

CONT	SECT	JOB	HIGHWAY
1780	01	009	FM 1047
DIST	COUNTY		SHEET NO.
BWD	MILLS		1

FUNCTIONAL CLASSIFICATION =MINOR COLLECTOR  
 DESIGN SPEED = 45 MPH  
 A.D.T. (2020) = 91  
 A.D.T. (2040) = 127

**INDEX OF SHEETS**

SHEET NO.	DESCRIPTION
1	TITLE SHEET
2	PROJECT INDEX

**STATE OF TEXAS  
 DEPARTMENT OF TRANSPORTATION**

**PLANS OF PROPOSED  
 STATE HIGHWAY IMPROVEMENT**

FEDERAL AID PROJECT NO. BR 2022(304)

**FM 1047  
 MILLS COUNTY**

NET LENGTH OF ROADWAY = 895.00 FT. = 0.170 MI.  
 NET LENGTH OF BRIDGE = 180.00 FT. = 0.034 MI.  
 NET LENGTH OF PROJECT = 1,075.00 FT. = 0.204 MI.

LIMITS: AT BENNETT BRANCH

FOR THE CONSTRUCTION OF BRIDGE REPLACEMENT  
 CONSISTING OF REPLACE BRIDGE AND APPROACHES

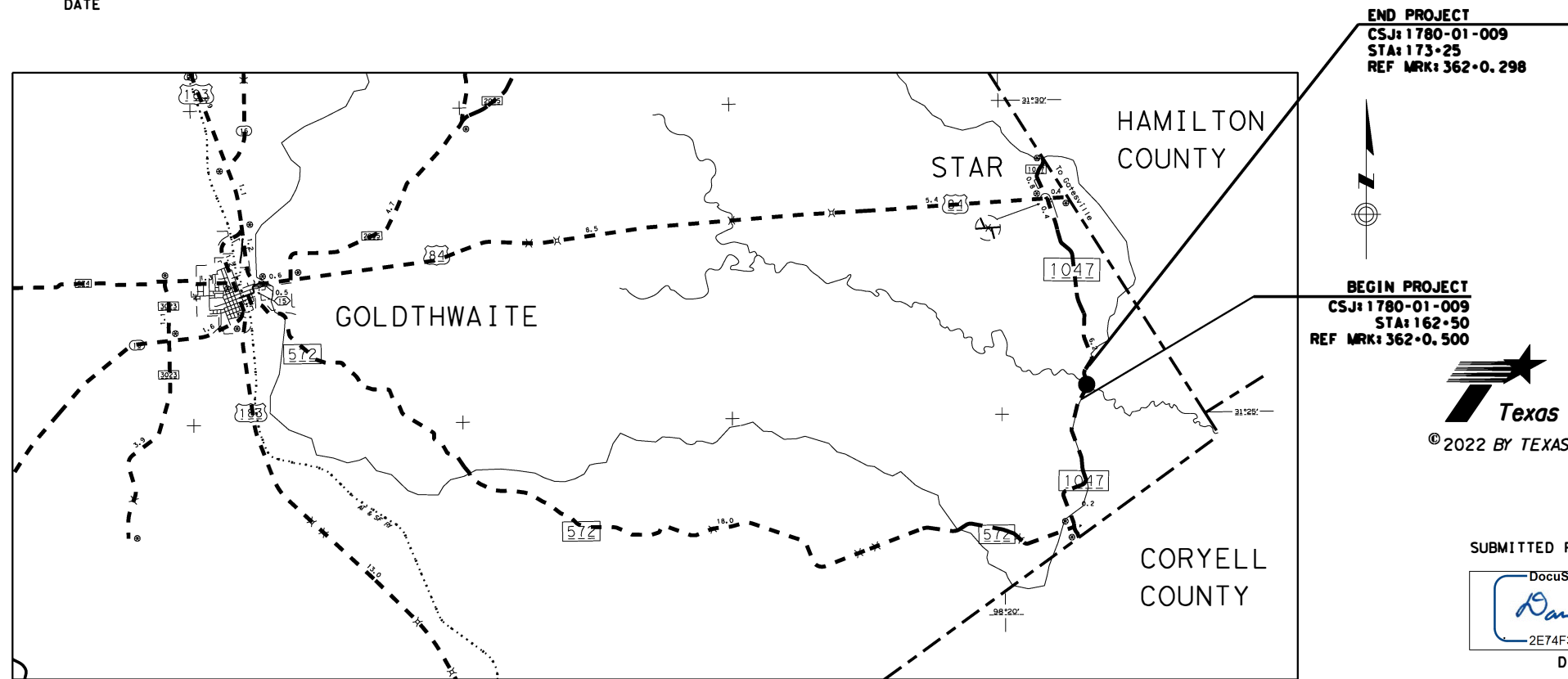
REQUIRED SIGNS SHALL BE IN ACCORDANCE WITH BC (1) - 21 THRU BC (12) - 21 AND THE "TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES".

**FINAL PLANS**

LETTING DATE: \_\_\_\_\_  
 DATE CONTRACTOR BEGAN WORK: \_\_\_\_\_  
 DATE WORK WAS COMPLETED & ACCEPTED: \_\_\_\_\_  
 FINAL CONTRACT COST: \$ \_\_\_\_\_  
 CONTRACTOR : \_\_\_\_\_

THE CONSTRUCTION WORK WAS PERFORMED IN ACCORDANCE WITH THE PLANS AND CONTRACT.

P. E. \_\_\_\_\_  
 DATE \_\_\_\_\_



SUBMITTED FOR LETTING: 1/2/2022

DocuSigned by:  
*Dan A. Hohmann, P.E.*  
 2E74F333C7B14AA...  
 DISTRICT DESIGN ENGINEER

RECOMMENDED FOR LETTING: 1/3/2022

DocuSigned by:  
*MA Stett, P.E.*  
 77D14777834646F...  
 DISTRICT DIRECTOR OF TRANSPORTATION  
 PLANNING AND DEVELOPMENT

RECOMMENDED FOR LETTING: 1/3/2022

DocuSigned by:  
*Elias Ruceli, P.E.*  
 BB9FD402431A4A3...  
 DISTRICT ENGINEER

NO EXCEPTIONS  
 NO EQUATIONS  
 NO RAILROAD CROSSINGS

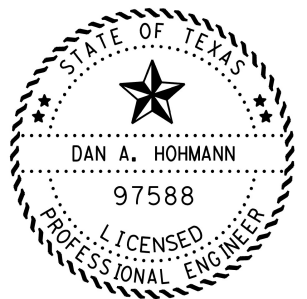
TRIANGULAR SLIP BASES FOR SMALL ROADSIDE SIGN ASSEMBLIES WILL BE SUPPLIED BY THE DEPARTMENT. SEE THE GENERAL NOTES FOR ADDITIONAL INFORMATION.

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

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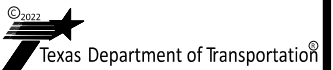
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*Dan A. Hohmann, P.E.*

01/26/2022

FM 1047  
PROJECT INDEX



THE STANDARD SHEETS SPECIFICALLY IDENTIFIED ON THIS SHEET HAVE BEEN ISSUED BY ME AND ARE APPLICABLE TO THIS PROJECT.

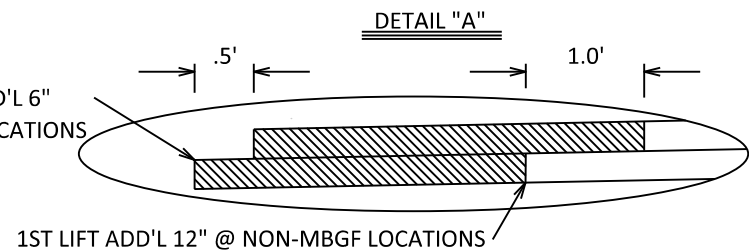
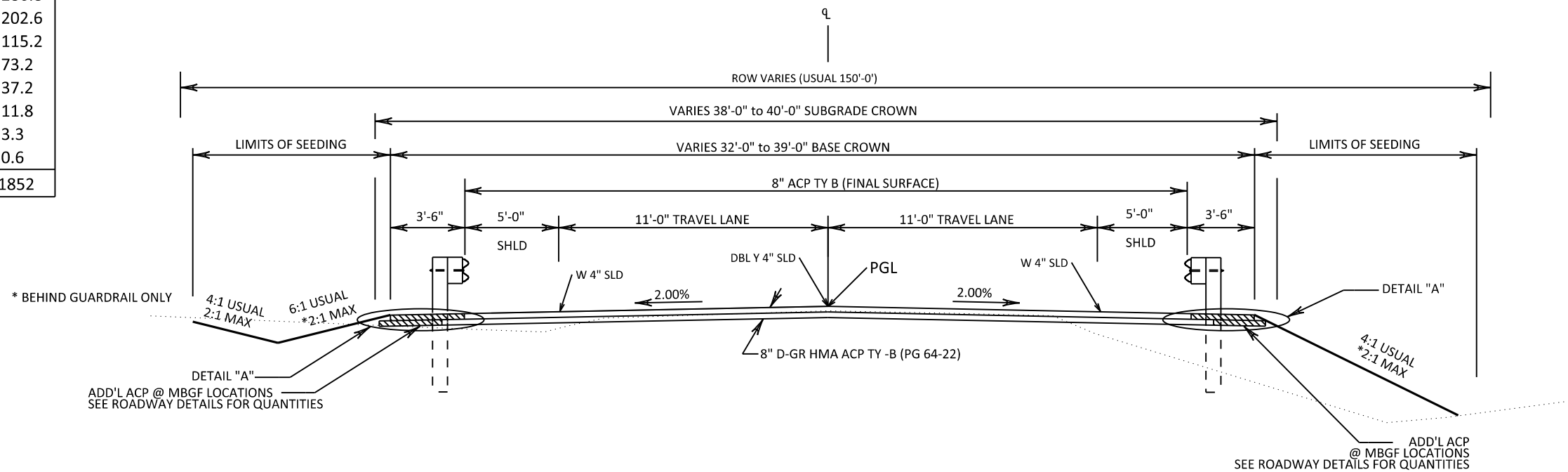
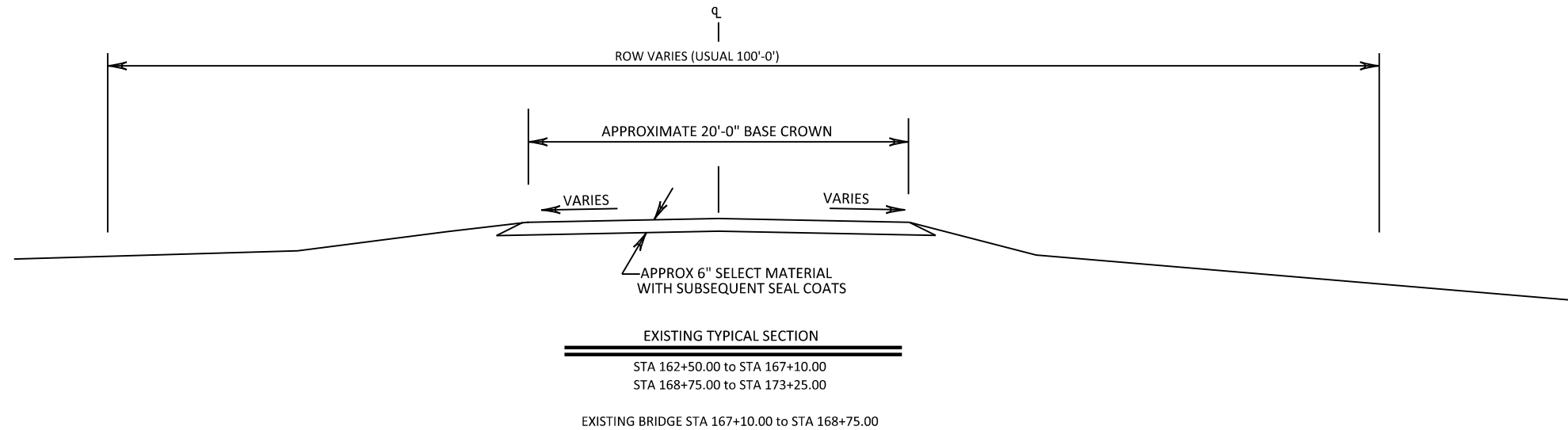
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1780	01	009	FM 1047
DIST	COUNTY		SHEET NO.
23	MILLS		2

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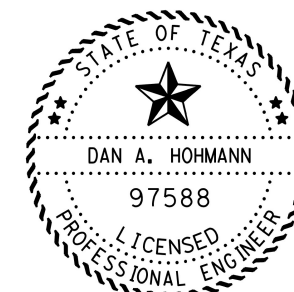
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EARTHWORK SUMMARY

STATION	CUT	FILL
162+50 R1		
163+00 R1	7.3	4
163+50 R1	14.4	49.2
164+00 R1	14.7	72.7
164+50 R1	15.7	33.5
165+00 R1	14	11.5
165+50 R1	5.9	25.5
166+00 R1	0	90.7
166+50 R1	0	189.7
166+82 R1	0	138
167+00 R1	0	71.1
167+02 R1	0	7.8
168+82 R1	0	0
169+00 R1	0	72.8
169+02 R1	0	16.1
169+50 R1	0	339.4
170+00 R1	0	286.8
170+50 R1	5.4	202.6
171+00 R1	13.8	115.2
171+50 R1	23.3	73.2
172+00 R1	24.7	37.2
172+50 R1	18.6	11.8
173+00 R1	19.1	3.3
173+25 R1	10.3	0.6
TOTALS	187	1852



ITEM	CODE	DESCRIPTION	UNIT	QUANTITY
0110	6006	EMBANKMENT (FINAL) (ORD COMP)(TY C)	CY	1852
0132	6001	EXCAVATION (ROADWAY)	CY	187
0666	6315	RE PM W/RET REQ TY I (Y)4"(SLD)(100MIL)	LF	2315
0666	6303	RE PM W/RET REQ TY I (W)4"(SLD)(100MIL)	LF	2315
0672	6009	REFL PAV MRKR TY II-A-A	EA	27



Dan A. Hohmann, P.E.

01/26/2022

FM 1047  
TYPICAL SECTION



CONT	SECT	JOB	HIGHWAY
1780	01	009	FM 1047
DIST	COUNTY	SHEET NO.	
BWD	MILLS	3	

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**GENERAL NOTES**

TEST TO BE IN ACCORDANCE WITH  
TEXAS DEPARTMENT OF TRANSPORTATION  
STANDARD TEST METHODS.

Item	Description	Soil Constants		
		Max LL.	Max. PI	Min. PI
* 132	Embankment (Final)(Ord Comp)(Ty C)	40	25	3

\* Applies to borrow only.

Job control samples for gradation and P.I. testing will be taken from the windrow after blade mixing.

Asphalt Surface Areas-SY

Item	Description	Course	Roadway
3076	4" D-GR HMA TY-B PG64-22	1 <sup>st</sup> Lift	3440 SY
3076	TACK COAT	2 <sup>nd</sup> Lift	3241 SY
3076	4" D-GR HMA TY-B PG64-22	2 <sup>nd</sup> Lift	3241 SY

Basis of Estimate

Item	Description	Course	Rate	SY	Quantity
3076	4" D-GR HMA TY-B PG64-22	1 <sup>st</sup>	110 LBS/SY/IN	3440	757 TONS
3076	TACK COAT	2 <sup>nd</sup>	.10 GAL/SY	3241	324 GAL
3076	4" D-GR HMA TY-B PG64-22	2 <sup>nd</sup>	110 LBS/SY/IN	3241	713 TONS

The Contractor will not be allowed to store equipment, materials, incidentals, hazardous chemicals, petroleum products, concrete washouts, etc. in the Department's R.O.W. without written permission from the Engineer.

Trees that are to be trimmed and brush that is to be trimmed or removed that are not over the roadway or bridge(s), will be trimmed or removed in accordance with the Roadside Vegetation Management Manual to a height of fourteen feet. Remove limbs at the trunk with less than twenty-one feet of clearance above the pavement or bridge(s).

**See the "Environmental" section of the plans for additional information.**

**TEXAS ONE CALL**

Fiber optic cable systems, gas lines, underground power lines, water lines, sewer lines, and other various utilities may be buried within the project limits. Protection of these utility systems is of extreme importance since any break could disrupt service to users resulting in business interruption and loss of revenue and profits. The Contractor will telephone Texas One Call at 1-800-344-8377 (a 24-hour number), to determine

if utilities are buried anywhere on the project in accordance with all UNDERGROUND FACILITY DAMAGE PREVENTION AND SAFETY laws. This action; however, will in no way be interpreted as relief of responsibilities under the terms of the Contract as set out in the plans and specifications. Coordinate the repair of all damages caused by daily operations and have facilities restored to service in a timely manner as directed at no additional cost to TxDOT.

**GENERAL**

Unless specifically noted as applying to only a certain project or projects, these general notes will apply to all projects associated to this contract.

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

Name	Email Address
Bart Fris P.E.	<a href="mailto:bart.fris@txdot.gov">bart.fris@txdot.gov</a>

Contractor questions will be accepted through email, phone, and in person by the above individual(s).

All contractor questions will be reviewed by the Engineer. Once a response is developed, it will be posted to TxDOT's Public FTP at the following Address:

<https://ftp.dot.state.tx.us/pub/txdot-info/Pre-Letting%20Responses/>

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

The term "Article" or "Section" referred to hereon is defined in the forward of the Standard Specifications for Construction and Maintenance of Highways, Streets, And Bridges adopted by the Texas Department of Transportation November 2014.

Saw-Cutting with approved equipment as directed by the Engineer will be required at project limits, longitudinally, and/or at notch downs to establish clean and straight joints. This work will not be paid for directly but will be considered subsidiary to various bids.

The Contractor will establish drainage in ditches before seeding or as directed by the Engineer.

Watering for dust control will be required as Directed by the Engineer and will be considered subsidiary to the various bid items.

**ITEM 5 CONTROL OF WORK**

The responsibility for the construction surveying on this contract will be in accordance with Section 5.9.1. "Method A".

The contractor will be required to place and maintain Blue Tops with wooden hubs for each layer of pavement structure material unless otherwise directed by the Engineer.

Prior to contract letting, bidders may obtain a computerized transfer of files (from the Engineer's office) that contains the earthwork information.

When a precast or cast-in-place concrete element is included in the plans, a precast concrete alternate may be submitted in accordance with "Standard Operating Procedure for Alternate Precast Proposal Submission" found online at <https://www.txdot.gov/inside-txdot/forms-publications/consultants-contractors/publications/bridge.html#design>. Acceptance or denial of an alternate is at the sole discretion of the Engineer. Impacts to the project schedule and any additional costs resulting from the use of alternates are the sole responsibility of the Contractor.

**ITEM 6 CONTROL OF MATERIALS**

In accordance with **Section 6.10.2**, the Contractor will dispose of all painted steel at a steel recycling or smelting facility and a receipt will be required. In lieu of this, the Contractor has the option to either show proof that the paint is lead free or show proof that the lead paint has been abated by an abatement certified company. The Department will not be obligated for the cost of paint testing and/or abatement materials, processes, personnel, incidentals, etc.

Lead-Containing Paint (LCP):

The structural steel to be removed contains lead paint in the gray painted metal guardrails. Submit a proposed demolition plan for approval by the Engineer at least 60 days prior to the desired demolition date. LCP disturbance will not be allowed. The material will be disposed of in accordance with **Section 6.10.2**. Provide copies of disposal manifests to the Engineer.

See **SP 006-012** for additional information.

**ITEM 7 LEGAL RELATIONS AND RESPONSIBILITIES**

No significant traffic generator events identified.

**ITEM 8 PROSECUTION AND PROGRESS**

Working days will be computed and charged in accordance with Section 8.3.1.2. "Six-Day Workweek".

Work will not be performed without time being charged unless otherwise exempted by the Section as defined above.

Working day charges will be in accordance with **SP 008---003** (90 calendar days after the date of the written authorization to begin work. Do not begin any work before the end of this period unless authorized in writing by the Engineer.) **This delay is for manufacturing bridge beams.**

Construction will be completed in order, sequentially; as described in the traffic control plan phasing. Each step/phase will be completed before starting on the next step/phase unless otherwise approved by the Engineer.

PROJECT SCHEDULES

Critical Path Method (CPM) scheduling will be required to be submitted and maintained monthly by the Contractor unless otherwise directed by the Engineer. (8.5.2.)

For monthly submittals, the Contractor will provide the schedule in an Adobe Acrobat compatible format (PDF file). If the Engineer requests the schedule in an electronic format, the Contractor will submit a schedule that is fully compatible with Primavera P6 Professional Release 15.

**ITEM 9 MEASUREMENT AND PAYMENT**

Monthly estimates will be computed from the 28th of the previous month through the 27th of the current month unless otherwise approved in writing by the Engineer.

**ITEM 100 PREPARING RIGHT OF WAY**

Remove all trees, brush, and shrubs within the construction limits, unless otherwise directed by the Engineer. Perform Preparing Right of Way in such a manner that does not disturb the native grasses unnecessarily.

Within the construction limits, blade and windrow the top 8 inches of vegetative material to just outside the construction limits. Once ditch slopes and drainage have been established and approved, blade the windrow evenly over the disturbed area within the construction limits. This work is to be done as the job progresses and in conjunction with seeding. Work on the project may be suspended, if in the opinion of the Engineer, the Contractor does not make a good faith effort to stabilize loose material as the project progresses. Time will not be suspended. This work is subsidiary to Item 100.

The removal of existing and temporary fence will not be paid for directly but will be considered subsidiary to Item 100 "Preparing Right Of Way".

**ITEM 132 EMBANKMENT**

Refer to Item 210 "Rolling" for additional roller requirements.

Shape the embankment, near the drainage structures, to the slope of the safety end treatment.

Embankment for the drainage structures is included in the quantities shown on the plan & profile sheets.

“Final” embankment that is not accounted for in the cross section(s) or typical section(s) but that has been estimated or shown for informational purposes, e.g., additional areas under guard fence, around S.E.T.s, etc.; will be measured in its final position as defined in Section 132.4.1. Shrinkage or swell factors will not be considered in determining the calculated quantities.

Embankment as shown in the plans or placed as directed will be placed before the installation of MGBF.

**ITEM 164 SEEDING FOR EROSION CONTROL**

The Contractor should anticipate multiple mobilizations for seeding.

Additional wildflower seed will be required to be added to the seeding mixture. The wildflower seed will be provided by TxDOT and is estimated at 5 lbs/acre in addition to the required seeding as specified in Item 164. The Contractor will notify the Area Engineer a minimum of 4 weeks in advance of permanent/final seeding to ensure time for the proper seed to be acquired. The Contractor can acquire this additional seed at the County Maintenance office. The equipment, labor, tools, and incidentals to mix and apply this seed will be considered subsidiary to Item 164.

**ITEM 166 FERTILIZER**

Fertilize all areas of project to be seeded.

Furnish and apply fertilizer with analysis of 20-10-10 at a rate of 300 bulk pounds per acre.

**ITEM 168 VEGETATIVE WATERING**

Water all areas of project to be seeded or sodded.

Vegetative watering is estimated at 1 inch per week for 4 weeks.

Vegetative watering may be adjusted as directed by the Engineer to ensure saturation for vegetative establishment.

**ITEM 169 SOIL RETENTION BLANKETS**

Soil retention blankets will only be used as directed by the Engineer.

An approved Bonded Fiber Matrix Soil Retention Blanket will be used at the TTI tested rate shown below:

Cocoflex ET-FGM	3500 lbs/acre
Earthguard Fiber Matrix	3000 lbs/acre
EcoFlex HP	3500 lbs/acre
Flexterra HP-FGM	3500 lbs/acre
Flexterra FGM	3500lbs/acre

Flexterra ultra	3500 lbs/acre
Hy-C3	3500 lbs/acre
HY-C4	4000 lbs/acre
Hyrda-CX2	4000 lbs/acre
Hydra CM	3500 lbs/acre
Hydroblanket BFM	3500 lbs/acre
Hydrostraw BFM	3500 lbs/acre
ProMatrix EFM	3500 lbs/acre
Soil Guard	3700 lbs/acre sand, 3500 lbs/acre clay
Terra Matrix	3000 Lbs/acre
SprayMatrix FRM	3500 lbs/acre
Wood-Lok HPM	3500 lbs/acre
Proganics Dual	5500 lbs/acre
ProGuard	3000 lbs/acre
Conwed Fiber 2000	2500 lbs/acre

**ITEM 210 ROLLING**

Required Roller Type and Size for Compacted Layers

Thickness of compacted lift	Minimum Static weight of roller (tons)	Drum Type
< 6 inches	12	Smooth
6 to 7 inches	15	Smooth or Padfoot
8 to 9 inches	18	Padfoot
10 inches or greater	20	Padfoot

**ITEM 216 PROOF ROLLING**

Proof Rolling will be required for subgrade throughout the entire project and is estimated at 4 hours.

**ITEM 416 DRILLED SHAFT FOUNDATIONS**

The Contractor Force Account “Other” that has been established for this project is intended to be utilized for core holes. In accordance with Section 416.5.2 core holes will be paid at \$200 each. 4 core holes are estimated for this project.

**ITEM 420 CONCRETE SUBSTRUCTURES**

Culverts will be constructed in conjunction with roadway construction phasing, unless otherwise directed by the Engineer.

All Class C Concrete has been measured for plan quantity payment.

**ITEM 421 HYDRAULIC CEMENT CONCRETE**

Furnish dome lids with 4" x 8" cylinder test molds.

Strength testing equipment is not required for Contract controlling test.

**ITEM 422 CONCRETE SUPERSTRUCTURES**

Transverse saw-cut grooves will be required in the bridge deck and will not be paid for directly but will be considered subsidiary to the various bridge items

**ITEM 427 SURFACE FINISHES FOR CONCRETE**

Surface Area II will receive a rub finish.

**ITEM 432 RIPRAP**

Locations and quantities may be varied as directed by the Engineer to accommodate field conditions.

Limit excavation to within 1' of riprap. If excavation exceeds these limits without the Engineer's approval, riprap will be extended to the limits of the disturbance. No additional compensation will be allowed for this work.

Riprap proposed under the bridge will be installed before the bridge beams (bridge deck) is installed.

**ITEM 459 GABIONS AND GABION MATTRESSES**

Type 2 filter fabric in accordance with DMS6200, "Filter Fabric" is required for this project.

Locations and quantities may be varied as directed by the Engineer to accommodate field conditions.

Due to field conditions changing during the removal of the existing bridge and the construction of the new structure, gabion installation will be verified by the Engineer before the Contractor installs the gabion(s) or gabion mattress(s). Gabion(s) or gabion mattress(s) located under the bridge will be installed before the bridge beams are installed.

Limit excavation to within 1' of the gabion(s) or gabion mattress(s). If excavation exceeds these limits without the Engineer's approval, the gabion(s) or gabion mattress(s) will be extended to the limits of the disturbance. No compensation for the additional work will be allowed.

**ITEM 467 SAFETY END TREATMENT**

For SET's being installed on existing corrugated metal pipe, upon removal of the existing SET and if there is damage to the existing end of pipe, the Contractor will saw cut a straight end and remove 3ft minimum of existing CMP. This new length of pipe will be supplied by the Contractor before installing the proposed

SET. The removal and replacement of the length of pipe will be considered subsidiary to the SET. Any deviation to this process will have to be approved in writing by the Engineer.

**ITEM 496 REMOVING STRUCTURES**

Handle materials when removing structures in accordance with Item 6.

Notify TxDOT at least 60 days prior to any bridge removal. The Texas Department of State Health Services (DSHS) requires TxDOT to notify the DSHS of the bridge removal even if no asbestos is present. The notification form to retain/notify the DSHS licensed asbestos consultant must be postmarked at least 10 working days prior to the scheduled abatement and/or demolition. If the work does not happen on the notified date, then another 10 Working-Day, Prior-To-Work Notification will be required.

Provide a detailed plan for the removal of the existing structure to include the schedule of removal and list of all equipment to be used.

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

The Contractor will be required to keep all TCP devices clean. If notified by the Engineer to clean the TCP devices, the Contractor will have until the end of that daylight period to comply. Failure to comply will result in a suspension of all work until the TCP devices are clean. Time will not be suspended.

The Contractor Force Account "Safety Contingency" that has been established for this project is intended to be utilized for work zone enhancements, to improve the effectiveness of the Traffic Control Plan, that could not be foreseen in the project planning and design stage. These enhancements will be mutually agreed upon by the Engineer and the Contractor's Responsible Person based on weekly or more frequent traffic management reviews on the project. The Engineer may choose to use existing bid items if it does not slow the implementation of enhancement.

The Engineer will determine the locations of regulatory construction speed zone signs. The Contractor will furnish, install and remove speed zone signs at locations as directed by the Engineer.

The Contractor will be responsible for maintaining the edge of the roadway throughout the project in a traversable condition and/or as directed by the Engineer. This work will not be paid for directly and will be considered subsidiary to Item 502 "Barricades, Signs, and Traffic Handling".

All devices shown on the TCP Standards are required and considered subsidiary to Item 502 unless specifically outlined elsewhere in the plans.

All signs will be constructed in accordance with the details shown in the current Standard Highway Sign Designs for Texas manual.

**ITEM 504 FIELD OFFICE AND LABORATORY**

Furnish and provide a Type E structure that meets all of the following requirements:

1. Provide at least 325 square feet of gross floor area in rooms 8 feet high. Partition the floor area into at least 2 interconnected rooms with doors, 2 exterior doors, and at least 2 windows in each room. One exterior door opening must be 48-inch minimum width. If steps are required to gain access to the 48-inch door, provide handrails and a strong and sturdy loading dock with minimum dimensions of 60 inches wide by 60 inches deep.
2. The strong floor and landing of the facility shall support the weight of all equipment and personnel, providing a stable, essentially zero deflection, during testing operations, acceptable to the Engineer.
3. Conforms to Laboratory requirements in Item 504.2.1.2.2 and conforms to Asphalt Content by Ignition Method in Item 504.2.2.4.1
4. Provide water, electricity, chairs, trash disposal, and janitorial services.
5. Furnish and install adequate equipment, outlets, lighting, air-conditioning, heating, and ventilation. Provide a partitioned restroom furnished with restroom supplies, a lavatory, and a flush toilet connected to a sewer or septic tank.

This structure type will be located at each HMA plant for the sole use of the Engineer and will be separate from the Contractors' testing lab. In addition, provide the following:

The Contractor will furnish the Superpave or Texas Gyro Compactor to the Engineer under the asphalt concrete pavement Item(s) of work.

The remaining lab testing equipment and calibrations will be provided by TxDOT.

No direct payment will be made for Engineer field labs. All construction, maintenance, utilities, custodial services, security, and permits necessary to establish and maintain readiness of this facility will be the responsibility of the Contractor.

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

The Contractor should anticipate multiple mobilizations for the installation of BMP's on this project.

The Engineer will determine actual time and placement locations of BMP's and temporary measures.

Contractor will not install BMPs until locations are approved by the Engineer.

Stockpile sites may be cleared of cover vegetation, but the vegetation root system will not be destroyed.

Erosion Control Logs Dam (CL-D) shall have stakes placed upstream in an alternating pattern of the downstream stakes as shown for CL-SST or CL-SSL details on the Erosion Control Standards.

**ITEM 540 METAL BEAM GUARD FENCE**

The area shown on the Roadway Details – MBGF sheets having a one course surface treatment will match the rates as shown on the basis of estimate for "ROADWAY" unless otherwise directed by the Engineer.

Metal beam guard fence will not be installed until the embankment, flex base, and/or one course surface treatment is complete.

**ITEM 552 WIRE FENCE**

Wire fence quantities shown on the plans are approximate and may be adjusted in the field as approved by the Engineer.

Notify the Engineer three weeks prior to beginning any fence work.

All end posts, corner and pull posts, posts and braces, shall be steel pipe with a minimum of 2" Std. pipe (2.375" O.D., 0.154" wall thickness) with a 1 1/4" Std. pipe brace (1.660" O.D., 0.140" wall thickness), with a 2"x2"x1/4" angle, or other as approved by the Engineer.

**ITEM 585 RIDE QUALITY FOR PAVEMENT SURFACES**

Surface Test Type B will be required on this project.

Schedule 2 will be used when calculating Pay Adjustment for Ride quality.

Diamond grinding will not be allowed unless otherwise approved by the Engineer.

Refer to Item 247 and **SP 247-003** for ride quality requirements.

**ITEM 644 SMALL ROADSIDE SIGN ASSEMBLIES**

The Contractor will notify the Engineer 5 working days before installing any sign base. The Engineer will coordinate with the Contractor and the Maintenance office to assure proposed sign placements are in accordance with the current version of the Sign Crew Field Book and the TMUTCD. Any signs that are placed without this coordination by the Contractor that are not located correctly will be removed and relocated at the Contractor's expense.

**Triangular Slip Bases will be supplied by TxDOT.** All other components of the sign assembly (stubs, posts, hardware, signs, etc.) will be supplied by the Contractor. The Contractor can acquire the bases at the Mills County Maintenance office located at 130 US Hwy 84, Goldthwaite, Tx. Contact the Mills County Maintenance Supervisor (Christopher Smith) at (325) 648-3028 for further information.

For Triangular Slip Base systems use HWYCOM (3 way set screw), Southern Plains (2 bolt clamp), or approved equivalent.



Build signs not detailed in the plans according to the latest edition of the Standard Highway Sign Designs for Texas.

TxDOT will mark the locations of the SPEED LIMIT (R2-1) and REDUCED SPEED LIMIT AHEAD (W3-5) signs.

Existing roadside signs are to be removed/relocated and mounted on temporary supports and placed during construction as directed by the Engineer. The removal/relocation and temporary mounting of any existing sign (stop, yield, warning, etc.) will not be paid for directly but will be considered subsidiary to Item 644 unless otherwise directed by the Engineer.

Signs that are to be transferred to new posts must be placed upon the new supports before the end of the working day. Regulatory signs must be transferred immediately.

Conformable Retroreflective Sheeting in accordance with DMS 8300 will be required on all Warning, Stop, and Yield signs. Retroreflective sheeting wrapped around a sign support is yellow unless the sign on the support is a Stop or Yield, in which case the sheeting will be red. Retroreflective sheeting will have a height on the post of 12 inches and the bottom of the sheeting will be 4 feet above the edge of the travel lane. Retroreflective sheeting will not be paid for directly but will be considered subsidiary to Item 644 Small Roadside Sign Assemblies.

**ITEM 662 WORK ZONE PAVEMENT MARKINGS**

Temporary tabs will not be placed on a road more than 24 hours prior to operations beginning on the road.

The temporary tabs will be removed by an acceptable method approved by the Engineer once final striping has been placed.

**ITEM 666 RETROREFLECTORIZED PAVEMENT MARKINGS**

A mobile retroreflectometer is not required for this project.

Furnish a needlepoint micrometer gauge Mitutoyo - Model 342-711-30 or equivalent.

Sealed roadways will be allowed to cure for 3 days before final striping is placed unless otherwise directed by the Engineer.

**ITEM 672 RAISED PAVEMENT MARKERS**

Place raised pavement markers no sooner than 24 hours after final striping has been placed or as directed.

**ITEM 3076 DENSE – GRADED HOT-MIX ASPHALT (QCQA)**

RAS will not be allowed.

A Superpave Gyratory Compactor (SGC) is required for this project.

Power washing each lift of hot-mix before the placement of consecutive lifts may be required as directed by the Engineer to ensure proper surface preparation. (Article 3076.4.7.)

During paving operations; proper adjustment of Surge Volume Remixing MTV is required to ensure clean pickup of HMAC and to have residual HMAC not be in excess of 1/4" to 3/8" as approved by the Engineer. HMAC will not be dumped in a windrow that is determined by the Engineer to be an excessive distance from the paving operation.

Belly dumps will not be allowed if a spray paver is used.

See item 504 for additional structure requirements located at HMAC plant(s).

**ITEM 6001 PORTABLE CHANGEABLE MESSAGE SIGN**

2 portable changeable message signs are estimated for this project and will be placed in advance of the road closure as directed by the Engineer. (2 PCMB X 7 Days = 14 TOTAL)

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

Provide the number of vehicles with truck mounted attenuators (TMA) listed in the table below. The Contractor will be responsible for determining if one or more of these operations will be ongoing at the same time to determine the total number of TMAs needed for the project.

STANDARD / PHASE	# TMA'S REQUIRED
TCP(1-1)	1
TCP(1-2)	1
TCP(3-1)	2
TCP(3-3)	2 or 3
TCP(7-1)	N/A to be used in conjunction with another TCP

Stationary shadow vehicle(s) with TMA are estimated at 10 days for this project. (10 days x 1 TMA's)

Mobile shadow vehicle(s) with TMA are estimated at 3 day for this project. (1 days x 3 TMA's)



CONTROLLING PROJECT ID 1780-01-009

DISTRICT Brownwood  
HIGHWAY FM 1047

COUNTY Mills

# Estimate & Quantity Sheet

CONTROL SECTION JOB				1780-01-009		TOTAL EST.	TOTAL FINAL
PROJECT ID				A00052108			
COUNTY				Mills			
HIGHWAY				FM 1047			
ALT	BID CODE	DESCRIPTION	UNIT	EST.	FINAL		
	100-6002	PREPARING ROW	STA	11.000		11.000	
	100-6004	PREPARING ROW(TREE)(12" TO 24" DIA)	EA	6.000		6.000	
	100-6016	PREPARING ROW (TREE) (36" TO 48" DIA)	EA	1.000		1.000	
	104-6009	REMOVING CONC (RIPRAP)	SY	776.000		776.000	
	104-6045	REMOVE CONC (MISC)	EA	1.000		1.000	
	110-6001	EXCAVATION (ROADWAY)	CY	187.000		187.000	
	110-6002	EXCAVATION (CHANNEL)	CY	2,362.000		2,362.000	
	132-6005	EMBANKMENT (FINAL)(ORD COMP)(TY C)	CY	1,852.000		1,852.000	
	164-6003	BROADCAST SEED (PERM) (RURAL) (CLAY)	SY	4,710.000		4,710.000	
	164-6009	BROADCAST SEED (TEMP) (WARM)	SY	2,355.000		2,355.000	
	164-6011	BROADCAST SEED (TEMP) (COOL)	SY	2,355.000		2,355.000	
	168-6001	VEGETATIVE WATERING	MG	106.000		106.000	
	169-6007	SOIL RETENTION BLANKETS (CL 2) (TY G)	SY	494.000		494.000	
	216-6001	PROOF ROLLING	HR	4.000		4.000	
	400-6005	CEM STABIL BKFL	CY	94.000		94.000	
	416-6004	DRILL SHAFT (36 IN)	LF	763.000		763.000	
	420-6013	CL C CONC (ABUT)	CY	47.000		47.000	
	420-6025	CL C CONC (BENT)	CY	28.600		28.600	
	420-6037	CL C CONC (COLUMN)	CY	25.400		25.400	
	422-6001	REINF CONC SLAB	SF	6,120.000		6,120.000	
	422-6015	APPROACH SLAB	CY	61.200		61.200	
	425-6038	PRESTR CONC GIRDER (TX46)	LF	714.000		714.000	
	432-6035	RIPRAP (STONE PROTECTION)(24 IN)	CY	1,120.000		1,120.000	
	450-6006	RAIL (TY T223)	LF	404.000		404.000	
	454-6004	ARMOR JOINT (SEALED)	LF	136.000		136.000	
	459-6009	GABIONS (3' X 3')(GALV)	CY	397.000		397.000	
	459-6013	GABION (1.5' X 3')(GALV)	CY	69.000		69.000	
	467-6439	SET (TY II) (36 IN) (CMP) (3: 1) (C)	EA	1.000		1.000	
	467-6441	SET (TY II) (36 IN) (CMP) (4: 1) (C)	EA	1.000		1.000	
	496-6010	REMOV STR (BRIDGE 100 - 499 FT LENGTH)	EA	1.000		1.000	
	496-6077	REMOVE STR (PILING)	LF	40.000		40.000	
	500-6001	MOBILIZATION	LS	1.000		1.000	
	502-6001	BARRICADES, SIGNS AND TRAFFIC HANDLING	MO	4.000		4.000	
	506-6002	ROCK FILTER DAMS (INSTALL) (TY 2)	LF	110.000		110.000	
	506-6011	ROCK FILTER DAMS (REMOVE)	LF	110.000		110.000	
	506-6038	TEMP SEDMT CONT FENCE (INSTALL)	LF	2,240.000		2,240.000	
	506-6039	TEMP SEDMT CONT FENCE (REMOVE)	LF	2,240.000		2,240.000	



DISTRICT	COUNTY	CCSJ	SHEET
Brownwood	Mills	1780-01-009	5



# Estimate & Quantity Sheet

CONTROLLING PROJECT ID 1780-01-009

DISTRICT Brownwood  
HIGHWAY FM 1047

COUNTY Mills

CONTROL SECTION JOB				1780-01-009		TOTAL EST.	TOTAL FINAL
PROJECT ID				A00052108			
COUNTY				Mills			
HIGHWAY				FM 1047			
ALT	BID CODE	DESCRIPTION	UNIT	EST.	FINAL		
	506-6041	BIODEG EROSN CONT LOGS (INSTL) (12")	LF	100.000		100.000	
	506-6043	BIODEG EROSN CONT LOGS (REMOVE)	LF	100.000		100.000	
	540-6002	MTL W-BEAM GD FEN (STEEL POST)	LF	300.000		300.000	
	540-6006	MTL BEAM GD FEN TRANS (THRIE-BEAM)	EA	4.000		4.000	
	542-6001	REMOVE METAL BEAM GUARD FENCE	LF	370.000		370.000	
	544-6001	GUARDRAIL END TREATMENT (INSTALL)	EA	4.000		4.000	
	644-6001	IN SM RD SN SUP&AM TY10BWG(1)SA(P)	EA	10.000		10.000	
	644-6076	REMOVE SM RD SN SUP&AM	EA	12.000		12.000	
	658-6014	INSTL DEL ASSM (D-SW)SZ (BRF)CTB (BI)	EA	8.000		8.000	
	658-6062	INSTL DEL ASSM (D-SW)SZ 1(BRF)GF2(BI)	EA	8.000		8.000	
	658-6073	INSTL OM ASSM (OM-2Y)(WC)GND(BI)	EA	2.000		2.000	
	662-6111	WK ZN PAV MRK SHT TERM (TAB)TY Y-2	EA	54.000		54.000	
	666-6303	RE PM W/RET REQ TY I (W)4"(SLD)(100MIL)	LF	2,315.000		2,315.000	
	666-6315	RE PM W/RET REQ TY I (Y)4"(SLD)(100MIL)	LF	2,315.000		2,315.000	
	672-6009	REFL PAV MRKR TY II-A-A	EA	27.000		27.000	
	677-6028	ELIM EXT PV MRK & MRKS (RUMBLE STRIP)	LF	80.000		80.000	
	3076-6001	D-GR HMA TY-B PG64-22	TON	1,470.000		1,470.000	
	3076-6066	TACK COAT	GAL	324.000		324.000	
	6001-6001	PORTABLE CHANGEABLE MESSAGE SIGN	DAY	14.000		14.000	
	6056-6001	PREFORMED IN-LANE(TRANS) RUMBLE STRIP	LF	80.000		80.000	
	6185-6002	TMA (STATIONARY)	DAY	10.000		10.000	
	6185-6005	TMA (MOBILE OPERATION)	DAY	3.000		3.000	
18		OTHER: CONTRACTOR FORCE ACCOUNT WORK (PARTICIPATING)	LS	1.000		1.000	
		SAFETY CONTINGENCY: CONTRACTOR FORCE ACCOUNT WORK (PARTICIPATING)	LS	1.000		1.000	
		EROSION CONTROL MAINTENANCE: CONTRACTOR FORCE ACCOUNT WORK (PART)	LS	1.000		1.000	



Beginning chain EXIST ALIGN description

Point 1000 N 10,488,047.2811 E 2,928,471.0635 Sta 160+04.35

Course from 1000 to PC EXIST ALIGN1 N 28° 09' 16.91" E Dist 367.1766

Curve Data  
\*-----\*

Curve EXIST ALIGN1

P.I. Station 165+14.73 N 10,488,497.2728 E 2,928,711.8891  
 Delta = 24° 29' 44.21" (LT)  
 Degree = 8° 41' 07.18"  
 Tangent = 143.2052  
 Length = 282.0344  
 Radius = 659.6848  
 External = 15.3646  
 Long Chord = 279.8914  
 Mid. Ord. = 15.0149  
 P.C. Station 163+71.53 N 10,488,371.0122 E 2,928,644.3172  
 P.T. Station 166+53.56 N 10,488,640.1861 E 2,928,721.0284  
 C.C. N 10,488,682.2869 E 2,928,062.6885  
 Back = N 28° 09' 16.91" E  
 Ahead = N 3° 39' 32.71" E  
 Chord Bear = N 15° 54' 24.81" E

Course from PT EXIST ALIGN1 to PC EXIST ALIGN2 N 3° 39' 32.71" E Dist 297.2883

Curve Data  
\*-----\*

Curve EXIST ALIGN2

P.I. Station 170+84.34 N 10,489,070.0893 E 2,928,748.5208  
 Delta = 20° 11' 05.50" (LT)  
 Degree = 7° 38' 21.97"  
 Tangent = 133.4931  
 Length = 264.2192  
 Radius = 750.0000  
 External = 11.7876  
 Long Chord = 262.8550  
 Mid. Ord. = 11.6052  
 P.C. Station 169+50.85 N 10,488,936.8683 E 2,928,740.0013  
 P.T. Station 172+15.07 N 10,489,198.0681 E 2,928,710.5491  
 C.C. N 10,488,984.7331 E 2,927,991.5302  
 Back = N 3° 39' 32.71" E  
 Ahead = N 16° 31' 32.79" W  
 Chord Bear = N 6° 26' 00.04" W

Course from PT EXIST ALIGN2 to 1001 N 16° 31' 32.79" W Dist 477.7837

Point 1001 N 10,489,656.1154 E 2,928,574.6451 Sta 176+92.85

Ending chain EXIST ALIGN description

Beginning profile PROP1PROF description:

	STATION	ELEV	GRADE	TOTAL L	BACK L	AHEAD L
VPI	1	164+10.00	1,215.6999			
VPC		164+50.00	1,215.8115	0.2789	K = 98.6	
VPI	2	165+00.00	1,215.9510	100.0000	50.0000	50.0000
VPT		165+50.00	1,216.5973	1.2927		
VPC		166+00.00	1,217.2437	1.2927	K = 77.4	SSD = 884.7
VPI	3	166+50.00	1,217.8900	100.0000	50.0000	50.0000
VPT		167+00.00	1,217.8900	0.0000		
VPC		168+87.50	1,217.8900	0.0000	K = 75.8	SSD = 716.8
VPI	4	169+50.00	1,217.8900	125.0000	62.5000	62.5000
VPT		170+12.50	1,216.8593	-1.6491		
VPC		170+15.00	1,216.8181	-1.6491	K = 100.8	
VPI	5	170+75.00	1,215.8286	120.0000	60.0000	60.0000
VPT		171+35.00	1,215.5532	-0.4590		
VPI	6	171+50.00	1,215.4843	-0.4590		

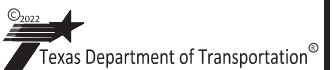
Ending profile PROP1PROF description



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01/02/2022

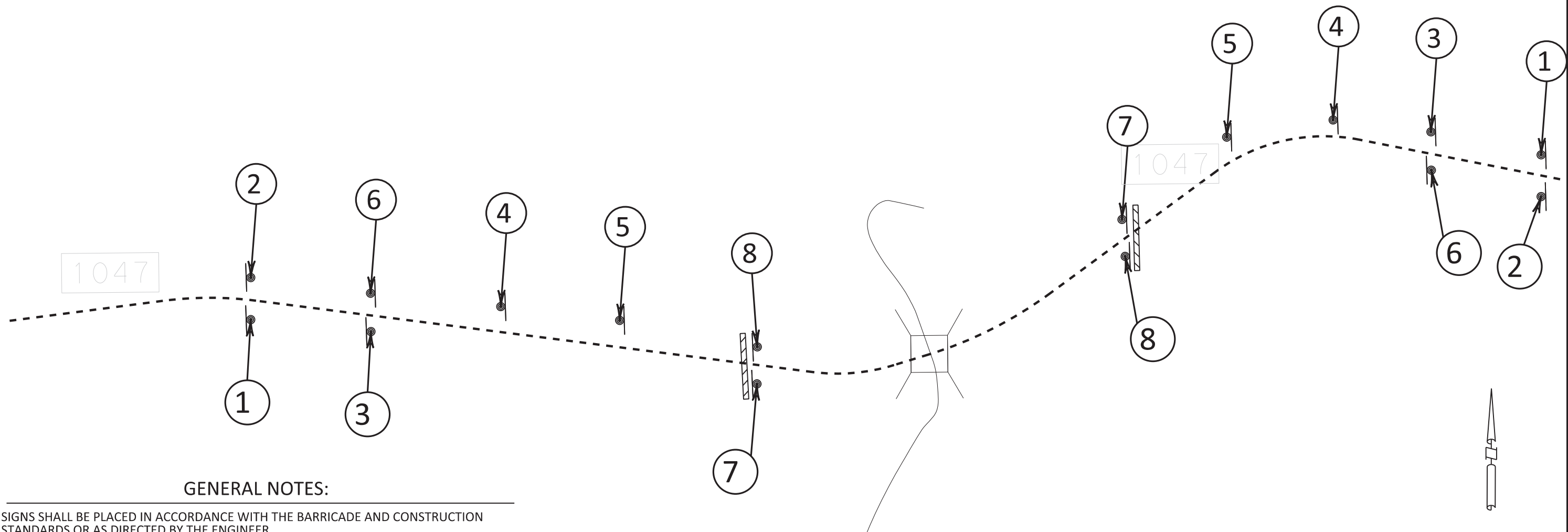
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ALIGNMENT  
DATA



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DIST	COUNTY	SHEET NO.	
BWD	MILLS	7	

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**GENERAL NOTES:**

SIGNS SHALL BE PLACED IN ACCORDANCE WITH THE BARRICADE AND CONSTRUCTION STANDARDS OR AS DIRECTED BY THE ENGINEER.

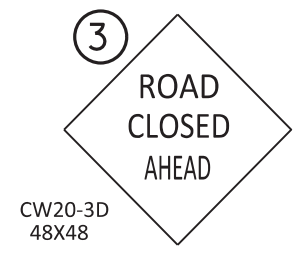
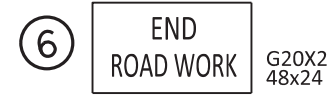
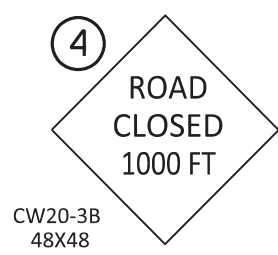
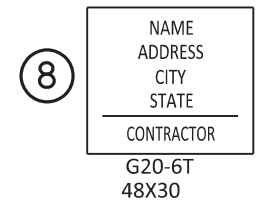
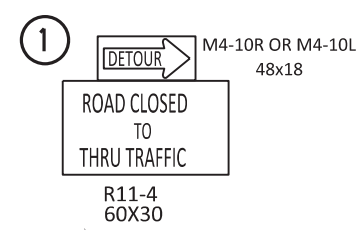
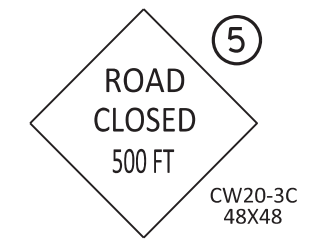
OTHER SIGNS AS DETAILED IN THE BARRICADE AND CONSTRUCTION STANDARDS AND IN THE MUTCD MAY BE USED AS REQUIRED BY THE ENGINEER IN ORDER TO PROVIDE FOR THE SAFE PASSAGE OF TRAFFIC THROUGH THE PROJECT. PAYMENT FOR ALL SUCH SIGNS, BARRICADES OR TRAFFIC CONTROL DEVICES SHALL BE CONSIDERED SUBSIDIARY TO ITEM 502 " BARRICADES, SIGNS AND TRAFFIC HANDLING."

PROVIDE ACCESS TO AND FROM DRIVEWAYS AND ALL ADJACENT PROPERTY AT ALL TIMES.

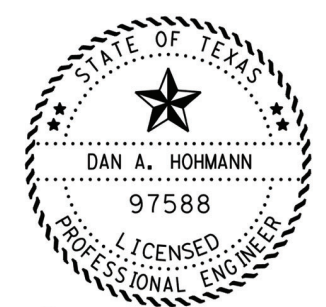
**SEQUENCE OF WORK**

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

1. INSTALL PROJECT LIMIT SIGNING AND BARRICADES AND SW3P PRIOR TO BEGINNING ANY OTHER WORK.
2. ALL ROAD CLOSURE SIGNING SHALL BE IN PLACE PRIOR TO ANY ACTIVITIES WHICH WILL PROHIBIT THROUGH TRAFFIC AND SHALL NOT BE PLACED MORE THAN 24 HOURS PRIOR TO SUCH ACTIVITY.
3. COMPLETE THE CONSTRUCTION OF THE BRIDGE AND APPROACHES ACCORDING TO THE PLANS AND SPECIFICATIONS AND AS DIRECTED BY THE ENGINEER.
4. THE ROADWAY SHALL BE OPEN TO THROUGH TRAFFIC AS SOON AS DETERMINED PRACTICAL BY THE ENGINEER.
5. COMPLETE ALL OTHER WORK AS DIRECTED BY THE ENGINEER.



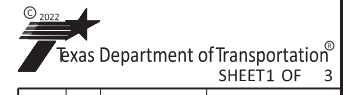
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*Dan A. Hohmann, P.E.*

01/02/2022

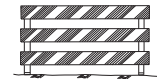
FM 1047  
 TCP  
 1780-01-009



CONT	SECT	JOB	HIGHWAY
1780	01	009	FM 1047
DIST	COUNTY	SHEET NO.	
BWD	MILLS	8	

LEGEND

SIGN AND SIGN SUPPORT



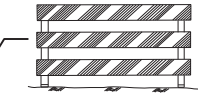
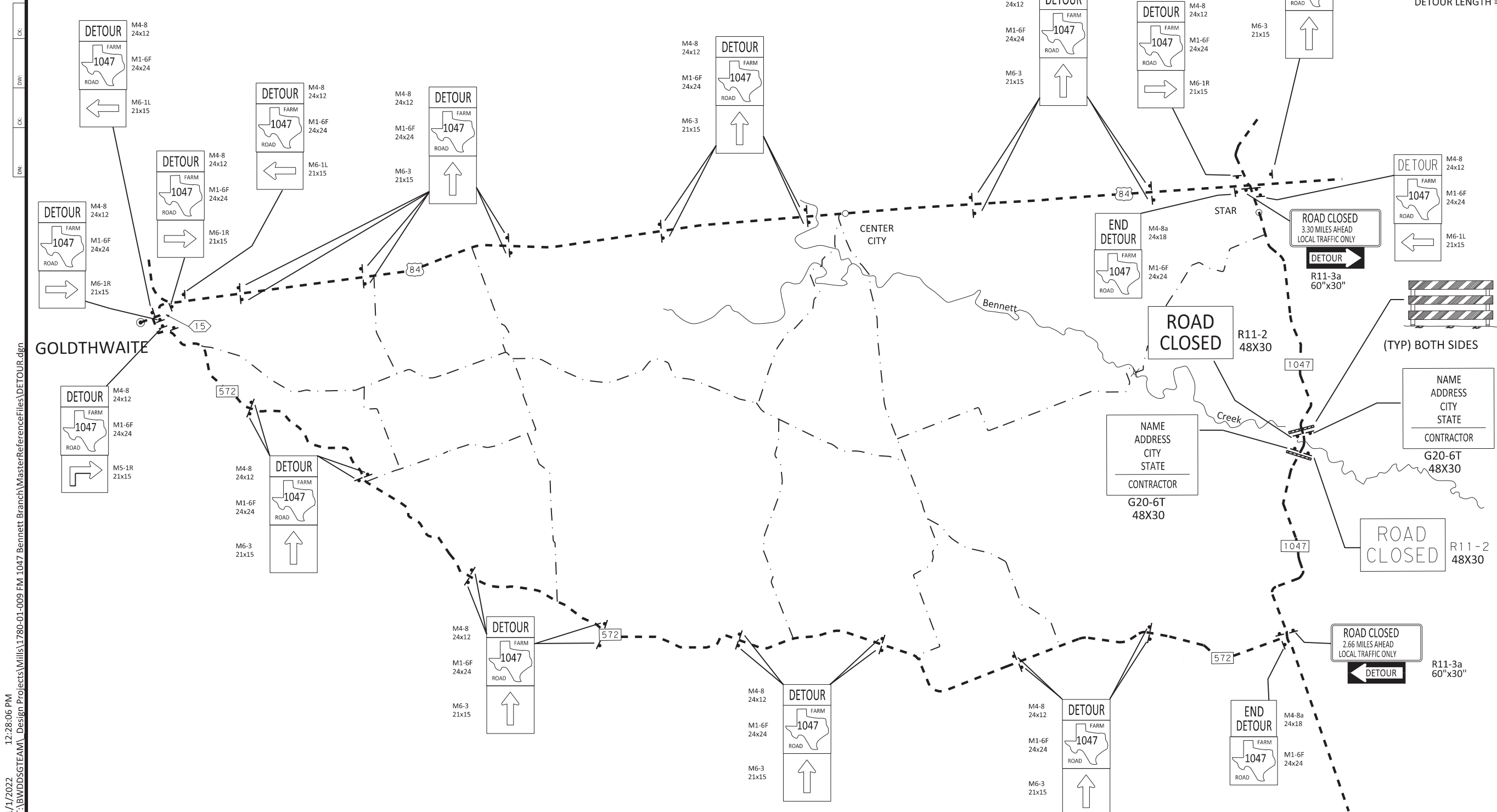
TYPE III BARRICADE

GENERAL NOTES

SIGNS SHALL BE PLACED IN ACCORDANCE WITH THE BARRICADE AND CONSTRUCTION STANDARDS OR AS DIRECTED BY THE ENGINEER.

OTHER SIGNS AS DETAILED IN THE BARRICADE AND CONSTRUCTION STANDARDS AND IN THE TMUTCD MAY BE USED AS REQUIRED BY THE ENGINEER.

DETOUR LENGTH = 33.10 MI



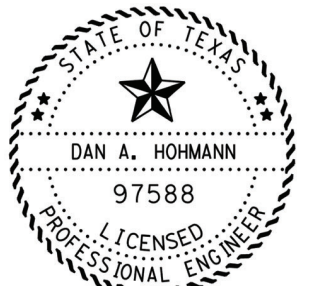
(TYP) BOTH SIDES

NAME  
ADDRESS  
CITY  
STATE  
CONTRACTOR  
G20-6T  
48X30

NAME  
ADDRESS  
CITY  
STATE  
CONTRACTOR  
G20-6T  
48X30

ROAD CLOSED  
R11-2  
48X30

ROAD CLOSED  
2.66 MILES AHEAD  
LOCAL TRAFFIC ONLY  
DETOUR



Dan A. Hohmann, P.E.

01/02/2022

FM 1047  
TCP  
1780-01-009

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SHEET 2 OF 3

CONT	SECT	JOB	HIGHWAY
1780	01	009	FM 1047
DIST	COUNTY	SHEET NO.	
BWD	MILLS	9	

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DN

DATE: 1/1/2022 10:48:06 AM  
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Warning Sign Sequence in Opposite Direction same as below.

Existing Type 2 Double Yellow

OPPOSING TRAFFIC LANE DIVIDERS AND VERTICAL PANELS. REFER TO BC(9) FOR TYPICAL APPLICATION

NOTE: BEGINNING AND EVERY FIFTH CHANNELIZING DEVICE SHALL BE A OTLD

End of Pavement

Existing Type 2 Double Yellow

CW14-3

NO PASSING ZONE

Rumble Strips (See Std RS(5))

Flags shown are required.

Non surfaced Area limited to 1/2 the length of work zone

CW8-3

PAVEMENT ENDS

CW8-12

NO CENTER LINE

CW8-7

LOOSE GRAVEL

CW8-8

ROUGH ROAD

XX MPH

CW13-1P

The Engineer shall choose the advisory speed based on the conditions during construction.

CW8-3

PAVEMENT ENDS

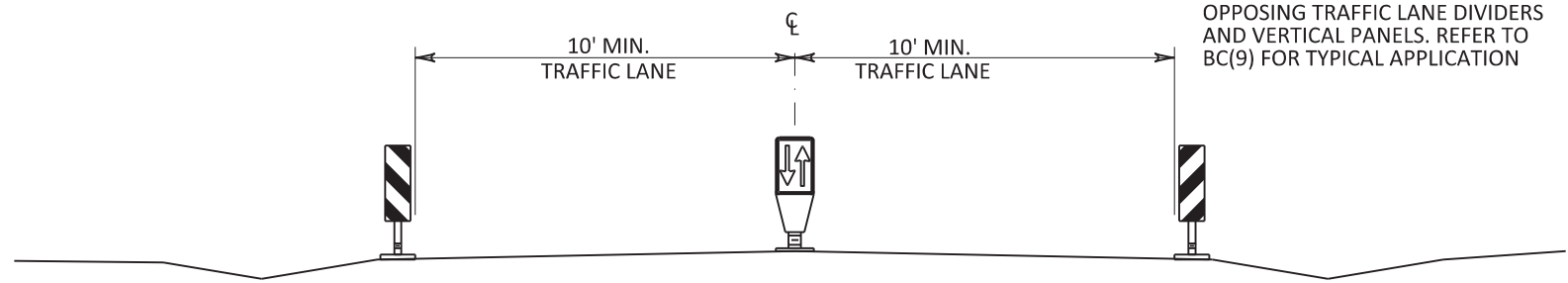
W16-3aP

Flags shown are required.

1/2 MILE

## TWO-WAY TRAFFIC OPERATIONS

TO BE IN PLACE WHEN ONE-WAY TRAFFIC CONTROL IS NOT IN USE



## TWO-WAY TRAFFIC

### General Notes

Contractor is required to maintain traffic through the project at all times. Contractor shall utilize ONE-WAY TRAFFIC CONTROL as required for day-time operations. Roadway shall be open to Two-Way Traffic as shown for night-time and any other time One-Way Traffic Control is not in place. Two-way traffic control shall be in place by sunset each day. Self-Righting Supports with portable bases, Vertical Panels and 'Opposing Lane Divider' panels shall be used for two-way traffic until surface and pavement markings are in place.

For daytime operations TCP (1-2b) "Control with Flaggers" Shall be used for One-Way Traffic Control. Pilot car is required for daytime operations unless otherwise approved by the Engineer.

Refer to TCP (1-2) for Traffic Control & WZ(UL) for Uneven Lane Signs and placement. To be used as directed by the Engineer. No uneven lanes are allowed except during daytime operations.

Existing roadside signs including Chevrons are to be mounted on temporary supports adjacent to work areas as directed by the Engineer.

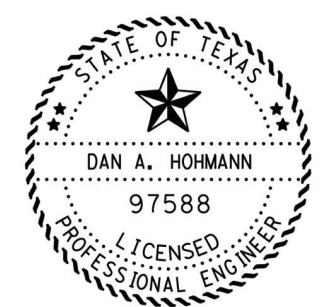
In-Lane Rumble Strips shall be placed as directed by the Engineer.

### Barricades and Warning Signs

- See BC Standards for project limit devices and warning sign spacing (x).
- Drums, panels, and cones shall be used as directed by the Engineer.
- See BC, WZ, and TCP sheets for additional Traffic Control details.

ITEM	CODE	DESCRIPTION	UNIT	EST.
*	662	6111 WK ZN PAV MRK SHT TERM (TAB) TY Y-2	EA	54
**	677	6028 ELIM EXT PAV MRK & MRKS (RUMBLE STRIP)	LF	80
	6056	6001 PREFORMED IN-LANE(TRANS) RUMBLE STRIP	LF	80

\*\* RUMBLE STRIPS TO BE REMOVED UPON PROJECT COMPLETION  
\* TWO MOBILIZATIONS ARE ESTIMATED FOR WK ZN PAV MRKS



Dan A. Hohmann, P.E.

01/02/2022

FM 1047  
TRAFFIC  
CONTROL PLAN  
TWO-WAY TRAFFIC  
OPERATIONS



CONT	SECT	JOB	HIGHWAY
1780	01	009	FM 1047
DIST	COUNTY	SHEET NO.	
BWD	MILLS	10	



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

1. The Barricade and Construction Standard Sheets (BC sheets) are intended to show typical examples for placement of temporary traffic control devices, construction pavement markings, and typical work zone signs. The information contained in these sheets meet or exceed the requirements shown in the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD).
2. The development and design of the Traffic Control Plan (TCP) is the responsibility of the Engineer.
3. The Contractor may propose changes to the TCP that are signed and sealed by a licensed professional engineer for approval. The Engineer may develop, sign and seal Contractor proposed changes.
4. The Contractor is responsible for installing and maintaining the traffic control devices as shown in the plans. The Contractor may not move or change the approximate location of any device without the approval of the Engineer.
5. Geometric design of lane shifts and detours should, when possible, meet the applicable design criteria contained in manuals such as the American Association of State Highway and Transportation Officials (AASHTO), "A Policy on Geometric Design of Highways and Streets," the TxDOT "Roadway Design Manual" or engineering judgment.
6. When projects abut, the Engineer(s) may omit the END ROAD WORK, TRAFFIC FINES DOUBLE, and other advance warning signs if the signing would be redundant and the work areas appear continuous to the motorists. If the adjacent project is completed first, the Contractor shall erect the necessary warning signs as shown on these sheets, the TCP sheets or as directed by the Engineer. The BEGIN ROAD WORK NEXT X MILES sign shall be revised to show appropriate work zone distance.
7. The Engineer may require duplicate warning signs on the median side of divided highways where median width will permit and traffic volumes justify the signing.
8. All signs shall be constructed in accordance with the details found in the "Standard Highway Sign Designs for Texas," latest edition. Sign details not shown in this manual shall be shown in the plans or the Engineer shall provide a detail to the Contractor before the sign is manufactured.
9. The temporary traffic control devices shown in the illustrations of the BC sheets are examples. As necessary, the Engineer will determine the most appropriate traffic control devices to be used.
10. 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).

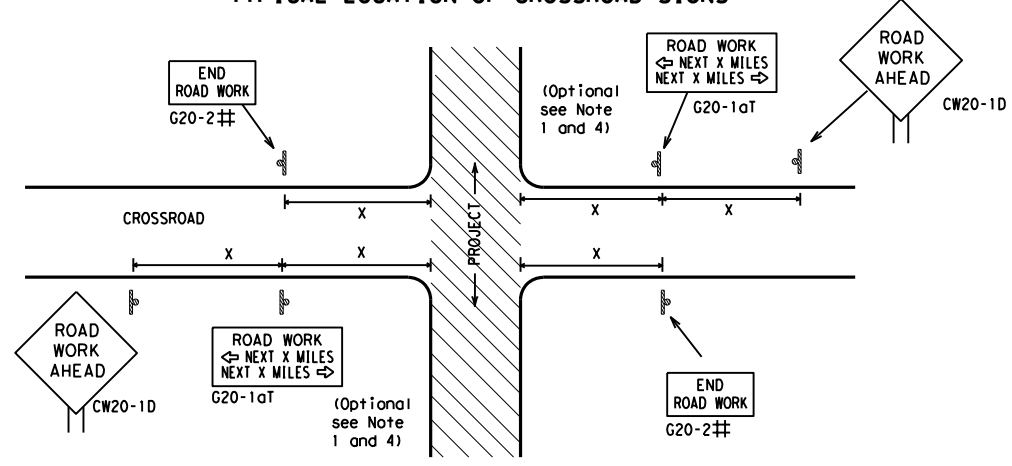
<b>THE DOCUMENTS BELOW CAN BE FOUND ON-LINE AT</b> <a href="http://www.txdot.gov">http://www.txdot.gov</a>
COMPLIANT WORK ZONE TRAFFIC CONTROL DEVICES LIST (CWZTCD)
DEPARTMENTAL MATERIAL SPECIFICATIONS (DMS)
MATERIAL PRODUCER LIST (MPL)
ROADWAY DESIGN MANUAL - SEE "MANUALS (ONLINE MANUALS)"
STANDARD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

SHEET 1 OF 12

 Texas Department of Transportation		Traffic Safety Division Standard	
<b>BARRICADE AND CONSTRUCTION GENERAL NOTES AND REQUIREMENTS</b>			
<b>BC (1) - 21</b>			
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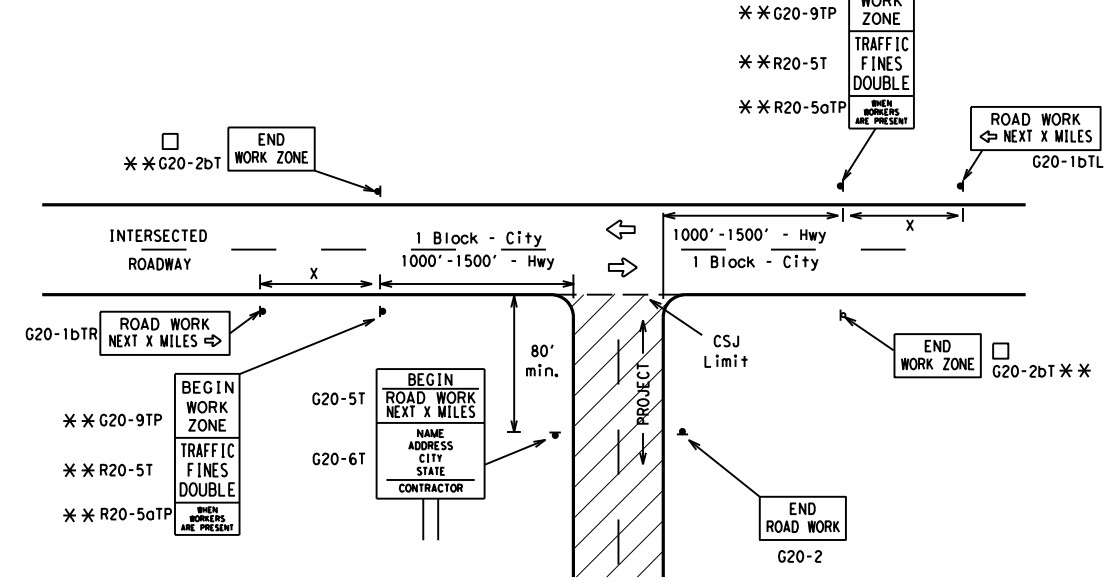
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**TYPICAL LOCATION OF CROSSROAD SIGNS**



- ## May be mounted on back of "ROAD WORK AHEAD" (CW20-1D) sign with approval of Engineer. (See note 2 below)
- 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<sup>1,5,6</sup>**

Sign Number or Series	SIZE		SPACING	
	Conventional Road	Expressway/Freeway	Posted Speed MPH	Sign Δ Spacing "x" Feet (Apprx.)
CW20 <sup>4</sup>	48" x 48"	48" x 48"	30	120
CW21			35	160
CW22			40	240
CW23			45	320
CW25			50	400
CW1, CW2, CW7, CW8, CW9, CW11, CW14	36" x 36"	48" x 48"	55	500 <sup>2</sup>
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>

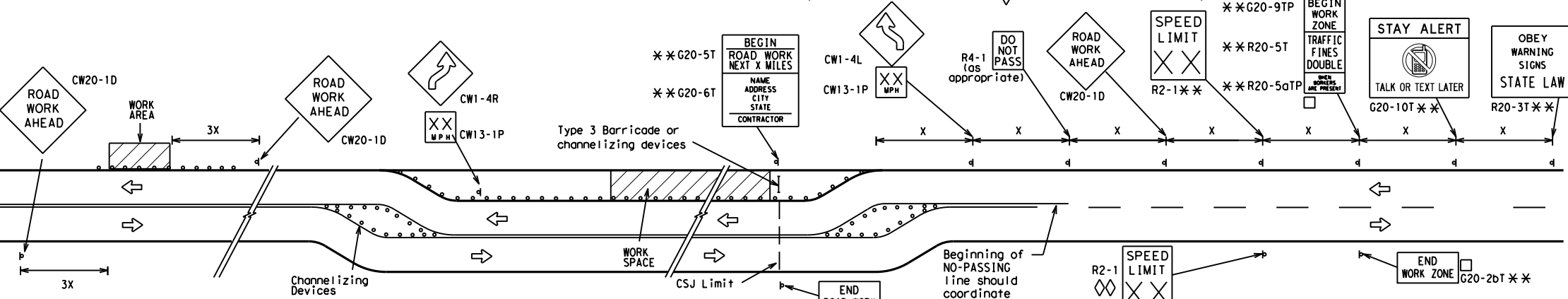
\* For typical sign spacings on divided highways, expressways and freeways, see Part 6 of the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD) typical application diagrams or TCP Standard Sheets.

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

**GENERAL NOTES**

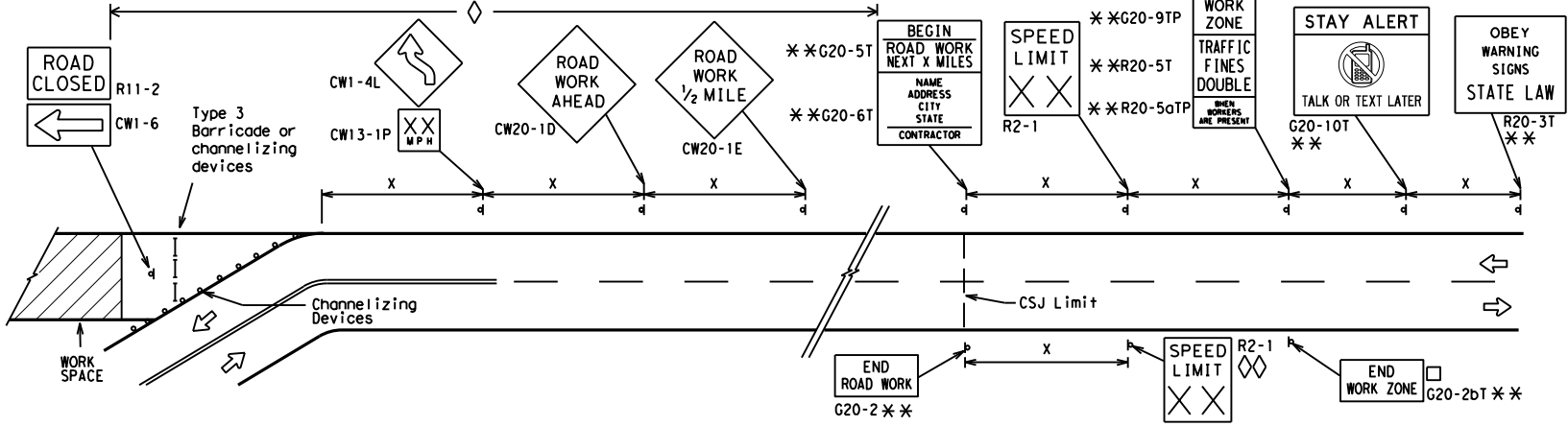
- Special or larger size signs may be used as necessary.
- Distance between signs should be increased as required to have 1500 feet advance warning.
- Distance between signs should be increased as required to have 1/2 mile or more advance warning.
- 36" x 36" "ROAD WORK AHEAD" (CW20-1D) signs may be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

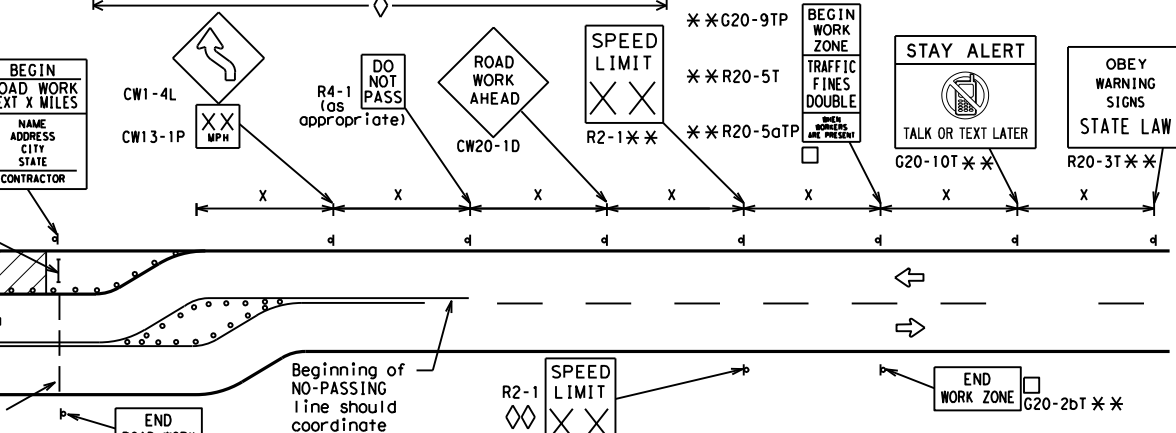


When extended distances occur between minimal work spaces, the Engineer/Inspector should ensure additional "ROAD WORK AHEAD" (CW20-1D) signs are placed in advance of these work areas to remind drivers they are still within the project limits. See the applicable TCP sheets for exact location and spacing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

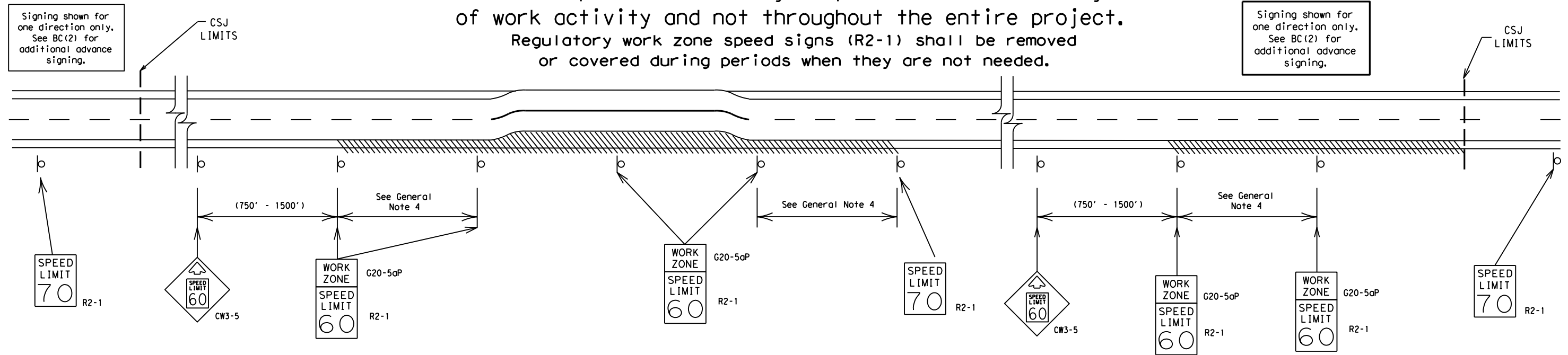
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# TYPICAL APPLICATION OF WORK ZONE SPEED LIMIT SIGNS

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:
  - Law 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

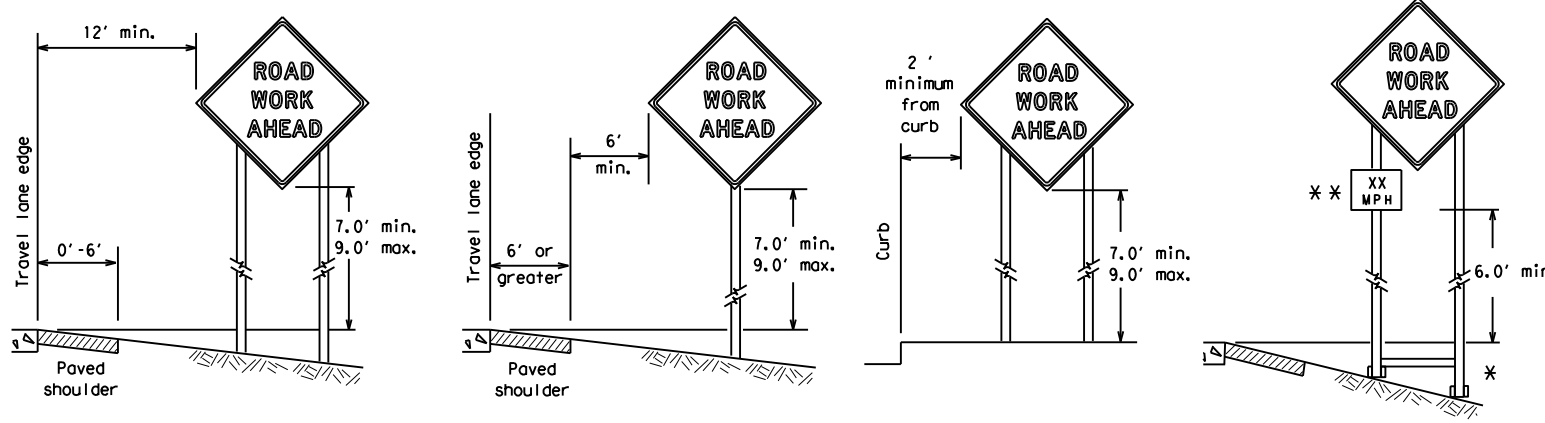
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© TxDOT	November 2002	CONT	SECT	JOB	HIGHWAY				
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9-07	8-14	DIST	COUNTY	SHEET NO.					
7-13	5-21	BWD	MILLS	13					

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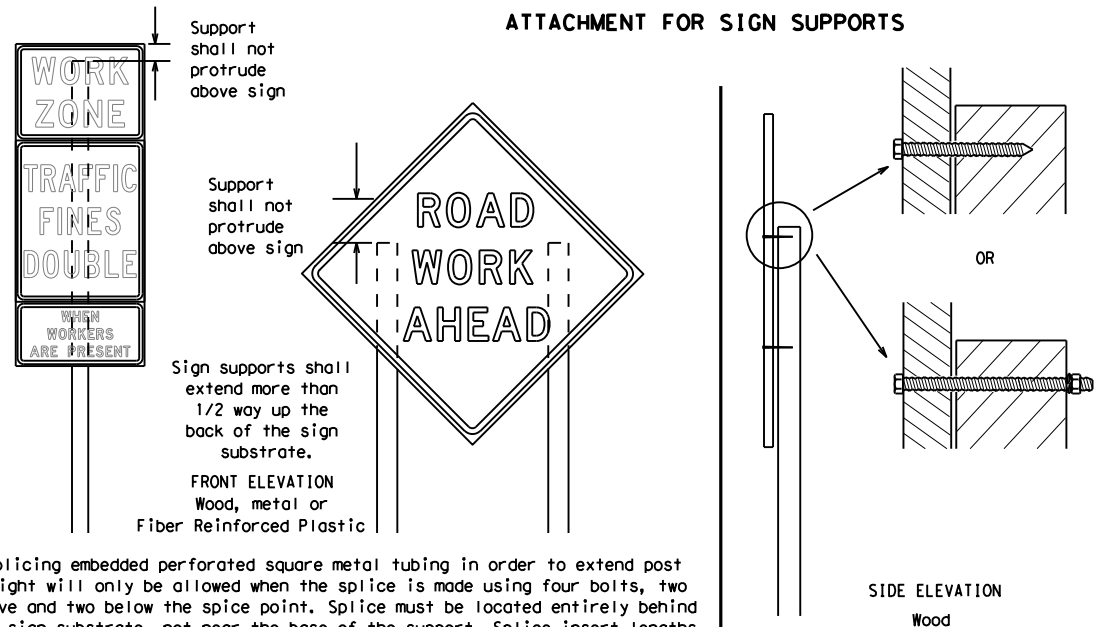
**TYPICAL MINIMUM CLEARANCES FOR LONG TERM AND INTERMEDIATE TERM SIGNS**



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

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

**ATTACHMENT FOR SIGN SUPPORTS**

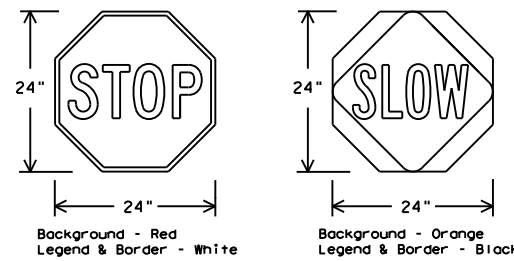


**Nails shall NOT be allowed.**  
 Each sign shall be attached directly to the sign support. Multiple signs shall not be joined or spliced by any means. Wood supports shall not be extended or repaired by splicing or other means.

Splicing embedded perforated square metal tubing in order to extend post height will only be allowed when the splice is made using four bolts, two above and two below the 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 retroreflectORIZED when used at night.
3. STOP/SLOW paddles may be attached to a staff with a minimum length of 6' to the bottom of the sign.
4. Any lights incorporated into the STOP or SLOW paddle faces shall only be as specifically described in Section 6E.03 Hand Signaling Devices in the TMUTCD.



SHEETING REQUIREMENTS (WHEN USED AT NIGHT)		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	RED	TYPE B OR C SHEETING
BACKGROUND	ORANGE	TYPE B <sub>FL</sub> OR C <sub>FL</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 CWZTCD list. The signs shall meet the required mounting heights shown on the BC, or the SMD standard sheets during construction. This work should be paid for under the appropriate pay item for relocating existing signs.
6. Any sign or traffic control device that is struck or damaged by the Contractor or his/her construction equipment shall be replaced as soon as possible by the Contractor to ensure proper guidance for the motorists. This will be subsidiary to Item 502.

**GENERAL NOTES FOR WORK ZONE SIGNS**

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

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

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

**SIGN MOUNTING HEIGHT**

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

**SIZE OF SIGNS**

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

**SIGN SUBSTRATES**

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

**REFLECTIVE SHEETING**

1. All signs shall be retroreflective and constructed of sheeting meeting the color and retro-reflectivity requirements of DMS-8300 for rigid signs or DMS-8310 for roll-up signs. The web address for DMS specifications is shown on BC(1).
2. White sheeting, meeting the requirements of DMS-8300 Type A, shall be used for signs with a white background.
3. Orange sheeting, meeting the requirements of DMS-8300 Type B<sub>FL</sub> or Type C<sub>FL</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 CWZTCD list.
7. Sandbags shall only be placed along or laid over the base supports of the traffic control device and shall not be suspended above ground level or hung with rope, wire, chains or other fasteners. Sandbags shall be placed along the length of the skids to weigh down the sign support.
8. Sandbags shall NOT be placed under the skid and shall not be used to level sign supports placed on slopes.

