

|                   |                 |                |           |
|-------------------|-----------------|----------------|-----------|
| FED. RD. DIV. NO. | PROJECT NUMBER  | HIGHWAY NUMBER |           |
| 6                 | RMC 6444-52-001 | US 190, ETC.   |           |
| STATE             | DISTRICT        | COUNTY         |           |
| TEXAS             | BRY             | BRAZOS, ETC.   |           |
| CONTROL           | SECTION         | JOB            | SHEET NO. |
|                   |                 |                | 1         |

# STATE OF TEXAS DEPARTMENT OF TRANSPORTATION

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## PLANS OF PROPOSED HIGHWAY ROUTINE MAINTENANCE CONTRACT

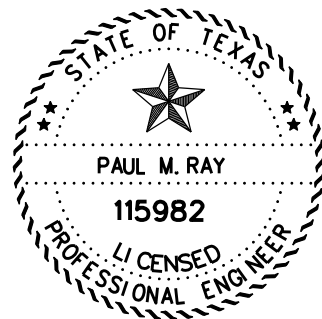
PROJECT NUMBER: RMC 6444-52-001

US 190, ETC.

BRAZOS COUNTY, ETC.

DISTRICTWIDE  
TYPE OF WORK: INSTALLATION OF DRIVEWAY PIPE

LIMITS: FROM VARIOUS  
TO VARIOUS



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

DocuSigned by:

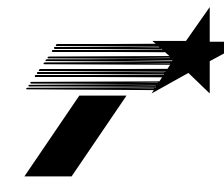
*Paul M. Ray P.E.*

PAUL M. RAY, P.E. (NO. 115982)

5/1/2023

DATE

NO EXCEPTIONS  
NO EQUATIONS  
NO RAILROAD CROSSINGS



TEXAS DEPARTMENT OF TRANSPORTATION

SPECIFICATIONS ADOPTED BY THE TEXAS DEPARTMENT OF TRANSPORTATION, NOVEMBER 1, 2014 SHALL GOVERN ON THIS PROJECT.

RECOMMENDED FOR LETTING

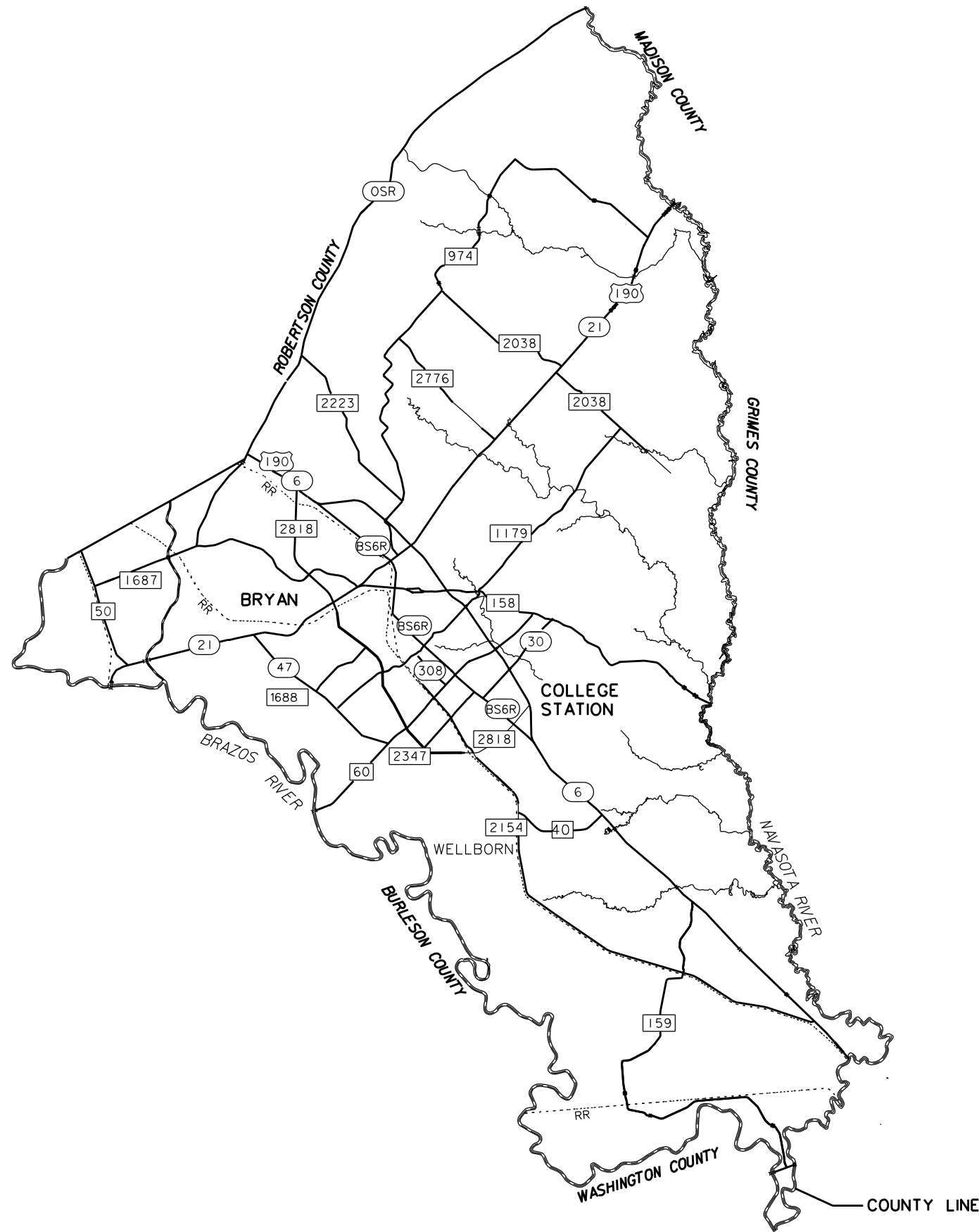
DocuSigned by:

*Jace Lee, P.E.*

JACE LEE, P.E. DIRECTOR OF MAINTENANCE

5/1/2023

DATE:



BRAZOS COUNTY

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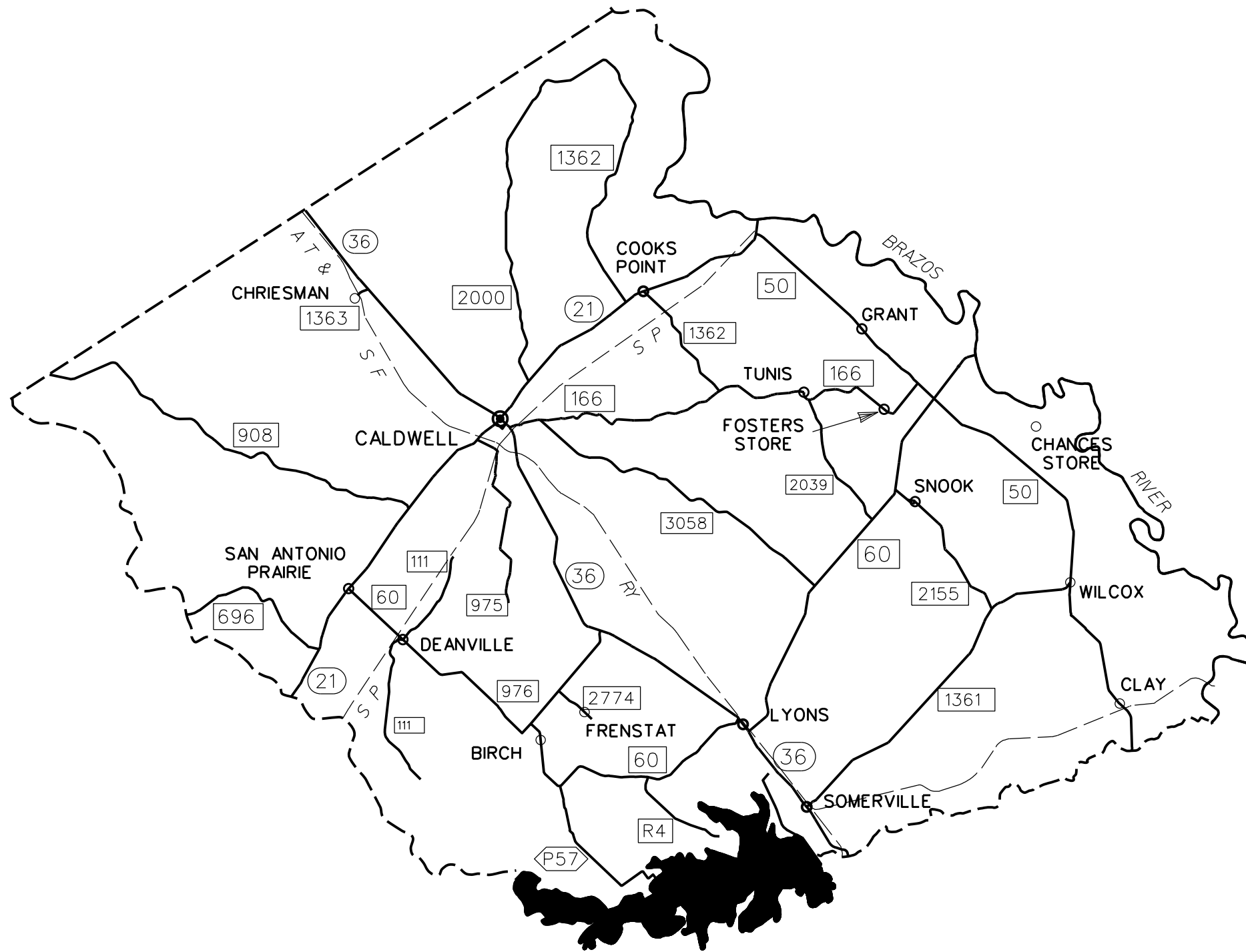
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LOCATION MAP

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| CONTROL           | SECTION         | JOB SHEET NO.  |
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BURLESON COUNTY

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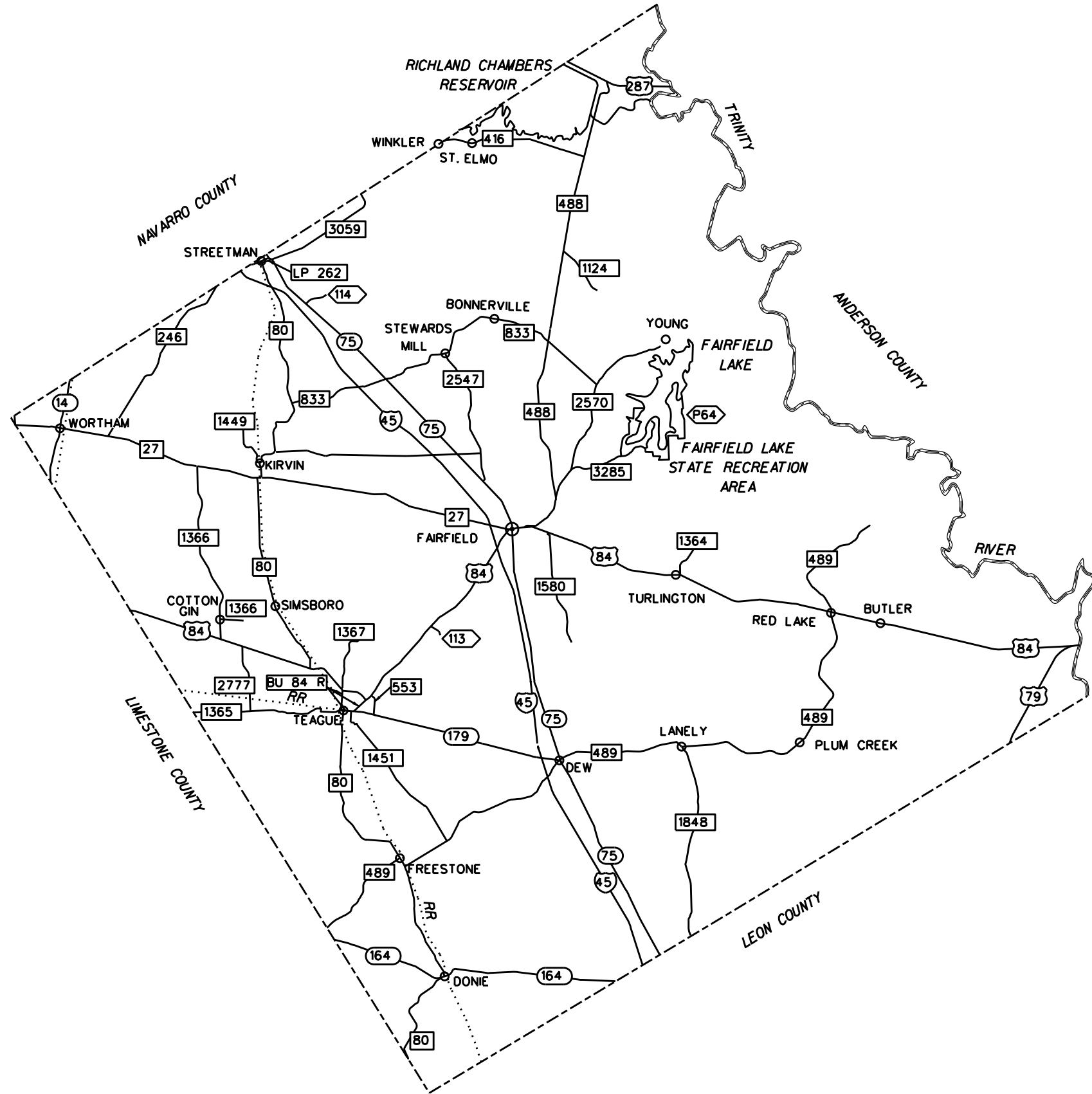
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LOCATION MAP

SHEET 2 OF 10 SHEETS

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|-------------------|-----------------|----------------|
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| CONTROL           | SECTION         | JOB SHEET NO.  |
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FREESTONE COUNTY

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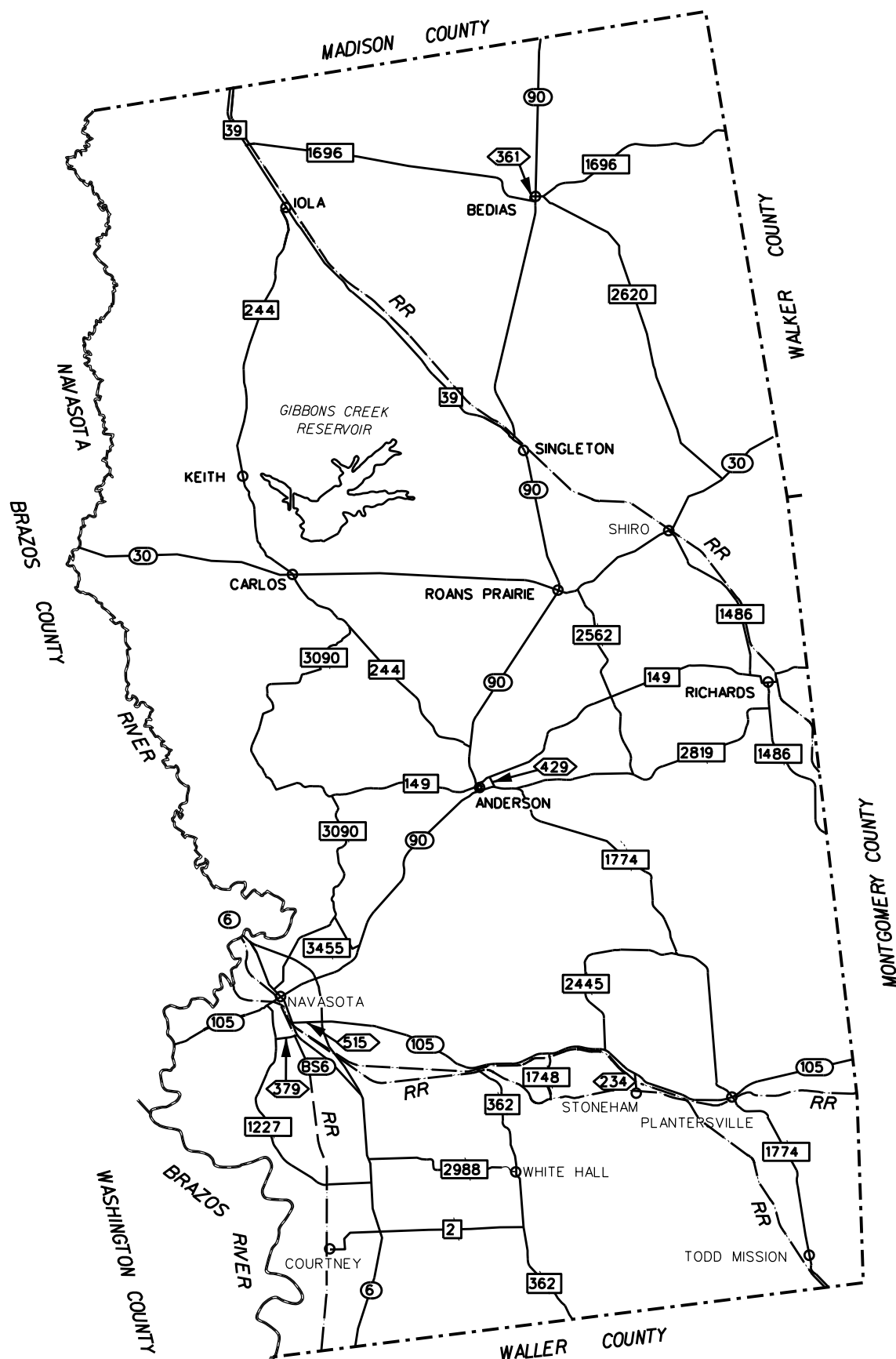
LOCATION MAP

SHEET 3 OF 10 SHEETS

|                   |                 |                |           |
|-------------------|-----------------|----------------|-----------|
| FED. RD. DIV. NO. | PROJECT NUMBER  | HIGHWAY NUMBER |           |
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| CONTROL           | SECTION         | JOB            | SHEET NO. |
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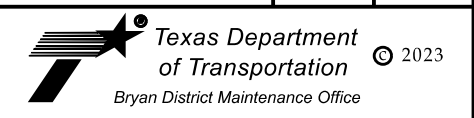




GRIMES COUNTY

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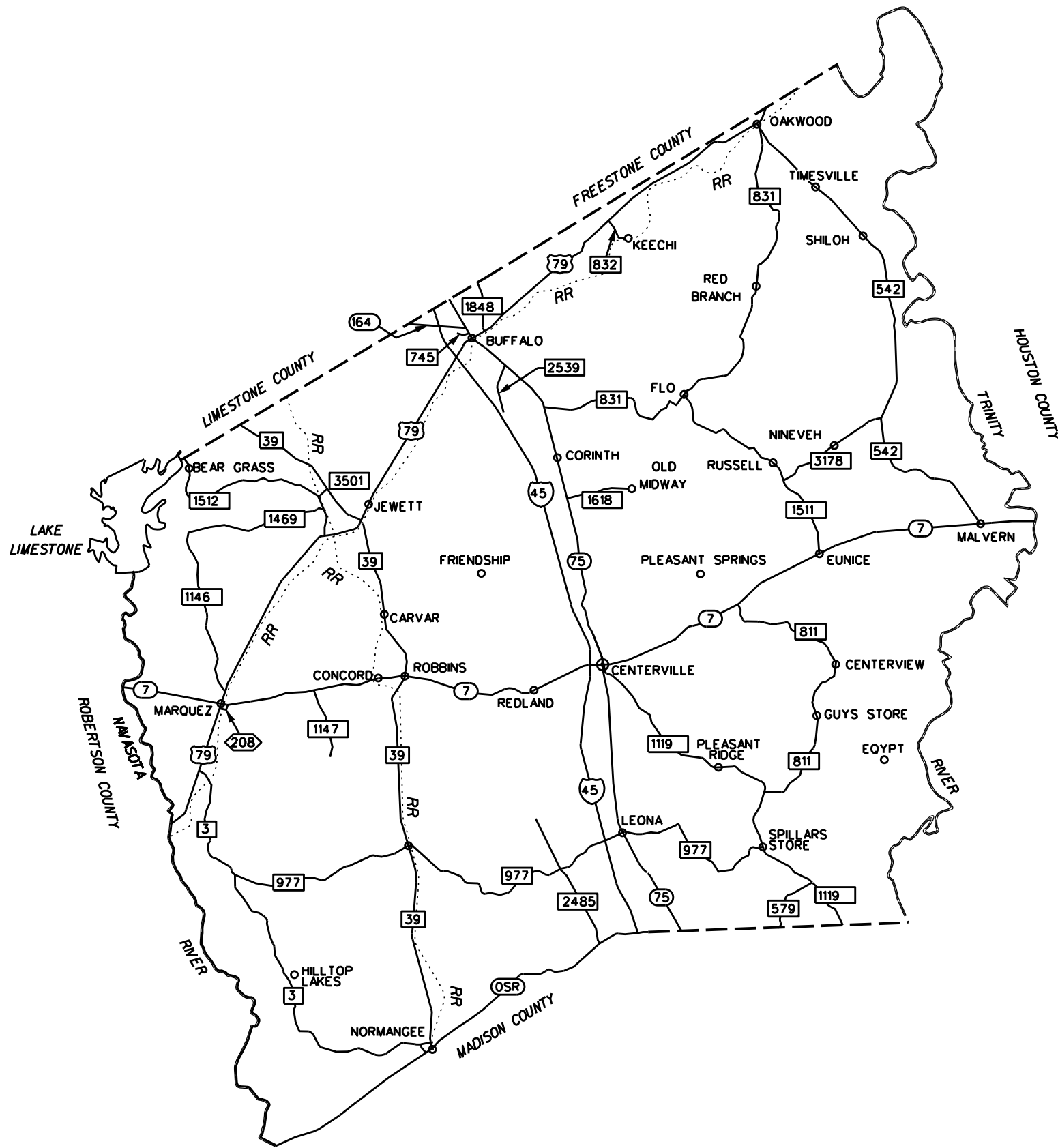
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LOCATION MAP

SHEET 4 OF 10 SHEETS

|                   |                 |                |
|-------------------|-----------------|----------------|
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| 6                 | RMC 6444-52-001 | US 190, ETC.   |
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LEON COUNTY

Drawings Not To Scale

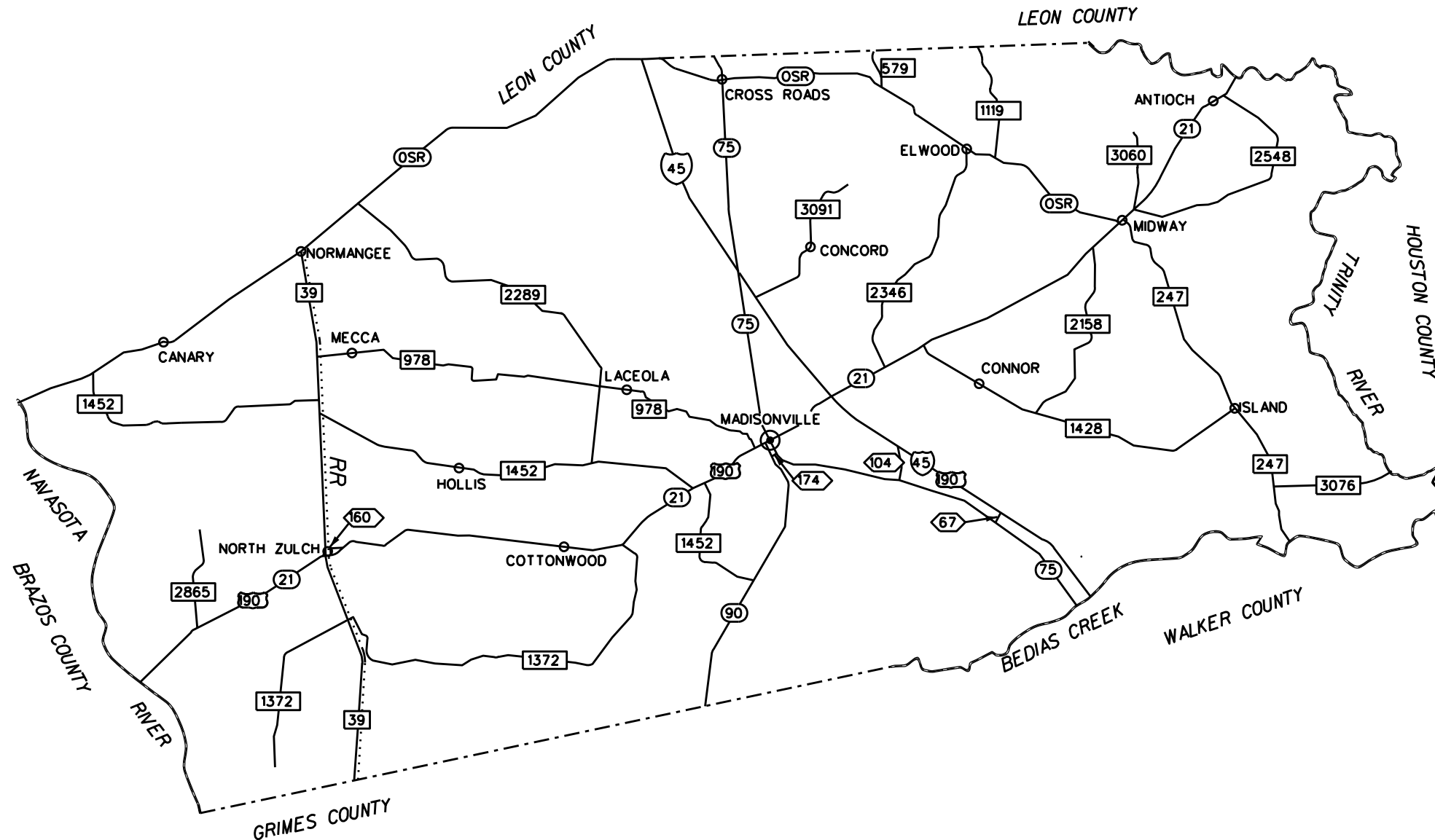
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LOCATION MAP

SHEET 5 OF 10 SHEETS

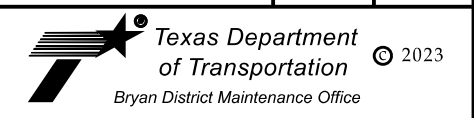
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| FED. RD. DIV. NO. | PROJECT NUMBER  | HIGHWAY NUMBER |
| 6                 | RMC 6444-52-001 | US 190, ETC.   |
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| TEXAS             | BRY             | BRAZOS, ETC.   |
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MADISON COUNTY

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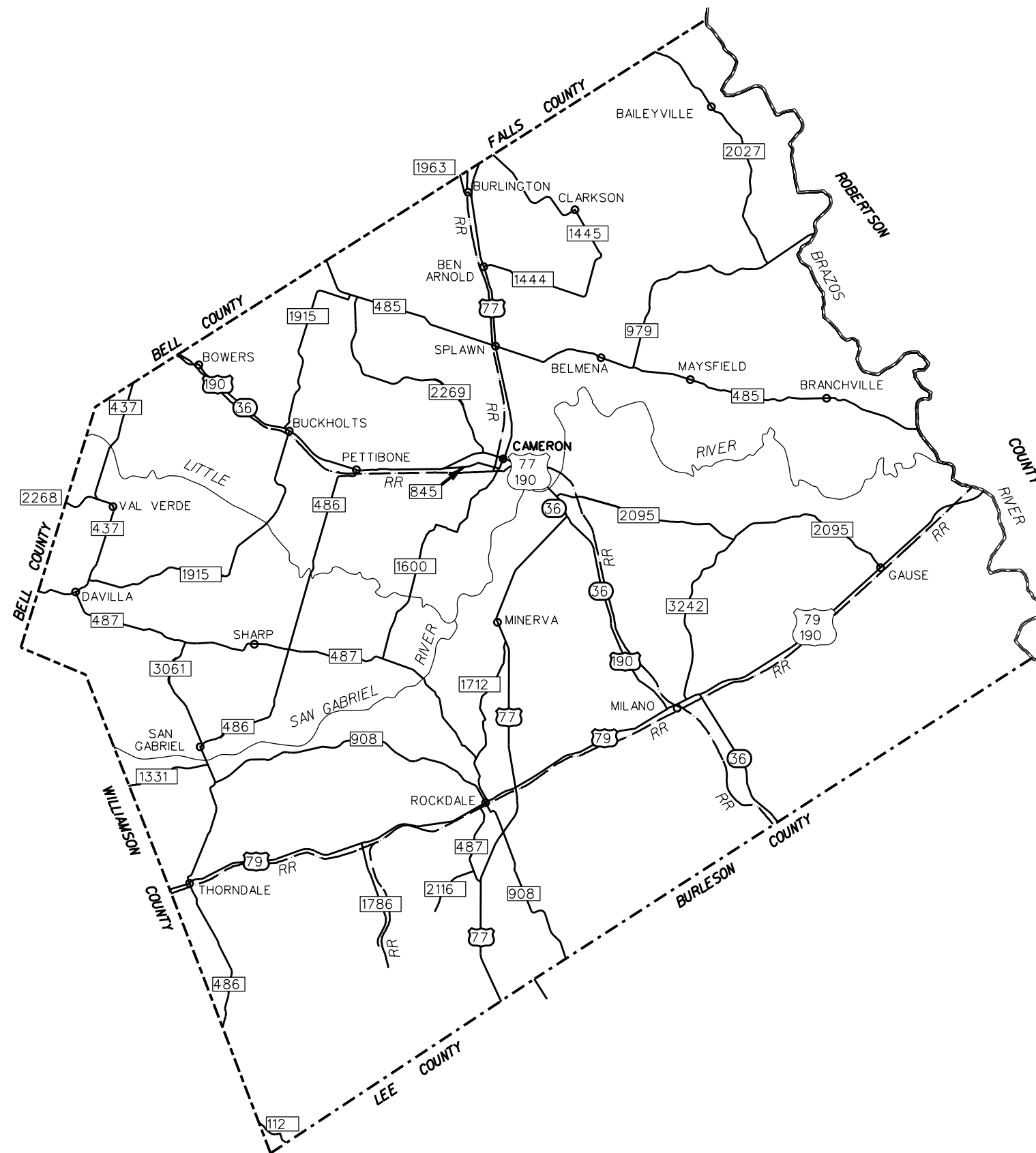
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LOCATION MAP

SHEET 6 OF 10 SHEETS

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|-------------------|-----------------|----------------|
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| 6                 | RMC 6444-52-001 | US 190, ETC.   |
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| CONTROL           | SECTION         | JOB SHEET NO.  |
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MILAM COUNTY

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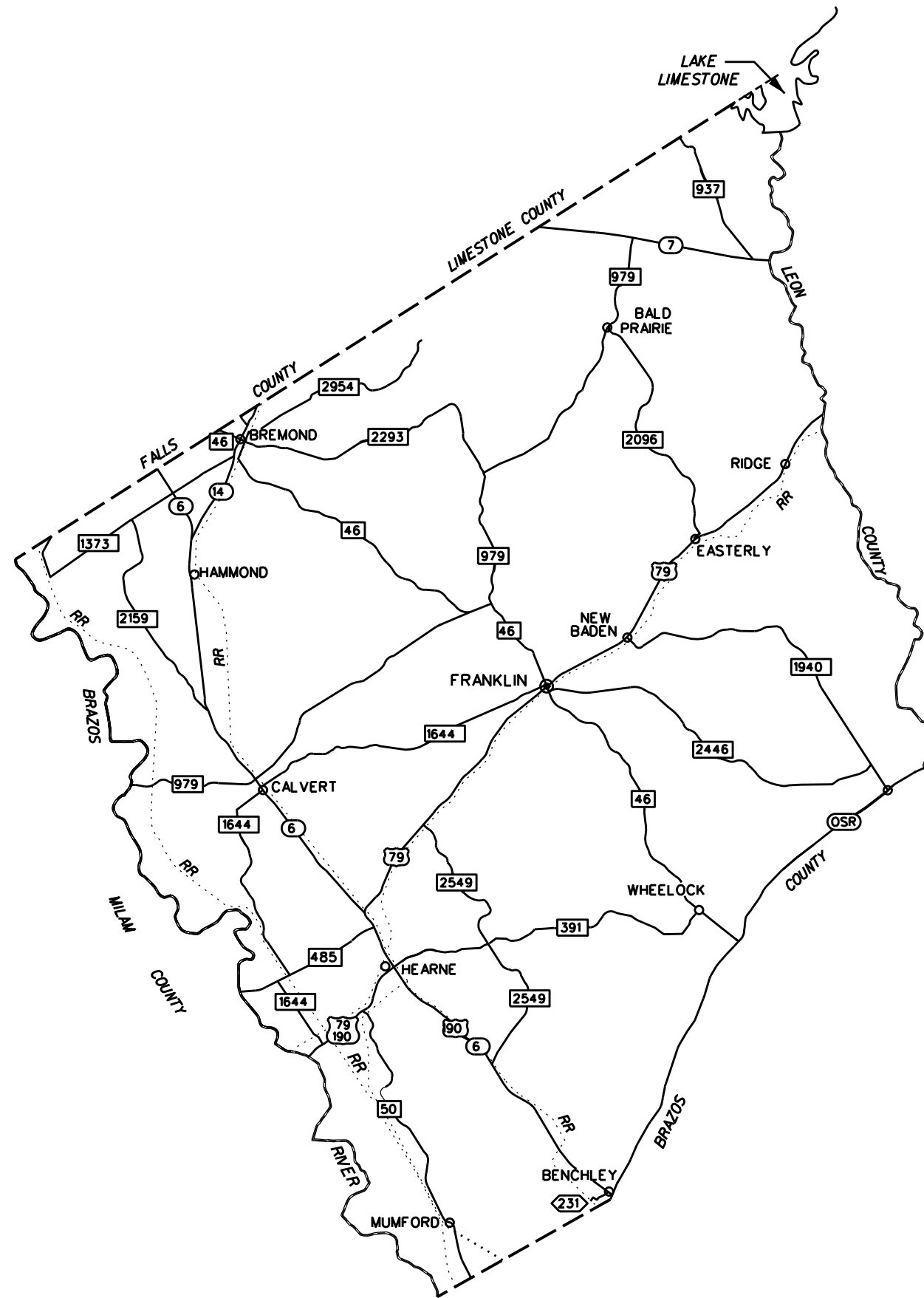
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LOCATION MAP

SHEET 7 OF 10 SHEETS

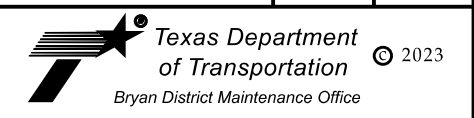
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| FED. RD. DIV. NO. | PROJECT NUMBER  | HIGHWAY NUMBER |
| 6                 | RMC 6444-52-001 | US 190, ETC.   |
| STATE             | DISTRICT        | COUNTY         |
| TEXAS             | BRY             | BRAZOS, ETC.   |
| CONTROL           | SECTION         | JOB SHEET NO.  |
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ROBERTSON COUNTY

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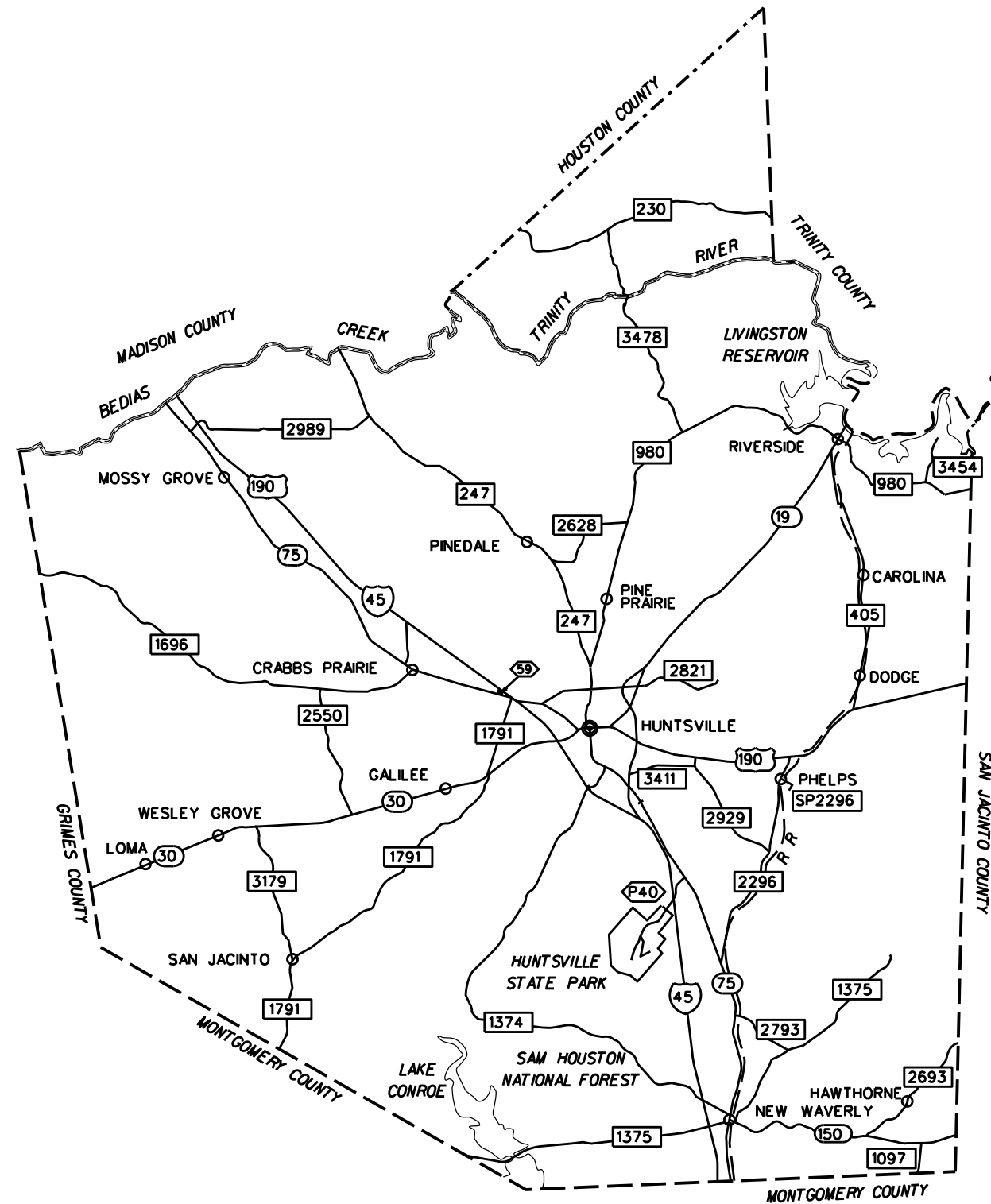


LOCATION MAP

SHEET 8 OF 10 SHEETS

|                   |                 |                |
|-------------------|-----------------|----------------|
| FED. RD. DIV. NO. | PROJECT NUMBER  | HIGHWAY NUMBER |
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| STATE             | DISTRICT        | COUNTY         |
| TEXAS             | BRY             | BRAZOS, ETC.   |
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WALKER COUNTY

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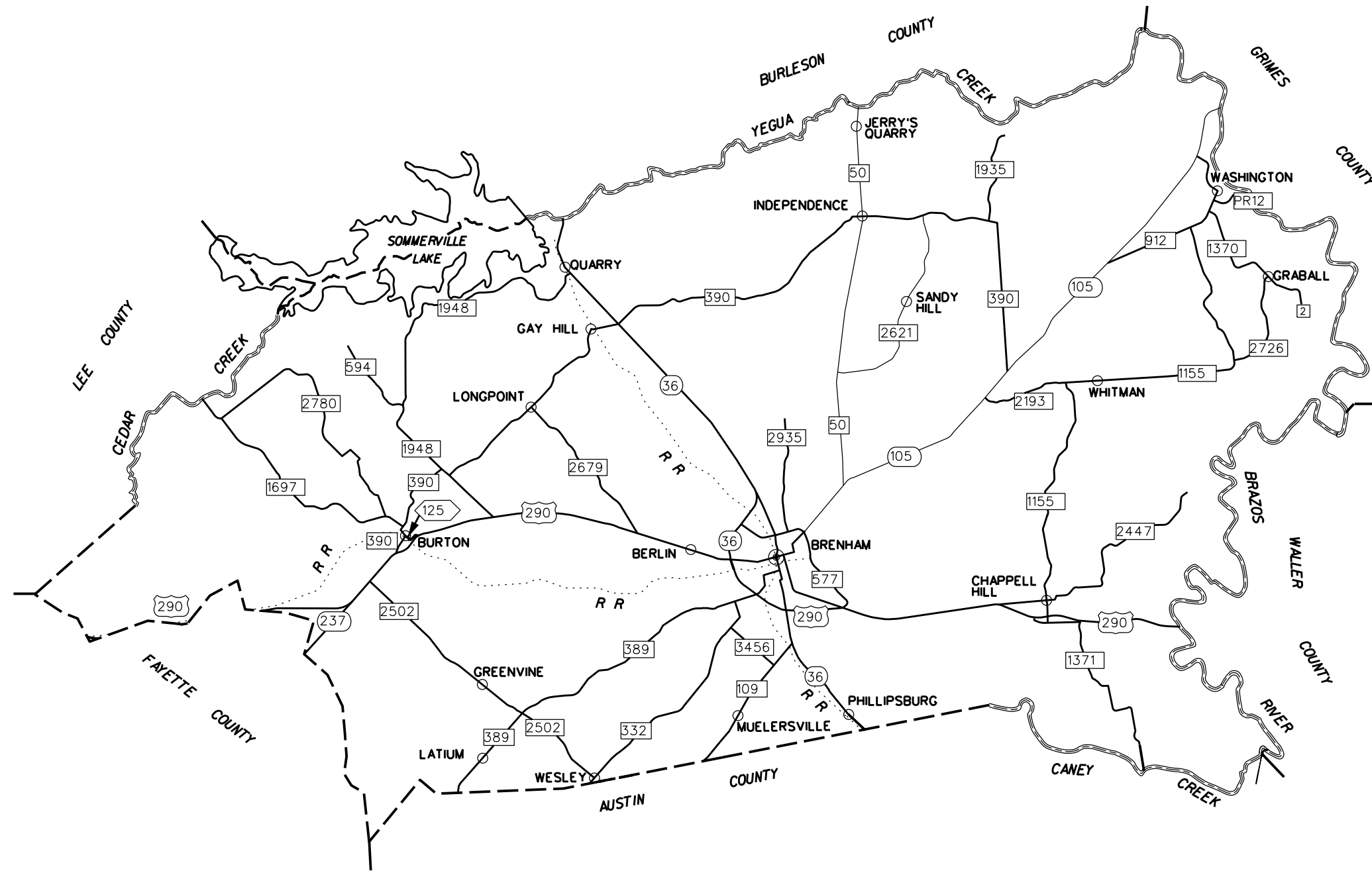
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LOCATION MAP

SHEET 9 OF 10 SHEETS

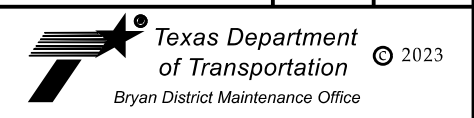
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| FED. RD. DIV. NO. | PROJECT NUMBER  | HIGHWAY NUMBER |
| 6                 | RMC 6444-52-001 | US 190, ETC.   |
| STATE             | DISTRICT        | COUNTY         |
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WASHINGTON COUNTY

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LOCATION MAP

SHEET 10 OF 10 SHEETS

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|-------------------|-----------------|----------------|
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| STATE             | DISTRICT        | COUNTY         |
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**GENERAL NOTES:**

**DEBT TO THE STATE:**

If the Comptroller is currently prohibited from issuing a warrant to the Contractor because of a debt owed to the State, then the Contractor agrees that any payment owing under the contract will be applied toward the debt or delinquent taxes until the debt or delinquent taxes are paid in full.

