGF

## 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.




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 | 6439 | 16 | 001 | VAR |
| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 50 |

DATE: _03/20/23_ _11:30_
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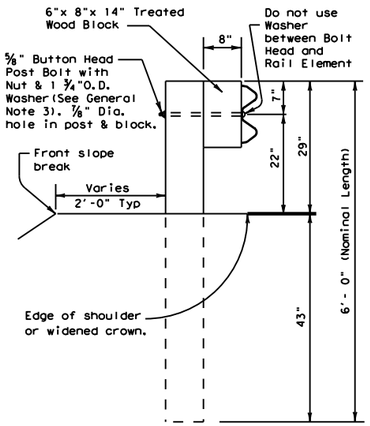
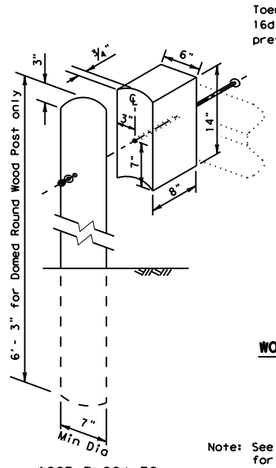
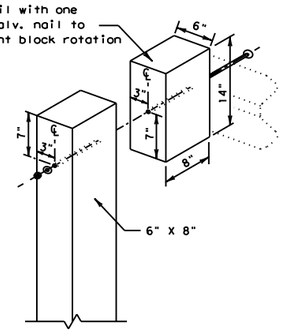
DATE: 03/20/23
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties



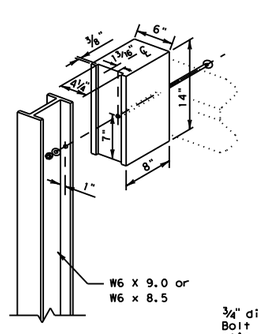

**TYPICAL POST**



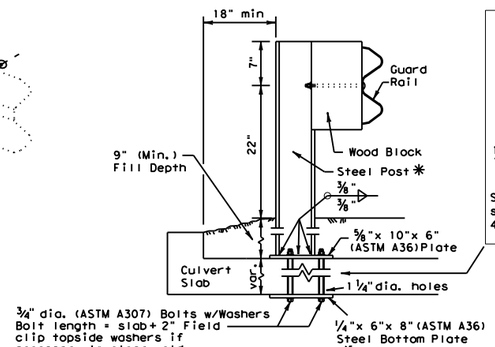

**WOOD BLOCK TO ROUND WOOD POST**




**WOOD BLOCK TO RECTANGULAR WOOD POST**

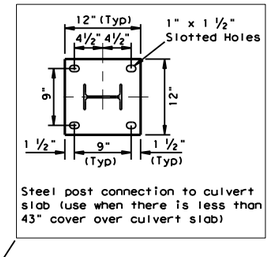



**WOOD BLOCK TO STEEL POST**

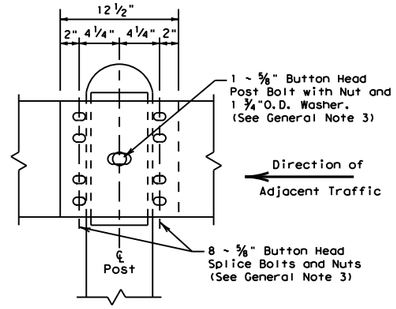



*** LOW FILL CULVERT POST**

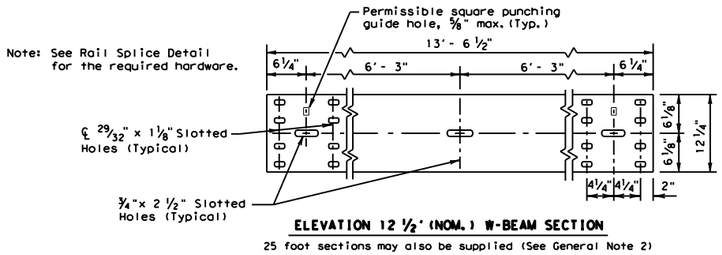
**FOR USE ON NON-BRIDGE CLASS CULVERTS ONLY**




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




**RAIL SPLICE DETAIL**

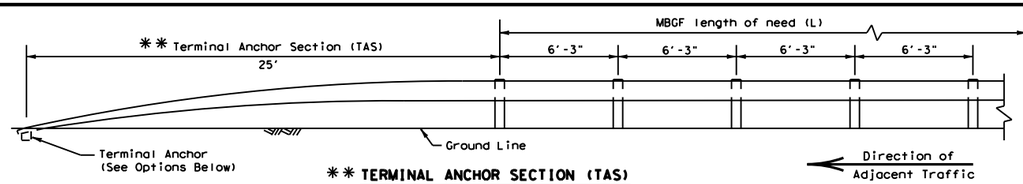



**ELEVATION 12½' (NOM.) W-BEAM SECTION**

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

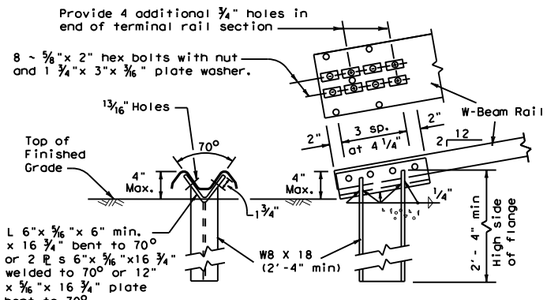
## GENERAL NOTES

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



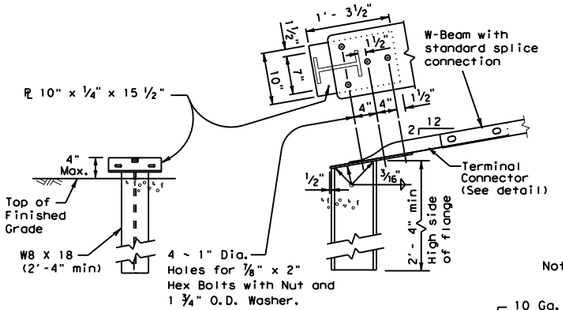

**** TERMINAL ANCHOR SECTION (TAS)**

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




**OPTION (1)**

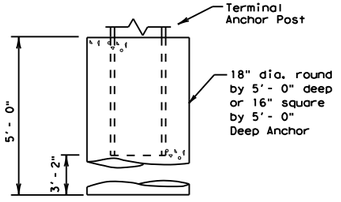
Note: This anchor post requires four additional ¾" holes (shop or field) in the rail member with eight ⅝" hex bolts with nut and plate washer.




**OPTION (2)**

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

**TERMINAL ANCHOR POST OPTIONS**
(See General Note 11)



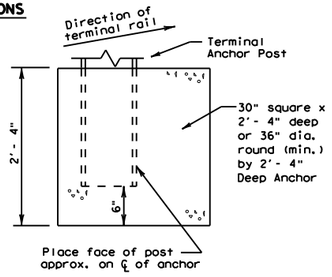

Notes:

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

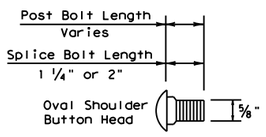
No construction joint is allowed in the concrete anchor.

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

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



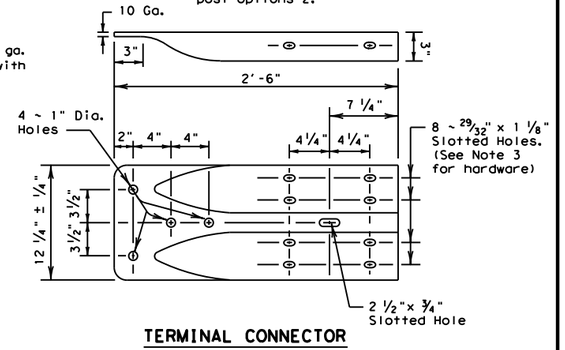

**TERMINAL CONCRETE ANCHOR OPTIONS**
(See General Note 11)




**BUTTON HEAD BOLT**

Post and Splice Bolts
(See General Note 3)

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




**TERMINAL CONNECTOR**

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

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

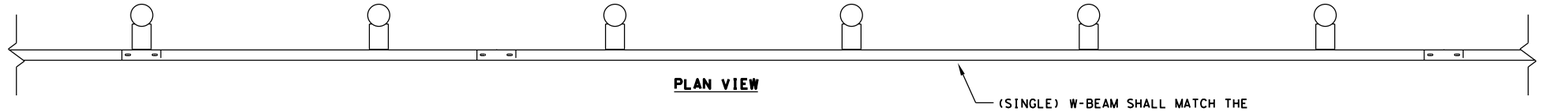
Texas Department of Transportation

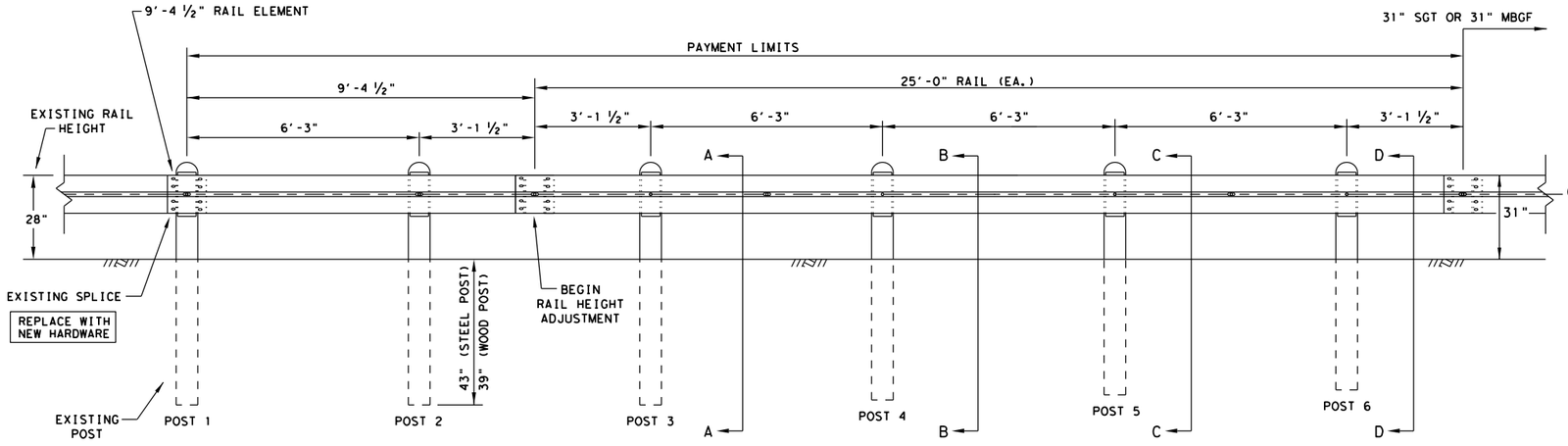
*Design Division Standard*

# METAL BEAM GUARD FENCE

# MBGF-19

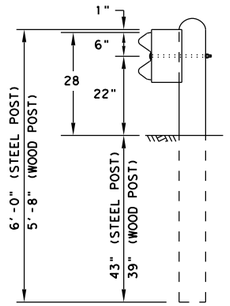
| FILE: mbgf19.dgn | DN: TxDOT | CK: KM | DW: BD | CK: VP |
|---|---|---|---|---|
| ©TxDOT NOVEMBER 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 51 |



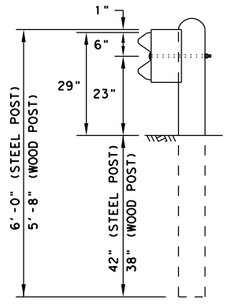




## ELEVATION VIEW

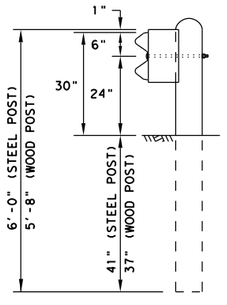
✳ "WOOD" INDICATES DIMENSIONS FOR BOTH ROUND AND RECTANGULAR WOOD POST SYSTEMS.



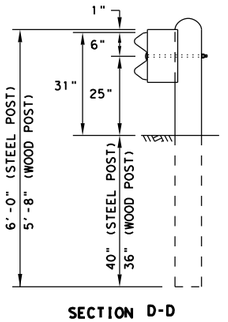

SECTION A-A



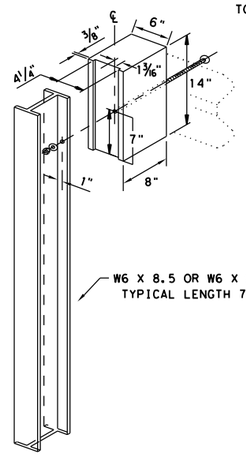

SECTION B-B



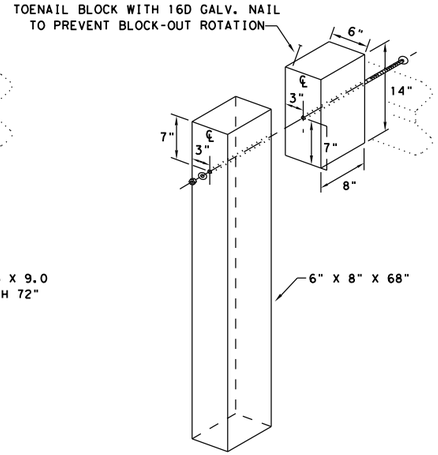

SECTION C-C



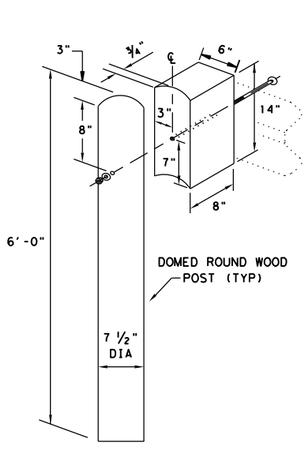

SECTION D-D




ROUTED WOOD BLOCK-OUT TO STEEL POST




WOOD BLOCK TO RECTANGULAR WOOD POST




WOOD BLOCK-OUT TO DOMED ROUND WOOD POST

POST AND BLOCK-OUT TYPES AVAILABLE

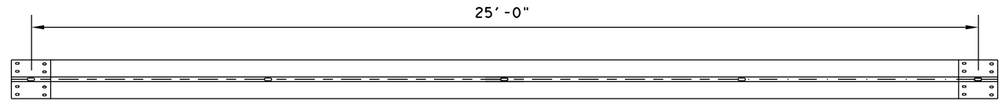
| | QTY | HARDWARE LIST DESCRIPTION |
|---|---|---|
| | 1 | 9'-4 ½" W-BEAM RAIL ELEMENT 12GA. |
| | 1 | 25'-0" W-BEAM RAIL ELEMENT 12GA. (TYP) |
| | 6 | 7 ½" DIA X 6'-0" DOMED ROUND WOOD POSTS (TYP) |
| | 6 | 6" X 8" X 68" RECTANGULAR WOOD POSTS (TYP) |
| | 6 | W6 X 8.5 OR W6 X 9 X 72" STEEL POSTS (TYP)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

NOTE: HARDWARE SHALL MEET THE FOLLOWING REQUIREMENTS.

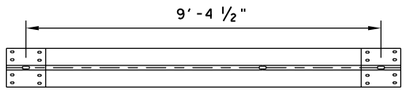
GUARDRAIL POST BOLTS (ASTM A307 GR.A)
GUARDRAIL ROUND WASHERS (ASTM F436)
GUARDRAIL DOUBLE RECESSED NUTS (ASTM A563)
GUARDRAIL SPLICE BOLTS (ASTM A307 GR.A)
GUARDRAIL SPLICE NUTS (ASTM A563)

## GENERAL NOTES

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




25'-0" (NOM.) W-BEAM RAIL ELEMENT




9'-4 ½" (NOM.) W-BEAM RAIL ELEMENT

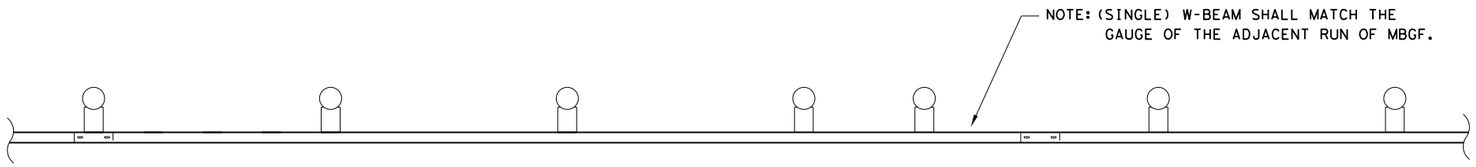
Texas Department of Transportation

Design Division Standard

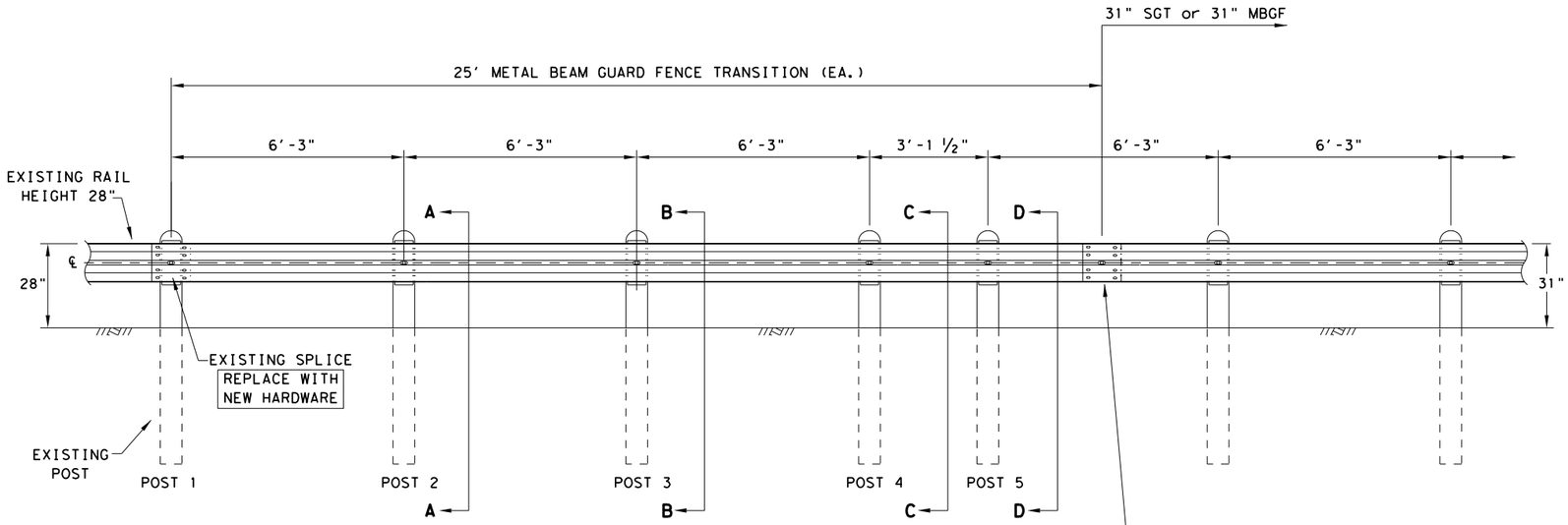
# METAL BEAM GUARD FENCE RAIL HEIGHT ADJUSTMENT (28" TO 31") TL-3 MASH COMPLIANT

# RAIL-ADJ(A)-19

| FILE: railadja19 | DN: TxDOT | CK: KM | DW: VP | CK: CGL/AG |
|---|---|---|---|---|
| ©TxDOT: NOVEMBER 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 52 |

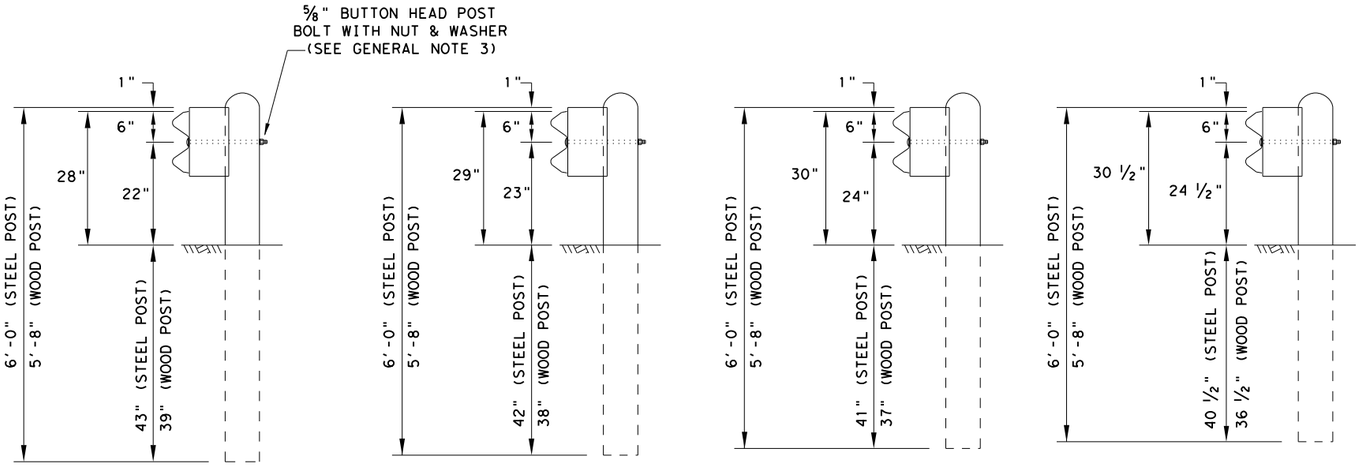



PLAN VIEW




ELEVATION VIEW

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




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

## GENERAL NOTES

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

POST AND BLOCK-OUT TYPES AVAILABLE

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

NOTE: HARDWARE SHALL MEET THE FOLLOWING REQUIREMENTS.

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

Texas Department of Transportation | Design Division Standard

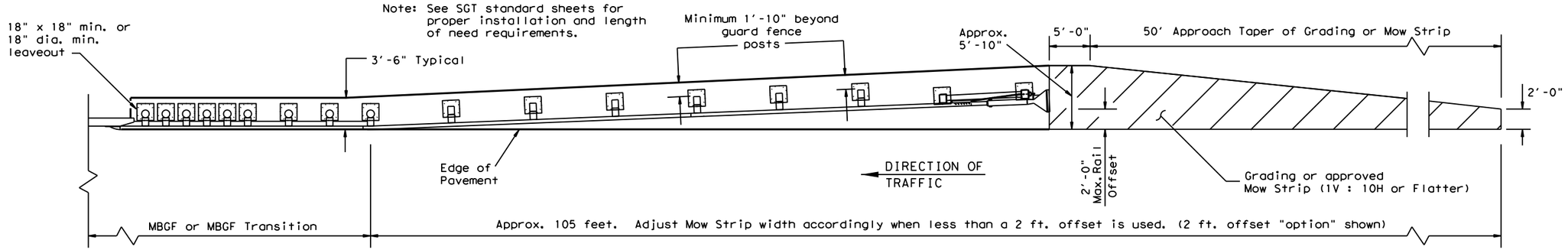
# METAL BEAM GUARD FENCE RAIL HEIGHT ADJUSTMENT (28" TO 31") TL-3 MASH COMPLIANT

# RAIL-ADJ(B)-19

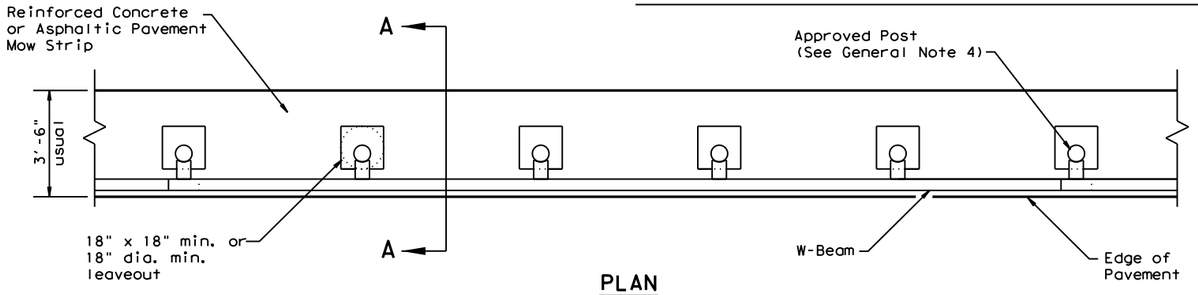
| FILE: railadjb19 | DN: TxDOT | CK: KM | DW: VP | CK: CGL/AG |
|---|---|---|---|---|
| ©TxDOT: NOVEMBER 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 53 |

DATE: _03/20/23_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties

DATE: _03/20/23_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties

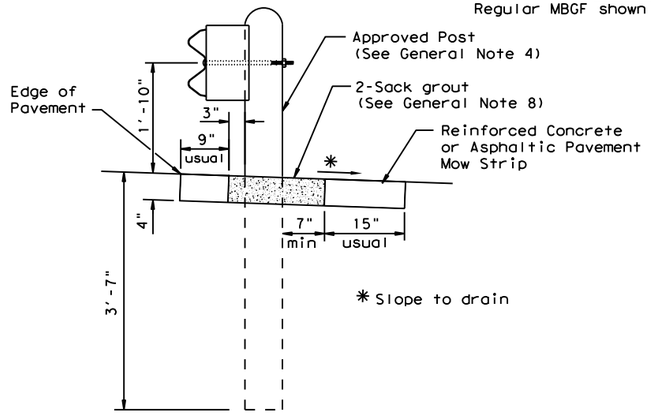



# GRADING AND MOW STRIP AT GUARDRAIL END TREATMENTS



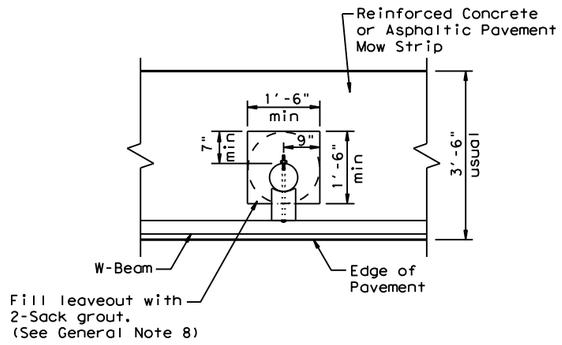

## PLAN

Regular MBGF shown with Mow Strip



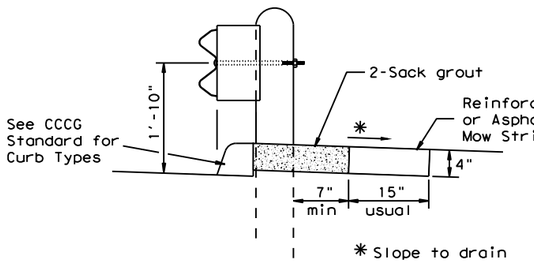

## SECTION A-A

Typical



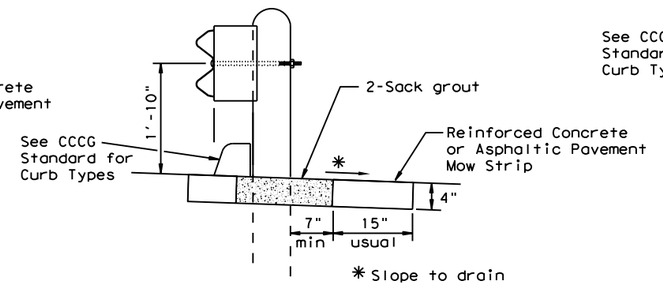

## MOW STRIP DETAIL

Reinforced Concrete or Asphaltic Pavement Mow Strip with 18" x 18" or 18" dia. minimum leaveout.



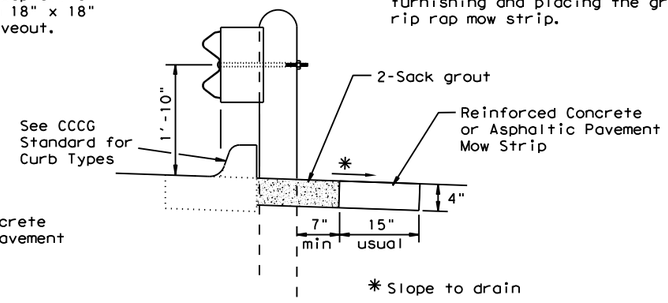

## CURB OPTION (1)

This option will increase the post embedment through out 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 SGT standards for proper SGT installation).
2. Mow strips shall be asphaltic pavement or reinforced concrete (wire mesh or synthetic fiber), as shown on the plans and will be paid for under the pertinent bid item of work. Asphaltic pavement shall meet the requirements of the item, and be placed in accordance with the pertinent bid item as shown on the plans. 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 leaveout behind the post shall be a minimum of 7".
4. The type of approved post will be shown elsewhere in the plans. See the applicable standard sheets for additional details and information.
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. Depth of mow strip will be 4".
7. The limits of payment for asphaltic pavement or reinforced concrete will include leaveouts for posts.
8. The leave-outs shall be filled with no more than a 2-sack grout mixture (1 part cement, 5 parts water, and 14 parts sand by volume) with a 28-day compressive strength of approximately 120 psi or less. Provide grout of a consistency that will flow into and completly 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 rip rap mow strip.

**ONLY FOR USE IN MAINTENANCE REPAIRS.**

Texas Department of Transportation | Design Division Standard

# METAL BEAM GUARD FENCE

## (MOW STRIP)

## MBGF (MS) - 19

| FILE: mbgfms19.dgn | DN: TxDOT | CK: KM | DW: TXDOT | CK: CL |
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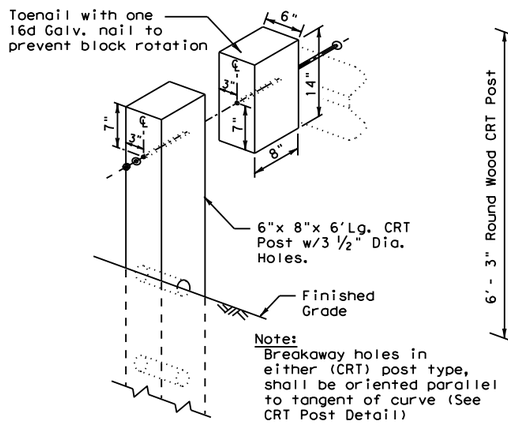
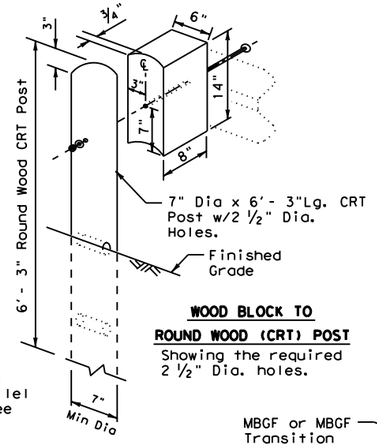
| © TxDOT NOVEMBER 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 54 |

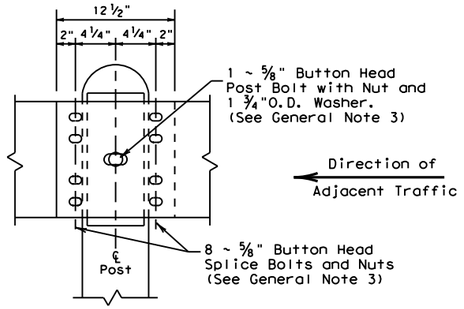



Note: Breakaway holes in either (CRT) post type, shall be oriented parallel to tangent of curve (See CRT Post Detail)

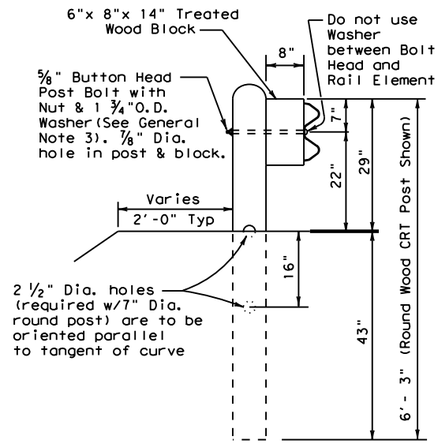
**WOOD BLOCK TO RECTANGULAR WOOD (CRT) POST**
Showing the required 3 ½" Dia. holes.




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

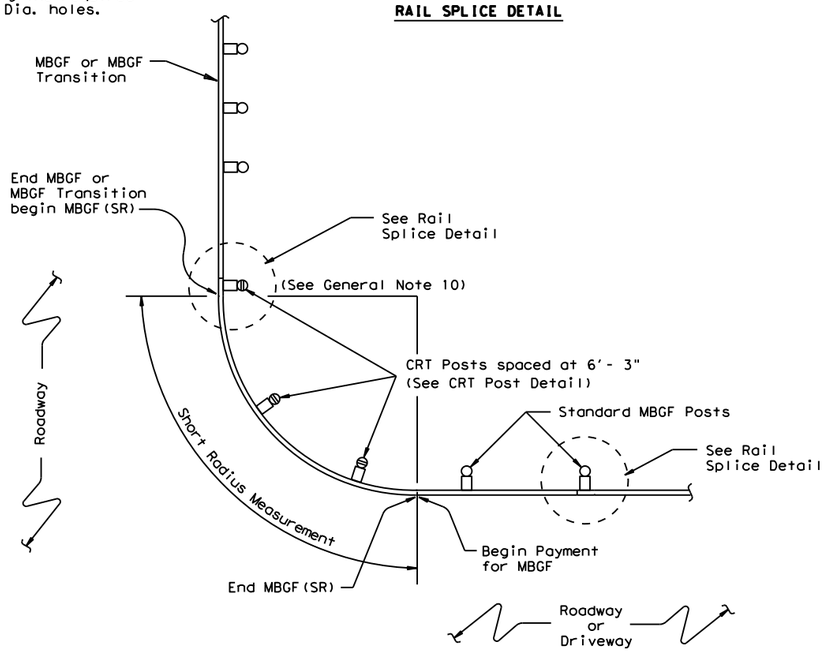



**RAIL SPLICE DETAIL**




## (CRT) POST DETAIL
## CONTROLLED RELEASE TERMINAL POST

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




## PLAN VIEW
## SHOWING TYPICAL RADIUS

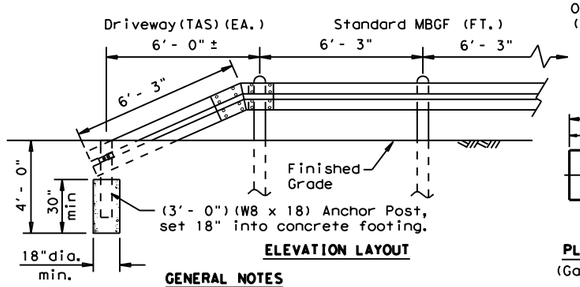
The required radius is shown elsewhere on the plans.

## GENERAL NOTES

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

## "DRIVEWAY" TERMINAL ANCHOR SECTION

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




**ELEVATION LAYOUT**

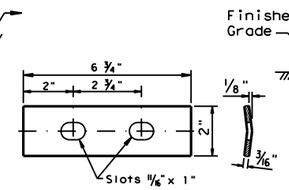
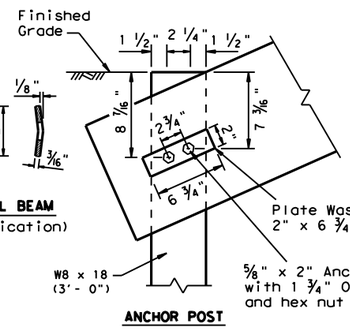
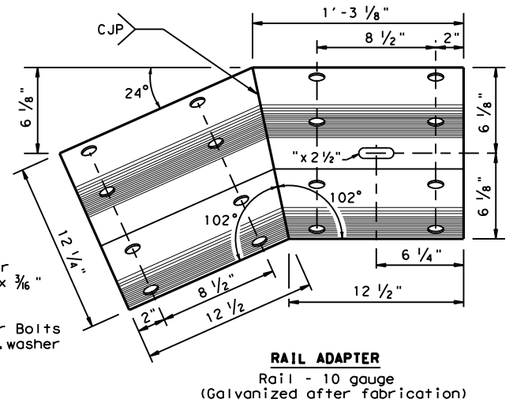



**PLATE WASHER FOR METAL BEAM**
(Galvanized after fabrication)




**ANCHOR POST**




**RAIL ADAPTER**
Rail - 10 gauge
(Galvanized after fabrication)

**GENERAL NOTES**

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

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

Texas Department of Transportation — Design Division Standard

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

| FILE: mbgfsr19.dgn | DN: TxDOT | CK: KM | DW: BD | CK: VP |
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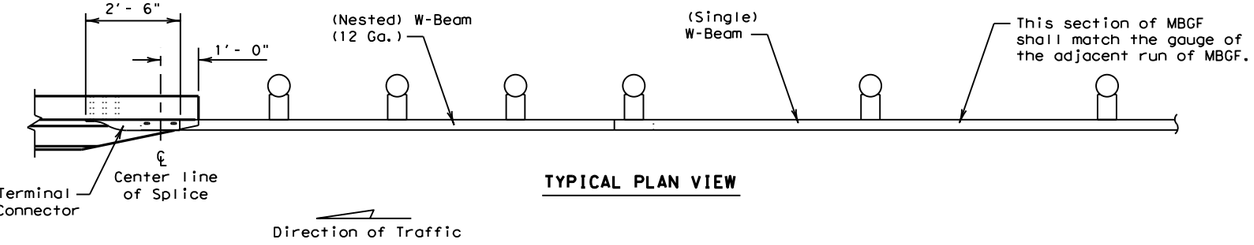
| ©TxDOT NOVEMBER 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 55 |

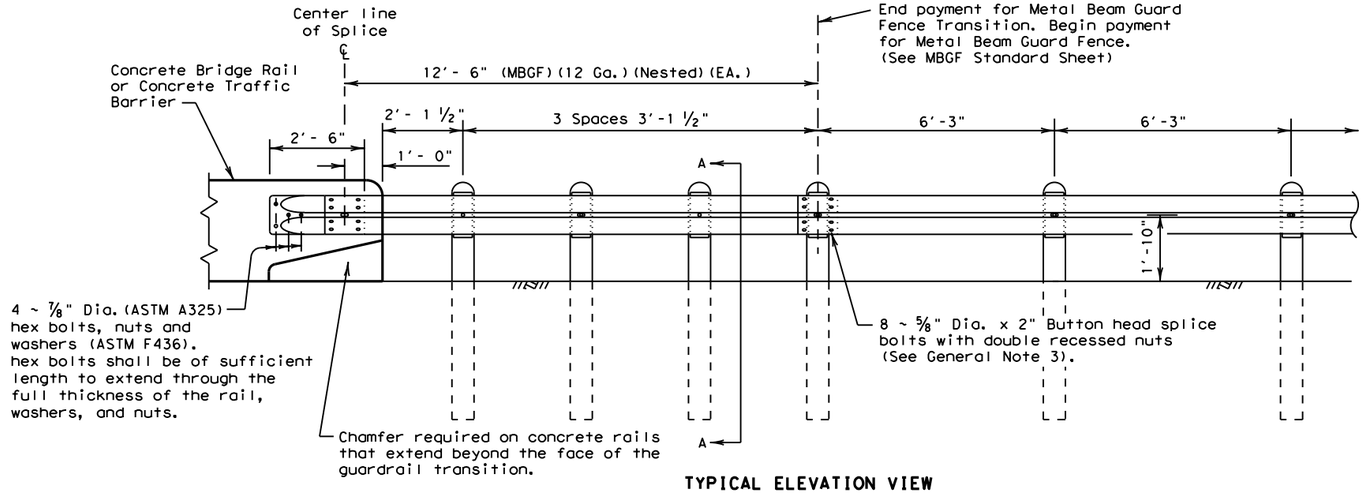
DATE: _03/20/23_
FILE: _LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties

DATE: _03/20/23_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties




TYPICAL PLAN VIEW

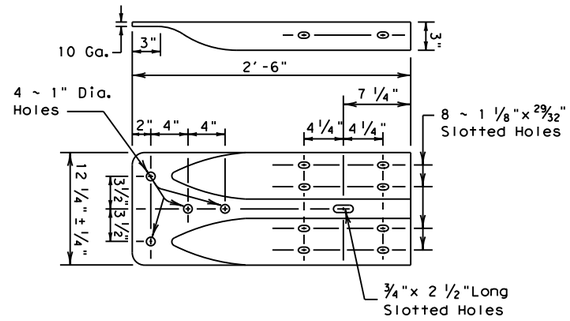
Direction of Traffic




TYPICAL ELEVATION VIEW

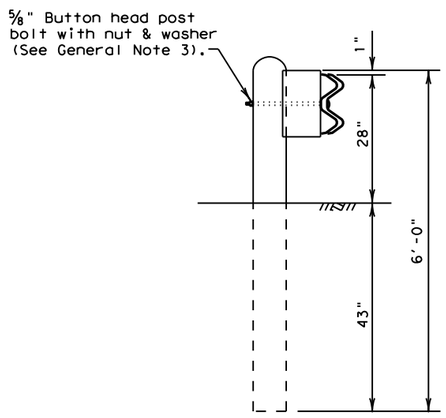
## GENERAL NOTES

1. The type of post (round wood post, rectangular wood post, or steel post) will be shown elsewhere in the plans. The exact position of transitions shall be shown elsewhere in the plans or as directed by the Engineer.
2. Rail element shall meet the requirements of Item 540, "Metal Beam Guard Fence" except as modified on the plans.
3. Button head "post" bolts (ASTM A307) shall be of sufficient length to extend through the full thickness of the nut and Type A 1 ¾" O.D. washer and not more than 1" beyond it. Button head "splice" bolts (ASTM A307) are ⅝" x 2" (at triple rail splices) with ⅝" double recessed nuts (ASTM A563).
4. Fittings (bolts, nuts, and washers) shall be galvanized in accordance with Item 445, "Galvanizing." Fittings shall be subsidiary to the bid item requiring construction of the transition.
5. Crown will be widened to accommodate transitions.
6. If solid rock is encountered. See the MBGF standard sheet for the proper installation guidance.
7. Posts shall not be set in concrete.
8. Unless otherwise shown in the plans, a composite material post and/or block that meets the requirements of DMS-7210, "Composite Material Posts and Blocks for Metal Beam Guard Fence" may be substituted for posts and/or blocks of similar dimensions. The Construction Division, TxDOT, maintains a Material Producer List (MPL) for producers of materials conforming to DMS-7210. Only producers on the MPL can furnish composite material posts and/or blocks.
9. Refer to MBGF standard sheet for additional details.

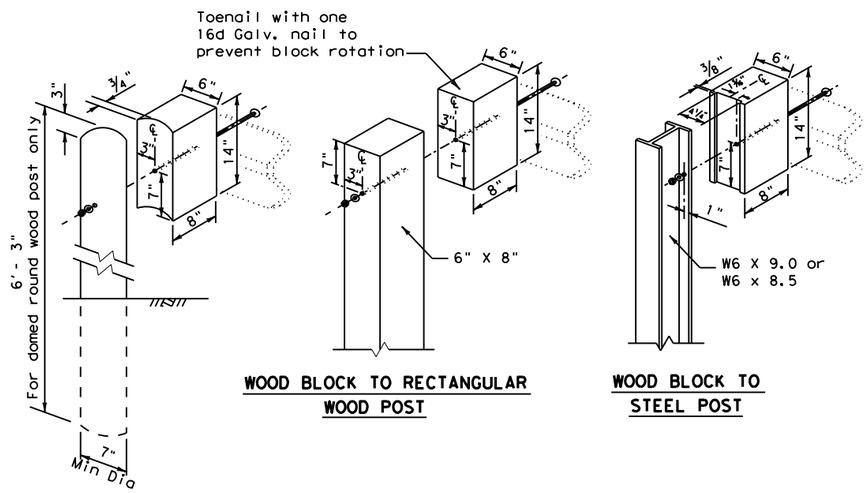



TERMINAL CONNECTOR

FOR USE WITH MBGF CONNECTIONS TO CONCRETE BRIDGE RAILS AND TRAFFIC BARRIERS




SECTION A-A




WOOD BLOCK TO ROUND WOOD POST

WOOD BLOCK TO RECTANGULAR WOOD POST

WOOD BLOCK TO STEEL POST

**ONLY FOR USE IN MAINTENANCE REPAIRS.**

Texas Department of Transportation

Design Division Standard

# METAL BEAM GUARD FENCE TRANSITION (TL2)

## (Low Speed Transition)

## MBGF (TL2)-19

| | | | | |
|---|---|---|---|---|
| FILE: mbgft1219.dgn | DN: TxDOT | CK: KM | DW: BD | CK: VP |
| ©TxDOT NOVEMBER 2019 | CONT | SECT | JOB | HIGHWAY |
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| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 56 |

DATE: _03/20/23_
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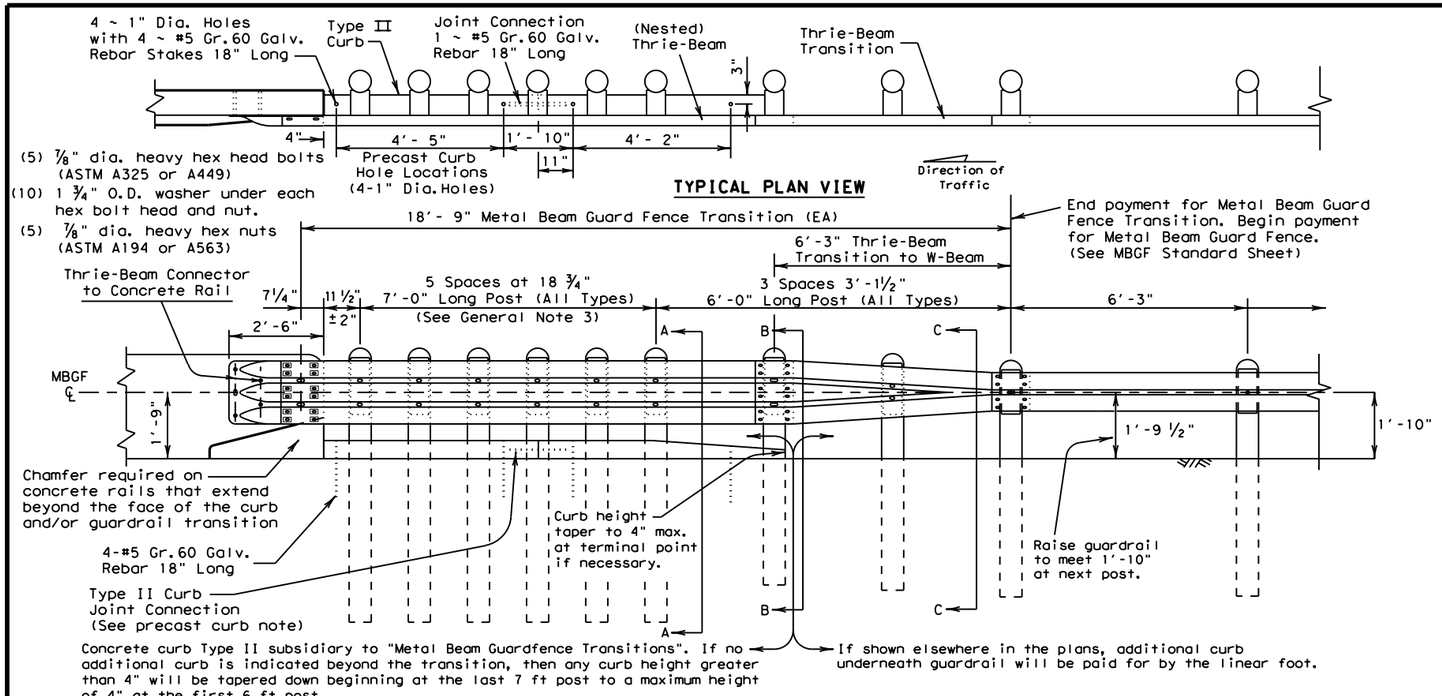
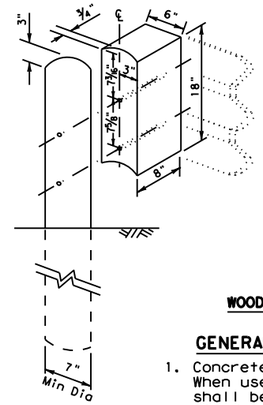
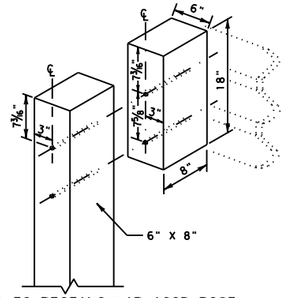
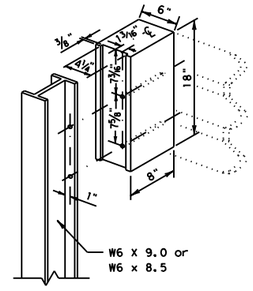



WOOD BLOCK TO ROUND WOOD POST




WOOD BLOCK TO RECTANGULAR WOOD POST




WOOD BLOCK TO STEEL POST

## GENERAL NOTES

1. Concrete curb may be cast-in-place or precast as shown on this sheet. When used in conjunction with thrie-beam guard fence transitions, curb shall be Type II (Typically 5 3/4" height above surface; See CCCG standard sheet) unless otherwise shown in the plans. 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.

   Contact the Design Division for drainage cut options needed within the curb section of the transition.

2. The type of post (round wood, rectangular wood or steel) will be shown elsewhere in the plans.

3. 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 5/8" in height, and visible after installation. Wooden posts shall be marked with a brand, and steel posts with a stencil before galvanizing.

4. Rail element 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.

5. Unless otherwise shown in the plans, transitions shall be placed with the block face in front of or directly above the curb face.

6. Install terminal connector with (12) rectangular guardrail plate washers: (FWR03) and (12) 5/8" X 2" button head splice bolts with recessed nuts.

7. 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.

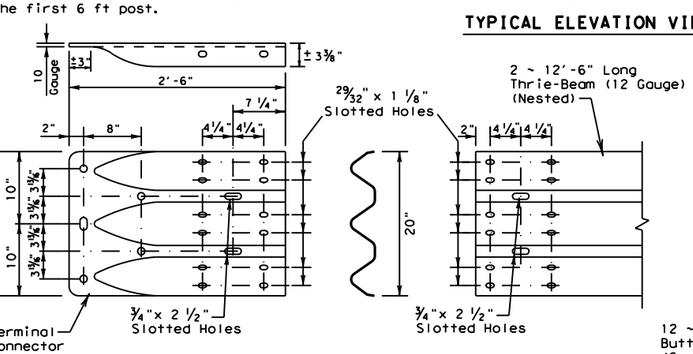
8. Fittings (bolts, nuts, and washers) shall be galvanized in accordance with Item 445, "Galvanizing". Fittings shall be subsidiary to the bid item.

9. Crown shall be widened to accommodate transitions.

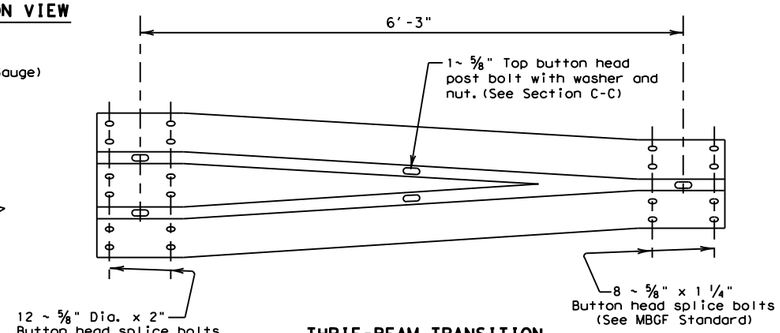
10. If solid rock is encountered. See the MBGF standard sheet for the proper installation guidance.

11. Posts shall not be set in concrete.

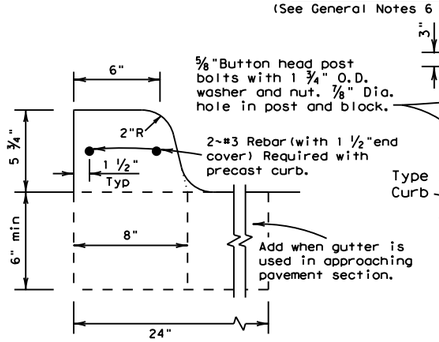
12. Unless otherwise shown in the plans, a composite material post and/or block that meets the requirements of DMS-7210, "Composite Material Posts and Blocks for Metal Beam Guard Fence" may be substituted for posts and/or blocks of similar dimensions. The Construction Division, TxDOT, maintains a Material Producer List (MPL) for producers of materials conforming to DMS-7210. Only producers on the MPL can furnish composite material posts and/or blocks.




THRIE-BEAM TERMINAL CONNECTION
(See General Notes 6 & 7 for required hardware)

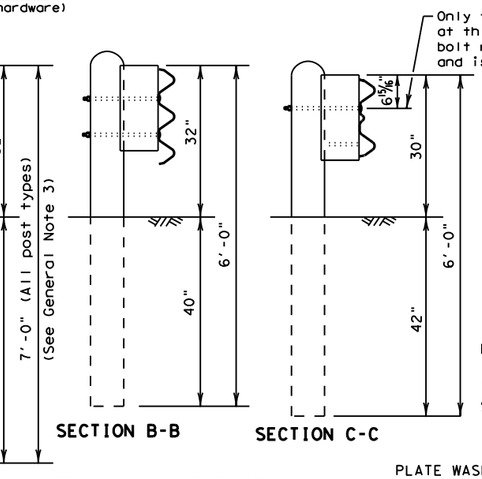



THRIE-BEAM TRANSITION TO W-BEAM (10 Gauge)

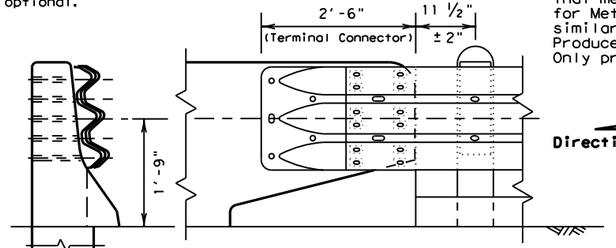



TYPE II CURB
Cast-in-Place or Precast

PRECAST CURB: Type II Precast Curb secured with 4~#5 Gr.60 Galv. Rebar stakes 18" long. The 12'- 2" section of curb may be cast in two sections.
Section ① 5'- 8" long
Section ② 6'- 6" long with the last 3'- 6" of curb tapered to a 4" height.
The Joint Connection is two 9" long 1" dia female ends connected with 1~#5 Gr.60 Galv. Rebar 18" long.




TRANSITION SECTIONS




CONNECTION TO CONCRETE BRIDGE RAIL AND TRAFFIC BARRIERS

NOTES:
(5) 7/8" dia. heavy hex bolts, length will vary depending on width of concrete rail, leave 1" of bolt length past the 5/8" hex nut. Trim as required.
See General Notes: 6 & 7 for additional connection details.

PLATE WASHER INSTRUCTIONS

BRIDGE APPROACH - UPSTREAM: THE NESTED RAIL LAPS OVER THE TERMINAL CONNECTOR. PLATE WASHERS ARE INSTALLED UNDER THE SPLICE NUTS AGAINST INSIDE OF CONNECTOR.
BRIDGE EXIT - DOWNSTREAM: THE TERMINAL CONNECTOR LAPS OVER THE NESTED RAIL. PLATE WASHERS ARE INSTALLED UNDER THE BOLT HEAD AGAINST OUTSIDE OF CONNECTOR.

**ONLY FOR USE IN MAINTENANCE REPAIRS.**

Texas Department of Transportation

Design Division Standard

# METAL BEAM GUARD FENCE TRANSITION (THRIE-BEAM TRANSITION) MBGF(TR)-19

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|---|---|---|---|---|
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| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 57 |

DATE: _03/20/23_
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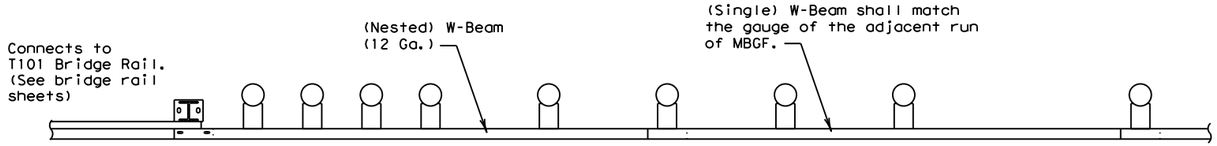
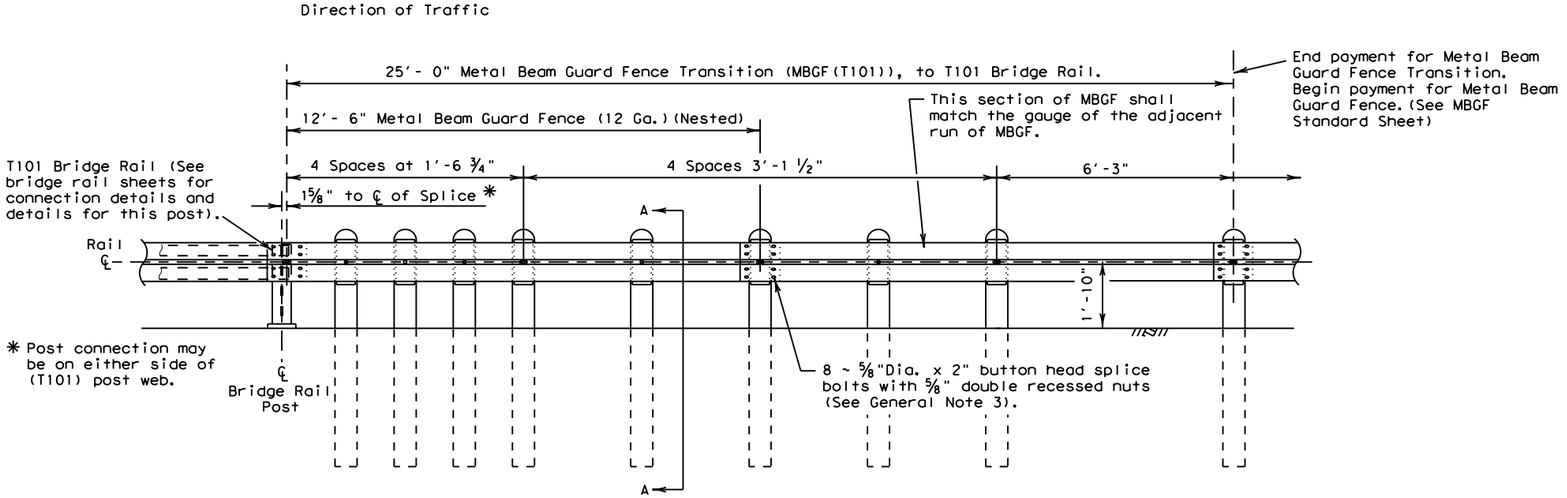
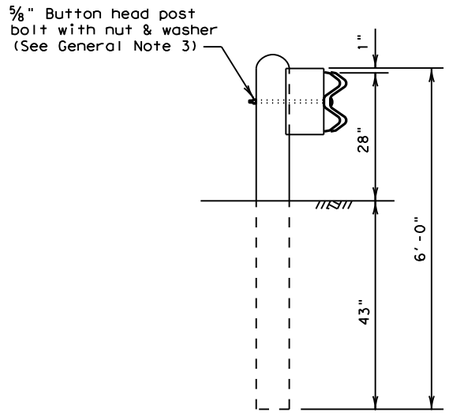


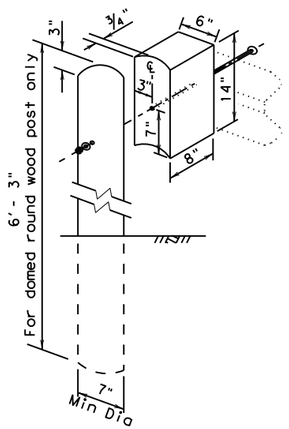

TYPICAL PLAN VIEW



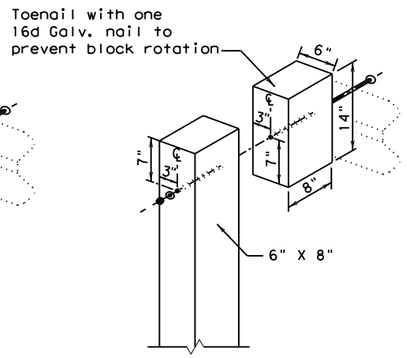

TYPICAL ELEVATION VIEW



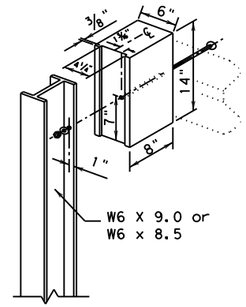

SECTION A-A




WOOD BLOCK TO
ROUND WOOD POST




WOOD BLOCK TO RECTANGULAR
WOOD POST




WOOD BLOCK TO
STEEL POST

## GENERAL NOTES

1. The type of post (round wood post, rectangular wood post, or steel post) will be shown elsewhere in the plans. The exact position of transitions shall be shown elsewhere in the plans or as directed by the Engineer.
2. Rail element shall meet the requirements of Item 540, "Metal Beam Guard Fence" except as modified on the plans.
3. Button head "post" bolts (ASTM A307) shall be of sufficient length to extend through the full thickness of the nut (ASTM A563) and the Type A 1 3/4" O.D. washer and not more than 1" beyond it. Button head "splice" bolts (ASTM A307) are 5/8" x 2" (at triple rail splices) with a 5/8" double recessed nuts (ASTM A563).
4. Fittings (bolts, nuts, and washers) shall be galvanized in accordance with Item 445, "Galvanizing." Fittings shall be subsidiary to the bid item requiring construction of the transition.
5. Crown will be widened to accommodate transitions.
6. If solid rock is encountered. See the MBGF standard sheet for proper installation guidance.
7. Posts shall not be set in concrete.
8. Unless otherwise shown in the plans, a composite material post and/or block that meets the requirements of DMS-7210, "Composite Material Posts and Blocks for Metal Beam Guard Fence" may be substituted for posts and/or blocks of similar dimensions. The Construction Division, TxDOT, maintains a Material Producer List (MPL) for producers of materials conforming to DMS-7210. Only producers on the MPL can furnish composite material posts and/or blocks.
8. Refer to MBGF Standard Sheet for additional details.

**ONLY FOR USE IN MAINTENANCE REPAIRS.**

Texas Department of Transportation | Design Division Standard

# METAL BEAM GUARD FENCE TRANSITION (T101)

## (T101 BRIDGE RAIL)

## MBGF(T101)-19

| | | | | | | |
|---|---|---|---|---|---|---|
| FILE: mbgft10119.dgn | DN: TxDOT | | CK: KM | DW: BD | | CK: VP |
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| | DIST | COUNTY | | | SHEET NO. | |
| | 22 | VAR | | | 58 | |

DATE: _03/20/23_
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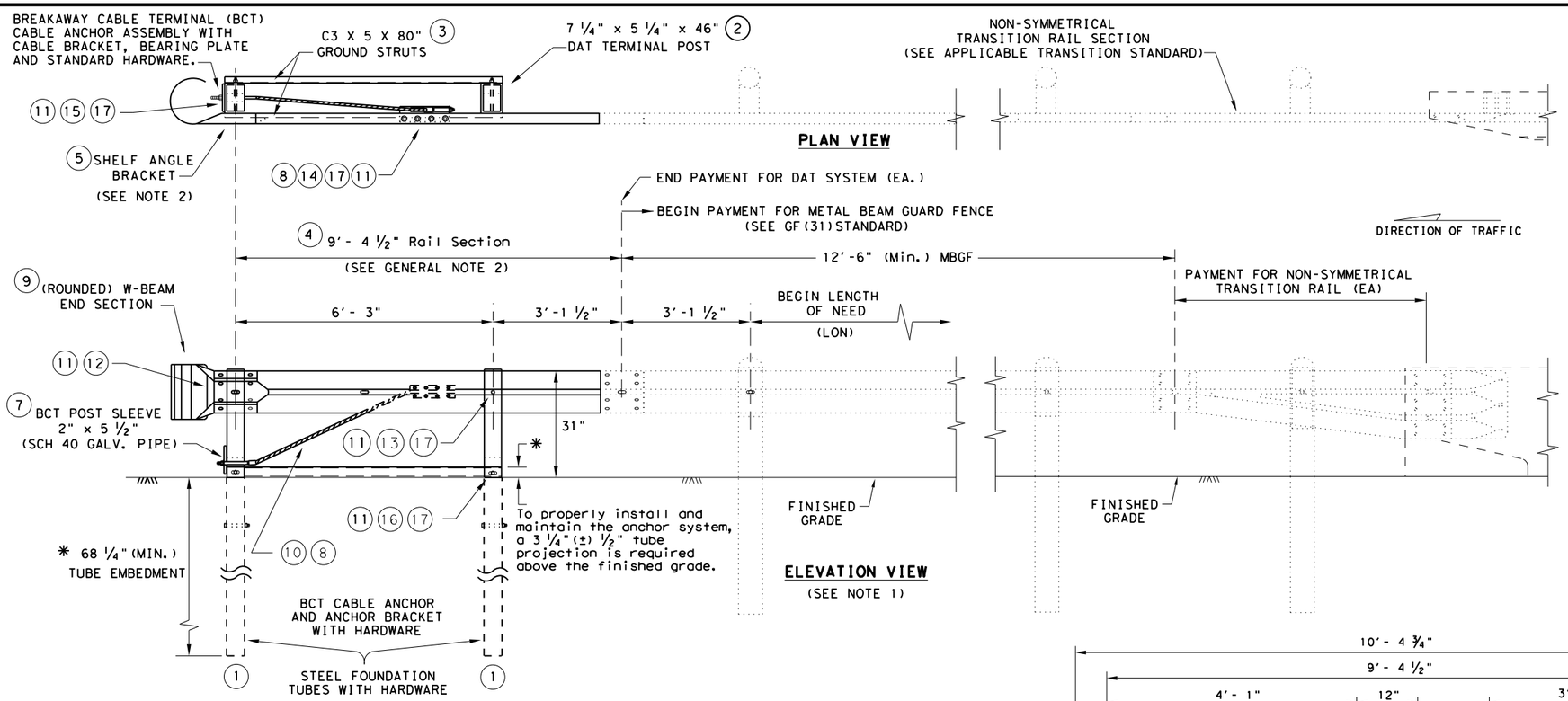



## DOWNSTREAM ANCHOR TERMINAL (DAT)

NOTE: ONLY FOR DOWNSTREAM USE, WHEN LOCATED OUTSIDE THE HORIZONTAL CLEARANCE AREA OF OPPOSING TRAFFIC.

## GENERAL NOTES

1. THE DETAIL SHOWN IS THE MINIMUM LENGTH OF NEED (LON) FOR A DOWNSTREAM ANCHOR TERMINAL (DAT) CONNECTED TO A CONCRETE RAIL.
2. THE RAIL SECTION AT THE END POST IS SUPPORTED BY THE SHELF ANGLE BRACKET. THE RAIL ELEMENT IS NOT ATTACHED TO THE END POST.
3. THE FOUNDATION TUBES SHALL NOT PROJECT MORE THAN 3 3/4" ABOVE THE FINISHED GRADE.
4. ALL HARDWARE FOR DAT SHALL BE ASTM A307 UNLESS OTHERWISE SHOWN.
5. REFER TO GF(31) SHEET FOR TERMINAL CONNECTION DETAILS.

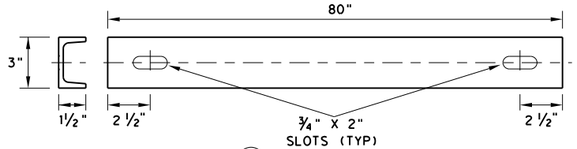
## MOW STRIP INSTALLATION

IF A MOW STRIP IS REQUIRED WITH THE DAT INSTALLATION THE LEAVE-OUT AREA AROUND THE STEEL FOUNDATION TUBES AND THE TWO CHANNEL STRUTS MAY BE OMITTED. THIS WILL REQUIRE A FULL POUR AT THE FOUNDATION TUBES.

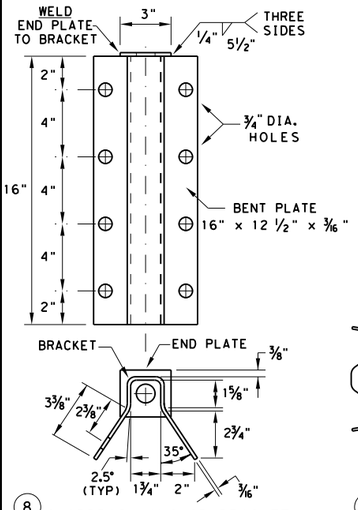
| # | (DAT) PARTS LIST | QTY |
|---|---|---|
| (1) | STEEL FOUNDATION TUBE | 2 |
| (2) | DAT TERMINAL POST | 2 |
| (3) | CHANNEL STRUT | 2 |
| (4) | TERMINAL RAIL ELEMENT | 1 |
| (5) | SHELF ANGLE BRACKET | 1 |
| (6) | BCT BEARING PLATE | 1 |
| (7) | BCT POST SLEEVE | 1 |
| (8) | GUARDRAIL ANCHOR BRACKET | 1 |
| (9) | (ROUNDED) W-BEAM END SECTION | 1 |
| (10) | BCT CABLE ANCHOR | 1 |
| (11) | RECESSED NUT, GUARDRAIL | 20 |
| (12) | 1 1/4" BUTTON HEAD BOLT | 4 |
| (13) | 10" BUTTON HEAD BOLT | 2 |
| (14) | 5/8" X 2" HEX HEAD BOLT | 8 |
| (15) | 5/8" X 8" HEX HEAD BOLT | 4 |
| (16) | 5/8" X 10" HEX HEAD BOLT | 2 |
| (17) | 5/8" FLAT WASHER | 18 |



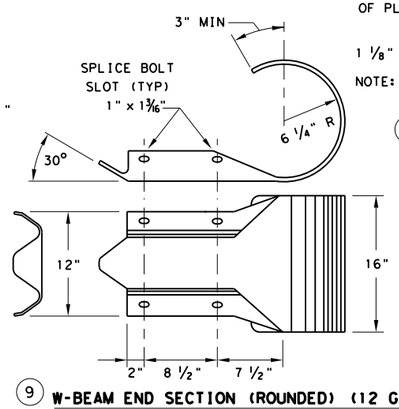

(4) TERMINAL RAIL ELEMENT FOR DAT



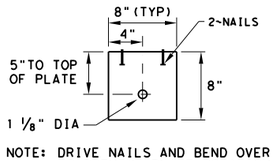

(3) CHANNEL STRUT
C3 X 5 X 80", GRADE A36




(8) GUARDRAIL ANCHOR BRACKET

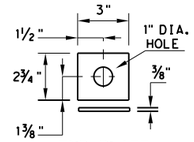



(9) W-BEAM END SECTION (ROUNDED) (12 GA.)

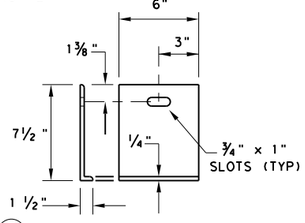



NOTE: DRIVE NAILS AND BEND OVER TO PREVENT PLATE ROTATION

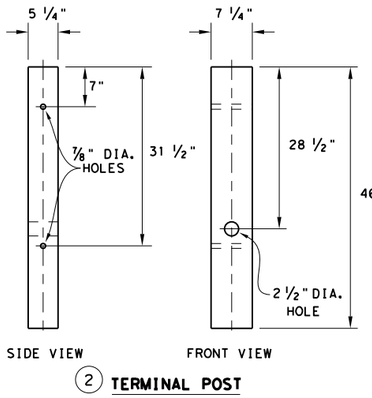
(6) BEARING PLATE
8"x 8"x 5/8" R



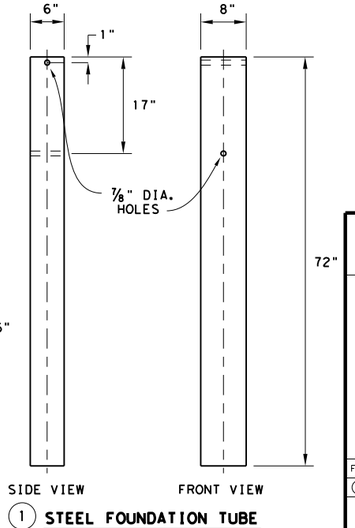

END PLATE




(5) SHELF ANGLE BRACKET




(2) TERMINAL POST
7 1/4"x 5 1/4"x 46" WOOD POST




(1) STEEL FOUNDATION TUBE
6"x 8"x 1/8" x 72" STEEL TUBE

Texas Department of Transportation — Design Division Standard

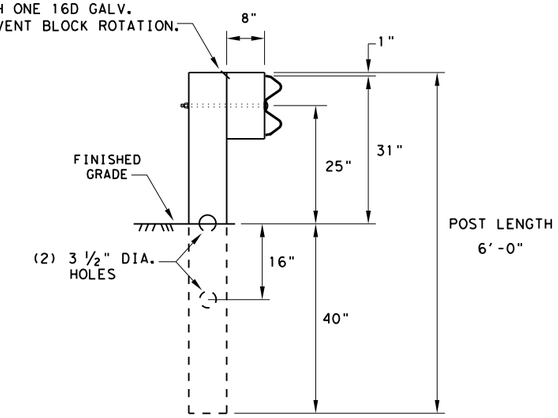
# METAL BEAM GUARD FENCE
## (DOWNSTREAM ANCHOR TERMINAL)
## TL-3 MASH COMPLIANT

# GF(31)DAT-19

| FILE: gf31dat19.dgn | DN: TxDOT | CK: KM | DW: VP | CK: CGL/AG |
|---|---|---|---|---|
| ©TxDOT: NOVEMBER 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 59 |

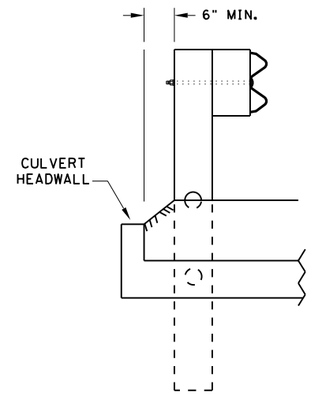
DATE: _03/20/23_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties

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




**RECTANGULAR CRT POST (6"X 8" X 6' LONG)**

(6) CRT REQUIRED
SEE ELEVATION DETAIL FOR LOCATIONS




**LATERAL OFFSET BETWEEN THE GUARDRAIL AND THE CULVERT HEADWALL**

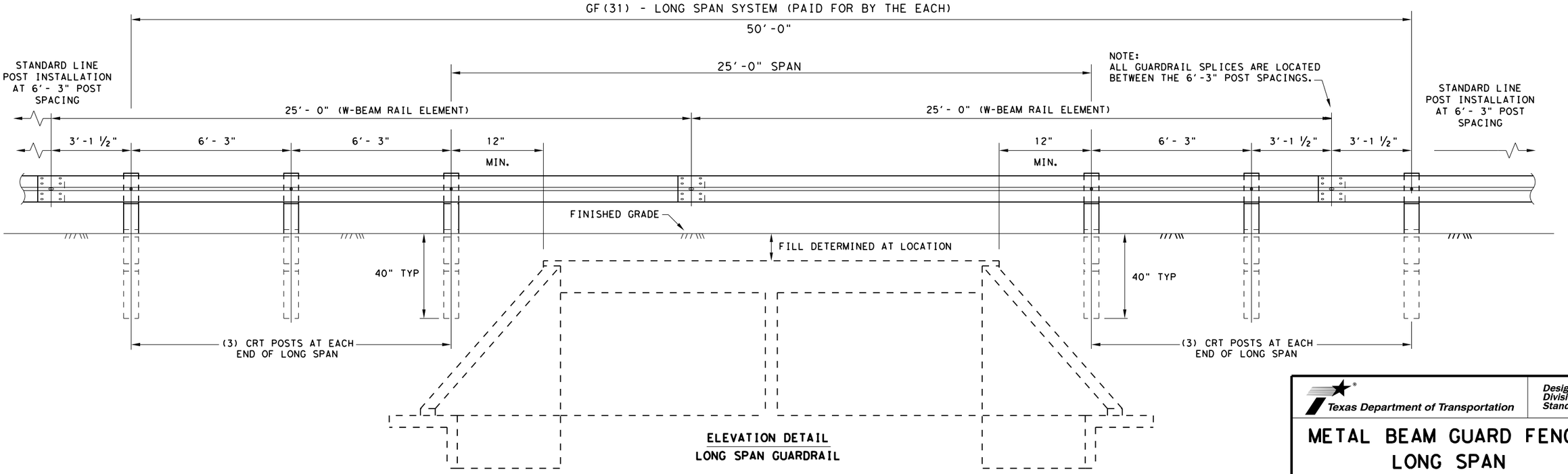
## GENERAL NOTES

1. THE TYPE OF LINE POST (ROUND WOOD POST, RECTANGULAR WOOD POST, OR STEEL POST) WILL BE AS SHOWN IN THE PLANS. THE EXACT POSITION OF THE TRANSITIONS SHALL BE AS SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER. STEEL POSTS TO BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING."
2. RAIL ELEMENT SHALL MEET ALL REQUIREMENTS OF ITEM 540, "METAL BEAM GUARD FENCE" EXCEPT AS MODIFIED ON THE PLANS. THE CONTRACTOR MAY FURNISH RAIL ELEMENTS OF 12'- 6" OR 25'- 0" NOMINAL LENGTHS.
3. RAIL POST HOLES ARE OFFSET 3'- 1 ½" FROM STANDARD GUARDRAIL TO ACCOMMODATE THE MIDSPAN SPLICING.
4. 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 NO MORE THAN 1" BEYOND IT.
5. FITTINGS (BOLTS, NUTS, AND WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING". FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
6. WHERE SOLID ROCK IS ENCOUNTERED, CONTACT THE DESIGN DIVISION FOR ADDITIONAL GUIDANCE. (512) 416-2678
7. POSTS SHALL NOT BE SET IN CONCRETE, OF ANY DEPTH.
8. REFER TO GF(31) STANDARD SHEET FOR ADDITIONAL DETAILS.
9. FLAME CUTTING OF HOLES IN GUARDRAIL SHALL NOT BE PERMITTED. IF YOU ENCOUNTER MIS-ALIGNED BOLT HOLES IN GUARDRAIL CONTACT THE DESIGN DIVISION FOR ADDITIONAL INFORMATION & OPTIONS.