**FLAGS ON SIGNS**

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

SHEET 4 OF 12

Texas Department of Transportation  
 Traffic Safety Division Standard

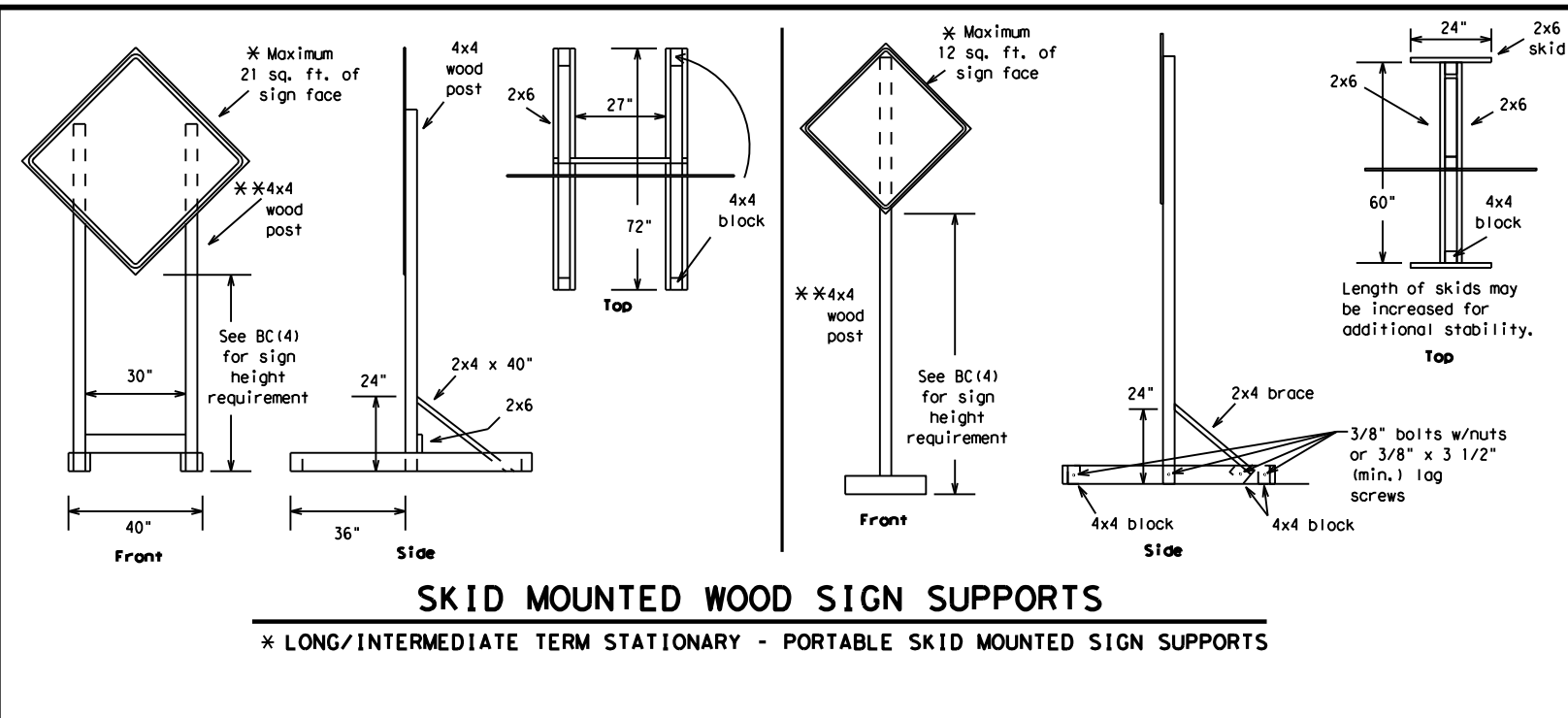
**BARRICADE AND CONSTRUCTION TEMPORARY SIGN NOTES**

**BC (4) - 21**

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© TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
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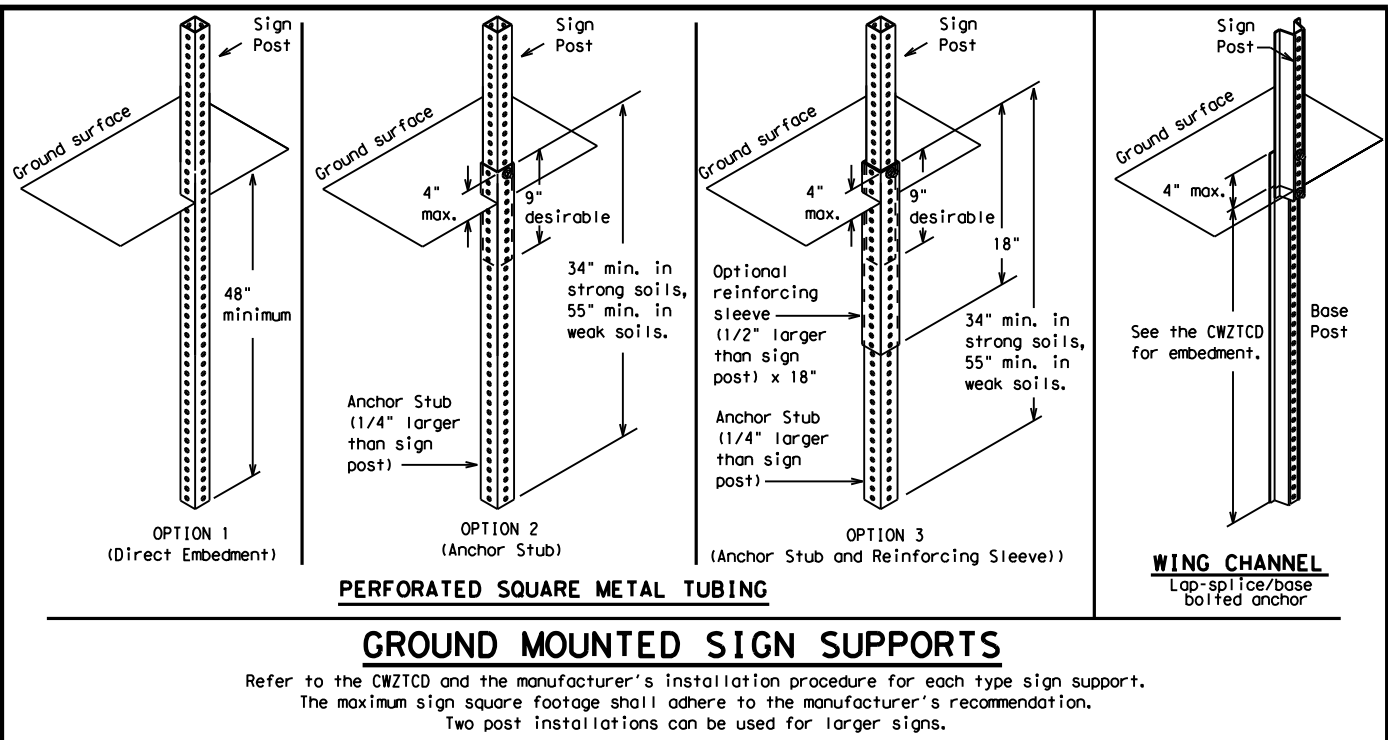
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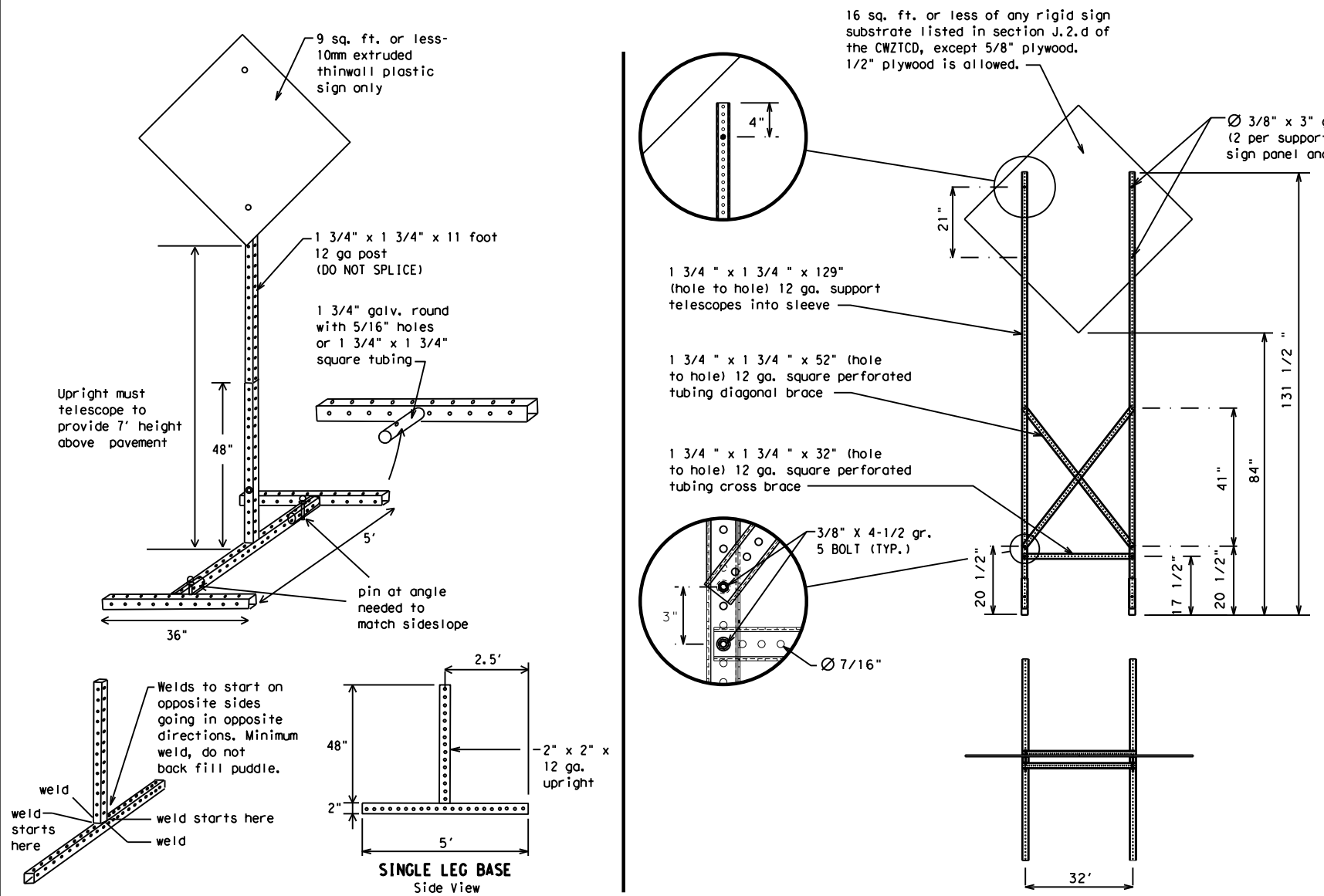
**SKID MOUNTED WOOD SIGN SUPPORTS**

\* 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**
- 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.
  - No more than 2 sign posts shall be placed within a 7 ft. circle, except for specific materials noted on the CWZTCD List.
  - 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.

**BARRICADE AND CONSTRUCTION TYPICAL SIGN SUPPORT**

**BC(5) - 21**

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REVISIONS	1780	01	009	FM 1047
9-07 8-14	DIST	COUNTY	SHEET NO.	
7-13 5-21	BWD	MILLS	15	

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
Canot	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 X MILE
ROAD CLOSED AT SH XXX
ROAD CLSD AT FM XXXX
RIGHT X LANES CLOSED
CENTER LANE CLOSED
NIGHT LANE CLOSURES
VARIOUS LANES CLOSED
EXIT CLOSED
MALL DRIVEWAY CLOSED
XXXXXXXX BLVD CLOSED

### Other Condition List

FRONTAGE ROAD CLOSED
SHOULDER CLOSED XXX FT
RIGHT LN CLOSED XXX FT
RIGHT X LANES OPEN
DAYTIME LANE CLOSURES
I-XX SOUTH EXIT CLOSED
EXIT XXX CLOSED X MILE
RIGHT LN TO BE CLOSED
X LANES CLOSED TUE - FRI

ROADWORK XXX FT
FLAGGER XXXX FT
RIGHT LN NARROWS XXXX FT
MERGING TRAFFIC XXXX FT
LOOSE GRAVEL XXXX FT
DETOUR X MILE
ROADWORK PAST SH XXXX
BUMP XXXX FT
TRAFFIC SIGNAL XXXX FT

ROAD REPAIRS XXXX FT
LANE NARROWS XXXX FT
TWO-WAY TRAFFIC XX MILE
CONST TRAFFIC XXX FT
UNEVEN LANES XXXX FT
ROUGH ROAD XXXX FT
ROADWORK NEXT FRI-SUN
US XXX EXIT 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 X EXITS
USE EXIT XXX
STAY ON US XXX SOUTH
TRUCKS USE US XXX N
WATCH FOR TRUCKS
EXPECT DELAYS
REDUCE SPEED XXX FT
USE OTHER ROUTES
STAY IN LANE *

FORM X LINES RIGHT
USE XXXXX RD EXIT
USE EXIT I-XX NORTH
USE I-XX E TO I-XX N
WATCH FOR TRUCKS
EXPECT DELAYS
PREPARE TO STOP
END SHOULDER USE
WATCH FOR WORKERS

### Location List

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

### Warning List

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

### \*\* Advance Notice List

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

\*\* See Application Guidelines Note 6.

## APPLICATION GUIDELINES

- 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 shall 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 MI, 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 "Flagger Symbol" (CW20-7) are represented graphically on the Full Matrix PCMS sign and, with the approval of the Engineer, it shall maintain the legibility/visibility requirement listed above.
- 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

<h3>BARRICADE AND CONSTRUCTION PORTABLE CHANGEABLE MESSAGE SIGN (PCMS)</h3>			
<h2>BC (6) - 21</h2>			
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© TxDOT	November 2002	CONT:	1780
REVISIONS:		SECT:	01
9-07	8-14	JOB:	009
7-13	5-21	HIGHWAY:	FM 1047
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		COUNTY:	
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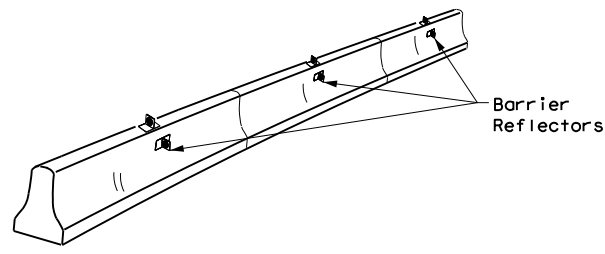
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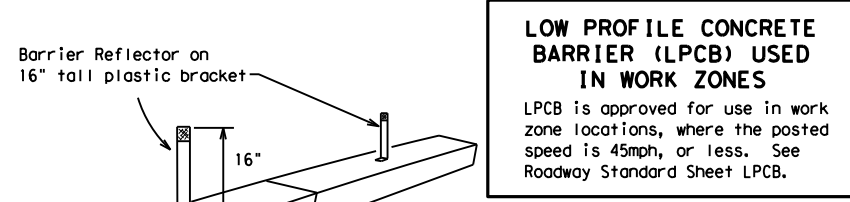
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- Barrier Reflectors shall be pre-qualified, and conform to the color and reflectivity requirements of DMS-8600. A list of prequalified Barrier Reflectors can be found at the Material Producer List web address shown on BC(1).
- Color of Barrier Reflectors shall be as specified in the TMUTCD. The cost of the reflectors shall be considered subsidiary to Item 512.



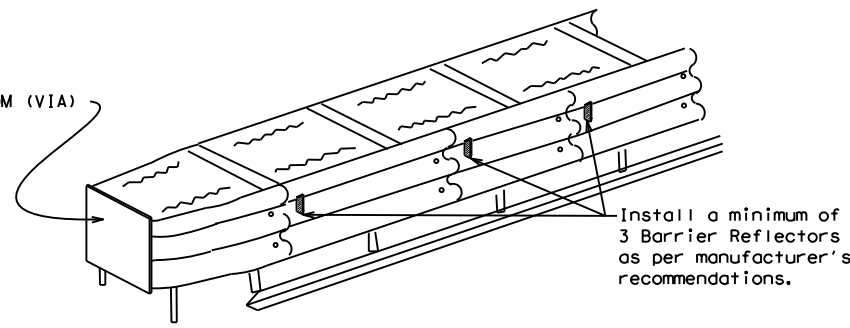
**CONCRETE TRAFFIC BARRIER (CTB)**

- 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 edgeline 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.

**LOW PROFILE CONCRETE BARRIER (LPCB)**



**DELINEATION OF END TREATMENTS**

**END TREATMENTS FOR CTB'S USED IN WORK ZONES**  
 End treatments used on CTB's in work zones shall meet the 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**

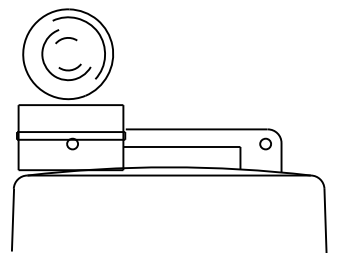
- Warning lights shall meet the requirements of the TMUTCD.
- Warning lights shall NOT be installed on barricades.
- Type A-Low Intensity Flashing Warning Lights are commonly used with drums. They are intended to warn of or mark a potentially hazardous area. Their use shall be as indicated on this sheet 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<sub>FL</sub> or C<sub>FL</sub> 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 lights certification. The warning light manufacturer will certify the warning lights meet the requirements of the latest ITE Purchase Specifications for Flashing and Steady-Burn Warning Lights.
- 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**

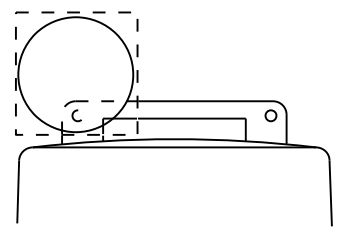
- Type A flashing warning lights are intended to warn drivers that they are approaching or are in a potentially hazardous area.
- Type A random flashing warning lights are not intended for delineation and shall not be used in a series.
- A series of sequential flashing warning lights placed on channelizing 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.



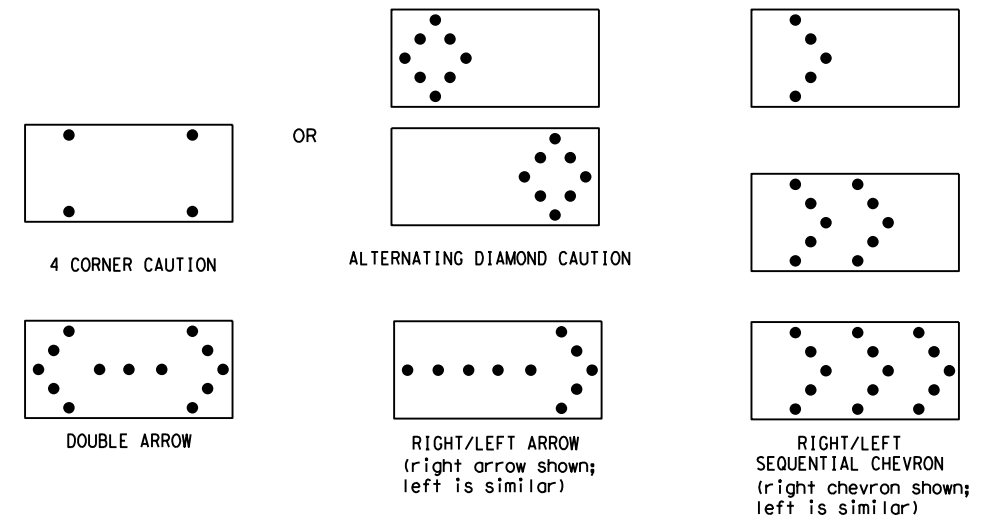
Type C Warning Light or approved substitute mounted on a drum adjacent to the travel way.



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**

FILE:	bc-21.dgn	DN:	TxDOT	CR:	TxDOT	OW:	TxDOT	CK:	TxDOT
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REVISIONS		1780	01	009	FM 1047				
9-07	8-14	DIST	COUNTY		SHEET NO.				
7-13	5-21	BWD	MILLS		17				

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**GENERAL NOTES**

- For long term stationary work zones on freeways, drums shall be used as the primary channelizing device.
- 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.
- 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.
- 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).
- 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.
- 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:

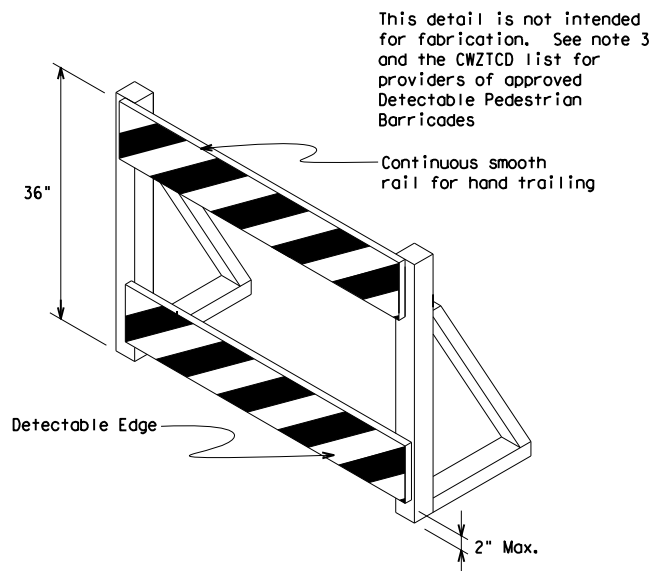
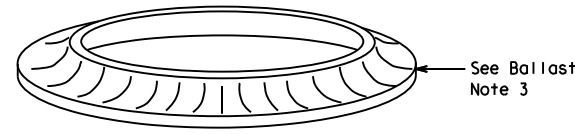
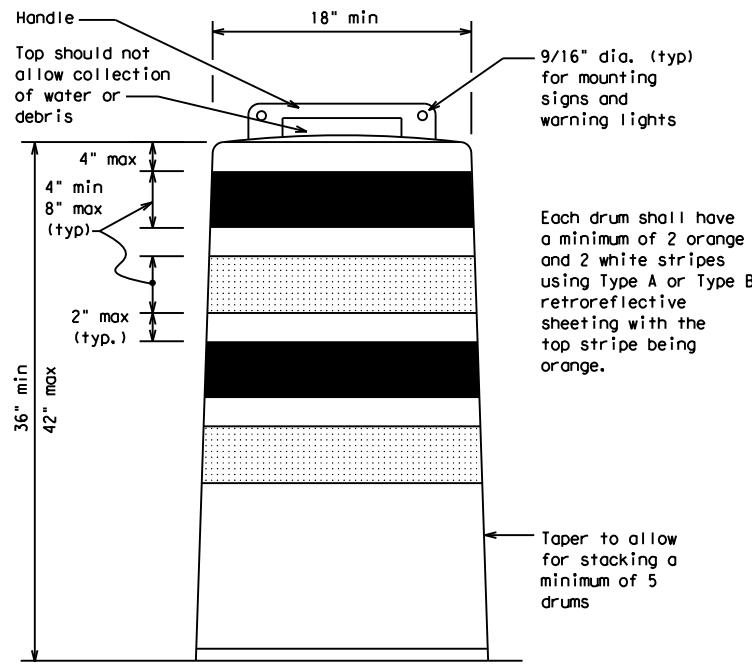
- Plastic drums shall be a two-piece design; the "body" of the drum shall be the top portion and the "base" shall be the bottom.
- The body and base shall lock together in such a manner that the body separates from the base when impacted by a vehicle traveling at a speed of 20 MPH or greater but prevents accidental separation due to normal handling and/or air turbulence created by passing vehicles.
- 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.
- 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.
- 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.
- 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.
- 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.
- Plastic drums shall be constructed of ultra-violet stabilized, orange, high-density polyethylene (HDPE) or other approved material.
- Drum body shall have a maximum unballasted weight of 11 lbs.
- Drum and base shall be marked with manufacturer's name and model number.

**RETROREFLECTIVE SHEETING**

- 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.
- 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.

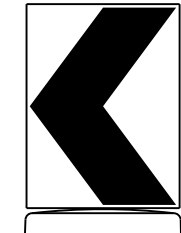
**BALLAST**

- 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.
- 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.
- Recycled truck tire sidewalls may be used for ballast on drums approved for this type of ballast on the CWZTCD list.
- 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.
- 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.
- Ballast shall not be placed on top of drums.
- Adhesives may be used to secure base of drums to pavement.

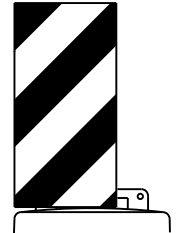


**DETECTABLE PEDESTRIAN BARRICADES**

- 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.
- 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.
- 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.
- 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.
- Warning lights shall not be attached to detectable pedestrian barricades.
- 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**

- Signs used on plastic drums shall be manufactured using substrates listed on the CWZTCD.
- Chevrons and other work zone signs with an orange background shall be manufactured with Type B<sub>FL</sub> or Type C<sub>FL</sub> Orange sheeting meeting the color and retroreflectivity requirements of DMS-8300, "Sign Face Material," unless otherwise specified in the plans.
- 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.
- 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.
- Signs shall be installed using a 1/2 inch bolt (nominal) and nut, two washers, and one locking washer for each connection.
- Mounting bolts and nuts shall be fully engaged and adequately torqued. Bolts should not extend more than 1/2 inch beyond nuts.
- Chevrons may be placed on drums on the outside of curves, on merging tapers or on shifting tapers. When used in these locations, they may be placed on every drum or spaced not more than on every third drum. A minimum of three (3) should be used at each location called for in the plans.
- 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**

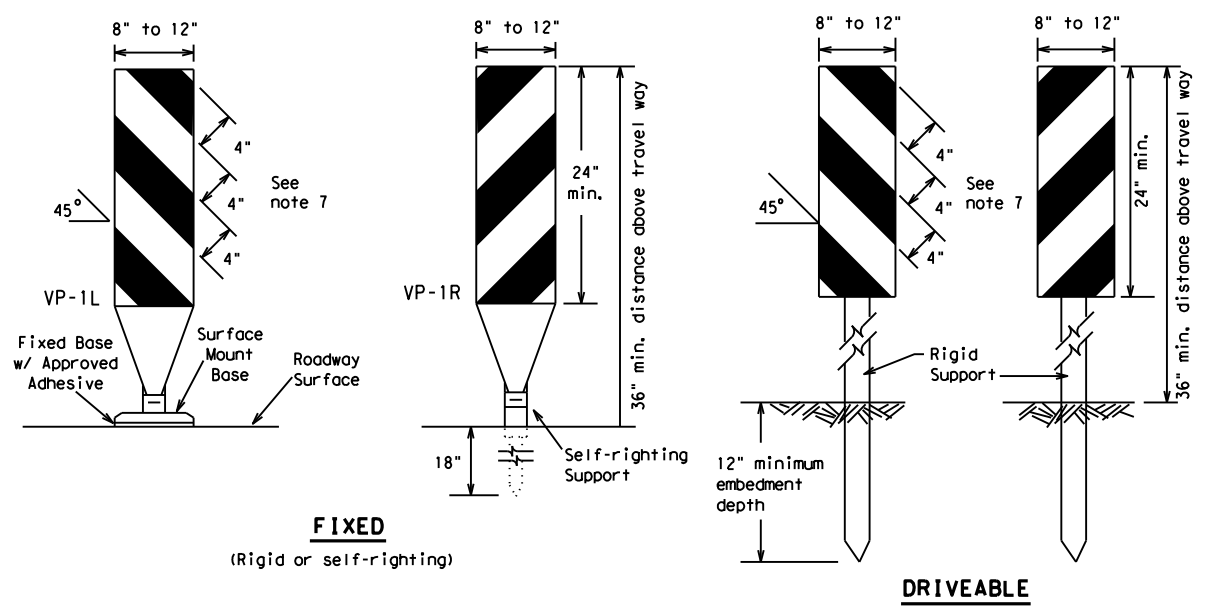
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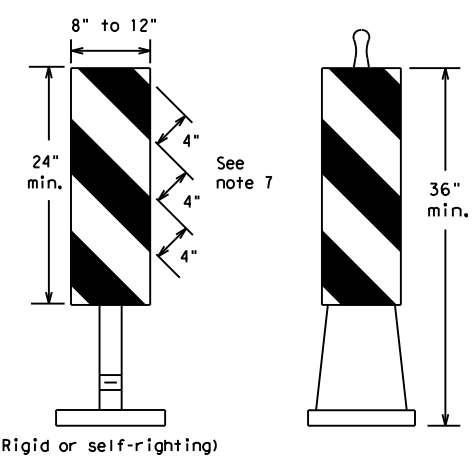
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**FIXED**  
(Rigid or self-righting)

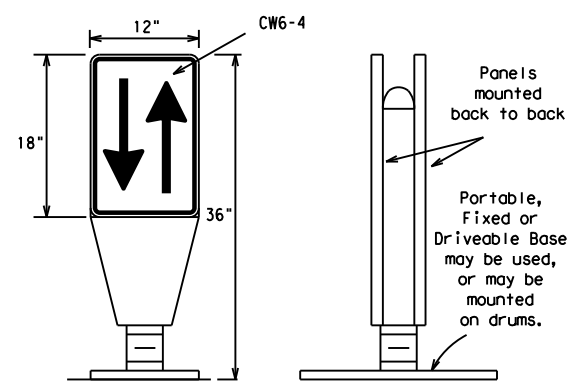
**DRIVEABLE**



**PORTABLE**

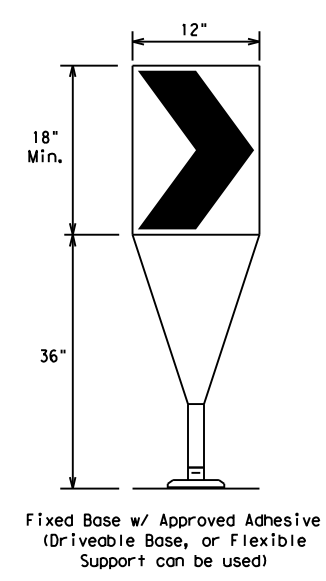
**VERTICAL PANELS (VPs)**

- Vertical Panels (VP's) are normally used to channelize traffic or divide opposing lanes of traffic.
- VP's may be used in daytime or nighttime situations. They may be used at the edge of shoulder drop-offs and other areas such as lane transitions where positive daytime and nighttime delineation is required. The Engineer/Inspector shall refer to the Roadway Design Manual for additional requirements on the use VP's for drop-offs.
- 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 panel is 36 inches or greater, a panel stripe of 6 inches shall be used.



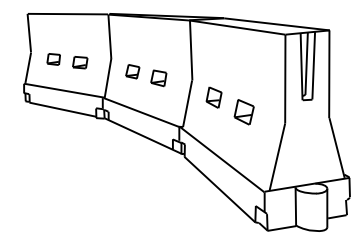
**OPPOSING TRAFFIC LANE DIVIDERS (OTLD)**

- 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<sub>FL</sub> or Type C<sub>FL</sub> conforming to Departmental Material Specification DMS-8300, unless noted otherwise. The legend shall meet the requirements of DMS-8300.



- 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<sub>FL</sub> or Type C<sub>FL</sub> 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 canes and the top of the unit shall not be less than 32 inches in height.

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

**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'

\* \* \* 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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**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.

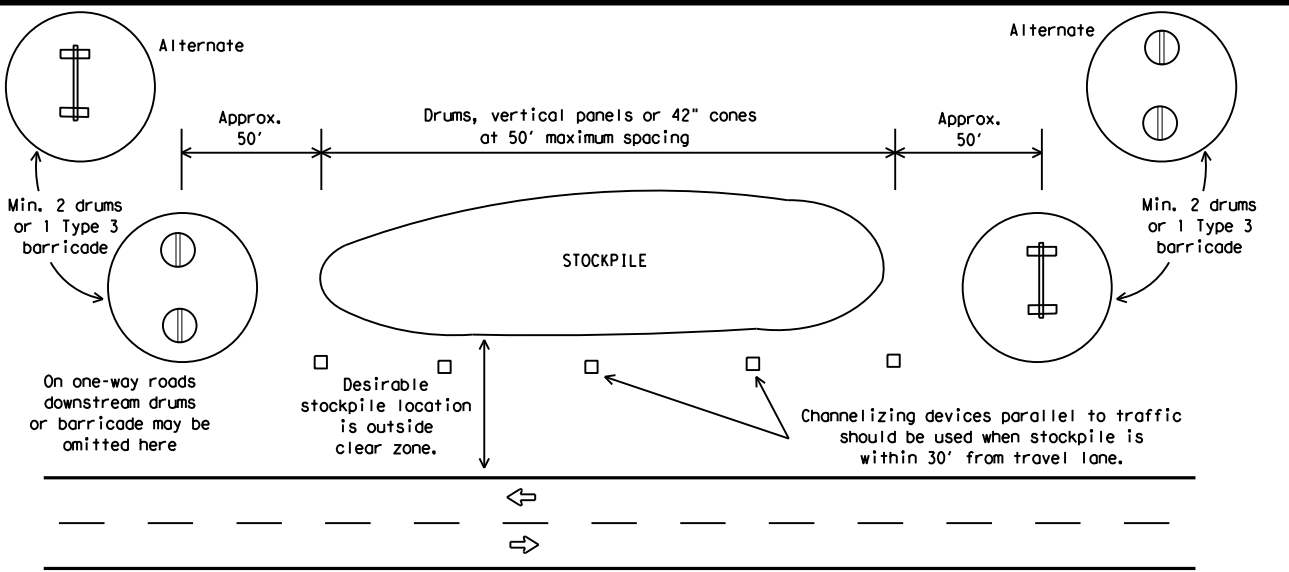
Barricades shall NOT be used as a sign support.



**TYPICAL STRIPING DETAIL FOR BARRICADE RAIL**

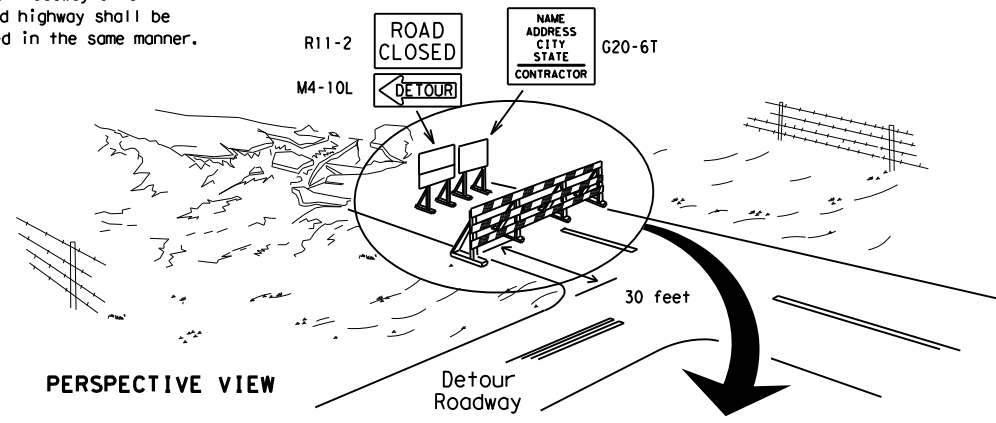


**TYPICAL PANEL DETAIL FOR SKID OR POST TYPE BARRICADES**



**TRAFFIC CONTROL FOR MATERIAL STOCKPILES**

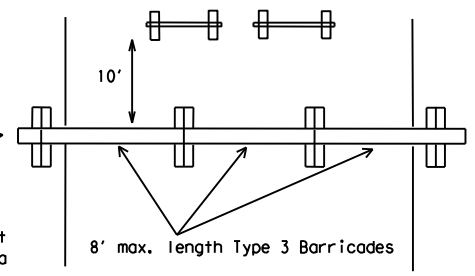
Each roadway of a divided highway shall be barricaded in the same manner.



**PERSPECTIVE VIEW**

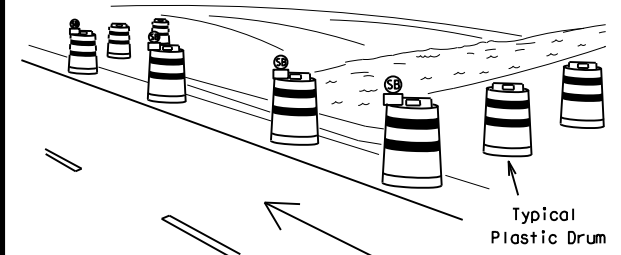
The three rails on Type 3 barricades shall be reflectorized orange and reflective white stripes on one side facing one-way traffic and both sides for two-way traffic. Barricade striping should slant downward in the direction of detour.

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.

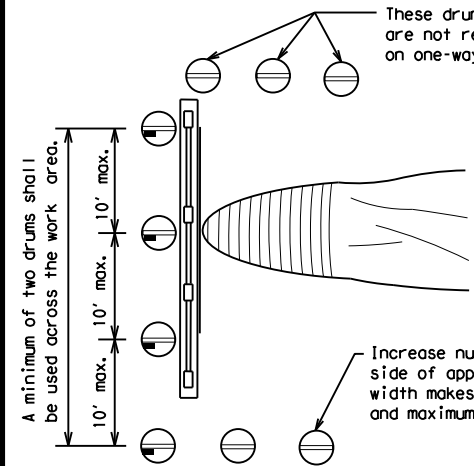


**PLAN VIEW**

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



**PERSPECTIVE VIEW**

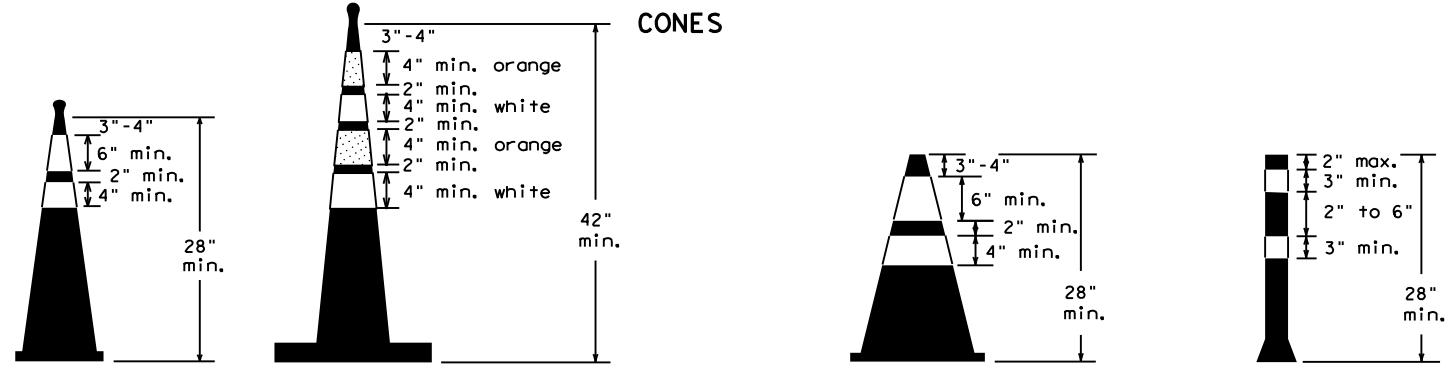


**PLAN VIEW**

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

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



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.

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



**BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES**

**BC(10)-21**

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7-13 5-21	BWD	MILLS	20	

## WORK ZONE PAVEMENT MARKINGS

### GENERAL

- 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.
- Color, patterns and dimensions shall be in conformance with the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD).
- Additional supplemental pavement marking details may be found in the plans or specifications.
- Pavement markings shall be installed in accordance with the TMUTCD and as shown on the plans.
- 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).
- 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.
- All work zone pavement markings shall be installed in accordance with Item 662, "Work Zone Pavement Markings."

### RAISED PAVEMENT MARKERS

- Raised pavement markers are to be placed according to the patterns on BC(12).
- 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

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

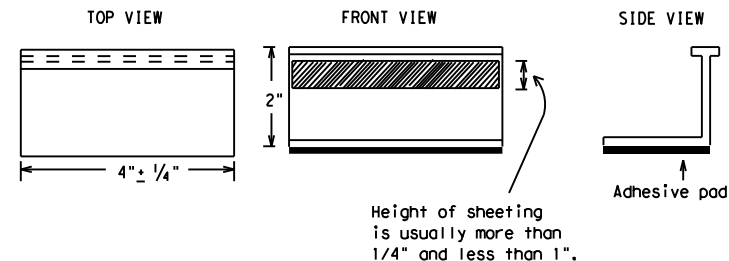
### MAINTAINING WORK ZONE PAVEMENT MARKINGS

- The Contractor will be responsible for maintaining work zone pavement markings within the work limits.
- 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.
- 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.
- 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

- 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.
- 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.
- 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".
- The removal of pavement markings may require resurfacing or seal coating portions of the roadway as described in Item 677.
- Subject to the approval of the Engineer, any method that proves to be successful on a particular type pavement may be used.
- Blast cleaning may be used but will not be required unless specifically shown in the plans.
- Over-painting of the markings SHALL NOT BE permitted.
- Removal of raised pavement markers shall be as directed by the Engineer.
- 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.
- Black-out marking tape may be used to cover conflicting existing markings for periods less than two weeks when approved by the Engineer.

## Temporary Flexible-Reflective Roadway Marker Tabs



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

- Temporary flexible-reflective roadway marker tabs used as guidemarks shall meet the requirements of DMS-8242.
- 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.
  - 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.
  - 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.
- Small design variances may be noted between tab manufacturers.
- 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

- Raised pavement markers used as guidemarks shall be from the approved product list, and meet the requirements of DMS-4200.
- All temporary construction raised pavement markers provided on a project shall be of the same manufacturer.
- 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



## BARRICADE AND CONSTRUCTION PAVEMENT MARKINGS

**BC(11)-21**

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CR: TxDOT
© TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS	1780	01	009	FM 1047
2-98 9-07 5-21	DIST	COUNTY	SHEET NO.	
1-02 7-13	BWD	MILLS	21	
11-02 8-14				

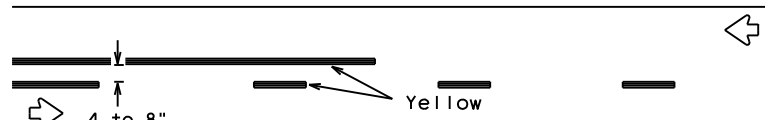
DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

DATE: 1/1/2022 10:48:14 AM  
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## PAVEMENT MARKING PATTERNS

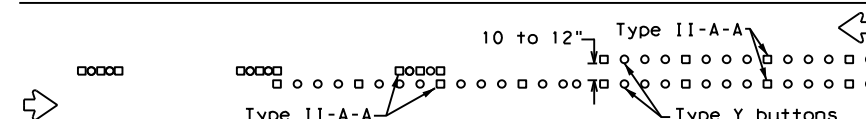


REFLECTORIZED PAVEMENT MARKINGS - PATTERN A

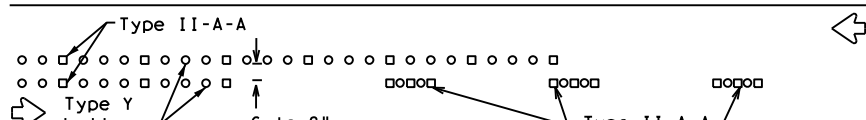


REFLECTORIZED PAVEMENT MARKINGS - PATTERN B

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



RAISED PAVEMENT MARKERS - PATTERN A



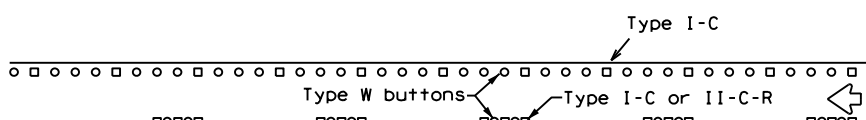
RAISED PAVEMENT MARKERS - PATTERN B

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



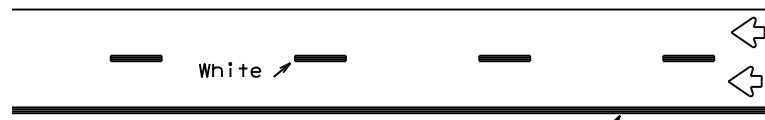
REFLECTORIZED PAVEMENT MARKINGS

Prefabricated markings may be substituted for reflectORIZED pavement markings.



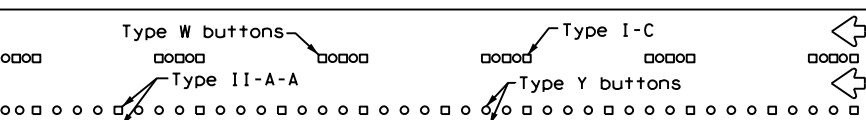
RAISED PAVEMENT MARKERS

## EDGE & LANE LINES FOR DIVIDED HIGHWAY



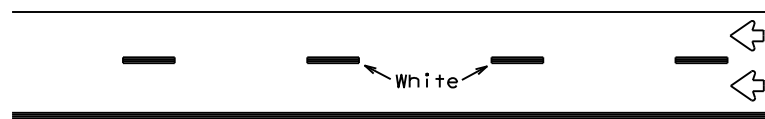
REFLECTORIZED PAVEMENT MARKINGS

Prefabricated markings may be substituted for reflectORIZED pavement markings.



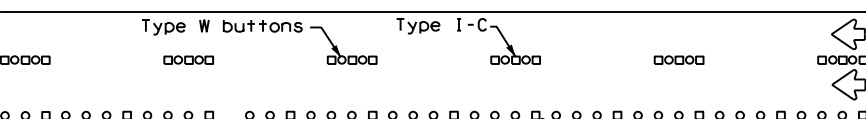
RAISED PAVEMENT MARKERS

## LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



REFLECTORIZED PAVEMENT MARKINGS

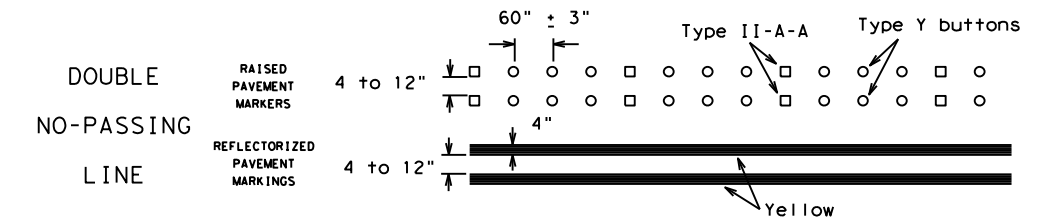
Prefabricated markings may be substituted for reflectORIZED pavement markings.



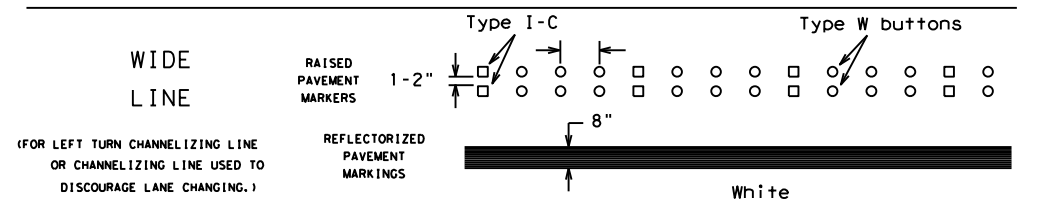
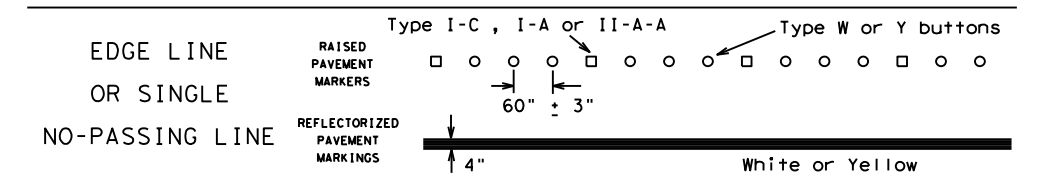
RAISED PAVEMENT MARKERS

## TWO-WAY LEFT TURN LANE

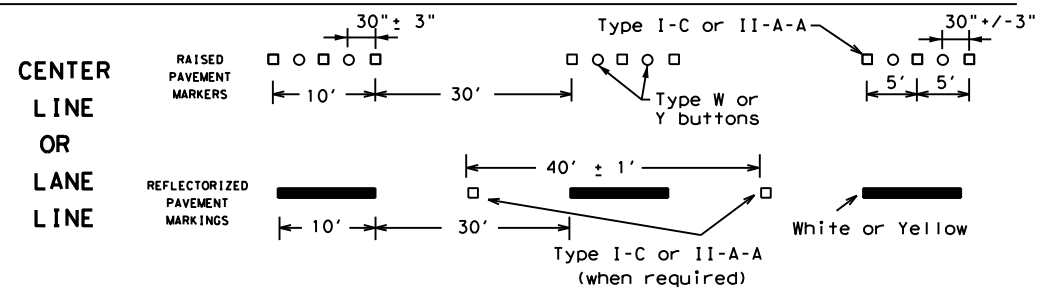
## STANDARD WORK ZONE PAVEMENT MARKINGS DETAILS



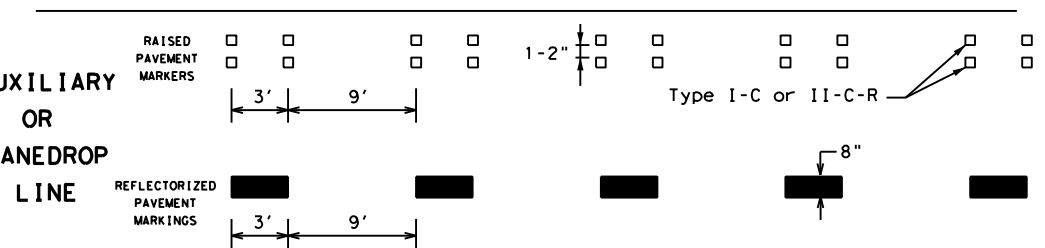
### SOLID LINES



### BROKEN LINES

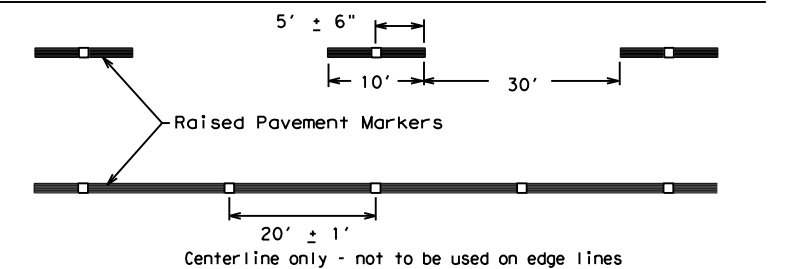


### AUXILIARY OR LANEDROP LINE



### 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

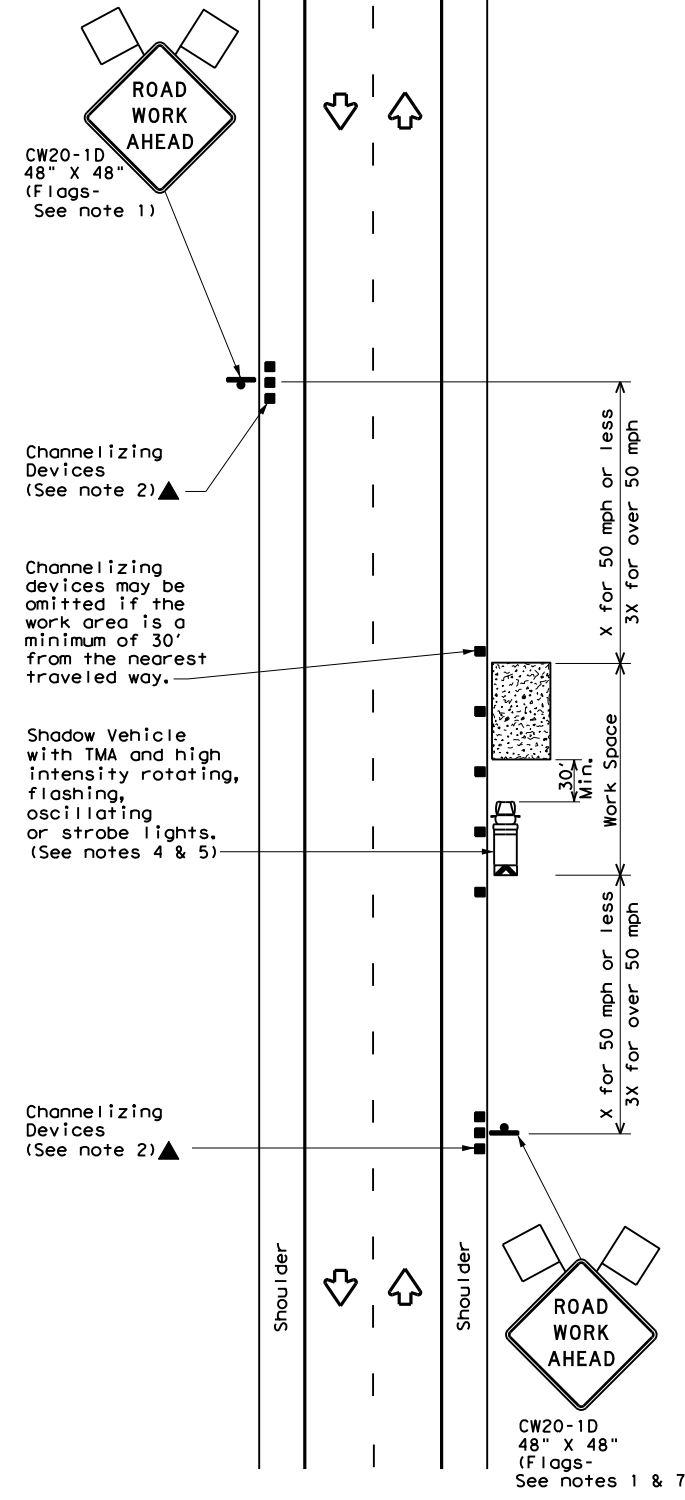
BC(12)-21

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©TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS	1780	01	009	FM 1047
1-97 9-07 5-21				
2-98 7-13				
11-02 8-14	DIST	COUNTY	SHEET NO.	
	BWD	MILLS	22	

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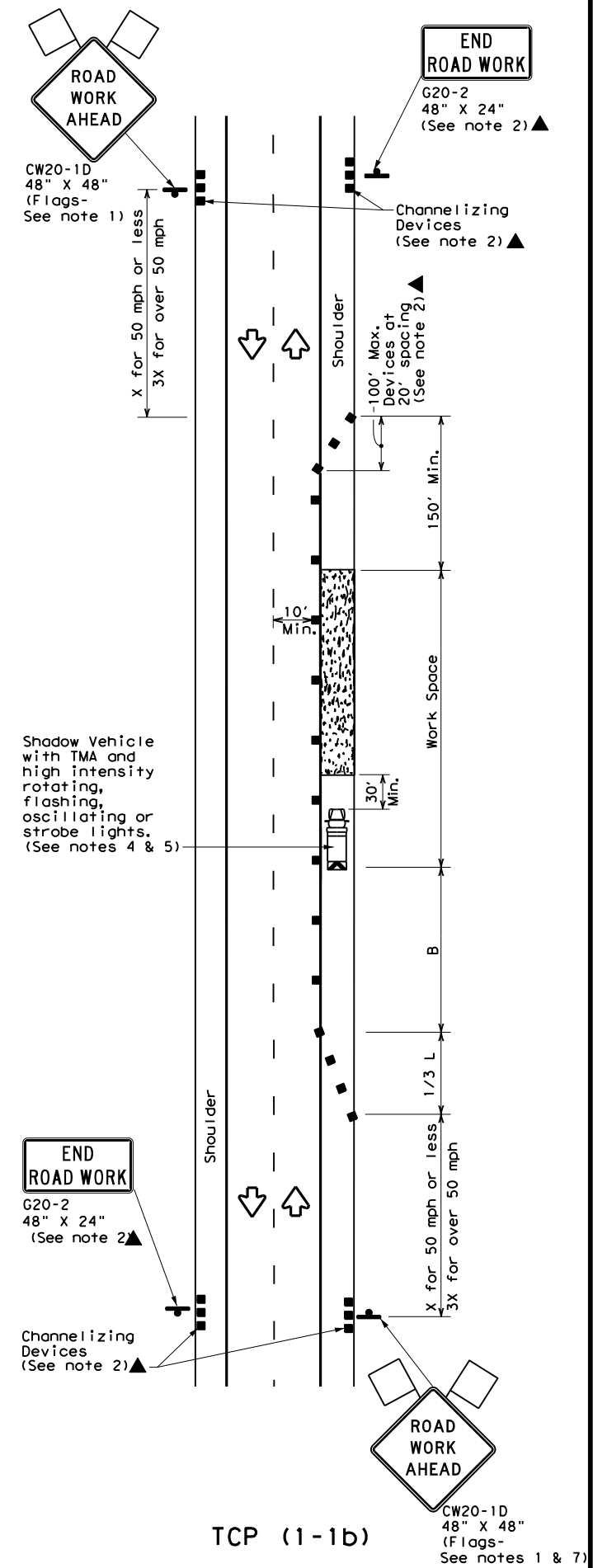
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DATE: 1/1/2022 10:48:16 AM  
 FILE: T:\BWDSDGTEAM\Design Projects\Mills\1780-01-009 FM 1047 Bennett Branch\Traffic Control Plans\TC1-18.dgn  
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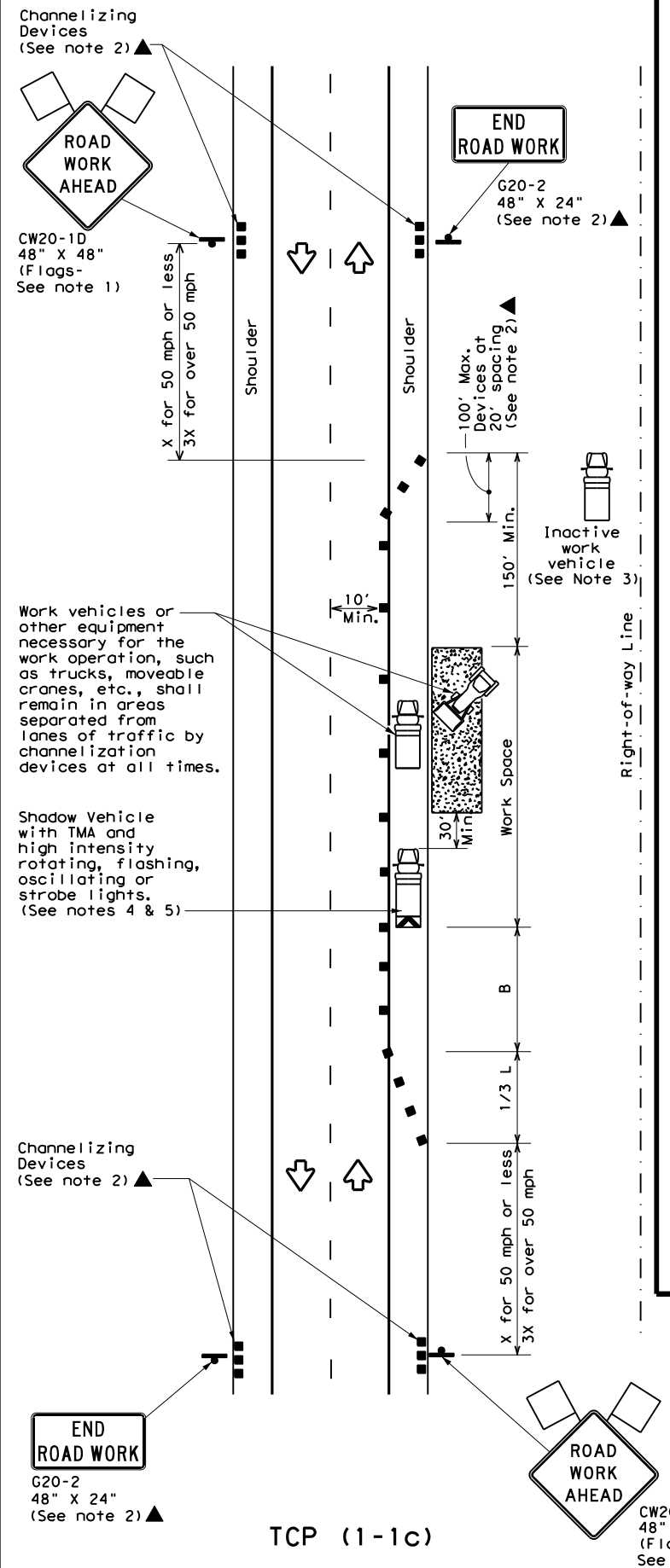
TCP (1-1a)

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

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

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

- GENERAL NOTES**
- 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**

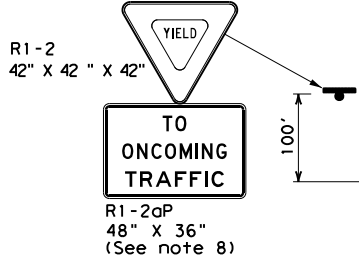
**TCP (1-1) - 18**

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© TxDOT December 1985	CON:	SECT:	JOB:	HIGHWAY:
REVISIONS	1780	01	009	FM 1047
2-94 4-98	DIST:	COUNTY:	SHEET NO.:	
8-95 2-12	BWD	MILLS	23	
1-97 2-18				

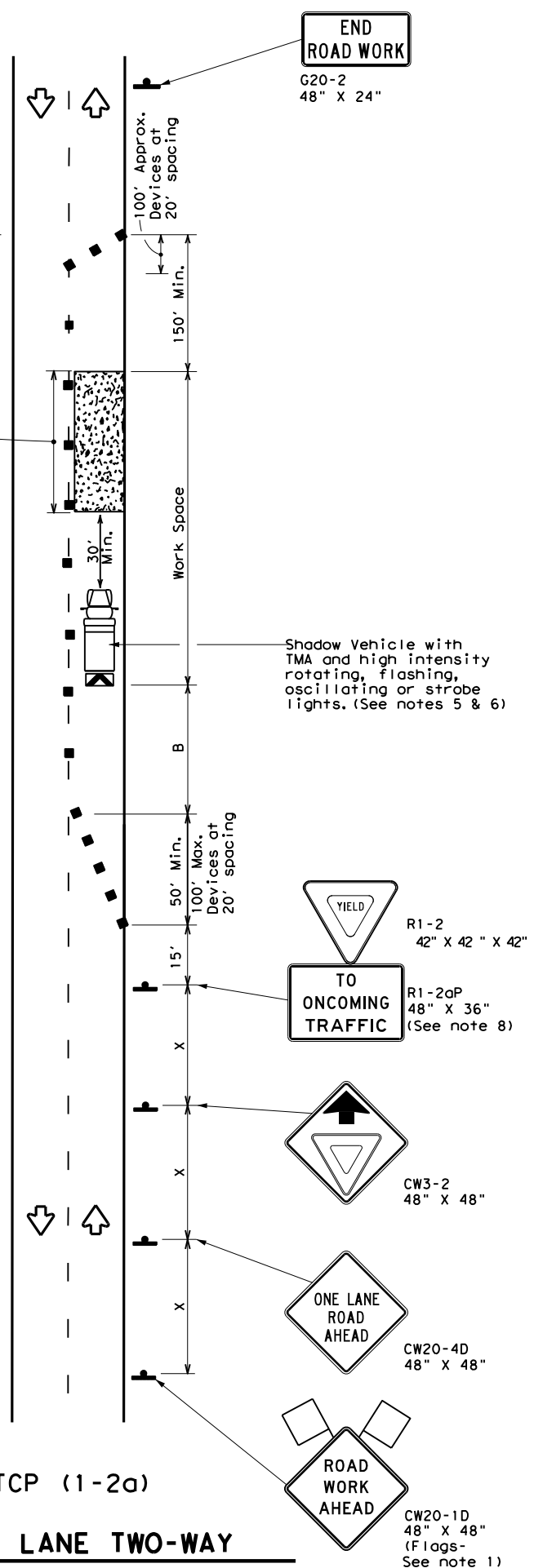
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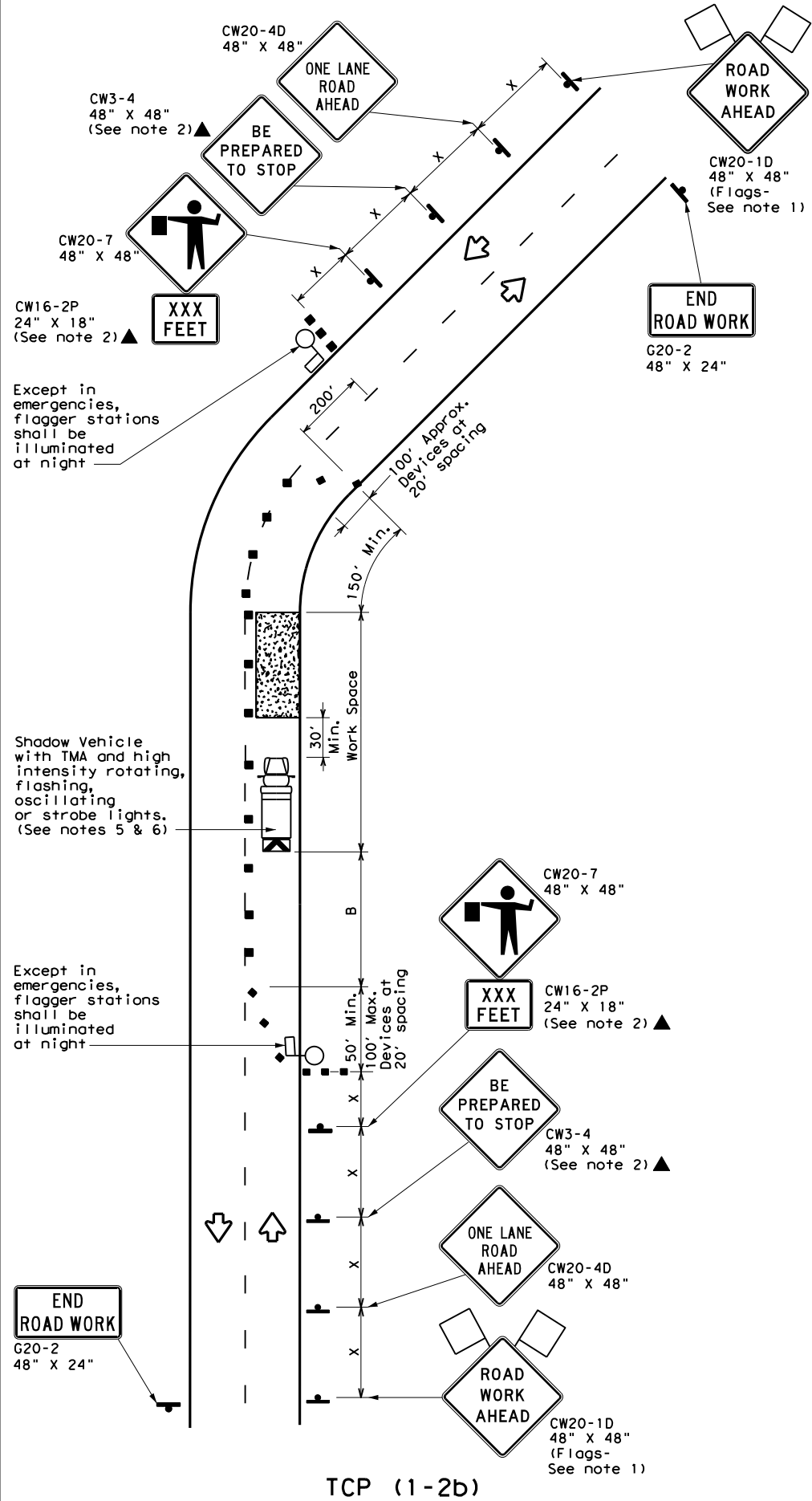
Warning Sign Sequence in Opposite Direction Same as Below



Channelizing devices separate work space from traveled way



**TCP (1-2a)**  
**ONE LANE TWO-WAY CONTROL WITH YIELD SIGNS**  
 (Less than 2000 ADT - See note 7)



**TCP (1-2b)**  
**ONE LANE TWO-WAY CONTROL WITH FLAGGERS**

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

Posted Speed * X	Formula L = WS <sup>2</sup> / 60	Minimum Desirable Taper Lengths **			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		150'	165'	180'	30'	60'	120'	90'	200'
35		205'	225'	245'	35'	70'	160'	120'	250'
40		265'	295'	320'	40'	80'	240'	155'	305'
45	L = WS	450'	495'	540'	45'	90'	320'	195'	360'
50		500'	550'	600'	50'	100'	400'	240'	425'
55		550'	605'	660'	55'	110'	500'	295'	495'
60		600'	660'	720'	60'	120'	600'	350'	570'
65		650'	715'	780'	65'	130'	700'	410'	645'
70		700'	770'	840'	70'	140'	800'	475'	730'
75		750'	825'	900'	75'	150'	900'	540'	820'

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

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

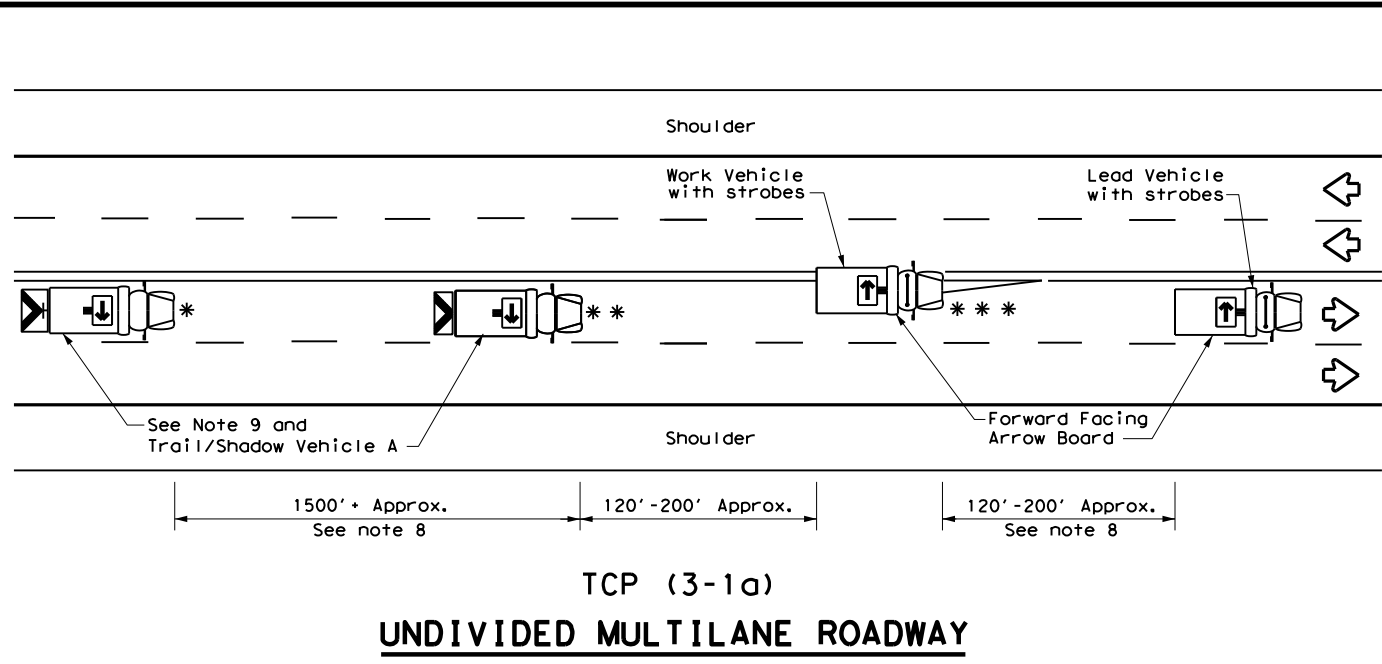
**GENERAL NOTES**

- 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 150 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 R1-2aP "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.

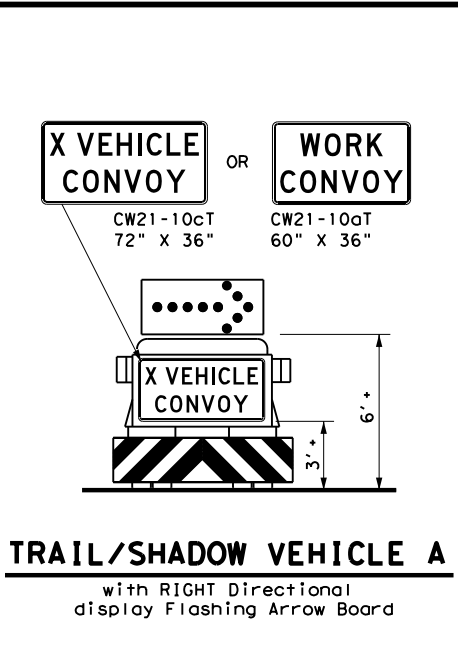
		Traffic Operations Division Standard	
<b>TRAFFIC CONTROL PLAN</b> <b>ONE-LANE TWO-WAY</b> <b>TRAFFIC CONTROL</b>			
<b>TCP (1-2) - 18</b>			
FILE: tcp1-2-18.dgn	DN: 1780	CK: 01	DW: 009
© TxDOT December 1985	REVISIONS	SECT	JOB
4-90 4-98	1780	01	009
2-94 2-12			FM 1047
1-97 2-18			
	DIST	COUNTY	SHEET NO.
	BWD	MILLS	24

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DATE: 1/11/2022 10:48:18 AM  
 FILE: T:\BWDSDTEAM\Design Projects\M111s\1780-01-009\_FM 1047 Bennett Branch\Traffic Control Plan\1780-01-009-FM 1047.dgn



TCP (3-1a)  
**UNDIVIDED MULTILANE ROADWAY**



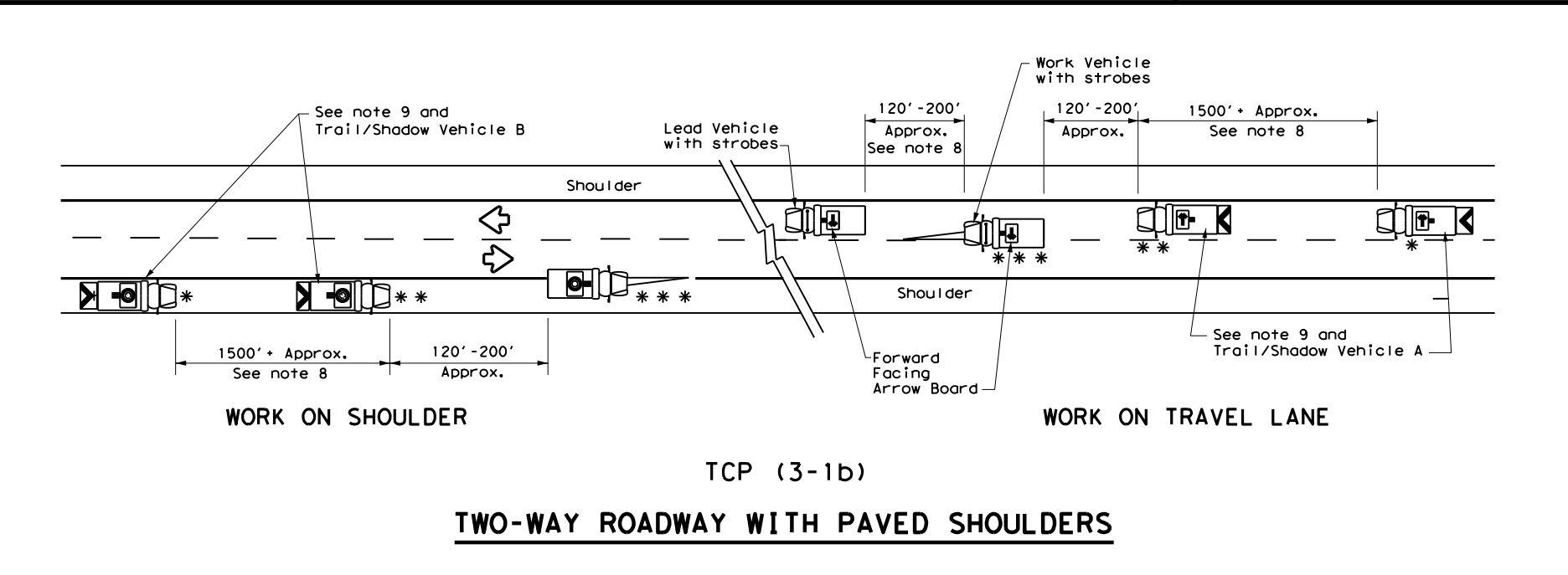
**TRAIL/SHADOW VEHICLE A**  
 with RIGHT Directional display Flashing Arrow Board

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

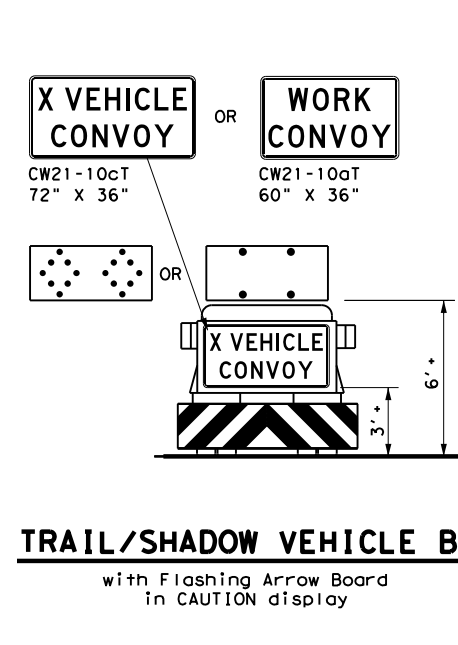
TYPICAL USAGE				
MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
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**GENERAL NOTES**

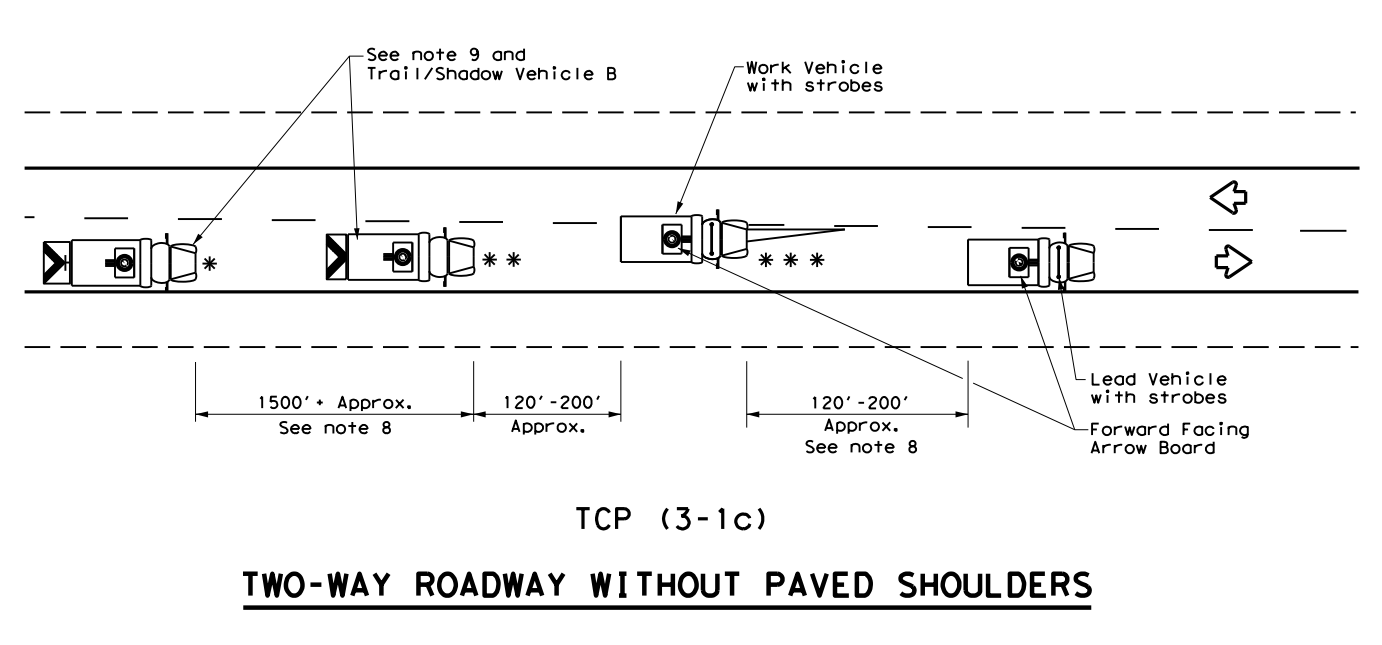
1. TRAIL, SHADOW, and LEAD vehicles shall be equipped with arrow boards as illustrated. When a LEAD vehicle is not used the WORK vehicle must be equipped with an arrow board. The Engineer will determine if the LEAD VEHICLE and/or TRAIL VEHICLE are required based on prevailing roadway conditions, traffic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



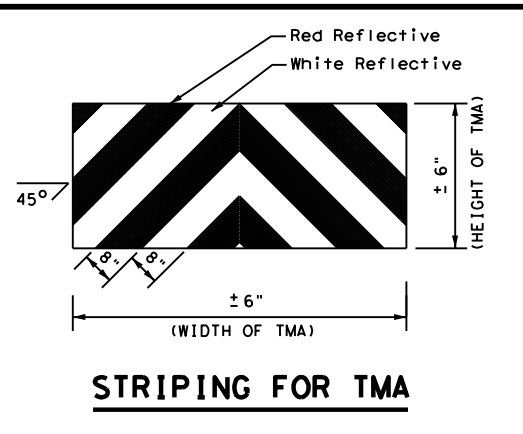
TCP (3-1b)  
**TWO-WAY ROADWAY WITH PAVED SHOULDERS**



**TRAIL/SHADOW VEHICLE B**  
 with Flashing Arrow Board in CAUTION display



TCP (3-1c)  
**TWO-WAY ROADWAY WITHOUT PAVED SHOULDERS**



**STRIPING FOR TMA**

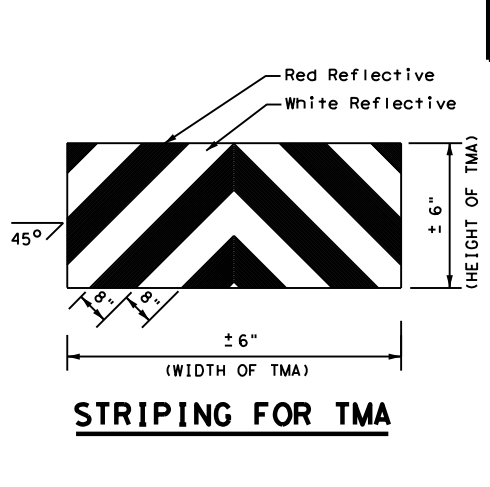
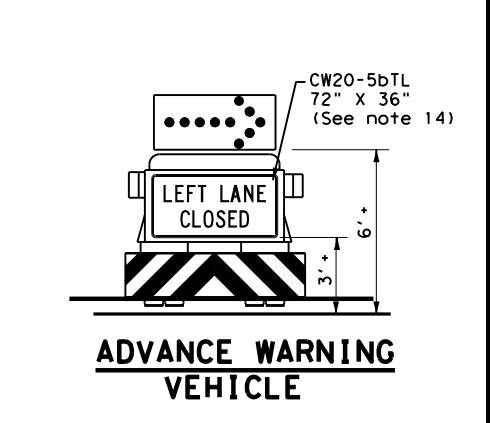
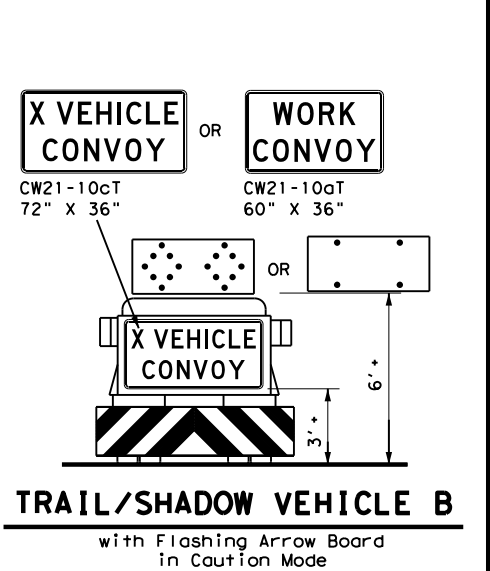
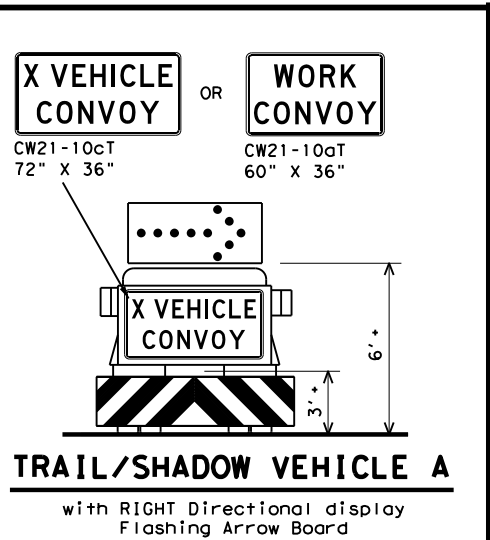
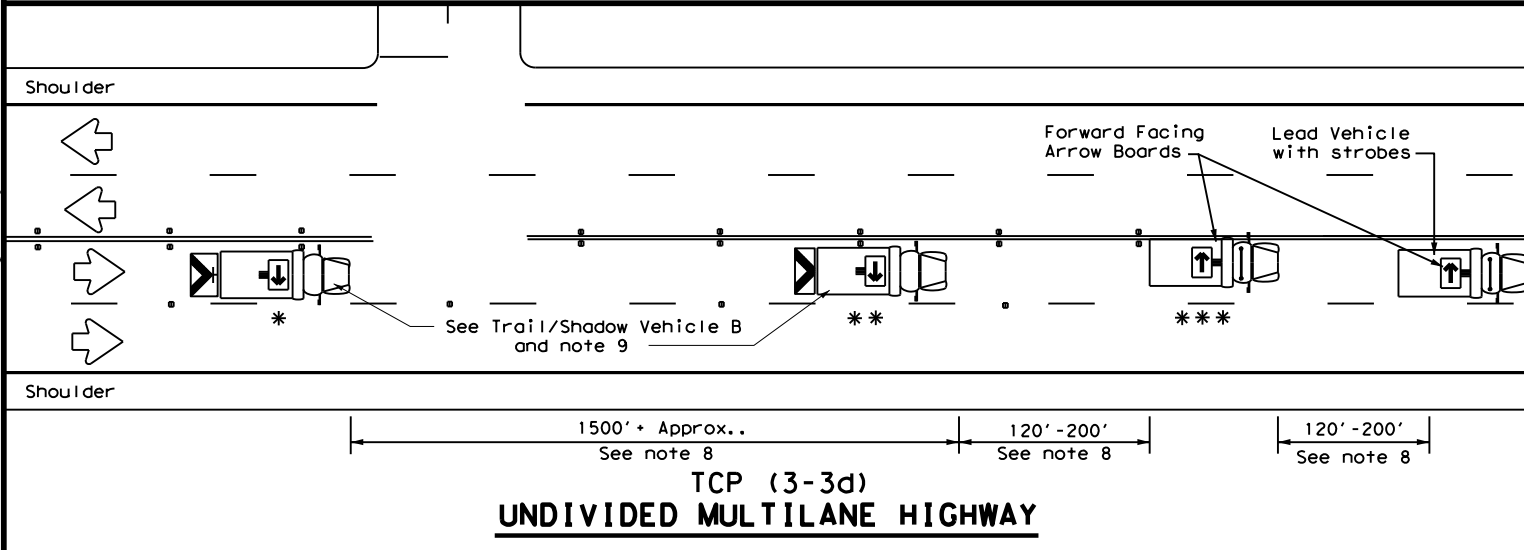
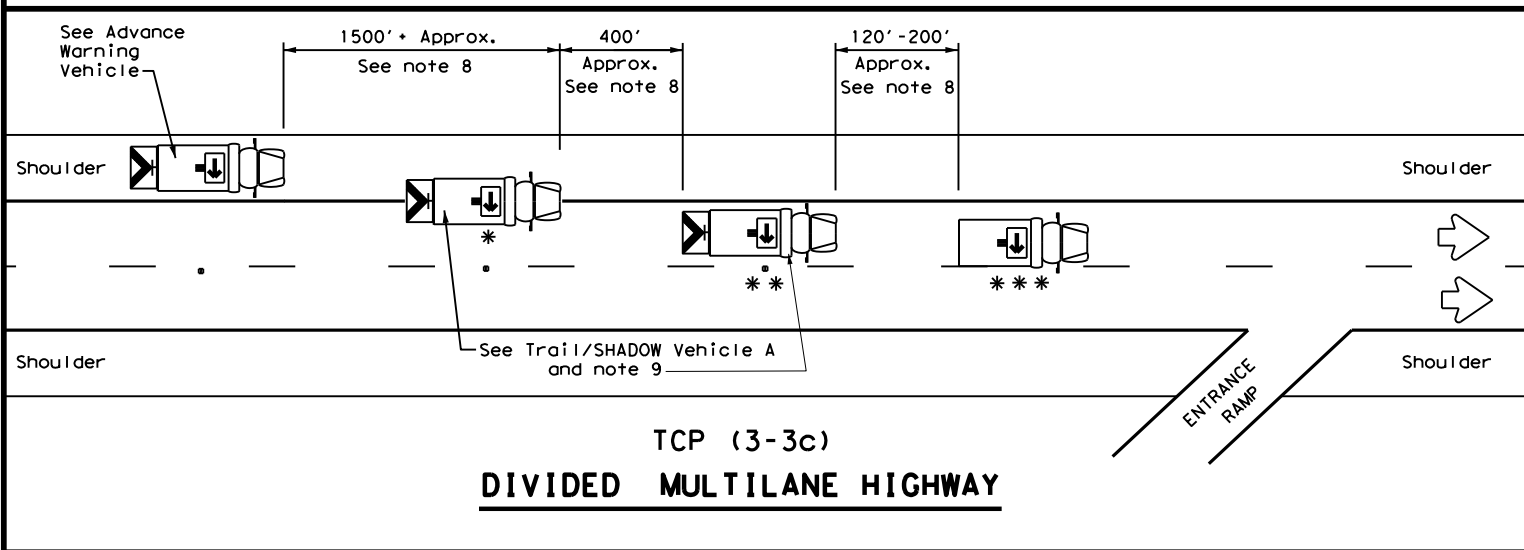
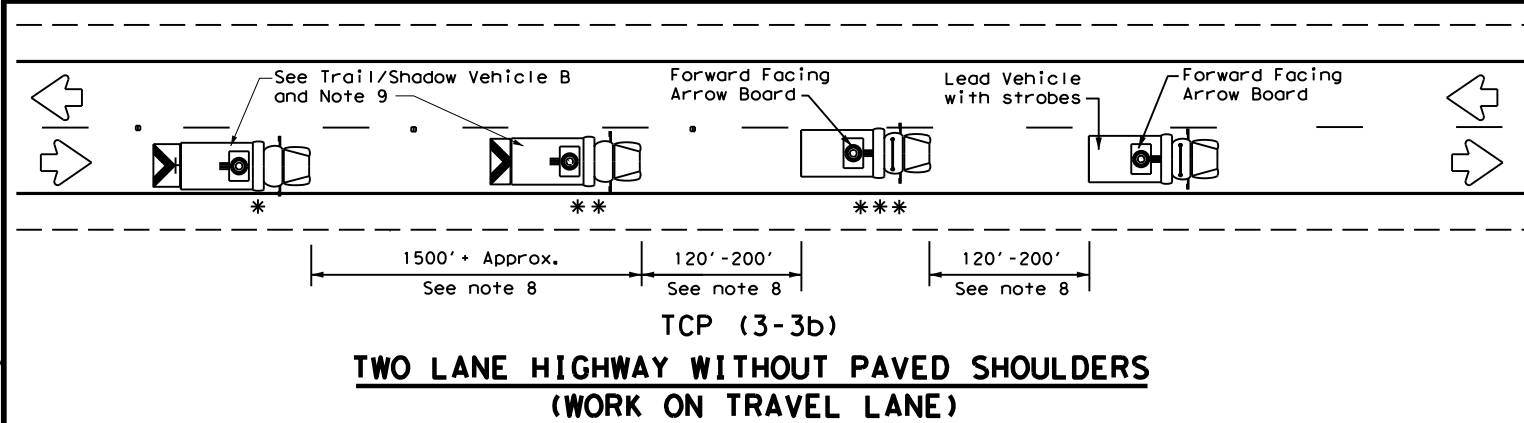
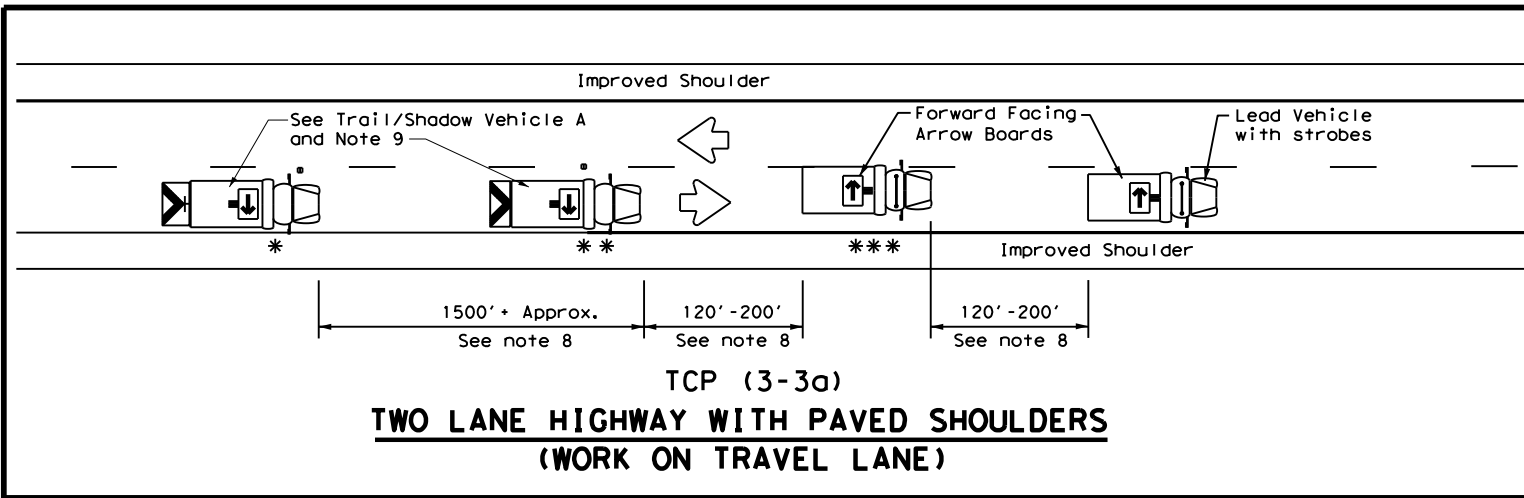
Texas Department of Transportation  
 Traffic Operations Division Standard

**TRAFFIC CONTROL PLAN  
 MOBILE OPERATIONS  
 UNDIVIDED HIGHWAYS**

**TCP (3-1) - 13**

FILE: tcp3-1.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS	1780	01	009	FM 1047
2-94 4-98	DIST	COUNTY	SHEET NO.	
8-95 7-13	BWD	MILLS	25	
1-97				

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LEGEND		
* Trail Vehicle	ARROW BOARD DISPLAY	
** Shadow Vehicle		
*** Work Vehicle		RIGHT Directional
		LEFT Directional
		Double Arrow
		CAUTION (Alternating Diamond or 4 Corner Flash)

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

**GENERAL NOTES**

- TRAIL, SHADOW, and LEAD vehicles shall be equipped with arrow boards as illustrated. When a LEAD vehicle is not used on two way roads the WORK vehicle must have an arrow board. For divided roadways, the arrow board on the WORK vehicle is optional based on the type of work being performed. The Engineer will determine if the LEAD vehicle and/or TRAIL vehicle are required based on prevailing roadway conditions, traffic volume, and sight distance restrictions.
- The use of amber high intensity rotating, flashing, oscillating, or strobe lights on vehicles are required. Blue high intensity rotating, flashing, oscillating, or strobe lights when mounted on the driver's side of the vehicle may be operated simultaneously with the amber beacons or strobe lights.
- The use of truck mounted attenuators (TMA) on the SHADOW VEHICLE, ADVANCE WARNING and TRAIL VEHICLE are required.
- Reflective sheeting on the rear of the TMA shall meet or exceed the reflectivity and color requirements of DEPARTMENTAL MATERIAL SPECIFICATION DMS 8300, Type A.
- Flashing arrow boards shall be Type B or Type C as per the Barricade and Construction (BC) standards. The board shall be controlled from inside the vehicle.
- Each vehicle shall have two-way radio communication capability.
- When work convoys must change lanes, the TRAIL VEHICLE should change lanes first to shadow the other convoy vehicles.
- Vehicle spacing between the TRAIL VEHICLE and the SHADOW VEHICLE will vary depending on sight distance restrictions. Motorists approaching the convoy should be able to see the TRAIL VEHICLE in time to slow down and/or change lanes as they approach the TRAIL VEHICLE. Vehicle spacing between the WORK VEHICLE and SHADOW VEHICLE and vehicle spacing between WORK VEHICLE and LEAD VEHICLE may vary according to terrain, work activity and other factors.
- X VEHICLE CONVOY (CW21-10cT) or WORK CONVOY (CW21-10aT) signs shall be used on TRAIL VEHICLES and SHADOW VEHICLES as shown. As an option 48" x 48" diamond shaped WORK CONVOY (CW21-10T) or X VEHICLE CONVOY (CW21-10bT) signs may be used where adequate mounting space exists. When used, the X VEHICLE CONVOY sign shall have the number of the convoy vehicles displayed on the sign in the number designation "X" location. The X VEHICLE CONVOY sign shall not be used on the SHADOW VEHICLE if a TRAIL VEHICLE is used.
- For divided highways with two or three lanes in one direction, the appropriate LEFT LANE CLOSED (CW20-5bTL), RIGHT LANE CLOSED (CW20-5bTR), or CENTER LANE CLOSED (CW20-5dT) sign should be used on the Advance Warning Vehicle. As an option, a portable changeable message sign (PCMS) or truck mounted changeable message sign (TMCMS) with a minimum character height of 12", and displaying the same legend may be substituted for these signs. An appropriate directional arrow display, simulating the size and legibility of the flashing arrow board may be used in the second phase of the PCMS/TMCMS message. When this is done, the arrow board will not be required on the Advance Warning Vehicle.
- A double arrow shall not be displayed on the arrow board on the Advance Warning Vehicle.
- For divided highways with three or four lanes in each direction, use TCP(3-2).
- Standard diamond shape versions of the CW20-5 series signs may be used as an option if the rectangular signs shown are not available.
- The Advance Warning Vehicle may straddle the edgeline when Shoulder width makes it necessary.
- On two-lane two-way roadways, the work and protection vehicles should pull over periodically to allow motor vehicle traffic to pass. If motorists are not allowed to pass the work convoy, a DO NOT PASS (R4-1) sign should be placed on the back of the rearmost protection vehicle.