**GENERAL:**

Bid all work as shown on plans. This is a multiple county contract.

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

Paul M. Ray, P.E. – District Maintenance – [Paul.Ray@txdot.gov](mailto:Paul.Ray@txdot.gov)  
Michael Estillette – District Maintenance – [Michael.Estillette@txdot.gov](mailto:Michael.Estillette@txdot.gov)

Questions may be submitted via the Letting Pre-Bid Q&A web page. This webpage can be accessed from the Notice to Contractors dashboard located at the following Address:  
<https://tableau.txdot.gov/views/ProjectInformationDashboard/NoticetoContractors>

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

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

**ITEM 2 – INSTRUCTIONS TO BIDDERS:**

View (Chrome, Edge, or Firefox) plan sheets on-line or download from the web at:  
<http://www.txdot.gov/business/letting-bids/plans-online.html>

Order plans from any of the plan reproduction companies shown on the web at:  
[http://www.dot.state.tx.us/business/contractors\\_consultants/repro\\_companies.htm](http://www.dot.state.tx.us/business/contractors_consultants/repro_companies.htm)

By signing this proposal, the Contract bidder acknowledges they have a copy of the “Standard Specifications for Construction of Highways, Streets and Bridges”, adopted by the Texas Department of Transportation, November 1, 2014.

**ITEM 3 AWARD AND EXECUTION OF CONTRACT:**

Multiple work orders will be used to procure work of the type identified in the contract at locations that have not yet been determined.

This Contract includes callout work for all items of the contract.

Work orders may be issued until August 31, 2025. The contract will be in effect until the work on the last work order prior to this date is completed.

This Contract allows for an extension for up to an additional 2-yrs. as covered in Special Provision (SP) 004-002 when there is a mutual agreement in writing between the Contractor and the Engineer.

**ITEM 4 SCOPE OF WORK:**

This contract upgrades private, commercial, and public driveway pipes. Work includes placement of safety end treatments, riprap, embankment, raising or lowering a pipe, or any other item of work related to the correction of driveway pipe installations.

**ITEM 6 CONTROL OF MATERIALS:**

The contractor will provide all materials to complete the work on this project. Quantities shown are estimates only. Payment will be based on actual quantities placed .

**ITEM 7 LEGAL RELATIONS AND RESPONSIBILITIES:**

State contract mowers will mow the right of way during the growing season. The Contractor will be notified by the Engineer one week in advance of the anticipated time when mowers will be in the limits of the project. Clean the right of way to such a condition that allows the mowing contractors to safely mow.

This project is on a hurricane evacuation route. Furnish at the pre-construction meeting a written plan outlining procedures to suspend work, secure the job site and safely handle traffic through and across the project in the event of a hurricane evacuation.

During the hurricane season (June 1 through November 30), do not close any travel lanes except when the Contractor can demonstrate that he can provide labor, equipment, material, work plan, and quality of work to satisfactorily return all lanes to an open, all-weather travel surface within three days of receiving written or verbal notice but no later than 3 days prior to hurricane landfall. Construction of temporary lanes to an all-weather surface will be paid in accordance with Article 9.7, “Payment for Extra Work and Force Account Method.”

In addition to lane closures, cease work 3 days prior to hurricane landfall on or near the roadway that adversely impacts the flow of traffic and reduces the capacity of the highway during an evacuation. Prohibit the Contractor’s, sub-contractors’ or material suppliers’ vehicles from entering or exiting the stream of traffic including material hauling and delivery, and mobilization or demobilization of equipment. When directed, this prohibition will include a reasonable time period for the evacuees to return to their point of origin.

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RMC:6444-52-001

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GENERAL NOTES

SHEET 1 OF 3 SHEETS

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| FED. RD. DIV. NO. | PROJECT NUMBER  | HIGHWAY NUMBER |
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In the event of the declaration of a hurricane watch, warning, other severe weather warning or national or state emergency that requires the roadways in the vicinity be used as evacuation routes, cease all work that requires the Contractor's, sub-contractors' or material suppliers' vehicles to enter the stream of traffic on these primary or secondary evacuation routes. This work includes material hauling and delivery, and mobilization or demobilization of equipment.

The following roadways are recognized evacuation routes in the Bryan District:

Primary Evacuation Routes: IH 45, US 290, SH 6, SH 36

Secondary Evacuation Routes: US 79, US 84, SH 7, SH 30, SH 21, SH 105.

Other routes may be designated.

**ITEM 8 PROSECUTION AND PROGRESS:**

Contract length will be computed and charged in accordance with Article 8.3.1.5. Calendar Day.

Work orders will be issued in accordance with Section 8.3.1.4. "Standard Workweek."

The time allowed for each work order will be based on a production rate of two (2) working days per location.

Commence work upon the issuance of work order by the Engineer. Work orders may contain multiple locations on multiple roadways. Each work order stands alone with regard to assessing liquidated damages. Work orders will be issued for minimum of \$1,500.00 worth of work.

By noon of each Wednesday for an active work order, provide the Engineer a written outline of the daily work schedule for the following week. Include in the outline the times and places for proposed traffic control changes, lane and shoulder closures, and moving operations or other operations that affect traffic on the roadway.

Equipment and material may be pre-staged at approved locations.

Continuously prosecute work to complete the work order unless otherwise directed by the engineer.

When work is being done at a location which experiences a heavy volume of traffic in the AM and PM commuting periods, the Engineer can direct the Contractor not to perform work for periods appropriate to the locations that may impact the free flow of traffic (including lane closures). Performing work prior to AM time restrictions and continuing work after PM time restrictions will be determined by the Engineer. Otherwise, do not commence work before sunrise. Coordinate work so no personnel or machinery is on the travel-way or in picnic areas after sunset. Complete work during daylight hours when weather conditions are appropriate.

Open the entire driveway at the end of each workday.

**ITEM 132 EMBANKMENT:**

Embankment material used for all work will meet a plasticity index between 15 and 35. This applies for sources inside and outside of the ROW.

Embankment use is to establish proper slopes and grades around installed safety end treatments.

Material meeting the specifications of this Item used for pavement repairs is subsidiary to Item 530.

**ITEM 247 FLEXIBLE BASE:**

Flexible Base material shall be of Type A, Grand 1 or 2. Ordinary compaction will be used to densify material at time of placement.

Depth of lifts when placing flexible base shall be a maximum of 8 in. unless otherwise approved by the Engineer.

Thickness of the placed flexible base shall match the existing section of improved material under the surface of the surface layer.

Measurement shall be by the capacity of the vehicle in CY.

Payment for this item is subsidiary to ITEM 530.

**ITEM 464 REINFORCED CONCRETE PIPE:**

Seal RCP joints using cold applied plastic asphalt sewer compound or cold applied preformed plastic gaskets. Cohesionless, sandy material (PI < 10) is not allowed for backfill. The Contractor may use the unacceptable material by either adding cement at a rate suitable to stabilize the material or the Contractor may mix it with a suitable soil material at a ratio which produces a cohesive material subject to approval by the Engineer.

**ITEM 467 SAFETY END TREATMENT:**


Install CMP SET's for CM pipes and RCP SET's for RC pipes, unless otherwise approved by the engineer.

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

Where shown on applicable TCP standards, channelizing devices on the centerline are required at all times; including when a pilot vehicle is used to lead traffic. Mount a G20-4 sign at a conspicuous location on the rear of the vehicle. Traffic delays caused by one-lane, two-way traffic control, will not be allowed to exceed 5 minutes unless approved by the Engineer.

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Bryan District Maintenance Office

GENERAL NOTES

**SHEET 2 OF 3 SHEETS**

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|-------------------|-----------------|----------------|
| FED. RD. DIV. NO. | PROJECT NUMBER  | HIGHWAY NUMBER |
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| STATE             | DISTRICT        | COUNTY         |
| TEXAS             | BRY             | BRAZOS, ETC.   |
| CONTROL           | SECTION         | JOB SHEET NO.  |
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Provide construction fencing as approved at all work locations to protect pedestrian or bicycle traffic. This material and its placement will be considered subsidiary to Item 502.

During one-way operations, station flaggers at all county roads and any other locations, such as private businesses, that may have traffic entering the work area.

Removal of ground mounted temporary signs and supports as specified on standard sheet BC(5), shall include the immediate backfilling of support holes with Type B embankment material and the compaction of the backfill material.

PCMS required by TCP standard sheets shall not be paid for directly, but shall be considered subsidiary to various bid items of the Contract.

When a lane closure is used in the operation, rumble strips will be used along with the TCP in accordance with plan sheet WZ(RS)-22, "TEMPORARY RUMBLE STRIPS".

Barricades, signs, and traffic handling will be subsidiary to the various bid items of the Contract.

**ITEM 506 TEMPORARY EROSION, SEDIMENTATION AND ENVIRONMENTAL CONTROLS:**

It is not anticipated that any erosion control devices will be needed on this project. However, in the event that any devices are needed, payment for the work will be determined in accordance with Article 9.7, "Payment for Extra Work and Force Account Method".

**ITEM 529 CONCRETE CURB, GUTTER, AND COMBINED CURB AND GUTTER**

Provide steel reinforcement in all concrete curb, gutter, and combined curb and gutter in accordance with the plans and specifications. Use synthetic fiber in lieu of steel reinforcing when approved in writing by the Engineer.

**ITEM 530 INTERSECTIONS, DRIVEWAYS, AND TURNOUTS:**

Driveway access will be maintained at all times.

Concrete shall be Class A for a minimum thickness of the existing concrete section of the intersection, driveway or driveway being replaced unless otherwise approved by the Engineer.

HMA shall be Type C for a minimum thickness of the existing HMA section of the intersection, driveway or turnout being replaced unless otherwise approved by the Engineer.

This Item provides full compensation for furnishing and operating equipment; excavation and embankment; base and pavement materials; and labor, materials, tools and incidentals.

Drainage Structures will be measured and paid for in accordance with the pertinent bid items.

**ITEM 6001 PORTABLE CHANGEABLE MESSAGE SIGN:**

Furnish, install, and operate up to 2 Portable Changeable Message Signs (PCMS) for this project. The signs can be used both on the project and within a ten (10) mile radius of the project. Locations, messages, and durations of use will be specified by the Engineer. The primary uses will be to inform the public of special events, lane and road closures, and changes in traffic control. Signs will be paid for only when used as directed by the Engineer.

**ITEM 6185 TRUCK MOUNTED ATTENUATOR (TMA) AND TRAILER ATTENUATOR (TA)**

The truck mounted attenuators (TMA) as shown in the Traffic Control Plan Standard Sheets are not optional and are required to be mounted on each shadow vehicle. The Contractor shall refer to the General Notes in each TCP sheet to determine the number of TMAs required for daily operations.

TMA's will be paid under Item 6185-6002 'TMA (STATIONARY)'

TMA's shall meet the requirements of the Compliant Work Zone Traffic Control Device List. <http://ftp.txdot.gov/pub/txdot-info/cmd/mpl/cwztc.pdf>

Signs and arrow boards required on truck-mounted attenuators and pilot vehicles are subsidiary to Item 6185.

Submit to the Engineer at or before the pre-construction meeting a letter certifying all TMA devices used on the project meet NCHRP 350 or AASHTO Manual for assessing Safety Hardware (MASH) requirements.

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**GENERAL NOTES**

SHEET 3 OF 3 SHEETS

|                   |                 |                |
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**ESTIMATE SUMMARY**

| ITEM CODE |           |        | DESCRIPTION                           | UNIT | PROJECT: 6444-52-001  |  |
|-----------|-----------|--------|---------------------------------------|------|-----------------------|--|
| ITEM NO.  | DESC CODE | SP NO. |                                       |      | HIGHWAY: US 190, ETC. |  |
|           |           |        |                                       |      | ALL BID ITEMS         |  |
|           |           |        |                                       | EST  | Revised               |  |
| 104       | 6029      |        | REMOVING CONC (CURB OR CURB & GUTTER) | LF   | 500.000               |  |
| 132       | 6005      |        | EMBANKMENT(FINAL)(ORD COMP)(TY C)     | CY   | 500.000               |  |
| 402       | 6001      |        | TRENCH EXCAVATION PROTECTION          | LF   | 80.000                |  |
| 420       | 6002      |        | CL A CONC (MISC)                      | CY   | 40.000                |  |
| 420       | 6012      |        | CL B CONC (MISC)                      | CY   | 40.000                |  |
| 460       | 6002      |        | CMP (GAL STL 18 IN)                   | LF   | 1,000.000             |  |
| 460       | 6003      |        | CMP (GAL STL 24 IN)                   | LF   | 650.000               |  |
| 460       | 6004      |        | CMP (GAL STL 30 IN)                   | LF   | 120.000               |  |
| 460       | 6005      |        | CMP (GAL STL 36 IN)                   | LF   | 120.000               |  |
| 460       | 6006      |        | CMP (GAL STL 42 IN)                   | LF   | 80.000                |  |
| 460       | 6007      |        | CMP (GAL STL 48 IN)                   | LF   | 80.000                |  |
| 464       | 6003      |        | RC PIPE (CL III)(18 IN)               | LF   | 80.000                |  |
| 464       | 6005      |        | RC PIPE (CL III)(24 IN)               | LF   | 120.000               |  |
| 464       | 6007      |        | RC PIPE (CL III)(30 IN)               | LF   | 80.000                |  |
| 464       | 6008      |        | RC PIPE (CL III)(36 IN)               | LF   | 80.000                |  |
| 464       | 6009      |        | RC PIPE (CL III)(42 IN)               | LF   | 80.000                |  |
| 464       | 6010      |        | RC PIPE (CL III)(48 IN)               | LF   | 80.000                |  |
| 467       | 6348      |        | SET (TY II) (18 IN) (CMP) (6:1) (P)   | EA   | 16.000                |  |
| 467       | 6363      |        | SET (TY II) (18 IN) (RCP) (6:1) (P)   | EA   | 50.000                |  |
| 467       | 6380      |        | SET (TY II) (24 IN) (CMP) (6:1) (P)   | EA   | 8.000                 |  |
| 467       | 6395      |        | SET (TY II) (24 IN) (RCP) (6:1) (P)   | EA   | 30.000                |  |
| 467       | 6410      |        | SET (TY II) (30 IN) (CMP) (6:1) (P)   | EA   | 4.000                 |  |
| 467       | 6423      |        | SET (TY II) (30 IN) (RCP) (6:1) (P)   | EA   | 16.000                |  |
| 467       | 6444      |        | SET (TY II) (36 IN) (CMP) (6:1) (P)   | EA   | 2.000                 |  |
| 467       | 6454      |        | SET (TY II) (36 IN) (RCP) (6:1) (P)   | EA   | 8.000                 |  |
| 467       | 6460      |        | SET (TY II) (42 IN) (CMP) (6:1) (P)   | EA   | 4.000                 |  |
| 467       | 6466      |        | SET (TY II) (42 IN) (RCP) (6:1) (P)   | EA   | 4.000                 |  |
| 467       | 6471      |        | SET (TY II) (48 IN) (CMP) (6:1) (P)   | EA   | 4.000                 |  |
| 467       | 6480      |        | SET (TY II) (48 IN) (RCP) (6:1) (P)   | EA   | 4.000                 |  |
| 472       | 6004      |        | REMOV & RE-LAY PIPE (18 IN)           | LF   | 150.000               |  |
| 472       | 6006      |        | REMOV & RE-LAY PIPE (24 IN)           | LF   | 150.000               |  |
| 472       | 6008      |        | REMOV & RE-LAY PIPE (30 IN)           | LF   | 120.000               |  |
| 472       | 6011      |        | REMOV & RE-LAY PIPE (36 IN)           | LF   | 120.000               |  |
| 472       | 6012      |        | REMOV & RE-LAY PIPE (42 IN)           | LF   | 120.000               |  |
| 472       | 6013      |        | REMOV & RE-LAY PIPE (48 IN)           | LF   | 120.000               |  |
| 496       | 6007      |        | REMOV STR (PIPE)                      | LF   | 1,500.000             |  |
| 500       | 6033      |        | MOBILIZATION (CALLOUT )               | EA   | 6.000                 |  |
| 529       | 6001      |        | CONC CURB (TY I)                      | LF   | 500.000               |  |
| 529       | 6002      |        | CONC CURB (TY II)                     | LF   | 500.000               |  |
| 529       | 6007      |        | CONC CURB & GUTTER (TY I)             | LF   | 500.000               |  |
| 529       | 6008      |        | CONC CURB & GUTTER (TY II)            | LF   | 500.000               |  |
| 529       | 6025      |        | CONC CURB (TY III)                    | LF   | 500.000               |  |
| 529       | 6026      |        | CONC CURB (TY IV)                     | LF   | 500.000               |  |
| 530       | 6004      |        | DRIVEWAYS (CONC)                      | SY   | 100.000               |  |
| 530       | 6005      |        | DRIVEWAYS (ACP)                       | SY   | 1,600.000             |  |
| 6185      | 6002      |        | TMA (STATIONARY)                      | DAY  | 10.000                |  |

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RMC:6444-52-001

PRINT DATE REVISION DATE



ESTIMATE AND QUANTITY SHEET

|                   |                 |                |
|-------------------|-----------------|----------------|
| FED. RD. DIV. NO. | PROJECT NUMBER  | HIGHWAY NUMBER |
| 6                 | RMC 6444-52-001 | US 190, ETC.   |
| STATE             | DISTRICT        | COUNTY         |
| TEXAS             | BRY             | BRAZOS, ETC.   |
| CONTROL           | SECTION         | JOB SHEET NO.  |
|                   |                 | 15             |

**BARRICADE AND CONSTRUCTION (BC) STANDARD SHEETS GENERAL NOTES:**

1. The Barricade and Construction Standard Sheets (BC sheets) are intended to show typical examples for placement of temporary traffic control devices, construction pavement markings, and typical work zone signs. The information contained in these sheets meet or exceed the requirements shown in the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD).
2. The development and design of the Traffic Control Plan (TCP) is the responsibility of the Engineer.
3. The Contractor may propose changes to the TCP that are signed and sealed by a licensed professional engineer for approval. The Engineer may develop, sign and seal Contractor proposed changes.
4. The Contractor is responsible for installing and maintaining the traffic control devices as shown in the plans. The Contractor may not move or change the approximate location of any device without the approval of the Engineer.
5. Geometric design of lane shifts and detours should, when possible, meet the applicable design criteria contained in manuals such as the American Association of State Highway and Transportation Officials (AASHTO), "A Policy on Geometric Design of Highways and Streets," the TxDOT "Roadway Design Manual" or engineering judgment.
6. When projects abut, the Engineer(s) may omit the END ROAD WORK, TRAFFIC FINES DOUBLE, and other advance warning signs if the signing would be redundant and the work areas appear continuous to the motorists. If the adjacent project is completed first, the Contractor shall erect the necessary warning signs as shown on these sheets, the TCP sheets or as directed by the Engineer. The BEGIN ROAD WORK NEXT X MILES sign shall be revised to show appropriate work zone distance.
7. The Engineer may require duplicate warning signs on the median side of divided highways where median width will permit and traffic volumes justify the signing.
8. All signs shall be constructed in accordance with the details found in the "Standard Highway Sign Designs for Texas," latest edition. Sign details not shown in this manual shall be shown in the plans or the Engineer shall provide a detail to the Contractor before the sign is manufactured.
9. The temporary traffic control devices shown in the illustrations of the BC sheets are examples. As necessary, the Engineer will determine the most appropriate traffic control devices to be used.
10. Where highway construction or maintenance work is being undertaken, other than mobile operations as defined by the Texas Manual on Uniform Traffic Control Devices, CSJ limit signs are required. CSJ limit signs are shown on BC(2). The OBEY WARNING SIGNS STATE LAW sign, STAY ALERT TALK OR TEXT LATER and the WORK ZONE TRAFFIC FINES DOUBLE sign with plaque shall be erected in advance of the CSJ limits. The BEGIN ROAD WORK NEXT X MILES, CONTRACTOR and END ROAD WORK signs shall be erected at or near the CSJ limits. For mobile operations, CSJ limit signs are not required.
11. Traffic control devices should be in place only while work is actually in progress or a definite need exists.
12. The Engineer has the final decision on the location of all traffic control devices.
13. Inactive equipment and work vehicles, including workers' private vehicles must be parked away from travel lanes. They should be as close to the right-of-way line as possible, or located behind a barrier or guardrail, or as approved by the Engineer.

**WORKER SAFETY NOTES:**

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

**COMPLIANT WORKZONE TRAFFIC CONTROL DEVICES**

1. Only pre-qualified products shall be used. The "Compliant Work Zone Traffic Control Devices List" (CWZTCD) describes pre-qualified products and their sources.
2. Work zone traffic control devices shall be compliant with the Manual for Assessing safety Hardware (MASH).

|  |
|--|
| <p><b>THE DOCUMENTS BELOW CAN BE FOUND ON-LINE AT</b><br/> <a href="http://www.txdot.gov">http://www.txdot.gov</a></p> |
| 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  |

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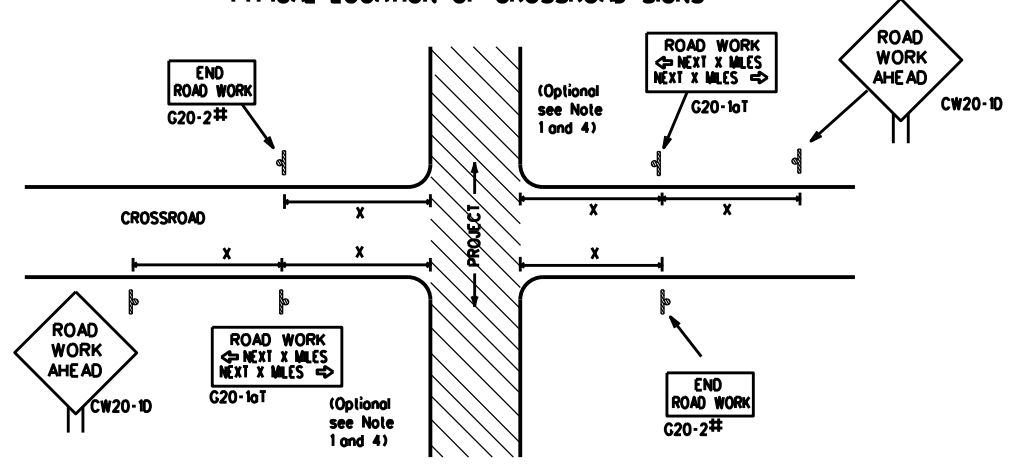


**BARRICADE AND CONSTRUCTION  
GENERAL NOTES  
AND REQUIREMENTS**

**BC(1)-21**

|         |               |      |       |             |       |     |       |     |              |
|---------|---------------|------|-------|-------------|-------|-----|-------|-----|--------------|
| FILE:   | bc-21.dgn     | DN:  | TxDOT | CK:         | TxDOT | DW: | TxDOT | CK: | TxDOT        |
| © TxDOT | November 2002 |      |       | RMC         | *     |     |       |     | HIGHWAY      |
|         | REVISIONS     |      |       | 6444-52-001 |       |     |       |     | US 190, ETC. |
| 4-03    | 7-13          |      |       |             |       |     |       |     |              |
| 9-07    | 8-14          | DIST |       | COUNTY      |       |     |       |     | SHEET NO.    |
| 5-10    | 5-21          | BRY  |       | BRAZOS, ETC |       |     |       |     | 16           |

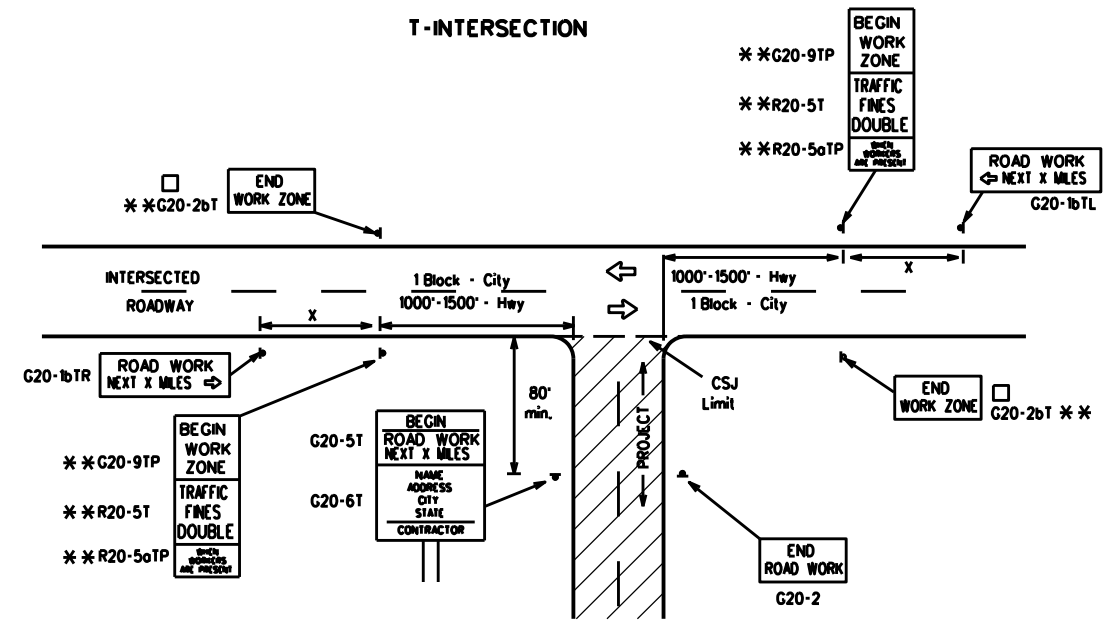
TYPICAL LOCATION OF CROSSROAD SIGNS



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

- 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.
- The Engineer may use the reduced size 36" x 36" ROAD WORK AHEAD (CW20-1D) sign mounted back to back with the reduced size 36" x 18" "END ROAD WORK" (G20-2) sign on low volume crossroads (see Note 4 under "Typical Construction Warning Sign Size and Spacing"). See the "Standard Highway Sign Designs for Texas" manual for sign details. The Engineer may omit the advance warning signs on low volume crossroads. The Engineer will determine whether a road is low volume as per TMUTCD Part 5. This information shall be shown in the plans.
- 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.
- 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.
- Additional traffic control devices may be shown elsewhere in the plans for higher volume crossroads.
- 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

- 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.
- 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

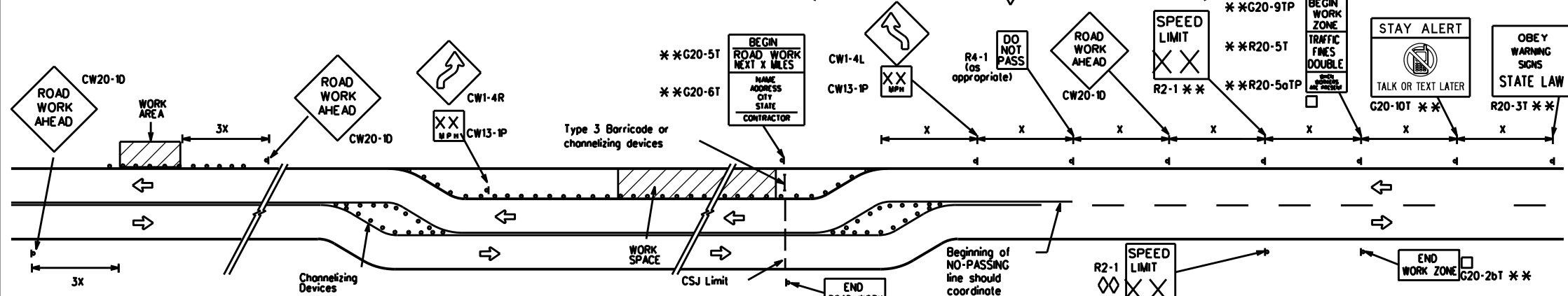
| Sign Number or Series                 | SIZE              |                    | SPACING          |                                |
|---------------------------------------|-------------------|--------------------|------------------|--------------------------------|
|                             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

- 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

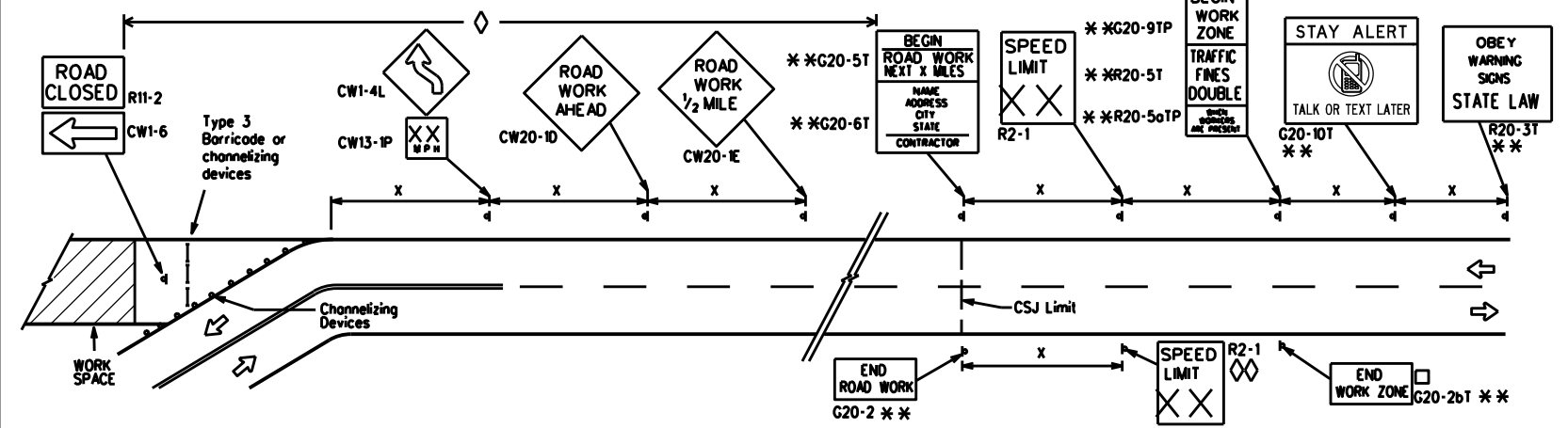
- Special or larger size signs may be used as necessary.
- Distance between signs should be increased as required to have 1500 feet advance warning.
- Distance between signs should be increased as required to have 1/2 mile or more advance warning.
- 36" x 36" "ROAD WORK AHEAD" (CW20-1D) signs may be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

WORK AREAS IN MULTIPLE LOCATIONS WITHIN CSJ LIMITS

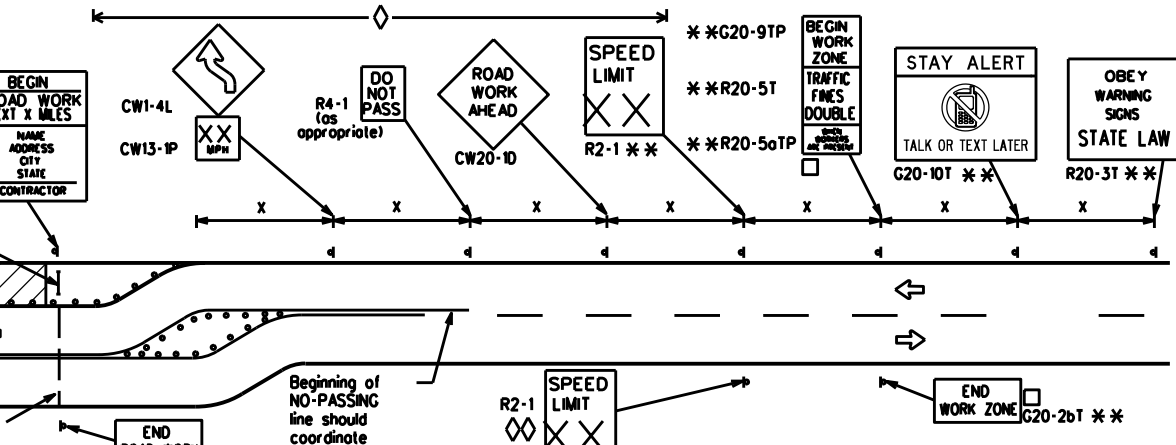


When extended distances occur between minimal work spaces, the Engineer/Inspector should ensure additional "ROAD WORK AHEAD" (CW20-1D) signs are placed in advance of these work areas to remind drivers they are still within the project limits. See the applicable TCP sheets for exact location and spacing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

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



SAMPLE LAYOUT OF SIGNING FOR WORK BEGINNING AT THE CSJ LIMITS



NOTES

- The Contractor shall determine the appropriate distance to be placed on the G20-1 series signs and "BEGIN ROAD WORK NEXT X MILES" (G20-5T) sign for each specific project. This distance shall replace the "X" and shall be rounded to the nearest whole mile with the approval of the Engineer. No decimals shall be used.
- The "BEGIN WORK ZONE" (G20-9TP) and "END WORK ZONE" (G20-2bT) shall be used as shown on the sample layout when advance signs are required outside the CSJ Limits. They inform the motorist of entering or leaving a part of the work zone lying outside the CSJ Limits where traffic fines may double if workers are present.
- CSJ limit signing is required for highway construction and maintenance work, with the exception of mobile operations.
- Area for placement of "ROAD WORK AHEAD" (CW20-1D) sign and other signs or devices as called for on the Traffic Control Plan.
- Contractor will install a regulatory speed limit sign at the end of the work zone.