DIRECTION OF TRAFFIC

NOTE: SEE GF(31) STANDARD FOR STANDARD LINE POSTS.

GF(31) - LONG SPAN SYSTEM (PAID FOR BY THE EACH)




**ELEVATION DETAIL**
**LONG SPAN GUARDRAIL**

Texas Department of Transportation

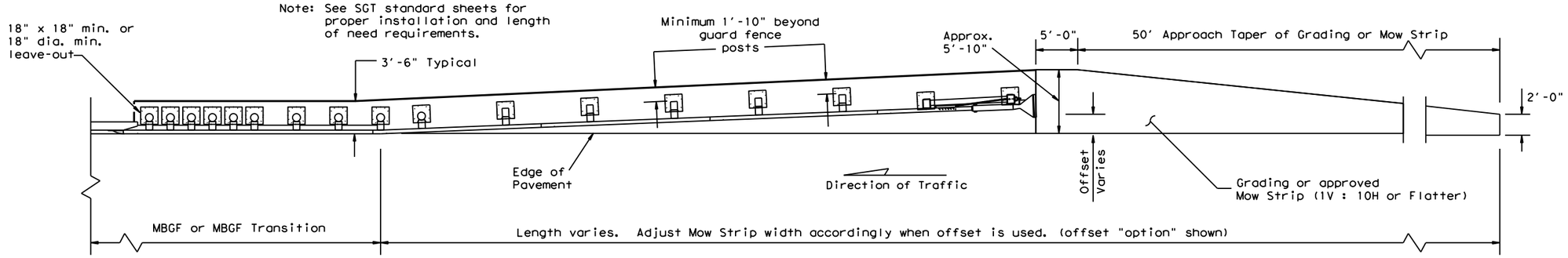
Design Division Standard

# METAL BEAM GUARD FENCE LONG SPAN TL-3 MASH COMPLIANT

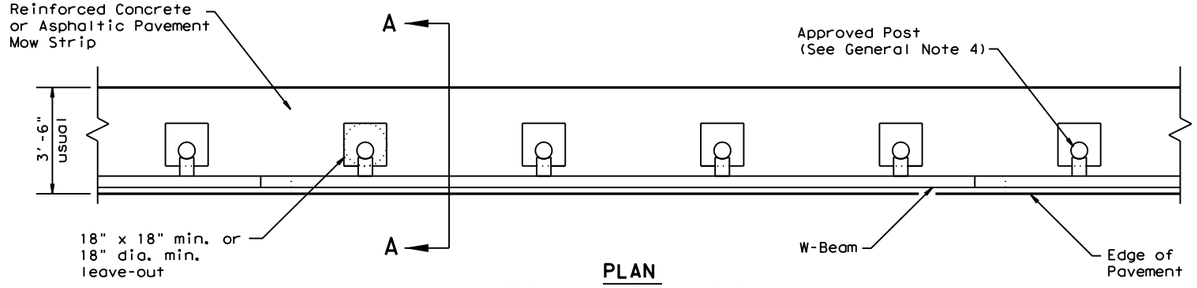
## GF(31)LS-19

| | | | | | |
|---|---|---|---|---|---|
| FILE: gf31ls19.dgn | DN: TxDOT | CK: KM | DW: VP | CK: CGL/AG | |
| ©TxDOT: NOVEMBER 2019 | CONT | SECT | JOB | HIGHWAY | |
| REVISIONS | 6439 | 16 | 001 | VAR | |
| | DIST | COUNTY | | SHEET NO. | |
| | 22 | VAR | | 60 | |

DATE: _03/20/23_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties

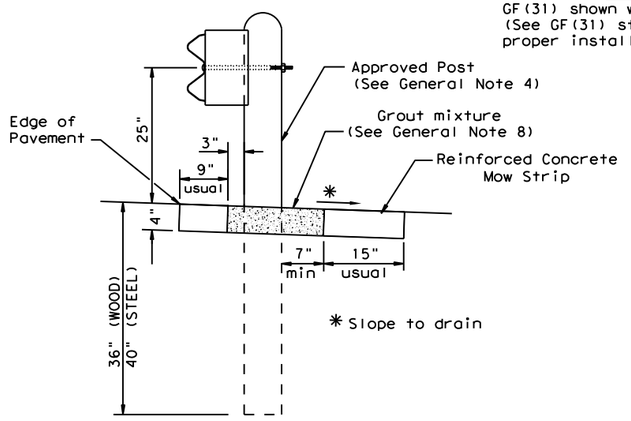



## GRADING AND MOW STRIP AT GUARDRAIL END TREATMENTS



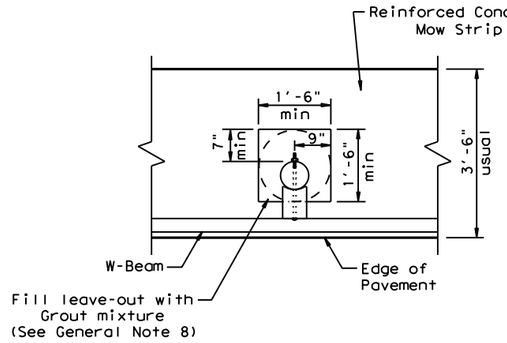

### PLAN

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



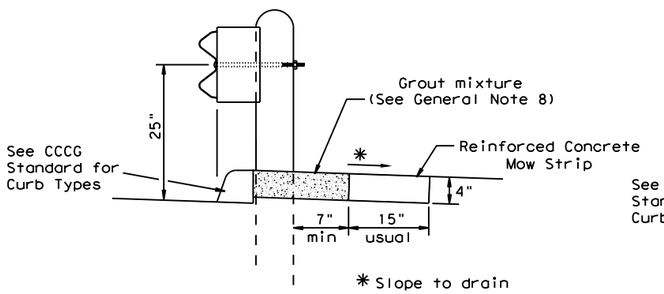

### SECTION A-A

Typical



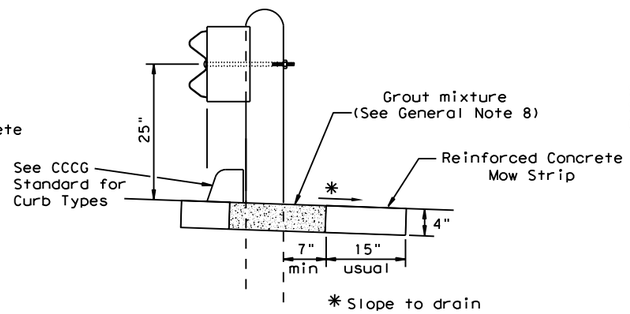

### MOW STRIP DETAIL

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



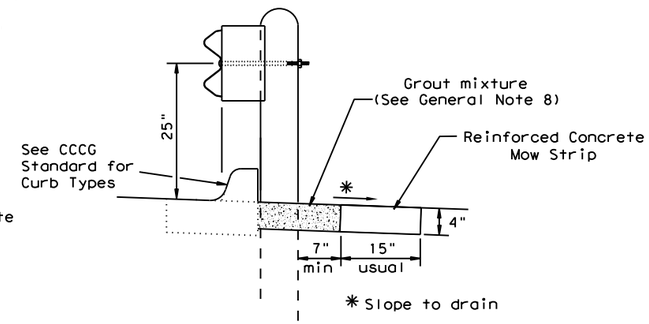

### CURB OPTION (1)

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.

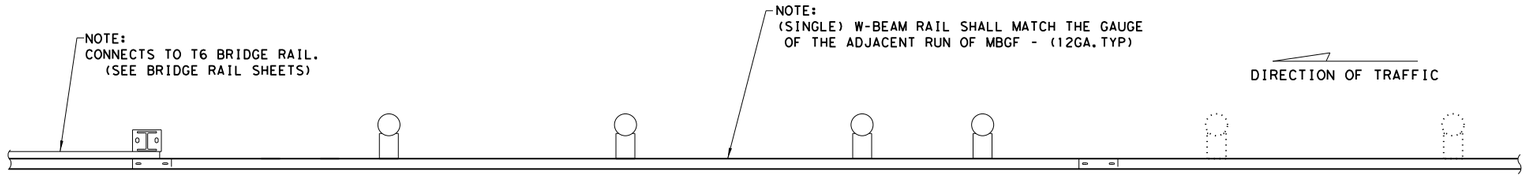
Texas Department of Transportation | Design Division Standard

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

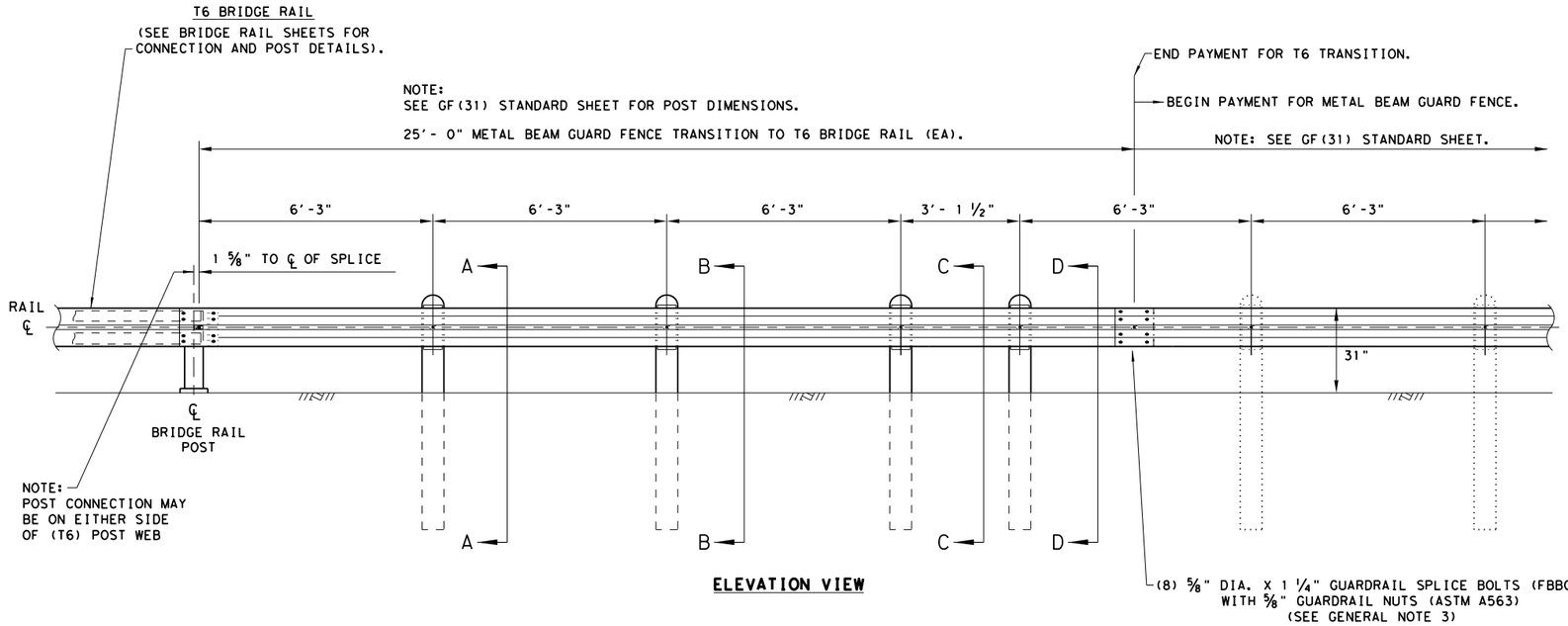
# GF(31)MS-19

| FILE: gf31ms19.dgn | DN: TxDOT | CK: KM | DW: VP | CK: CGL/AG |
|---|---|---|---|---|
| ©TxDOT: NOVEMBER 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 61 |

DATE: _03/20/23_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties




**PLAN VIEW**

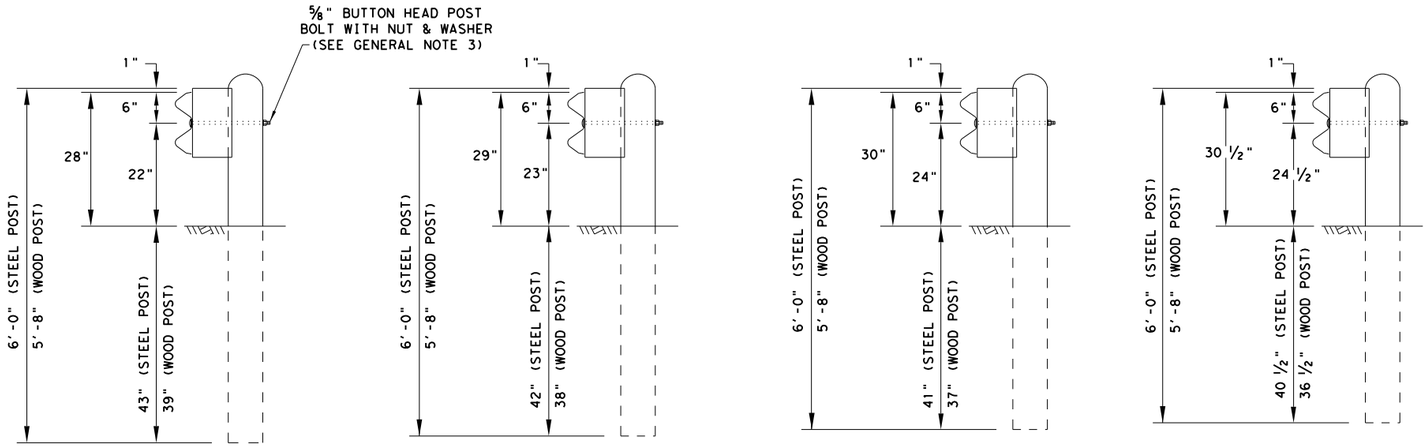



**ELEVATION VIEW**

## 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 ELEMENT SHALL MEET THE REQUIREMENTS OF ITEM 540,"METAL BEAM GUARD FENCE" EXCEPT AS MODIFIED IN THE PLANS. THE CONTRACTOR MAY FURNISH RAIL ELEMENTS OF 25'- 0", OR 12'- 6" (NOM.) LENGTHS. RAIL ELEMENTS MAY HAVE SLOTTED HOLES AT 3'- 1 1/2" C-C OR 6'-3" C-C. A SPECIAL LENGTH OF RAIL MAY BE MANUFACTURED TO ACCOMMODATE THE TRANSITION SECTIONS OF GUARDRAIL.
3. BUTTON HEAD "POST" BOLTS (ASTM A307 GR.A) SHALL BE OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT (ASTM A563) AND 5/8" ROUND WASHER (ASTM F436) AND NOT MORE THAN 1" BEYOND IT. BUTTON HEAD "SPLICE" BOLTS (ASTM A307) ARE 5/8" X 1- 1/4" WITH 5/8" NUTS (ASTM A563).
4. FITTINGS (BOLTS, NUTS, AND WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING." FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM REQUIRING CONSTRUCTION OF THE TRANSITION.
5. CROWN SHALL BE WIDENED TO ACCOMMODATE THE METAL BEAM GUARD FENCE.
6. WHERE SOLID ROCK IS ENCOUNTERED. CONTACT THE DESIGN DIVISION FOR ADDITIONAL GUIDANCE. (512) 416-2678
7. POSTS SHALL NOT BE SET IN CONCRETE.
8. 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.
9. REFER TO STANDARD GF(31) & APPLICABLE BRIDGE RAILING STANDARD FOR ADDITIONAL DETAILS.

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




**SECTION A-A** **SECTION B-B** **SECTION C-C** **SECTION D-D**

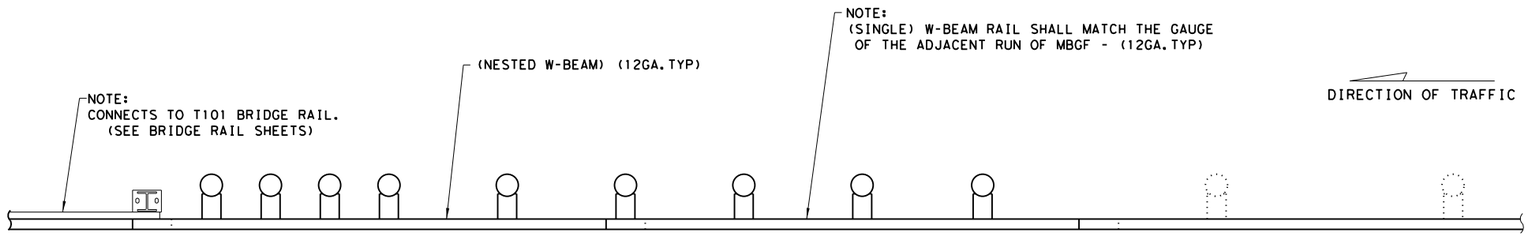
Texas Department of Transportation — Design Division Standard

# METAL BEAM GUARD FENCE TRANSITION (T6)

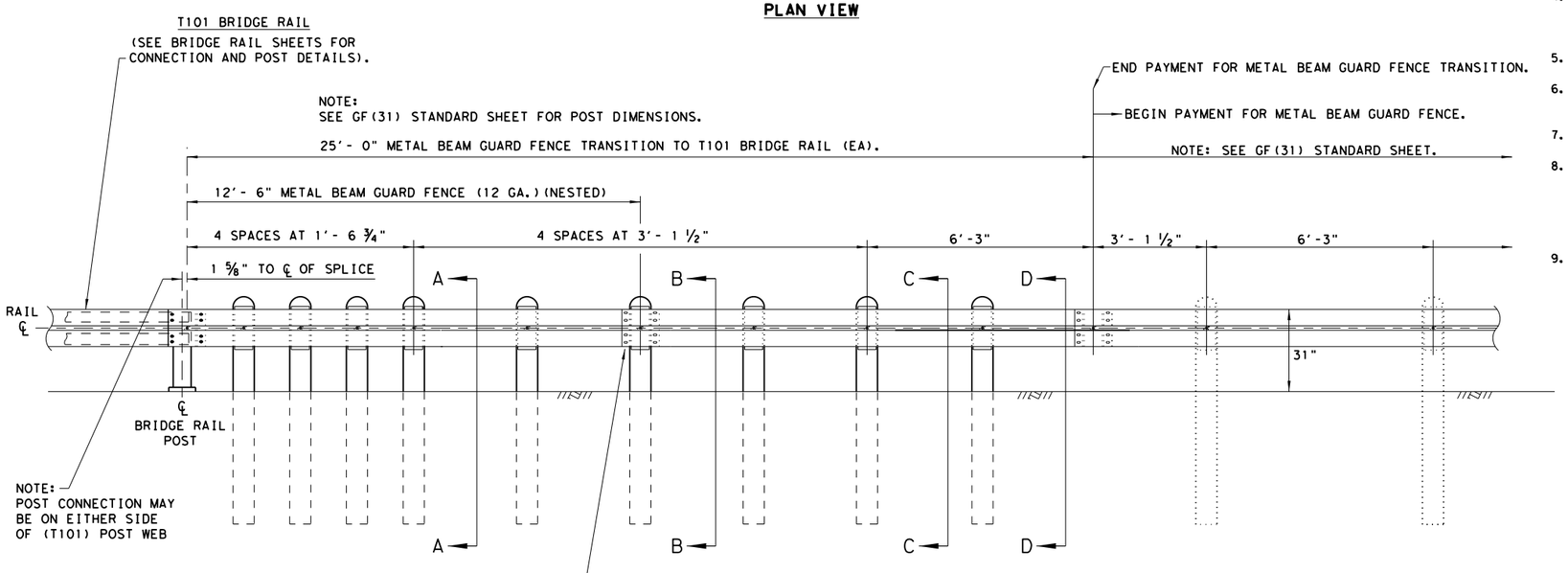
# GF(31)T6-19

| | | | | | |
|---|---|---|---|---|---|
| FILE: gf31t619.dgn | DN: TxDOT | CK: KM | DW: VP | CK: CGL/AG | |
| ©TxDOT: NOVEMBER 2019 | CONT | SECT | JOB | HIGHWAY | |
| REVISIONS | 6439 | 16 | 001 | VAR | |
| | DIST | COUNTY | | SHEET NO. | |
| | 22 | VAR | | 62 | |

DATE: 03/20/23
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties




## PLAN VIEW

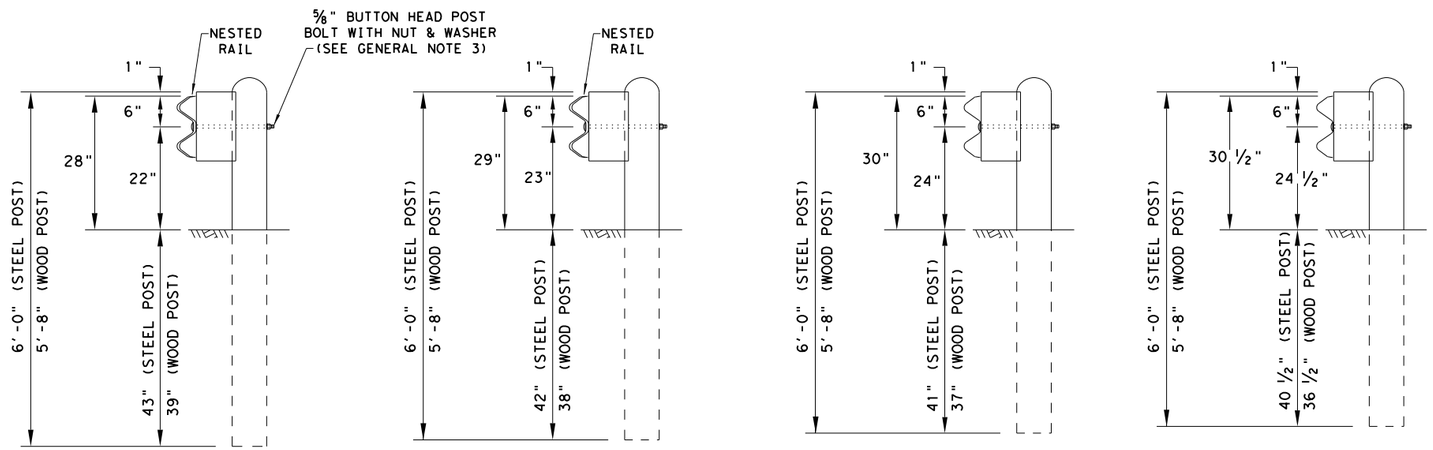



## ELEVATION VIEW

## 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 ELEMENT SHALL MEET THE REQUIREMENTS OF ITEM 540, "METAL BEAM GUARD FENCE" EXCEPT AS MODIFIED IN THE PLANS. THE CONTRACTOR MAY FURNISH RAIL ELEMENTS OF 25'- 0", OR 12'- 6" (NOM.) LENGTHS. RAIL ELEMENTS MAY HAVE SLOTTED HOLES AT 3'- 1 1/2" C-C OR 6'-3" C-C. A SPECIAL LENGTH OF RAIL MAY BE MANUFACTURED TO ACCOMMODATE THE TRANSITION SECTIONS OF GUARDRAIL.
3. BUTTON HEAD "POST" BOLTS (ASTM A307 GR.A) SHALL BE OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT (ASTM A563) AND 5/8" ROUND WASHER (ASTM F436) AND NOT MORE THAN 1" BEYOND IT. BUTTON HEAD "SPLICE" BOLTS (ASTM A307) ARE 5/8" X 1- 1/4" WITH 5/8" NUTS (ASTM A563).
4. FITTINGS (BOLTS, NUTS, AND WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING." FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM REQUIRING CONSTRUCTION OF THE TRANSITION.
5. CROWN SHALL BE WIDENED TO ACCOMMODATE THE METAL BEAM GUARD FENCE.
6. WHERE SOLID ROCK IS ENCOUNTERED. CONTACT THE DESIGN DIVISION FOR ADDITIONAL GUIDANCE. (512) 416-2678
7. POSTS SHALL NOT BE SET IN CONCRETE.
8. 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.
9. REFER TO STANDARD GF(31) AND APPLICABLE BRIDGE RAILING STANDARD FOR ADDITIONAL DETAILS.

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




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

Texas Department of Transportation — Design Division Standard

# METAL BEAM GUARD FENCE TRANSITION (T101)

# GF(31)T101-19

| | | | | | |
|---|---|---|---|---|---|
| FILE: gf31t10119 | DN: TxDOT | CK: KM | DW: VP | CK: CGL/AG | |
| ©TxDOT: NOVEMBER 2019 | CONT | SECT | JOB | HIGHWAY | |
| REVISIONS | 6439 | 16 | 001 | VAR | |
| | DIST | COUNTY | | SHEET NO. | |
| | 22 | VAR | | 63 | |

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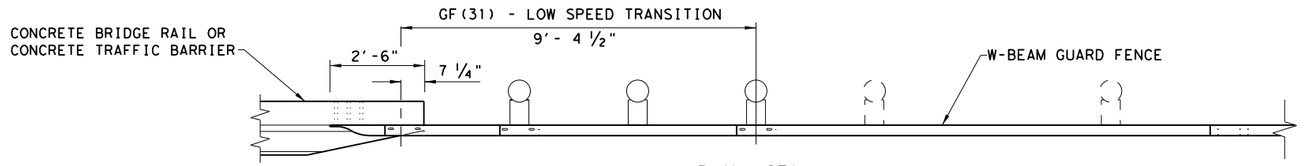
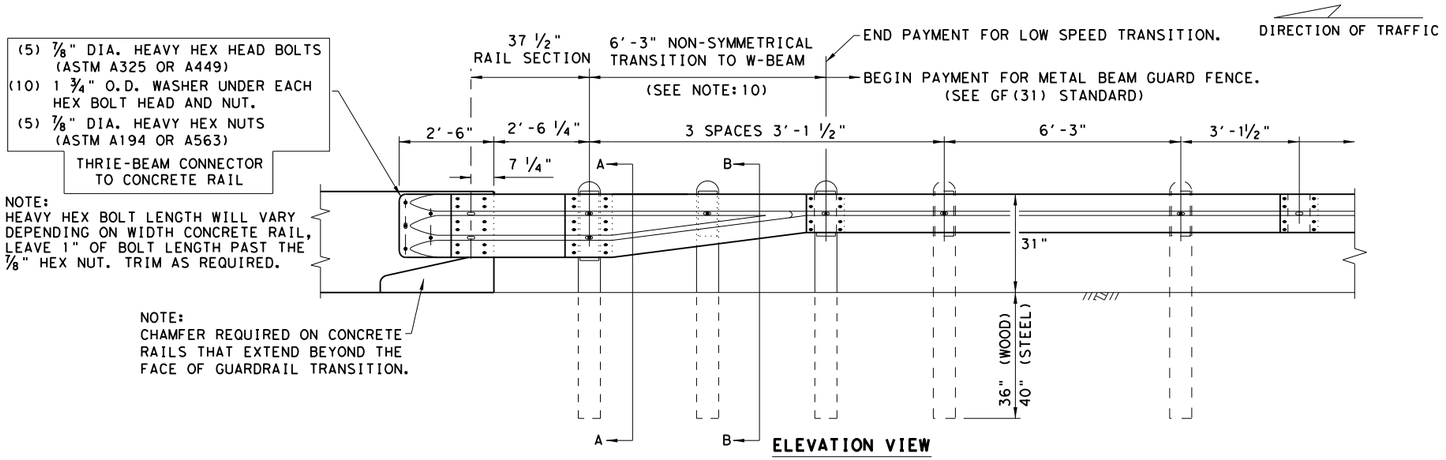


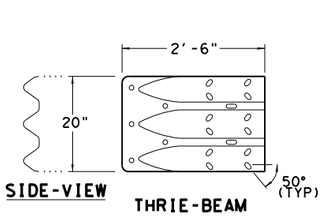

PLAN VIEW




ELEVATION VIEW

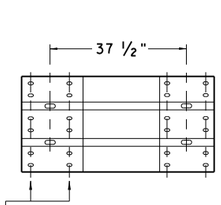
## GENERAL NOTES

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 TRANSITIONS SHALL BE AS SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER. REFER TO GF(31)STANDARD SHEET.
2. RAIL ELEMENT SHALL MEET THE REQUIREMENTS OF ITEM 540, "METAL BEAM GUARD FENCE" EXCEPT AS MODIFIED IN THE PLANS.
3. FITTINGS (BOLTS, NUTS, AND WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING." FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM REQUIRING CONSTRUCTION OF THE TRANSITION.
4. 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 BOLT LENGTH TO MEET REQUIRED LENGTH.
5. POSTS SHALL NOT BE SET IN CONCRETE, OF ANY DEPTH.
6. CROWN SHALL BE WIDENED TO ACCOMMODATE TRANSITIONS.
7. WHERE SOLID ROCK IS ENCOUNTERED, CONTACT THE DESIGN DIVISION FOR ADDITIONAL GUIDANCE. (512) 416-2678
8. 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 CAN FURNISH COMPOSITE MATERIAL BLOCKS.
9. REFER TO GF(31)STANDARD SHEET & BRIDGE RAILING DETAILS FOR ADDITIONAL DETAILS.
10. FOR ROUND WOOD POSTS SYSTEMS, ALL ROUND WOOD POSTS SHALL BE 7 ½" DIA. MINIMUM THROUGHOUT THE TRANSITION.

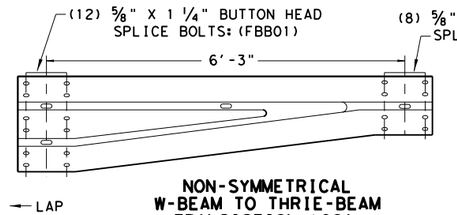



SIDE-VIEW

THRIE-BEAM TERMINAL CONNECTOR 10GA.
PART DESIGNATOR RTE01b



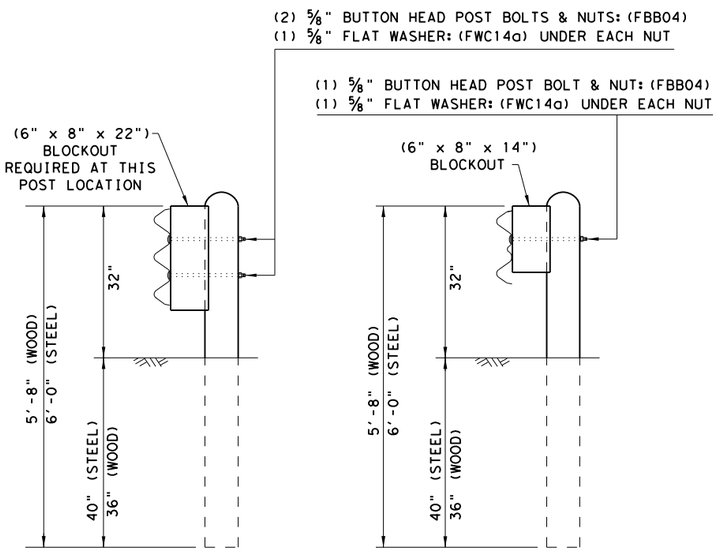

THRIE-BEAM RAIL SHORT SECTION 10GA.
PART DESIGNATOR RTM01a




NON-SYMMETRICAL W-BEAM TO THRIE-BEAM TRANSISTION 10GA.
PART DESIGNATOR RWT02a OR RWT02b

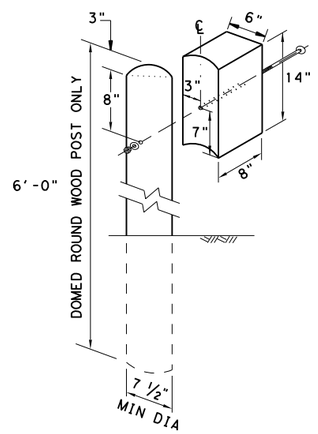
PLATE WASHER INSTRUCTIONS

BRIDGE APPROACH - UPSTREAM: THE SHORT RAIL LAPS OVER THE TERMINAL CONNECTOR. PLATE WASHERS ARE INSTALLED UNDER THE SPLICE NUTS AGAINST INSIDE OF CONNECTOR.
BRIDGE EXIT - DOWNSTREAM: THE TERMINAL CONNECTOR LAPS OVER THE NESTED RAIL. PLATE WASHERS ARE INSTALLED UNDER THE BOLT HEAD AGAINST OUTSIDE OF CONNECTOR.

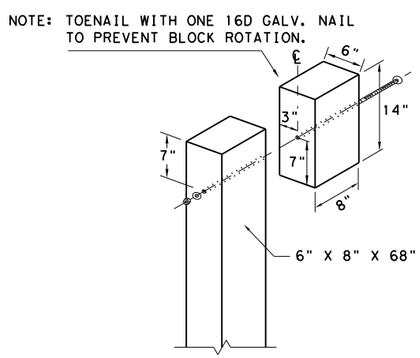



SECTION A-A

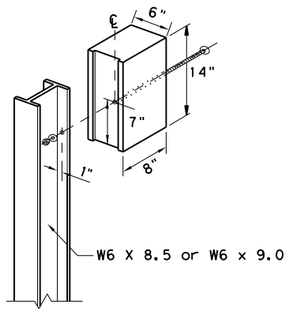
SECTION B-B




WOOD BLOCK TO ROUND WOOD POST




WOOD BLOCK TO RECTANGULAR WOOD POST




ROUTED WOOD BLOCK TO I-BEAM STEEL POST

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

LOW-SPEED TRANSITION

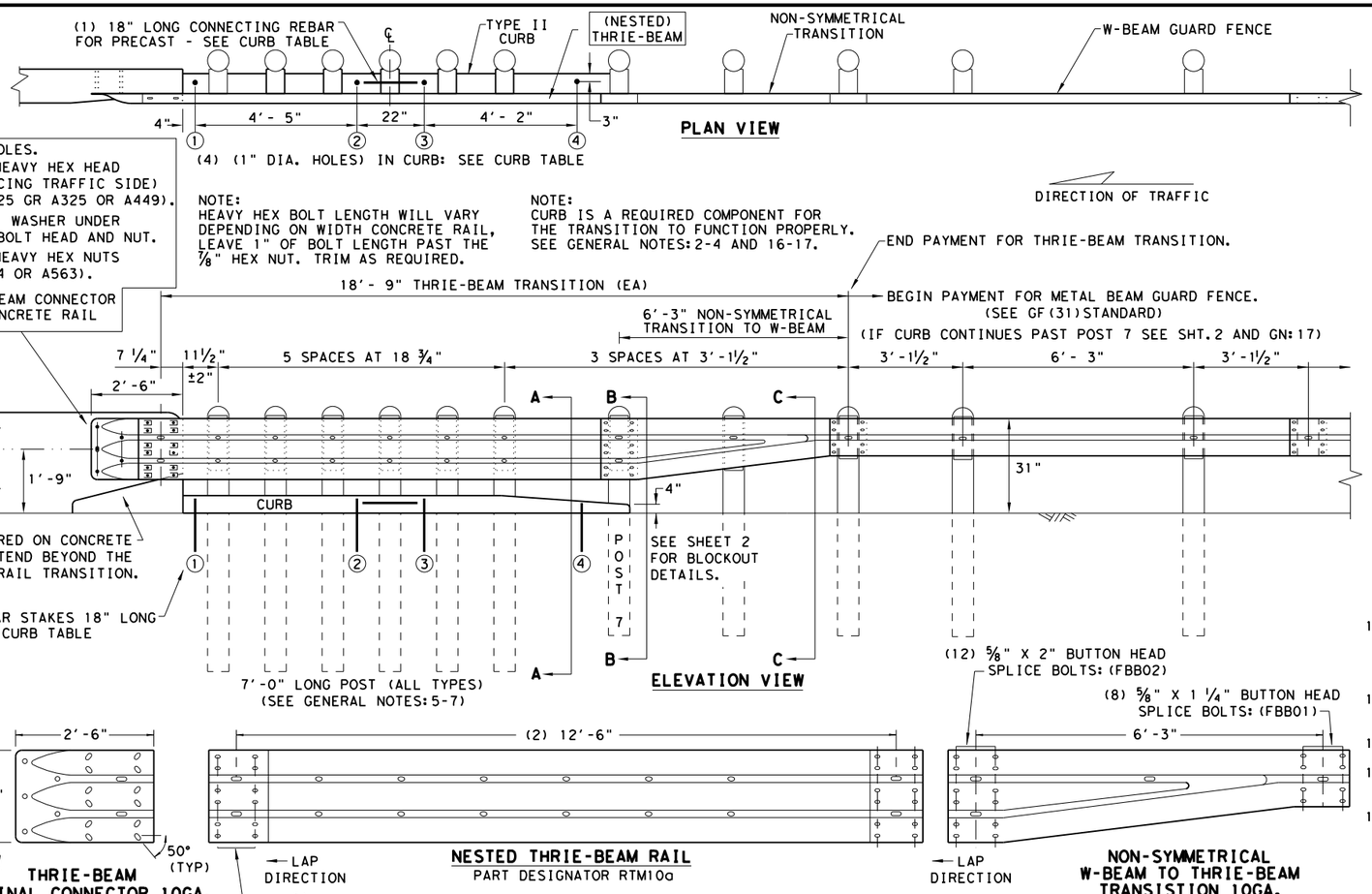
Texas Department of Transportation | Design Division Standard

# METAL BEAM GUARD FENCE THRIE-BEAM TRANSITION TL-2 MASH COMPLIANT

# GF(31)TR TL2-19

| | | | | |
|---|---|---|---|---|
| FILE: gf31tr1219.dgn | DN: TxDOT | CK: KM | DW: VP | CK: CGL/AG |
| ©TxDOT: NOVEMBER 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 64 |

DATE: _03/20/23_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties




## 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- 3/4" 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 1/2" 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 5/8" 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 5/8" 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.

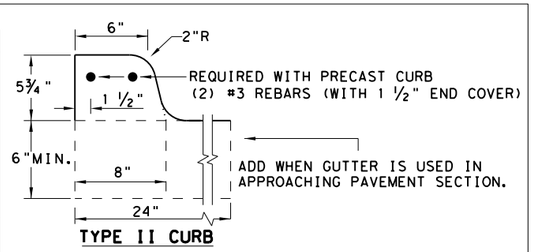
### THRIE-BEAM TERMINAL - CURB TABLE

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 1/2" 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



Texas Department of Transportation | Design Division Standard

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

# GF(31)TR TL3-20

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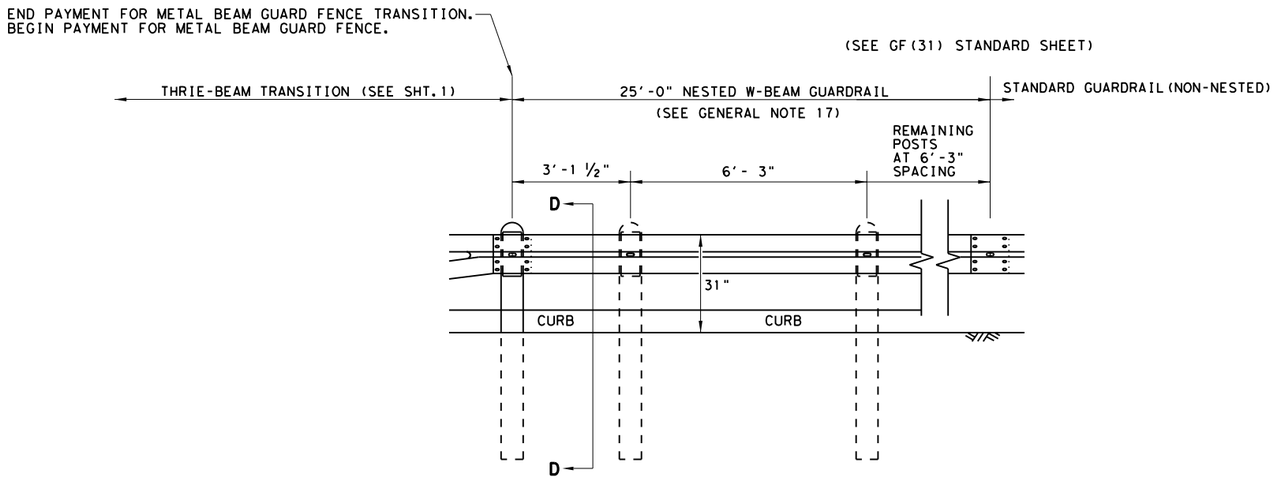
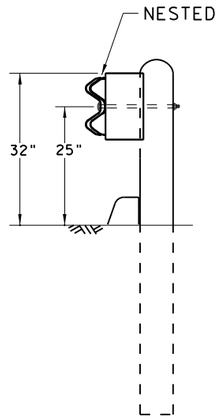
|---|---|---|---|---|
| ©TxDOT: NOVEMBER 2020 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 65 |

DATE: _03/20/23_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties

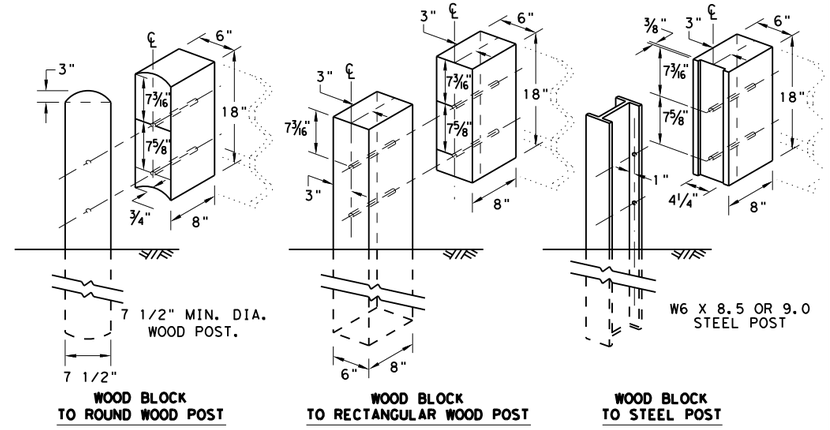
REQUIRED ALTERNATIVE FOR CONTINUOUS CURB EXTENDING PAST POST 7 (SEE SHT. 1 GENERAL NOTE 17)




ELEVATION VIEW




SECTION D-D




THRIE BEAM TRANSITION BLOCKOUT DETAILS

HIGH-SPEED TRANSITION

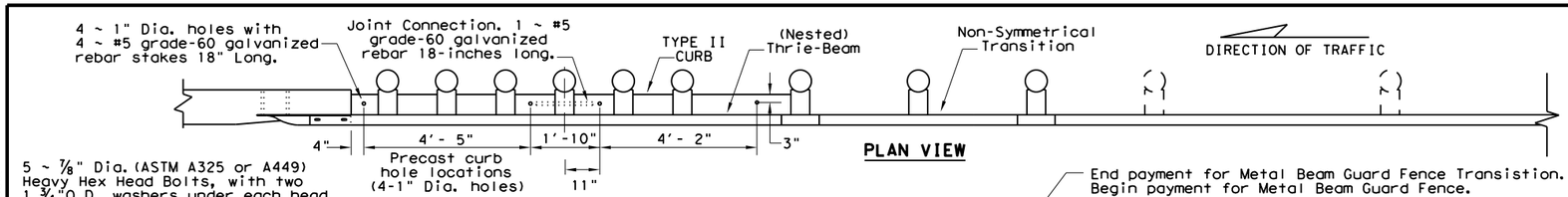
SHEET 2 OF 2

Texas Department of Transportation | Design Division Standard

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

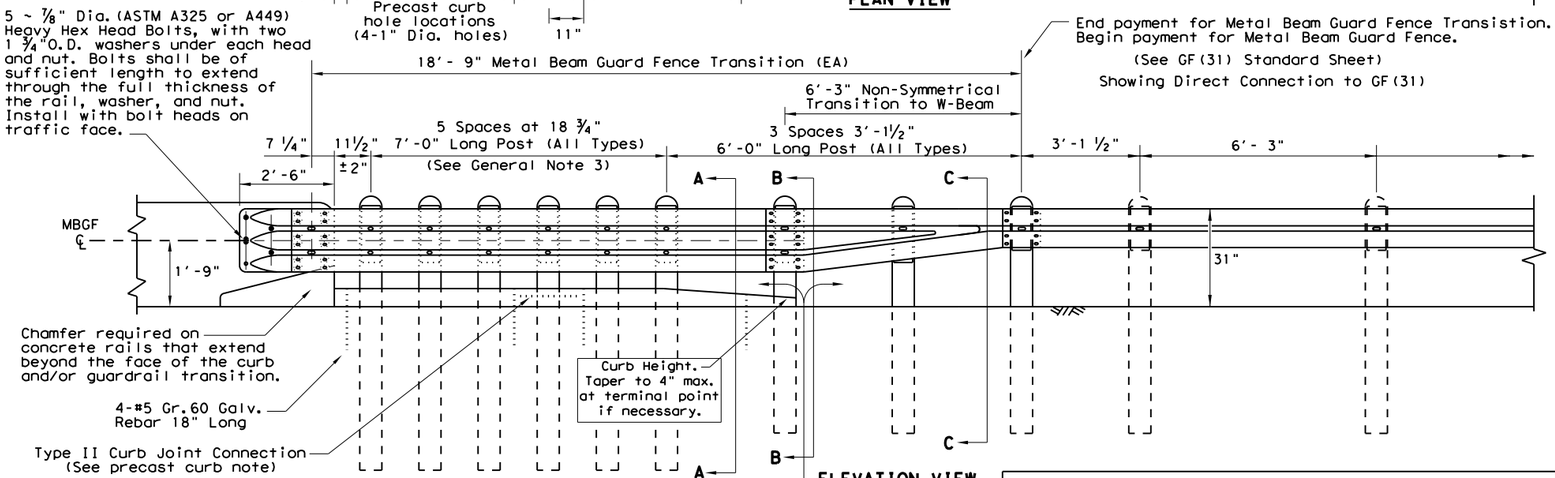
## GF(31)TR TL3-20

| FILE: gf31tr1320.dgn | DN: TxDOT | CK: KM | DW: KM | CK: CGL/AG |
|---|---|---|---|---|
| ©TxDOT: NOVEMBER 2020 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 66 |




PLAN VIEW

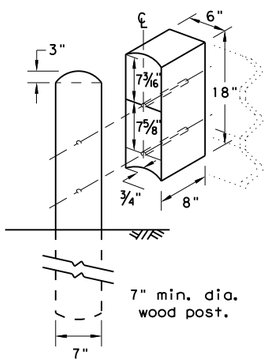
5 ~ ⅞" Dia. (ASTM A325 or A449) Heavy Hex Head Bolts, with two 1 ¾" O.D. washers under each head and nut. Bolts shall be of sufficient length to extend through the full thickness of the rail, washer, and nut. Install with bolt heads on traffic face.



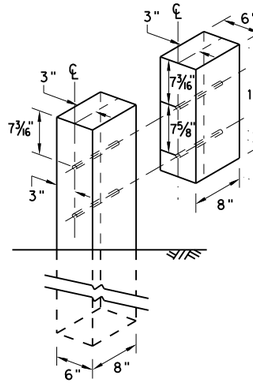

ELEVATION VIEW

Concrete curb Type II subsidiary to "Metal Beam Guardfence Transitions". 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 the first 6 ft post.

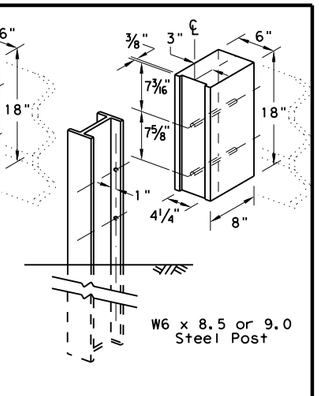
If shown elsewhere in the plans, additional curb underneath guardrail will be paid for by the linear foot.




WOOD BLOCK TO ROUND WOOD POST




WOOD BLOCK TO RECTANGULAR WOOD POST




WOOD BLOCK TO STEEL POST

## GENERAL NOTES

1. Concrete curb may be cast-in-place or precast as shown on this sheet. When used in conjunction with thrie-beam guard fence transitions, curb shall be Type II (Typically 5 ¾" height above surface; See CCCG standard sheet) unless otherwise shown in the plans. 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.

   Contact the Design Division for drainage cut options needed within the curb section of the transition.

2. The type of post (round wood post, rectangular wood post or steel post) will be as shown in the plans.

3. 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 ⅜" in height, and visible after installation. Wooden posts shall be marked with a brand, and steel posts with a stencil before galvanizing.

4. Rail element 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.

5. Unless otherwise shown in the plans, transitions shall be placed with the block face in front of or directly above the curb face.

6. Galvanized washers used with the ⅝" dia. post bolts shall be Type A 1 ¾" O.D. washers. The (12) plate washers (FWR03) required at the terminal connector splice.

7. Button head "post" bolts (ASTM A307) shall be of sufficient length to extend through the full thickness of the nut (ASTM A563) and washer and not more than 1" beyond it. Button head "splice" bolts (ASTM A307) ⅝" Dia. x 2" (at triple rail splices) with ⅜" double recessed nuts.

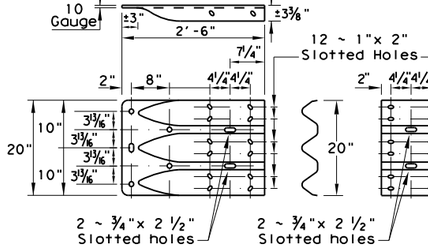
8. Fittings (bolts, nuts, and washers) shall be galvanized in accordance with Item 445, "Galvanizing". Fittings shall be subsidiary to the bid item.

9. Crown shall be widened to accommodate transitions.

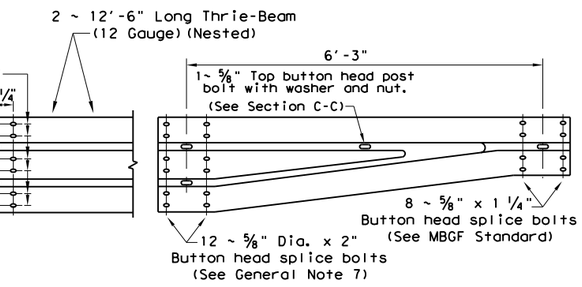
10. If solid rock is encountered. See the MBGF standard sheet for the proper installation guidance.

11. Posts shall not be set in concrete.

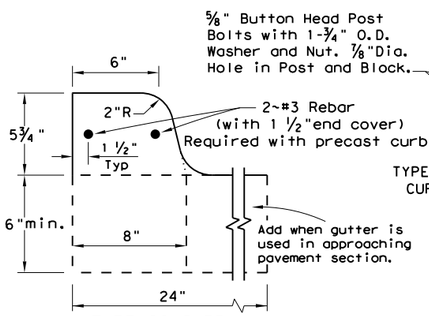
12. Unless otherwise shown in the plans, a composite material post and/or block that meets the requirements of DMS-7210, "Composite Material Posts and Blocks for Metal Beam Guard Fence" may be substituted for posts and/or blocks of similar dimensions. The Construction Division, TxDOT, maintains a Material Producer List (MPL) for producers of materials conforming to DMS-7210. Only producers on the MPL can furnish composite material posts and/or blocks.




THRIE-BEAM TERMINAL CONNECTION
(See General Notes 6 & 7 for required hardware)

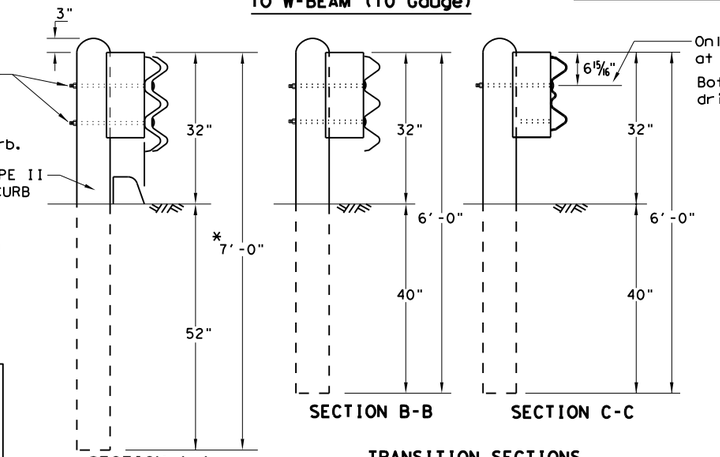



NON-SYMMETRICAL TRANSITION TO W-BEAM (10 Gauge)




TYPE II CURB
Cast-in-Place or Precast

PRECAST CURB:
Type II Precast Curb secured with 4~#5 Gr.60 Galv. Rebar stakes 18" long. The 12'- 2" section of curb may be cast in two sections.
Section ① 5'- 8" long
Section ② 6'- 6" long with the last 3'- 6" of curb tapered to a 4" height.
The Joint Connection is two 9" long 1" Dia. female ends connected with 1~#5 Gr.60 Galv. Rebar 18" long.

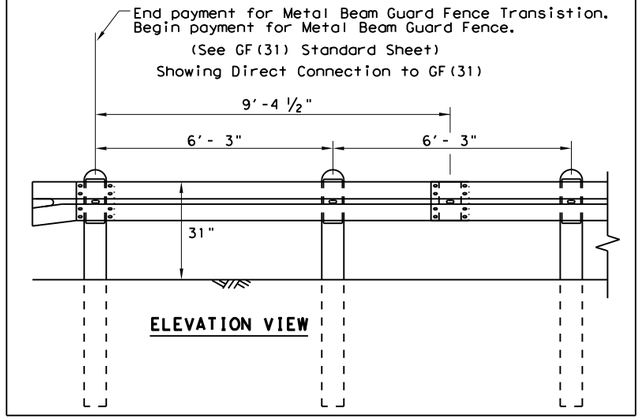



SECTION A-SECTION B-B SECTION C-C

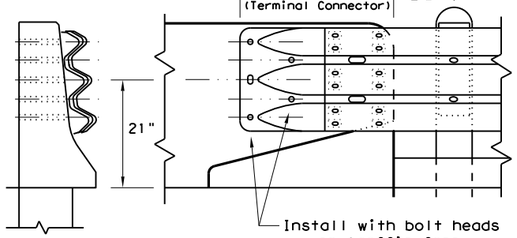
TRANSITION SECTIONS

*Note: (All post types) (See General Note 3)

## ALTERNATE CONNECTION OPTION




ELEVATION VIEW




CONNECTION TO CONCRETE BRIDGE RAIL AND TRAFFIC BARRIERS

(12) Galvanized rectangular washers (FWR03) are required under the recessed nut at the terminal connector splice to nested thrie-beam. (See General Notes 6 & 7).

DIRECTION OF TRAFFIC

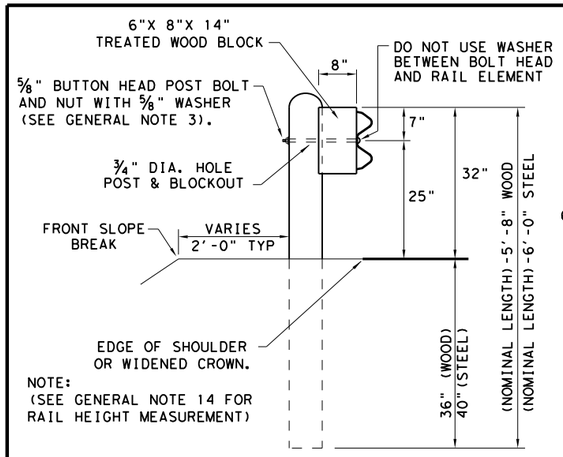
Texas Department of Transportation — Design Division Standard

# METAL BEAM GUARD FENCE TRANSITION
## (Thrie-Beam Transition)
## GF(31)TR-14

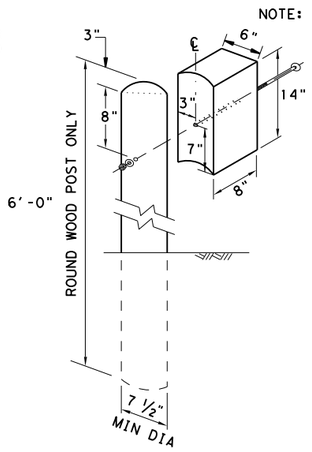
| FILE: gf31tr14.dgn | DN: TxDOT | CK: AM | DW: VP | CK: CGL |
|---|---|---|---|---|
| ©TxDOT: December 2011 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 67 |

DATE: _03/20/23_ 11:30_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties

DATE: _03/20/23_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties

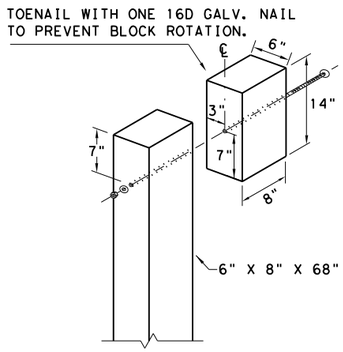



**TYPICAL POST PLACEMENT**

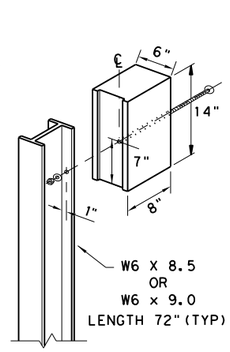



**WOOD BLOCK TO ROUND WOOD POST**

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

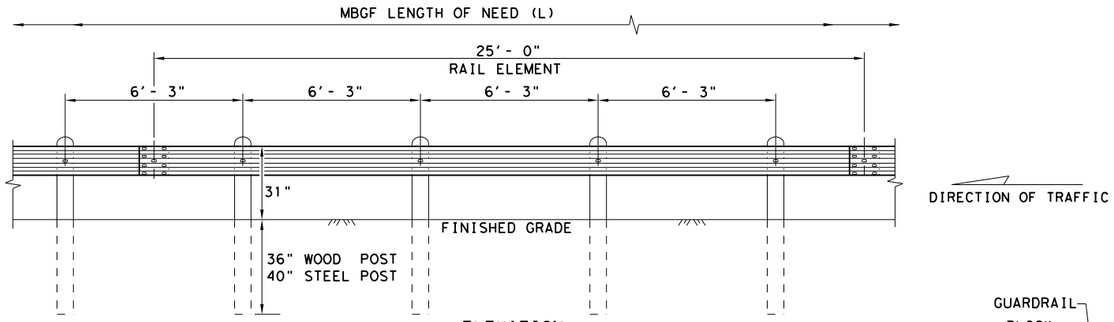



**WOOD BLOCK TO RECTANGULAR WOOD POST**



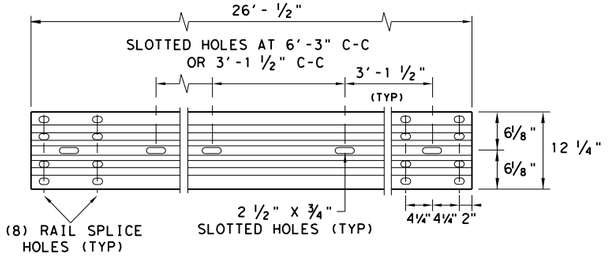

**ROUTED WOOD BLOCK TO I-BEAM STEEL POST**

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




**ELEVATION**
**MID-SPAN RAIL SPLICE**

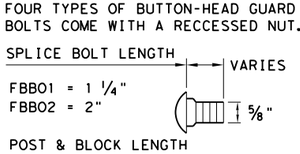
SHOWING A 25'- 0" SECTION OF W-BEAM RAIL. (SEE GENERAL NOTE 2)




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

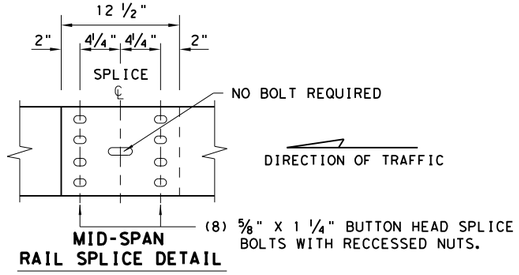
NOTES: SEE GENERAL NOTE 2 FOR ALLOWABLE RAIL TYPES.
SEE RAIL SPLICE DETAIL FOR REQUIRED HARDWARE.

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



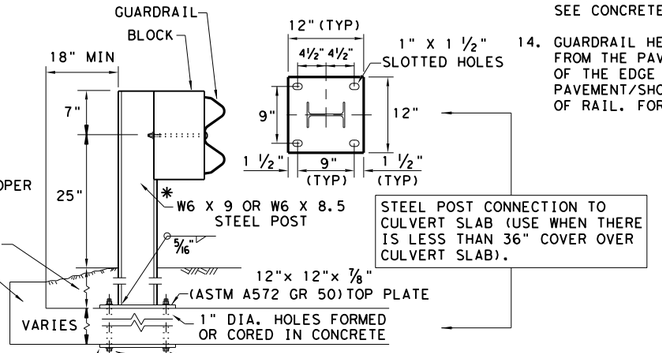

**BUTTON HEAD BOLT**

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.




* 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).

12" X 12" X ¼" (ASTM A36) STEEL BOTTOM PLATE WITH 1" DIA. HOLES REQUIRED WITH BOLT-THROUGH INSTALLATION.

**LOW FILL CULVERT POST**

NOTE: TWO INSTALLATION OPTIONS.

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

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

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

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

## GENERAL NOTES

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

Texas Department of Transportation

Design Division Standard

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

| FILE: gf3119.dgn | DN: TxDOT | CK: KM | DW: VP | CK: CGL/AG |
|---|---|---|---|---|
| ©TxDOT: NOVEMBER 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 68 |

DATE: 03/20/23
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties

NOTE: STEEL I-BEAM POST W6 X 8.5 (6'-0") PN: 533G
STANDARD WOOD BLOCKOUTS (6"X8"X14") PN: 4076B
AT (POSTS 2 THRU 8)

⅝" X 10" HGR BOLT PN: 3500G
⅝" HGR NUT PN: 3340G

LINE AT THE BACK OF POST #2 THRU #8

FROM THE CENTERLINE OF POST(1) & POST(0)

ANCHOR PADDLE PN: 15204A

ANGLE STRUT PN: 15202G

16"

POST(8) POST(7) POST(6) POST(5) POST(4) POST(3) POST(1) POST(0)

## PLAN VIEW

MASH TEST LEVEL 3 (TL-3) LENGTH OF SoftStop TERMINAL (50'-9 ½")

BEGIN LENGTH OF NEED

DO NOT BOLT ANCHOR RAIL TO - POST (2)

SEE DETAIL 1

TRAFFIC FLOW

50'-9 ½" STANDARD INSTALLATION LENGTH (MASH TL-3 SoftStop)

BEGIN STANDARD MBGF

END PAYMENT FOR SGT

6¼" 3'-1 ½" 6'-3" 6'-3"

ANCHOR RAIL WITH SLOTS - (THREADED THRU HEAD)
SEE SoftStop MANUAL FOR COMPLETE DETAILS

MIDDLE SLOT CUTOUT
(1) 1 ¾" X 6'-10 ¼"

OUTSIDE SLOTS CUTOUT
(2) ½" X 6'-9 ⅝"

MBGF LAPPED IN DIRECTION OF TRAFFIC FLOW

25'-0" DOWNSTREAM W-BEAM GUARDRAIL PN: 61G

SoftStop ANCHOR RAIL (12GA) PN: 15215G

SoftStop FACE SEE GN(3) & NOTE: B

3'-1 ½"(+/-) 6'-3" 6'-3" 6'-3" 6'-3" 6'-3" 6'-3" 5'-8" 4'-7"

ANCHOR PADDLE PN: 15204A

END OF ANCHOR RAIL PN: 15215G

SEE NOTE: A

SEE NOTE: C

POST 32" HEIGHT

31" RAIL HEIGHT

RAIL 25'-0" PN: 61G

RAIL 25'-0" PN: 15215G

(8) ⅝"× 1- ¼" GR BOLTS PN: 3360G
⅝" HEX NUTS PN: 3340G

(8) ⅝"× 1- ¼" HGR BOLTS PN: 3360G
⅝" HEX NUTS PN: 3340G

POST 40" DEPTH (TYP 1-8)

DO NOT BOLT ANCHOR RAIL TO POST(2)

SEE DETAIL 2

SEE DETAIL 3

13/16" DIA. YIELDING HOLES

13/16" DIA. YIELDING HOLES

6'-1⅜"

POST(8) POST(7) POST(6) POST(5) POST(4) POST(3) POST(2) 6'-0" (SYTP) PN: 15000G POST(1) 4'-9 ½" SYTP PN: 15203G POST(0) 6'-5 ⅜" PN: 15205A

## ELEVATION VIEW

HARDWARE FOR POST(2) THRU POST(8)
(1) ⅝"× 10" HGR BOLT PN: 3500G
(1) ⅝" HGR HEX NUT PN: 3340G

NOTE: DO NOT BOLT ANCHOR RAIL PANEL TO POST(2)

ALTERNATE BLOCKOUT SEE GENERAL NOTE: 6

4" X 7 ½" X 14" BLOCKOUT COMPOSITE PN: 6777B

6" X 8" X 14" BLOCKOUT WOOD PN: 4076B

NOTE: DO NOT BOLT ANCHOR RAIL TO POST(2)

8" 6" 14"

⅝" HGR NUT PN: 3340G

⅝" X 10" HGR POST BOLT PN: 3500G

13/16" DIAMETER YIELDING HOLES LOCATED IN FLANGES

FINISHED GRADE

(HOLES APROXIMATELY CENTERED AT FINISHED GRADE)

## ISOMETRIC VIEW POST(1 & 2)

W6 X 8.5 I-BEAM POST SHOWING STANDARD WOOD BLOCKOUT

NOTE: NO BLOCKOUT INSTALLED AT POST(1)

(1) ⅝" x 1 ¾" HEX HD BOLT PN 3391G

ANGLE STRUT PN: 15202G

(2) ⅝" WASHERS PN 4372G

(1) ⅝" HGR HEX NUT PN 3340G

## DETAIL 1

SHOWN AT POST(1) NEAR GROUND

(1) ⅝" HEX NUT

(1) ⅝" x 1- ½" HEX HD BOLT-GR-5 PN: 105286

(2) ⅝" ROUND WASHERS PN: 3240G

## DETAIL 2

SHOWN AT POST(1)

ANCHOR KEEPER PLATE (24 GA) PN: 15207G

ANCHOR PLATE WASHER ½" THICK PN: 15206G

1" ROUND WASHER F463 PN: 4902G

(2) ⅝" x 2 ½" HEX HD BOLT GR-5 PN: 105285G

ALTERNATE BLOCKOUT SEE GENERAL NOTE: 6

(2) ⅝" ROUND WASHER (WIDE) PN: 3240G

1" NUT PN: 3908G SHALL BE SECURELY TIGHTENED AFTER FINAL ASSEMBLY, BUT NOT DEFORMING THE KEEPER PLATE.

ANCHOR PADDLE PN: 15204A

(2) ⅝" HEX NUT A563 GR. DH PN: 3245G

W-BEAM FLATTENED (4 PLIES)

ANGLE STRUT PN: 15202G

SEE NOTE: A

(2) ¾" x 2 ½" HEX BOLT (TYP) PN: 3717G

(4) ¾" FLAT WASHER (TYP) PN: 3701G

(2) ¾" HEX NUT (TYP) PN: 3704G

6'-1 ⅜" POST DEPTH

(2) ANCHOR POST ANGLE PN: 15201G

## DETAIL 3 AT POST(0)

6'-5 ⅜" (W6 X 15) I-BEAM POST PN: 15205A

TRAFFIC FLOW

W-BEAM RAIL 25'-0"

6" X 8" X 14" BLOCKOUT WOOD

⅝" X 10" HGR POST BOLT PN: 3500G

⅝" HGR NUT PN: 3340G

POST HEIGHT 32"

31" RAIL HEIGHT

40"

LINE POST (3, 4, 5, 6, 7 & 8)

FINISHED GRADE

## SECTION VIEW B-B

6'-0" (W6 X 8.5) I-BEAM POST PN: 533G

## SECTION VIEW A-A

6'-0" (W6 X 8.5) (SYTP) I-BEAM POST PN: 15000G

POST(2)

NOTE: DO NOT BOLT ANCHOR RAIL PANEL TO POST(2)

POST 17"- ½" HEIGHT

4'- 9 ½"

13/16" DIA. YIELDING HOLES

40"

POST(1)

## FRONT VIEW POST(1)

4'-9 ½" (W6 X 8.5) (SYTP) I-BEAM POST PN: 15203G

NOTE: NO BLOCKOUT INSTALLED AT POST(1)

APPROX 5'-10"

5'-0"

50' APPROACH GRADING

2'-0"

STANDARD MBGF

EDGE OF PAVEMENT

NOTE: ADJUST WIDTH ACCORDINGLY WHEN OFFSET IS USED. (OFFSET "OPTION" SHOWN)

2'-0" MAX. RAIL OFFSET

APPROACH GRADING (1V:10H OR FLATTER) SEE PRODUCT ASSEMBLY MANUAL FOR ADDITIONAL GUIDANCE.

## APPROACH GRADING AT GUARDRAIL END TREATMENTS

### GENERAL NOTES

1. FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: TRINITY HIGHWAY AT 1(888)323-6374. 2525 N. STEMMONS FREEWAY, DALLAS, TX 75207
2. FOR INSTALLATION, REPAIR AND MAINTENANCE REFER TO THE; SoftStop END TERMINAL, PRODUCT DESCRIPTION ASSEMBLY MANUAL. PN: 620237B
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. A COMPOSITE MATERIAL BLOCKOUT 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.
7. IF SOLID ROCK IS ENCOUNTERED SEE THE MANUFACTURER'S INSTALLATION MANUAL AND REFER TO THE LATEST ROADWAY MBGF STANDARD FOR INSTALLATION GUIDANCE.
8. POSTS SHALL NOT BE SET IN CONCRETE.
9. IT IS ACCEPTABLE TO INSTALL THE SoftStop IMPACT HEAD PARALLEL TO THE GRADE LINE OR WITH AN UPWARD TILT.
10. DO NOT ATTACH THE SoftStop SYSTEM DIRECTLY TO A RIGID BARRIER.
11. UNDER NO CIRCUMSTANCES SHALL THE GUARDRAIL WITHIN THE SoftStop 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.

| | |
|---|---|
| NOTE: A | THE INSTALLATION HEIGHT OF FULLY ASSEMBLED ANCHOR POST WILL VARY FROM 3-¾" MIN. TO 4" MAX. ABOVE FINISHED GRADE. |
| NOTE: B | PART PN: 5852B RIGHT-SIDE (HIGH INTENSITY REFLECTIVE SHEETING)<br>PART PN: 5851B LEFT-SIDE (HIGH INTENSITY REFLECTIVE SHEETING) |
| NOTE: C | W-BEAM SPLICE LOCATED BETWEEN LINE POST(4) AND LINE POST(5)<br>GUARDRAIL PANEL 25'-0" PN: 61G<br>ANCHOR RAIL 25'-0" PN: 15215G<br>LAP GUARDRAIL IN DIRECTION OF TRAFFIC FLOW. |

| PART | QTY | MAIN SYSTEM COMPONENTS |
|---|---|---|
| 620237B | 1 | PRODUCT DESCRIPTION ASSEMBLY MANUAL (LATEST REV.) |
| 15208A | 1 | SoftStop HEAD (SEE MANUAL FOR RIGHT-LEFT APPROACH) |
| 15215G | 1 | SoftStop ANCHOR RAIL (12GA) WITH CUTOUT SLOTS |
| 61G | 1 | SoftStop DOWNSTREAM W-BEAM RAIL (12GA) (25'- 0") |
| 15205A | 1 | POST #0 - ANCHOR POST (6'- 5 ⅜") |
| 15203G | 1 | POST #1 - (SYTP) (4'- 9 ½") |
| 15000G | 1 | POST #2 - (SYTP) (6'- 0") |
| 533G | 6 | POST #3 THRU #8 - I-BEAM (W6 x 8.5) (6'- 0") |
| 4076B | 7 | BLOCKOUT - WOOD (ROUTED) (6" x 8" x 14") |
| 6777B | 7 | BLOCKOUT - COMPOSITE (4" x 7 ½" x 14") |
| 15204A | 1 | ANCHOR PADDLE |
| 15207G | 1 | ANCHOR KEEPER PLATE (24 GA) |
| 15206G | 1 | ANCHOR PLATE WASHER ( ½" THICK ) |
| 15201G | 2 | ANCHOR POST ANGLE (10" LONG) |
| 15202G | 1 | ANGLE STRUT |
| | | **HARDWARE** |
| 4902G | 1 | 1" ROUND WASHER F436 |
| 3908G | 1 | 1" HEAVY HEX NUT A563 GR. DH |
| 3717G | 2 | ¾" x 2 ½" HEX BOLT A325 |
| 3701G | 4 | ¾" ROUND WASHER F436 |
| 3704G | 2 | ¾" HEAVY HEX NUT A563 GR. DH |
| 3360G | 16 | ⅝" x 1 ¼" W-BEAM RAIL SPLICE BOLTS HGR |
| 3340G | 25 | ⅝" W-BEAM RAIL SPLICE NUTS HGR |
| 3500G | 7 | ⅝" x 10" HGR POST BOLT A307 |
| 3391G | 1 | ⅝" x 1 ¾" HEX HD BOLT A325 |
| 4489G | 1 | ⅝" x 9" HEX HD BOLT A325 |
| 4372G | 4 | ⅝" WASHER F436 |
| 105285G | 2 | ⅝" x 2 ½" HEX HD BOLT GR-5 |
| 105286G | 1 | ⅝" x 1 ½" HEX HD BOLT GR-5 |
| 3240G | 6 | ⅝" ROUND WASHER (WIDE) |
| 3245G | 3 | ⅝" HEX NUT A563 GR. DH |
| 5852B | 1 | HIGH INTENSITY REFLECTIVE SHEETING - SEE NOTE: B |

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

Texas Department of Transportation

Design Division Standard

# TRINITY HIGHWAY
# SOFTSTOP END TERMINAL
# MASH - TL-3
# SGT(10S)31-16

| FILE: sgt10s3116 | DN: TxDOT | CK: KM | DW: VP | CK: MB/VP |
|---|---|---|---|---|
| ©TxDOT: JULY 2016 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 69 |

DATE: 03/20/23
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties

(SEE GN NOTE 15)
STANDARD 31" MBGF

ITEM (6) INNER SIDE SLIDER (ISS) PANEL FOR RAIL 3

FIELD-SIDE (RAIL 3)

NOTE: RECESSED HEX NUTS FACING TRAFFIC-SIDE **SEE DETAIL (C)**

REFERENCE LINE USED TO INSTALL LINE POST(9) THRU POST(2)

POST 1 OFFSET DISTANCE MEASURED 7-⅝" FROM REFERENCE LINE

POST 9 POST 8 POST 7 POST 6 POST 5 POST 4 POST 3 POST 2

ITEM (10) CABLE ASSEMBLY

ITEM (2) GROUNDSTRUT

RAIL 4 RAIL 3 RAIL 2 RAIL 1

CABLES

NO BLOCKOUT AT (POST 1)

NOTES:
1. ITEM (12) COMPOSITE BLOCKOUTS INSTALLED AT LINE POST(9) THRU LINE POST(2).
2. DO NOT INSTALL A BLOCKOUT AT LINE POST(1).

**PLAN VIEW**

ITEM (5) TRAFFIC SIDE SLIDER (TSS) PANEL FOR RAIL 2

NOTE: SECURE THE (TSS) PANEL TO OUTSIDE OF RAIL 2 WITH THE PANEL ARROWS POINTING TOWARDS THE HEAD.

INSTALL GUARD FENCE RECESSED HEX NUTS ON TRAFFIC-SIDE

MBGF RAIL 2

MBGF RAIL 1

**DETAIL (C)**

TRAFFIC FLOW

END PAYMENT (SGT) BY EACH

DO NOT BOLT RAIL TO POST 6

BEGIN LENGTH OF NEED

INSTALLATION LENGTH 55'- ½"

49'-8 5/16"

ITEM (25) MAX-TENSION HEAD **SEE DETAIL (A)**

6'-3" 6'-3" 6'-3" 6'-¾" 6'-3" 6'-3" 6'-3" 37½" 5'-3 11/16"

RAIL HEIGHT 31"

ARROWS

RAIL HEIGHT 31"

HEAD HEIGHT

**DETAIL (B)**

32-¼"

ITEM (13) RAIL 4 ITEM (13) RAIL 3 ITEM (13) RAIL 2 ITEM (13) RAIL 1

**DETAIL (D)**

FINISHED GRADE

CABLES

FINISHED GRADE

ITEM (10) CABLE ASSEMBLY

ITEM (2) GROUNDSTRUT

68-⅛"

POST 9 POST 8 POST 7 POST 6 POST 5 POST 4 POST 3 POST 2 POST 1

ITEM (4) I-BEAM W6 X 9

NO BLOCKOUT AT (POST 1)

SOIL ANCHOR POST ITEM (1)

(8) X-LITE LINE POST - ITEM (11)

**ELEVATION VIEW**

A

A

TSS PANEL GALVANIZED ITEM (5)

RSS PLATE GALVANIZED ITEM (8)

INSTALL THE TSS AND RSS WITH THE ARROWS POINTING TOWARDS THE MAX-HEAD

TSS PANEL AND RSS PLATE

**DETAIL (D)**

HEAD HEIGHT 32-¼"

TOP OF POST

31-⅞"

FINISHED GRADE

40-⅛"

68-⅛" ANCHOR POST DEPTH

ITEM (1) ANCHOR

ITEM (11) LINE POSTS 2 THRU 9

(NOTE: ITEM (4) POST 1 (NOT SHOWN), TO BE INSTALLED AT SAME DEPTH AS LINE POSTS.)