Texas Department of Transportation

Traffic Operations Division Standard

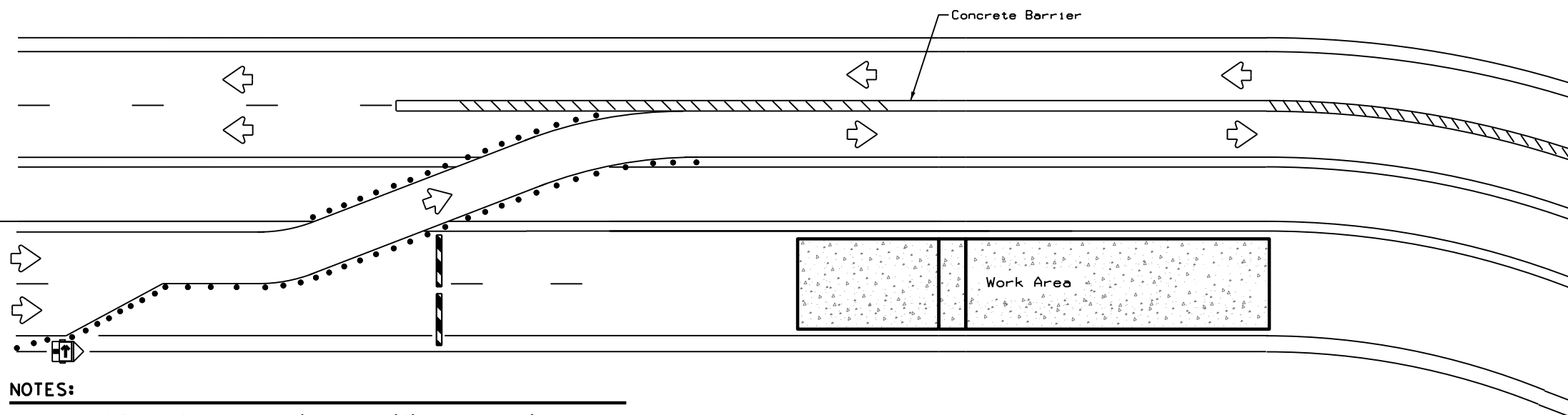
## TRAFFIC CONTROL PLAN MOBILE OPERATIONS RAISED PAVEMENT MARKER INSTALLATION/ REMOVAL TCP (3-3) - 14

FILE: tcp3-3.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT September 1987	CONT	SECT	JOB	HIGHWAY
REVISIONS	1780	01	009	FM 1047
2-94 4-98	DIST	COUNTY	SHEET NO.	
8-95 7-13	BWD	MILLS	26	
1-97 7-14				





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LEGEND	
	Type 3 Barricade
	Channelizing Devices
	Trailer Mounted Flashing Arrow Board
	Sign
	Safety glare screen

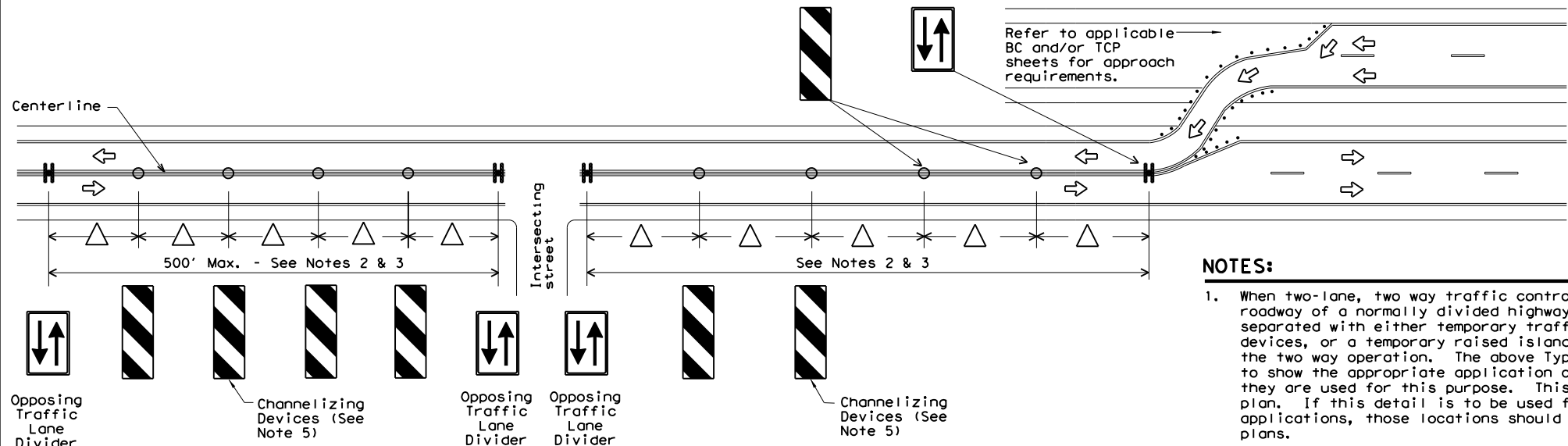
DEPARTMENTAL MATERIAL SPECIFICATIONS	
SIGN FACE MATERIALS	DMS-8300
DELINEATORS AND OBJECT MARKERS	DMS-8600
MODULAR GLARE SCREENS FOR HEADLIGHT BARRIER	DMS-8610

Only pre-qualified products shall be used. A copy of the Compliant Work Zone Traffic Control Devices List" (CWZTCD) describes pre-qualified products and their sources and may be found at the following web address:  
  
<http://www.txdot.gov/business/resources/producer-list.html>

**NOTES:**

- Length of Safety Glare screen will be specified elsewhere in the plans.
- The cumulative nominal length of the modular safety glare screen units shall equal the length of the individual sections of temporary concrete traffic barrier on which they are installed so the joint between barrier sections will not be spanned by any one safety glare screen unit.
- Screen Panel/blades will be designed such that reflective sheeting conforming with Departmental Material Specification DMS-8300, Sign Face Materials, Type B or C Yellow, minimum size of 2 inches by 12 inches can be attached to the edge of the panel/blade. The sheeting shall be attached to one glare screen panel/blade per section of concrete barrier not to exceed a spacing of 30 feet. Barrier reflectors are not necessary when panel/blades are installed with reflective sheeting as described.
- Payment for these devices will be under statewide Special Specification "Modular Glare Screens for Headlight Barrier."
- This detail is only intended to show types of locations where Glare Screens would be appropriate. Required signing and other devices shall be as shown elsewhere in the plans.

**BARRIER DELINEATION WITH MODULAR GLARE SCREENS**



**NOTES:**

- When two-lane, two way traffic control must be maintained on one roadway of a normally divided highway, opposing traffic shall be separated with either temporary traffic barriers, channelizing devices, or a temporary raised island throughout the length of the two way operation. The above Typical Application is intended to show the appropriate application of channelizing devices when they are used for this purpose. This is not a traffic control plan. If this detail is to be used for other types of roads or applications, those locations should be stated elsewhere in the plans.
- Space devices according to the Tangent Spacing shown on the Device Spacing table on BC(9) but not exceeding 100'.
- Every fifth device should be an OTLD except when spaced closer to accommodate an intersection. An OTLD should be the first device on each side of intersecting streets or roads.
- Locations where surface mount bases with adhesives or self-righting devices will be required in order to maintain them in their proper position should be noted elsewhere in the plans.
- Channelizing devices are to be vertical panels, 42" cones or tubular markers that are at least 36" tall. Tubular markers used to separate traffic should have a rubber base weighing at least 30 pounds. Tubular markers that are 42" tall or more shall have four bands of reflective material as detailed for 42" cones on BC(10). Tubular markers less than 42" but at least 36" tall shall have three bands of 3" wide white reflective material spaced 2" apart. Reflective material shall meet DMS-8300, Type A.

**VERTICAL PANELS & OPPOSING TRAFFIC LANE DIVIDERS (OTLD) SEPARATING TWO-WAY TRAFFIC ON NORMALLY DIVIDED HIGHWAYS**

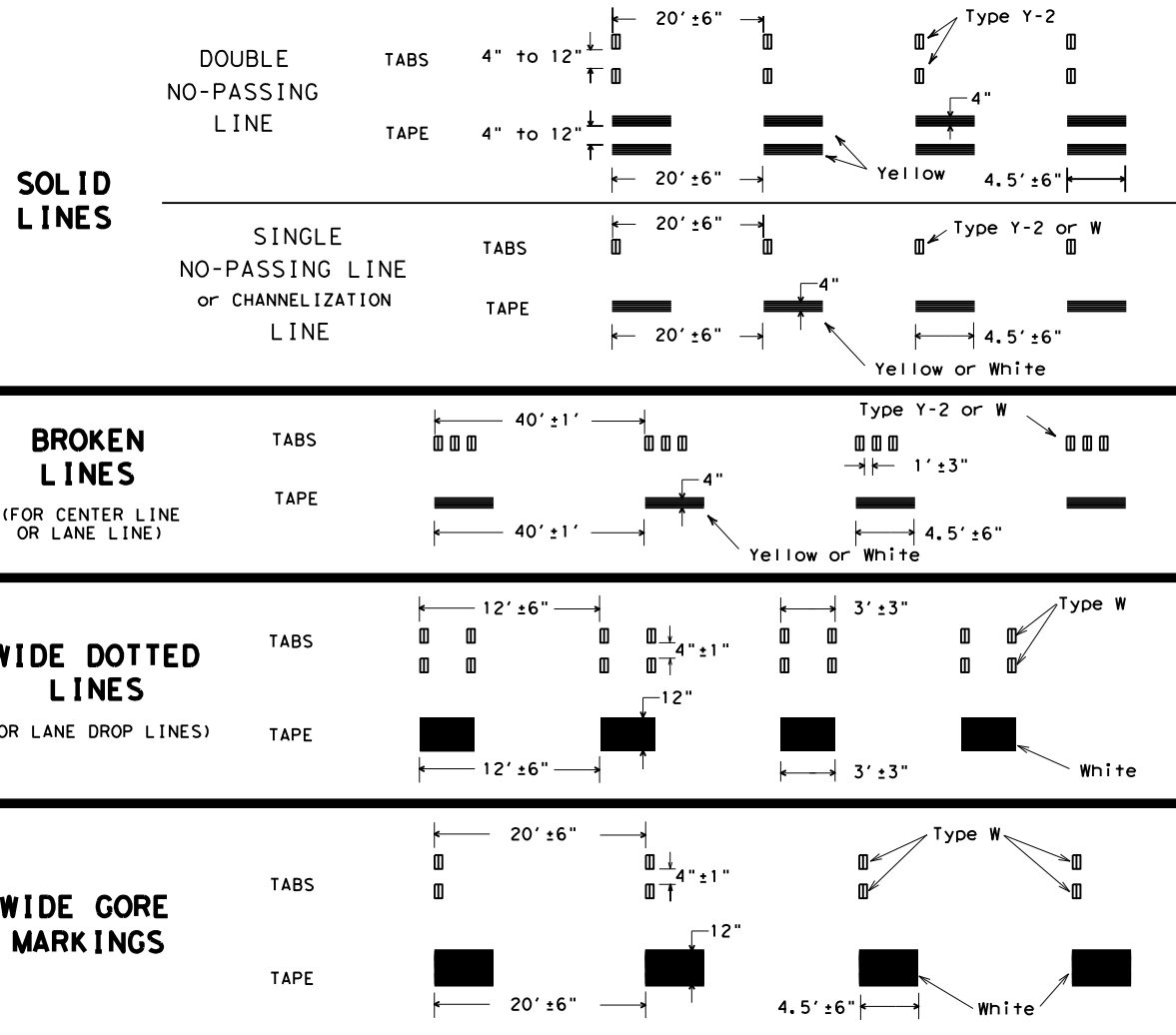
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<b>TRAFFIC CONTROL PLAN TYPICAL DETAILS</b>			
<b>WZ(TD) - 17</b>			
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© TxDOT	February 1998	CK:	TxDOT
REVISIONS		OW:	TxDOT
4-98	2-17	CONT	SECT
3-03		1780	01
7-13		JOB	009
		HIGHWAY	FM 1047
		DIST	COUNTY
		BWD	MILLS
		SHEET NO.	28



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## WORK ZONE SHORT TERM PAVEMENT MARKINGS DETAILS



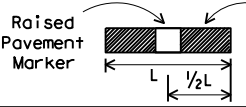
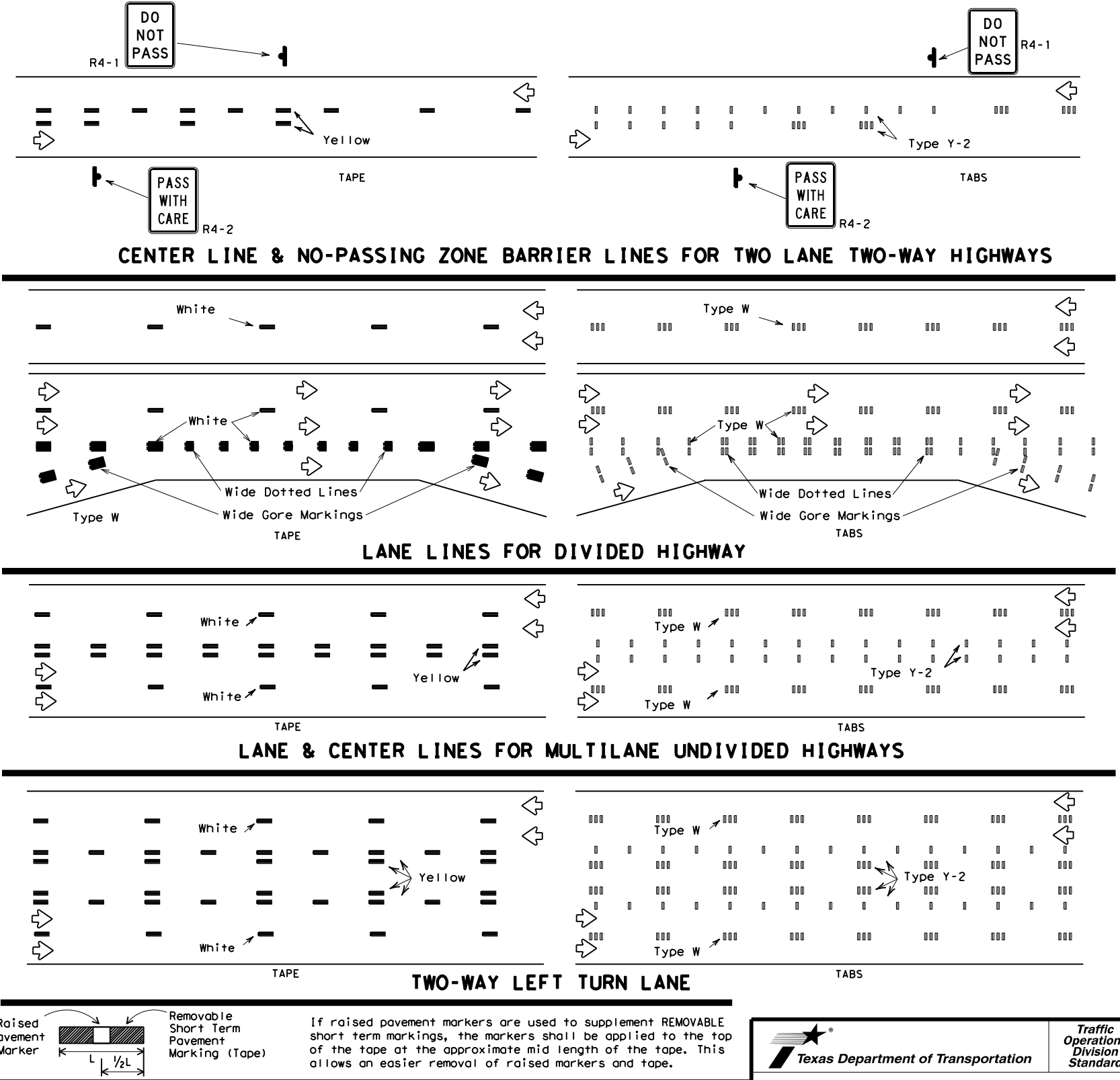
### NOTES:

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

### TEMPORARY FLEXIBLE, REFLECTIVE ROADWAY MARKER TABS (TABS)

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

## WORK ZONE SHORT TERM PAVEMENT MARKINGS PATTERNS



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

### PREFABRICATED PAVEMENT MARKINGS

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

### RAISED PAVEMENT MARKERS

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

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

- DMSs referenced above can be found along with embedded links to their respective MPLs at the following website:  
[http://www.txdot.gov/business/contractors\\_consultants/material\\_specifications/default.htm](http://www.txdot.gov/business/contractors_consultants/material_specifications/default.htm)



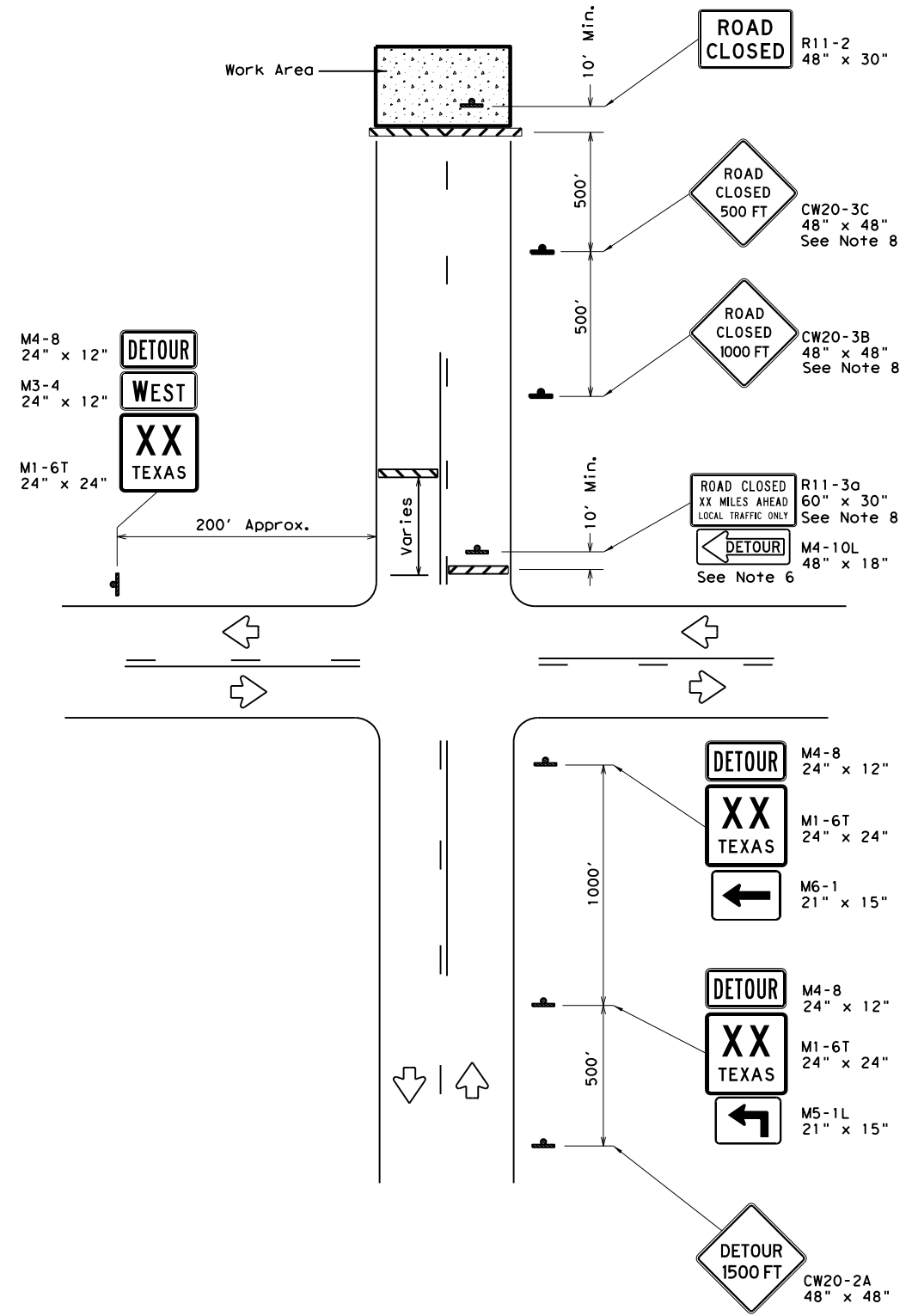
## WORK ZONE SHORT TERM PAVEMENT MARKINGS

### WZ (STPM) - 13

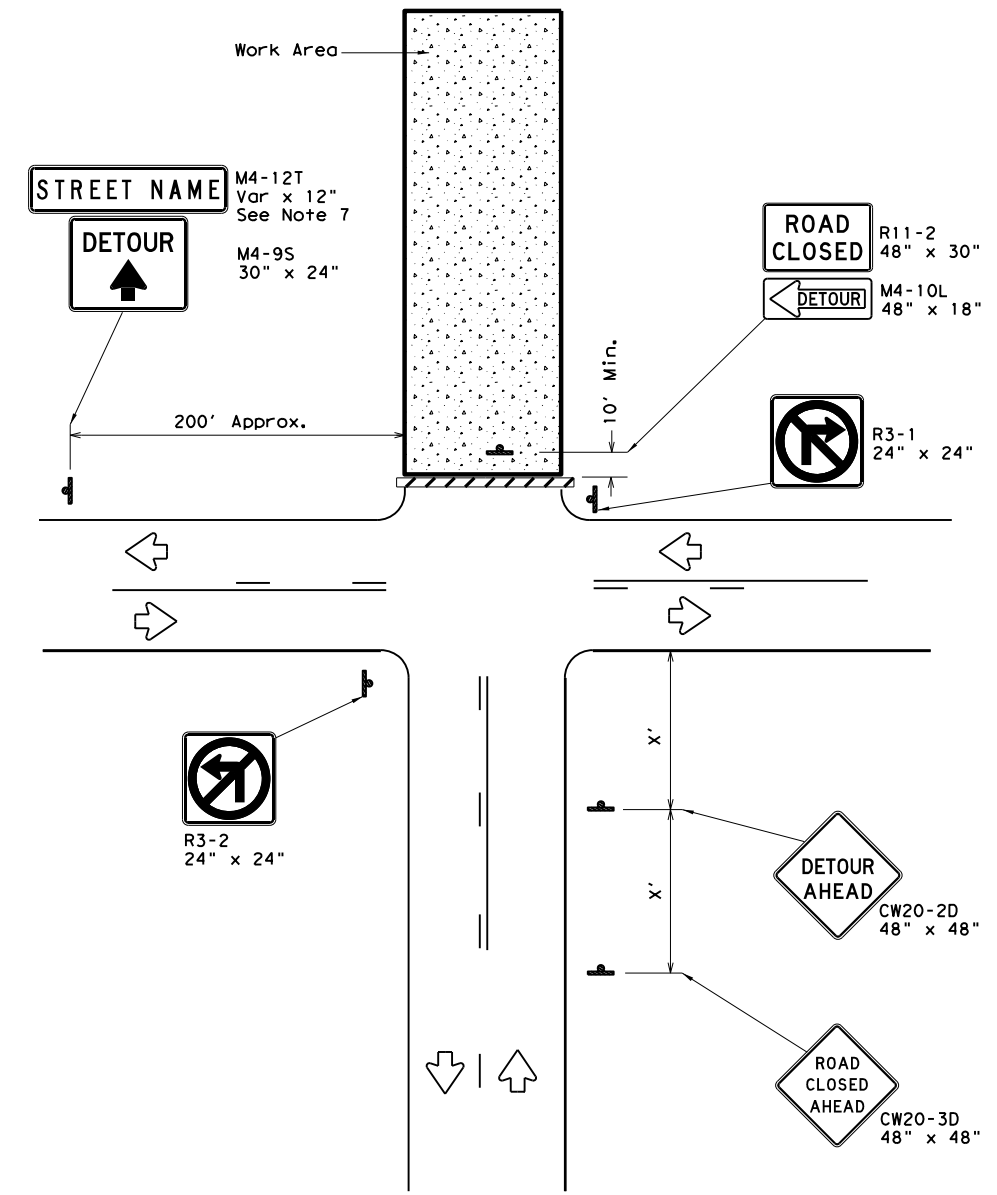
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© TxDOT	April 1992	CONT	1780	SECT	01	JOB	009	HIGHWAY	FM 1047
REVISIONS		DIST	BWD	COUNTY	MILLS	SHEET NO.	30		

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**ROAD CLOSURE BEYOND THE INTERSECTION**  
 Signing for a Numbered Route with an Off-Site Detour



**ROAD CLOSURE AT THE INTERSECTION**  
 Signing for an Un-numbered Route with an Off-Site Detour

LEGEND	
	Type 3 Barricade
	Sign

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

\* Conventional Roads Only

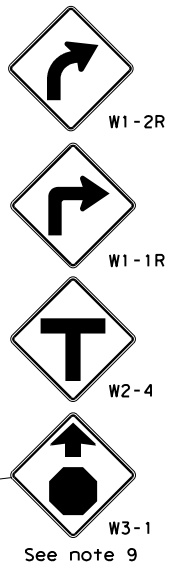
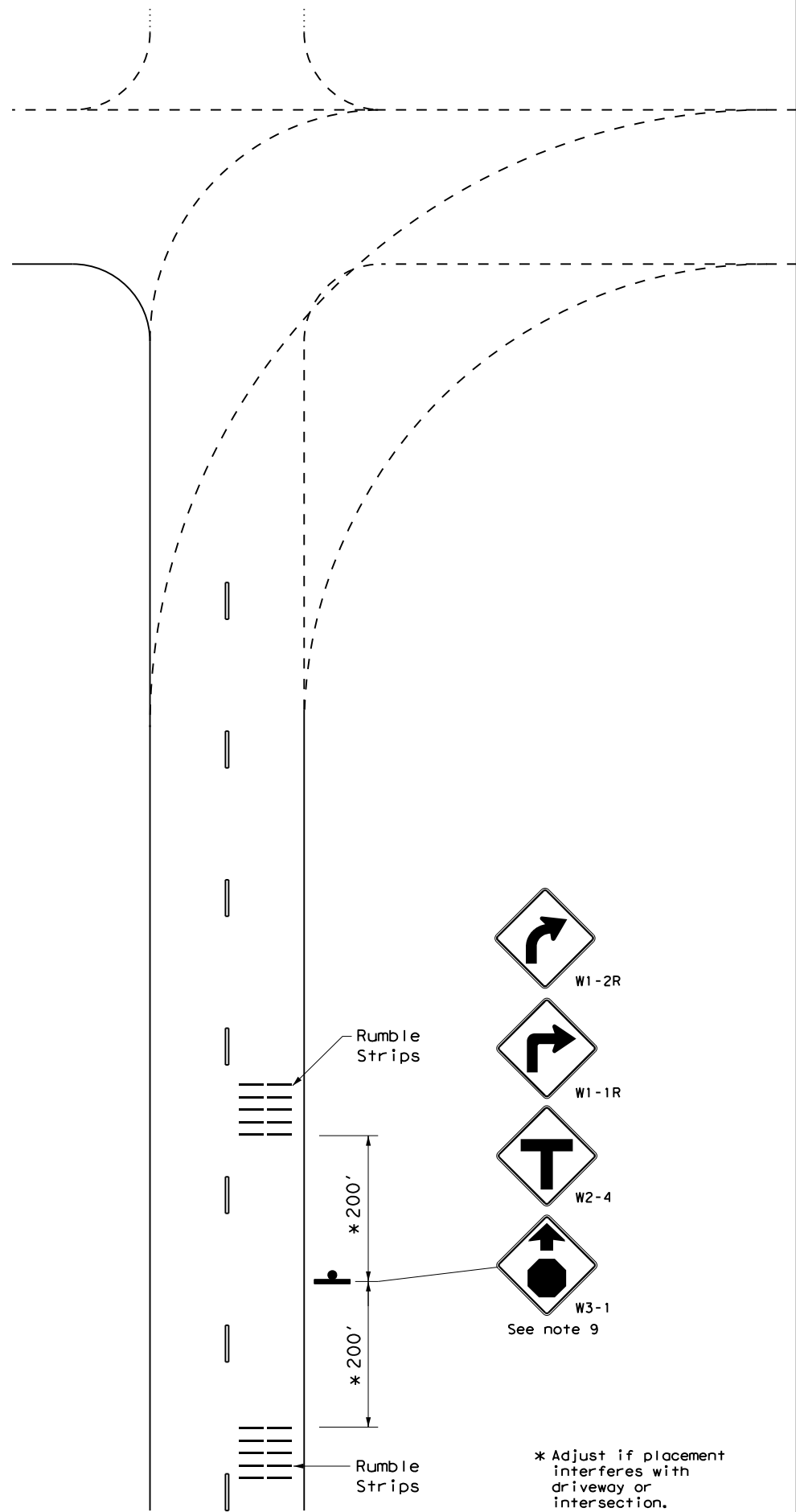
**GENERAL NOTES**

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

		Traffic Operations Division Standard	
<b>WORK ZONE ROAD CLOSURE DETAILS</b>			
<b>WZ (RCD) - 13</b>			
FILE: wzrcd-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT
© TxDOT August 1995	CONT	SECT	JOB
REVISIONS	1780	01	009
1-97 4-98 7-13	DIST	COUNTY	SHEET NO.
2-98 3-03	BWD	MILLS	31

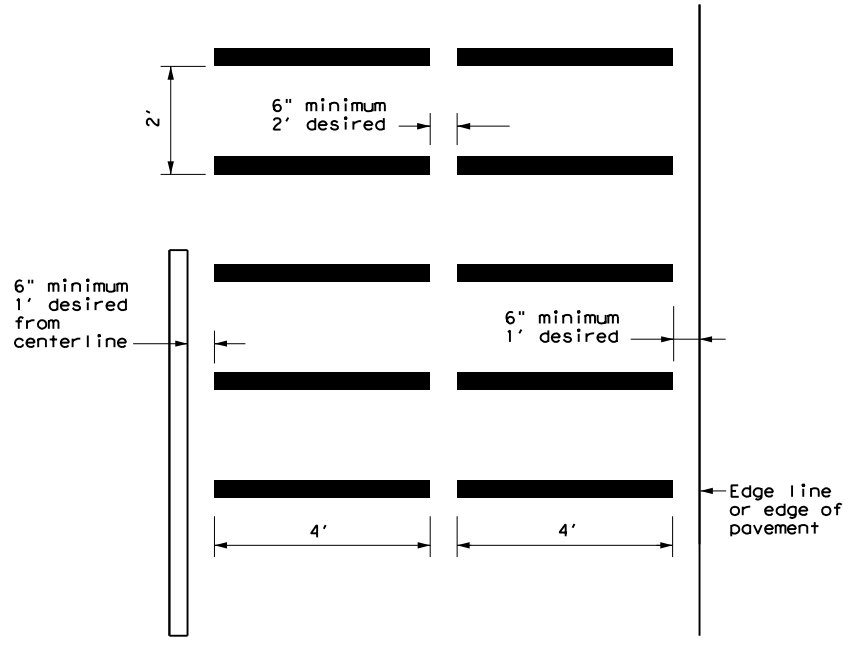
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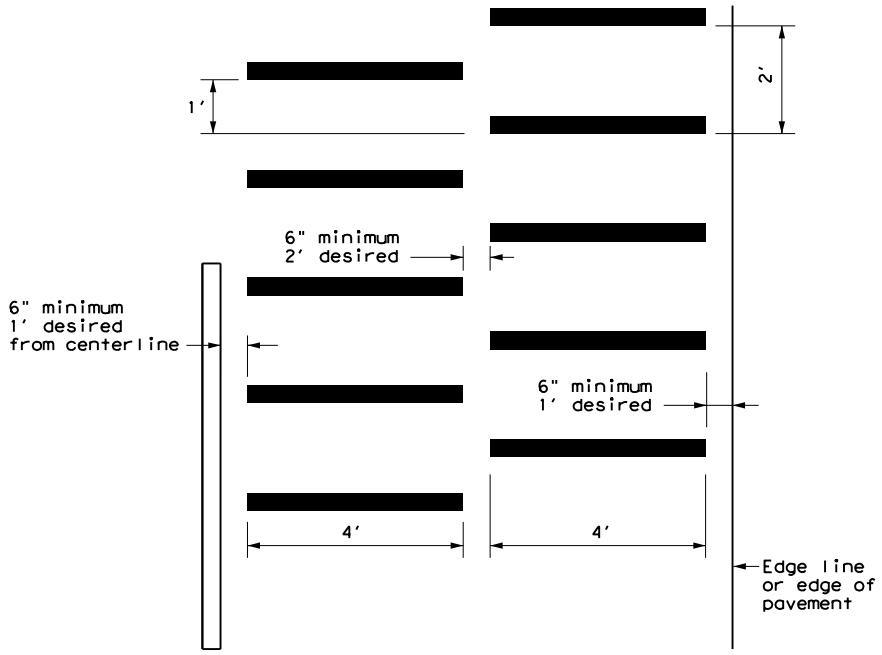


\* Adjust if placement interferes with driveway or intersection.

### STANDARD PATTERN



### ALTERNATIVE PATTERN



### GENERAL NOTES

1. Transverse or in-lane rumble strips should only be used at high incident and special geometric locations. These special geometric locations may include: approaches to rural, high speed signalized or Stop-controlled intersections with sight restrictions and/or high crash rates, approaches to unexpected urban intersections, approaches to newly installed Stop or signalized controlled intersections, approaches to toll plazas, approaches to hazardous horizontal curves, and approaches to railroad grade crossings.
2. When used, the rumble strips shall be placed 200 feet prior to and after the placement of the warning device.
3. The use of rumble strips should not be widespread or used indiscriminately.
4. Preformed black raised rumble strips should be used. They should be installed in accordance with the manufacturer's recommendations.
5. A list of approved, preformed raised rumble strips can be obtained from the Traffic Operations Division.
6. Consideration should be given to noise levels when in-lane or transverse rumble strips are installed near residential areas, schools, churches, etc.
7. The use of the "Rumble Strips Ahead" sign may be used in advance of in-lane or transverse rumble strips, based on engineering judgement. This sign is typically not necessary for rumble strip installations built to the guidelines on this standard sheet. When used, this sign should be spaced in advance of the rumble strips based on the guidelines for advance placement of warning sign included in the "Texas Manual on Uniform Traffic Control Devices".

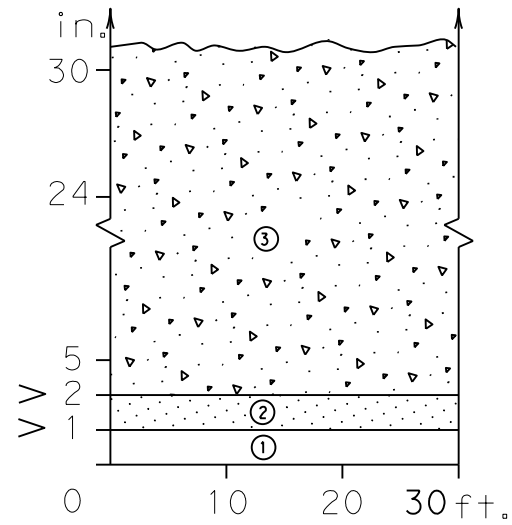


8. Consideration should be given to bicyclists. A 12 inch gap from the edge line may be used to accommodate bicyclists when a usable shoulder is not available. Additional gaps in the in-lane or transverse rumble strips are not recommended since they could cause motorists to swerve to avoid the rumble strips.
9. Other signs can be used as conditions warrant.

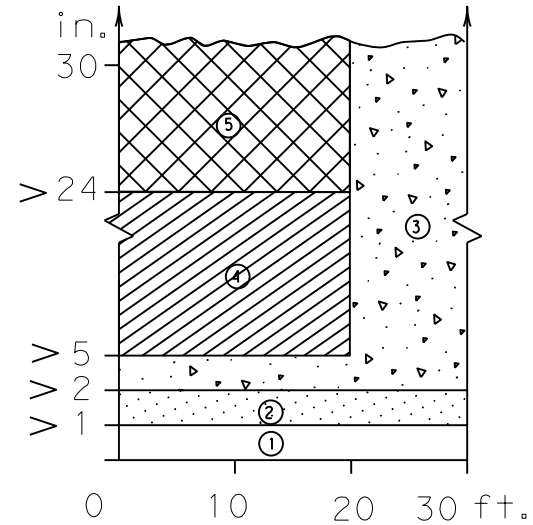
		Traffic Operations Division Standard	
<h2>TRANSVERSE OR IN-LANE RUMBLE STRIPS</h2> <h3>RS(5) - 13</h3>			
FILE: rs(5) - 13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT
© TxDOT April 2006	CONT	SECT	HIGHWAY
REVISIONS	1780	01	009 FM 1047
2-10	DIST	COUNTY	SHEET NO.
10-13	BWD	MILLS	32

# DEFINITION OF TREATMENT ZONES FOR VARIOUS EDGE CONDITIONS

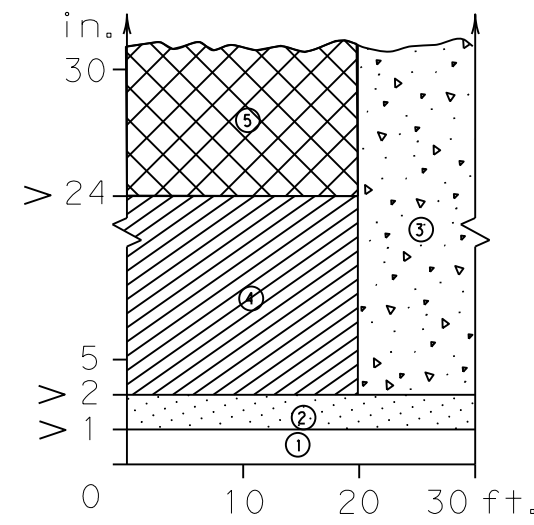
Edge Height (D) in Inches versus Lateral Clearance (Y) in Feet



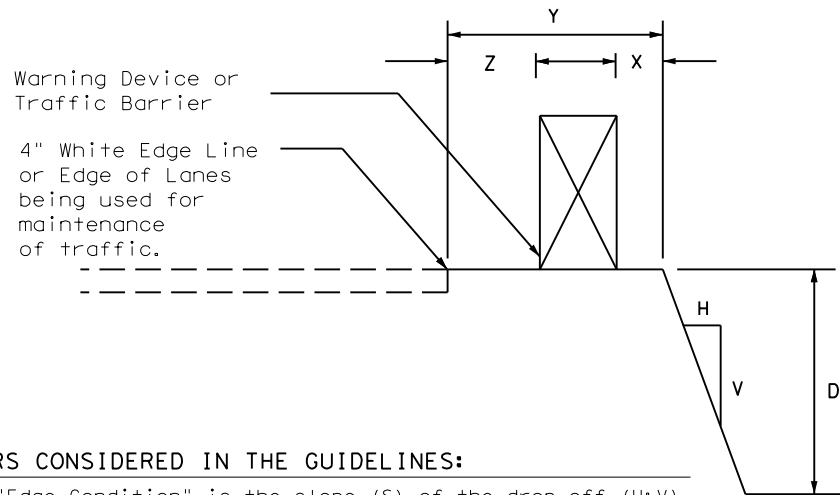
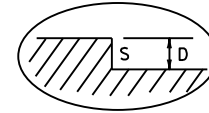
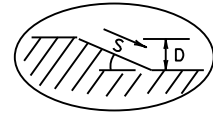
Edge Condition I  
S = (3:1) (or flatter)



Edge Condition II  
S = ((2.99):1) to (1:1)



Edge Condition III  
S is steeper than (1:1)



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

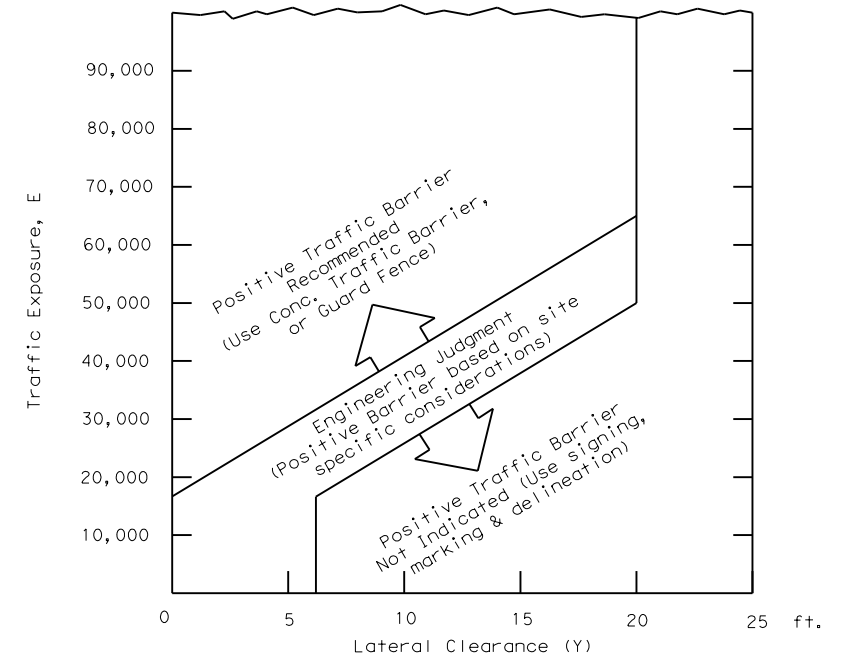
### FACTORS CONSIDERED IN THE GUIDELINES:

- The "Edge Condition" is the slope (S) of the drop-off (H:V). The "Edge Height" is the depth of the drop-off "D".
- Distance "X" is to be the maximum practical under job conditions. Two feet minimum for high speed conditions. Distance "Y" is the lateral clearance from edge of travel lane to edge of dropoff. Distance "Z" does not have a minimum.
- In addition to the factors considered in the guidelines, each construction zone drop-off situation should be analyzed individually, taking into account other variables, such as: traffic mix, posted speed in the construction zone, horizontal curvature, and the practicality of the treatment options.
- The conditions for indicating the use of positive or protective barriers are given by Zone-5 and Figure-1. Traffic barriers are primarily applicable for high speed conditions. Urban areas with speeds of 30 mph or less may have a lesser need for signing, delineation, and barriers. Right-angled edges, however, with "D" greater than 2 inches and located within a lateral offset of 6 feet, may indicate a higher level of treatment.
- If the distance "Y" must be less than 3 feet, the use of a positive barrier may not be feasible. In such a case, consider either: 1) narrowing the lanes to a desired 11 to 12 feet or 10 foot minimum (see CW20-8 sign), or 2) provide an edge slope such as Edge Condition I.

### Edge Condition Notes:

- Edge Condition I: Most vehicles are able to traverse an edge condition with a slope rate of (3 to 1) or flatter. The slope must be constructed with a compacted material capable of supporting vehicles.
- Edge Condition II: Most vehicles are able to traverse an edge condition with a slope between (2.99 to 1) and (1 to 1) so long as "D" does not exceed 5 inches. Under-carriage drag on most automobiles will occur when "D" exceeds 6 inches. As "D" exceeds 24 inches, the possibility for rollover is greater in most vehicles.
- Edge Condition III: When slopes are greater than (1 to 1) and where "D" is greater than 2 inches, a more difficult control factor may exist for some vehicles, if not properly treated. For example, where "D" is greater than 2 inches and up to 24 inches different types of vehicles may experience different steering control at different edge heights. Automobiles might experience more steering control differential when "D" is greater than 2 inches and up to 5 inches. Trucks, particularly those with high loads, have more steering control differential when "D" is greater than 5 inches and up to 24 inches. When "D" exceeds 24 inches, the possibility of rollover is greater for most vehicles.
- Milling or overlay operations that result in Edge Condition III should not be in place without appropriate warning treatments, and these conditions should not be left in place for extended periods of time.

## FIGURE-1: CONDITIONS INDICATING USE OF POSITIVE BARRIER FOR ZONE 5 ( [Cross-hatched] )



- $E = ADT \times T$   
Where ADT is that portion of the average daily traffic volume traveling within 20 feet (generally two adjacent lanes) of the edge dropoff condition; and, T is the duration time in years of the dropoff condition.
- Figure-1 provides a practical approach to the use of positive barriers for the protection of vehicles from pavement drop-offs. Other factors, such as the presence of heavy machinery, construction workers, or the mix and volume of traffic may make the use of positive barriers appropriate, even when the edge condition alone may not justify the use of a barrier.
- An approved end treatment should be provided for any positive barrier end located within the clear zone.

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

Engineer's Seal

Date \_\_\_\_\_



## TREATMENT FOR VARIOUS EDGE CONDITIONS

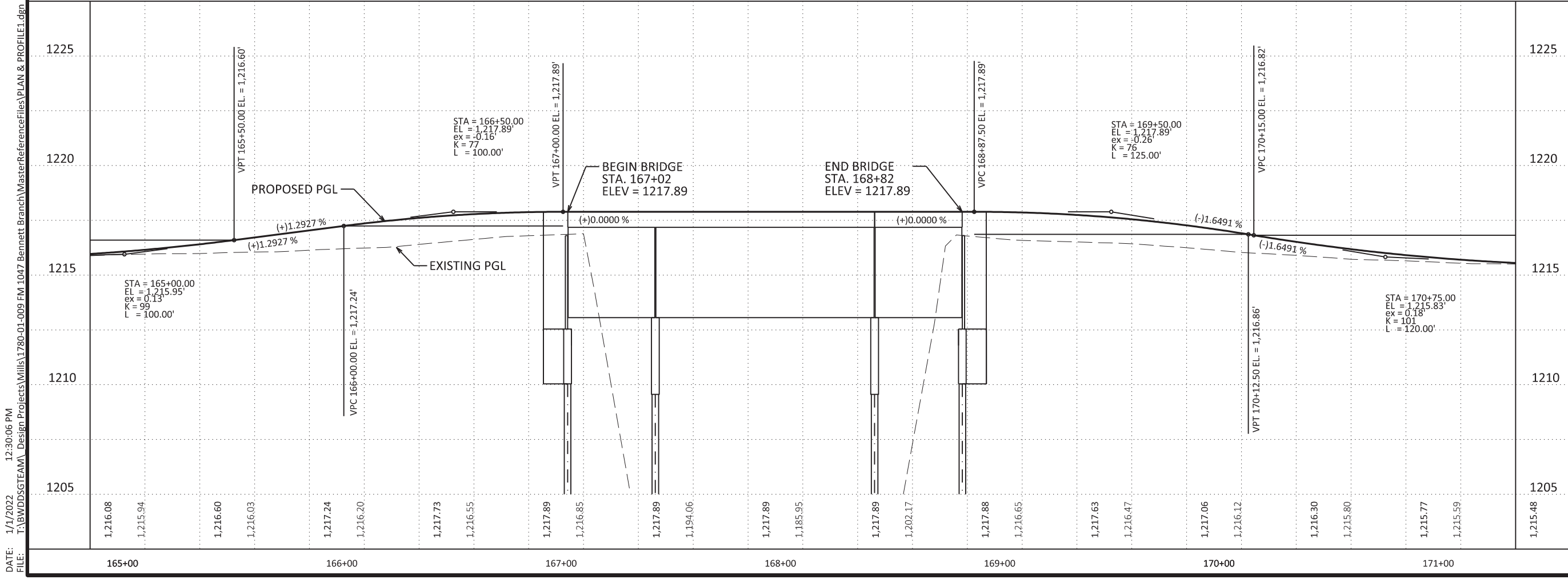
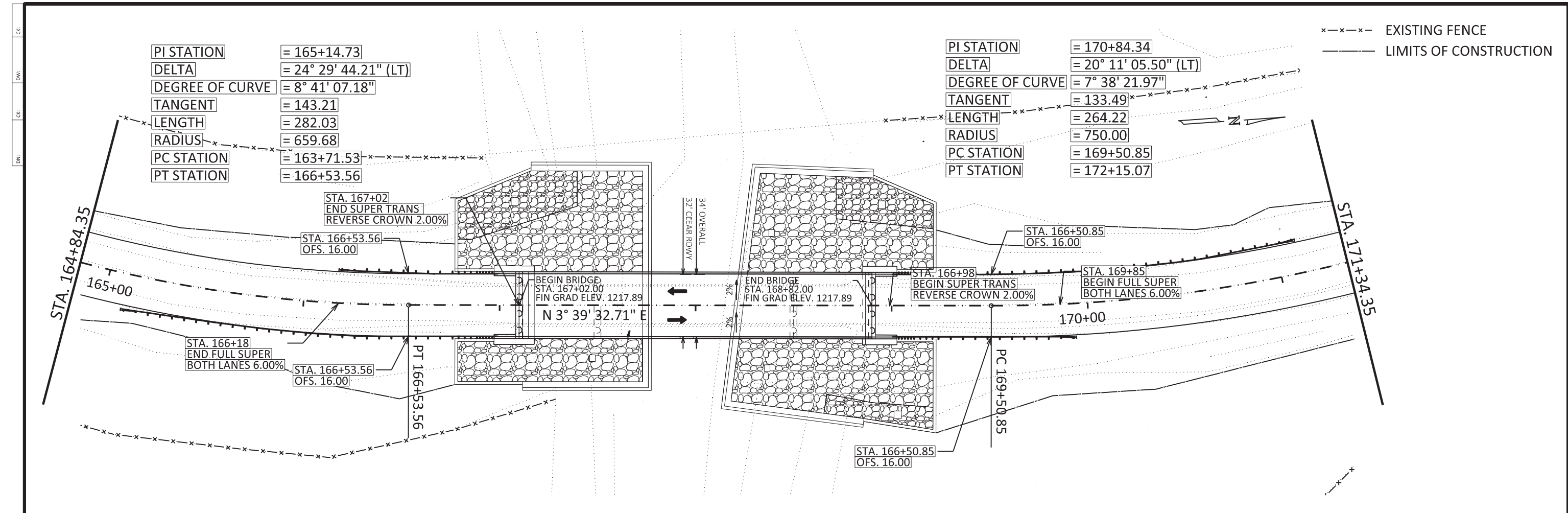
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© TxDOT August 2000	CONT	SECT	JOB	HIGHWAY
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03-01	DIST	COUNTY	SHEET NO.	
08-01	BWD	MILLS	33	
9-21				

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DAN A. HOHMANN  
97588  
LICENSED PROFESSIONAL ENGINEER

*Dan A. Hohmann, P.E.*

01/02/2022

FM 1047  
PLAN & PROFILE

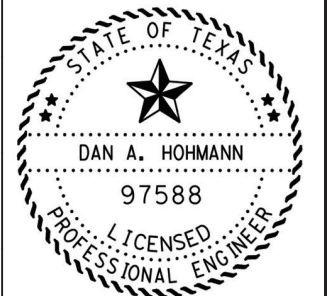
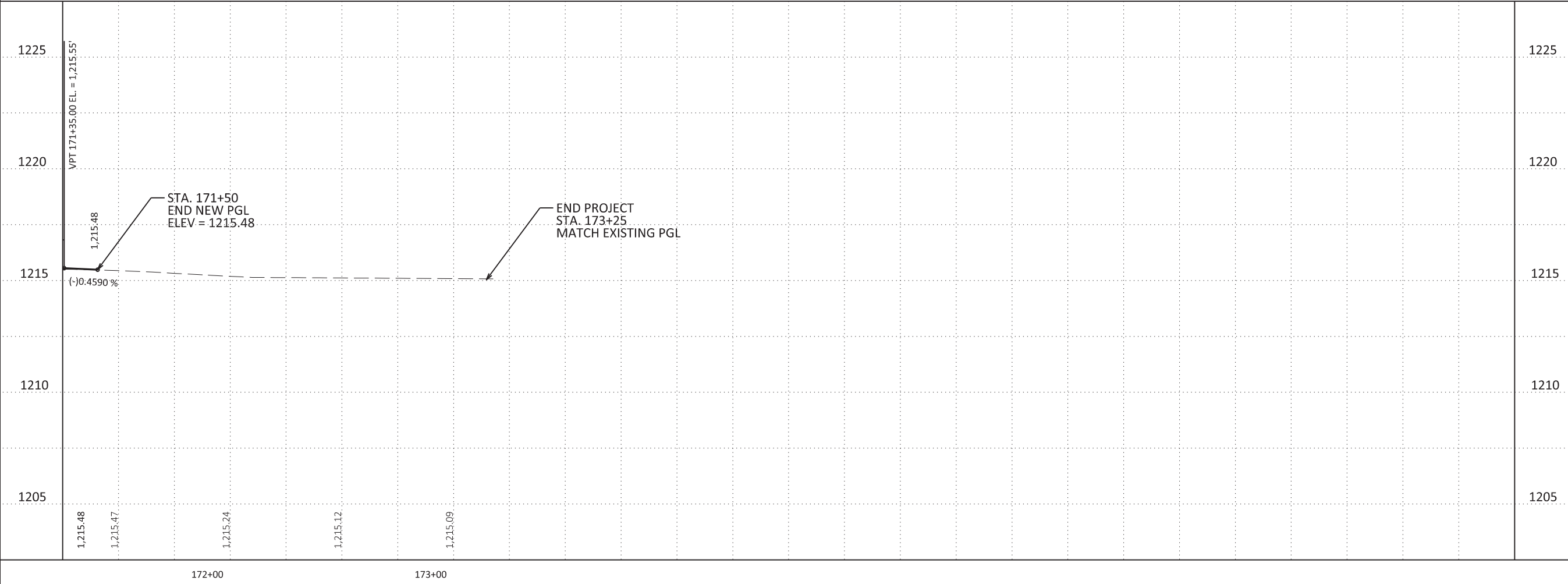
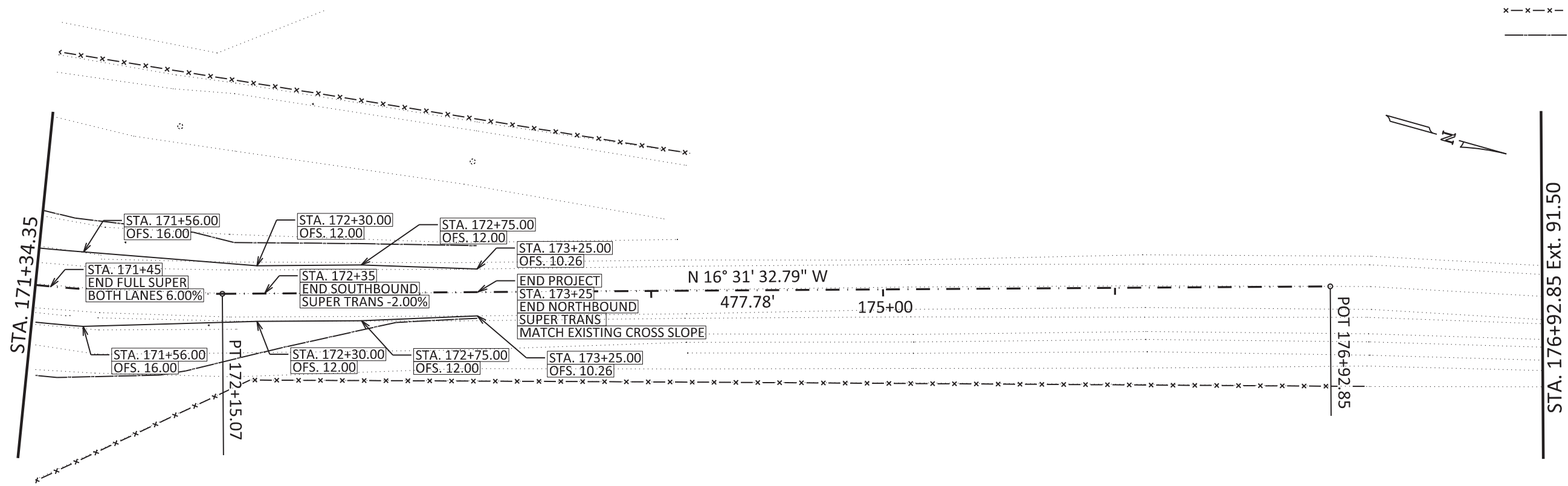
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DN:  
CK:  
DW:  
CG:

-x-x-x- EXISTING FENCE  
 ——— LIMITS OF CONSTRUCTION

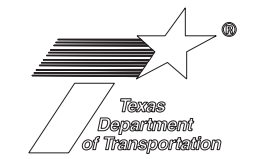


*Don A. Hohmann, P.E.*

01/02/2022

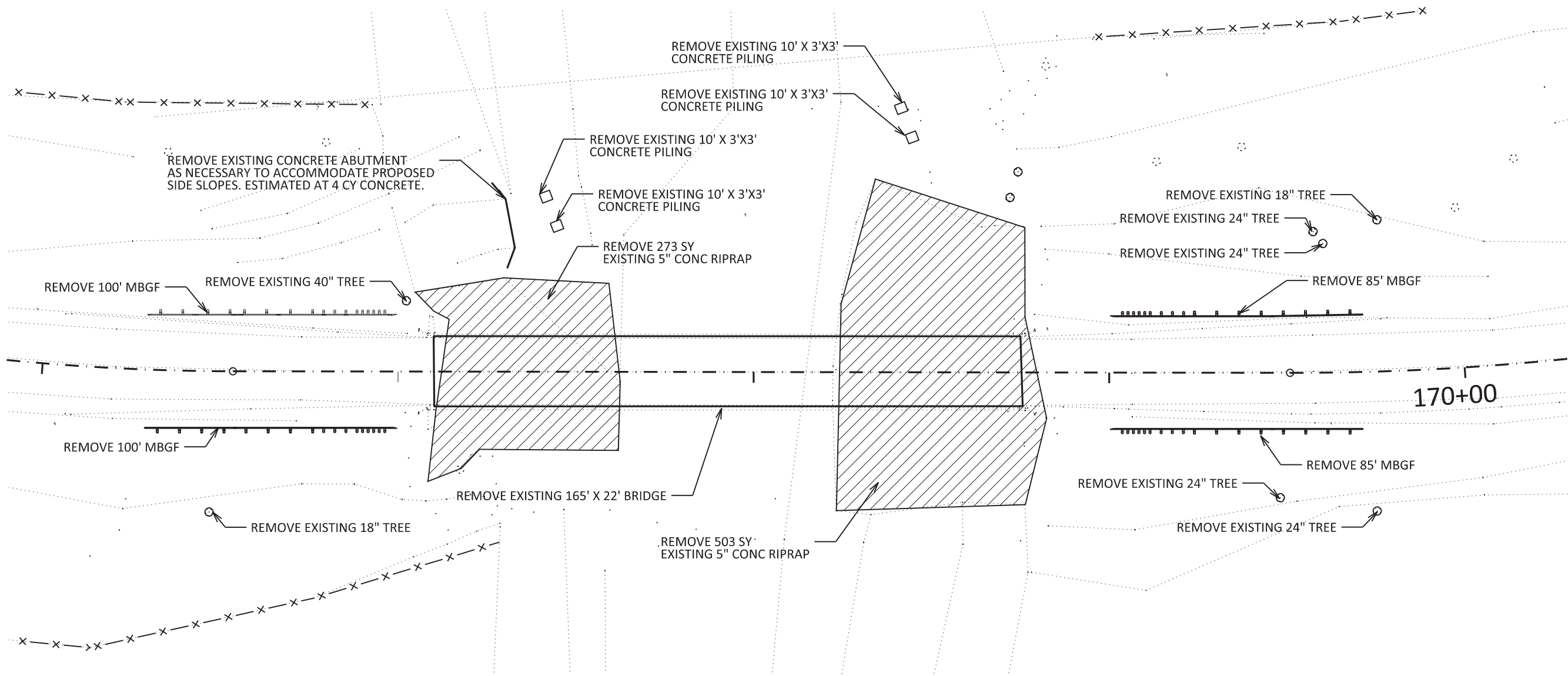
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SHEET 3 OF 3



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**NOTES:**

REMOVE TREES IN ACCORDANCE WITH ITEM 100 "PREPARING ROW."

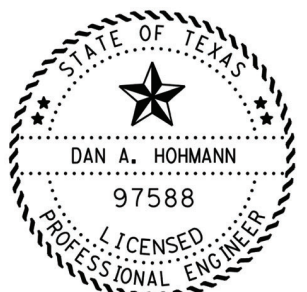
ITEM 100 6002 (PREPARING ROW) IS TO BE USED ONLY WITHIN LIMITS OF CONSTRUCTION.

ALL TREES AND BRUSH WITHIN CONSTRUCTION LIMITS THAT ARE NOT ESTIMATED INDIVIDUALLY WILL BE PAID FOR UNDER ITEM 100 6002 (PREPARING ROW).

SEE PLAN & PROFILE SHEETS AND CROSS-SECTIONS FOR PROPOSED CONSTRUCTION LIMITS.

ITEM CODE	DESCRIPTION	UNIT	QTY
100 6002	PREPARING ROW	STA	11
100 6004	PREPARING ROW (TREE)(12" TO 24" DIA)	EA	6
100 6016	PREPARING ROW (TREE)(24" TO 36" DIA)	EA	1
104 6009	REMOVING CONC (RIPRAP)	SY	776
104 6045	REMOVING CONC (MISC)	EA	1
496 6010	REMOVE STR (BRIDGE 100-499 FT LENGTH)	EA	1
496 6077	REMOVE STR (PILING)	LF	40
542 6001 *	REMOVE METAL BEAM GUARD FENCE	LF	370

\* REMOVAL INCLUDES TERMINALS AND CONNECTIONS



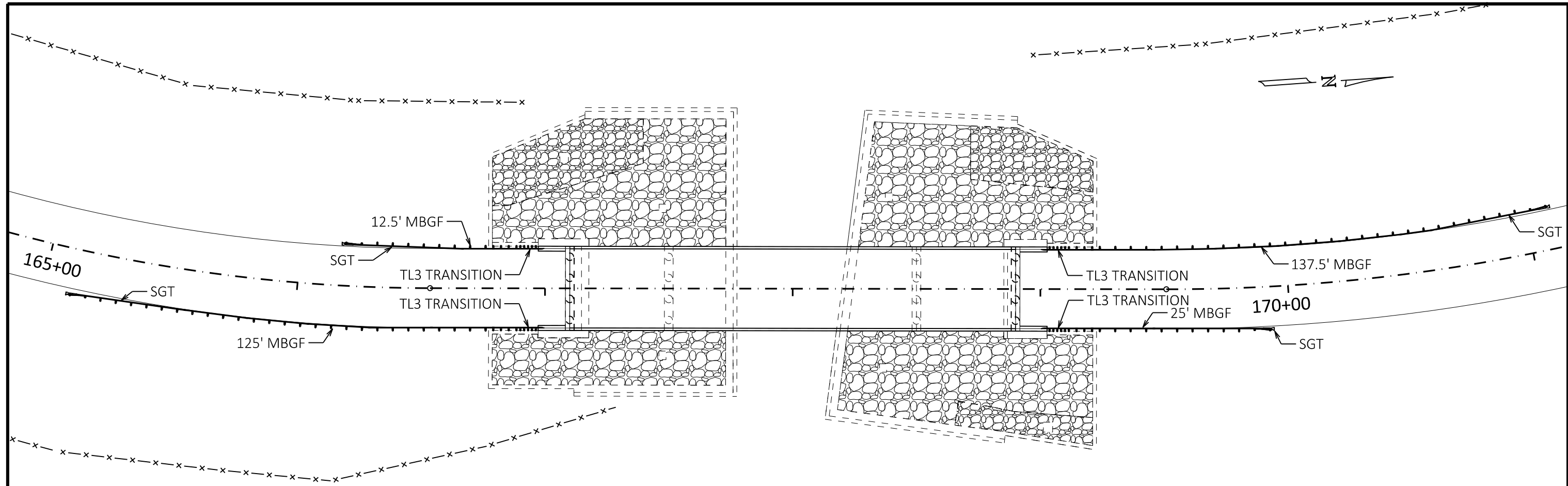
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01/02/2022

FM 1047  
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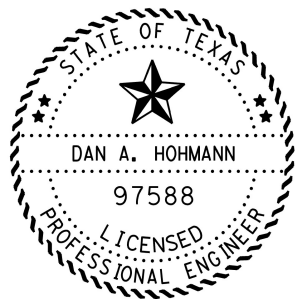


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DIST	COUNTY	SHEET NO.	
BWD	MILLS	37	



ITEM CODE	DESCRIPTION	UNIT	QTY
540 6002	METAL W-BEAM GD FEN (STEEL POST)	LF	300
540 6006	MTL BEAM GD FEN TRANS (THRIE-BEAM)	EA	4
544 6001	GUARDRAIL END TREATMENT (INSTALL)	EA	4
658 6062	IN STL DEL ASSM (D-SW)SZ 1(BRF)GF2(BI)	EA	8
658 6014	IN STL DEL ASSM (D-SW)SZ (BRF)CTB (BI)	EA	8

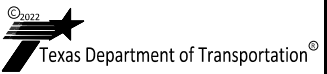
\*\* ADD'L ACP EST. @ 272 SY  
SEE BASIS OF ESTIMATE FOR PAYMENT



*Dan A. Hohmann, P.E.*

01/26/2022

FM 1047  
ROADWAY  
DETAILS

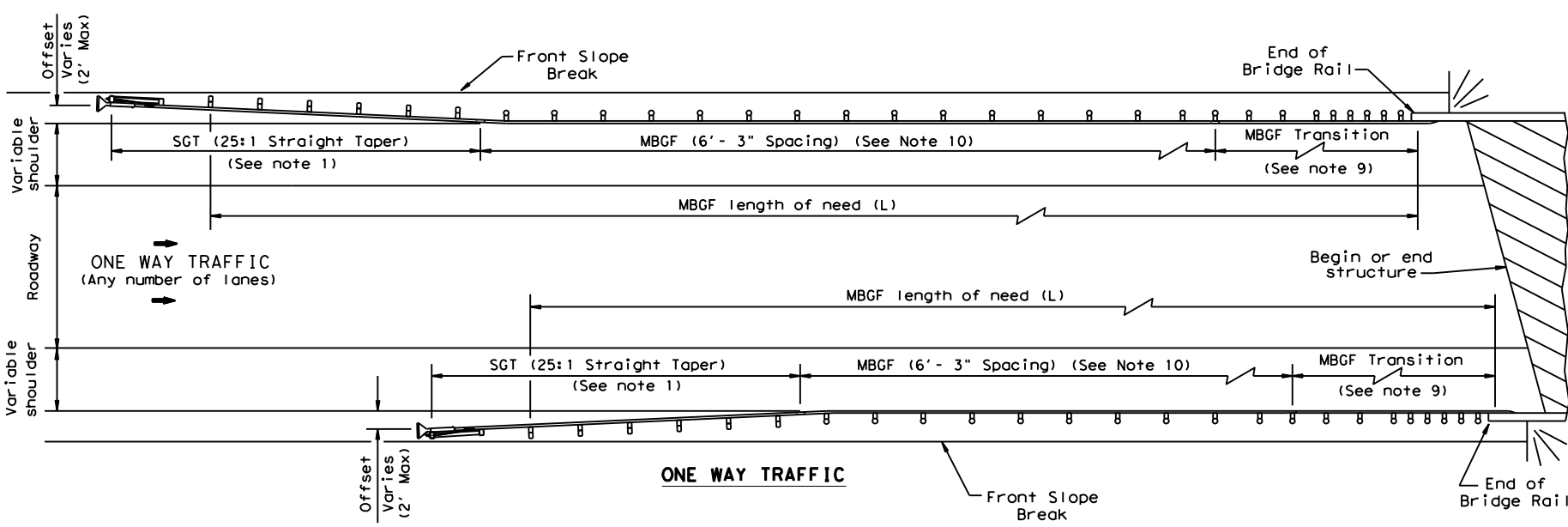
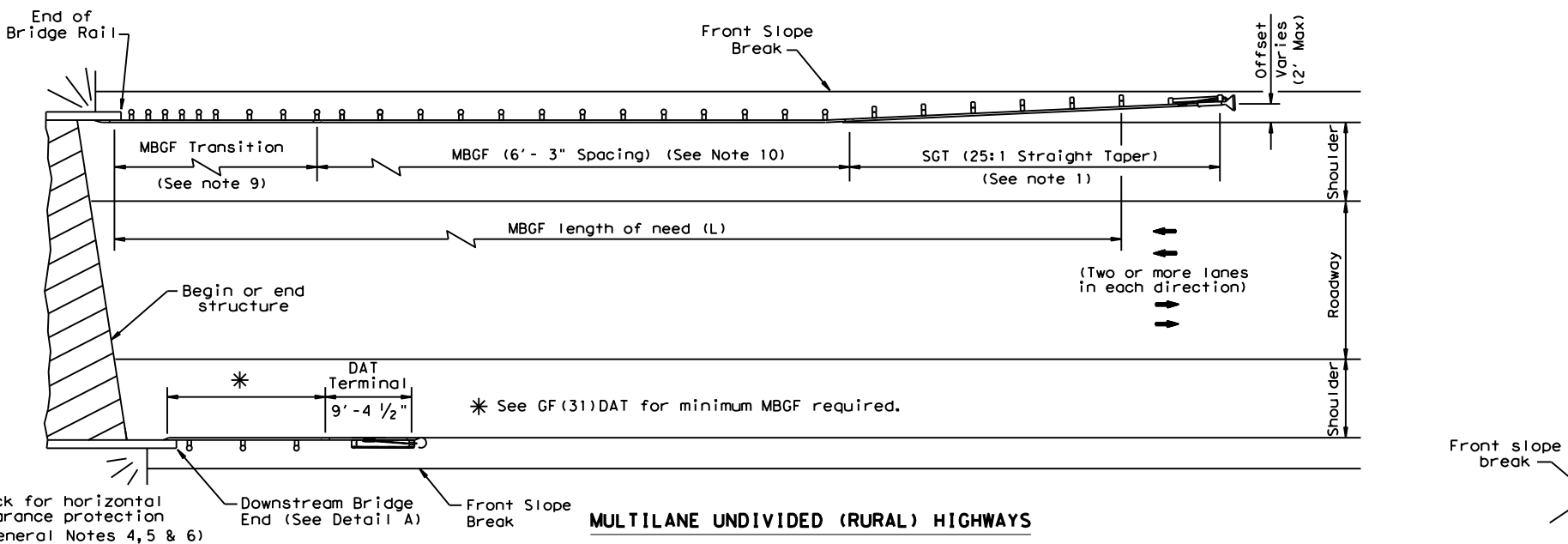
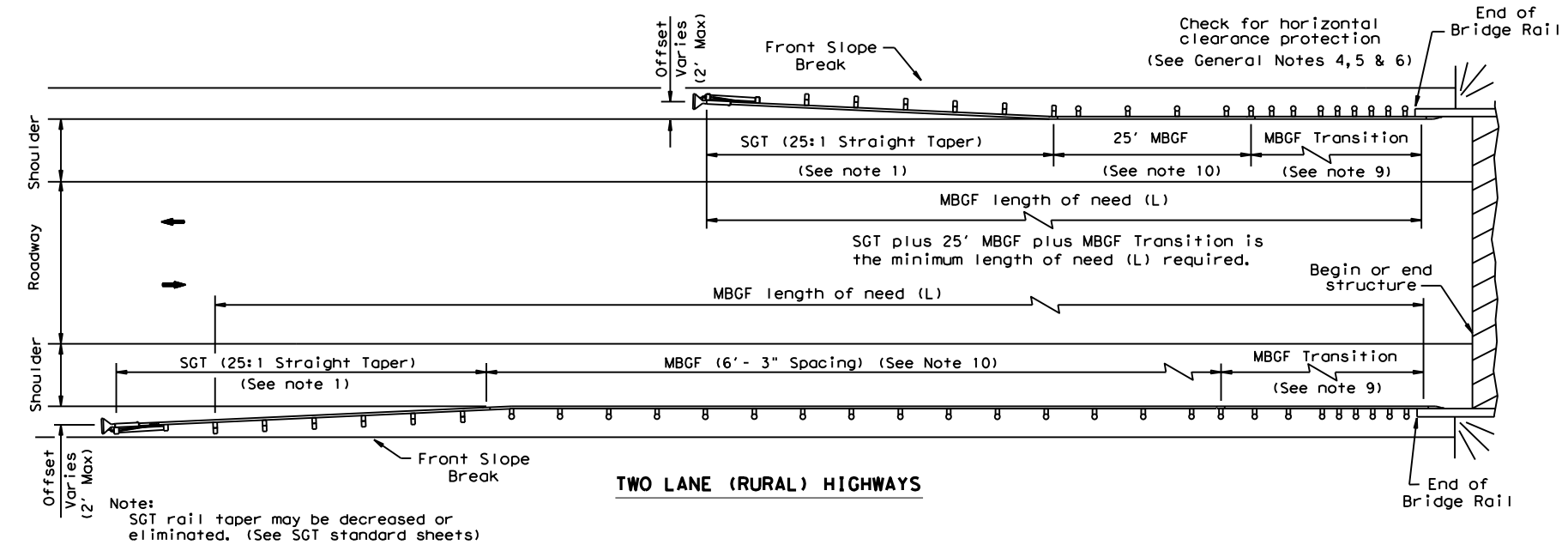


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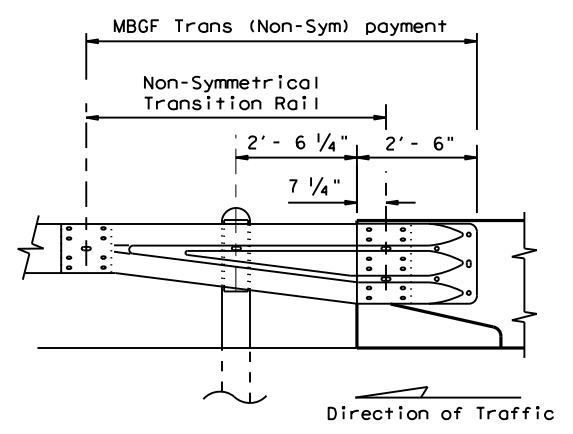
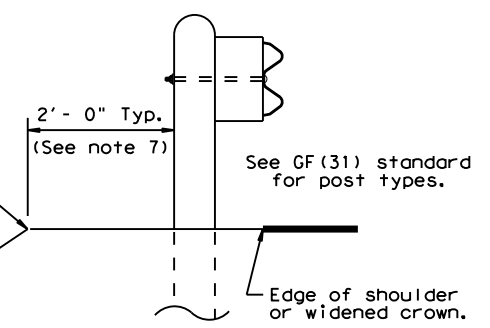
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- GENERAL NOTES**
- For more detail: See GF(31), SGT( )31, GF(31)TR, and GF(31)TL2 standard sheets.
  - Quantities of metal beam guard fence (MBGF) at individual bridge ends are as shown in the plans.
  - Use average daily traffic (ADT) for the current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



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

Texas Department of Transportation

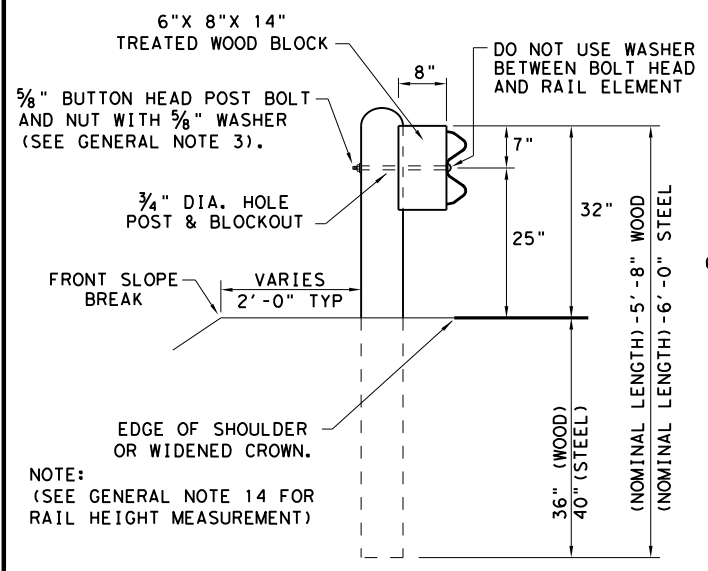
**BRIDGE END DETAILS**  
(METAL BEAM GUARD FENCE APPLICATIONS TO RIGID RAILS)

**BED-14**

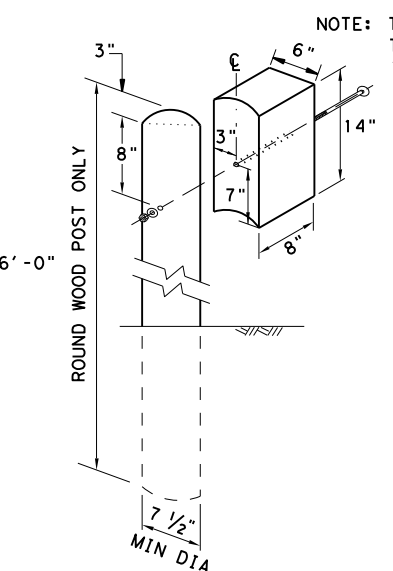
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REVISED APRIL 2014 SEE (MEMO 0414)	DIST	COUNTY		SHEET NO.
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Design Division Standard

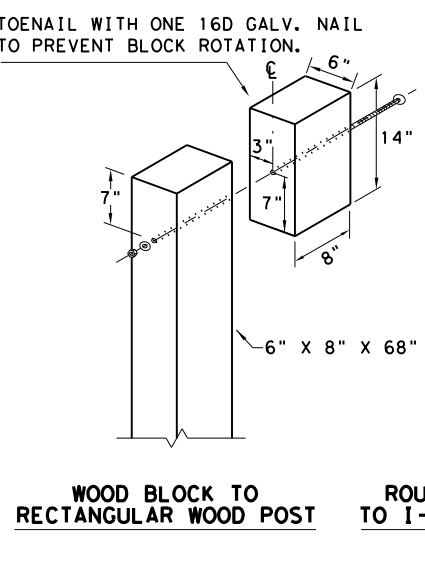
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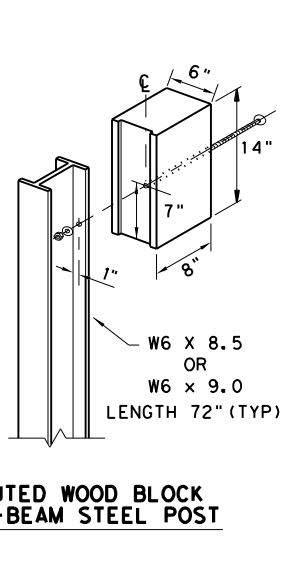
**TYPICAL POST PLACEMENT**



**WOOD BLOCK TO ROUND WOOD POST**



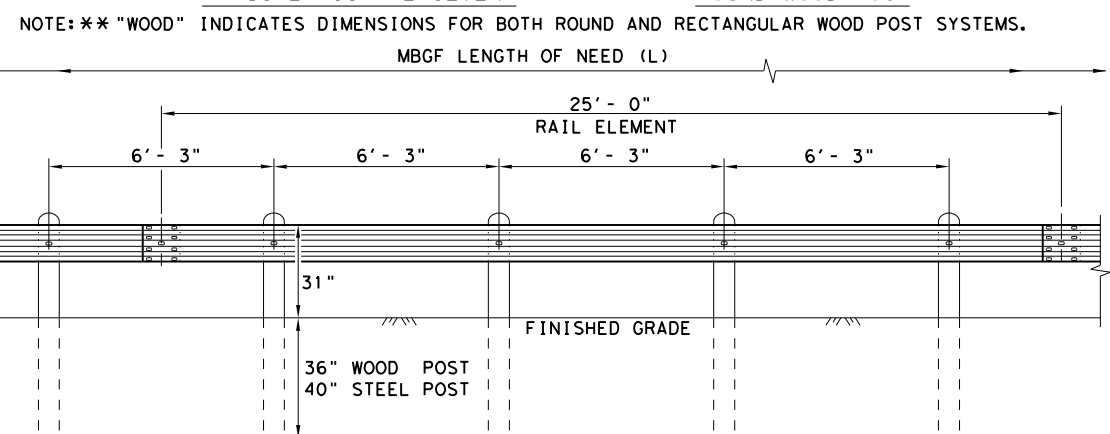
**WOOD BLOCK TO RECTANGULAR WOOD POST**



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

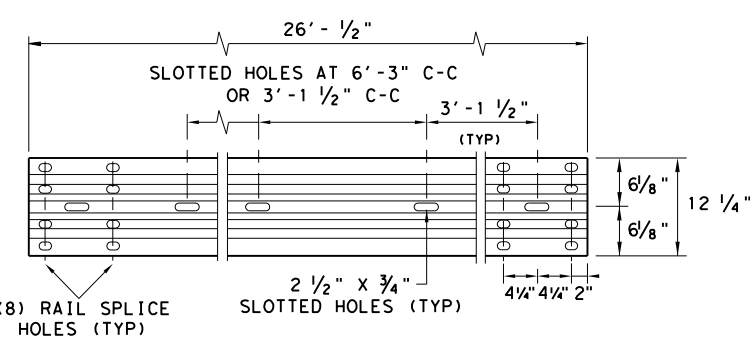
**GENERAL NOTES**

1. THE TYPE OF POST (ROUND WOOD POST, RECTANGULAR WOOD POST, OR STEEL POST) WILL BE AS SHOWN IN THE PLANS. THE EXACT POSITION OF MBGF SHALL BE SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER. STEEL POSTS TO BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING."
2. RAIL ELEMENTS SHALL MEET THE REQUIREMENTS OF ITEM 540, "METAL BEAM GUARD FENCE" EXCEPT AS MODIFIED IN THE PLANS. THE CONTRACTOR MAY FURNISH RAIL ELEMENTS OF 25'-0", OR 12'-6" (NOM.) LENGTHS. RAIL ELEMENTS MAY HAVE SLOTTED HOLES AT 3'-1 1/2" C-C OR 6'-3" C-C. A SPECIAL LENGTH OF RAIL MAY BE MANUFACTURED TO ACCOMMODATE THE DOWNSTREAM ANCHOR TERMINAL (DAT) AND THE TRANSITION SECTIONS OF GUARDRAIL.
3. BUTTON HEAD "POST BOLTS & NUTS" SHALL MEET THE REQUIREMENTS OF (ASTM A307), AND SHALL BE OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT AND 3/8" WASHER (FWC16G) AND NOT MORE THAN 1" BEYOND IT. TRIM REMAINING BOLT LENGTH TO MEET REQUIRED LENGTH.
4. FITTINGS (BOLTS, NUTS, AND WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING." FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
5. CROWN SHALL BE WIDENED TO ACCOMMODATE THE METAL BEAM GUARD FENCE.
6. THE LATERAL APPROACH TO THE GUARD FENCE, SHALL HAVE A MAXIMUM SLOPE OF 1V:10H.
7. IF SHOWN ELSEWHERE IN THE PLANS OR AS DIRECTED BY THE ENGINEER, THE GUARD FENCE MAY BE FLARED AT A RATE OF 25:1 OR FLATTER.
8. UNLESS OTHERWISE SHOWN IN THE PLANS, GUARD FENCE PLACED IN THE VICINITY OF CURBS SHALL BE POSITIONED SO THAT THE FACE OF CURB IS LOCATED DIRECTLY BELOW OR BEHIND THE FACE OF THE RAIL. RAIL PLACED OVER CURBS SHALL BE INSTALLED SO THAT THE POST BOLT IS LOCATED APPROXIMATELY 25 INCHES ABOVE THE GUTTER PAN OR EDGE OF SHOULDER.
9. APPLICATIONS IN SOLID ROCK ARE ONLY ALLOWED WITH STEEL POSTS. IF SOLID ROCK IS ENCOUNTERED WITHIN 0 TO 18" OF THE FINISHED GRADE, DRILL A 24" DIA. HOLE, 24" INTO THE ROCK. IF SOLID ROCK IS ENCOUNTERED BELOW 18", DRILL A 12" DIA. HOLE, 12" INTO THE ROCK OR TO THE STANDARD EMBEDMENT DEPTH, WHICHEVER MAYBE LESS. ANY EXCESS POST LENGTH, AFTER MEETING THESE DEPTHS, MAY BE FIELD CUT TO ENSURE PROPER GUARDRAIL MOUNTING HEIGHT. BACKFILL WITH COARSE AGGREGATE MATERIAL.
10. POSTS SHALL NOT BE SET IN CONCRETE, OF ANY DEPTH.
11. SPECIAL FABRICATION WILL BE REQUIRED AT INSTALLATION LOCATIONS HAVING A CURVATURE OF LESS THAN 150 FT. RADIUS.
12. UNLESS OTHERWISE SHOWN IN THE PLANS, A COMPOSITE MATERIAL BLOCK THAT MEETS THE REQUIREMENTS OF DMS-7210, "COMPOSITE MATERIAL POSTS AND BLOCKS FOR METAL BEAM GUARD FENCE" MAY BE SUBSTITUTED FOR BLOCKS OF SIMILAR DIMENSIONS. THE CONSTRUCTION DIVISION, TXDOT MAINTAINS A MATERIAL PRODUCER LIST (MPL) FOR PRODUCERS OF MATERIALS CONFORMING TO DMS-7210 ONLY PRODUCERS ON THE MPL MAY FURNISH COMPOSITE MATERIAL BLOCKS.
13. FOR THE LOW FILL CULVERT OPTION, POSTS LOCATED PARTIALLY OR WHOLLY BETWEEN PRECAST BOX CULVERT UNITS, THE USE OF A CAST-IN-PLACE CONCRETE CLOSURE BETWEEN BOXES IS REQUIRED. THE LENGTH OF THE CAST-IN-PLACE CONCRETE CLOSURE SHALL ACCOMMODATE THE PLACEMENT OF THE LOW FILL CULVERT OPTION. SEE CONCRETE CLOSURE DETAILS ON BRIDGE STANDARD SCP-MD.
14. GUARDRAIL HEIGHT MEASUREMENT: WHEN THE GUARDRAIL IS LOCATED ABOVE PAVEMENT, MEASURE THE HEIGHT FROM THE PAVEMENT TO THE TOP OF THE W-BEAM RAIL. WHEN THE GUARDRAIL IS LOCATED UP TO 2 FT. OFF OF THE EDGE OF PAVEMENT OR FOR A PAVEMENT OVERLAY, USE A 10-FOOT STRAIGHTEDGE TO EXTEND THE PAVEMENT/SHOULDER SLOPE TO THE BACK OF RAIL, MEASURE FROM THE BOTTOM OF STRAIGHTEDGE TO THE TOP OF RAIL. FOR GUARDRAIL LOCATED DOWN A 10:1 SLOPE, MEASURE FROM THE NOMINAL TERRAIN.