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

SHEET 2 OF 12



BARRICADE AND CONSTRUCTION PROJECT LIMIT

BC(2)-21

|                       |             |              |           |           |
|-----------------------|-------------|--------------|-----------|-----------|
| FILE: bc-21.dgn       | DN: TxDOT   | CK: TxDOT    | DW: TxDOT | CK: TxDOT |
| © TxDOT November 2002 | RMC         |              | HIGHWAY   |           |
| REVISIONS             | 6444-52-001 | US 190, ETC. |           |           |
| 9-07 8-14             | DIST        | COUNTY       | SHEET NO. |           |
| 7-13 5-21             | BRY         | BRAZOS, ETC  | 17        |           |

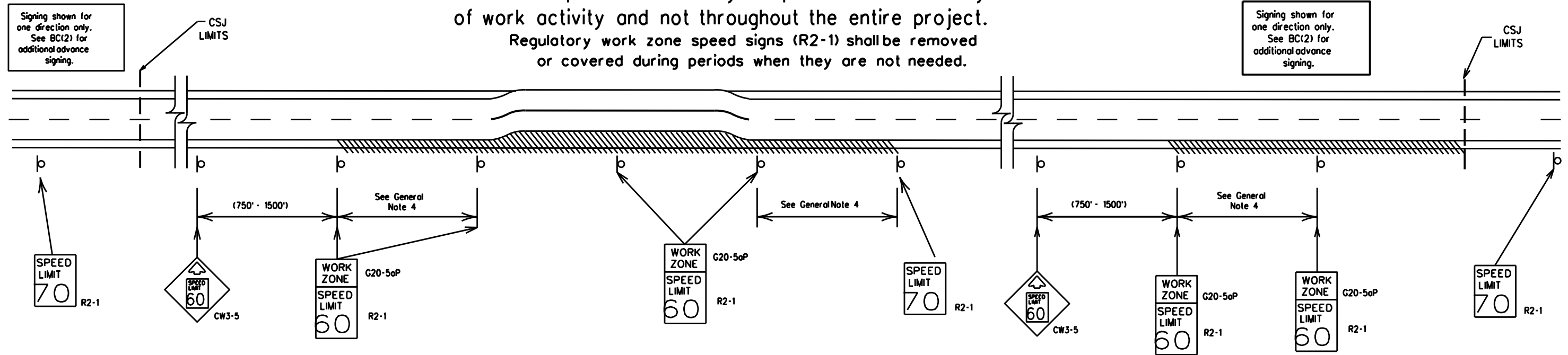
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# TYPICAL APPLICATION OF WORK ZONE SPEED LIMIT SIGNS

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:

- rough road or damaged pavement surface
- substantial alteration of roadway geometrics (diversions)
- construction detours
- grade
- width
- other conditions readily apparent to the driver

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

### SHORT TERM WORK ZONE SPEED LIMITS

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

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

## GENERAL NOTES

- Regulatory work zone speed limits should be used only for sections of construction projects where speed control is of major importance.
- Regulatory work zone speed limit signs shall be placed on supports at a 7 foot minimum mounting height.
- Speed zone signs are illustrated for one direction of travel and are normally posted for each direction of travel.
- 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
- Regulatory speed limit signs shall have black legend and border on a white reflective background (See "Reflective Sheeting" on BC(4)).
- 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.
- Turning signs from view, laying signs over or down will not be allowed, unless as otherwise noted under "REMOVING OR COVERING" on BC(4).
- Techniques that may help reduce traffic speeds include but are not limited to:
  - Low enforcement.
  - Flagger stationed next to sign.
  - Portable changeable message sign (PCMS).
  - Low-power (drone) radar transmitter.
  - Speed monitor trailers or signs.
- Speeds shown on details above are for illustration only. Work Zone Speed Limits should only be posted as approved for each project.
- For more specific guidance concerning the type of work, work zone conditions and factors impacting allowable regulatory construction speed zone reduction see TxDOT form \*1204 in the TxDOT e-form system.

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SHEET 3 OF 12



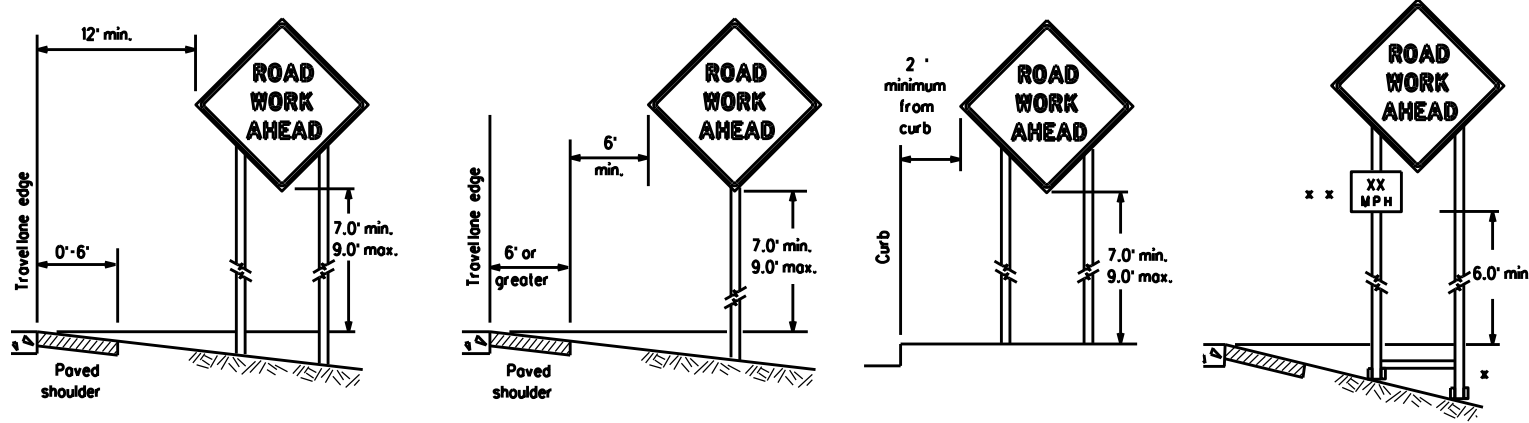
## BARRICADE AND CONSTRUCTION WORK ZONE SPEED LIMIT

BC(3)-21

|                       |             |             |              |           |
|-----------------------|-------------|-------------|--------------|-----------|
| FILE: bc-21.dgn       | DN: TxDOT   | CK: TxDOT   | DW: TxDOT    | CK: TxDOT |
| © TxDOT November 2002 | RMC         |             | HIGHWAY      |           |
| REVISIONS             | 6444-52-001 |             | US 190, ETC. |           |
| 9-07 8-14             | DIST        | COUNTY      | SHEET NO.    |           |
| 7-13 5-21             | BRY         | BRAZOS, ETC | 18           |           |



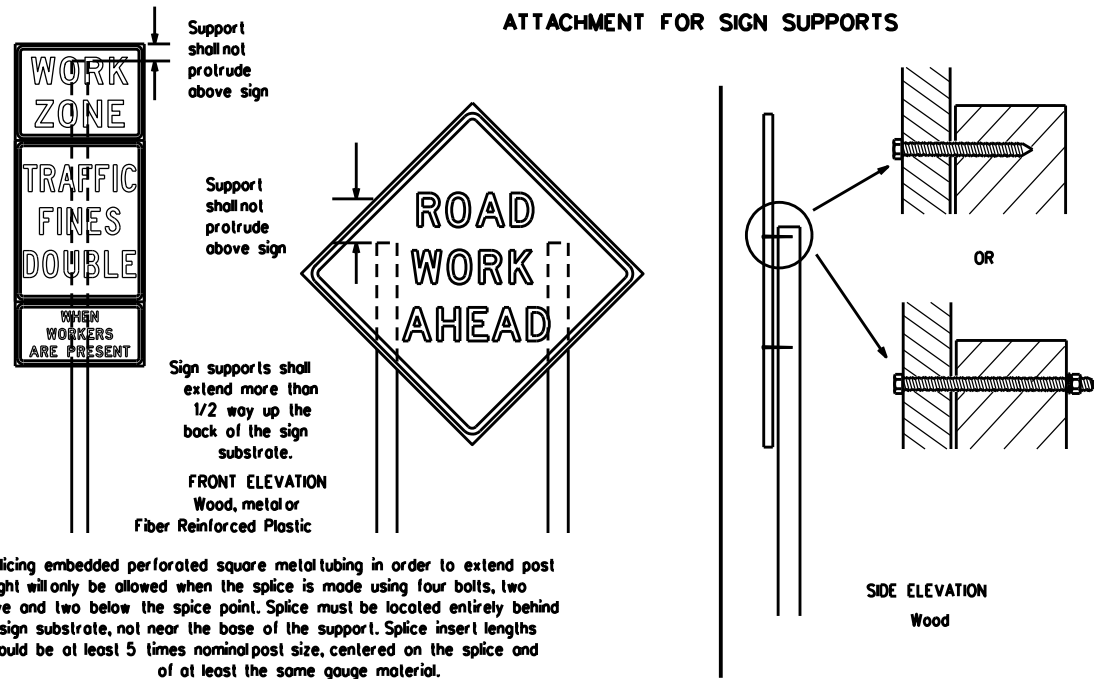
**TYPICAL MINIMUM CLEARANCES FOR LONG TERM AND INTERMEDIATE TERM SIGNS**



\* 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**



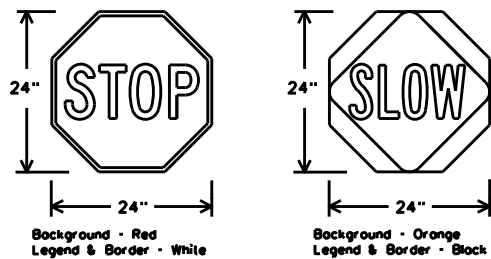
Attachment to wooden supports will be by bolts and nuts or screws. Use TxDOT's or manufacturer's recommended procedures for attaching sign substrates to other types of sign supports

Nois 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 splice point. Splice must be located entirely behind the sign substrate, not near the base of the support. Splice insert lengths should be at least 5 times nominal post size, centered on the splice and of at least the same gauge material.

**STOP/SLOW PADDLES**

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



| SHEETING REQUIREMENTS (WHEN USED AT NIGHT) |        |  |
|--|--------|--|
| USAGE                                      | COLOR  | SIGN FACE MATERIAL                               |
| BACKGROUND                                 | RED    | TYPE B OR C SHEETING                             |
| BACKGROUND                                 | ORANGE | TYPE B <sub>TL</sub> OR C <sub>TL</sub> SHEETING |
| LEGEND & BORDER                            | WHITE  | TYPE B OR C SHEETING                             |
| LEGEND & BORDER                            | BLACK  | ACRYLIC NON-REFLECTIVE FILM                      |

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

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

**GENERAL NOTES FOR WORK ZONE SIGNS**

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

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

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

**SIGN MOUNTING HEIGHT**

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

**SIZE OF SIGNS**

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

**SIGN SUBSTRATES**

1. The Contractor shall ensure the sign substrate is installed in accordance with the manufacturer's recommendations for the type of sign support that is being used. The CWZTCO 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 or Type C<sub>L</sub>, 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 CWZTCO 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.

SHEET 4 OF 12



**BARRICADE AND CONSTRUCTION TEMPORARY SIGN NOTES**

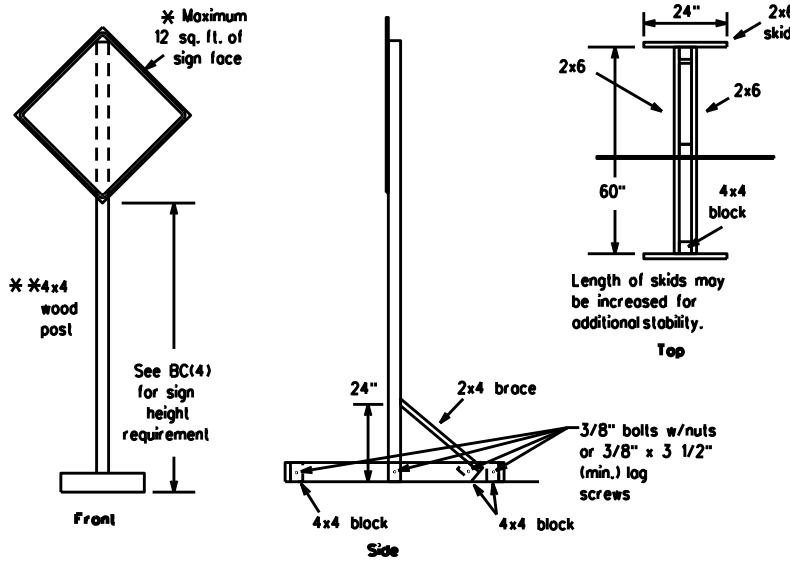
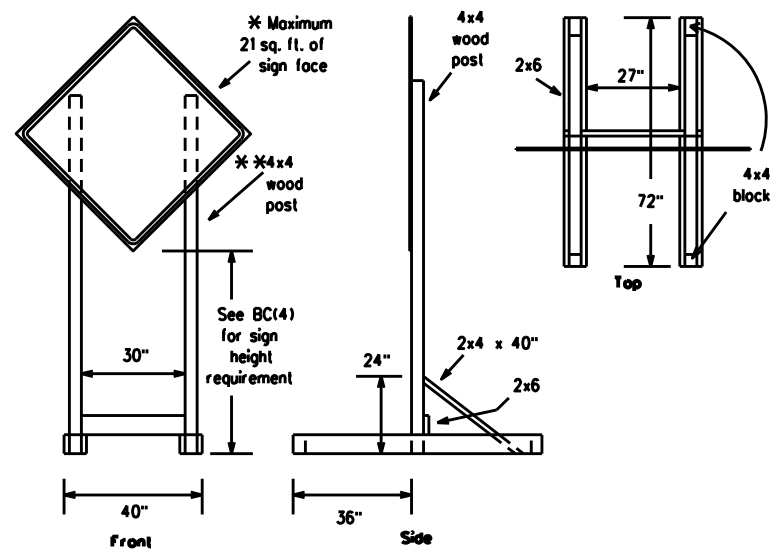
BC(4)-21

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| © TxDOT November 2002 | RMC         |             | HIGHWAY      |           |
| REVISIONS             | 6444-52-001 |             | US 190, ETC. |           |
| 9-07 8-14             | DIST        | COUNTY      | SHEET NO.    |           |
| 7-13 5-21             | BRY         | BRAZOS, ETC | 19           |           |

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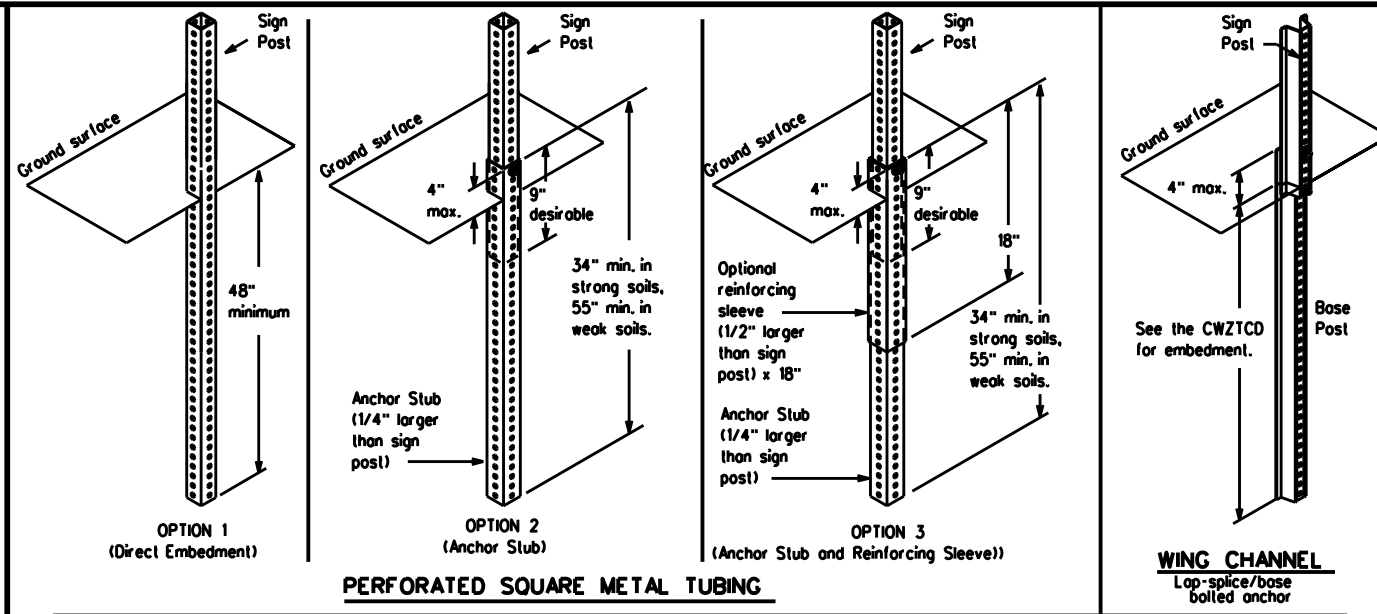
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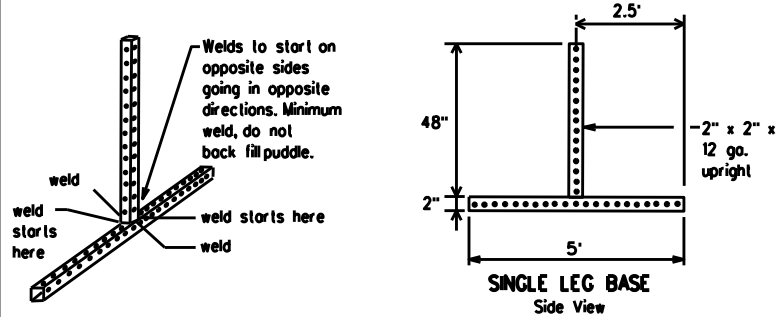
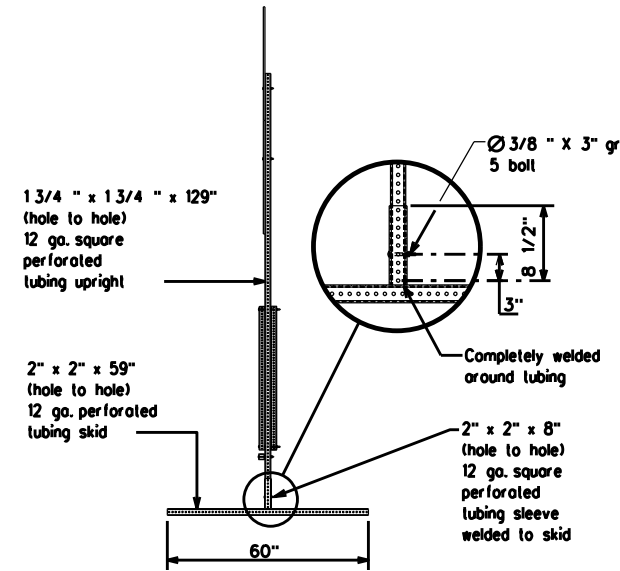
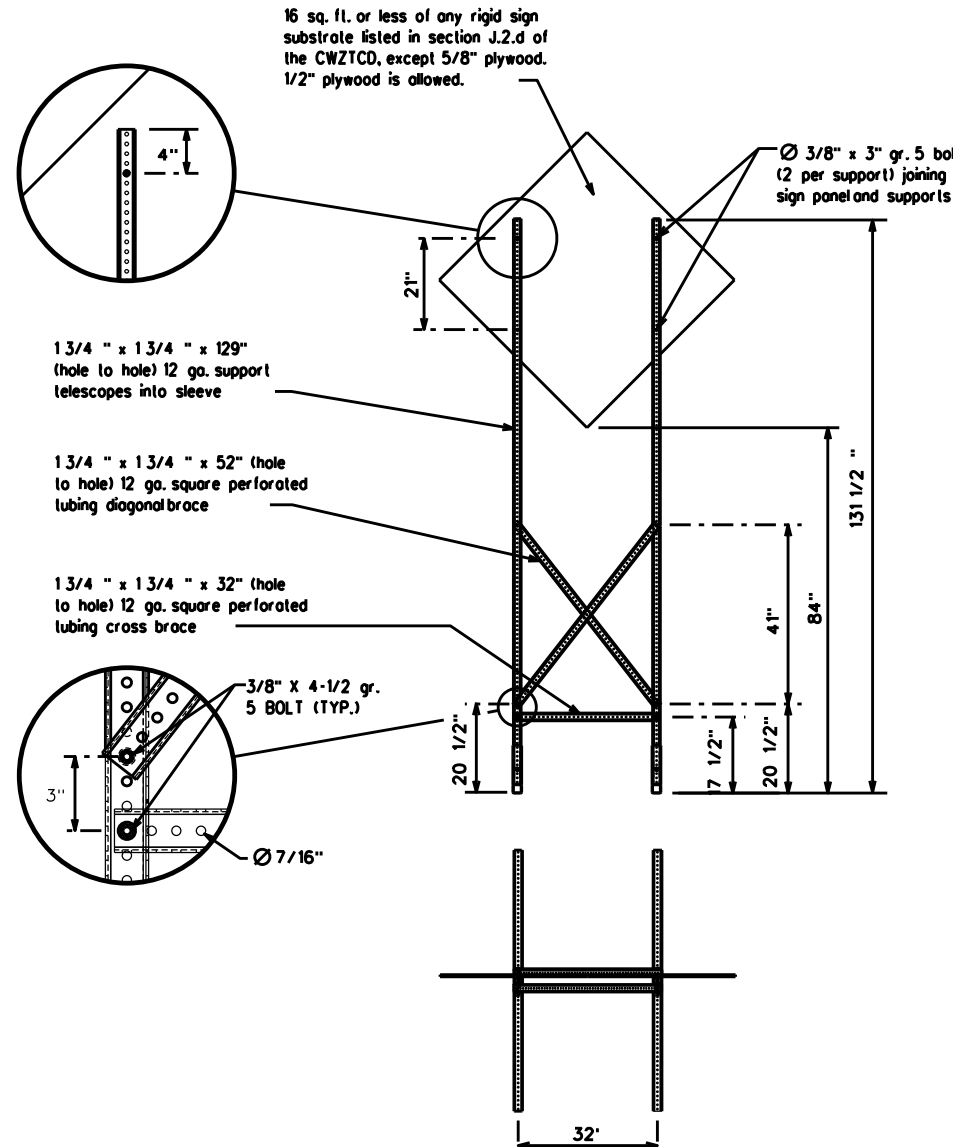
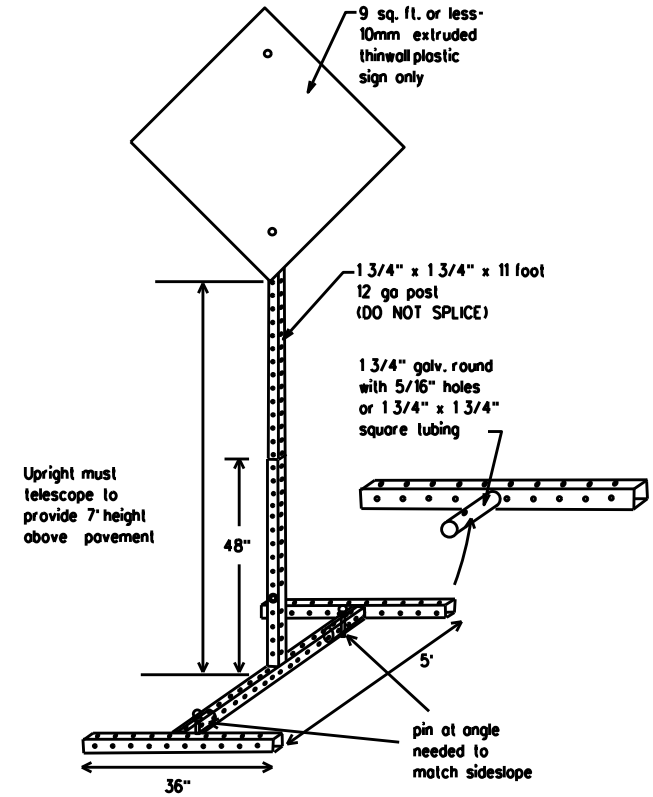
### SKID MOUNTED WOOD SIGN SUPPORTS

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



### GROUND MOUNTED SIGN SUPPORTS

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



### SKID MOUNTED PERFORATED SQUARE STEEL TUBING SIGN SUPPORTS

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

### WEDGE ANCHORS

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

### OTHER DESIGNS

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

### GENERAL NOTES

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

- \* See BC(4) for definition of "Work Duration."
- \*\* Wood sign posts MUST be one piece. Splicing will NOT be allowed. Posts shall be painted white.
- ☐ See the CWZTCD for the type of sign substrate that can be used for each approved sign support.

SHEET 5 OF 12



## BARRICADE AND CONSTRUCTION TYPICAL SIGN SUPPORT

BC(5)-21

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| REVISIONS             | 6444-52-001 | US 190, ETC. |           |           |
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| 7-13 5-21             | BRY         | BRAZOS, ETC  | 20        |           |

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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

# RECOMMENDED PHASES AND FORMATS FOR PCMS MESSAGES DURING ROADWORK ACTIVITIES

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

## PORTABLE CHANGEABLE MESSAGE SIGNS

- The Engineer/Inspector shall approve all messages used on portable changeable message signs (PCMS).
- 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.
- 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.
- Use the word "EXIT" to refer to an exit ramp on a freeway; i.e., "EXIT CLOSED." Do not use the term "RAMP."
- Always use the route or interstate designation (IH, US, SH, FM) along with the number when referring to a roadway.
- When in use, the bottom of a stationary PCMS message panel should be a minimum 7 feet above the roadway, where possible.
- 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.
- 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.
- Do not "flash" messages or words included in a message. The message should be steady burn or continuous while displayed.
- 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.
- Do not use the word "Danger" in message.
- Do not display the message "LANES SHIFT LEFT" or "LANES SHIFT RIGHT" on a PCMS. Drivers do not understand the message.
- Do not display messages that scroll horizontally or vertically across the face of the sign.
- 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.
- 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.
- Each line of text should be centered on the message board rather than left or right justified.
- 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.

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

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

## Phase 1: Condition Lists

### Road/Lane/Ramp Closure List

|                             |
|-----------------------------|
| FREEWAY CLOSED<br>X MILE    |
| ROAD CLOSED<br>AT SH XXX    |
| ROAD CLSD AT<br>FM XXXX     |
| RIGHT X LANES<br>CLOSED     |
| CENTER LANE<br>CLOSED       |
| NIGHT LANE<br>CLOSURES      |
| VARIOUS LANES<br>CLOSED     |
| EXIT CLOSED                 |
| MALL DRIVEWAY<br>CLOSED     |
| XXXXXXXXX<br>BLVD<br>CLOSED |

### Other Condition List

|                                |
|--------------------------------|
| FRONTAGE ROAD<br>CLOSED        |
| SHOULDER CLOSED<br>XXX FT      |
| RIGHT LN CLOSED<br>XXX FT      |
| RIGHT X LANES<br>OPEN          |
| DAYTIME LANE<br>CLOSURES       |
| I-XX SOUTH<br>EXIT<br>CLOSED   |
| EXIT XXX<br>CLOSED<br>X MILE   |
| RIGHT LN TO BE<br>CLOSED       |
| X LANES<br>CLOSED<br>TUE - FRI |
| ROADWORK<br>XXX FT             |
| FLAGGER<br>XXXX FT             |
| RIGHT LN NARROWS<br>XXXX FT    |
| MERGING TRAFFIC<br>XXXX FT     |
| LOOSE GRAVEL<br>XXXX FT        |
| DETOUR X MILE                  |
| ROADWORK PAST<br>SH XXXX       |
| BUMP<br>XXXX FT                |
| TRAFFIC SIGNAL<br>XXXX FT      |
| ROAD REPAIRS<br>XXXX FT        |
| LANE NARROWS<br>XXXX FT        |
| TWO-WAY TRAFFIC<br>XX MILE     |
| CONST TRAFFIC<br>XXX FT        |
| UNEVEN LANES<br>XXXX FT        |
| ROUGH ROAD<br>XXXX FT          |
| ROADWORK NEXT<br>FRI-SUN       |
| US XXX<br>EXIT<br>X MILES      |
| 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             |
| DETOUR NEXT<br>X EXITS  |
| USE EXIT XXX            |
| STAY ON US XXX<br>SOUTH |
| TRUCKS USE<br>US XXX N  |
| WATCH FOR TRUCKS        |
| EXPECT DELAYS           |
| REDUCE SPEED<br>XXX FT  |
| USE OTHER ROUTES        |
| STAY IN LANE            |

### Location List

|                             |
|-----------------------------|
| AT FM XXXX                  |
| BEFORE RAILROAD<br>CROSSING |
| NEXT X MILES                |
| PAST US XXX<br>EXIT         |
| XXXXXXXXX TO<br>XXXXXXXXX   |
| US XXX TO<br>FM XXXX        |

### Warning List

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

### \*\* Advance Notice List

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

\*\* See Application Guidelines Note 6.

## APPLICATION GUIDELINES

- Only 1 or 2 phases are to be used on a PCMS.
- The 1st phase (or both) should be selected from the "Road/Lane/Ramp Closure List" and the "Other Condition List".
- A 2nd phase can be selected from the "Action to Take/Effect on Travel, Location, General Warning, or Advance Notice Phase Lists".
- A Location Phase is necessary only if a distance or location is not included in the first phase selected.
- If two PCMS are used in sequence, they must be separated by a minimum of 1000 ft. Each PCMS should be limited to two phases, and should be understandable by themselves.
- 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

- The words RIGHT, LEFT and ALL can be interchanged as appropriate.
- Roadway designations IH, US, SH, FM and LP can be interchanged as appropriate.
- EAST, WEST, NORTH and SOUTH (or abbreviations E, W, N and S) can be interchanged as appropriate.
- Highway names and numbers replaced as appropriate.
- ROAD, HIGHWAY and FREEWAY can be interchanged as needed.
- AHEAD may be used instead of distances if necessary.
- FT and M, MILE and MILES interchanged as appropriate.
- AT, BEFORE and PAST interchanged as needed.
- 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

- 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.
- When symbol signs, such as the "Flogger 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.
- 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.
- 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.

SHEET 6 OF 12



## BARRICADE AND CONSTRUCTION PORTABLE CHANGEABLE MESSAGE SIGN (PCMS)

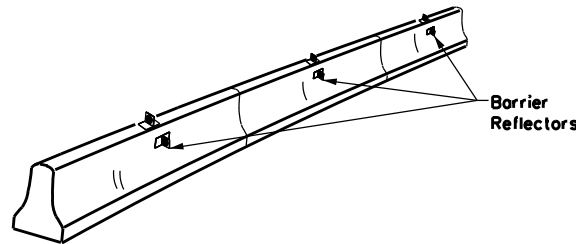
BC(6)-21

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| 7-13 5-21             | BRY         | BRAZOS, ETC | 21           |           |

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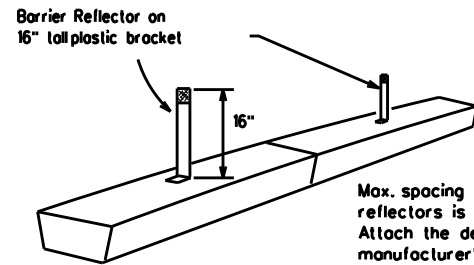
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- Barrier Reflectors shall be pre-qualified, and conform to the color and reflectivity requirements of DMS-8600. A list of prequalified Barrier Reflectors can be found at the Material Producer List web address shown on BC(1).
- Color of Barrier Reflectors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



**CONCRETE TRAFFIC BARRIER (CTB)**

- 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.
- 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.
- When CTB separates traffic traveling in the same direction, no barrier reflectors will be required on top of the CTB.
- Barrier Reflector units shall be yellow or white in color to match the edge line being supplemented.
- Maximum spacing of Barrier Reflectors is forty (40) feet.
- Pavement markers or temporary flexible-reflective roadway marker tabs shall NOT be used as CTB delineation.
- Attachment of Barrier Reflectors to CTB shall be per manufacturer's recommendations.
- Missing or damaged Barrier Reflectors shall be replaced as directed by the Engineer.
- Single slope barriers shall be delineated as shown on the above detail.



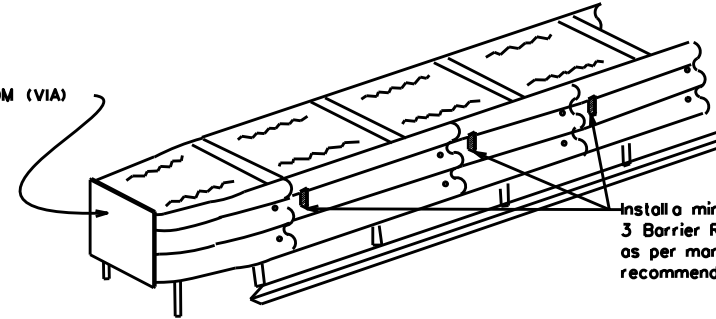
**LOW PROFILE CONCRETE BARRIER (LPCB) USED IN WORK ZONES**

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

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

**LOW PROFILE CONCRETE BARRIER (LPCB)**

See D & OM (VIA)



Install a minimum of 3 Barrier Reflectors as per manufacturer's recommendations.

**DELINEATION OF END TREATMENTS**

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

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

**BARRIER REFLECTORS FOR CONCRETE TRAFFIC BARRIER AND ATTENUATORS**

**WARNING LIGHTS**

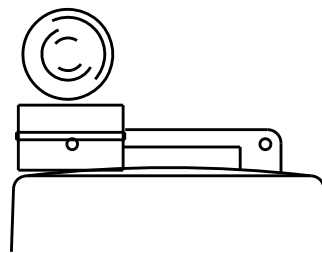
- Warning lights shall meet the requirements of the TMUTCD.
- Warning lights shall NOT be installed on barricades.
- Type A-Low intensity Flashing Warning Lights are commonly used with drums. They are intended to warn of or mark a potentially hazardous area. Their use shall be as indicated on this sheet 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 or C sheeting, meeting the requirements of Departmental Material Specification DMS-8300.
- 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".
- The Engineer/Inspector or the plans shall specify the location and type of warning lights to be installed on the traffic control devices.
- When required by the Engineer, the Contractor shall furnish a copy of the warning light 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.
- 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.
- The location of warning lights and warning reflectors on drums shall be as shown elsewhere in the plans.

**WARNING LIGHTS MOUNTED ON PLASTIC DRUMS**

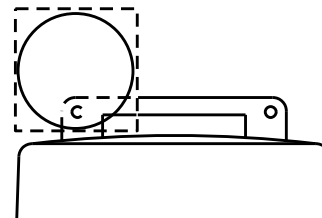
- Type A flashing warning lights are intended to warn drivers that they are approaching or are in a potentially hazardous area.
- Type A random flashing warning lights are not intended for delineation and shall not be used in a series.
- A series of sequential flashing warning lights placed on channelizing 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.
- 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.
- Type A, Type C and Type D warning lights shall be installed at locations as detailed on other sheets in the plans.
- Warning lights shall not be installed on a drum that has a sign, chevron or vertical panel.
- 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**

- 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.
- 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.
- The warning reflector shall have a minimum retroreflective surface area (one-side) of 30 square inches.
- Round reflectors shall be fully reflectorized, including the area where attached to the drum.
- 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.
- 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.
- When used near two-way traffic, both sides of the warning reflector shall be reflectorized.
- The warning reflector should be mounted on the side of the handle nearest approaching traffic.
- The maximum spacing for warning reflectors should be identical to the channelizing device spacing requirements.



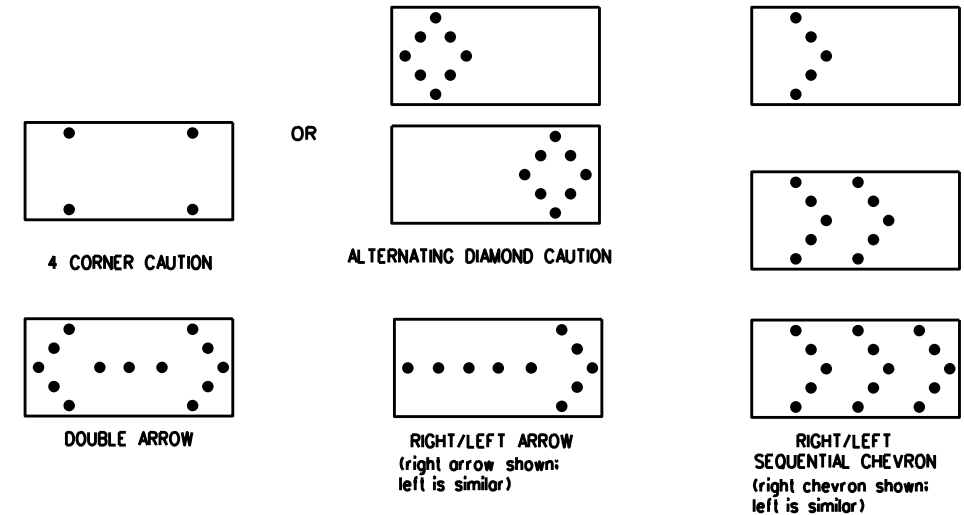
Type C Warning Light or approved substitute mounted on a drum adjacent to the travel way.



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

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.

- 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.
- 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.
- 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.
- The Flashing Arrow Board should be able to display the following symbols:



- The "CAUTION" display consists of four corner lamps flashing simultaneously, or the Alternating Diamond Caution mode as shown.
- The straight line caution display is NOT ALLOWED.
- 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.
- 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.
- The sequential arrow display is NOT ALLOWED.
- The flashing arrow display is the TxDOT standard; however, the sequential chevron display may be used during daylight operations.
- The Flashing Arrow Board shall be mounted on a vehicle, trailer or other suitable support.
- A Flashing Arrow Board SHALL NOT BE USED to laterally shift traffic.
- 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.
- 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**

SHEET 7 OF 12

**TRUCK-MOUNTED ATTENUATORS**

- Truck-mounted attenuators (TMA) used on TxDOT facilities must meet the requirements outlined in the Manual for Assessing Safety Hardware (MASH).
- Refer to the CWZTCD for the requirements of Level 2 or Level 3 TMAs.
- Refer to the CWZTCD for a list of approved TMAs.
- TMAs are required on freeways unless otherwise noted in the plans.
- 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.
- 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.



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

**BC(7)-21**

|         |               |      |       |             |       |     |       |     |              |
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| 9-07    | 8-14          |      |       |             |       |     |       |     |              |
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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:

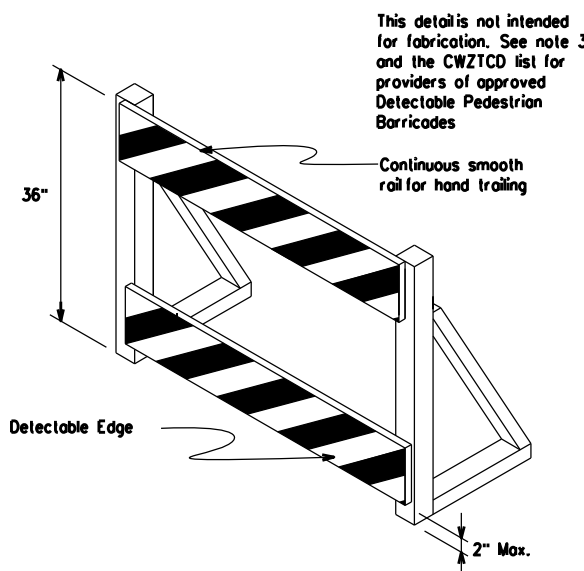
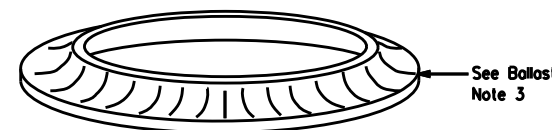
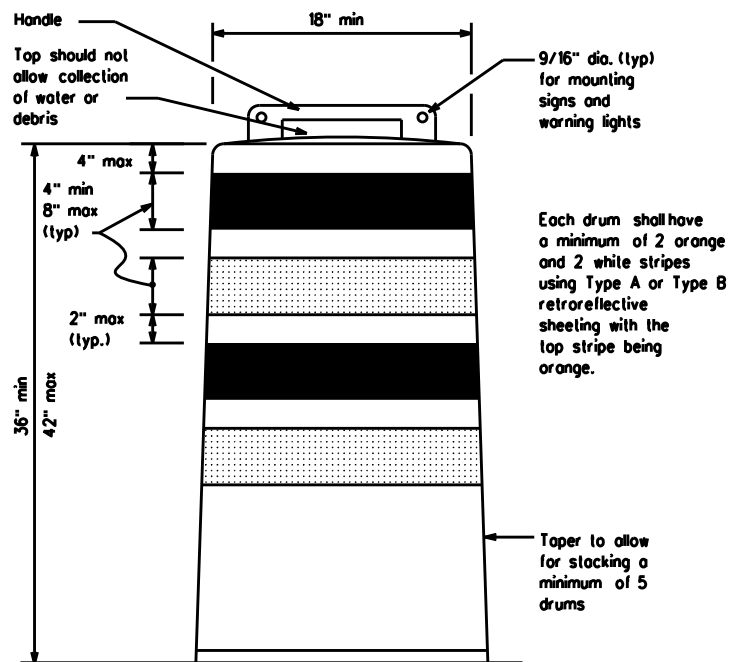
1. Plastic drums shall be a two-piece design; the "body" of the drum shall be the top portion and the "base" shall be the bottom.
2. The body and base shall lock together in such a manner that the body separates from the base when impacted by a vehicle traveling at a speed of 20 MPH or greater but prevents 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 or Type B reflective sheeting shall be supplied unless otherwise specified in the plans.
2. The sheeting shall be suitable for use on and shall adhere to the drum surface such that, upon vehicular impact, the sheeting shall remain adhered in-place and exhibit no delaminating, cracking, or loss of retroreflectivity other than that loss due to abrasion of the sheeting surface.