**SOIL ANCHOR, POST 1 & LINE POST 2 THRU 9**

**SECTION VIEW A-A**

NOTE:
USE THE MASH APPROVED X-TENSION CABLE ASSEMBLY.

7 5/16"

2 1/8"

UPPER CABLE (BACK SIDE)

LOWER CABLE (TRAFFIC SIDE)

**DETAIL (B)**

CABLE FRICTION PLATE HEAD UNIT ITEM (9)

NOTE: INSTALL ⅝" RECESSED HEX NUTS ON TRAFFIC SIDE.

ITEM (24)

ITEM (21)

ITEM (20) 8X

ITEM (17) 8X

ITEM (23) 6X 3 SCREWS EACH SIDE

ITEM (22) BRACKET SHIPPED FLAT

ITEM (3)

ITEM (16) 4X

(RAIL 1)

* ITEM (25) HIGH INTENSITY REFLECTIVE SHEETING

NOTE: DELINEATION MARKER IN ACCORDANCE WITH TEXAS MUTCD.

SPLICE FOR IMPACT-HEAD TO GUARD FENCE (RAIL1)

**DETAIL (A)**

APPROX 5'-10"

5'-0"

50' APPROACH GRADING

STANDARD MBGF

2'-0"

EDGE OF PAVEMENT

NOTE: ADJUST WIDTH ACCORDINGLY WHEN OFFSET IS USED. (OFFSET "OPTION" SHOWN)

2'-0" MAX. RAIL OFFSET

APPROACH GRADING (1V:10H OR FLATTER) SEE PRODUCT ASSEMBLY MANUAL FOR ADDITIONAL GUIDANCE.

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

**APPROACH GRADING AT GUARDRAIL END TREATMENTS**

TRAFFIC FLOW

## GENERAL NOTES

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

| ITEM # | PART NUMBER | DESCRIPTION | QTY |
|---|---|---|---|
| 1 | BSI-1610060-00 | SOIL ANCHOR - GALVANIZED | 1 |
| 2 | BSI-1610061-00 | GROUND STRUT - GALVANIZED | 1 |
| 3 | BSI-1610062-00 | MAX-TENSION IMPACT HEAD | 1 |
| 4 | BSI-1610063-00 | W6x9 I-BEAM POST 6FT.-GALVANIZED | 1 |
| 5 | BSI-1610064-00 | TSS PANEL - TRAFFIC SIDE SLIDER | 1 |
| 6 | BSI-1610065-00 | ISS PANEL - INNER SIDE SLIDER | 1 |
| 7 | BSI-1610066-00 | TOOTH - GEOMET | 1 |
| 8 | BSI-1610067-00 | RSS PLATE - REAR SIDE SLIDER | 1 |
| 9 | B061058 | CABLE FRICTION PLATE - HEAD UNIT | 1 |
| 10 | BSI-1610069-00 | CABLE ASSEMBLY - MASH X-TENSION | 2 |
| 11 | BSI-1012078-00 | X-LITE LINE POST-GALVANIZED | 8 |
| 12 | B090534 | 8" W-BEAM COMPOSITE-BLOCKOUT XT110 | 8 |
| 13 | BSI-4004386 | 12'-6" W-BEAM GUARD FENCE PANELS 12GA. | 4 |
| 14 | BSI-1102027-00 | X-LITE SQUARE WASHER | 1 |
| 15 | BSI-2001886 | ⅝" X 7" THREAD BOLT HH (GR.5)GEOMET | 1 |
| 16 | BSI-2001885 | ¾" X 3" ALL-THREAD BOLT HH (GR.5)GEOMET | 4 |
| 17 | 4001115 | ⅝" X 1 ¼" GUARD FENCE BOLTS (GR.2)MGAL | 48 |
| 18 | 2001840 | ⅝" X 10" GUARD FENCE BOLTS MGAL | 8 |
| 19 | 2001636 | ⅝" WASHER F436 STRUCTURAL MGAL | 2 |
| 20 | 4001116 | ⅝" RECESSED GUARD FENCE NUT (GR.2)MGAL | 59 |
| 21 | BSI-2001888 | ⅝" X 2" ALL THREAD BOLT (GR.5)GEOMET | 1 |
| 22 | BSI-1701063-00 | DELINEATION MOUNTING (BRACKET) | 1 |
| 23 | BSI-2001887 | ¼" X ¾" 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 |
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| © TxDOT: FEBRUARY 2018 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| | DIST | COUNTY | | SHEET NO. |
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DATE: _03/20/23_
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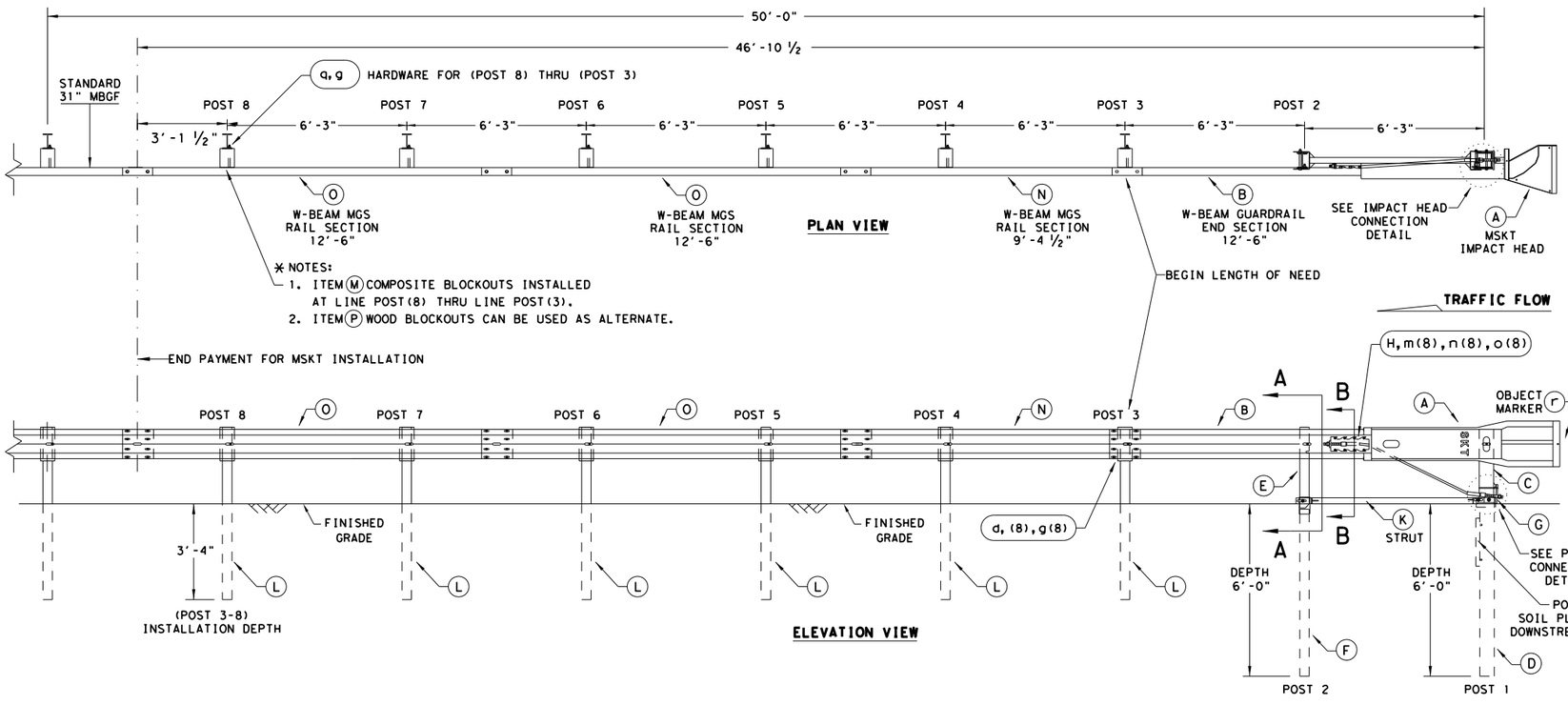
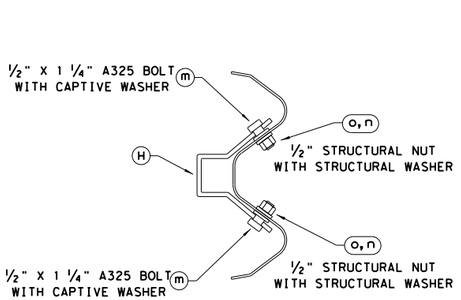
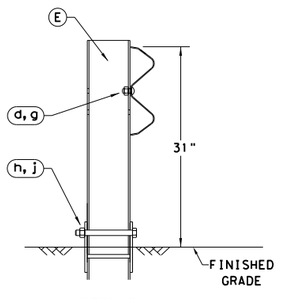


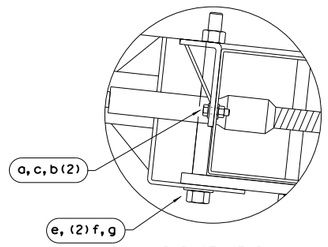

NOTE: SEE (GENERAL NOTE 14) FOR DRIVING CAP INFORMATION.



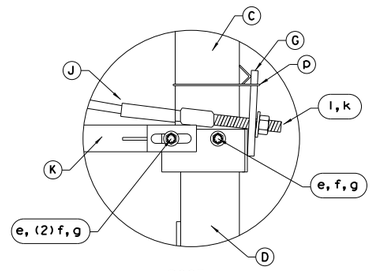

SECTION B-B
ANCHOR BRACKET




POST 2
SECTION A-A




IMPACT HEAD
CONNECTION DETAIL




POST 1
CONNECTION DETAIL

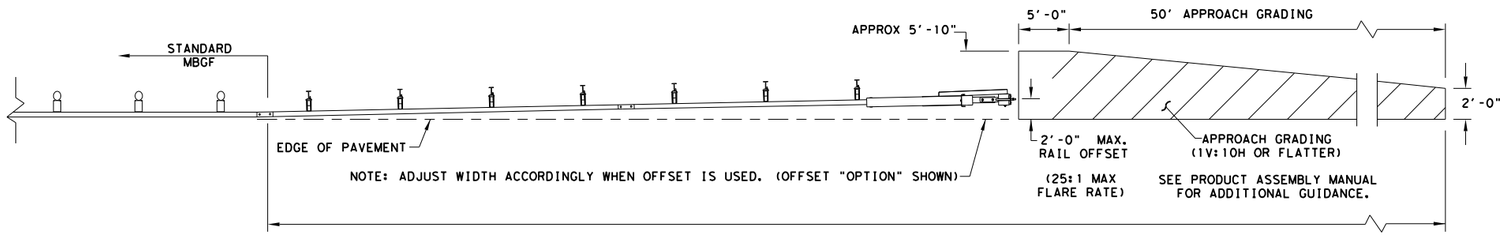
## GENERAL NOTES

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

| ITEM | QTY | MAIN SYSTEM COMPONENTS | ITEM NUMBERS |
|---|---|---|---|
| A | 1 | MSKT IMPACT HEAD | MS3000 |
| B | 1 | W-BEAM GUARDRAIL END SECTION, 12 Ga. | SF1303 |
| C | 1 | POST 1 - TOP (6" X 6" X ⅛" 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 ½") | 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 | ⅝" x 1" HEX BOLT (GRD 5) | B5160104A |
| b | 4 | ⅝" WASHER | W0516 |
| c | 2 | ⅝" HEX NUT | N0516 |
| d | 25 | ⅝" Dia. x 1 ¼" SPLICE BOLT (POST 2) | B580122 |
| e | 2 | ⅝" Dia. x 9" HEX BOLT (GRD A449) | B580904A |
| f | 3 | ⅝" WASHER | W050 |
| g | 33 | ⅝" Dia. H.G.R NUT | N050 |
| h | 1 | ¾" Dia. x 8 ½" HEX BOLT (GRD A449) | B340854A |
| j | 1 | ¾" Dia. HEX NUT | N030 |
| k | 2 | 1 ANCHOR CABLE HEX NUT | N100 |
| l | 2 | 1 ANCHOR CABLE WASHER | W100 |
| m | 8 | ½" x 1 ¼" A325 BOLT WITH CAPTIVE WASHER | SB12A |
| n | 8 | ½" 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 | ⅝" x 10" H.G.R. BOLT | B581002 |
| r | 1 | OBJECT MARKER 18" X 18" | E3151 |

SEE NOTES: *

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




NOTE: ADJUST WIDTH ACCORDINGLY WHEN OFFSET IS USED. (OFFSET "OPTION" SHOWN)

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

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| © TxDOT: APRIL 2018 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| | DIST | COUNTY | | SHEET NO. |
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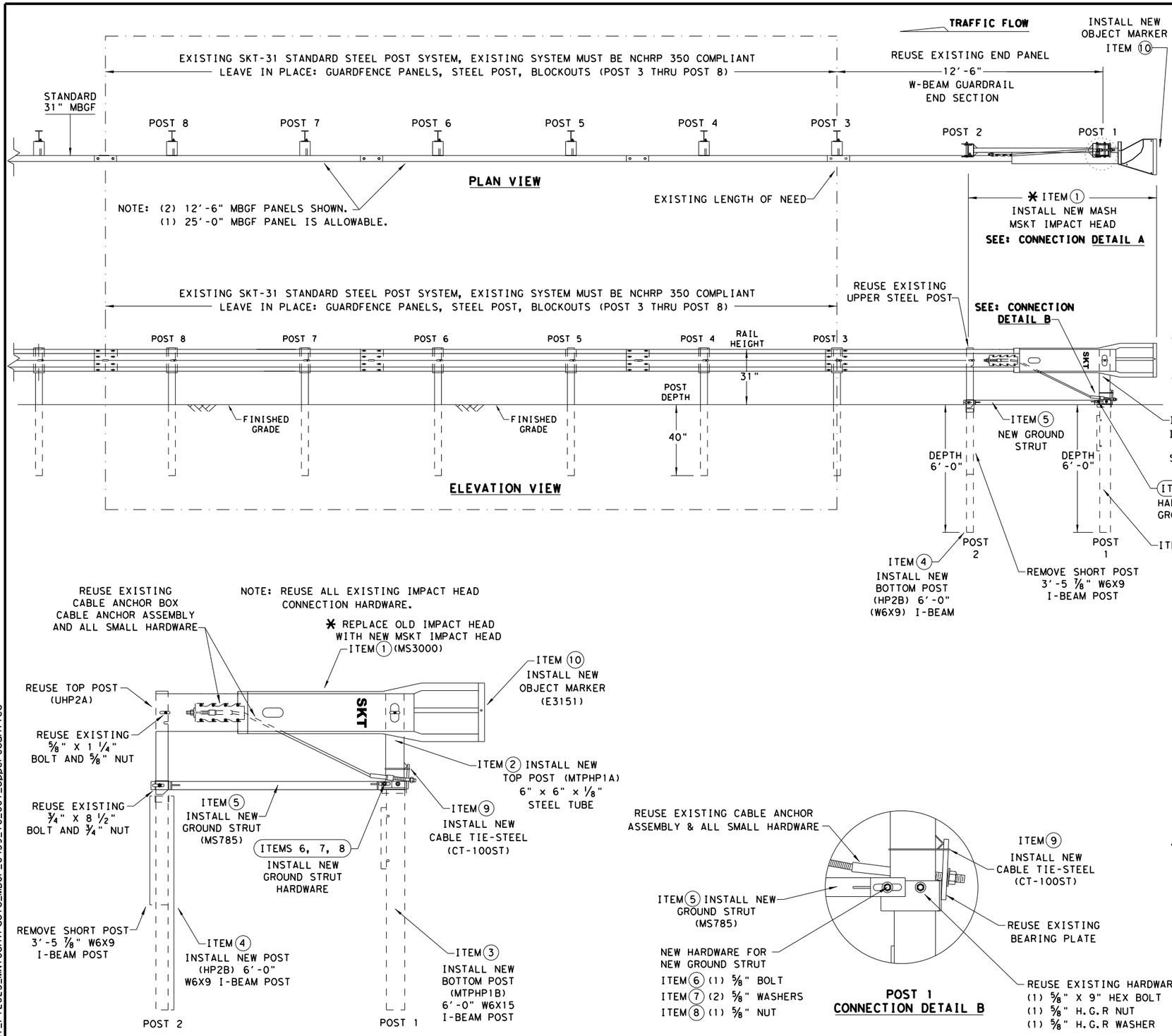


## GENERAL NOTES

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; 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. IF SOLID ROCK IS ENCOUNTERED IN THE AREA OF (POST 1) AND / OR (POST 2) CONTACT THE MANUFACTURER, AND REFER TO THE LATEST ROADWAY MBGF STANDARD FOR INSTALLATION GUIDANCE.
7. POSTS SHALL NOT BE SET IN CONCRETE.
8. THE EXISTING SKT 31" STANDARD STEEL POST SYSTEM MUST BE THOROUGHLY INSPECTED, AND DETERMINED TO BE INTACT, AND FREE OF ANY DAMAGE OR DEFECTS BEFORE RETROFITTING. THIS INSPECTION INCLUDES COMPLETING THE MSKT RETROFIT INSPECTION CHECKLIST FOR THE EXISTING SKT 31" STEEL POST NCHRP 350 SYSTEM. ALL EXISTING, AND REUSABLE PARTS MUST BE FREE OF ANY DAMAGE FOR A MASH COMPLIANT RETROFIT.
9. UNDER NO CIRCUMSTANCES SHALL THE GUARDRAIL WITHIN THE MSKT SYSTEM BE CURVED.
10. 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.
11. SPECIAL DRIVING CAP TO BE USED WHEN DRIVING (LOWER POSTS 1 & 2) TO PREVENT DAMAGE TO THE WELDED PLATES.




CONNECTION DETAIL A
IMPACT HEAD (POST 1 & POST 2)




POST 1
CONNECTION DETAIL B

| ITEMS | QTY | MAIN SYSTEM COMPONENTS | PART NUMBERS |
|---|---|---|---|
| * 1 | 1 | MSKT IMPACT HEAD | MS3000 |
| 2 | 1 | POST 1 - TOP (6" X 6" X 1/8" TUBE) | MTPHP1A |
| 3 | 1 | POST 1 - BOTTOM (6' W6X15) | MTPHP1B |
| 4 | 1 | POST 2 - ASSEMBLY BOTTOM (6' W6X9) | HP2B |
| 5 | 1 | GROUND STRUT | MS785 |
| 6 | 1 | 5/8" X 9" HEX BOLT (GRD A449) | B580904A |
| 7 | 2 | 5/8" WASHERS | W050 |
| 8 | 1 | 5/8" H.G.R NUT | N050 |
| 9 | 1 | CABLE TIE-STEEL | CT-100ST |
| * 10 | 1 | OBJECT MARKER 18" X 18" | E3151 |

**COMPONENTS REQUIRED TO RETROFIT: EXISTING 31" STEEL POST (NCHRP 350 SKT) GUARDRAIL TERMINAL WITH THE NEW 31" (MASH COMPLIANT MSKT IMPACT HEAD).**

*** IF THE EXISTING NCHRP 350 (31" STEEL POST SKT) ALREADY HAS THE MSKT IMPACT HEAD THERE IS NO NEED TO REPLACE THE IMPACT HEAD OR OBJECT MARKER AS LONG AS IT IS NOT DAMAGED.**

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

Texas Department of Transportation

Design Division Standard

# RETROFIT STANDARD SKT 31" STEEL POST SYSTEM TO MASH MSKT

## SGT(13S)31-18

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| ©TxDOT: APRIL 2018 | CONT | SECT | JOB | HIGHWAY |
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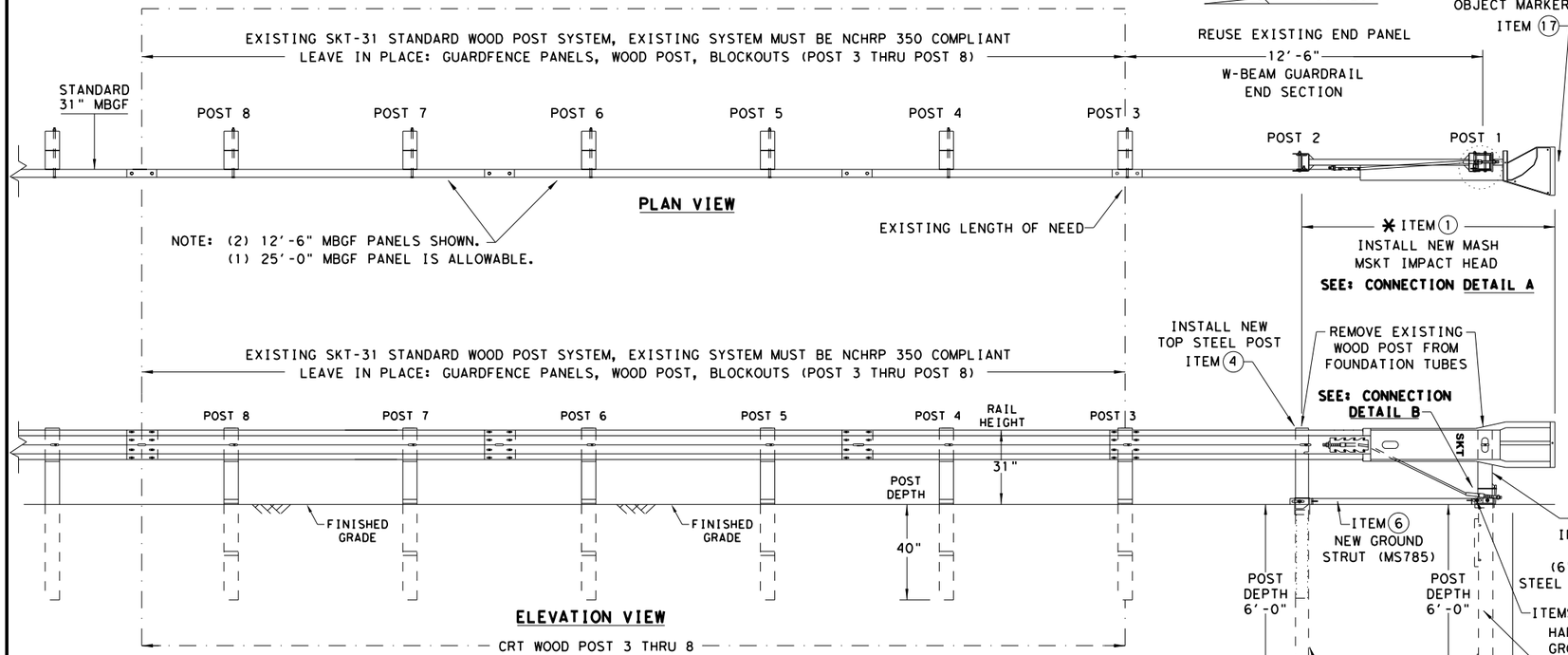
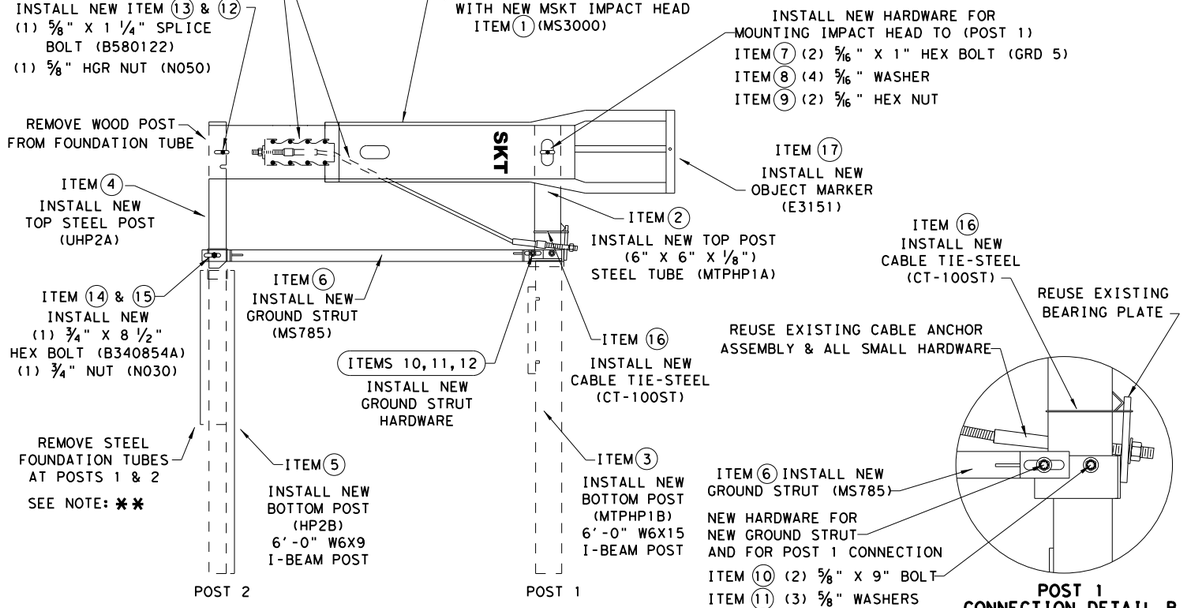


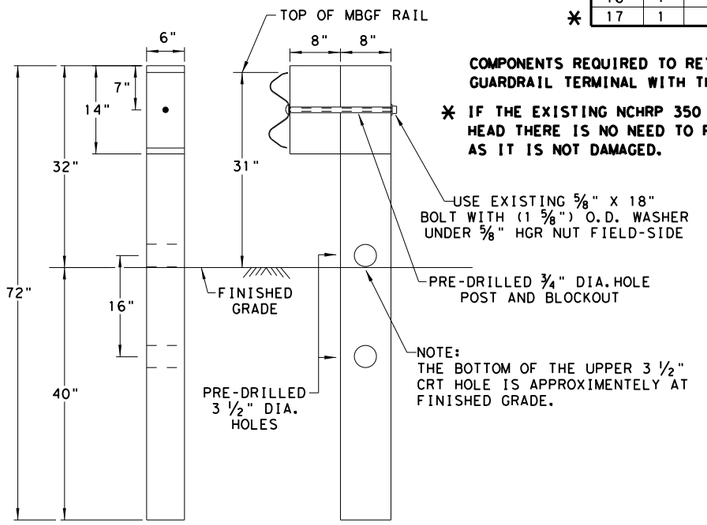




**CONNECTION DETAIL A**
**IMPACT HEAD (POST 1 & POST 2)**




**POST 1**
**CONNECTION DETAIL B**

** NOTE: EXTRA SOIL COMPACTION WILL BE NEEDED AROUND NEW (POSTS 1 & 2) DUE TO THE REMOVAL OF THE STEEL FOUNDATION TUBES.




**FRONT VIEW** **SIDE VIEW**
**EXISTING WOOD POSTS 3-8**
**CONTROLLED RELEASE TERMINAL (CRT)**

NOTE: THIS STANDARD IS A BASIC REPRESENTATION OF THE EXISTING; SKT END TERMINAL RETROFITED TO THE MSKT MASH COMPLIANT TERMINAL, IT 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: ROAD SYSTEMS, INC. (432)263-2435. 3616 OLD HOWARD COUNTY AIRPORT, BIG SPRING, TX 79720
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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. IF SOLID ROCK IS ENCOUNTERED IN THE AREA OF (POST 1) AND / OR (POST 2) CONTACT THE MANUFACTURER, AND REFER TO THE LATEST ROADWAY MBGF STANDARD FOR INSTALLATION GUIDANCE.
7. POSTS SHALL NOT BE SET IN CONCRETE.
8. THE EXISTING SKT 31" STANDARD WOOD POST SYSTEM MUST BE THOROUGHLY INSPECTED, AND DETERMINED TO BE INTACT, AND FREE OF ANY DAMAGE OR DEFECTS BEFORE RETROFITTING. THIS INSPECTION INCLUDES COMPLETING THE MSKT RETROFIT INSPECTION CHECKLIST FOR THE EXISTING SKT 31" WOOD POST NCHRP 350 SYSTEM. ALL EXISTING, AND REUSABLE PARTS MUST BE FREE OF ANY DAMAGE FOR A MASH COMPLIANT RETROFIT.
9. UNDER NO CIRCUMSTANCES SHALL THE GUARDRAIL WITHIN THE MSKT SYSTEM BE CURVED.
10. 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.
11. SPECIAL DRIVING CAP TO BE USED WHEN DRIVING (LOWER POSTS 1 & 2) TO PREVENT DAMAGE TO THE WELDED PLATES.

| ITEMS | QTY | MAIN SYSTEM COMPONENTS | PART NUMBERS |
|---|---|---|---|
| 1 | 1 | MSKT IMPACT HEAD | MS3000 |
| 2 | 1 | POST 1 - TOP (6" X 6" X 1/8" TUBE) | MTPHP1A |
| 3 | 1 | POST 1 - BOTTOM (6' W6X15) | MTPHP1B |
| 4 | 1 | POST 2 - ASSEMBLY TOP | UHP2A |
| 5 | 1 | POST 2 - ASSEMBLY BOTTOM (6' W6X9) | HP2B |
| 6 | 1 | GROUND STRUT | MS785 |
| 7 | 2 | 5/16" X 1" HEX BOLT (GRD 5) | B516014A |
| 8 | 4 | 5/16" WASHERS | W0516 |
| 9 | 2 | 5/16" HEX NUT | N0516 |
| 10 | 2 | 5/8" X 9" HEX BOLT (GRD A449) | B580904A |
| 11 | 3 | 5/8" WASHERS | W050 |
| 12 | 3 | 5/8" H.G.R NUT | N050 |
| 13 | 1 | 5/8" X 1 1/4" SPLICE BOLT | B580122 |
| 14 | 1 | 3/4" X 8 1/2" HEX BOLT (GRD 5) | B340854A |
| 15 | 1 | 3/4" HEX NUT | N030 |
| 16 | 1 | CABLE TIE-STEEL | CT-100ST |
| * 17 | 1 | OBJECT MARKER 18" X 18" | E3151 |

**COMPONENTS REQUIRED TO RETROFIT: EXISTING 31" WOOD POST (NCHRP 350 SKT) GUARDRAIL TERMINAL WITH THE NEW 31" (MASH COMPLIANT MSKT IMPACT HEAD).**

*** IF THE EXISTING NCHRP 350 (31" WOOD POST SKT) ALREADY HAS THE MSKT IMPACT HEAD THERE IS NO NEED TO REPLACE THE IMPACT HEAD OR OBJECT MARKER AS LONG AS IT IS NOT DAMAGED.**

Texas Department of Transportation

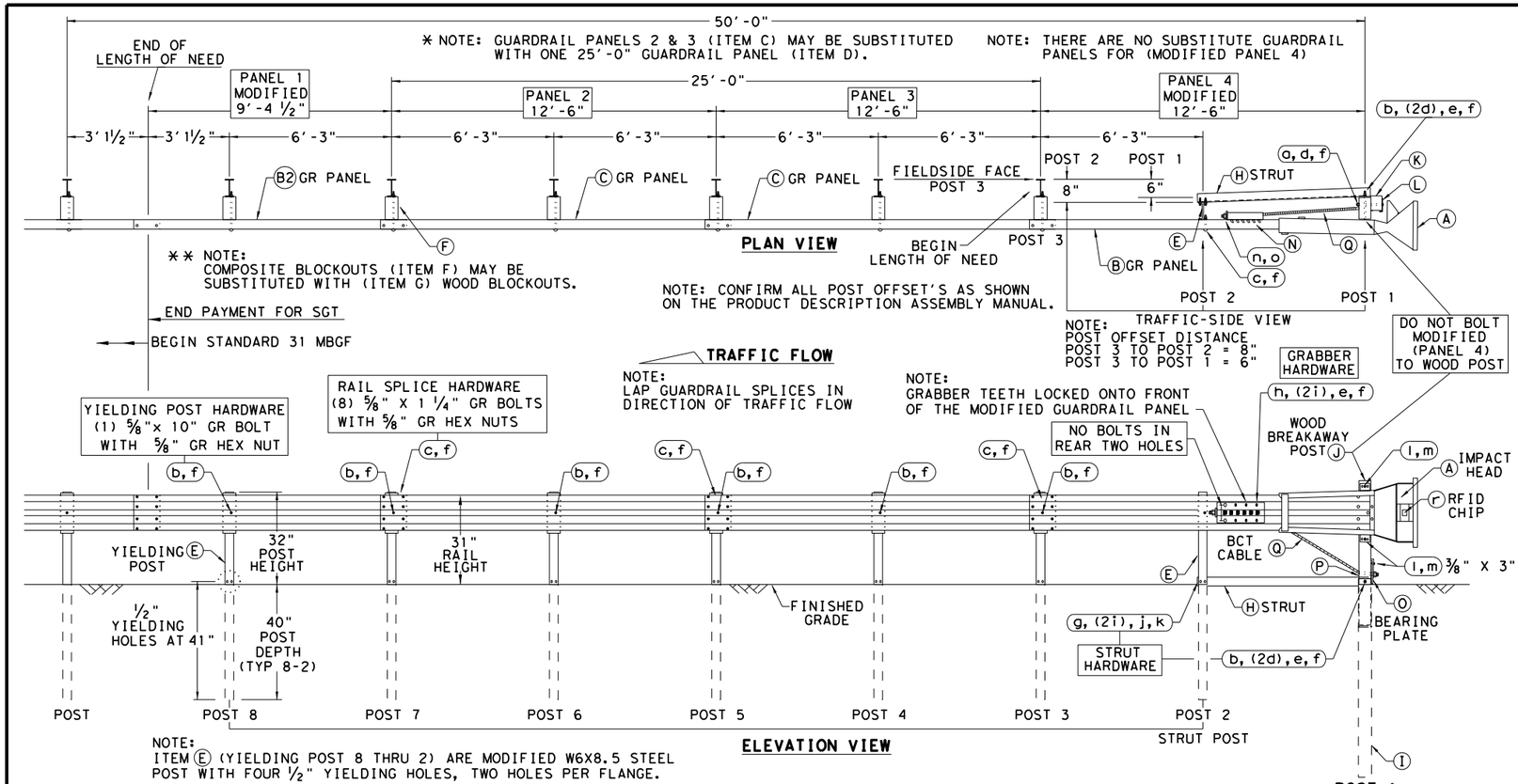
Design Division Standard

# RETROFIT STANDARD SKT 31" WOOD POST SYSTEM TO MASH MSKT

# SGT(14W)31-18

| FILE: sgt14w3118.dgn | DN: TxDOT | CK: KM | DW: VP | CK: CL |
|---|---|---|---|---|
| ©TxDOT: APRIL 2018 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 73 |

DATE: _03/20/23_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties

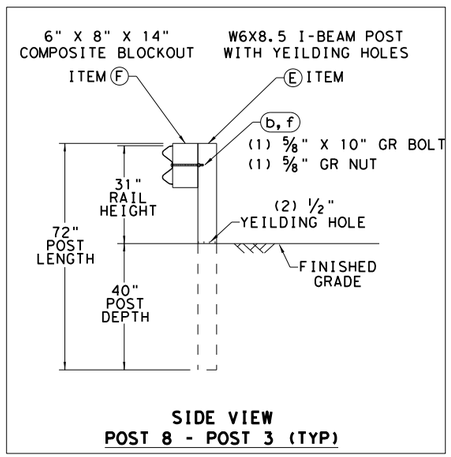



## GENERAL NOTES

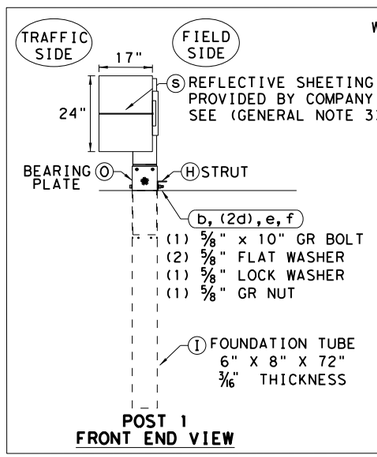
1. FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: SPIG INDUSTRY, INC. AT 1(267) 644-9510. 14675 INDUSTRIAL PARK RD; BRISTOL, VA 24202
2. FOR INSTALLATION, REPAIR AND MAINTENANCE REFER TO THE MANUFACTURER'S; SGET END TERMINAL, PRODUCT DESCRIPTION ASSEMBLY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

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

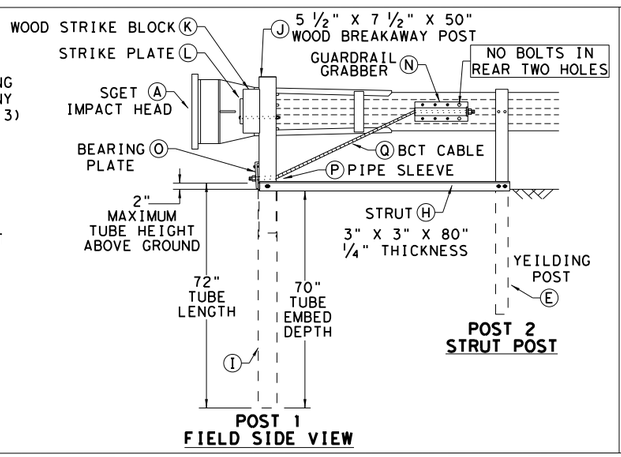
ALTERNATIVE ITEMS
* D
** G
NOTE: SEE PLAN VIEW



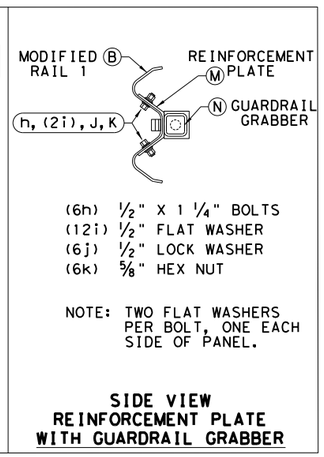

SIDE VIEW
POST 8 - POST 3 (TYP)



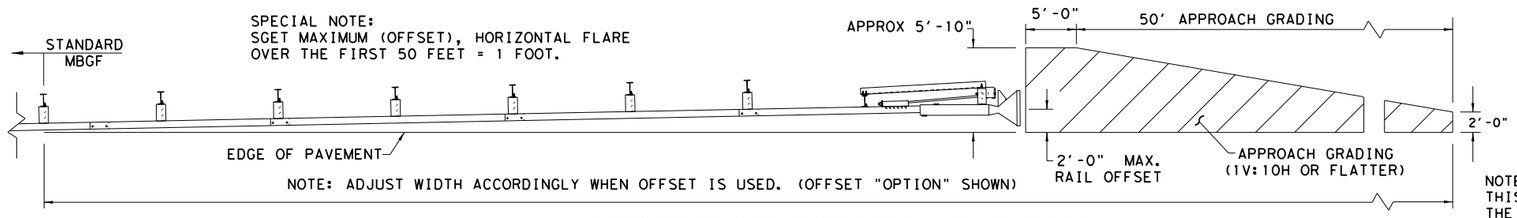

POST 1
FRONT END VIEW




POST 1
FIELD SIDE VIEW
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.

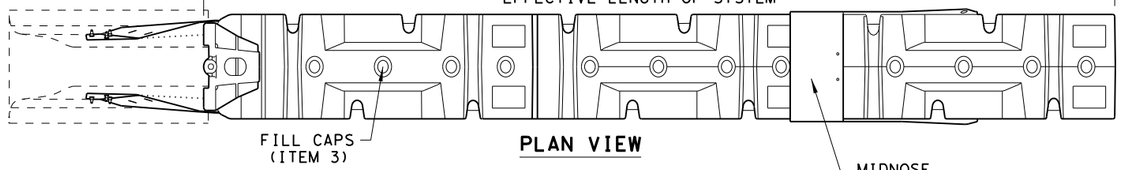
Texas Department of Transportation
Design Division Standard

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

| FILE: sgt153120.dgn | DN: TxDOT | CK: KM | DW: VP | CK: VP |
|---|---|---|---|---|
| © TxDOT: APRIL 2020 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 74 |

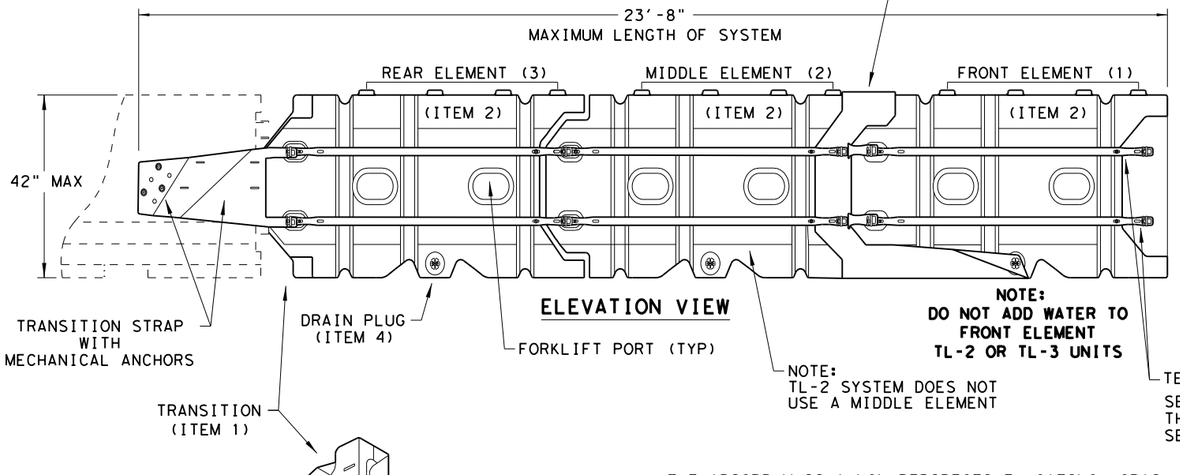
DATE: _03/20/23_
FILE: LRDDSIMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties

SYSTEM SHOWN - ABSORB-M TL-3



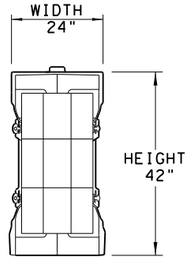

PLAN VIEW

TRAFFIC FLOW

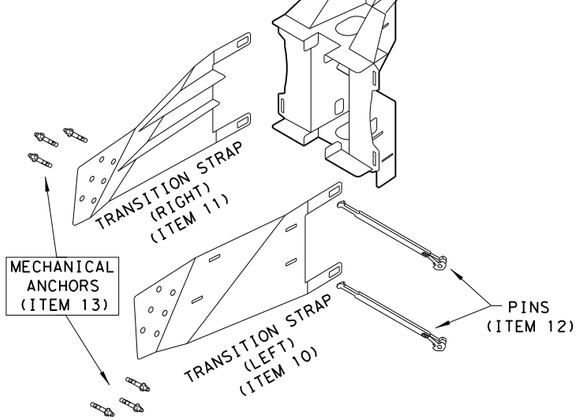



ELEVATION VIEW

TRAFFIC FLOW




SECTION A-A




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

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

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

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

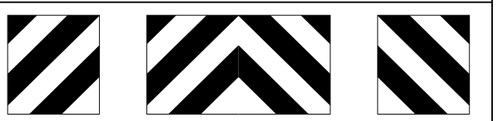
## GENERAL NOTES

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

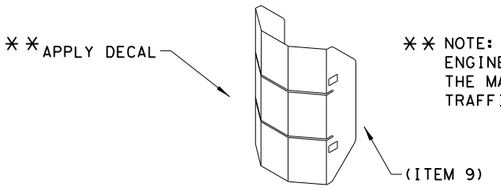
| BILL OF MATERIALS (BOM) ABSORB-M TL-3 & TL-2 SYSTEMS | | | QTY | QTY |
|---|---|---|---|---|
| ITEM # | PART NUMBER | PART DESCRIPTION | TL-2 SYSTEM | TL-3 SYSTEM |
| 1 | BSI-1809036-00 | TRANSITION-(GALV) | 1 | 1 |
| * 2 | BSI-1808002-00 | PRE-ASSEMBLED ABSORBING (ELEMENTS) | 2 | 3 |
| * 3 | BSI-4004598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

*COMPONENTS PRE-ASSEMBLED WITH ELEMENT ASSEMBLY

**DELINEATION DECAL PLACEMENT GUIDE**



TRAFFIC FLOW LEFT-SIDE BARRIER | TRAFFIC FLOW BOTH-SIDE BARRIER | TRAFFIC FLOW RIGHT-SIDE BARRIER




NOSE PLATE

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

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

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

SACRIFICIAL

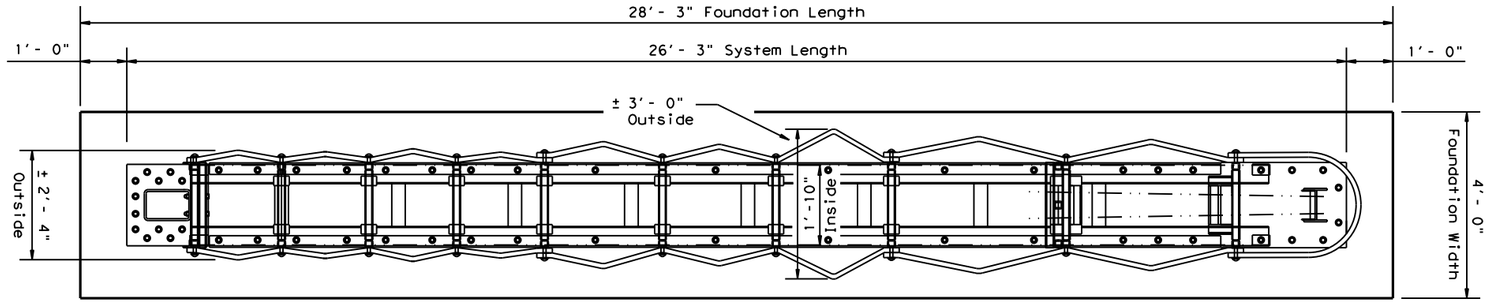
Texas Department of Transportation — Design Division Standard

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

| FILE: absorbm19 | DN: TxDOT | CK: KM | DW: VP | CK: |
|---|---|---|---|---|
| © TxDOT: JULY 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 75 |

DATE: _03/20/23_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties

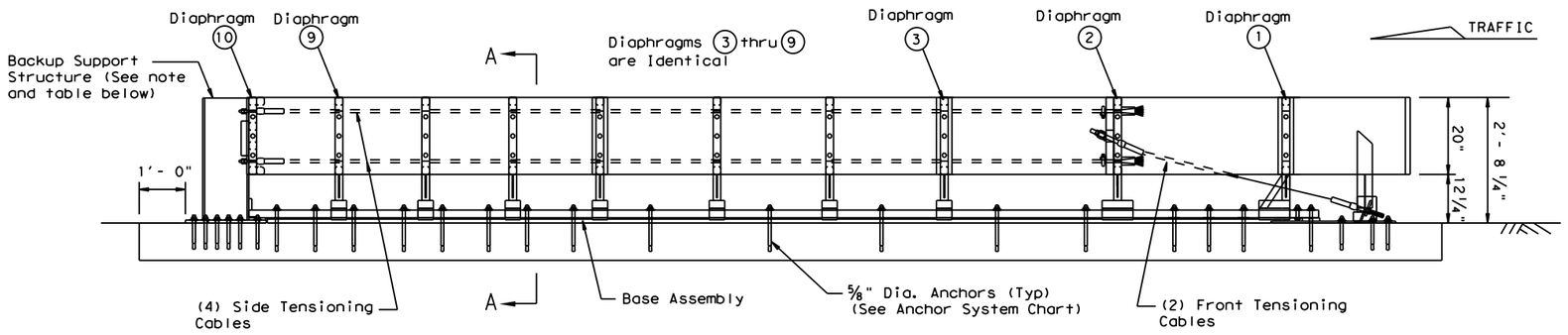
## PLAN VIEW

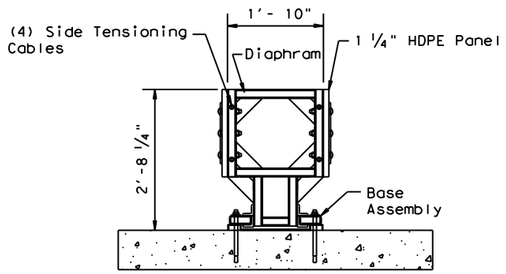



NOTE:
BACKUP SUPPORT SHOWN IS THE STEEL POST OPTION. THE HEART SYSTEM MAY BE CONNECTED WITH RECTANGULAR CROSS SECTIONS SUCH AS: PIERS, PARAPETS AND CONCRETE TRAFFIC BARRIERS.

SYSTEM SHOWN IS HEART (TL-3) WITH UNI-DIRECTIONAL TRAFFIC

## ELEVATION VIEW




## SECTION A-A

| ANCHOR SYSTEM CHART |
|---|
| On Concrete:<br>10" Bolts used on base rails,<br>7 ½" Bolts used on base plates. |
| On Asphalt:<br>18" Bolts used on base rails<br>and base plates. |

| HEART (NARROW) SYSTEM | | |
|---|---|---|
| TEST LEVEL | SYSTEM LENGTH | PAD LENGTH |
| TL-2 | 13'- 9 ½" | 15'- 9 ½" |
| TL-3 | 26'- 3" | 28'- 3" |
| 70 | 28'- 9" | 30'- 9" |

CONCRETE PAD LENGTH ON THE HEART SYSTEM DEPENDS ON BACKUP TYPE. (MINIMUM LENGTH SHOWN)

| FOUNDATION OPTIONS |
|---|
| 6" Reinforced Concrete |
| 8" Unreinforced Concrete |
| 8" Minimum Asphalt |
| For asphalt overlays on concrete, contact the manufacturer. |

FOR STEEL PLACEMENT IN CONCRETE FOUNDATIONS (SEE MANUFACTURER'S PRODUCT MANUAL)

| BACKUP SUPPORT OPTIONS |
|---|
| Steel Post Backup (Shown) |
| Rectangular Concrete Backup (18" Width Max.) |
| Concrete Barrier (CTB) Backup |
| Single Slope Concrete Barrier (SSCB) |

| TRANSITION OPTIONS |
|---|
| THE HEART SYSTEM IS APPROVED FOR USE AT BI-DIRECTIONAL SITES, ADDITIONAL HARDWARE IS REQUIRED. (SEE MANUFACTURER'S PRODUCT MANUAL) |

BACKUP AND TRANSITION TYPES ARE SHOWN ELSEWHERE ON THE PLANS. (I.E. ATTENUATOR LOCATION DETAILS OR IN THE GENERAL NOTES)

## GENERAL NOTES

1. For specific information regarding installation and technical guidance of the system, contact: Trinity Highway at 1(888)323-6374. 2525 N. Stemmons Freeway, Dallas, TX 75207
2. For bi-directional traffic, appropriate transition panels will be required.
3. Details of components for the HEART and backups and reinforcing details 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 p.s.i.
5. If the cross-slope varies more than 2% over the length of the system, the concrete pad will require levelling. Maximum permissible cross-slope is 8%.
6. The installation area should be free from curbs, elevated objects, or depressions.
7. The HEART system should be approximately parallel with the barrier or ℄ of merging barriers.

Texas Department of Transportation

Design Division Standard

# TRINITY HIGHWAY
# HEART HYBRID ENERGY ABSORBING TERMINAL
# HEART-16

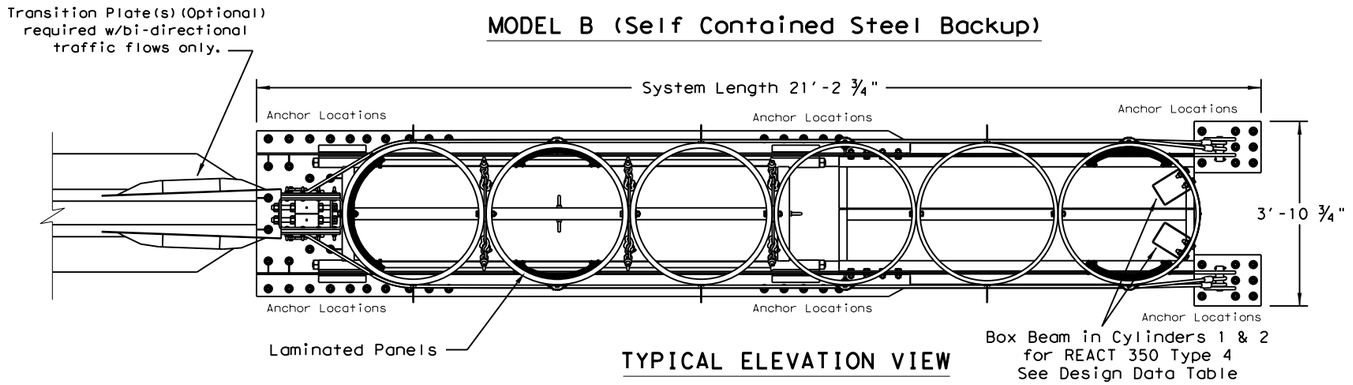
| FILE: heart16.dgn | DN: TxDOT | CK: KM | DW: VP | CK: VP |
|---|---|---|---|---|
| ©TxDOT: March 2010 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| REVISED 06,2013 (VP) | DIST | COUNTY | | SHEET NO. |
| REVISED 03,2016 (VP) | 22 | VAR | | 76 |

LOW MAINTENANCE

DATE: 03/20/23
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties

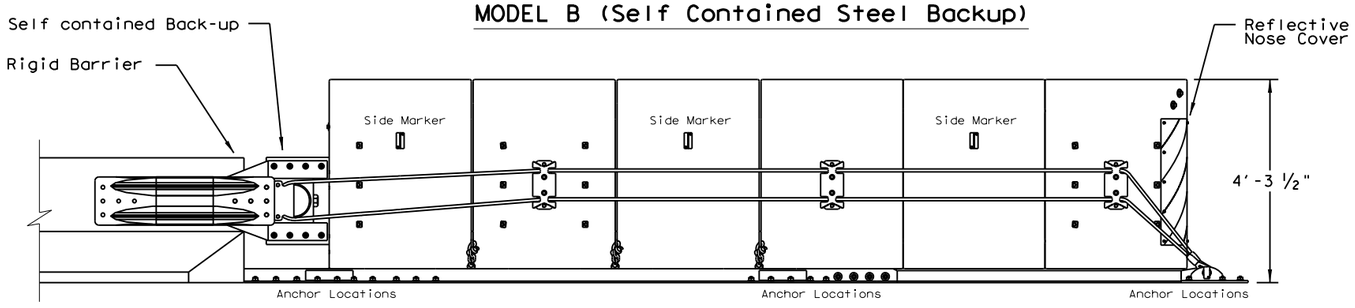
## TYPICAL PLAN VIEW

### MODEL B (Self Contained Steel Backup)



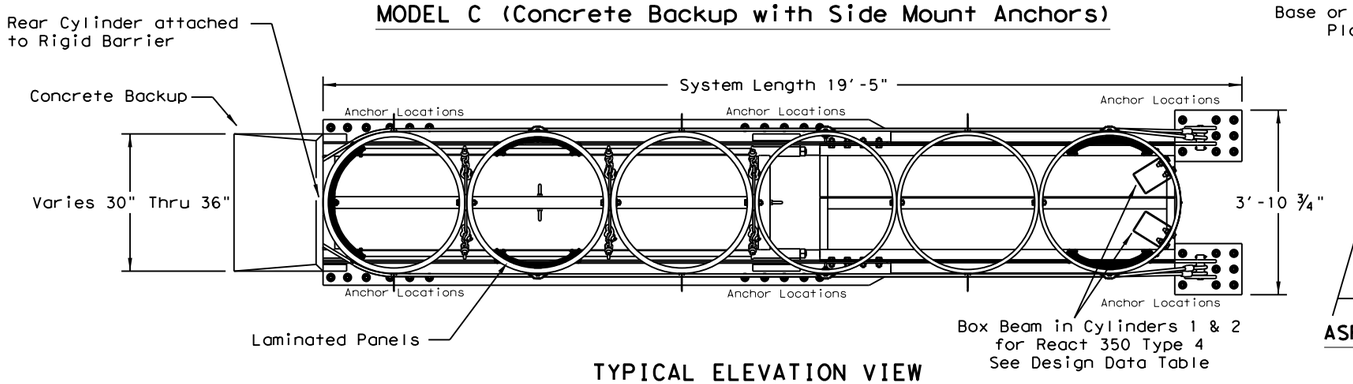

## TYPICAL ELEVATION VIEW

### MODEL B (Self Contained Steel Backup)



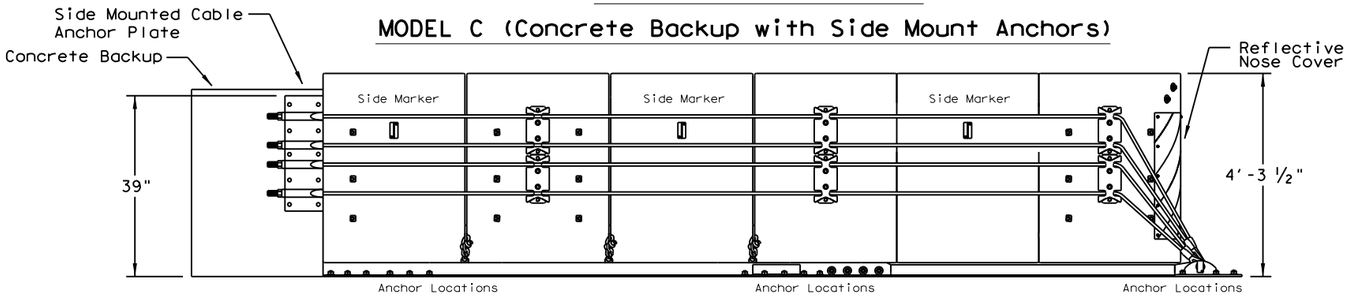

## TYPICAL PLAN VIEW

### MODEL C (Concrete Backup with Side Mount Anchors)




## TYPICAL ELEVATION VIEW

### MODEL C (Concrete Backup with Side Mount Anchors)

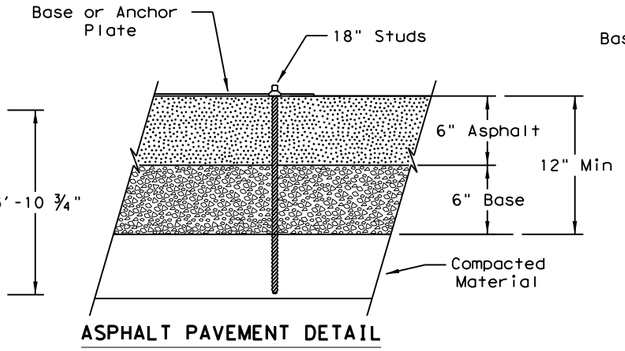



## GENERAL NOTES

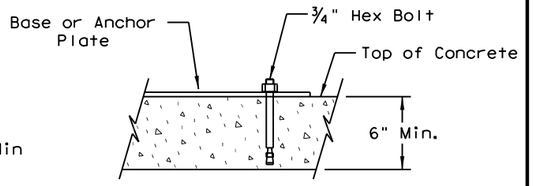
1. For specific information regarding installation and technical guidance of the system, contact: Trinity Highway - Energy Absorption at 1(888)323-6374. 70 W. Madison St. Suite 2350. Chicago, IL 60602
2. The nose of the REACT 350 shall be clad with a plastic wrap with standard delineation adhered to 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. All steel components to be hot dipped galvanized except stakes, drive spikes, threaded bolts in backup unit, and wedge fittings on cables.
4. The installation area should be free from curbs, elevated objects, or depressions. If the REACT system is to span expansion joints contact the manufacturer.
5. The REACT system should be approximately parallel with the barrier or ℄ of merging barriers. The maximum permissible cross-slope is 8%.
6. REACT 350 II has laminated panels in cyliners 1, 5, & 6.

| DESIGN DATA TABLE FOR REACT 350 AND REACT 350 II | | | | |
|---|---|---|---|---|
| TYPE | REACT 350 4-B | REACT 350 4-C | REACT 350 II 6-B | REACT 350 II 6-C |
| Test Level | TL-2 | TL-2 | TL-3 | TL-3 |
| OVERALL LENGTH | 15'-3" | 13'-9" | 21'-3" | 19'-5" |

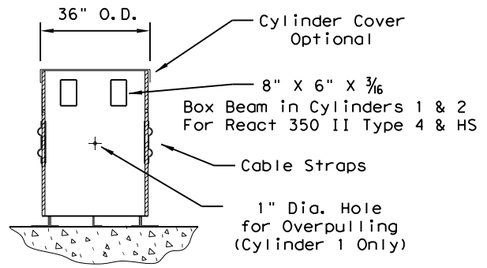
| FOUNDATION AND ANCHORAGE TABLE FOR REACT 350 AND REACT 350 II | | | |
|---|---|---|---|
| FOUNDATION TYPE | | MINIMUM THICKNESS | ANCHORAGE |
| A | CONCRETE PAD OR ROADWAY | 6" | MP-3 WITH 7" STUDS [5.5" EMBEDMENT] |
| B | ASPHALT OVER CONCRETE PAVEMENT | 6" CONCRETE PAVEMENT | ANCHOR LENGTH REQUIRED IS 7" STUD PLUS ASPHALT THICKNESS |
| C | ASPHALT OVER BASE | 6" ACP + 6" BASE | MP-3 WITH 18" STUDS [16.5" EMBEDMENT] |
| D | ASPHALT ONLY | 8" | MP-3 WITH 18" STUDS [16.5" EMBEDMENT] |




ASPHALT PAVEMENT DETAIL




CONCRETE PAVEMENT DETAIL




TYPICAL CYLINDER

Texas Department of Transportation

Design Division Standard

# TRINITY HIGHWAY ENERGY ABSORPTION (REACT 350 NARROW) (REACT 350 II NARROW)

# REACT(N)-16

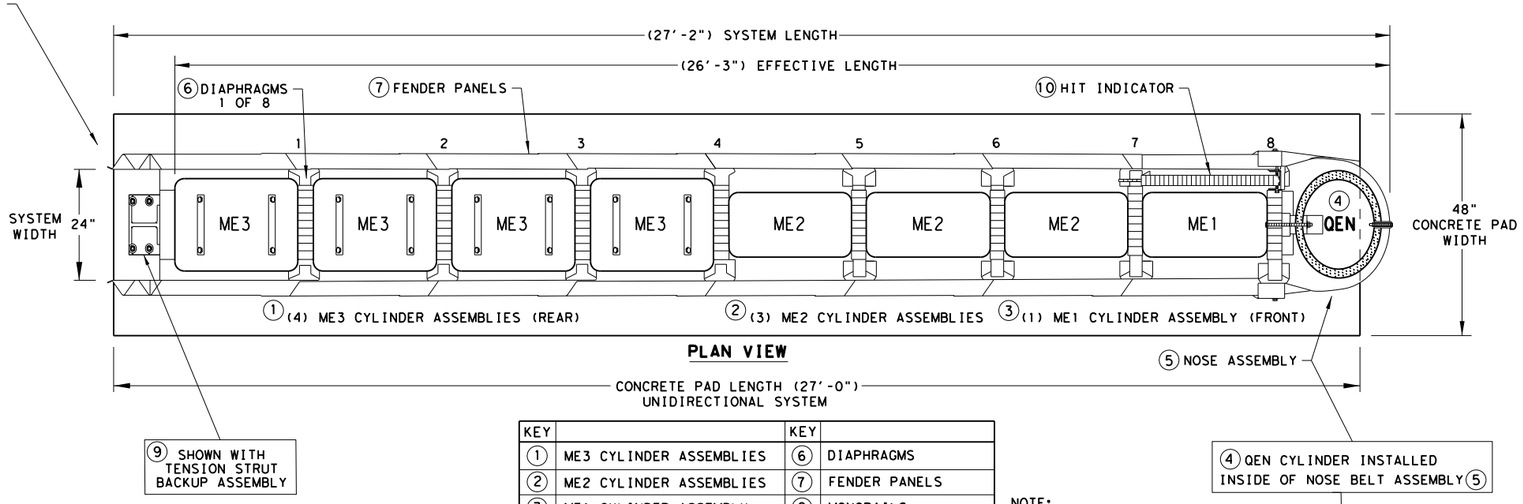
| FILE: reactn16.dgn | DN: TxDOT | CK: KM | DW: VP | CK: VP |
|---|---|---|---|---|
| ©TxDOT February 1998 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| REVISED 06,2013 (VP) | DIST | COUNTY | | SHEET NO. |
| REVISED 03,2016 (VP) | 22 | VAR | | 77 |

LOW MAINTENANCE

DATE: _03/20/23_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties

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

## QUADGUARD ELITE M10 24" WIDE (8 BAY) SYSTEM




**PLAN VIEW**

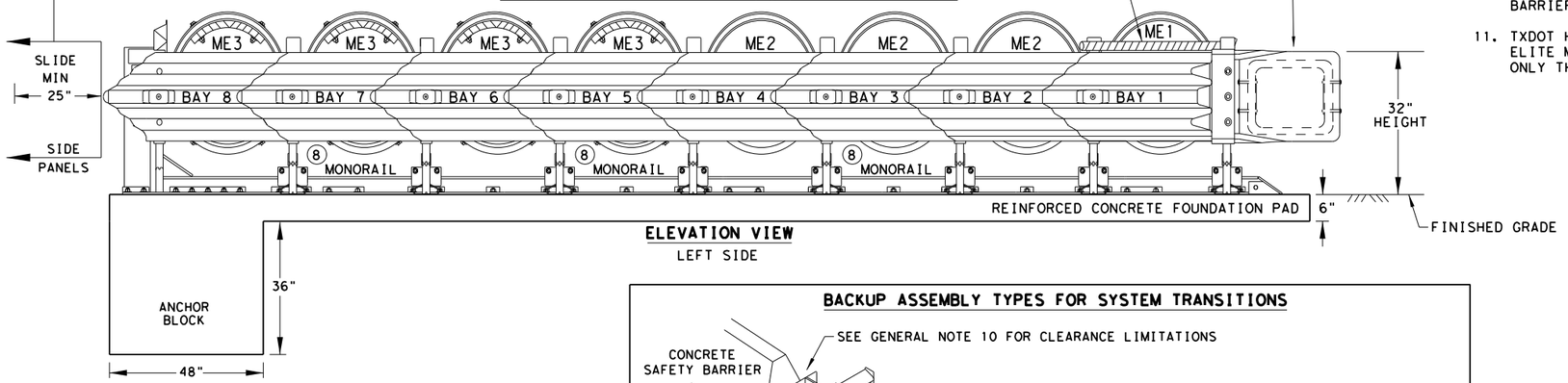
⑨ SHOWN WITH TENSION STRUT BACKUP ASSEMBLY

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

NOTE:
HIT INDICATOR WILL RAISE UPON IMPACT.




**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.

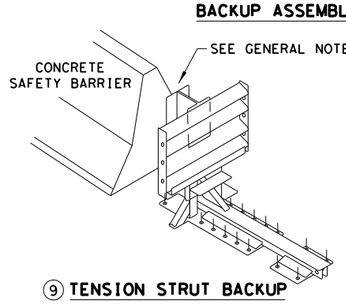
8" NON-REINFORCED CONCRETE PAD MAY NOT REQUIRE AN ANCHOR BLOCK, IF THE PAD IS INSTALLED AGAINST AN IMMOVABLE CONCRETE BACKUP.

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

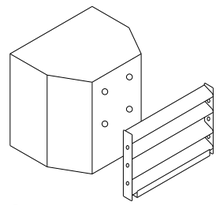



⑨ TENSION STRUT BACKUP

| 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

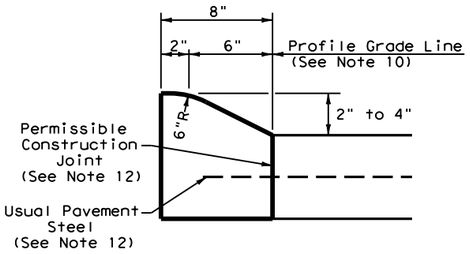
Texas Department of Transportation
Design Division Standard

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

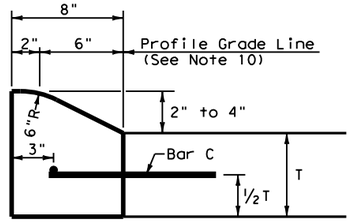
## QGELITE(M10)(N)-20

| FILE: qgelitem10n20.dgn | DN:TxDOT | CK:KM | DW:VP | CK:AG |
|---|---|---|---|---|
| ©TxDOT: NOVEMBER 2020 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 78 |

DATE: _03/20/23_ _11:30_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties




TYPE I CURB (MONOLITHIC)
2" - 4" HEIGHT

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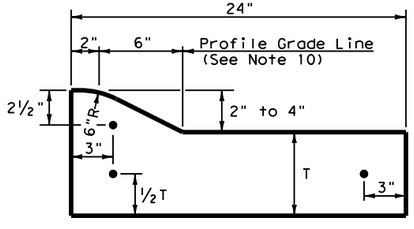
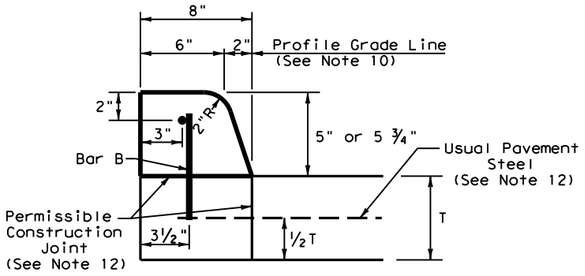
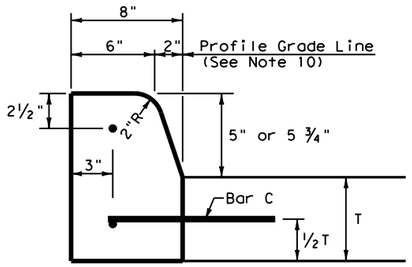


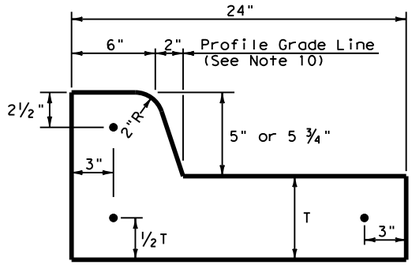

TYPE I CURB AND GUTTER
2" - 4" HEIGHT



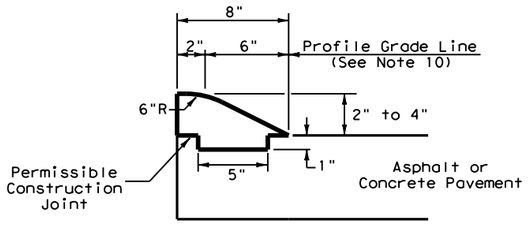

TYPE II CURB (MONOLITHIC)
5" - 5 ¾" HEIGHT



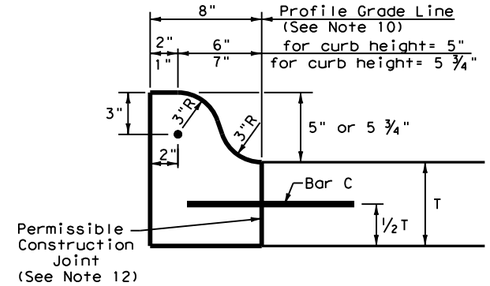

TYPE II CURB
5" - 5 ¾" HEIGHT



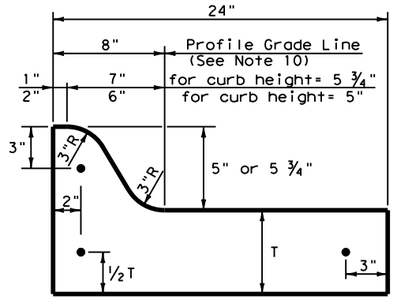

TYPE II CURB AND GUTTER
5" - 5 ¾" HEIGHT



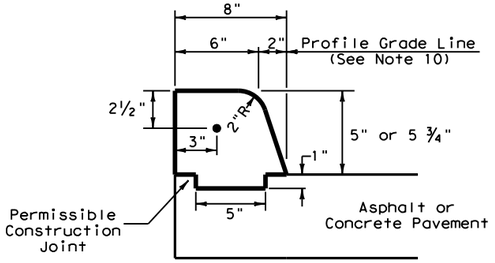

TYPE III CURB (KEYED)
2" - 4" HEIGHT



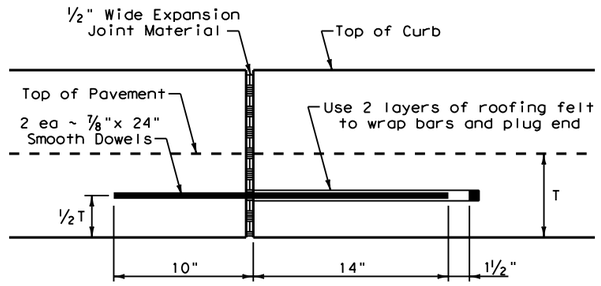

TYPE IIa CURB
5" - 5 ¾" HEIGHT




TYPE IIa CURB AND GUTTER
5" - 5 ¾" HEIGHT

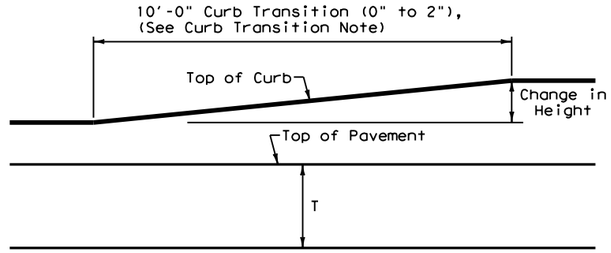



TYPE IV CURB (KEYED)
5" - 5 ¾" HEIGHT




EXPANSION JOINT DETAIL

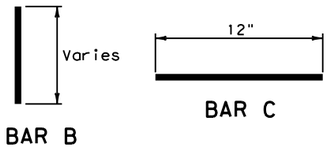
Curb Transition Note:
Field conditions may require a longer or shorter transition, and shall be shown elsewhere in the plans, or as directed by the Engineer.




CURB TRANSITION
Note: To be paid for as Highest Curb

## General Notes

1. All materials and construction shall be in accordance with Item 529, "Concrete Curb, Gutter, and Combined Curb and Gutter."
2. Concrete shall be Class A.
3. When reinforcing bars are used, they shall be No. 4 unless otherwise shown. The use of synthetic fiber in lieu of steel reinforcing is acceptable, provided the fiber producer is on the Department Producer List (MPL), maintained by TxDOT, Construction Division.
4. Round exposed sharp edges with a rounding tool, to a minimum radius of ¼ inch.
5. All existing curbs and driveways to be removed shall be sawed or removed at existing joints.
6. Where concrete curb is placed on existing concrete pavement, the pavement shall be drilled and the reinforcing bars grouted in place.
7. Expansion and contraction joints shall be constructed to match pavement joints in all curbs and curb and gutter adjacent to jointed concrete pavement. Where placement of curb or curb and gutter is not adjacent to concrete pavement, expansion joints shall be provided at structures, curb returns at streets, and at locations directed by The Engineer.
8. Vertical and horizontal dowel bars and transverse reinforcing bars shall be placed at four feet C-C.
9. Dimension 'T' shown is the thickness of concrete pavement. When curb is installed adjacent to flexible pavement dimension 'T' is 8" maximum.
10. Usual profile grade line. Refer to typical sections and plan-profile sheets for exact locations.
11. One-half inch expansion joint material shall be provided where curb or curb and gutter is adjacent to sidewalk or riprap.
12. When vertical permissible construction joints are used, resulting in a longitudinal construction joint in the pavement, the longitudinal pavement steel shall be placed in accordance with pavement details shown elsewhere in the plans for longitudinal construction joints. Reinforcing steel for curb section shall then conform to that required for concrete curb.