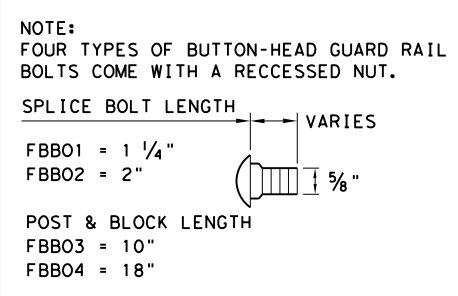
**ELEVATION MID-SPAN RAIL SPLICE**

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

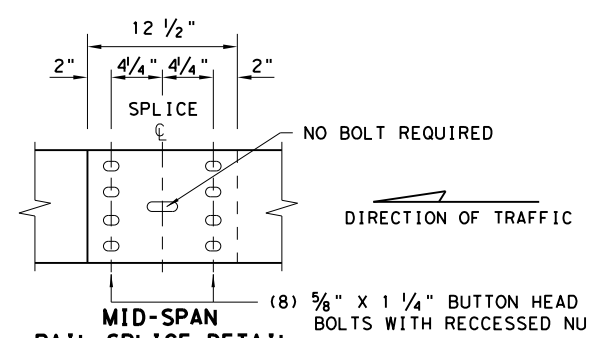


**ELEVATION 25'-0" (NOM.) W-BEAM SECTION**

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



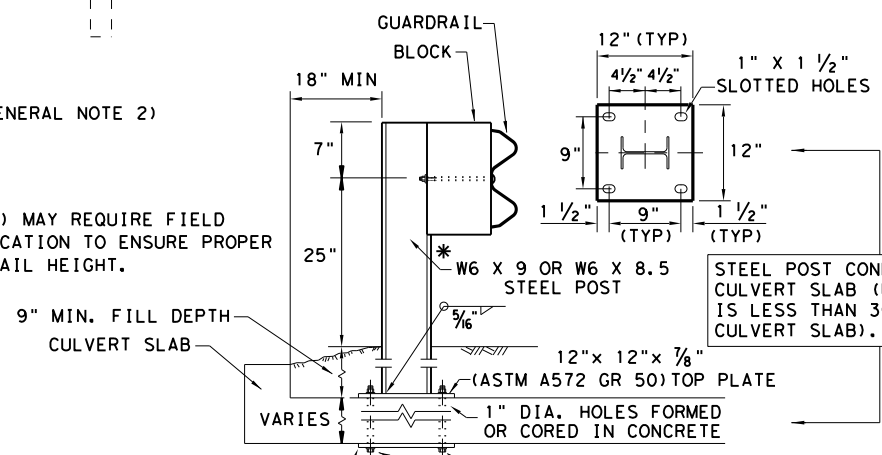
**BUTTON HEAD BOLT**



**MID-SPAN RAIL SPLICE DETAIL**

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

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



**LOW FILL CULVERT POST**

1. **BOLT-THROUGH OPTION:** REQUIRES A 6" MIN. SLAB THICKNESS. 7/8" DIA (ASTM A449) HEAVY HEX BOLTS WITH TWO HARDENED WASHER EACH AND HEAVY HEX NUTS. NOTE: BOLT LENGTH = SLAB PLUS 2 1/4" MIN.
2. **EPOXY ANCHOR OPTION:** THIS OPTION MAY ONLY BE USED IF THE CULVERT SLAB IS 9" MIN. THICK. THREADED ANCHOR RODS MUST BE 7/8" DIA. ASTM A449 OR A193 GRADE B7 WITH HEAVY HEX NUT, AND ONE HARDENED WASHER EACH. EMBED ANCHOR RODS 6" WITH HILTI HIT RE 500 EPOXY ADHESIVE. OTHER TYPE III CLASS C EPOXY ADHESIVES MEETING THE REQUIREMENTS OF DMS-6100, "EPOXIES AND ADHESIVES", MAY BE USED IF IT CAN BE DEMONSTRATED THAT THEY MEET OR EXCEED THE STRENGTH OF HILTI HIT RE 500 WITH THE SAME EMBEDMENT DEPTH AND THREADED ROD DIA. FOLLOW THE MANUFACTURER'S REQUIREMENTS FOR INSTALLING EPOXIED THREADED RODS. EXTEND RODS 1/4" MIN. BEYOND NUT.

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

				Design Division Standard
<b>METAL BEAM GUARD FENCE</b> <b>TL-3 MASH COMPLIANT</b> <b>GF (31)-19</b>				
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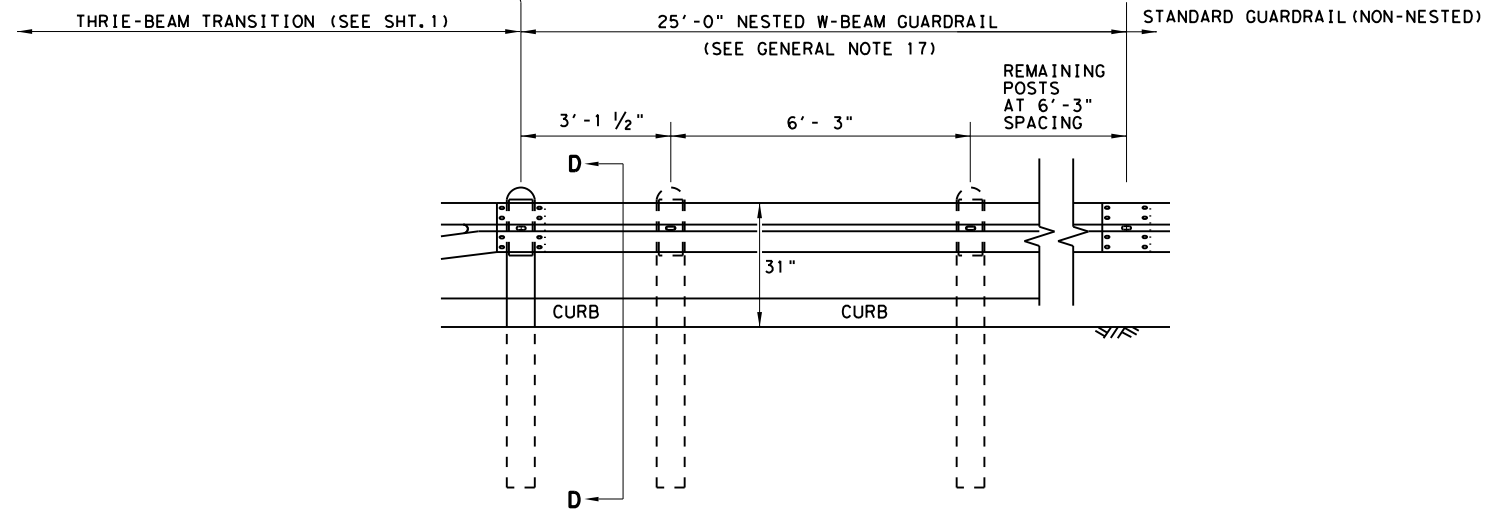
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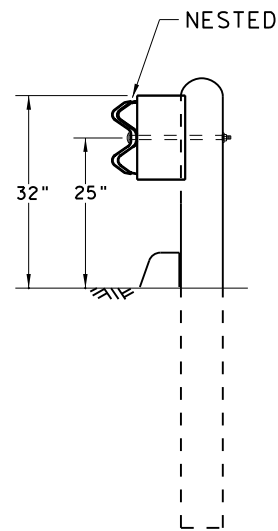
REQUIRED ALTERNATIVE FOR CONTINUOUS CURB EXTENDING PAST POST 7 (SEE SHT. 1 GENERAL NOTE 17)

END PAYMENT FOR METAL BEAM GUARD FENCE TRANSITION.  
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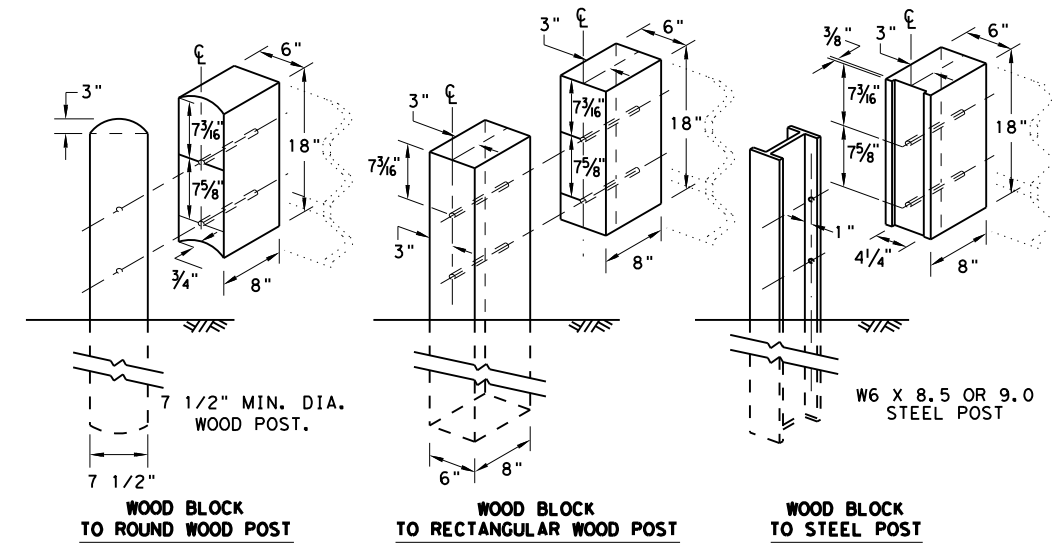
(SEE GF (31) STANDARD SHEET)



ELEVATION VIEW



SECTION D-D



THREE BEAM TRANSITION BLOCKOUT DETAILS

HIGH-SPEED TRANSITION

SHEET 2 OF 2

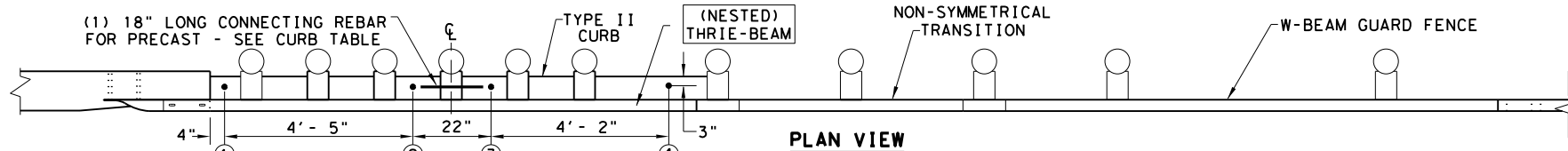


METAL BEAM GUARD FENCE  
 THREE-BEAM TRANSITION  
 TL-3 MASH COMPLIANT

GF (31) TR TL3-20

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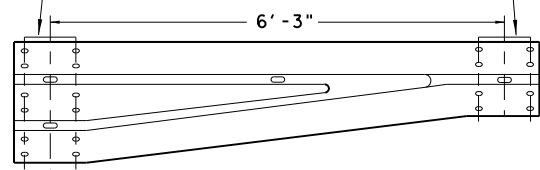
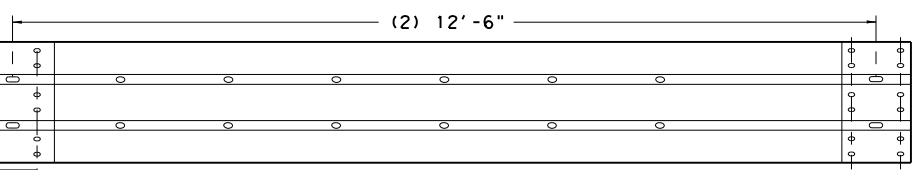
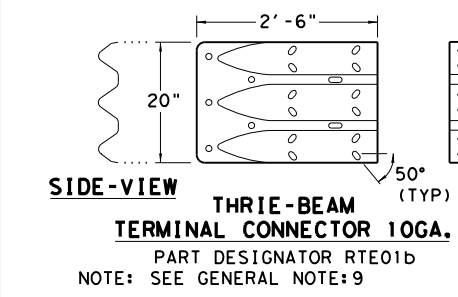
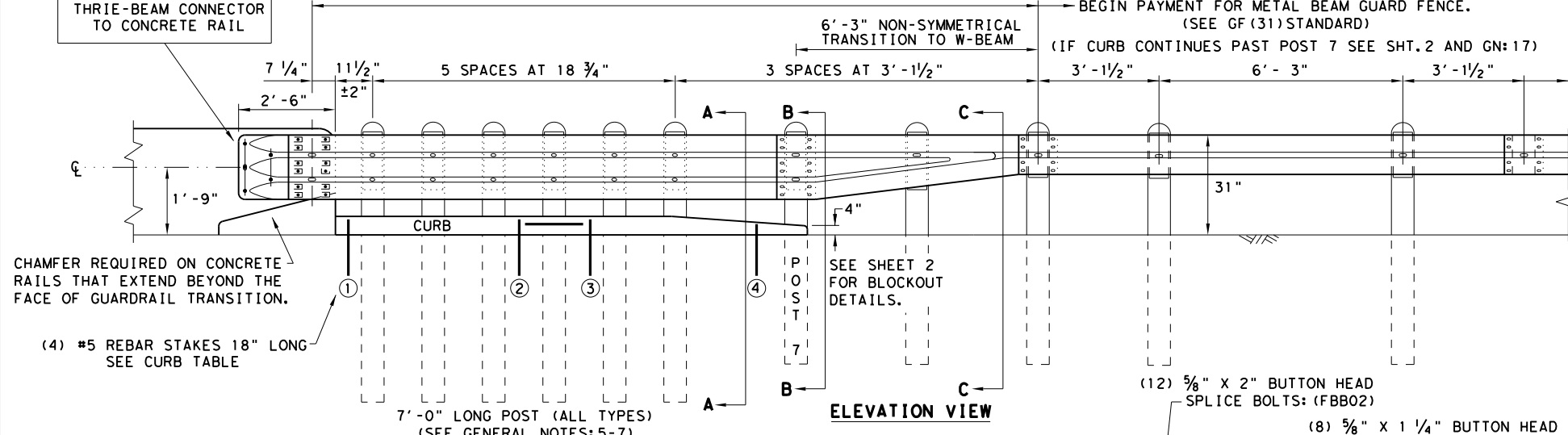
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 DISCLAIMER: THE USE OF THIS STANDARD IS GOVERNED BY THE "TEXAS ENGINEERING PRACTICE ACT". NO WARRANTY OF ANY KIND IS MADE BY TXDOT FOR ANY PURPOSE WHATSOEVER. TXDOT ASSUMES NO RESPONSIBILITY FOR THE CONVERSION OF THIS STANDARD TO OTHER FORMATS OR FOR INCORRECT RESULTS OR DAMAGES RESULTING FROM ITS USE.



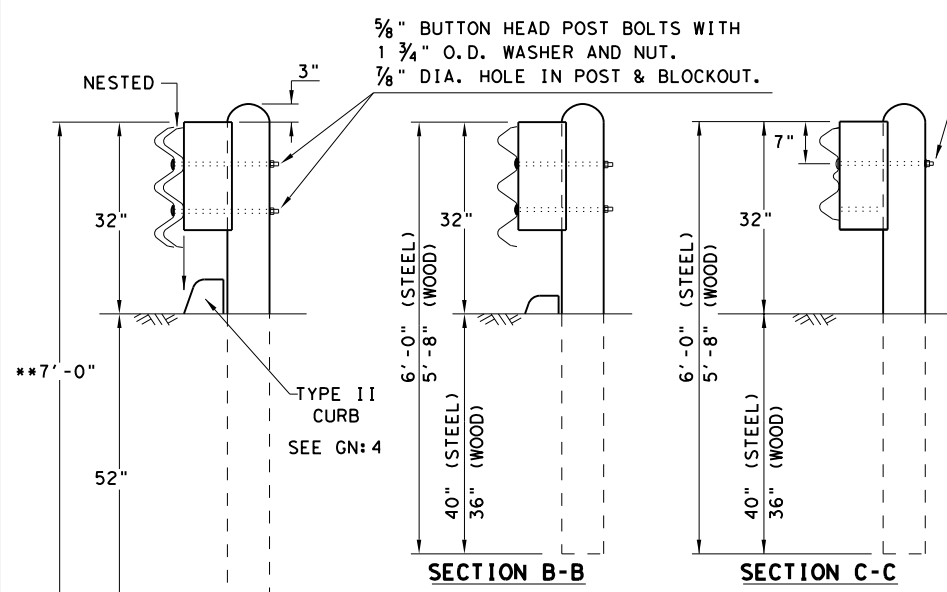
- (5) 1" DIA. HOLES.
- (5) 7/8" DIA. HEAVY HEX HEAD BOLTS (FACING TRAFFIC SIDE) (ASTM F3125 GR A325 OR A449).
- (10) 1 3/4" O.D. WASHER UNDER EACH HEX BOLT HEAD AND NUT.
- (5) 7/8" DIA. HEAVY HEX NUTS (ASTM A194 OR A563).

NOTE:  
HEAVY HEX BOLT LENGTH WILL VARY DEPENDING ON WIDTH CONCRETE RAIL, LEAVE 1" OF BOLT LENGTH PAST THE 7/8" HEX NUT. TRIM AS REQUIRED.

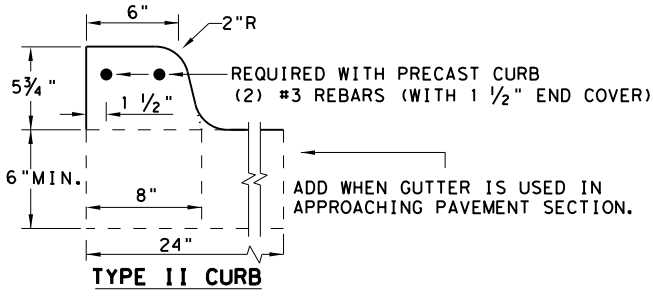
NOTE:  
CURB IS A REQUIRED COMPONENT FOR THE TRANSITION TO FUNCTION PROPERLY. SEE GENERAL NOTES: 2-4 AND 16-17.



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



THRIE-BEAM TERMINAL - CURB TABLE	
PRECAST CURB FULL LENGTH EQUALS 12'- 2"	
THE PRECAST CURB MAY BE FORMED INTO TWO SECTIONS.	
CURB (1)	LENGTH 5'- 8"
CURB (2)	LENGTH 6'- 6"
TAPER CURB (2) TO A HEIGHT OF 4" AT POST 7	
CONNECTING PRECAST CURB SECTIONS (1) & (2):	
FORM OR CORE 1" DIA. HOLE 9" LONG INTO EACH CURB END.	
USE (1) #5 GR.60 REBAR 18" LONG TO CONNECT BOTH CURBS.	
SECURING PRECAST OR CAST-IN-PLACE TO FINISHED GRADE *:	
FORM OR CORE (4) 1" DIA. HOLES, SEE PLAN AND ELEVATION VIEWS FOR HOLE LOCATIONS. DRIVE (4) #5 GR.60 REBAR STAKES 18" LONG INTO THE GROUND AND 1/2" BELOW TOP OF CURB.	
FILL HOLES WITH APPROVED GROUT MIXTURE.	



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

**GENERAL NOTES**

1. CONTACT THE DESIGN DIVISION FOR DRAINAGE CUT OUT OPTIONS NEEDED WITHIN THE CURB SECTION OF THE THRIE-BEAM TRANSITION. (512) 416-2678
2. CONCRETE CURB MAY BE CAST-IN-PLACE OR PRECAST AS SHOWN ON THIS SHEET. WHEN USED IN CONJUNCTION WITH THE THRIE-BEAM TRANSITIONS, CURB SHALL BE TYPE II (5- 3/4" HEIGHT); SEE CURRENT CCGG STANDARD SHEET FOR FURTHER DETAILS. IF OTHER CURB HEIGHTS ARE SHOWN IN THE PLANS IN CONJUNCTION WITH THE TRANSITION, THE CURB HEIGHT MAY BE FROM 4" TO 8" WITH A RELATIVELY VERTICAL FACE. CONCRETE CURB SHALL BE CONTINUOUS TO THE SEVENTH POST UNLESS OTHERWISE SHOWN IN THE PLANS. SEE GENERAL NOTE:17 FOR CIRCUMSTANCES WHERE CURB CONTINUES PAST POST 7.
3. CONCRETE CURB TYPE II SUBSIDIARY TO "METAL BEAM GUARD FENCE TRANSITION". IF NO ADDITIONAL CURB IS INDICATED BEYOND THE TRANSITION, THEN ANY CURB HEIGHT GREATER THAN 4" WILL BE TAPERED DOWN BEGINNING AT THE LAST 7 FT. POST TO A MAXIMUM HEIGHT OF 4" AT POST 7. IF SHOWN ELSEWHERE IN THE PLANS, ADDITIONAL CURB UNDERNEATH GUARDRAIL WILL BE PAID FOR BY THE LINEAR FOOT.
4. UNLESS OTHERWISE SHOWN IN THE PLANS, TRANSITIONS SHALL BE PLACED WITH THE BLOCKOUT FACE IN FRONT OF OR DIRECTLY ABOVE THE CURB FACE. SEE SECTION A-A.
5. FOR ROUND WOOD POST SYSTEMS, ALL ROUND WOOD POSTS SHALL BE 7 1/2" DIA. MINIMUM THROUGHOUT THE THRIE-BEAM TRANSITION.
6. THE TYPE OF POST (ROUND WOOD POST, RECTANGULAR WOOD POST OR STEEL POST) WILL BE AS SHOWN IN THE PLANS. REFER TO GF (31) STANDARD SHEET.
7. THE POST LENGTH SHALL BE MARKED ON ALL 7'- 0" LONG POSTS BY THE MANUFACTURER. THE MARK SHALL BE LOCATED WITHIN THE TOP 1 FT. REGION OF THE POST, AT LEAST 5/8" IN HEIGHT, AND VISIBLE AFTER INSTALLATION. WOODEN POSTS SHALL BE MARKED WITH A BRAND, AND STEEL POSTS WITH A STENCIL BEFORE GALVANIZING.
8. POSTS SHALL NOT BE SET IN CONCRETE, OF ANY DEPTH.
9. RAIL ELEMENTS SHALL MEET THE REQUIREMENTS OF ITEM 540, "METAL BEAM GUARD FENCE" EXCEPT AS MODIFIED ON THE PLANS. THE THRIE-BEAM TERMINAL CONNECTOR AND THE THRIE-BEAM TRANSITION TO W-BEAM SHALL BE OF THE SAME MATERIAL, BUT SHALL NOT BE LESS THAN 10 GAUGE. CONTRACTOR SHALL VERIFY THAT THE LOCATIONS OF BOLT HOLES MATCH THOSE IN THE THRIE-BEAM TERMINAL CONNECTOR PRIOR TO ORDERING MATERIALS.
10. BUTTON HEAD "POST BOLTS & NUTS" SHALL MEET THE REQUIREMENTS OF (ASTM A307), AND SHALL BE OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT AND 5/8" WASHER (FWC16G) AND NOT MORE THAN 1" BEYOND IT. TRIM REMAINING BOLT LENGTH TO MEET REQUIRED LENGTH.
11. FITTINGS (BOLTS, NUTS, AND WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING". FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
12. CROWN SHALL BE WIDENED TO ACCOMMODATE TRANSITIONS.
13. WHERE SOLID ROCK IS ENCOUNTERED, CONTACT THE DESIGN DIVISION FOR ADDITIONAL GUIDANCE. (512) 416-2678
14. UNLESS OTHERWISE SHOWN IN THE PLANS, A COMPOSITE MATERIAL BLOCK THAT MEETS THE REQUIREMENTS OF DMS-7210, "COMPOSITE MATERIAL POSTS AND BLOCKS FOR METAL BEAM GUARD FENCE" MAY BE SUBSTITUTED FOR BLOCKS OF SIMILAR DIMENSIONS. TXDOT'S MATERIALS AND TESTS DIVISION MAINTAINS A MATERIAL PRODUCER LIST (MPL) FOR PRODUCERS OF MATERIALS CONFORMING TO DMS-7210. ONLY PRODUCERS ON THE MPL CAN FURNISH COMPOSITE MATERIAL BLOCKS.
15. REFER TO GF (31) STANDARD SHEET & BRIDGE RAILING DETAILS FOR ADDITIONAL DETAILS.
16. THE INSTALLATION OF THE TYPE II CURB IS CRITICAL FOR THE PERFORMANCE OF THE THRIE-BEAM TRANSITION SYSTEM. THE CURB PREVENTS (VEHICLE WHEEL SNAGGING) AT THE CONCRETE RAIL AND IS REQUIRED TO MEET MASH CRASH TEST CRITERIA.
17. IF CURB EXTENDS BEYOND POST 7, 25' OF NESTED W-BEAM GUARDRAIL SHALL BE INSTALLED BEYOND THE PAY LIMITS OF THRIE-BEAM TRANSITION SECTION, (SEE SHT.2). PAYMENT FOR THIS 25' SECTION WILL BE BY LINEAR FOOT, PAY ITEM "0540 6XXX MTL W-BEAM GD FEN (NESTED) (TIM POST)" OR "540 6XXX MTL W-BEAM GD FEN (NESTED) (STEEL POST)" AS APPLICABLE FOR POST TYPE. SEE SHT.2 FOR ADDITIONAL INFORMATION.

**HIGH-SPEED TRANSITION  
SHEET 1 OF 2**

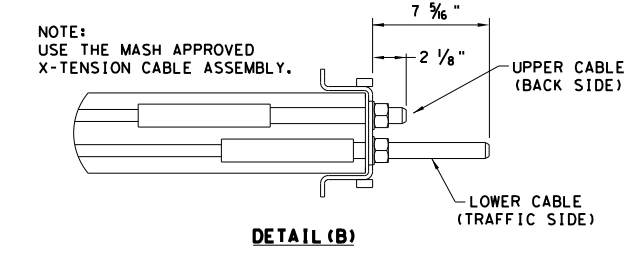
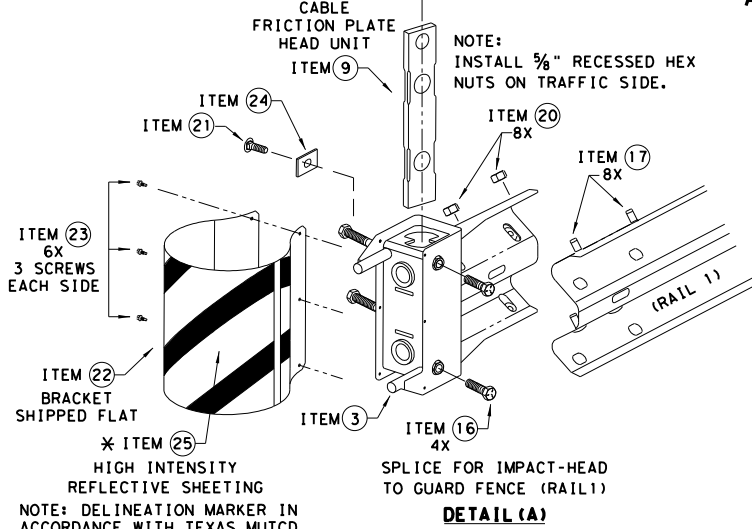
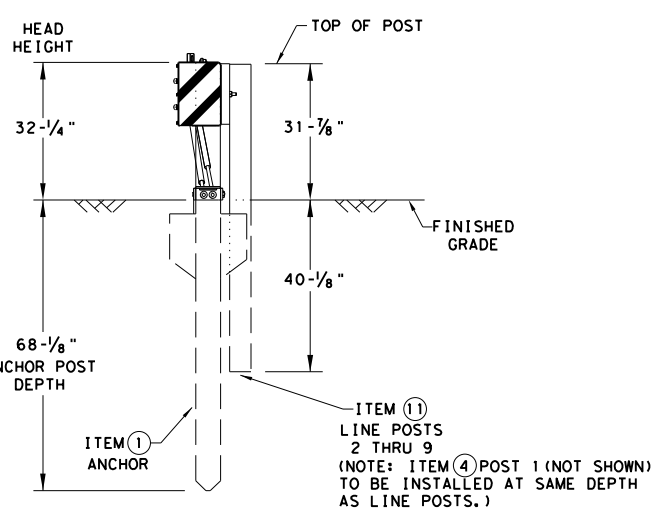
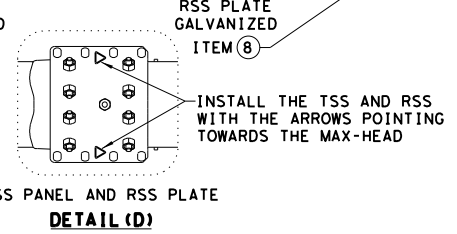
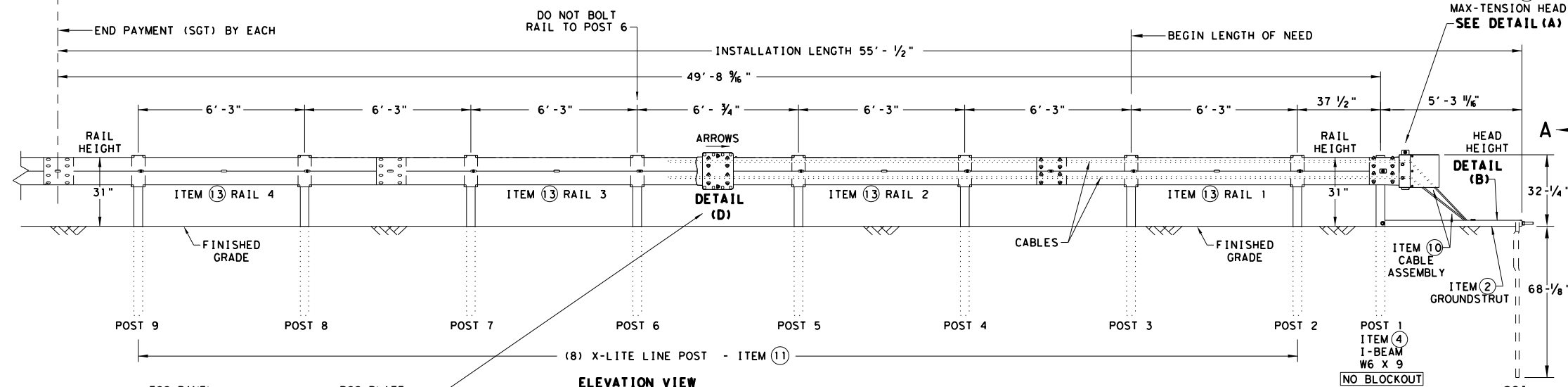
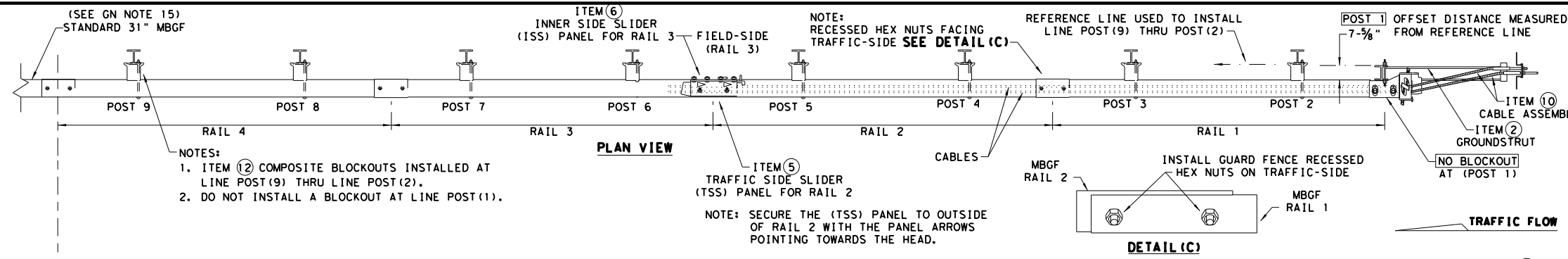
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<b>GF (31) TR TL3-20</b>			
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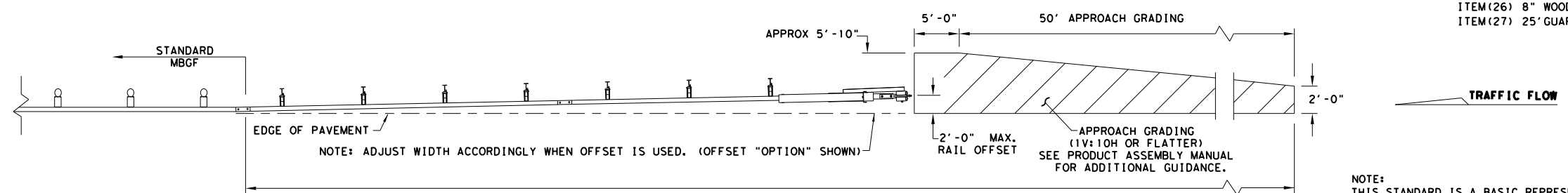
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- GENERAL NOTES**
- FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: LINDSAY TRANSPORTATION SOLUTIONS (LTS) - BARRIER SYSTEMS, INC. AT (707) 374-6800
  - FOR INSTALLATION, REPAIR, & MAINTENANCE REFER TO THE: MAX-TENSION INSTALLATION INSTRUCTION MANUAL. P/N MANMAX REV D (ECN 3516).
  - APPLY HIGH INTENSITY REFLECTIVE SHEETING, "OBJECT MARKER" ON THE FRONT FACE OF THE DEVICE PER MANUFACTURER'S RECOMMENDATIONS. OBJECT MARKER SHALL CONFORM TO THE STANDARDS REQUIRED IN TEXAS MUTCD.
  - FOR POST (LEAVE-OUT) INSTALLATION AND GUIDANCE SEE TxDOT'S LATEST ROADWAY MOW STRIP STANDARD.
  - ALL STEEL COMPONENTS ARE GALVANIZED PER ASTM A123 OR EQUIVALENT UNLESS OTHERWISE STATED.
  - SYSTEM SHOWN USING STEEL WIDE FLANGE POST WITH COMPOSITE BLOCKOUTS.
  - COMPOSITE MATERIAL BLOCKOUT THAT MEETS THE REQUIREMENTS OF DMS-7210, MAY BE SUBSTITUTED FOR BLOCKOUTS SIMILAR DIMENSIONS. SEE CONSTRUCTION DIVISION MATERIAL PRODUCER LIST (MPL) FOR CERTIFIED PRODUCERS.
  - REFER TO INSTALLATION MANUAL FOR SPECIFIC PANEL LAPPING GUIDANCE.
  - IF SOLID ROCK IS ENCOUNTERED SEE THE MANUFACTURER'S INSTALLATION MANUAL FOR INSTALLATION GUIDANCE.
  - POSTS SHALL NOT BE SET IN CONCRETE.
  - A DRIVING CAP WITH A TIMBER OR PLASTIC INSERT SHALL BE USED WHEN DRIVING POST TO PREVENT DAMAGE TO THE GALVANIZING ON TOP OF THE POST.
  - MAX-TENSION SYSTEM SHALL NEVER BE INSTALLED WITHIN A CURVED SECTION OF GUARDRAIL.
  - IF A DELINEATION MARKER IS REQUIRED, MARKER SHALL BE IN ACCORDANCE WITH TEXAS MUTCD.
  - THE SYSTEM IS SHOWN WITH 12'-6" MBGF PANELS, 25'-0" MBGF PANELS ARE ALSO ALLOWED.
  - A MINIMUM OF 12'-6" OF 12GA. MBGF IS REQUIRED IMMEDIATELY DOWNSTREAM OF THE MAX-TENSION SYSTEM.

ITEM #	PART NUMBER	DESCRIPTION	QTY
1	BSI-1610060-00	SOIL ANCHOR - GALVANIZED	1
2	BSI-1610061-00	GROUND STRUT - GALVANIZED	1
3	BSI-1610062-00	MAX-TENSION IMPACT HEAD	1
4	BSI-1610063-00	W6x9 I-BEAM POST 6FT. -GALVANIZED	1
5	BSI-1610064-00	TSS PANEL - TRAFFIC SIDE SLIDER	1
6	BSI-1610065-00	ISS PANEL - INNER SIDE SLIDER	1
7	BSI-1610066-00	TOOTH - GEOMET	1
8	BSI-1610067-00	RSS PLATE - REAR SIDE SLIDER	1
9	B061058	CABLE FRICTION PLATE - HEAD UNIT	1
10	BSI-1610069-00	CABLE ASSEMBLY - MASH X-TENSION	2
11	BSI-1012078-00	X-LITE LINE POST - GALVANIZED	8
12	B090534	8" W-BEAM COMPOSITE-BLOCKOUT XT110	8
13	BSI-4004386	12'-6" W-BEAM GUARD FENCE PANELS 12GA.	4
14	BSI-1102027-00	X-LITE SQUARE WASHER	1
15	BSI-2001886	3/8" X 7" THREAD BOLT HH (GR.5) GEOMET	1
16	BSI-2001885	3/4" X 3" ALL-THREAD BOLT HH (GR.5) GEOMET	4
17	4001115	5/8" X 1 1/4" GUARD FENCE BOLTS (GR.2) MGAL	48
18	2001840	5/8" X 10" GUARD FENCE BOLTS MGAL	8
19	2001636	5/8" WASHER F436 STRUCTURAL MGAL	2
20	4001116	5/8" RECESSED GUARD FENCE NUT (GR.2) MGAL	59
21	BSI-2001888	3/8" X 2" ALL THREAD BOLT (GR.5) GEOMET	1
22	BSI-1701063-00	DELINEATION MOUNTING (BRACKET)	1
23	BSI-2001887	1/4" X 3/4" SCREW SD HH 410SS	7
24	4002051	GUARDRAIL WASHER RECT AASHTO FWRO3	1
25	SEE NOTE BELOW	HIGH INTENSITY REFLECTIVE SHEETING	1
26	4002337	8" W-BEAM TIMBER-BLOCKOUT, PDB01B	8
27	BSI-4004431	25' W-BEAM GUARDRAIL PANEL, 8-SPACE, 12GA.	2
28	MANMAX Rev-(D)	MAX-TENSION INSTALLATION INSTRUCTIONS	1



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

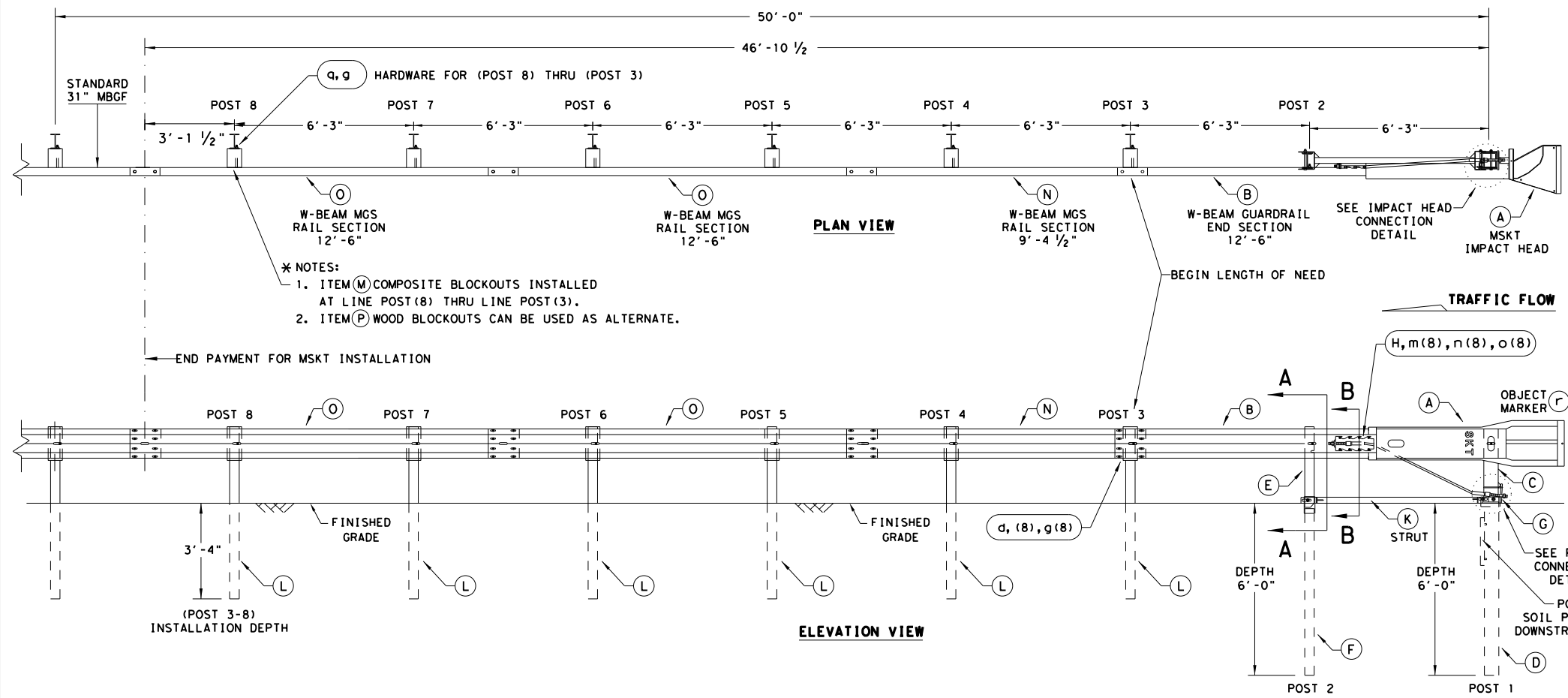
NOTE: THIS STANDARD IS A BASIC REPRESENTATION OF THE MAX-TENSION END TERMINAL, IT IS NOT INTENDED TO REPLACE THE PRODUCT DESCRIPTION ASSEMBLY MANUAL.

**Texas Department of Transportation**  
 Design Division Standard

**MAX-TENSION END TERMINAL  
 MASH - TL-3  
 SGT (11S) 31-18**

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© TxDOT: FEBRUARY 2018	CONT	SECT	JOB	HIGHWAY
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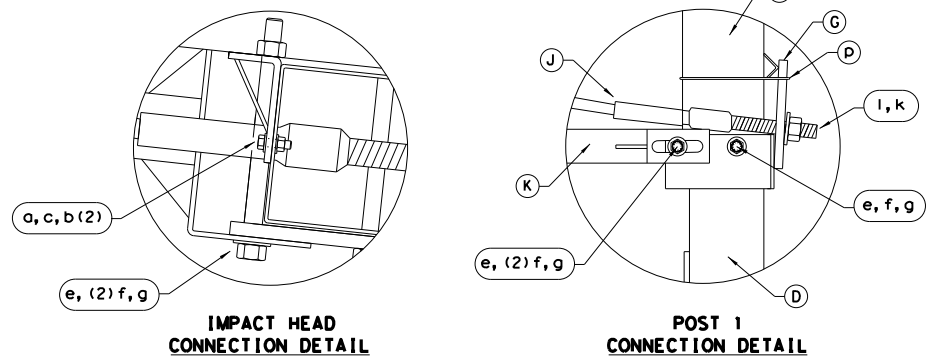
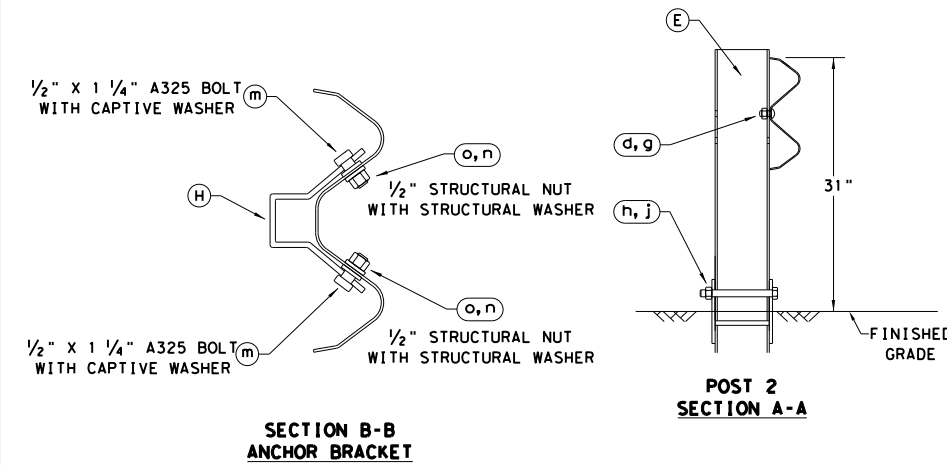
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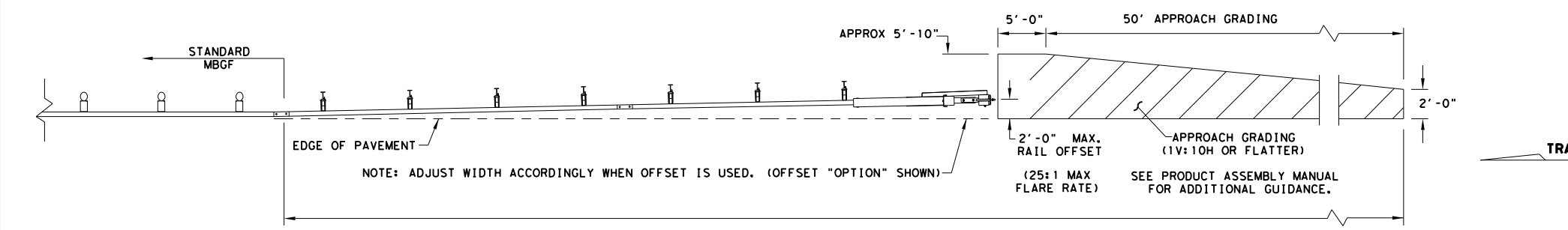
- \* NOTES:**
- ITEM (M) COMPOSITE BLOCKOUTS INSTALLED AT LINE POST (8) THRU LINE POST (3).
  - ITEM (P) WOOD BLOCKOUTS CAN BE USED AS ALTERNATE.

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

ITEM	QTY	MAIN SYSTEM COMPONENTS	ITEM NUMBERS
A	1	MSKT IMPACT HEAD	MS3000
B	1	W-BEAM GUARDRAIL END SECTION, 12 Go.	SF1303
C	1	POST 1 - TOP (6" X 6" X 1/8" TUBE)	MTPHP1A
D	1	POST 1 - BOTTOM (6' W6X15)	MTPHP1B
E	1	POST 2 - ASSEMBLY TOP	UHP2A
F	1	POST 2 - ASSEMBLY BOTTOM (6' W6X9)	HP2B
G	1	BEARING PLATE	E750
H	1	CABLE ANCHOR BOX	S760
J	1	BCT CABLE ANCHOR ASSEMBLY	E770
K	1	GROUND STRUT	MS785
L	6	W6X9 OR W6X8.5 STEEL POST	P621
M	6	COMPOSITE BLOCKOUTS	CBSP-14
N	1	W-BEAM MGS RAIL SECTION (9'-4 1/2")	G12025
O	2	W-BEAM MGS RAIL SECTION (12'-6")	G1203A
P	6	WOOD BLOCKOUT 6" X 8" X 14"	P675
Q	1	W-BEAM MGS RAIL SECTION (25'-0")	G1209
SMALL HARDWARE			
a	2	5/8" x 1" HEX BOLT (GRD 5)	B5160104A
b	4	5/8" WASHER	W0516
c	2	5/8" HEX NUT	N0516
d	25	5/8" Dia. x 1 1/4" SPLICE BOLT (POST 2)	B580122
e	2	5/8" Dia. x 9" HEX BOLT (GRD A449)	B580904A
f	3	5/8" WASHER	W050
g	33	5/8" Dia. H.G.R NUT	N050
h	1	3/4" Dia. x 8 1/2" HEX BOLT (GRD A449)	B340854A
j	1	3/4" Dia. HEX NUT	N030
k	2	1 ANCHOR CABLE HEX NUT	N100
l	2	1 ANCHOR CABLE WASHER	W100
m	8	1/2" x 1 1/4" A325 BOLT WITH CAPTIVE WASHER	SB12A
n	8	1/2" STRUCTURAL NUTS	N012A
o	8	1 1/8" O.D. x 3/8" I.D. STRUCTURAL WASHERS	W012A
p	1	BEARING PLATE RETAINER TIE	CT-100ST
q	6	5/8" x 10" H.G.R. BOLT	B581002
r	1	OBJECT MARKER 18" X 18"	E3151



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



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

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

Design Division Standard

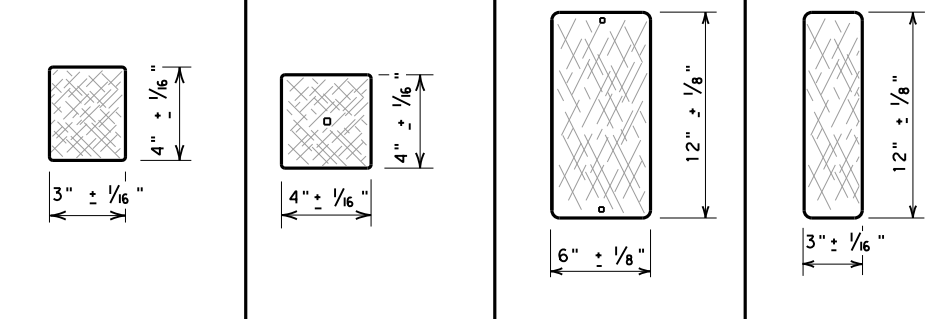
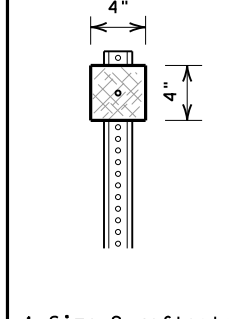
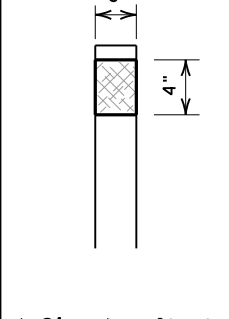
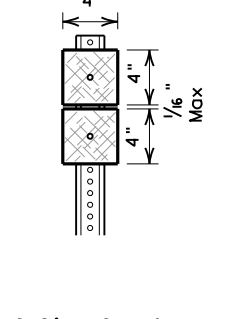
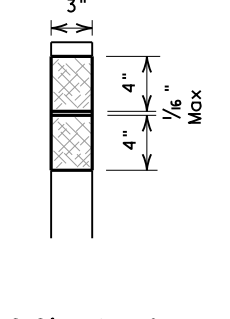
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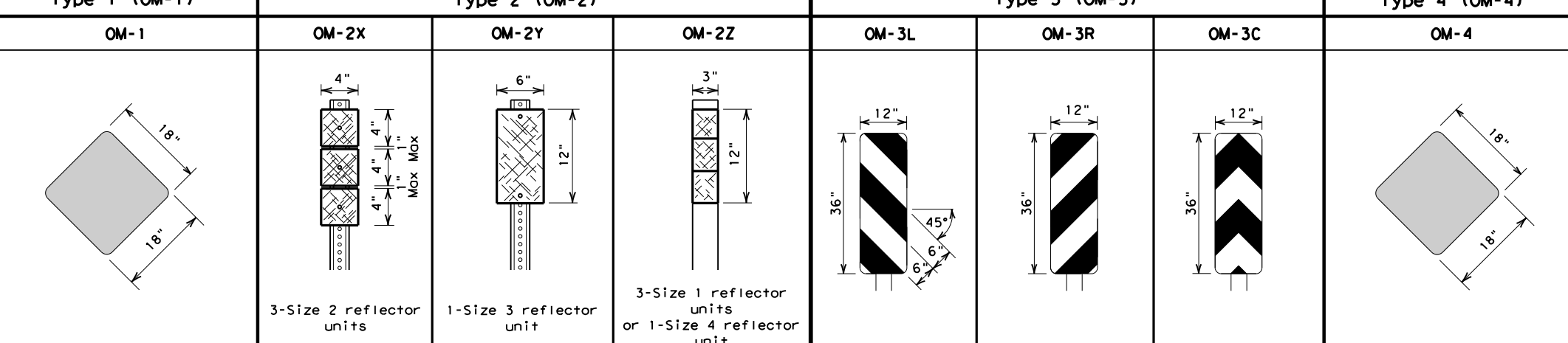
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### SGT (12S) 31-18

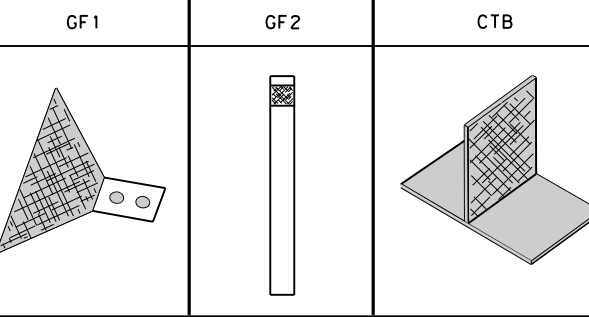

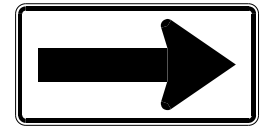
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REFLECTOR UNIT SIZES FOR DELINEATORS AND OBJECT MARKERS				DELINEATORS				D & OM DESCRIPTIVE CODES		
DEVICE	SIZE 1	SIZE 2	SIZE 3	SIZE 4	SINGLE		DOUBLE		INSTL DEL ASSM (D-XX)SZ X (XXXX)XXX(XX) NUMBER OF REFLECTORS S = Single D = Double COLOR OF REFLECTORS W = White Y = Yellow R = Red REFLECTOR UNIT SIZE 1 or 2 TYPE OF POST OR DELINEATOR WC = Wing Channel Post YFLX = Yellow Flexible Post WFLX = White Flexible Post BRFL = Barrier Reflector TYPE OF MOUNT GND = Embedded (drivable or set in concrete) CTB = Concrete Barrier Mount GF1 or GF2 = Guard Fence Attachment SRF = Surface Mount DIRECTION If Required BI = Bi-Directional BR = Bi-Directional with red on back	
										
SHEETING	Yellow, White or Red Type B or C reflective sheeting				SHEETING		Yellow, White or Red Type B or C Reflective Sheeting			
NOTE	1. Size 1 and 4 - Direct applied reflective sheeting for use on flexible post (fix). 2. Size 2 and 3 - For use on wing channel (wc) post only. Use approved metal, plastic or fiberglass backplate with 17/64" mounting holes.				POST TYPE	WC	YFLX, WFLX	WC	YFLX, WFLX	INSTL OM ASSM (OM-XX) (XXXX)XXX(XX) TYPE OF OBJECT MARKER 1, 2, 3, or 4 NUMBER OF REFLECTORS OR DIRECTION X = 3-Size 2 reflector unit (Type 2 only) Y = 1-Size 3 reflector unit (Type 2 only) Z = 3-Size 1 or 1-Size 4 reflector unit(s) (Type 2 only) L = Left Side (Type 3 Object Marker only) R = Right Side (Type 3 Object Marker only) C = Center (Type 3 Object Marker only) TYPE OF POST WC = Wing Channel Post WFLX = White Flexible Post TWT = Thin Walled Tubing TYPE OF MOUNT GND = Embedded (drivable) SRF = Surface Mount WAS = Wedge Anchor Steel WAP = Wedge Anchor Plastic DIRECTION If Required BI = Bi-Directional
					MOUNT TYPE	GND	GND, SRF	GND	GND, SRF	

OBJECT MARKERS									
DEVICE	Type 1 (OM-1)		Type 2 (OM-2)			Type 3 (OM-3)			Type 4 (OM-4)
	OM-1	OM-2X	OM-2Y	OM-2Z	OM-3L	OM-3R	OM-3C	OM-4	
									
SHEETING	Yellow-Type B <sub>FL</sub> or C <sub>FL</sub> Sheeting		Yellow - Type B or C Sheeting			Alternating acrylic black and retroreflective yellow - Type B <sub>FL</sub> or C <sub>FL</sub> Sheeting			Red -Type B <sub>FL</sub> or C <sub>FL</sub> Sheeting
POST TYPE	TWT		WC	WC	WFLX	TWT			TWT
MOUNT TYPE	WAS, WAP		GND	GND	GND, SRF	WAS, WAP			WAS, WAP

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

BARRIER REFLECTORS (BRF)			CHEVRONS				ONE DIRECTION LARGE ARROW		NOTE: Delineator and object marker substrates and sign substrates shall be 0.080" Aluminum sign blank to conform to ASTM B-209 Alloy 6061-T6 or approved alternative.
DEVICE	GF1	GF2	CTB	W1-8		W1-6			
									
NOTE	1. Barrier reflectors shall meet the requirements of DMS 8600. 2. Approved Barrier Reflectors are listed on the "Barrier Reflectors" Material Producer List at: www.txdot.gov.			SIZE (W x L)		SIZE (W x L)			
				18" x 24" (Conventional)		48" x 24" (Conventional)			
				24" x 30" (Conventional Oversize)		60" x 30" (Expressway & Freeway)			
				30" x 36" (Expressway)					
				36" x 48" (Freeway)					
				MOUNTING HEIGHT		MOUNTING HEIGHT			
				4'-0" or 7'-0"		7'-0"			
				1. CHEVRON (W1-8) signs and ONE DIRECTION LARGE ARROW (W1-6) Signs shall be installed per Sign Mounting Details (SMD) Standard Sheets and paid under Item 644 (Small Roadside Sign Assemblies). 2. When there is a need to increase conspicuity, the Texas version of the ONE DIRECTION LARGE ARROW sign (W1-9T) may be used instead of the ONE DIRECTION LARGE ARROW (W1-6).					
SHEETING	Yellow, White, Red								
NOTE	1. Reflective sheeting shall have a minimum dimension of 3 inches and minimum surface area of 9 square inches.								


 Traffic Safety Division Standard

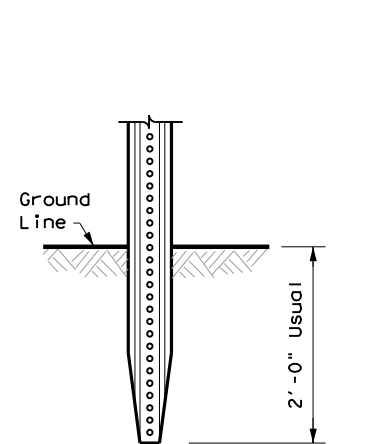
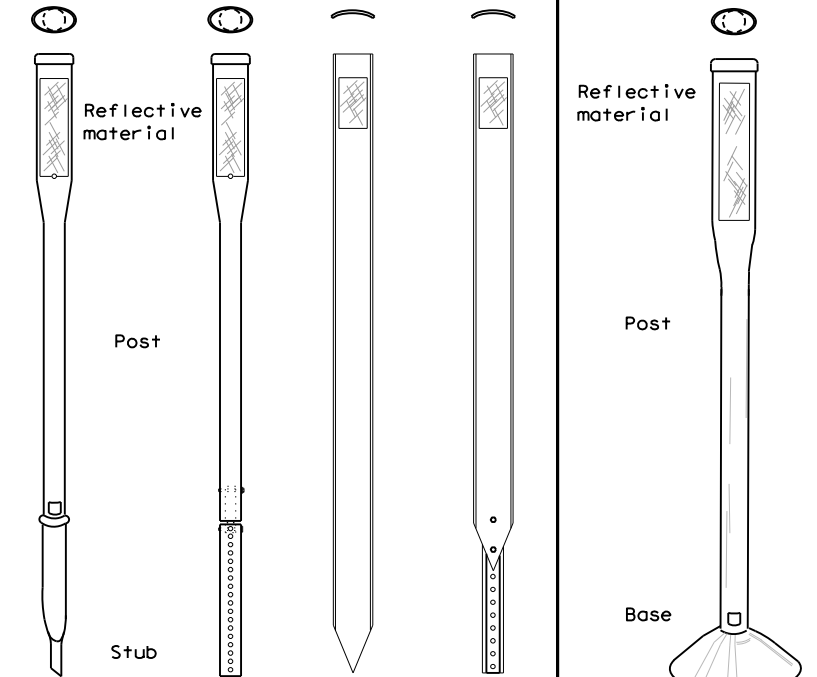
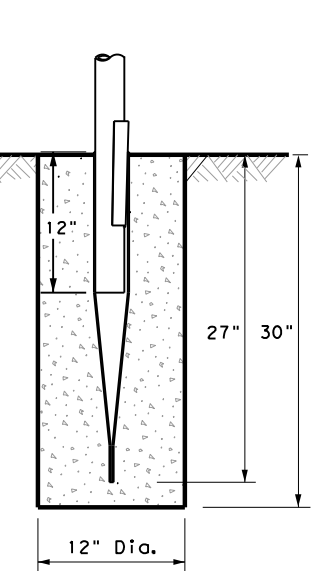
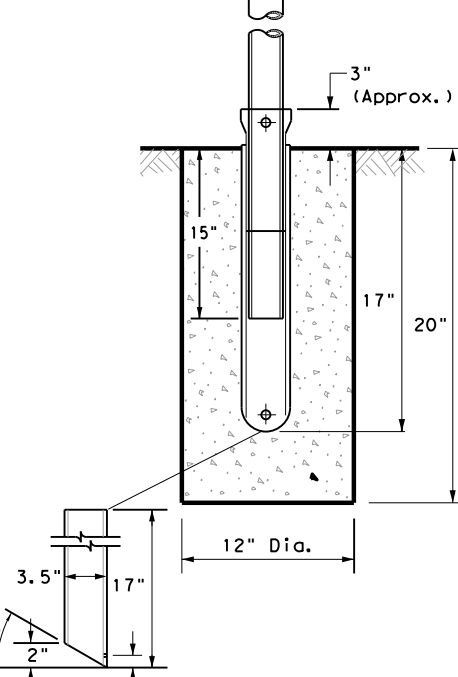
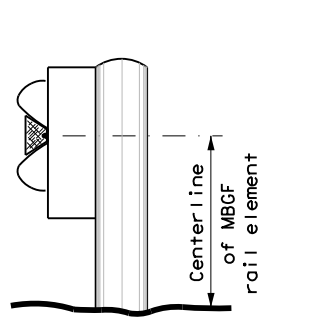
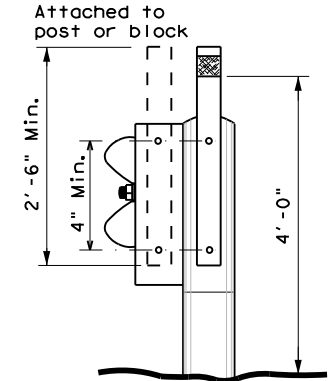
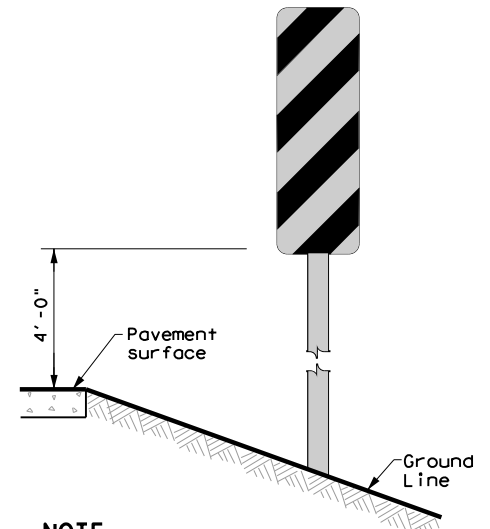
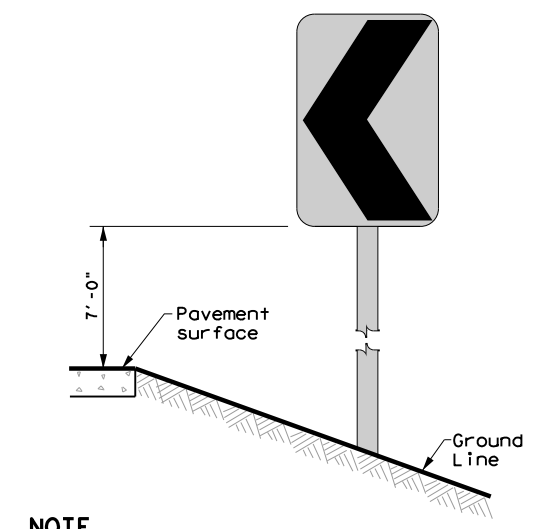
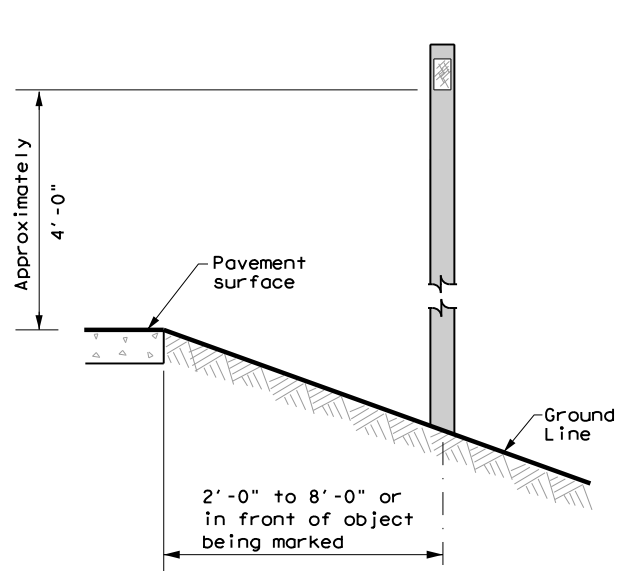
## DELINEATOR & OBJECT MARKER MATERIAL DESCRIPTION


### D & OM(1)-20

FILE: dom1-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CR: TXDOT
© TXDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	1780	01	009	FM 1047
10-09 3-15	DIST	COUNTY	SHEET NO.	
4-10 7-20	BWD	MILLS	46	

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DATE: 1/11/2022 10:48:40 AM  
 FILE: T:\BWDSD\TEAM\Design Projects\Mills\1780-01-009 FM 1047 Bennett Branch\BWDSD\Traffic Safety Division\20B.dgn

POST TYPE AND SUPPORT FOUNDATION DETAILS				TYPE OF BARRIER MOUNTS		
WING CHANNEL (WC)	FLEXIBLE POSTS (YFLX, WFLX)		WEDGE ANCHOR SYSTEMS		GUARD FENCE ATTACHMENT	
GND	GND	SRF	WAS	WAP	GF 1	GF 2
 <p style="text-align: center;">2'-0" Usual</p>						
	<b>EMBEDDED</b>	<b>SURFACE MOUNT</b>	<b>STEEL</b>	<b>PLASTIC</b>	<b>CONCRETE TRAFFIC BARRIER (CTB)</b>	
<b>NOTES</b> 1. Embedded Wing Channel (WC) post option may be used for Type 2 Object Markers and Delineators only. 2. 1.12 lbs/ft steel per ASTM A 1011 SS Gr. 50, or ASTM A499.			<b>NOTE</b> 1. Install per manufacturer's recommendations.		<b>GENERAL NOTES</b> 1. Place delineators on a section of roadway at a consistent distance from the edge of pavement. 2. Where a restriction prevents consistent placement from the pavement edge, place the affected object markers in line with the innermost edge of the obstruction. 3. When Type 2 object markers and delineators are more than 8'-0" from the edge of the pavement, it may not be possible to maintain a height of approximately 4'-0". If this is the case, place the object marker or delineator as close to the desired height as possible. 4. Install all delineators, object markers and barrier reflectors in accordance with the manufacturer's recommendation. 5. Barrier reflectors should be installed a minimum of 18 inches above the edge of the pavement surface. 6. Diagonal stripes on Type 3 object markers shall slope down toward the intended travel lane.	
<b>NOTES</b> 1. See "Flexible Delineator and Object Marker Posts" Material Producer List for approved devices. 2. Install per manufacturer's recommendations. 3. Post length may vary to meet field conditions. 4. When using yellow delineators with flexible posts to separate opposing direction of travel, such as centerline or median use, the flexible posts shall be yellow.						
<b>TYPES 1,3, AND 4 OBJECT MARKERS AND CHEVRONS</b>		<b>CHEVRONS AND ONE DIRECTION LARGE ARROW SIGN</b>		<b>DELINEATORS AND TYPE 2 OBJECT MARKERS</b>		
						
<b>NOTE</b> Mounting at 4 feet to the bottom of the chevron is permitted for chevrons that will not exceed a height of 6'-6" to the top of the chevron (sizes 24" x 30" and smaller)		<b>NOTE</b> Chevrons 30" x 36" and larger shall be mounted at a height of 7' to the bottom of the chevron. Chevron sign and ONE DIRECTION LARGE ARROW sign (W1-9T) shall be installed per SMD standard sheets and paid under item 644.		<b>NOTE</b> See general notes 1, 2 and 3.		



Traffic Safety Division Standard

## DELINEATOR & OBJECT MARKER INSTALLATION

### D & OM(2)-20

FILE: dom2-20.dgn	DW: TxDOT	CK: TxDOT	OW: TxDOT	CR: TxDOT
© TxDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	1780	01	009	FM 1047
10-09 3-15	DIST	COUNTY		SHEET NO.
4-10 7-20	BWD	MILLS		47

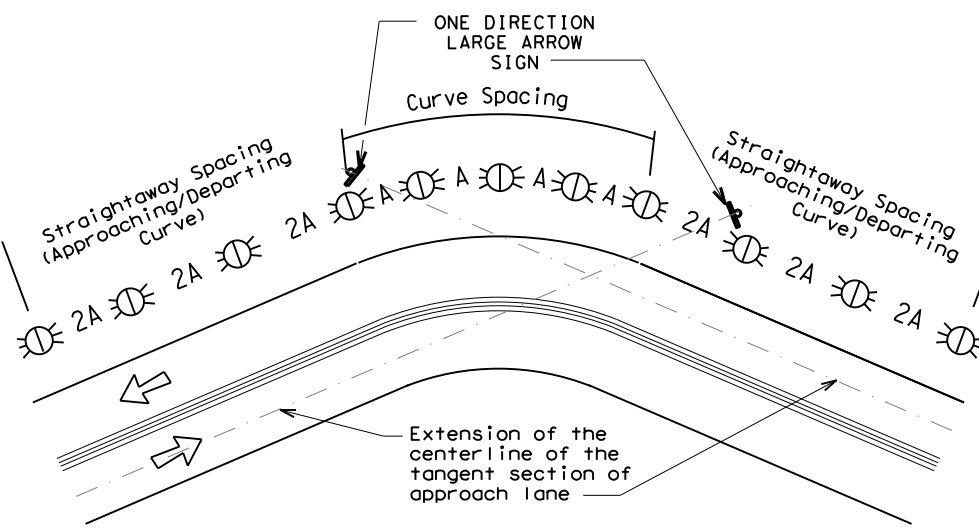
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### MINIMUM WARNING DEVICES AT CURVES WITH ADVISORY SPEEDS

Amount by which Advisory Speed is less than Posted Speed	Curve Advisory Speed	
	Turn (30 MPH or less)	Curve (35 MPH or more)
5 MPH & 10 MPH	• RPMs	• RPMs
15 MPH & 20 MPH	• RPMs and One Direction Large Arrow sign	• RPMs and Chevrons; or • RPMs and One Direction Large Arrow sign where geometric conditions or roadside obstacles prevent the installation of chevrons.
25 MPH & more	• RPMs and Chevrons; or • RPMs and One Direction Large Arrow sign where geometric conditions or roadside obstacles prevent the installation of chevrons	• RPMs and Chevrons

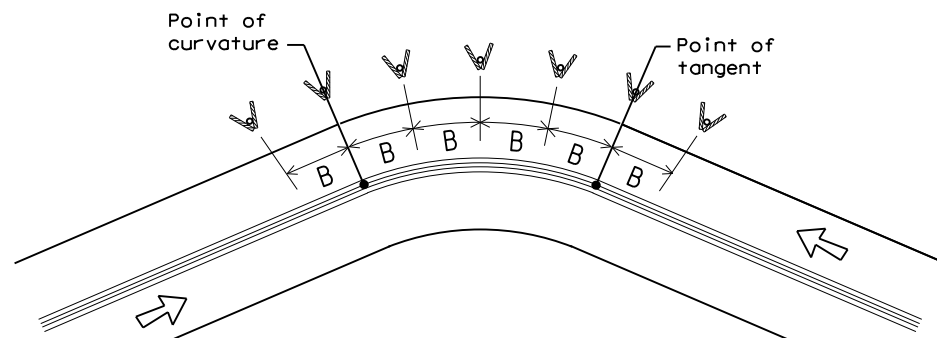
### SUGGESTED SPACING FOR DELINEATORS ON HORIZONTAL CURVES



**NOTE**

ONE DIRECTION LARGE ARROW (W1-6) sign should be located at approximately and perpendicular to the extension of the centerline of the tangent section of approach lane.

### SUGGESTED SPACING FOR CHEVRONS ON HORIZONTAL CURVES



**NOTE**

At least one chevron pair is installed beyond the point of tangent in tangent section.

### DELINEATOR AND CHEVRON SPACING

WHEN DEGREE OF CURVE OR RADIUS IS KNOWN				
Degree of Curve	FEET			
	Radius of Curve	Spacing in Curve	Spacing in Straightaway	Chevron Spacing in Curve
		A	2A	B
1	5730	225	450	—
2	2865	160	320	—
3	1910	130	260	200
4	1433	110	220	160
5	1146	100	200	160
6	955	90	180	160
7	819	85	170	160
8	716	75	150	160
9	637	75	150	120
10	573	70	140	120
11	521	65	130	120
12	478	60	120	120
13	441	60	120	120
14	409	55	110	80
15	382	55	110	80
16	358	55	110	80
19	302	50	100	80
23	249	40	80	80
29	198	35	70	40
38	151	30	60	40
57	101	20	40	40

Curve delineator approach and departure spacing should include 3 delineators spaced at 2A. This spacing should be used during design preparation or when the degree of curve is known.

### DELINEATOR AND CHEVRON SPACING

WHEN DEGREE OF CURVE OR RADIUS IS NOT KNOWN			
Advisory Speed (MPH)	Spacing in Curve	Spacing in Straightaway	Chevron Spacing in Curve
	A	2xA	B
65	130	260	200
60	110	220	160
55	100	200	160
50	85	170	160
45	75	150	120
40	70	140	120
35	60	120	120
30	55	110	80
25	50	100	80
20	40	80	80
15	35	70	40

If the degree of curve is not known, delineator spacing may be determined based on the Advisory Speed of the curve. Use the delineator curve spacing for each Advisory Speed (MPH).

### DELINEATOR AND OBJECT MARKER APPLICATION AND SPACING

CONDITION	REQUIRED TREATMENT	MINIMUM SPACING
Frwy./Exp. Tangent	RPMs	See PM-series and FPM-series standard sheets
Frwy./Exp. Curve	Single delineators on right side	See delineator spacing table
Frwy/Exp. Ramp	Single delineators on at least one side of ramp (should be on outside of curves) (see Detail 3 on D&OM(4))	100 feet on ramp tangents Use delineator spacing table for ramp curves ("straightway spacing" does not apply to ramp curves)
Acceleration/Deceleration Lane	Double delineators (see Detail 3 on D&OM(4))	100 feet (See Detail 3 on D & OM (4))
Truck Escape Ramp	Single red delineators on both sides	50 feet
Bridge Rail (steel or concrete) and Metal Beam Guard Fence	Bi-Directional Delineators when undivided with one lane each direction Single Delineators when multiple lanes each direction	Equal spacing (100' max) but not less than 3 delineators
Concrete Traffic Barrier (CTB) or Steel Traffic Barrier	Barrier reflectors matching the color of the edge line	Equal spacing 100' max
Cable Barrier	Reflectors matching the color of the edge line	Every 5th cable barrier post (up to 100' max)
Guard Rail Terminus/Impact Head	Divided highway - Object marker on approach end Undivided 2-lane highways - Object marker on approach and departure end	Requires reflective sheeting provided by manufacturer per D & OM (VIA) or a Type 3 Object Marker (OM-3) in front of the terminal end See D & OM (5) and D & OM (6)
Bridges with no Approach Rail	Type 3 Object Marker (OM-3) at end of rail and 3 single delineators approaching rail	See D & OM(5)
Reduced Width Approaches to Bridge Rail	Type 2 and Type 3 Object Markers (OM-3) and 3 single delineators approaching bridge	Requires reflective sheeting provided by manufacturer per D & OM (VIA) or a Type 3 Object Marker (OM-3) in front of the terminal end See D & OM (5)
Culverts without MBGF	Type 2 Object Markers	See Detail 2 on D & OM(4)
Crossovers	Double yellow delineators and RPMs	See Detail 1 on D & OM (4)
Pavement Narrowing (lane merge) on Freeways/Expressway	Single delineators adjacent to affected lane for full length of transition	100 feet

**NOTES**

- Unless indicated otherwise, the delineator or barrier reflector color shall conform to the color of the pavement edge line on the side of the road where the delineators or barrier reflectors are placed.
- Barrier reflectors may be used to replace required delineators.
- Single red delineators may be mounted on the back side of delineator posts for wrong way driver applications

LEGEND	
	Bi-directional Delineator
	Delineator
	Sign

Traffic Safety Division Standard

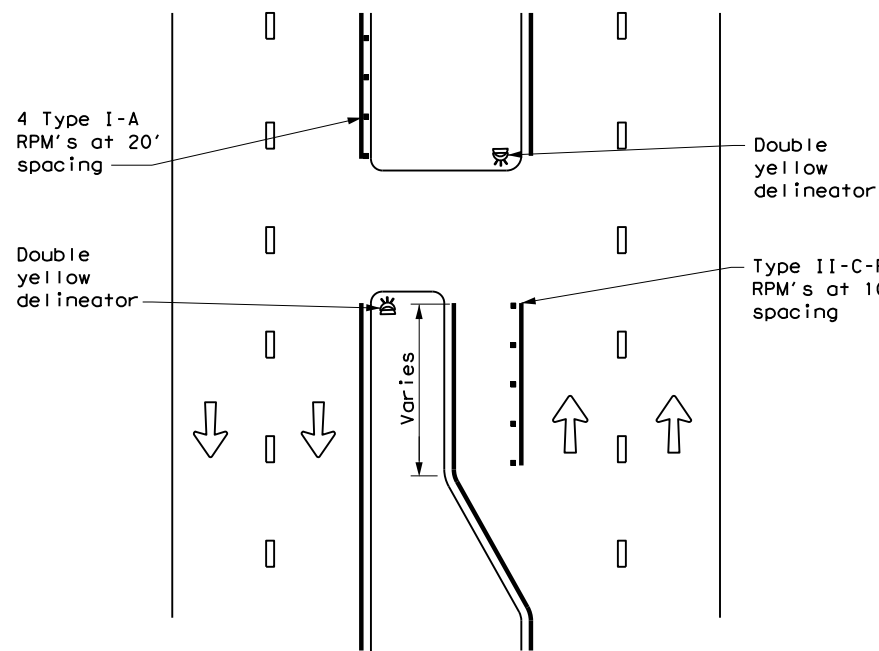
## DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

### D & OM(3)-20

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© TXDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	1780	01	009	FM 1047
3-15 8-15	DIST	COUNTY	SHEET NO.	
8-15 7-20	BWD	MILLS	48	

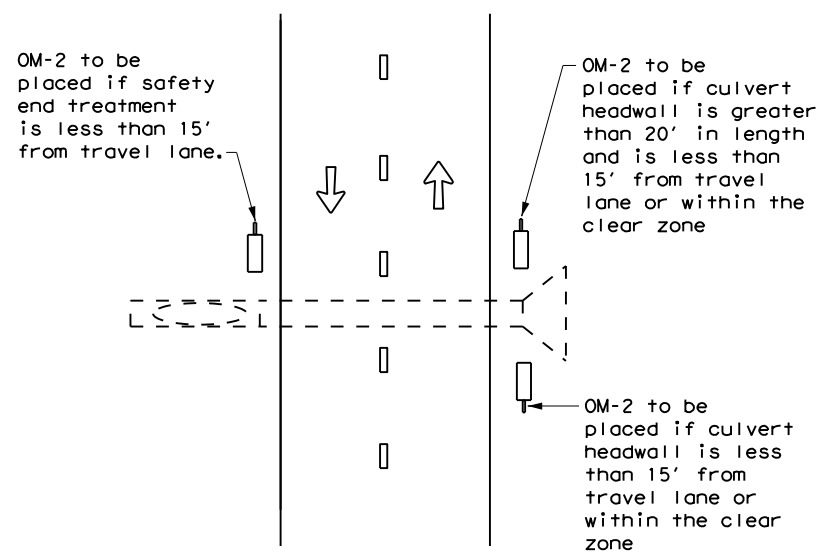
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**CROSSOVERS**



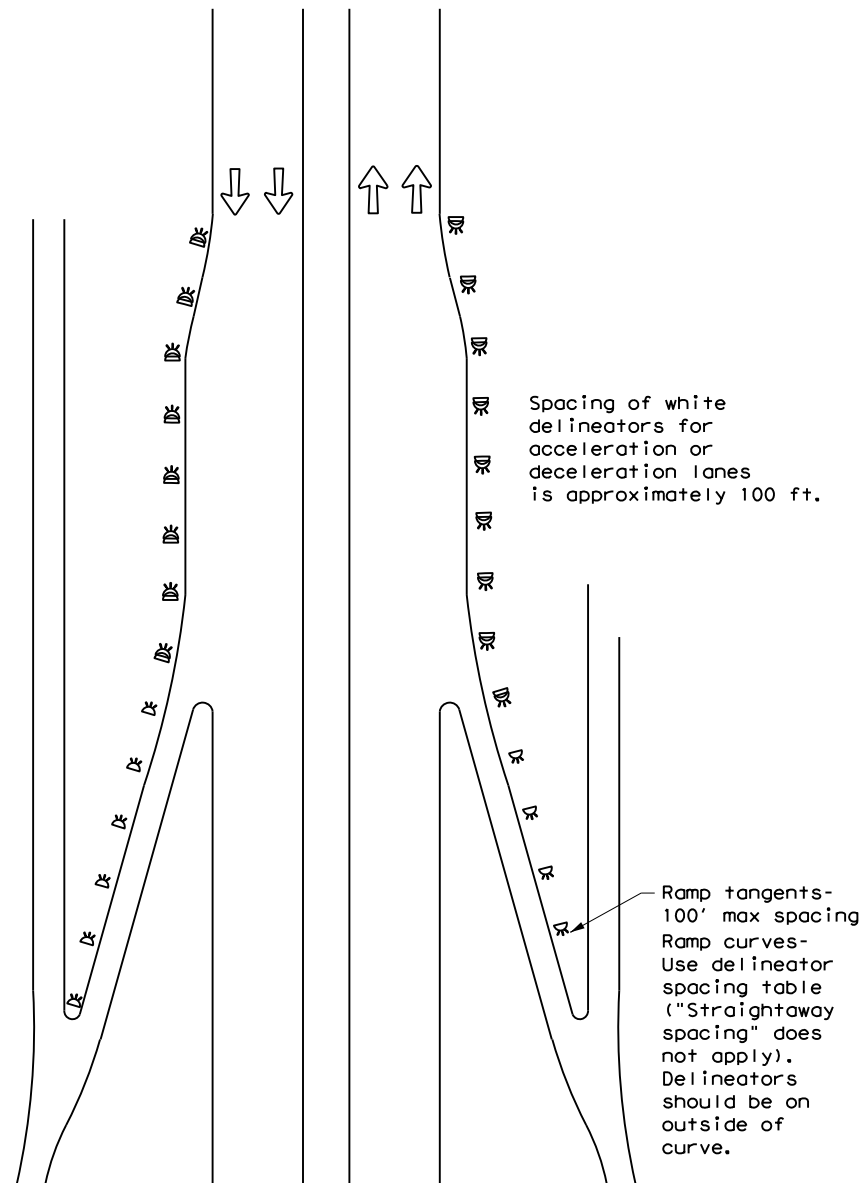
**DETAIL 1**

**FOR CULVERTS WITHOUT MBGF**



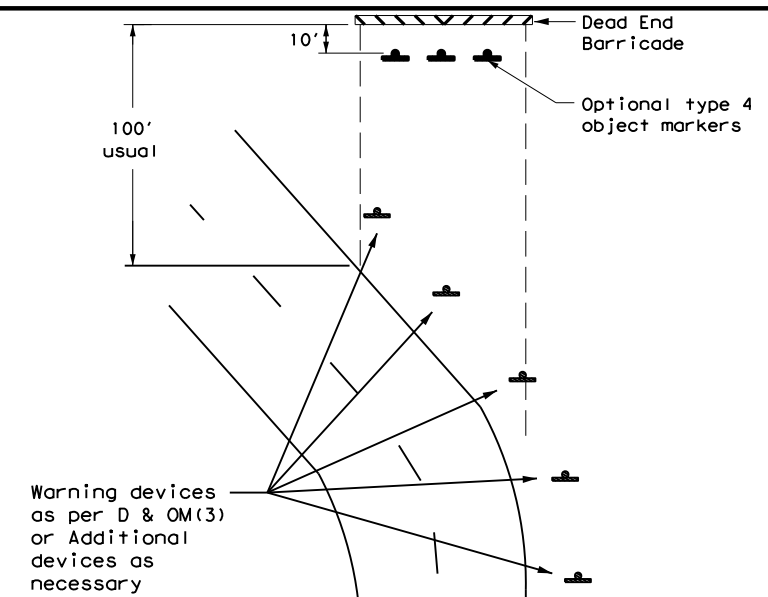
**DETAIL 2**

**FREEWAY DELINEATION FOR RAMPS AND ACCELERATION/DECELERATION LANES**



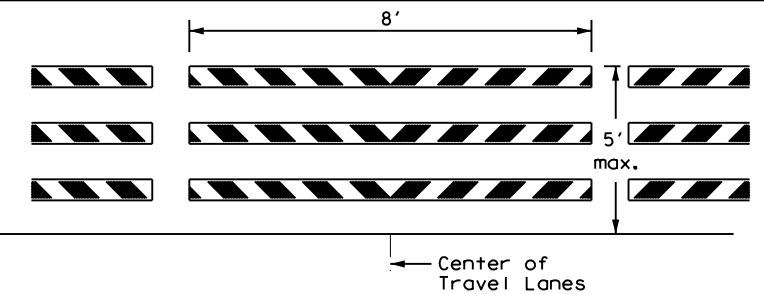
**DETAIL 3**

**TYPICAL APPLICATION OF DEAD END BARRICADE**



**DETAIL 4**

**TYPICAL DEAD END BARRICADE INSTALLATION**



**NOTES**

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

**DETAIL 5**

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



**DELINEATOR & OBJECT MARKER PLACEMENT DETAILS**

**D & OM(4) -20**

FILE: dom4-20.dgn	DN: TXDOT	CK: TXDOT	OW: TXDOT	CK: TXDOT
© TXDOT August 2004	CONT	SECT	JOB	HIGHWAY
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3-15	DIST	COUNTY	SHEET NO.	
7-20	BWD	MILLS	49	