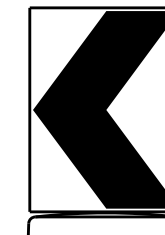
**BALLAST**

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

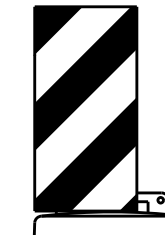


**DETECTABLE PEDESTRIAN BARRICADES**

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



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



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

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

**SIGNS, CHEVRONS, AND VERTICAL PANELS MOUNTED ON PLASTIC DRUMS**

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

SHEET 8 OF 12



**BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES**

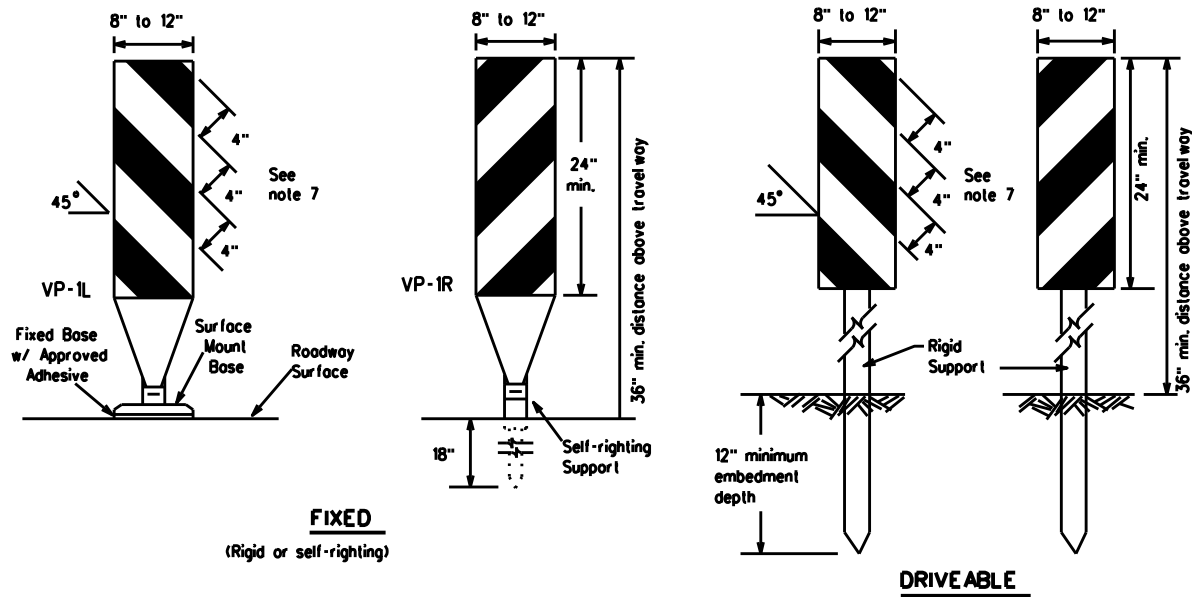
**BC(8)-21**

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|         | REVISIONS     |     |       | 6444-52-001 |             |     |       | US 190, ETC. |       |
| 4-03    | 8-14          |     |       |             |             |     |       |              |       |
| 9-07    | 5-21          |     |       | DIST        | COUNTY      |     |       | SHEET NO.    |       |
| 7-13    |               |     |       | BRY         | BRAZOS, ETC |     |       | 23           |       |

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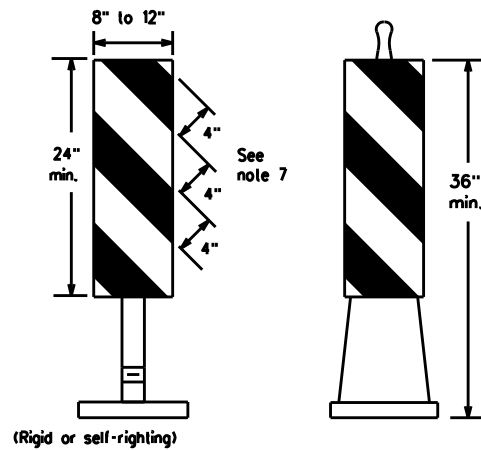
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**FIXED**  
(Rigid or self-righting)

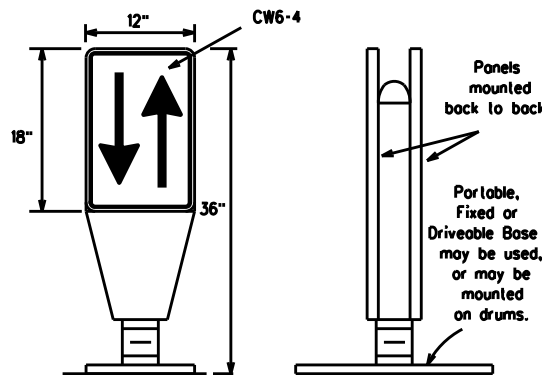
**DRIVEABLE**



**PORTABLE**

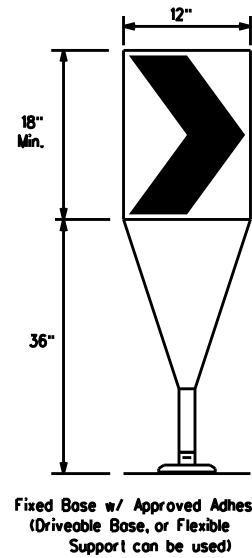
**VERTICAL PANELS (VPs)**

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



**OPPOSING TRAFFIC LANE DIVIDERS (OTLD)**

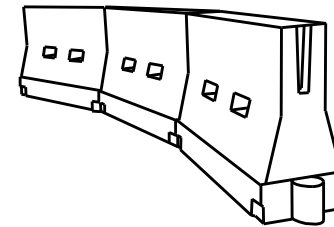
- Opposing Traffic Lane Dividers (OTLD) are delineation devices designed to convert a normal one-way roadway section to two-way operation. OTLD's are used on temporary centerlines. The upward and downward arrows on the sign's face indicate the direction of traffic on either side of the divider. The base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



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

- The chevron shall be a vertical rectangle with a minimum size of 12 by 18 inches.
- 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.
- 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.
- To be effective, the chevron should be visible for at least 500 feet.
- Chevrons shall be orange with a black nonreflective legend. Sheeting for the chevron shall be retroreflective Type B or Type C conforming to Departmental Material Specification DMS-8300, unless noted otherwise. The legend shall meet the requirements of DMS-8300.
- 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**



**LONGITUDINAL CHANNELIZING DEVICES (LCD)**

- 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.
- LCDs may be used instead of a line of cones or drums.
- LCDs shall be placed in accordance to application and installation requirements specific to the device, and used only when shown on the CWZTCD list.
- LCDs should not be used to provide positive protection for obstacles, pedestrians or workers.
- LCDs shall be supplemented with retroreflective delineation as required for temporary barriers on BC(7) when placed roughly parallel to the travel lanes.
- LCDs used as barricades placed perpendicular to traffic should have at least one row of reflective sheeting meeting the requirements for barricade rails as shown on BC(10). Place reflective sheeting near the top of the LCD along the full length of the device.

**WATER BALLASTED SYSTEMS USED AS BARRIERS**

- Water ballasted systems used as barriers shall not be used solely to channelize road users, but also to protect the work space per the appropriate Manual for Assessing Safety Hardware (MASH) crashworthiness requirements based on roadway speed and barrier application.
- 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.
- 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.
- 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.
- 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 cones 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**

**GENERAL NOTES**

- 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).
- 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.
- 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).
- 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.
- Portable bases shall be fabricated from virgin and/or recycled rubber. The portable bases shall weigh a minimum of 30 lbs.
- 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.
- 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.

| Posted Speed | Formula                  | Minimum Desirable Taper Lengths |            |            | Suggested Maximum Spacing of Channelizing Devices |              |
|--------------|--------------------------|---------------------------------|------------|------------|---|--------------|
|              |                          | 10' Offset                      | 11' Offset | 12' Offset | On a Taper  | On a Tangent |
| 30           | L = WS <sup>2</sup> / 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'  |              |

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

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

SHEET 9 OF 12



**BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES**

**BC(9)-21**

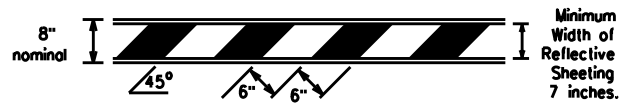
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|---------|---------------|-----|-------|-----------|-------------|-----|-------|--------------|-------|
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| © TxDOT | November 2002 |     |       | RMC       |             |     |       | HIGHWAY      |       |
|         |               |     |       | REVISIONS | 6444-52-001 |     |       | US 190, ETC. |       |
| 9-07    | 8-14          |     |       | DIST      | COUNTY      |     |       | SHEET NO.    |       |
| 7-13    | 5-21          |     |       | BRY       | BRAZOS, ETC |     |       | 24           |       |

DATE:  
FILE:

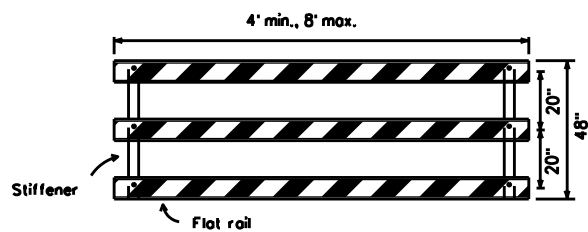
**TYPE 3 BARRICADES**

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

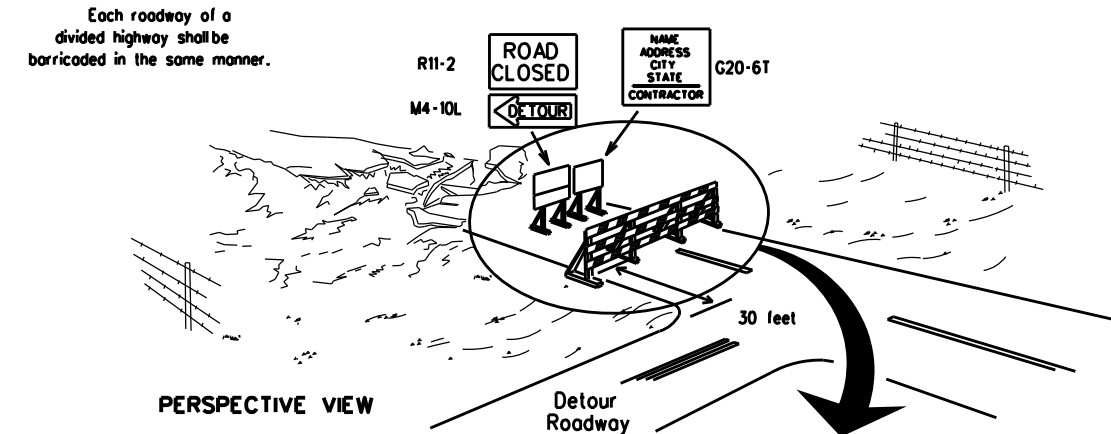
Barricades shall NOT be used as a sign support.



**TYPICAL STRIPING DETAIL FOR BARRICADE RAIL**

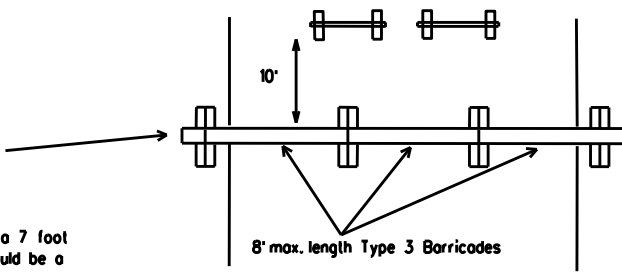


**TYPICAL PANEL DETAIL FOR SKID OR POST TYPE BARRICADES**



PERSPECTIVE VIEW

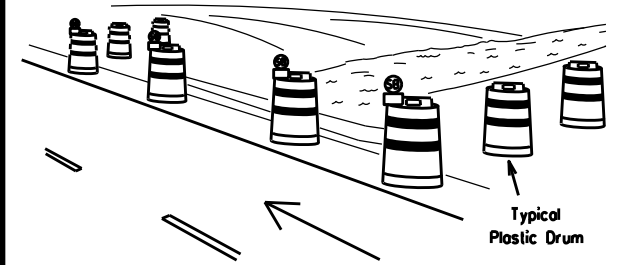
The three rails on Type 3 barricades shall be reflectorized orange and reflective white stripes on one side facing one-way traffic and both sides for two-way traffic. Barricade striping should slant downward in the direction of detour.



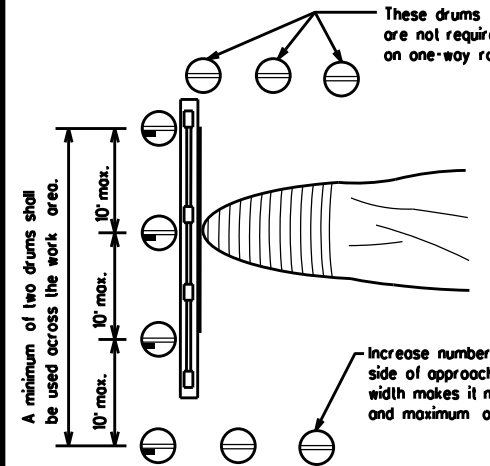
PLAN VIEW

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

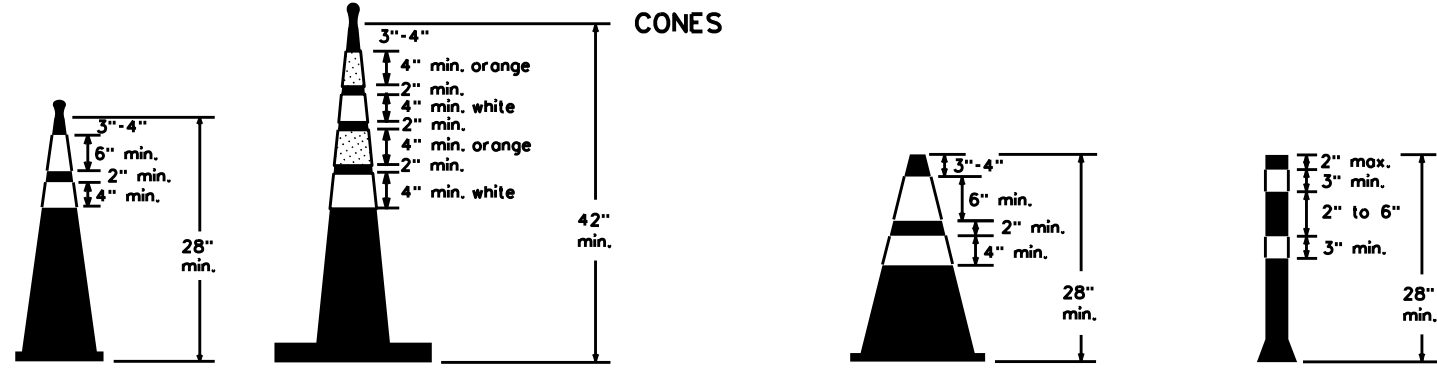


PLAN VIEW

1. Where positive redirection 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 |
|        | Steady burn warning light or yellow warning reflector           |

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

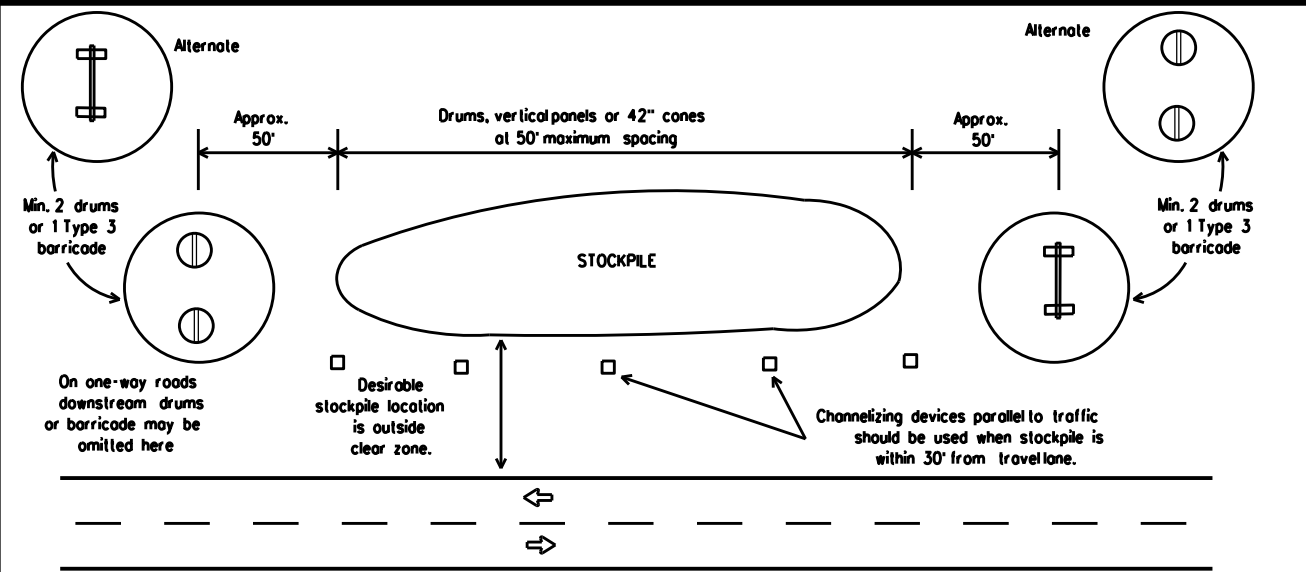


Two-Piece cones

One-Piece cones

Tubular Marker

28" Cones shall have a minimum weight of 9 1/2 lbs.  
42" 2-piece cones shall have a minimum weight of 30 lbs. including base.



**TRAFFIC CONTROL FOR MATERIAL STOCKPILES**

1. Traffic cones and tubular markers shall be predominantly orange, and meet the height and weight requirements shown above.
2. One-piece cones have the body and base of the cone molded in one consolidated unit. Two-piece cones have a cone shaped body and a separate rubber base, or ballast, that is added to keep the device upright and in place.
3. Two-piece cones may have a handle or loop extending up to 8" above the minimum height shown, in order to aid in retrieving the device.
4. Cones or tubular markers shall have white or white and orange reflective bands as shown above. The reflective bands shall have a smooth, sealed outer surface and meet the requirements of Departmental Material Specification DMS-8300 Type A or Type B.
5. 28" cones and tubular markers are generally suitable for short duration and short-term stationary work as defined in 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.

**BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES**

**BC(10)-21**

|                       |             |             |              |           |
|-----------------------|-------------|-------------|--------------|-----------|
| FILE: bc-21.dgn       | DN: TxDOT   | CK: TxDOT   | DW: TxDOT    | CK: TxDOT |
| © TxDOT November 2002 | RMC         |             | HIGHWAY      |           |
| REVISIONS             | 6444-52-001 |             | US 190, ETC. |           |
| 9-07 8-14             | DIST        | COUNTY      | SHEET NO.    |           |
| 7-13 5-21             | BRY         | BRAZOS, ETC | 25           |           |

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DATE: FILE:

## WORK ZONE PAVEMENT MARKINGS

### GENERAL

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

### RAISED PAVEMENT MARKERS

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

### PREFABRICATED PAVEMENT MARKINGS

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

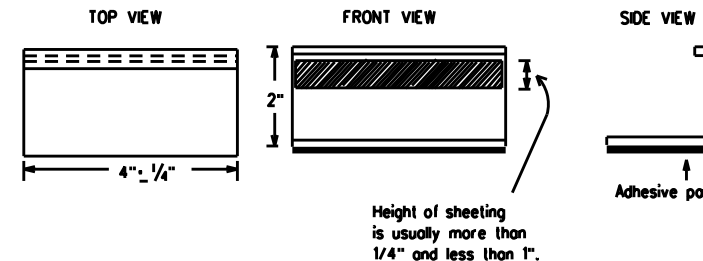
### MAINTAINING WORK ZONE PAVEMENT MARKINGS

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

### REMOVAL OF PAVEMENT MARKINGS

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

SHEET 11 OF 12

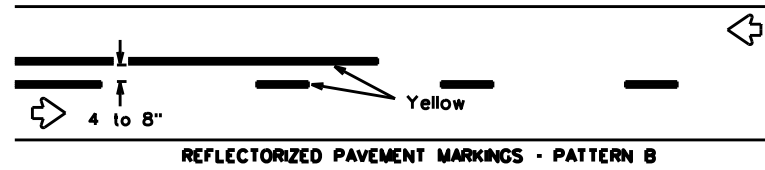
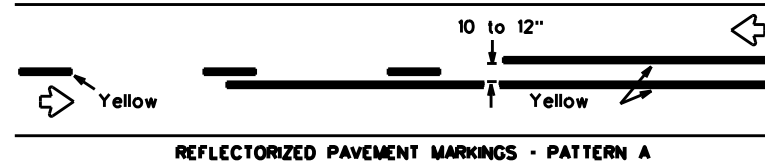
|  |   |                          |           |           |
|--|---|--------------------------|-----------|-----------|
| <span style="font-size: small; vertical-align: middle;">Texas Department of Transportation</span>                  | <span style="font-size: x-small;">Traffic<br/>Safety<br/>Division<br/>Standard</span> |                          |           |           |
| <h1 style="margin: 0;">BARRICADE AND CONSTRUCTION<br/>PAVEMENT MARKINGS</h1> <h2 style="margin: 0;">BC(11)-21</h2> |   |                          |           |           |
| FILE: bc-21.dgn  | DN: TxDOT   | CK: TxDOT                | DW: TxDOT | CR: TxDOT |
| © TxDOT February 1998  |   | RMC                      | HIGHWAY   |           |
| REVISIONS  |   | 6444-52-001 US 190, ETC. |           |           |
| 2-98   | 9-07  | 5-21                     |           |           |
| 1-02   | 7-13  |                          |           |           |
| 11-02  | 8-14  |                          |           |           |
| DIST   | COUNTY  |                          | SHEET NO. |           |
| BRY  | BRAZOS, ETC   |                          | 26        |           |

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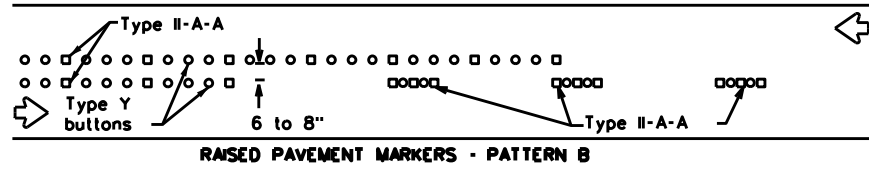
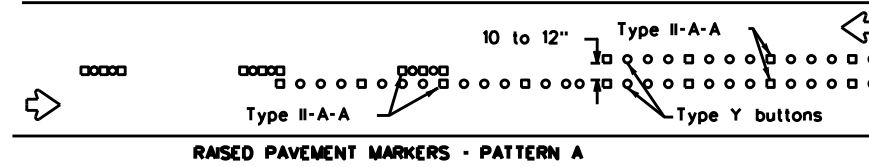
DATE:  
FILE:



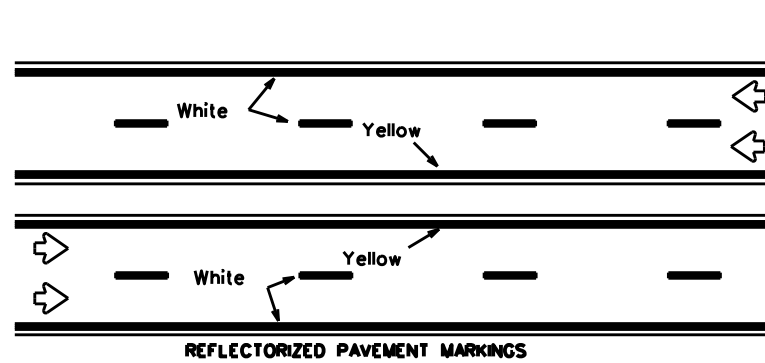
## PAVEMENT MARKING PATTERNS



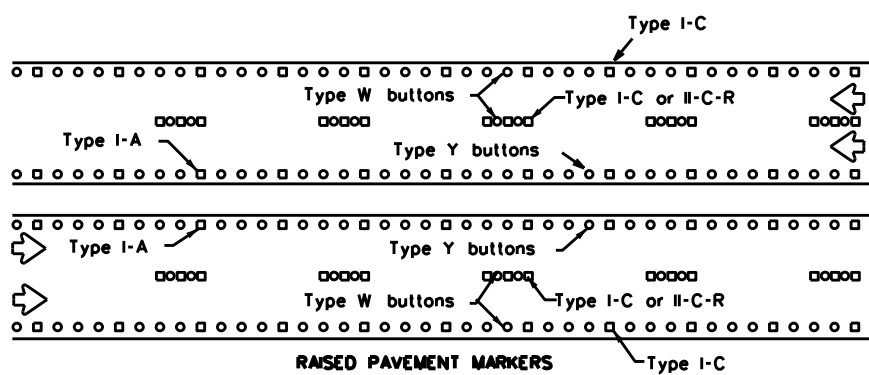
Pattern A is the TxDOT Standard, however Pattern B may be used if approved by the Engineer. Prefabricated markings may be substituted for reflectORIZED pavement markings.



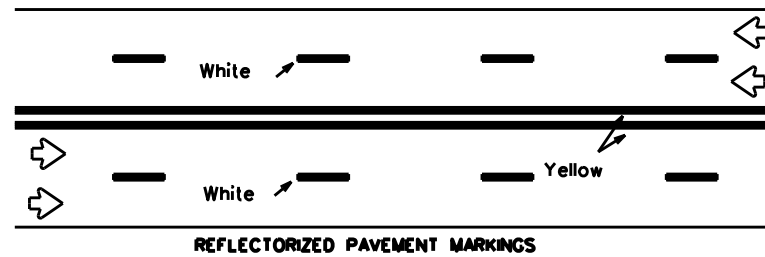
## CENTER LINE & NO-PASSING ZONE BARRIER LINES FOR TWO-LANE, TWO-WAY HIGHWAYS



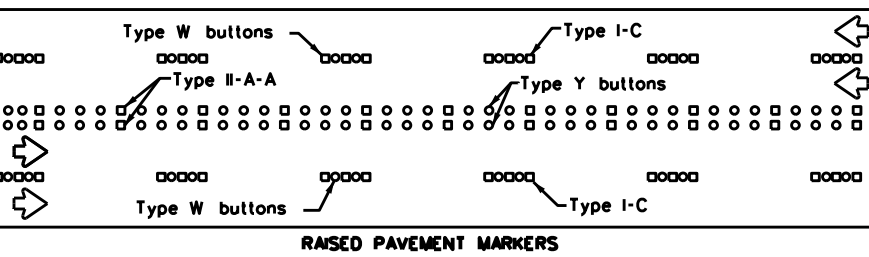
Prefabricated markings may be substituted for reflectORIZED pavement markings.



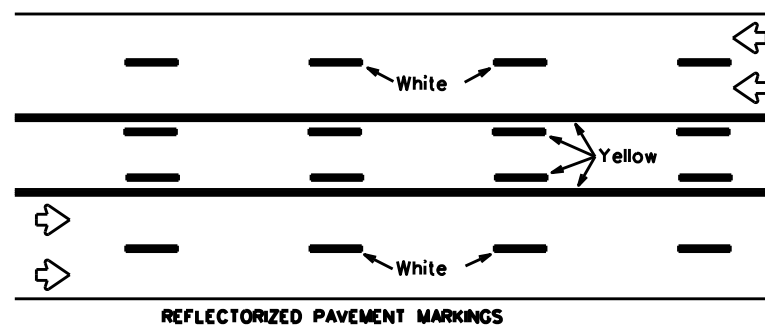
## EDGE & LANE LINES FOR DIVIDED HIGHWAY



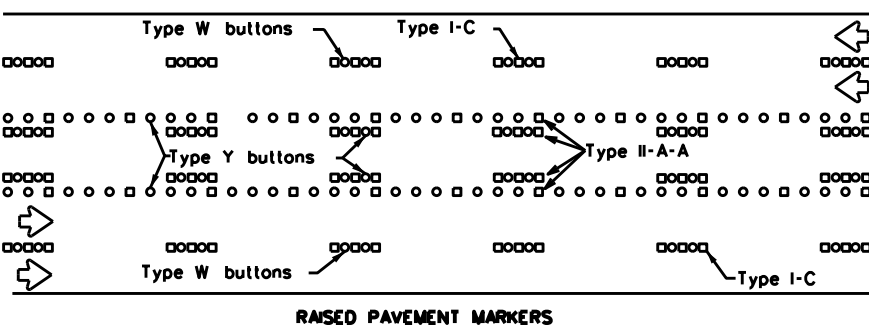
Prefabricated markings may be substituted for reflectORIZED pavement markings.



## LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS

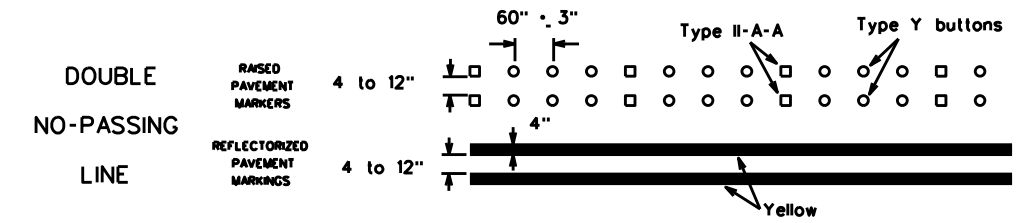


Prefabricated markings may be substituted for reflectORIZED pavement markings.

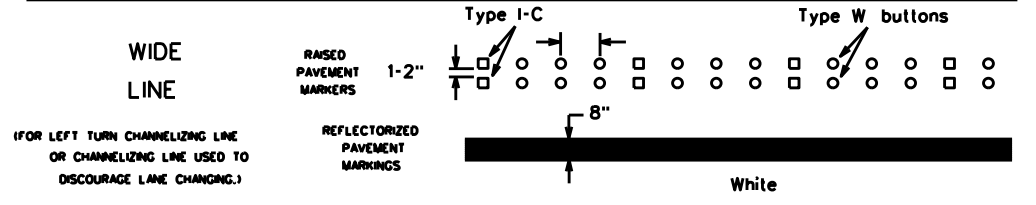
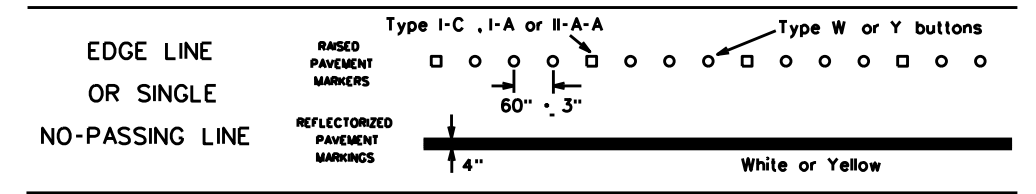


## TWO-WAY LEFT TURN LANE

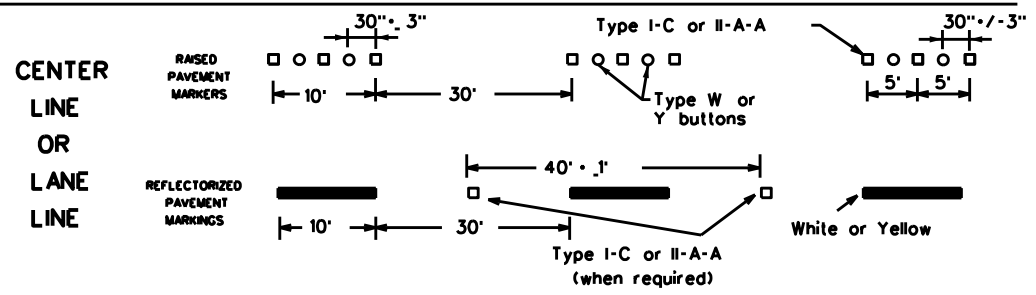
## STANDARD WORK ZONE PAVEMENT MARKINGS DETAILS



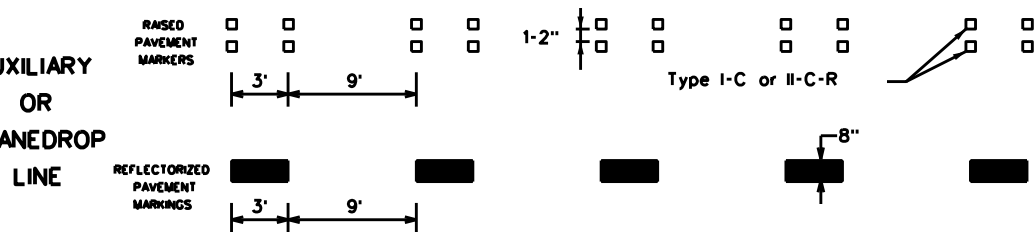
### SOLID LINES



### BROKEN LINES

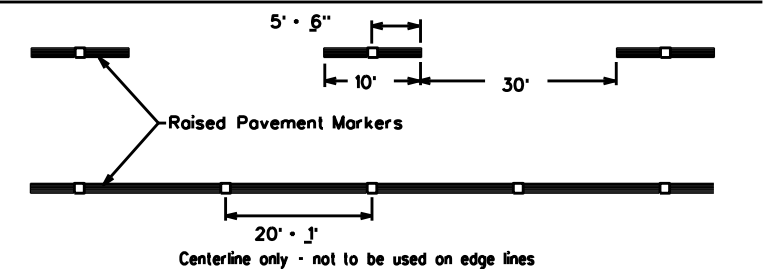


### AUXILIARY OR LANEDROP LINE



### 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.



SHEET 12 OF 12



## BARRICADE AND CONSTRUCTION PAVEMENT MARKING PATTERNS

BC(12)-21

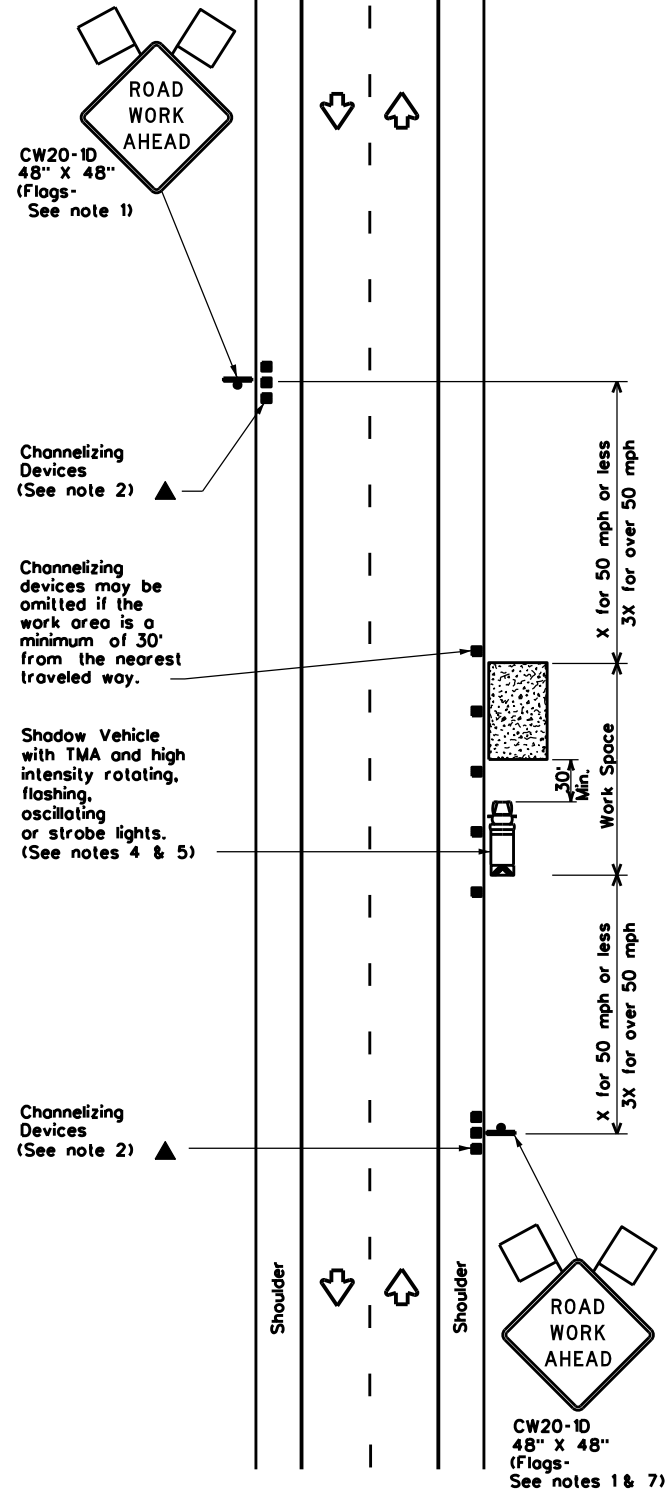
Raised pavement markers used as standard pavement markings shall be from the approved products list and meet the requirements of Item 672 "RAISED PAVEMENT MARKERS."

|                       |             |           |              |           |
|-----------------------|-------------|-----------|--------------|-----------|
| FILE: bc-21.dgn       | DN: TxDOT   | CK: TxDOT | DW: TxDOT    | CK: TxDOT |
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| REVISIONS             | 6444-52-001 |           | US 190, ETC. |           |
| 1-97 9-07 5-21        | DIST        |           | COUNTY       |           |
| 2-98 7-13             | BRY         |           | BRAZOS, ETC  |           |
| 11-02 8-14            |             |           | SHEET NO.    |           |
|                       |             |           | 27           |           |