BAR B
BAR C

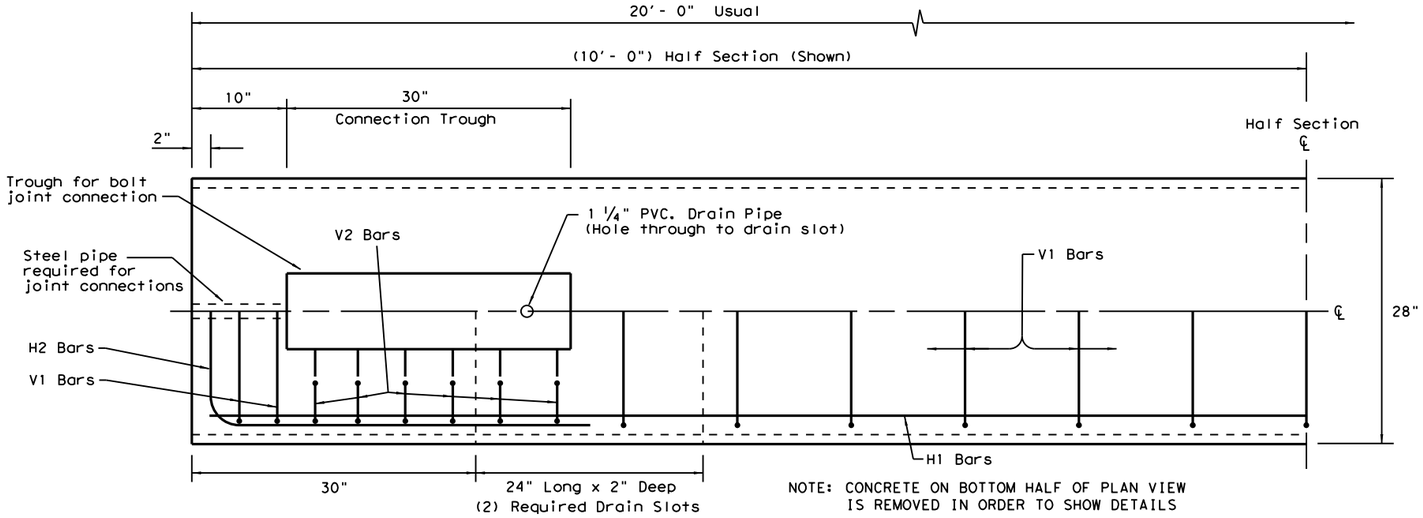
Texas Department of Transportation
Design Division Standard

# CONCRETE CURB AND CURB AND GUTTER

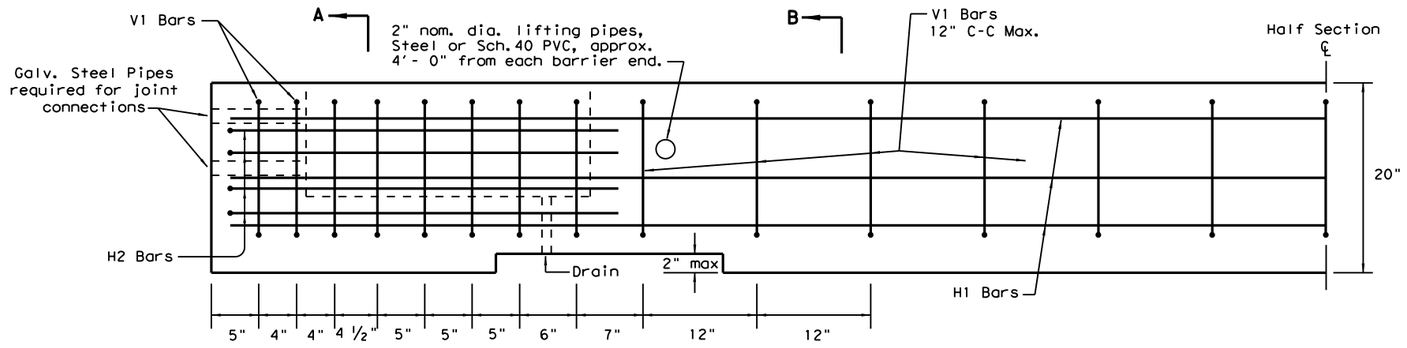
# CCCG-12

| FILE: cccg12.dgn | DN: TxDOT | CK: AM | DW: VP | CK: VP |
|---|---|---|---|---|
| © TxDOT: 1995 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS UPDATED 2012 - VP | 6439 | 16 | 001 | VAR |
| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 79 |

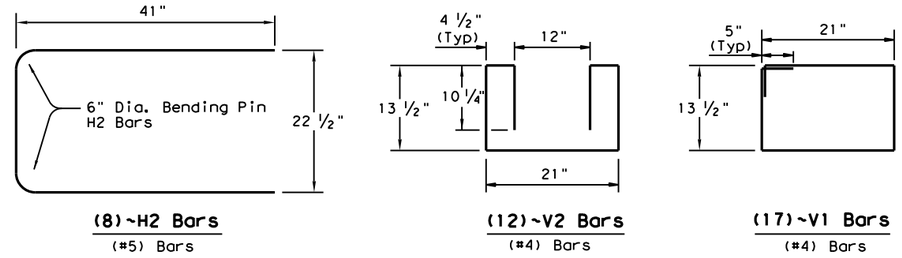
DATE: _03/20/23_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties




## PLAN
## (TYPE 1) BARRIER SEGMENT
(SYMMETRICAL ABOUT CENTER LINES)




## ELEVATION
## (TYPE 1) BARRIER SEGMENT
(SYMMETRICAL ABOUT CENTER LINES)



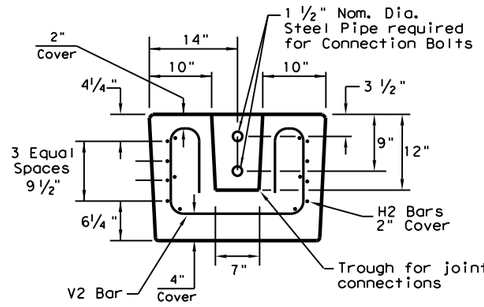

**(8)~H2 Bars** (#5) Bars

**(12)~V2 Bars** (#4) Bars

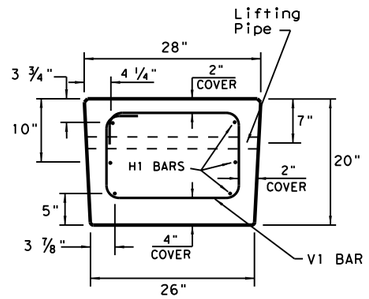
**(17)~V1 Bars** (#4) Bars

## REINFORCING STEEL DETAILS
TYPE 1 - BARRIER SEGMENT

Note: Use 2" Dia. Bending Pin, unless otherwise shown




SECTION A-A



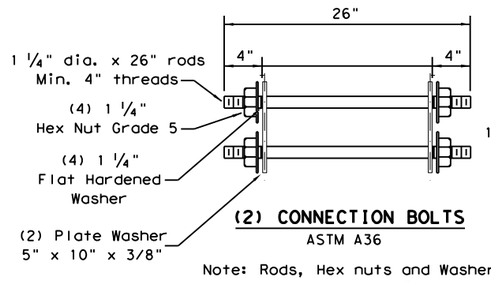

SECTION B-B

### GENERAL NOTES

1. Low Profile Concrete Barrier (LPCB), is approved for use in temporary work zone locations, where the posted speed is 45 mph, or less.
2. Concrete shall be Class H for precast barrier with a minimum compressive strength of 3,600 psi.
3. Where used, rebar reinforcement shall be Grade 60 and conform to ASTM A615.
4. Precast LPCB barrier length shall be 20 ft.
5. All barrier edges shall have ¾" chamfer or a tooled radius.
6. Joint connection hardware shall be in accordance with Item 449, "Anchor Bolts." and is considered subsidiary.
7. Steel pipe required for joint connection bolts shall be galvanized in accordance with Item 445, "Galvanizing."
8. Welded wire reinforcement (WWR) may be used in lieu of conventional reinforcement for Type 1 barrier, and shall meet the requirements shown.

### FOR CONTRACTORS INFORMATION ONLY

| (TYPE 1) APPROX. QUANTITIES 20 FT. SECTION | | |
|---|---|---|
| CONCRETE | CY | 2.6 |
| REINFORCING STEEL | LBS | 330 |
| TOTAL BARRIER WT. | LBS | 11000 |




**(2) CONNECTION BOLTS**
ASTM A36

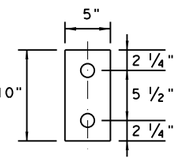
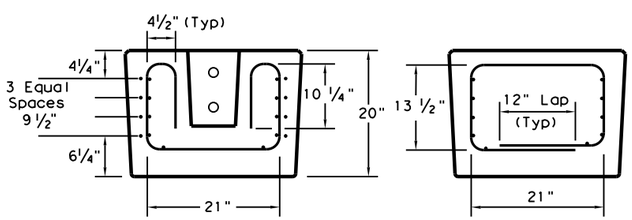



**PLATE WASHER**
5" x 10" x ⅜"

Note: Rods, Hex nuts and Washers shall be Galvanized.




SECTION A-A SECTION B-B

### (WWR) GENERAL NOTES

1. Deformed Welded Wire Reinforcement shall conform to ASTM A497.
2. Welded wire cage may be cut or bent, if necessary, but must be approved by the Engineer.
3. Combinations of reinforcing steel and WWR are permitted, as directed by the Engineer. The dimensions from the end of the barrier section to the first wire shall not exceed 3".

**REQUIRED (WWR) WIRE DESIGN**

8 ~ (D31) Horizontal Wires (Equally spaced)
10 ~ (D20) Horizontal Wires (Equally spaced)
29 ~ (D20) Vertical Wires (Spaced as shown in Elevation View)

## WELDED WIRE REINFORCEMENT (WWR)- OPTIONAL REINFORCING

SHEET 1 OF 2

Texas Department of Transportation — Design Division Standard

# LOW PROFILE CONCRETE BARRIER
## PRECAST BARRIER (TYPE 1)
# LPCB-13

| FILE: lpcb13.dgn | DN: TxDOT | CK: AM | DW: VP | CK: |
|---|---|---|---|---|
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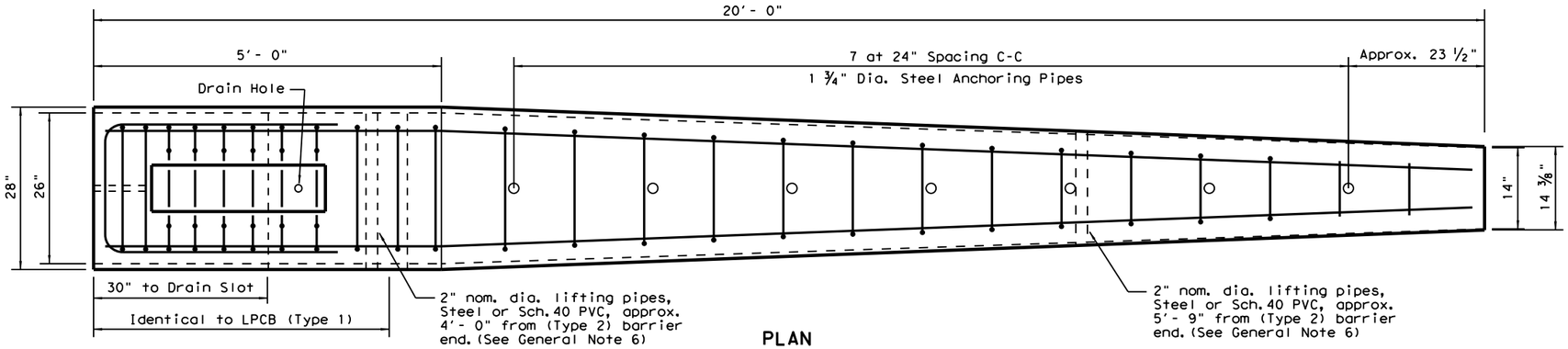
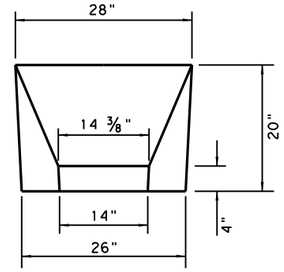
| REVISIONS | 6439 | 16 | 001 | VAR |
| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 80 |

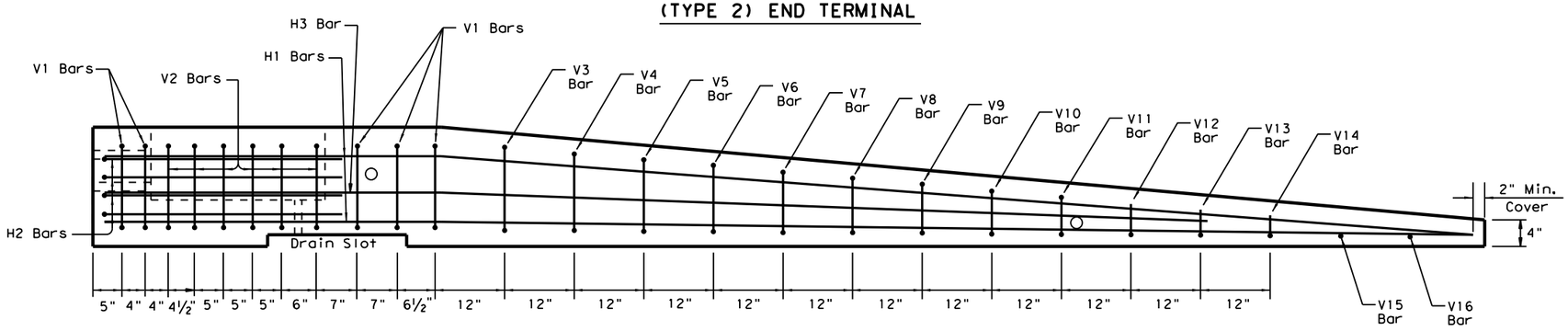
DATE: _03/20/23_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties




## PLAN
## (TYPE 2) END TERMINAL




## APPROACH VIEW

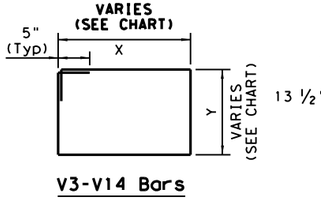



## ELEVATION
## (TYPE 2) END TERMINAL

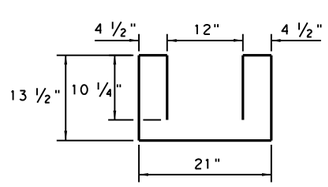
Note:
Anchoring pipes not shown in Elevation View

## TYPE 2 - NOTES

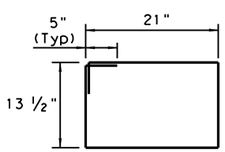
1. Welded wire reinforcment (WWR) is "not" an option for Type 2 Barrier.
2. Type 2 Barrier shall be used as an end treatment for the Type 1 barrier segments, when applicable.
3. The end treatment can be used without the anchor pins in locations that can accommodate approximately 4 ft. of lateral displacement of the end treatment. The use of non-pinned end treatment does not affect the performance or the deflection of the Low-Profile barrier system.
4. The anchor pins are all the same length and are to be driven flush with the top of the (Type 2) barrier surface.
5. The bends in the H3 and H1 bars are slight, no formal bend is necessary.
6. The Type 2 barrier segment must be lifted from the rear first, to prevent cracking of sloped section.
7. See LPCB sheet 1 for additional information.



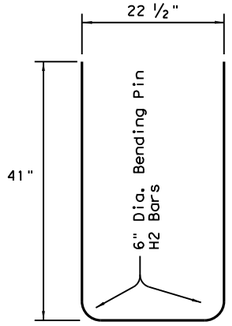

V3-V14 Bars



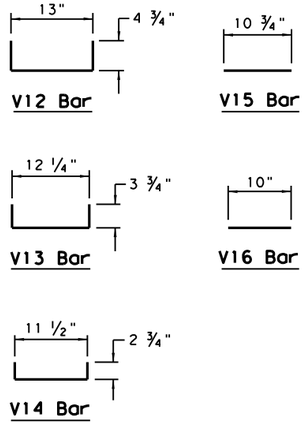

(6)~V2 Bars




(5)~V1 Bars



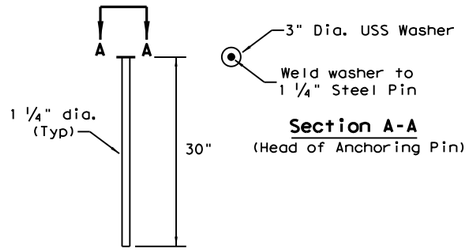

(4)~H2 Bars
(#5) Bars




Note: All V Bars are (#4)

| BAR (#4) | X (IN.) | Y (IN.) |
|---|---|---|
| V3 BAR | 20 ¼ | 14 ½ |
| V4 BAR | 19 ½ | 13 ½ |
| V5 BAR | 18 ½ | 12 ¼ |
| V6 BAR | 17 ½ | 11 ¼ |
| V7 BAR | 17 | 10 ¼ |
| V8 BAR | 16 ¼ | 9 |
| V9 BAR | 15 ½ | 8 |
| V10 BAR | 14 ½ | 7 |
| V11 BAR | 13 ¾ | 6 |

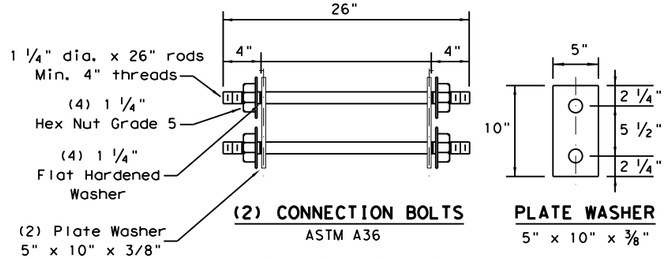
## REINFORCING STEEL DETAILS
TYPE 2 - END TERMINAL




(7) Anchor Pins
ASTM A36 Steel

Section A-A
(Head of Anchoring Pin)

(See Note 3)

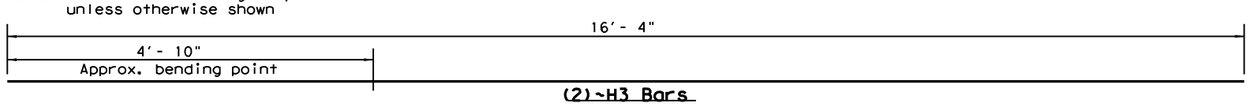



(2) CONNECTION BOLTS
ASTM A36

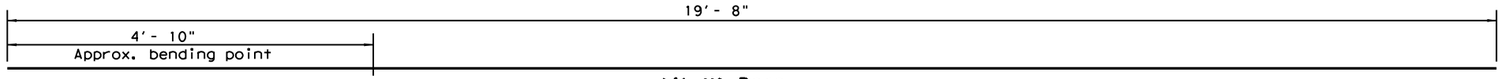
PLATE WASHER
5" x 10" x ⅜"

Note: Rods, Hex nuts and Washers shall be Galvanized.

Note: Use 2" Dia. Bending Pin, unless otherwise shown




(2)~H3 Bars
(#5) Bar




Note: Bends on H1 and H3 bars are slight and do not require formal bends.

(4)~H1 Bars
(#5) Bar

## FOR CONTRACTORS INFORMATION ONLY

| (TYPE 2) APPROX. QUANTITIES | 20 FT. SECTION | |
|---|---|---|
| CONCRETE | CY | 1.65 |
| REINFORCING STEEL | LBS | 240 |
| TOTAL BARRIER WT. | LBS | 7000 |



Texas Department of Transportation

Design Division Standard

# LOW PROFILE CONCRETE BARRIER
## PRECAST BARRIER (TYPE 2)
## LPCB-13

| FILE: lpcb13.dgn | DN: TxDOT | CK: AM | DW: VP | CK: |
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| | 22 | VAR | | 81 |

DATE: _03/20/23_ _11:30_
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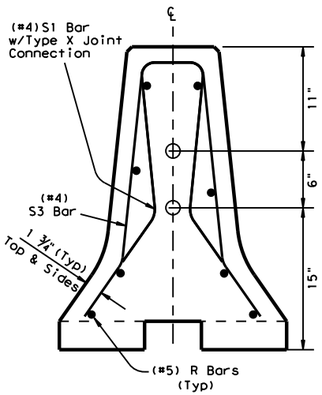
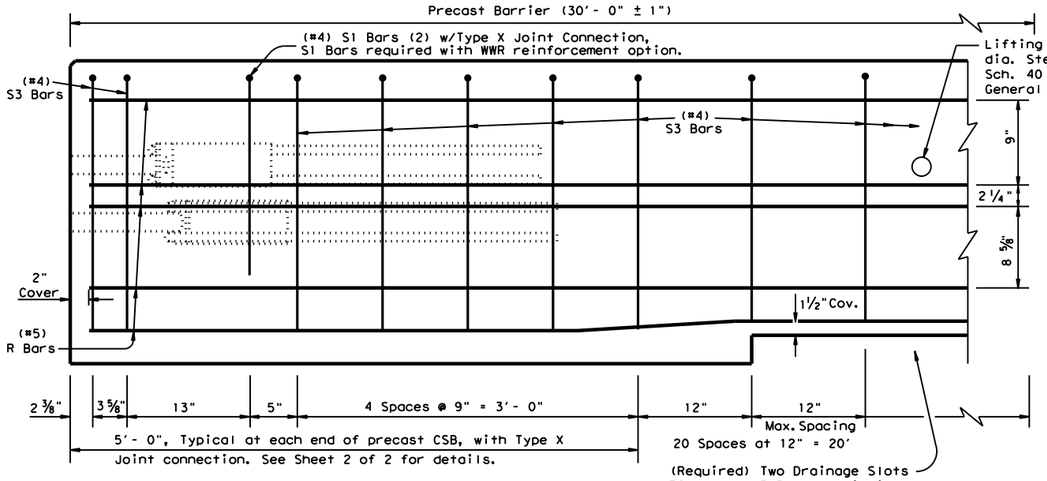


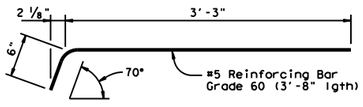

## End View Precast Barrier

See sheet 2 of 3 for Joint connection Type X



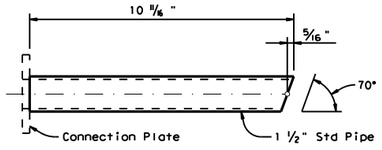

## Reinforcement for Precast (CSB) Concrete Safety Barrier (Type 1)

Showing reinforcement for Joint Type X



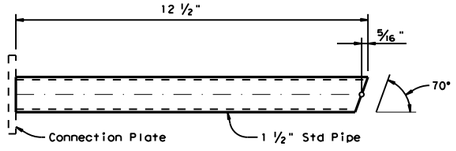

## DEFORMED BAR ANCHOR DETAILS

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



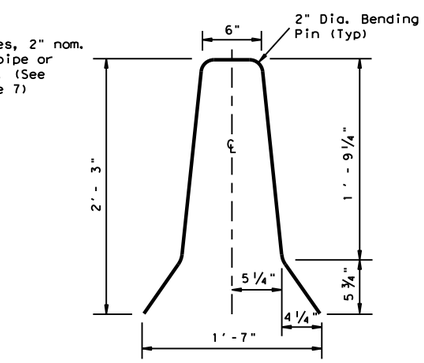

## UPPER CONNECTION PIPE DETAILS

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



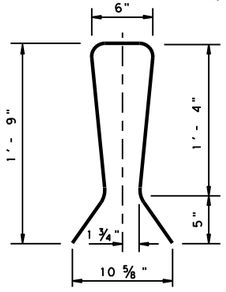

## LOWER CONNECTION PIPE DETAILS

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



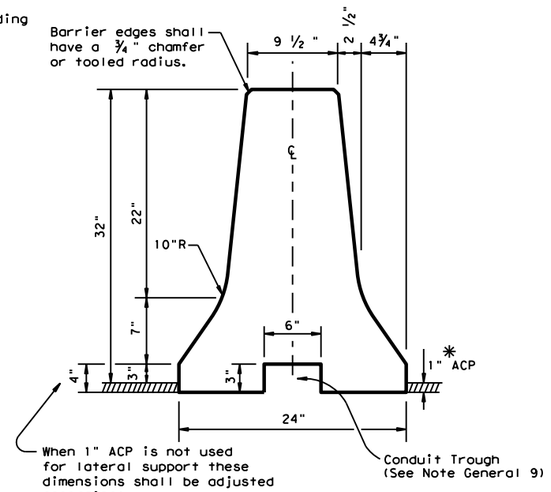

## S3 Bar

#4 Bar




## S1 Bar

#4 Bar (2)
(Joint Type X)

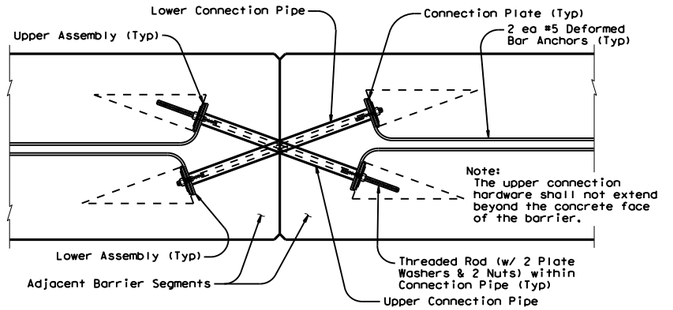



## Concrete Safety Barrier

✱ When 1" ACP is "not" used as lateral support for permanent barrier placement. A permissible method of attaining the equivalent lateral support may be used, See CSB(6) sheet.

### GENERAL NOTES

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




## TYPE X JOINT INSTALLATION DETAIL

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

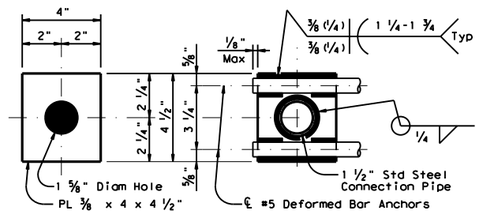
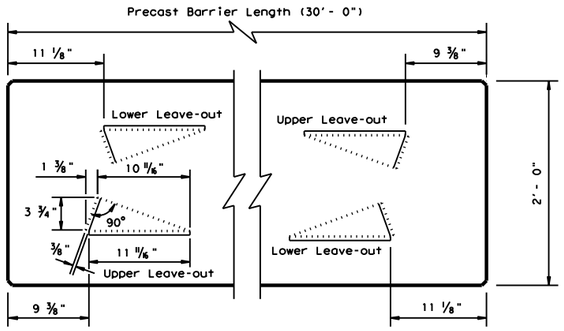


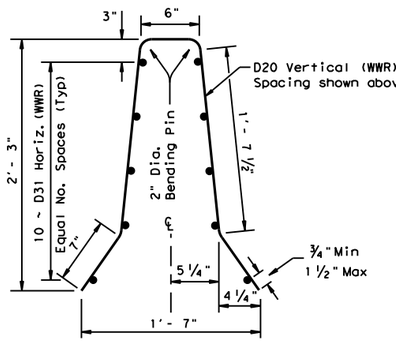

PLATE DIMENSIONS WELDING DETAILS

## CONNECTION PLATE DETAILS

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



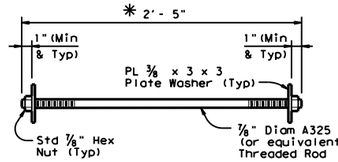

## BARRIER PLAN AT END JOINTS




## Welded Wire Reinforcement (WWR) Option for Bars R and S3

### (WWR) General Notes

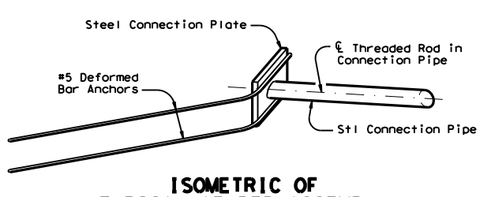
1. Deformed Welded Wire Reinforcement (WWR) shall conform to ASTM A497.
2. Welded wire cage may be cut or bent to accommodate the Type X joint connection and drainage slots, as directed by the Engineer.
3. All reinforcement shall comply with Item 440, "Reinforcing Steel."
4. Combinations of reinforcing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




## CONNECTION BOLT OR THREADED ROD DETAIL

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

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




## ISOMETRIC OF TYPICAL WELDED ASSEMBLY

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

Weight of one Precast 30 ft. (CSB) segment = Approx. 6.5 Tons or 440 lbs per ft.

SHEET 1 OF 2

Texas Department of Transportation | Design Division Standard

# CONCRETE SAFETY BARRIER (F-SHAPE)

PRECAST BARRIER (TYPE 1)

# CSB(1)-10

| FILE: csb110.dgn | DN: TxDOT | CK: AM | DW: BD | CK: VP |
|---|---|---|---|---|
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DATE: _03/20/23_ _11:30_
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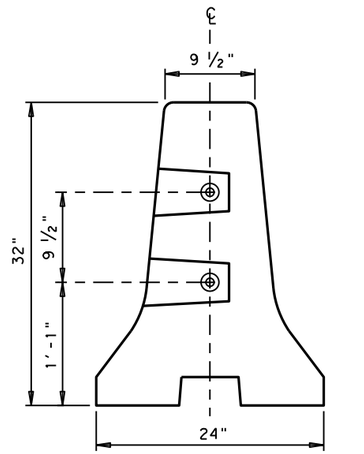
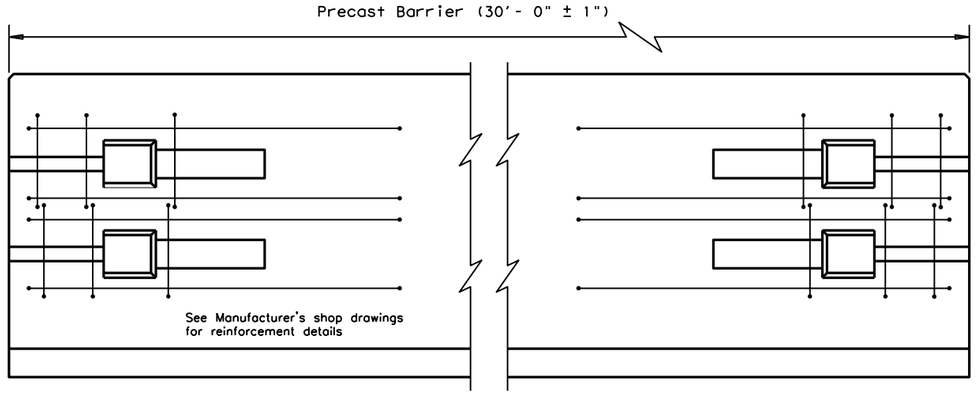
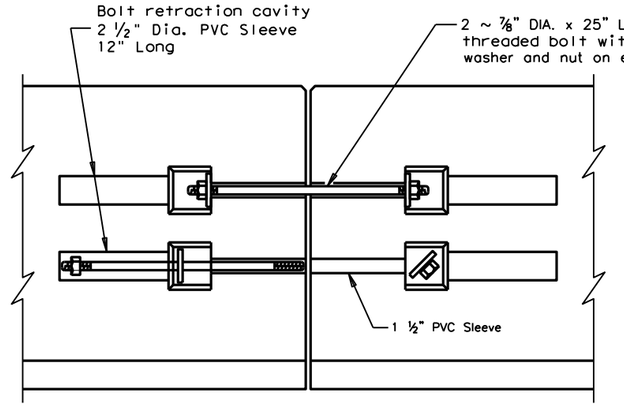



END VIEW (CSB) QUICK-BOLT
QUICK-BOLT POCKET LOCATIONS

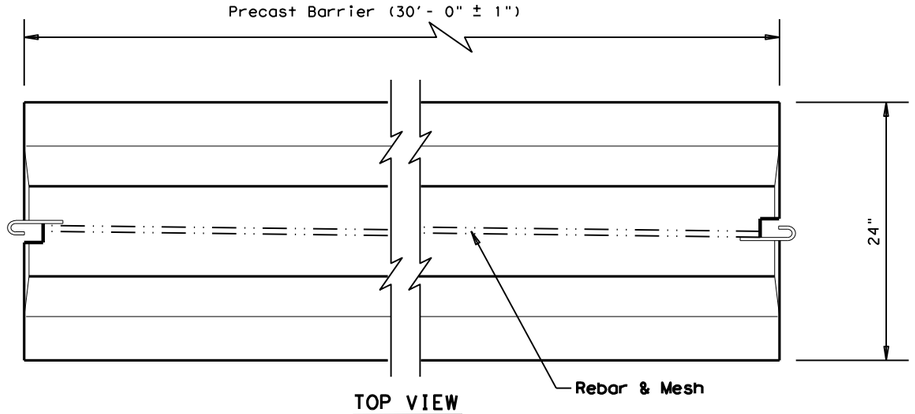



ELEVATION (CSB) QUICK-BOLT
See Manufacturer's shop drawing for additional details

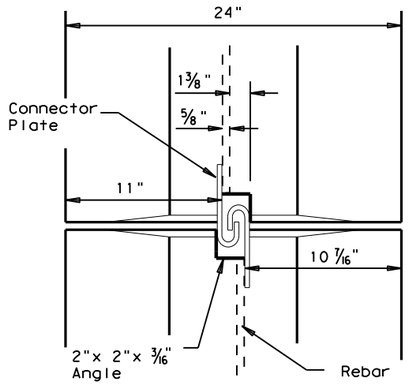



ELEVATION VIEW SHOWING JOINT CONNECTION
"QUICK-BOLT"

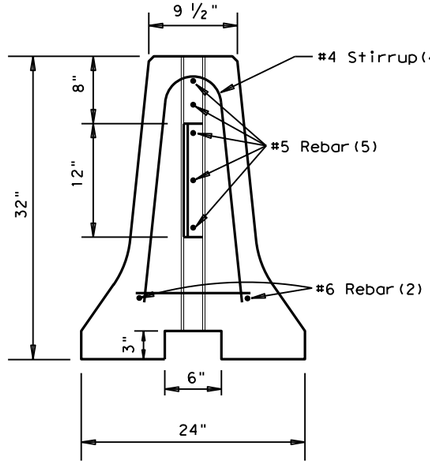
## Joint Connection (Type Q)




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




VIEW FROM ABOVE
J-J HOOK CONNECTION




END VIEW
J-J HOOK CONNECTION

## Joint Connection (Type J)

**Proprietary Joint Connections (CSB)**

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

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

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



Texas Department of Transportation
Design Division Standard

# CONCRETE SAFETY BARRIER (F-SHAPE)

PRECAST BARRIER
(TYPE 1)

# CSB(1)-10

| FILE: csb110.dgn | DN: TxDOT | CK: AM | DW: BD | CK: VP |
|---|---|---|---|---|
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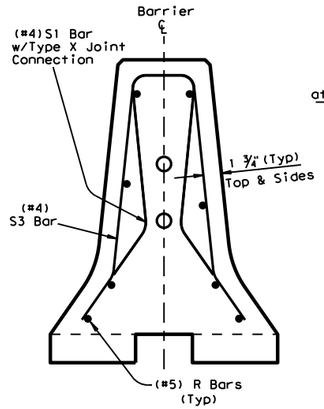
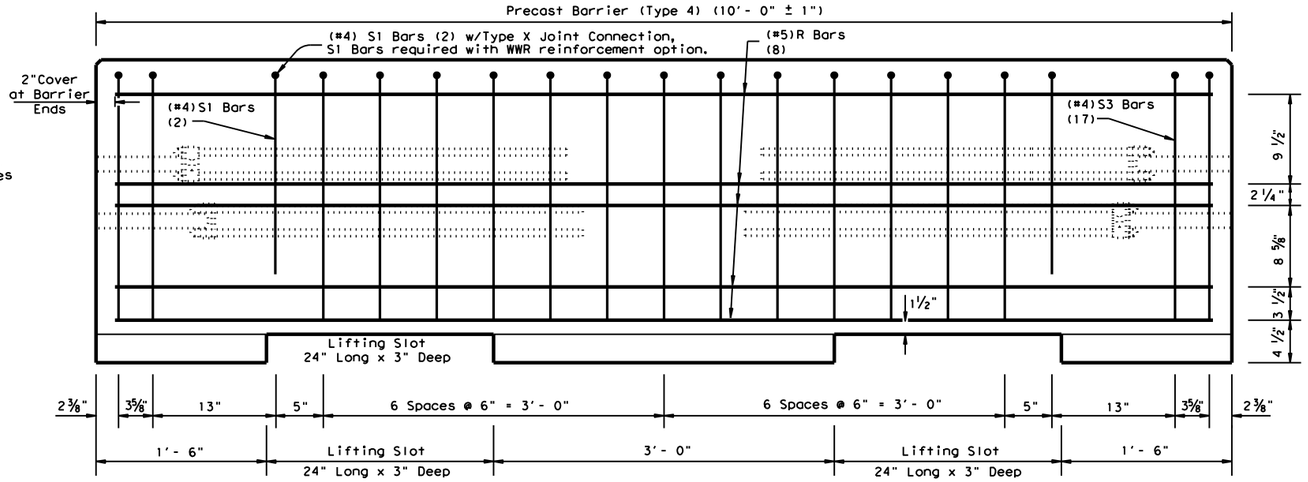
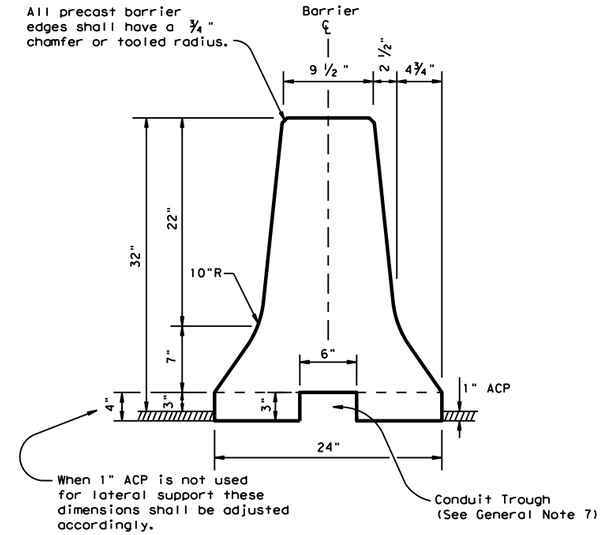



End View
Precast Barrier




Reinforcement for (10 ft) Precast
Concrete Safety Barrier (Type 4)

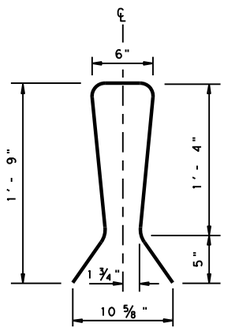



Concrete Safety Barrier

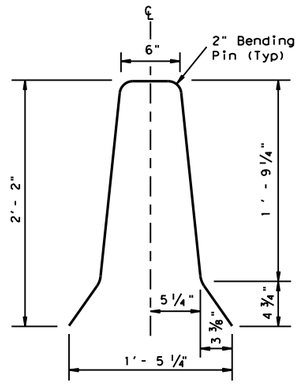
Schedule of reinforcement for each 10 foot precast section.

| BAR | SIZE | QUANTITY |
|---|---|---|
| S1 | #4 | 2 |
| R3 | #4 | 17 |
| R | #5 | 8 |

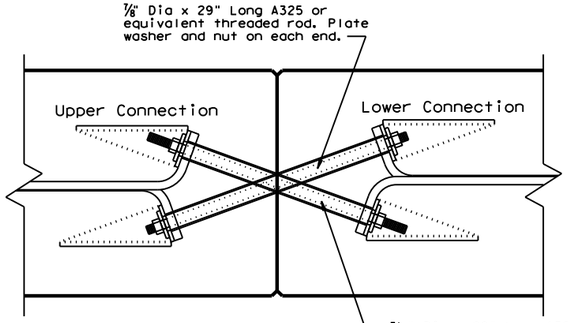
Note:
Two S1 Bars are required with the use of WWR reinforcement option. The S1 Bars may need a slight modification to fit within the WWR cage, as directed by the Engineer.




S1 Bar
#4 Bar (2)




S3 Bar
#4 Bar (17)

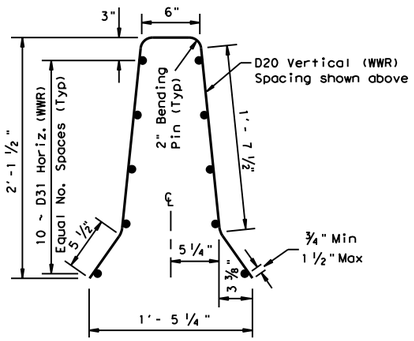



Top view showing
Joint Connection Type X

Joint Type X Connection Required with (10 foot) barrier length, See CSB(1), sheet 1 of 2 for Joint Type X details.

| Approximate Per L.F. Quantities | | |
|---|---|---|
| | | Precast |
| Concrete | CY. | 0.108 |
| Rebar | LB. | 14.8 |

For Contractor's information only
Weight of one Precast 10 ft. unit = Approx. 2 Tons




## Welded Wire Reinforcement (WWR) Option for Bars R and S3

### (WWR) General Notes

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

### General Notes

1. The 10 foot barrier is intended for maintenance applications of short duration periods. The 10 foot barrier is limited to use in temporary work zone conditions not to exceed 2 calendar months, unless approved in writing by the TxDOT engineer, noting the duration and location of the barrier placement in the written approval.
2. 30 ft. (Type 1) barrier and 10 ft. (Type 4) barrier sections shall not be mixed in a single run of barrier.
3. Barrier lengths other than 10 ft. for (Type 4) barrier are not allowed.
4. Concrete shall be Class H, with a minimum compressive strength of 3,600 psi.
5. Where used, rebar reinforcement shall be Grade 60 and conform to ASTM A615.
6. Only the Type X joint connection system is to be used with Type 4 barrier and is considered subsidiary. See CSB(1), Sheet 1 of 2 , for (Type X) connection details.
7. Conduit trough may be omitted, as shown elsewhere or as directed by the Engineer.

**NOTE:**
USAGE OF THE 10 FT (TYPE 4) CSB BARRIER REQUIRES A MINIMUM OF 100 LINEAR FEET.

SHORTER LENGTHS THAN THESE SHOULD BE DISCUSSED WITH THE DESIGN DIVISION.

Texas Department of Transportation

Design Division Standard

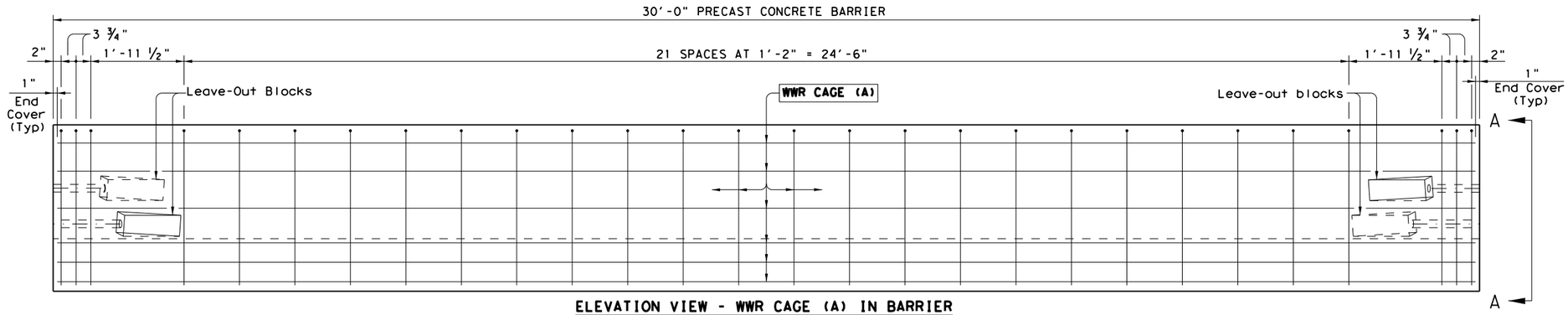
# CONCRETE SAFETY BARRIER (F-SHAPE)

## PRECAST BARRIER (TYPE 4) (10 FOOT, BARRIER SEGMENT)

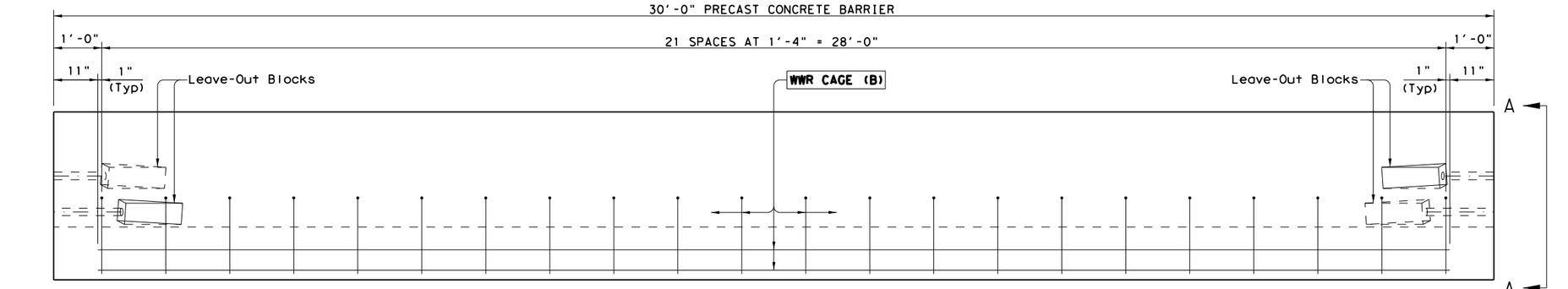
## CSB(8)-10

| FILE: csb810.dgn | DN: TxDOT | CK: AM | DW: BD | CK: |
|---|---|---|---|---|
| ©TxDOT December 2010 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 84 |

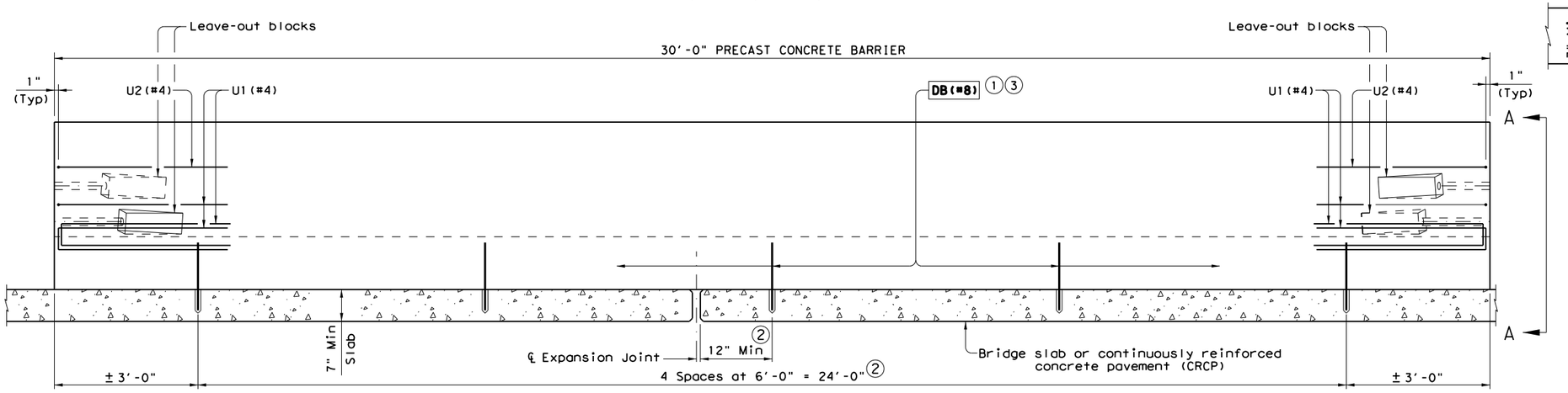
DATE: _03/20/23_
FILE: LRDDSIMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties



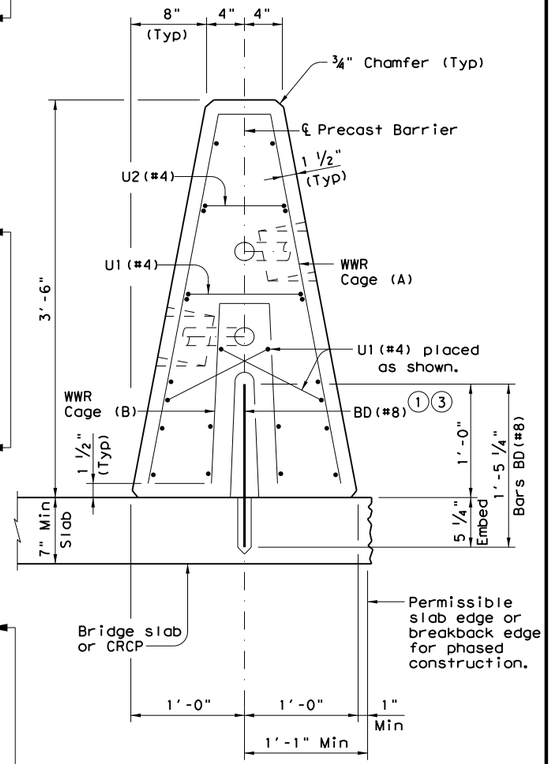

**ELEVATION VIEW - WWR CAGE (A) IN BARRIER**
(REINFORCING STEEL CAGE B, U1(#4), U2(#4), & DB(#8) NOT SHOWN FOR CLARITY)




**ELEVATION VIEW - WWR CAGE (B) IN BARRIER**
(REINFORCING STEEL CAGE A, U1(#4), U2(#4),& DB(#8) NOT SHOWN FOR CLARITY)




**ELEVATION VIEW - DB(#8) ANCHORS & U(#4) BAR PLACEMENT IN BARRIER**
(REINFORCING STEEL CAGE A & CAGE B NOT SHOWN FOR CLARITY)




**VIEW A-A**

NOTE: THREADED RODS WITH NUTS AND WASHERS FOR X-BOLT CONNECTION NOT SHOWN FOR CLARITY.

① Embed DB(#8) anchor bars plumb with a Type III, Class C, D, E, or F anchor adhesive. Minimum adhesive anchor embedment depth is 5 ¼". Anchor adhesive chosen must be able to achieve a basic bond strength in tension, Nba, of 26 kips. Submit signed and sealed calculations or the manufacturers published literature showing the proposed adhesives anchor ability to develop this load to the Engineer for approval prior to use. Anchor installation, including the hole size, drilling and clean out, must be in accordance with Item 450, "Railing".

② DB(#8) anchor bar nearest to a slab expansion joint, construction joint or end of structure may be shifted up to 12" longitudinally along center of barrier in order to satisfy the minimum offset dimension.

③ Provide stainless steel for BD(#8) when bar is to remain embedded in finished bridge slab or CRCP.

SHEET 1 OF 2

Texas Department of Transportation | Design Division Standard

# SINGLE SLOPE CONCRETE BARRIER (PRECAST)
## X-BOLT CONNECTION RESTRAINED MASH TL-4
## SSCB-P(XB1)-20

| | | | | | |
|---|---|---|---|---|---|
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| © TxDOT: NOVEMBER 2020 | CONT | SECT | JOB | HIGHWAY | |
| REVISIONS | 6439 | 16 | 001 | VAR | |
| | DIST | COUNTY | | SHEET NO. | |
| | 22 | VAR | | 85 | |

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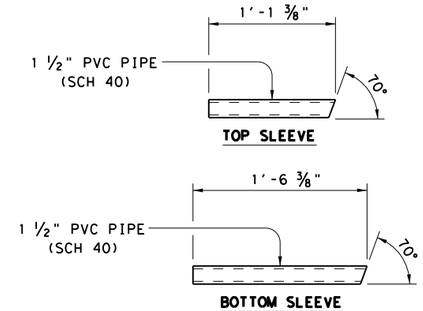
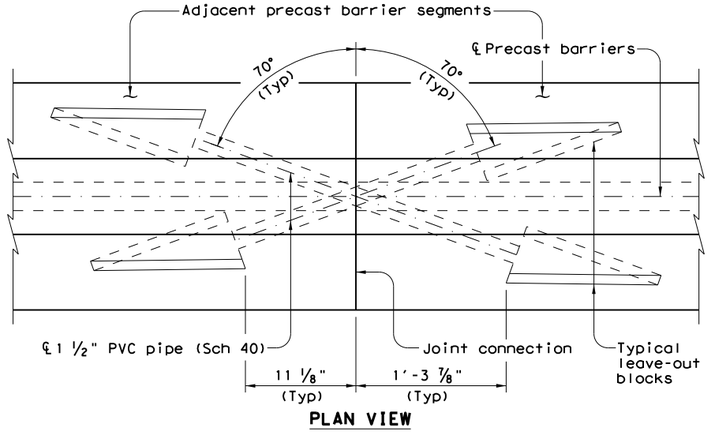
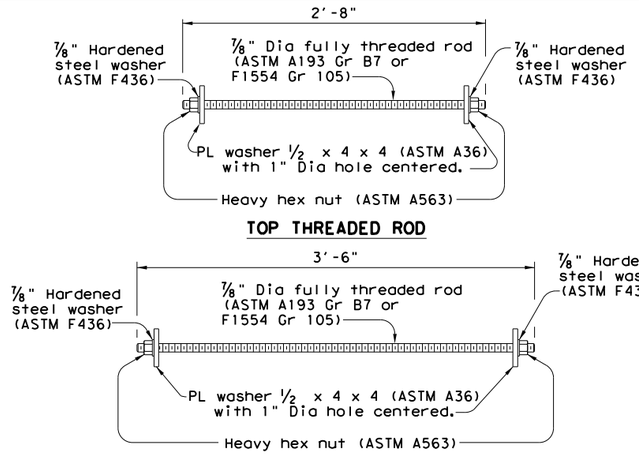



SLEEVE DETAILS

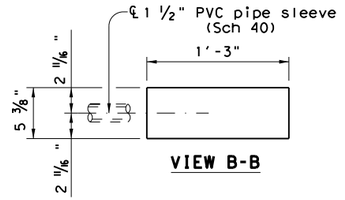


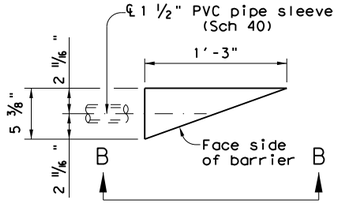

PLAN VIEW



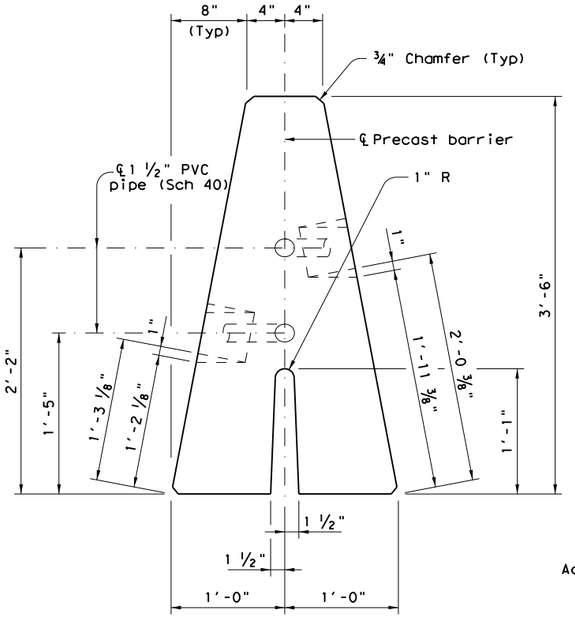

THREADED ROD ASSEMBLY DETAILS

Showing hardware for one complete X-bolt connection.
Installation of threaded rods must not extend beyond face of barrier.

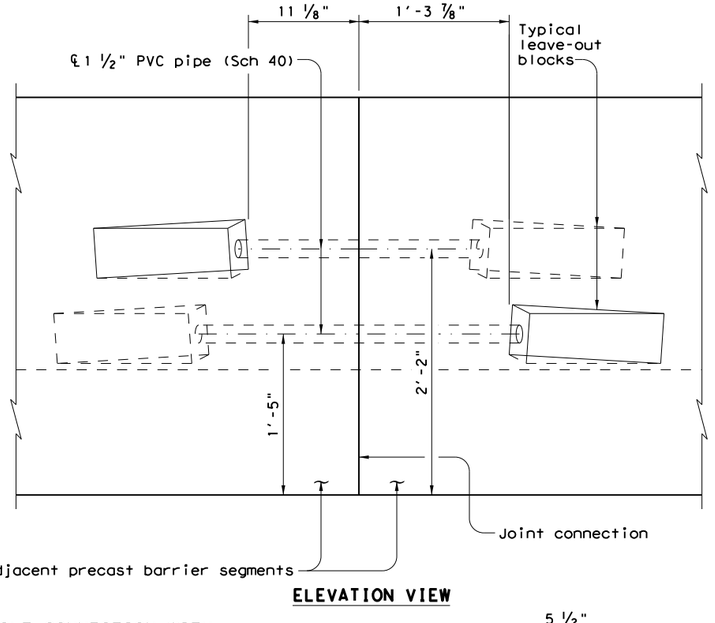



LEAVE-OUT BLOCK DETAILS




SECTION AT BARRIER JOINT

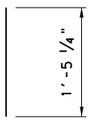



ELEVATION VIEW

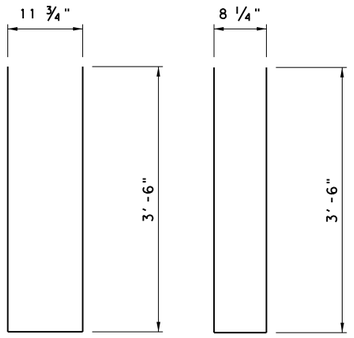
X-BOLT CONNECTION WITH
FORMING & LEAVE-OUT BLOCK PLACEMENT DETAILS

REINFORCING STEEL AND THREADED RODS WITH NUTS AND WASHERS NOT SHOWN FOR CLARITY.

③ Provide stainless steel for BD(#8) when bar is to remain embedded in finished bridge slab or CRCP.



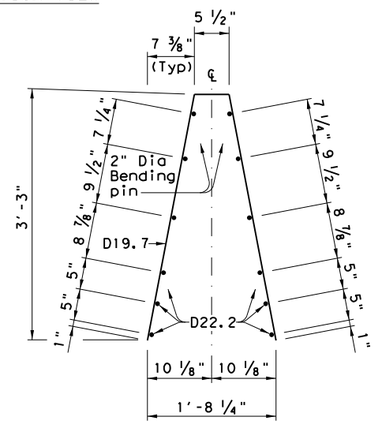

BARS BD (#8) ③



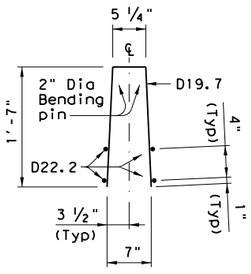

BARS U1 (#4)




BARS U2 (#4)




CAGE (A)




CAGE (B)

WELDED WIRE REINFORCEMENT (WWR) DETAILS

**CONSTRUCTION NOTES:**
At the Contractor's or Engineer's direction provide lifting devices (lugs, loops, etc.) in the rail. Locate lifting devices in rail so as to not exceed tensile strength of the concrete during lifting. Galvanize all permanent steel lifting components.
Chamfer all exposed corners.
Remove bars BD(#8) when barrier is removed. Cut bars and grind flush to finished bridge slab or CRCP unless directed otherwise by Engineer.
Test adhesive anchors in accordance with Item 450.3.3, "Tests". Test 3 anchors per 100 anchors installed. Perform corrective measures to provide adequate capacity if any of the tests do not meet the required test load. Repair damage from testing as directed.

**MATERIAL NOTES:**
Galvanize all metal components of barrier system.
Provide Class "S" concrete (f'c = 4,000 psi). Provide Class "S" (HPC) if required elsewhere.
Galvanize all reinforcing steel and WWR if required or shown elsewhere.
Provide stainless steel in accordance with Item 440.2.10., for BD(#8) when bar is to remain embedded in finished bridge slab or continuously reinforced concrete pavement (CRCP).
Provide Grade 60 reinforcing steel.
Provide deformed welded wire reinforcement (WWR) (ASTM A1064).
Provide welded wire reinforcement (WWR) laps, where required, as follows:
Uncoated or galvanized ~ D22.2 = 1'-7"

**GENERAL NOTES:**
This barrier system has been successfully evaluated by full-scale crash test to meet MASH TL-4 criteria. This barrier system had approximately 7 inches of dynamic deflection and 1.5 inches of permanent deflection as it contains and redirects the TL-4 (single-unit truck) errant vehicle.
Average weight of one 30' precast barrier is 19,960 Lb.
Average weight of precast barrier is 665 plf.

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



Texas Department of Transportation

Design Division Standard

# SINGLE SLOPE CONCRETE BARRIER (PRECAST)
## X-BOLT CONNECTION RESTRAINED MASH TL-4
## SSCB-P(XB1)-20

| FILE: sscbpxb120.dgn | DN: TxDOT | CK: KM | DW: JTR | CK: CGL |
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| © TxDOT: NOVEMBER 2020 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 86 |

DATE: 03/20/23
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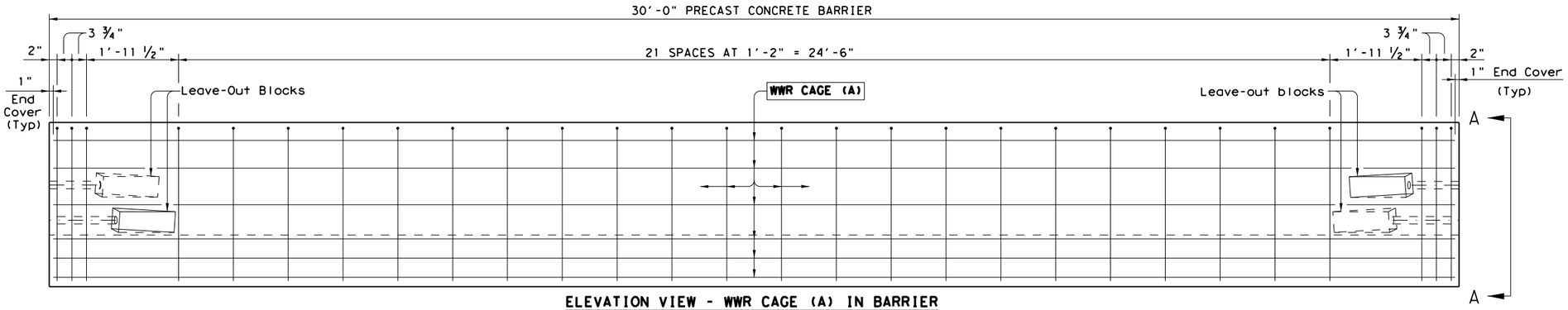
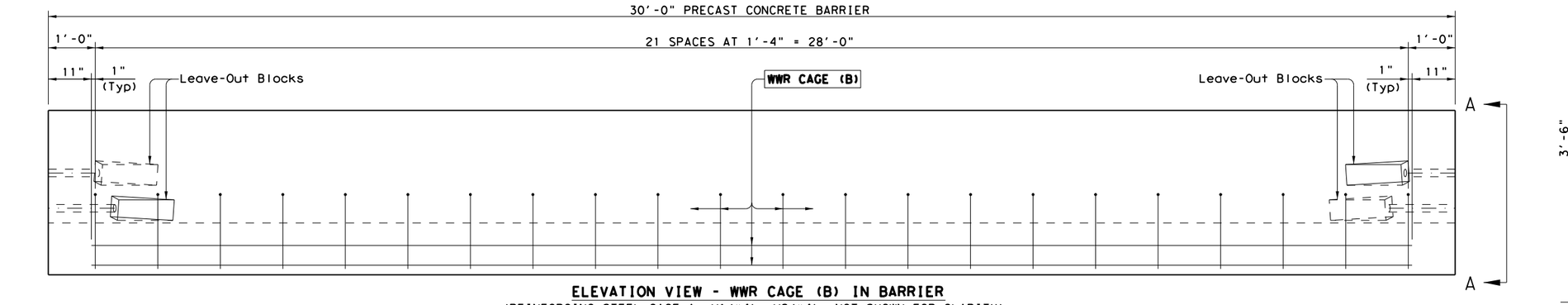
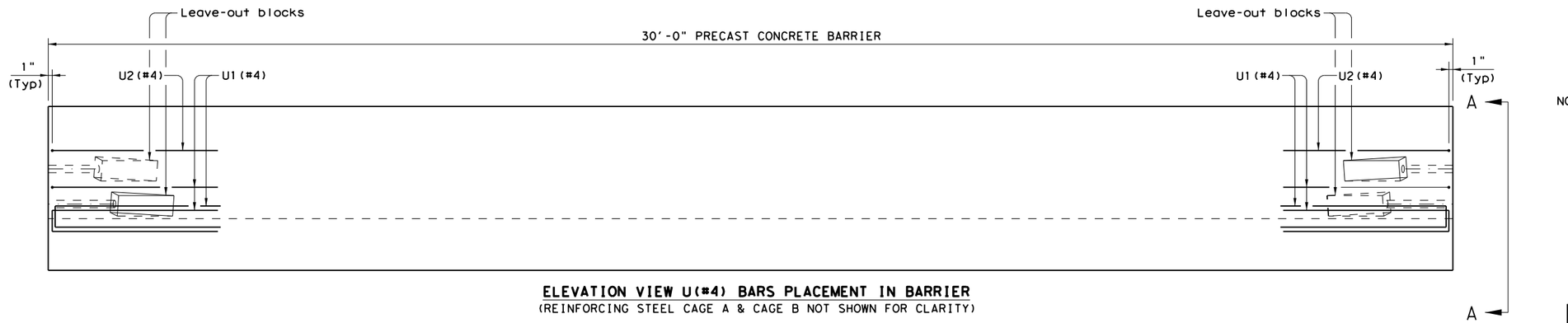


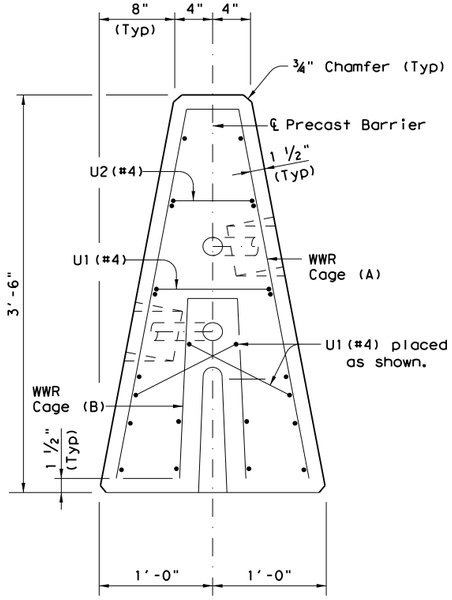

**ELEVATION VIEW - WWR CAGE (A) IN BARRIER**
(REINFORCING STEEL CAGE B, U1(#4), U2(#4), NOT SHOWN FOR CLARITY)




**ELEVATION VIEW - WWR CAGE (B) IN BARRIER**
(REINFORCING STEEL CAGE A, U1(#4), U2(#4), NOT SHOWN FOR CLARITY)




**ELEVATION VIEW U(#4) BARS PLACEMENT IN BARRIER**
(REINFORCING STEEL CAGE A & CAGE B NOT SHOWN FOR CLARITY)




**VIEW A-A**

NOTE: THREADED RODS WITH NUTS AND WASHERS FOR X-BOLT CONNECTION NOT SHOWN FOR CLARITY.



Texas Department of Transportation

Design Division Standard

# SINGLE SLOPE CONCRETE BARRIER (PRECAST) X-BOLT CONNECTION UNRESTRAINED MASH TL-4

## SSCB-P(XB2)-20

| | | | | | |
|---|---|---|---|---|---|
| FILE: sscbpxb220.dgn | DN: TxDOT | CK: KM | DW: JTR | CK: CGL | |
| © TxDOT: NOVEMBER 2020 | CONT | SECT | JOB | HIGHWAY | |
| REVISIONS | 6439 | 16 | 001 | VAR | |
| | DIST | COUNTY | | SHEET NO. | |
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DATE: _03/20/23_
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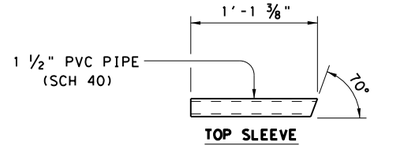
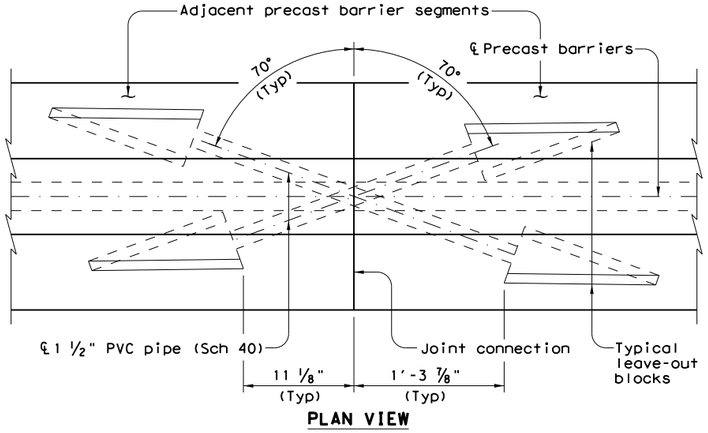
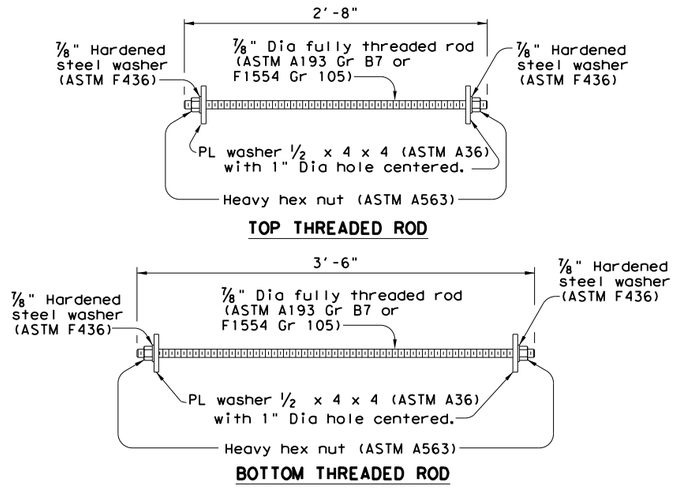



SLEEVE DETAILS

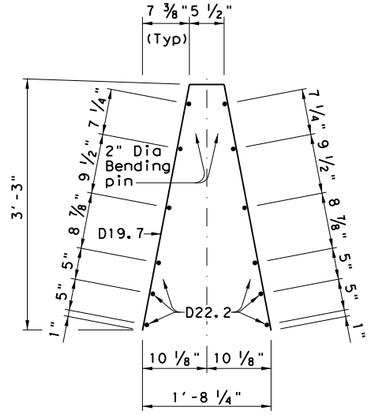



PLAN VIEW

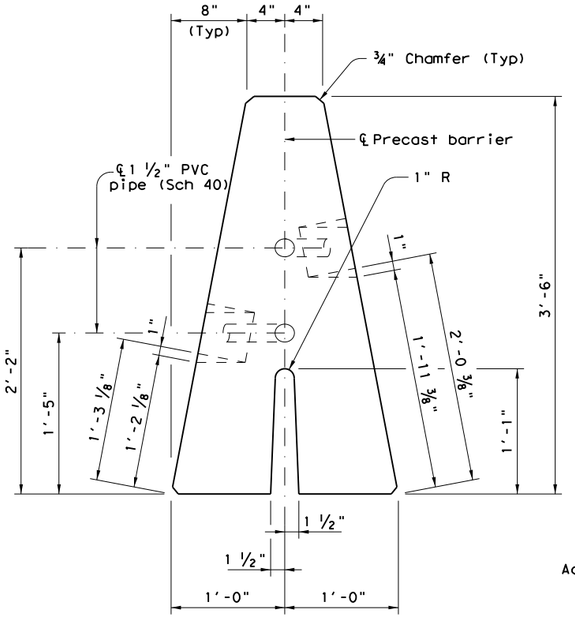



THREADED ROD ASSEMBLY DETAILS

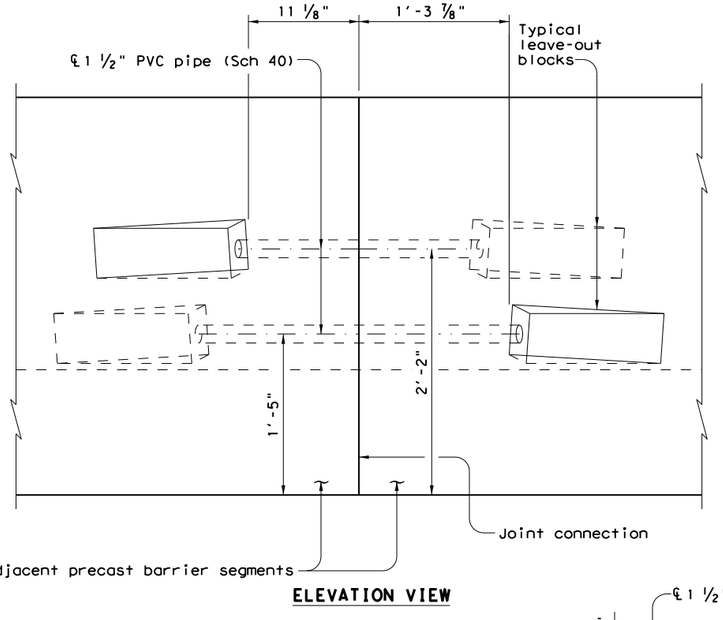
Showing hardware for one complete X-bolt connection.
Installation of threaded rods must not extend beyond face of barrier.




WELDED WIRE REINFORCEMENT (WWR) CAGE (A)



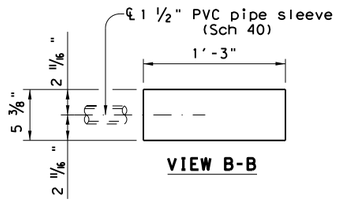

SECTION AT BARRIER JOINT



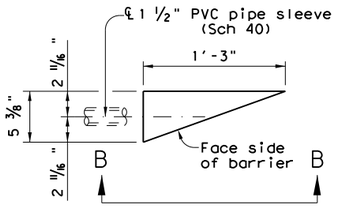

ELEVATION VIEW

X-BOLT CONNECTION WITH
FORMING & LEAVE-OUT BLOCK PLACEMENT DETAILS

REINFORCING STEEL AND THREADED RODS WITH NUTS AND WASHERS NOT SHOWN FOR CLARITY.

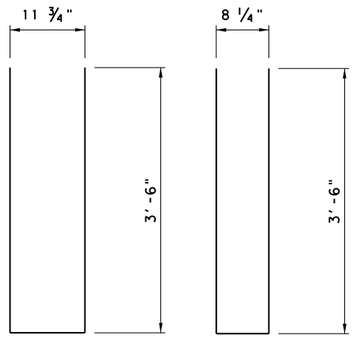



VIEW B-B

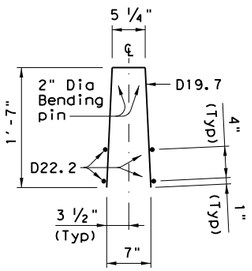



TOP VIEW

LEAVE-OUT BLOCK DETAILS




BARS U1 (#4) BARS U2 (#4)




WELDED WIRE REINFORCEMENT (WWR) CAGE (B)

**CONSTRUCTION NOTES:**

At the Contractor's or Engineer's direction provide lifting devices (lugs, loops, etc.) in the rail. Locate lifting devices in rail so as to not exceed tensile strength of the concrete during lifting. Galvanize all permanent steel lifting components.
Chamfer all exposed corners.

**MATERIAL NOTES:**

Galvanize all metal components of barrier system.
Provide Class "S" concrete (f'c = 4,000 psi). Provide Class "S" (HPC) if required elsewhere.
Galvanize all reinforcing steel and WWR if required or shown elsewhere.
Provide Grade 60 reinforcing steel.
Provide deformed welded wire reinforcement (WWR) (ASTM A1064).
Provide welded wire reinforcement (WWR) laps, where required, as follows:
Uncoated or galvanized ~ D22.2 = 1'-7"

**GENERAL NOTES:**

This barrier system has been successfully evaluated by full-scale crash test to meet MASH TL-4 criteria. This barrier system is designed to have approximately 33 inches of dynamic or permanent deflection as it contains and redirects the TL-4 (single-unit truck) errant vehicle. This barrier system is designed to have approximately 15 inches of dynamic or permanent deflection as it contains and redirects the TL-3 (pickup truck) errant vehicle.

Average weight of one 30' precast barrier is 19,960 Lb.
Average weight of precast barrier is 665 plf.