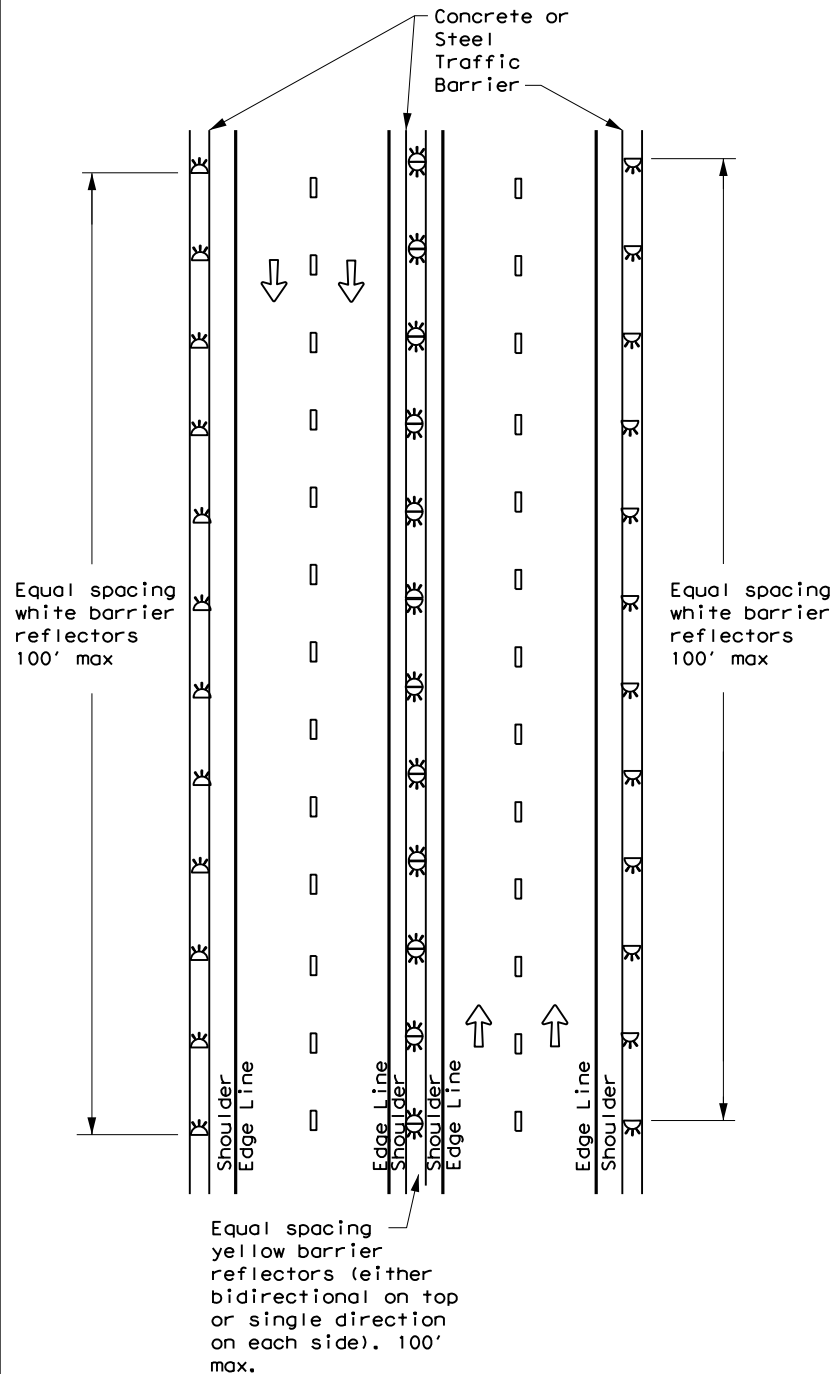




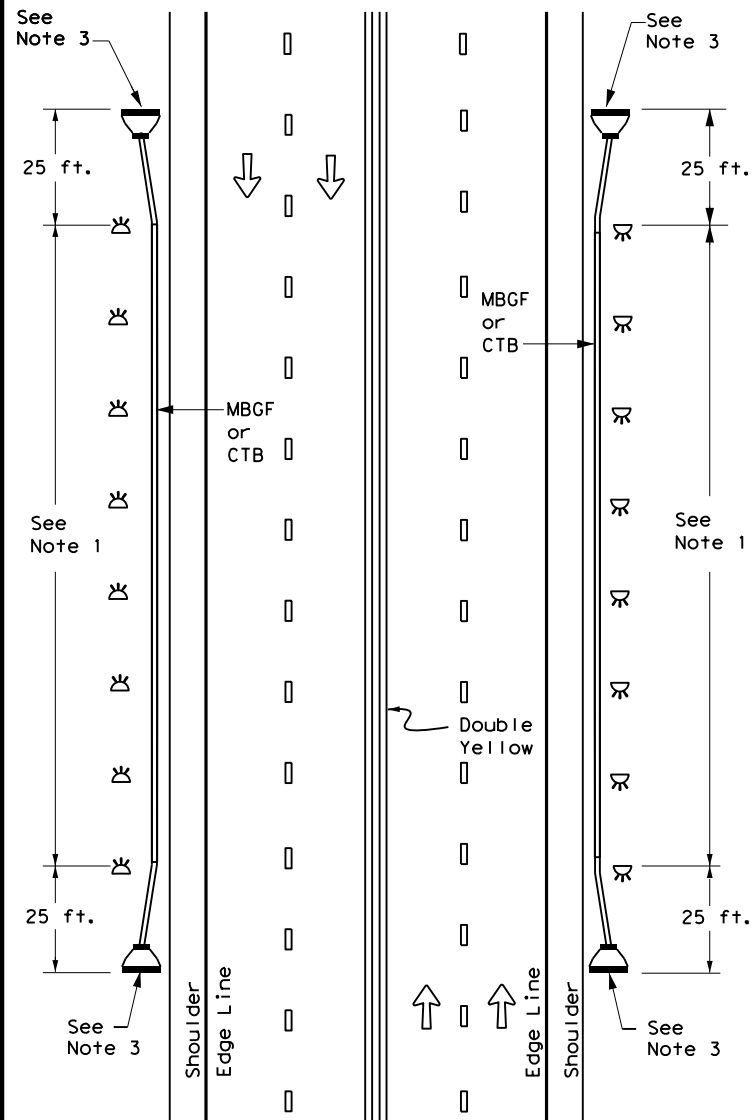
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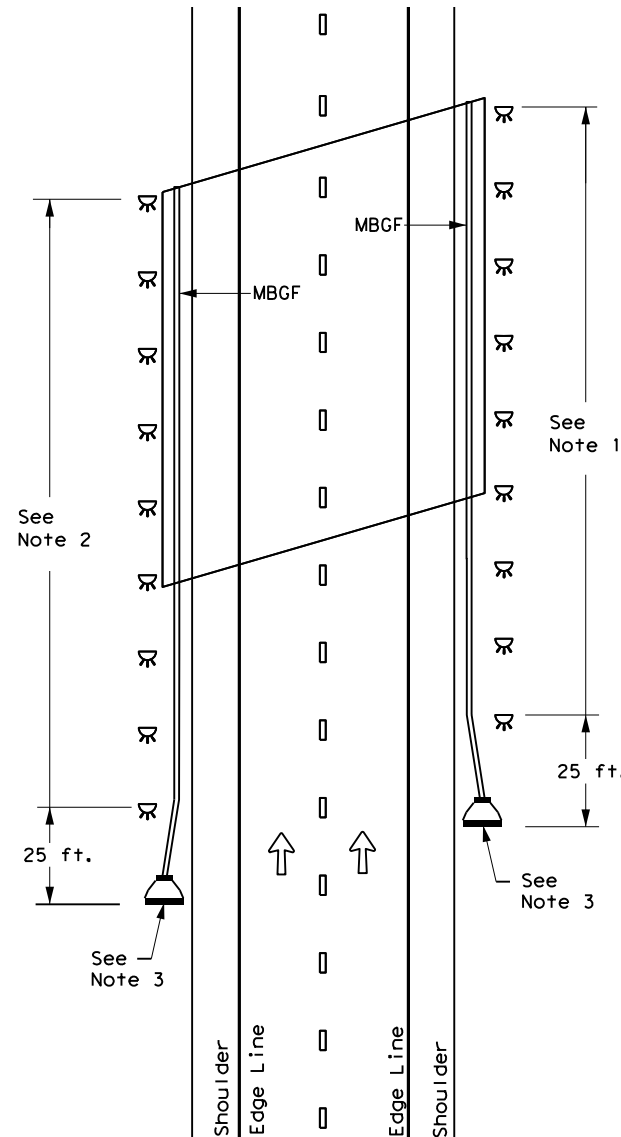
**CONTINUOUS CONCRETE OR STEEL BARRIER**



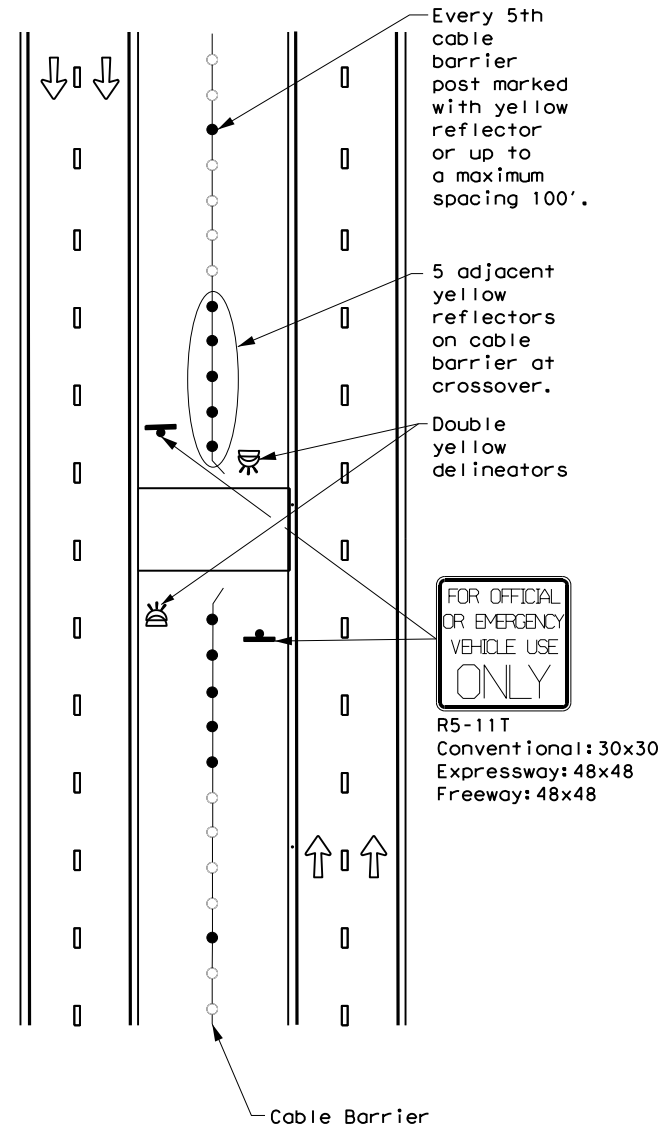
**MULTI-LANE UNDIVIDED, TWO-WAY ROADWAY WITH METAL BEAM GUARD FENCE (MBGF)**



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



**EMERGENCY CROSSOVER**



**NOTES**

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

**LEGEND**

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



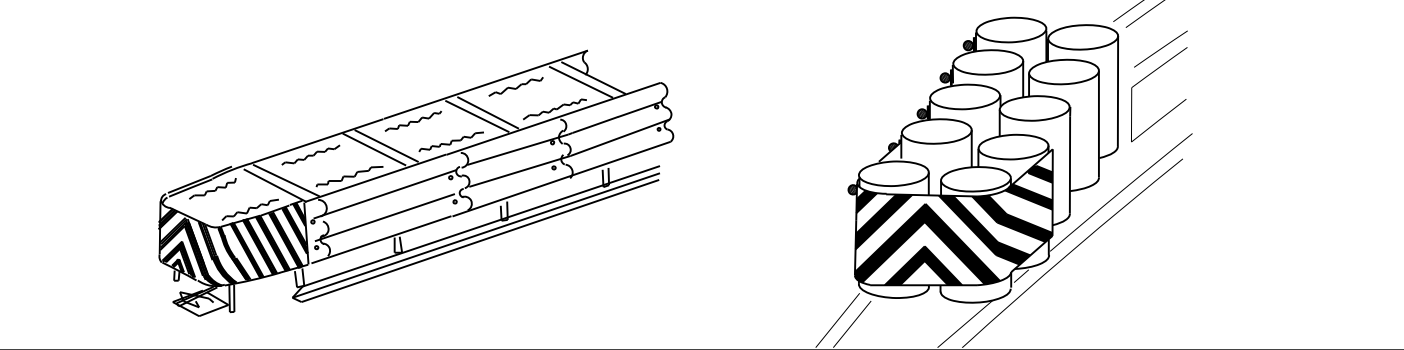
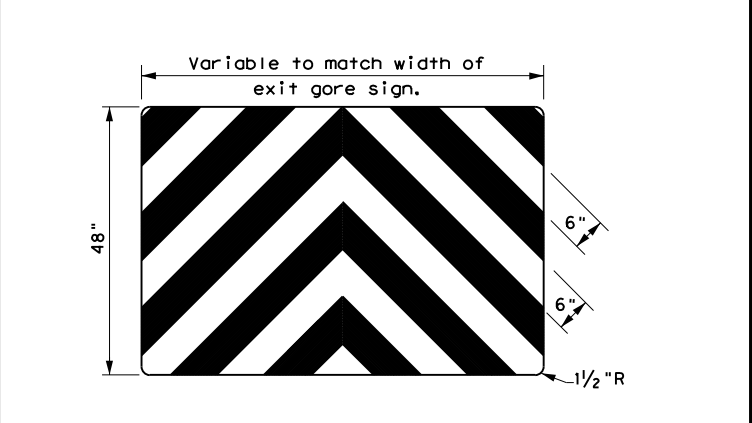
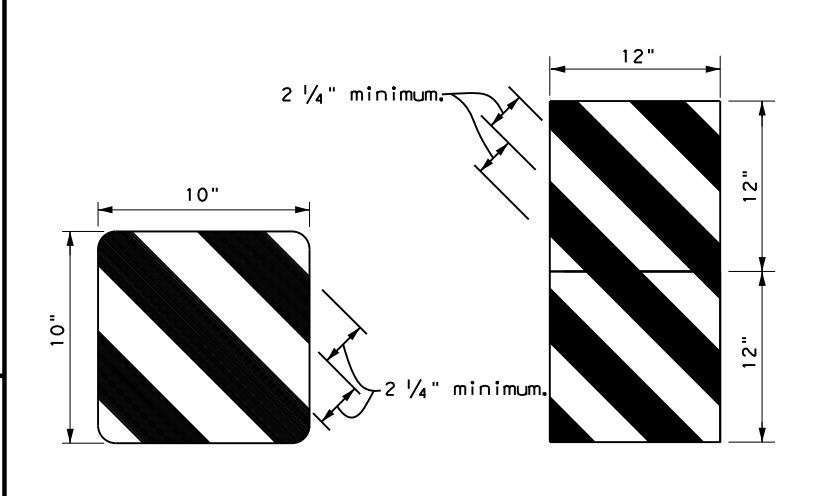
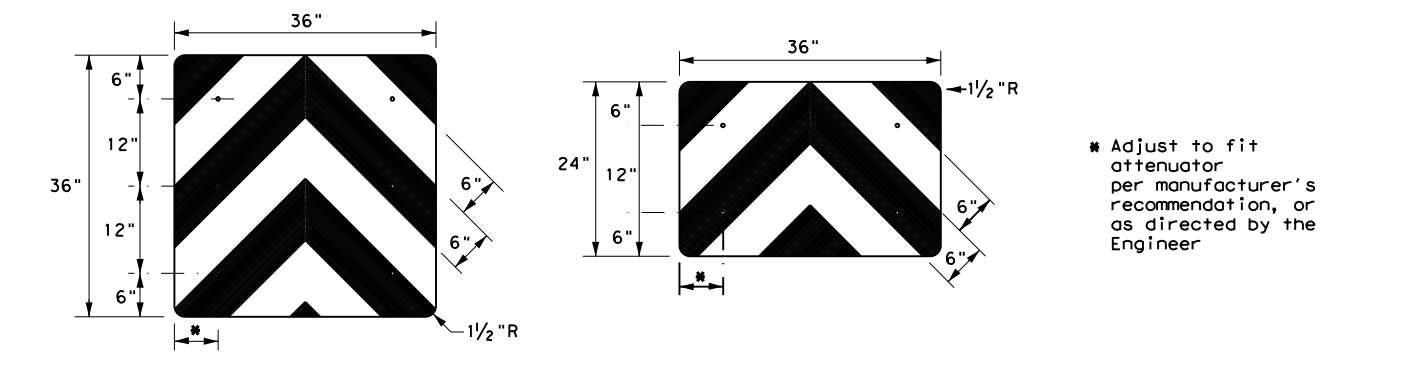
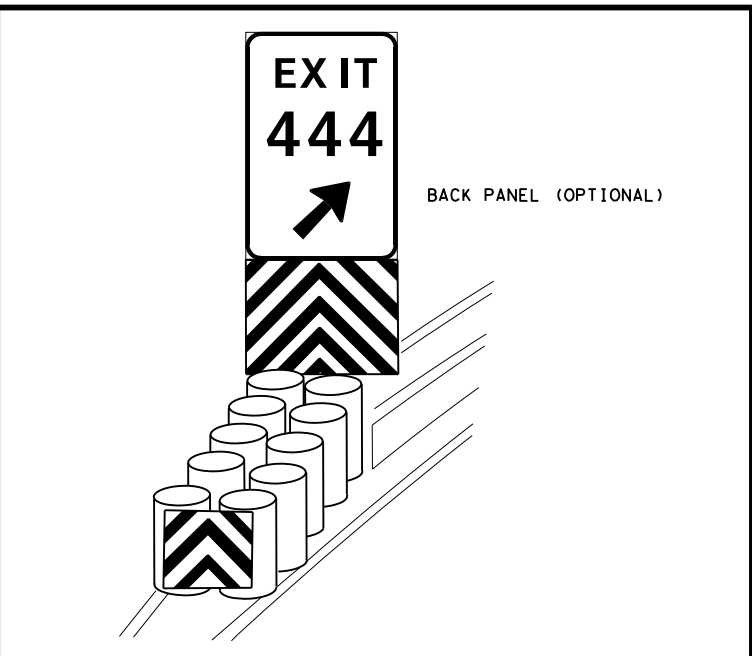
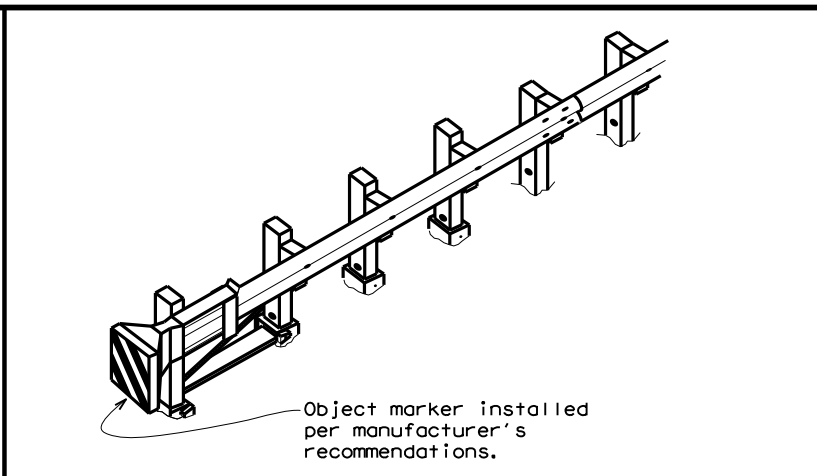
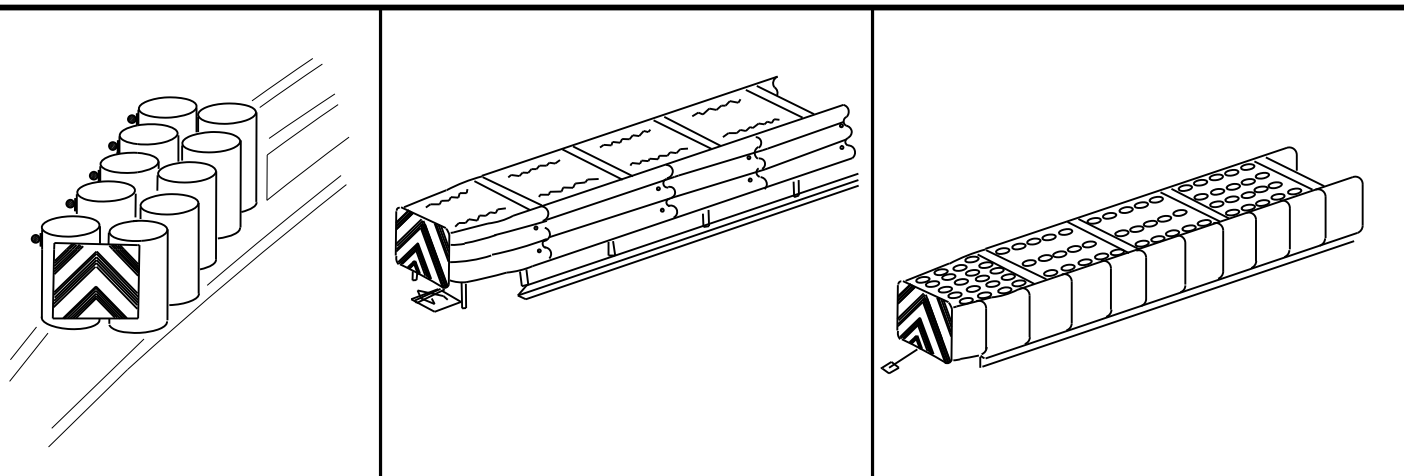
**DELINEATOR & OBJECT MARKER PLACEMENT DETAILS**

**D & OM(6)-20**

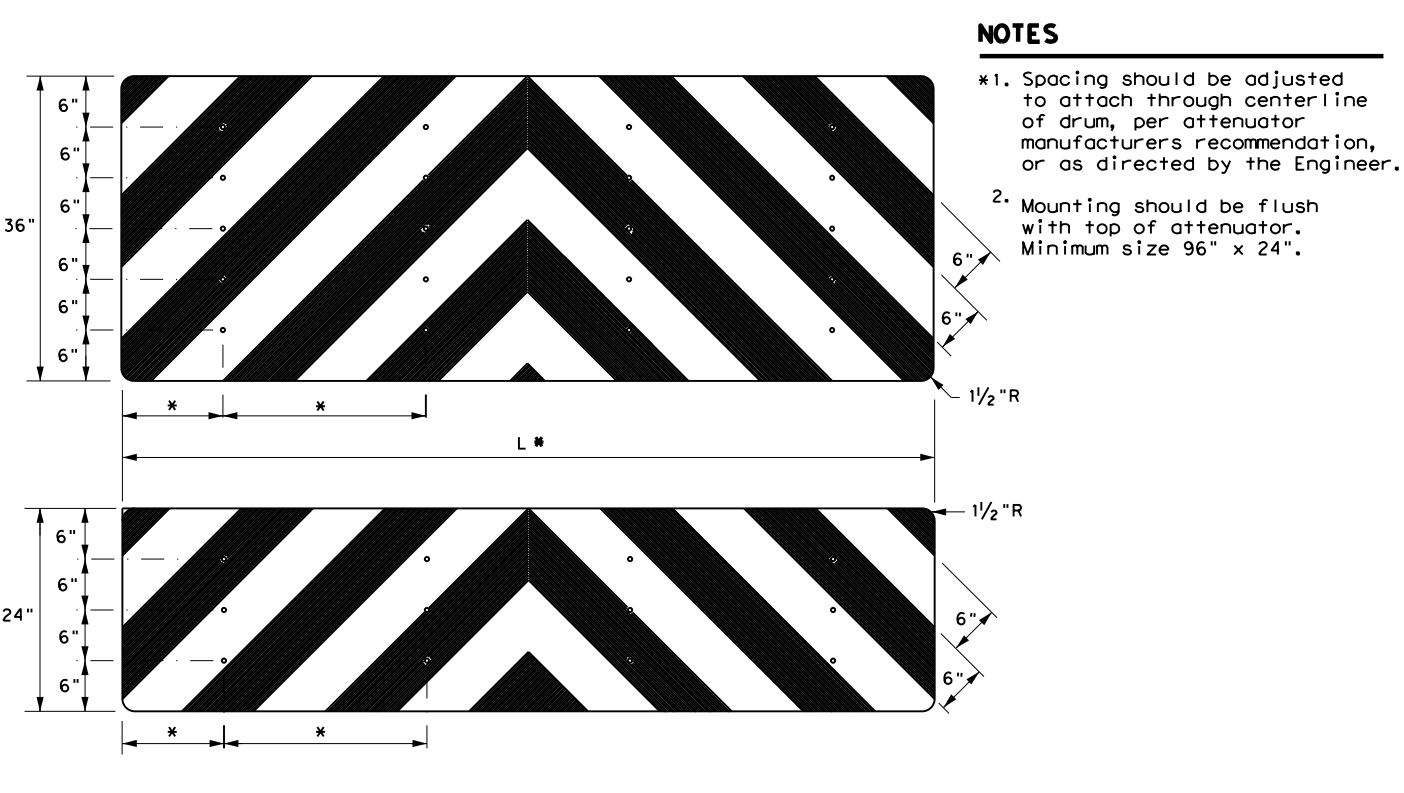
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© TxDOT August 2015	CONT	SECT	JOB	HIGHWAY
REVISIONS	1780	01	009	FM 1047
7-20	DIST	COUNTY	SHEET NO.	
	BWD	MILLS	51	

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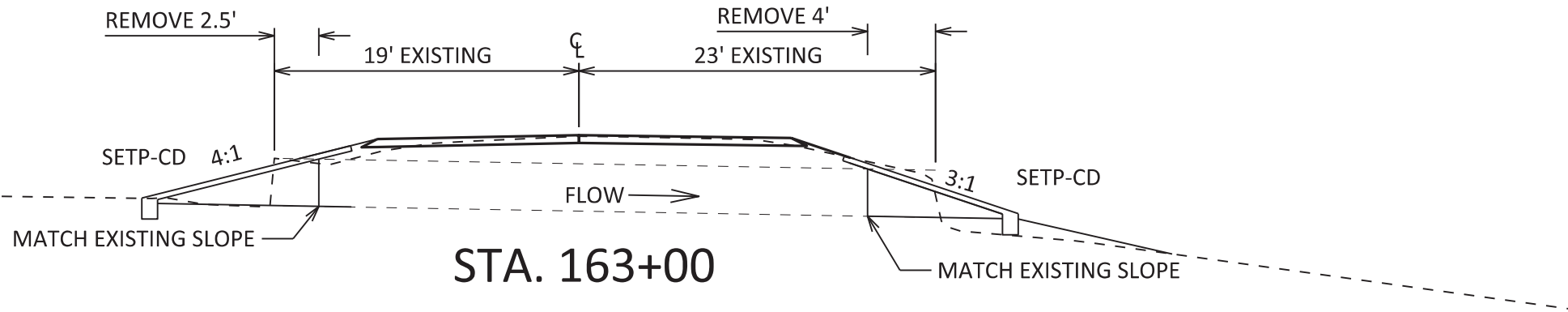
OBJECT MARKERS SMALLER THAN 3 FT<sup>2</sup>



**NOTES**

- Object Markers shall conform to the Texas MUTCD and meet the color and reflectivity requirement of Department Material Specification DMS 8300. Background shall be yellow reflective sheeting (Type B or C) and Chevron shall be black.
- Object Markers may be fabricated from adhesive backed reflective sheeting applied directly to guardrail end treatment, or applied directly to an "end cap" as per the manufacturer's recommendation. Direct applied sheeting shall provide a smooth surface and have no wrinkles, air bubbles, cuts or tears. A radius at the corners is not required for direct applied sheeting.
- Object Marker size may be reduced to fit smaller devices. Width of alternating black and yellow stripes are typically 6". Object Markers smaller than 3ft may have reduced width stripes of a minimum of 2 1/4".
- Pop rivets, screws, or nuts and bolts may be used to attach object markers and reflectors. Holes, slots or other openings may be cut or drilled through object markers to allow cable or other attachments.
- Object Marker at nose of attenuator is subsidiary to the attenuator.
- See D & OM (1-4) for required barrier reflectors.

		<b>Traffic Safety Division Standard</b>	
<b>DELINEATOR &amp; OBJECT MARKER FOR VEHICLE IMPACT ATTENUATORS</b> <b>D &amp; OM(VIA) -20</b>			
FILE: domvia20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT
© TXDOT December 1989	CONT	SECT	JOB
REVISIONS	1780	01	009
4-92 8-04	DIST	COUNTY	SHEET NO.
8-95 3-15	BWD	MILLS	52
4-98 7-20			
20G			



STA. 163+00

EXIST: 36" X 42' CMP

PROP: REMOVE 2.5' AND PLACE SETP-CD (UPSTRM)  
REMOVE 4' AND PLACE SETP-CD (DNSTRM)

CSJ: 1780-01-009

ITEM	CODE	DESCRIPTION	QTY	UNIT
467	6441	SET (TY II)(36 IN)(CMP)(4:1)(C)	1	EA
467	6439	SET (TY II)(36 IN)(CMP)(3:1)(C)	1	EA
658	6073	INSTL OM ASSM (OM-2Y)(WC)GND(BI)	2	EA



*Dan A. Hohmann, P.E.*

01/02/2022

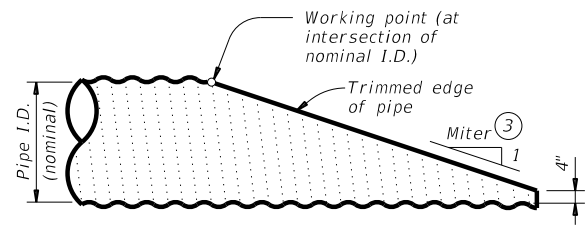
FM 1047  
CULVERT  
LAYOUT



CONT	SECT	JOB	HIGHWAY
1780	01	009	FM 1047
DIST	COUNTY	SHEET NO.	
BWD	MILLS	53	

1/11/2022 10:48:46 AM  
 DATE: 1/11/2022 10:48:46 AM  
 FILE: T:\BWDSDTEAM\Design Projects\Mi11s\1780-01-009 FM 1047 Bennett Branch\Standards\SETP-CD.dgn

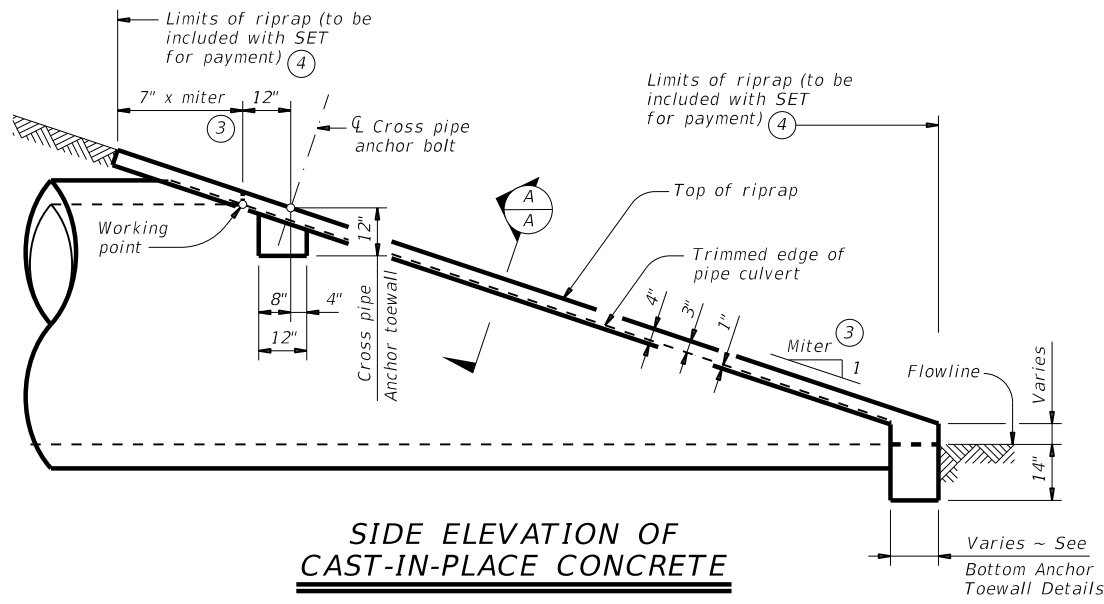
DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of units or for incorrect results or damages resulting from its use.



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

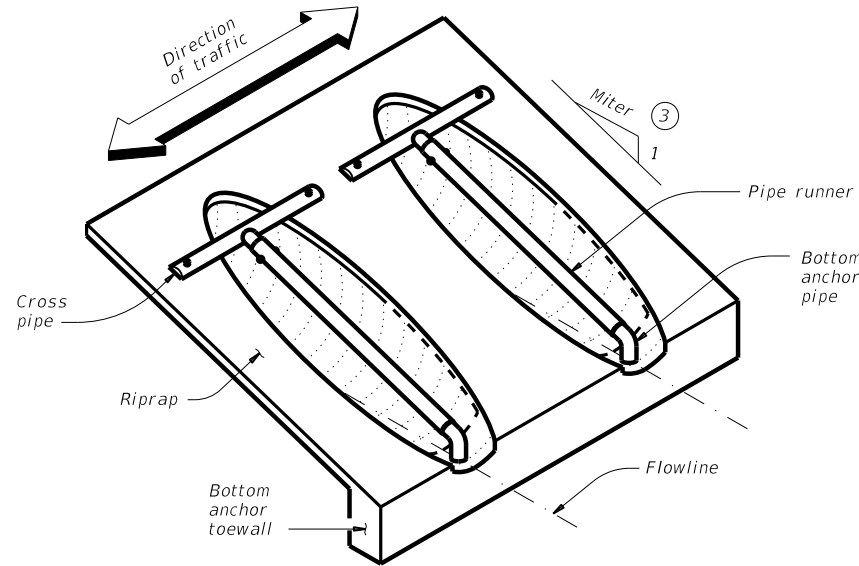
**SIDE ELEVATION OF TYPICAL PIPE CULVERT MITER**

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



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

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



**ISOMETRIC VIEW OF TYPICAL INSTALLATION**

(Showing installation with no skew.)

**CROSS PIPE LENGTHS AND PIPE RUNNER LENGTHS (1)(2)**

Nominal Culvert I.D.	Pipe Culvert Spa ~ G	Cross Pipe Length	Pipe Runner Length											
			3:1 Side Slope				4:1 Side Slope				6:1 Side Slope			
			0° Skew	15° Skew	30° Skew	45° Skew	0° Skew	15° Skew	30° Skew	45° Skew	0° Skew	15° Skew	30° Skew	45° Skew
24"	1' - 7"	3' - 5"	N/A	N/A	N/A	5' - 10"	N/A	N/A	N/A	8' - 1"	N/A	N/A	N/A	12' - 9"
27"	1' - 8"	3' - 8"	N/A	N/A	5' - 5"	6' - 11"	N/A	N/A	7' - 7"	9' - 7"	N/A	N/A	11' - 11"	14' - 11"
30"	1' - 10"	3' - 11"	N/A	N/A	6' - 4"	8' - 0"	N/A	N/A	8' - 9"	11' - 0"	N/A	N/A	13' - 8"	17' - 0"
33"	1' - 11"	4' - 2"	6' - 2"	6' - 5"	7' - 3"	9' - 1"	8' - 6"	8' - 10"	10' - 0"	12' - 5"	13' - 3"	13' - 9"	15' - 5"	19' - 2"
36"	2' - 1"	4' - 5"	6' - 11"	7' - 3"	8' - 2"	10' - 2"	9' - 6"	9' - 11"	11' - 2"	13' - 10"	14' - 9"	15' - 3"	17' - 2"	21' - 3"
42"	2' - 4"	4' - 11"	8' - 6"	8' - 10"	9' - 11"	12' - 4"	11' - 7"	12' - 0"	13' - 6"	16' - 8"	17' - 9"	18' - 5"	20' - 8"	25' - 7"
48"	2' - 7"	5' - 5"	10' - 1"	10' - 5"	11' - 9"	N/A	13' - 7"	14' - 2"	15' - 10"	N/A	20' - 9"	21' - 6"	24' - 2"	N/A
54"	3' - 0"	5' - 11"	11' - 8"	12' - 1"	N/A	N/A	15' - 8"	16' - 3"	N/A	N/A	23' - 10"	24' - 8"	N/A	N/A
60"	3' - 3"	6' - 5"	13' - 3"	N/A	N/A	N/A	17' - 9"	N/A	N/A	N/A	26' - 10"	N/A	N/A	N/A

**TYPICAL PIPE CULVERT MITERS (3)**

Side Slope	0° Skew	15° Skew	30° Skew	45° Skew
3:1	3:1	3.106:1	3.464:1	4.243:1
4:1	4:1	4.141:1	4.619:1	5.657:1
6:1	6:1	6.212:1	6.928:1	8.485:1

**CONDITIONS WHERE PIPE RUNNERS ARE NOT REQUIRED (2)**

Nominal Culvert I.D.	Single Pipe Culvert	Multiple Pipe Culverts
12" thru 21"	Skews thru 45°	Skews thru 45°
24"	Skews thru 45°	Skews thru 30°
27"	Skews thru 30°	Skews thru 15°
30"	Skews thru 15°	Skews thru 15°
33"	Skews thru 15°	Always required
36"	Normal (no skew)	Always required
42" thru 60"	Always required	Always required

**STANDARD PIPE SIZES AND MAX PIPE RUNNER LENGTHS (1)**

Pipe Size	Pipe O.D.	Pipe I.D.	Max Pipe Runner Length
2" STD	2.375"	2.067"	N/A
3" STD	3.500"	3.068"	10' - 0"
4" STD	4.500"	4.026"	19' - 8"
5" STD	5.563"	5.047"	34' - 2"

**ESTIMATED CONCRETE RIPRAP QUANTITIES (CY) (5)**

Nominal Culvert I.D.	3:1 Side Slope				4:1 Side Slope				6:1 Side Slope			
	0° Skew	15° Skew	30° Skew	45° Skew	0° Skew	15° Skew	30° Skew	45° Skew	0° Skew	15° Skew	30° Skew	45° Skew
12"	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.7	0.7	0.7	0.8
15"	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.9
18"	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.8	0.8	0.8	0.9	1.0
21"	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.9	0.9	0.9	1.0	1.2
24"	0.6	0.7	0.7	0.8	0.8	0.8	0.8	1.0	1.0	1.0	1.1	1.3
27"	0.7	0.7	0.8	0.9	0.8	0.9	0.9	1.1	1.1	1.1	1.2	1.4
30"	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.2	1.2	1.2	1.3	1.6
33"	0.8	0.8	0.9	1.0	1.0	1.0	1.1	1.3	1.3	1.4	1.5	1.7
36"	0.9	0.9	0.9	1.1	1.1	1.1	1.2	1.4	1.4	1.5	1.6	1.8
42"	1.0	1.0	1.1	1.3	1.2	1.3	1.3	1.6	1.6	1.7	1.8	2.1
48"	1.1	1.1	1.2	N/A	1.4	1.4	1.5	N/A	1.9	1.9	2.1	N/A
54"	1.3	1.3	N/A	N/A	1.6	1.6	N/A	N/A	2.1	2.1	N/A	N/A
60"	1.4	N/A	N/A	N/A	1.7	N/A	N/A	N/A	2.3	N/A	N/A	N/A

(1) Provide pipe runner of the size shown in the tables. Provide cross pipe of the same size as the pipe runner. Provide cross pipe stub out and bottom anchor pipe of the next smaller size pipe as shown in the Standard Pipe Sizes and Max Pipe Runner Lengths table.

(2) This standard allows for the placement of only one pipe runner across each culvert pipe opening. In order to limit the clear opening to be traversed by an errant vehicle, the following conditions must be met:

- For 60" culvert pipes, the skew must not exceed 0°.
- For 54" culvert pipes, the skew must not exceed 15°.
- For 48" culvert pipes, the skew must not exceed 30°.
- For all culvert pipe sizes 42" and less, the skew must not exceed 45°.

If the above conditions cannot be met, the designer should consider using a safety end treatment with flared wings. For further information, refer to the TxDOT Roadway Design Manual.

(3) Miter = slope of mitered end of pipe culvert.

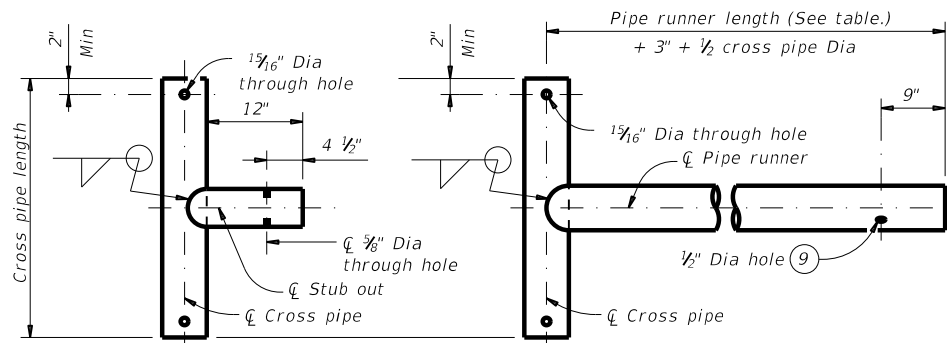
(4) Riprap placed beyond the limits shown will be paid for as concrete riprap in accordance with Item 432, "Riprap".

(5) Quantities shown are for one end of one reinforced concrete pipe (RCP) culvert. For multiple pipe culverts or for corrugated metal pipe (CMP) culverts, quantities will need to be adjusted. Riprap quantities are for Contractor's information only.

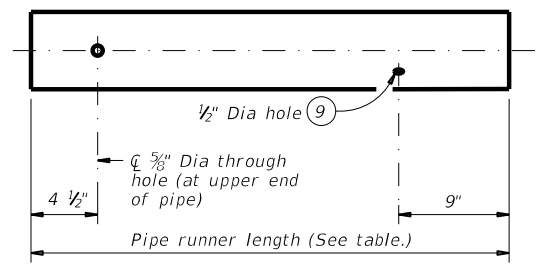
SHEET 1 OF 2

<b>SAFETY END TREATMENT</b> FOR 12" DIA TO 60" DIA PIPE CULVERTS TYPE II ~ CROSS DRAINAGE			
<b>SETP-CD</b>			
FILE: setpcdse-20.dgn	DN: GAF	CK: CAT	DW: JRP
©TxDOT February 2020	CONT SECT	JOB	HIGHWAY
REVISIONS	1780 01	009	FM 1047
	DIST	COUNTY	SHEET NO.
	BWD	MILLS	54

DATE: 1/11/2022 10:48:47 AM  
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 DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of units or for incorrect results or damages resulting from its use.

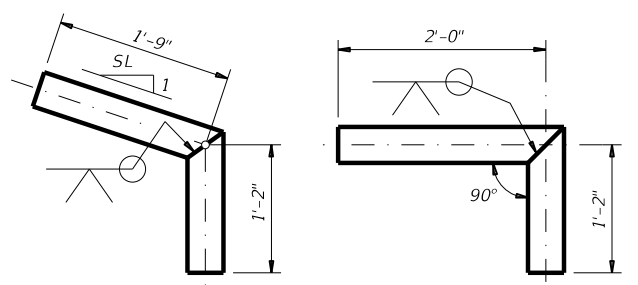


**OPTION A1**      **OPTION A2**  
**CROSS PIPE AND CONNECTIONS DETAILS**

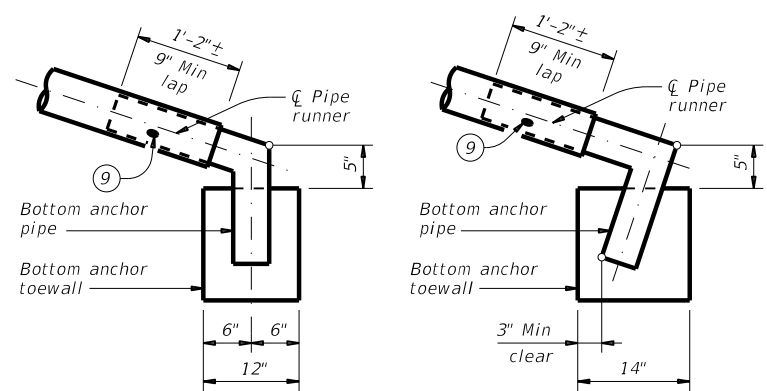


NOTE: The separate pipe runner shown is required when Cross Pipe Connection Option A1 is used.

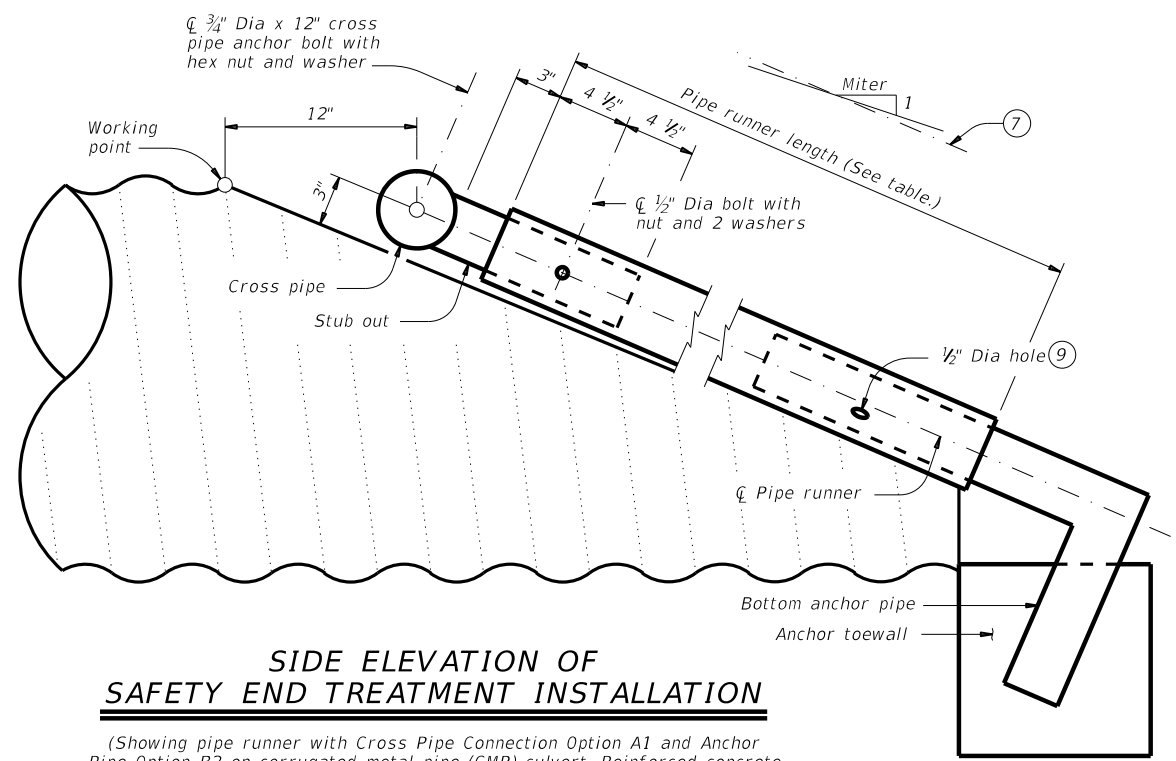
**PIPE RUNNER DETAILS**



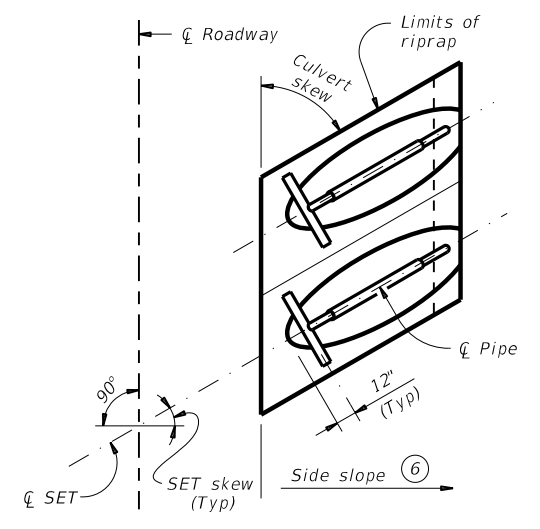
**OPTION B1**      **OPTION B2**  
**BOTTOM ANCHOR PIPE DETAILS** ⑩



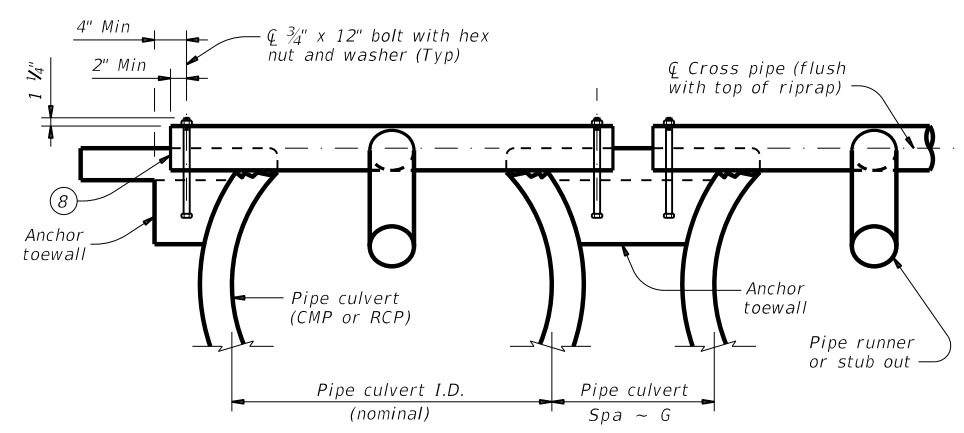
**OPTION B1**      **OPTION B2**  
**BOTTOM ANCHOR TOEWALL DETAILS**  
 (Culvert and riprap not shown for clarity.)



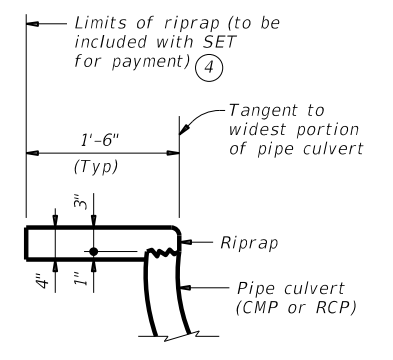
**SIDE ELEVATION OF SAFETY END TREATMENT INSTALLATION**  
 (Showing pipe runner with Cross Pipe Connection Option A1 and Anchor Pipe Option B2 on corrugated metal pipe (CMP) culvert. Reinforced concrete pipe culvert (RCP) details are similar. Riprap not shown for clarity.)



**PLAN OF SKEWED INSTALLATION**



**SECTION A-A**  
 SHOWING CROSS PIPE AND ANCHOR TOEWALL



**SHOWING TYPICAL PIPE CULVERT AND RIPRAP**

- ④ Riprap placed beyond the limits shown will be paid for as concrete riprap in accordance with Item 432, "Riprap".
- ⑥ Recommended values of side slope are 3:1, 4:1, and 6:1. All quantities, calculations, and dimensions shown herein are based on these recommended values. Slope of 3:1 or flatter is required for vehicle safety.
- ⑦ Note that actual slope of pipe runner may vary slightly from side slope of riprap and trimmed culvert pipe edge.
- ⑧ Ensure that riprap concrete does not flow into the cross pipe so as to permit disassembly of the bolted connection to allow cleanout access.
- ⑨ After installation, inspect the 1/2" hole to ensure that the lap of the pipe runner with the bottom anchor pipe is adequate.
- ⑩ At fabricator's option, a heat bend to a smooth 5" radius or a manufactured elbow (of the same material as the runner) may be substituted for the mitered and welded joint in the bottom anchor pipe.

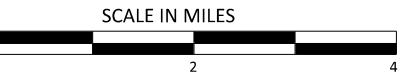
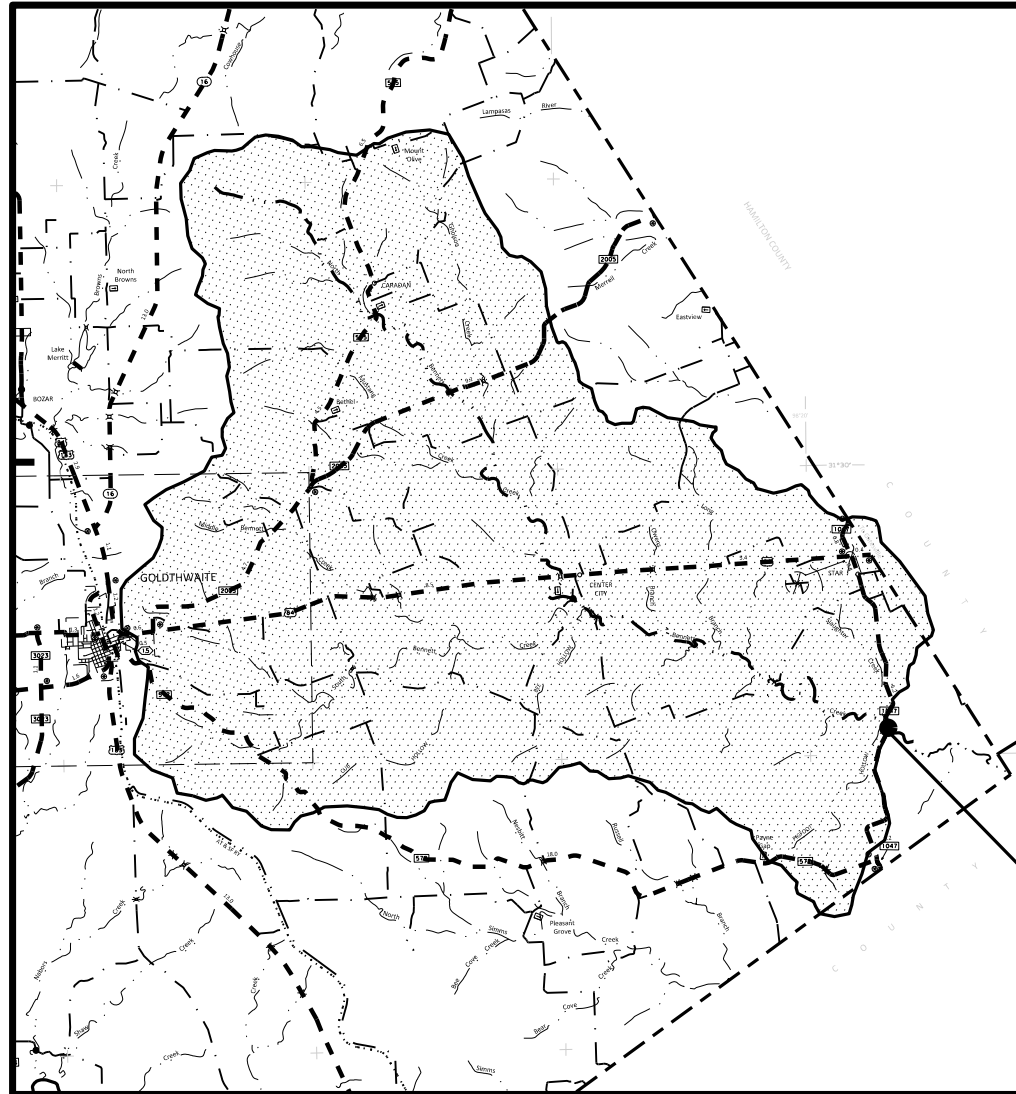
**MATERIAL NOTES:**  
 Synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) may be used in lieu of steel reinforcing in riprap concrete unless noted otherwise.  
 Provide pipe runners, cross pipes, and anchor pipes conforming to the requirements of ASTM A53 (Type E or S,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

**GENERAL NOTES:**  
 Pipe runners are designed for a traversing load of 1,800 pounds at yield as recommended by Research Report 280-1, "Safety Treatment of Roadside Cross-Drainage Structures", Texas Transportation Institute, March 1981.  
 Safety end treatments (SET) shown herein are intended for use in those installations where out of control vehicles are likely to traverse the openings approximately perpendicular to the pipe runners.  
 Payment for riprap and toewall is included in the price bid for each safety end treatment.  
 Construct concrete riprap and all necessary inverts in accordance with the requirements of Item 432, "Riprap".

SHEET 2 OF 2

		<b>Bridge Division Standard</b>	
<b>SAFETY END TREATMENT</b>			
FOR 12" DIA TO 60" DIA			
PIPE CULVERTS			
TYPE II ~ CROSS DRAINAGE			
<b>SETP-CD</b>			
FILE: setpcdse-20.dgn	DN: GAF	CK: CAT	DW: JRP
©TxDOT February 2020	CONT SECT	JOB	HIGHWAY
REVISIONS	1780 01	009	FM 1047
	DIST	COUNTY	SHEET NO.
	BWD	MILLS	55

DATE: 1/26/2022 2:25:34 PM  
 FILE: T:\BWD\SSG\TEAM\Design Projects\Mills\1780-01-009 FM 1047 Bennett Branch\MasterReferenceFiles\HYDRAULICS.dgn



BENNETT CREEK

DRAINAGE AREA = 145.3 MI<sup>2</sup>  
 ANNUAL PRECIPITATION IN INCHES = 29.8 IN  
 SLOPE = 0.0050 FT/FT  
 OmegaEM = -0.106

HYDROLOGIC METHOD USED: OmegaEM REGRESSION EQUATION

Q25 = 15,611 CFS  
 Q100 = 27,175 CFS

### BENNETT CREEK

HEADWATER COMPUTATION METHOD:  
 HEC-RAS VERSION 5.0.6

THE TAILWATER WAS DETERMINED  
 USING NORMAL DEPTH COMPUTATION

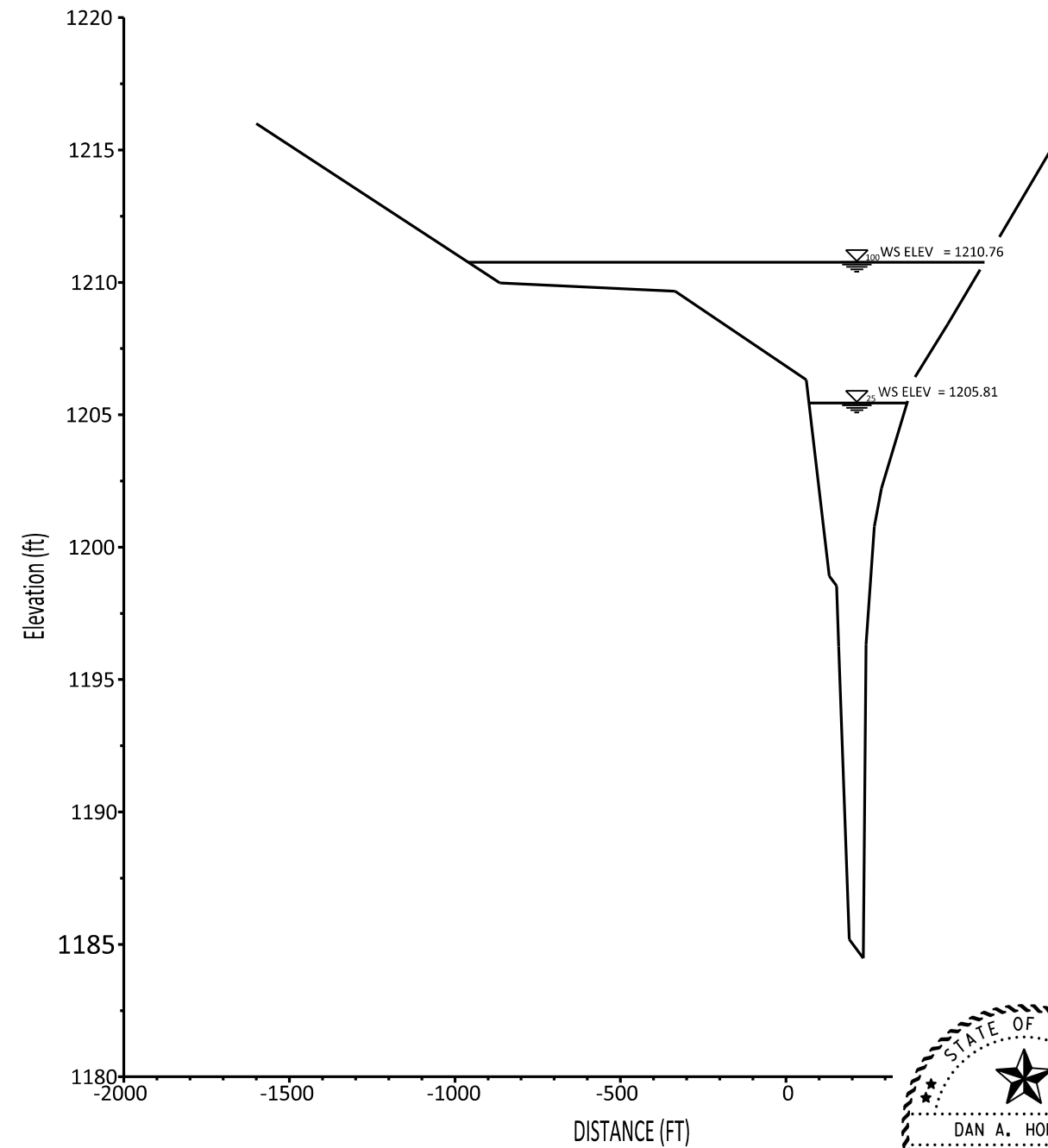
#### PROPOSED BRIDGE 25 YEAR DISCHARGE

Bottom Girder Elev = 1212.80  
 Freeboard = 6.32 ft  
 Percent of Flow Overtopping Road = 0.0%

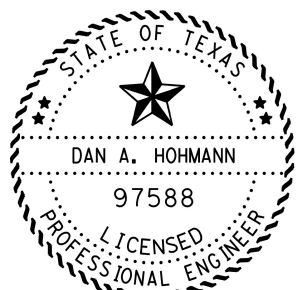
#### 100 YEAR DISCHARGE

Bottom Girder Elev = 1212.80  
 Freeboard = 1.84 ft  
 Percent of Flow Overtopping Road = 0.00%

PROJECT LOCATION



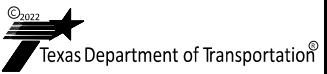
HORIZONTAL LOCATION MEASURED PERPENDICULAR  
 TO FLOW OF Q<sub>25</sub> AND Q<sub>100</sub> EVENTS.  
 SECTION 250 FT DOWNSTREAM OF PROPOSED STRUCTURE



Dan A. Hohmann, P.E.

01/26/2022

FM 1047  
 HYDROLOGY &  
 HYDRAULICS  
 1780-01-009



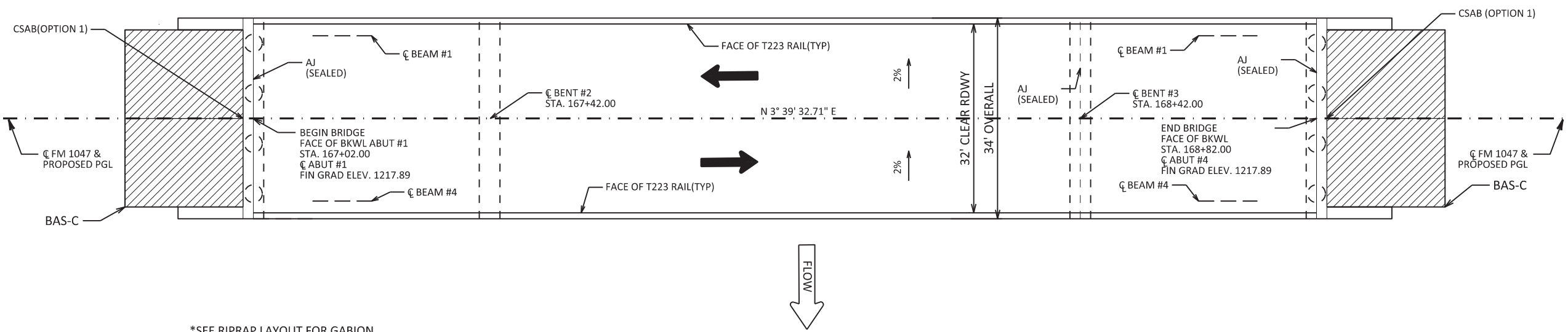
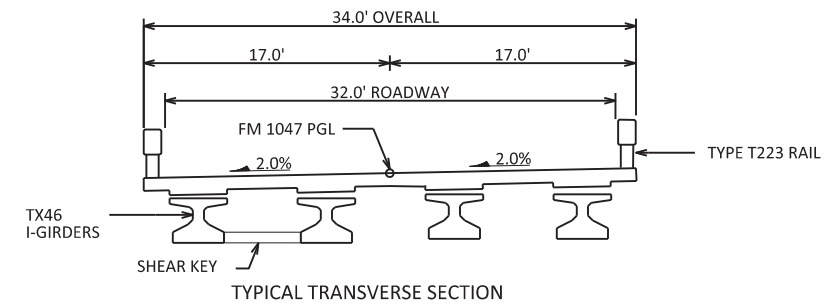
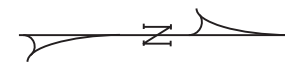
LOCATON	PROPOSED STRUCTURE						EXISTING STRUCTURE					
	DESIGN 25 YR			100 YR			DESIGN 25 YR			100 YR		
	Q (cfs)	V (ft/s)	WSEL (ft)	Q (cfs)	V (ft/s)	WSEL (ft)	Q (cfs)	V (ft/s)	WSEL (ft)	Q (cfs)	V (ft/s)	WSEL (ft)
SECTION 1 250' DNSTRM OF C (END OF EXPANSION)	15,611	9.2	1205.81	27,175	9.5	1210.76	15,611	9.1	1205.44	27,175	9.5	1210.76
SECTION 2 30' DNSTRM OF C	15,611	8.3	1206.24	27,175	10.8	1210.68	15,611	8.2	1205.89	27,175	10.8	1210.68
SECTION 3 30' UPSTRM OF C	15,611	8.2	1206.48	27,175	10.7	1210.96	15,611	7.9	1206.41	27,175	10.1	1211.84
SECTION 4 160' UPSTRM OF C (WITH BRIDGE) "APPR (CONSTR)"	15,611	8.1	1206.60	27,175	9.2	1211.77	15,611	7.8	1206.52	27,175	7.6	1212.96

CONT	SECT	JOB	HIGHWAY
1780	01	009	FM 1047
DIST	COUNTY	SHEET NO.	
BWD	MILLS	56	

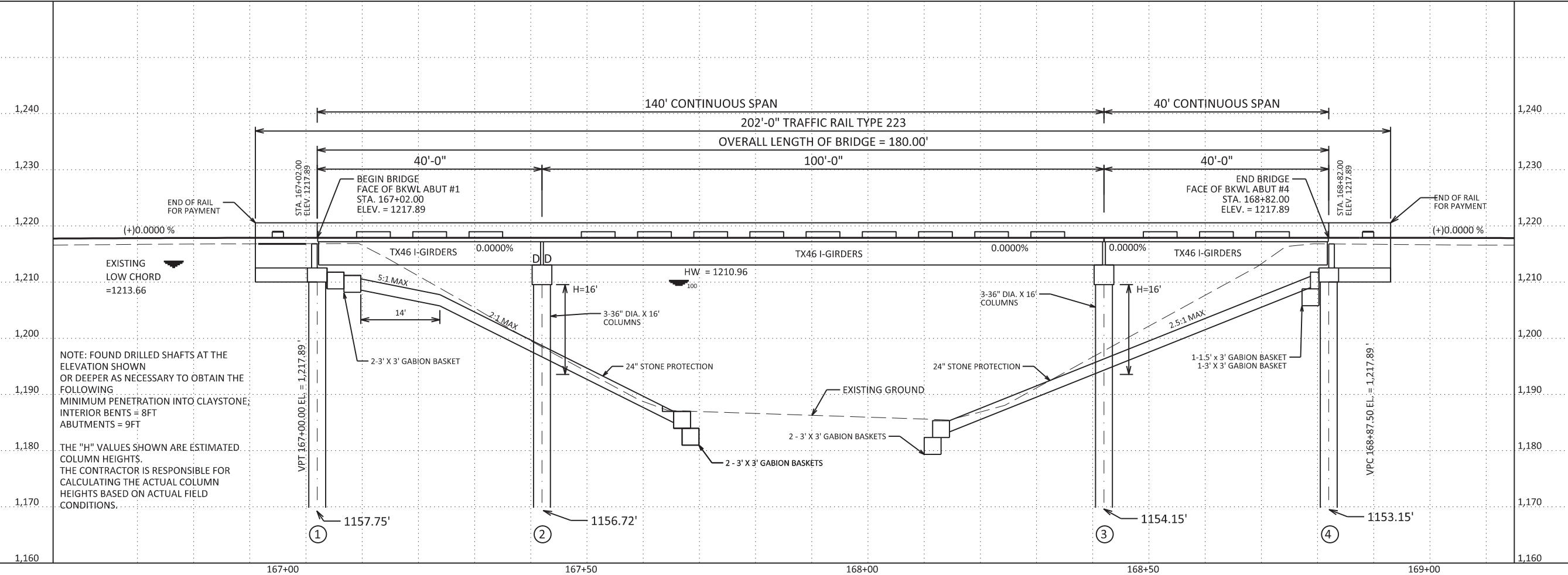
EXISTING STRUCTURE  
 STA 167+10 - 168+75.00  
 (1 - 25'),(1 - 40'),(4 - 25')  
 DECK SLAB BEAM UNITS  
 165' OVERALL LENGTH

PROPOSED STRUCTURE  
 STA 167+02.00 - 168+82.00  
 (1 - 40'),(1 - 100'),(1 - 40')  
 PRESTR CONC BEAM UNITS(TX46)  
 180' OVERALL LENGTH

ALL BENTS BEARING  
 N 3° 39' 32.71" E



\*SEE RIPRAP LAYOUT FOR GABION AND STONE PROTECTION DETAILS



NOTE: FOUND DRILLED SHAFTS AT THE ELEVATION SHOWN OR DEEPER AS NECESSARY TO OBTAIN THE FOLLOWING MINIMUM PENETRATION INTO CLAYSTONE; INTERIOR BENTS = 8FT ABUTMENTS = 9FT

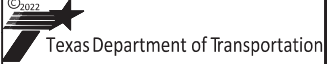
THE "H" VALUES SHOWN ARE ESTIMATED COLUMN HEIGHTS. THE CONTRACTOR IS RESPONSIBLE FOR CALCULATING THE ACTUAL COLUMN HEIGHTS BASED ON ACTUAL FIELD CONDITIONS.

DESIGN SPEED: 45 MPH  
 FUNCTIONAL CLASS: MINOR COLLECTOR  
 EXIST (2020)ADT: 158  
 FUTURE(2040)ADT: 193  
 EXIST NBI = 23-167-0-1780-01-002  
 NEW NBI = 23-167-0-1780-01-009  
 HORIZONTAL SCALE 1:20  
 VERTICAL SCALE 1:20



Dan A. Hohmann, P.E.  
 01/26/2022

### FM 1047 BRIDGE LAYOUT



CONT	SECT	JOB	HIGHWAY
1780	01	009	FM 1047
DIST	COUNTY	SHEET NO.	
23	MILLS	57	

SUMMARY OF ESTIMATED BRIDGE QUANTITIES CSJ: 1780-01-009

STRUCTURE UNIT	ITEM 400	ITEM 416	ITEM 420	ITEM 420	ITEM 420	ITEM 422	ITEM 422	ITEM 425	ITEM 432	ITEM 450	ITEM 454	ITEM 459	ITEM 459
	6005	6004	6013	6025	6037	6001	6015	6038	6035	6006	6004	6009	6013
	CEM STABIL BKFL CY	DRILL SHAFT (36 IN) LF	CL C CONC (ABUT) CY	CL C CONC (BENT) CY	CL C CONC (COLUMN) CY	REINF CONC SLAB SF	APPROACH SLAB CY	PRESTR CONC GIRDER TX46 LF	RIPRAP (STONE PROTECTION) (24 IN) CY	RAIL (TY 223) LF	ARMOR JOINT (WITH SEAL) LF	GABION (3'X3')(GALV) CY	GABION (1.5'X3')(GALV) CY
2-AIG-32 ABUTMENTS	94	763	47								136	397	69
2-BIG-32 BENTS				28.6	25.4								
CONCRETE I-GIRDERS						6120	61.2	714	1120	404			
TOTALS	94	763	47	28.6	25.4	6120	61.2	714	1120	404	136	397	69

BEGIN AND END BRIDGE ELEVATIONS

BEGIN BRIDGE STATION 167+02.00 ELEVATION 1217.89 FT  
 END BRIDGE STATION 168+82.00 ELEVATION 1217.89 FT

SECTION DEPTHS

	"X" at CL Brng (Top of Slab to Top of Beam)	"Y" at CL Brng (Top of Slab to Bottom of Beam)
SPAN 1	1' - 0"	4' - 10"
SPAN 2	1' - 0"	4' - 10"
SPAN 3	1' - 0"	4' - 10"

BEARING SEAT ELEVATIONS (FT)

	GIRDER 1	GIRDER 2	GIRDER 3	GIRDER 4
ABUT 1 (FWD)	1212.548	1212.734	1212.921	1213.108

	GIRDER 1	GIRDER 2	GIRDER 3	GIRDER 4
BENT 2 (BK)	1212.548	1212.734	1212.921	1213.108
(FWD)	1212.548	1212.734	1212.921	1213.108

	GIRDER 1	GIRDER 2	GIRDER 3	GIRDER 4
BENT 3 (BK)	1212.548	1212.734	1212.921	1213.108
(FWD)	1212.548	1212.734	1212.921	1213.108

	GIRDER 1	GIRDER 2	GIRDER 3	GIRDER 4
ABUT 4 (BK)	1212.548	1212.734	1212.921	1213.108

BEAM SLOPES (FT/FT)

	GIRDER 1	GIRDER 2	GIRDER 3	GIRDER 4
SPAN 1	0.0000	0.0000	0.0000	0.0000

	GIRDER 1	GIRDER 2	GIRDER 3	GIRDER 4
SPAN 2	0.0000	0.0000	0.0000	0.0000

	GIRDER 1	GIRDER 2	GIRDER 3	GIRDER 4
SPAN 3	0.0000	0.0000	0.0000	0.0000



Dan A. Hohmann, P.E.

01/02/2022

FM 1047  
BEARING  
SEAT  
ELEVATIONS

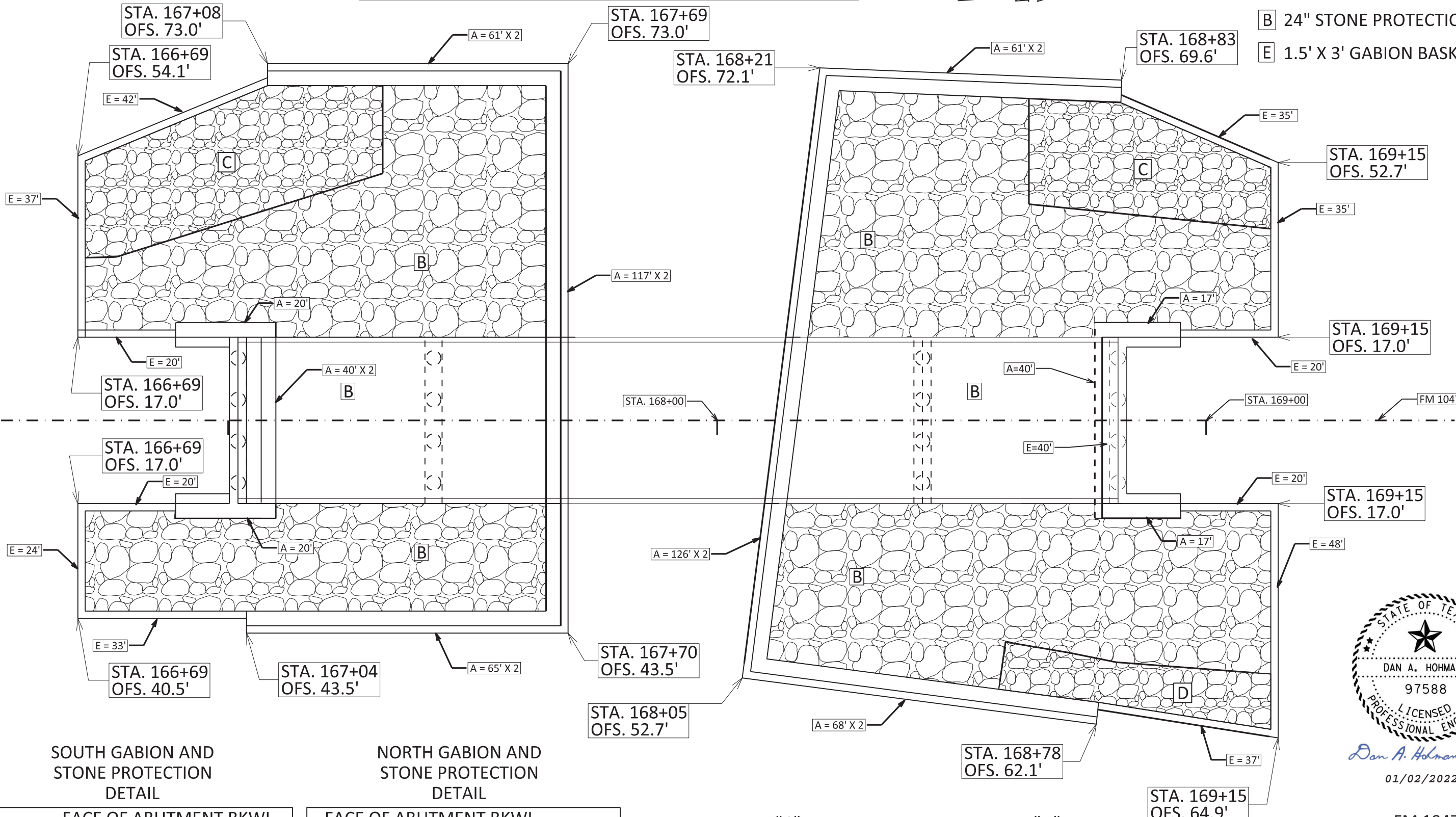


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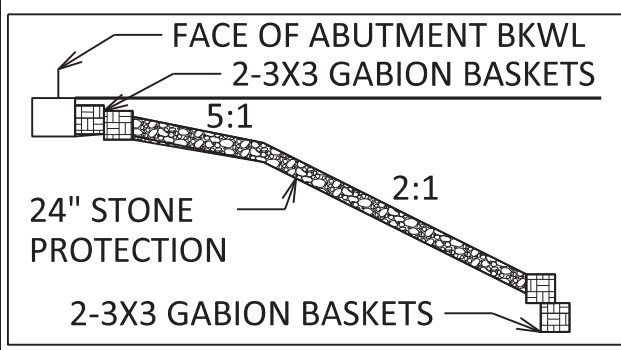


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110 6002	EXCAVATION (CHANNEL)	CY	2362

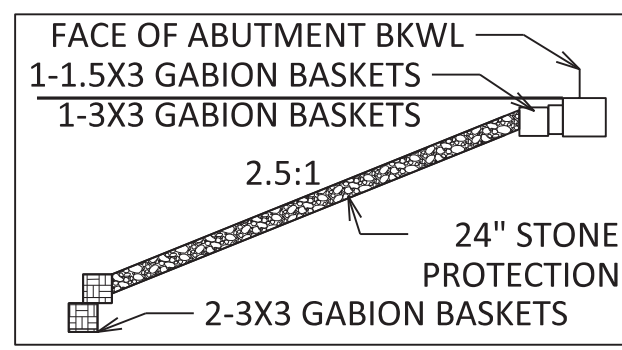


- A 3' X 3' GABION BASKETS
- B 24" STONE PROTECTION
- E 1.5' X 3' GABION BASKET

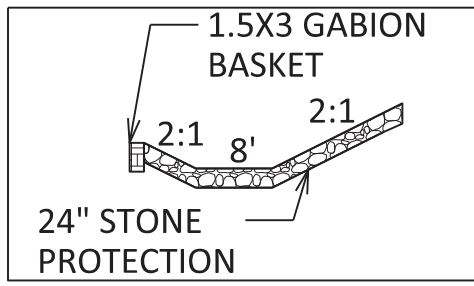
SOUTH GABION AND STONE PROTECTION DETAIL



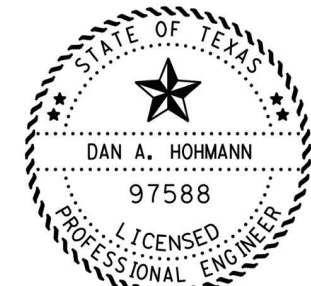
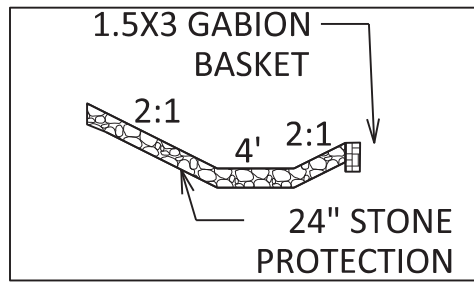
NORTH GABION AND STONE PROTECTION DETAIL



DETAIL "C"



DETAIL "D"



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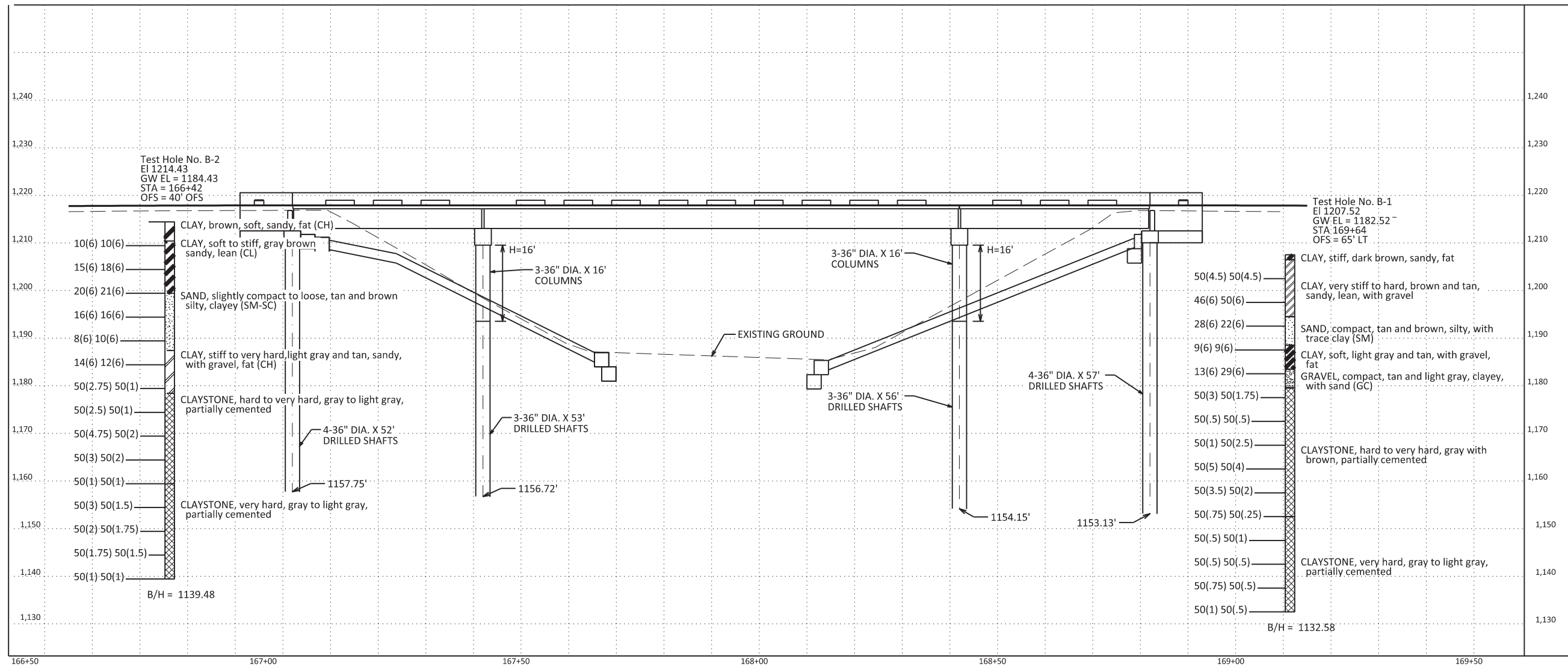
FM 1047  
RIPRAP  
LAYOUT

SCALE:  
1"=20'



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BWD	MILLS	59	



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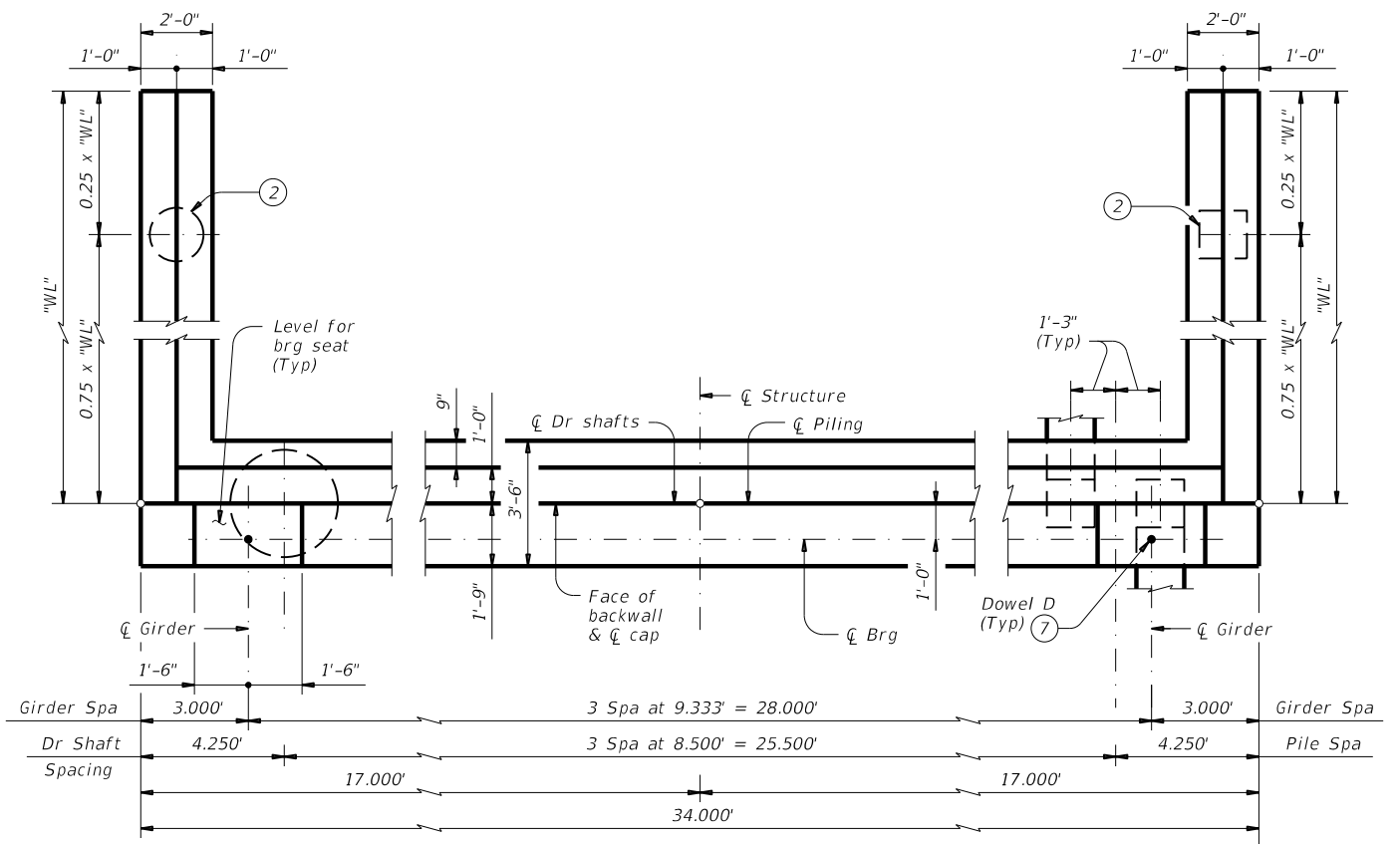
01/02/2022

FM 1047  
 FOUNDATION  
 DESIGN  
 NTS



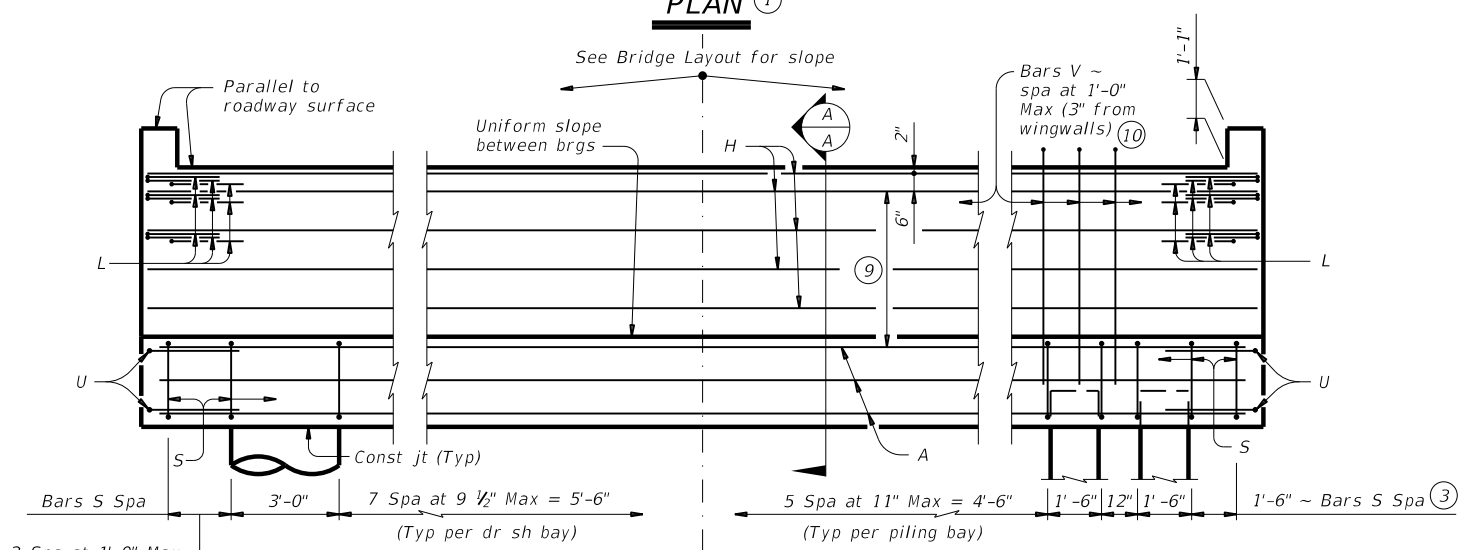
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SHOWING DRILLED SHAFTS      SHOWING PILES

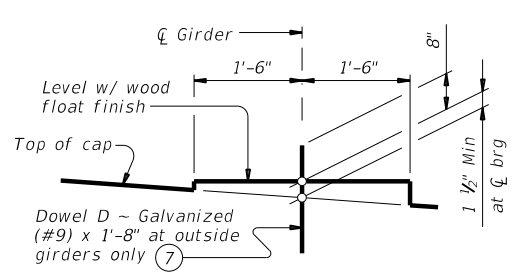
PLAN ①



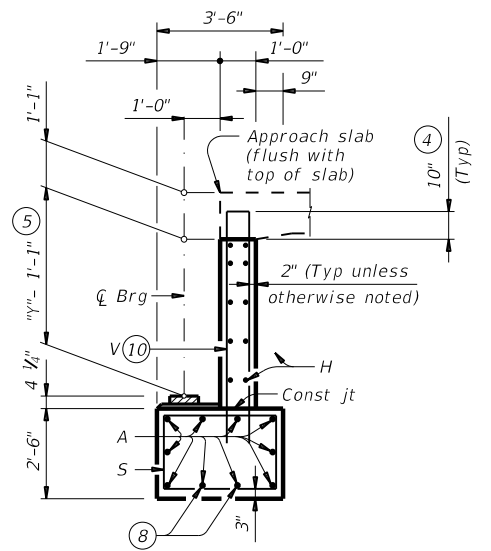
SHOWING DRILLED SHAFTS      SHOWING PILES

ELEVATION

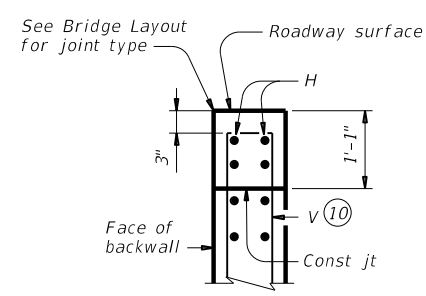
TABLE A			
Header Slope	Girder Type	Wingwall Type	Wingwall Lgth "WL"
2:1	Tx28	Cantilevered	8.000'
	Tx34	Cantilevered	9.000'
	Tx40	Cantilevered	10.000'
	Tx46	Cantilevered	11.000'
	Tx54	Cantilevered	12.000'
3:1	Tx28	Cantilevered	12.000'
	Tx34	Founded	13.000'
	Tx40	Founded	15.000'
	Tx46	Founded	16.000'
	Tx54	Founded	18.000'



BEARING SEAT DETAIL  
 (Bearing surface must be clean and free of all loose material before placing bearing pad.)