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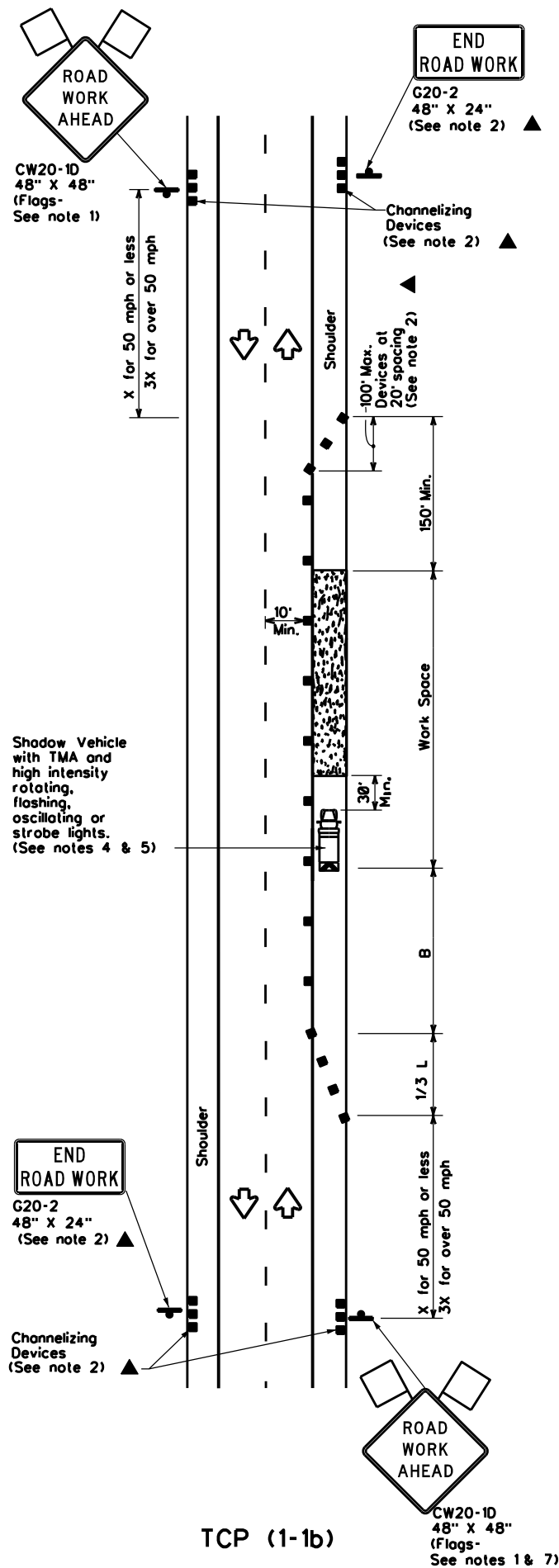
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FILE:

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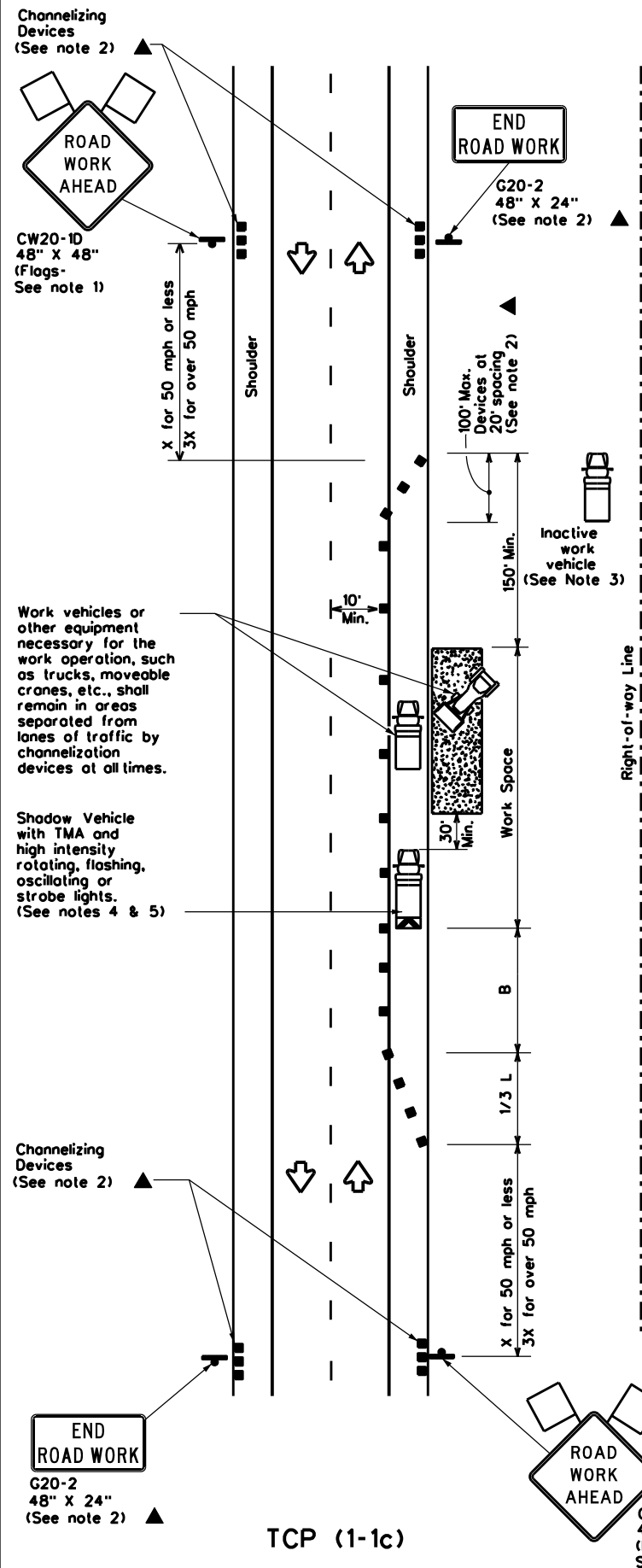
TCP (1-1a)

**WORK SPACE NEAR SHOULDER**  
Conventional Roads



TCP (1-1b)

**WORK SPACE ON SHOULDER**  
Conventional Roads



TCP (1-1c)

**WORK VEHICLES ON SHOULDER**  
Conventional Roads

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

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

x Conventional Roads Only  
 x x 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**

- Flags attached to signs where shown are REQUIRED.
- 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.
- Inactive work vehicles or other equipment should be parked near the right-of-way line and not parked on the paved shoulder.
- 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.
- Additional Shadow Vehicles with TMAs may be positioned off the paved surface, next to those shown in order to protect wider work spaces.
- See TCP(5-1) for shoulder work on divided highways, expressways and freeways.
- CW21-5 "SHOULDER WORK" signs may be used in place of CW20-1D "ROAD WORK AHEAD" signs for shoulder work on conventional roadways.

**TRAFFIC CONTROL PLAN**  
**CONVENTIONAL ROAD**  
**SHOULDER WORK**

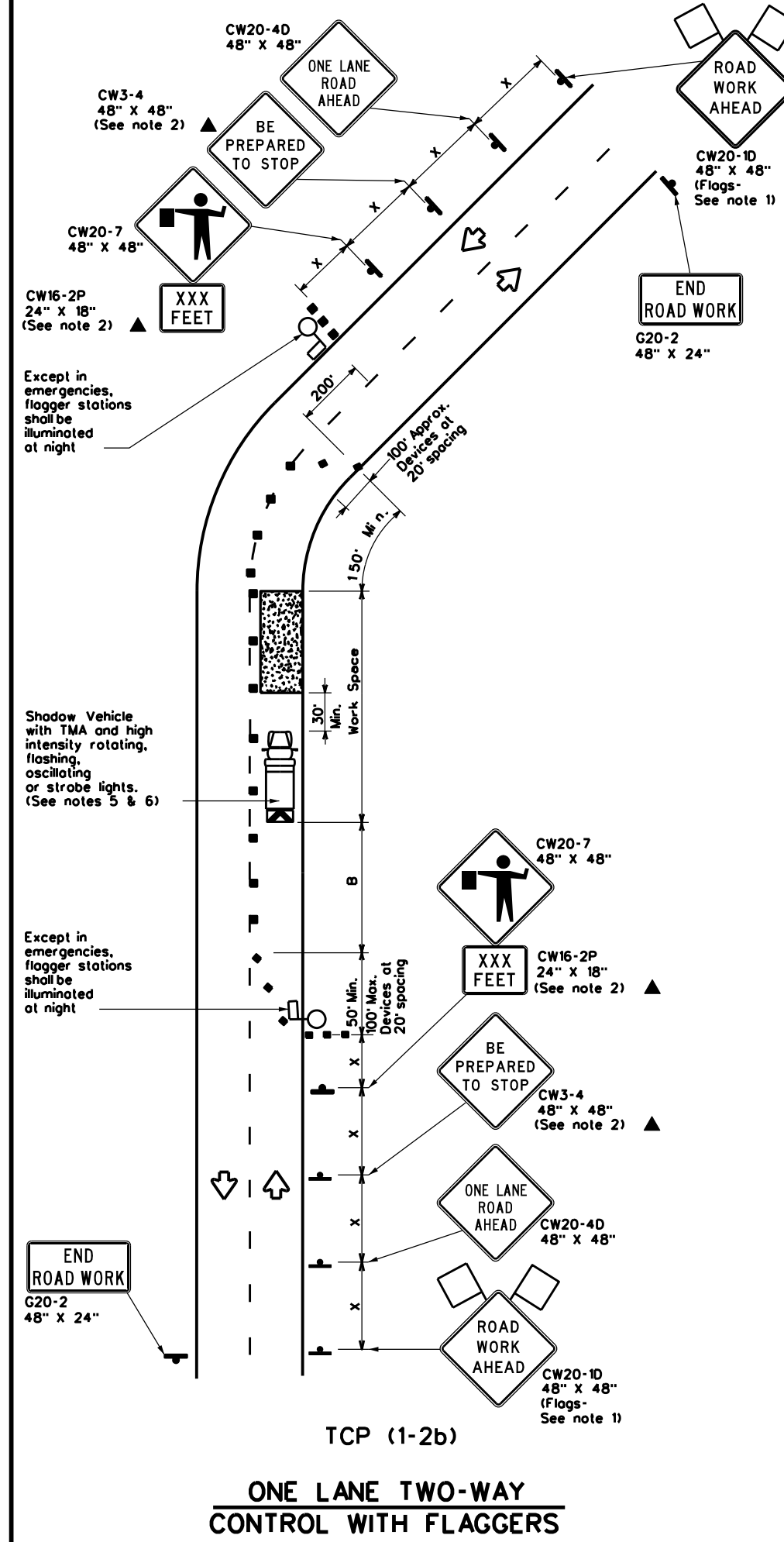
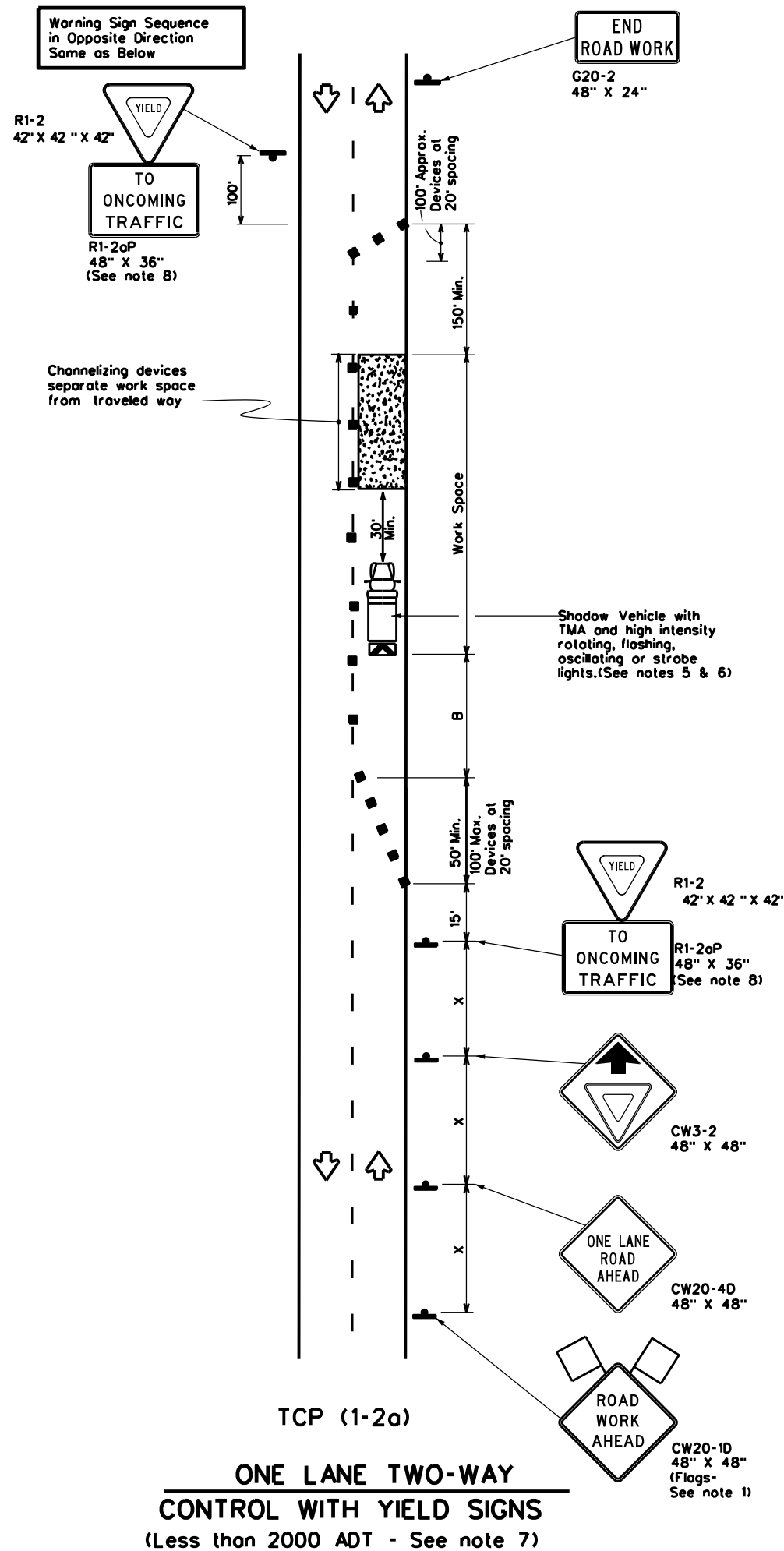
**TCP(1-1)-18**

|                       |                          |      |     |         |
|-----------------------|--------------------------|------|-----|---------|
| FILE: tcp1-1-18.dgn   | DN:                      | CK:  | DW: | CK:     |
| © TxDOT December 1985 | CONT                     | SECT | JOB | HIGHWAY |
| REVISIONS             | 6444-52-001 US 190, ETC. |      |     |         |
| 2-94 4-98             | DIST COUNTY SHEET NO.    |      |     |         |
| 8-95 2-12             | BRY BRAZOS, ETC. 28      |      |     |         |
| 1-97 2-18             |                          |      |     |         |



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DATE: FILE:



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

| Posted Speed<br>x | Formula                  | Minimum Desirable Taper Lengths x |            |            | Suggested Maximum Spacing of Channelizing Devices |              | Minimum Sign Spacing "x" Distance | Suggested Longitudinal Buffer Space "B" | Stopping Sight Distance |
|-------------------|--------------------------|-----------------------------------|------------|------------|---|--------------|-----------------------------------|---|-------------------------|
|                   |                          | 10' Offset                        | 11' Offset | 12' Offset | On a Taper  | On a Tangent |                                   |   |                         |
| 30                | L = WS <sup>2</sup> / 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'                    |

x Conventional Roads Only  
 x x 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**

- Flags attached to signs where shown are REQUIRED.
  - 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.
  - 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.
  - 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.
  - 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.
  - 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)**
- 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.
  - R1-2 "YIELD" sign with R1-2oP "TO ONCOMING TRAFFIC" plaque shall be placed on a support at a 7 foot minimum mounting height.
- TCP (1-2b)**
- Flaggers should use two-way radios or other methods of communication to control traffic.
  - Length of work space should be based on the ability of flaggers to communicate.
  - 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).
  - Channelizing devices on the center-line may be omitted when a pilot car is leading traffic and approved by the Engineer.
  - 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

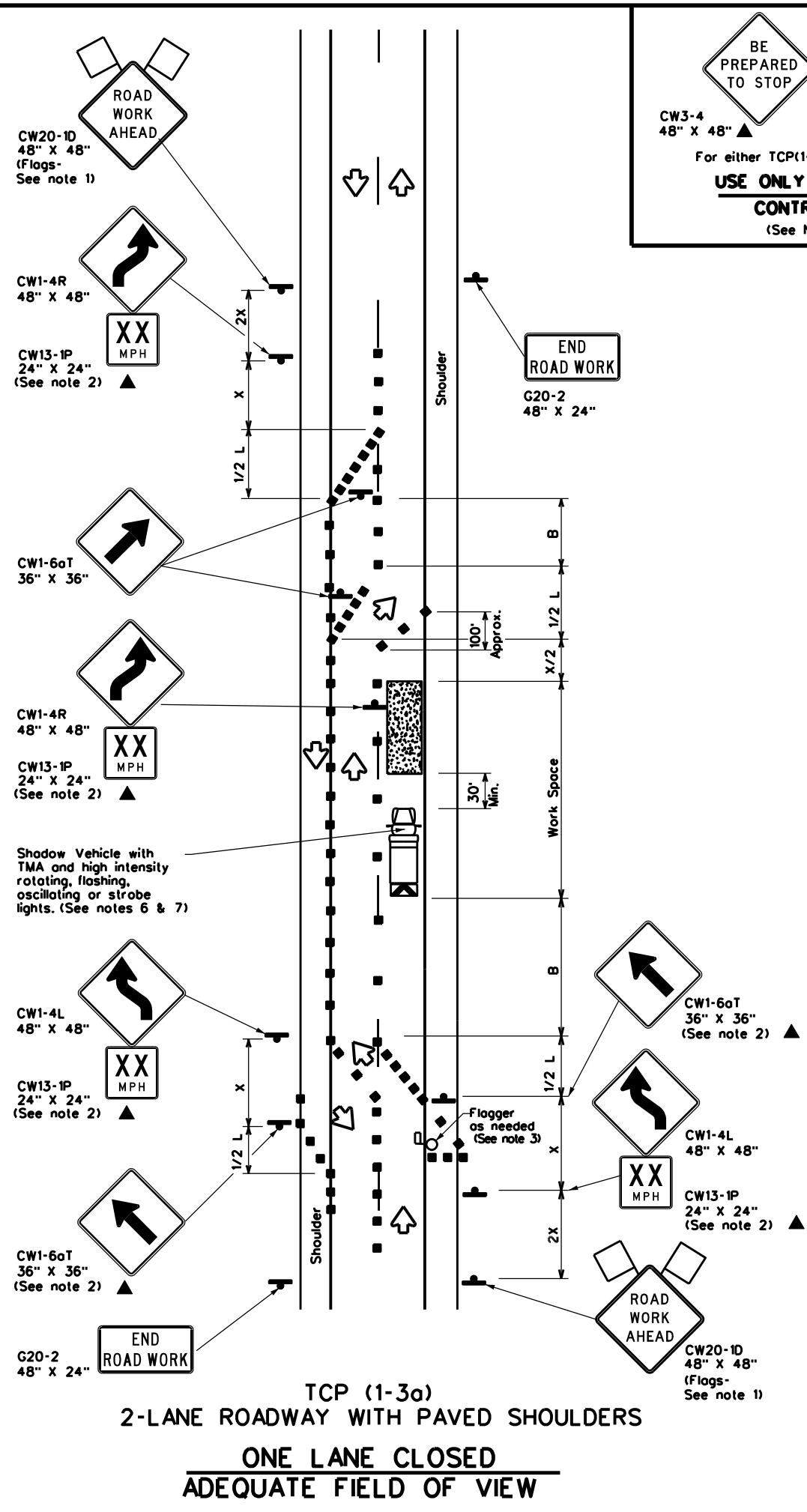
**TRAFFIC CONTROL PLAN**  
**ONE-LANE TWO-WAY**  
**TRAFFIC CONTROL**

**TCP(1-2)-18**

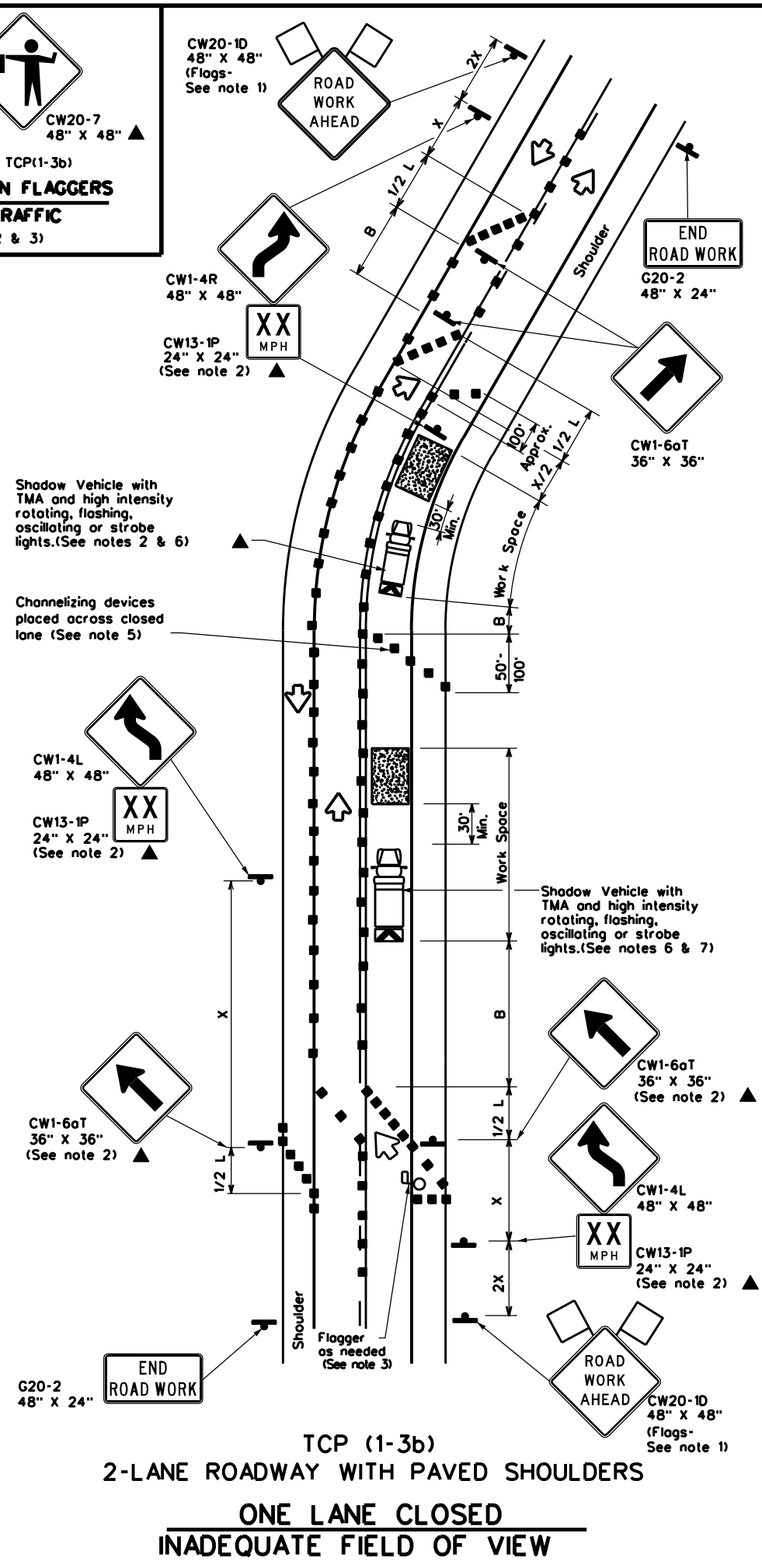
|                       |                          |       |      |          |
|-----------------------|--------------------------|-------|------|----------|
| FILE: tcp1-2-18.dgn   | DN:                      | CK:   | DW:  | CK:      |
| © TxDOT December 1985 | CON:                     | SECT: | JOB: | HIGHWAY: |
| REVISIONS             | 6444-52-001 US 190, ETC. |       |      |          |
| 4-90 4-98             | DIST COUNTY SHEET NO.    |       |      |          |
| 2-94 2-12             | BRY BRAZOS, ETC. 29      |       |      |          |
| 1-97 2-18             |                          |       |      |          |

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DATE: FILE:



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



**LEGEND**

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

| Posted Speed<br>x | Formula                  | Minimum Desirable Taper Lengths<br>x x |            |            | Suggested Maximum Spacing of Channelizing Devices |              | Minimum Sign Spacing<br>"x" Distance | Suggested Longitudinal Buffer Space<br>"B" |
|-------------------|--------------------------|--|------------|------------|---|--------------|--------------------------------------|--|
|                   |                          | 10' Offset                             | 11' Offset | 12' Offset | On a Taper  | On a Tangent |                                      |  |
| 30                | L - WS <sup>2</sup> / 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'                                       |

x Conventional Roads Only  
 xx 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**
- Flags attached to signs where shown are REQUIRED.
  - 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.
  - 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.
  - DO NOT PASS, PASS WITH CARE and construction regulatory speed zone signs may be installed downstream of the ROAD WORK AHEAD signs.
  - 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.
  - 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.
  - Additional Shadow Vehicles with TMAs may be positioned off the paved surface, next to those shown in order to protect wider work spaces.
  - 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.

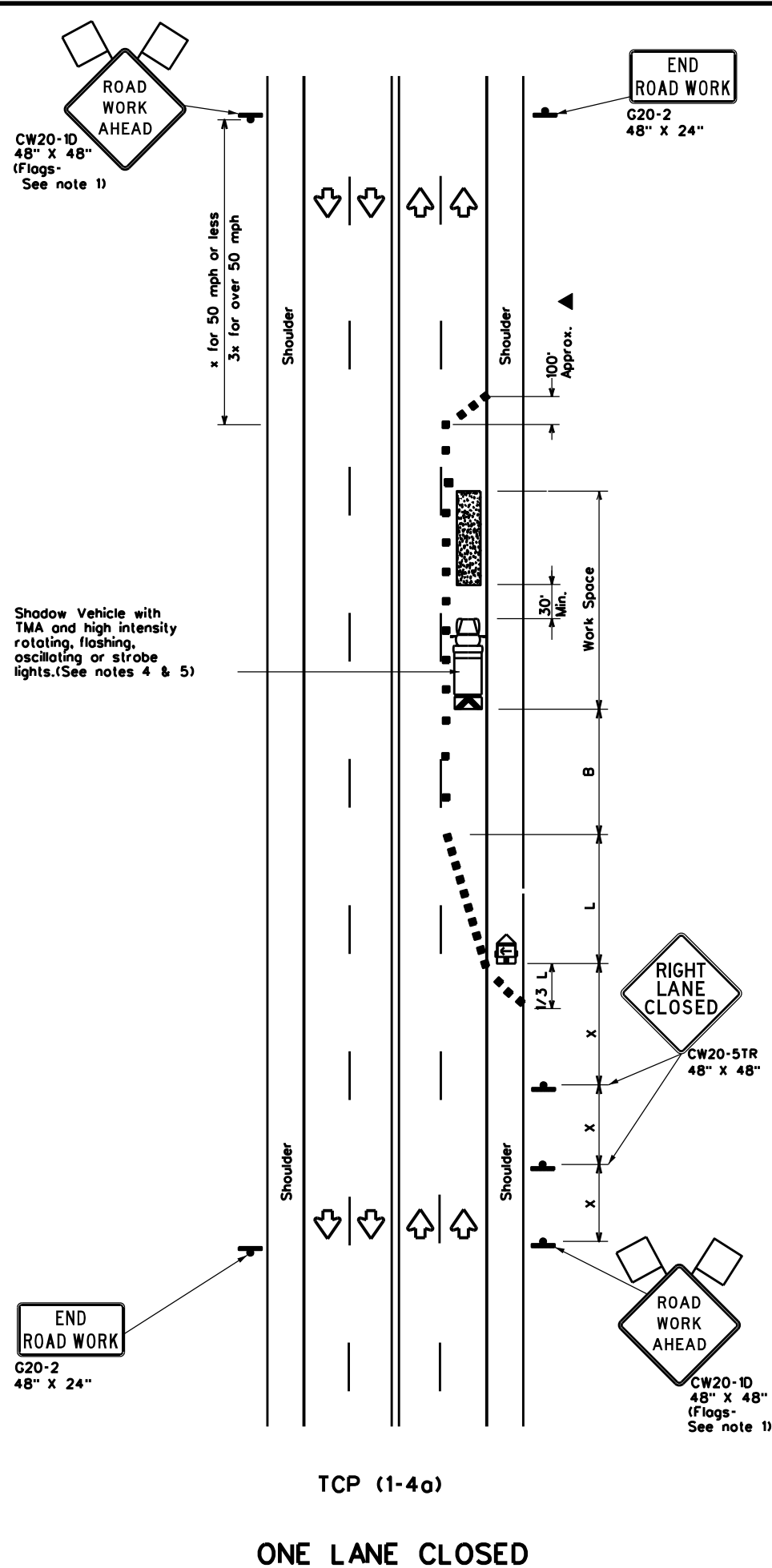
Texas Department of Transportation  
Traffic Operations Division Standard

**TRAFFIC CONTROL PLAN**  
**TRAFFIC SHIFTS ON**  
**TWO LANE ROADS**  
**TCP(1-3)-18**

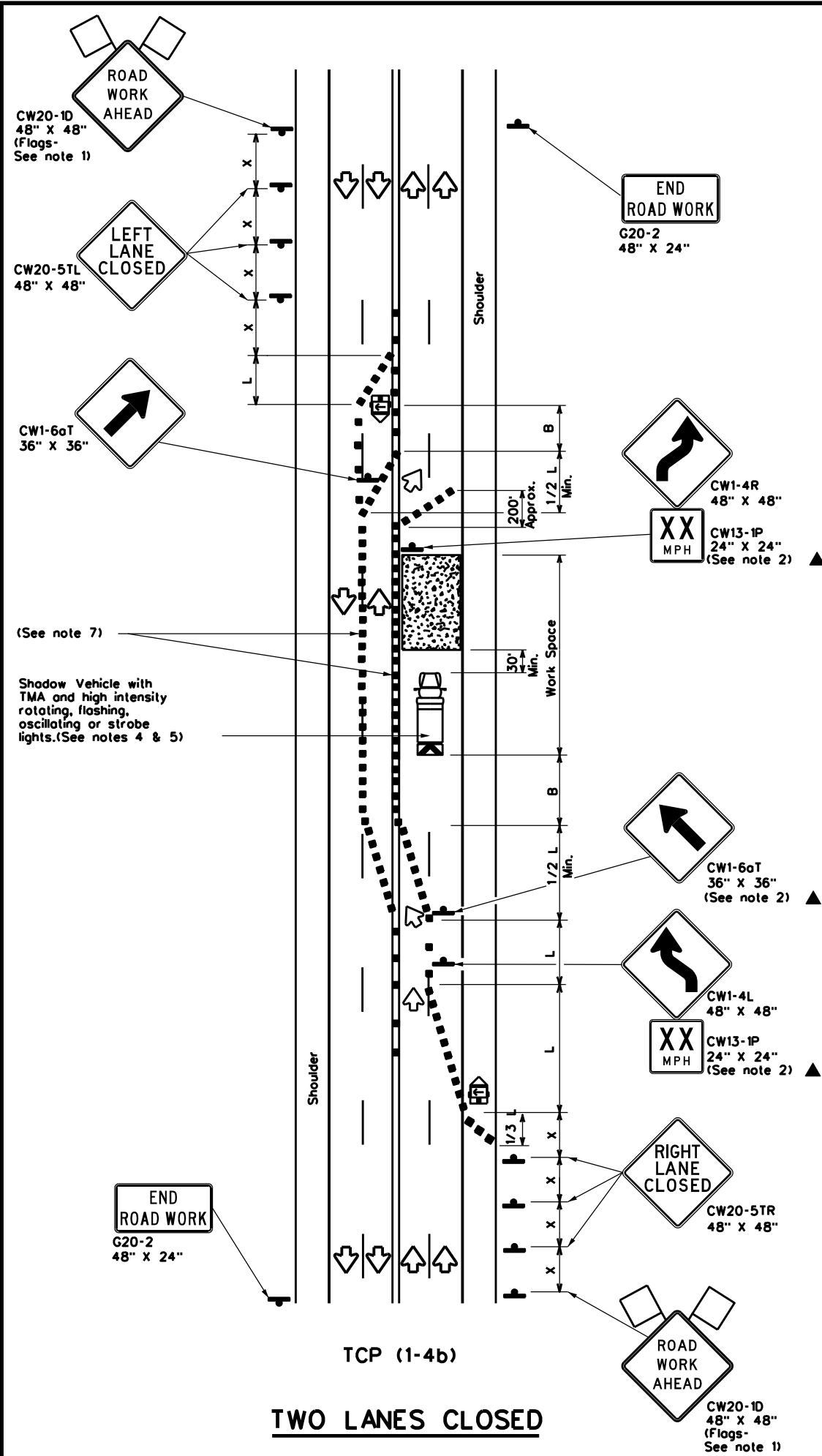
|                       |       |                          |              |           |
|-----------------------|-------|--------------------------|--------------|-----------|
| FILE: tcp1-3-18.dgn   | DN:   | CK:                      | DW:          | CK:       |
| © TxDOT December 1985 | CON:  | SECT:                    | JOB:         | HIGHWAY:  |
| REVISIONS             |       | 6444-52-001 US 190, ETC. |              |           |
| 2-94 4-98             | DIST: |                          | COUNTY:      | SHEET NO. |
| 8-95 2-12             | BRY:  |                          | BRAZOS, ETC. | 30        |
| 1-97 2-18             |       |                          |              |           |

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DATE: FILE:



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 |  | Portable Changeable Message Sign (PCMS) |
|        | Sign                                 |  | Traffic Flow                            |
|        | Flag                                 |  | Flagger                                 |

| Posted Speed<br>x | Formula                  | Minimum Desirable Taper Lengths<br>x z |            |            | Suggested Maximum Spacing of Channelizing Devices |              | Minimum Sign Spacing<br>"x"<br>Distance | Suggested Longitudinal Buffer Space<br>"B" |
|-------------------|--------------------------|--|------------|------------|---|--------------|---|--|
|                   |                          | 10' Offset                             | 11' Offset | 12' Offset | On a Taper  | On a Tangent |   |  |
| 30                | L = WS <sup>2</sup> / 60 | 150'                                   | 165'       | 180'       | 30'   | 60'          | 120'                                    | 90'  |
| 35                |                          | 205'                                   | 225'       | 245'       | 35'   | 70'          | 160'                                    | 120'                                       |
| 40                | L = WS                   | 265'                                   | 295'       | 320'       | 40'   | 80'          | 240'                                    | 155'                                       |
| 45                |                          | 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'                                    |  |

x Conventional Roads Only  
 xx 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**
- Flags attached to signs where shown are REQUIRED.
  - 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.
  - The CW20-1D "ROAD WORK AHEAD" sign may be repeated if the visibility of the work zone is less than 1500 feet.
  - 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.
  - Additional Shadow Vehicles with TMAs may be positioned off the paved surface, next to those shown in order to protect wider work spaces.

**TCP (1-4g)**  
 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**

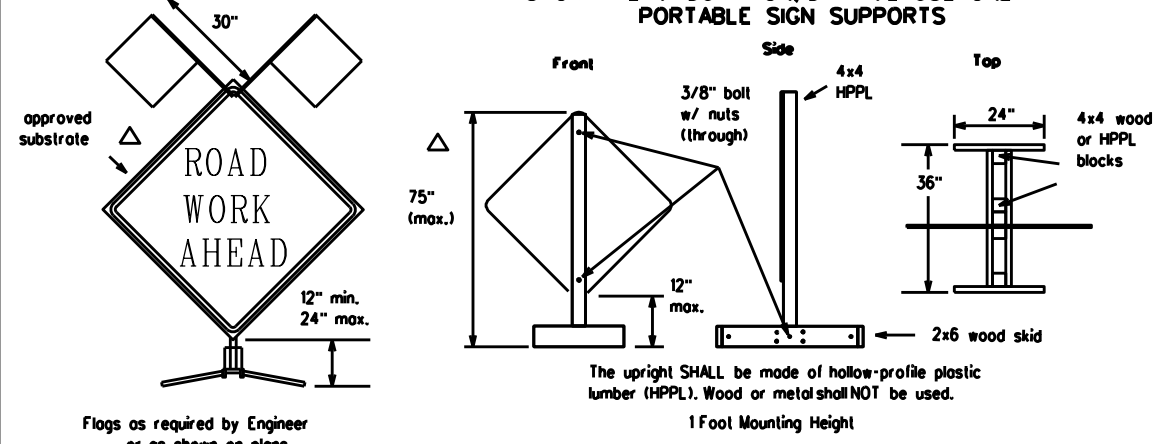
|                       |       |                          |              |           |
|-----------------------|-------|--------------------------|--------------|-----------|
| FILE: tcp1-4-18.dgn   | DN:   | CK:                      | DW:          | CK:       |
| © TxDOT December 1985 | CON:  | SECT:                    | JOB:         | HIGHWAY:  |
| REVISIONS             |       | 6444-52-001 US 190, ETC. |              |           |
| 2-94 4-98             | DIST: |                          | COUNTY:      | SHEET NO. |
| 8-95 2-12             | BRY:  |                          | BRAZOS, ETC. | 31        |
| 1-97 2-18             |       |                          |              |           |

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

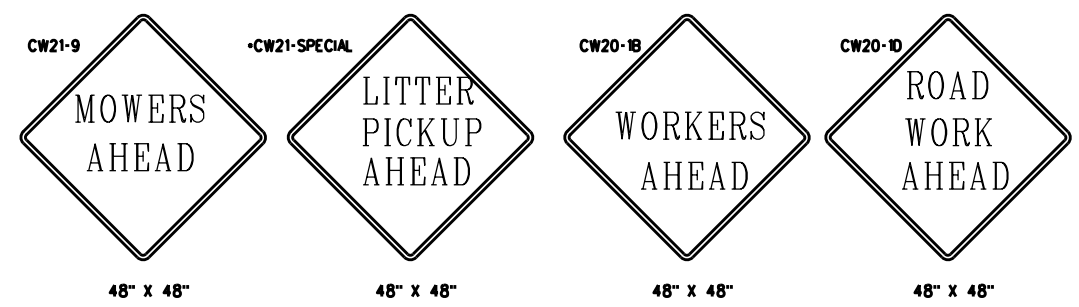
△ See the CWZTCO for the type of sign substrate that can be used for each approved sign support.