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



Texas Department of Transportation

Design Division Standard

# SINGLE SLOPE CONCRETE BARRIER (PRECAST) X-BOLT CONNECTION UNRESTRAINED MASH TL-4

## SSCB-P(XB2)-20

| | | | | | | |
|---|---|---|---|---|---|---|
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| © TxDOT: NOVEMBER 2020 | CONT | SECT | JOB | HIGHWAY | | |
| REVISIONS | 6439 | 16 | 001 | VAR | | |
| | DIST | COUNTY | | SHEET NO. | | |
| | 22 | VAR | | 88 | | |

DATE: 03/20/23
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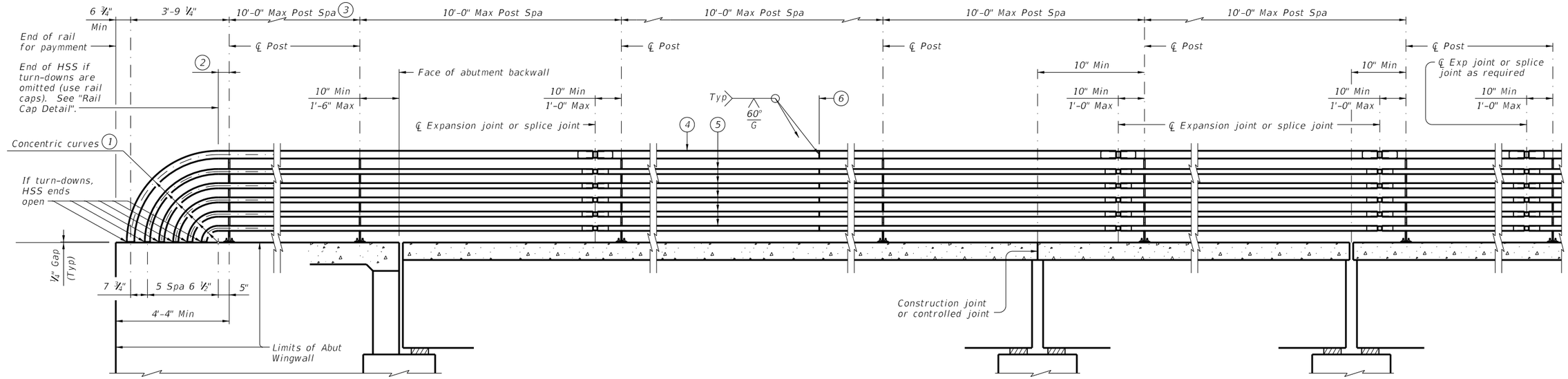
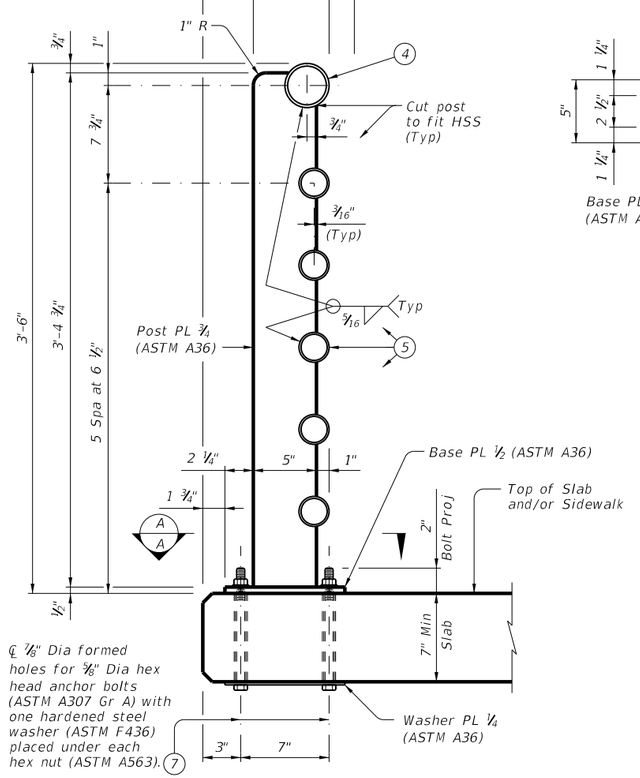



AT ABUTMENTS

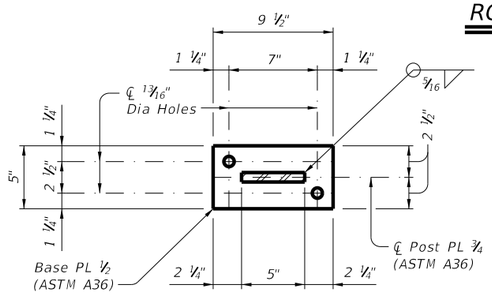
AT BENTS WITHOUT SLAB EXP JOINTS

AT BENTS WITH SLAB EXP JOINTS

## ROADWAY ELEVATION OF RAIL

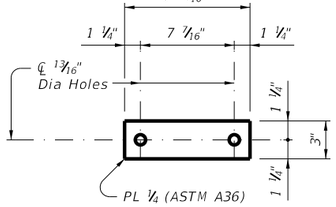



ON BRIDGE SLAB

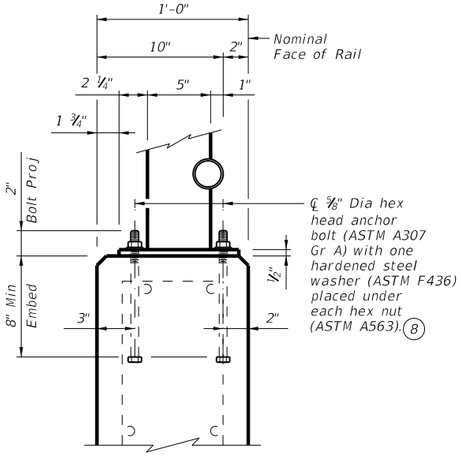



SECTION A-A

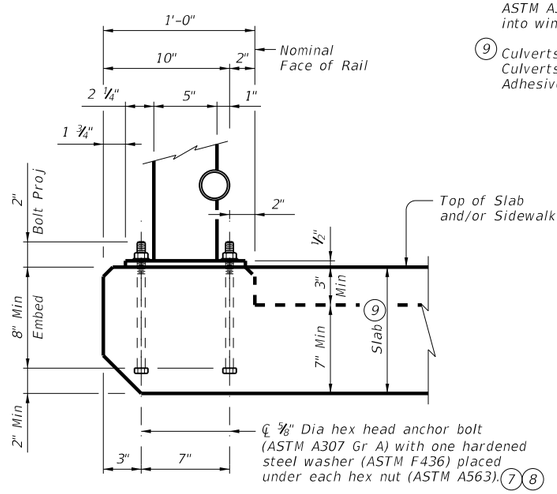
Showing base plate detail.




WASHER PLATE DETAIL




ON ABUTMENT WINGWALLS OR CIP RETAINING WALLS




ON CULVERTS WITH OR WITHOUT CURBS

Used with 1'-0" Min thick parallel wings on culverts.

## SECTIONS THRU RAIL

(1) Portion of railing with turn-downs to be used or omitted as indicated on Bridge Layout.

(2) 10" Min ~ 1'-6" Max if turn-downs are omitted.

(3) Min of 2 posts required on wingwall.

(4) HSS 3.500 x 0.216 (Rail Member)

(5) HSS 2.375 x 0.154 (Rail Member)

(6) One shop splice per panel is permitted (with minimum 85 percent penetration). The weld may be square groove or single vee groove. Grind smooth.

(7) At Contractor's option, adhesive anchors may be used. Adhesive anchors must be ⅝" Dia ASTM A307 Grade A fully threaded rods. Minimum adhesive anchor embedment depth is 5" into slabs or culverts without curbs. See "Material Notes" for adhesive anchor requirements.

(8) At Contractor's option, adhesive anchors may be used. Adhesive anchors must be ⅝" Dia ASTM A307 Grade A fully threaded rods. Minimum adhesive anchor embedment depth is 7" into wingwalls or culverts with curbs. See "Material Notes" for adhesive anchor requirements.

(9) Culverts without curbs for cast-in-place anchor bolts require a 10" Min slab thickness. Culverts with curbs for cast-in-place anchor bolts require a curb plus slab thickness of 10" Min. Adhesive anchors may be used with a 7" Min slab thickness or culverts with curbs.



Texas Department of Transportation

Bridge Division Standard

# PEDESTRIAN RAIL

# TYPE PR11

| FILE: rlstd028-19.dgn | DN: TAR | CK: TBE | DW: JTR | CK: TAR |
|---|---|---|---|---|
| ©TxDOT September 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 89 |

DATE: _03/20/23_ _11:30_
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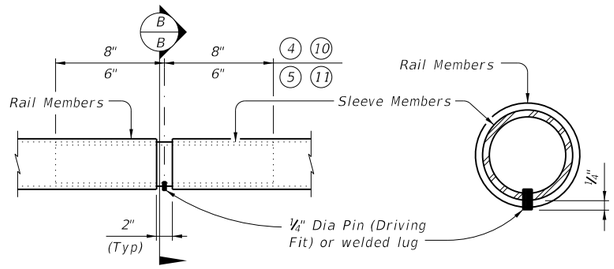
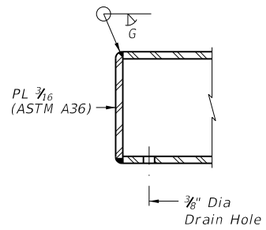


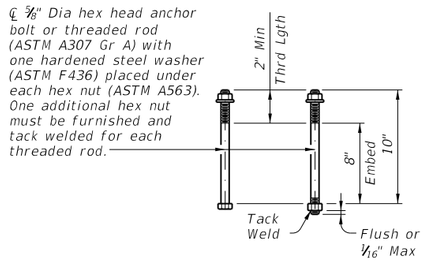

AT SPLICES OR EXP JTS SECTION B-B

## PIPE SPLICE DETAIL




## RAIL CAP DETAIL

(4) HSS 3.500 x 0.216 (Rail Member)
(5) HSS 2.375 x 0.154 (Rail Member)
(10) HSS 2.875 x 0.203 (Sleeve Member)
(11) HSS 1.900 x 0.145 (Sleeve Member)




## CAST-IN-PLACE & FORMED HOLE ANCHOR BOLT OPTIONS

### CONSTRUCTION NOTES:

Panel lengths of railing must be attached to a minimum of three posts except at abutment wingwalls.

At the Contractor's option anchor bolts may be an adhesive anchorage system. See "Material Notes".

Test adhesive anchors in accordance with Item 450.3.3, "Tests". Test 3 anchors per 100 anchors installed. Perform corrective measures to provide adequate capacity if any of the tests do not meet the required test load. Repair damage from testing as directed.

Face of rail and posts must be vertical transversely unless otherwise approved. Posts must be perpendicular to adjacent roadway grade. Use Type VIII epoxy mortar under post base plates if gaps larger than 1/16" exist.

For curved railing applications, fabricate the HSS rail to the radius when the radius is 600' or less. Submit shop drawings for approval when tubes are required to be fabricated to a radius. Shop drawings must be submitted to the Engineer for approval.

Round or chamfer all exposed edges of steel components 1/16" by grinding prior to galvanizing.

### MATERIAL NOTES:

Provide ASTM A500 Gr B, A1085 or A53 Gr B for all HSS.

Galvanize all metal components of steel rail system. Apply additional coatings when shown elsewhere on the plans. When plans require paint over galvanizing, follow the requirements for painting galvanized steel in Item 445, "Galvanizing" and when field painting, Item 446, "Field Cleaning and Painting Steel". Sleeve members and anchor bolts must receive galvanization prior to installation and only field paint after installation unless directed otherwise by Engineer.

Anchor bolts must be ⅝" Dia ASTM A307 Gr A with one hardened steel washer (ASTM F436) placed under each hex nut or ASTM A307 Gr A threaded rods with one tack welded hex nut each and with one hex nut with one hardened steel washer (ASTM F436) each. Nuts must conform to ASTM A563 requirements.

Optional adhesive anchorage system must be ⅝" Dia ASTM A307 Gr A fully threaded rods with one hex nut and one hardened steel washer (ASTM F436). Nuts must conform to ASTM A563 requirements. Embed fully threaded rods into slab, wingwalls, or culvert curbs using a Type III, Class C, D, E, or F anchor adhesive. Anchor adhesive chosen must be able to achieve a nominal bond strength in tension, Na, of a single anchor of 10 kips (edge distance must be accounted for). Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use. Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing".

### GENERAL NOTES:

Designed according to AASHTO LRFD Specifications.

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.

For all rails, submit erection drawings showing section lengths, splice locations, rail post spacing and anchor bolt setting for approval.

Average weight of railing is 30 plf.



Texas Department of Transportation

Bridge Division Standard

# PEDESTRIAN RAIL

## TYPE PR11

| FILE: | rlstd028-19.dgn | DN: TAR | CK: TBE | DW: JTR | CK: TAR |
|---|---|---|---|---|---|
| ©TxDOT | September 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | | 6439 | 16 | 001 | VAR |
| | | DIST | COUNTY | | SHEET NO. |
| | | 22 | VAR | | 90 |

DATE: _03/20/23_ _11:30_
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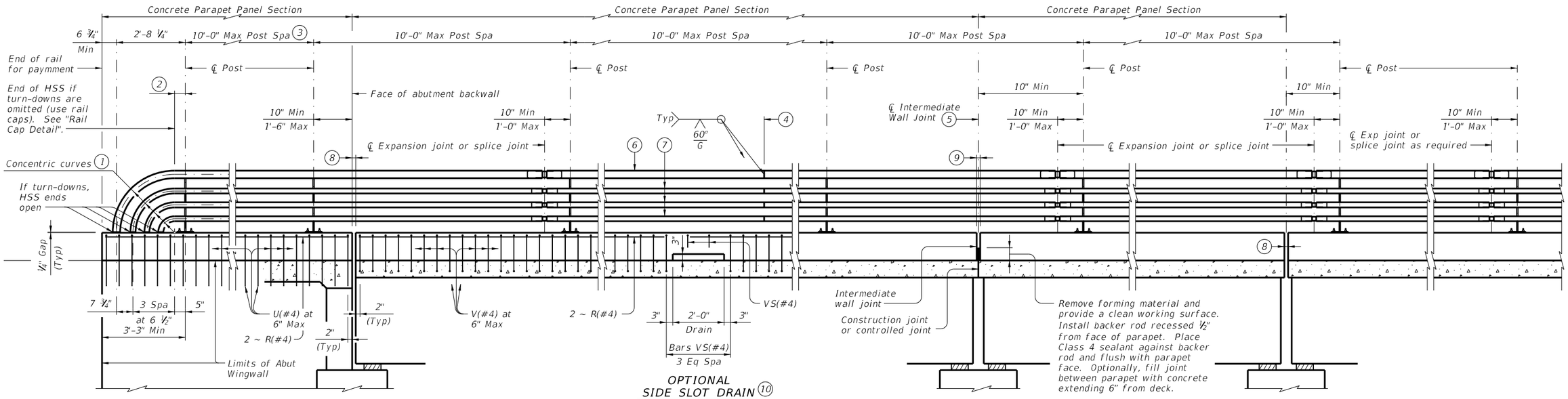
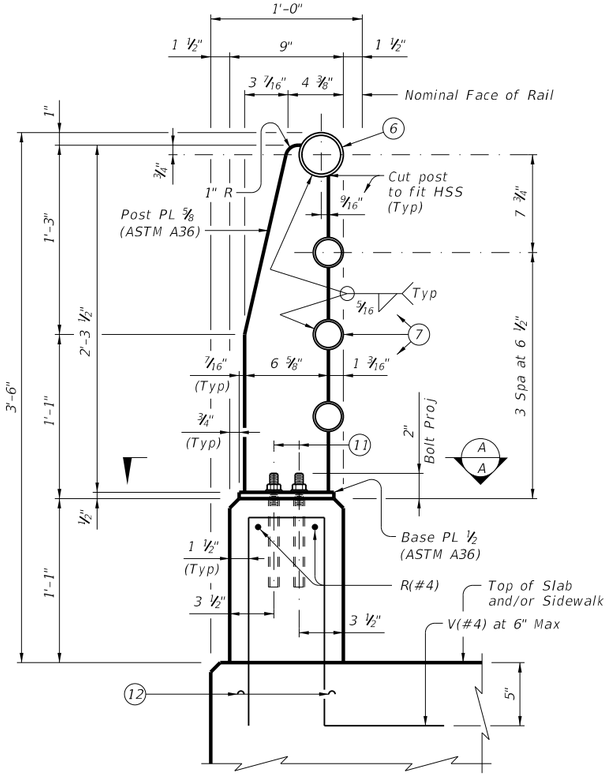
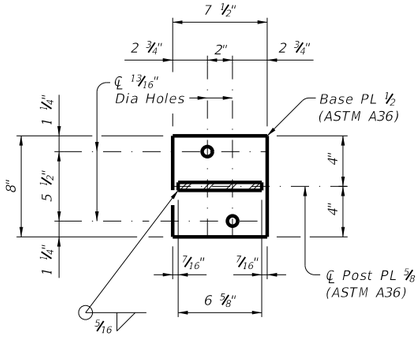



## ROADWAY ELEVATION OF RAIL




## SECTIONS THRU RAIL




## SECTION A-A

Showing base plate detail.

(1) Portion of railing with turn-downs to be used or omitted as indicated on Bridge Layout.

(2) 10" Min ~ 1'-6" Max if turn-downs are omitted.

(3) Min of 2 posts required on wingwall.

(4) One shop splice per panel is permitted (with minimum 85 percent penetration). The weld may be square groove or single vee groove. Grind smooth.

(5) Provide at all interior bents without slab expansion joints.

(6) HSS 3.500 x 0.216 (Rail Member)

(7) HSS 2.375 x 0.154 (Rail Member)

(8) Same as slab joint opening. (5" Max Expansion Joint)

(9) Opening ¼" Min, ¾" Max.

(10) Drains may be used where shown elsewhere on the plans or as directed by the Engineer. Do not place drains over railroad tracks, lower roadways, or sidewalks. When side slot drains are used, provide 3'-0" Min clear spacing between drains slots and ℄ bents or joint locations with a 8'-0" Min clear spacing between drain slots.

(11) ℄ anchor bolts. See "Material Notes" for anchor bolt information.

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



Texas Department of Transportation

Bridge Division Standard

# PEDESTRIAN RAIL

## TYPE PR22

| FILE: | rlstd029-19.dgn | DN: TAR | CK: TBE | DW: JTR | CK: TAR |
|---|---|---|---|---|---|
| ©TxDOT | September 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | | 6439 | 16 | 001 | VAR |
| | | DIST | COUNTY | | SHEET NO. |
| | | 22 | VAR | | 91 |

DATE: _03/20/23_ _11:30_
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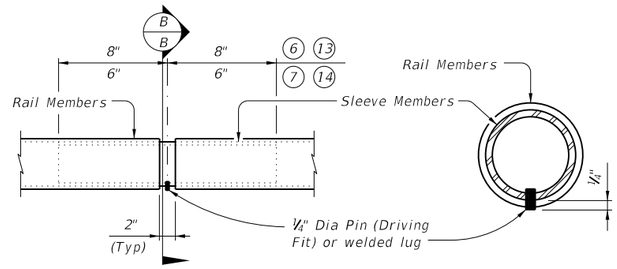
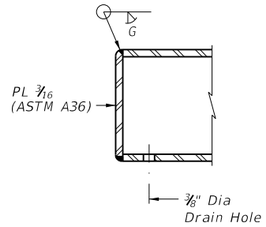


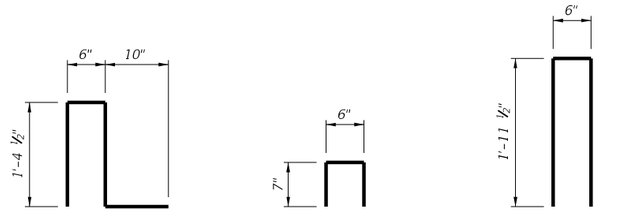

AT SPLICES OR EXP JTS  SECTION B-B

## PIPE SPLICE DETAIL

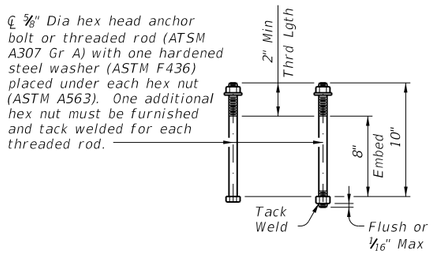



## RAIL CAP DETAIL

(6) HSS 3.500 x 0.216 (Rail Member)
(7) HSS 2.375 x 0.154 (Rail Member)
(13) HSS 2.875 x 0.203 (Sleeve Member)
(14) HSS 1.900 x 0.145 (Sleeve Member)




BARS V (#4)  BARS VS (#4)  BARS U (#4)




## CAST-IN-PLACE ANCHOR BOLT OPTIONS

### CONSTRUCTION NOTES:

This rail may be slip-formed if approved by the Engineer when epoxy adhesive anchor bolts are used.

Slip-forming parapet is not allowed if anchor bolts are cast with parapet wall.

If rail is slip-formed, apply an heavy epoxy bead 1" behind toe of traffic side of rail to concrete deck just prior to slip forming. Provide a ⅜" width x ¼" tall heavy epoxy bead with Type III, Class C or a Type V epoxy.

At the Contractor's option anchor bolts may be cast with the parapet. See "Material Notes".

Panel lengths of railing must be attached to a minimum of three posts except on abutment wingwalls.

Test adhesive anchors in accordance with Item 450.3.3, "Tests". Test 3 anchors per 100 anchors installed. Perform corrective measures to provide adequate capacity if any of the tests do not meet the required test load. Repair damage from testing as directed.

Face of rail, posts and parapet must be vertical transversely unless otherwise approved. Rail posts must be perpendicular to top of adjacent concrete parapet grade. Use Type VIII epoxy mortar under post base plates if gaps larger than 1/16" exist.

For curved railing applications, fabricate the HSS rail to the radius when the radius is 600' or less. Submit shop drawings for approval when tubes are required to be fabricated to a radius. Shop drawings must be submitted to the Engineer for approval.

Round or chamfer all exposed edges of steel components 1/16" by grinding prior to galvanizing.

Chamfer all exposed concrete corners.

### MATERIAL NOTES:

Provide ASTM A500 Gr B, A1085 or A53 Gr B for all HSS.

Galvanize all metal components of steel rail system. Apply additional coatings when shown elsewhere on the plans. When plans require paint over galvanizing, follow the requirements for painting galvanized steel in Item 445, "Galvanizing" and when field painting, Item 446, "Field Cleaning and Painting Steel". Sleeve members and anchor bolts must receive galvanization prior to installation and only field paint after installation unless directed otherwise by Engineer.

Anchor bolts must be ⅝" Dia ASTM A307 Gr A fully threaded rods with one hex nut and one hardened steel washer (ASTM F436). Nuts must conform to ASTM A563 requirements. Embed fully threaded rods into parapet using a Type III, Class C, D, E, or F anchor adhesive. Minimum adhesive anchor embedment depth is 7". Anchor adhesive chosen must be able to achieve a nominal bond strength in tension of a single anchor, Na, 8.5 kips (edge distance must be accounted for). Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use. Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing".

Optional cast-in-place anchor bolts must be ⅝" Dia ASTM A307 Gr A with one hardened steel washer (ASTM F436) placed under each hex nut or ASTM A307 Gr A threaded rods with one tack welded hex nut each and with one hex nut with one hardened steel washer (ASTM F436) each. Nuts must conform to ASTM A563 requirements.

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

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

Provide Grade 60 reinforcing steel.

Deformed Welded Wire Reinforcement (WWR) (ASTM A1064) of equal size and spacing may be substituted for Bars U, and V unless noted otherwise.

Provide bar laps, where required, as follows:

Uncoated or galvanized ~ #4 = 1'-7"
Epoxy coated ~ #4 = 2'-5"

### GENERAL NOTES:

Designed according to AASHTO LRFD Specifications.

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.

For all rails, submit erection drawings showing section lengths, splice locations, rail post spacing and anchor bolt setting for approval.

Average weight of railing: 146 plf ~ total
122 plf ~ Conc (with no Overlay)
24 plf ~ Steel

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

# PEDESTRIAN RAIL

## TYPE PR22

| FILE: | r1std029-19.dgn | DN: TAR | CK: TBE | DW: JTR | CK: TAR |
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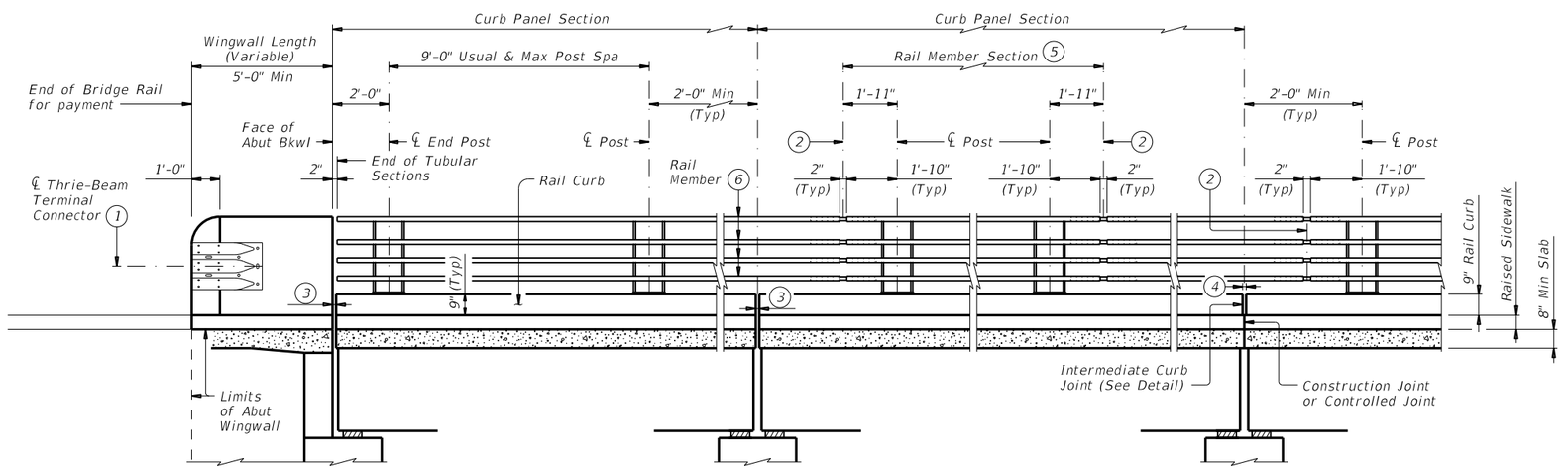
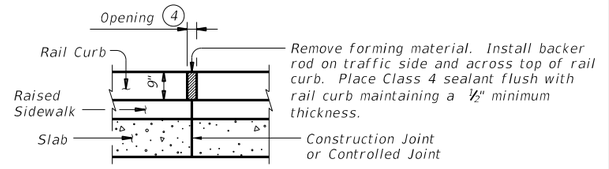
| REVISIONS | | 6439 | 16 | 001 | VAR |
| | | DIST | COUNTY | | SHEET NO. |
| | | 22 | VAR | | 92 |




AT ABUTMENTS | AT BENTS WITH SLAB EXP JOINTS | AT BENTS WITHOUT SLAB EXP JOINTS

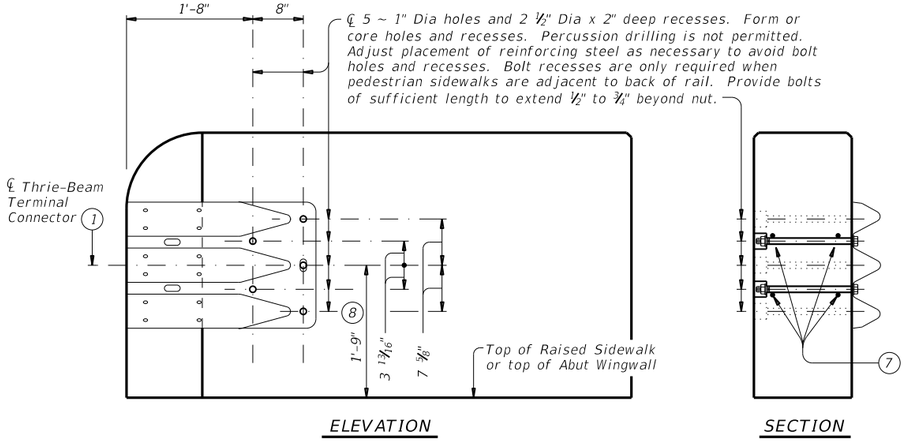
## ROADWAY ELEVATION OF RAIL

Showing combination rail on a raised sidewalk.



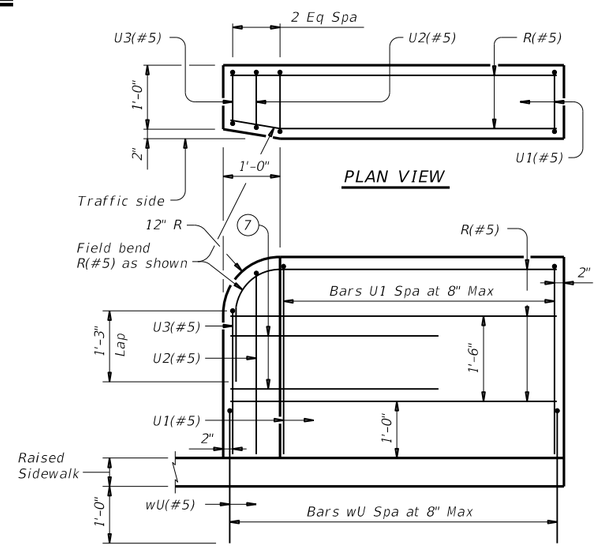

## INTERMEDIATE CURB JOINT DETAIL

Provide at all interior bents without slab expansion joints.

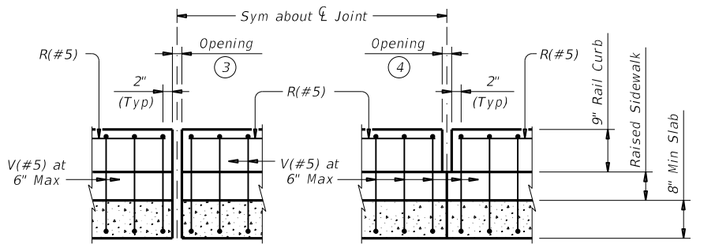



ELEVATION | SECTION

## TERMINAL CONNECTION DETAILS




AT ABUTMENT WINGWALL




AT BENTS WITH SLAB EXPANSION JOINTS | AT BENTS WITHOUT SLAB EXP JOINTS

## ELEVATION SHOWING TYPICAL REINFORCING PLACEMENT

Showing with raised sidewalk

(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) ℄ Expansion Joint or Splice Joint as required.

(3) Same as slab joint opening. (5" Max Expansion Joint).

(4) ¼" Min, ¾" Max.

(5) Rail member sections must have at least two posts but not more than four.

(6) HSS 6 x 2 x ¼ (ASTM-A1085 or A500 Grade B).

(7) Place 4 additional Bars R(#5) 3'-8" in length inside Bars U(#5) and centered 2'-0" from end of rail when Terminal Connections are required. Field bend as needed.

(8) Increase 2" for structures with Overlay.



Texas Department of Transportation | Bridge Division Standard

# COMBINATION RAIL

## TYPE C1W

| FILE: | r1std017-19.dgn | DN: TxDOT | CK: TxDOT | DW: JTR | CK: JMH |
|---|---|---|---|---|---|
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| REVISIONS | | 6439 | 16 | 001 | VAR |
| | | DIST | COUNTY | | SHEET NO. |
| | | 22 | VAR | | 93 |

DATE: _03/20/23_ _11:30_
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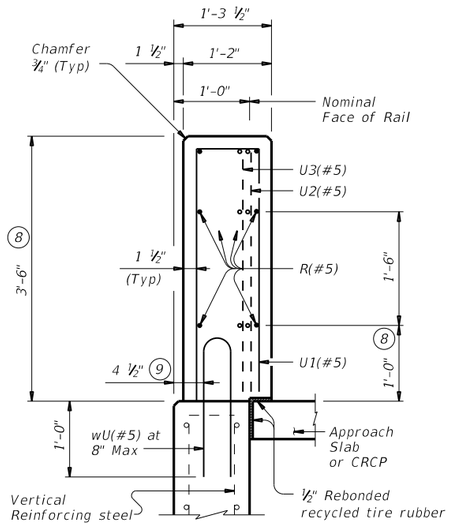
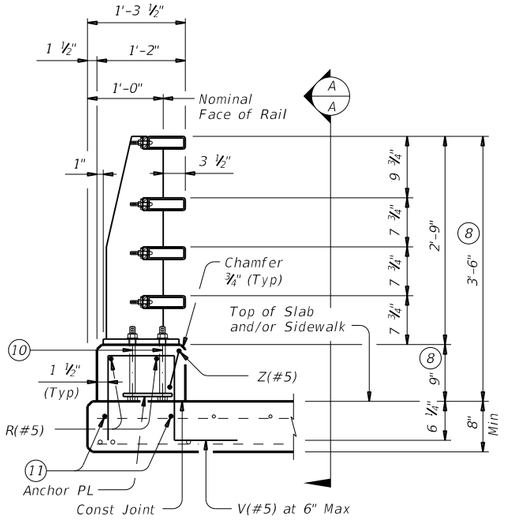
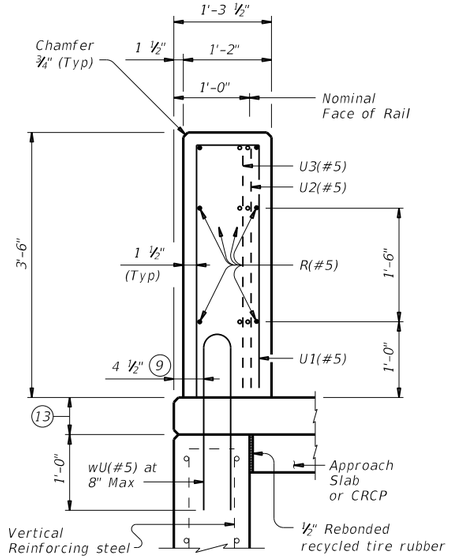



ON ABUTMENT WINGWALLS OR CIP RETAINING WALLS

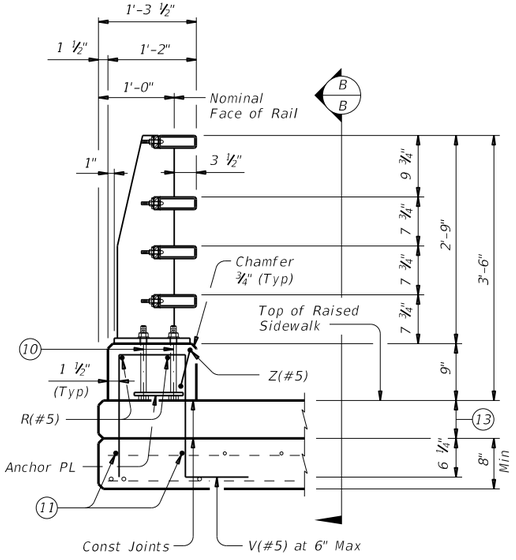



ON BRIDGE SLAB

## SECTIONS THRU RAIL WITHOUT RAISED SIDEWALK

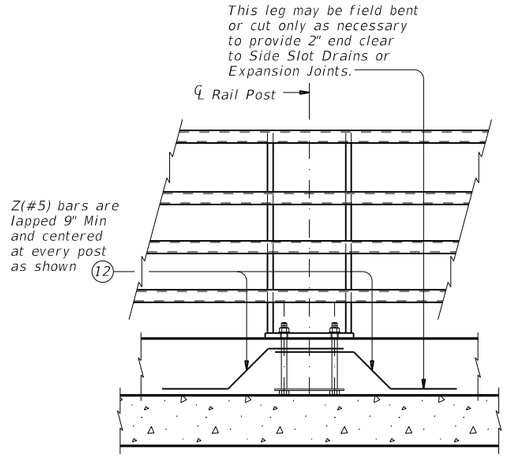



ON ABUTMENT WINGWALLS OR CIP RETAINING WALLS



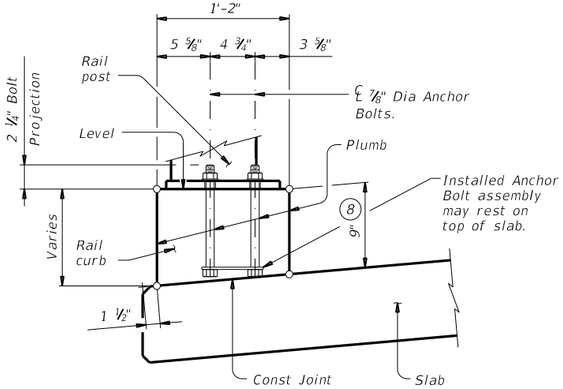

ON BRIDGE SLAB

## SECTIONS THRU RAIL WITH RAISED SIDEWALK

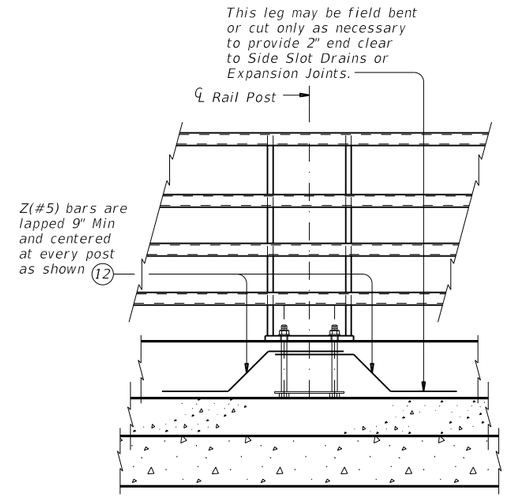



## VIEW A-A

Bars V and R omitted for clarity.
Showing without raised sidewalk.

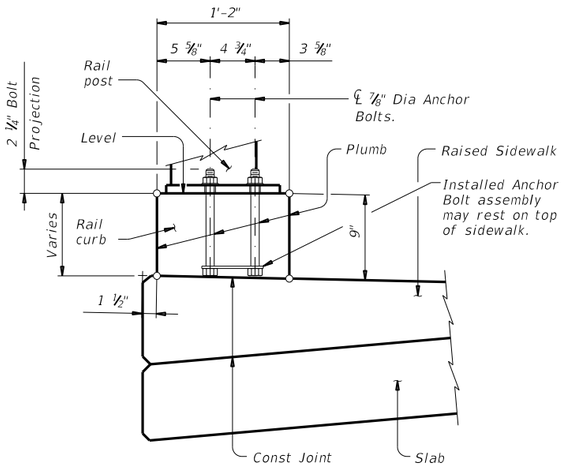



WITHOUT RAISED SIDEWALK




## VIEW B-B

Bars V and R omitted for clarity.
Showing with raised sidewalk.




WITH RAISED SIDEWALK

## RAIL CURB FORMING DETAIL

Reinforcing steel and rail curb chamfers not shown for clarity.

(8) Increase 2" for structures with Overlay.

(9) 5 ¼" when vertical reinforcing has closer clear cover over horizontal reinforcing in abutment wingwalls or retaining walls on traffic side of wall.

(10) ℄ ⅞" Dia Anchor Bolts. See "Anchor Bolt Assembly Details".

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

(12) Adjust Bars Z(#5) as necessary to avoid Bars V(#5).

(13) Raised Sidewalk.



Texas Department of Transportation

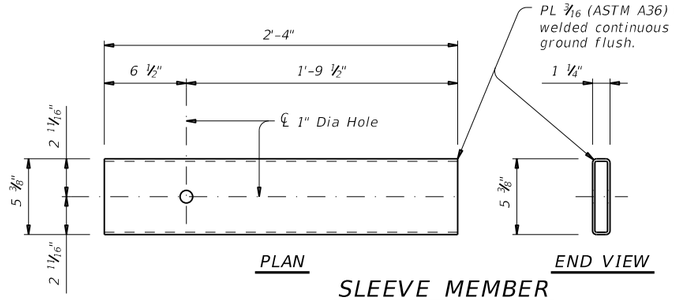
Bridge Division Standard

# COMBINATION RAIL

## TYPE C1W

| FILE: | r1std017-19.dgn | DN: TxDOT | CK: TxDOT | DW: JTR | CK: JMH |
|---|---|---|---|---|---|
| ©TxDOT | September 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | | 6439 | 16 | 001 | VAR |
| | | DIST | COUNTY | | SHEET NO. |
| | | 22 | VAR | | 94 |

DATE: _03/20/23_ _11:30_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties

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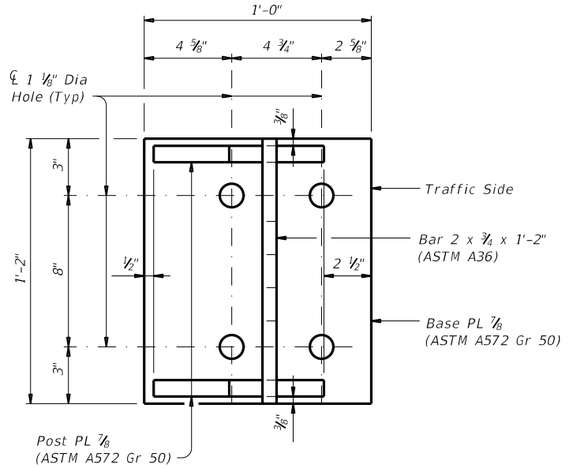
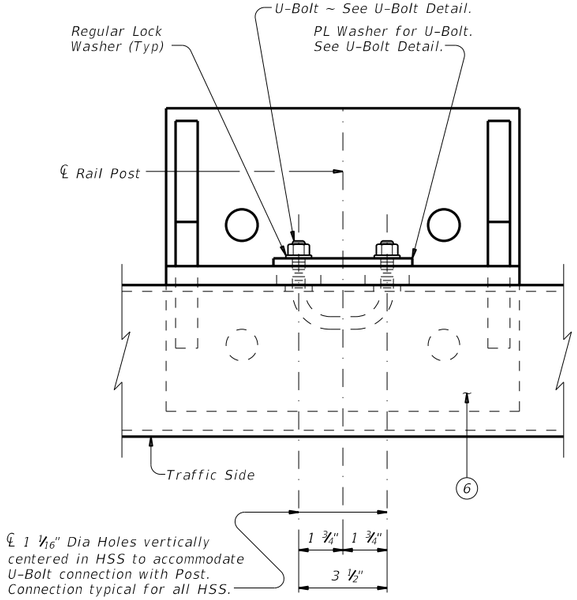


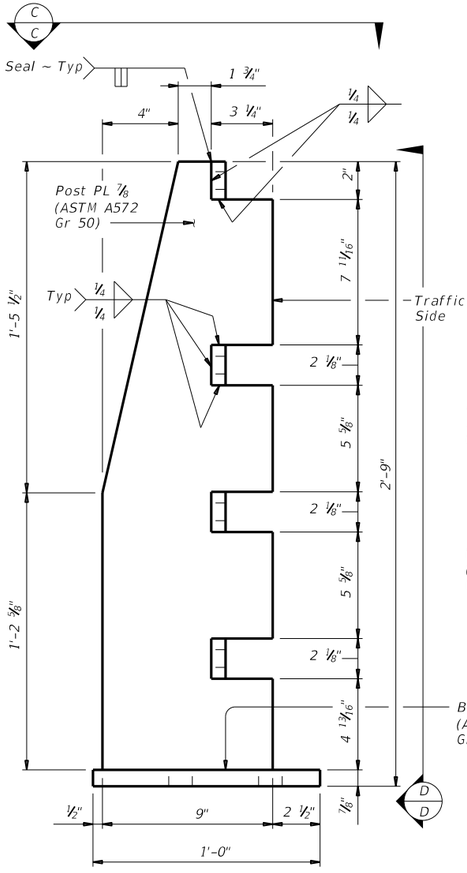

## VIEW C-C

(Showing Hole location in Base PL)

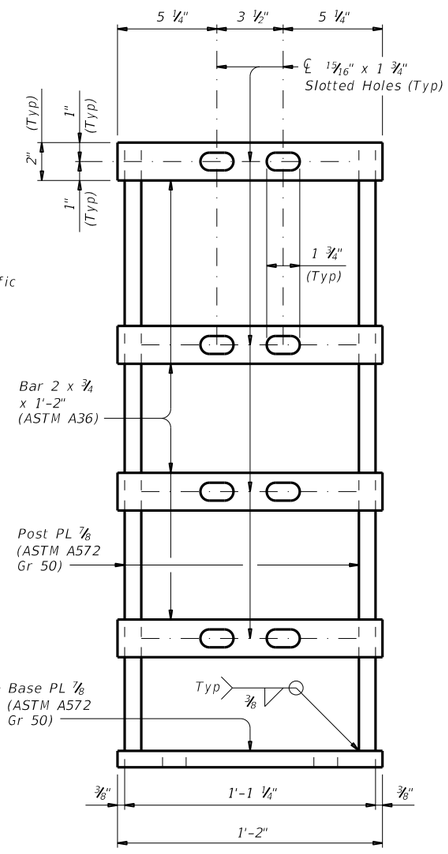



## TOP VIEW OF RAIL POST

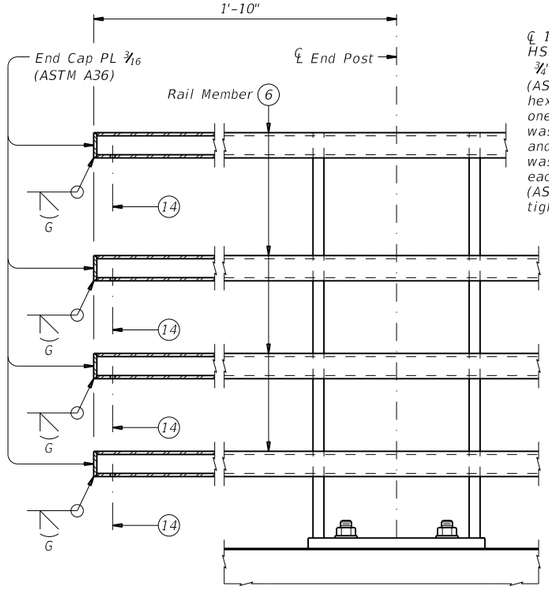
(Showing connection for rail post and HSS.)



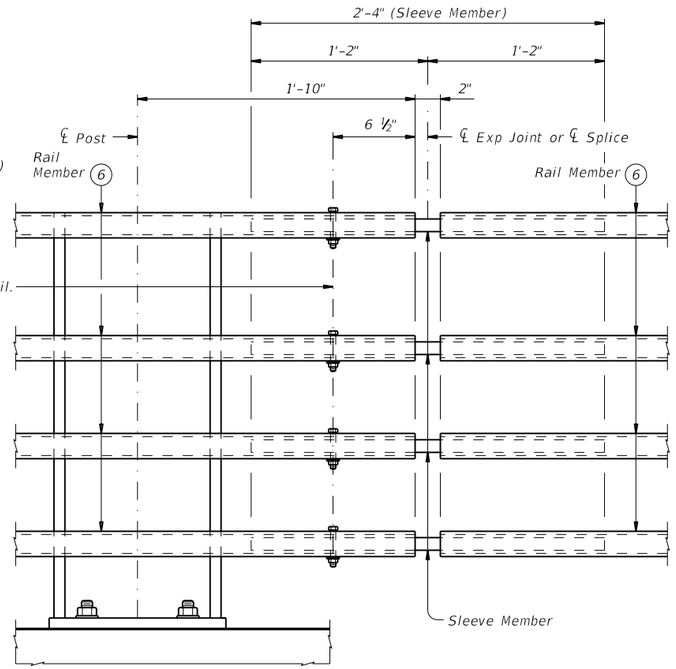

## POST DETAIL



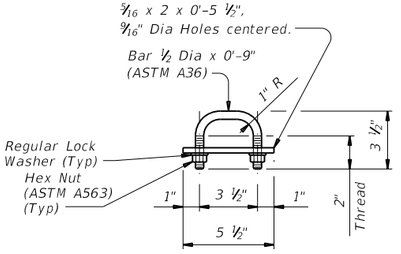

## VIEW D-D




## END CAPS ON HSS AT END POST




## EXPANSION JOINT OR SPLICE




## U-BOLT DETAIL

(Showing U-Bolt for rail post and HSS.)

(6) HSS 6 x 2 x ¼ (ASTM A1085 or A500 Grade B).

(14) ℄ ⅜" Dia Drain Hole in bottom of HSS.

SHEET 3 OF 4

Texas Department of Transportation

Bridge Division Standard

# COMBINATION RAIL

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| | | | | | |
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| | 22 | VAR | | 95 | |

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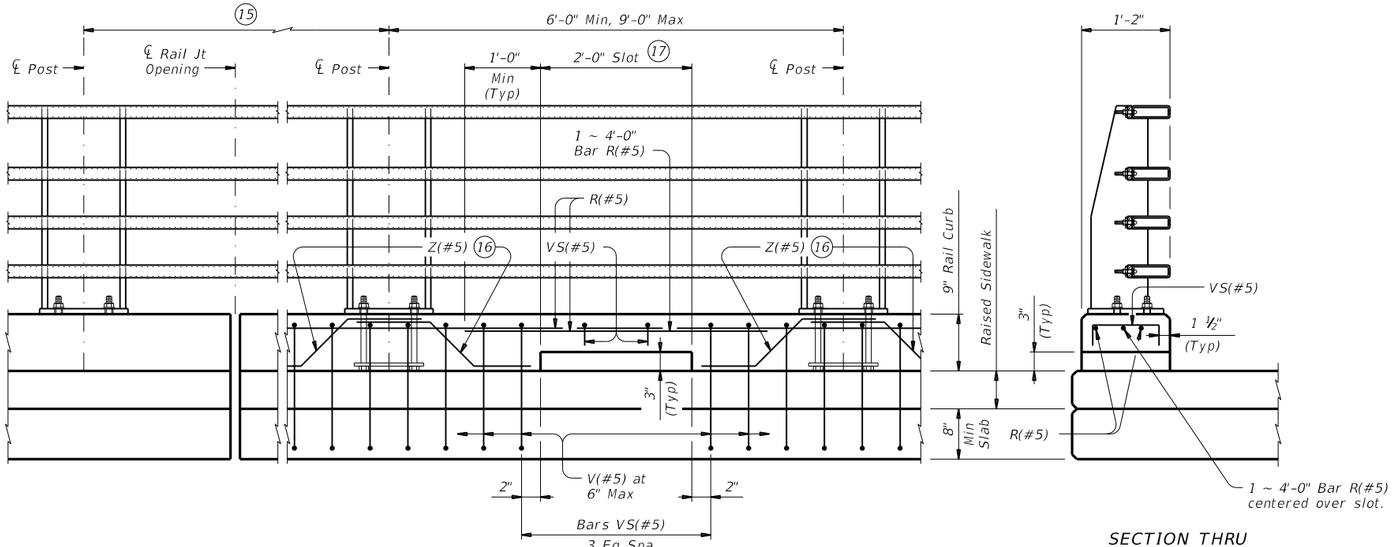


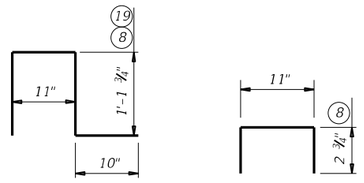

ELEVATION




SECTION THRU SIDE SLOT DRAIN

# OPTIONAL SIDE SLOT DRAIN DETAILS 18

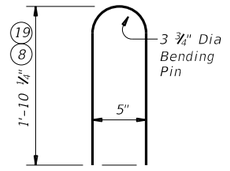
*Showing side slot drain on raised sidewalk, without raised sidewalk similar.*



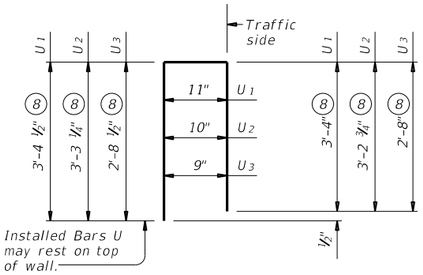

BARS V(#5)



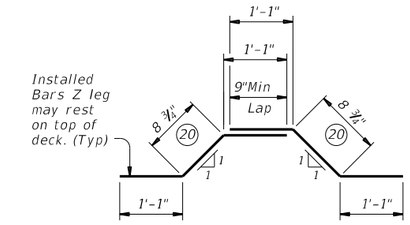

BARS VS(#5)




BARS wU(#5)




BARS U(#5)




BARS Z(#5)

## CONSTRUCTION NOTES:

The face of tubular sections and rail curb must be plumb unless otherwise approved by the Engineer. Steel posts must be square to the top of curb. Use Type VIII epoxy mortar under post base plates if gaps larger than 1/16" exist.

Bend tubes to required radius for curved rails. Shop drawings for approval are required for curved rails.

One shop splice per rail member section is permitted with minimum 85 percent penetration. The weld may be square groove or single vee groove. Grind smooth.

Round or chamfer exposed edges of rail members and rail posts must be rounded or chamfered to approximately 1/16" by grinding.

Chamfer all exposed concrete corners.

## MATERIAL NOTES:

Provide ASTM A1085 or A500 Gr B for all HSS.

Provide Grade 60 reinforcing steel.

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

Galvanize all metal components of steel rail system. Apply additional coatings when shown elsewhere on the plans. When plans require paint over gavanizing, follow the requirements for painting galvanized steel in Item 445, "Galvanizing" and when field painting, Item 446, "Field Cleaning and Painting Steel". Sleeve members and anchor bolts must receive galvanization prior to installation and only field paint after installation unless directed otherwise by Engineer.

Provide 7/8" Dia ASTM F3125 Gr A325 or A449 bolts (or ASTM A193 Gr B7 or F1554 Gr 105 threaded rods with one tack welded heavy hex nut each) with one hardened steel washer (ASTM F436) placed under each heavy hex nut that conforms to ASTM A563 requirements.

Provide ½" Dia round bar U-bolts (ASTM A36) with plate washer (ASTM A36) and regular lock washers placed under hex nuts that conform to ASTM A563 requirements. See "U-Bolt Detail".

Provide Class "S" concrete. When Class "S" concrete for slab is HPC, include a minimum of 3 gallons of calcium nitrite inorganic corrosion inhibitor per cubic yard of Class "S" concrete.

Provide bar laps, where required, as follows:

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

## GENERAL NOTES:

This rail has been successfully evaluated by full-scale crash test to meet MASH TL-4 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.

This railing cannot be used on bridges with expansion joints providing more than 5" movement or on cast-in-place retaining walls, unless otherwise noted.

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

Submit erection drawings showing panel lengths, rail post spacing, and anchor bolt setting, to the Engineer for approval.

Average weight of railing with no overlay:

205 plf total
131 plf (Conc)
74 plf (Steel).

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




PLAN OF ANCHOR PLATE




ELEVATION

## ANCHOR BOLT ASSEMBLY DETAILS




## PLAN OF RAIL AT EXPANSION JOINTS

*Example showing Slab Expansion Joints without breakbacks.*




## ANCHOR BOLT OPTIONS

*(Showing Anchor Bolts for Base Plate)*

(8) Increase 2" for structures with Overlay.

(15) Side slot drains are not allowed in areas where there is a joint in the concrete curb between rail posts.

(16) Bars Z(#5). See "Section Thru Rail" and "View A-A or B-B" for Bar Z placement and spacing.

(17) Center side slot drain between posts within the limits shown.

(18) Side slot drains may be used where shown elsewhere on the plans or as directed by the Engineer. Do not place drains over railroad tracks, lower roadways, or sidewalks. When this rail is used as a separator between a roadway and a sidewalk, side slot drains are not permitted.

(19) For raised sidewalks, add sidewalk height to total bar height. Use sidewalk height at rail's location.

(20) Increase 2 ¾" for structures with Overlay.



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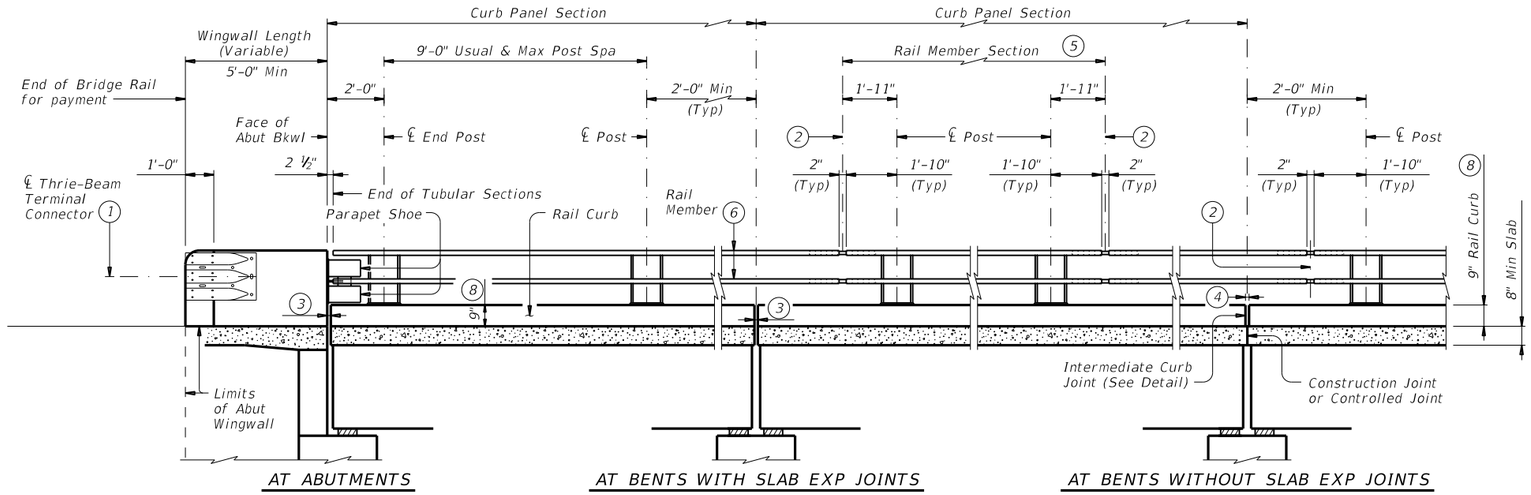
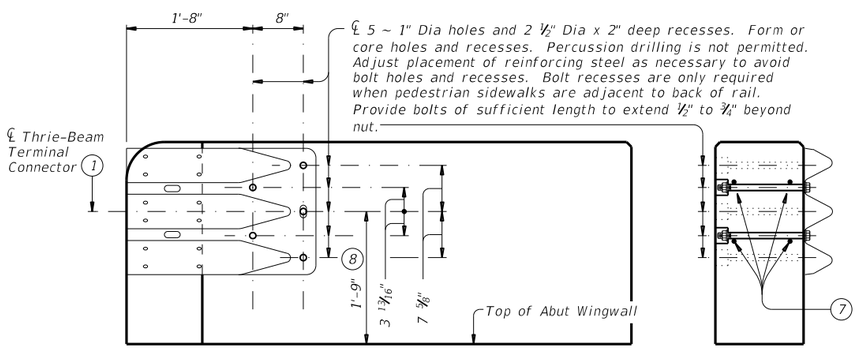
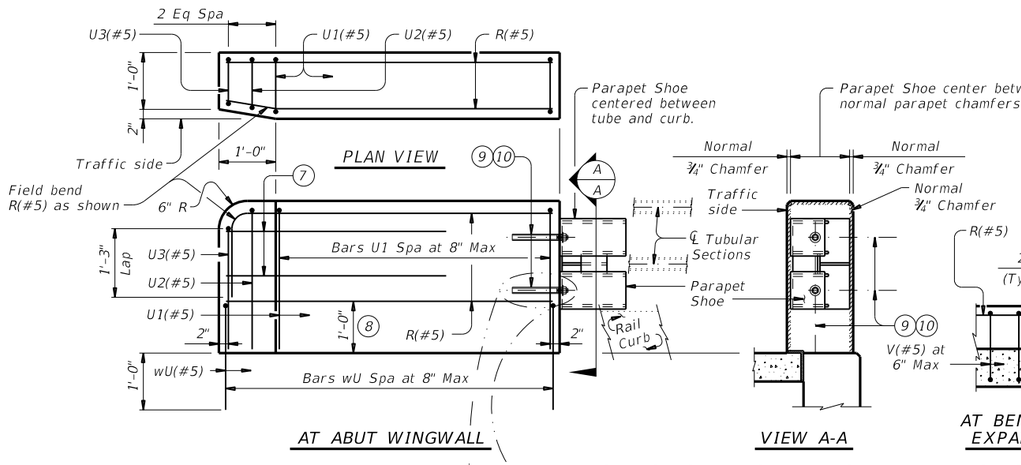



## ROADWAY ELEVATION OF RAIL

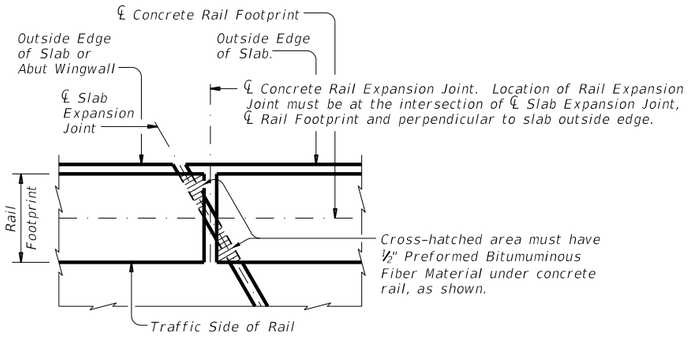
1. Terminal Connectors and associated hardware are to be paid for under the Item "Metal Beam Guard Fence". Attach Metal Beam Guard Fence Transitions to the bridge rail and extend along the embankment unless otherwise shown in the plans.
2. ℄ Expansion Joint or Splice Joint as required.
3. Same as slab joint opening. (5" Max Expansion Joint).
4. ¼" Min, ¾" Max.
5. Rail member sections must have at least two posts but not more than four.
6. HSS 6 x 2 x ¼ (ASTM A1085 or A500 Gr B).
7. Place 4 additional Bars R(#5) 3'-8" in length inside Bars U(#5) and centered 2'-0" from end of rail when Terminal Connections are required. Field bend as needed.
8. Increase 2" for structures with overlay.
9. Anchor bolts must be ⅞" Dia ASTM A193 Gr B7 or F1554 Gr 105 fully threaded rods with heavy hex nuts and one hardened steel washer (ASTM F436) each. Nuts must conform to ASTM A563 requirements. Embed fully threaded rods into parapet wall with a Type III, Class C, D, E, or F anchor adhesive. Adhesive anchor embedment depth is 8". Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing".
10. Install Parapet Shoe after rail has been placed. To ease installation, temporarily brace parapet shoe until the anchorage system achieves manufacturer's recommended curing time. Anchorage system must be assembled with one hardened steel washer (ASTM F436) and one heavy hex nut (ASTM A563) each. Remove temporary bracing after anchorage systems has been firmly tightened.




## TERMINAL CONNECTION DETAILS

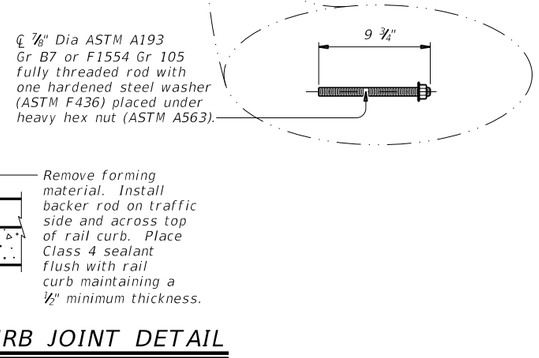


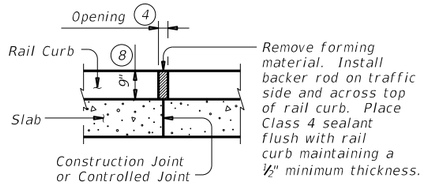

## ELEVATION SHOWING TYPICAL REINFORCING PLACEMENT




## PLAN OF RAIL AT EXPANSION JOINTS

Example showing Slab Expansion Joints without breakbacks.




## INTERMEDIATE CURB JOINT DETAIL

Provide at all interior bents without slab expansion joints.



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# TRAFFIC RAIL

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DATE: 03/20/23
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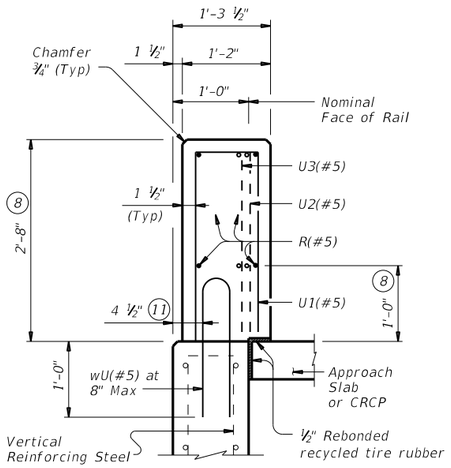
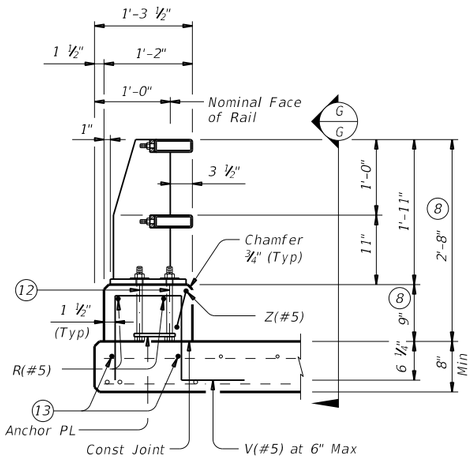
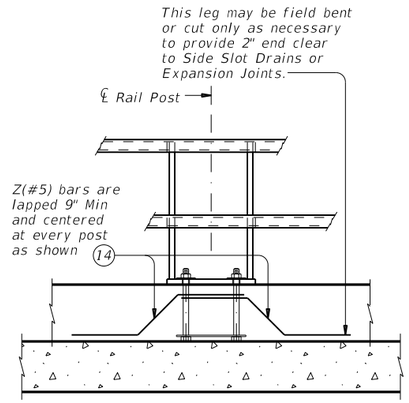



ON ABUTMENT WINGWALLS OR CIP RETAINING WALLS

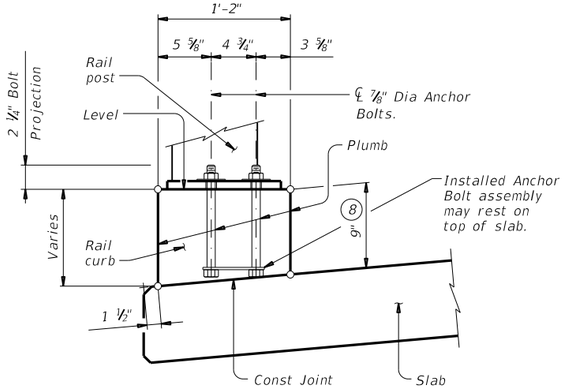



ON BRIDGE SLAB




VIEW G-G

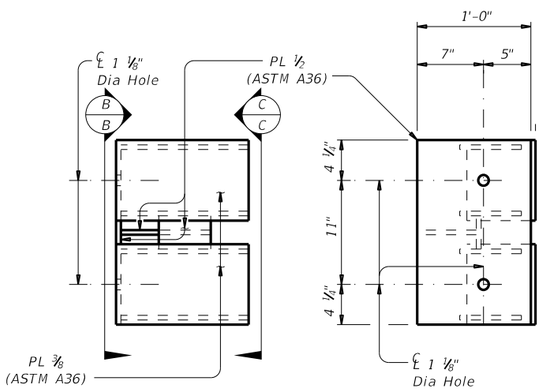
Bars V and R omitted for clarity.




RAIL CURB FORMING DETAIL

Reinforcing steel and rail curb chamfers not shown for clarity.

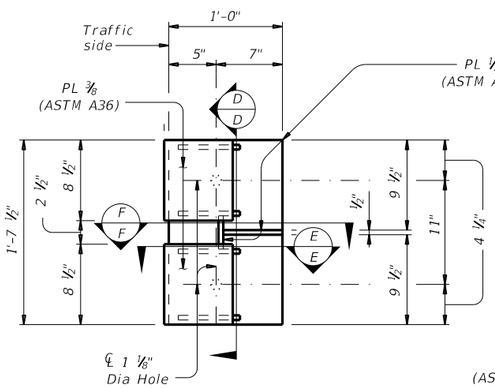
## SECTIONS THRU RAIL



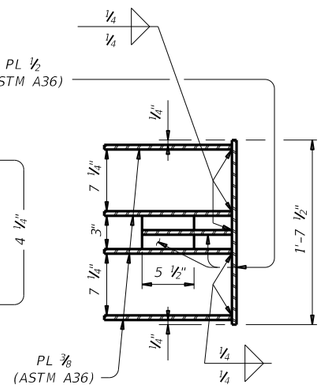

PARAPET SHOE

(Parapet Shoe weight = 92 lb each, for contractor's information only).

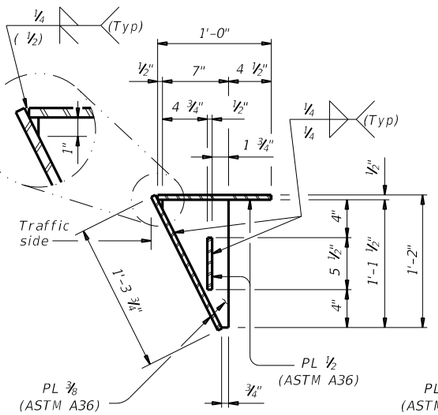
VIEW B-B



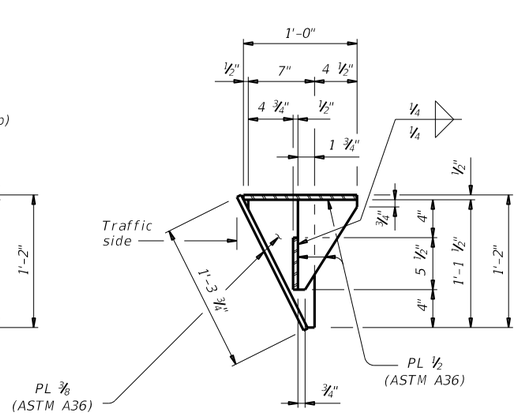

VIEW C-C




SECTION D-D




SECTION E-E




SECTION F-F

(8) Increase 2" for structures with overlay.

(11) 5 ¼" when vertical reinforcing has closer clear cover over horizontal reinforcing in abutment wingwalls or retaining walls on traffic side of wall.

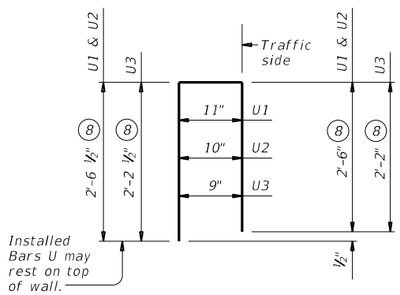
(12) ℄ ⅞" Dia Anchor Bolts. See "Anchor Bolt Assembly Details".

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

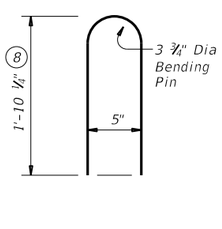
(14) Adjust Bars Z(#5) as necessary to avoid Bars V(#5).

(15) Length shown for 6 ¼" Min bar embedment with no overlay. Adjust as required.

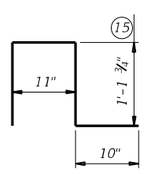
(16) Increase 2 ¾" for structures with overlay.



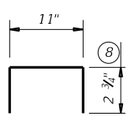

BARS U(#5)



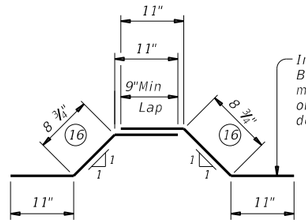

BARS wU(#5)




BARS V(#5)




BARS VS(#5)




BARS Z(#5)

SHEET 2 OF 4

Texas Department of Transportation

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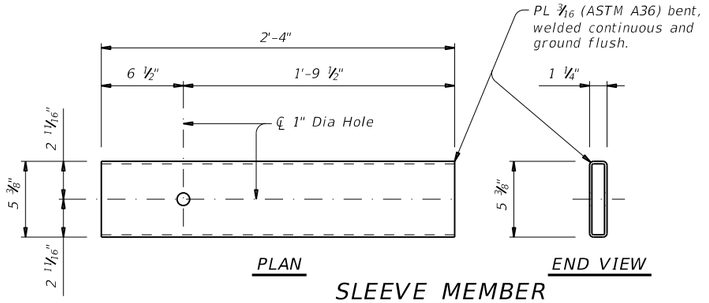
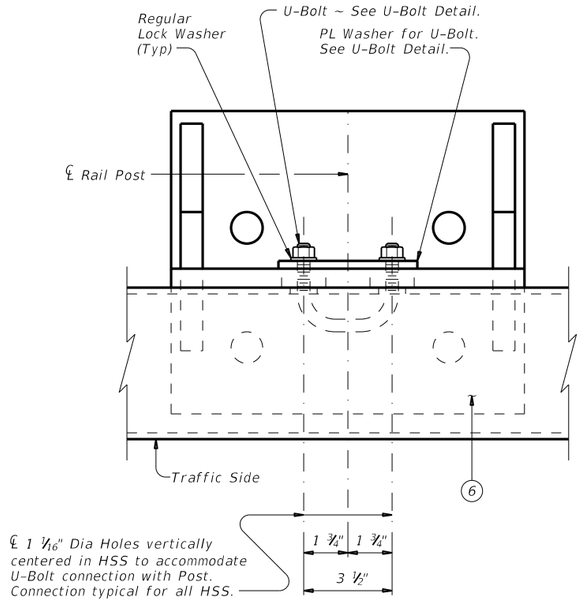
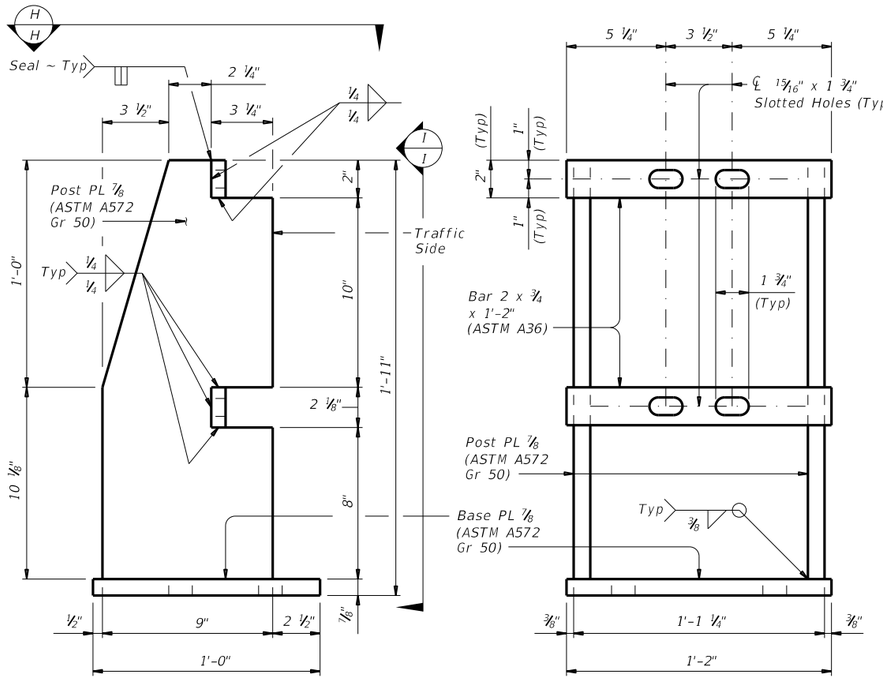



## SLEEVE MEMBER



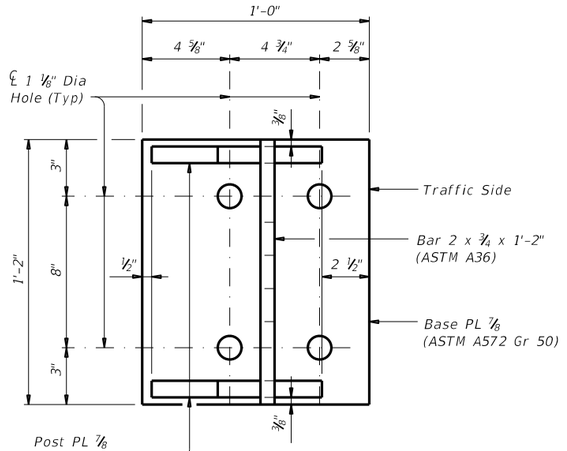

## TOP VIEW OF RAIL POST

(Showing connection for rail post and HSS.)



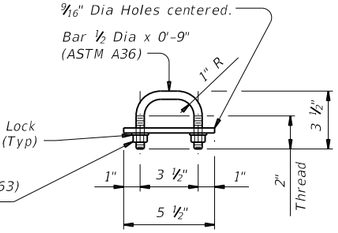

## POST DETAIL

## VIEW I-I




## VIEW H-H

(Showing Hole location in Base PL)

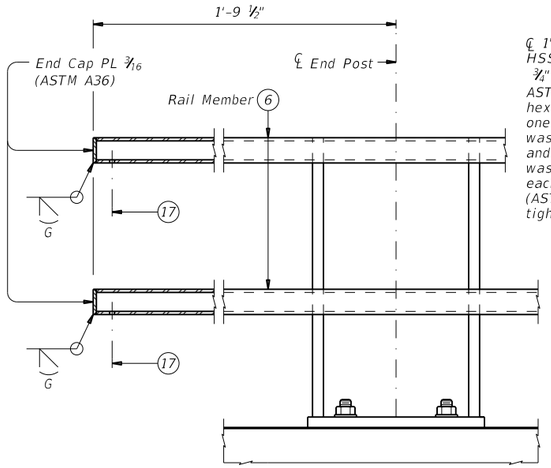



## U-BOLT DETAIL

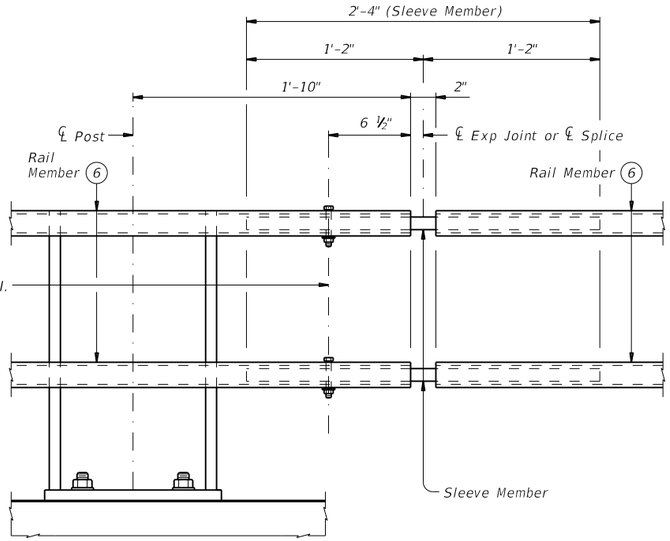
(Showing U-Bolt for rail post and HSS.)

⑥ HSS 6 x 2 x ¼ (ASTM A1085 or A500 Gr B).

⑰ ℄ ⅜" Dia Drain Hole in bottom of HSS.