SECTION A-A  
 (With approach slab) ⑥



BACKWALL DETAIL  
 (Without approach slab) ⑥

- ① See Table A for variable dimensions based on header slope and girder type.
- ② See Table A to determine if wingwall foundations are required.
- ③ For piling larger than 16" adjust Bars S spacing as required to avoid piling.
- ④ Increase as required to maintain 3" from finished grade.
- ⑤ See Span details for "Y" value.
- ⑥ See Bridge Layout to determine if approach slab is present.
- ⑦ Omit Dowels D at end of multi-span unit. Adjust reinforcing steel total accordingly.
- ⑧ With pile foundations, move Bars A shown to clear piles.
- ⑨ Spacing based on girder type:  
 Tx28 ~ 3 spaces at 1'-0" Max  
 Tx34 ~ 3 spaces at 1'-0" Max  
 Tx40 ~ 4 spaces at 1'-0" Max  
 Tx46 ~ 4 spaces at 1'-0" Max  
 Tx54 ~ 5 spaces at 1'-0" Max
- ⑩ Field bend as needed to clear piles.

TABLE OF FOUNDATION LOADS		
Span Length	All Girder Types	
	Tons/Shaft	Tons/Pile
40	53	47
45	56	49
50	60	51
55	63	53
60	66	54
65	70	56
70	73	58
75	76	59
80	79	61
85	82	62
90	86	64
95	89	66
100	92	67
105	95	69
110	98	70
115	101	72
120	104	74

**GENERAL NOTES:**  
 Designed according to AASHTO LRFD Bridge Design Specifications.  
 See Bridge Layout for header slope and foundation type, size and length.  
 See Common Foundation Details (FD) standard sheet for all foundation details and notes.  
 See Concrete Riprap (CRR) standard sheet or Stone Riprap (SRR) standard sheet for riprap attachment details, if applicable.  
 See applicable rail details for rail anchorage in wingwalls.  
 These abutment details may be used with standard SIG-32 only.

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

**MATERIAL NOTES:**  
 Provide Class C concrete ( $f'c = 3,600$  psi).  
 Provide Class C (HPC) concrete if shown elsewhere in the plans.  
 Provide Grade 60 reinforcing steel.  
 Galvanize dowel bars D.

HL93 LOADING      SHEET 1 OF 3

**Texas Department of Transportation**      Bridge Division Standard

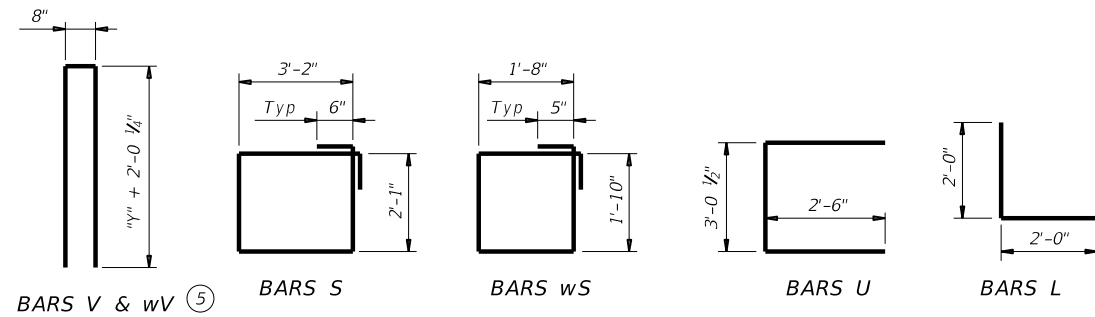
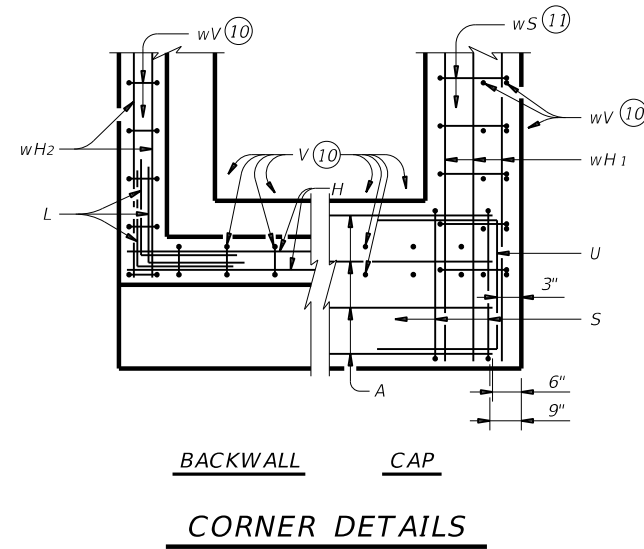
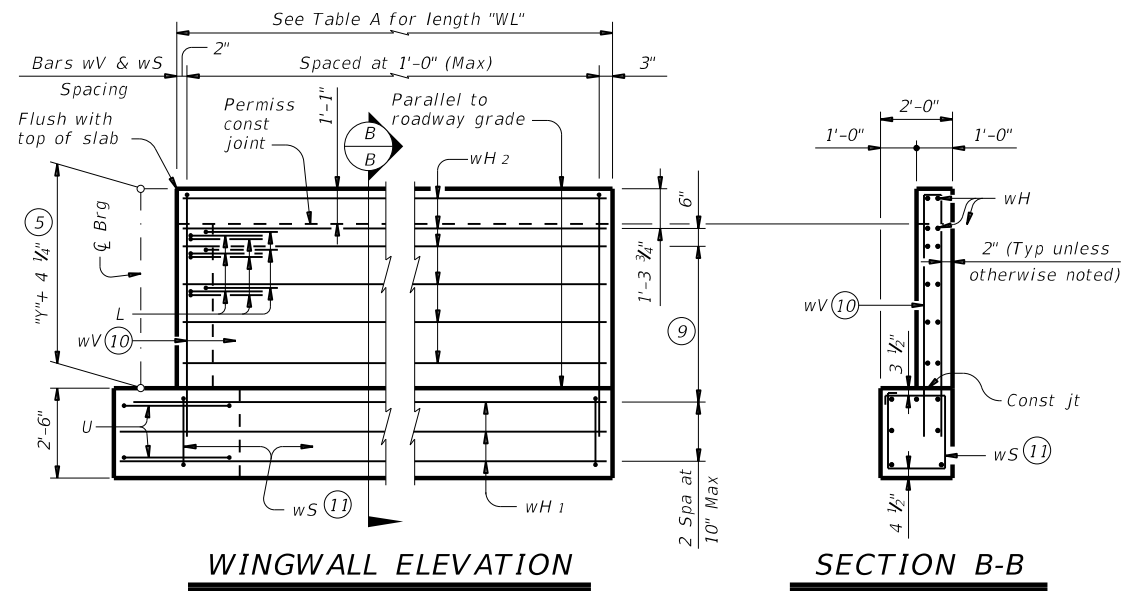
**ABUTMENTS**  
 TYPE TX28 THRU TX54  
 PRESTR CONC I-GIRDERS  
 32' ROADWAY

**AIG-32**

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©TxDOT August 2017	CON: August 2017	SECT:	JOB:	HIGHWAY:
REVISIONS	1780 01	009	FM 1047	
DIST: BWD	COUNTY: MILLS	SHEET NO. 61		

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⑤ See Span details for "y" value.

⑨ Spacing based on girder type:  
 Tx28 ~ 3 spaces at 1'-0" Max  
 Tx34 ~ 3 spaces at 1'-0" Max  
 Tx40 ~ 4 spaces at 1'-0" Max  
 Tx46 ~ 4 spaces at 1'-0" Max  
 Tx54 ~ 5 spaces at 1'-0" Max

⑩ Field bend as needed to clear piles.

⑪ Adjust as required to avoid piling.

HL93 LOADING

SHEET 2 OF 3



**ABUTMENTS**  
 TYPE TX28 THRU TX54  
 PRESTR CONC I-GIRDERS  
 32' ROADWAY

**AIG-32**

FILE: aig41sts-17.dgn	DN: TAR	CK: KCM	DW: JTR	CK: TAR
©TxDOT August 2017	CONT	SECT	JOB	HIGHWAY
REVISIONS	1780	01	009	FM 1047
DIST	COUNTY		SHEET NO.	
BWD	MILLS		62	

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**TABLES OF ESTIMATED QUANTITIES WITH 2:1 HEADER SLOPE ⑫**


TYPE Tx28 Girders					TYPE Tx34 Girders					TYPE Tx40 Girders					TYPE Tx46 Girders					TYPE Tx54 Girders									
Bar	No.	Size	Length	Weight	Bar	No.	Size	Length	Weight	Bar	No.	Size	Length	Weight	Bar	No.	Size	Length	Weight	Bar	No.	Size	Length	Weight					
A	10	#11	33'-0"	1,753	A	10	#11	33'-0"	1,753	A	10	#11	33'-0"	1,753	A	10	#11	33'-0"	1,753	A	10	#11	33'-0"	1,753					
D(7)	2	#9	1'-8"	11	D(7)	2	#9	1'-8"	11	D(7)	2	#9	1'-8"	11	D(7)	2	#9	1'-8"	11	D(7)	2	#9	1'-8"	11					
H	8	#6	33'-8"	405	H	8	#6	33'-8"	405	H	10	#6	33'-8"	506	H	10	#6	33'-8"	506	H	12	#6	33'-8"	607					
L	18	#6	4'-0"	108	L	18	#6	4'-0"	108	L	18	#6	4'-0"	108	L	18	#6	4'-0"	108	L	18	#6	4'-0"	108					
S	30	#5	11'-6"	360	S	30	#5	11'-6"	360	S	30	#5	11'-6"	360	S	30	#5	11'-6"	360	S	30	#5	11'-6"	360					
U	4	#6	8'-1"	49	U	4	#6	8'-1"	49	U	4	#6	8'-1"	49	U	4	#6	8'-1"	49	U	4	#6	8'-1"	49					
V	33	#5	11'-4"	390	V	33	#5	12'-4"	425	V	33	#5	13'-4"	459	V	33	#5	14'-4"	493	V	33	#5	15'-8"	539					
wH1	14	#6	9'-5"	198	wH1	14	#6	10'-5"	219	wH1	14	#6	11'-5"	240	wH1	14	#6	12'-5"	261	wH1	14	#6	13'-5"	282					
wH2	20	#6	7'-8"	230	wH2	20	#6	8'-8"	260	wH2	24	#6	9'-8"	348	wH2	24	#6	10'-8"	385	wH2	28	#6	11'-8"	491					
wS	18	#4	7'-10"	94	wS	20	#4	7'-10"	105	wS	22	#4	7'-10"	115	wS	24	#4	7'-10"	126	wS	26	#4	7'-10"	136					
wV	18	#5	11'-4"	213	wV	20	#5	12'-4"	257	wV	22	#5	13'-4"	306	wV	24	#5	14'-4"	359	wV	26	#5	15'-8"	425					
Reinforcing Steel				Lb	3,811	Reinforcing Steel				Lb	3,952	Reinforcing Steel				Lb	4,255	Reinforcing Steel				Lb	4,411	Reinforcing Steel				Lb	4,761
Class "C" Concrete				CY	18.5	Class "C" Concrete				CY	20.1	Class "C" Concrete				CY	21.8	Class "C" Concrete				CY	23.5	Class "C" Concrete				CY	25.6

**TABLES OF ESTIMATED QUANTITIES WITH 3:1 HEADER SLOPE ⑫**

TYPE Tx28 Girders					TYPE Tx34 Girders					TYPE Tx40 Girders					TYPE Tx46 Girders					TYPE Tx54 Girders									
Bar	No.	Size	Length	Weight	Bar	No.	Size	Length	Weight	Bar	No.	Size	Length	Weight	Bar	No.	Size	Length	Weight	Bar	No.	Size	Length	Weight					
A	10	#11	33'-0"	1,753	A	10	#11	33'-0"	1,753	A	10	#11	33'-0"	1,753	A	10	#11	33'-0"	1,753	A	10	#11	33'-0"	1,753					
D(7)	2	#9	1'-8"	11	D(7)	2	#9	1'-8"	11	D(7)	2	#9	1'-8"	11	D(7)	2	#9	1'-8"	11	D(7)	2	#9	1'-8"	11					
H	8	#6	33'-8"	405	H	8	#6	33'-8"	405	H	10	#6	33'-8"	506	H	10	#6	33'-8"	506	H	12	#6	33'-8"	607					
L	18	#6	4'-0"	108	L	18	#6	4'-0"	108	L	18	#6	4'-0"	108	L	18	#6	4'-0"	108	L	18	#6	4'-0"	108					
S	30	#5	11'-6"	360	S	30	#5	11'-6"	360	S	30	#5	11'-6"	360	S	30	#5	11'-6"	360	S	30	#5	11'-6"	360					
U	4	#6	8'-1"	49	U	4	#6	8'-1"	49	U	4	#6	8'-1"	49	U	4	#6	8'-1"	49	U	4	#6	8'-1"	49					
V	33	#5	11'-4"	390	V	33	#5	12'-4"	425	V	33	#5	13'-4"	459	V	33	#5	14'-4"	493	V	33	#5	15'-8"	539					
wH1	14	#6	13'-5"	282	wH1	14	#6	14'-5"	303	wH1	14	#6	16'-5"	345	wH1	14	#6	17'-5"	366	wH1	14	#6	19'-5"	408					
wH2	20	#6	11'-8"	350	wH2	20	#6	12'-8"	381	wH2	24	#6	14'-8"	529	wH2	24	#6	15'-8"	565	wH2	28	#6	17'-8"	743					
wS	26	#4	7'-10"	136	wS	28	#4	7'-10"	147	wS	32	#4	7'-10"	167	wS	34	#4	7'-10"	178	wS	38	#4	7'-10"	199					
wV	26	#5	11'-4"	307	wV	28	#5	12'-4"	360	wV	32	#5	13'-4"	445	wV	34	#5	14'-4"	508	wV	38	#5	15'-8"	621					
Reinforcing Steel				Lb	4,151	Reinforcing Steel				Lb	4,302	Reinforcing Steel				Lb	4,732	Reinforcing Steel				Lb	4,897	Reinforcing Steel				Lb	5,398
Class "C" Concrete				CY	21.1	Class "C" Concrete				CY	22.8	Class "C" Concrete				CY	25.3	Class "C" Concrete				CY	27.2	Class "C" Concrete				CY	30.4

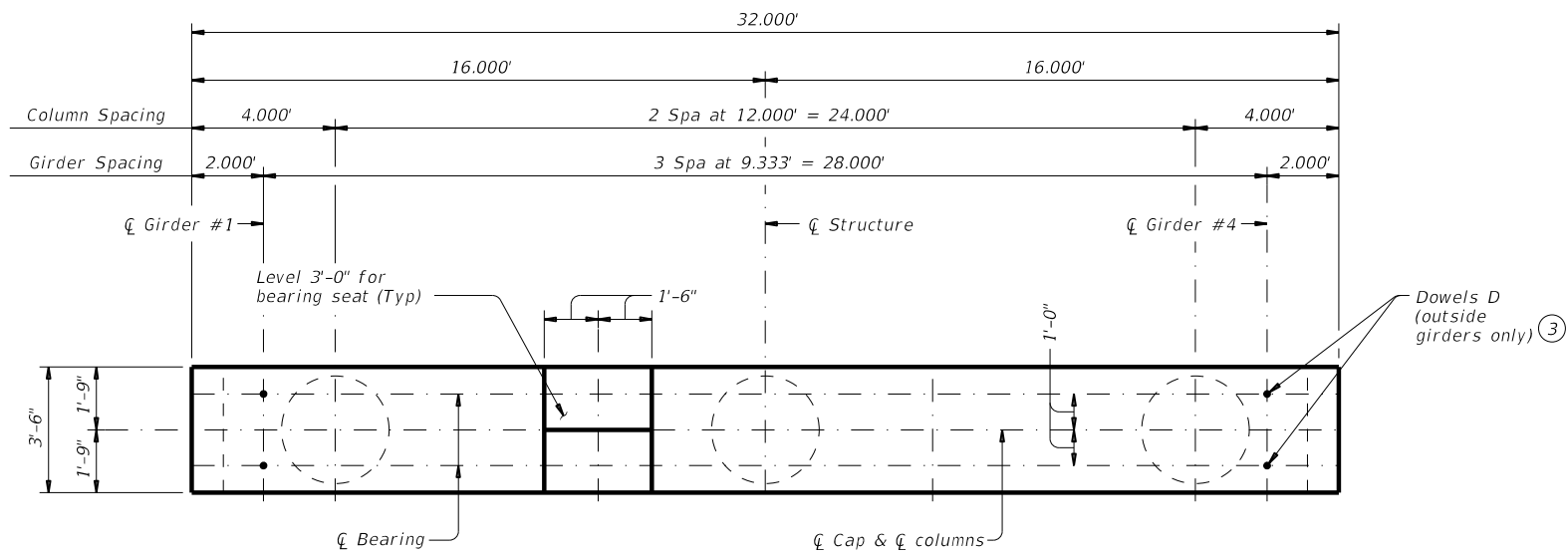
⑦ Omit Dowels D at end of multi-span unit. Adjust reinforcing steel total accordingly.

⑫ Quantities shown are for one abutment only (with approach slab). With no approach slab, add 1.3 CY Class "C" concrete and 202 lbs reinforcing steel for 4 additional Bars H.

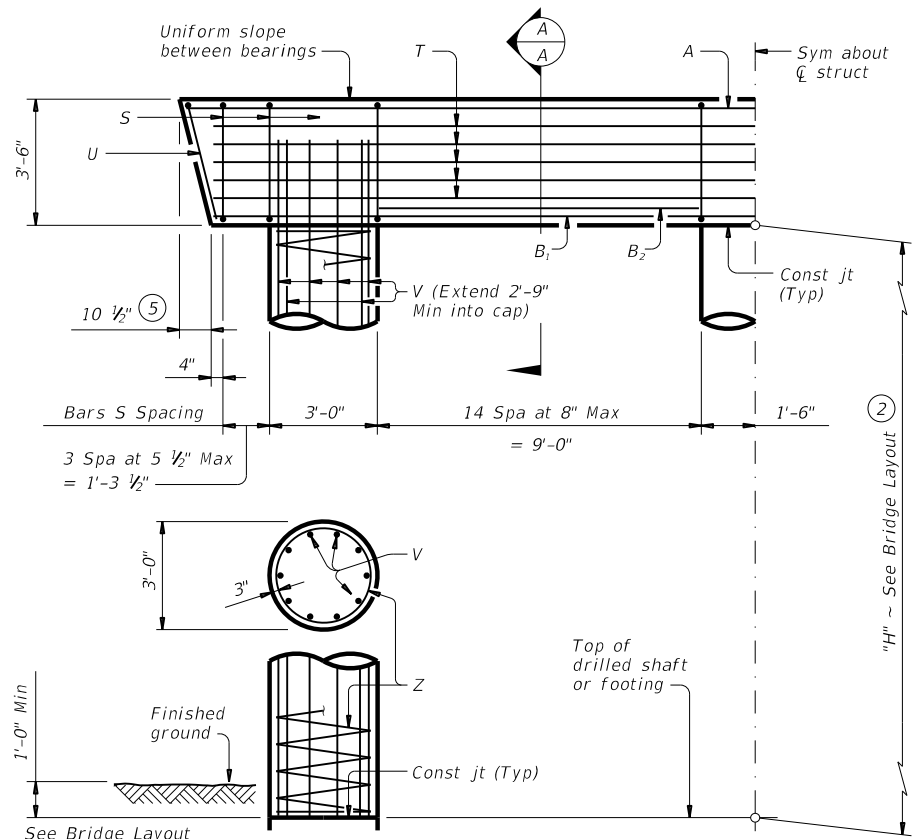
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REVISIONS	1780 01	009	FM 1047
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BWD	MILLS	63	

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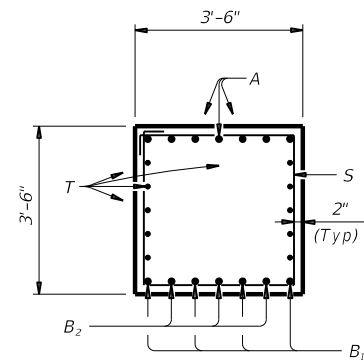
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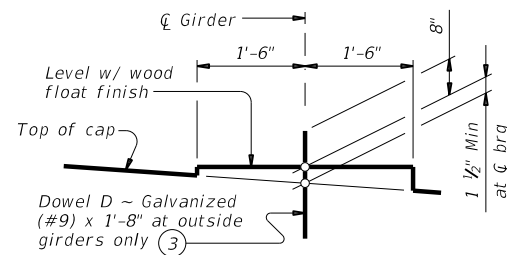
**PLAN**



**HALF ELEVATION**

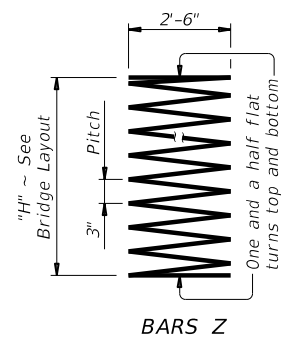
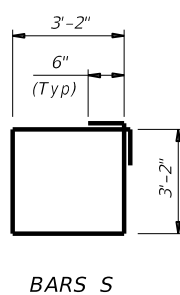
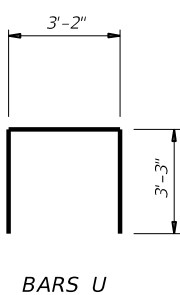


**SECTION A-A**



**BEARING SEAT DETAIL**

(Bearing surface must be clean and free of all loose material before placing bearing pad.)



- Quantities shown are based on an "H" value of 36'. For each linear foot variation in "H" value, make the following adjustments:  
 Bars V length, 1'-0"  
 Bars Z length, 31'-5"  
 Reinforcing steel, 165 Lb  
 Class "C" conc (col), 0.78 CY
- This standard may not be used for "H" heights exceeding 36'. In areas of very soft soil or where scour is anticipated, allowable "H" heights must be evaluated by the Engineer prior to the use of this standard.
- Omit Dowels D at end of multi-span units. Adjust reinforcing steel total accordingly.
- Foundation Loads based on "H" = 36'.
- Measured parallel to top of cap cross-slope.

TABLE OF ESTIMATED QUANTITIES ①					
Bar	No.	Size	Length	Weight	
A	7	#11	31'- 6"	1,172	
B <sub>1</sub>	4	#11	30'- 0"	638	
B <sub>2</sub>	6	#11	9'- 0"	287	
D ③	4	#9	1'- 8"	23	
S	38	#5	13'- 8"	627	
T	10	#5	30'- 0"	313	
U	2	#5	9'- 8"	20	
V	30	#9	38'- 9"	3,953	
Z	3	#4	1154'- 7"	2,314	
Reinforcing Steel				Lb	9,262
Class "C" Concrete (Cap)				CY	14.3
Class "C" Concrete (Col)				CY	28.3

FOUNDATION LOADS ④				
Span Average	Drilled Shaft Loads	Pile Load (Tons/Pile)		
		3 Pile Ftg	4 Pile Ftg	5 Pile Ftg
Ft	Tons/Shaft			
40	113	41	31	26
45	121	44	33	27
50	130	47	36	29
55	138	49	38	31
60	147	52	40	33
65	155	55	42	34
70	163	58	44	36
75	172	61	46	38
80	180	63	48	39
85	188	66	50	41
90	196	69	52	42
95	205	72	54	44
100	213	74	56	46
105	221	77	58	47
110	229	80	60	49
115	237	82	62	51
120	245	85	64	52

**GENERAL NOTES:**  
 Designed according to AASHTO LRFD Bridge Design Specifications. See Bridge Layout for foundation type, size and length. See Common Foundation Details (FD) standard sheet for all foundation details and notes. See Shear Key (IGSK) standard sheet for all shear key details and notes, if applicable. Bent selected must be based on the average span length rounded up to the next 5 ft increment. These bent details may be used with standard SIG-32 only.  
 Cover dimensions are clear dimensions, unless noted otherwise. Reinforcing bar dimensions shown are out-to-out of bar.

**MATERIAL NOTES:**  
 Provide Class C concrete (f'c = 3,600 psi). Provide Class C (HPC) concrete if shown elsewhere in the plans. Provide Grade 60 reinforcing steel. Galvanize dowel bars D.  
 HL93 LOADING

Texas Department of Transportation  
 Bridge Division Standard

**INTERIOR BENTS  
 TYPE TX28 THRU TX54  
 PRESTR CONC I-GIRDERS  
 32' ROADWAY**

**BIG-32**

FILE: big41sts-17.dgn	DN: TAR	CK: SDB	DW: JTR	CK: TAR
©TxDOT August 2017	CONTRACT	SECTION	JOB	HIGHWAY
REVISIONS	1780	01	009	FM 1047
	DIST	COUNTY	SHEET NO.	
	BWD	MILLS	64	

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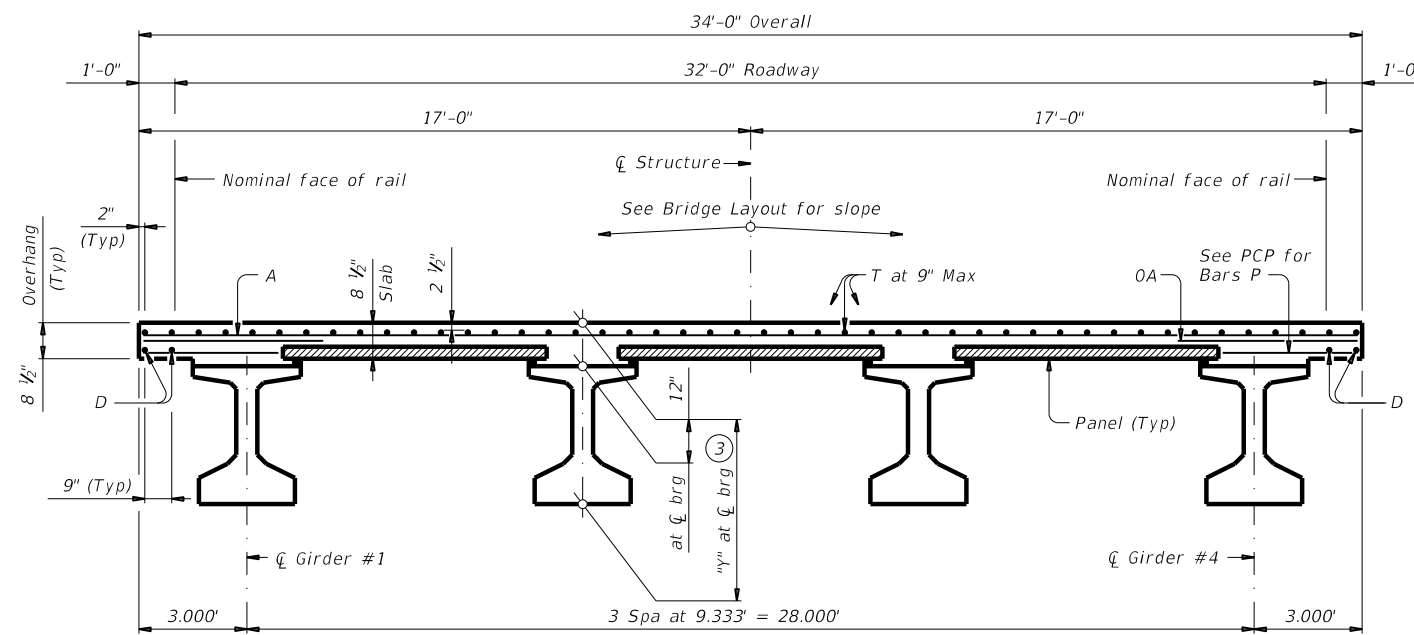
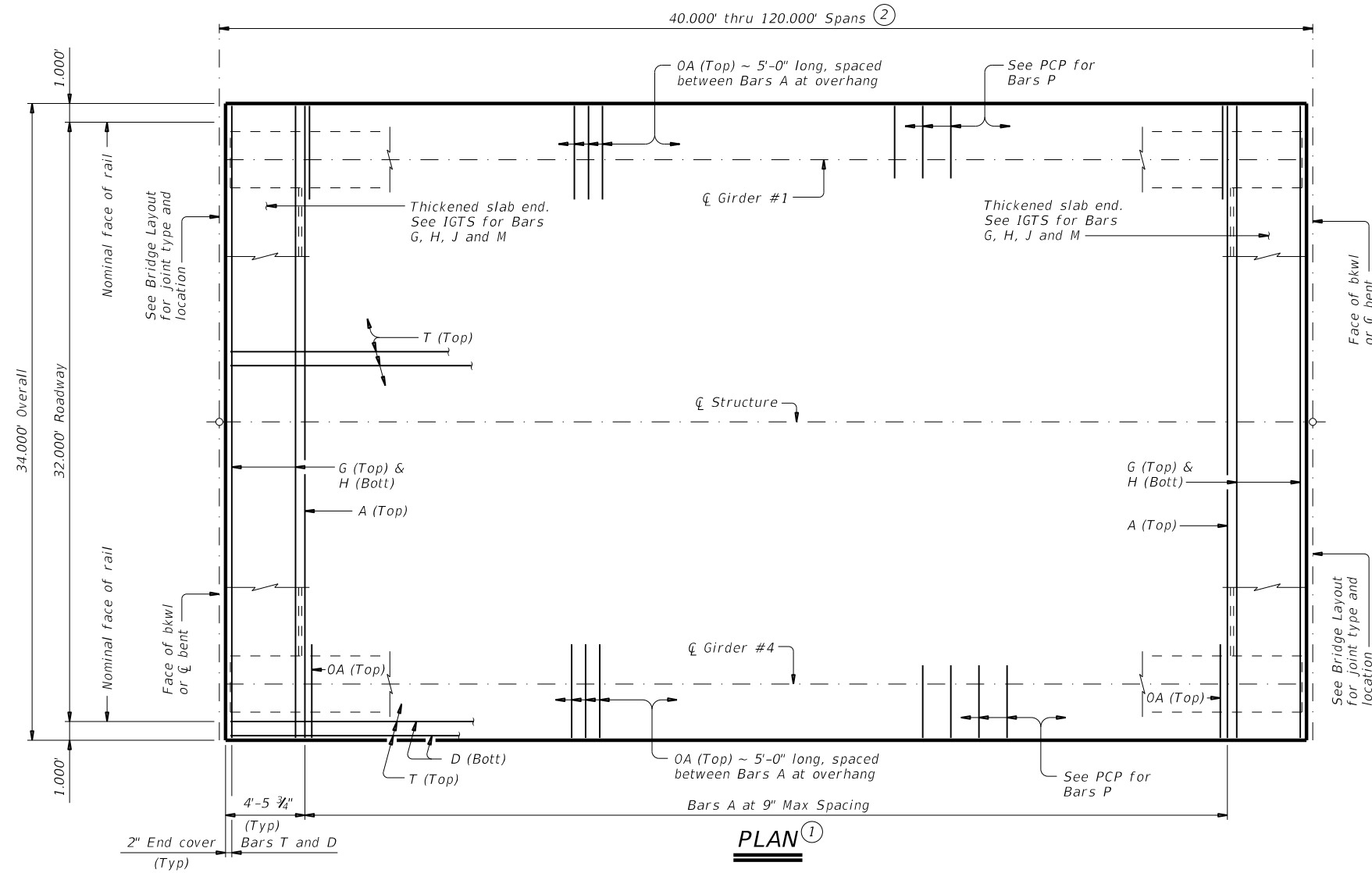


TABLE OF SECTION DEPTHS	
GIRDER TYPE	"y" AT ̄ BRG ③
	Ft/In
Tx28	3'-4"
Tx34	3'-10"
Tx40	4'-4"
Tx46	4'-10"
Tx54	5'-6"

BAR TABLE	
BAR	SIZE
A	#4
D	#4
G	#4
H	#4
J	#4
M	#4
OA	#5
P	#4
T	#4

- ① If multi-span units (with slab continuous over interior bents) are indicated on the Bridge Layout, see standard IGCS for adjustment to slab reinforcement and quantities.
- ② Span lengths for prestressed concrete I-Girder type:  
 Type Tx28 for spans lengths 40.000' thru 65.000'.  
 Type Tx34 for spans lengths 40.000' thru 80.000'.  
 Type Tx40 for spans lengths 40.000' thru 90.000'.  
 Type Tx46 for spans lengths 40.000' thru 100.000'.  
 Type Tx54 for spans lengths 40.000' thru 120.000'.
- ③ "y" value shown is based on theoretical girder camber, dead load deflection from an 8 1/2" concrete slab, a constant roadway grade, and using precast panels (PCP). The Contractor will adjust this value as necessary for any roadway vertical curve and/or if the precast overhang panel (PCP(0)) option is used.

HL93 LOADING SHEET 1 OF 2

Texas Department of Transportation  
 Bridge Division Standard

**PRESTRESSED CONCRETE I-GIRDER SPANS (TYPE Tx28 THRU Tx54) 32' ROADWAY**

**SIG-32**

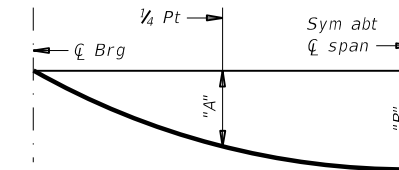
FILE: sig41sts-19.dgn	DN: JMH	CK: ASB	DW: JTR	CK: TAR
©TxDOT August 2017	CONT	SECT	JOB	HIGHWAY
REVISIONS	1780	01	009	FM 1047
10-19: Increased "X" and "Y" Values	DIST	COUNTY	SHEET NO.	
	BWD	MILLS	65	

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**TABLE OF DEAD LOAD DEFLECTIONS**

TYPE Tx28 GIRDERS			TYPE Tx34 GIRDERS			TYPE Tx40 GIRDERS			TYPE Tx46 GIRDERS			TYPE Tx54 GIRDERS		
SPAN LENGTH	"A"	"B"	SPAN LENGTH	"A"	"B"	SPAN LENGTH	"A"	"B"	SPAN LENGTH	"A"	"B"	SPAN LENGTH	"A"	"B"
Ft	Ft	Ft	Ft	Ft	Ft	Ft	Ft	Ft	Ft	Ft	Ft	Ft	Ft	Ft
40	0.011	0.015	40	0.006	0.009	40	0.004	0.006	40	0.003	0.004	40	0.002	0.003
45	0.017	0.024	45	0.010	0.014	45	0.006	0.009	45	0.004	0.006	45	0.003	0.004
50	0.026	0.037	50	0.016	0.022	50	0.011	0.015	50	0.007	0.010	50	0.005	0.007
55	0.040	0.056	55	0.024	0.033	55	0.016	0.022	55	0.011	0.015	55	0.007	0.010
60	0.057	0.080	60	0.034	0.048	60	0.022	0.031	60	0.015	0.021	60	0.010	0.014
65	0.079	0.111	65	0.047	0.066	65	0.031	0.043	65	0.021	0.030	65	0.014	0.020
			70	0.064	0.090	70	0.042	0.059	70	0.028	0.040	70	0.019	0.027
			75	0.085	0.120	75	0.056	0.078	75	0.038	0.053	75	0.025	0.035
			80	0.111	0.156	80	0.073	0.102	80	0.049	0.069	80	0.033	0.046
						85	0.093	0.131	85	0.063	0.089	85	0.042	0.059
						90	0.118	0.165	90	0.080	0.113	90	0.053	0.074
									95	0.100	0.140	95	0.066	0.093
									100	0.123	0.173	100	0.081	0.114
									105			105	0.100	0.140
									110			110	0.120	0.169
									115			115	0.144	0.202
									120			120	0.172	0.241



**DEAD LOAD DEFLECTION DIAGRAM**

Calculated deflections shown are due to the concrete slab on interior girders only ( $E_c = 5000$  ksi). Adjust values as required for exterior girders and if optional slab forming is used. These values may require field verification.

**TABLE OF ESTIMATED QUANTITIES**

SPAN LENGTH	REINF CONCRETE SLAB	Prestressed Concrete Girders			TOTAL REINF STEEL <sup>5</sup>
		ABUT TO INT BT <sup>4</sup>	INT BT TO INT BT <sup>4</sup>	ABUT TO ABUT <sup>4</sup>	
Ft	SF	LF	LF	LF	Lb
40	1,360	158.00	158.00	158.00	3,128
45	1,530	178.00	178.00	178.00	3,519
50	1,700	198.00	198.00	198.00	3,910
55	1,870	218.00	218.00	218.00	4,301
60	2,040	238.00	238.00	238.00	4,692
65	2,210	258.00	258.00	258.00	5,083
70	2,380	278.00	278.00	278.00	5,474
75	2,550	298.00	298.00	298.00	5,865
80	2,720	318.00	318.00	318.00	6,256
85	2,890	338.00	338.00	338.00	6,647
90	3,060	358.00	358.00	358.00	7,038
95	3,230	378.00	378.00	378.00	7,429
100	3,400	398.00	398.00	398.00	7,820
105	3,570	418.00	418.00	418.00	8,211
110	3,740	438.00	438.00	438.00	8,602
115	3,910	458.00	458.00	458.00	8,993
120	4,080	478.00	478.00	478.00	9,384

- <sup>4</sup> Fabricator will adjust lengths for girder slopes as required.
- <sup>5</sup> Reinforcing steel weight is calculated using an approximate factor of 2.3 lbs/SF.

**GENERAL NOTES:**

Designed according to AASHTO LRFD Bridge Design Specifications.  
 Multi-span units, with slab continuous over interior bents, may be formed with the details shown on this sheet and standard IGCS.  
 See IGTS standard for Thickened Slab End details and quantity adjustments.  
 See PCP and PCP-FAB for panel details not shown.  
 See PCP(O) and PCP(O)-FAB for precast overhang panel details if this option is used.  
 See IGMS standard for miscellaneous details.  
 See applicable rail details for rail anchorage in slab.  
 See PMDF standard for details and quantity adjustments if this option is used.  
 This standard does not support the use of transition bents.

Cover dimensions are clear dimensions, unless noted otherwise.

**MATERIAL NOTES:**

Provide Class S concrete ( $f'c = 4,000$  psi).  
 Provide Class S (HPC) concrete if shown elsewhere in the plans.  
 Provide Grade 60 reinforcing steel.  
 Provide bar laps, where required, as follows:  
 Uncoated ~ #4 = 1'-7"  
 Epoxy coated ~ #4 = 2'-5"  
 Deformed Welded Wire Reinforcement (WWR) (ASTM A1064) of equal size and spacing may be substituted for Bars A, D, OA, P or T unless noted otherwise.

HL93 LOADING SHEET 2 OF 2

		<b>Bridge Division Standard</b>	
<p><b>PRESTRESSED CONCRETE I-GIRDER SPANS</b>          (TYPE Tx28 THRU Tx54)          32' ROADWAY</p>			
<p><b>SIG-32</b></p>			
FILE: sig41sts-19.dgn	DN: JMH	CK: ASB	DW: JTR
©TxDOT August 2017	CONT SECT	JOB	HIGHWAY
REVISIONS	1780 01	009	FM 1047
10-19: Increased "X" and "Y" Values	DIST	COUNTY	SHEET NO.
	BWD	MILLS	66



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STRUCTURE	DESIGNED GIRDERS									DEPRESSED STRAND PATTERN		CONCRETE		OPTIONAL DESIGN					LOAD RATING		
	SPAN NO.	GIRDER NO.	GIRDER TYPE	PRESTRESSING STRANDS					NO.	TO END (in)	RELEASE STRGTH f <sub>ci</sub> (ksi)	MINIMUM 28 DAY COMP STRGTH f <sub>c</sub> (ksi)	DESIGN LOAD COMP STRESS (TOP $\epsilon$ ) f <sub>ct</sub> (ksi)	DESIGN LOAD TENSILE STRESS (BOT $\epsilon$ ) f <sub>cb</sub> (ksi)	REQUIRED MINIMUM ULTIMATE MOMENT CAPACITY (STRENGTH I) (kip-ft)	LIVE LOAD DISTRIBUTION FACTOR		STRENGTH			
				NON-STD STRAND PATTERN	TOTAL NO.	SIZE (in)	STRGTH f <sub>pu</sub> (ksi)	"e" $\bar{\epsilon}$ (in)								"e" END (in)	Moment	Shear	Inv	Opr	Inv
Type Tx28 Girders 32' Roadway 8.5" Slab	40	ALL	Tx28		14	0.6	270	10.48	9.34	2	10.5	4.000	5.000	1.189	-1.700	1731	0.850	1.070	1.58	2.04	2.01
	45	ALL	Tx28		14	0.6	270	10.48	9.34	2	10.5	4.000	5.400	1.507	-2.077	1717	0.820	1.080	1.48	1.91	1.57
	50	ALL	Tx28		16	0.6	270	10.23	9.23	4	8.5	4.000	5.800	1.853	-2.508	2040	0.800	1.080	1.39	1.80	1.30
	55	ALL	Tx28		18	0.6	270	10.04	8.26	4	12.5	4.100	6.400	2.247	-2.980	2377	0.780	1.090	1.26	1.69	1.07
	60	ALL	Tx28		22	0.6	270	9.75	7.57	4	16.5	4.800	6.900	2.655	-3.462	2715	0.760	1.090	1.24	1.82	1.05
	65	ALL	Tx28		26	0.6	270	9.56	7.71	4	16.5	5.600	7.300	3.104	-3.978	3064	0.740	1.100	1.09	1.76	1.07
Type Tx34 Girders 32' Roadway 8.5" Slab	40	ALL	Tx34		12	0.6	270	13.01	13.01			4.000	5.000	0.934	-1.303	1975	0.880	1.050	1.77	2.29	2.35
	45	ALL	Tx34		14	0.6	270	13.01	12.15	2	8.5	4.000	5.000	1.180	-1.588	2124	0.850	1.060	1.75	2.27	2.11
	50	ALL	Tx34		16	0.6	270	12.76	11.76	4	8.5	4.000	5.000	1.437	-1.907	2248	0.830	1.060	1.64	2.13	1.82
	55	ALL	Tx34		16	0.6	270	12.76	11.76	4	8.5	4.000	5.000	1.739	-2.263	2449	0.810	1.060	1.37	1.77	1.35
	60	ALL	Tx34		18	0.6	270	12.57	11.23	4	10.5	4.000	5.500	2.068	-2.640	2806	0.790	1.070	1.30	1.72	1.17
	65	ALL	Tx34		22	0.6	270	12.28	7.92	4	28.5	4.000	6.000	2.424	-3.039	3173	0.770	1.070	1.59	2.08	1.34
	70	ALL	Tx34		26	0.6	270	12.09	8.09	4	30.5	4.700	6.500	2.807	-3.458	3548	0.750	1.080	1.08	1.81	1.04
	75	ALL	Tx34		30	0.6	270	11.81	7.41	6	28.5	5.200	6.700	3.195	-3.894	3951	0.740	1.080	1.44	1.93	1.12
Type Tx40 Girders 32' Roadway 8.5" Slab	40	ALL	Tx40		12	0.6	270	15.60	15.60			4.000	5.000	0.768	-1.053	2052	0.910	1.030	2.02	2.62	2.88
	45	ALL	Tx40		14	0.6	270	15.60	15.60			4.700	5.000	0.967	-1.282	2430	0.880	1.040	2.01	2.61	2.63
	50	ALL	Tx40		14	0.6	270	15.60	15.60			4.500	5.000	1.195	-1.554	2558	0.860	1.040	1.91	2.48	2.29
	55	ALL	Tx40		16	0.6	270	15.35	14.35	4	8.5	4.000	5.000	1.442	-1.834	2685	0.830	1.050	1.60	2.07	1.79
	60	ALL	Tx40		18	0.6	270	15.16	13.82	4	10.5	4.000	5.000	1.687	-2.118	2875	0.810	1.050	1.57	2.03	1.61
	65	ALL	Tx40		18	0.6	270	15.16	13.82	4	10.5	4.000	5.000	1.978	-2.447	3277	0.800	1.060	1.31	1.70	1.22
	70	ALL	Tx40		20	0.6	270	15.00	13.40	4	12.5	4.000	5.200	2.288	-2.783	3666	0.780	1.060	1.13	1.68	1.08
	75	ALL	Tx40		24	0.6	270	14.77	9.77	4	34.5	4.100	5.700	2.619	-3.135	4064	0.760	1.060	1.60	2.07	1.26
	80	ALL	Tx40		28	0.6	270	14.60	10.60	4	32.5	4.900	6.000	2.964	-3.509	4498	0.750	1.070	1.27	1.99	1.14
	85	ALL	Tx40		32	0.6	270	14.23	8.60	6	36.5	5.100	6.200	3.328	-3.900	4944	0.740	1.070	1.29	2.04	1.08
Type Tx46 Girders 32' Roadway 8.5" Slab	40	ALL	Tx46		12	0.6	270	17.60	17.60			4.000	5.000	0.678	-0.844	2150	0.950	1.020	2.22	2.88	3.41
	45	ALL	Tx46		14	0.6	270	17.60	17.60			4.500	5.000	0.846	-1.024	2543	0.920	1.020	2.22	2.88	3.17
	50	ALL	Tx46		14	0.6	270	17.60	17.60			4.500	5.000	1.041	-1.235	3012	0.890	1.030	1.82	2.36	2.47
	55	ALL	Tx46		16	0.6	270	17.35	16.35	4	8.5	4.000	5.000	1.257	-1.465	3277	0.870	1.030	1.77	2.30	2.22
	60	ALL	Tx46		16	0.6	270	17.35	16.35	4	8.5	4.000	5.000	1.489	-1.701	3221	0.840	1.040	1.51	1.95	1.77
	65	ALL	Tx46		18	0.6	270	17.16	15.83	4	10.5	4.000	5.000	1.732	-1.957	3424	0.830	1.040	1.48	1.92	1.59
	70	ALL	Tx46		18	0.6	270	17.16	15.83	4	10.5	4.000	5.000	2.001	-2.227	3834	0.810	1.040	1.26	1.64	1.23
	75	ALL	Tx46		20	0.6	270	17.00	15.40	4	12.5	4.000	5.000	2.289	-2.510	4254	0.790	1.040	1.16	1.63	1.10
	80	ALL	Tx46		24	0.6	270	16.77	14.10	4	20.5	4.000	5.100	2.579	-2.804	4703	0.780	1.050	1.28	1.83	1.14
	85	ALL	Tx46		28	0.6	270	16.60	11.46	4	40.5	4.200	5.500	2.905	-3.125	5181	0.770	1.050	1.38	1.98	1.14
90	ALL	Tx46		32	0.6	270	16.23	9.48	6	42.5	4.400	5.700	3.234	-3.438	5624	0.750	1.050	1.46	2.11	1.13	
95	ALL	Tx46		34	0.6	270	16.07	11.13	6	34.5	5.000	5.900	3.582	-3.777	6117	0.740	1.060	1.49	2.12	1.12	
100	ALL	Tx46		38	0.6	270	15.81	11.39	6	34.5	5.600	6.600	3.961	-4.139	6635	0.730	1.060	1.31	1.78	1.03	

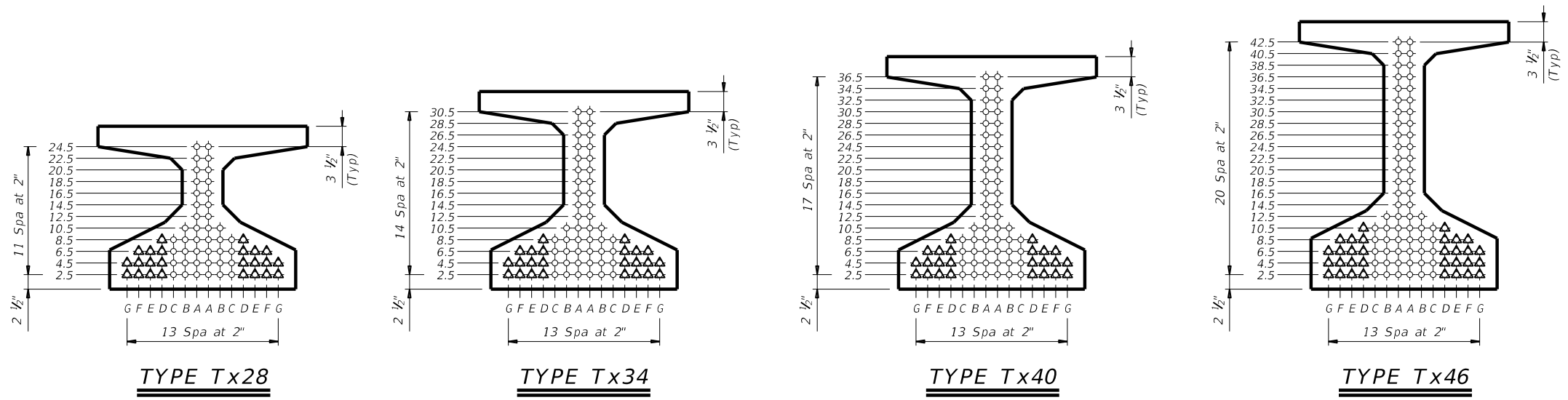
NON-STANDARD STRAND PATTERNS		
PATTERN	STRAND ARRANGEMENT AT $\bar{\epsilon}$ OF GIRDER	

- ① Based on the following allowable stresses (ksi):  
 Compression = 0.65 f<sub>ci</sub>  
 Tension = 0.24  $\sqrt{f'_{ci}}$   
 Optional designs must likewise conform.
- ② Portion of full HL93.

**DESIGN NOTES:**  
 Designed according to AASHTO LRFD Bridge Design Specifications. Load rated using Load and Resistance Factor Rating according to AASHTO Manual for Bridge Evaluation.  
 Optional designs for girders 120 feet or longer must have a calculated residual camber equal to or greater than that of the designed girder.  
 Prestress losses for the designed girders have been calculated for a relative humidity of 60 percent. Optional designs must likewise conform.

**FABRICATION NOTES:**  
 Provide Class H concrete.  
 Provide Grade 60 reinforcing steel bars.  
 Use low relaxation strands, each pretensioned to 75 percent of f<sub>pu</sub>.  
 Strand debonding must comply with Item 424.4.2.2.4. Full-length debonded strands are only permitted in positions marked  $\Delta$ . Double wrap full-length debonded strands in outer most position of each row.  
 When shown on this sheet, the Fabricator has the option of furnishing either the designed girder or an approved optional design. All optional design submittals must be signed, sealed and dated by a Professional Engineer registered in the State of Texas.  
 Seal cracks in girder ends exceeding 0.005" in width as directed by the Engineer. The fabricator is permitted to decrease the spacing of Bars R and S by providing additional bars to help limit crack width provided the decreased spacing results in no less than 1" clear between bars. The fabricator must take an approved corrective action if cracks greater than 0.005" form on a repetitive basis.

**DEPRESSED STRAND DESIGNS:**  
 Locate strands for the designed girder as low as possible on the 2" grid system unless a non-standard strand pattern is indicated. Fill row "2.5", then row "4.5", then row "6.5", etc., beginning each row in the "A" position and working outward until the required number of strands is reached. All strands in the "A" position must be depressed, maintaining the 2" spacing so that, at the girder ends, the upper two strands are in the position shown in the table.



HL93 LOADING SHEET 1 OF 2

Texas Department of Transportation  
 Bridge Division Standard

## PRESTRESSED CONCRETE I-GIRDER STANDARD DESIGNS

### 32' ROADWAY

### IGSD-32

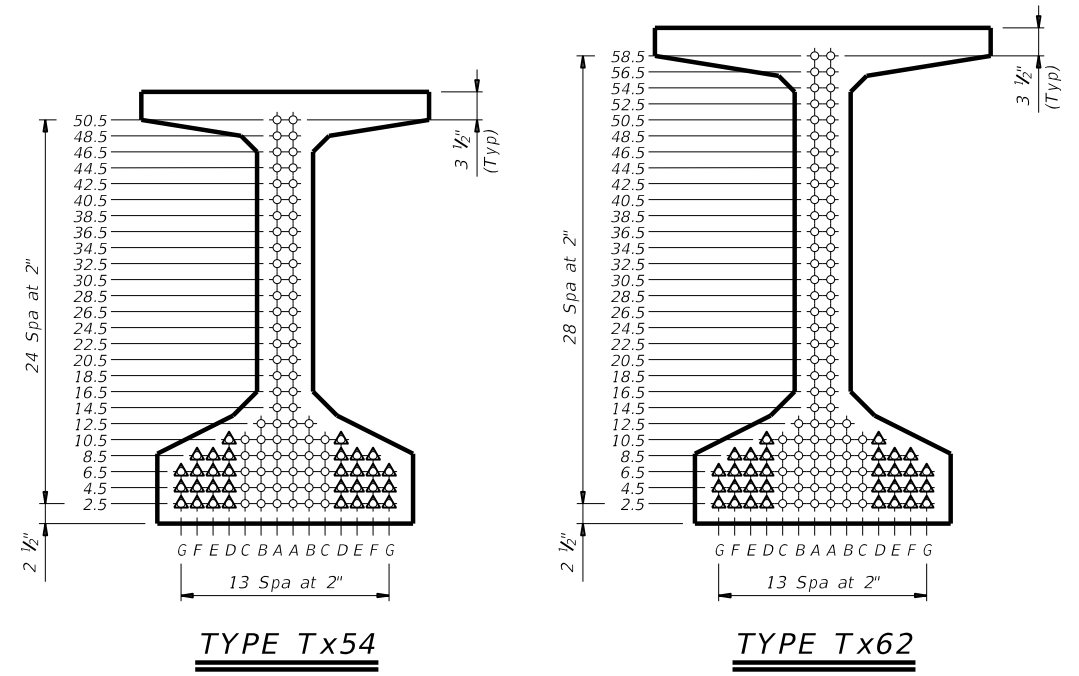
FILE: ig06stds-21.dgn	DN: EFC	CK: AJF	DW: EFC	CK: TAR
©TxDOT August 2017	CONT	SECT	JOB	HIGHWAY
REVISIONS 10-19: Redesigned girders. 1-21: Added load rating.	1780	01	009	FM 1047
DIST	COUNTY		SHEET NO.	
BWD	MILLS		67	

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 FILE: T:\BWDSDGTEAM\Design Projects\Mi11s\1780-01-009 FM 1047 Bennett Branch\Standards\IGSD-32.dgn

STRUCTURE	DESIGNED GIRDERS									DEPRESSED STRAND PATTERN		CONCRETE		OPTIONAL DESIGN				LOAD RATING			NON-STANDARD STRAND PATTERNS	
	SPAN NO.	GIRDER NO.	GIRDER TYPE	PRESTRESSING STRANDS					NO.	TO END (in)	RELEASE STRGTH (1) f'ci (ksi)	MINIMUM 28 DAY COMP STRGTH f'c (ksi)	DESIGN LOAD COMP STRESS (TOP $\epsilon$ ) (SERVICE I) fct(ksi)	DESIGN LOAD TENSILE STRESS (BOTTL $\epsilon$ ) (SERVICE III) fcb(ksi)	REQUIRED MINIMUM ULTIMATE MOMENT CAPACITY (STRENGTH I) (kip-ft)	LIVE LOAD DISTRIBUTION FACTOR (2)		STRENGTH I		SERVICE III	PATTERN	STRAND ARRANGEMENT AT $\epsilon$ OF GIRDER
				NON-STD STRAND PATTERN	TOTAL NO.	SIZE (in)	STRGTH fpu (ksi)	"e" $\epsilon$ (in)								"e" END (in)	Moment	Shear	Inv			
Type Tx54 Girders 32' Roadway 8.5" Slab	40	ALL	Tx54		12	0.6	270	21.01	21.01			0.561	-0.686	2216	0.980	1.010	2.55	3.30	4.09			
	45	ALL	Tx54		12	0.6	270	21.01	21.01			0.703	-0.835	2629	0.950	1.010	2.12	2.75	3.32			
	50	ALL	Tx54		14	0.6	270	21.01	21.01			0.858	-1.003	3108	0.920	1.020	2.10	2.73	3.05			
	55	ALL	Tx54		16	0.6	270	20.76	20.26	4	6.5	1.035	-1.189	3629	0.900	1.020	2.05	2.66	2.77			
	60	ALL	Tx54		16	0.6	270	20.76	20.26	4	6.5	1.224	-1.381	3931	0.870	1.020	1.76	2.28	2.27			
	65	ALL	Tx54		18	0.6	270	20.56	19.23	4	10.5	1.430	-1.588	4159	0.850	1.020	1.75	2.26	2.09			
	70	ALL	Tx54		18	0.6	270	20.56	19.23	4	10.5	1.653	-1.815	4103	0.840	1.030	1.49	1.93	1.68			
	75	ALL	Tx54		20	0.6	270	20.41	18.81	4	12.5	1.877	-2.035	4399	0.820	1.030	1.50	1.94	1.56			
	80	ALL	Tx54		20	0.6	270	20.41	18.81	4	12.5	2.129	-2.284	4880	0.810	1.030	1.29	1.67	1.23			
	85	ALL	Tx54		22	0.6	270	20.28	18.46	4	14.5	2.392	-2.534	5339	0.790	1.040	1.30	1.68	1.12			
	90	ALL	Tx54		26	0.6	270	20.08	16.39	4	28.5	2.665	-2.800	5839	0.780	1.040	1.22	1.67	1.00			
	95	ALL	Tx54		28	0.6	270	20.01	14.29	4	44.5	2.951	-3.075	6353	0.770	1.040	1.38	1.86	1.03			
	100	ALL	Tx54		32	0.6	270	19.63	12.51	6	44.5	3.262	-3.370	6892	0.760	1.040	1.42	1.99	1.03			
	105	ALL	Tx54		36	0.6	270	19.34	12.01	6	50.5	3.574	-3.667	7434	0.750	1.040	1.48	2.10	1.05			
110	ALL	Tx54		40	0.6	270	19.11	12.51	6	50.5	3.899	-3.973	7988	0.740	1.050	1.53	2.19	1.08				
115	ALL	Tx54		44	0.6	270	18.83	11.55	8	48.5	4.252	-4.301	8569	0.730	1.050	1.29	1.74	1.03				
120	ALL	Tx54	*	48	0.6	270	18.42	10.09	10	50.5	4.619	-4.640	9165	0.720	1.050	1.28	1.69	1.01				
Type Tx62 Girders 32' Roadway 8.5" Slab	60	ALL	Tx62		16	0.6	270	25.53	25.53			0.961	-1.157	4309	0.900	1.010	1.98	2.56	2.74			
	65	ALL	Tx62		16	0.6	270	25.53	25.53			1.121	-1.331	4614	0.880	1.010	1.69	2.19	2.26			
	70	ALL	Tx62		18	0.6	270	25.33	25.33			1.292	-1.514	4894	0.860	1.020	1.71	2.21	2.12			
	75	ALL	Tx62		18	0.6	270	25.33	25.33			1.475	-1.705	4844	0.840	1.020	1.48	1.92	1.75			
	80	ALL	Tx62		20	0.6	270	25.18	24.38	4	8.5	1.659	-1.903	5116	0.830	1.020	1.49	1.93	1.64			
	85	ALL	Tx62		20	0.6	270	25.18	24.38	4	8.5	1.866	-2.120	5578	0.820	1.020	1.29	1.67	1.32			
	90	ALL	Tx62		20	0.6	270	25.18	24.38	4	8.5	2.080	-2.338	6072	0.800	1.030	1.31	1.70	1.23			
	95	ALL	Tx62		24	0.6	270	24.94	22.94	4	16.5	2.310	-2.574	6621	0.790	1.030	1.31	1.70	1.12			
	100	ALL	Tx62		26	0.6	270	24.85	22.39	4	20.5	2.531	-2.805	7159	0.780	1.030	1.27	1.70	1.03			
	105	ALL	Tx62		30	0.6	270	24.58	14.18	6	58.5	2.771	-3.050	7723	0.770	1.030	1.64	2.16	1.31			
	110	ALL	Tx62		34	0.6	270	24.25	15.42	6	56.5	3.020	-3.304	8301	0.760	1.030	1.60	2.10	1.21			
	115	ALL	Tx62		36	0.6	270	24.11	17.44	6	46.5	3.291	-3.576	8909	0.750	1.030	1.53	2.04	1.13			
	120	ALL	Tx62		40	0.6	270	23.88	16.68	6	54.5	3.545	-3.835	9493	0.740	1.040	1.63	2.12	1.47			
	125	ALL	Tx62		44	0.6	270	23.60	14.87	8	56.5	3.836	-4.124	10128	0.730	1.040	1.51	2.04	1.35			
130	ALL	Tx62		48	0.6	270	23.28	15.28	8	56.5	4.144	-4.438	10849	0.730	1.040	1.44	1.80	1.11				

(1) Based on the following allowable stresses (ksi):  
 Compression = 0.65 f'ci  
 Tension = 0.24  $\sqrt{f'ci}$   
 Optional designs must likewise conform.  
 (2) Portion of full HL93.



HL93 LOADING SHEET 2 OF 2

Texas Department of Transportation Bridge Division Standard

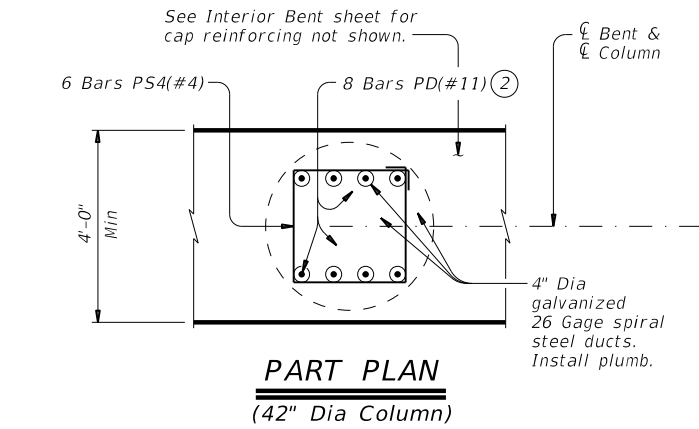
**PRESTRESSED CONCRETE I-GIRDER STANDARD DESIGNS**  
 32' ROADWAY

**IGSD-32**

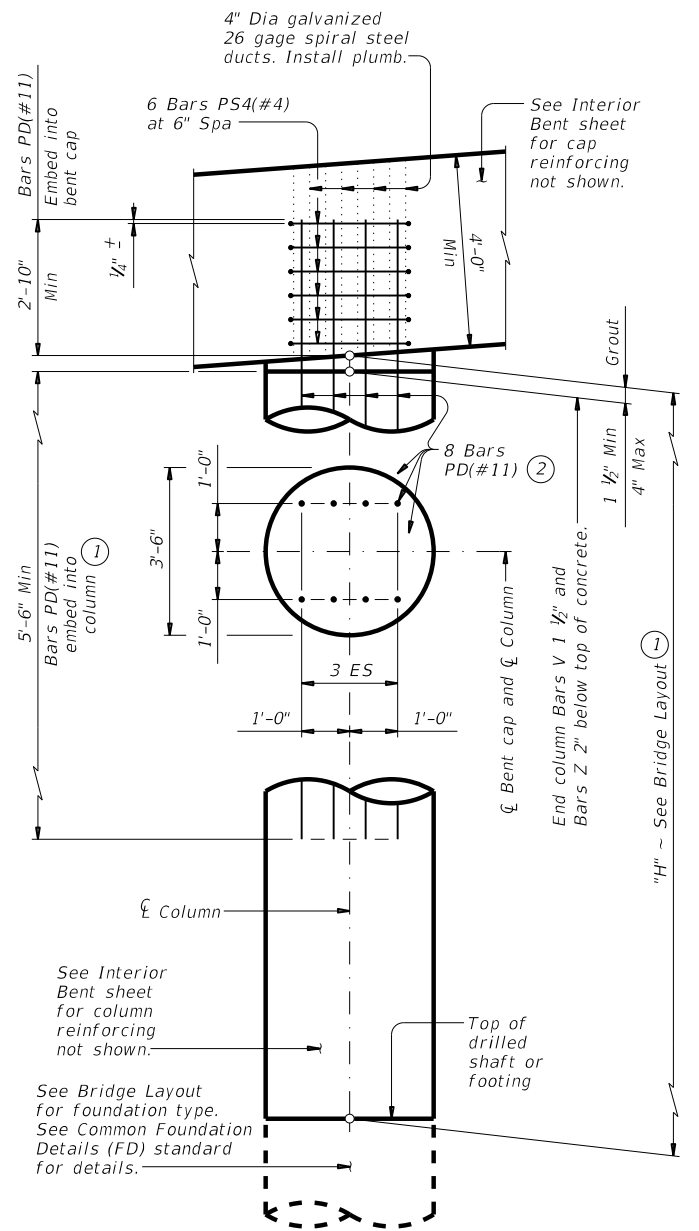
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©TxDOT August 2017	CONT	SECT	JOB	HIGHWAY
REVISIONS	1780	01	009	FM 1047
10-19: Redesigned girders. 1-21: Added load rating.	DIST	COUNTY	SHEET NO.	
	BWD	MILLS	68	

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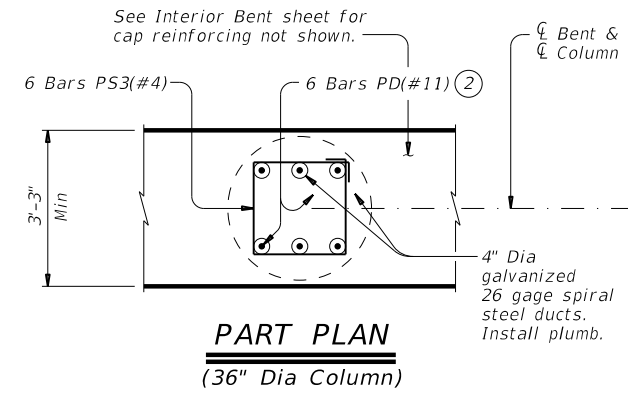
DATE: 1/11/2022 10:49:04 AM  
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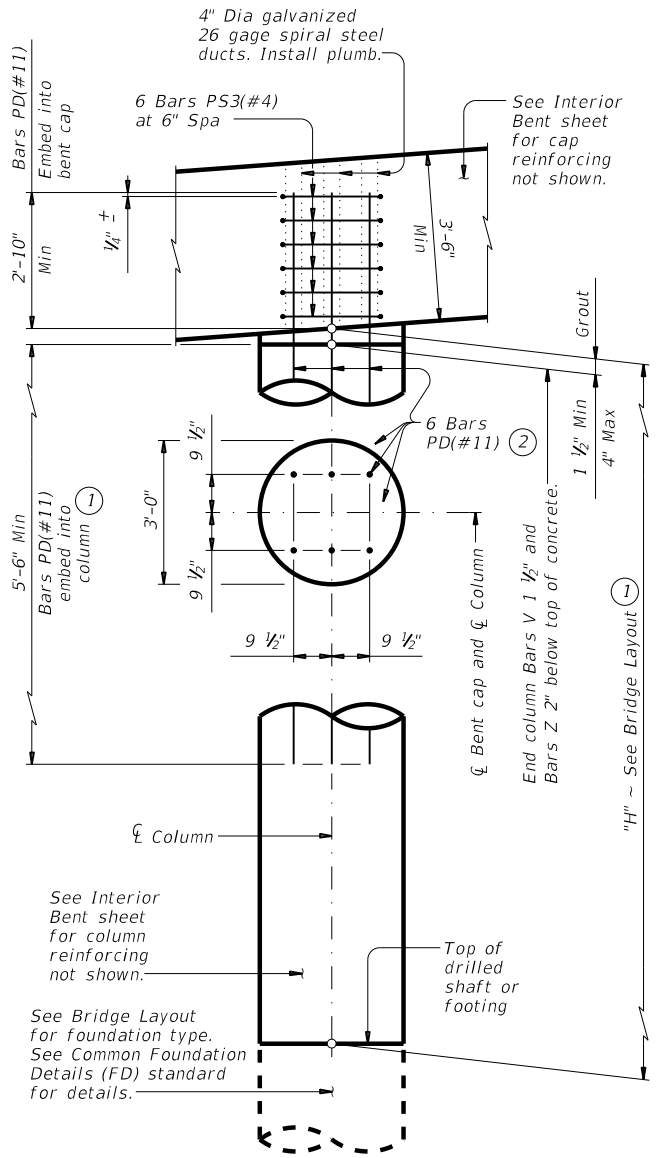
**PART PLAN**  
(42" Dia Column)



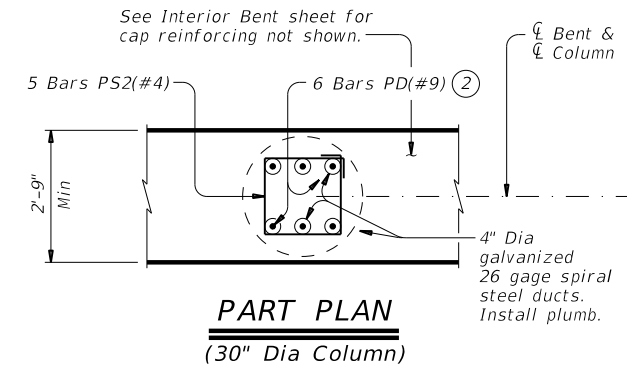
**PART ELEVATION**  
(42" Dia Column)



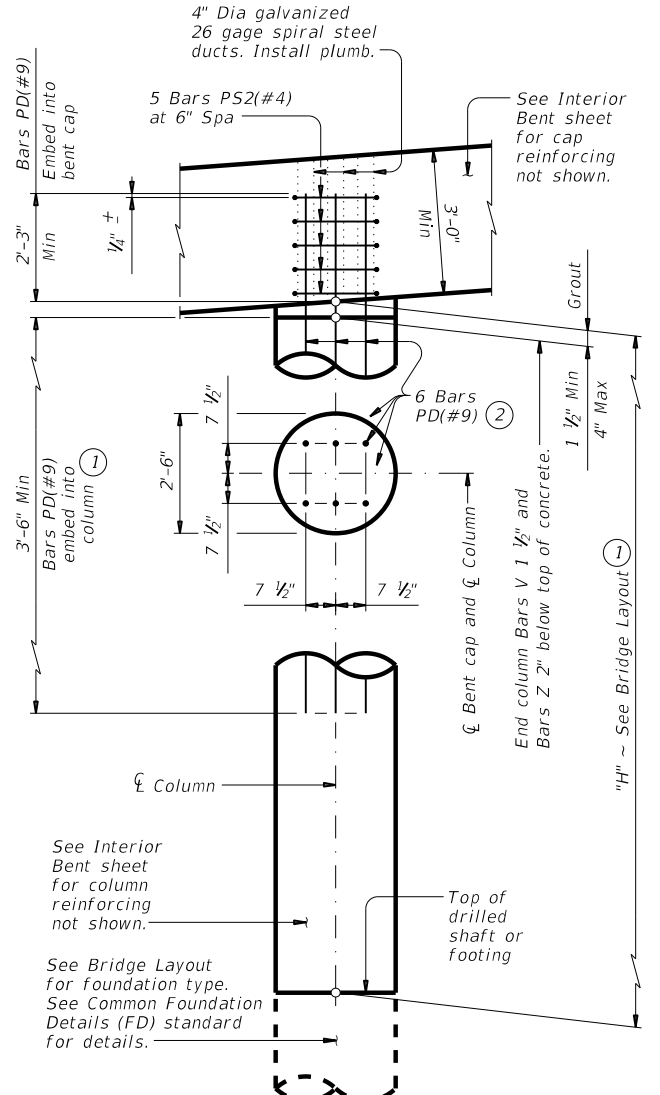
**PART PLAN**  
(36" Dia Column)



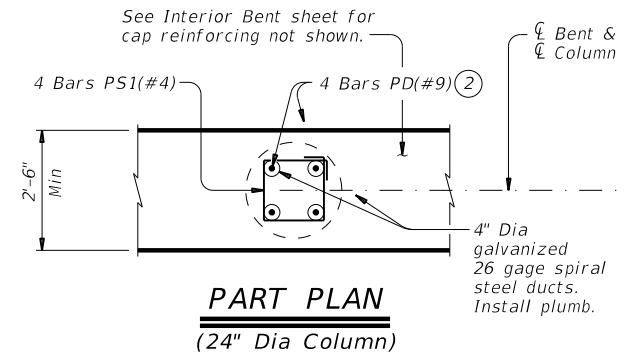
**PART ELEVATION**  
(36" Dia Column)



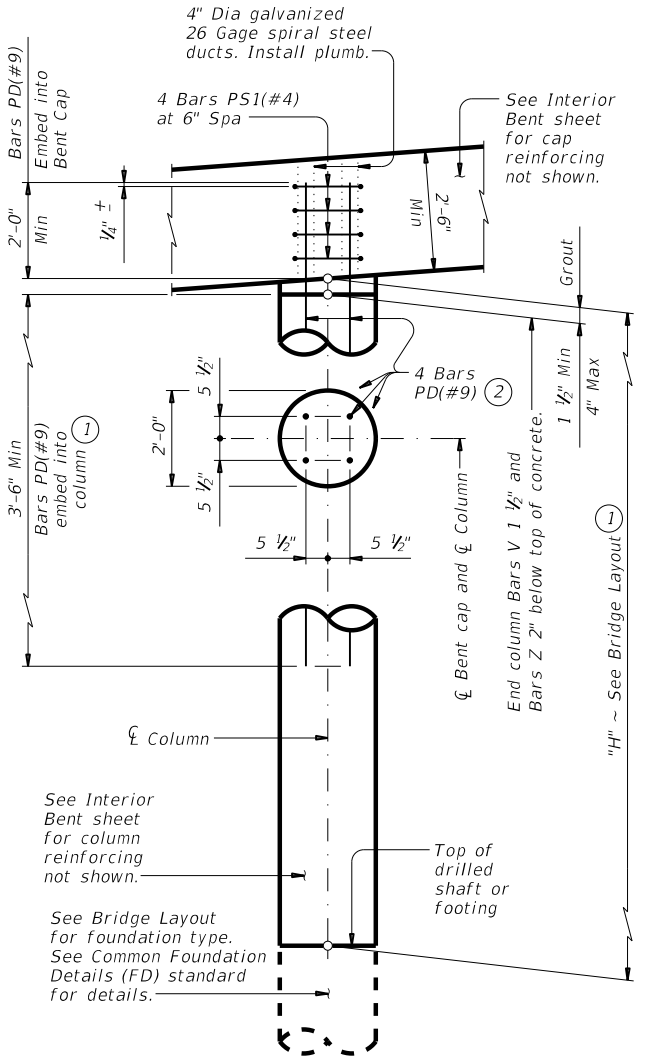
**PART PLAN**  
(30" Dia Column)



**PART ELEVATION**  
(30" Dia Column)



**PART PLAN**  
(24" Dia Column)



**PART ELEVATION**  
(24" Dia Column)

PS1	1'-4 1/4"
PS2	1'-8 1/4"
PS3	2'-0 1/4"
PS4	2'-5 1/4"

PS1	PS2	PS3	PS4
1'-4 1/4"	1'-8 1/4"	2'-0 1/4"	2'-5 1/4"

BARS PS (#4)

- ① Bars PD may need to be embedded in footing or drilled shaft for short columns.
- ② Location tolerance of dowels in columns/drilled shafts is 1/4" from plan location, transversely and longitudinally.

HL93 LOADING SHEET 1 OF 2

Texas Department of Transportation  
 Bridge Division Standard

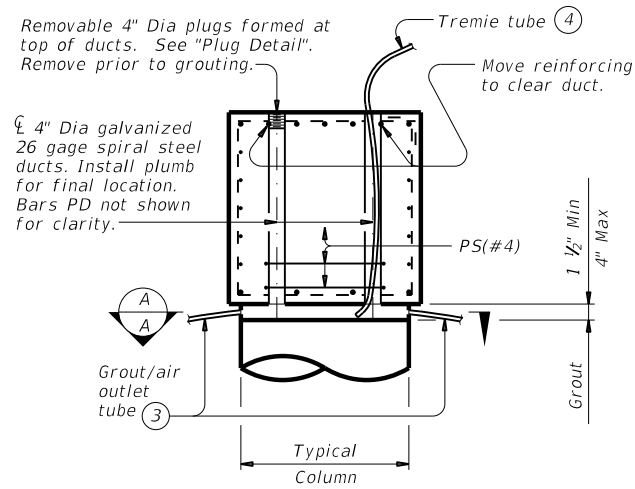
**PRECAST CONCRETE BENT CAP OPTION FOR ROUND COLUMNS**

**PBC-RC**

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©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	1780	01	009	FM 1047
DIST	COUNTY	SHEET NO.		
BWD	MILLS	69		

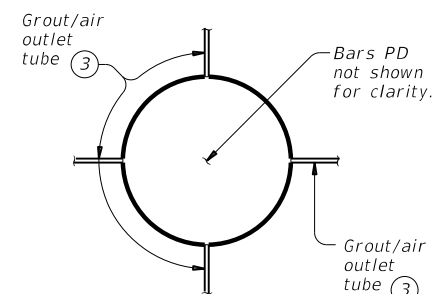
DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of units or for incorrect results or damages resulting from its use.

DATE: 1/11/2022 10:49:05 AM  
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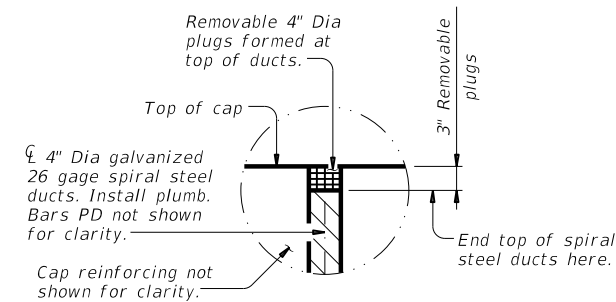


**TYPICAL SECTION THRU CAP**

(Showing example of ducts and cap reinforcing.)



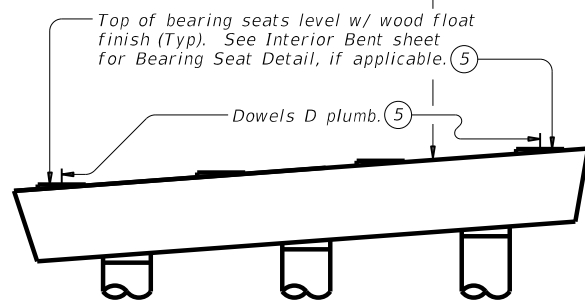
**SECTION A-A**



**PLUG DETAIL**

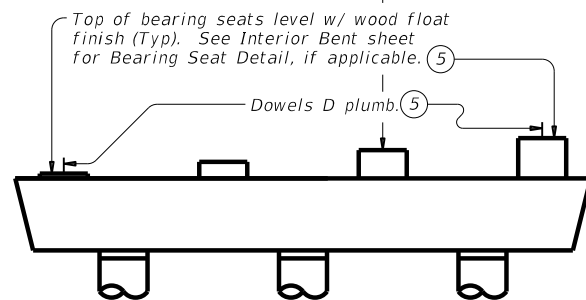
(To keep concrete out of ducts during concrete placement. Remove prior to grouting)

Slope top of cap between bearing seats in accordance with Item 420.4.9 "Treatment and Finishing of Horizontal Surfaces", unless directed otherwise by the Engineer.



**CAP SET AT SLOPE**

Reinforce bearing seats over 3" tall and slope top of cap between bearing seats in accordance with Item 420.4.9 "Treatment and Finishing of Horizontal Surfaces", unless directed otherwise by the Engineer.



**CAP SET LEVEL**

**EXAMPLES OF PRECAST BENTS WITH DOWELS D**

- ③ Provide at least 4 grout/air outlet tubes equally spaced around the perimeter of the column. Install at bottom of cap to avoid air entrapment. Seal off tubes sequentially when a steady flow of grout without air occurs. Secondary tubes to help drain water, located at top of column, may also be installed.
- ④ Continuous gravity-flow grouting through a tremie tube is recommended. With this method, lower a flexible tremie tube through one of the vertical ducts to the bottom of the bedding layer and fill the connection from the bottom upward with a continuous flow of grout. This method requires a sufficient amount of grout to be mixed prior to grouting and that the funnel connected to the tremie tube have adequate volume capacity (4 quarts Min is recommended). A valve may be used to stop the flow during grouting to allow refilling the funnel or to tamp the grout. The tube should remain within the grout and gradually withdraw as the level of the grout rises in the ducts. It is critical to ensure a continuous flow of grout to avoid air entrapment. Alternative methods, including pressure grouting with low pressure pumps, may be used provided they are proved effective in providing void-free connections during the mock-up phase.
- ⑤ Unless otherwise shown.

**CONSTRUCTION NOTES:**

**Cap Fabrication:**

Construct and cure cap in accordance with Item 420, "Concrete Substructures". Secure ducts to prevent their movement during concrete placement. Location tolerance of ducts is 1/4" from plan location, transversely and longitudinally. Seal ducts to prevent intrusion of concrete.

Bearing seats may be precast with the cap. Bearing seats over 3" in height must be reinforced as per Item 420.4.9. Do not locate lift points at bearing seats if bearing seats are precast.

Cap concrete must achieve a compressive strength of 2,500 psi prior to lifting. Limit flexural stress in cap to 250 psi during handling and storage. Store and handle caps in accordance with Item 424, "Precast Concrete Structural Members (Fabrication)". Do not stack caps. Caps that become cracked or otherwise damaged may be rejected.

**Cap-to-Column Connection:**

Make a trial batch of grout using the same material, equipment and personnel to be used for actual grouting operations and grout a mock-up of the connection at least one week before grouting and in the presence of the Engineer. This mock-up test must demonstrate the reliability of the Contractor's grouting procedures to provide a connection free of voids. Field test the trial batch grout to the same level required for the actual grouting.

Caps may be placed on columns/drilled shafts after column/drilled shaft concrete has achieved a flexural stress of 355 psi (or 2,500 psi compressive strength). Use plastic shims or friction collars to support the cap at the proper elevation prior to grouting. Total area of plastic shims used on top of each column may not exceed 6 percent of the column area. Column/drilled shaft curing may be interrupted a maximum of 2 hours for placement of plastic shims or friction collars and cap placement.

Surfaces in contact with grout must be clean and in a saturated, surface-dry condition, immediately prior to grouting. Provide water tight forms. Fill the forms with water and drain just prior to grouting. Ponding or free-standing water is not permitted. Use compressed air to blow out excess water.

Mix grout in accordance with the manufacturer's directions. Evidence of frothing, foaming, or segregation is cause for rejection. Transport grout from mixer to final location by wheel barrow, bucket or pumping.

Perform sampling and testing of grout by trained personnel at the Contractor's expense and while witnessed by the Engineer. Grouted connections must be free of voids.

Trowel finish top surface of cap anchorage ducts flush with top of cap. Wet mat cure these locations for at least 48 hours. Recess lifting loops 1-inch minimum using exothermic cutting rods. Do not overheat or damage the surrounding concrete. Abrade the concrete surfaces of excavation and end of the lifting loop to remove all slag with a needle gun, steel brush, or other suitable means. Coat the inside of the recessed area, including the lifting loops, with 10 mils (minimum) of neat, Type VIII epoxy and patch the recess with epoxy mortar.

Friction collars may be removed, if used, and beams placed on the cap after the grout obtains a compressive strength of 2,500 psi. Subsequent loading can occur when the grout reaches its final required 28 day compressive strength.

**MATERIAL NOTES:**

Provide a pre-qualified grout from TxDOT's Material Producer List "Cementitious Grouts and Mortars for Miscellaneous Applications", conforming to DMS-4675.

Provide semi-rigid spirally crimped, corrugated duct of galvanized, cold rolled steel conforming to ASTM A653. Corrugations must have a minimum amplitude of 0.094".

Grout tubes and forms must be approved prior to grouting.

Provide Grade 60 reinforcing steel. Epoxy coat or galvanize all reinforcement if column reinforcement is epoxy coated or galvanized.

**GENERAL NOTES:**

Designed in accordance with AASHTO LRFD Bridge Design Specifications.

The Contractor has the option to provide precast bent caps in accordance with the details shown. No additional payment will be made if the Contractor uses precast caps.

Submit shop drawings of precast caps for approval prior to construction. Indicate lifting attachments and locations on the shop drawings.

Precast Concrete Bent Cap Option shown on this standard may require modification for select structure types. See appropriate details elsewhere in plans for these modifications.

See Interior Bent sheet for details and notes not shown.

Reinforcing bar dimensions shown are out-to-out of bar.



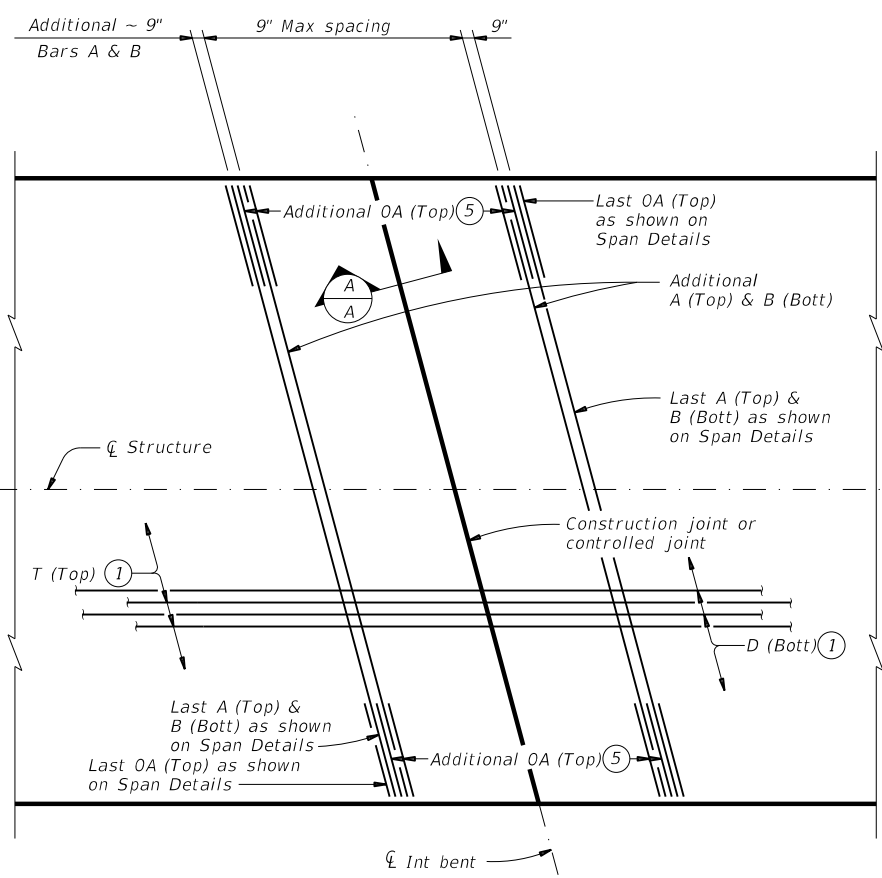
**PRECAST CONCRETE BENT CAP OPTION FOR ROUND COLUMNS**

**PBC-RC**

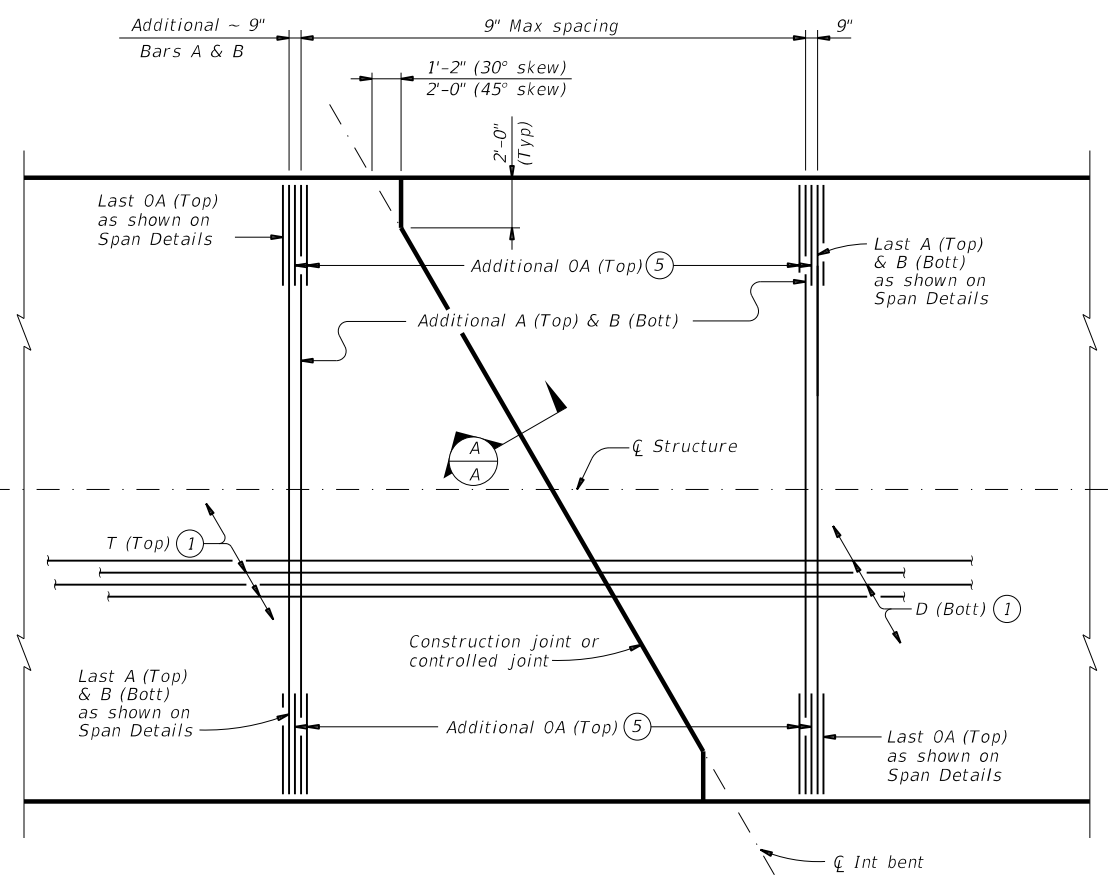
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©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	1780	01	009	FM 1047
DIST	COUNTY		SHEET NO.	
BWD	MILLS		70	

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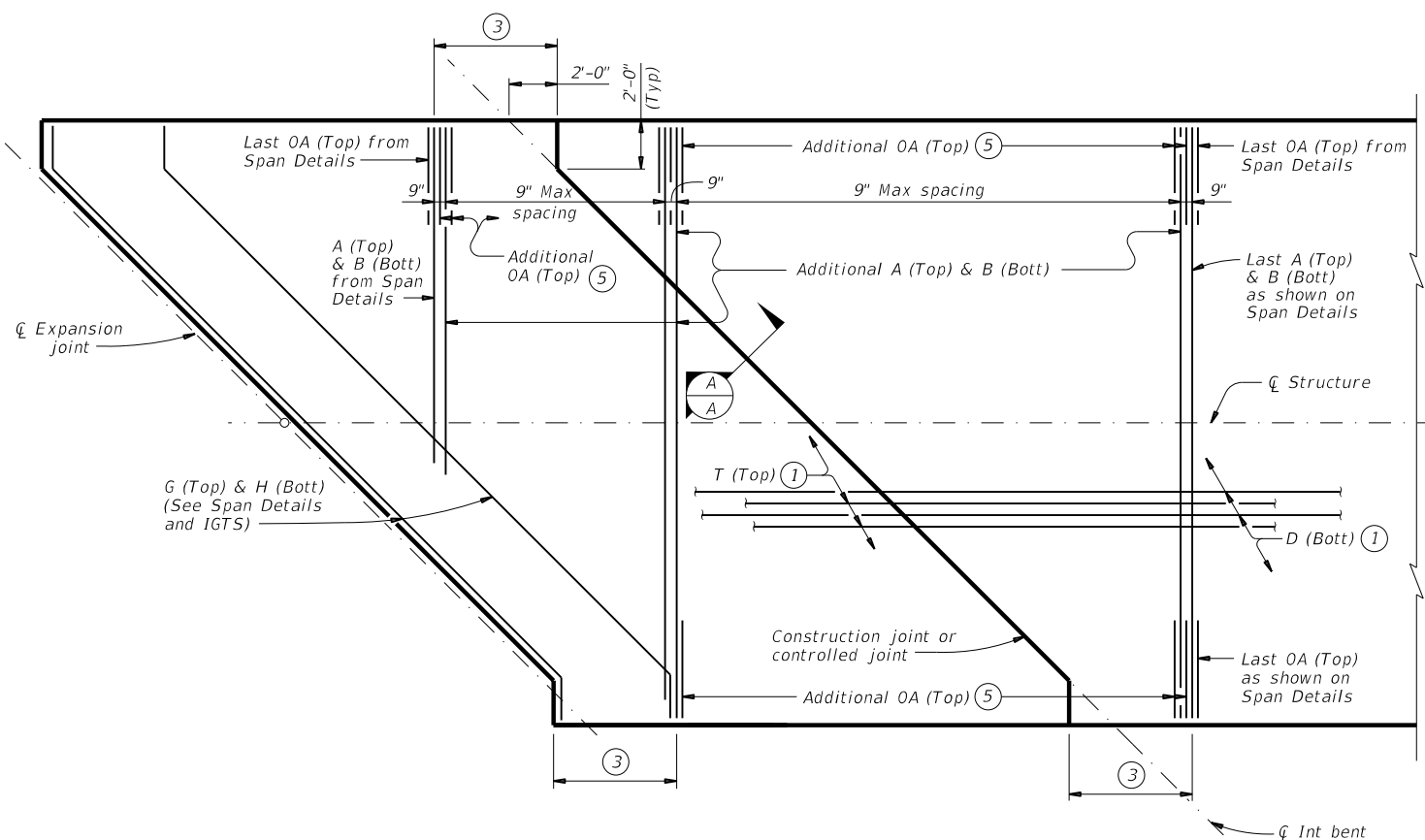
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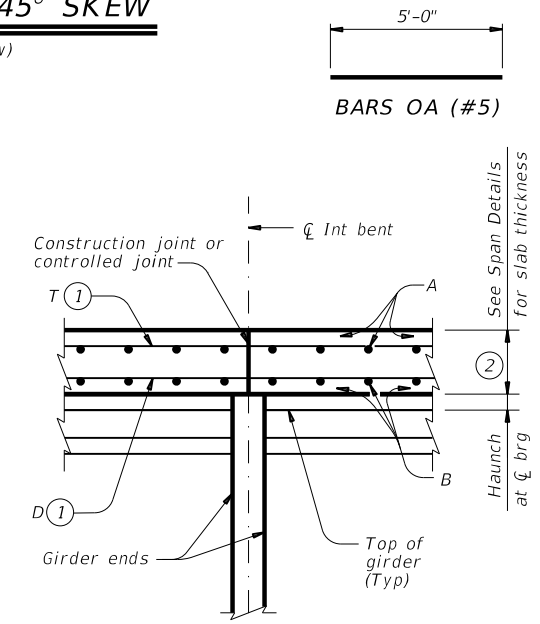
**PLAN FOR 0° OR 15° SKEW**  
 (Showing 15° skew)



**PLAN FOR 30° OR 45° SKEW**  
 (Showing 30° skew)



**PLAN FOR 45° SKEW**  
 (Showing short span condition.)



**SECTION A-A**  
 Bars OA (Top) not shown for clarity.

- ① Top and bottom mats must be continuous through joint.
- ② Maintain a constant slab thickness over the bent.
- ③ 5'-4" as shown on Span Details.
- ④ Use these details when no full slab width bars A and B are shown on Span Details.
- ⑤ Bars OA (Top) at 9" Max spacing between Bars A (Top).
- ⑥ Values in table assume a temperature change of 70° F after erection when calculating thermal movement in one direction (not total).