### EXAMPLES OF 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 will NOT be allowed.**



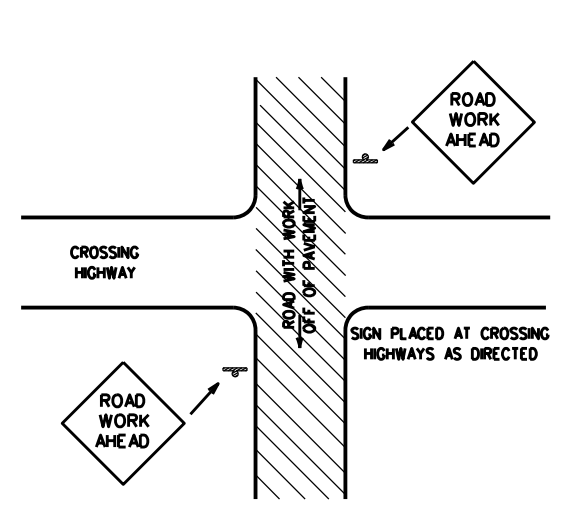
**SIGN IN ACCORDANCE WITH THE TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS**

**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 CWZTCO ALLOWED

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

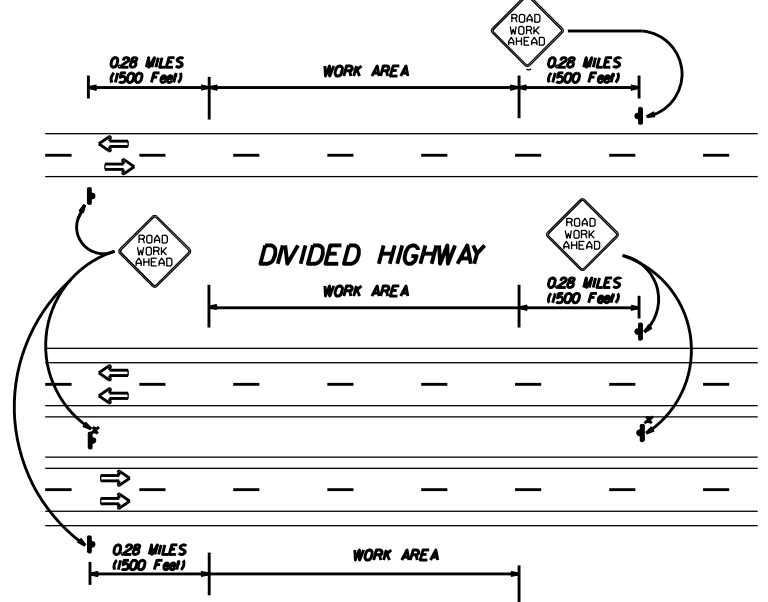


TYPICAL LOCATION OF SIGNS AT HIGHWAY CROSSING

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

- Contractor shall install and maintain signs in a straight and plumb condition and/or as directed by the Engineer.
  - Wooden sign posts shall be painted white.
  - Barricades shall NOT be used as sign supports.
  - Nails shall NOT be used to attach signs to any support.
  - 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.
  - 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.
  - The Contractor shall furnish sign supports listed in the "Compliant Work Zone Traffic Control Device List" (CWZTCO). 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.
  - 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.
  - 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".
  - 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 Uniform Traffic Control Devices" Part VII)**
- 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.
  - The Contractor shall furnish the sign sizes shown on this sheet or as directed by the Engineer.

#### SIGN SUBSTRATES

- The Contractor shall ensure that the sign substrate is allowed for the type of sign support that is being used. The CWZTCO lists each substrate that can be used on the different types and models of sign supports.
- "Mesh" type materials are NOT an approved sign substrate.
- 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

- 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/colmatex/GenericCollectionView.aspx?default:ts-default>
- White sheeting, meeting the requirements of DMS-8300 Type C (High Specific Intensity), shall be used for signs with white background and channelizing devices.
- Orange sheeting, meeting the requirements of DMS-8300 Type E (Fluorescent Prismatic), shall be used for signs with orange backgrounds.

#### SIGN LETTERS

- 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

- Signs should be removed or completely covered when not mowing.
- Duct tape or other adhesive material shall NOT be affixed to a sign face.
- Signs and supports shall be removed by the end of the day.

#### SIGN SUPPORT WEIGHTS

- Where sign supports 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.
- Rock, concrete, iron, steel or other solid objects will not be permitted for use as sign support weights.
- 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.
- Rubber ballasts (such as those used with cones or edgeline channelizers) shall NOT be used as sign support weights.
- 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.
- 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" (CWZTCO) 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 "CWZTCO" on TxDOT website are:

Start of website - [www.dot.state.tx.us](http://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.



## ROADSIDE TRAFFIC CONTROL PLAN

|                             |                       |                     |                      |                                  |           |
|-----------------------------|-----------------------|---------------------|----------------------|----------------------------------|-----------|
| SHEET 1 OF 1                |                       | RS-TCP-05           |                      | NOT TO SCALE                     |           |
| FILE: RSTCP05.DGN           | DN: LJB               | CK: JG              | DW: -                | CK: -                            | NEG NO: - |
| © TxDOT FEBRUARY 2005       |                       | STATE DISTRICT: BRY | FEDERAL REGION: N/A  | FEDERAL AID PROJECT: 6444-52-001 |           |
| REVISED: September 17, 2004 | Sign placement in TCP |                     | COUNTY: BRAZOS, ETC. | CONTROL SECTION: N/A             | JOB: N/A  |
| REVISED: FEBRUARY 2, 2005   |                       |                     |                      | SECTION: N/A                     | JOB: N/A  |

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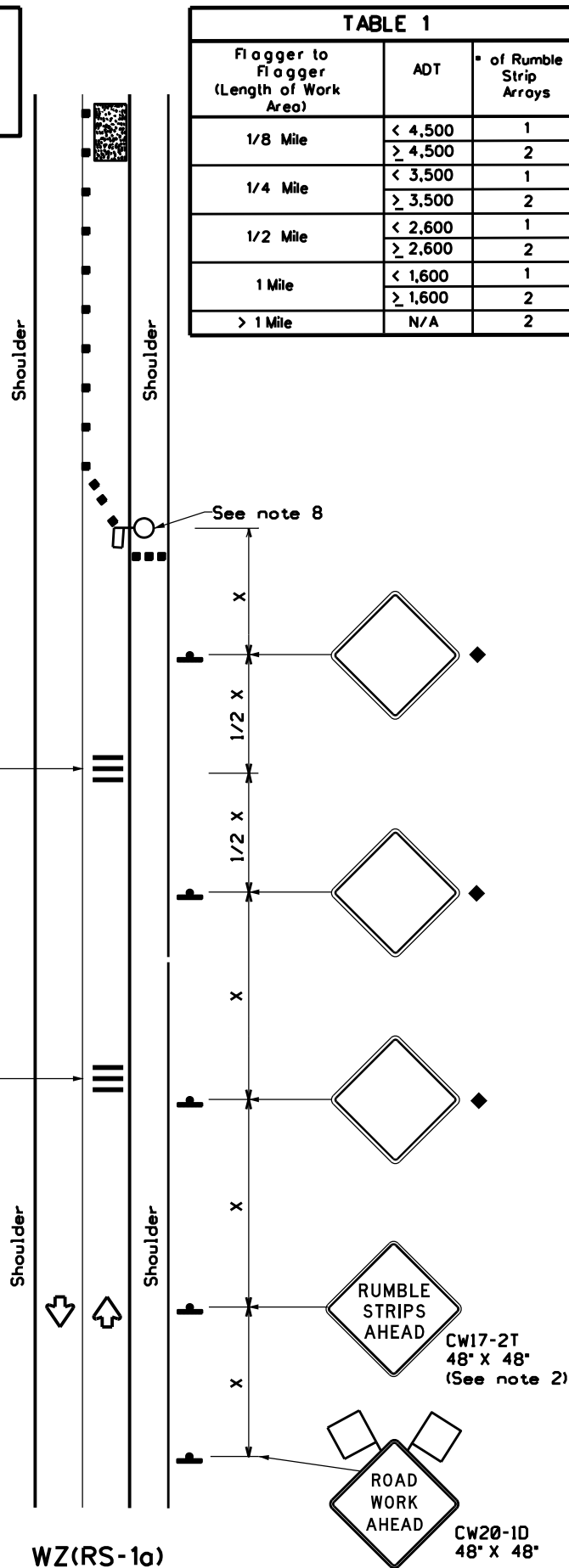
Warning sign and rumble strip sequence in opposite direction is same as below.

| 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                        |

Rumble Strip Array (See note 1)

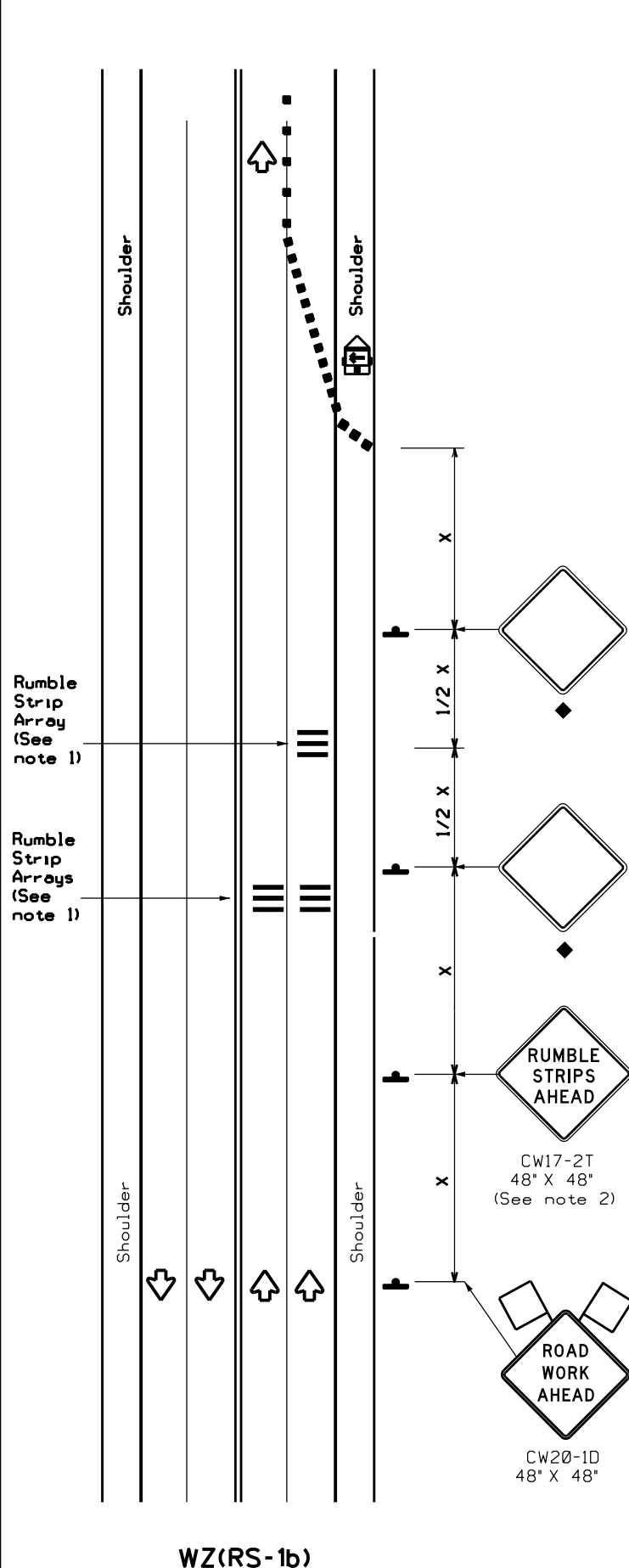
Rumble Strip Array (See note 1)

The second Rumble Strip Array is required when the ADT thresholds in Table 1 indicate the need for 2 Arrays.



WZ(RS-1a)

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



WZ(RS-1b)

**RUMBLE STRIPS FOR LANE CLOSURE ON CONVENTIONAL ROADWAY**

**GENERAL NOTES**

- 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.
- 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.
- Temporary Rumble Strips will be considered subsidiary to Item 502, and shall be a product listed on the Compliant Work Zone Traffic Control Devices.
- Remove Temporary Rumble Strips before removing the advanced warning signs.
- Temporary Rumble Strips should not be used on horizontal curves, loose gravel, soft or bleeding asphalt, heavily rutted pavements or unpaved surfaces.
- Temporary Rumble Strips shall be installed and maintained as per manufacturer's recommendations.
- This standard sheet shall be used in conjunction with other appropriate TCP standard, TMUTCD typical application or project specific detail for the project.
- The one-lane two-way application may utilize a flagger, an Automated Flagger Assistance Device (AFAD) or a Portable Traffic Signal (PTS).
- Replace defective Temporary Rumble Strips as directed by the Engineer.
- Temporary Rumble Strips may be used on freeways or expressways based on engineering judgment and written direction from the Engineer.

| Speed               | Approximate distance between strips in an array |
|---------------------|---|
| ≤ 40 MPH            | 10'   |
| > 40 MPH & ≤ 55 MPH | 15'   |
| = 60 MPH            | 20'   |
| ≥ 65 MPH            | • 35'+  |

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

| Posted Speed<br>x | Formula                  | Minimum Desirable Taper Lengths<br>x x |            |            | Suggested Maximum Spacing of Channelizing Devices |              | Minimum Sign Spacing<br>"x"<br>Distance | Suggested Longitudinal Buffer Space<br>"B" |
|-------------------|--------------------------|--|------------|------------|---|--------------|---|--|
|                   |                          | 10' Offset                             | 11' Offset | 12' Offset | On a Taper  | On a Tangent |   |  |
| 30                | L = WS <sup>2</sup> / 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'                                       |

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

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

◆ Signs are for illustrative purposes only. Signs required may vary depending on the TCP, TMUTCD Typical Application, or project specific details for the project.  
 • For posted speeds in excess of 65 MPH, it is recommended that spacing is increased as speed limits increase. Increasing space between rumble strips will improve effectiveness.

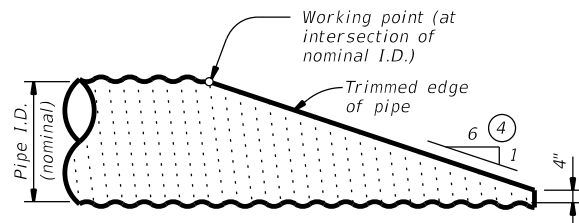
Texas Department of Transportation Traffic Safety Division Standard

**TEMPORARY RUMBLE STRIPS**

**WZ(RS)-22**

|                       |                         |             |           |           |
|-----------------------|-------------------------|-------------|-----------|-----------|
| FILE: wzrs22.dgn      | DN: TxDOT               | CK: TxDOT   | DW: TxDOT | CK: TxDOT |
| © TxDOT November 2012 | CONT                    | SECT        | JOB       | HIGHWAY   |
| REVISIONS             | 6444-52-001 US 190, ETC |             |           |           |
| 2-14 1-22             | DIST                    | COUNTY      | SHEET NO. |           |
| 4-16                  | BRY                     | BRAZOS, ETC | 33        |           |

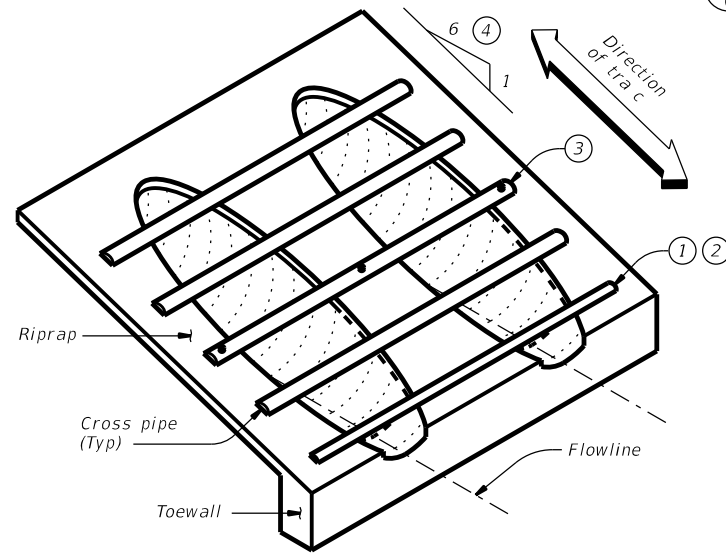
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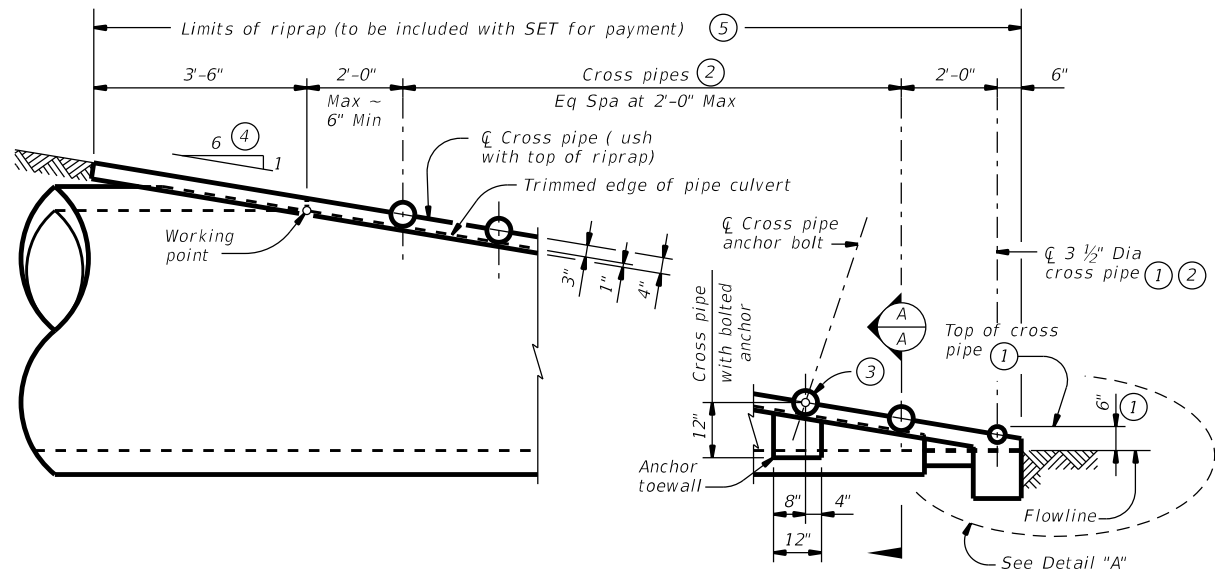
NOTE: All cross pipes, calculations, and dimensions are based on the pipe culverts mitered as shown in this detail. Alternate styles of mitered ends will require that appropriate adjustments be made to the values presented on this standard.

**SIDE ELEVATION OF TYPICAL PIPE CULVERT MITER**

(Showing corrugated metal pipe (CMP) culvert. Details at reinforced concrete pipe (RCP) culvert are similar.)

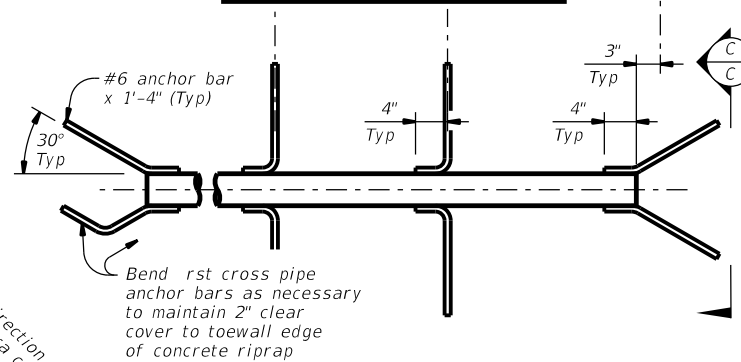
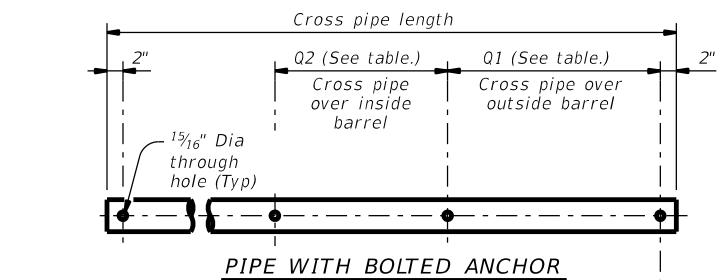


**ISOMETRIC VIEW OF TYPICAL INSTALLATION**

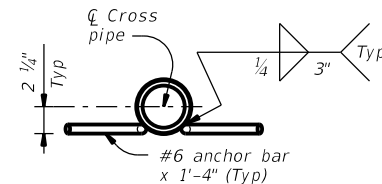


**SIDE ELEVATION OF CAST-IN-PLACE CONCRETE**

(Showing reinforced concrete pipe (RCP) culvert. Details at corrugated metal pipe (CMP) culvert are similar.)

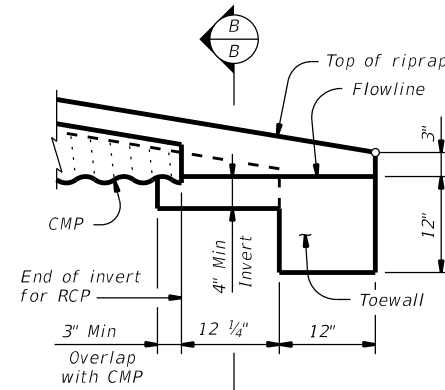


**PIPE WITH ANCHOR BARS**



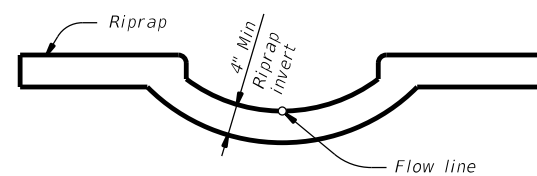
**SECTION C-C**

**CROSS PIPE DETAILS**



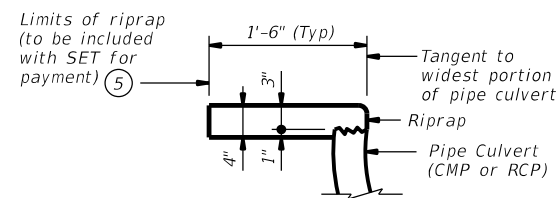
**DETAIL "A"**

(Showing invert with corrugated metal pipe (CMP) culvert. Reinforced concrete pipe (RCP) culvert details are similar. Cross pipes not shown for clarity.)

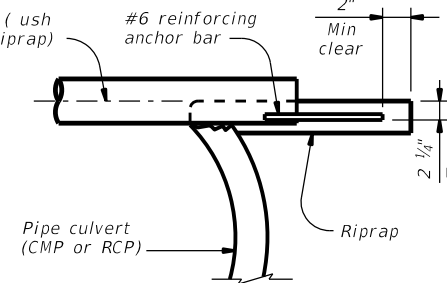


**SECTION B-B**

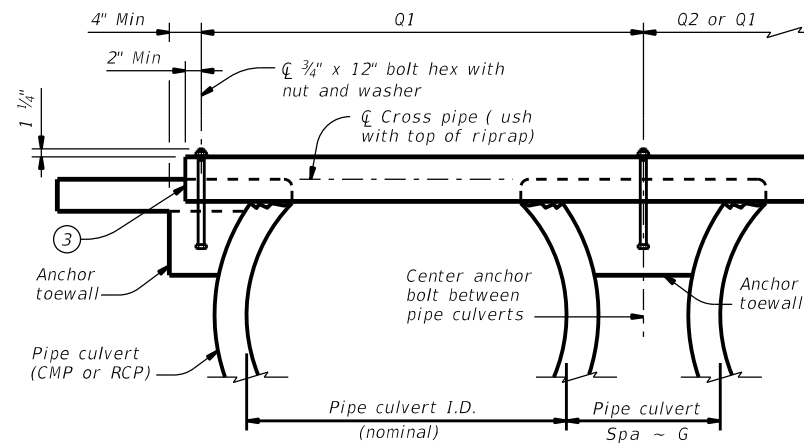
(Cross pipes not shown for clarity.)



**SHOWING TYPICAL PIPE CULVERT AND RIPRAP**



**SHOWING CROSS PIPE WITH ANCHOR BAR**



**SHOWING CROSS PIPE WITH BOLTED ANCHOR**

**SECTION A-A**

**CROSS PIPE LENGTHS, REQUIRED PIPE SIZES, AND RIPRAP QUANTITIES**

| Nominal Culvert I.D. | Conc Riprap (CY) (6) | Pipe Culvert Spa ~ G | Single Barrel ~ Q1 | Multi-Barrel ~ Q1 | Q2       | Conditions for Use of Cross Pipes | Cross Pipe Sizes         |
|----------------------|----------------------|----------------------|--------------------|-------------------|----------|-----------------------------------|--------------------------|
| 12"                  | 0.6                  | 0' - 9"              | N/A                | 2' - 1"           | 1' - 9"  | 3 or more pipe culverts           | 3" Std (3.500" O.D.)     |
| 15"                  | 0.7                  | 0' - 11"             | N/A                | 2' - 5"           | 2' - 2"  |                                   |                          |
| 18"                  | 0.8                  | 1' - 2"              | N/A                | 2' - 10"          | 2' - 8"  |                                   |                          |
| 21"                  | 0.9                  | 1' - 4"              | N/A                | 3' - 2"           | 3' - 1"  |                                   |                          |
| 24"                  | 0.9                  | 1' - 7"              | N/A                | 3' - 6"           | 3' - 7"  | 3 or more pipe culverts           | 3 1/2" Std (4.000" O.D.) |
| 27"                  | 1.0                  | 1' - 8"              | N/A                | 3' - 10"          | 3' - 11" |                                   |                          |
| 30"                  | 1.1                  | 1' - 10"             | N/A                | 4' - 2"           | 4' - 4"  | 2 or more pipe culverts           | 4" Std (4.500" O.D.)     |
| 33"                  | 1.2                  | 1' - 11"             | 4' - 2"            | 4' - 5"           | 4' - 8"  | All pipe culverts                 |                          |
| 36"                  | 1.3                  | 2' - 1"              | 4' - 5"            | 4' - 9"           | 5' - 1"  | All pipe culverts                 | 4" Std (4.500" O.D.)     |
| 42"                  | 1.5                  | 2' - 4"              | 4' - 11"           | 5' - 5"           | 5' - 10" |                                   |                          |
| 48"                  | 1.7                  | 2' - 7"              | 5' - 5"            | 6' - 0"           | 6' - 7"  | All pipe culverts                 | 5" Std (5.563" O.D.)     |
| 54"                  | 2.0                  | 3' - 0"              | 5' - 11"           | 6' - 9"           | 7' - 6"  |                                   |                          |
| 60"                  | 2.2                  | 3' - 3"              | 6' - 5"            | 7' - 4"           | 8' - 3"  |                                   |                          |
| 66"                  | 2.4                  | 3' - 3"              | 6' - 11"           | 7' - 10"          | 8' - 9"  |                                   |                          |
| 72"                  | 2.7                  | 3' - 4"              | 7' - 5"            | 8' - 5"           | 9' - 4"  |                                   |                          |

- The proper installation of the first cross pipe is critical for vehicle safety. Place the top of the first cross pipe no more than 6" above the flow line.
- Provide cross pipes, except the first bottom pipe, of the size shown in the table. Provide a 3 1/2" standard pipe (4" O.D.) for the first bottom pipe.
- Install the third cross pipe from the bottom of the culvert using a bolted connection. Ensure that riprap concrete does not flow into the cross pipe so as to permit disassembly of the bolted connection to allow cleanout access. At the Contractor's option, install all other cross pipes using the bolted connection details.
- Match cross slope as shown elsewhere in the plans. Cross slope of 6:1 or steeper is required for vehicle safety.
- Riprap placed beyond the limits shown will be paid for as concrete riprap in accordance with Item 432, "Riprap".
- Quantities shown are for one end of one reinforced concrete pipe (RCP) culvert. For multiple pipe culverts or for corrugated metal pipe (CMP) culverts, quantities will need to be adjusted. Riprap quantities are for contractor's information only.

**MATERIAL NOTES:**

Synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) may be used in lieu of steel reinforcing in riprap concrete unless noted otherwise. Provide cross pipes that meet the requirements of ASTM A53 (Type E or S, Gr B), ASTM A500 (Gr B), or API 5LX52. Provide ASTM A307 bolts and nuts. Galvanize all steel components, except concrete reinforcing, after fabrication. Repair galvanizing damaged during transport or construction in accordance with the specifications.

**GENERAL NOTES:**

Cross pipes are designed for a traversing load of 10,000 pounds at yield as recommended by Research Report 280-2F, "Safety Treatment of Roadside Parallel-Drainage Structures", Texas Transportation Institute, March 1981. Safety end treatments (SET) shown herein are intended for use in those installations where out of control vehicles are likely to traverse the openings approximately perpendicular to the cross pipes. Construct concrete riprap and all necessary inverts in accordance with the requirements of Item 432, "Riprap". Payment for riprap and toewall is included in the Price Bid for each Safety End Treatment.

**Texas Department of Transportation** Bridge Division Standard

**SAFETY END TREATMENT FOR 12" DIA TO 72" DIA PIPE CULVERTS TYPE II ~ PARALLEL DRAINAGE**

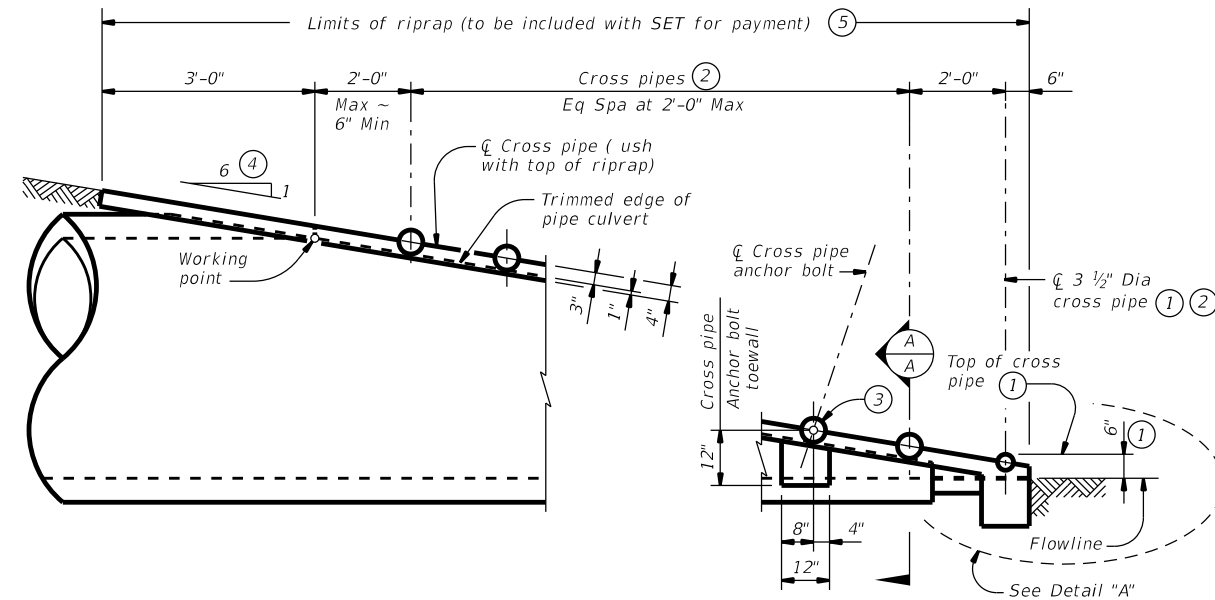
**SETP-PD**

|                       |             |         |             |         |
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| ©TxDOT February 2020  | CONTRACT    | SECTION | JOB         | HIGHWAY |
| REVISIONS             | 6444-52-001 |         | US 190, ETC |         |
| DIST                  | COUNTY      |         | SHEET NO.   |         |
| BRY                   | BRAZOS, ETC |         | 34          |         |

DATE: FILE:

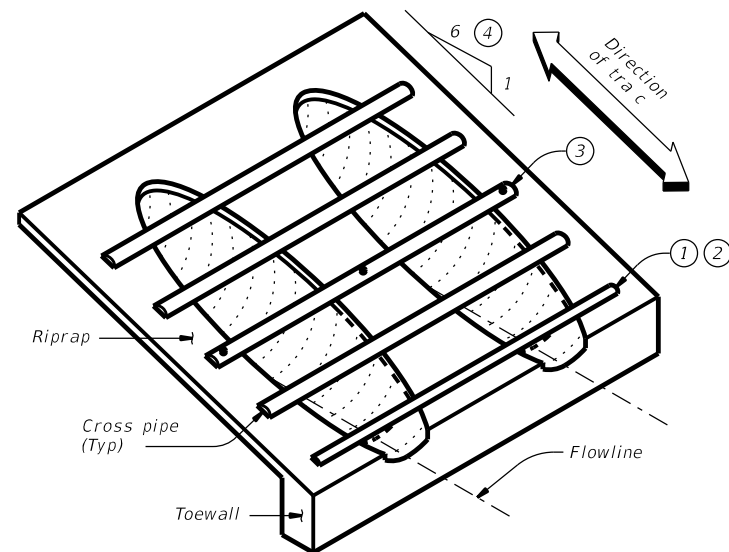
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DATE: FILE:

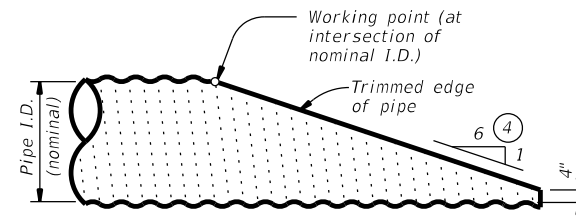


**SIDE ELEVATION OF CAST-IN-PLACE CONCRETE**

(Showing reinforced concrete pipe (RCP) culvert. Details of corrugated metal pipe (CMP) culvert are similar. pipe runners not shown for clarity.)



**ISOMETRIC VIEW OF TYPICAL INSTALLATION**



NOTE: All cross pipes, calculations, and dimensions are based on the pipe culverts mitered as shown in this detail. Alternate styles of mitered ends will require that appropriate adjustments be made to the values presented on this standard.

**SIDE ELEVATION OF TYPICAL PIPE CULVERT MITER**

(Showing corrugated metal pipe (CMP) culvert. Details of reinforced concrete pipe (RCP) culvert are similar.)

**CROSS PIPE LENGTHS AND REQUIRED PIPE SIZES ②**

| Corrugated Metal Pipe (CMP) Culverts |                    |                   |                   |                      |                    |                   |          |                                   |                          |
|--------------------------------------|--------------------|-------------------|-------------------|----------------------|--------------------|-------------------|----------|-----------------------------------|--------------------------|
| Design                               | Conc Riprap (CY) ⑥ | Pipe Culvert Span | Pipe Culvert Rise | Pipe Culvert Spa ~ G | Single Barrel ~ Q1 | Multi-Barrel ~ Q1 | Q2       | Conditions for Use of Cross Pipes | Cross Pipe Sizes         |
| 1                                    | 0.6                | 17"               | 13"               | 1' - 0"              | N/A                | 2' - 8"           | 2' - 5"  | 3 or more pipe culverts           | 3" Std (3.500" O.D.)     |
| 2                                    | 0.7                | 21"               | 15"               | 1' - 2"              | N/A                | 3' - 1"           | 2' - 11" |                                   | 3 1/2" Std (4.000" O.D.) |
| 3                                    | 0.9                | 28"               | 20"               | 1' - 5"              | N/A                | 3' - 9"           | 3' - 9"  |                                   | 4" Std (4.500" O.D.)     |
| 4                                    | 1.0                | 35"               | 24"               | 1' - 8"              | 4' - 4"            | 4' - 6"           | 4' - 7"  | All pipe culverts                 | 4" Std (4.500" O.D.)     |
| 5                                    | 1.2                | 42"               | 29"               | 1' - 11"             | 4' - 11"           | 5' - 2"           | 5' - 5"  |                                   |                          |
| 6                                    | 1.4                | 49"               | 33"               | 2' - 2"              | 5' - 6"            | 5' - 11"          | 6' - 3"  | All pipe culverts                 | 5" Std (5.563" O.D.)     |
| 7                                    | 1.6                | 57"               | 38"               | 2' - 5"              | 6' - 2"            | 6' - 8"           | 7' - 2"  |                                   |                          |
| 8                                    | 1.8                | 64"               | 43"               | 2' - 10"             | 6' - 9"            | 7' - 6"           | 8' - 2"  |                                   |                          |
| 9                                    | 1.9                | 71"               | 47"               | 3' - 2"              | 7' - 4"            | 8' - 3"           | 9' - 1"  |                                   |                          |

| Reinforced Concrete Pipe (RCP) Culverts |                    |                   |                   |                      |                    |                   |             |                                   |                          |
|---|--------------------|-------------------|-------------------|----------------------|--------------------|-------------------|-------------|-----------------------------------|--------------------------|
| Design                                  | Conc Riprap (CY) ⑥ | Pipe Culvert Span | Pipe Culvert Rise | Pipe Culvert Spa ~ G | Single Barrel ~ Q1 | Multi-Barrel ~ Q1 | Q2          | Conditions for Use of Cross Pipes | Cross Pipe Sizes         |
| 1                                       | 0.6                | 22"               | 13 1/2"           | 1' - 0"              | N/A                | 3' - 1"           | 2' - 10"    | 3 or more pipe culverts           | 3" Std (3.500" O.D.)     |
| 2                                       | 0.7                | 26"               | 15 1/2"           | 1' - 2"              | N/A                | 3' - 6"           | 3' - 4"     |                                   | 3 1/2" Std (4.000" O.D.) |
| 3                                       | 0.9                | 28 1/2"           | 18"               | 1' - 5"              | N/A                | 3' - 10"          | 3' - 9 1/2" |                                   | 4" Std (4.500" O.D.)     |
| 4                                       | 1.0                | 36 1/4"           | 22 1/2"           | 1' - 8"              | 4' - 5"            | 4' - 7"           | 4' - 8 1/4" | All pipe culverts                 | 4" Std (4.500" O.D.)     |
| 5                                       | 1.2                | 43 3/4"           | 26 5/8"           | 1' - 11"             | 5' - 1"            | 5' - 4"           | 5' - 6 3/4" |                                   |                          |
| 6                                       | 1.4                | 51 1/8"           | 31 5/16"          | 2' - 2"              | 5' - 8"            | 6' - 1"           | 6' - 5 1/4" | All pipe culverts                 | 5" Std (5.563" O.D.)     |
| 7                                       | 1.6                | 58 1/2"           | 36"               | 2' - 5"              | 6' - 4"            | 6' - 10"          | 7' - 3 1/2" |                                   |                          |
| 8                                       | 1.8                | 65"               | 40"               | 2' - 10"             | 6' - 10"           | 7' - 7"           | 8' - 3"     |                                   |                          |
| 9                                       | 1.9                | 73"               | 45"               | 3' - 2"              | 7' - 6"            | 8' - 5"           | 9' - 3"     |                                   |                          |

- ① The proper installation of the first cross pipe is critical for vehicle safety. Place the top of the first cross pipe no more than 6" above the flow line.
- ② Provide cross pipes, except the first bottom pipe, of the size shown in the table. Provide a 3 #2" standard pipe (4" O.D.) for the first bottom pipe.
- ③ Install the third Cross Pipe from the bottom of the culvert using a bolted connection. Ensure that riprap concrete does not flow into the cross pipe so as to permit disassembly of the bolted connection to allow cleanout access. At the Contractor's option, install all other cross pipes using the bolted connection details.
- ④ Match cross slope as shown elsewhere in the plans. Cross slope of 6:1 or steeper is required for vehicle safety.
- ⑤ Riprap placed beyond the limits shown will be paid as concrete riprap in accordance with Item 432, "Riprap".
- ⑥ Quantities shown are for one end of one pipe culvert. For multiple Pipe Culverts, quantities will need to be adjusted. Riprap quantities are for Contractor's information only.