## END CAPS ON HSS AT END POST




## EXPANSION JOINT OR SPLICE

SHEET 3 OF 4

Texas Department of Transportation

Bridge Division Standard

# TRAFFIC RAIL

## TYPE T1W

| FILE: r1std002-19.dgn | DN: TxDOT | CK: TxDOT | DW: JTR | CK: JMH |
|---|---|---|---|---|
| ©TxDOT September 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 99 |

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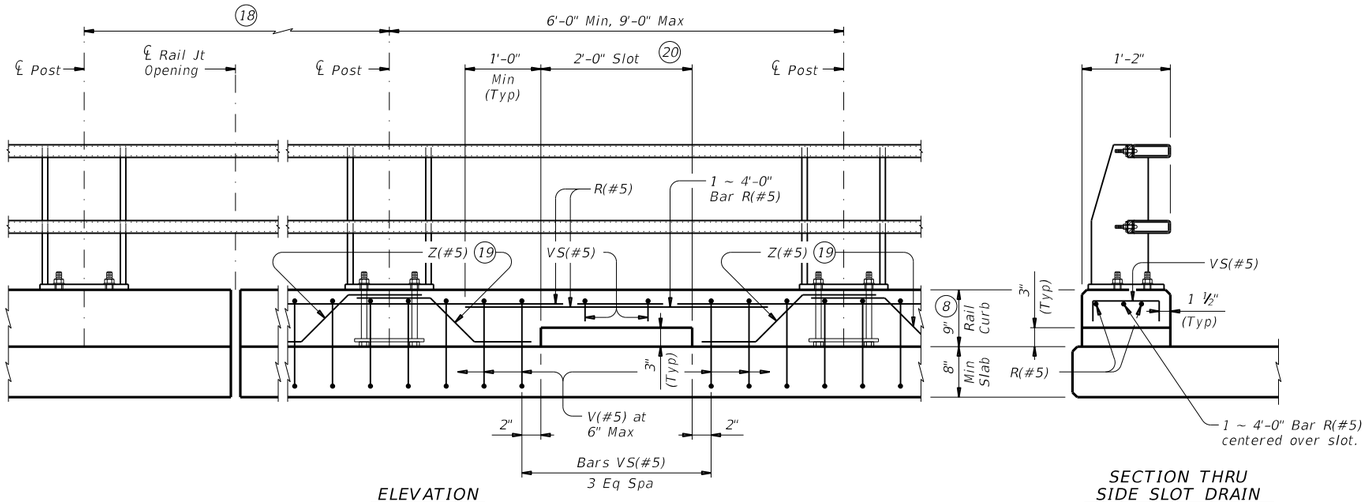
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties




ELEVATION

SECTION THRU SIDE SLOT DRAIN

## OPTIONAL SIDE SLOT DRAIN DETAILS (21)




PLAN OF ANCHOR PLATE




ELEVATION

## ANCHOR BOLT ASSEMBLY DETAILS




## ANCHOR BOLT OPTIONS

(Showing Anchor Bolts for Base Plate)

(8) Increase 2" for structures with Overlay.

(18) Side slot drains are not allowed in areas where there is a joint in the concrete curb between rail posts.

(19) Bars Z(#5). See "Section Thru Rail" and "View G-G" for Bar Z placement and spacing.

(20) Center side slot drain between posts within the limits shown.

(21) Side slot drains may be used where shown elsewhere on the plans or as directed by the Engineer. Do not place drains over railroad tracks, lower roadways, or sidewalks. When this rail is used as a separator between a roadway and a sidewalk, side slot drains are not permitted.

### CONSTRUCTION NOTES:

The face of tubular sections and rail curb must be plumb unless otherwise approved. Steel posts must be square to the top of curb. Use Type VIII epoxy mortar under post base plates if gaps larger than 1/16" exist.

Bend tubes to required radius for curved rails. Shop drawings for approval are required for curved rails.

One shop splice per rail member section is permitted with minimum 85 percent penetration. The weld may be square groove or single vee groove. Grind smooth.

Round or chamfer exposed edges of rail members and rail posts to approximately 1/16" by grinding.

Chamfer all exposed concrete corners.

### MATERIAL NOTES:

Provide ASTM A1085 or A500 Gr B for all HSS.

Provide Grade 60 reinforcing steel.

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

Galvanize all metal components of steel rail system. Apply additional coatings when shown elsewhere on the plans. When plans require paint over gavanizing, follow the requirements for painting galvanized steel in Item 445, "Galvanizing" and when field painting, Item 446, "Field Cleaning and Painting Steel". Sleeve members and anchor bolts must receive galvanization prior to installation and only field paint after installation unless directed otherwise by Engineer.

Anchor bolts for base plate must be ⅞" Dia ASTM F3125 Gr A325 or A449 bolts (or ASTM A193 Gr B7 or F1554 Gr 105 threaded rods with one tack welded heavy hex nut each) with one hardened steel washer (ASTM F436) placed under each heavy hex nut. Nuts must conform to ASTM A563 requirements.

Provide ¾" Dia x 3 ½" hex head bolts (ASTM F3125 Gr A325) for expansion or splice joints in HSS with one regular washer and one regular lock washer placed under each heavy hex nut. Nuts must conform to ASTM A563 requirements.

Provide ½" Dia round bar U-bolts (ASTM A36) with plate washer (ASTM A36) and regular lock washers placed under hex nuts that conform to ASTM A563 requirements. See "U-Bolt Detail".

Provide Class "S" concrete. When Class "S" concrete for slab is HPC, include a minimum of 3 gallons of calcium nitrite inorganic corrosion inhibitor per cubic yard of Class "S" concrete.

Provide bar laps, where required, as follows:
Uncoated or galvanized ~ #5 = 2'-0"
Epoxy coated ~ #5 = 3'-0"

### GENERAL NOTES:

This rail has been successfully 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.

This railing cannot be used on bridges with expansion joints providing more than 5" movement or on cast-in-place retaining walls, unless otherwise noted.

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

Submit erection drawings showing panel lengths, rail post spacing, and anchor bolt setting, to the Engineer for approval.

Average weight of railing with no overlay: 173 plf total
131 plf (Conc)
42 plf (Steel).

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



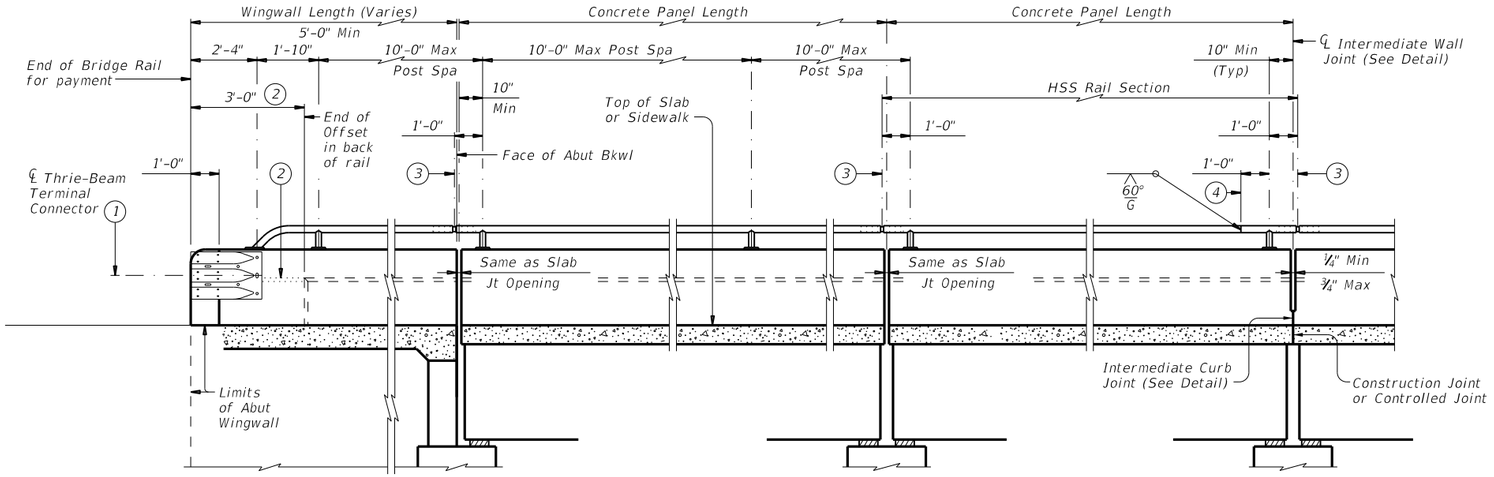
Texas Department of Transportation

Bridge Division Standard

# TRAFFIC RAIL

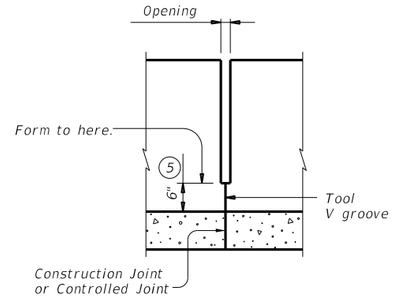
## TYPE T1W

| FILE: rlstd002-19.dgn | DN: TxDOT | CK: TxDOT | DW: JTR | CK: JMH |
|---|---|---|---|---|
| ©TxDOT September 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 100 |




AT ABUTMENTS | AT BENTS WITH SLAB EXP JOINTS | AT BENTS WITHOUT SLAB EXP JOINTS

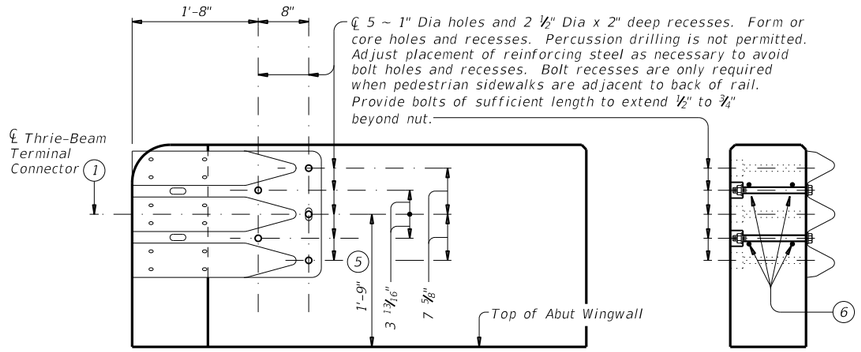
## ROADWAY ELEVATION OF RAIL




## INTERMEDIATE WALL JOINT DETAIL

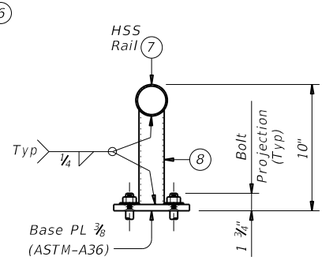
Provide at all interior bents without slab expansion joints.

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. Back of rail offset may, with Engineer's approval, be continued to the end of the railing.
3. ℄ Exp Joint or Splice Joint as required.
4. One shop splice per HSS rail section is permitted with minimum 85 percent penetration. The weld may be square groove, or single vee groove. Grind smooth.
5. Increase 2" for structures with overlay.
6. Place 4 additional Bars R(#4) 3'-8" in length inside Bars S(#4) and centered 2'-0" from end of rail when Terminal Connections are required. Field bend as needed.
7. HSS 2.875 x 0.203
8. HSS 2.375 x 0.154
9. ⅞" Dia Hole in bottom of HSS rail (Minimum 1 hole between posts ~ Typ)

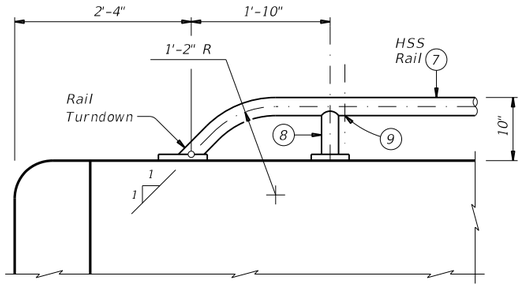



ELEVATION | SECTION

## TERMINAL CONNECTION DETAILS

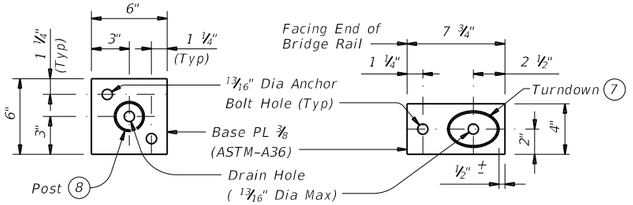



TRANSVERSE SECTION



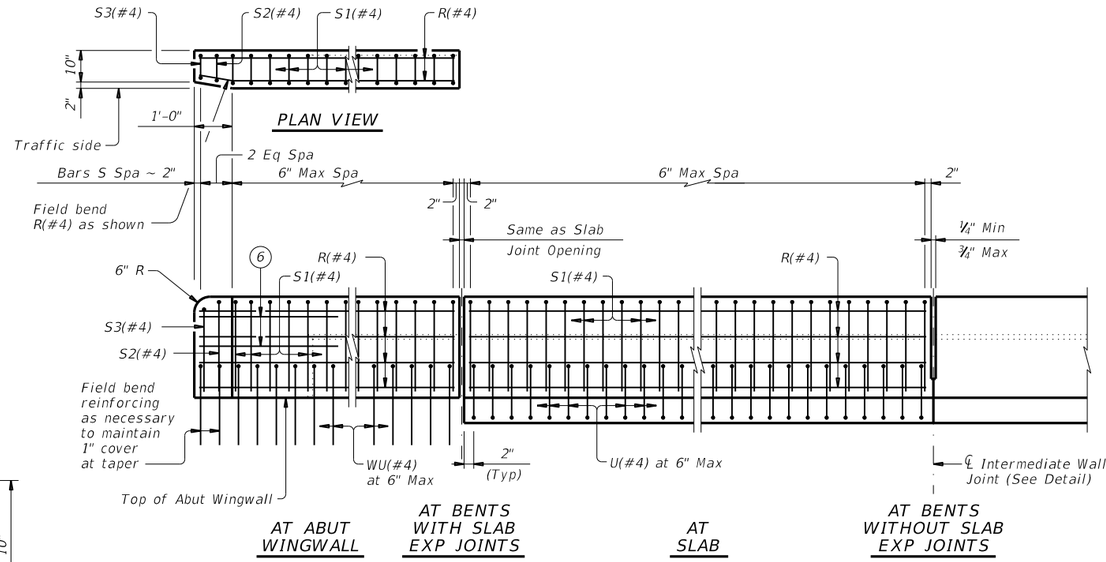

Note that at least two anchor points (as shown) are required for the Bridge Rail on the Abutment Wingwall. Longer Wingwalls may require more than two Rail anchorages.

## HSS RAIL TERMINAL DETAIL




POST BASE PLATE PLAN | RAIL TURNDOWN BASE PLATE PLAN

## HSS RAIL DETAILS




AT ABUT WINGWALL | AT BENTS WITH SLAB EXP JOINTS | AT SLAB | AT BENTS WITHOUT SLAB EXP JOINTS

## ELEVATION SHOWING TYPICAL REINFORCING PLACEMENT

(Showing without raised sidewalk)

SHEET 1 OF 3

Texas Department of Transportation

Bridge Division Standard

# COMBINATION RAIL

# TYPE C221

| FILE: | rlstd018-19.dgn | DN: TxDOT | CK: TxDOT | DW: JTR | CK: JMH |
|---|---|---|---|---|---|
| ©TxDOT | September 2019 | CONT | SECT | JOB | HIGHWAY |
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| | | DIST | COUNTY | | SHEET NO. |
| | | 22 | VAR | | 101 |



DATE: _03/20/23_ _11:30_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties

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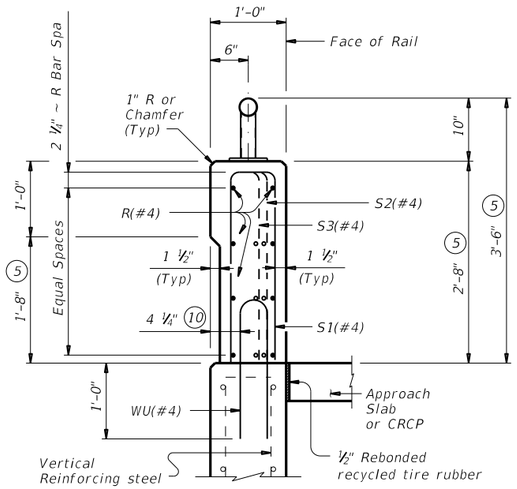
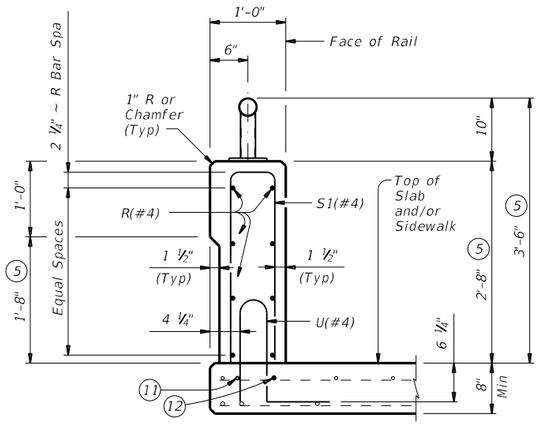
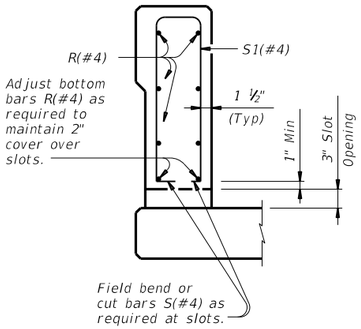



ON ABUTMENT WINGWALLS OR CIP RETAINING WALLS

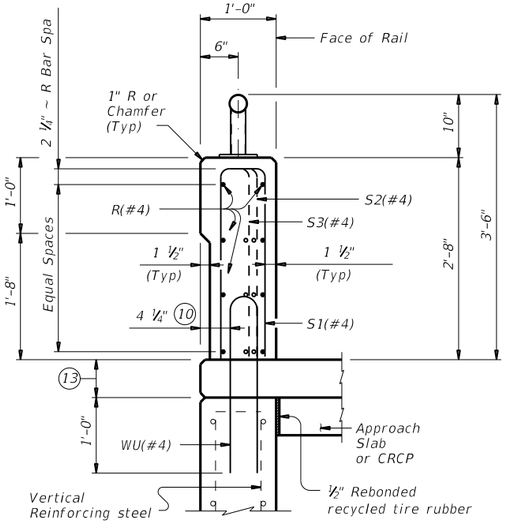



ON BRIDGE SLAB

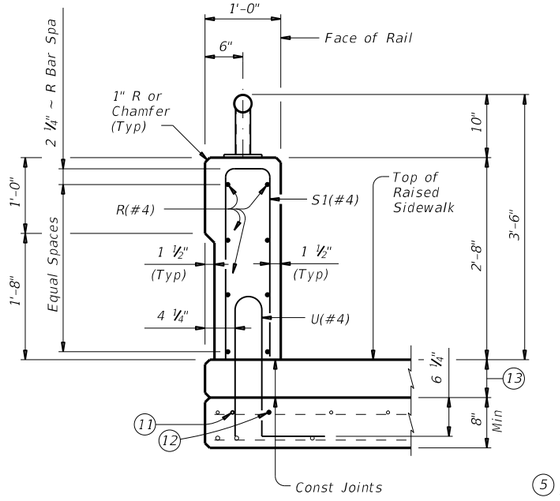
## SECTIONS THRU RAIL WITHOUT RAISED SIDEWALK




## SECTION THRU OPTIONAL SIDE SLOT DRAIN

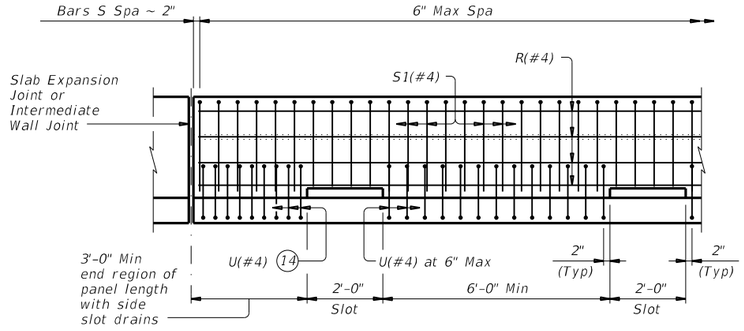



ON ABUTMENT WINGWALLS OR CIP RETAINING WALLS




ON BRIDGE SLAB

## SECTIONS THRU RAIL WITH RAISED SIDEWALK




## OPTIONAL SIDE SLOT DRAIN DETAIL

Note: Side Slot Drains may be used where shown elsewhere on the plans or as directed by the Engineer. Drains should not be placed over railroad tracks, lower roadways, or sidewalks. When this rail is used as a separator between a roadway surface and a sidewalk surface, side drain slots will not be permitted.

(5) Increase 2" for structures with overlay.

(10) 5 ¼" when vertical reinforcing has closer clear cover over horizontal reinforcing in abutment wingwalls or retaining walls on traffic side of wall.

(11) As an aid in supporting reinforcement, additional longitudinal bars may be used in the slab with the approval of the Engineer. Such bars must be furnished at the Contractors expense.

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

(13) Raised Sidewalk

(14) Space U(#4) bars at 4" Max when end region of panel length is less than 6'-0" to side slot drain. Space U(#4) bars at 6" Max when end region of panel length is 6'-0" and greater to side slot drain.



Texas Department of Transportation

Bridge Division Standard

# COMBINATION RAIL

# TYPE C221

| FILE: | r1std018-19.dgn | DN: TxDOT | CK: TxDOT | DW: JTR | CK: JMH |
|---|---|---|---|---|---|
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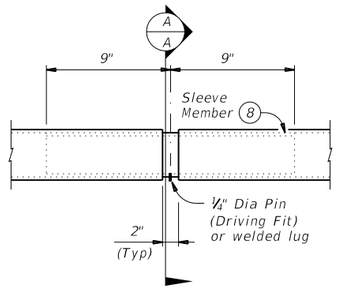
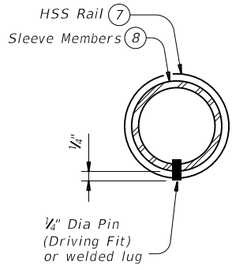
## RAIL DATA FOR HORIZONTAL CURVES

| | RADIUS TO FACE OF RAIL | MAX CHORD LENGTH | CONSTRUCT OR FABRICATE |
|---|---|---|---|
| HSS Rail | Over 2800' | 29'-0" | Straight rail panels |
| | Over 1400' thru 2800' | 14'-6" | To required radius or to chords shown |
| | Over 700' thru 1400' | 7'-3" | |
| | Thru 700' | Zero | To required radius |

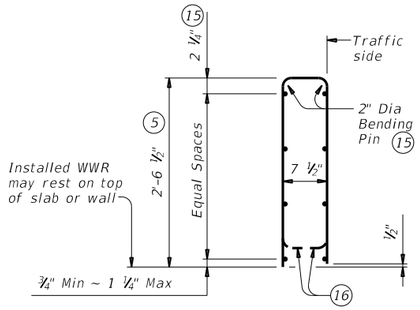



AT SPLICE OR EXP JTS




SECTION A-A

## PIPE SPLICE DETAILS




OPTIONAL WELDED WIRE REINFORCEMENT (WWR)

| DESCRIPTION | LONGITUDINAL WIRES | VERTICAL WIRES |
|---|---|---|
| Minimum (Cumulative Total) Wire Area | 1.067 Sq In. | 0.267 Sq In. per Ft |
| | No. of Wires | Spacing |
| Minimum | 8 | 4" |
| Maximum | 10 | 8" |
| Maximum Wire Size Differential | The smaller wire must have an area of 40% or more of the larger wire. | |

### CONSTRUCTION NOTES:

This railing may be constructed by the slipform process when approved by the Engineer, with equipment approved by the Engineer and when adhesive anchor bolts are used. Slipforming parapet is not allowed if anchor bolts are cast with parapet wall. Provide sensor control for both line and grade. Tack welding to provide bracing for slipform operations is acceptable. Welding may be performed at a minimum spacing of 3 ft between the cage and the anchorage. It is permissible to weld to bars U, WU and S at any location on the cage. If increased bracing is needed, provide additional anchorage devices and weld in the upper two thirds of the cage. Paint welded areas on epoxy coated and/or galvanized reinforcing with an organic zinc rich paint in accordance with Item 445 "Galvanizing".

If rail is slipformed, apply an heavy epoxy bead 1" behind toe of traffic side of rail to concrete deck just prior to slip forming. Provide a ⅜" width x ¼" tall heavy epoxy bead with Type III, Class C or a Type V epoxy.

Test adhesive anchors in accordance with Item 450.3.3, "Tests". Test 3 anchors per 100 anchors installed. Perform corrective measures to provide adequate capacity if any of the tests do not meet the required test load. Repair damage from testing as directed.

At the Contractor's option anchor bolts may be cast with the parapet. See "Material Notes".

Face of rail, parapet must be plumb unless otherwise approved by the Engineer. HSS rail posts must be square to the top of parapet. Use epoxy mortar under post base plates if gaps larger than 1/16" exist.

Round or chamfer exposed edges of HSS rail and HSS rail posts to approximately 1/16" by grinding.

HSS rail sections must not include less than two posts, and no more than four (except at Abutments).

Chamfer all parapet exposed corners.

### MATERIAL NOTES:

Provide Class "C" concrete. Povide 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.

Provide ASTM A1085 or A500 Gr B or A53 Gr B for all HSS.

Galvanize all metal components of steel rail system. Apply additional coatings when shown elsewhere on the plans. When plans require paint over gavanizing, follow the requirements for painting galvanized steel in Item 445, "Galvanizing" and when field painting, Item 446, "Field Cleaning and Painting Steel". Sleeve members and anchor bolts must receive galvanization prior to installation and only field paint after installation unless directed otherwise by Engineer.

Deformed Welded Wire Reinforcement (WWR) (ASTM A1064) of equal size and spacing may be substituted for Bars U and WU unless noted otherwise. Deformed WWR (ASTM 1064) may be substituted for Bars R and S, as shown. Combinations of reinforcing steel and WWR or configurations of WWR other that shown are permitted if conditions in the table are satisfied. Provide the same laps as required for reinforcing bars.

Anchor bolts must be ⅞" Dia ASTM A307 Gr A fully threaded rods with one hex nut and one hardened steel washer (ASTM F436) each. Nuts must conform to ASTM A563 requirements. Embed fully threaded rods into parapet wall with a Type III, Class C, D, E, or F anchor adhesive. Minimum adhesive anchor embedment depth is 3". Anchor adhesive chosen must be able to achieve a nominal bond strength in tension of a single anchor, Na, of 5 kips (edge distance must be accounted for). Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use. Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing".

Optional cast-in-place anchor bolts must be ⅞" Dia ASTM A307 Gr A bolts (or threaded rods with one tack welded hex nut each) with one hex nut and one hardened steel washer (ASTM F436) at each bolt. Nuts must conform to ASTM A563 requirements.

Provide bar laps, where required, as follows: Uncoated or galvanized ~ #4 = 1'-7"
Epoxy coated ~ #4 = 2'-5"

### GENERAL NOTES:

This rail has been evaluated and accepted to be of equal strength to railings with like geometry, which have been crash tested 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.

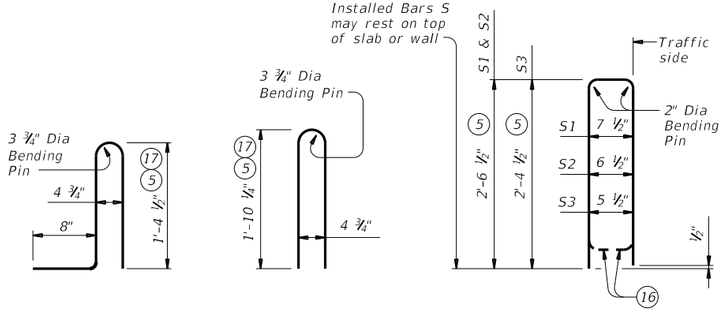
Do not use this railing on bridges with expansion joints providing more than 5" movement.

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

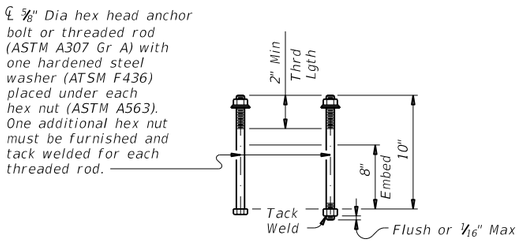
Submit erection drawings showing panel lengths, rail post spacing, and anchor bolt setting to the Engineer for approval.

Average weight of railing with no overlay: 380 plf (total)
370 plf (Conc)
10 plf (Steel)

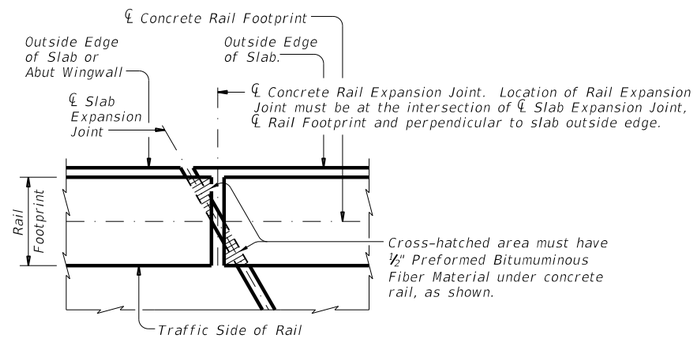
Cover dimensions are clear dimensions, unless noted otherwise.
Reinforcing bar dimensions shown are out-to-out of bar.




BARS U (#4) BARS WU (#4) BARS S (#4)




CAST-IN-PLACE ANCHOR BOLT OPTIONS (18)




PLAN OF RAIL AT EXPANSION JOINTS

Example showing Slab Expansion Joints without breakbacks.

(5) Increase 2" for structures with overlay.
(7) HSS 2.875 x 0.203
(8) HSS 2.375 x 0.154
(15) No longitudinal wires may be in top center of cage.
(16) Bend or cut as required to clear drain slots.
(17) For raised sidewalks, add sidewalk height to total bar height. Use sidewalk height at rail's location.
(18) See "Material Notes" for anchor bolt information.



Texas Department of Transportation

Bridge Division Standard

# COMBINATION RAIL

## TYPE C221

| FILE: | r1std018-19.dgn | DN: TxDOT | CK: TxDOT | DW: JTR | CK: JMH |
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| ©TxDOT | September 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | | 6439 | 16 | 001 | VAR |
| | | DIST | COUNTY | | SHEET NO. |
| | | 22 | VAR | | 103 |

DATE: 03/20/23
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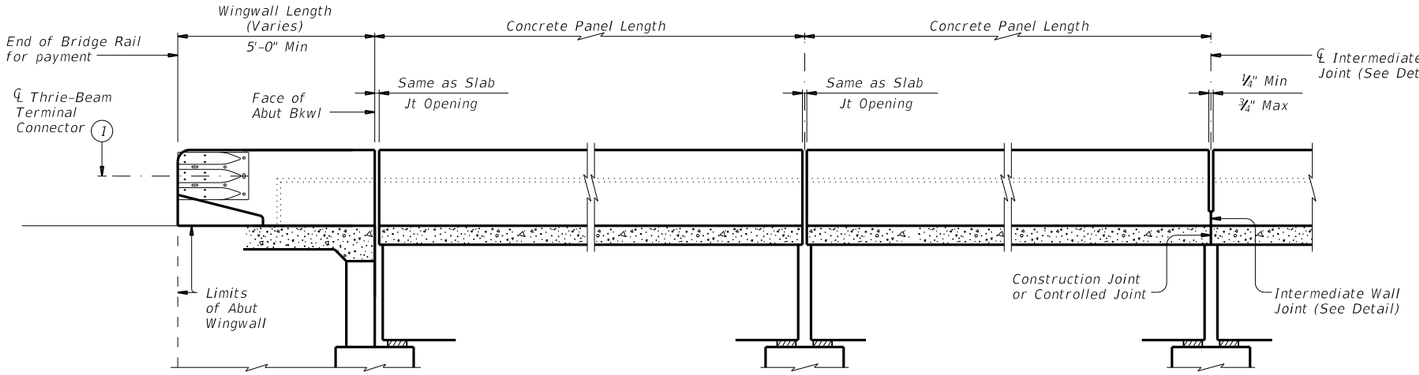
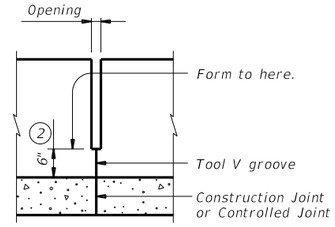


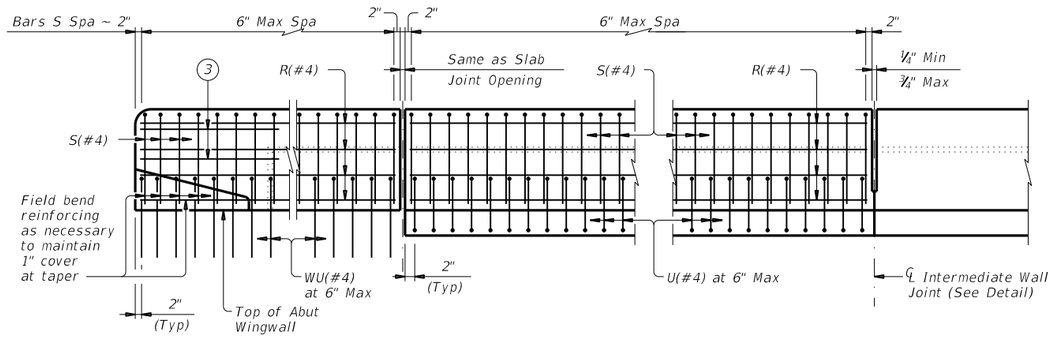

AT ABUTMENTS | AT BENTS WITH SLAB EXP JOINTS | AT BENTS WITHOUT SLAB EXP JOINTS

## ROADWAY ELEVATION OF RAIL

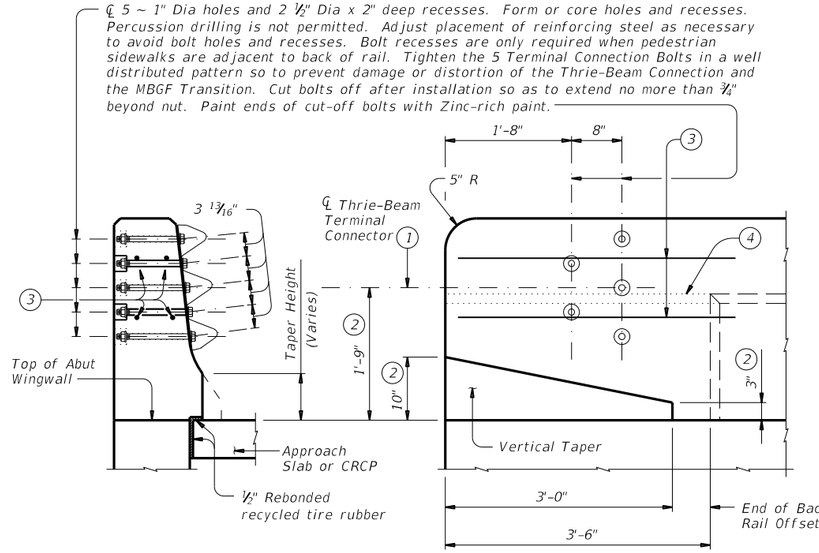



## INTERMEDIATE WALL JOINT DETAIL

*Provide at all interior bents without slab expansion joints.*

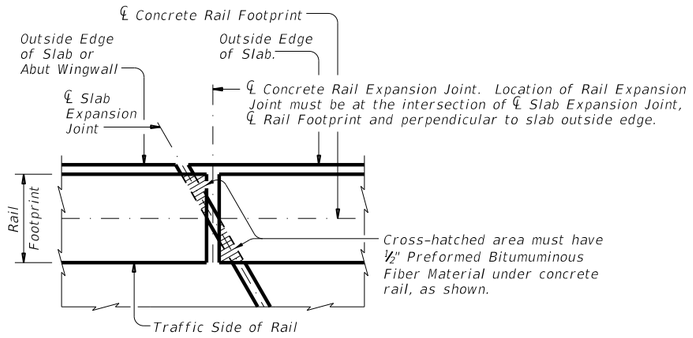



## ELEVATION SHOWING TYPICAL REINFORCING PLACEMENT




SECTION | ELEVATION

## TERMINAL CONNECTION DETAILS




## PLAN OF RAIL AT EXPANSION JOINTS

*Example showing Slab Expansion Joints without breakbacks.*

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. Increase 2" for structures with overlay.
3. Place 4 additional Bars R(#4) 3'-8" in length inside Bars S(#4) and centered 2'-0" from end of rail when Terminal Connections are required.
4. Back of rail offset may, with Engineer's approval, be continued to the end of the railing.

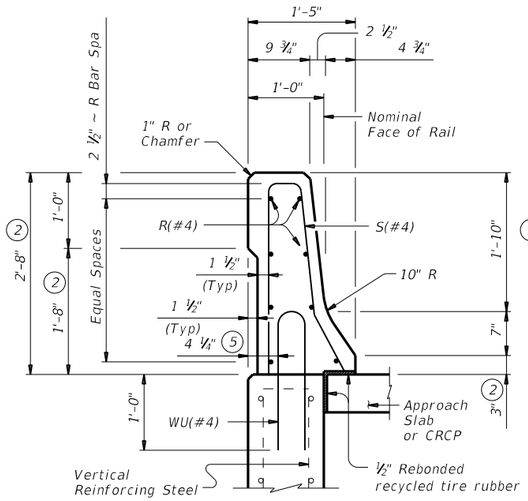


Texas Department of Transportation | Bridge Division Standard

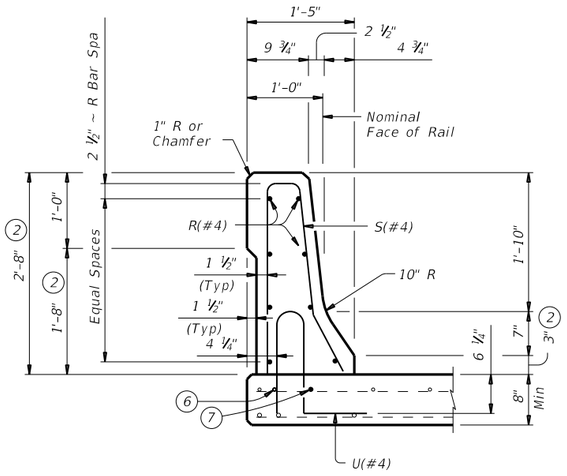
# TRAFFIC RAIL

## TYPE T551

| FILE: rlstd009-19.dgn | DN: TxDOT | CK: TxDOT | DW: JTR | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT September 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 104 |

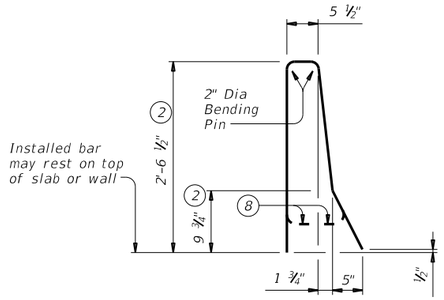



ON ABUTMENT WINGWALLS OR CIP RETAINING WALLS

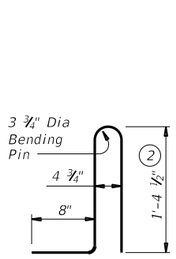



ON BRIDGE SLAB

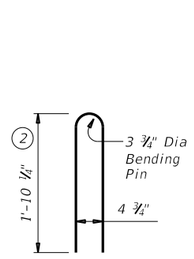
## SECTIONS THRU RAIL



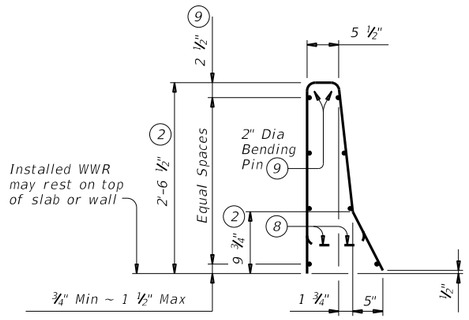

BARS S (#4)




BARS U (#4)

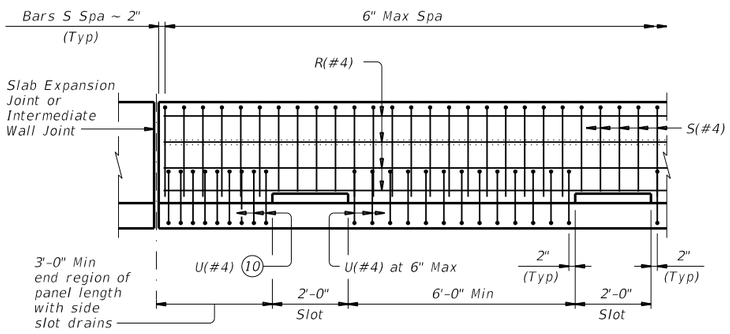



BARS WU (#4)



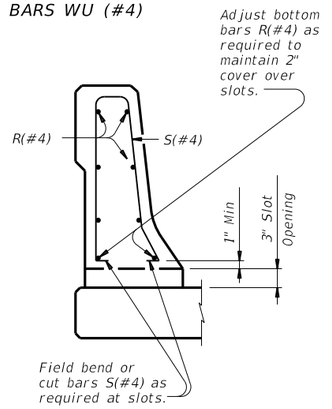

OPTIONAL WELDED WIRE REINFORCEMENT (WWR)

| DESCRIPTION | LONGITUDINAL WIRES | VERTICAL WIRES |
|---|---|---|
| Minimum (Cumulative Total) Wire Area | 1.067 Sq In. | 0.267 Sq In. per Ft |
| | No. of Wires | Spacing |
| Minimum | 8 | 4" |
| Maximum | 10 | 8" |
| Maximum Wire Size Differential | The smaller wire must have an area of 40% or more of the larger wire. | |




## OPTIONAL SIDE SLOT DRAIN DETAIL

Note: Side Slot Drains may be used where shown elsewhere on the plans or as directed by the Engineer. If continuous slots at 8 ft c-c are required, then details as on standard Type T552 should apply. Do not place drains over railroad tracks, lower roadways, or sidewalks. When this rail is used as a separator between a roadway surface and a sidewalk surface, side drain slots will not be permitted.




## SECTION THRU OPTIONAL SIDE SLOT DRAIN

2 Increase 2" for structures with overlay.

5 ¼" when vertical reinforcing has closer clear cover over horizontal reinforcing in abutment wingwalls or retaining walls on traffic side of wall.

6 As an aid in supporting reinforcement, additional longitudinal bars may be used in the slab with the approval of the Engineer. Such bars will be furnished at the Contractor's expense.

7 Top longitudinal slab bar may be adjusted laterally 3" plus or minus to tie reinforcing.

8 Bend or cut as required to clear drain slots.

9 No longitudinal wires may be in top center of cage.

10 Space U(#4) bars at 4" Max when end region of panel length is less than 6'-0" to side slot drain. Space U(#4) bars at 6" Max when end region of panel length is 6'-0" and greater to side slot drain.

### CONSTRUCTION NOTES:

This railing may be constructed by the slipform process when approved by the Engineer, with equipment approved by the Engineer. Provide sensor control for both line and grade. Tack welding to provide bracing for slipform operations is acceptable. Welding may be performed at a minimum spacing of 3 ft between the cage and the anchorage. It is permissible to weld to bars U, WU and S at any location on the cage. If increased bracing is needed, provide additional anchorage devices and weld in the upper two thirds of the cage. Paint welded areas on epoxy coated and/or galvanized reinforcing with an organic zinc rich paint in accordance with Item 445 "Galvanizing".

If rail is slipformed, apply an heavy epoxy bead 1" behind toe of traffic side of rail to concrete deck just prior to slip forming. Provide a ⅜" width x ½" tall heavy epoxy bead with Type III, Class C or a Type V epoxy.

The back of railing must be vertical 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 slab bars are epoxy coated or galvanized.

Deformed Welded Wire Reinforcement (WWR) (ASTM A1064) of equal size and spacing may be substituted for Bars U and WU unless noted otherwise. Deformed WWR (ASTM A1064) may be substituted for Bars R and S, as shown. Combinations of reinforcing steel and WWR or configurations of WWR other than shown are permitted if conditions in the table are satisfied. Provide the same laps as required for reinforcing bars.

Provide bar laps, where required, as follows:

Uncoated or galvanized ~ #4 = 1'-7"

Epoxy coated ~ #4 = 2'-5"

### GENERAL NOTES:

This rail has been evaluated and accepted to be of equal strength to railings with like geometry, which have been crash tested 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 will not be required for this rail.

Average weight of railing with no overlay is 382 plf.

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

# TYPE T551

| FILE: | rlstd009-19.dgn | DN: TxDOT | CK: TxDOT | DW: JTR | CK: TxDOT |
|---|---|---|---|---|---|
| ©TxDOT | September 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | | 6439 | 16 | 001 | VAR |
| | | DIST | COUNTY | | SHEET NO. |
| | | 22 | VAR | | 105 |

DATE: _03/20/23_ _11:30_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties

DATE: _03/20/23_ _11:30_
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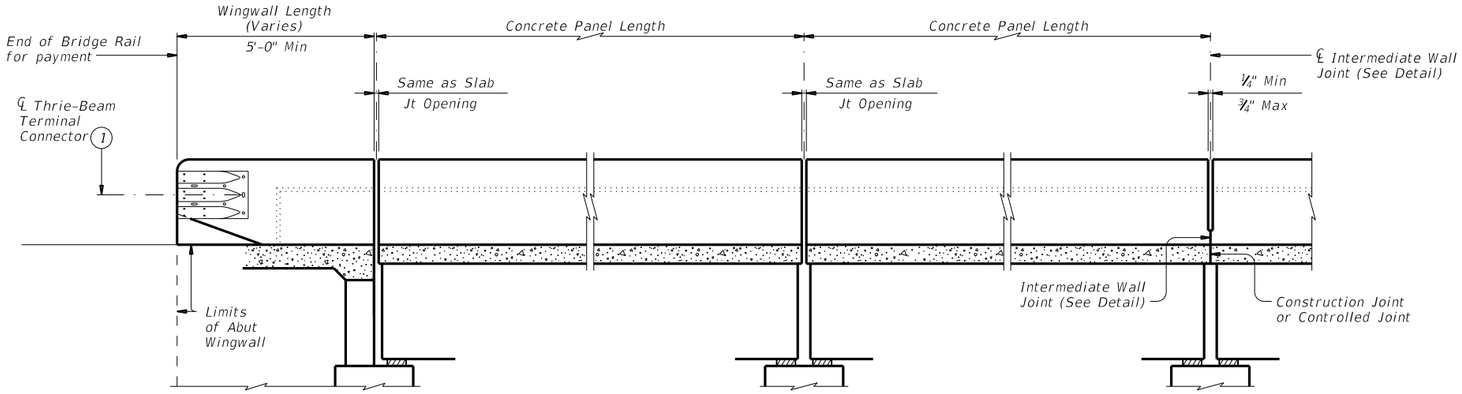
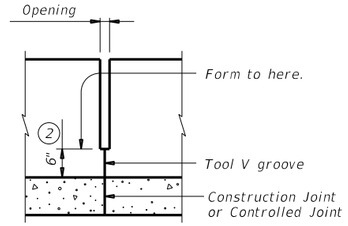


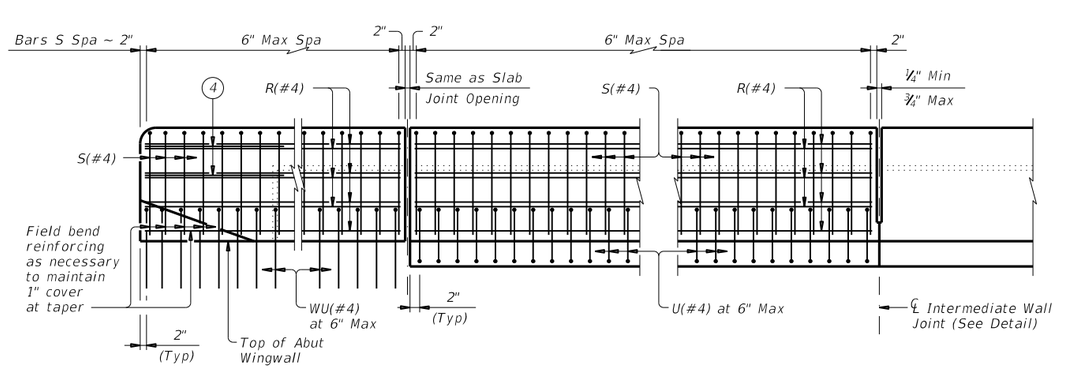

AT ABUTMENTS | AT BENTS WITH SLAB EXP JOINTS | AT BENTS WITHOUT SLAB EXP JOINTS

## ROADWAY ELEVATION OF RAIL

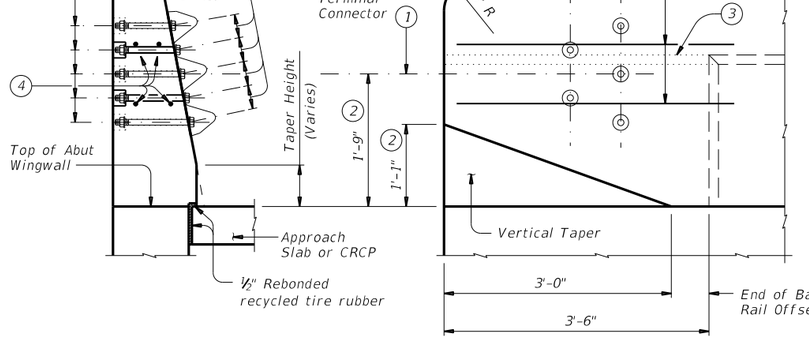



## INTERMEDIATE WALL JOINT DETAIL

Provide at all interior bents without slab expansion joints.

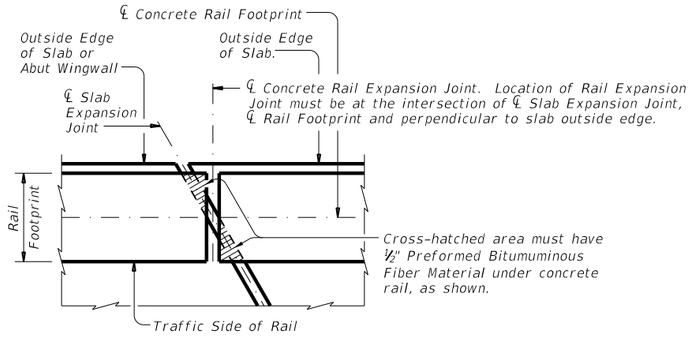



## ELEVATION SHOWING TYPICAL REINFORCING PLACEMENT




SECTION | ELEVATION

## TERMINAL CONNECTION DETAILS




## PLAN OF RAIL AT EXPANSION JOINTS

Example showing Slab Expansion Joints without breakbacks.

(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) Increase 2" for structures with Overlay.

(3) Back of rail offset may, with Engineer's approval, be continued to the end of the railing.

(4) Place 4 additional Bars R(#4) 3'-8" in length inside Bars S(#4) and centered 2'-0" from end of rail when Terminal Connections are required.



Texas Department of Transportation | Bridge Division Standard

# TRAFFIC RAIL SINGLE SLOPE

## TYPE SSTR

| FILE: | rlstd014-19.dgn | DN: TxDOT | CK: TxDOT | DW: JTR | CK: TxDOT |
|---|---|---|---|---|---|
| ©TxDOT | September 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | | 6439 | 16 | 001 | VAR |
| | | DIST | COUNTY | | SHEET NO. |
| | | 22 | VAR | | 106 |

DATE: _03/20/23_ _11:30_
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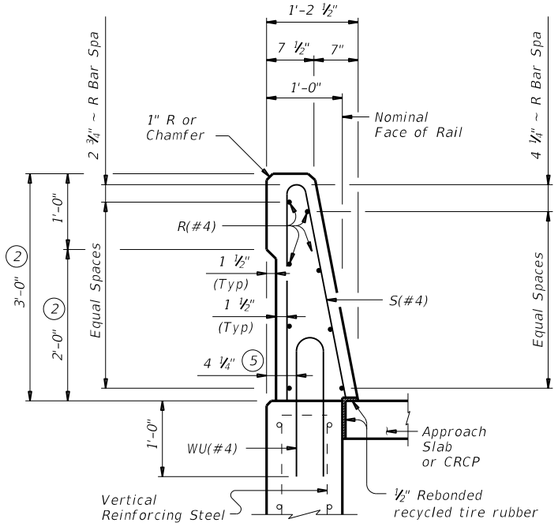
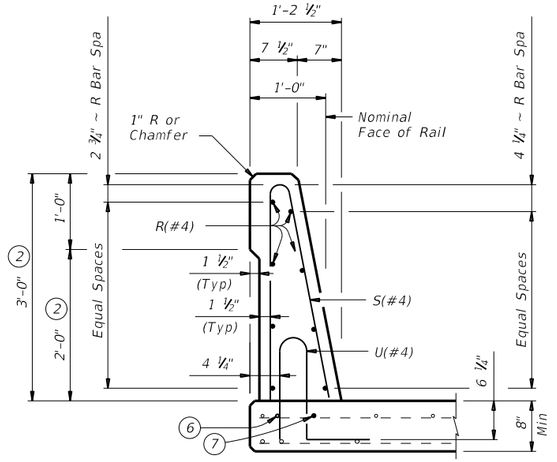



ON ABUTMENT WINGWALLS OR CIP RETAINING WALLS




ON BRIDGE SLAB

## SECTIONS THRU RAIL

(2) Increase 2" for structures with Overlay.

(5) 5 ¼" when vertical reinforcing has closer clear cover over horizontal reinforcing in abutment wingwalls or retaining walls on traffic side of wall.

(6) As an aid in supporting reinforcement, additional longitudinal bars may be used in the slab with the approval of the Engineer. Such bars must be furnished at the Contractor's expense.

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

(8) No longitudinal wires may be within upper bend.

(9) Bend or cut as required to clear drain slots.

(10) Space U(#4) bars at 4" Max when end region of panel length is less than 6'-0" to side slot drain. Space U(#4) bars at 6" Max when end region of panel length is 6'-0" and greator to side slot drain.

### CONSTRUCTION NOTES:

This railing may be constructed by the slipform process when approved by the Engineer, with equipment approved by the Engineer. Provide sensor control for both line and grade. Tack welding to provide bracing for slipform operations is acceptable. Welding may be performed at a minimum spacing of 3 ft between the cage and the anchorage. It is permissible to weld to bars U, WU and S at any location on the cage. If increased bracing is needed, provide additional anchorage devices and weld in the upper two thirds of the cage. Paint welded areas on epoxy coated and/or galvanized reinforcing with an organic zinc rich paint in accordance with Item 445 "Galvanizing".

If rail is slipformed, apply an heavy epoxy bead 1" behind toe of traffic side of rail to concrete deck just prior to slip forming. Provide a ⅜" width x ¼" tall heavy epoxy bead with Type III, Class C or a Type V epoxy.

The back of railing must be vertical unless otherwise shown in 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 slab bars are epoxy coated or galvanized.

Deformed Welded Wire Reinforcement (WWR) (ASTM A1064) of equal size and spacing may be substituted for Bars U and WU unless noted otherwise. Deformed WWR (ASTM A1064) may be substituted for Bars R and S, as shown. Combinations of reinforcing steel and WWR or configurations of WWR other than shown are permitted if conditions in the table are satisfied. Provide the same laps as required for reinforcing bars.

Provide bar laps, where required, as follows:

Uncoated or galvanized ~ #4 = 1'-7"

Epoxy coated ~ #4 = 2'-5"

### GENERAL NOTES:

This rail has been successfully evaluated by full-scale crash test to meet MASH TL-4 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.

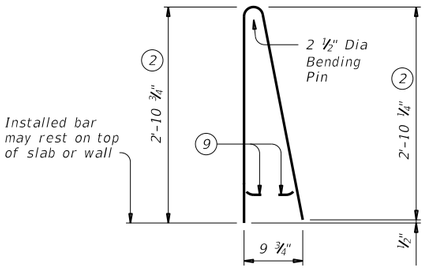
Rail anchorage details shown on this standard may require modification for select structure types. See appropriate details elsewhere in plans for these modifications.

Shop drawings will not be required for this rail.

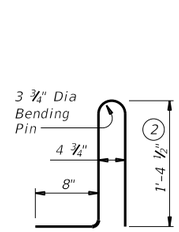
Average weight of railing with no overlay is 376 plf.

Cover dimensions are clear dimensions, unless noted otherwise.

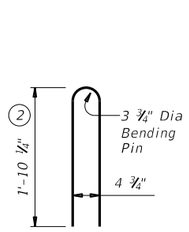
Reinforcing bar dimensions shown are out-to-out of bar.



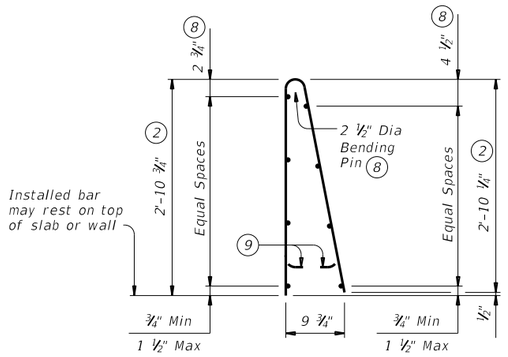

BARS S (#4)




BARS U (#4)

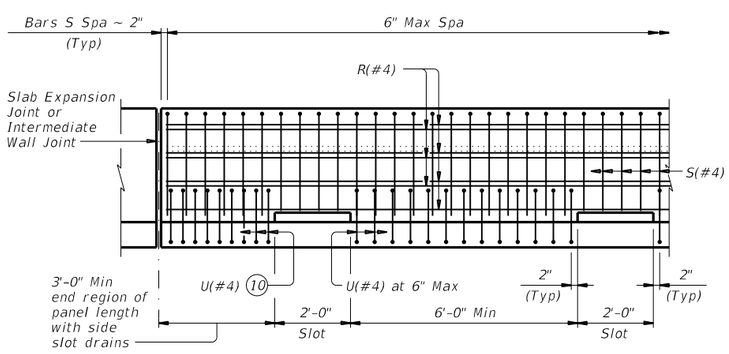



BARS WU (#4)



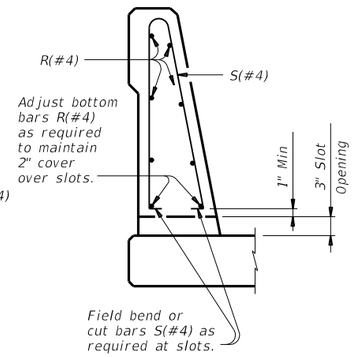

OPTIONAL WELDED WIRE REINFORCEMENT (WWR)

| DESCRIPTION | LONGITUDINAL WIRES | VERTICAL WIRES |
|---|---|---|
| Minimum (Cumulative Total) Wire Area | 1.067 Sq In. | 0.267 Sq In. per Ft |
| | No. of Wires | Spacing |
| Minimum | 8 | 4" |
| Maximum | 10 | 8" |
| Maximum Wire Size Differential | The smaller wire must have an area of 40% or more of the larger wire. | |




OPTIONAL SIDE SLOT DRAIN DETAIL

Note: Side Slot Drains may be used where shown elsewhere on the plans or as directed by the Engineer. Drains should not be placed over railroad tracks, lower roadways, or sidewalks. When this rail is used as a separator between a roadway surface and a sidewalk surface, side drain slots will not be permitted.




SECTION THRU OPTIONAL SIDE SLOT DRAIN



Texas Department of Transportation

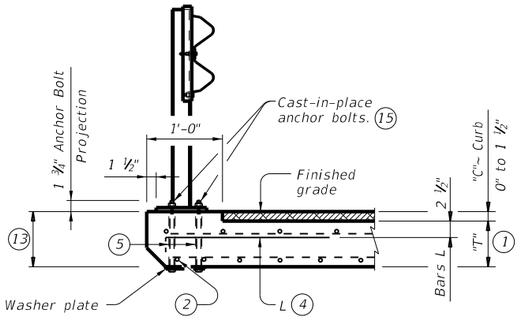
Bridge Division Standard

# TRAFFIC RAIL SINGLE SLOPE

# TYPE SSTR

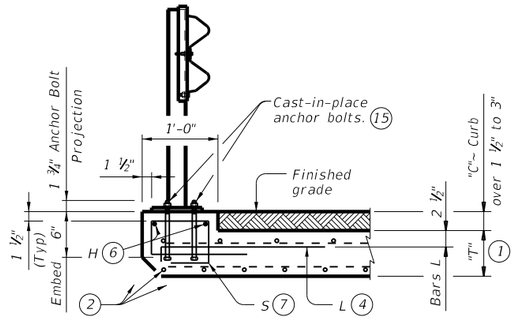
| FILE: | r1std014-19.dgn | DN: TxDOT | CK: TxDOT | DW: JTR | CK: TxDOT |
|---|---|---|---|---|---|
| ©TxDOT | September 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | | 6439 | 16 | 001 | VAR |
| | | DIST | COUNTY | | SHEET NO. |
| | | 22 | VAR | | 107 |

DATE: _03/20/23_ _11:30_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties



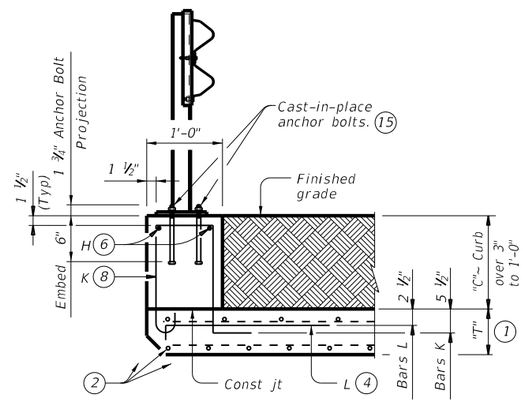

## SECTION - TYPE 1 (3)

*Used for curbs 1 ½" and Less*
*(Showing "C"= 1 ½")*



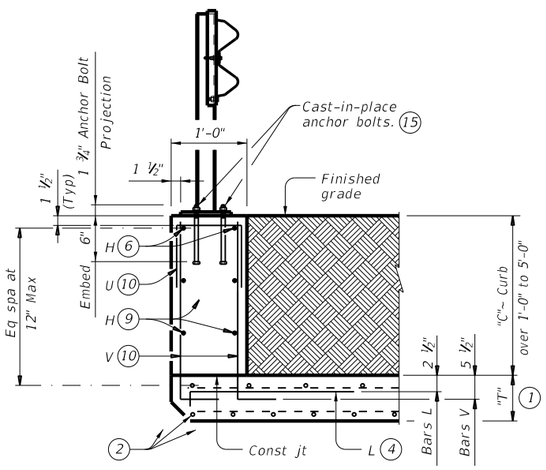

## SECTION - TYPE 2

*Used for curbs over 1 ½" to 3"*
*(Showing "C"= 3")*



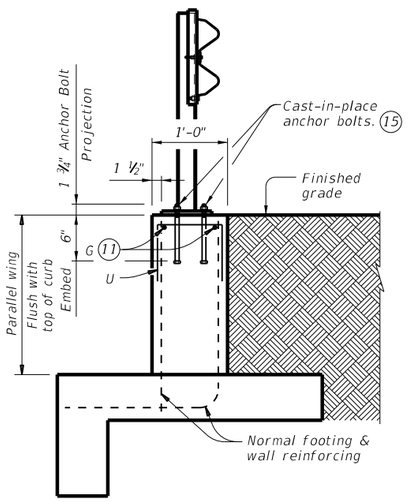

## SECTION - TYPE 3

*Used for curbs over 3" to 1'-0"*
*(Showing "C"= 1'-0")*



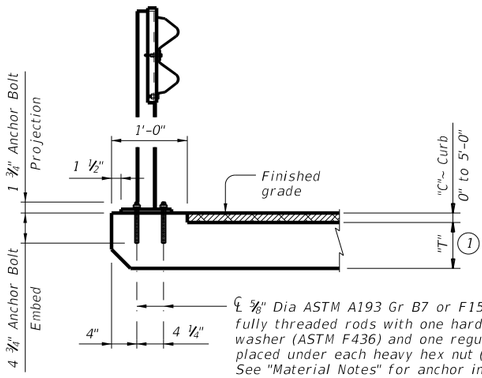

## SECTION - TYPE 4

*Used for curbs over 1'-0" to 5'-0"*
*(Showing "C"= 2'-0")*



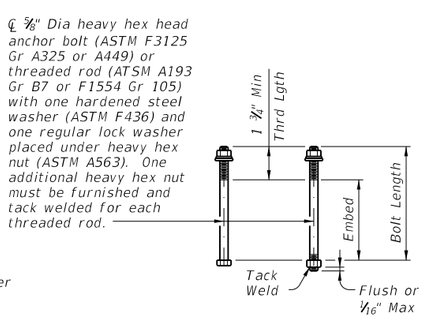

## TYPICAL SECTION THRU PARALLEL WINGWALL (15)

*Use with all curb heights shown*




## OPTIONAL ADHESIVE ANCHORAGE

*Optional adhesive anchor may replace cast-in-place anchor bolts for Type 1 thru Type 4 and on Typical Section Thru Parallel Wingwalls. Reinforcement for optional adhesive anchorage matches details shown for Type 1 thru Type 4 and on Typical Section Thru Parallel Wingwalls.*




## CAST-IN-PLACE & FORMED HOLE ANCHOR BOLT OPTIONS

*Applies to T631LS and T631 traffic rails.*

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

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

(3) *Omit normal culvert curb Bars K and H.*

(4) *Place Bars L as shown. Tilt hook as necessary to maintain cover.*

(5) *4 formed holes for anchor bolts at each rail post. See rail standard for information not shown.*

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

(7) *Omit normal culvert curb Bars K. Place Bars S as shown. Tilt Bars S as necessary to maintain cover.*

(8) *Place normal culvert curb Bars K spaced at 12" Max as shown. Tilt Bars K as necessary to maintain cover. Refer to box culvert details sheets for Bars K details.*

(9) *Additional Bars H (#4) as required to maintain 12" Max spa.*

(10) *At TYPE 4 mountings, replace normal culvert curb Bars K with one Bar U and two Bars V as shown spaced at 12" Max. Adjust length of Bars V as necessary to maintain clear cover.*

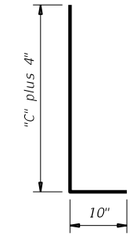
(11) *Adjust parallel wing Bars G to positions shown.*

(12) *Optional Bars L are to be used only for precast box culverts with 3'-0" closure pour.*

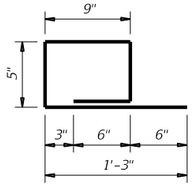
(13) *If "T" plus "C" is greater than 8", provide reinforcement per TYPE 1 mounting and anchor bolts per TYPE 2 mounting.*

(14) *Quantities shown are for Contractor's information only. Quantities are per linear foot of curb length. The values for each section type in table can be interpolated for intermediate values of curb height, "C". Quantity includes Bars K (when applicable).*

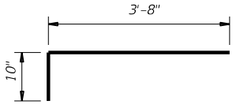
(15) *See "Cast-In-Place & Formed Hole Anchor Bolt Options".*



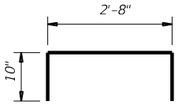

**BARS V (#5) (10)**
*Spaced at 12" Max*



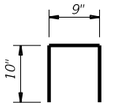

**BARS S (#4) (7)**
*Spaced at 12" Max*




**BARS L (#5) (4)(12)**
*Spaced at 12" Max*




**OPTIONAL BARS L (#5) (4)(12)**
*Spaced at 12" Max*




**BARS U (#4) (10)**
*Spaced at 12" Max*

## TABLE OF ESTIMATED CURB QUANTITIES (14)

| Curb Height "C" | Section Type | Conc (CY/LF) | Reinf Steel (Lb/LF) |
|---|---|---|---|
| 1 ½" | 1 | 0.005 | 4.7 |
| 3" | 2 | 0.009 | 8.4 |
| 6" | 3 | 0.019 | 8.9 |
| 1'-0" | 3 | 0.037 | 8.9 |
| 1'-6" | 4 | 0.056 | 14.3 |
| 2'-0" | 4 | 0.074 | 15.4 |
| 2'-6" | 4 | 0.093 | 17.7 |
| 3'-0" | 4 | 0.111 | 18.8 |
| 3'-6" | 4 | 0.130 | 21.2 |
| 4'-0" | 4 | 0.148 | 22.2 |
| 4'-6" | 4 | 0.167 | 24.6 |
| 5'-0" | 4 | 0.185 | 25.6 |

### CONSTRUCTION NOTES:

*For vehicle safety, finished grade must be flush with top of curb.*
*Adjust reinforcing as necessary to provide 1 ½" cover.*
*At the Contractor's option, anchor bolts may be an adhesive anchor system.*
*Test adhesive anchors in accordance with Item 450.3.3, "Tests". Test 3 anchors per 100 anchors installed. Perform corrective measures to provide adequate capacity if any of the tests do not meet the required test load. Repair damage from testing as directed.*

### MATERIAL NOTES:

*Provide concrete for curb of the same Class and strength as the box culvert top slab.*
*Galvanize all steel components of steel rail system.*
*Provide Grade 60 reinforcing steel.*
*Galvanize all reinforcing steel if required elsewhere.*
*Anchor bolts for base plate must be ⅝" Dia ASTM F3125 Gr A325 or A449 bolts (or ASTM A193 Gr B7 or F1554 Gr 105 threaded rods with one tack welded heavy hex nut each) with one hardened steel washer (ASTM F436) and one regular lock washer placed under each heavy hex nut. Nuts must conform to ASTM A563 requirements.*
*Optional adhesive anchor system must be ⅝" Dia ASTM A193 Gr B7 or F1554 Gr 105 fully threaded rods with one hardened steel washer (ASTM F436) and one regular lock washer placed under each heavy hex nut. Nuts must conform to ASTM A563 requirements. Embed fully threaded rod into slab and/or abutment wingwall using a Type III, Class C, D, E, or F anchor adhesive. Minimum adhesive anchor embedment depth is 4 ¾". Anchor adhesive chosen must be able to achieve a nominal bond strength in tension of a single anchor, Na, of 8 kips (edge distance must be accounted for). Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use. Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing."*

### GENERAL NOTES:

*Designed in accordance with AASHTO LRFD Bridge Design Specifications.*
*See T631LS or T631 rail standard for approved speed restrictions, notes and details not shown.*
*The curb is considered as part of the box culvert for payment.*
*These details are for use with curbs that are 5'-0" tall and less only. Curb heights that are less than or greater than those shown will require special design.*

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

**The use of the T631LS rail is restricted to speeds of 45 mph or less.**

Texas Department of Transportation

**Bridge Division Standard**

# BOX CULVERT MOUNTING DETAILS FOR TYPE T631LS & T631 RAILS (CURBS 5' TALL AND LESS ONLY)

# T631-CM

| FILE: | rlstd040-20.dgn | DN: TxDOT | CK: TxDOT | DW: JTR | CK: AES |
|---|---|---|---|---|---|
| ©TxDOT | February 2020 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | | 6439 | 16 | 001 | VAR |
| | | DIST | COUNTY | | SHEET NO. |
| | | 22 | VAR | | 108 |

DATE: _03/20/23_ _11:30_
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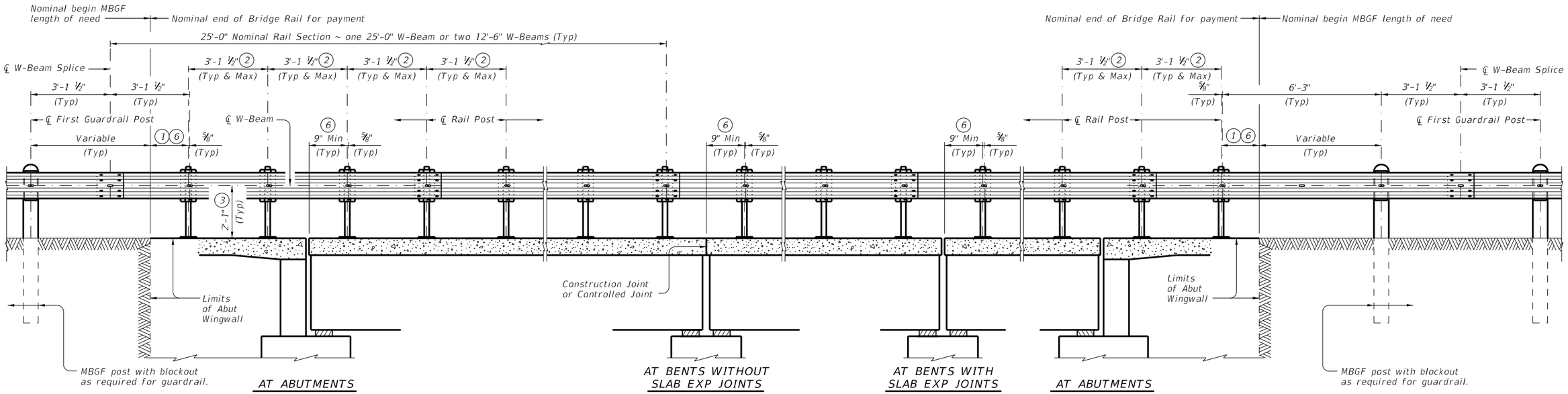
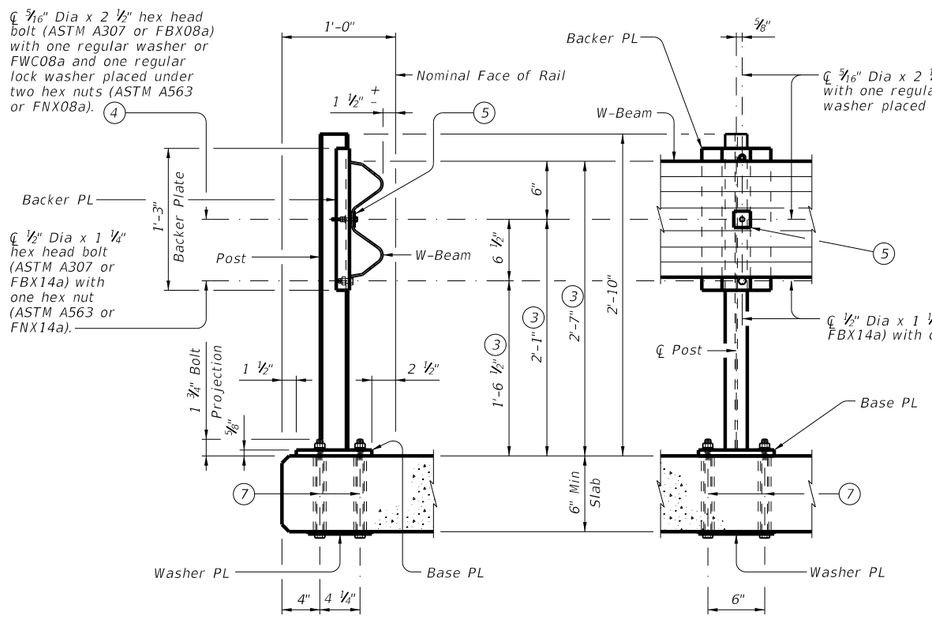



## ROADWAY ELEVATION OF RAIL

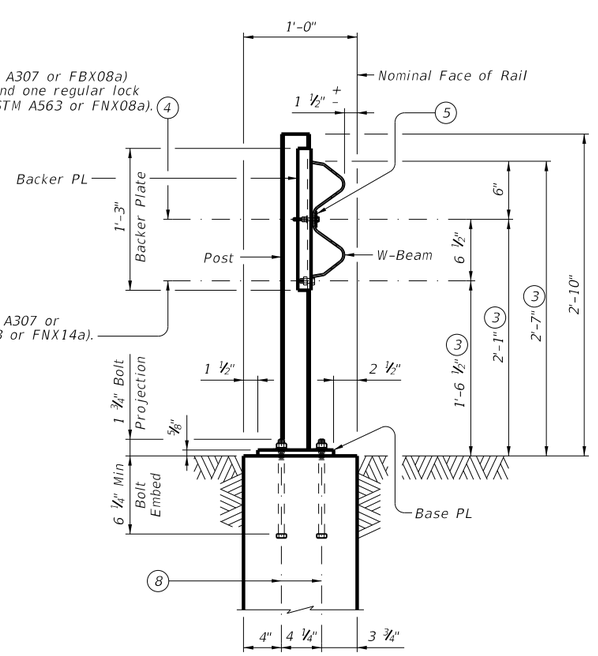
Showing without overlay.




RAIL SECTION — TRAFFIC SIDE RAIL VIEW

## RAIL DETAILS ON BRIDGE SLAB

Showing without overlay.




## RAIL SECTION ON ABUTMENT WINGWALL

Showing without overlay.

(1) 9" Min, 5'-9" Max

(2) Maintain 3'-1 ½" Rail Post spacing wherever possible for use with nominal 25'-0" or 12'-6" W-Beam sections. Symmetry of post spacing on both sides and along the structure is not necessary.

(3) Increase 2" for structures with overlay.

(4) Tighten the first hex nut by hand until the top and bottom edges of the W-Beam engage the Backer Plate (Backer Plate should be snug against the post). Then tighten hex nut one revolution with wrench and secure with the second hex nut.

(5) PL ⅛ x 1 ¾ x 1¾ with ⅞ Dia Hole centered in PL (ASTM A36). Square Guardrail Washer (FWR01).

(6) The post nearest to a slab joint or end of structure may be shifted up to 9" in order to satisfy the minimum offset dimension. Drill a new ¾" Dia hole on the centerline of W-beam for shifted post. Paint hole with two coats of zinc-rich paint conforming to the Item "Galvanizing". All other posts must remain on the typical spacing.

(7) ℄ ⅞" Dia formed holes for ℄ ⅝" Dia heavy hex head anchor bolt (ASTM F3125 Gr A325 or A449) or threaded rod (ATSM A193 Gr B7 or F1554 Gr 105) with one hardened steel washer (ASTM F436) and one regular lock washer placed under heavy hex nut (ASTM A563). One additional heavy hex nut must be furnished and tack welded for each threaded rod. See "Cast-In-Place & Formed Hole Anchor Bolt Options".

(8) ℄ ⅝" Dia heavy hex head anchor bolt (ASTM F3125 Gr A325 or A449) or threaded rod (ATSM A193 Gr B7 or F1554 Gr 105) with one hardened steel washer (ASTM F436) and one regular lock washer placed under heavy hex nut (ASTM A563). One additional heavy hex nut must be furnished and tack welded for each threaded rod. See "Cast-In-Place & Formed Hole Anchor Bolt Options".