**TABLE OF ⑥ ALLOWABLE UNIT LENGTH**

Max Rdwy Grade, Percent	Unit Length Factor
0.00	4.1
1.00	3.9
2.00	3.7
3.00	3.5
4.00	3.3
5.00	3.1

Unit length must not exceed the length of the shortest end span times the Unit Length Factor shown in table or 400', whichever is less.

**BAR TABLE**

BAR	SIZE
A	#4
B	#4
D	#4
T	#4
OA	#5

The details shown on this sheet are applicable for two and three span units comprised of the same girder type. Units may be comprised of different span lengths. See "Table of Allowable Unit Length".

**GENERAL NOTES:**

Designed according to AASHTO LRFD Bridge Design Specifications.  
 This standard is drawn showing right forward skew. See Bridge Layout for actual skew direction.

**CONSTRUCTION NOTES:**

Where multi-span units are indicated on the Bridge Layout, the thickened slab end details and reinforcement shown on IGTS standard (Bars AA, G, H, J, K, and M) and on the Span Details will be omitted where slabs are continuous over interior bents. At these locations, the slab details and reinforcement will be as shown on this sheet or on PCP standard (if using this option).  
 Thickened slab end reinforcement and details still apply at expansion joint locations (ends of units).  
 See Span Details for remainder of slab reinforcement and details.

**MATERIAL NOTES:**

Provide Grade 60 reinforcing steel.  
 Provide Class "S" concrete (f'c = 4,000 psi).  
 Provide Class "S" (HPC) if shown elsewhere on the plans.  
 Provide bar laps, where required, as follows:  
 Uncoated ~ #4 = 1'-7"  
 Epoxy Coated ~ #4 = 2'-5"

The details shown on this sheet are applicable for use only with the Prestressed Concrete I-Girder Standard Designs shown on standards IGSD-24, IGSD-28, IGSD-30, IGSD-32, IGSD-38, IGSD-40 and IGSD-44.

HL93 LOADING

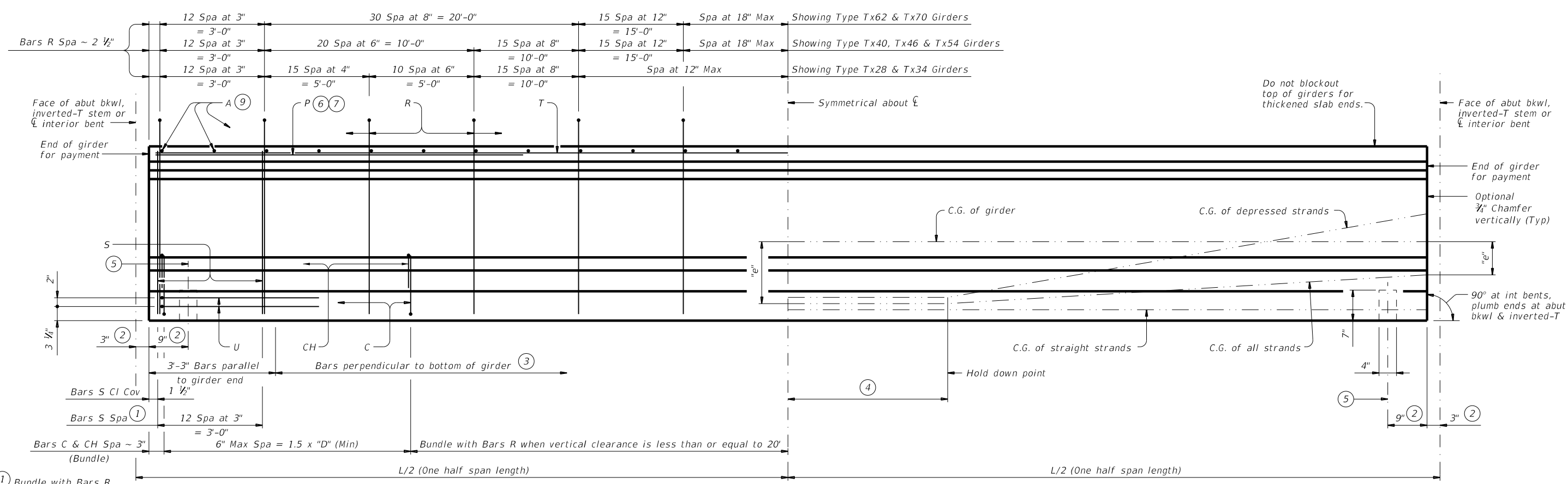
Texas Department of Transportation  
 Bridge Division Standard

**CONTINUOUS SLAB DETAILS**  
**PRESTR CONC I-GIRDER SPANS**

IGCS

FILE: igcs1sts-19.dgn	DN: JMH	CK: TxDOT	DW: JTR	CK: TxDOT
©TxDOT August 2017	CONT	SECT	JOB	HIGHWAY
REVISIONS	1780	01	009	FM 1047
10-19: Added bubble note 6.	DIST	COUNTY	SHEET NO.	
	BWD	MILLS	71	

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 DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of units or for incorrect results or damages resulting from its use.



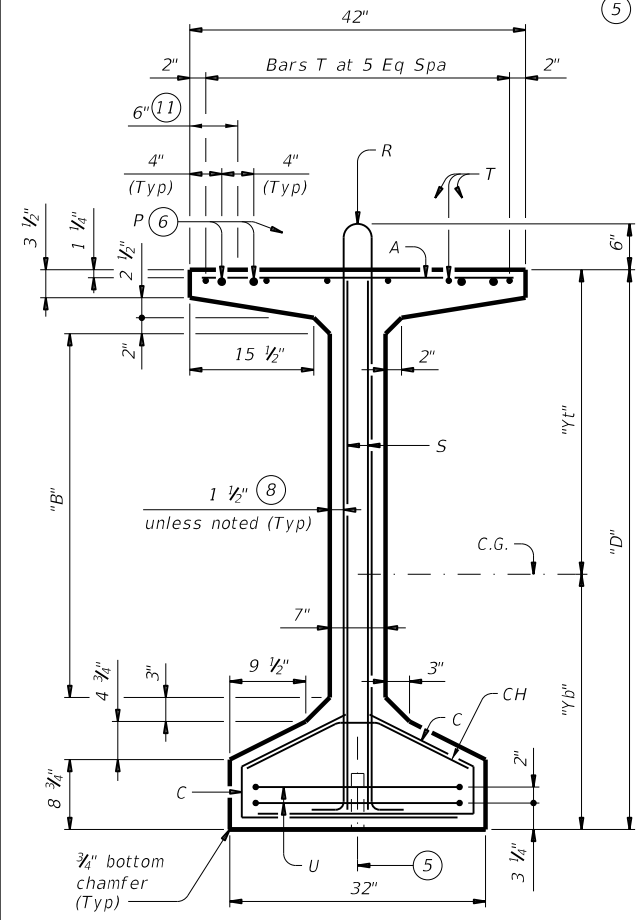
- ① Bundle with Bars R.
- ② Measured along C.G. Girder at interior bents; perpendicular to abutment bkwl or inverted-T stem.
- ③ The average of the top and bottom spacing of Bars R cannot exceed the required spacing.
- ④ L/20, but not less than 5'-0" (-0,+2').

### GIRDER ELEVATION

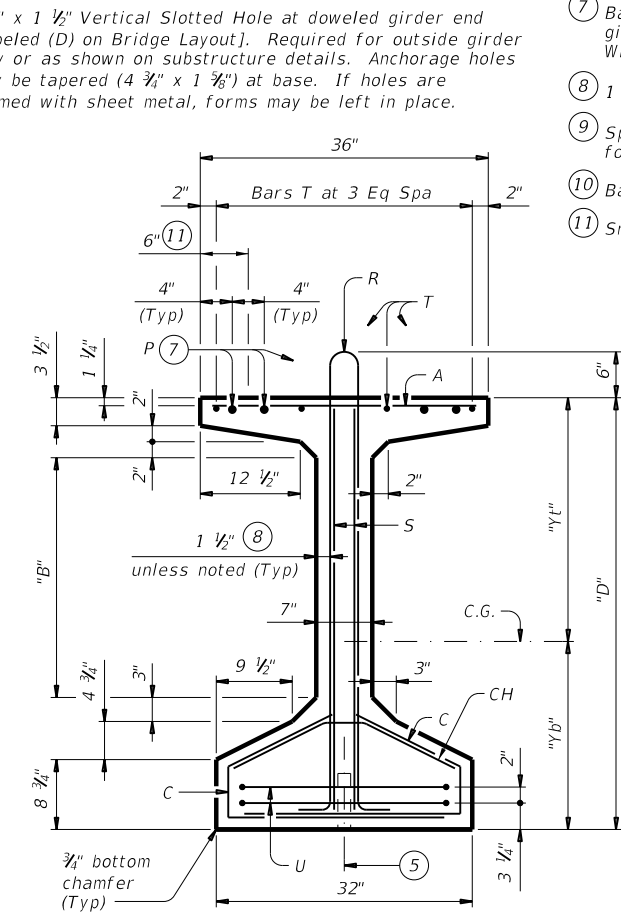
- ⑥ Bars P (#6 x 15'-0") required in Tx62 and Tx70 girders. At the fabricator's option bars larger than #6 may be used. When L is less than 50 ft, Bars P are to be the same length as Bars T.
- ⑦ Bars P (#6 x 15'-0") are only required in Tx28, Tx34, Tx40, Tx46, and Tx54 girders when "e" at girder ends exceeds 0.25 x "D". At the fabricator's option bars larger than #6 may be used. When L is less than 50 ft, Bars P are to be the same length as Bars T.
- ⑧ 1 3/8" Clear Cover to Bars S.
- ⑨ Space Bars A at 6" Max for girders requiring overhang bracket hangers. Space at 12" Max for all other girders. Tie to Bars R as necessary. See standard IGMS for "Deck Forming Notes".
- ⑩ Based on 155 pcf total weight of concrete and reinforcing steel.
- ⑪ Smooth trowel finish on the slab overhang side of exterior girder.

GIRDER DIMENSIONS AND SECTION PROPERTIES								
Girder Type	"D"	"B"	"Yt"	"Yb"	Area	"Ix"	"Iy"	Weight (10)
	(in.)	(in.)	(in.)	(in.)	(in. <sup>2</sup> )	(in. <sup>4</sup> )	(in. <sup>4</sup> )	(plf)
Tx28	28	6	15.02	12.98	585	52,772	40,559	630
Tx34	34	12	18.49	15.51	627	88,355	40,731	675
Tx40	40	18	21.90	18.10	669	134,990	40,902	720
Tx46	46	22	25.90	20.10	761	198,089	46,478	819
Tx54	54	30	30.49	23.51	817	299,740	46,707	880
Tx62	62	37 1/2"	33.72	28.28	910	463,072	57,351	980
Tx70	70	45 1/2"	38.09	31.91	966	628,747	57,579	1,040

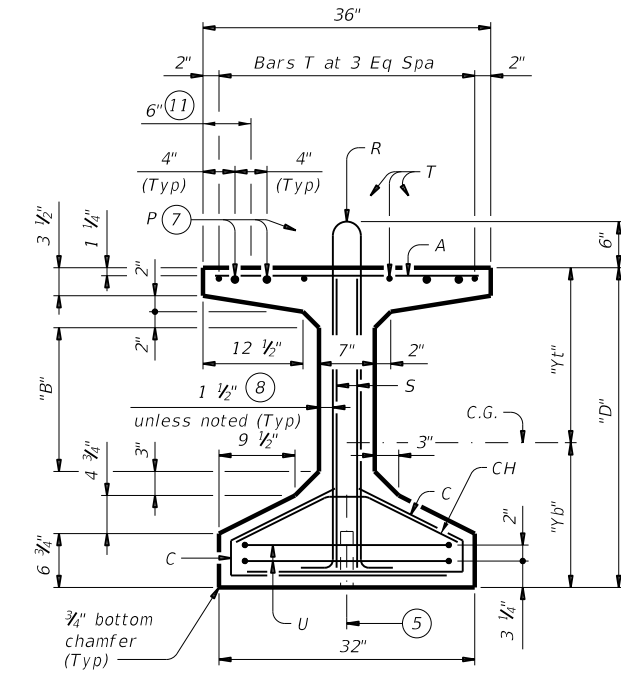
**GENERAL NOTES:**  
 Designed according to AASHTO LRFD Bridge Design Specifications. Provide Class H concrete. Provide Grade 60 reinforcing steel. An equal area of deformed Welded Wire Reinforcement (WWR) (ASTM A1064) may be substituted for Bars A, C, R or T unless otherwise noted. It is permissible for bars or strands to come in contact with materials used in forming anchor holes.  
 Cover dimensions are clear dimensions, unless noted otherwise. Reinforcing bar dimensions shown are out-to-out of bar.



**TYPE Tx62 & Tx70**



**TYPE Tx46 & Tx54**



**TYPE Tx28, Tx34 & Tx40**

HL93 LOADING SHEET 1 OF 2

Texas Department of Transportation  
 Bridge Division Standard

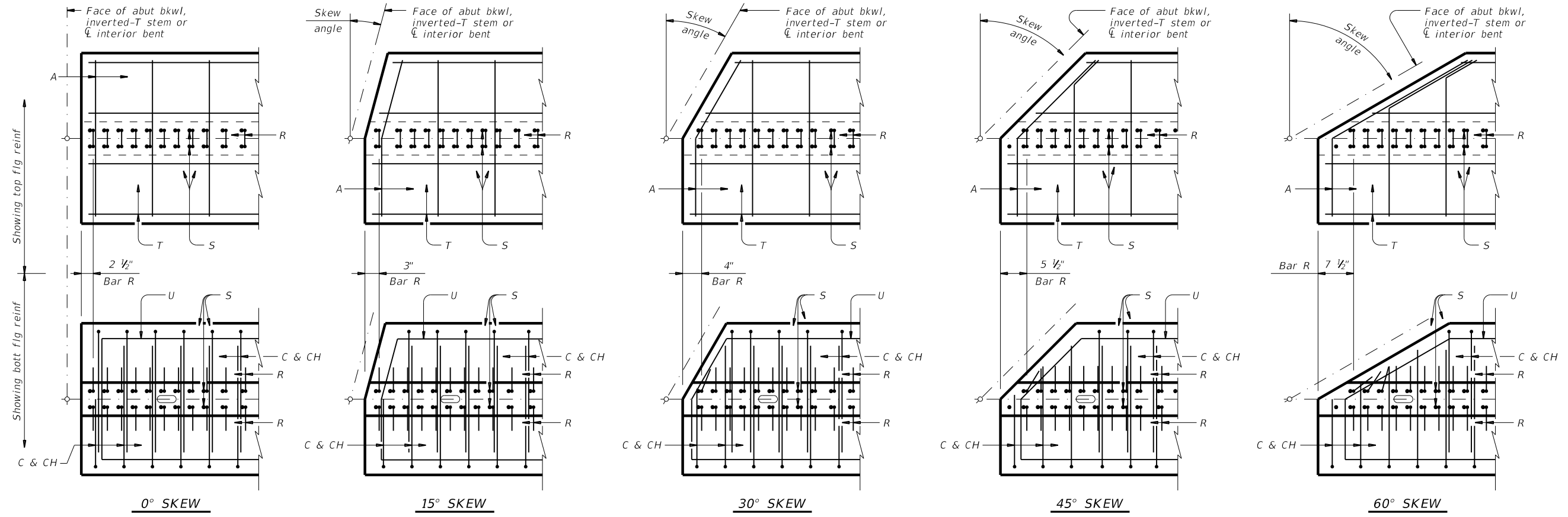
## PRESTRESSED CONCRETE I-GIRDER DETAILS

IGD

FILE: igdstds1-19.dgn	DN: TxDOT	CK: JMH	DW: JTR	CK: TAR
©TxDOT August 2017	CONV	SECT	JOB	HIGHWAY
REVISIONS	1780	01	009	FM 1047
10-19: Added Bars C and CH full length for VC <= 20'	DIST	COUNTY	SHEET NO.	
	BWD	MILLS	72	

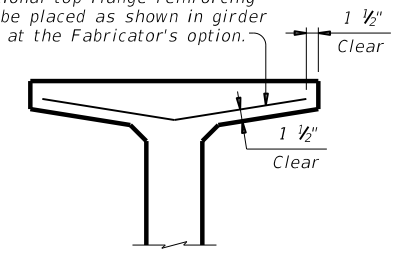
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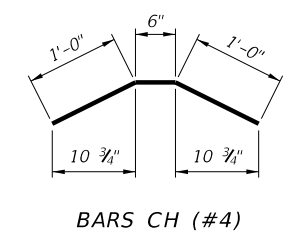


**PLAN OF GIRDER ENDS (12)**

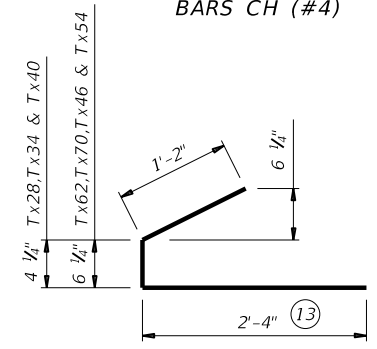
To control top flange cracking that may occur during form removal, additional top flange reinforcing may be placed as shown in girder ends at the Fabricator's option.



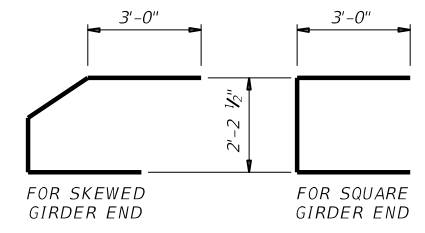
**OPTIONAL TOP FLANGE REINFORCING DETAIL**



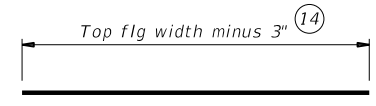
BARS CH (#4)



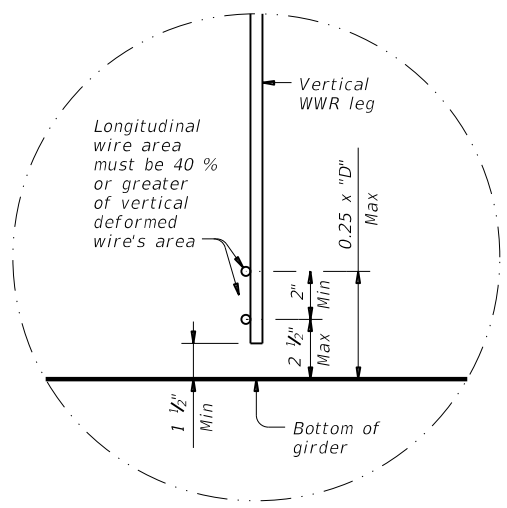
BARS C (#4)



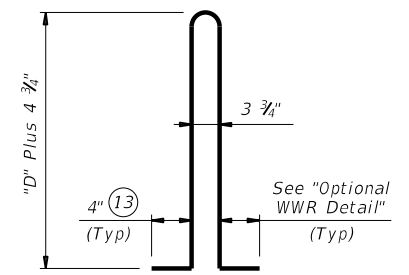
BARS U (#5)



BARS A (#3)



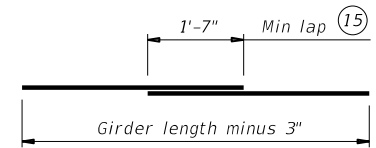
**OPTIONAL WELDED WIRE REINFORCEMENT (WWR) DETAIL**



BARS R (#4) (16)



BARS S (#6)



BARS T (#4)

- (12) Reinforcing patterns shown are provided as guides to determine reinforcement placement in skewed ends. Place Bars S as close to girder end as cover requirements permit, which may prevent them to be bundled with Bars R.
- (13) Bars may be cut or bent at skewed end as required.
- (14) Increase as necessary for bars at skewed end.
- (15) No portion of bar less than 10 ft.
- (16) For Welded Wire Reinforcement (WWR) option, area of Bars R may be reduced in proportion to the increase in reinforcement yield strength over 60 ksi. Yield strength of WWR is limited to 75 ksi.



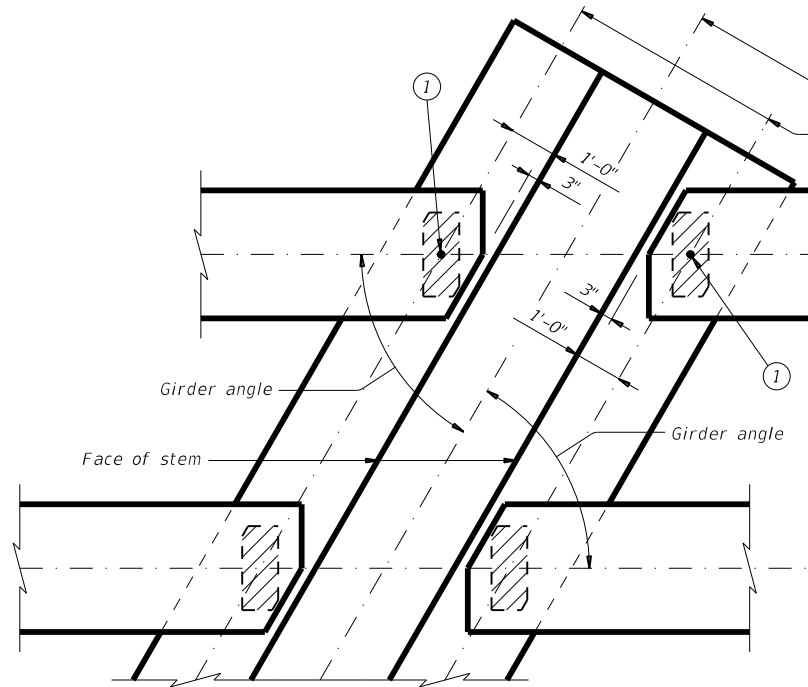
**PRESTRESSED CONCRETE I-GIRDER DETAILS**

IGD

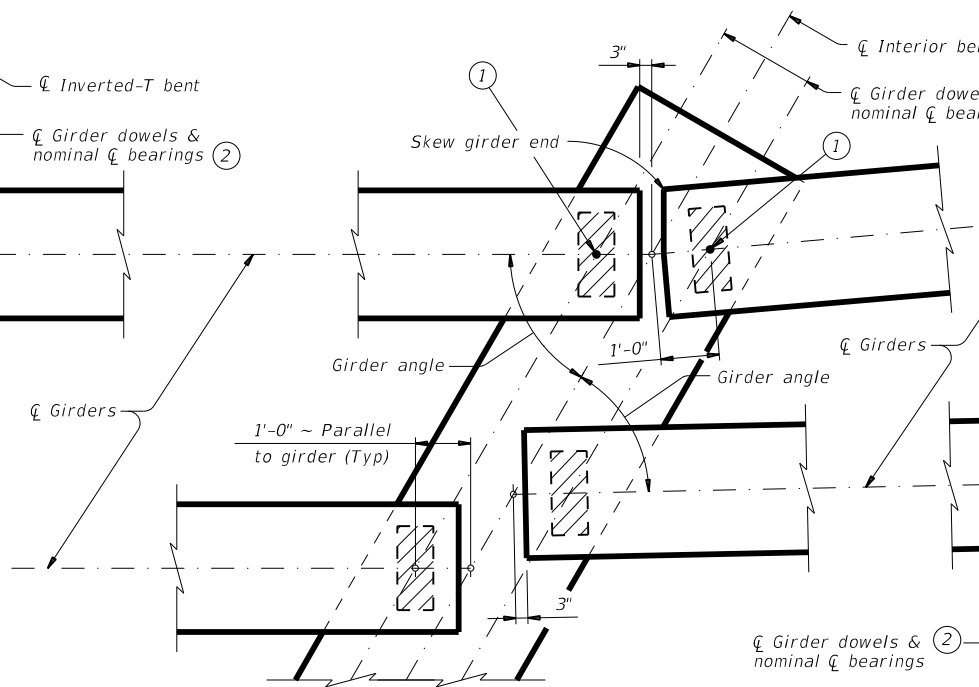
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REVISIONS	1780	01	009	FM 1047
10-19: Added Bars C and CH full length for VC <= 20'	DIST	COUNTY	SHEET NO.	
	BWD	MILLS	73	

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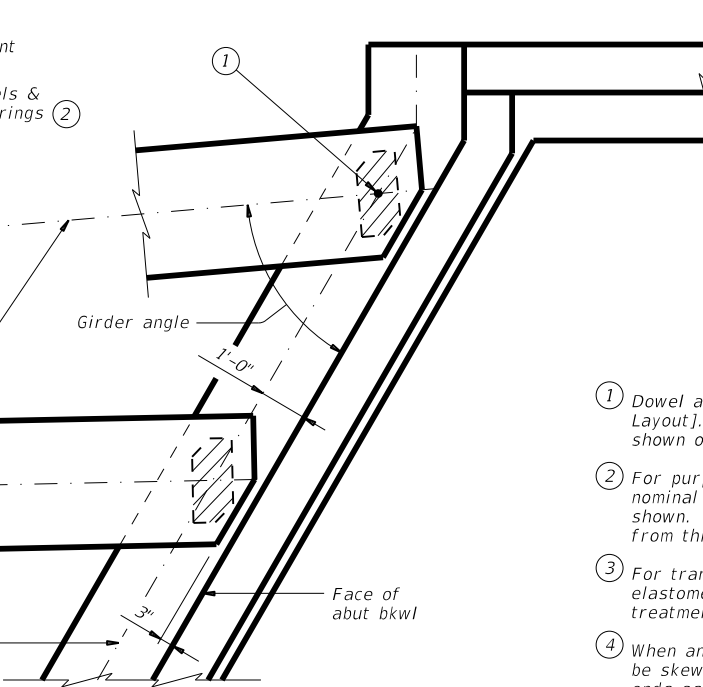
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AT INVERTED-T BENT W/SKEW

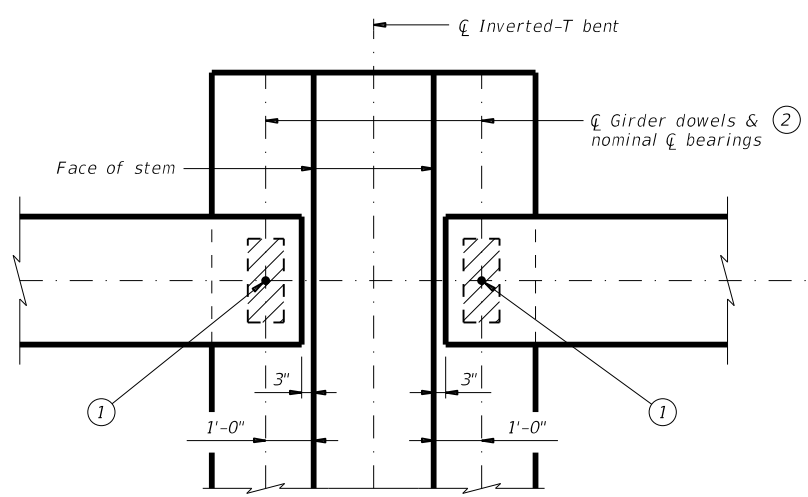


AT CONVENTIONAL INTERIOR BENT W/SKEW

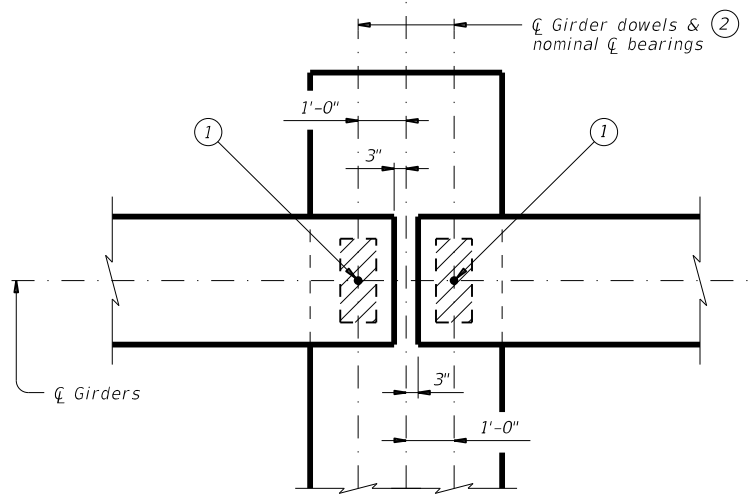


AT ABUTMENT W/SKEW

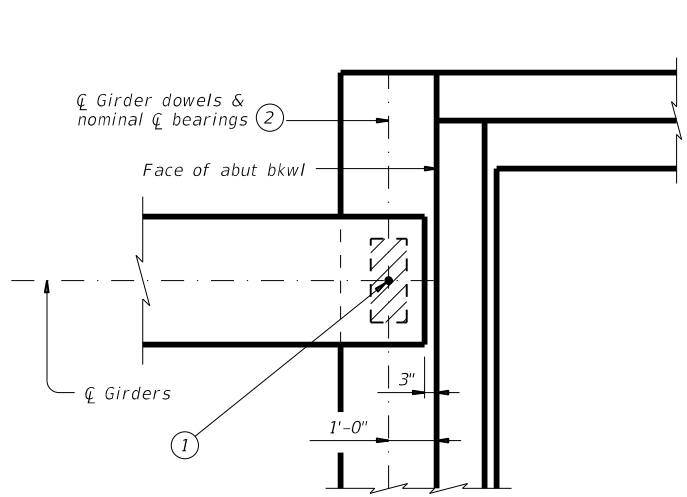
- ① Dowel at doweled girder end [labeled (D) on Bridge Layout]. Required for outside girder only or as shown on substructure details.
- ② For purposes of computing bearing seat elevations, nominal centerline of bearing must be defined as shown. The actual center of bearing pad may vary from this line.
- ③ For transition bents with backwall, girder and elastomeric bearings must receive the same treatment as shown for abutments.
- ④ When angle exceeds 0°, one or both girders ends must be skewed to maintain the clearance between girder ends as shown in view.
- ⑤ See Table of Bearing Pad Dimensions for bearing size. Girder end skew angles in Table not applicable for this situation. Table reflects girder conflicts of this type on radial bents only.



AT INVERTED-T BENT



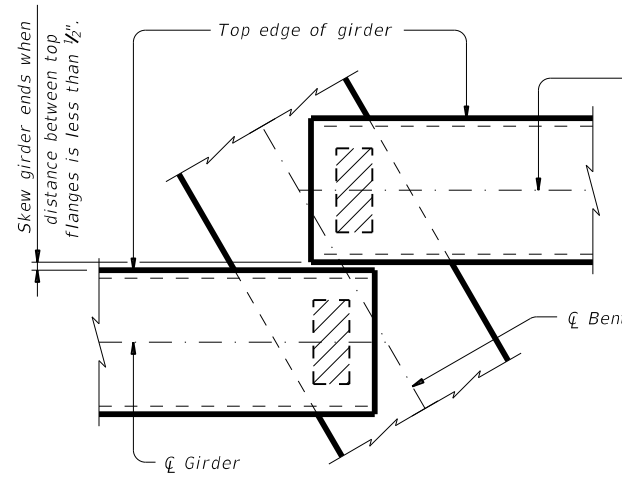
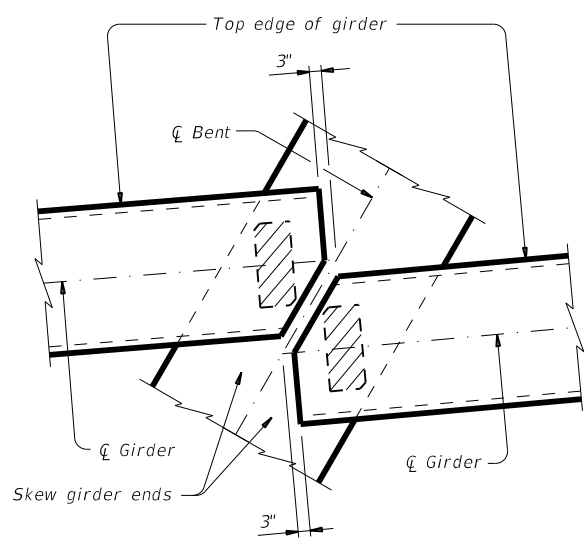
AT CONVENTIONAL INTERIOR BENT



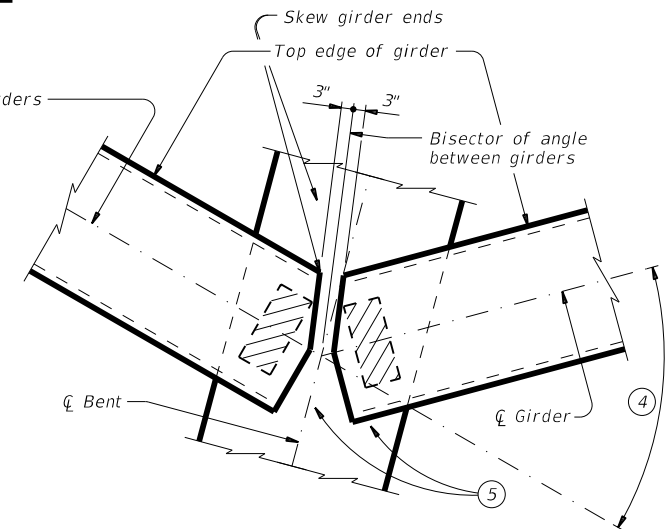
AT ABUTMENT

**GENERAL NOTES:**  
 These details accommodate skew angles up to 60°. Shop drawings for approval are required. A bearing layout which identifies location and orientation of all bearings must be developed by the bearing fabricator. Permanently mark each bearing in accordance with the bearing layout. A copy of the bearing layout is to be provided to the Engineer. Cost of furnishing and installing elastomeric bearings, including beveled and embedded steel plates, must be included in unit price bid for "Prestressed Concrete Girders".

**GIRDER END DETAILS**



**GIRDER CONFLICT DETAILS**



HL93 LOADING SHEET 1 OF 3

Texas Department of Transportation  
 Bridge Division Standard

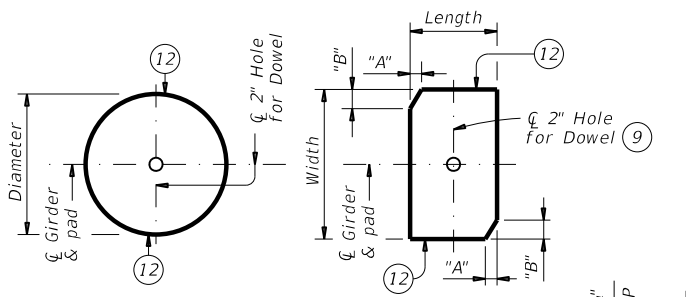
**ELASTOMERIC BEARING AND GIRDER END DETAILS**  
 PRESTR CONCRETE I-GIRDERS

**IGEB**

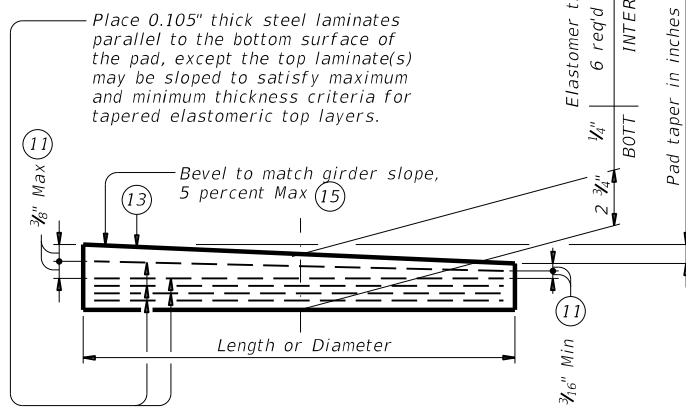
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REVISIONS	1780	01	009	FM 1047
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**PLANS (10)**



**ELEVATION**

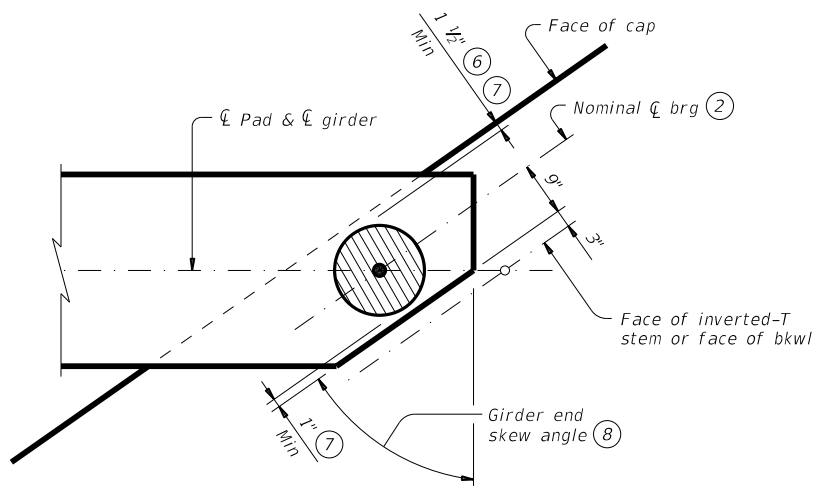
**LAMINATED ELASTOMERIC BEARING PAD**  
(50 DUROMETER)

**TABLE OF MINIMUM SUBSTRUCTURE DIMENSIONS (14)**

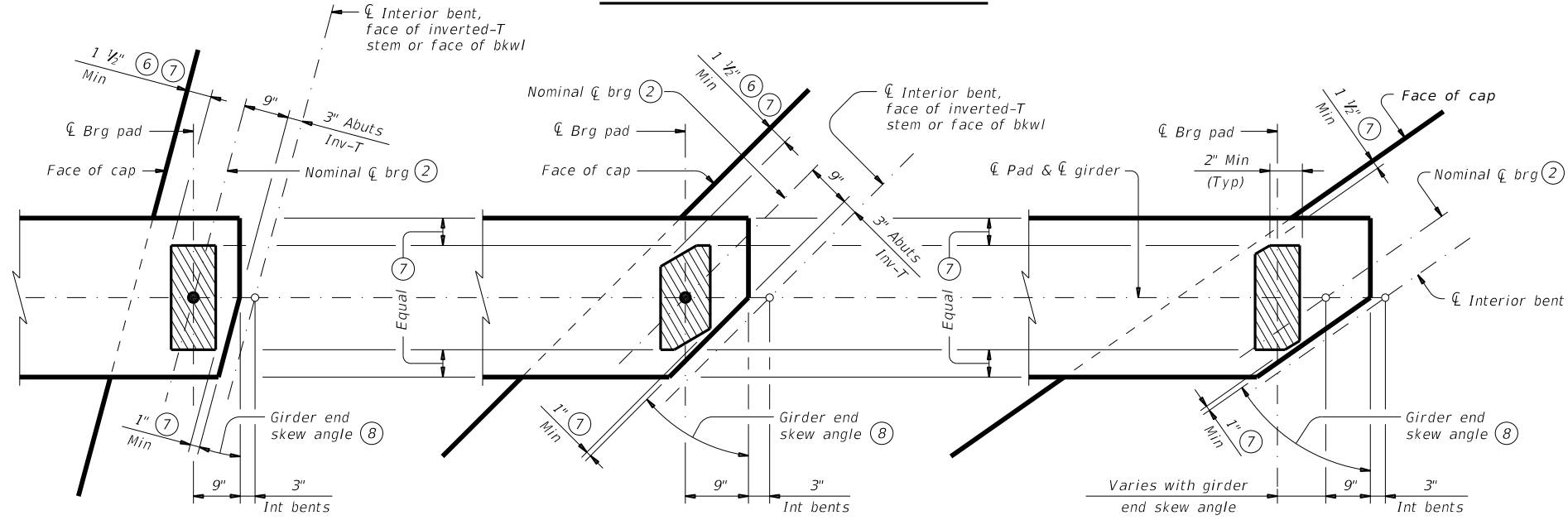
Girder Type	Abutments	Int Bents	Inv-T Bents
	Face of Bkwl to Face of Cap	Overall Cap Width	Corbel Width
Tx28 thru Tx54	1'-9"	3'-6"	1'-10 1/2"
Tx62 & Tx70	2'-0"	4'-0"	2'-1 1/2"

**TABLE OF BEARING PAD DIMENSIONS**

Bent Type	Girder Type	Bearing Type (13)	Girder End Skew Angle Range	Pad Size Lgth x Wdth	Pad Clip Dimensions	
					"A"	"B"
ABUTMENTS, INVERTED-T AND TRANSITION BENTS WITH BACKWALLS	Tx28, Tx34, Tx40, Tx46 & Tx54	G-1-"N"	0° thru 21°	8" x 21"	---	---
		G-2-"N"	21°+ thru 30°	8" x 21"	1 1/2"	2 1/2"
		G-3-"N"	30°+ thru 45°	9" x 21"	4 1/2"	4 1/2"
		G-4-"N"	45°+ thru 60°	15" Dia	---	---
	Tx62 & Tx70	G-5-"N"	0° thru 21°	9" x 21"	---	---
		G-6-"N"	21°+ thru 30°	9" x 21"	1 1/2"	2 1/2"
		G-7-"N"	30°+ thru 45°	10" x 21"	4 1/2"	4 1/2"
		G-8-"N"	45°+ thru 60°	10" x 21"	7 1/4"	4 1/4"
CONVENTIONAL INTERIOR BENTS	Tx28, Tx34, Tx40, Tx46 & Tx54	---	---	---	---	---
	Tx62 & Tx70	G-5-"N"	0° thru 60°	9" x 21"	---	---
CONVENTIONAL INTERIOR BENTS WITH SKEWED GIRDER ENDS (GIRDER CONFLICTS) (16)	Tx28, Tx34, Tx40, Tx46 & Tx54	G-1-"N"	0° thru 18°	8" x 21"	---	---
		G-2-"N"	18°+ thru 30°	8" x 21"	1 1/2"	2 1/2"
		G-9-"N"	30°+ thru 45°	8" x 21"	3"	3"
		G-10-"N"	45°+ thru 60°	9" x 21"	6"	3 1/2"
	Tx62 & Tx70	G-5-"N"	0° thru 18°	9" x 21"	---	---
		G-11-"N"	18°+ thru 30°	9" x 21"	---	---
G-12-"N"	30°+ thru 45°	9" x 21"	1 1/2"	1 1/2"		
G-12-"N"	45°+ thru 60°	9" x 21"	3"	1 3/4"		



**ROUND BEARINGS FOR SKEWED GIRDER ENDS AT FACE OF INVERTED-T STEM OR FACE OF BKWL**



**SKewed GIRDER ENDS AT INT BENTS, FACE OF INVERTED-T STEM OR FACE OF BKWL**

**SKewed GIRDER ENDS AT CONVENTIONAL INTERIOR BENTS (16) (NO GIRDER DOWELS)**

**BEARING PAD PLACEMENT DIAGRAMS**

- (2) For purposes of computing bearing seat elevations, nominal centerline of bearing must be defined as shown. The actual center of bearing pad may vary from this line.
- (6) 3" for inverted-T.
- (7) Place centerline pad as near nominal centerline bearing as possible between limits shown.
- (8) Girder end skew angle is equal to 90° minus the girder angle except at some conflicting girders.
- (9) Provide 2" dia hole only at locations required. See Substructure details for location.
- (10) See Table of Bearing Pad Dimensions for dimensions.
- (11) Maximum and minimum layer thicknesses shown are for elastomer only, on tapered layers.
- (12) Locate Permanent Mark here.
- (13) Indicate BEARING TYPE on all pads. For tapered pads, locate BEARING TYPE on the high side. The Fabricator must include the value of "N" (amount of taper in 1/8" increments) in this mark.  
Examples: N=0, (for 0" taper)  
N=1, (for 1/8" taper)  
N=2, (for 1/4" taper)  
(etc.)  
Fabricated pad top surface slope must not vary from plan girder slope by more than (0.0625" / IN) IN/IN.
- (14) Substructure dimensions must satisfy the minimums provided to accommodate the elastomeric bearings shown on this standard.
- (15) See sheet 3 of 3 for beveled plate use when slopes exceed 5 percent.
- (16) If girder end is skewed for a girder conflict at an interior bent and a beveled sole plate is required, use bearing type for abutments at this location. Location of bearing centerline is to be set as for abutments in this case.

HL93 LOADING SHEET 2 OF 3

Texas Department of Transportation  
Bridge Division Standard

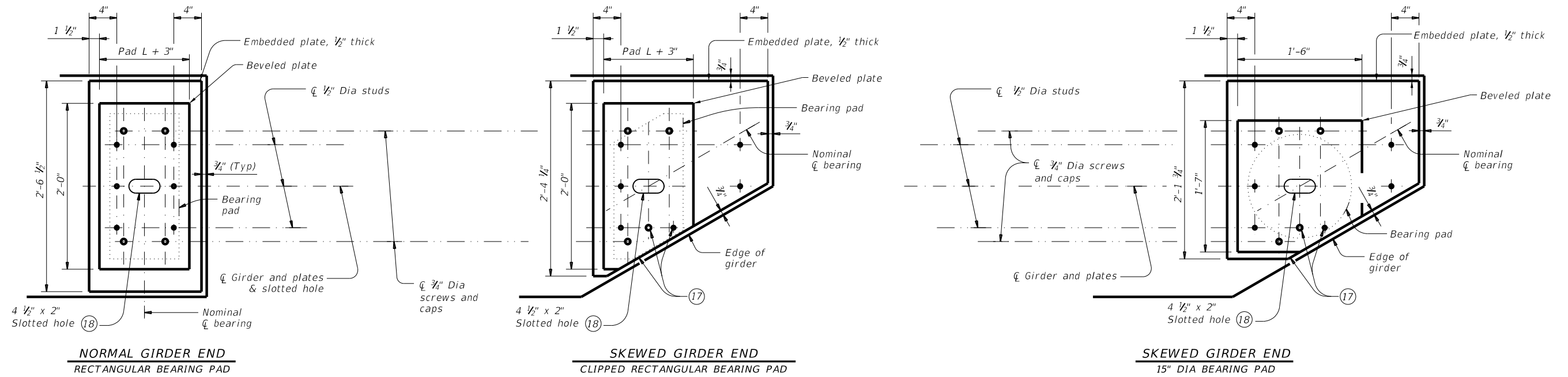
**ELASTOMERIC BEARING AND GIRDER END DETAILS**  
PRESTR CONCRETE I-GIRDERS

**IGEB**

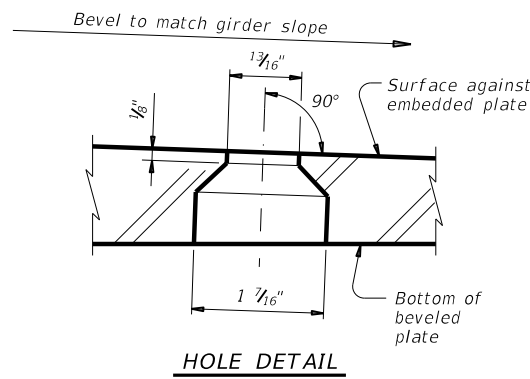
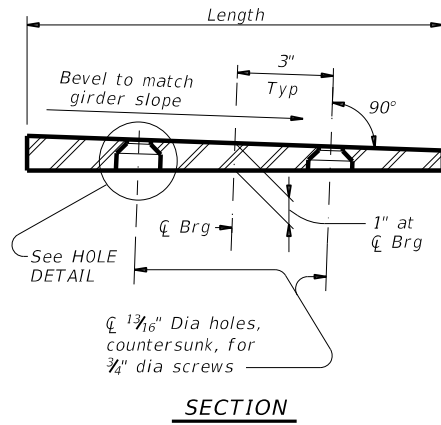
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DIST	COUNTY		SHEET NO.	
BWD	MILLS		75	

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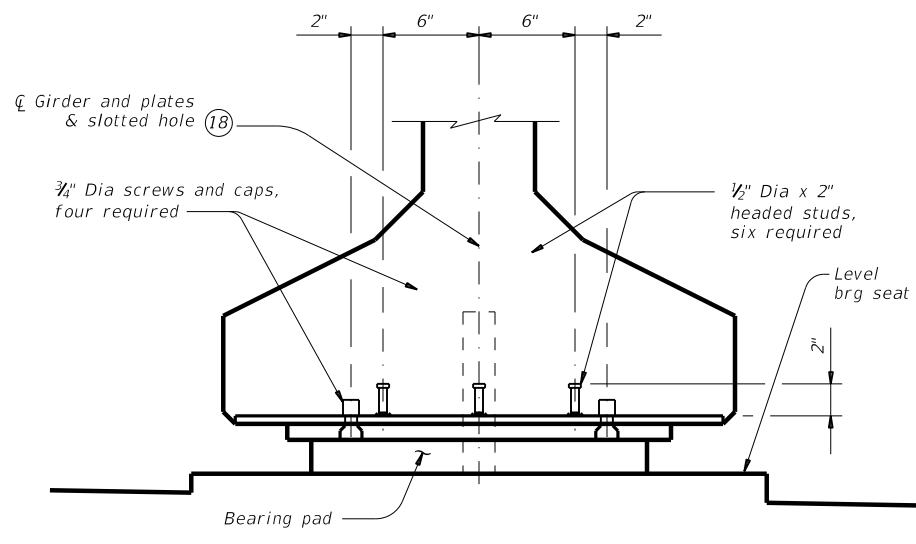
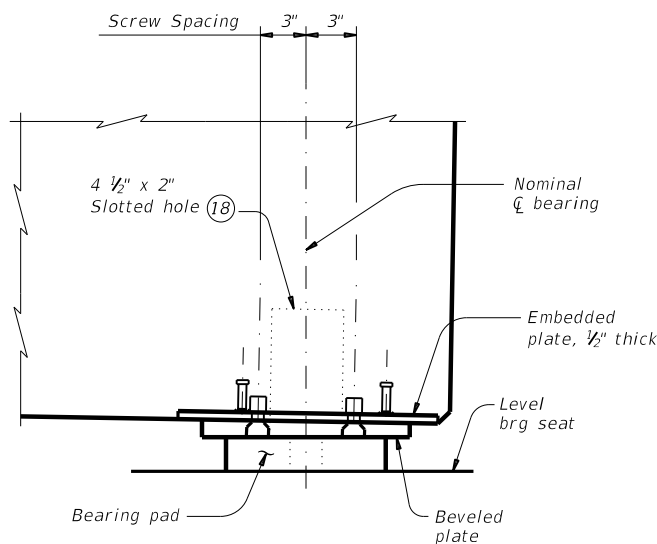
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**PLAN VIEW OF SOLE PLATE DETAILS**



**BEVELED PLATE DETAILS**



**GIRDER DETAILS**

**SOLE PLATE NOTES:**

Provide constant thickness elastomeric bearings with beveled and embedded steel sole plates in accordance with these details when the girder slope exceeds 5 percent or if otherwise required in the plans. Provide for all girders in the span.

On the shop drawings, dimension sole plates to the nearest 1/16" based on required thickness at centerline of bearing and slope of girder. Thickness tolerance variation from the approved shop drawings is 1/16" +/-, except variation from a plane parallel to the theoretical top surface can not exceed 1/16" total. Bearing surface tolerances listed in Item 424 apply to embedded and beveled plates.

Steel plate must conform to ASTM A36, A572 Gr 50, or A709 Gr 36 or Gr 50. Hot dip galvanize both the embedded plate and beveled sole plate after fabrication. Seal weld caps to embedded plate before galvanizing.

When determining if relocation of screw holes and studs are necessary for skewed girder ends, minimum clearance from screw or stud centerline to plate edge is 1.25".

Tap threads in the embedded plate only. Drill and tap prior to galvanizing.

3/4" Dia screws must be electroplated, socket flat head countersunk cap screws conforming to ASTM F835. Electroplating must conform to ASTM B633, SC 2, Type I. Provide screws long enough to maintain a 3/4" minimum embedment into the embedded plate and galvanized cap. Provide galvanized steel caps (16 ga Min) with a nominal 1" inside diameter and deep enough to accommodate the screws, but not less than 1/2" deep or deeper than 1".

Install beveled sole plates prior to shipping girders. Installed screw heads must not protrude below the bottom of the beveled plate.

HL93 LOADING SHEET 3 OF 3



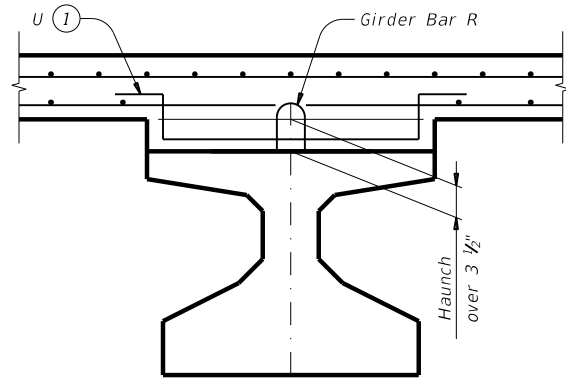
**ELASTOMERIC BEARING AND GIRDER END DETAILS  
PRESTR CONCRETE I-GIRDERS**

IGEB

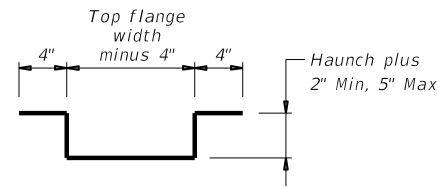
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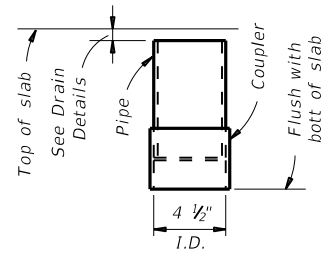
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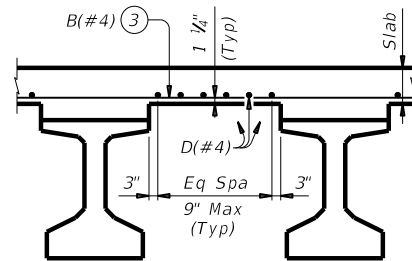
**HAUNCH REINFORCING DETAIL**



**BARS U (#4)**

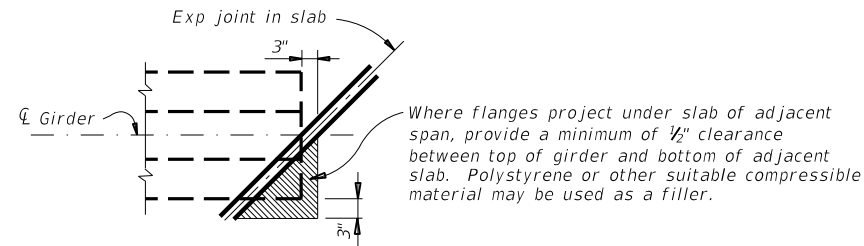


**C-I-P DRAIN DETAIL**

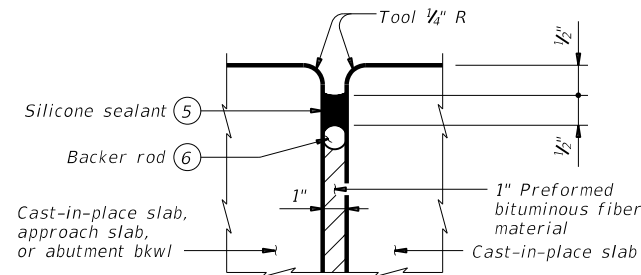


**TYPICAL PART TRANSVERSE SLAB SECTION WITHOUT PCP**

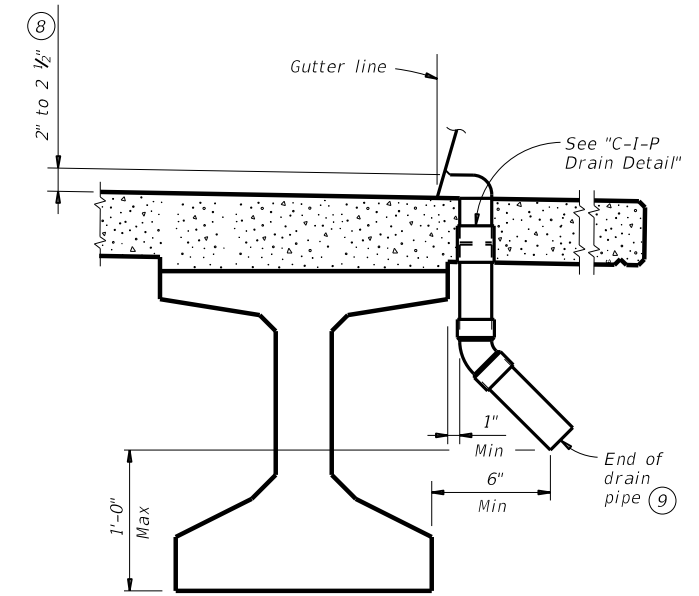
Top reinforcing steel not shown for clarity.



**TREATMENT AT GIRDER END FOR SKEWED SPANS**



**TYPE A JOINT DETAIL**



**DRAIN DETAIL**

**GENERAL NOTES:**  
 Designed according to AASHTO LRFD Bridge Design Specifications.  
 Payment for Type A joint will be as per Item 454, "Bridge Expansion Joints."  
 All other items (reinforcing steel, drains, etc.) shown on this sheet are subsidiary to other bid items.

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

**DECK FORMWORK NOTES:**  
 Overhang bracket hangers are limited to a safe working load of 3,600 lbs, applied to and along the axis of a coil rod at 45 degrees from vertical, regardless of higher loads permitted by hanger manufacturers. Do not place a hanger less than 12" from girder end. Space hangers accordingly.

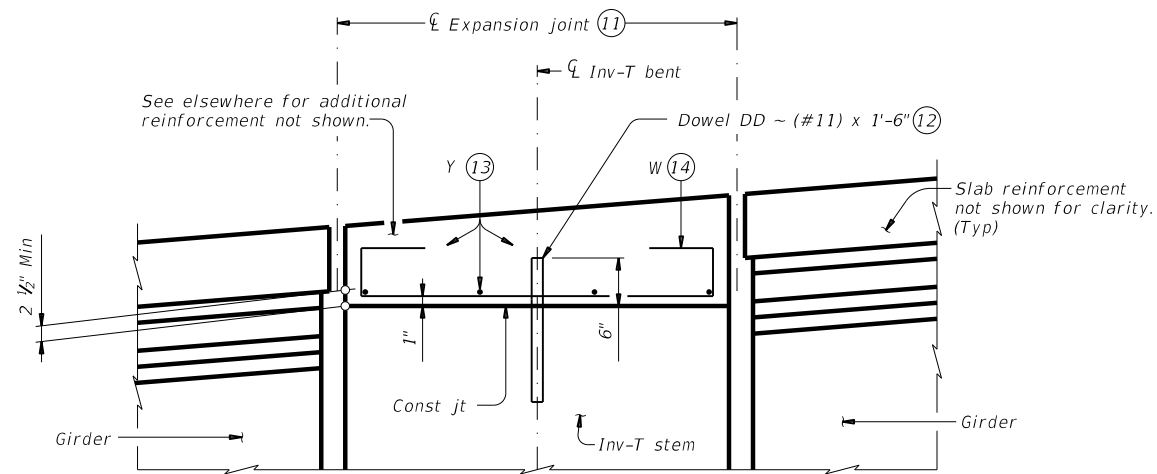
- ① Space Bars U with girder Bars R in all areas where measured haunch exceeds 3 1/2".
- ② Roughen outside of PVC with coarse rasp or equal to ensure bond with cast-in-place concrete.
- ③ Bars B(#4) spaced at 9" Max with 2" end cover. Overhang option, Contractor's may end alternating bars B(#4) at centerline outside girder.
- ④ Provide Grade 60 reinforcing steel. Provide bar laps, where required, as follows:  
 Uncoated ~ #4 = 1'-7"  
 Epoxy coated ~ #4 = 2'-5"
- ⑤ Class 7 silicone sealant that conforms to DMS-6310. Install when ambient temperature is between 55°F and 85°F and rising. Engineer to determine allowable hours for sealant application.
- ⑥ 1 1/4" backer rod must be compatible with joint sealant. Use of multiple pieces to create a backer rod cross section is not permitted. Top of backer rod must be convex as shown.
- ⑦ The maximum distance between Type A expansion joints is 100'. See Bridge Layout for location of joints.
- ⑧ Drain entrance formed in rail or sidewalk.
- ⑨ Water may not be discharged onto girders.
- ⑩ All drain pipe and fittings to be 4" diameter (Sch 40) PVC. See Item 481 "Pipe for Drains" for pipe, connections and solvent welding. Bend reinforcing steel to clear PVC 1". Drain length and location is as directed by the Engineer. Drains are not permitted over roadways or railroads, or within 10'-0" of bent caps. Degrease outside of exposed PVC, apply acrylic water base primer, then coat with same surface finishing material as used for outside girder face. Variations of the above designs, as required for the type of rail used and its location on the structure, may be installed with the approval and direction of the Engineer.

SHEET 1 OF 2

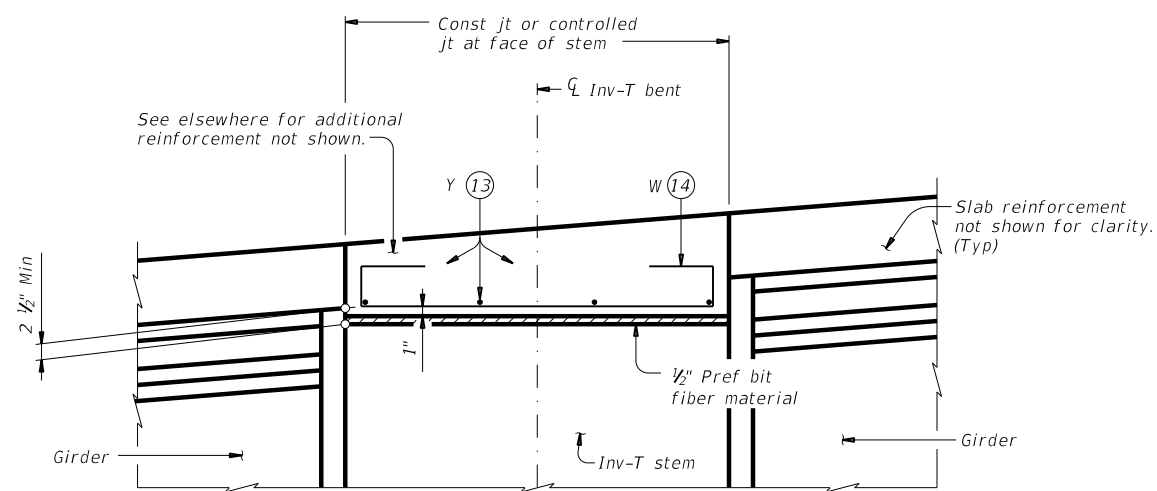
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<b>MISCELLANEOUS SLAB DETAILS</b> <b>PRESTR CONCRETE I-GIRDERS</b>			
<b>IGMS</b>			
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1780	01	009	FM 1047
10-19: Modified Note 7. Type A now a pay item.		DIST	SHEET NO.
BWD		MILLS	77

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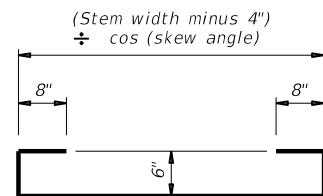
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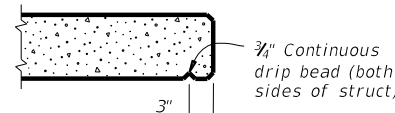
**SHOWING EXPANSION JOINTS**



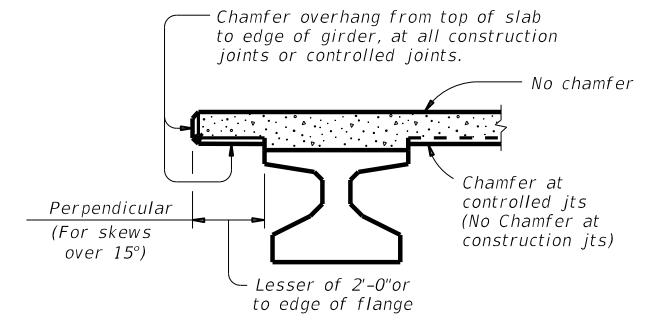
**SHOWING CONST JTS OR CONTROLLED JTS  
 REINFORCEMENT OVER INV-T BENTS**



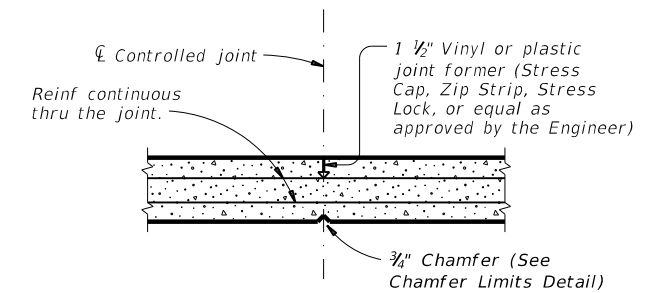
**BARS W (#4)**



**DRIP BEAD DETAIL**



**CHAMFER LIMITS DETAIL (15)**



**CONTROLLED JOINT DETAIL**

(Saw-cutting is not allowed)

- (11) See Layout for joint type.
- (12) Dowels DD (#11) spaced at 5 Ft Max. See Inv-T bents for quantity and location.
- (13) Space Bars Y (#4) at 12" Max. Use 2" end cover. Number of Bars Y must satisfy spacing limit. Place parallel to bent.
- (14) Space Bars W at 12" Max (3" from end of cap). Tilt if necessary to maintain cover requirements. Place parallel to longitudinal slab reinforcement.
- (15) See Span details for type of joint and joint locations.

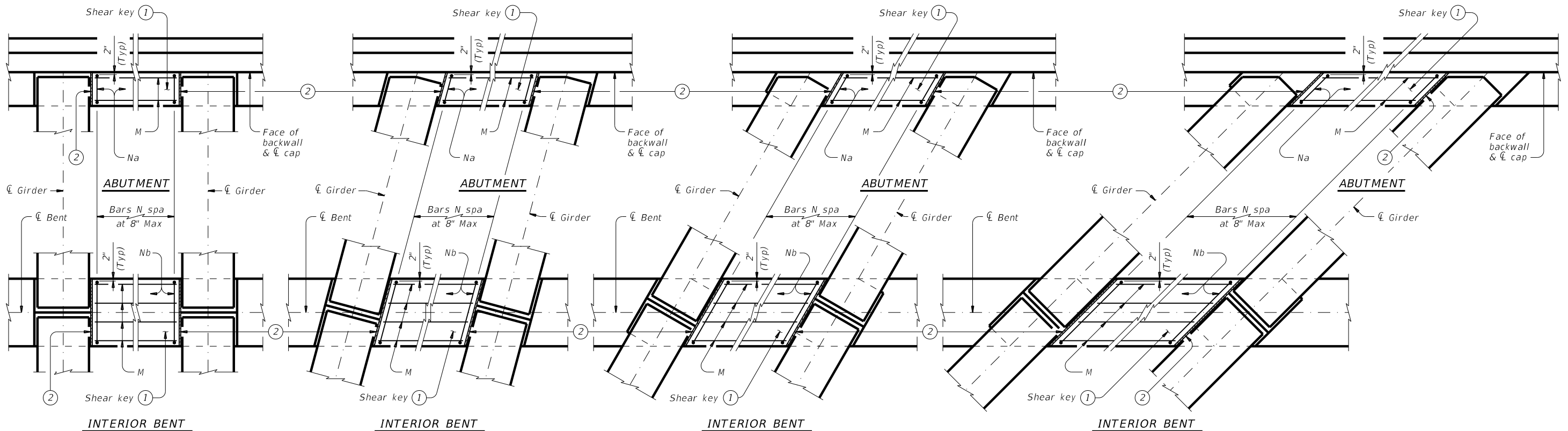
**MISCELLANEOUS  
 SLAB DETAILS  
 PRESTR CONCRETE I-GIRDERS**

**IGMS**

FILE: igmsts1-19.dgn	DN: TxDOT	CK: TxDOT	DW: JTR	CK: TxDOT
©TxDOT August 2017	CONT	SECT	JOB	HIGHWAY
REVISIONS	1780	01	009	FM 1047
10-19: Modified Note 7, Type A now a pay item.	DIST	COUNTY	SHEET NO.	
	BWD	MILLS	78	

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DATE: 1/11/2022 10:49:14 AM  
 FILE: T:\BWDSDTEAM\Design Projects\Mi11s\1780-01-009 FM 1047 Bennett Branch\Standard\IGSK.dgn



**PARTIAL PLANS WITH NO SKEW**

Showing shear keys on 3'-6" wide caps. 4'-0" caps similar.

**PARTIAL PLANS WITH 15° SKEW**

Showing shear keys on 3'-6" wide caps. 4'-0" caps similar.

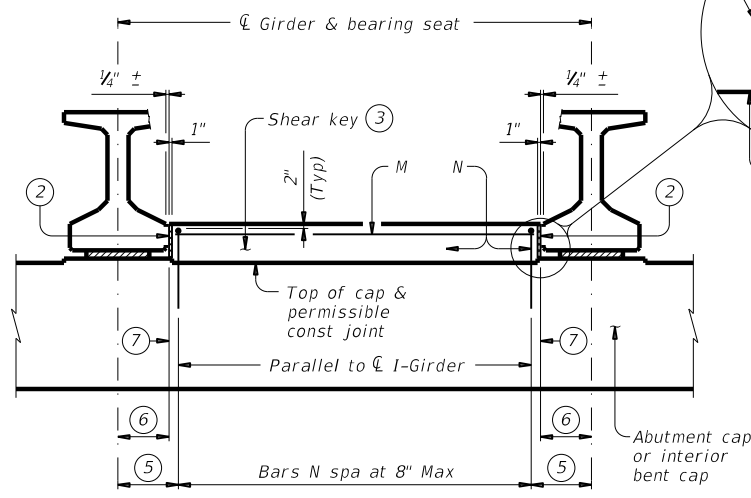
**PARTIAL PLANS WITH 30° SKEW**

Showing shear keys on 3'-6" wide caps. 4'-0" caps similar.

**PARTIAL PLANS WITH 45° SKEW**

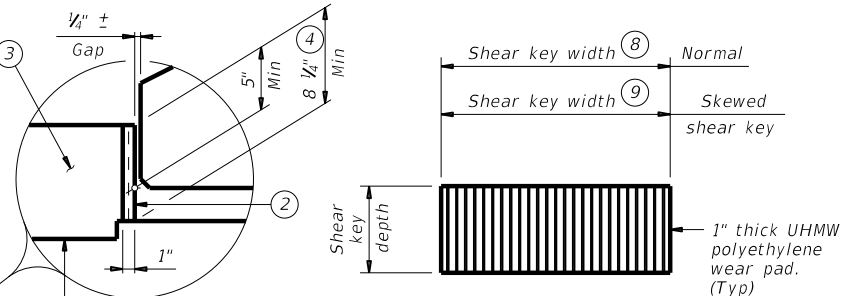
Showing shear keys on 3'-6" wide caps. 4'-0" caps similar.

- ① Place shear keys on the upstream side of structure between outside girder and next adjacent girder, unless shown otherwise on plans.
- ② UHMW polyethylene wear pad. (Typ)
- ③ Leave a 1/4" gap plus or minus between girder and face of wear pad. Cast wear pad with shear key, smooth side facing girder. Care must be taken to keep concrete from flowing under girder. Slope top of shear keys in accordance with Item 420.4.9, "Treatment and Finishing of Horizontal Surfaces."
- ④ Measure at higher bearing seat elevation forward or back. Dimension based on typical bearing pad and bearing seat. Increase as necessary to maintain 5" overlap.
- ⑤ With No Skew = 1'-8 1/4", measured along  $\bar{\ell}$  cap.  
With Skew = 1'-8 1/4"  $\div$  Cos Skew, measured along  $\bar{\ell}$  cap.
- ⑥ With No Skew = 1'-4 1/4", measured along  $\bar{\ell}$  cap.  
With Skew = 1'-4 1/4"  $\div$  Cos Skew, measured along  $\bar{\ell}$  cap.
- ⑦ Face of UHMW polyethylene wear pad. Smooth side of pad facing girder.
- ⑧ Abutments = 1/2 Cap width.  
Interior bents = Cap width.
- ⑨ Abutments = 1/2 Cap width  $\div$  Cos Skew.  
Interior bents = Cap width  $\div$  Cos Skew.

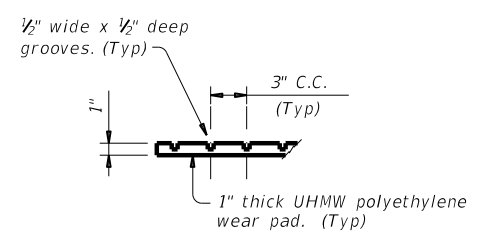


**PARTIAL ELEVATION OF ABUTMENT OR INTERIOR BENT CAP**

Showing shear key with girder Type Tx46. Other I-Girder types similar.

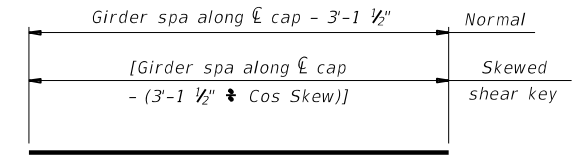


**ELEVATION**

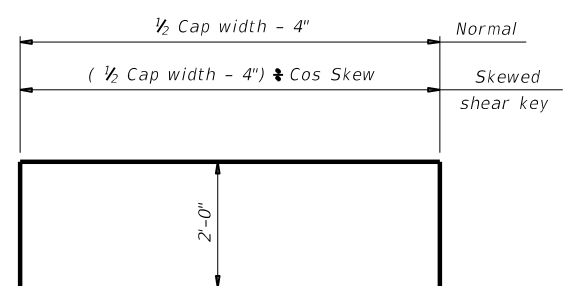


**PART SECTION**

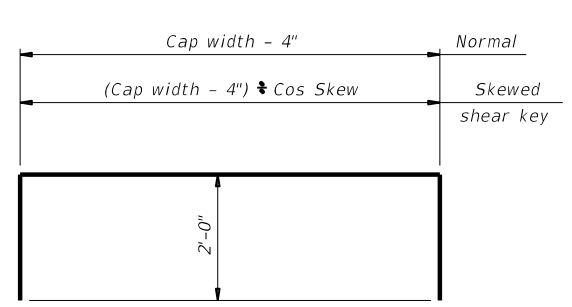
**ULTRA HIGH MOLECULAR WEIGHT (UHMW) POLYETHYLENE WEAR PAD DETAILS**



**BARS M (#5)**



**BARS Na (#5) (For abutments)**



**BARS Nb (#5) (For interior bents)**

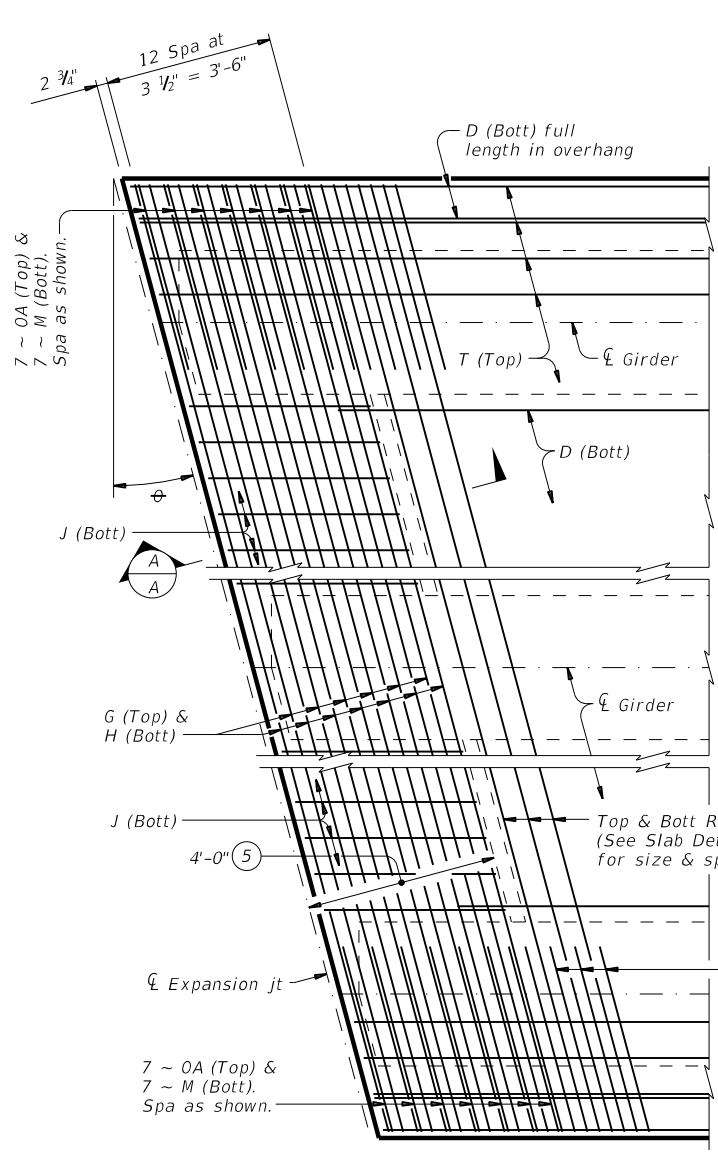
**CONSTRUCTION NOTES:**  
 Provide Class "C" concrete ( $f'_c = 3,600$  psi). Provide Class "C" (HPC) if shown elsewhere on the plans.  
 Provide Grade 60 reinforcing steel.  
 Provide epoxy coated reinforcing steel for shear key if abutment or interior bent reinforcing steel is epoxy coated.  
 Provide Ultra High Molecular Weight (UHMW) polyethylene wear pads in accordance with ASTM D6712.

**GENERAL NOTES:**  
 Designed according to AASHTO LRFD Bridge Design Specifications. Details showing skew are drawn showing right forward skew. See Bridge Layout for actual skew direction.  
 These details are limited to bridges skewed 45 degrees and less. This standard is only applicable for I-Girders.  
 Modify details for bearing conditions, and girder spacing not shown on this standard. Details do not account for sole plate or pedestal bearing seat.  
 Include shear key concrete in abutment or bent concrete for payment.  
 UHMW polyethylene wear pads are subsidiary to Class "C" concrete.  
 Cover dimensions are clear dimensions, unless noted otherwise. Reinforcing bar dimensions shown are out-to-out of bar.

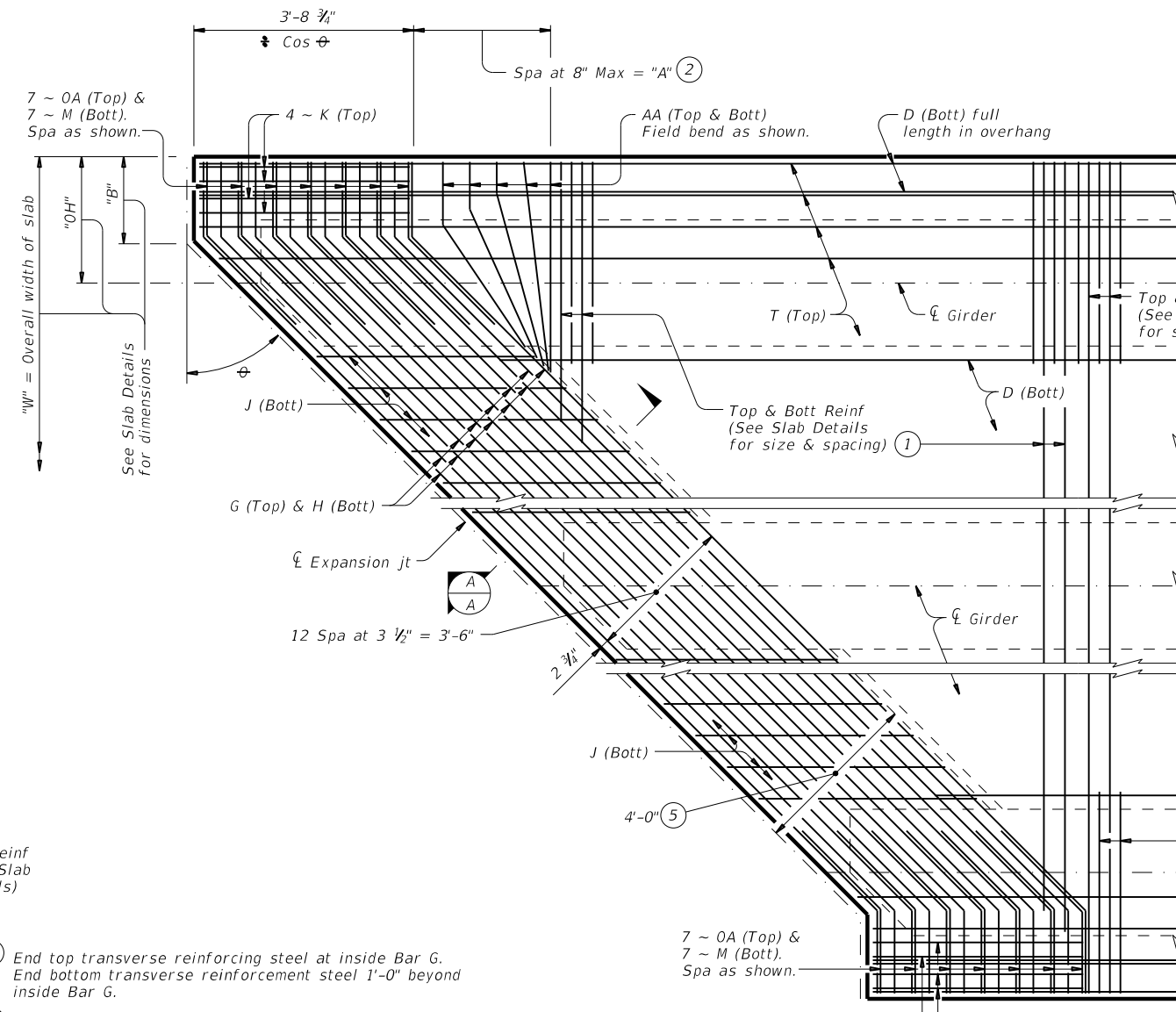
		<b>Bridge Division Standard</b>	
<b>SHEAR KEY DETAILS</b> <b>PRESTR CONCRETE I-GIRDERS</b>			
<b>IGSK</b>			
FILE: igskstds-17.dgn	DN: TxDOT	CK: TxDOT	DW: JTR
©TxDOT August 2017	CONTRACT: 1780	SECTION: 01	JOB: 009
REVISIONS	1780	01	009
	DIST: BWD	COUNTY: MILLS	SHEET NO: 79

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DATE: 1/11/2022 10:49:15 AM  
 FILE: T:\BWD\SGTEAM\Design Projects\Mi11s\1780-01-009 FM 1047 Bennett Branch\Standards\IGTS\IGTS.dwg

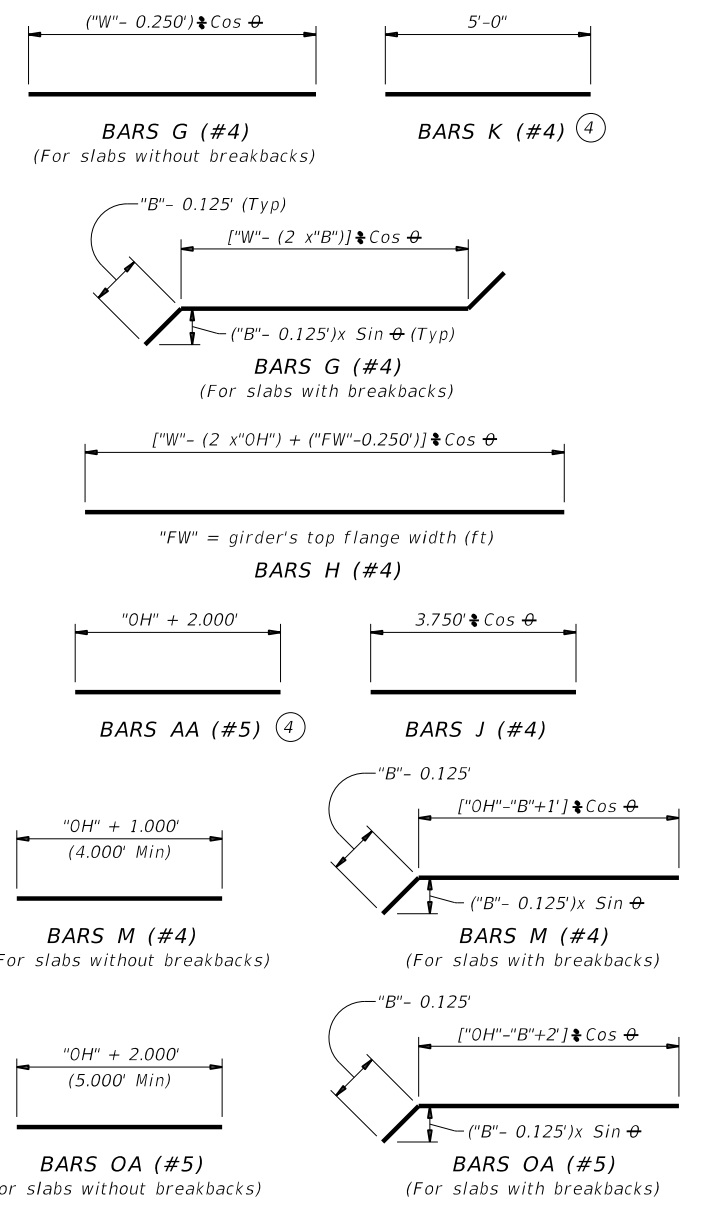


**PARTIAL PLAN FOR SLABS WITHOUT BREAKBACK**



**PARTIAL PLAN FOR SLABS WITH BREAKBACK**

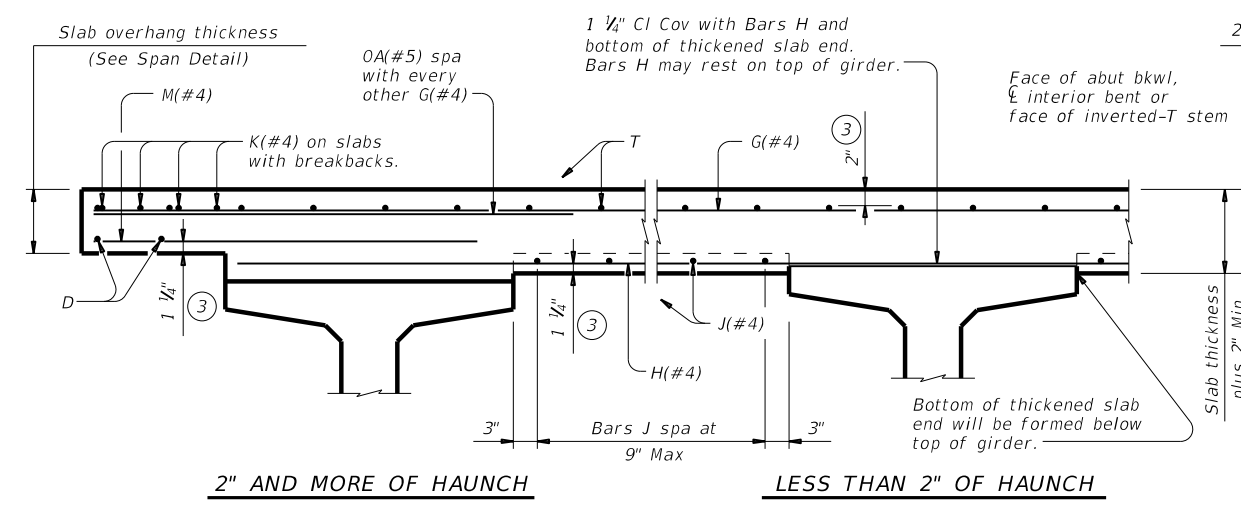
- ① End top transverse reinforcing steel at inside Bar G. End bottom transverse reinforcement steel 1'-0" beyond inside Bar G.
- ② "A" = ("OH" + 2.333 "B") x Tan  $\phi$
- ③ Provide clear cover as indicated unless otherwise shown on Span Details.
- ④ Only required on slabs with breakbacks.
- ⑤ Thickened slab end dimensioned perpendicular to face of bkwl, centerline interior bent or face of inverted-T stem.