**MATERIAL NOTES:**

Synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) may be used in lieu of steel reinforcing in riprap concrete unless noted otherwise.  
 Provide cross pipes that meet the requirements of ASTM A53 (Type E or S, Gr B), ASTM A500 Gr B, or API 5LX52.  
 Provide ASTM A307 bolts and nuts.  
 Galvanize all steel components, except concrete reinforcing, after fabrication. Repair galvanizing damaged during transport or construction in accordance with the specifications.

**GENERAL NOTES:**

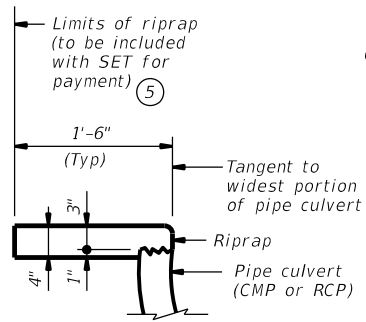
Pipe runners are designed for a traversing load of 10,000 pounds at yield as recommended by Research Report 280-2F, "Safety Treatment of Roadside Parallel-Drainage Structures", Texas Transportation Institute, March 1981.  
 Safety end treatments (SET) shown herein are intended for use in those installations where out of control vehicles are likely to traverse the openings approximately perpendicular to the Pipe Runners.  
 Construct concrete riprap and all necessary inverts in accordance with the requirements of Item 432, "Riprap".  
 Payment for riprap and toewall is included in the price bid for each safety end treatment.

SHEET 1 OF 2

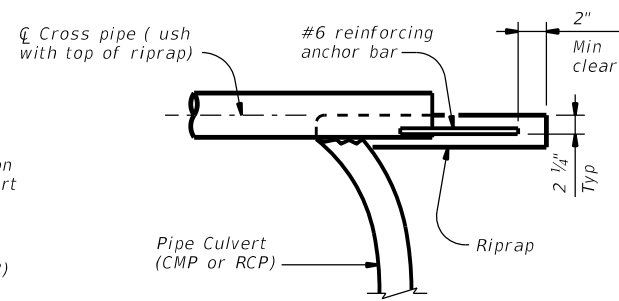
|  |             |                                 |             |
|--|-------------|---------------------------------|-------------|
|  |             | <b>Bridge Division Standard</b> |             |
| <b>SAFETY END TREATMENT FOR DESIGN 1 TO 9 ARCH PIPE CULVERTS TYPE II ~ PARALLEL DRAINAGE</b> |             |                                 |             |
| <b>SETP-PD-A</b>   |             |                                 |             |
| FILE: setppase-20.dgn  | DN: GAF     | CK: TxDOT                       | DW: JRP     |
| ©TxDOT February 2020   | CONTRACT    | SECTION                         | JOB         |
| REVISIONS  | 6444-52-001 |                                 | US 190, ETC |
| DIST   | COUNTY      |                                 | SHEET NO.   |
| BRY  | BRAZOS, ETC |                                 | 35          |



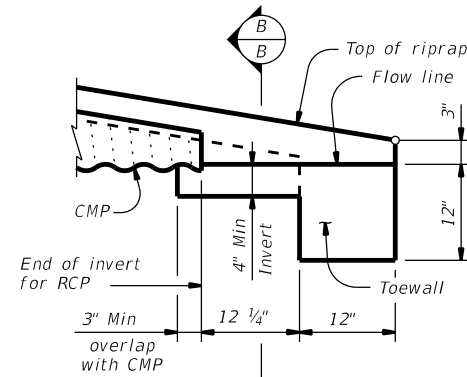
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SHOWING TYPICAL PIPE CULVERT AND RIPRAP

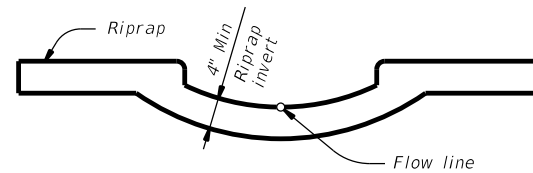


SHOWING CROSS PIPE WITH ANCHOR BAR



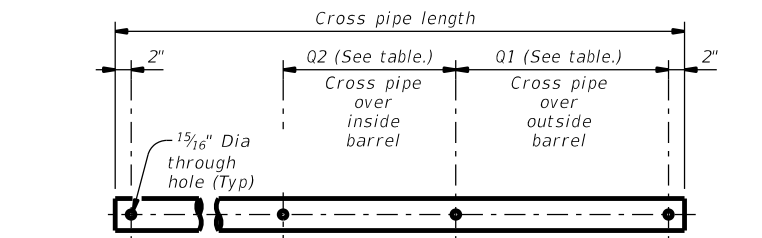
DETAIL "A"

(Showing invert with corrugated metal pipe (CMP) culvert. Reinforced concrete pipe (RCP) culvert details are similar. Cross pipes not shown for clarity.)

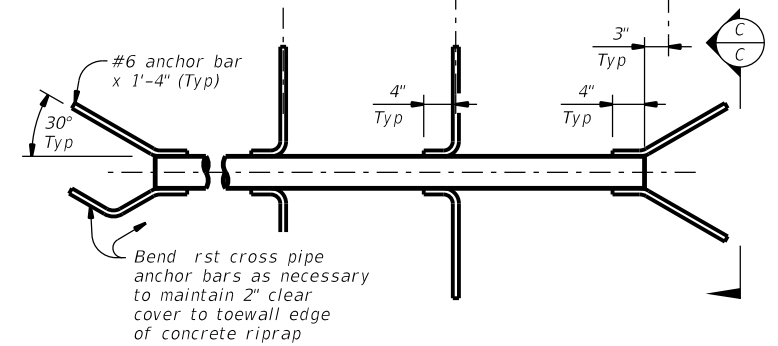


SECTION B-B

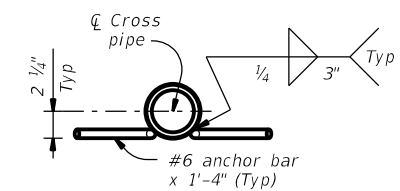
(Cross pipes not shown for clarity.)



PIPE WITH BOLTED ANCHOR

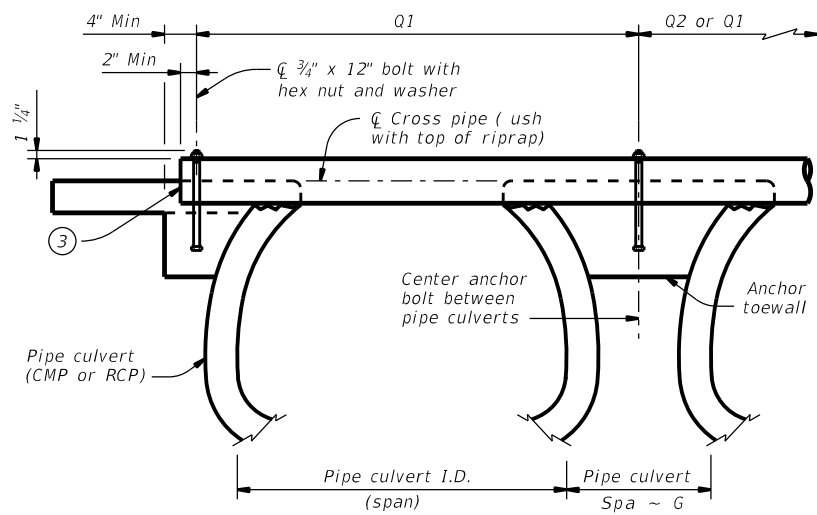


PIPE WITH ANCHOR BARS



SECTION C-C

CROSS PIPE DETAILS



SHOWING CROSS PIPE WITH BOLTED ANCHOR

SECTION A-A

SAFETY END TREATMENT FOR DESIGN 1 TO 9 ARCH PIPE CULVERTS TYPE II ~ PARALLEL DRAINAGE

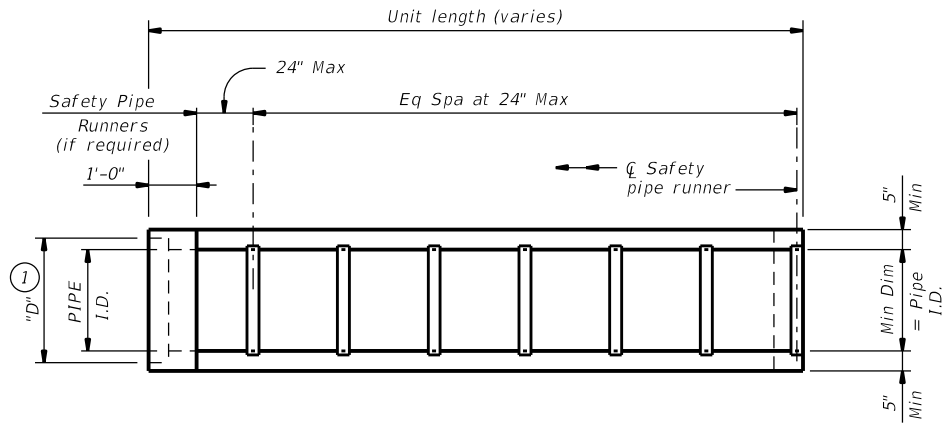
SETP-PD-A

|                       |             |           |             |         |
|-----------------------|-------------|-----------|-------------|---------|
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| ©TxDOT February 2020  | CONT        | SECT      | JOB         | HIGHWAY |
| REVISIONS             | 6444-52-001 |           | US 190, ETC |         |
| DIST                  | COUNTY      |           | SHEET NO.   |         |
| BRY                   | BRAZOS, ETC |           | 36          |         |



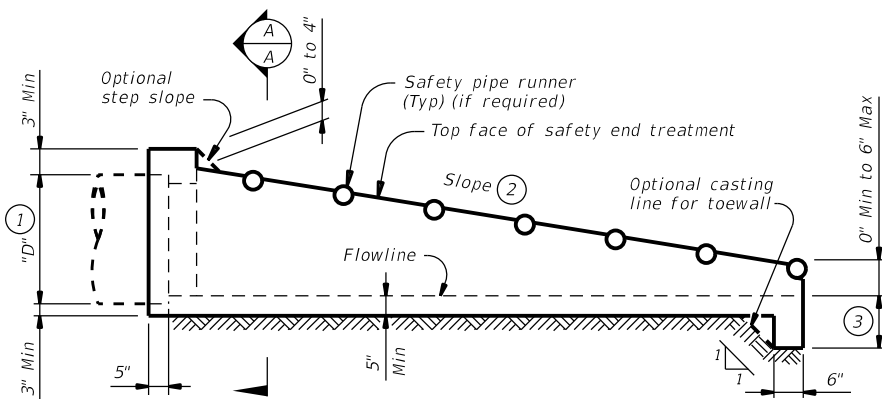
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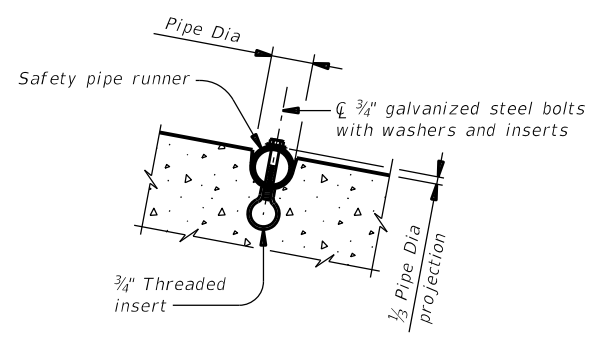
**PLAN**

(Showing bell end connection.)



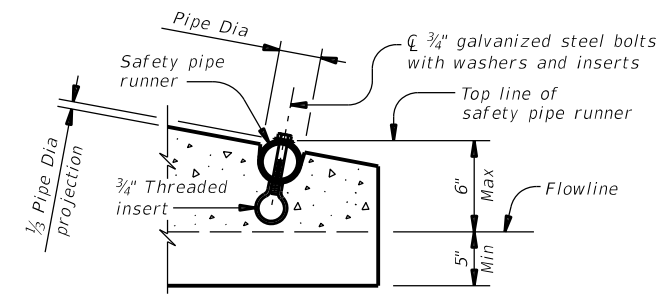
**LONGITUDINAL ELEVATION**

(Showing bell end connection.)

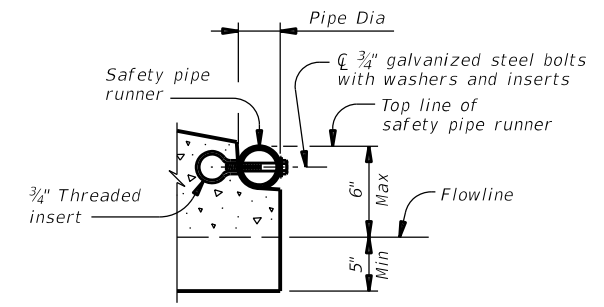


**INSTALLATION DETAIL FOR SAFETY PIPE RUNNERS**

(If required)



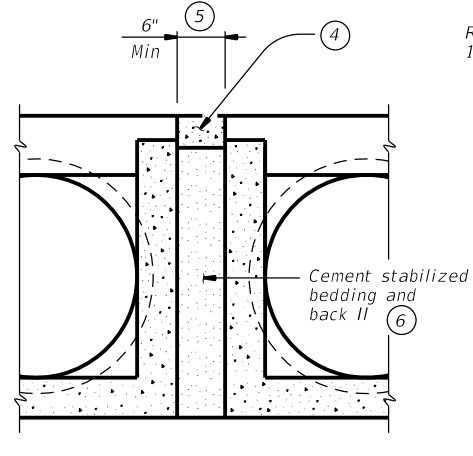
**OPTION A**



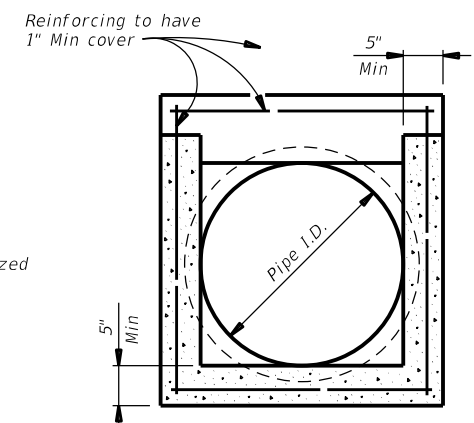
**OPTION B**

**END DETAILS FOR INSTALLATION OF SAFETY PIPE RUNNERS**

(If required)

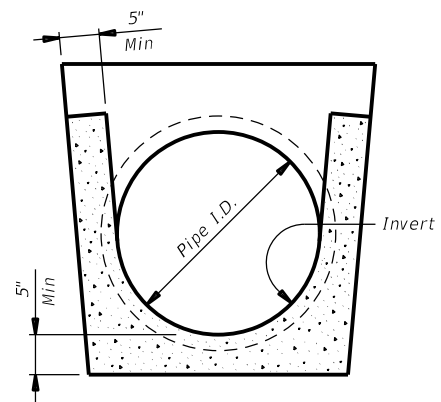


**MULTIPLE PIPE INSTALLATION**

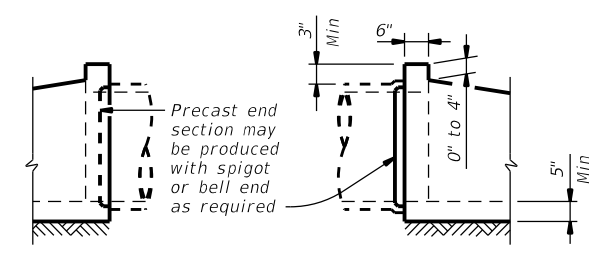


**OPTION WITH SQUARE BOTTOM**

**SECTION A-A**



**OPTION WITH INVERT BOTTOM**



**OPTIONAL JOINT FOR RCP**

(Showing joint between RCP and precast safety end treatment.)

**REQUIREMENTS FOR CULVERT PIPES AND SAFETY PIPE RUNNERS**

| Pipe I.D. | RCP Wall "B" Thickness | TP Wall Thickness (7) | "D" (1) | Slope | Min Length | Pipe Runners Required |                    | Required Pipe Runner Size |        |        |
|-----------|------------------------|-----------------------|---------|-------|------------|-----------------------|--------------------|---------------------------|--------|--------|
|           |                        |                       |         |       |            | Single Pipe           | Multiple Pipe      | Nominal Dia.              | O.D.   | I.D.   |
| 12"       | 2"                     | 1.15"                 | 17.00"  | 6:1   | 4' - 9"    | No                    | Yes, for > 2 pipes | 3" STD                    | 3.500" | 3.068" |
| 15"       | 2 1/4"                 | 1.30"                 | 20.50"  | 6:1   | 6' - 5"    | No                    | Yes, for > 2 pipes | 3" STD                    | 3.500" | 3.068" |
| 18"       | 2 1/2"                 | 1.60"                 | 24.00"  | 6:1   | 8' - 0"    | No                    | Yes, for > 2 pipes | 3" STD                    | 3.500" | 3.068" |
| 24"       | 3"                     | 1.95"                 | 31.00"  | 6:1   | 11' - 3"   | No                    | Yes, for > 2 pipes | 3" STD                    | 3.500" | 3.068" |
| 30"       | 3 1/2"                 | 2.65"                 | 38.50"  | 6:1   | 14' - 8"   | No                    | Yes                | 4" STD                    | 4.500" | 4.026" |
| 36"       | 4"                     | 2.75"                 | 45.50"  | 6:1   | 17' - 11"  | Yes                   | Yes                | 4" STD                    | 4.500" | 4.026" |
| 42"       | 4 1/2"                 | 2.7"                  | 52.50"  | 6:1   | 21' - 2"   | Yes                   | Yes                | 4" STD                    | 4.500" | 4.026" |

- Dimension "D" is based on reinforced concrete pipe (RCP) meeting the requirements of ASTM C-76, Class III, (RCP Wall "B" thickness). Adjust "D" for any other wall thickness used. For thermoplastic pipe (TP) take into account the annular space requirements for grouted connections.
- Slope as shown elsewhere in the plans. Slope of 6:1 or better is required for vehicle safety.
- Toewall to be used only when dimension is shown elsewhere in the plans.
- Fill the top 4" of void between precast end treatments with concrete riprap. Concrete riprap is considered subsidiary to the Item 467, "Safety End Treatment".
- Adjust clear distance between pipes to provide for the minimum distance between safety end treatments.
- Provide cement stabilized bedding and back II in accordance with the Item 400, "Excavation and Back II for Structures". Bedding and back II is considered subsidiary to the Item 467, "Safety End Treatment". When concrete riprap is specified around the safety end treatment, back II as directed by Engineer.
- Thermoplastic pipe wall thickness may vary. Adjust accordingly. Thermoplastic pipe requires the safety end treatments to have a bell end for grouted connections.

**GENERAL NOTES:**

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

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

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

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

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

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

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

Pipe runners are designed for a traversing load of 10,000 Lbs at yield as recommended by Research Report 280-2F, "Safety Treatment of Roadside Parallel-Drainage Structures", Texas Transportation Institute, March 1981.

Provide pipe runners meeting the requirements of ASTM A53 (Type E or S, Grade B), ASTM A500 (Grade B), or API 5LX52.

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

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

Texas Department of Transportation  
 Bridge Division Standard

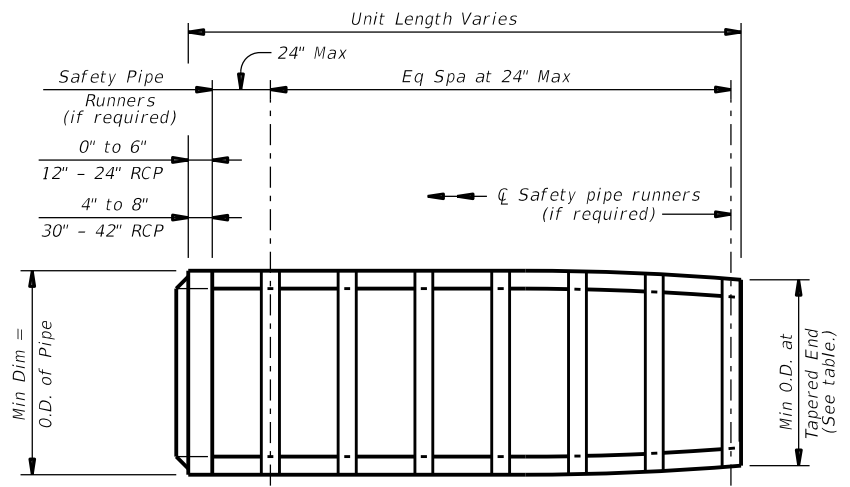
**PRECAST SAFETY END TREATMENT TYPE II ~ PARALLEL DRAINAGE**

**PSET-SP**

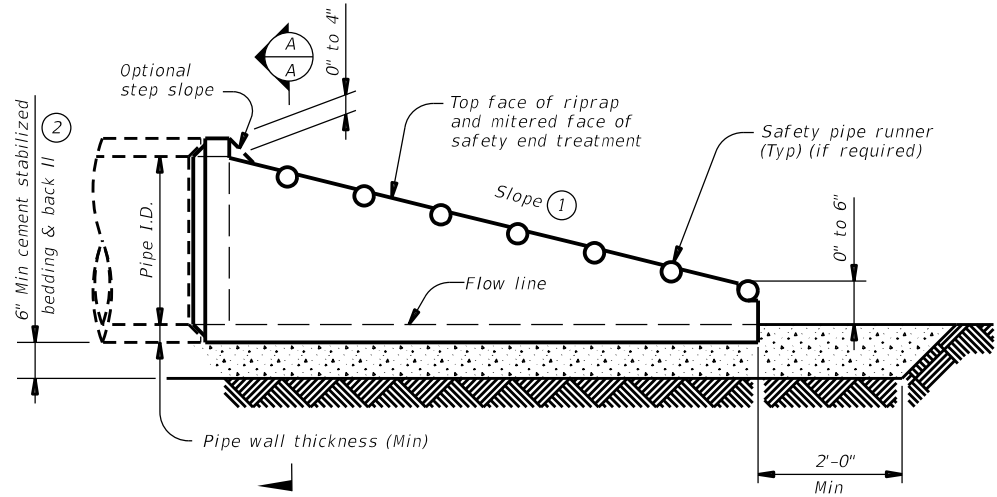
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| ©TxDOT February 2020  | CONT        | SECT        | JOB         | HIGHWAY |
| REVISIONS             | 6444-52-001 |             | US 190, ETC |         |
| 12-21: Added 42" TP   | DIST        | COUNTY      | SHEET NO.   |         |
|                       | BRY         | BRAZOS, ETC | 37          |         |

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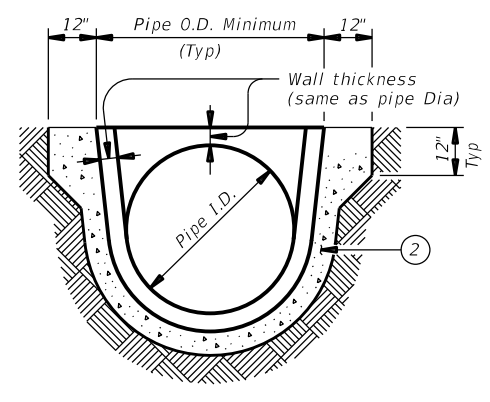
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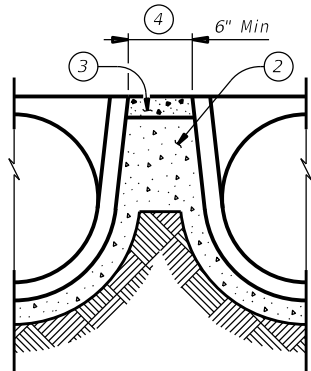
**PLAN VIEW - 12" THRU 24"**  
(Showing spigot end connection.)



**LONGITUDINAL ELEVATION - 12" THRU 24"**  
(Showing spigot end connection.)

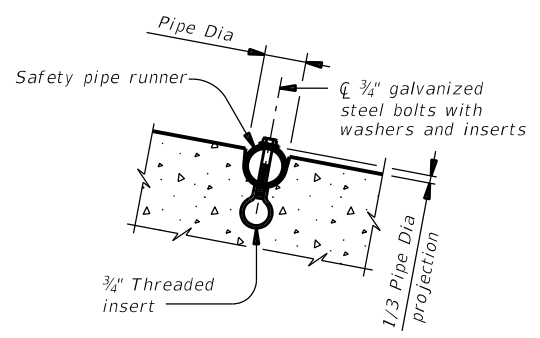


**SECTION A-A**

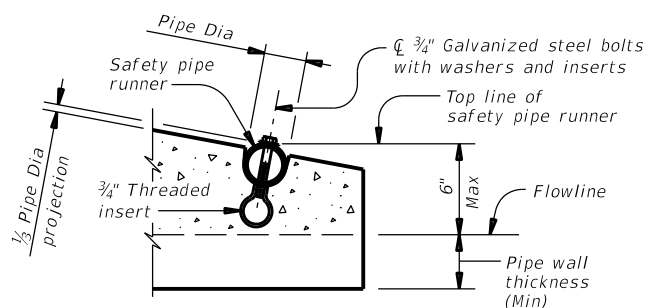


**MULTIPLE PIPE INSTALLATION**

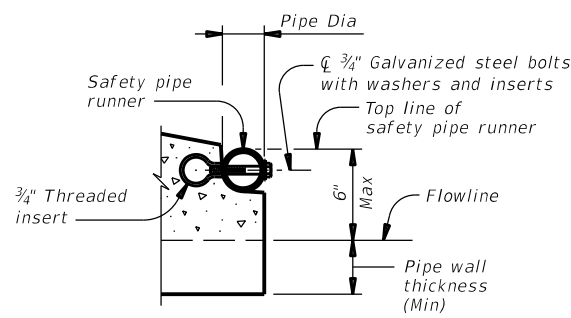
- ① Slope as shown elsewhere in the plans. Slope of 6:1 or steeper is required for vehicle safety.
- ② Provide cement stabilized bedding and backfill in accordance with the Item, "Excavation and Backfill for Structures". Bedding and backfill is considered subsidiary to the Item 467, "Safety End Treatment". When concrete riprap is specified around the safety end treatment, backfill as directed by Engineer.
- ③ Fill the top 4" of void between precast end treatments with concrete riprap. Concrete riprap is considered subsidiary to the Item 467, "Safety End Treatment".
- ④ Adjust clear distance between pipes to provide for the minimum distance between safety end treatments.
- ⑤ Safety pipe runners are required for multiple pipe culverts with more than two pipes.



**INSTALLATION DETAIL FOR SAFETY PIPE RUNNERS**  
(If required)



**OPTION A**



**OPTION B**

**END DETAILS FOR INSTALLATION OF SAFETY PIPE RUNNERS**  
(If required)

**REQUIREMENTS FOR CULVERT PIPES AND SAFETY PIPE RUNNERS**

| Pipe I.D. | Min Wall Thickness | Min O.D. | Min O.D. at Tapered End | Min Reinf Requirements (sq. in. per ft. of Pipe) | Max Slope | Min Length of Unit | Pipe Runner Requirements |               | Required Pipe Runner Sizes |        |        |
|-----------|--------------------|----------|-------------------------|--|-----------|--------------------|--------------------------|---------------|----------------------------|--------|--------|
|           |                    |          |                         |  |           |                    | Single Pipe              | Multiple Pipe | Nominal Dia                | O.D.   | I.D.   |
| 12"       | 2"                 | 16"      | 16"                     | 0.07 Circ.                                       | 6:1       | 4'-0"              | No                       | ⑤             | 3" STD                     | 3.500" | 3.068" |
| 15"       | 2 1/4"             | 19 1/2"  | 19"                     | 0.07 Circ.                                       | 6:1       | 5'-8"              | No                       | ⑤             | 3" STD                     | 3.500" | 3.068" |
| 18"       | 2 1/2"             | 23"      | 21 1/2"                 | 0.07 Circ.                                       | 6:1       | 7'-3"              | No                       | ⑤             | 3" STD                     | 3.500" | 3.068" |
| 24"       | 3"                 | 30"      | 27"                     | 0.07 Circ.                                       | 6:1       | 10'-6"             | No                       | ⑤             | 3" STD                     | 3.500" | 3.068" |
| 30"       | 3 1/2"             | 37"      | 31"                     | 0.18 Circ.                                       | 6:1       | 12'-1"             | No                       | Yes           | 4" STD                     | 4.500" | 4.026" |
| 36"       | 4"                 | 44"      | 36"                     | 0.19 Ellip.                                      | 6:1       | 15'-4"             | Yes                      | Yes           | 4" STD                     | 4.500" | 4.026" |
| 42"       | 4 1/2"             | 51"      | 41 1/2"                 | 0.23 Ellip.                                      | 6:1       | 18'-7"             | Yes                      | Yes           | 4" STD                     | 4.500" | 4.026" |

**MATERIAL NOTES:**  
Synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) may be used in lieu of steel reinforcing in riprap concrete unless noted otherwise.  
Provide pipe runners meeting the requirements of ASTM A53 (Type E or S, Gr B), ASTM A500 Gr B, or API 5LX52.  
Galvanize steel components except reinforcing steel after fabrication. Repair galvanizing damaged during transport or construction in accordance with the specifications.

**GENERAL NOTES:**  
Precast safety end treatment for reinforced concrete pipe (RCP) may be used for TYPE II end treatment as specified in Item 467, "Safety End Treatment".  
When precast safety end treatment is used as a Contractor's alternate to mitered RCP, riprap will not be required unless noted otherwise on the plans.  
Manufacture precast concrete end sections in accordance with Item 464, "Reinforced Concrete Pipe" and in accordance with ASTM Specification C-76, Class III, Wall B for circular pipe.  
Provide precast concrete end sections with a spigot or bell end for compatibility to upstream or downstream end conditions with sufficient annular space to allow for grout, mortar, cold applied asphalt joint compound or pre-formed plastic gasket material.  
Methods of lifting shall be provided by the manufacturer for ease of loading, unloading and installation.  
Pipe runners are designed for a traversing load of 10,000 Lbs at yield as recommended by Research Report 280-2F, "Safety Treatment of Roadside Parallel-Drainage Structures", Texas Transportation Institute, March 1981.



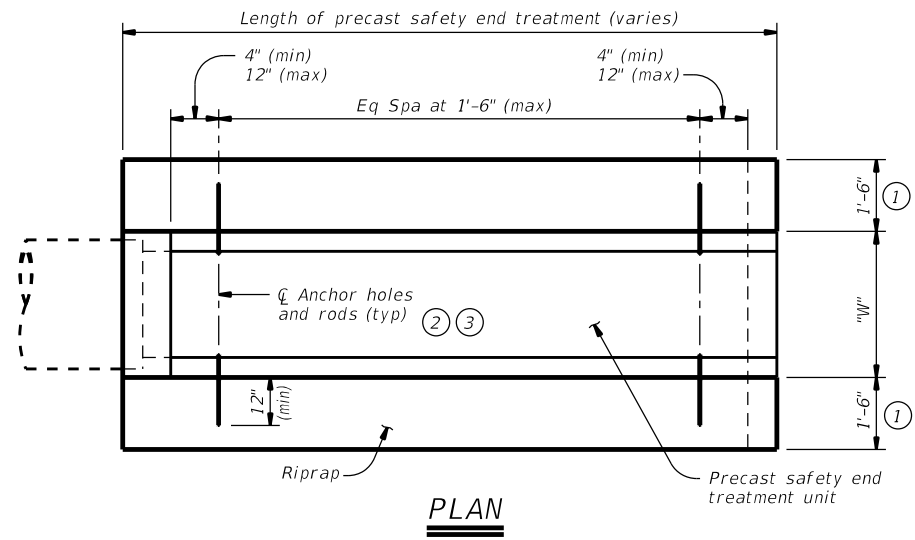
**PRECAST SAFETY END TREATMENT TYPE II ~ PARALLEL DRAINAGE**

**PSET-RP**

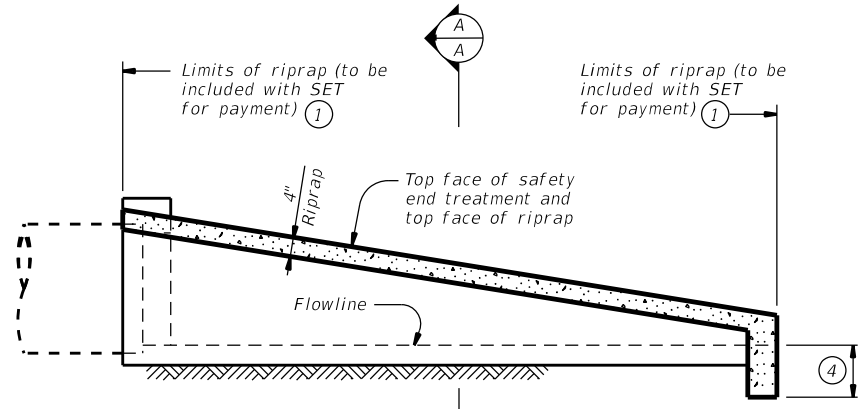
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| ©TxDOT February 2020  | CONT        | SECT        | JOB         | HIGHWAY |
| REVISIONS             | 6444-52-001 |             | US 190, ETC |         |
|                       | DIST        | COUNTY      | SHEET NO.   |         |
|                       | BRY         | BRAZOS, ETC | 38          |         |

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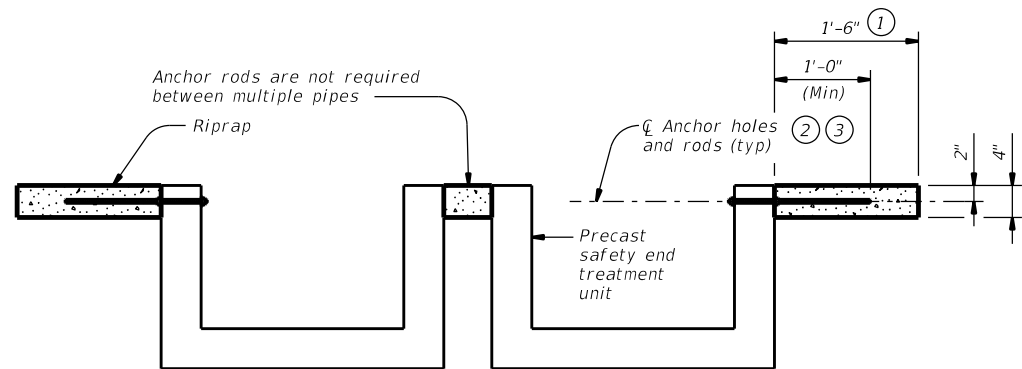
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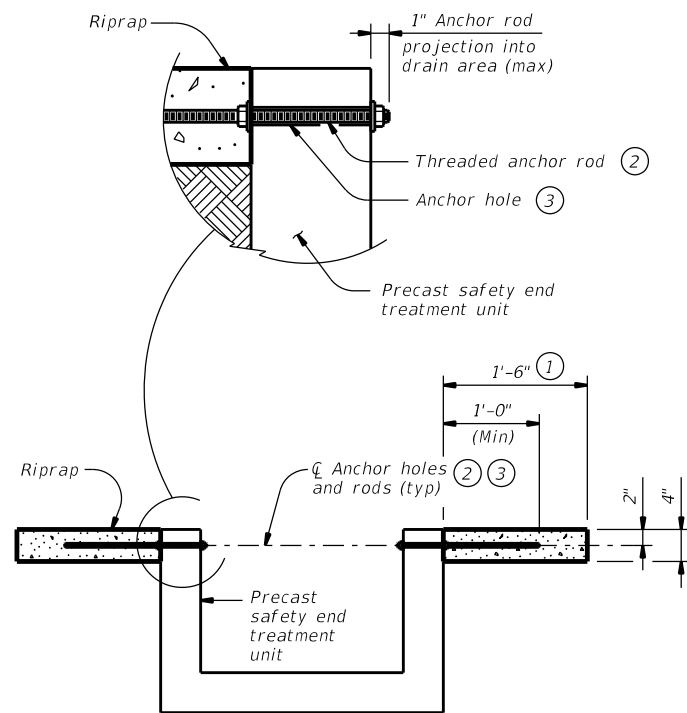
**PLAN**



**LONGITUDINAL ELEVATION**



**MULTIPLE PIPE INSTALLATION**



**SINGLE PIPE INSTALLATION**

**SECTION A-A**

**ESTIMATED CONCRETE RIPRAP QUANTITIES (CY)**

| Nominal Culvert (Pipe) I.D. | PSET-SC and PSET-SP Standards |            |     |     |                | PSET-RC and PSET-RP Standards |     |     |
|-----------------------------|-------------------------------|------------|-----|-----|----------------|-------------------------------|-----|-----|
|                             | Unit Width "W"                | Side Slope |     |     | Unit Width "W" | Side Slope                    |     |     |
|                             |                               | 3:1        | 4:1 | 6:1 |                | 3:1                           | 4:1 | 6:1 |
| 12"                         | 23.0"                         | 0.1        | 0.2 | 0.2 | 16.0"          | 0.1                           | 0.1 | 0.2 |
| 15"                         | 26.5"                         | 0.2        | 0.2 | 0.3 | 19.5"          | 0.1                           | 0.2 | 0.2 |
| 18"                         | 30.0"                         | 0.2        | 0.2 | 0.3 | 23.0"          | 0.2                           | 0.2 | 0.3 |
| 24"                         | 37.0"                         | 0.3        | 0.3 | 0.5 | 30.0"          | 0.2                           | 0.3 | 0.4 |
| 30"                         | 44.5"                         | 0.3        | 0.4 | 0.6 | 37.0"          | 0.3                           | 0.3 | 0.5 |
| 36"                         | 51.5"                         | 0.4        | 0.5 | 0.7 | 44.0"          | 0.3                           | 0.4 | 0.6 |
| 42"                         | 58.5"                         | 0.5        | 0.6 | 0.8 | 51.0"          | 0.4                           | 0.5 | 0.7 |

- ① Riprap placed beyond the limits shown will be paid as concrete riprap in accordance with Item 432, "Riprap". When riprap is cast integrally with the precast safety end treatment, this dimension is 1'-0" minimum.
- ② 1#2" Dia ASTM A307 Gr A threaded anchor rod with 2 nuts and 2 washers. Galvanize all components in accordance with Item 445, "Galvanizing". Repair galvanizing that is damaged during transport or construction in accordance with the specifications.
- ③ 3#4" through holes in walls of safety end treatment for riprap anchor rods may be drilled with rotary (coring or masonry) type drilling equipment or may be formed. Do not use percussive (star) type drilling equipment. If holes are drilled, patch spalls in the inside face of the wall exceeding 1#2" from the holes.
- ④ Provide riprap toe wall when dimension is shown elsewhere in the plans or when field conditions require a toe wall.
- ⑤ Quantities shown are for one end of one reinforced concrete pipe culvert. For multiple pipe culverts, quantities will need to be adjusted. Riprap quantities are for Contractor's information only. Quantities are based on the minimum unit lengths shown on the Precast Safety End Treatment (SET) standard sheets.