SHEET 1 OF 2

Texas Department of Transportation

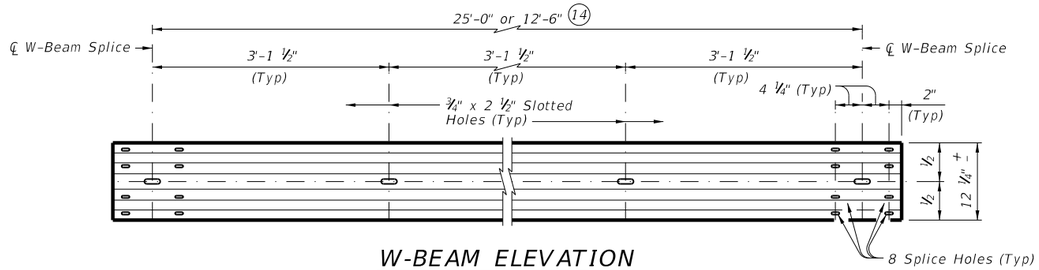
Bridge Division Standard

# TRAFFIC RAIL

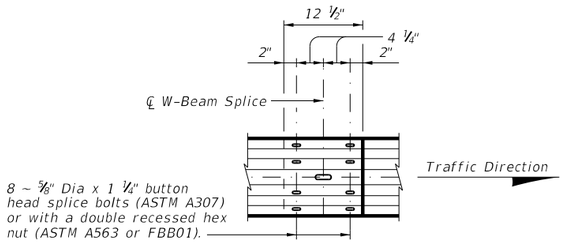
# TYPE T631

| FILE: RL-T631-23.dgn | DN: TxDOT | CK: AES | DW: JTR | CK: AES |
|---|---|---|---|---|
| ©TxDOT September 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| 07/2020: Allowing 9'-4 ½" or 6'-3" W-Beam sections. 03/2023: MBGF Notes. | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 109 |

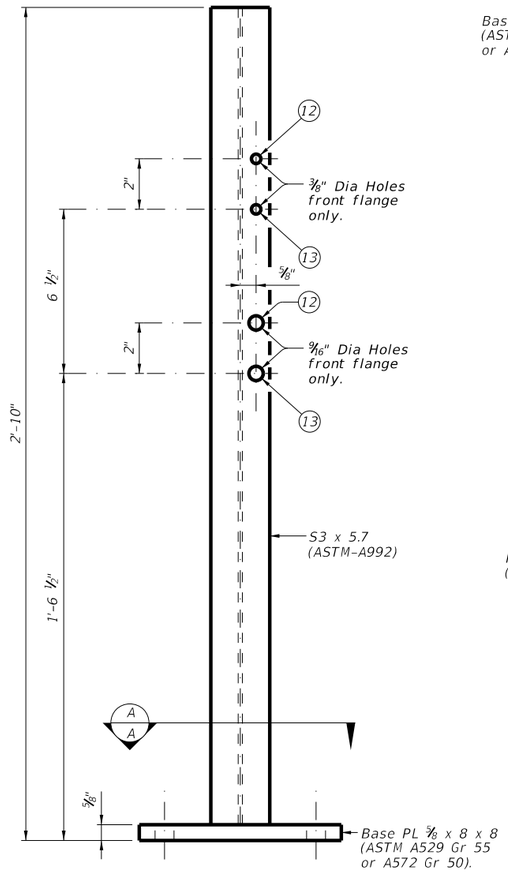
DATE: 03/20/23 11:30
FILE: LRDDSIMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties



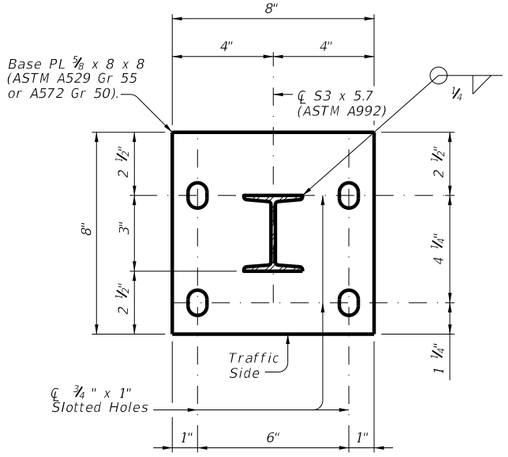

## W-BEAM ELEVATION



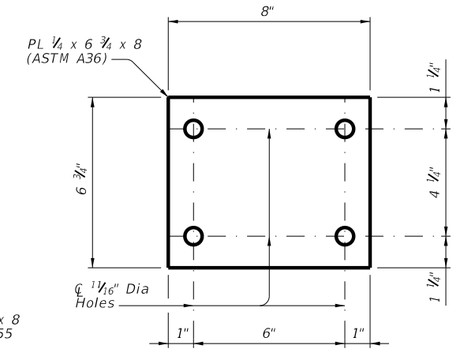

## W-BEAM SPLICE ELEVATION




## POST ELEVATION

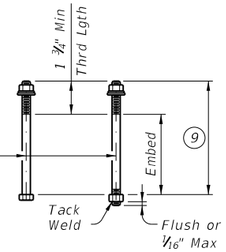



## SECTION A-A




## WASHER PLATE DETAIL

℄ ⅝" Dia heavy hex head anchor bolt (ASTM F3125 Gr A325 or A449) or threaded rod (ATSM A193 Gr B7 or F1554 Gr 105) with one hardened steel washer (ASTM F436) and one regular lock washer placed under heavy hex nut (ASTM A563). One additional heavy hex nut must be furnished and tack welded for each threaded rod.




## CAST-IN-PLACE & FORMED HOLE ANCHOR BOLT OPTIONS (10)

(9) See "Rail Details On Bridge Slab" and/or "Rail Section On Abutment Wingwall".

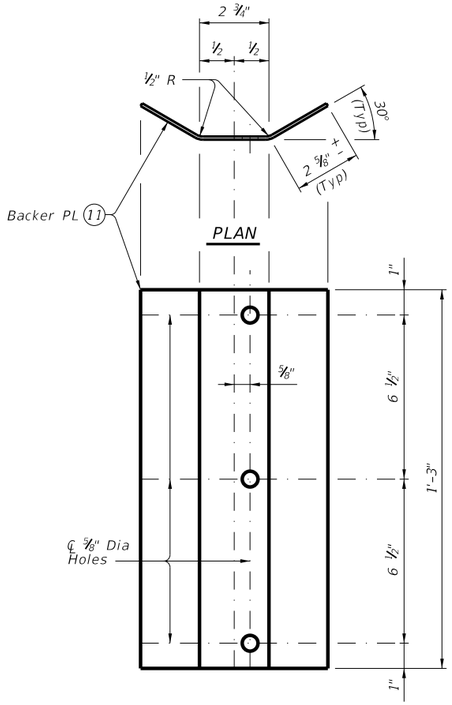
(10) See "Material Notes" for anchor bolt information.

(11) Backer PL ⅛ x 8 x 1'-3" (ASTM A1011 CS or SS Gr 33, or A1008 CS or SS Gr 33 (11 Gage acceptable)).

(12) Used for structures with overlay.

(13) Used for structures without overlay.

(14) At the nominal end of the bridge rail for payment, one 9'-4 ½" or 6'-3" W-beam section is permitted in order to achieve the required W-Beam splice location on the MBGF.




## BACKER PLATE

### MBGF AND END TREATMENT NOTES:

This traffic railing must be anchored by metal beam guard fence (MBGF) and guard fence end treatments. Determine MBGF length of need in accordance with the Roadway Design Manual, unless otherwise specified. The minimum MBGF length of need required for anchoring the railing is 25' of MBGF plus the appropriate end treatment installed tangent to the primary roadway.

### CONSTRUCTION NOTES:

Face of rail post must be plumb unless otherwise approved by the Engineer. Post must be perpendicular to adjacent roadway grade. Use epoxy mortar under post base plates if gaps larger than 1/16" exist.

Fully anchored guardrail must be attached to each end of rail. A metal beam guard fence transition is not used with this rail.

At the Contractor's option anchor bolts may be an adhesive anchor system. See "Material Notes".

Test adhesive anchors in accordance with Item 450.3.3, "Tests". Test 3 anchors per 100 anchors installed. Perform corrective measures to provide adequate capacity if any of the tests do not meet the required test load. Repair damage from testing as directed.

It is recommended to show a Rail Layout with rail posts and W-beam splices. Fabricator must submit erection drawings to the Engineer for approval.

Round or chamfer exposed edges of rail post and backer plate to approximately 1/16" by grinding.

Shop drawings are not required for this rail.

### MATERIAL NOTES:

Galvanize all steel components.

Anchor bolts for base plate must be ⅝" Dia ASTM F3125 Gr A325 or A449 bolts (or ASTM A193 Gr B7 or F1554 Gr 105 threaded rods with one tack welded heavy hex nut each) with one hardened steel washer (ASTM F436) and one regular lock washer placed under each heavy hex nut. Nuts must conform to ASTM A563 requirements.

Optional adhesive anchorage system must be ⅝" Dia ASTM A193 Gr B7 or F1554 Gr 105 fully threaded rods with one hardened steel washer (ASTM F436) and one regular lock washer placed under each heavy hex nut. Nuts must conform to ASTM A563 requirements. Embed fully threaded rod into slab and/or abutment wingwall using a Type III, Class C, D, E, or F anchor adhesive. Minimum adhesive anchor embedment depth is 4 ¾". Anchor adhesive chosen must be able to achieve a nominal bond strength in tension of a single anchor, Na, of 8 kips (edge distance must be accounted for). Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use. Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing."

W-beam must meet the requirements of Item 540, "Metal Beam Guard Fence" except as modified in the plans. The Contractor may furnish rail elements of 25'-0" or 12'-6" (Nominal) lengths and a single rail element of 9'-4 ½" or 6'-3" (Nominal) length. W-Beam must have slotted holes at 3'-1 ½".

Some part numbers from the "Task Force 13" Guide to Standardized Highway Barrier Hardware have been furnished for quick reference.

### GENERAL NOTES:

This railing has been successfully evaluated by full-scale crash test to meet MASH TL-3 criteria. This railing can be used for speeds of 50 mph and greater.

This rail is designed to deflect approximately 4' to 4'-6" as it contains and redirects the errant vehicle. This rail may not be installed on top of or behind curbs that project above finished grade, on bridges with expansion joints providing more than 5" movement, on retaining walls, or on grade separations and interchanges.

Repairs to impact-damaged post and base plate unit are not permitted. Replace all impact-damaged posts with a new post and base plate unit.

Average weight of railing with no overlay: 20 plf total.



Texas Department of Transportation

Bridge Division Standard

# TRAFFIC RAIL

# TYPE T631

| FILE: RL-T631-23.dgn | DN: TxDOT | CK: AES | DW: JTR | CK: AES |
|---|---|---|---|---|
| ©TxDOT September 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| 07/2020: Allowing 9'-4 ½" or 6'-3" W-Beam sections.<br>03/2023: MBGF Notes. | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 110 |

DATE: 03/20/23 11:30
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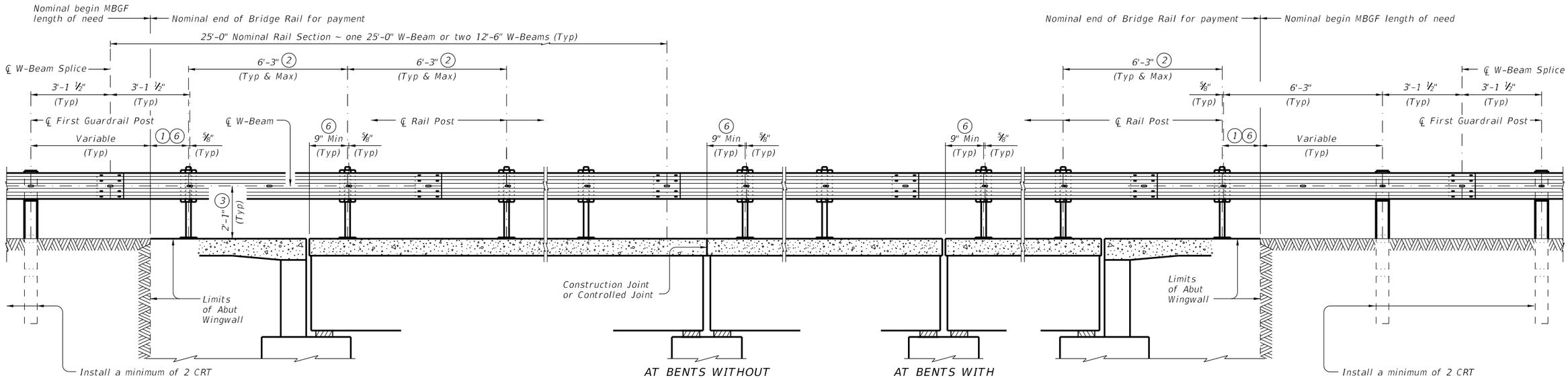
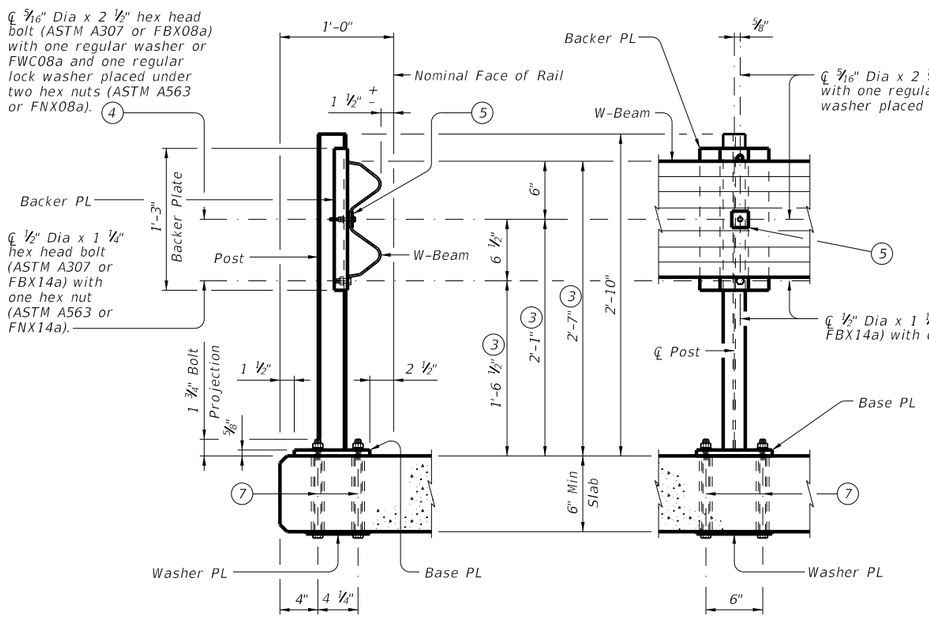



## ROADWAY ELEVATION OF RAIL

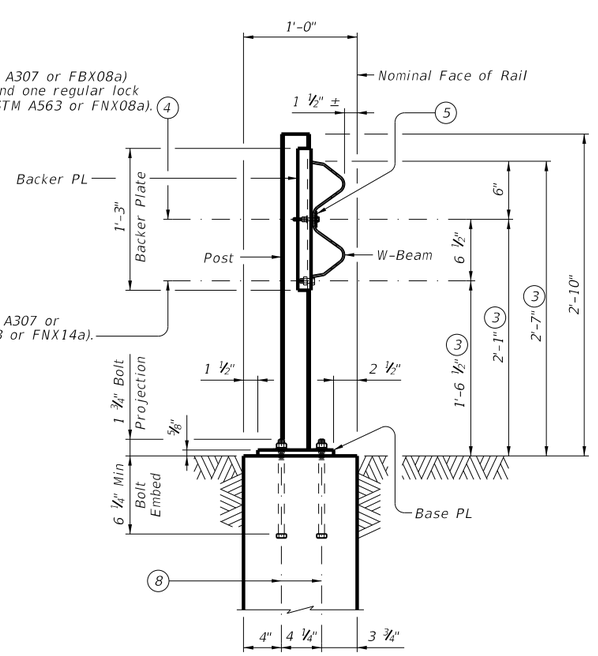
Showing without overlay.




RAIL SECTION — TRAFFIC SIDE RAIL VIEW

## RAIL DETAILS ON BRIDGE SLAB

Showing without overlay.




## RAIL SECTION ON ABUTMENT WINGWALL

Showing without overlay.

(1) 9" Min, 5'-9" Max

(2) Maintain 6'-3" Rail Post spacing wherever possible for use with nominal 25'-0" or 12'-6" W-Beam sections. Symmetry of post spacing on both sides and along the structure is not necessary.

(3) Increase 2" for structures with overlay.

(4) Tighten the first hex nut by hand until the top and bottom edges of the W-Beam engage the Backer Plate (Backer Plate should be snug against the post). Then tighten hex nut one revolution with wrench and secure with the second hex nut.

(5) PL ⅛ x 1 ¾ x 1¾ with ⅜ Dia Hole centered in PL (ASTM A36). Square Guardrail Washer (FWR01).

(6) The post nearest to a slab joint or end of structure may be shifted up to 9" in order to satisfy the minimum offset dimension. Drill a new ¾" Dia hole on the centerline of W-beam for shifted post. Paint hole with two coats of zinc-rich paint conforming to the Item "Galvanizing". All other posts must remain on the typical spacing.

(7) ℄ ⅝" Dia formed holes for ℄ ⅝" Dia heavy hex head anchor bolt (ASTM F3125 Gr A325 or A449) or threaded rod (ATSM A193 Gr B7 or F1554 Gr 105) with one hardened steel washer (ASTM F436) and one regular lock washer placed under heavy hex nut (ASTM A563). One additional heavy hex nut must be furnished and tack welded for each threaded rod. See "Cast-In-Place & Formed Hole Anchor Bolt Options".

(8) ℄ ⅝" Dia heavy hex head anchor bolt (ASTM F3125 Gr A325 or A449) or threaded rod (ATSM A193 Gr B7 or F1554 Gr 105) with one hardened steel washer (ASTM F436) and one regular lock washer placed under heavy hex nut (ASTM A563). One additional heavy hex nut must be furnished and tack welded for each threaded rod. See "Cast-In-Place & Formed Hole Anchor Bolt Options".

The use of this railing is restricted to speeds of 45 mph or less.



Texas Department of Transportation

Bridge Division Standard

# TRAFFIC RAIL

# TYPE T631LS

| FILE: RL-T631LS-23.dgn | DN: TxDOT | CK: AES | DW: JTR | CK: AES |
|---|---|---|---|---|
| ©TxDOT September 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| 07/2020: Allowing 9'-4 ½" or 6'-3" W-Beam sections. 03/2023: MBGF Notes. | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 111 |

DATE: 03/20/23 11:30
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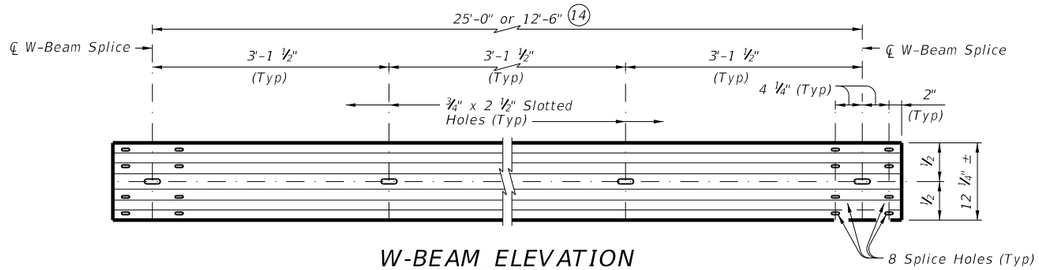
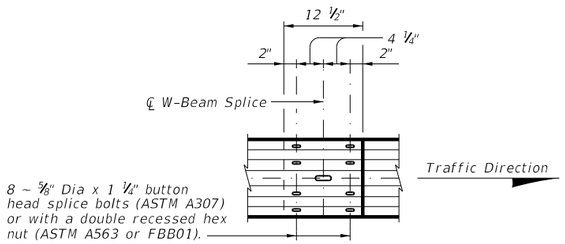
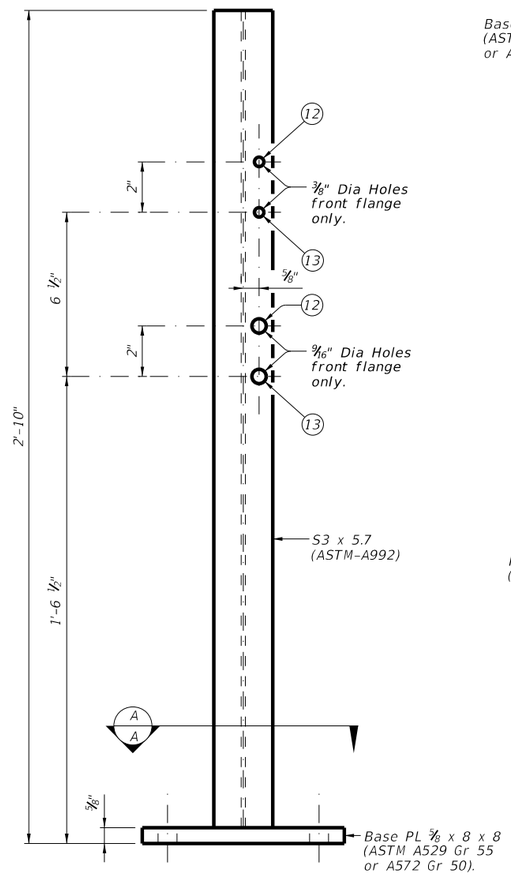


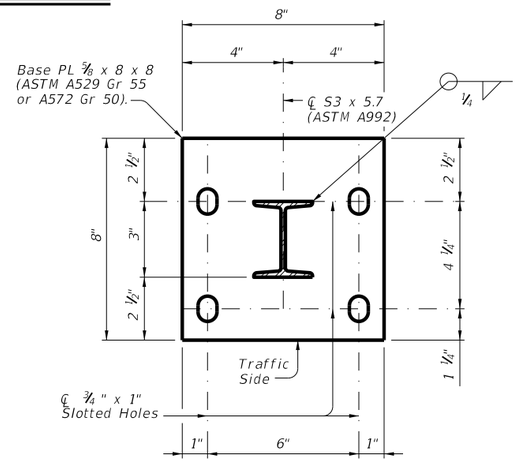

## W-BEAM ELEVATION



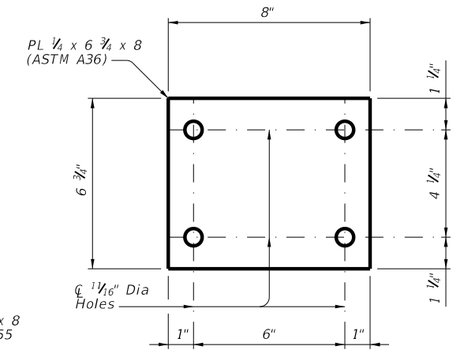

## W-BEAM SPLICE ELEVATION




## POST ELEVATION

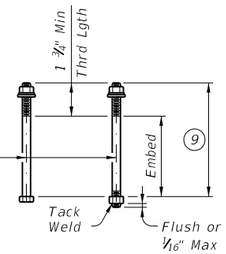



## SECTION A-A




## WASHER PLATE DETAIL

℄ ⅝" Dia heavy hex head anchor bolt (ASTM F3125 Gr A325 or A449) or threaded rod (ATSM A193 Gr B7 or F1554 Gr 105) with one hardened steel washer (ASTM F436) and one regular lock washer placed under heavy hex nut (ASTM A563). One additional heavy hex nut must be furnished and tack welded for each threaded rod.




## CAST-IN-PLACE & FORMED HOLE ANCHOR BOLT OPTIONS (10)

(9) See "Rail Details On Bridge Slab" and/or "Rail Section On Abutment Wingwall".

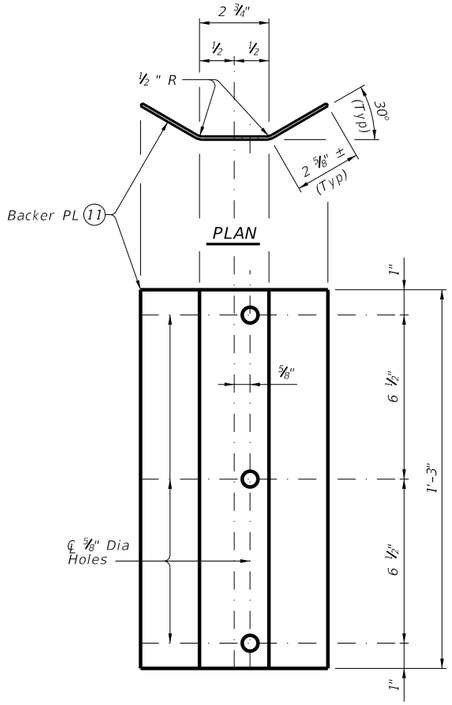
(10) See "Material Notes" for anchor bolt information.

(11) Backer PL ⅛ x 8 x 1'-3" (ASTM A1011 CS or SS Gr 33, or A1008 CS or SS Gr 33 (11 Gage acceptable)).

(12) Used for structures with overlay.

(13) Used for structures without overlay.

(14) At the nominal end of the bridge rail for payment, one 9'-4 ½" or 6'-3" W-beam section is permitted in order to achieve the required W-Beam splice location on the MBGF.




## BACKER PLATE

### MBGF AND END TREATMENT NOTES:

This traffic railing must be anchored by metal beam guard fence (MBGF) and/or guard fence end treatments. Determine MBGF length of need in accordance with the Roadway Design Manual, unless otherwise specified. The minimum MBGF length of need required for anchoring the railing is: SGT; or DAT plus 12.5' of MBGF, as applicable. Provide CRT posts as shown in "Roadway Elevation of Rail." The SGT and DAT plus 12.5' MBGF must be installed tangent to primary roadway.

### CONSTRUCTION NOTES:

Face of rail post must be plumb unless otherwise approved by the Engineer. Post must be perpendicular to adjacent roadway grade. Use epoxy mortar under post base plates if gaps larger than ¹⁄₁₆" exist.

Fully anchored guardrail must be attached to each end of rail. A metal beam guard fence transition is not used with this rail.

At the Contractor's option anchor bolts may be an adhesive anchor system. See "Material Notes".

Test adhesive anchors in accordance with Item 450.3.3, "Tests". Test 3 anchors per 100 anchors installed. Perform corrective measures to provide adequate capacity if any of the tests do not meet the required test load. Repair damage from testing as directed.

It is recommended to show a Rail Layout with rail posts and W-beam splices. Fabricator must submit erection drawings to the Engineer for approval.

Round or chamfer exposed edges of rail post and backer plate to approximately ¹⁄₁₆" by grinding.

Shop drawings are not required for this rail.

### MATERIAL NOTES:

Galvanize all steel components.

Anchor bolts for base plate must be ⅝" Dia ASTM F3125 Gr A325 or A449 bolts (or ASTM A193 Gr B7 or F1554 Gr 105 threaded rods with one tack welded heavy hex nut each) with one hardened steel washer (ASTM F436) and one regular lock washer placed under each heavy hex nut. Nuts must conform to ASTM A563 requirements.

Optional adhesive anchorage system must be ⅝" Dia ASTM A193 Gr B7 or F1554 Gr 105 fully threaded rods with one hardened steel washer (ASTM F436) and one regular lock washer placed under each heavy hex nut. Nuts must conform to ASTM A563 requirements. Embed fully threaded rod into slab and/or abutment wingwall using a Type III, Class C, D, E, or F anchor adhesive. Minimum adhesive anchor embedment depth is 4 ¾". Anchor adhesive chosen must be able to achieve a nominal bond strength in tension of a single anchor, Na, of 8 kips (edge distance must be accounted for). Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use. Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing."

W-beam must meet the requirements of Item 540, "Metal Beam Guard Fence" except as modified in the plans. The Contractor may furnish rail elements of 25'-0" or 12'-6" (Nominal) lengths and a single rail element of 9'-4 ½" or 6'-3" (Nominal) length. W-Beam must have slotted holes at 3'-1 ½".

Some part numbers from the "Task Force 13" Guide to Standardized Highway Barrier Hardware have been furnished for quick reference.

### GENERAL NOTES:

This railing has been successfully evaluated by full-scale crash test to meet MASH TL-2 criteria. This railing can be used for speeds of 45 mph and less.

This rail is designed to deflect approximately 2' to 2'-6" as it contains and redirects the errant vehicle. This rail may not be installed on top of or behind curbs that project above finished grade, on bridges with expansion joints providing more than 5" movement, on retaining walls, or on grade separations and interchanges.

Repairs to impact-damaged post and base plate unit are not permitted. Replace all impact-damaged posts with a new post and base plate unit.

Average weight of railing with no overlay: 13 plf total.



Texas Department of Transportation

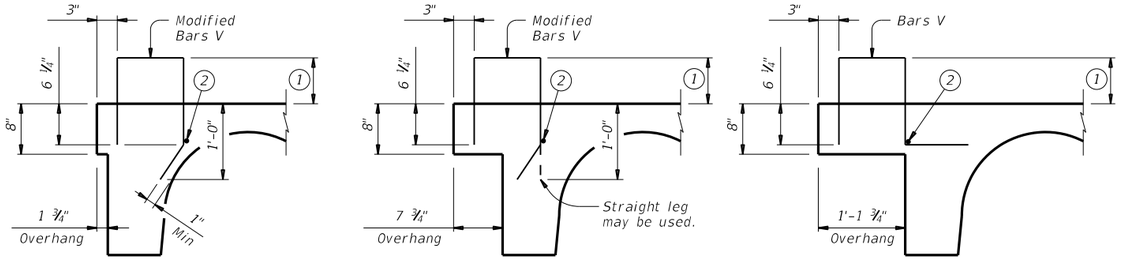
Bridge Division Standard

# TRAFFIC RAIL

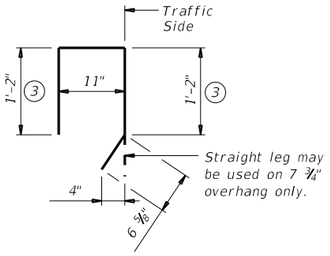
# TYPE T631LS

| FILE: RL-T631LS-23.dgn | DN: TxDOT | CK: AES | DW: JTR | CK: AES |
|---|---|---|---|---|
| ©TxDOT September 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| 07/2020: Allowing 9'-4 ½" or 6'-3" W-Beam sections. 03/2023: MBGF Notes. | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 112 |

DATE: 03/20/23 11:30
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties




T1F, T1W, T2P, C1W & C2P RAILS



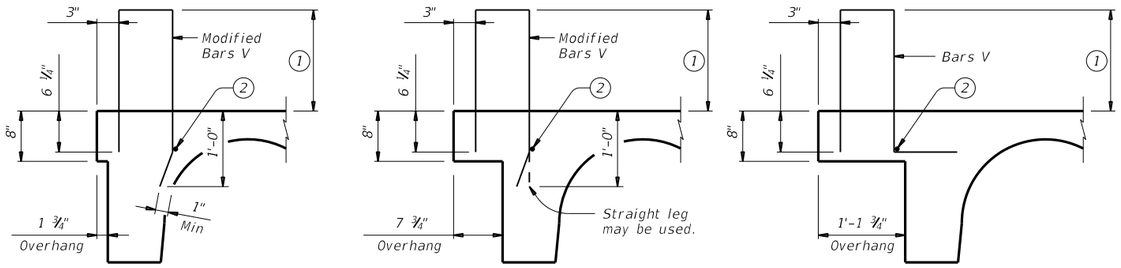

MODIFIED BARS V FOR T1F, T1W, T2P, C1W & C2P RAILS AT 1 ¾" & 7 ¾" OVERHANGS (4)

(1) See Rail standard for projection from finished grade or top of sidewalk.

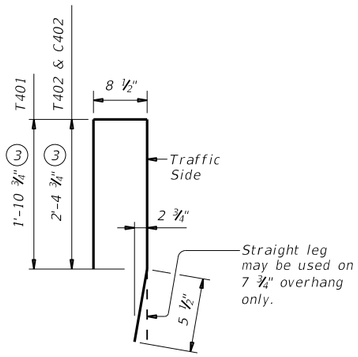
(2) Place additional #4 longitudinal bar. Bar embedded in slab must be provided by the contractor, included as part of railing reinforcement. Bar shown is required to control alignment of rail anchorage steel. Bar shown may be placed outside of slab at the contractor's option and removed after slab has cured.

(3) Length shown for 6 ¼" Min bar embedment with no overlay or raised sidewalk. Adjust as required.

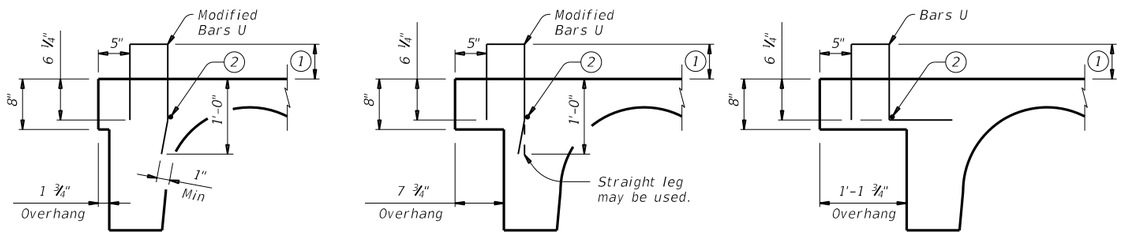
(4) See Rail standard for Bar size.



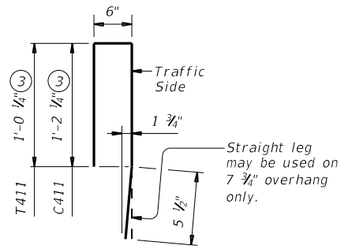

T401, T402 & C402 RAILS




MODIFIED BARS V FOR T401, T402 & C402 RAILS AT 1 ¾" & 7 ¾" OVERHANGS (4)




T411 & C411 RAILS




MODIFIED BARS U FOR T411 & C411 RAILS AT 1 ¾" & 7 ¾" OVERHANGS (4)

TYPICAL ANCHORAGE PLACEMENT

## CONSTRUCTION NOTES:

Rail anchorage bars may be field bent as required to clear rail reinforcing or to provide minimum cover shown on standard rail detail sheets.

Test adhesive anchors in accordance with Item 450.3.3, "Tests". Test 3 anchors per 100 anchors installed. Perform corrective measures to provide adequate capacity if any of the tests do not meet the required test load. Repair damage from testing as directed.

## MATERIAL NOTES:

Galvanize all steel components of steel rail system.

Provide Grade 60 reinforcing.

Cast-in-place anchor system for T631LS and T631 Rail must be ⅝" Dia ASTM F3125 Gr A325 or A449 bolts (or ASTM A193 Gr B7 or F1554 Gr 105 threaded rods with one tack welded heavy hex nut each) with one hardened steel washer (ASTM F436) and one regular lock washer placed under each heavy hex nut. Nuts must conform to ASTM A563 requirements.

Adhesive anchors for T631LS and T631 Rail must be ⅝" Dia ASTM A193 Gr B7 or F1554 Gr 105 fully threaded rods with one hardened steel washer (ASTM F436) and one regular lock washer placed under each heavy hex nut. Nuts must conform to ASTM A563 requirements. Embed fully threaded rod into slab and/or abutment wingwall using a Type III, Class C, D, E, or F anchor adhesive. Minimum adhesive anchor embedment depth is 4 ¾". Anchor adhesive chosen must be able to achieve a nominal bond strength in tension of a single anchor, Na, of 8 kips (edge distance must be accounted for). Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use. Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing."

Epoxy coat or galvanize reinforcing steel shown on this standard if rail reinforcement is epoxy coated or galvanized.

## GENERAL NOTES:

Designed in accordance with AASHTO LRFD Bridge Design Specifications.

The rail anchorage details shown on this standard are only applicable for 8" deep overhangs with the following overhang widths: 1 ¾", 7 ¾" and 1'-1 ¾".

This standard only applies to rails at the outside edge of the bridge, and not in conditions where interior rails and median barriers are used.

This standard does not support the use of Type T66, T224, T80HT, T80SS, C412, C66, PR11, PR22 and PR3 Rail on CG Span bridges.

See Rail standard sheets for approved speed restrictions, notes and details not shown.

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

# CONCRETE SLAB & GIRDER RAIL ANCHORAGE DETAILS

CGRAD

| FILE: cgradste-18.dgn | DN: TxDOT | CK: TxDOT | DW: JTR | CK: JMH |
|---|---|---|---|---|
| ©TxDOT October 2005 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6439 | 16 | 001 | VAR |
| 04-09; Updated for new rails. 07-14; Removed T101 & T6. Added T631. 03-16; T224 in general notes. 03-18; Adhesive anchorage option for T631. | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 113 |

DATE: _03/20/23_ _11:30_
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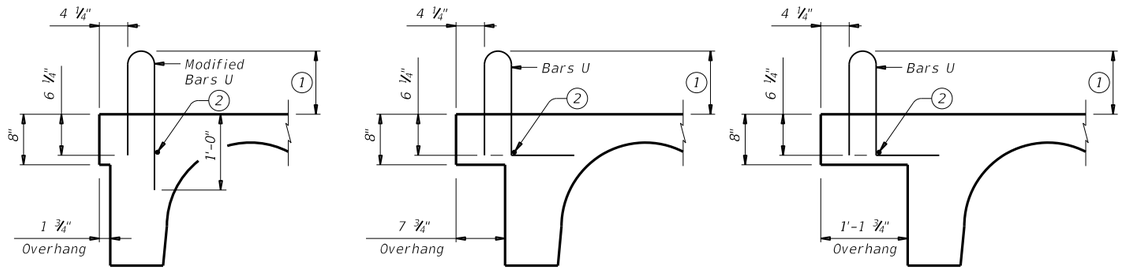
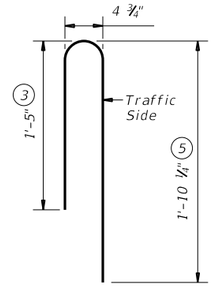
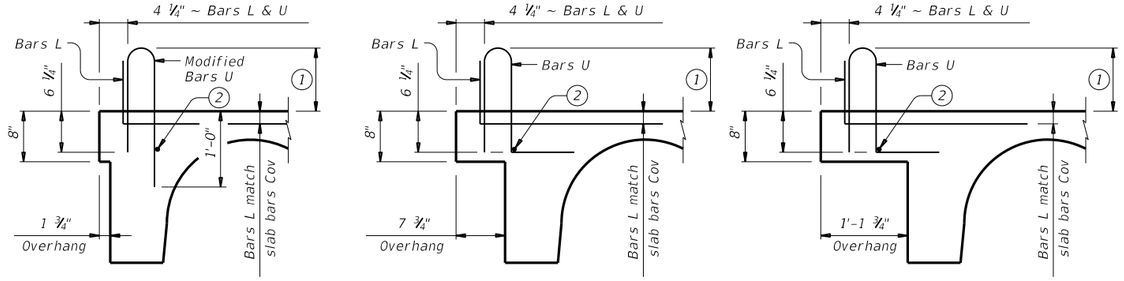


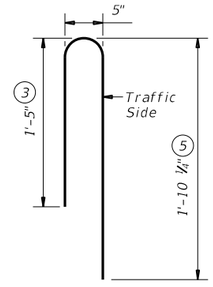

T221, T222, T551, T552, C221 & SSTR RAILS




MODIFIED BARS U
FOR T221, T222, T551, T552, C221 (4)
& SSTR RAILS AT 1 ¾" OVERHANG

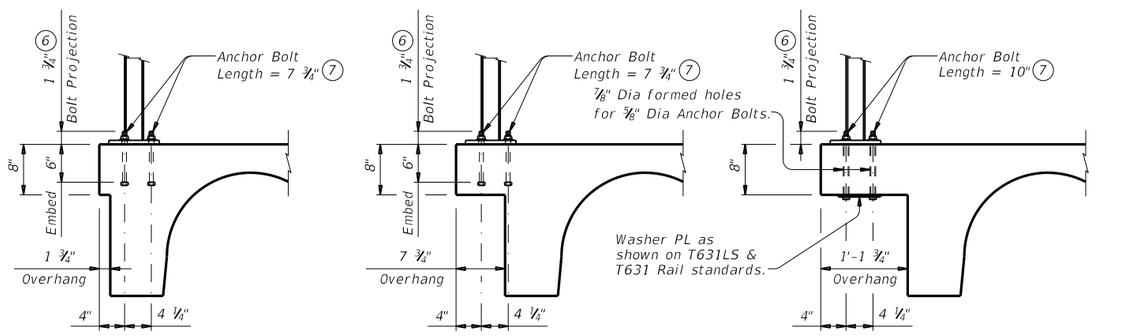



T223 & C223 RAILS

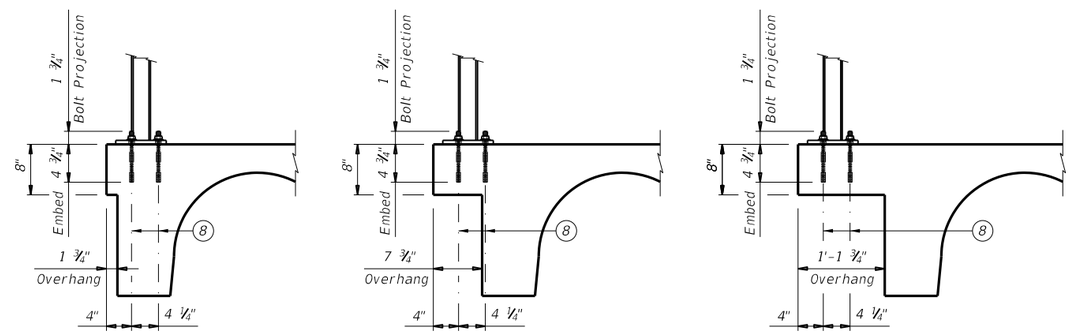



MODIFIED BARS U
FOR T223 & C223 (4)
RAILS AT 1 ¾" OVERHANG

1. See Rail standard for projection from finished grade or top of sidewalk.
2. Place additional #4 longitudinal bar. Bar embedded in slab must be provided by the contractor, included as part of railing reinforcement. Bar shown is required to control alignment of rail anchorage steel. Bar shown may be placed outside of slab at the contractor's option and removed after slab has cured.
3. Length shown for 6 ¼" Min bar embedment with no overlay or raised sidewalk. Adjust as required.
4. See Rail standard for Bar size.
5. Length shown for 1'-0" Min bar embedment with no overlay or raised sidewalk. Adjust as required.
6. After posts have been set and bolts tightened, bolt projection above nuts of more than ½" must be cut off and painted with two coats zinc-rich paint conforming to Item 445, "Galvanizing".
7. See "Cast-In-Place & Formed Hole Anchor Bolt Options".
8. ℄ ⅝" Dia ASTM A193 Gr B7 or F1554 Gr 105 fully threaded rods with one hardened steel washer (ASTM F436) and one regular lock washer placed under each heavy hex nut (ASTM A563). See "Material Notes" for installation.

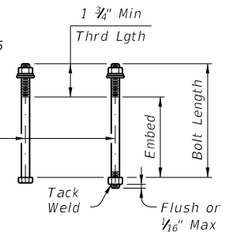



T631LS & T631 RAILS CAST-IN-PLACE ANCHOR OPTION




T631LS & T631 RAILS ADHESIVE ANCHOR OPTION

℄ ⅝" Dia heavy hex head anchor bolt (ASTM F3125 Gr A325 or A449) or threaded rod (ATSM A193 Gr B7 or F1554 Gr 105) with one hardened steel washer (ASTM F436) and one regular lock washer placed under heavy hex nut (ASTM A563). One additional heavy hex nut must be furnished and tack welded for each threaded rod.




CAST-IN-PLACE & FORMED
HOLE ANCHOR BOLT OPTIONS

Applies to T631LS and T631 traffic rails.

TYPICAL ANCHORAGE PLACEMENT



Texas Department of Transportation

Bridge Division Standard

# CONCRETE SLAB & GIRDER RAIL ANCHORAGE DETAILS

CGRAD

| FILE: cgradste-18.dgn | DN: TxDOT | CK: TxDOT | DW: JTR | CK: JMH |
|---|---|---|---|---|
| ©TxDOT October 2005 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS<br>04-09; Updated for new rails.<br>07-14; Removed T101 & T6. Added T631.<br>03-16; T224 in general notes.<br>03-18; Adhesive anchorage option for T631. | 6439 | 16 | 001 | VAR |
| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 114 |

DATE: _03/20/23_ _11:30_
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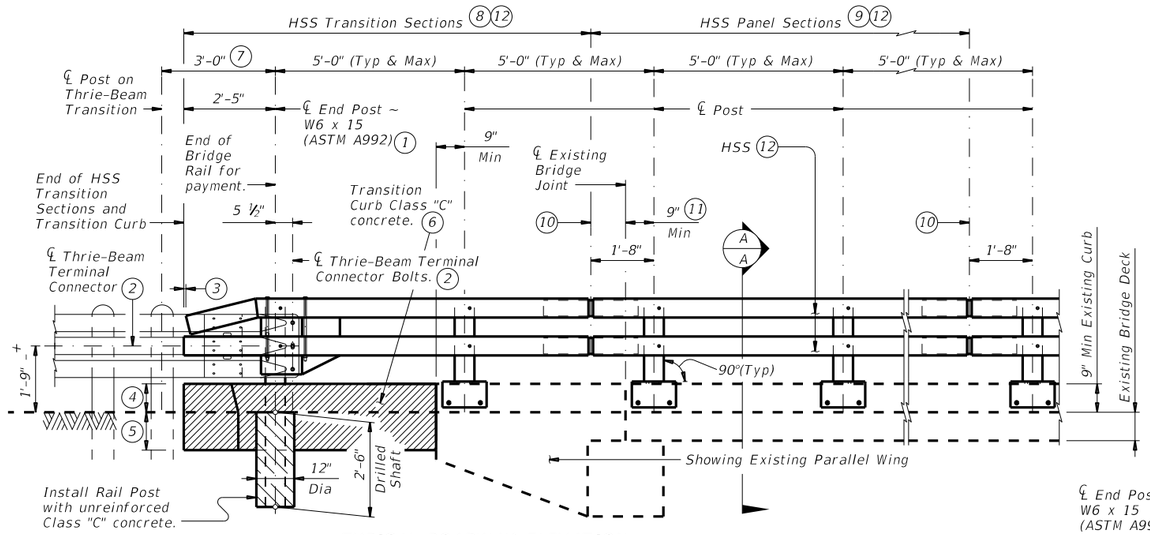
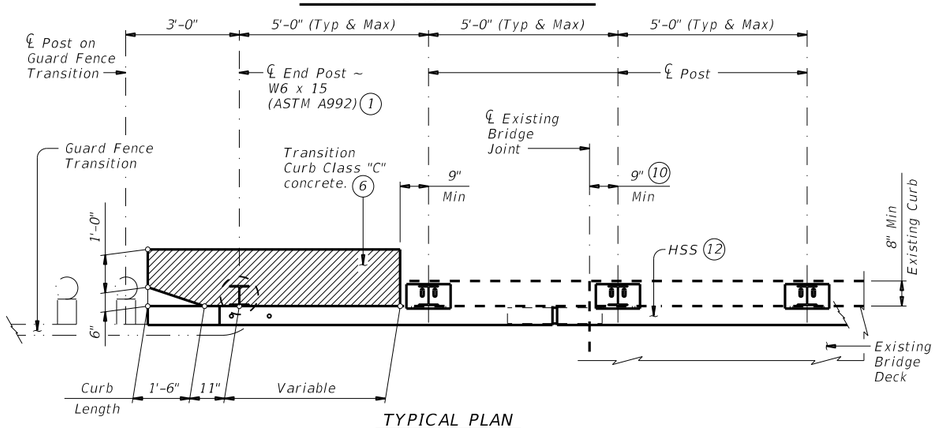



TYPICAL ROADWAY ELEVATION




TYPICAL PLAN

# EXAMPLE "A" RETROFIT WITH PARALLEL WING

(Showing 9" high and 8" wide curbs, higher and wider curbs similar)

(1) Post length = Top of rail elevation minus bottom of drilled shaft elevation.

(2) Terminal Connectors and associated hardware are to be paid for under the Item "Metal Beam Guard Fence". Attach the appropriate Metal Beam Guard Fence Transitions or Downstream Anchor Terminal to the bridge rail using 3 bolts as shown, and extend along the embankment.

(3) Top HSS can be shorter than bottom HSS ⅝" plus or minus.

(4) Match existing bridge curb height.

(5) Cast transition curb 1'-0" into soil or top of concrete approach slab. Remove any asphaltic concrete or mow strip if present.

(6) Match existing bridge curb face on traffic side of transition curb. Transition curb 6" x 1'-6" taper will remain vertical.

(7) Showing first post for a TL-3 rated guard fence transition. First post for a TL-2 rated guard fence transition or a guard fence downstream anchor terminal is 4'-4 ¾".

(8) HSS Transition Sections must have one soil mounted end post embedded in an unreinforced, Class "C" concrete drilled shaft as shown, and a minimum of one curb mounted post per transition section.

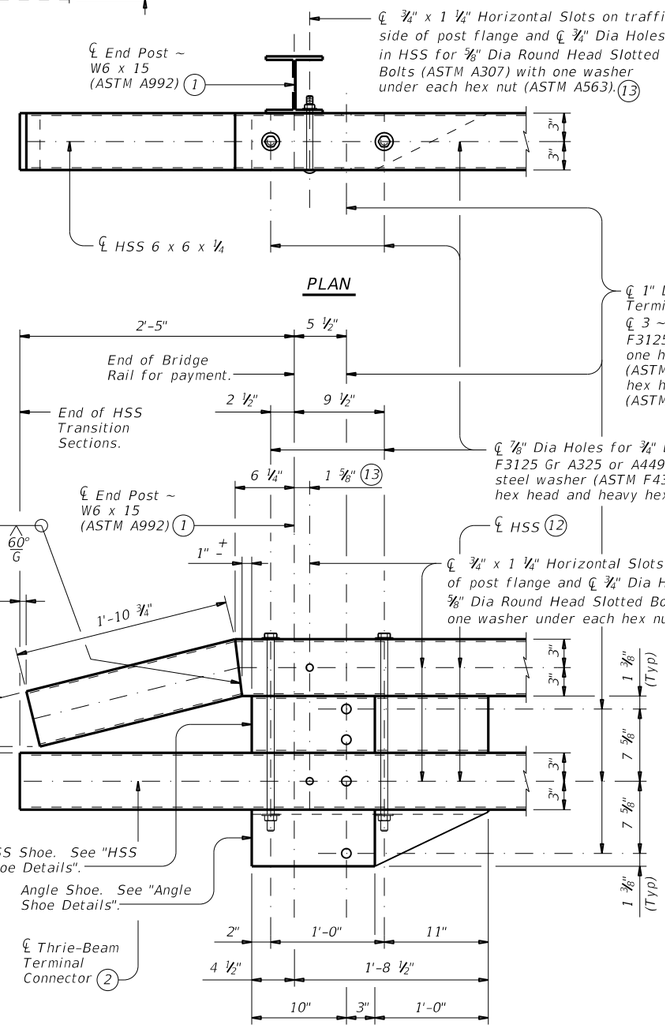
(9) HSS Panel Sections must have a minimum of three posts and a maximum of eight posts per panel section.

(10) ℄ HSS Expansion Joint or ℄ HSS Splice Joint as required.

(11) Use 9" minimum for both expansion joints and construction/controlled joints.

(12) HSS 6 x 6 x ¼ (ASTM A1085 or A500 Gr C).

(13) May be placed on either side of W6 x 15 web.




ROADWAY ELEVATION

# HSS TRANSITION SECTION END DETAILS

Thrie-Beam Terminal Connector not shown for clarity.

## CONSTRUCTION NOTES:

Field verify dimensions before commencing work and ordering materials.

Provide Type VIII epoxy mortar under post base plates if gaps larger than 1/16" exist.

One shop splice per rail member section is permitted with minimum 85 percent penetration.
The weld may be square groove or single vee groove.

Round or chamfer exposed edges of HSS rail, rail post and plate to approximately 1/16" by grinding.

Test adhesive anchors in accordance with Item 450.3.3, "Tests". Test 3 anchors per 100 anchors installed. Perform corrective measures to provide adequate capacity if any of the tests do not meet the required test load. Repair damage from testing as directed.

Submit erection drawings showing panel lengths, splice locations, post placement, anchor bolt locations and adhesive anchor test data to demonstrate pullout strength to the Engineer for approval. Shop drawings are not required.

## MATERIAL NOTES:

Galvanize all metal components of steel rail system.

Provide Grade 60 reinforcing steel.

Provide Class "C" concrete. As an alternate, provide Class "K" concrete, or a Type A-2 or Type C concrete repair material per DMS-4655 "Concrete Repair Materials". Do not use Type "B" (Ultra-Rapid) concrete repair materials.

Anchor bolts must be ¾" Dia ASTM A193 Gr B7 or ASTM A449 fully threaded rods with one heavy hex nut and one hardened steel washer (ASTM F436) each. Nuts must conform to ASTM A563 requirements. Embed fully threaded rods into concrete curb using a Type III, Class C, D, E, or F anchor adhesive. Minimum adhesive anchor embedment depth is 6 ¾". Anchor adhesive chosen must be able to achieve a basic bond strength in tension, Nba, of 30 kips. Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use. Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing".

## GENERAL NOTES:

This retrofit railing has been successfully evaluated by full-scale crash test to meet MASH TL-3 criteria. This retrofit railing 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.

Rail anchorage details shown on this guide may require modification for select structure types.

See "Section A-A" for limits on existing overlay/seal coats thickness based on existing curb height.

This rail is to be paid for as "Retrofit Rail (Ty T131RC)" under Item 451 "Retrofit Railing".

Average weight with no overlay: 55 plf (9", 11" & 12" Curbs)
53 plf (18" Curbs)

Cover dimensions are clear dimensions, unless noted otherwise.

This sheet is to be used as a guide for preparing project-specific details to retrofit existing curbed structures. Details with appropriate notes from this guide should be prepared for the specific application. Dimensions of existing slab thickness, curb widths, curb heights, curb slopes, and overlay/seal coats thickness, must be shown. Particular care should be taken in identifying the bridge abutment wingwall conditions and providing for proper reinforcement anchorage and approach guard fence post positioning. This sheet may not be used without modification. The details shown may need to be amended if the exact existing condition is not covered. In all cases, details and notes not required must be crossed out or eliminated, "(MOD)" added, the phrase "(Not to be used as a standard)" removed, and the sheet sealed and signed.



Texas Department of Transportation

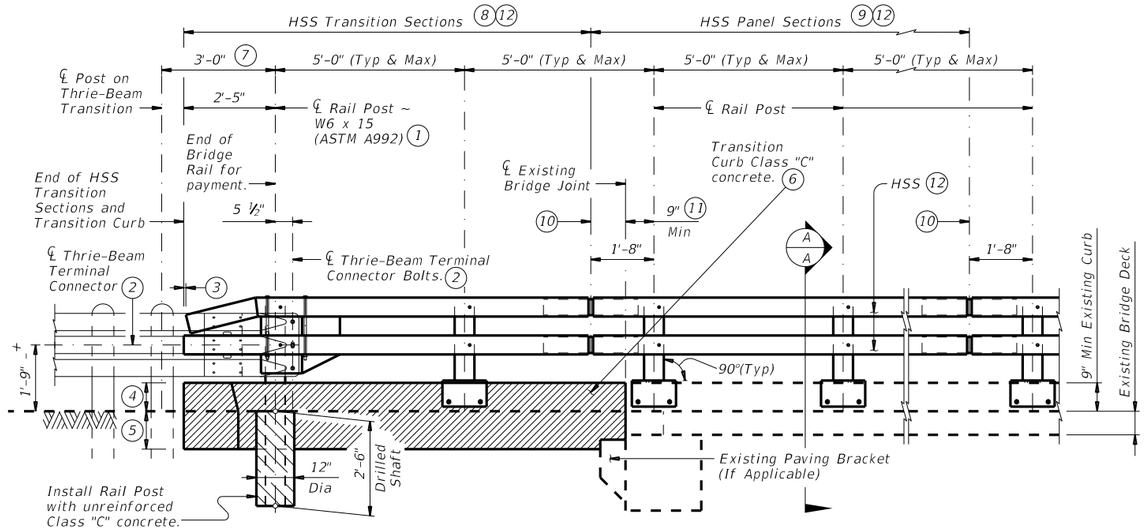
Bridge Division Standard

# RETROFIT GUIDE FOR T131RC RAIL ON CURBS

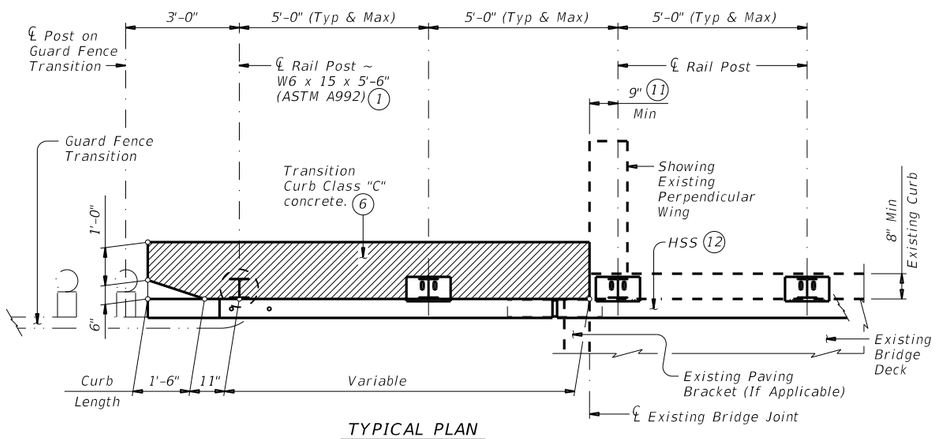
(NOT TO BE USED AS A STANDARD)

# TYPE T131RC

| FILE: | r1std034-19.dgn | DN: TxDOT | CK: JMH | DW: JTR | CK: MAS |
|---|---|---|---|---|---|
| ©TxDOT | September 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | | 6439 | 16 | 001 | VAR |
| | | DIST | COUNTY | | SHEET NO. |
| | | 22 | VAR | | 115 |




TYPICAL ROADWAY ELEVATION

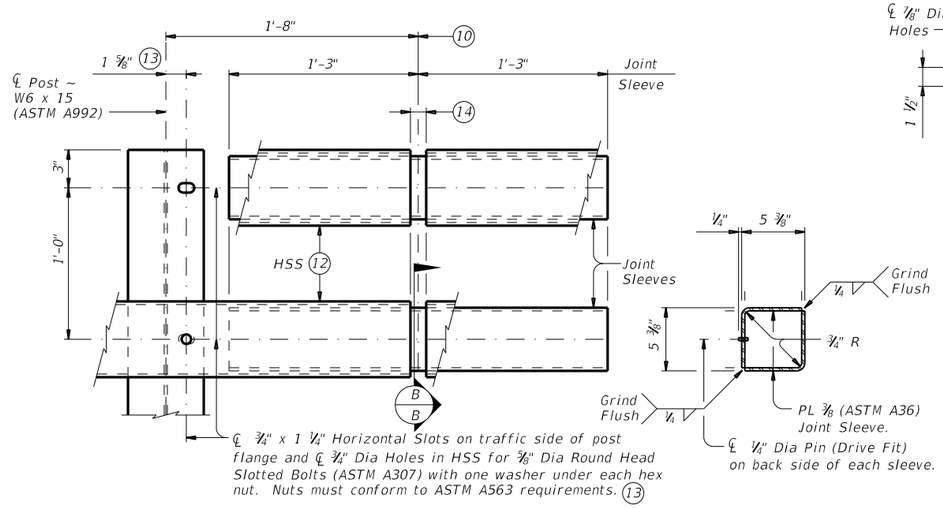



TYPICAL PLAN

## EXAMPLE "B" RETROFIT WITH PERPENDICULAR WING

(Showing 9" high and 8" wide curbs, higher and wider curbs similar)

1. Post length = Top of rail elevation minus bottom of drilled shaft elevation.
2. Terminal Connectors and associated hardware are to be paid for under the Item "Metal Beam Guard Fence". Attach the appropriate Metal Beam Guard Fence Transitions or Downstream Anchor Terminal to the bridge rail using 3 bolts as shown, and extend along the embankment.
3. Top HSS can be shorter than bottom HSS ⅝" plus or minus.
4. Match existing bridge curb height.
5. Cast transition curb 1'-0" into soil or top of concrete approach slab. Remove any asphaltic concrete or mow strip if present.
6. Match existing bridge curb face on traffic side of transition curb. Transition curb 6" x 1'-6" taper will remain vertical.
7. Showing first post for a TL-3 rated guard fence transition. First post for a TL-2 rated guard fence transition or a guard fence downstream anchor terminal is 4'-4 ¾".
8. HSS Transition Sections must have one soil mounted end post embedded in an unreinforced, Class "C" concrete drilled shaft as shown, and a minimum of one curb mounted post per transition section.
9. HSS Panel Sections must have a minimum of three posts and a maximum of eight posts per panel section.
10. ℄ HSS Expansion Joint or ℄ HSS Splice Joint as required.
11. Use 9" minimum for both expansion joints and construction/controlled joints.
12. HSS 6 x 6 x ¼ (ASTM A1085 or A500 Gr C).
13. May be placed on either side of W6 x 15 web.
14. Place HSS Expansion Joints in rail at every slab Expansion Joint. For Expansion and Splice Joints openings, use the greater of 1" or (slab opening plus ½").



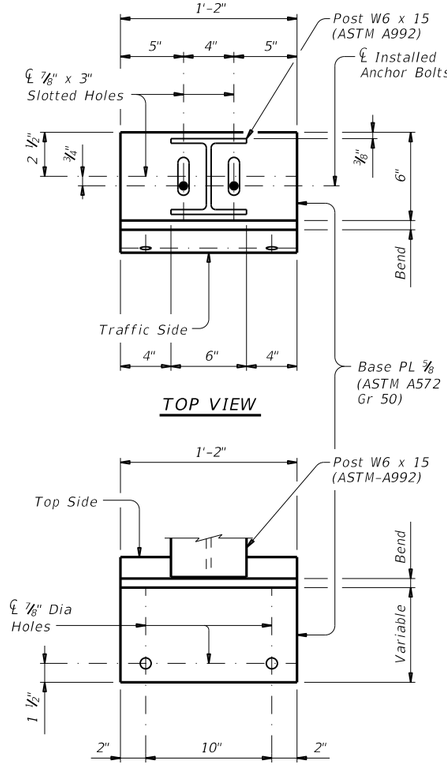

## TYPICAL POST CONNECTION AND SPLICE DETAIL FOR HSS

Showing post with HSS and HSS splice.




## SECTION B-B

Showing typical joint sleeve.

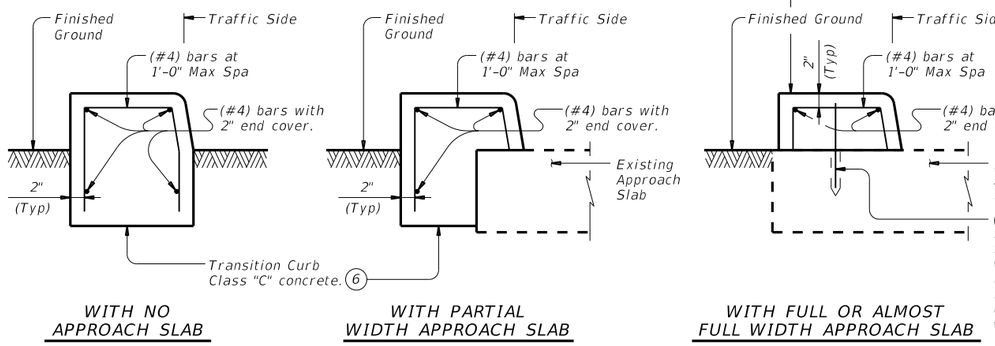



TOP VIEW




FRONT VIEW

## BASE PLATE DETAILS




(#4) anchor bars spaced longitudinally along new curb at 1'-6" Max (Spaced 3" longitudinally from outside edge). Embed (#4) anchor bars with a Type III Class C, D, E, or F anchor adhesive. Minimum adhesive anchor embedment is 5". Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing".

## EXAMPLES OF TRANSITION CURB SECTIONS

DATE: _03/20/23_ _11:30_
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Texas Department of Transportation — Bridge Division Standard

# RETROFIT GUIDE FOR T131RC RAIL ON CURBS

(NOT TO BE USED AS A STANDARD)

## TYPE T131RC

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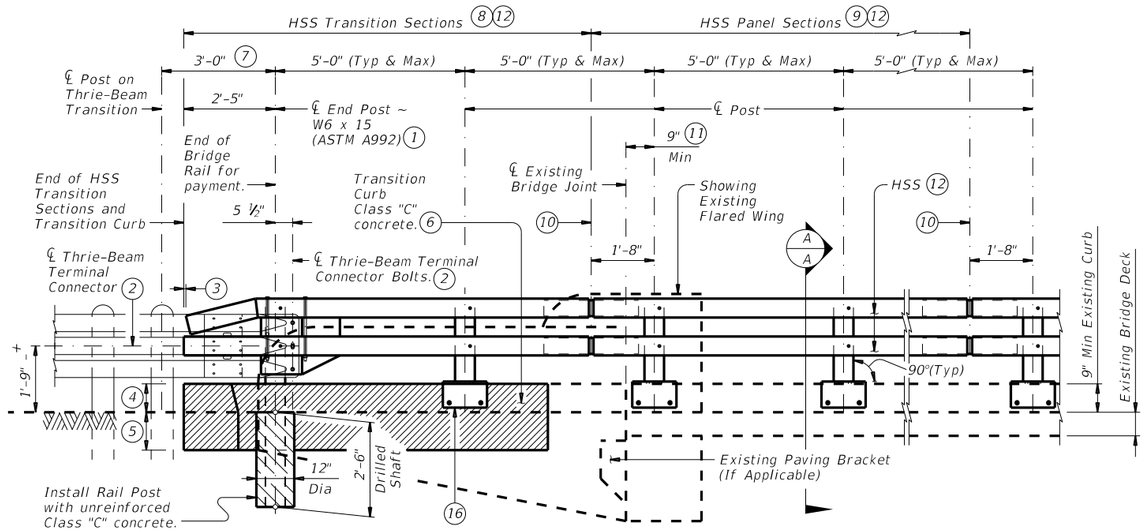
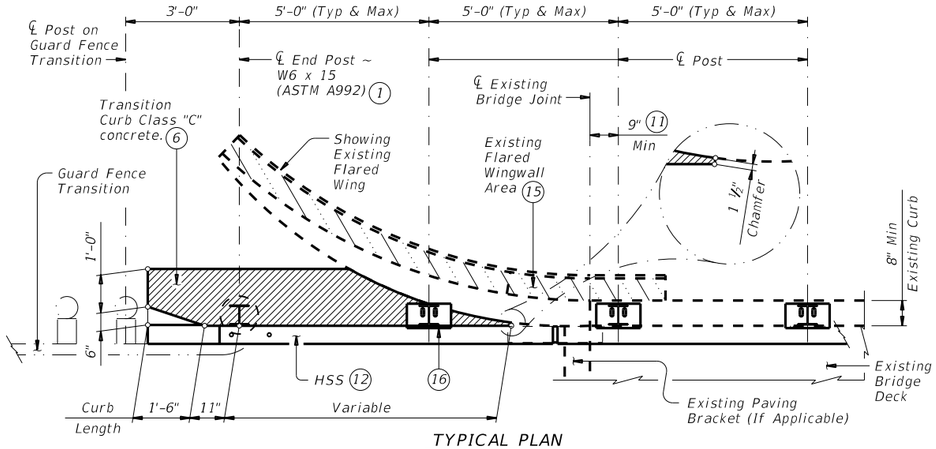


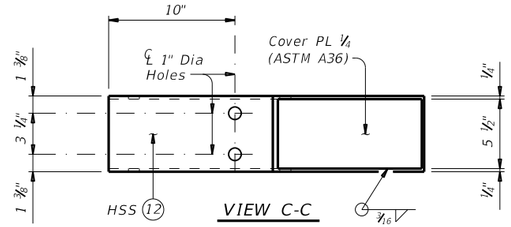

TYPICAL ROADWAY ELEVATION

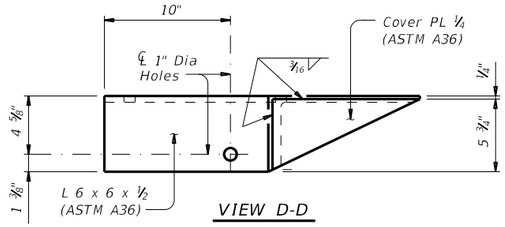


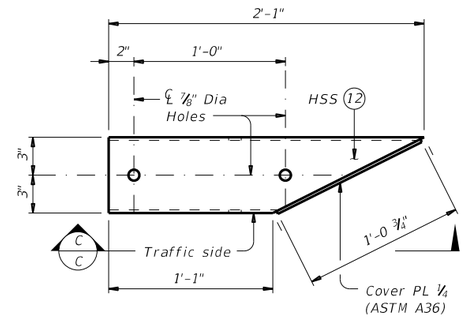

TYPICAL PLAN

## EXAMPLE "C" RETROFIT WITH FLARED WING

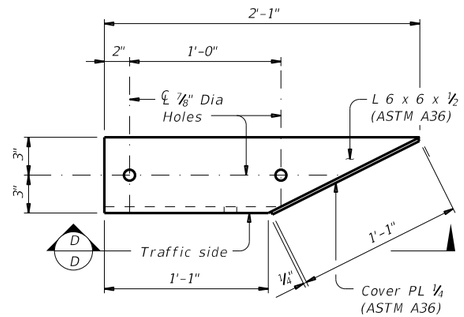
(Showing 9" high and 8" wide curbs, higher and wider curbs similar)




TOP VIEW




TOP VIEW

## HSS SHOE DETAILS

## ANGLE SHOE DETAILS

Angle Shoe shown is detailed for one side only, other side similar. For other side shoe must be built for opposite hand.

(1) Post length = Top of rail elevation minus bottom of drilled shaft elevation.

(2) Terminal Connectors and associated hardware are to be paid for under the Item "Metal Beam Guard Fence". The appropriate Metal Beam Guard Fence Transitions or Downstream Anchor Terminal must be attached to the bridge rail and extended along the embankment.

(3) Top HSS can be shorter than bottom HSS ⅝" plus or minus.

(4) Match existing bridge curb height.

(5) Cast transition curb 1'-0" into soil or top of concrete approach slab. Remove any asphaltic concrete or mow strip if present.

(6) Match existing bridge curb face on traffic side of transition curb. Transition curb 6" x 1'-6" taper will remain vertical.

(7) Showing first post for a TL-3 rated guard fence transition. First post for a TL-2 rated guard fence transition or a guard fence downstream anchor terminal is 4'-4 ¾".

(8) HSS Transition Sections must have one soil mounted end post embedded in an unreinforced, Class "C" concrete drilled shaft as shown, and a minimum of one curb mounted post per transition section.

(9) HSS Panel Sections must have a minimum of three posts and a maximum of eight posts per panel section.

(10) ℄ HSS Expansion Joint or ℄ HSS Splice Joint as required.

(11) Use 9" minimum for both expansion joints and construction/controlled joints.

(12) HSS 6 x 6 x ¼ (ASTM A1085 or A500 Gr C).

(15) Remove all existing structure area from top of existing curb. Cut and grind flush all existing reinforcing extending from top of existing curb and paint ends with two coats of zinc-rich paint conforming to the Item "Galvanizing".

(16) When post is mounted to the transition curb on flared wings as shown, transition curb must be supported laterally by the existing wingwall/curb.



Texas Department of Transportation

Bridge Division Standard

# RETROFIT GUIDE FOR T131RC RAIL ON CURBS

(NOT TO BE USED AS A STANDARD)

## TYPE T131RC

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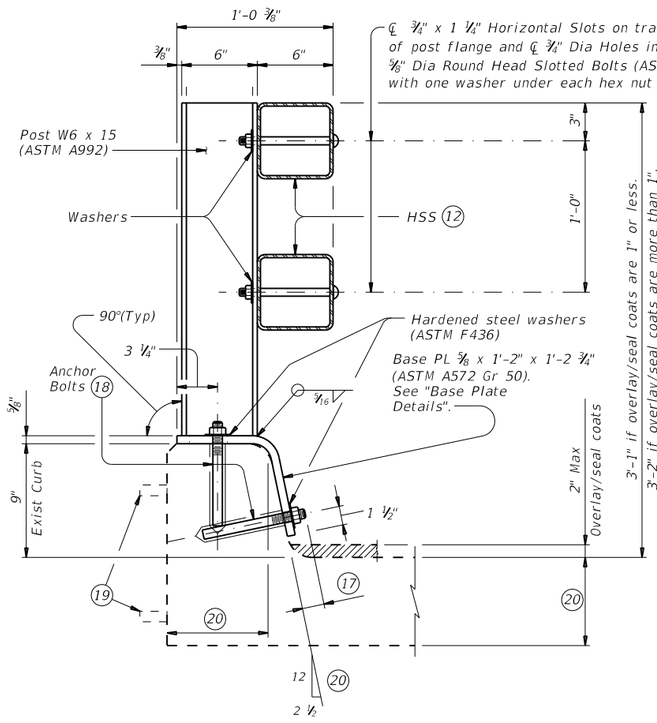
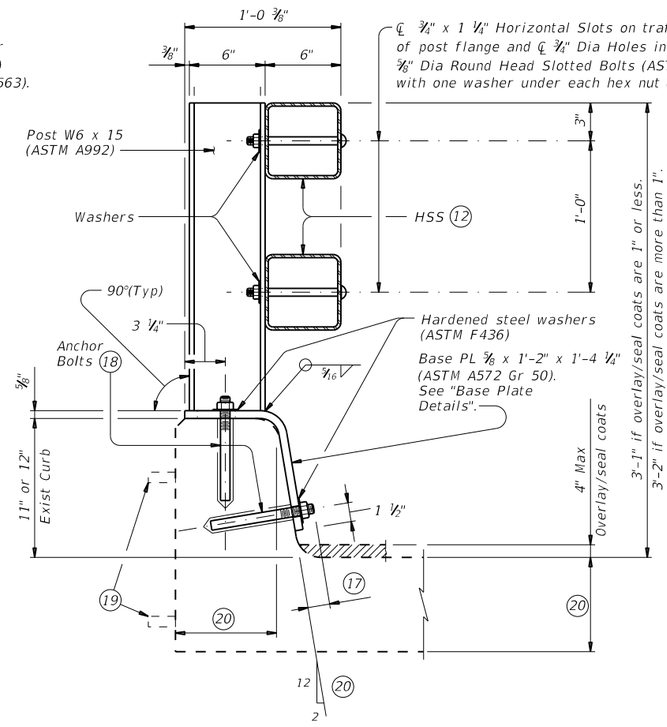


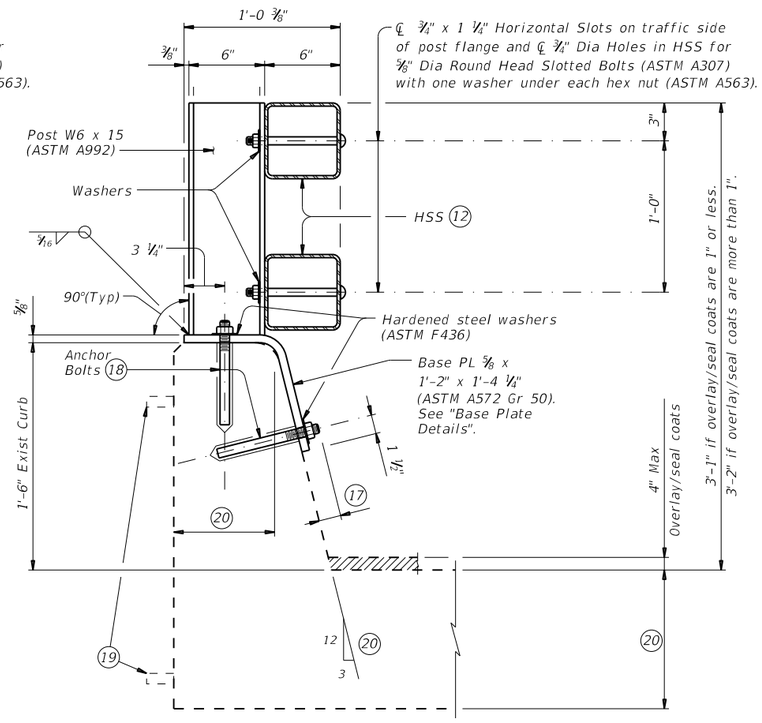

## SECTION A-A OF 9" HIGH CURBS

(Showing example of 8" Min width curb, wider curbs similar)



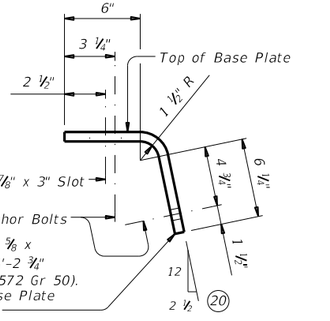

## SECTION A-A OF 11" & 12" HIGH CURBS

(Showing example of 8" Min width curb, wider curbs similar)

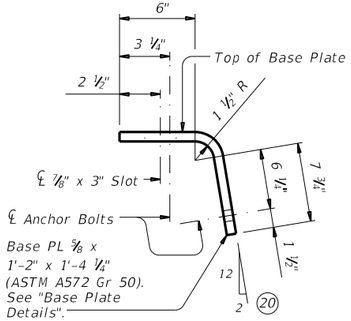



## SECTION A-A OF 18" HIGH CURBS

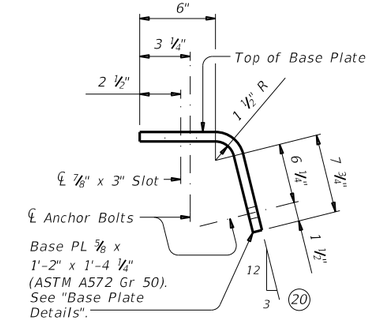
(Showing example of 8" Min width curb, wider curbs similar)




## 9" HIGH CURB BASE PLATE DETAIL




## 11" & 12" HIGH CURB BASE PLATE DETAIL




## 18" HIGH CURB BASE PLATE DETAIL

(12) HSS 6 x 6 x 1/4 (ASTM A1085 or A500 Gr C).