**MATERIAL NOTES:**

Provide Class "B" riprap in accordance with Item 432, "Riprap". Synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) may be used in lieu of steel reinforcing in riprap concrete unless noted otherwise. The anchor rods shown are always required.

**GENERAL NOTES:**

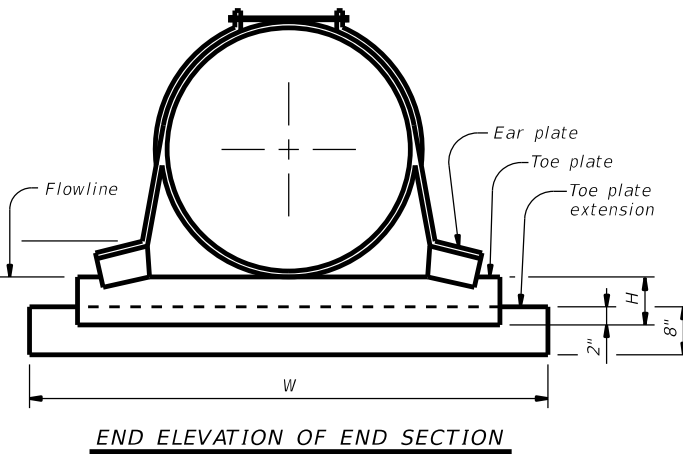
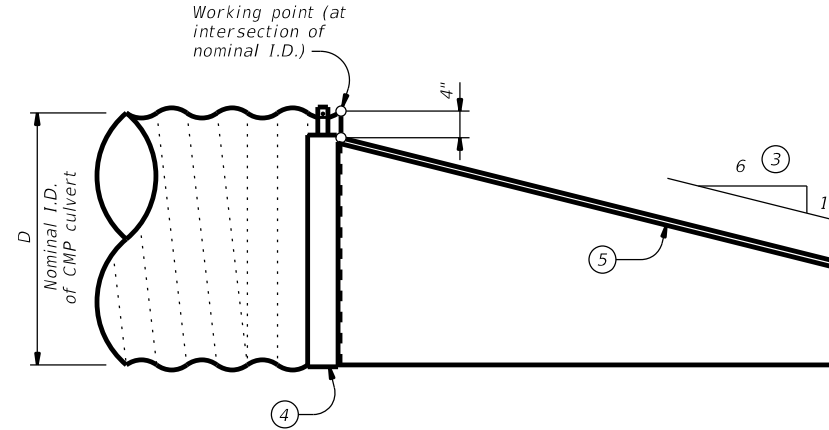
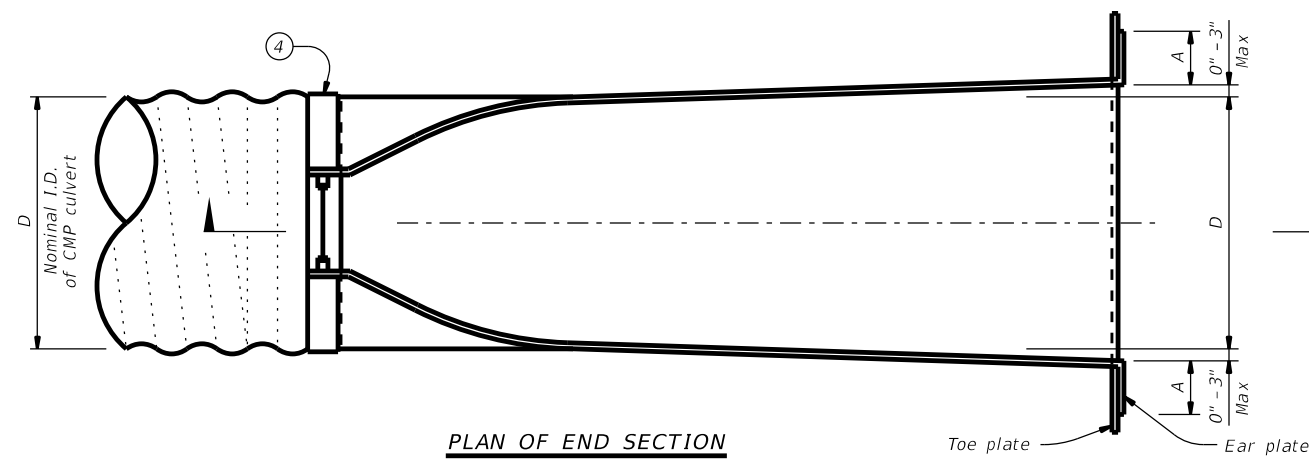
Precast safety end treatment for reinforced concrete pipe may be used for TYPE II end treatment as specified in Item 467, "Safety End Treatment". Refer to PSET-SC or PSET-SP standard sheets for details of square safety end treatments not shown. Refer to PSET-RC or PSET-RP standard sheets for details of round safety end treatments not shown. For precast units with integrally cast riprap, substitute reinforcing steel in the amount on 0.26 in./ft. minimum for the threaded anchor rods shown. When requested, submit sealed engineering drawings for approval prior to construction. Shop drawings will not be required. Note that a proprietary precast unit with integral riprap is available from L&R Precast Concrete Works, Inc. (956) 583-6293 or www.lrpccast.com. Payment for riprap and toewalls is included in the price bid for each safety end treatment.

These riprap details are only applicable when notes that require placement of riprap with precast safety end treatments are shown elsewhere in the plans.  
Precast units with integrally cast riprap are permitted unless noted otherwise on the plans.

|  |         |             |             |                                 |  |
|--|---------|-------------|-------------|---------------------------------|--|
|  |         |             |             | <b>Bridge Division Standard</b> |  |
| <b>PRECAST SAFETY END TREATMENT TYPE II RIPRAP DETAILS</b><br><b>PSET-RR</b> |         |             |             |                                 |  |
| FILE: psetrrse-20.dgn  | DN: GAF | CK: TxDOT   | DW: JRP     | CK: GAF                         |  |
| ©TxDOT February 2020   | CONT    | SECT        | JOB         | HIGHWAY                         |  |
| REVISIONS  |         |             | 6444-52-001 | US 190, ETC                     |  |
|  | DIST    | COUNTY      |             | SHEET NO.                       |  |
|  | BRY     | BRAZOS, ETC |             | 39                              |  |

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DATE: FILE:

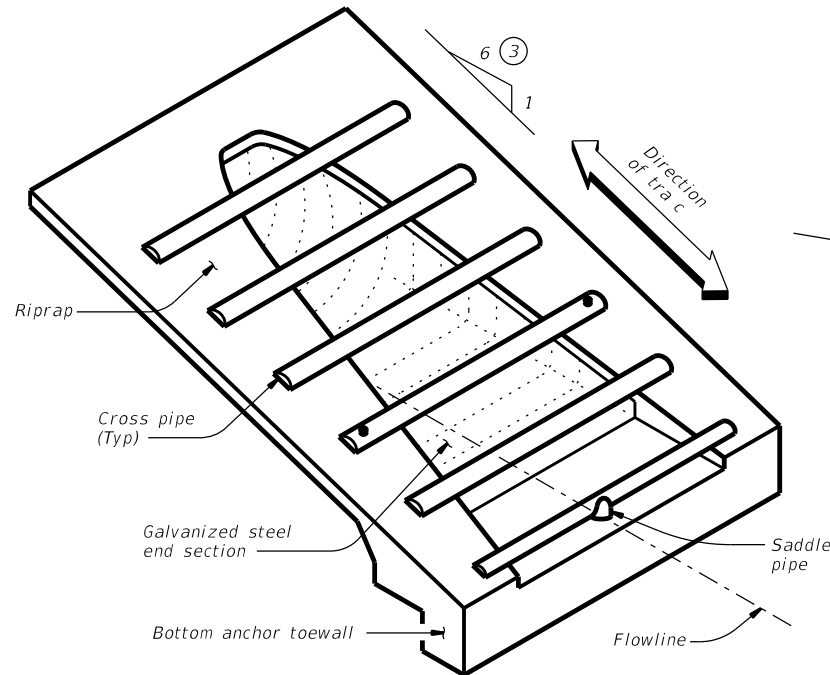


**SIDE ELEVATION OF END SECTION**

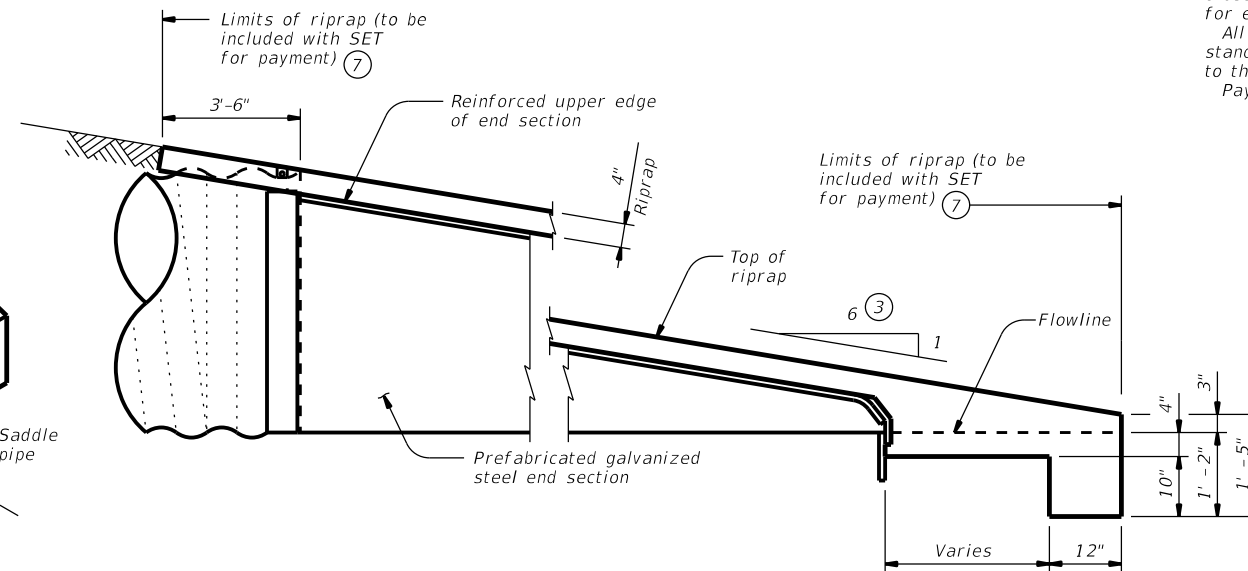
**END ELEVATION OF END SECTION**

**PREFABRICATED GALVANIZED STEEL END SECTION DETAILS**

(Safety end treatment and riprap are not shown for clarity.)



**ISOMETRIC VIEW OF TYPICAL INSTALLATION**



**SIDE ELEVATION OF CAST-IN-PLACE CONCRETE**

(Cross pipes are not shown for clarity.)

- 1 Provide size and lengths of cross pipes as shown in the tables, except the first cross pipe from the bottom and the saddle pipe must be 3 1/2".
- 2 Provide all 3-piece apron sections with 12 gage sides and 10 gage center panels.
- 3 Match cross slope as shown elsewhere in the plans. All quantities, calculations, and dimensions shown herein are based on the 6:1 Slope. 6:1 slope or flatter is required for vehicle safety.
- 4 Connection between corrugated metal pipe (CMP) culvert and galvanized prefabricated end section may be with strap and bolt as shown or other combinations of threaded rods and/or coupling bands.
- 5 Reinforce upper edge of prefabricated end section with minimum 3/8" dia smooth or deformed bar (pre-galvanized).
- 6 Values shown are minimum requirements.
- 7 Riprap placed beyond the limits shown will be paid as concrete riprap in accordance with Item 432, "Riprap".

**CROSS PIPE LENGTHS AND REQUIRED PIPE SIZES**

| D (Nominal Culvert I.D.) | Cross Pipe Length | Cross Pipes Required | Cross Pipe Size |
|--------------------------|-------------------|----------------------|-----------------|
| ≤ 30"                    | N/A               | No                   | N/A             |
| 36"                      | 4' - 5"           | Yes                  | 4.500 x 0.237   |
| 42"                      | 4' - 11"          |                      |                 |
| 48"                      | 5' - 5"           |                      |                 |
| 54"                      | 5' - 11"          | Yes                  | 5.563 x 0.258   |
| 60"                      | 6' - 5"           |                      |                 |

**PREFABRICATED END SECTION INFORMATION**

| D (Nominal Culvert I.D.) | H   | A   | W       | Gage  | HSS Size      | STD Size |
|--------------------------|-----|-----|---------|-------|---------------|----------|
| ≤ 24"                    | 6"  | 9"  | D + 24" | 16    | 4.000 x 0.154 | 2"       |
| 30"                      | 9"  | 12" | D + 32" | 14    | 4.500 x 0.216 | 3"       |
| 36"                      | 9"  | 12" | D + 32" | 14    | 5.563 x 0.237 | 4"       |
| ≥ 42"                    | 12" | 16" | D + 40" | 12/10 |               |          |

**STANDARD PIPE SIZES**

**MATERIAL NOTES:**

- Provide cross pipes and saddle pipes conforming to ASTM A1085, A500 Gr B, A53 (Type E or S, Gr B), or API 5LX52.
- Provide ASTM A307 bolts and nuts.
- Galvanize all steel components, except reinforcement, after fabrication. Repair galvanizing damaged during transport or construction in accordance with the specification.
- Toe plate extensions are required only when shown elsewhere in the plans.
- Concrete riprap is required only when cross pipes are required, unless otherwise shown in the plans. Provide concrete riprap in accordance with Item 432, "Riprap". Bolted anchor toewall may be omitted when an alternate end section with pre-attached cross pipes is supplied.
- Synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) may be used in lieu of reinforcing steel in concrete riprap unless noted otherwise.

**GENERAL NOTES:**

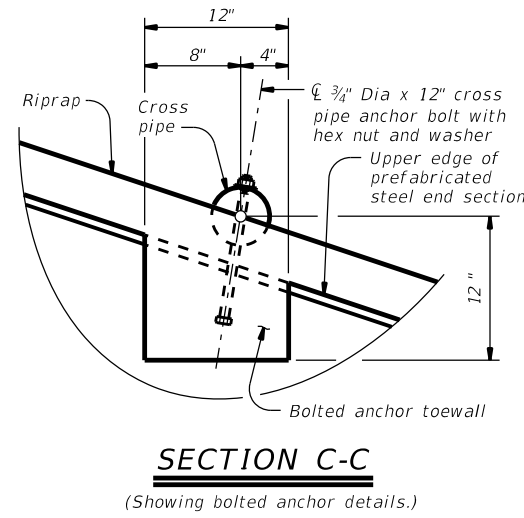
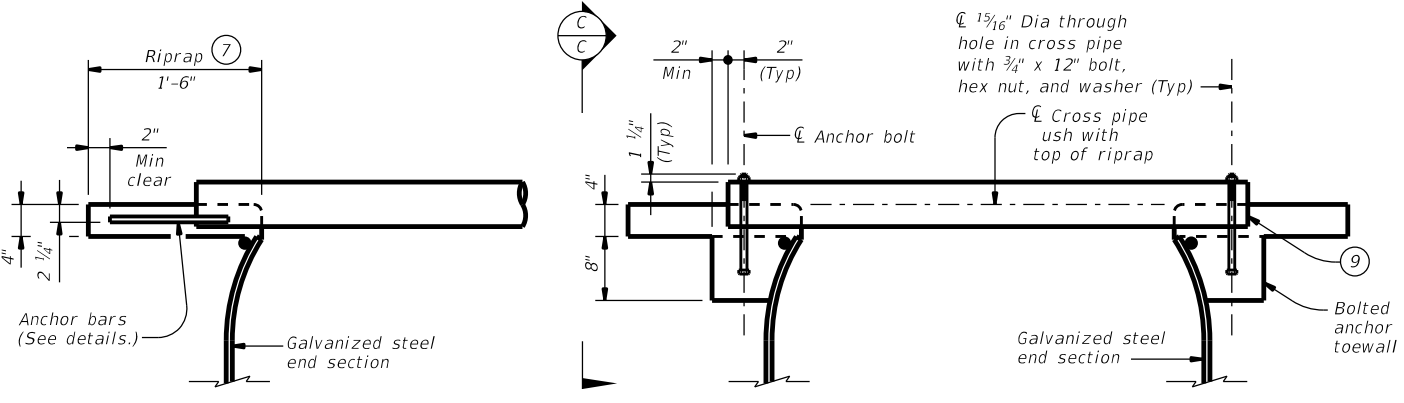
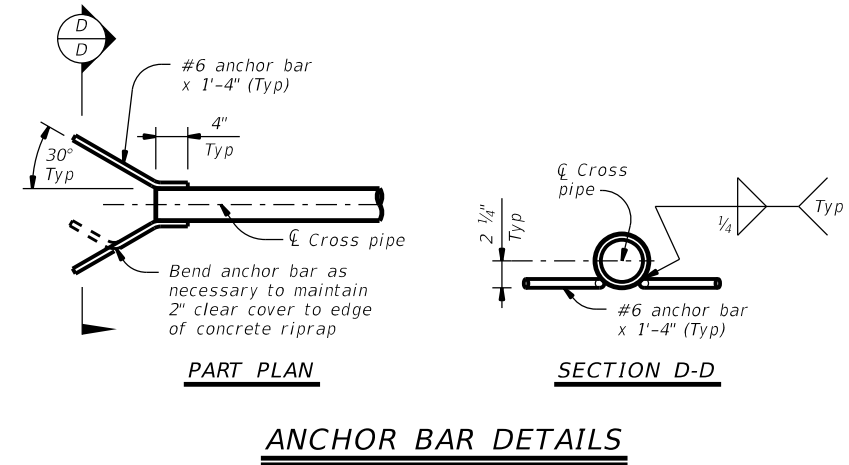
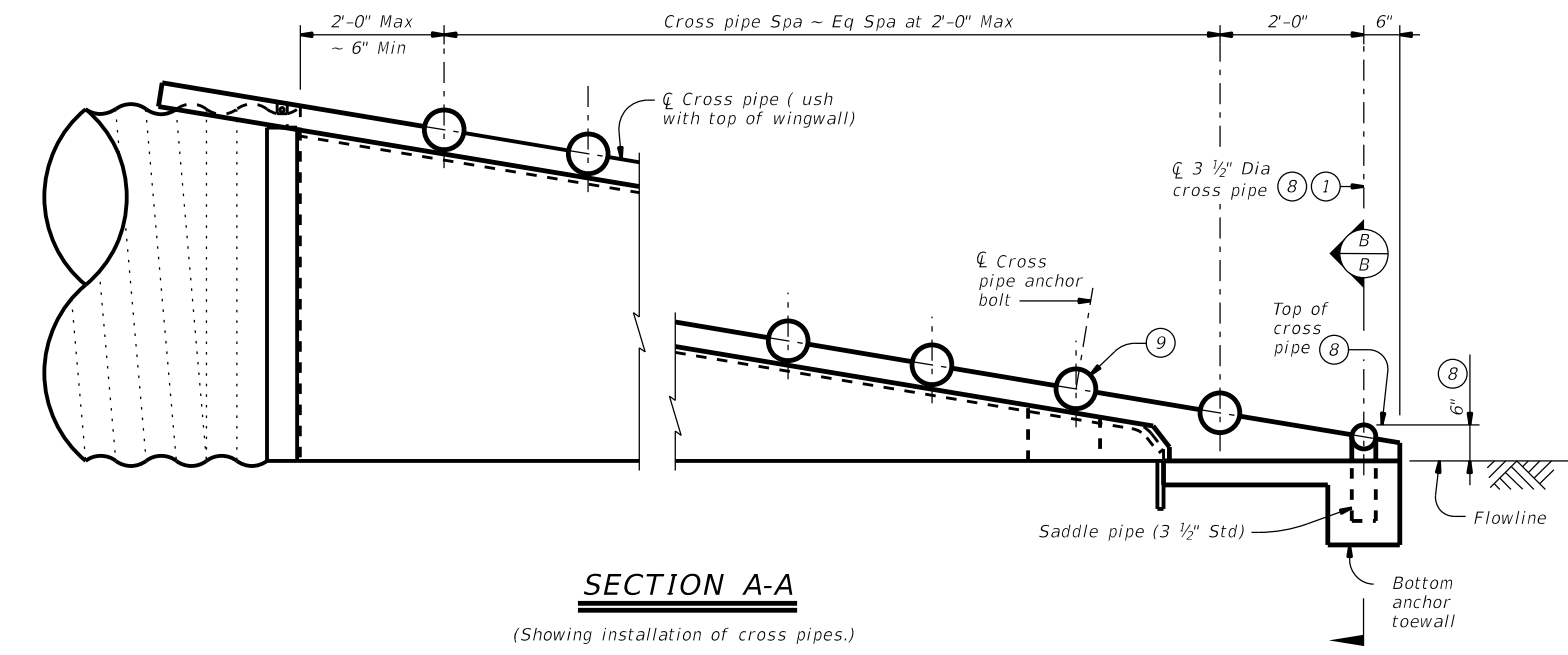
- Safety end treatments (SET) shown herein are intended for use in those installations where out of control vehicles are likely to traverse the openings approximately perpendicular to the cross pipes.
- Cross pipes are designed for a traversing load of 10,000 pounds at yield as recommended by Research Report 280-2F, "Safety Treatment of Roadside Parallel-Drainage Structures", Texas Transportation Institute, March 1981.
- Alternate styles of end sections, including those with pre-attached cross pipes, may be supplied. Alternate styles must meet all of the following: design values shown in tables for cross pipe size; spacing of cross pipes and location of first cross pipe; H, A, W, and gage for end section; and material requirements noted.
- All cross pipes, calculations, and dimensions are based on the end section shown on this standard. Alternate styles of end sections will require that appropriate adjustments be made to the values presented on this standard.
- Payment for riprap and toewall is included in price bid for each safety end treatment.

SHEET 1 OF 2

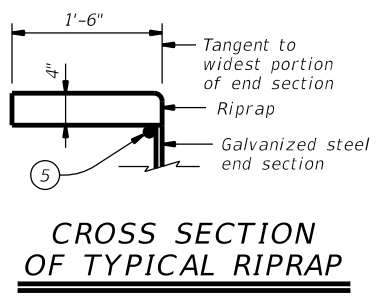
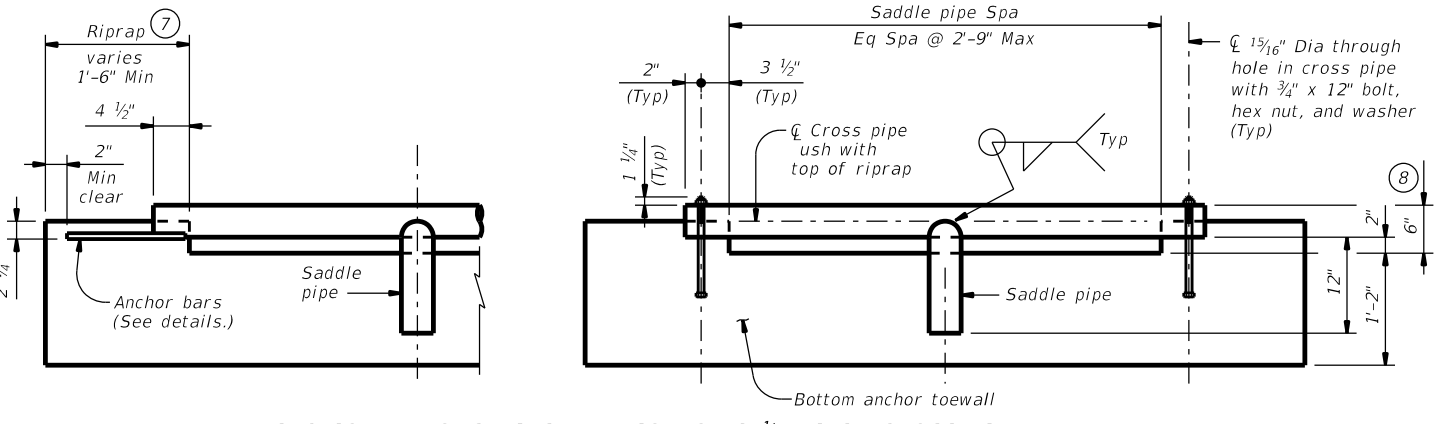
|  |           |             |             |                                 |  |
|--|-----------|-------------|-------------|---------------------------------|--|
|  |           |             |             | <b>Bridge Division Standard</b> |  |
| <b>PREFABRICATED GALVANIZED STEEL END SECTION SAFETY END TREATMENT FOR 12" TO 60" DIA CMP CULVERTS TYPE II ~ PARALLEL DRAINAGE</b> |           |             |             |                                 |  |
| <b>GS-ES-PD</b>  |           |             |             |                                 |  |
| FILE: gsespdse-20.dgn  | DN: TxDOT | CK: TxDOT   | DW: JRP     | CK: GAF                         |  |
| ©TxDOT February 2020   | CONT      | SECT        | JOB         | HIGHWAY                         |  |
| REVISIONS  |           |             | 6444-52-001 | US 190, ETC                     |  |
|  | DIST      | COUNTY      | SHEET NO.   |                                 |  |
|  | BRY       | BRAZOS, ETC | 40          |                                 |  |

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DATE: FILE:



- 1 Provide size and lengths of cross pipes as shown in the tables, except the first cross pipe from the bottom and the saddle pipe must be 3 1/2". All other values shown are minimum requirements.
- 5 Reinforce upper edge of prefabricated end section with minimum 3/8" diameter smooth or deformed bar (pre-galvanized).
- 7 Riprap placed beyond the limits shown will be paid as concrete riprap in accordance with Item 432, "Riprap".
- 8 The proper installation of the first cross pipe is critical for vehicle safety. The top of the first cross pipe must be placed at no more than 6" above the flow line.
- 9 The third cross pipe from the bottom of the culvert must always be installed using a bolted connection. Ensure that concrete does not flow into this cross pipe so as to permit disassembly of the bolted connection to allow cleanout access.
- 10 Riprap quantities shown are for one end of one culvert only. For multiple culverts, quantities will need to be adjusted. Riprap quantities are for Contractor's information only.



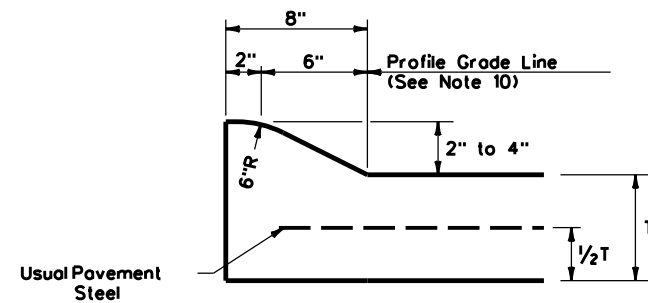
| ESTIMATED CONCRETE RIPRAP QUANTITIES |               |
|--------------------------------------|---------------|
| D (Nominal Culvert I.D.)             | Concrete (CY) |
| 12"                                  | 0.8           |
| 15"                                  | 0.9           |
| 18"                                  | 1.0           |
| 21"                                  | 1.1           |
| 24"                                  | 1.2           |
| 27"                                  | 1.3           |
| 30"                                  | 1.4           |
| 33"                                  | 1.5           |
| 36"                                  | 1.6           |
| 42"                                  | 1.8           |
| 48"                                  | 2.0           |
| 54"                                  | 2.2           |
| 60"                                  | 2.4           |

SHEET 2 OF 2

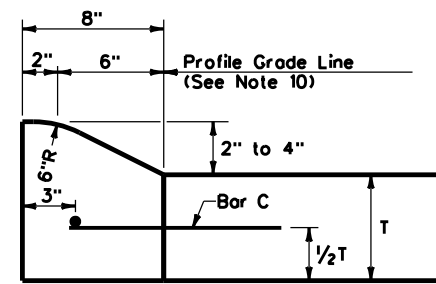
|   |             |                                 |             |
|---|-------------|---------------------------------|-------------|
|   |             | <b>Bridge Division Standard</b> |             |
| <b>PREFABRICATED GALVANIZED STEEL END SECTION SAFETY END TREATMENT FOR 12" TO 60" DIA C.M.P. CULVERTS TYPE II ~ PARALLEL DRAINAGE</b> |             |                                 |             |
| <b>GS-ES-PD</b>   |             |                                 |             |
| FILE: gsespdse-20.dgn   | DN: TxDOT   | CK: TxDOT                       | DW: JRP     |
| ©TxDOT February 2020  | CONT        | SECT                            | JOB         |
| REVISIONS   | 6444-52-001 |                                 | US 190, ETC |
| DIST  | COUNTY      | SHEET NO.                       |             |
| BRY   | BRAZOS, ETC | 41                              |             |

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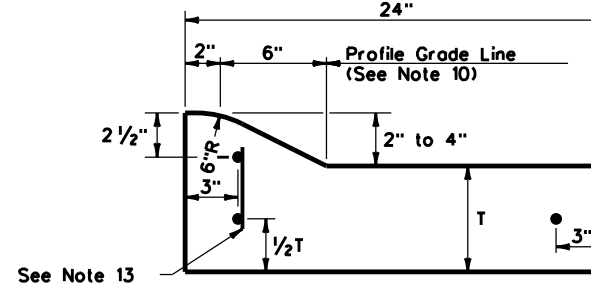
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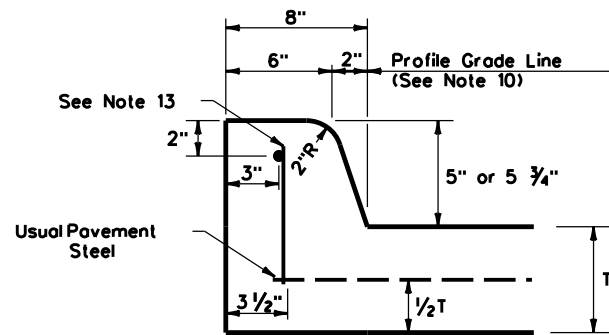
**TYPE I CURB (MONOLITHIC)  
2'' - 4'' HEIGHT**



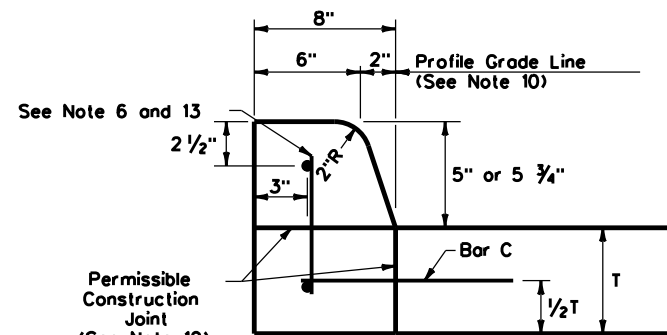
**TYPE I CURB  
2'' - 4'' HEIGHT**



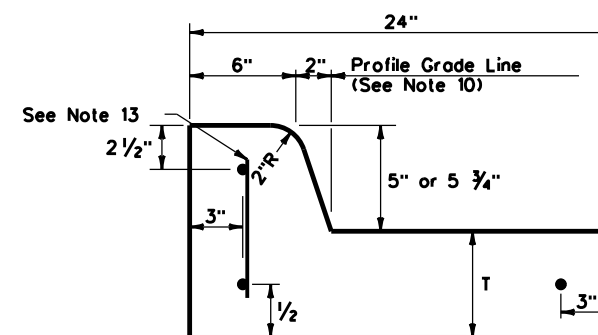
**TYPE I CURB AND GUTTER  
2'' - 4'' HEIGHT**



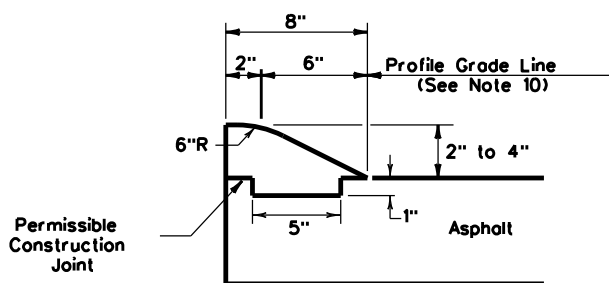
**TYPE II CURB (MONOLITHIC)  
5'' - 5 3/4'' HEIGHT**



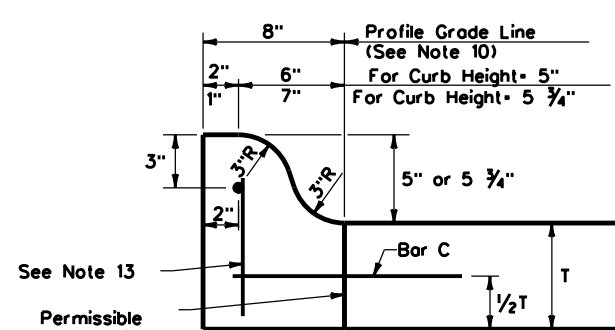
**TYPE II CURB  
5'' - 5 3/4'' HEIGHT**



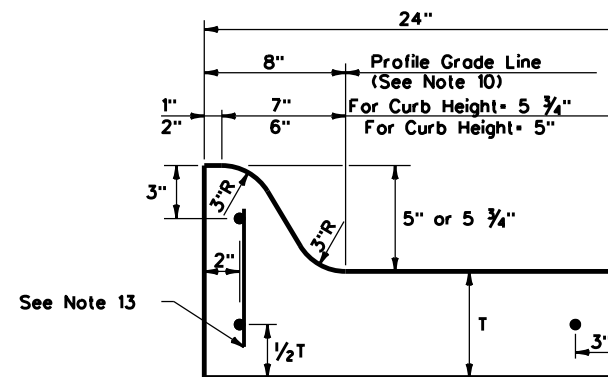
**TYPE II CURB AND GUTTER  
5'' - 5 3/4'' HEIGHT**



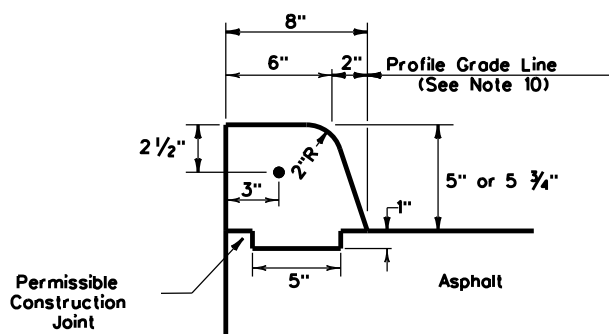
**TYPE III CURB (KEYED)  
2'' - 4'' HEIGHT**



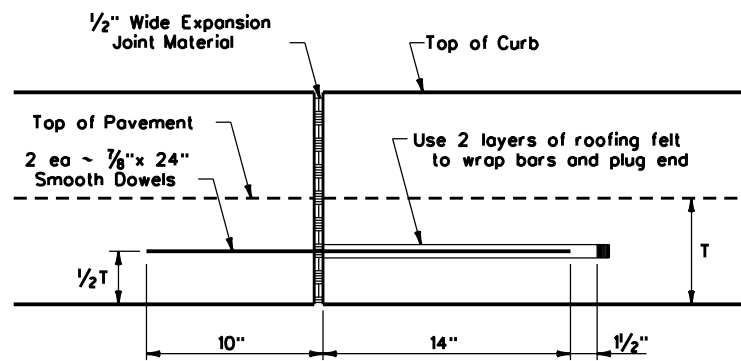
**TYPE IIa CURB  
5'' - 5 3/4'' HEIGHT**



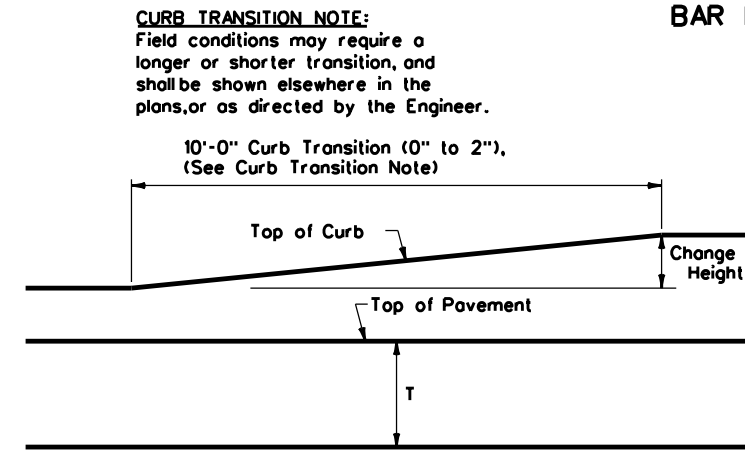
**TYPE IIa CURB AND GUTTER  
5'' - 5 3/4'' HEIGHT**



**TYPE IV CURB (KEYED)  
5'' - 5 3/4'' HEIGHT**



**EXPANSION JOINT DETAIL**

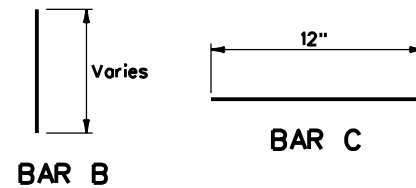


**CURB TRANSITION**

Note: To be paid for as Highest Curb

**GENERAL NOTES**

- All materials and construction shall be in accordance with Item 529, "Concrete Curb, Gutter, and Combined Curb and Gutter."
- Concrete shall be Class A.
- When reinforcing bars are used, they shall be No.4 unless otherwise shown. The use of fiber reinforced concrete in lieu of reinforcing steel is acceptable. Use fibers meeting the requirements of DMS 4550, "Fibers for Concrete," and dose fibers in accordance with Material Producers List (MPL) "Fibers for Class A and B Concrete Applications."
- Round exposed sharp edges with a rounding tool, to a minimum radius of 1/4 inch.
- All existing curbs and driveways to be removed shall be sawed or removed at existing joints.
- Where concrete curb is to be placed on existing concrete pavement, Bar B may be drilled and grouted in place, or may be inserted into fresh concrete.
- 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.
- Vertical and horizontal dowel bars and transverse reinforcing bars shall be placed at four feet C-C.
- Dimension 'T' shown is the thickness of concrete pavement. When curb is installed adjacent to flexible pavement dimension 'T' is 8" maximum.
- Usual profile grade line. Refer to typical sections and plan-profile sheets for exact locations.
- One-half inch expansion joint material shall be provided where curb or curb and gutter is adjacent to sidewalk or riprap.
- When horizontal permissible construction joints are used, the longitudinal pavement steel shall be placed in accordance with pavement details shown elsewhere in the plans. Reinforcing steel for curb section shall then conform to that required for concrete curb.
- Bar B placement as needed (typically at four ft. C-C) to support curb reinforcing steel during concrete placement.



|  |                     |                          |             |
|--|---------------------|--------------------------|-------------|
|  |                     | Design Division Standard |             |
| <h2>CONCRETE CURB AND GUTTER</h2> <h3>CCCG-22</h3> |                     |                          |             |
| FILE: cccg21.dgn                                   | DN: TXDOT           | CK: AN                   | DW: CS      |
| © TXDOT: JUNE 2022                                 | CONT: SECT          | JOB: HIGHWAY             | CK: KM      |
| REVISIONS  | 6444-52-001         |                          | US 190, ETC |
| DIST: BRY  | COUNTY: BRAZOS, ETC | SHEET NO. 42             |             |