(17) 1 3/4" Bolt Projection (Typ).

(18) See "Material Notes" for anchor Bolt information.

(19) Remove existing railing (including posts), cut and grind anchor bolts flush and paint ends with two coats of zinc-rich paint conforming to the Item "Galvanizing".

(20) See elsewhere in plans for dimensions (curb width and height, slab and overlay thickness). Slope of curb may differ from what is shown. Adjust base plate as necessary to conform to curb face geometry.



Texas Department of Transportation

Bridge Division Standard

# RETROFIT GUIDE FOR T131RC RAIL ON CURBS

(NOT TO BE USED AS A STANDARD)

## TYPE T131RC

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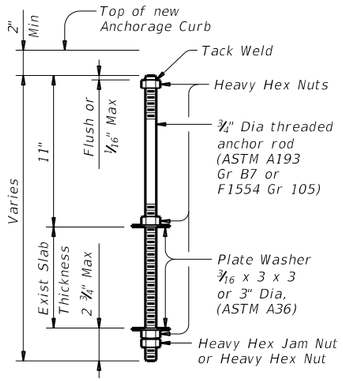
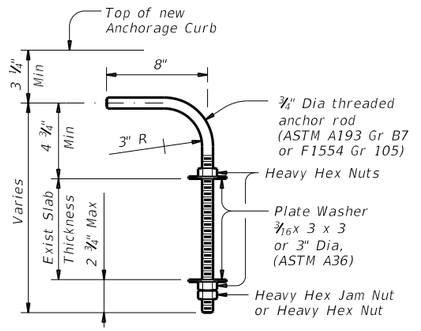
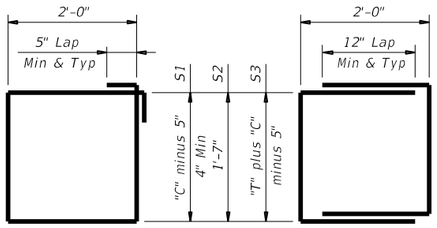



STRAIGHT ANCHOR (9)



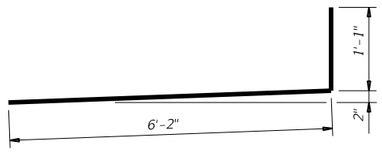

HOOKED ANCHOR (9)

## ANCHOR DETAILS

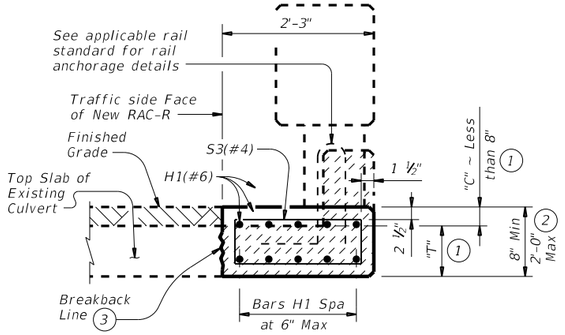



BARS S (#4)

OPTIONAL BARS S (#4)

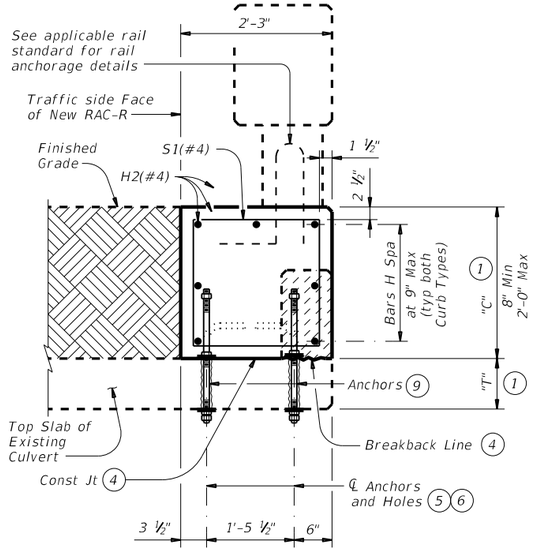



BARS L (#5)



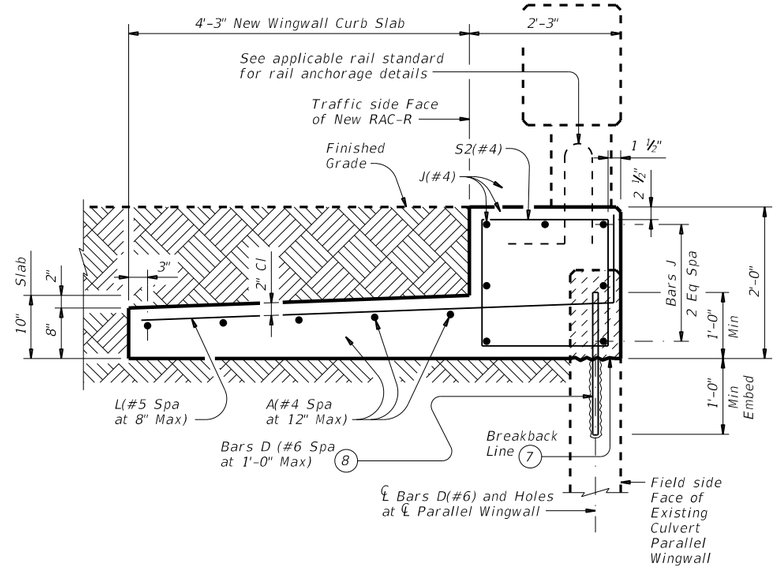

## TYPICAL SECTION ~ TYPE 1

Used when the top of the Retrofit Curb is less than 8" above existing slab. Showing T223 Rail other rails similar. (Bars L(#5) on T223 and C223 Rails are not used for this structure). Bars RH(#5) required on standards T80HT, T80SS and T224 are not required when used with the RAC-R standard.




## TYPICAL SECTION ~ TYPE 2

Used when the Retrofit Curb is 8" in height or greater. Showing T223 Rail, other rails similar. (Bars L(#5) on T223 and C223 Rails are not used for this structure). Bars RH(#5) required on standards T80HT, T80SS and T224 are not required when used with the RAC-R standard.




## TYPICAL SECTION ~ PARALLEL WINGWALL

Wingwall Anchorage Curb is required on Parallel Wingwalls only. Omit Wingwall Anchorage Curb on Flared and Straight Wingwalls. Showing T223 Rail, other rails similar. (Bars L(#5) on T223 and C223 Rails are not used for this structure). Bars RH(#5) required on standards T80HT, T80SS and T224 are not required when used with RAC-R standard.

(1) "T" is equal to the existing culvert top slab thickness. If "T" is less than 6", a special design will be required. "C" is equal to the Retrofit Rail Anchorage Curb thickness.

(2) The total thickness ("T" plus "C") must be 8" minimum in order to properly install the railing anchorage reinforcing.

(3) Remove shaded portion of existing concrete to Breakback Line shown. Care must be taken so as to not damage existing reinforcing. Replace damaged reinforcing with new, like reinforcing. Clean existing reinforcing and incorporate into new concrete construction.

(4) Saw cut (score) 1" deep flush with top of existing culvert slab, on the field side face of existing curb, if present. After scoring, remove shaded portion of existing concrete to Breakback Line shown. Do not damage existing reinforcing. Clean, bend and incorporate existing reinforcing into new concrete construction. Note that new anchors, as shown in the detail, are required even when existing reinforcing remains in use. Remove existing overlay and/or base material to flush with top of culvert in areas of new construction. Care must be taken to not damage the existing slab. In order to prevent existing asphalt remnants from acting as a bond breaker between the exposed, existing concrete and the retrofitted concrete curb, clean the newly exposed concrete with abrasive blasting or shot blasting. Remove all loose debris prior to placing new anchorage curb.

(5) Core drill 1" diameter holes through existing slab. Percussion drilling is not permitted. Patch spalls, when directed by the Engineer, in accordance with Item 429, "Concrete Structure Repair", at the Contractor's expense. Tighten nuts snug tight.

(6) Space field side anchors at 36" maximum. Space traffic side anchors at 11" maximum. Do not align field side and traffic side anchors transversely.

(7) Retrofit Wingwall Anchorage Curb must always be 2'-0" in height. Breakback existing wingwall as needed in order to properly align the wingwall Anchorage Curb with that placed on the existing culvert. Saw cut (score) 1" deep on field side face of the existing wingwall prior to breakback. Care must be taken so as to not damage existing reinforcing. Clean and extend existing reinforcing into new construction. Note that new Bars D(#6), as shown in the detail, are required even when existing reinforcing remains in use.

(8) Embed bars D(#6) into existing wingwall with a Type III, Class C, D, E, or F anchor adhesive. Minimum adhesive anchor embedment depth is 12". Anchor adhesive chosen must be able to achieve a basic bond strength in tension, Nba, of 26 kips. Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use. Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing." If existing parallel wingwall thickness is less than 8", a special design will be required.

(9) Use straight anchors if retrofit anchorage curb is 1'-2" or greater in thickness. Use hooked anchors for retrofit anchorage curb less than 1'-2" thick.

This sheet is intended to be used as a guide for retrofitting existing box culverts with traffic railing. Details with appropriate notes taken from this guide should be prepared for the specific application. Dimensions of existing culvert top slab thickness, wingwall thickness, fill height at traffic side face of rail anchorage curb retrofit etc. should be shown. Particular care should be taken in identifying the box culvert wingwall conditions, and providing for proper railing post anchorage and approach guard fence post positioning. This sheet may not be used without modification. The details shown may need to be amended if the exact existing condition is not covered. In all cases details and notes not required must be crossed out or eliminated, "(MOD)" added, the phrase "(Not to be used as a standard)" removed and the sheet sealed and signed.

### CONSTRUCTION NOTES:

Field verify dimensions before commencing work and ordering materials.

### MATERIAL NOTES:

Provide Class "C" concrete (f'c=3,600 psi). Provide Class "C" (HPC) concrete if shown elsewhere in the plans.

Chamfer all exposed corners ¾" unless shown otherwise.

Provide Grade 60 reinforcing steel.

Galvanize all reinforcing steel if required elsewhere.

Provide bar laps, where required, as follows: Uncoated or galvanized ~ #4 = 1'-11"

Galvanize ¾" Dia threaded rods, heavy hex nuts and plate washers, unless otherwise shown on plans.

### GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.

The rail anchorage curb details have sufficient strength for use with all standard rail types.

See appropriate rail standard for approved speed restrictions, notes and details not shown.

For vehicle safety, the top of the new curb must be flush with the finished grade.

These details are for use with curbs with a maximum height of 2'-0" only. Curb heights greater than 2'-0" will require special design.

Removal and replacement of backfill, subgrade, and asphalt or concrete pavement necessary for this installation is considered subsidiary to the rail anchorage curb.

Payment for rail anchorage curb (including wingwall curb slab) will be by CY of Class "C" or Class "C" (HPC) concrete.

Not all possible combinations of existing box culverts, curbs, wingwalls etc. have been shown on this sheet. Other combinations and reinforcement arrangements are permissible if they meet the same strength requirements as indicated on this sheet.

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

# RAIL ANCHORAGE CURB RETROFIT GUIDE

BOX CULVERT RAIL MOUNTING DETAILS
(CURBS 2'-0" TALL AND LESS ONLY)
(NOT TO BE USED AS A STANDARD)

# RAC-R

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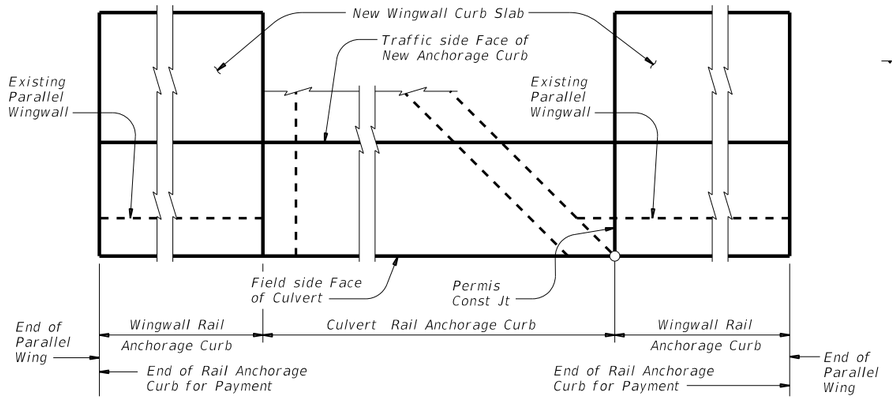
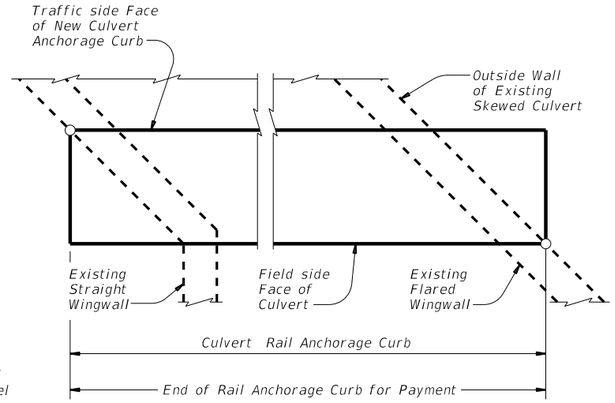



PARALLEL WINGWALL AT 0° SKEW CULVERT

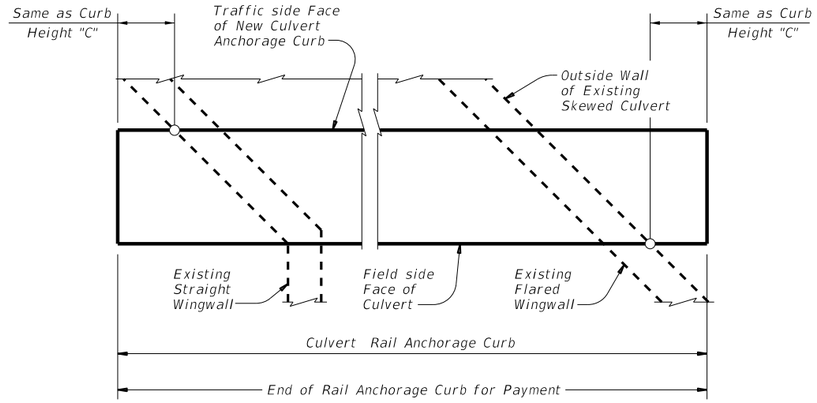
PARALLEL WINGWALL AT SKEWED CULVERT

Note that Wingwall Rail Anchorage Curb is used only at culverts with parallel wingwalls.




OPTION A ~ STRAIGHT WINGWALL AT SKEWED CULVERT (10)

OPTION A ~ FLARED WINGWALL AT SKEWED CULVERT (10)

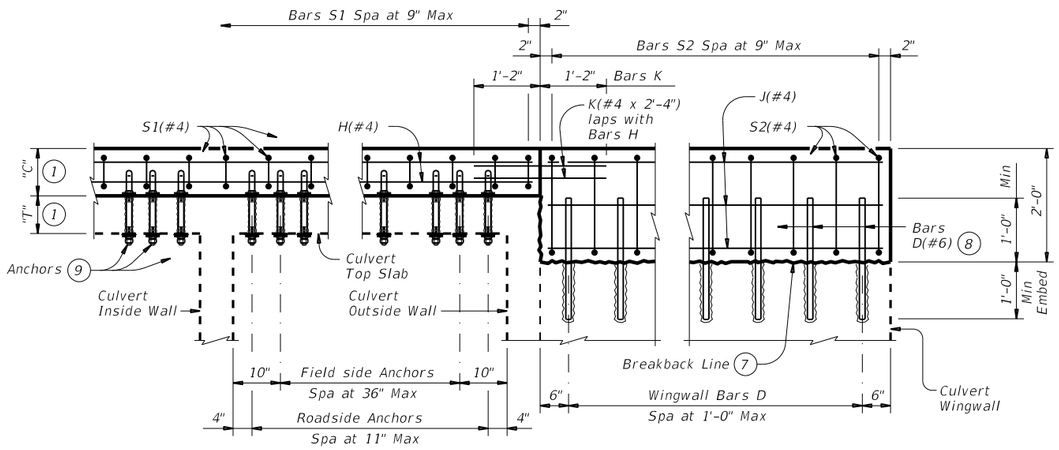



OPTION B ~ STRAIGHT WINGWALL AT SKEWED CULVERT (11)

OPTION B ~ FLARED WINGWALL AT SKEWED CULVERT (11)

## TYPICAL CURB PLANS

Showing Geometry only. Reinforcing, Curb Anchors, and Railing not shown for clarity.




SHOWING CULVERT ANCHORAGE CURB

Showing Anchorage Curb Type 2. Anchor and Bars S spacing are the same for Anchorage Type 1.

SHOWING WINGWALL ANCHORAGE CURB

Curb Slab and Slab reinforcing not shown for clarity.

## TYPICAL ELEVATIONS OF INSTALLATION

(1) "T" is equal to the existing culvert top slab thickness. If "T" is less than 6", a special design will be required. "C" is equal to the Retrofit Rail Anchorage Curb thickness.

(7) Retrofit Wingwall Anchorage Curb must always be 2'-0" in height. Breakback existing wingwall as needed in order to properly align the wingwall Anchorage Curb with that placed on the existing culvert. Saw cut (score) 1" deep on field side face of the existing wingwall prior to breakback. Care must be taken so as to not damage existing reinforcing. Clean and extend existing reinforcing into new construction. Note that new Bars D(#6), as shown in the detail, are required even when existing reinforcing remains in use.

(8) Embed bars D(#6) into existing wingwall with a Type III, Class C, D, E, or F anchor adhesive. Minimum adhesive anchor embedment depth is 12". Anchor adhesive chosen must be able to achieve a basic bond strength in tension, Nba, of 26 kips. Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use. Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing." If existing parallel wingwall thickness is less than 8", a special design will be required.

(9) Use straight anchors if retrofit anchorage curb is 1'-2" or greater in thickness. Use hooked anchors for retrofit anchorage curb less than 1'-2" thick.

(10) Use Option A if finished grade at face of rail anchorage curb remains unchanged, or if both wingwalls and rail anchorage curb will be vertically raised. Existing wingwalls must be checked for suitability of vertically raising.

(11) Use Option B if wingwalls will not be vertically raised when the curb height is increased. Verify adequacy of existing or proposed finished grade between end of rail anchorage curb and wingwall. Extension of rail anchorage curb beyond wingwall may need to be greater than "C" depending on side slope conditions.



Texas Department of Transportation

Bridge Division Standard

# RAIL ANCHORAGE CURB RETROFIT GUIDE

BOX CULVERT RAIL MOUNTING DETAILS
(CURBS 2'-0" TALL AND LESS ONLY)
(NOT TO BE USED AS A STANDARD)

## RAC-R

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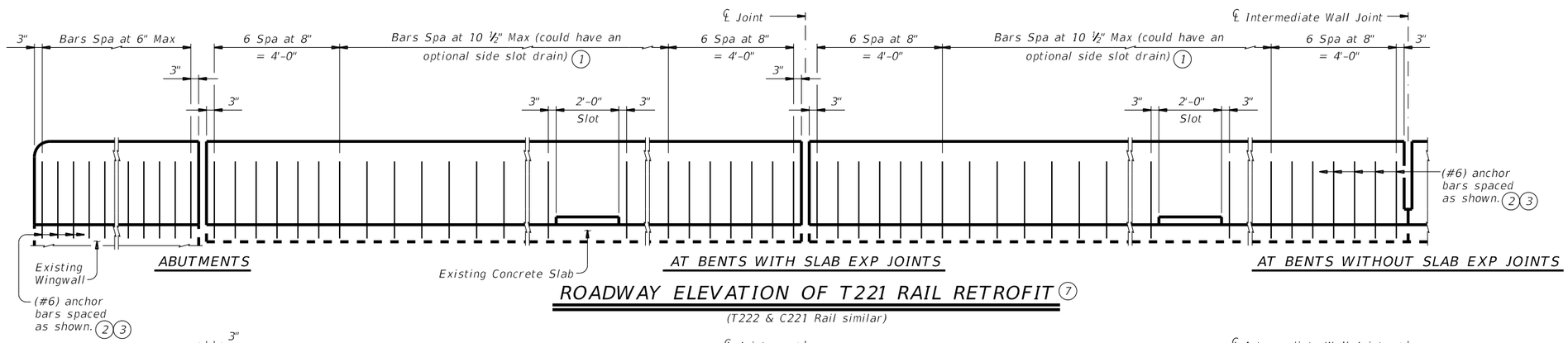
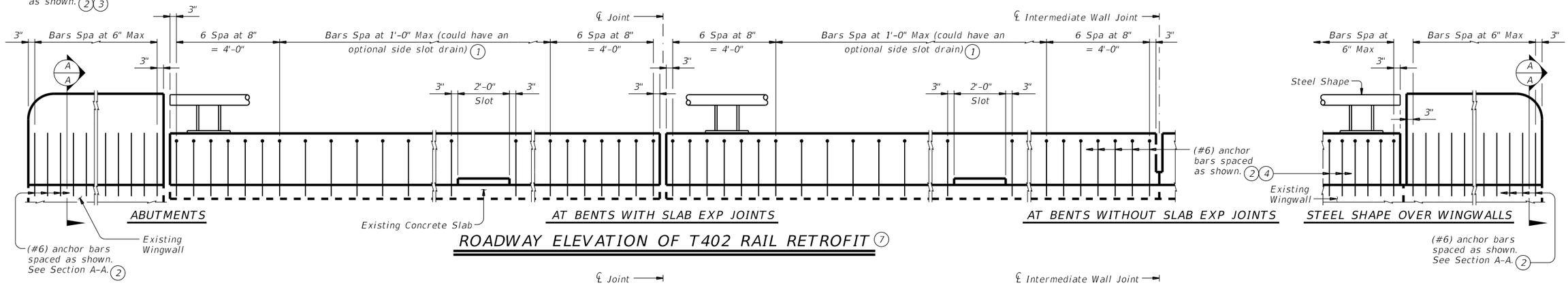
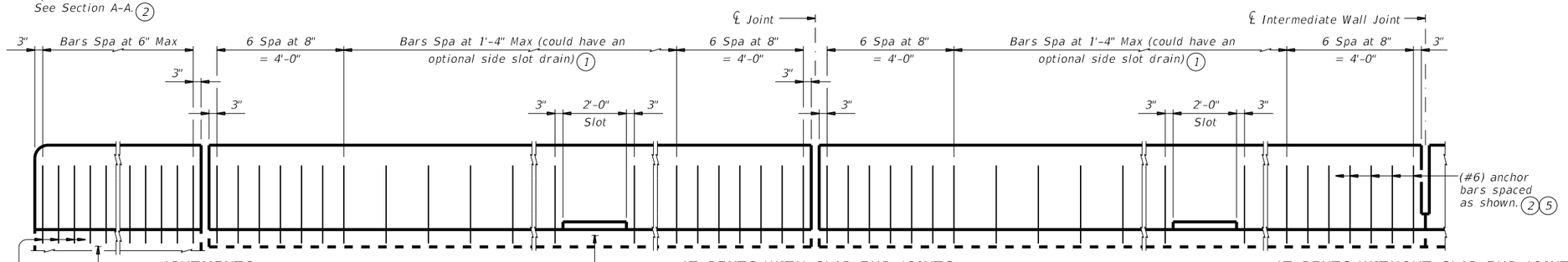



## ROADWAY ELEVATION OF T221 RAIL RETROFIT (7)

(T222 & C221 Rail similar)

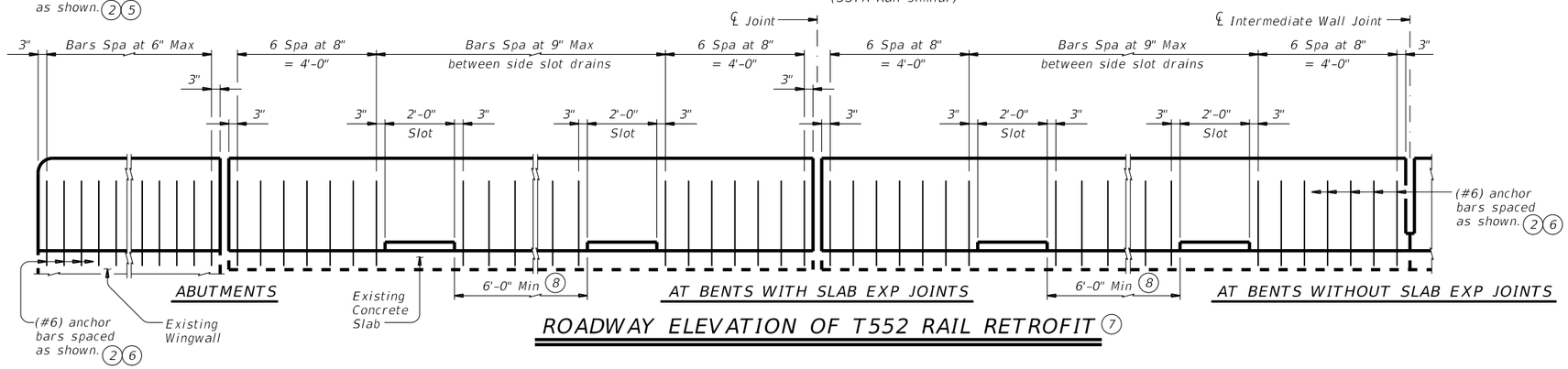



## ROADWAY ELEVATION OF T402 RAIL RETROFIT (7)




## ROADWAY ELEVATION OF T551 RAIL RETROFIT (7)

(SSTR Rail similar)




## ROADWAY ELEVATION OF T552 RAIL RETROFIT (7)

(1) When side slot drains are used, provide 8'-0" Min clear spacing between drain slots.

(2) Embed (#6) anchor bars with a Type III, Class C, D, E, or F anchor adhesive. Minimum adhesive anchor embedment depth is 5 ¼". Anchor adhesive chosen must be able to achieve a basic bond strength in tension, Nba, of 20 kips. Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use. Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing".

(3) See T221, T222 or C221 Rail Sections in "Rail Retrofit Section on Wingwalls using Adhesive Anchors" and/or "Rail Retrofit Section on Concrete Slabs using Adhesive Anchors".

(4) See T402 or C402 Rail Sections in "Rail Retrofit Section on Wingwalls using Adhesive Anchors" and/or "Rail Retrofit Section on Concrete Slabs using Adhesive Anchors".

(5) See T551 or SSTR Rail Sections in "Rail Retrofit Section on Wingwalls using Adhesive Anchors" and/or "Rail Retrofit Section on Concrete Slabs using Adhesive Anchors".

(6) See T552 Rail Sections in "Rail Retrofit Section on Wingwalls using Adhesive Anchors" and/or "Rail Retrofit Section on Concrete Slabs using Adhesive Anchors".

(7) Showing spacing of (#6) adhesive anchor in a rail retrofit condition. Secondary (#4) adhesive anchor in a rail retrofit not shown for clarity. Reinforcing steel and terminal connections not shown for clarity. See rail standard for details and notes not shown.

(8) Place side slot drains as shown. See appropriate rail standard for side slot drains, except as noted.



Texas Department of Transportation

Bridge Division Standard

# RETROFIT GUIDE FOR CONCRETE RAILS

(T221, T222, C221, T402, C402, T551, SSTR, & T552)

(NOT TO BE USED AS A STANDARD)

## C-RAIL-R

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| ©TxDOT September 2019 | CONT | SECT | JOB | HIGHWAY |
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| 07-20: Text change from epoxy to adhesive and changed MASH Test Level note. | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 121 |

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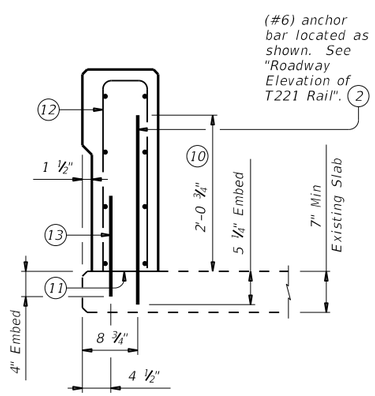
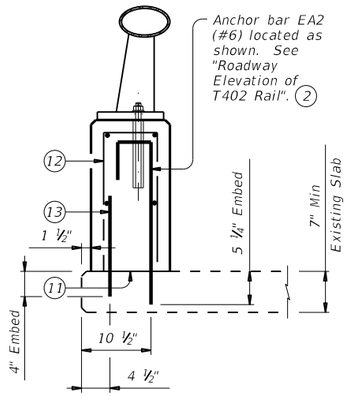
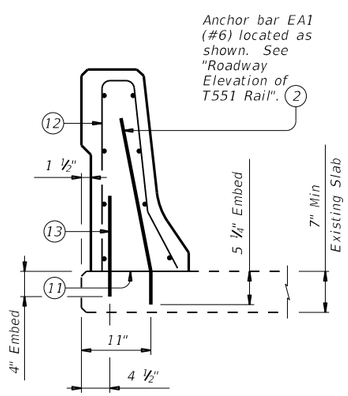


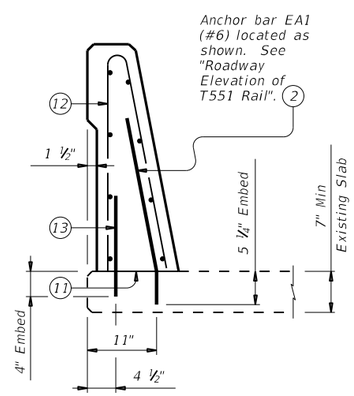

T221, T222 & C221 RAIL



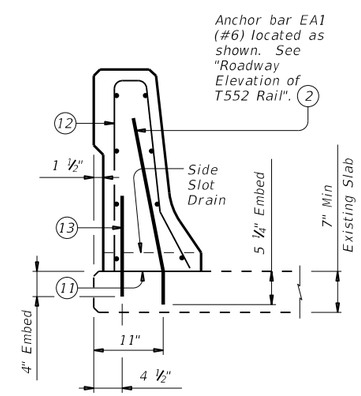

T402 & C402 RAIL




T551 RAIL

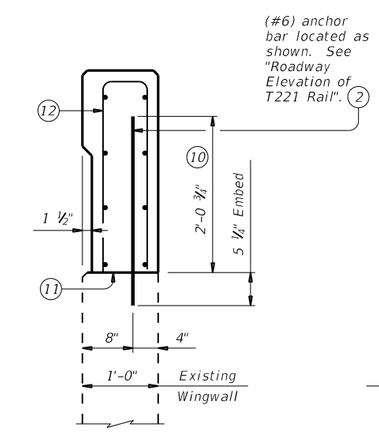



SSTR RAIL

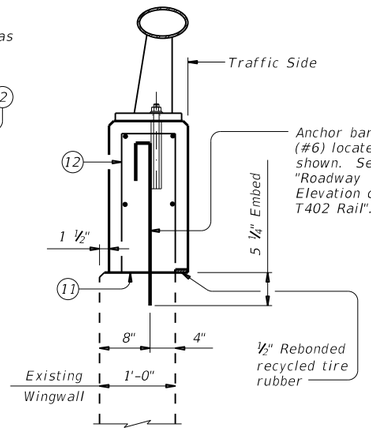



T552 RAIL

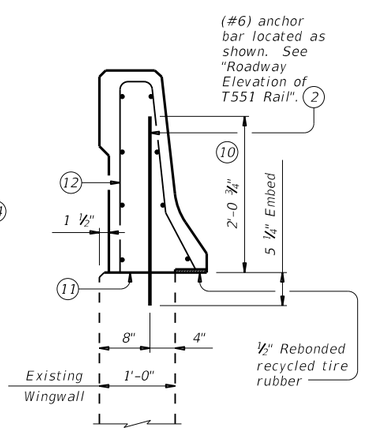
## RAIL RETROFIT SECTIONS ON CONCRETE SLABS USING ADHESIVE ANCHORS (9)



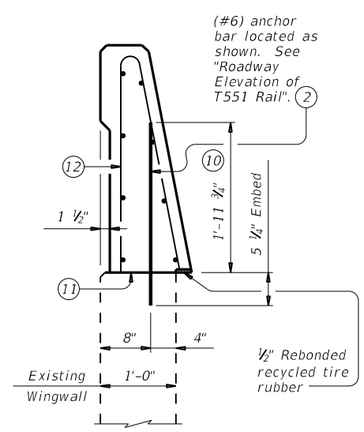

T221, T222 & C221 RAIL



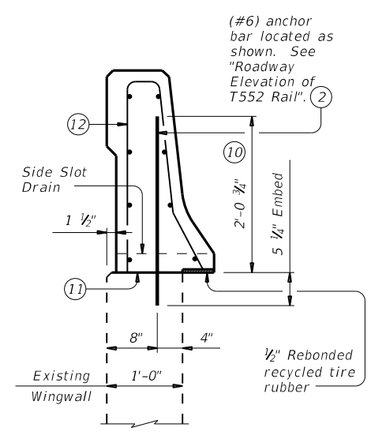

T402 & C402 RAIL




T551 RAIL



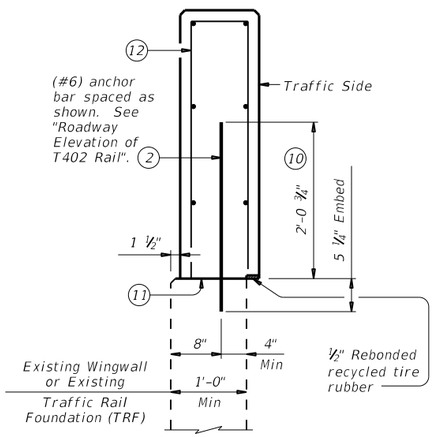

SSTR RAIL




T552 RAIL

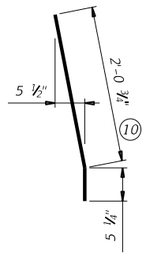
## RAIL RETROFIT SECTIONS ON WINGWALLS USING ADHESIVE ANCHORS (9)

*Rail retrofits on existing Traffic Rail Foundations (TRF) are similar.*

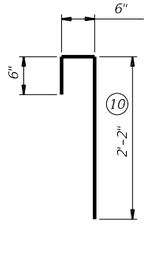



SECTION A-A (9)

(Showing parapet wall at end of T402 Rail & C402 Rail.)




ANCHOR BAR EA1 (#6)




ANCHOR BAR EA2 (#6)

(2) Embed (#6) anchor bars with a Type III, Class C, D, E, or F anchor adhesive. Minimum adhesive anchor embedment depth is 5 ¼". Anchor adhesive chosen must be able to achieve a basic bond strength in tension, Nba, of 20 kips. Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use. Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing".

(9) Showing location or locations of anchor bars in a rail retrofit condition. See appropriate rail standard for details and notes not shown.

(10) Increase by amount of existing overlay/seal coat thickness, not to exceed 2". If thickness of existing overlay/seal coat is greater than 2" at toe of rail, taper overlay at a 1:10 or flatter slope over shoulder width to a thickness of 2" or less at toe of rail.

(11) Do not cast rails or parapet walls on top of overlays/seal coats.

(12) See appropriate rail standard for reinforcing steel. Modify length of vertical reinforcing bars as required to fit existing structure. Longitudinal reinforcing bars may be removed only if their position puts them in conflict with un-removed portions of existing structure.

(13) Embed secondary (#4) anchor bars 1'-4" in length with a Type III Class C, D, E, or F anchor adhesive. Minimum adhesive anchor embedment depth is 4". Anchor adhesive chosen must be able to achieve a basic bond strength in tension, Nba, of 10 kips. Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use. Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing". (#4) anchor bars spaced longitudinally along rail at 4 ft Max (Spaced 3" longitudinally from outside edge and edge of side slot drains).

(14) (#6) anchor bars need to be rotated slightly to fit in designated area, as shown.



Texas Department of Transportation — Bridge Division Standard

# RETROFIT GUIDE FOR CONCRETE RAILS

(T221, T222, C221, T402, C402, T551, SSTR, & T552)

(NOT TO BE USED AS A STANDARD)

## C-RAIL-R

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| ©TxDOT September 2019 | CONT | SECT | JOB | HIGHWAY |
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| 07-20: Text change from epoxy to adhesive and changed MASH Test Level note. | DIST | COUNTY | | SHEET NO. |
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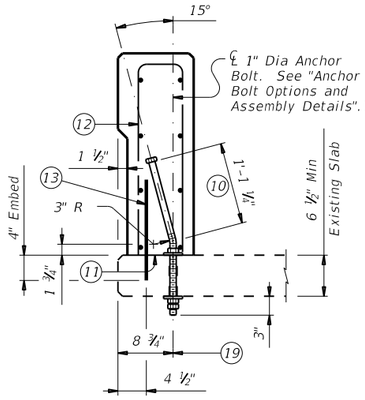
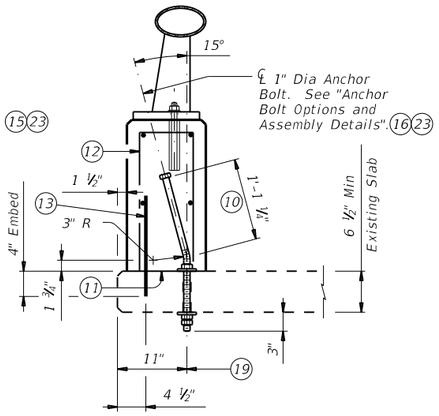
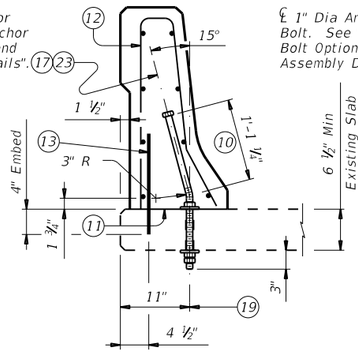


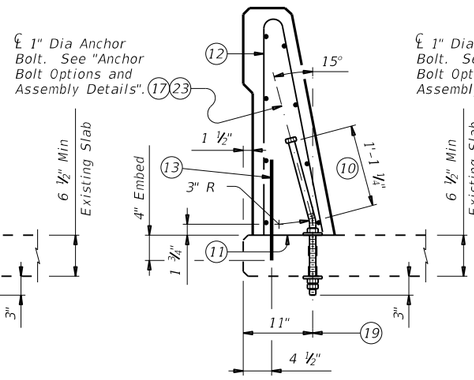

T221, T222 & C221 RAIL



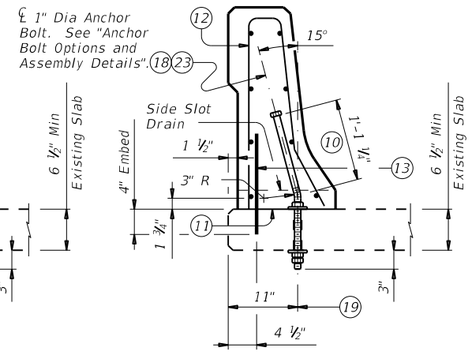

T402 & C402 RAIL




T551 RAIL




SSTR RAIL




T552 RAIL

## RAIL RETROFIT SECTIONS ON SLABS USING ANCHOR BOLTS (20)

(10) Increase by amount of existing overlay/seal coat thickness, not to exceed 2". If thickness of existing overlay/seal coat is greater than 2" at toe of rail, taper overlay at a 1:10 or flatter slope over shoulder width to a thickness of 2" or less at toe of rail.

(11) Do not cast rails or parapet walls on top of overlays/seal coats.

(12) See appropriate rail standard for reinforcing steel. Modify length of vertical reinforcing bars as required to fit existing structure. Longitudinal reinforcing bars may be removed only if their position puts them in conflict with un-removed portions of existing structure.

(13) Embed secondary (#4) anchor bars 1'-4" in length with a Type III Class C, D, E, or F anchor adhesive. Minimum adhesive anchor embedment depth is 4". Anchor adhesive chosen must be able to achieve a basic bond strength in tension, Nba, of 10 kips. Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use. Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing". (#4) anchor bars spaced longitudinally along rail at 4 ft Max (Spaced 3" longitudinally from outside edge and edge of side slot drains).

(15) ℄ 1" Dia Anchor Bolt Spaced longitudinally along rail at 18" Max (Spaced 6" longitudinally from outside edge and edge of optional side slot drains, if required).

(16) ℄ 1" Dia Anchor Bolt Spaced longitudinally along rail at 21" Max (Spaced 6" longitudinally from outside edge and edge of optional side slot drains, if required).

(17) ℄ 1" Dia Anchor Bolt Spaced longitudinally along rail at 24" Max (Spaced 6" longitudinally from outside edge and edge of optional side slot drains, if required).

(18) ℄ 1" Dia Anchor Bolt Spaced longitudinally along rail at 20" Max (Spaced 6" longitudinally from outside edge and edge of side slot drains).

(19) ℄ 1 1/16" to 1 ¼" Dia holes. Core drill holes through existing deck (percussion drilling not permitted). Concrete spalls in the bottom of the deck exceeding ½" from edge of holes will be patched in accordance with Item 429, "Concrete Structure Repair" at the Contractor's expense.

(20) Showing location of anchor bars and anchor bolts in a rail retrofit condition. See appropriate rail standard for details and notes not shown.

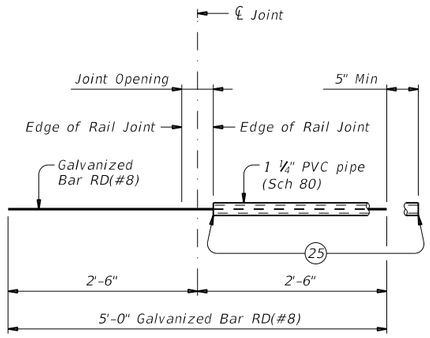
(21) ℄ 1" Dia ASTM F1554 Gr 55 Anchor Bolt or Threaded Rod. Nuts must conform to ASTM A563 requirements.

(22) Plate Washer ⅜ x 3 x 3 ASTM A36 with 1 1/16" Dia Hole centered.

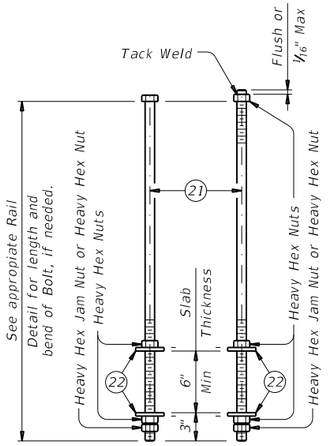
(23) Galvanize anchor bolts, nuts and plate washers.

(24) See "Bar RD(#8) Assembly Detail".

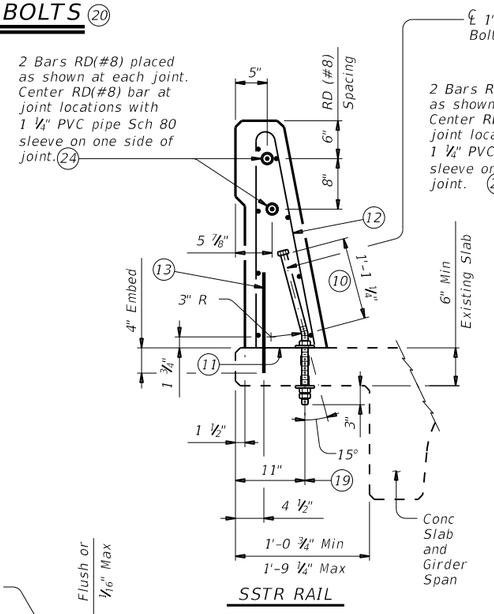
(25) Tape ends of 1 ¼" PVC pipe Sch 80 to prevent concrete or mortar from seeping in.



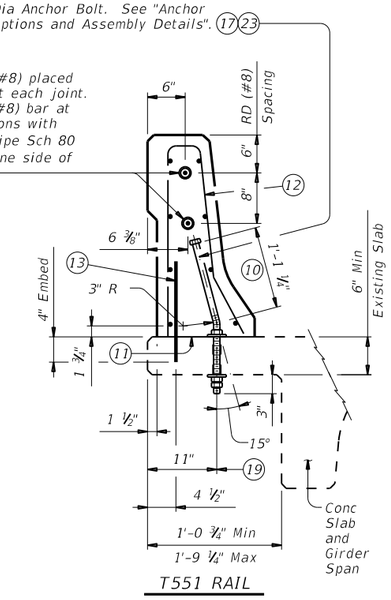

BAR RD(#8) ASSEMBLY DETAIL




ANCHOR BOLT OPTIONS AND ASSEMBLY DETAILS (23)




SSTR RAIL




T551 RAIL

## RAIL RETROFIT SECTIONS ON CG (PAN FORM) SPANS (20)

Only SSTR and T551 Rails can be retrofitted to Pan Form overhangs as shown.



Texas Department of Transportation

Bridge Division Standard

# RETROFIT GUIDE FOR CONCRETE RAILS

(T221, T222, C221, T402, C402, T551, SSTR, & T552)

(NOT TO BE USED AS A STANDARD)

## C-RAIL-R

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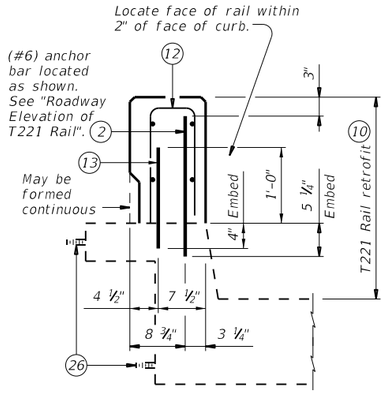
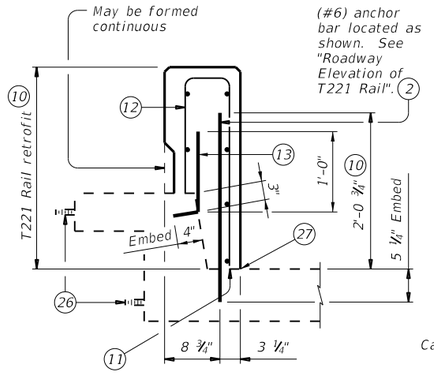
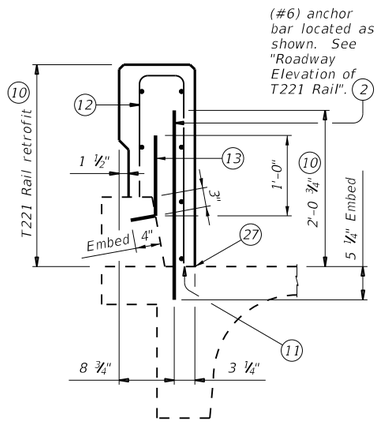



CASE (A)




CASE (B)

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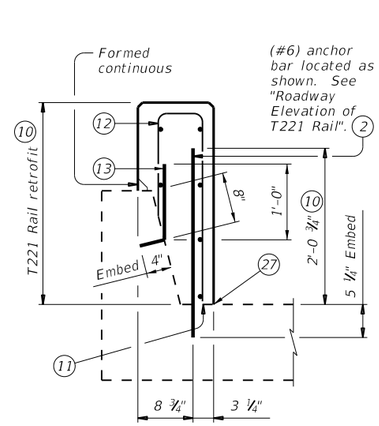



CASE (D)

## T221 RAIL RETROFIT EXAMPLES (9)

Case (A): Permitted only with Type T221, T222, C221 and SSTR rails. Do not use this detail unless existing curb is at least 10" wide at its base and the flexural strength, Mn, of the curb at its base is at least 10.5 kip-ft per foot, with no strength reduction factor applied.

Case (B): Locate anchor bar 2" from toe of curb.

Case (C): Locate anchor bar no closer than 2" from toe of curb.

Case (D): Do not remove any part of curb unless it has been determined to not be a structural element. Locate anchor bar 2" from toe of curb.

(2) Embed (#6) anchor bars with a Type III, Class C, D, E, or F anchor adhesive. Minimum adhesive anchor embedment depth is 5 ¼". Anchor adhesive chosen must be able to achieve a basic bond strength in tension, Nba, of 20 kips. Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use. Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing".

(9) Showing location or locations of anchor bars in a rail retrofit condition. See appropriate rail standard for details and notes not shown.

(10) Increase by amount of existing overlay/seal coat thickness, not to exceed 2". If thickness of existing overlay/seal coat is greater than 2" at toe of rail, taper overlay at a 1:10 or flatter slope over shoulder width to a thickness of 2" or less at toe of rail.

(11) Do not cast rails or parapet walls on top of overlays/seal coats.

(12) See appropriate rail standard for reinforcing steel. Modify length of vertical reinforcing bars as required to fit existing structure. Longitudinal reinforcing bars may be removed only if their position puts them in conflict with un-removed portions of existing structure.

(13) Embed secondary (#4) anchor bars 1'-4" in length with a Type III Class C, D, E, or F anchor adhesive. Minimum adhesive anchor embedment depth is 4". Anchor adhesive chosen must be able to achieve a basic bond strength in tension, Nba, of 10 kips. Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use. Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing". (#4) anchor bars spaced longitudinally along rail at 4 ft Max (Spaced 3" longitudinally from outside edge and edge of side slot drains).

(26) Remove existing rail, cut and grind anchor bolts flush, and paint ends with two coats of zinc-rich paint conforming to the Item "Galvanizing".

(27) Void out area in rail retrofit to accommodate existing drain holes in deck.

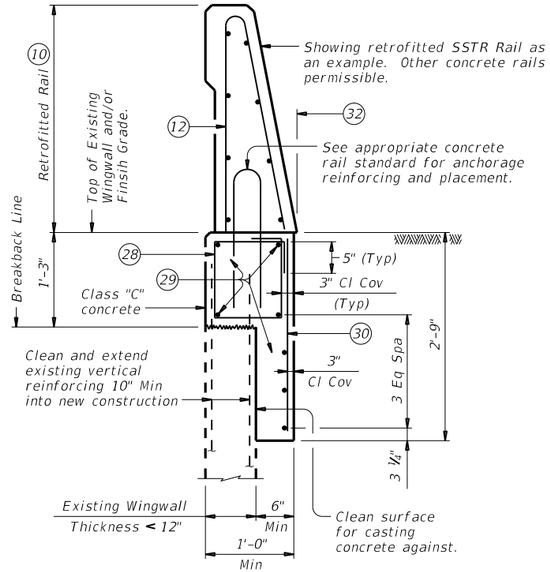
(28) Space (#4) stirrups at 8" Max. (Spaced 3 ¼" longitudinally from retrofitted ends of wingwall).

(29) 7 ~ (#5) bars with 3" end cover.

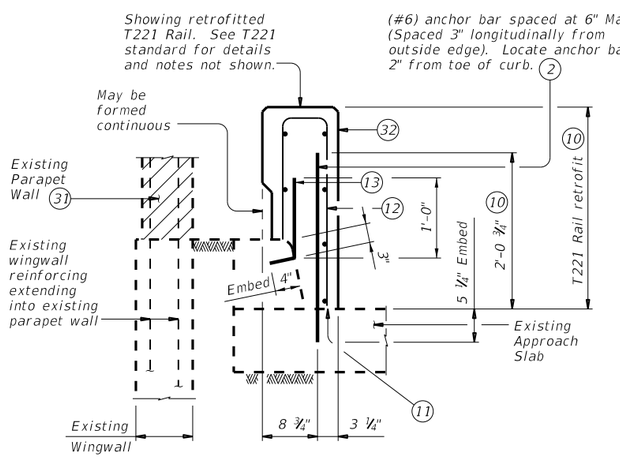
(30) Space (#4) bars at 8" Max with 3" end cover, spaced with (#4) stirrups.

(31) Remove all concrete and reinforcing steel from existing parapet wall. Existing reinforcing cut off from existing wingwall must be painted with two coats of a zinc-rich paint conforming to the Item "Galvanizing".

(32) Face of rail and/or toe of rail. Location or placement of rail retrofit must match face of rail and/or toe of rail on bridge.




## SECTION OF EXISTING PARALLEL WINGWALLS LESS THAN 12" THICK




## SECTION OF EXISTING PARALLEL OR FLARED WINGWALLS WITH APPROACH SLAB (9)

### CONSTRUCTION NOTES:

Field verify dimensions before commencing work and ordering materials.

By adding additional anchorage, welding can be performed at a minimum spacing of 3 ft between the cage and additional anchorage. By satisfying additional anchorage requirements slip forming is allowed. Do not weld to the required anchorage.

Test adhesive anchors in accordance with Item 450.3.3, "Tests". Test 3 anchors per 100 anchors installed. Perform corrective measures to provide adequate capacity if any of the tests do not meet the required test load. Repair damage from testing as directed.

### MATERIAL NOTES:

Provide Grade 60 reinforcing steel.

Epoxy coat or galvanize all reinforcing steel if required elsewhere.

(#6) and (#4) anchor bars used for the adhesive anchorage system must not be epoxy coated within the required embedment.

### GENERAL NOTES:

Use of these retrofit details will result in a railing acceptable for the MASH Test Level indicated on the applicable rail standard.

Rail anchorage details shown on this guide may require modification for select structure types. See appropriate details elsewhere in plans for these modifications. Not all possible combinations of existing railing, curbs, parapets etc. have been shown on this sheet. Other combinations and reinforcement arrangements are permissible if they meet the same strength requirements as indicated on this guide.

Do not remove any part of a curb until it has been evaluated to not be a load-carrying structural component.

Removal and replacement of backfill, subgrade, and asphalt or concrete pavement necessary for this installation is considered subsidiary to the retrofit railing.

Payment for a rail retrofit will be as per Item 451, "Retrofit Railing", by the type of the rail retrofit. All details shown herein are subsidiary to rail retrofit. Examples are "Retrofit Rail (Ty T551)", "Retrofit Rail (Ty SSTR)", etc.

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

This sheet is to be used as a guide for retrofitting existing structures with rails listed on this sheet. Details with appropriate notes from this guide should be prepared for the specific application. Dimensions of existing slab thickness, curb widths, heights, etc., should be shown. Particular care should be taken in identifying the bridge abutment wingwall conditions and providing for proper reinforcement anchorage and approach guard fence post positioning. This sheet may not be used without modification. The details shown may need to be amended if the exact existing condition is not covered. In all cases, details and notes not required must be crossed out or eliminated, "(MOD)" added, the phrase "(Not to be used as a standard)" removed, and the sheet sealed and signed.



Texas Department of Transportation

Bridge Division Standard

# RETROFIT GUIDE FOR CONCRETE RAILS

(T221, T222, C221, T402, C402, T551, SSTR, & T552)

(NOT TO BE USED AS A STANDARD)

## C-RAIL-R

| FILE: | r1std022-20.dgn | DN: TxDOT | CK: TxDOT | DW: JTR | CK: JMH |
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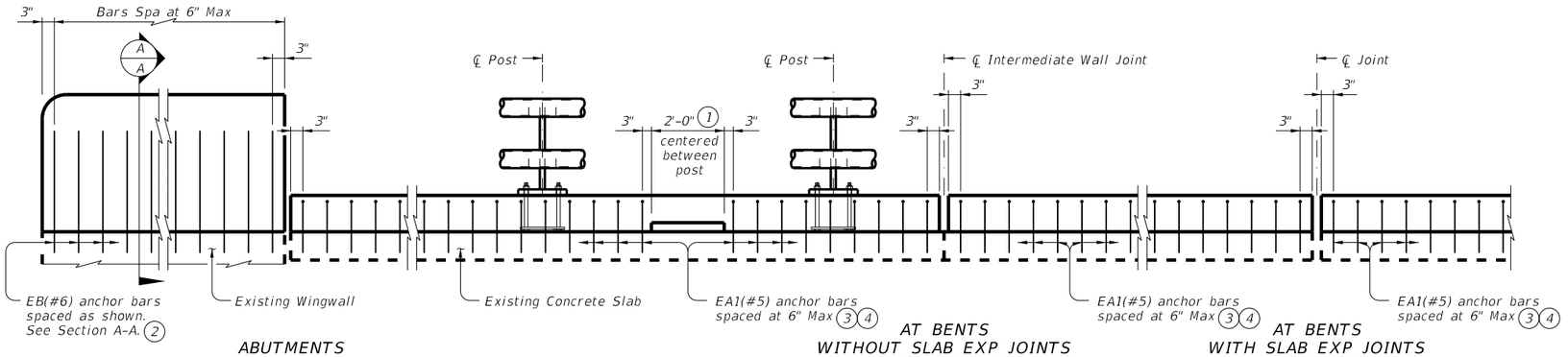
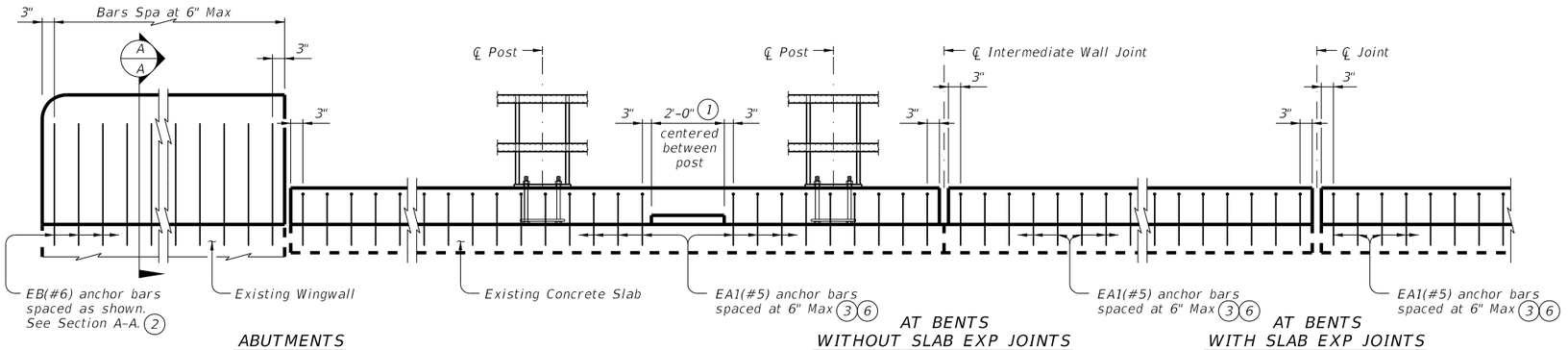
| ©TxDOT | September 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | | 6439 | 16 | 001 | VAR |
| 07-20: Text change from epoxy to adhesive and changed MASH Test Level note. | | DIST | COUNTY | | SHEET NO. |
| | | 22 | VAR | | 124 |




ABUTMENTS — AT BENTS WITHOUT SLAB EXP JOINTS — AT BENTS WITH SLAB EXP JOINTS

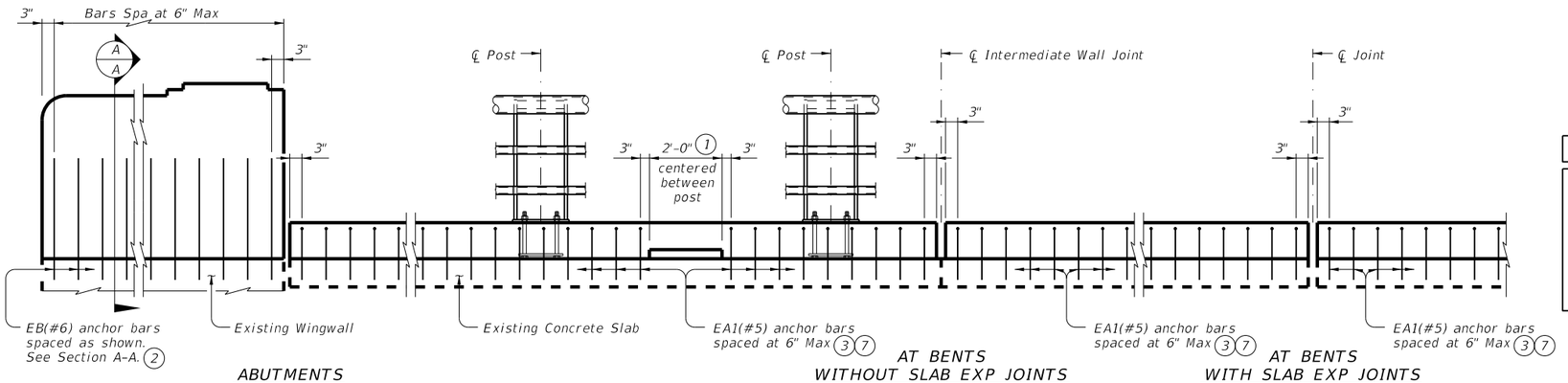
## ROADWAY ELEVATION OF T1F RAIL RETROFIT (5)




ABUTMENTS — AT BENTS WITHOUT SLAB EXP JOINTS — AT BENTS WITH SLAB EXP JOINTS

## ROADWAY ELEVATION OF T1W RAIL RETROFIT (5)

(C1W Rail similar)




ABUTMENTS — AT BENTS WITHOUT SLAB EXP JOINTS — AT BENTS WITH SLAB EXP JOINTS

## ROADWAY ELEVATION OF T2P RAIL RETROFIT (5)

(C2P Rail similar)

(1) Place optional side slot drains as shown. See appropriate rail standard for side slot drains, except as noted.

(2) Embed EB(#6) anchor bars with a Type III, Class C, D, E, or F anchor adhesive. Minimum adhesive anchor embedment depth is 5 3/4". Anchor adhesive chosen must be able to achieve a basic bond strength in tension, Nba, of 20 kips. Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use. Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing".

(3) Use drill equipped with depth gauge stop device to keep from drilling through bottom of slab. If hole extends through to bottom of slab, plug bottom of hole prior to placing adhesive anchorage system. Do not drill substitute hole next to drill through hole. Embed EA1(#5) anchor bars with a Type III, Class C, D, E, or F anchor adhesive. Minimum adhesive anchor embedment depth is 5 3/4". Anchor adhesive chosen must be able to achieve a basic bond strength in tension, Nba, of 20 kips. Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use. Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing".

(4) See T1F Rail Section in "Rail Retrofit Section on Concrete Slabs using Adhesive Anchors".

(5) Showing spacing of adhesive anchors in a rail retrofit condition. Reinforcing steel and terminal connections not shown for clarity. See appropriate rail standard for details and notes not shown.

(6) See T1W Rail Section or C1W Rail Section in "Rail Retrofit Section on Concrete Slabs using Adhesive Anchors".

(7) See T2P Rail Section or C2P Rail Section in "Rail Retrofit Section on Concrete Slabs using Adhesive Anchors".

### CONSTRUCTION NOTES:

Field verify dimensions before commencing work and ordering materials.

Test adhesive anchors in accordance with Item 450.3.3, "Tests". Test 3 anchors per 100 anchors installed. Perform corrective measures to provide adequate capacity if any of the tests do not meet the required test load. Repair damage from testing as directed.

### MATERIAL NOTES:

Provide Grade 60 reinforcing steel.

Epoxy coat or galvanize all reinforcing steel if required elsewhere.

(#6) and (#5) anchor bars used for the adhesive anchorage system must not be epoxy coated within the required embedment.

### GENERAL NOTES:

Use of these retrofit details will result in a railing acceptable for the MASH Test Level indicated on the applicable rail standard.

Rail anchorage details shown on this guide may require modification for select structure types. See appropriate details elsewhere in plans for these modifications. Not all possible combinations of existing railing, curbs, parapets etc. have been shown on this sheet. Other combinations and reinforcement arrangements are permissible if they meet the same strength requirements as indicated on this guide.

Do not remove any part of a curb until it has been evaluated to not be a load-carrying structural component.

Removal and replacement of backfill, subgrade, and asphalt or concrete pavement necessary for this installation is considered subsidiary to the rail retrofit.

Payment for a rail retrofit will be as per Item 451, "Retrofit Railing", by the type of the rail retrofit. All details shown herein are subsidiary to rail retrofit. Examples are "Retrofit Rail (Ty T1W)", "Retrofit Rail (Ty T2P)", etc.

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

This sheet is to be used as a guide for retrofitting existing structures with rails listed on this sheet. Details with appropriate notes from this guide should be prepared for the specific application. Dimensions of existing slab thickness, curb widths, heights, etc., should be shown. Particular care should be taken in identifying the bridge abutment wingwall conditions and providing for proper reinforcement anchorage and approach guard fence post positioning. This sheet may not be used without modification. The details shown may need to be amended if the exact existing condition is not covered. In all cases, details and notes not required must be crossed out or eliminated, "(MOD)" added, the phrase "(Not to be used as a standard)" removed, and the sheet sealed and signed.



DATE: 03/20/23
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties



Texas Department of Transportation — Bridge Division Standard

# RETROFIT GUIDE FOR CONCRETE CURB RAILS

(T1F, T1W, C1W, T2P, C2P, T66 & C66)

(NOT TO BE USED AS A STANDARD)

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| ©TxDOT July 2020 | CONT | SECT | JOB | HIGHWAY |
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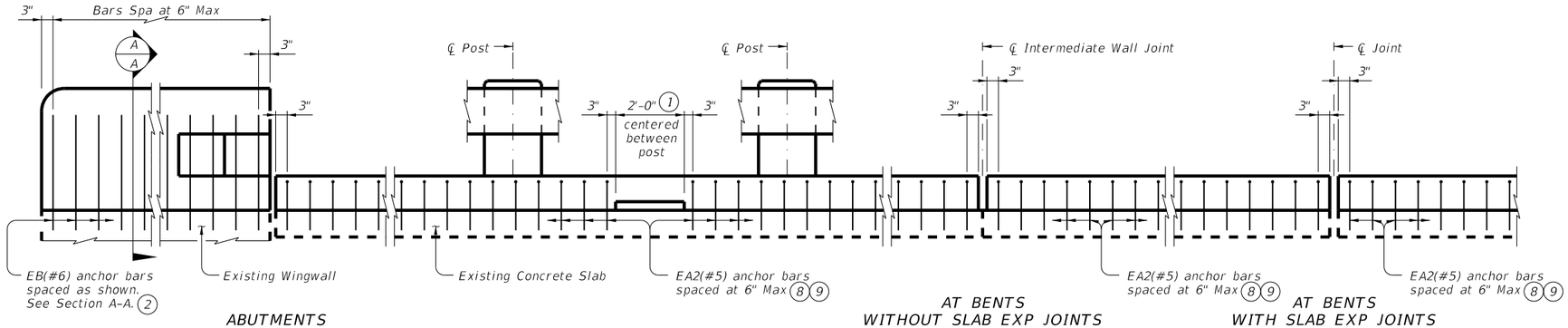
| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 125 |

DATE: _03/20/23_ _11:30_
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties



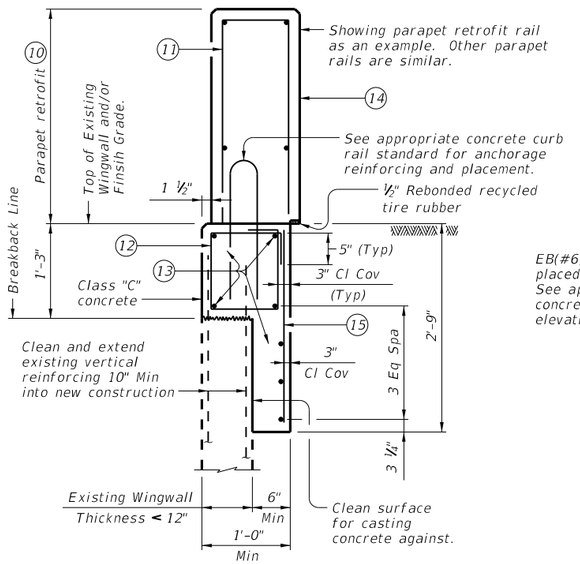

ABUTMENTS

AT BENTS WITHOUT SLAB EXP JOINTS

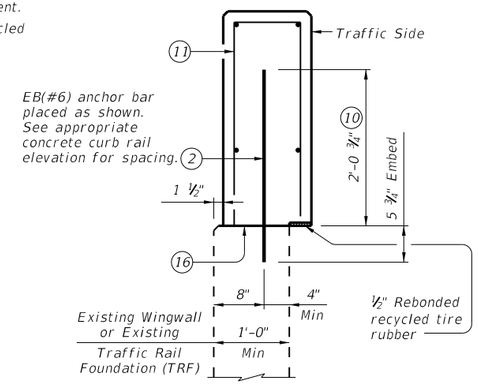
AT BENTS WITH SLAB EXP JOINTS

## ROADWAY ELEVATION OF T66 RAIL RETROFIT (4)

(C66 Rail similar)

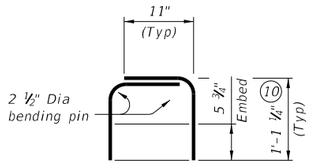



SECTION OF EXISTING PARALLEL WINGWALLS LESS THAN 12" THICK

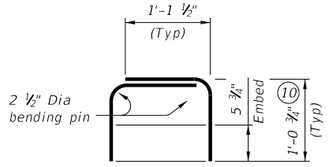



SECTION A-A (17)

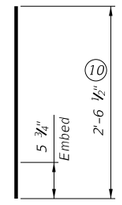
(Showing rail parapet retrofit at end of T1F Rail and T1W Rail. C1W, T2P, C2P, T66 and C66 are similar.)




BARS EA1 (#5)
Showing one complete bar.

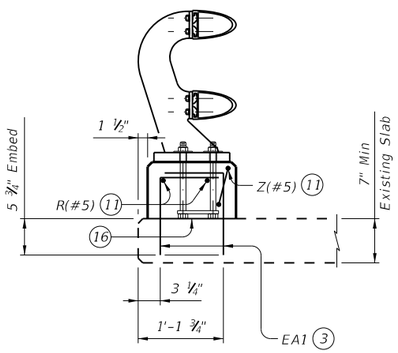



BARS EA2 (#5)
Showing one complete bar.

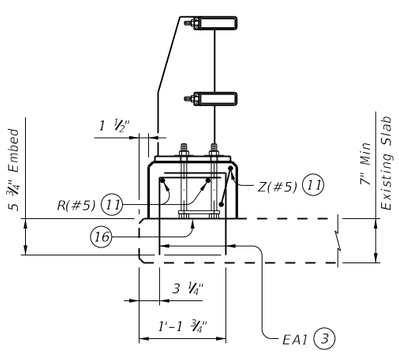



BARS EB (#6)

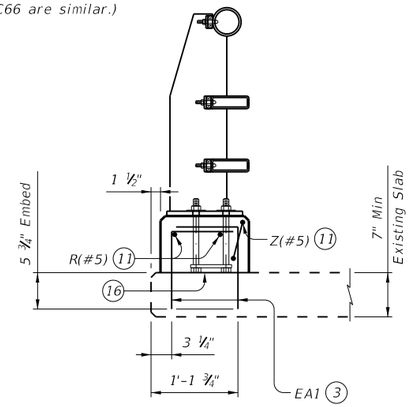
1. Place optional side slot drains as shown. See appropriate rail standard for side slot drains, except as noted.
2. Embed EB(#6) anchor bars with a Type III, Class C, D, E, or F anchor adhesive. Minimum adhesive anchor embedment depth is 5 ¾". Anchor adhesive chosen must be able to achieve a basic bond strength in tension, Nba, of 20 kips. Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use. Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing".
3. Use drill equipped with depth gauge stop device to keep from drilling through bottom of slab. If hole extends through to bottom of slab, plug bottom of hole prior to placing adhesive anchorage system. Do not drill substitute hole next to drill through hole. Embed EA1(#5) anchor bars with a Type III, Class C, D, E, or F anchor adhesive. Minimum adhesive anchor embedment depth is 5 ¾". Anchor adhesive chosen must be able to achieve a basic bond strength in tension, Nba, of 20 kips. Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use. Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing".
4. Showing spacing of adhesive anchors in a rail retrofit condition. Reinforcing steel and terminal connections not shown for clarity. See appropriate rail standard for details and notes not shown.
8. Use drill equipped with depth gauge stop device to keep from drilling through bottom of slab. If hole extends through to bottom of slab, plug bottom of hole prior to placing adhesive anchorage system. Do not drill substitute hole next to drill through hole. Embed EA2(#5) anchor bars with a Type III, Class C, D, E, or F anchor adhesive. Minimum adhesive anchor embedment depth is 5 ¾". Anchor adhesive chosen must be able to achieve a basic bond strength in tension, Nba, of 20 kips. Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use. Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing".
9. See T66 Rail Section or C66 Rail Section in "Rail Retrofit Section on Concrete Slabs using Adhesive Anchors".
10. Increase by amount of existing overlay/seal coat thickness, not to exceed 2". If thickness of existing overlay/seal coat is greater than 2" at toe of rail, taper overlay at a 1:10 or flatter slope over shoulder width to a thickness of 2" or less at toe of rail.
11. See appropriate rail standard for reinforcing steel.
12. Space (#4) stirrups at 8" Max. (Space 3 ¼" longitudinally from retrofitted ends of wingwall).
13. 7 ~ (#5) bars with 3" end cover.
14. Face of rail and/or toe of rail. Location or placement of rail retrofit must match face of rail and/or toe of rail on bridge.
15. Space (#4) bars at 8" Max with 3" end cover, spaced with (#4) stirrups.
16. Do not cast rails or parapet rails on top of overlays/seal coats.
17. Showing location(s) of anchor bars in a rail retrofit condition. See appropriate rail standard for details and notes not shown.



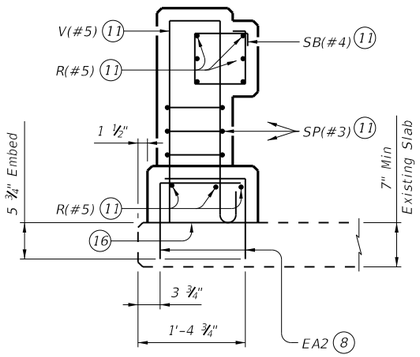

T1F Rail




T1W & C1W Rail
Showing T1W Rail, C1W Rail is similar.




T2P & C2P Rail
Showing T2P Rail, C2P Rail is simliar.




T66 & C66 Rail
Showing T66 Rail, C66 Rail is simliar.

## RAIL RETROFIT SECTIONS ON CONCRETE SLABS USING ADHESIVE ANCHORS (17)



Texas Department of Transportation

Bridge Division Standard

# RETROFIT GUIDE FOR CONCRETE CURB RAILS

(T1F, T1W, C1W, T2P, C2P, T66 & C66)

(NOT TO BE USED AS A STANDARD)

## CC-RAIL-R

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| ©TxDOT July 2020 | CONT | SECT | JOB | HIGHWAY |
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| | DIST | COUNTY | | SHEET NO. |
| | 22 | VAR | | 126 |

DATE: 03/20/23
FILE: LRDDSTMNT_FY2023_MNTContracts_MBGF_6439_16_001_UpperCounties

## I. STORMWATER POLLUTION PREVENTION-CLEAN WATER ACT SECTION 402

TPDES TXR 150000: Stormwater Discharge Permit or Construction General Permit required for projects with 1 or more acres disturbed soil. Projects with any disturbed soil must protect for erosion and sedimentation in accordance with Item 506.

List MS4 Operator(s) that may receive discharges from this project. They may need to be notified prior to construction activities.

1.

2.

☐ No Action Required ☐ Required Action

Action No.

1. Prevent stormwater pollution by controlling erosion and sedimentation in accordance with TPDES Permit TXR 150000
2. Comply with the SW3P and revise when necessary to control pollution or required by the Engineer.
3. Post Construction Site Notice (CSN) with SW3P information on or near the site, accessible to the public and TCEQ, EPA or other inspectors.
4. When Contractor project specific locations (PSL's) increase disturbed soil area to 5 acres or more, submit NOI to TCEQ and the Engineer.

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

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

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

☐ No Permit Required
☐ Nationwide Permit 14 - PCN not Required (less than 1/10th acre waters or wetlands affected)
☐ Nationwide Permit 14 - PCN Required (1/10 to <1/2 acre, 1/3 in tidal waters)
☐ Individual 404 Permit Required
☐ Other Nationwide Permit Required: NWP# _____

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

1.

2.

3.

4.

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

Best Management Practices:

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

## III. CULTURAL RESOURCES

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

☐ No Action Required ☐ Required Action

Action No.

1.

2.

3.

4.

## IV. VEGETATION RESOURCES

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

☐ No Action Required ☐ Required Action

Action No.

1.

2.

3.

4.

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

☐ No Action Required ☐ Required Action

Action No.

1.

2.

3.

4.

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

### LIST OF ABBREVIATIONS

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

## VI. HAZARDOUS MATERIALS OR CONTAMINATION ISSUES

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

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

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

Contact the Engineer if any of the following are detected:
* Dead or distressed vegetation (not identified as normal)
* Trash piles, drums, canister, barrels, etc.
* Undesirable smells or odors
* Evidence of leaching or seepage of substances

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

☐ Yes ☐ No

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

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

☐ Yes ☐ No

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

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

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

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

☐ No Action Required ☐ Required Action

Action No.

1.

2.

3.

## VII. OTHER ENVIRONMENTAL ISSUES

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

☐ No Action Required ☐ Required Action

Action No.

1.

2.

3.

Texas Department of Transportation — Design Division Standard

# ENVIRONMENTAL PERMITS, ISSUES AND COMMITMENTS

# EPIC

| FILE: epic.dgn | DN: TxDOT | CK: RG | DW: VP | CK: AR |
|---|---|---|---|---|
| © TxDOT: February 2015 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS 12-12-2011 (DS) | 6439 | 16 | 001 | VAR |
| 05-07-14 ADDED NOTE SECTION IV. | DIST | COUNTY | | SHEET NO. |
| 01-23-2015 SECTION I (CHANGED ITEM 1122 TO ITEM 506, ADDED GRASSY SWALES. | 22 | VAR | | 127 |