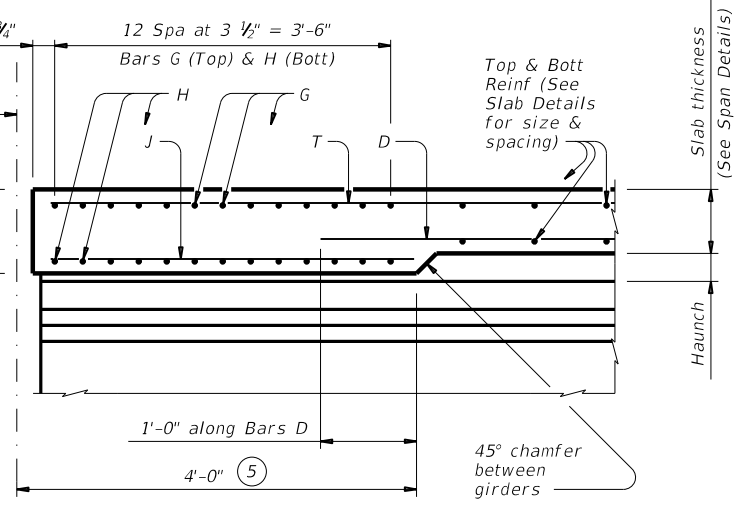
**GENERAL NOTES:**  
 Designed according to AASHTO LRFD Bridge Design Specifications. These details are restricted to Prestressed Concrete I-Girder Spans. These details are to be used in conjunction with the Span Details and PCP standard (if prestressed concrete panels are used). When Option 2 from PCP standard is used, provide Bars AA, G, K and OA in the slab.

**MATERIAL NOTES:**  
 Provide Grade 60 reinforcing steel. If slab reinforcing steel is shown on the Slab Details to be epoxy coated, then Bars AA, G, K, H, J, M and OA must be epoxy coated. Provide bar laps, where required, as follows:  
 Uncoated ~ #4 = 1'-7"  
 Epoxy Coated ~ #4 = 2'-5"

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



**TYPICAL TRANSVERSE SECTION**  
 (Showing Prestressed Conc I-Girders at  $\phi$  Brg)

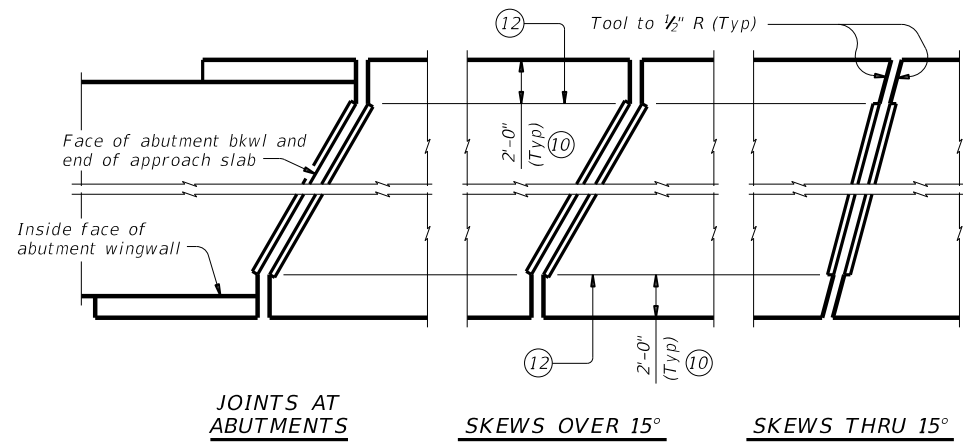


**SECTION A-A**  
 (Showing with 2" and more of haunch)

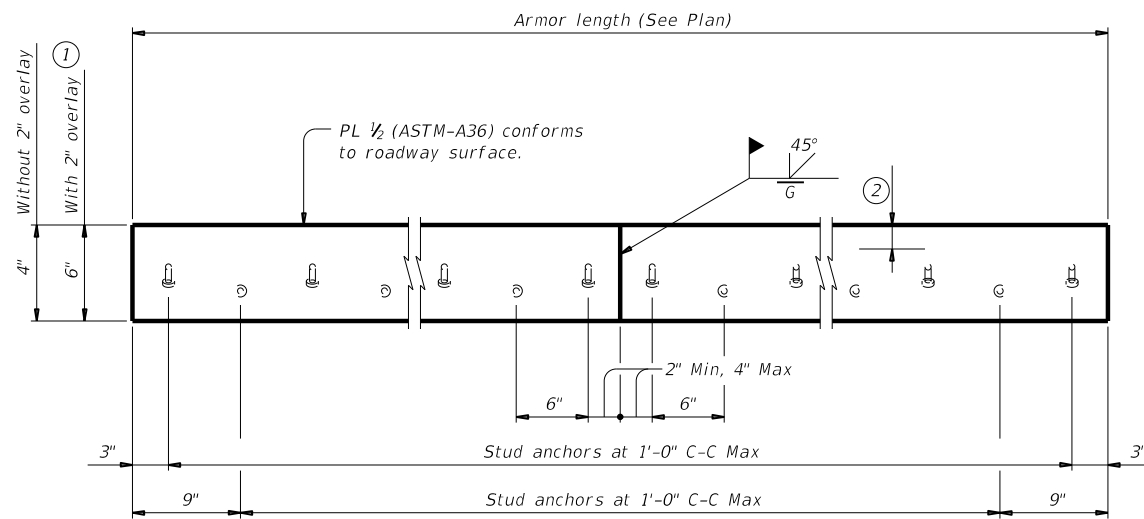
HL93 LOADING		Bridge Division Standard	
<b>THICKENED SLAB END DETAILS</b>			
<b>PRESTRESSED CONCRETE I-GIRDER SPANS</b>			
<b>IGTS</b>			
FILE: igtss1-17.dgn	DN: TxDOT	CK: TxDOT	DW: JTR
©TxDOT August 2017	CONT	SECT	JOB
REVISIONS	1780	01	009
	DIST	COUNTY	HIGHWAY
	BWD	MILLS	FM 1047
			SHEET NO.
			80

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DATE: 1/11/2022 10:49:16 AM  
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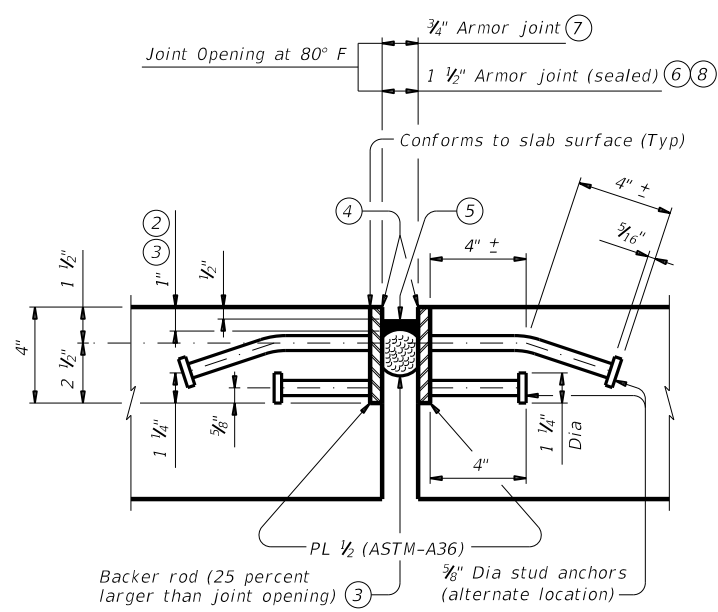


**JOINTS AT ABUTMENTS**  
**SKEWS OVER 15°**  
**SKEWS THRU 15°**  
**PLANS OF ARMOR PLATES**

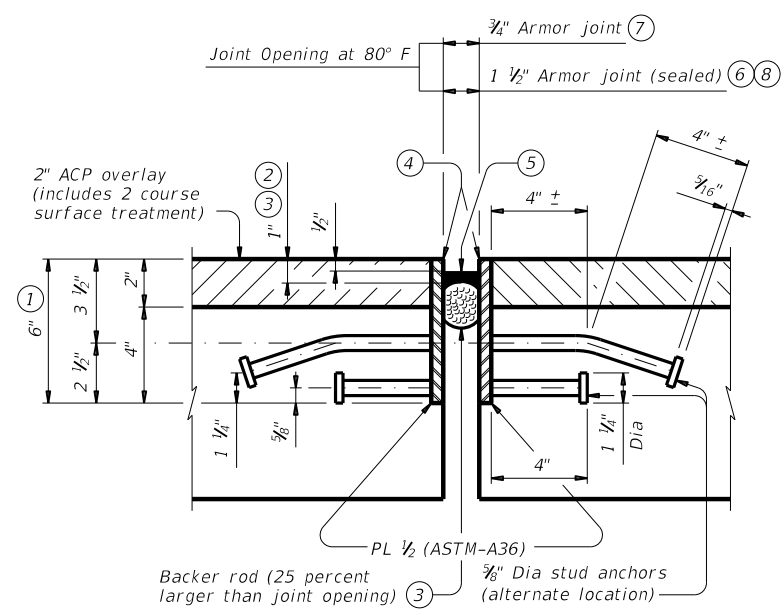


**ELEVATION OF BASIC ARMOR PLATE**

- ① Adjust 6" plate height for overlay thicknesses other than the 2" shown. Adjust weight by 1.70 plf for each 1/2" variation in thickness.
- ② Do not paint top 1/2" of plate if using sealed armor joint.
- ③ Set top of backer rod 1" below top of armor plate. Backer rod must be compatible with joint sealant. Use of multiple pieces to create a backer rod cross section is not permitted. Top of backer rod must be convex as shown.
- ④ Blast clean entire contact area between sealant and plate (SSPC-SP10) before installing sealant. Light brush blast and thoroughly clean all dust and debris from concrete surfaces in contact with joint sealant before application of silicone seal.
- ⑤ Use Class 7 joint sealant that conforms to DMS-6310.
- ⑥ Place sealant while ambient temperature is between 55°F and 80°F and is rising.
- ⑦ Armor joint does not include joint sealant or backer rod.
- ⑧ Armor joint (sealed) includes Class 7 joint sealant and backer rod.
- ⑨ Form vertical leg of seal as per the Manufacturer's recommendations. Use Class 4 joint sealant if Class 7 cannot be installed correctly. Install according to Manufacturer's recommendations.
- ⑩ Unless shown otherwise, terminate armor plate at slab break point if break is more than 2'-0" from slab edge.
- ⑪ See "Plans of Armor Plates".
- ⑫ At Fabricator's option, armor plate may extend up to 6" beyond this point for skews through 15°.
- ⑬ Align shipping angle perpendicular to joint.



**SHOWN WITHOUT 2" OVERLAY AT JOINT LOCATION**



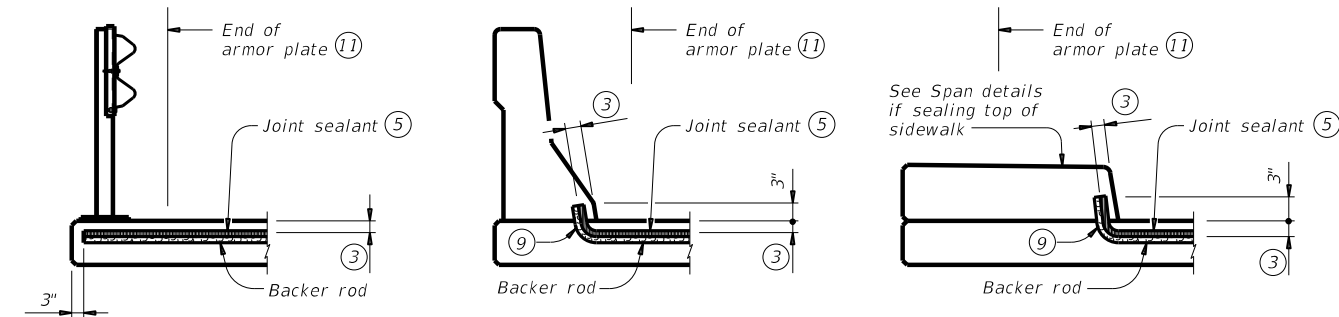
**SHOWN WITH 2" OVERLAY AT JOINT LOCATION**

**ARMOR JOINT SECTIONS**  
 Showing Armor Joint (Sealed)

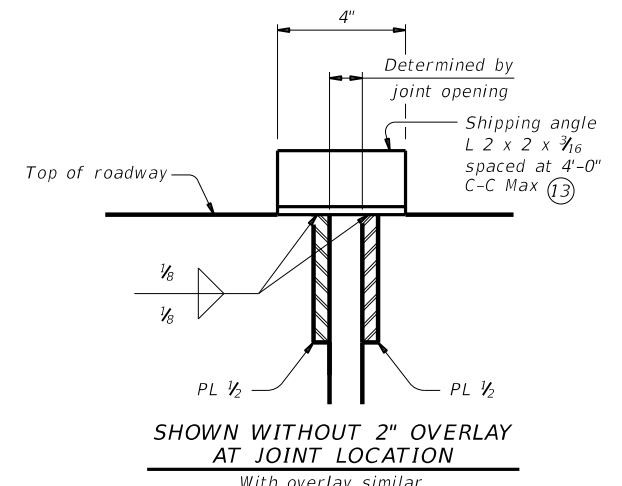
**FABRICATION NOTES:**  
 Match mark corresponding plate sections and secure together for shipment with shipping angle. Do not use erection bolts.  
 Ship armor joints in convenient lengths of 10'-0" Min and 24'-0" Max unless necessary for stage construction or widenings. One shop splice is permitted in each shipping length provided no piece is less than 2'-0" long and sufficient studs are added to limit the stud to shop splice distance to 2" Min and 4" Max.  
 Weld studs in accordance with AWS D1.1.  
 Use groove welds for all shop and field butt splices. Grind smooth areas in contact with seal. Make all necessary field splice joint preparations in the shop.  
 Paint the entire steel section, except as stated in Note 2, with System II or IV primer in accordance with Item 446 "Field Cleaning and Painting Steel." Provide paints in accordance with Item 446.2. Prepare steel and apply paint in accordance with Items 446.4.7.3 and 446.4.7.4.  
 Shop drawings for the fabrication of armor joints will not require the Engineer's approval if fabrication is in accordance with the details shown on this standard.

**CONSTRUCTION NOTES:**  
 Secure armor joints in position and place to proper grade and alignment by welding braces to adjacent reinforcing steel, to prestressed beam stirrups, or to anchors cast in concrete diaphragms. Include cost of temporary bracing in the price bid for Armor Joint.  
 Remove shipping angle immediately after each joint half is secured in place. Grind smooth, and touch up with organic zinc-rich paint.

**GENERAL NOTES:**  
 Provide armor joints at locations shown on the plans. Provide the seal when "Armor Joint (Sealed)" is noted on the plans. These joint details accommodate a joint movement range of 1 3/8" ( 3/4" opening movement and 5/8" closure movement). Payment for armor joint, with or without seal, is based on length of armor plate.



**JOINT SEALANT TERMINATION DETAILS**  
 Armor joint (sealed) only. Armor plate is not shown for clarity.



**SHIPPING ANGLE**

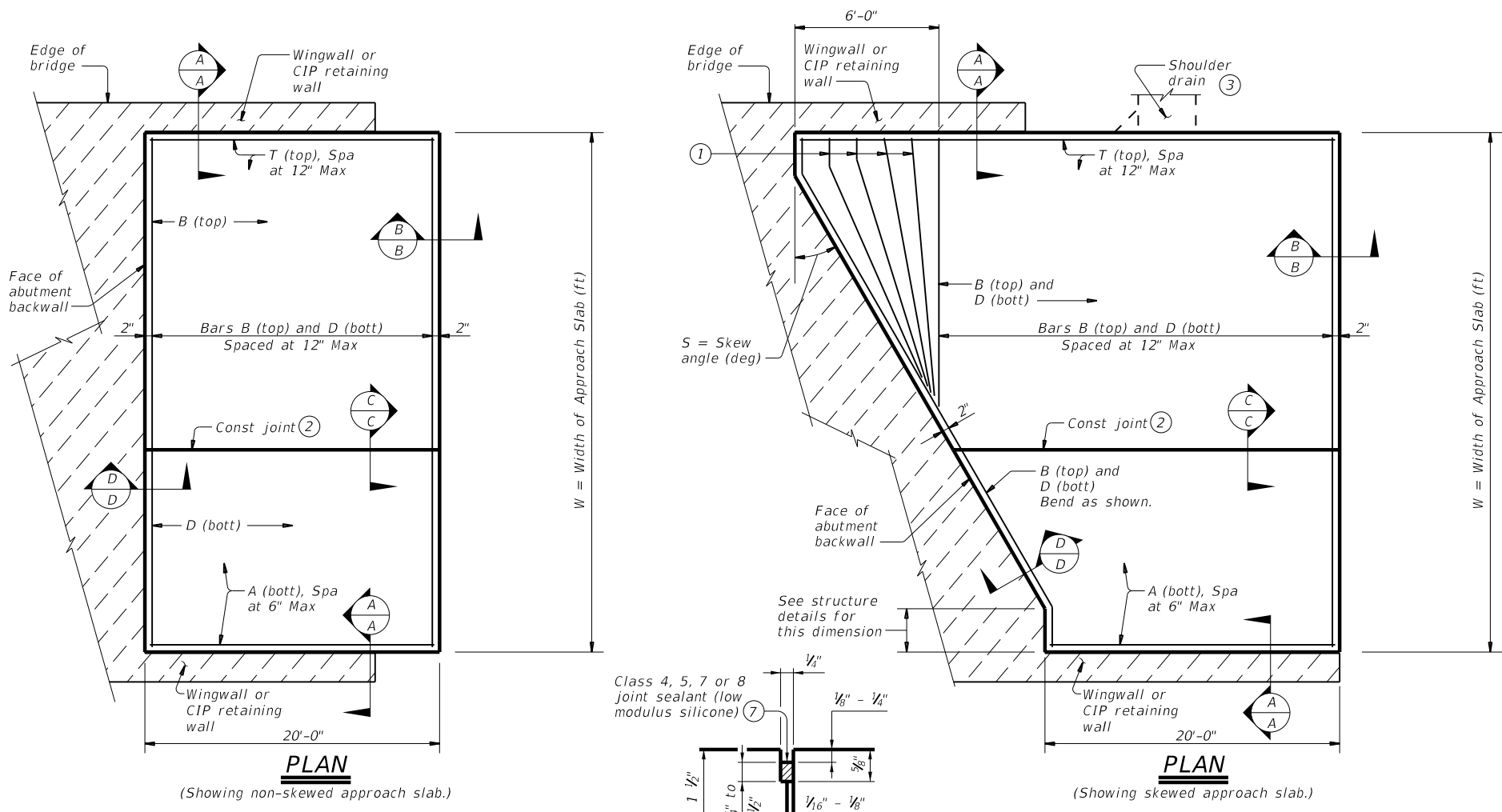
An alternate method of securing joint sections may be used if approved by the Bridge Division. Erection bolts are not allowed.

WEIGHTS FOR ONE ARMOR JOINT (2 PLATES)	
WITHOUT OVERLAY	16.10 plf
WITH 2" OVERLAY ①	22.90 plf

				<b>Bridge Division Standard</b>	
<b>ARMOR JOINT DETAILS</b>					
<b>AJ</b>					
FILE: ajstde01-19.dgn	DN: TxDOT	CK: TxDOT	OW: TxDOT	CK: TxDOT	
©TxDOT April 2019	CON: 1780	SECT: 01	JOB: 009	HIGHWAY: FM 1047	
REVISIONS	DIST: BWD	COUNTY: MILLS	SHEET NO: 81		

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BAR TABLE	
BAR	SIZE
A	#8
B	#5
D	#5
T	#5

**APPROXIMATE QUANTITIES** ④

Reinf steel weight = 8.5 Lbs/SF of Approach Slab

Volume of Appr Slab Conc (CY) = 0.802W + 0.02W<sup>2</sup> Tan S

W = Width of Approach Slab (ft)

S = Skew Angle (deg)

- ① Flare Bars B and D in this region (1'-6" Max Spa, 3" Min Spa). Minimum flared bar length = 2'-6". Bend bars as necessary.
- ② Provide longitudinal construction joints that align with longitudinal construction joints in the bridge slab with bridges built in stages. Other longitudinal construction joints must receive approval of the Engineer.
- ③ See details elsewhere in plans for shoulder drain location and details.
- ④ For Contractor's information only. Quantities shown are for one approach slab.
- ⑤ Multiple piece tie bars are acceptable at longitudinal construction joints provided minimum laps shown are achieved.
- ⑥ See details elsewhere in plans for required cross-slope.
- ⑦ Place in accordance with Item 438.
- ⑧ Provide backer rod that is 25% larger than joint opening and compatible with the sealant.
- ⑨ If bridge rail is present at the wingwall or CIP retaining wall, place 1/2" rebonded recycled tire rubber between concrete railing and top of approach slab as shown when concrete railing projects over the approach slab.

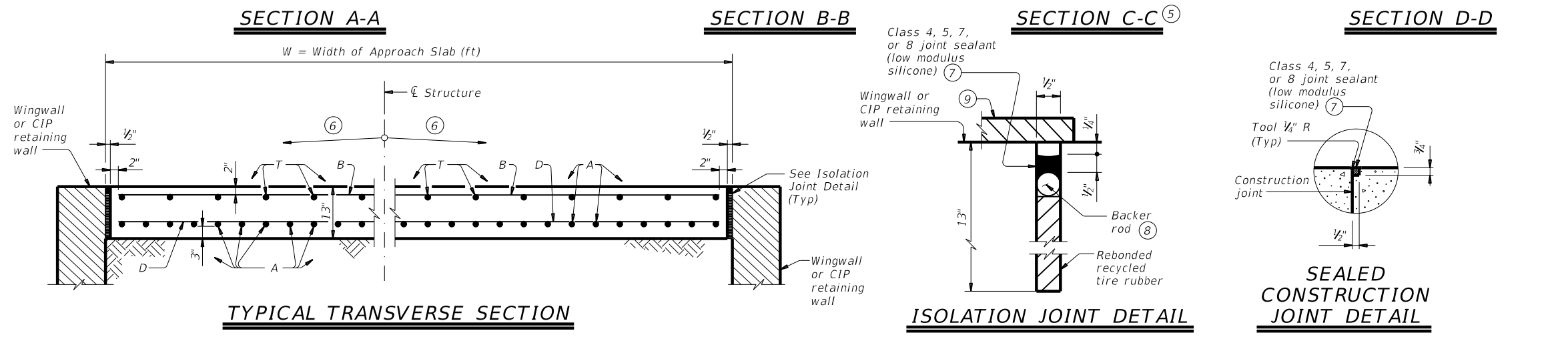
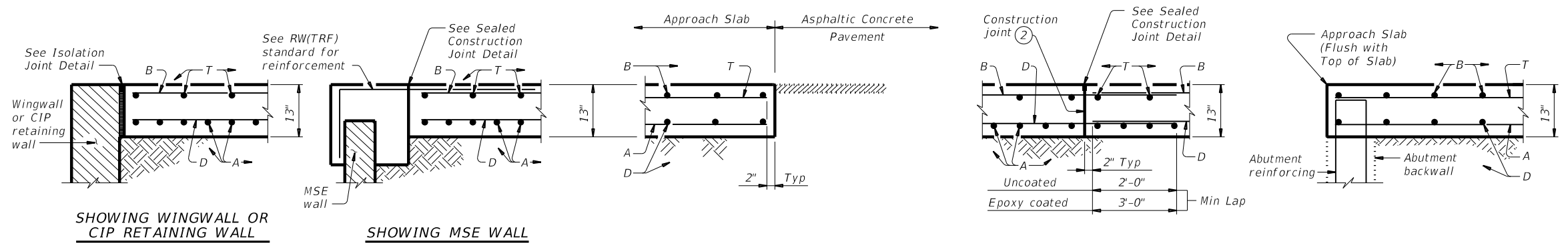
**GENERAL NOTES:**

Construct approach slab in accordance with Item 422. Provide Class "S" concrete with a minimum compressive strength of 4,000 psi. Provide Grade 60 reinforcing steel. Provide longitudinal joints as shown on the Longitudinal Saw Cut Joint Detail at lane lines and shoulders when width between longitudinal construction joints or edges of approach slab exceeds 16 feet. Saw cut joints within 24 hours of concrete placement to a depth of 1 1/2" and seal in accordance with Item 438. Alternately, provide a controlled joint consisting of 1 1/2" vinyl or plastic joint former (Stress Cap, Zip Strip, Stress Lock, or equal as approved by the Engineer.) Provide rebonded recycled tire rubber joint filler that meets the requirements of DMS-6310. "Joint Sealants and Fillers."

Construct the subgrade or subbase away from the bridge for a minimum distance of 100 feet prior to the approach slab, unless otherwise indicated on the plans. Compact and finish the subgrade or foundation for the approach slab to the typical cross-section and to the lines and grades shown on the plans. Cure for 4 days using water or membrane curing per Item 422. All details shown herein are subsidiary to bridge approach slab.

Cover dimensions are clear dimensions, unless noted otherwise.

**LONGITUDINAL SAW CUT JOINT DETAIL**



Texas Department of Transportation  
 Bridge Division Standard

**BRIDGE APPROACH SLAB  
 ASPHALTIC CONCRETE PAVEMENT**

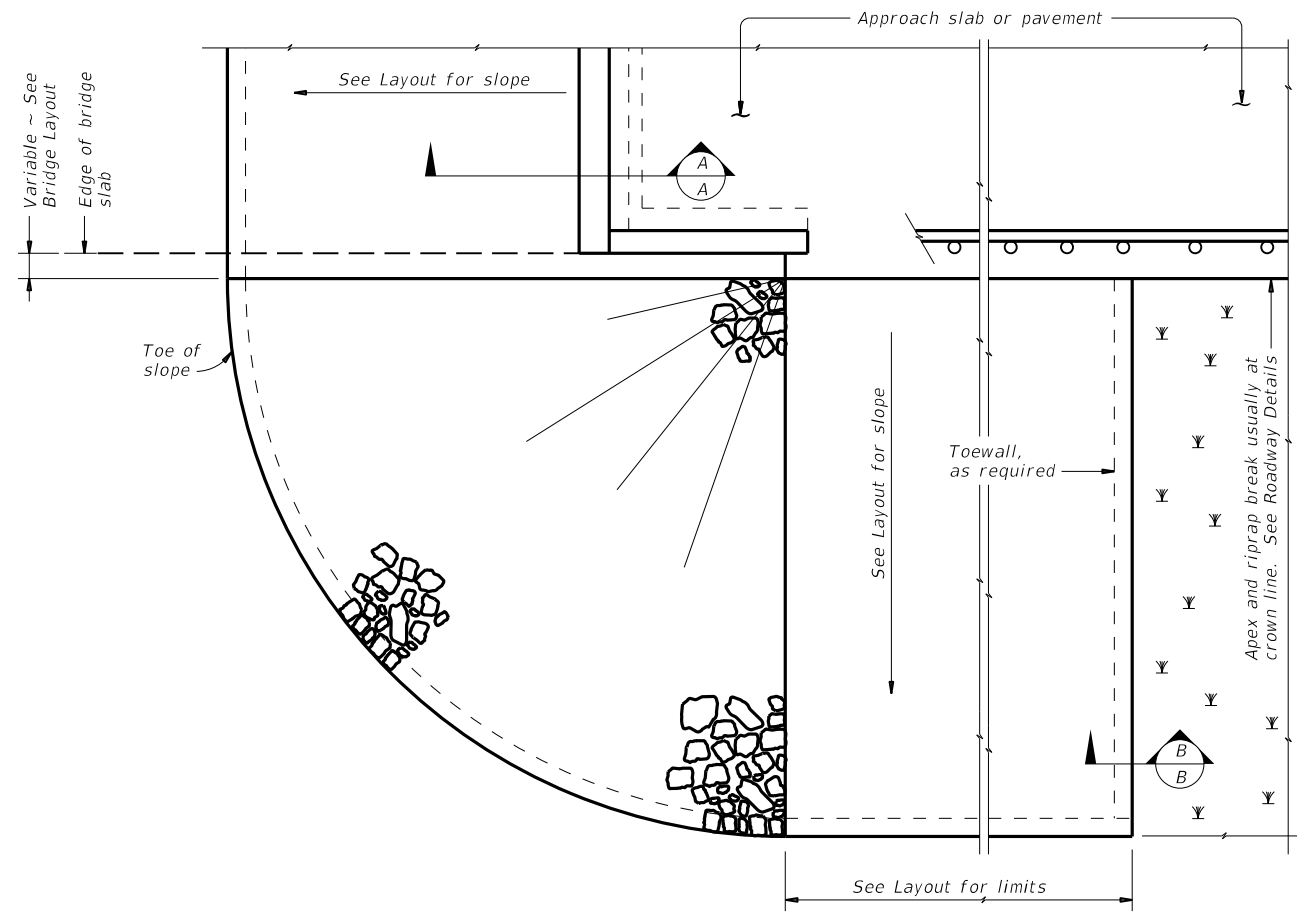
**BAS-A**

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©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	1780	01	009	FM 1047
02-20: Removed stress relieving pad.	DIST	COUNTY	SHEET NO.	
	BWD	MILLS		82

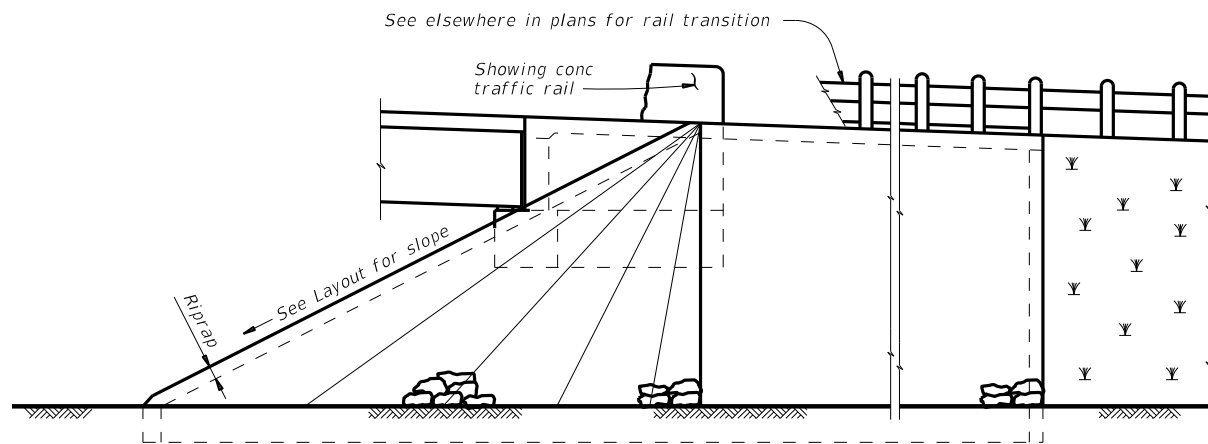


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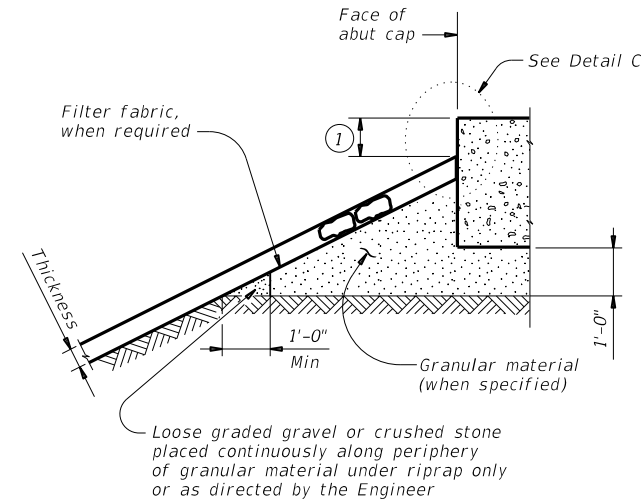
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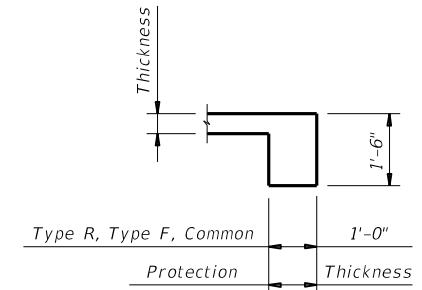
**PLAN**



**ELEVATION**



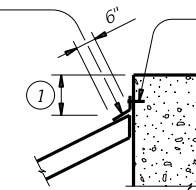
**SECTION A-A AT CAP**



**SECTION B-B**

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

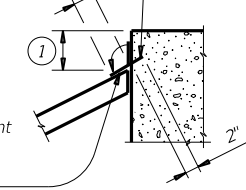
8"X 18 Gage galvanized flashing full length of cap



**CAP OPTION A**

Nail flashing to cap or wingwall and seal with joint sealer

8"X 18 Gage galvanized flashing full length of cap



**CAP OPTION B**

**DETAIL C**

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

**GENERAL NOTES:**

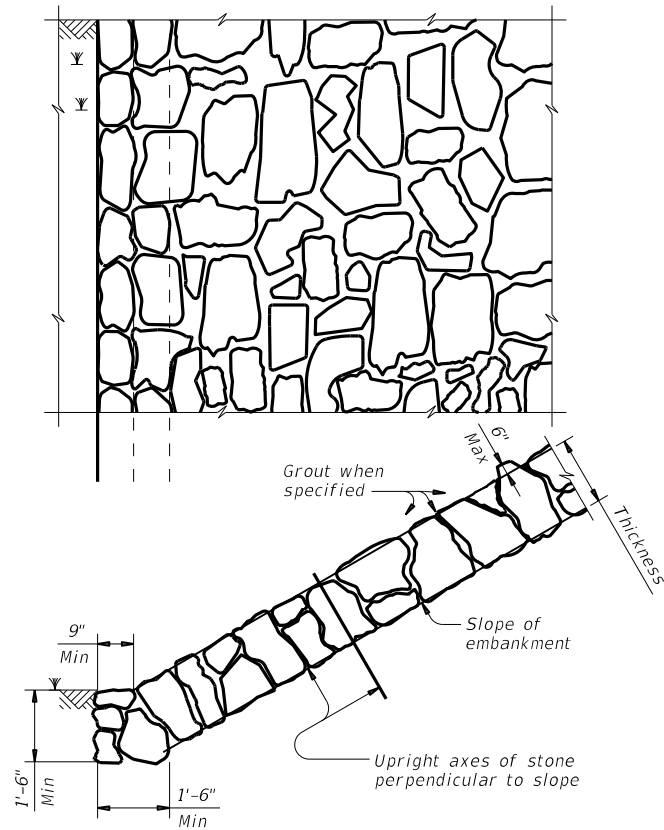
Refer to Item 432, "Riprap" for stone size and gradation, and construction details. See Layout for limits and thickness of riprap specified.  
 See elsewhere in plans for locations and details of shoulder drains.

SHEET 1 OF 2

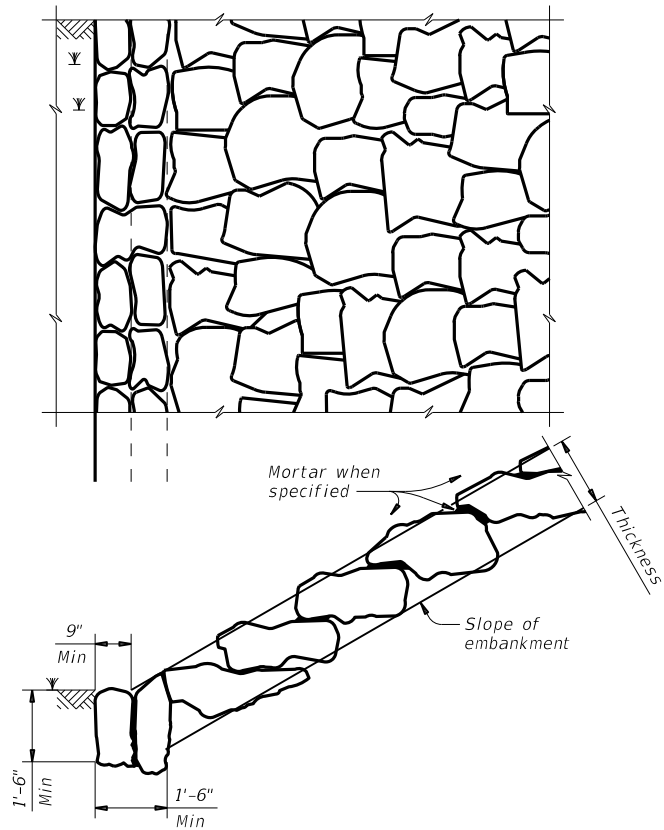
		<b>Bridge Division Standard</b>	
<h1>STONE RIPRAP</h1>			
<h2>SRR</h2>			
FILE: srrstd1-19.dgn	DN: AES	CK: JGD	DW: BWH
©TxDOT April 2019	CONT	SECT	JOB
REVISIONS	1780	01	009
DIST	COUNTY		SHEET NO.
BWD	MILLS		83

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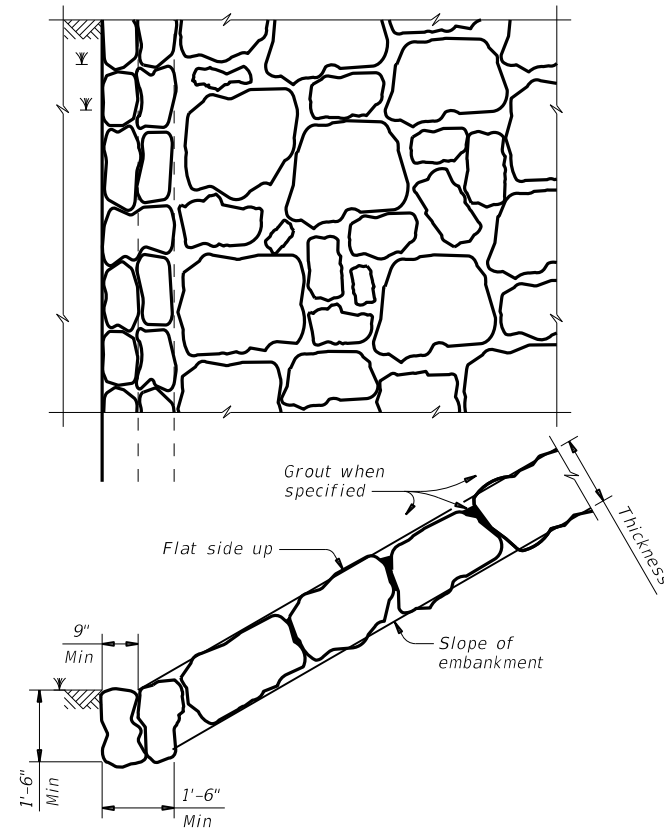
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**FIGURE 1 ~ TYPE R STONE RIPRAP**  
dry or grouted

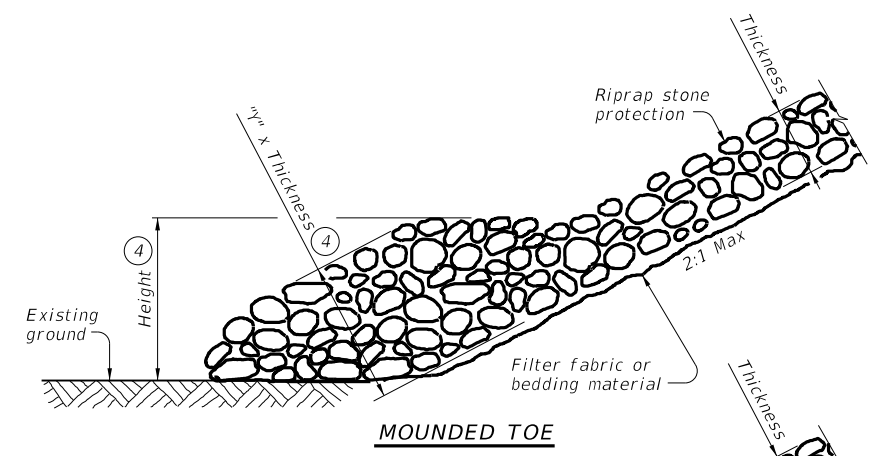


**FIGURE 2 ~ TYPE F STONE RIPRAP**  
dry or mortared

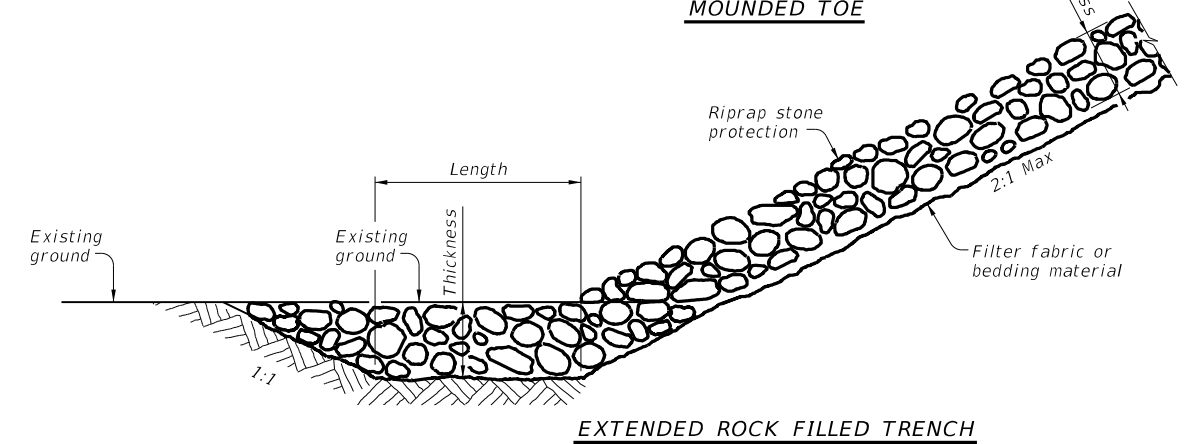


**FIGURE 3 ~ TYPE F STONE RIPRAP**  
grouted

- ② Provide bedding material instead of filter fabric if shown elsewhere in plans. See Layout for thickness of bedding material.
- ③ Minimum toe depth is the larger of the maximum scour depth or 2 times the riprap thickness.
- ④ "Y" and Height need to be defined. See layout or detail sheet for values if this option is used.
- ⑤ List Stone Protection as size (XX inch) and thickness (YY inch) on the layout.  
Example: Riprap (Stone Protection) XX inch, Thickness = YY inch.

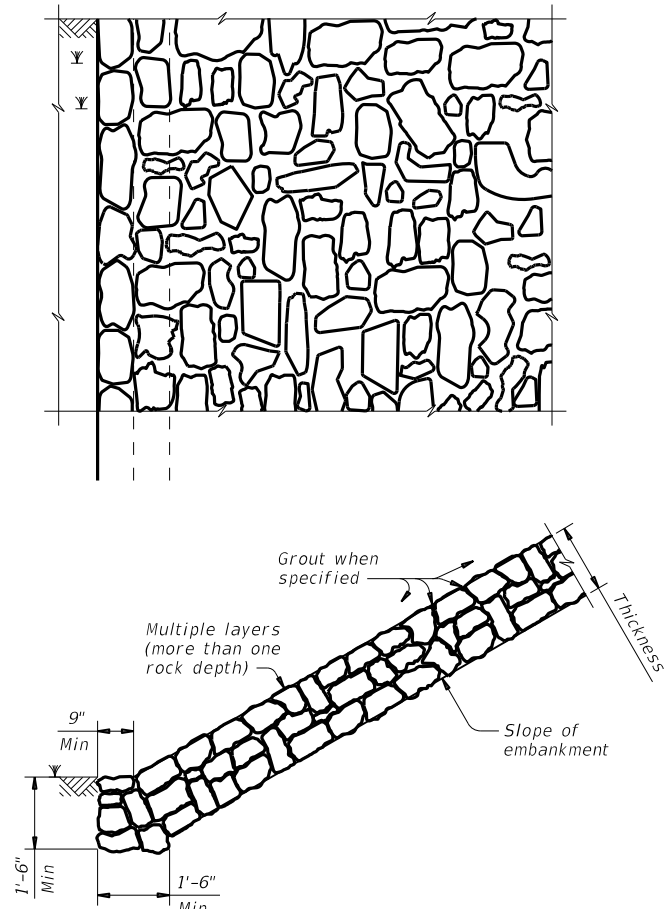


**MOUNDED TOE**

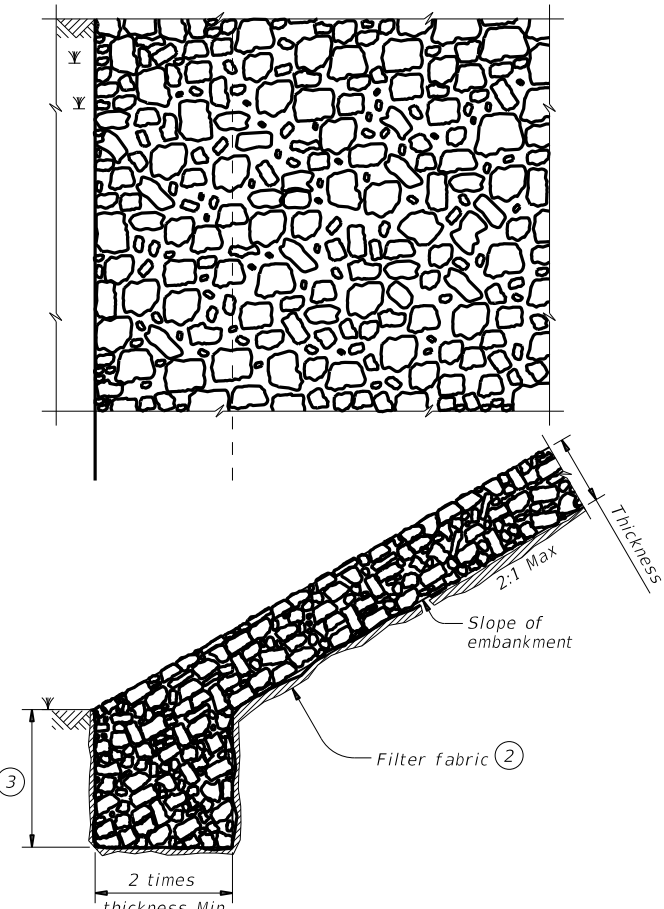


**EXTENDED ROCK FILLED TRENCH**

**PROTECTION STONE RIPRAP TOE OPTIONS ⑤**



**FIGURE 4 ~ COMMON STONE RIPRAP**  
dry or grouted



**FIGURE 5 ~ PROTECTION STONE RIPRAP ⑤**

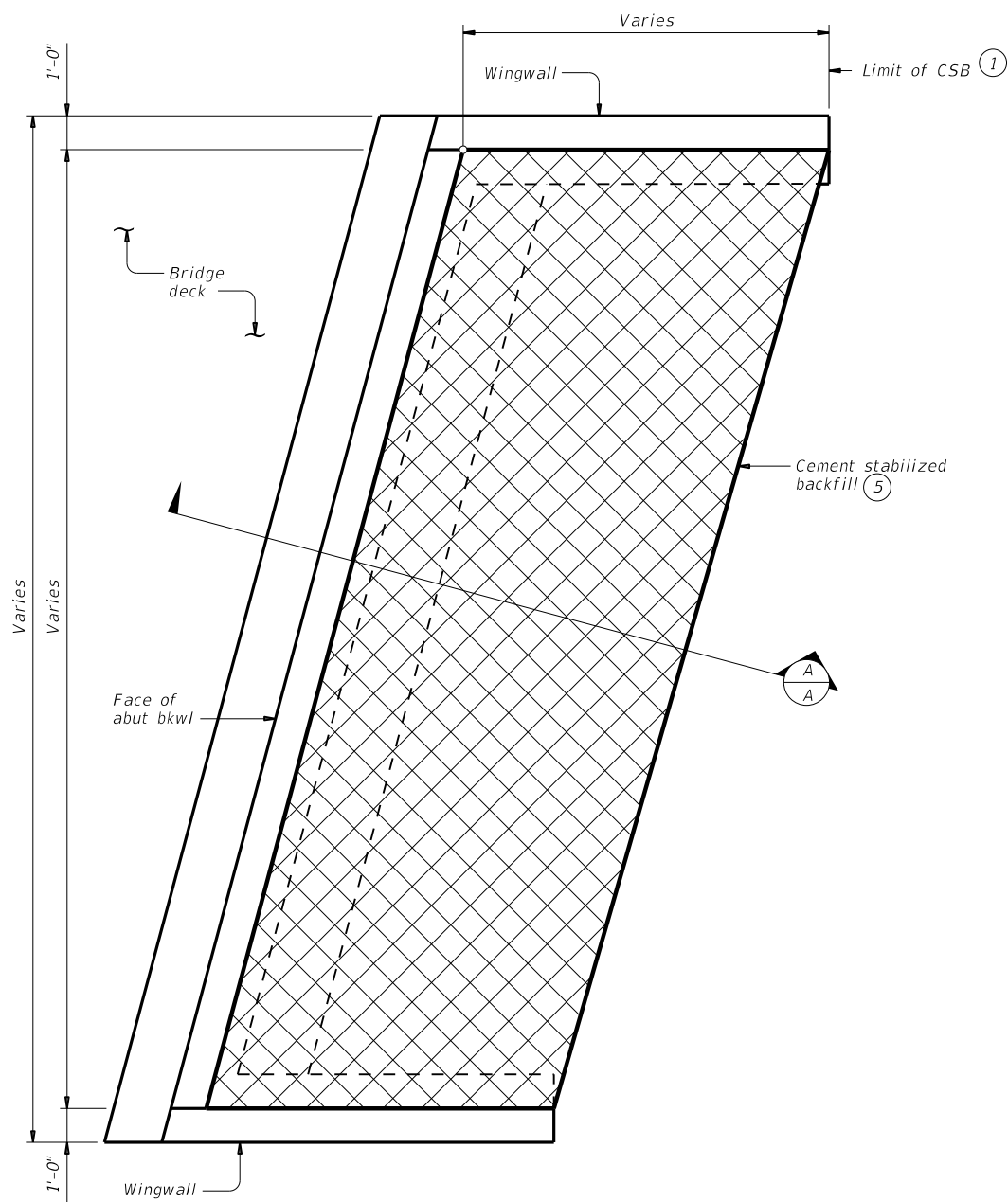
**STONE RIPRAP**

**SRR**

FILE: srrside1-19.dgn	DN: AES	CK: JGD	DW: BWH	CK: AES
©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	1780	01	009	FM 1047
	DIST	COUNTY	SHEET NO.	
	BWD	MILLS	84	

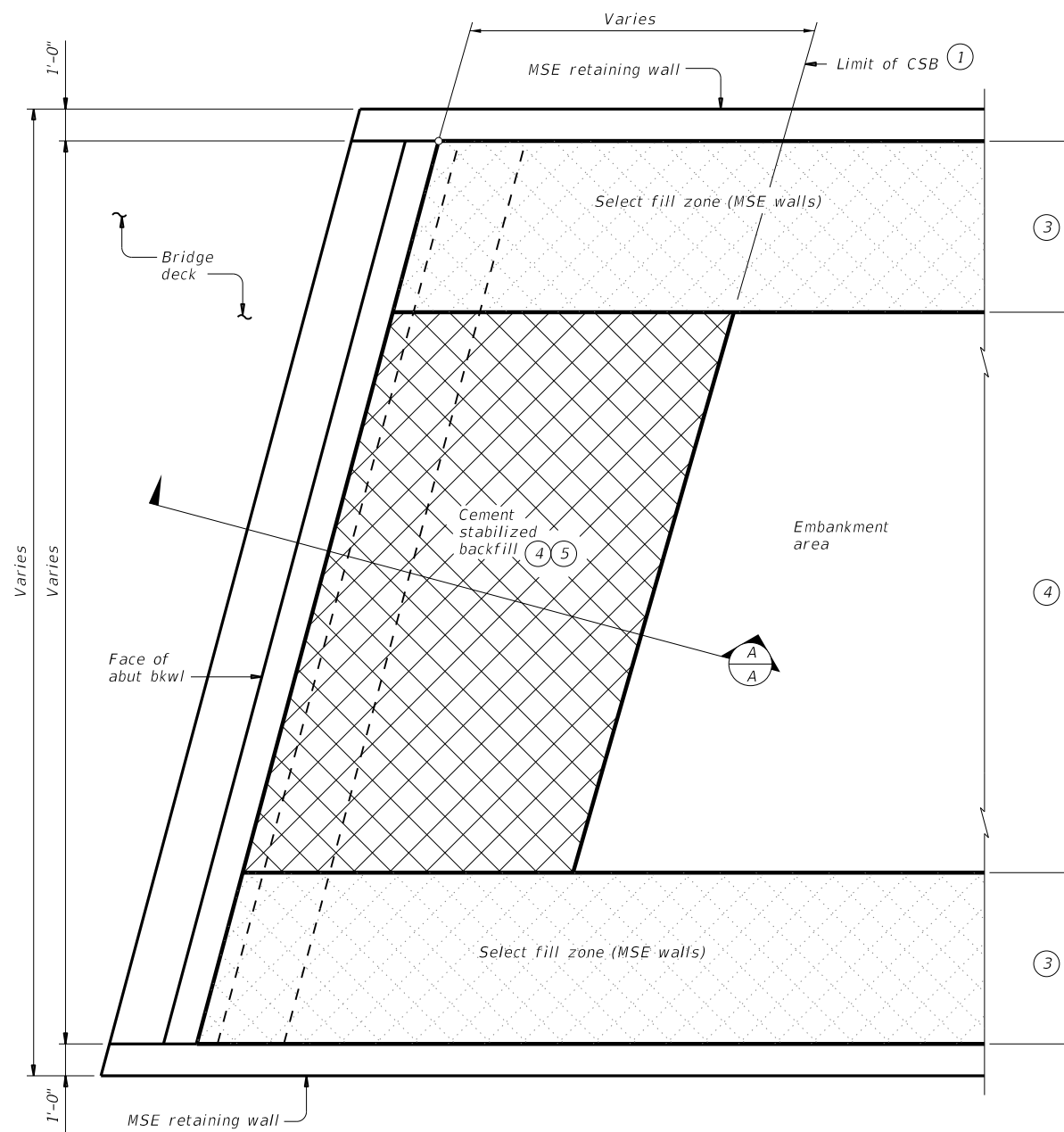
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DATE: 1/11/2022 10:49:20 AM  
 FILE: T:\BWDSDTEAM\Design Projects\Mi11s\1780-01-009 FM 1047 Bennett Branch\Standards\CSAB.dgn



**OPTION 1 ~ PLAN WITH WINGWALLS**

Cast-in-place retaining walls similar.

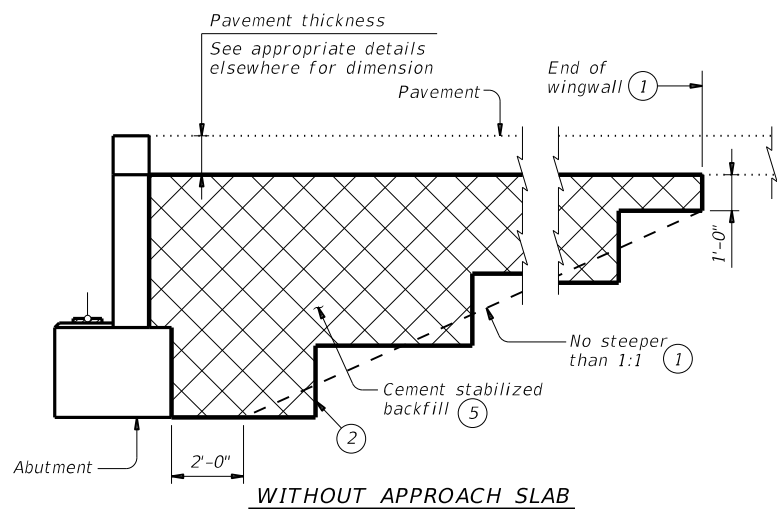


**OPTION 1 ~ PLAN WITH MSE RETAINING WALLS**

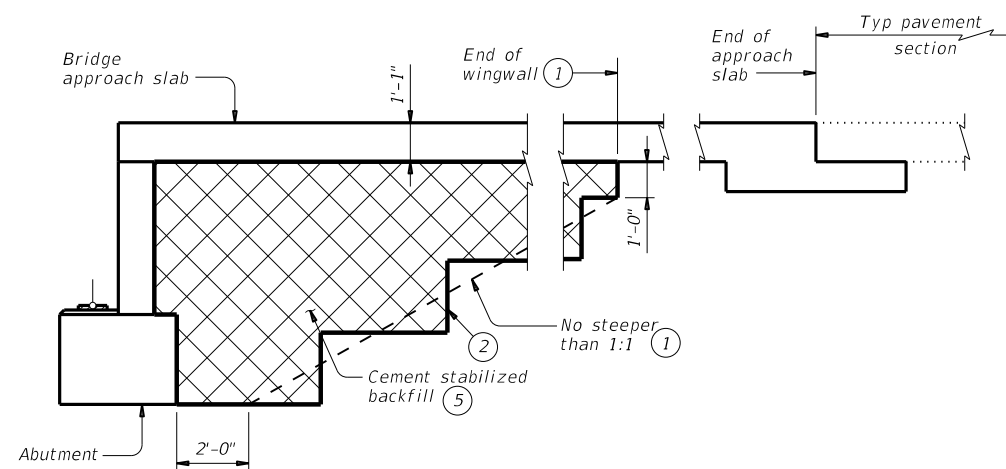
- ① Usual limit of Cement Stabilized Backfill is at end of wingwall. Extend CSB limits as required to maintain a slope no steeper than 1:1 at bottom of backfill.
- ② Bench backfill as shown with 12" (approximate) bench depths.
- ③ Where MSE retaining walls are present, adjust CSB limits to accommodate the select fill zone. See retaining wall details for additional information.
- ④ When distance between select fill zones is less than 5'-0", MSE select fill may be substituted for cement stabilized backfill with approval from the Engineer.
- ⑤ If shown in the plans flowable backfill can be used as a substitute for cement stabilized backfill with the following constraints:
  - a) If flowable backfill is to be placed over MSE backfill then a filter fabric will be placed over the MSE backfill prior to placement of the flowable fill; and
  - b) Place flowable fill in lifts not exceeding 2 feet in height, place each successive lift when the previous lift has stiffened/hardened (i.e. has lost its flowability).

**GENERAL NOTES:**

See the Bridge Layout for selected Option. Option 2 is intended for new construction requiring high plasticity embankment fill with a plasticity index (PI) greater than 30 or pavement built in poor native soil. Poor soils are defined as high plasticity clays or expansive clays. Option 1 is intended for construction only requiring PI controlled embankment fill or excavation in competent soils/rocks in order to construct the abutment. Provide Cement Stabilized Backfill (CSB) meeting the requirements of Item 400, "Excavation and Backfill for Structures", to the limits shown at bridge abutments. If required elsewhere in the plans, provide Flowable Backfill meeting the requirements of Item 401, "Flowable Backfill", to the limits shown at bridge abutments. Details are drawn showing left forward skew. See Bridge Layout for actual skew direction. These details do not apply when Concrete Block retaining walls are used in lieu of wingwalls.



**WITHOUT APPROACH SLAB**



**WITH APPROACH SLAB**  
 (Showing BAS-C, BAS-A similar.)

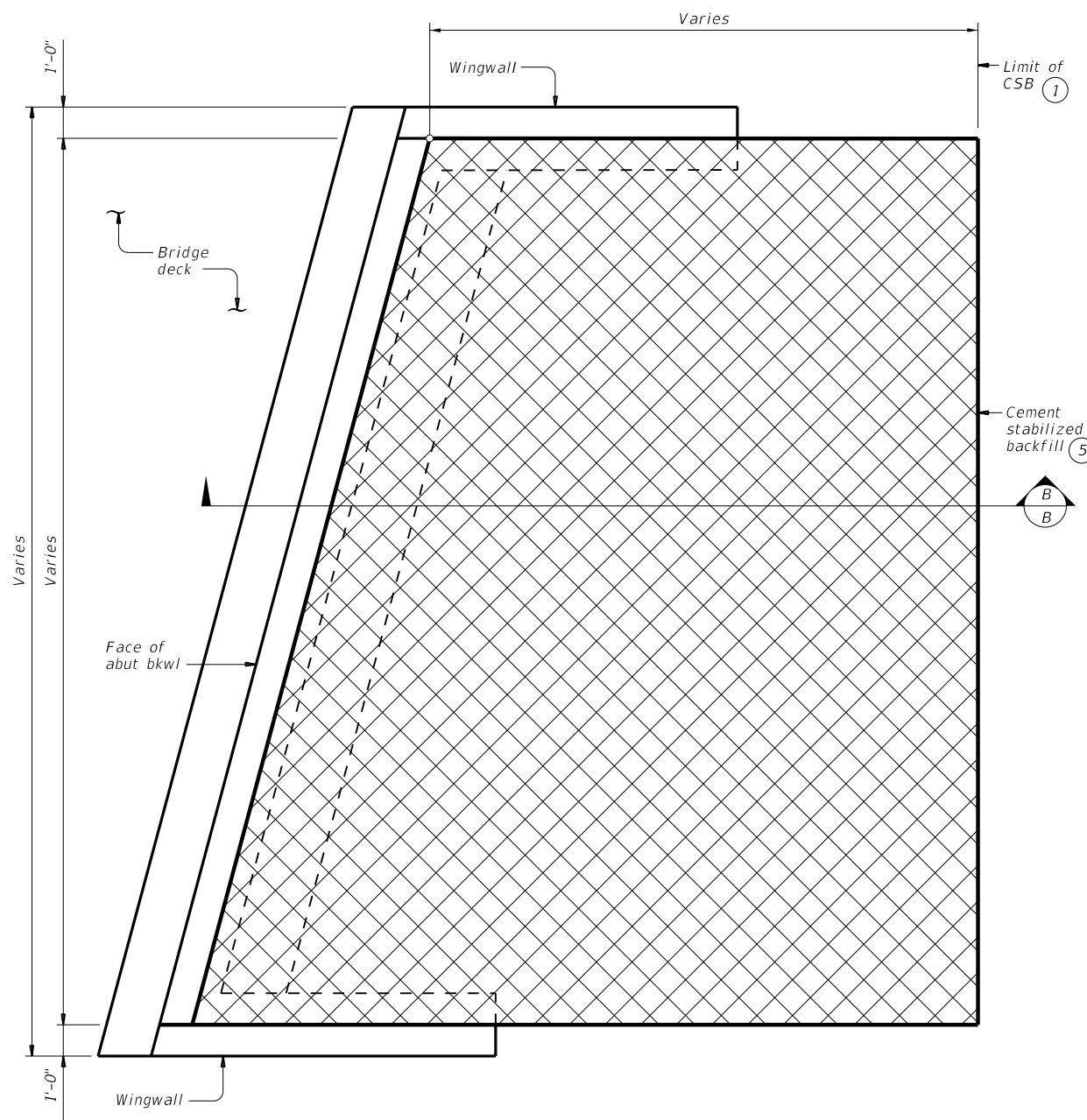
**SECTION A-A**

SHEET 1 OF 2

		<b>Bridge Division Standard</b>	
<b>CEMENT STABILIZED ABUTMENT BACKFILL BRIDGE ABUTMENT</b>			
<b>CSAB</b>			
FILE: csabste1-20.dgn	DN: TxDOT	CK: TxDOT	OW: TxDOT
©TxDOT	REVISIONS	CONTRACT	SECTION
1780	01	009	FM 1047
02-20: Added Option 2.	DIST	COUNTY	SHEET NO.
BWD	MILLS		85

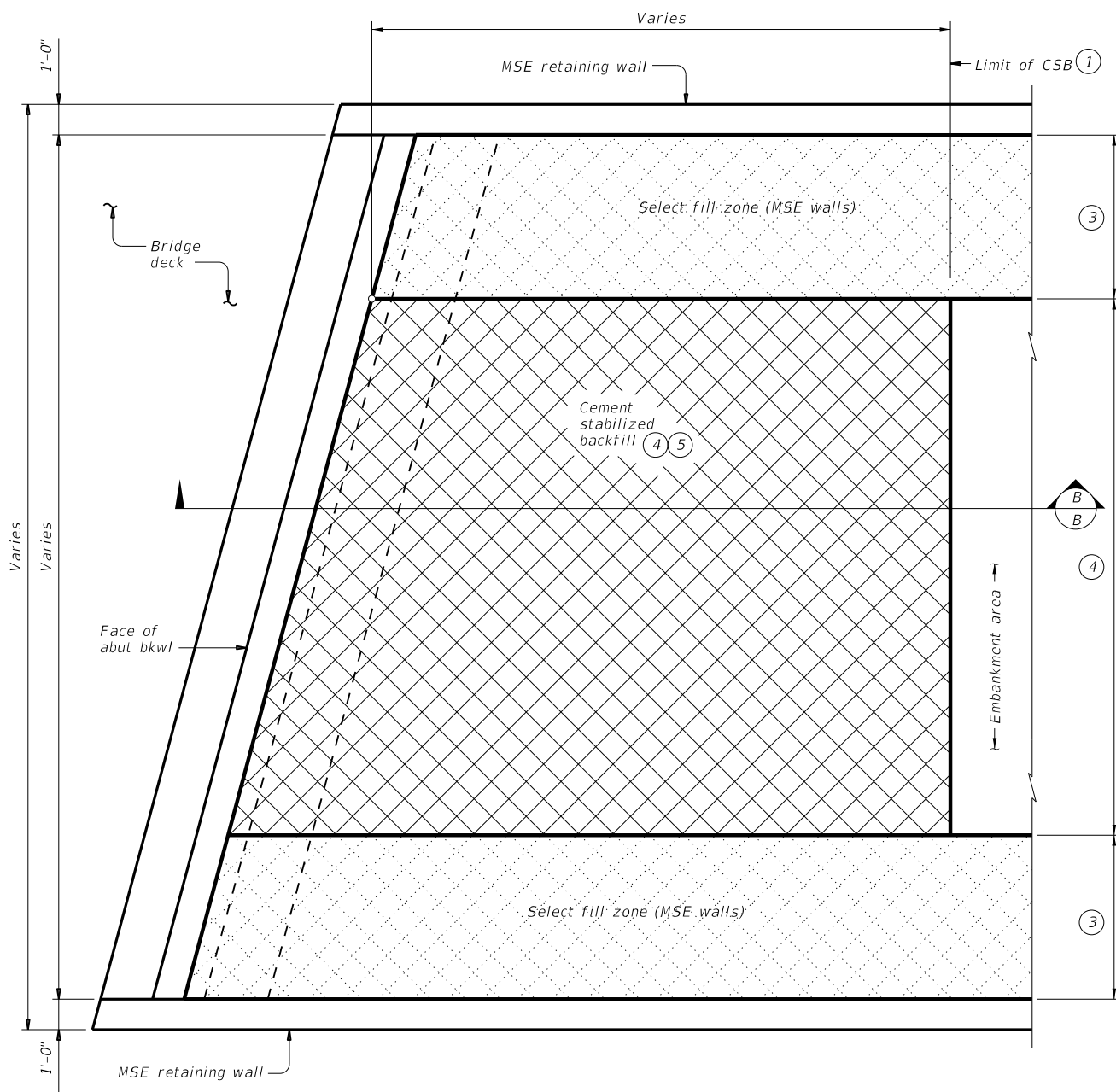
DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of units or for incorrect results or damages resulting from its use.

DATE: 1/11/2022 10:49:21 AM  
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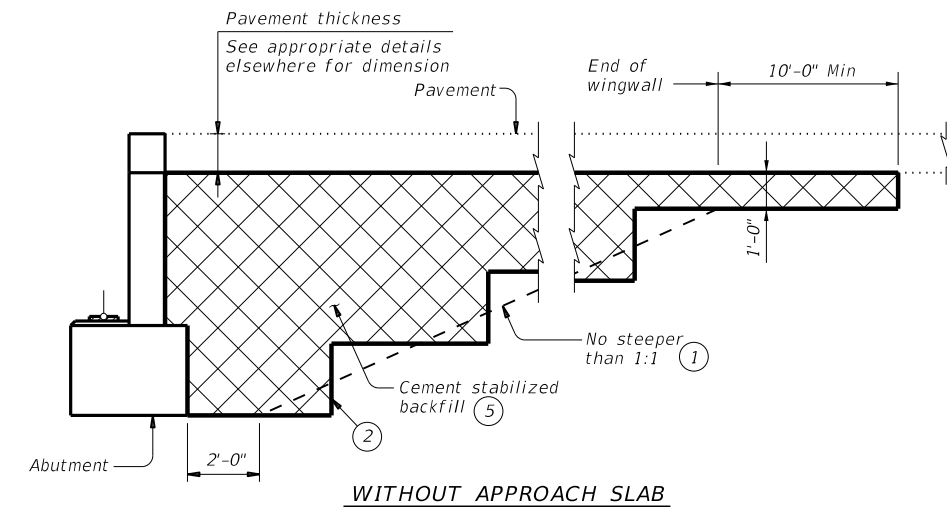
**OPTION 2 ~ PLAN WITH WINGWALLS**

Cast-in-place retaining walls similar.

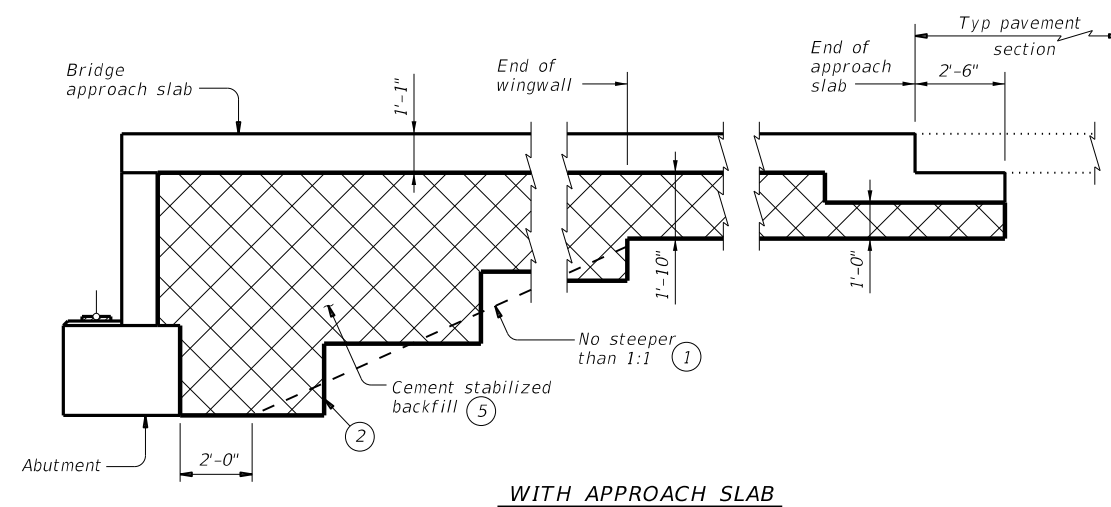


**OPTION 2 ~ PLAN WITH MSE RETAINING WALLS**

- ① Usual limit of Cement Stabilized Backfill is at end of wingwall. Extend CSB limits as required to maintain a slope no steeper than 1:1 at bottom of backfill.
- ② Bench backfill as shown with 12" (approximate) bench depths.
- ③ Where MSE retaining walls are present, adjust CSB limits to accommodate the select fill zone. See retaining wall details for additional information.
- ④ When distance between select fill zones is less than 5'-0", MSE select fill may be substituted for cement stabilized backfill with approval from the Engineer.
- ⑤ If shown in the plans flowable backfill can be used as a substitute for cement stabilized backfill with the following constraints:
  - a). If flowable backfill is to be placed over MSE backfill then a filter fabric will be placed over the MSE backfill prior to placement of the flowable fill; and
  - b). Place flowable fill in lifts not exceeding 2 feet in height, place each successive lift when the previous lift has stiffened/hardened (i.e. has lost its flowability).



**WITHOUT APPROACH SLAB**



**SECTION B-B**

**WITH APPROACH SLAB**  
 (Showing BAS-C, BAS-A similar.)

SHEET 2 OF 2



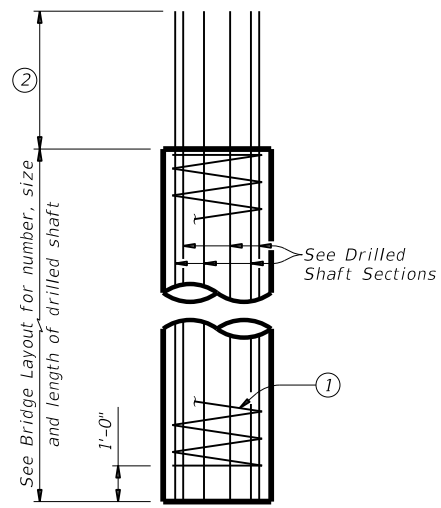
**CEMENT STABILIZED  
 ABUTMENT BACKFILL  
 BRIDGE ABUTMENT**

**CSAB**

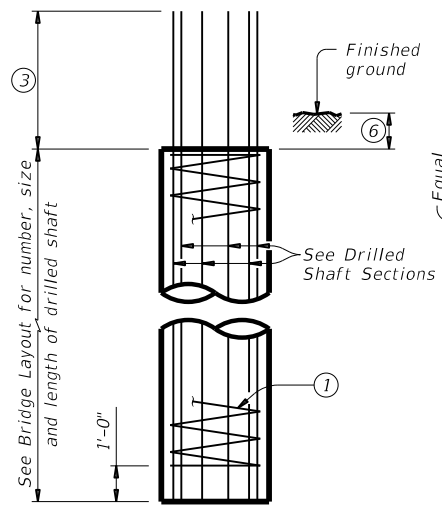
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©TxDOT April 2019	CONTRACT	SECTION	JOB	HIGHWAY
REVISIONS	1780	01	009	FM 1047
02-20: Added Option 2.	DIST	COUNTY	SHEET NO.	
	BWD	MILLS	86	

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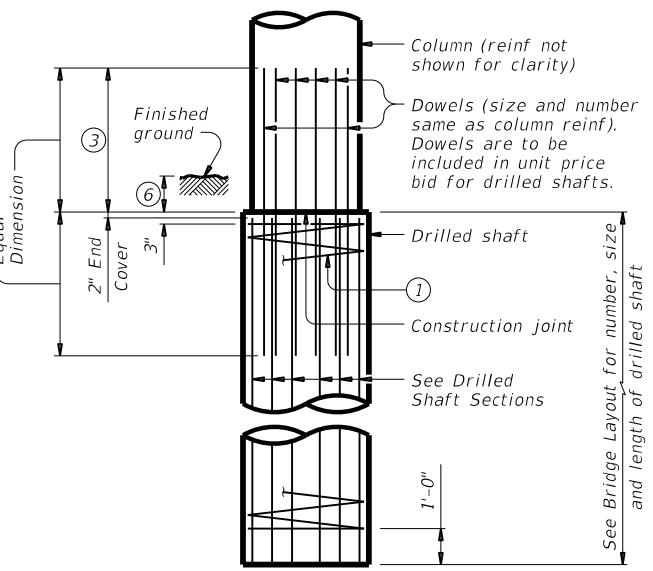
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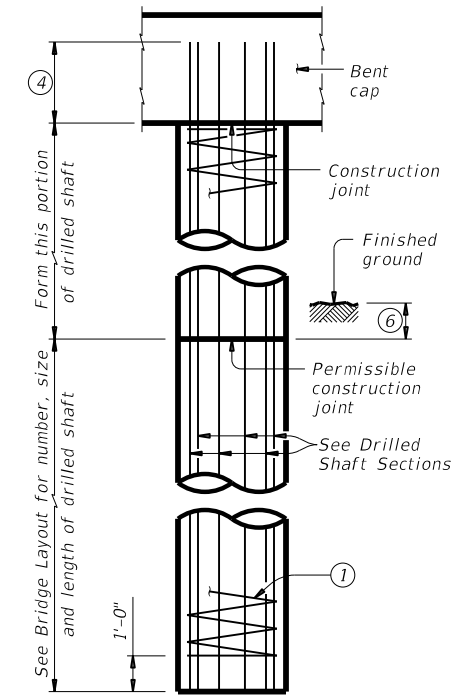
ABUTMENTS, WINGWALLS AND MULTI-DRILLED SHAFT FOOTINGS



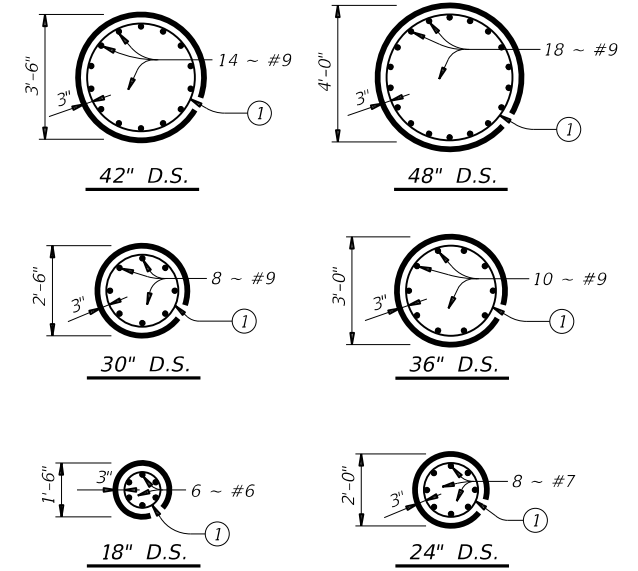
INTERIOR BENTS DRILLED SHAFT DIA EQUAL TO COLUMN DIA



INTERIOR BENTS DRILLED SHAFT DIA GREATER THAN COLUMN DIA



OPTIONAL INTERIOR BENT DRILLED SHAFT DETAIL

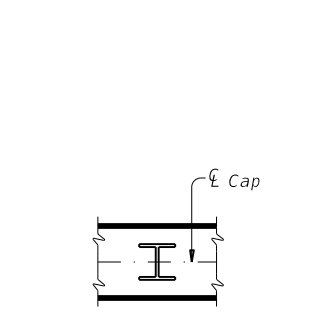


DRILLED SHAFT SECTIONS

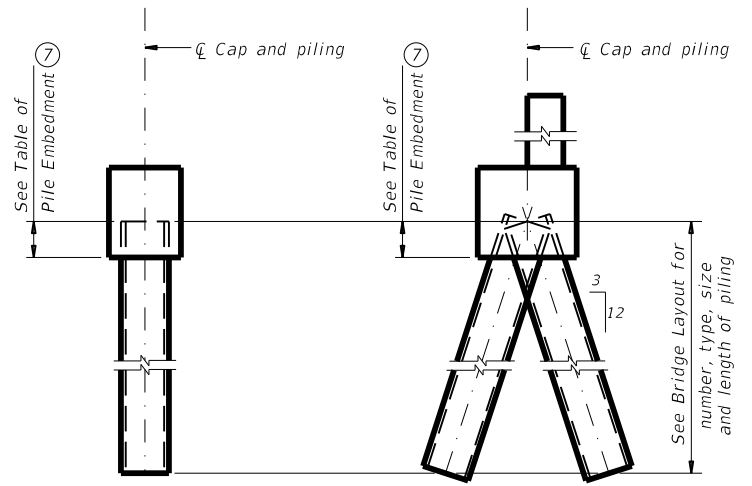
**DRILLED SHAFT DETAILS**

TABLE OF PILE EMBEDMENT	
Pile Type	Embedment Depth (Ft)
16" Sq Concrete 18" Sq Concrete HP14 Steel HP16 Steel	1'-0"
20" Sq Concrete 24" Sq Concrete HP18 Steel	1'-6"

See Prestressed Concrete Piling (CP) standard for additional details on concrete pile embedment.

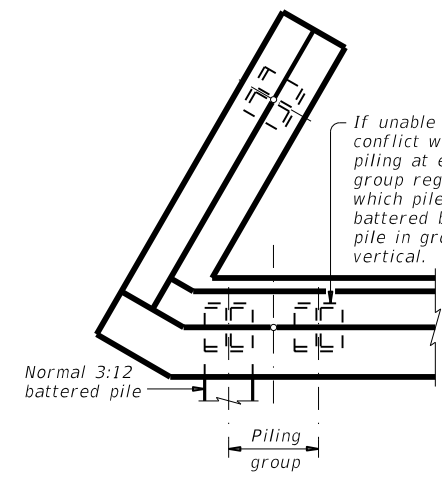


ORIENTATION OF STEEL H-PIILING



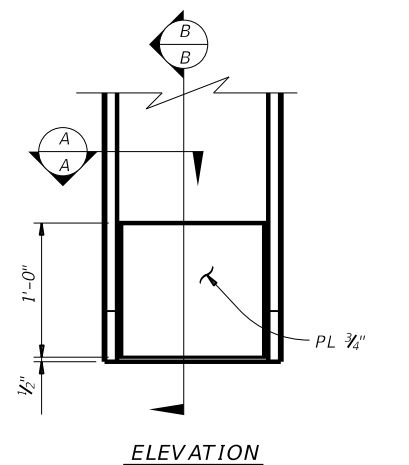
VERTICAL PILE BATTERED PILE

**PIILING DETAILS**  
(Concrete or steel H)

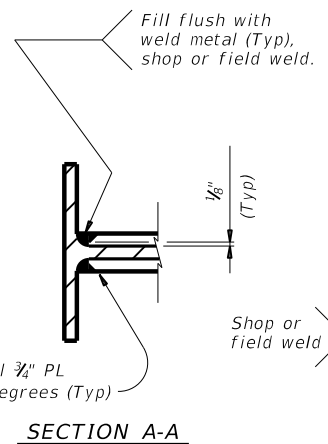


DETAIL "A"  
(Showing plan view of a 30° skewed abutment)

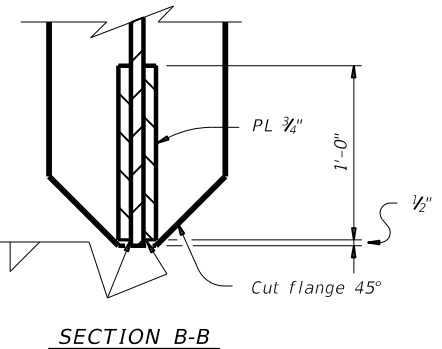
- ① #3 spiral at 6" pitch (one and a half flat turns top and bottom).
- ② Min extension into supported element:  
#6 Bars = 1'-11"  
#7 Bars = 2'-0"  
#9 Bars = 2'-3"
- ③ Min lap with column reinf:  
#7 Bars = 2'-11"  
#9 Bars = 3'-9"  
#11 Bars = 4'-8"
- ④ Min extension into supported element:  
#6 Bars = 1'-11"  
#7 Bars = 2'-3"  
#9 Bars = 2'-9"
- ⑤ Drilled shafts may extend to the bottom of bent caps for "H" heights of 6 ft and less (as shown on the Bridge Layout), if approved. This option can only be used when the drilled shaft diameter equals the column diameter. Obtain approval of the forming method above the ground line prior to construction. No adjustments in payment will be made if this option is used.
- ⑥ 1'-0" Min, unless shown otherwise on plans.
- ⑦ Or as shown on plans.



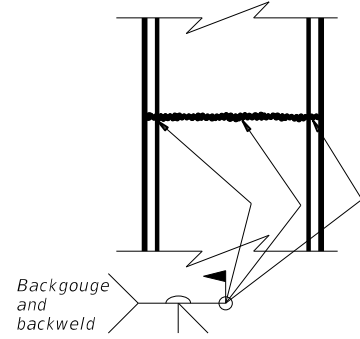
ELEVATION



SECTION A-A



SECTION B-B



SECTION THRU FLANGE OR WEB

**STEEL H-PILE SPLICE DETAIL**

Use when required.

**STEEL H-PILE TIP REINFORCEMENT**

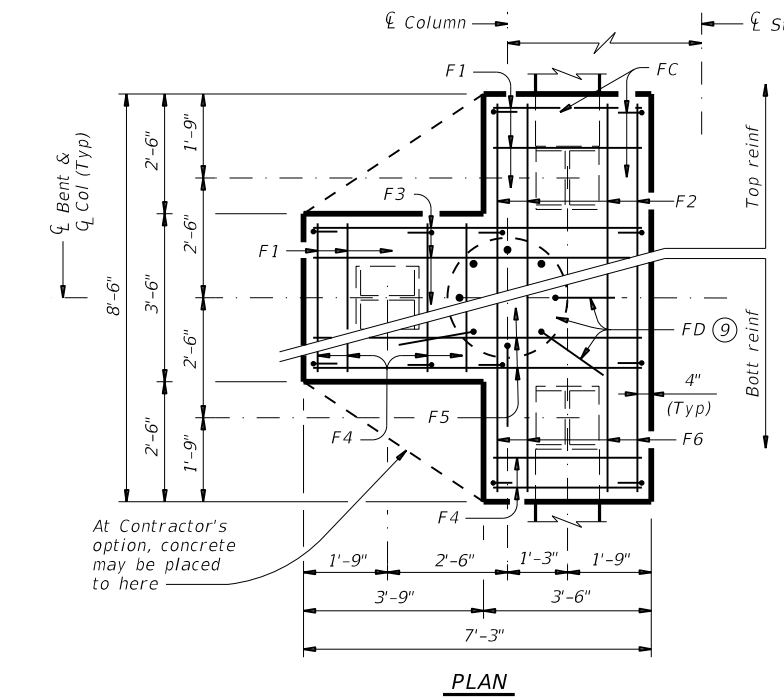
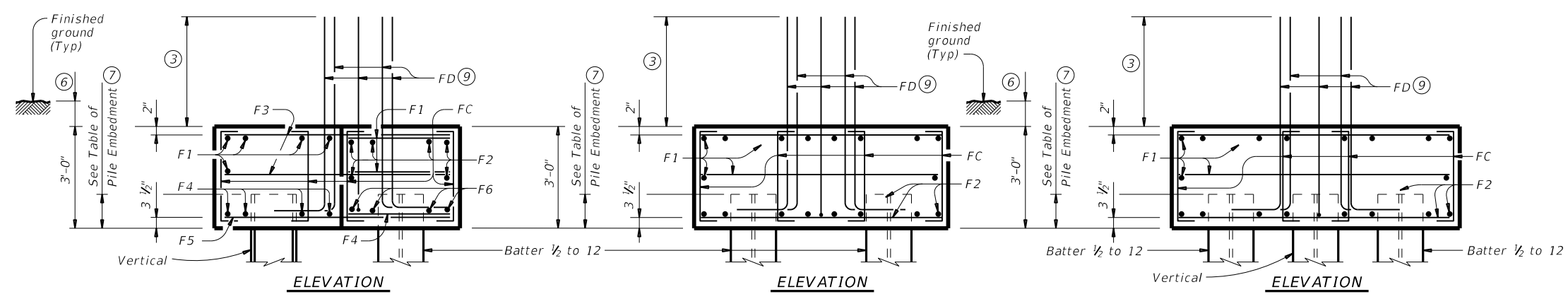
See Item 407 "Steel Piling" to determine when tip reinforcement is required and for options to the details shown.

SHEET 1 OF 2

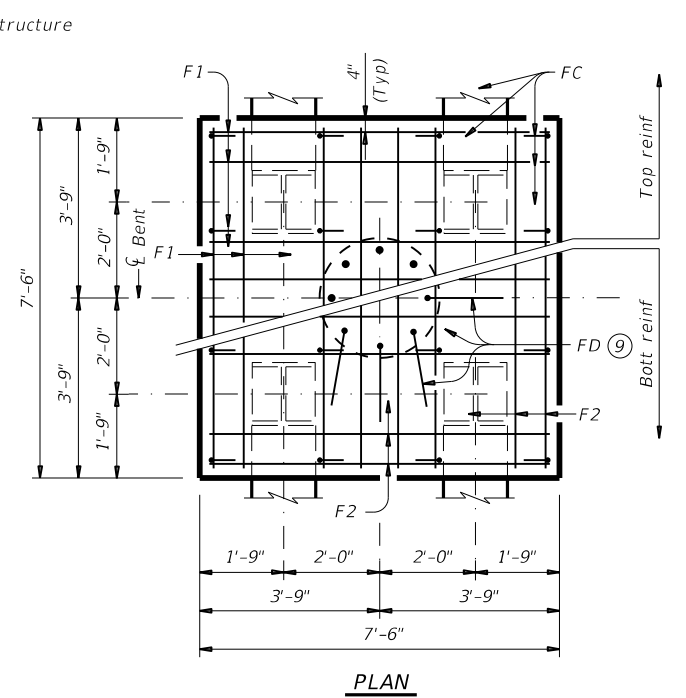
		<b>Bridge Division Standard</b>	
<b>COMMON FOUNDATION DETAILS</b>			
<b>FD</b>			
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©TxDOT April 2019	CONTRACT	JOB	HIGHWAY
1780	01	009	FM 1047
DIST		COUNTY	SHEET NO.
BWD		MILLS	87

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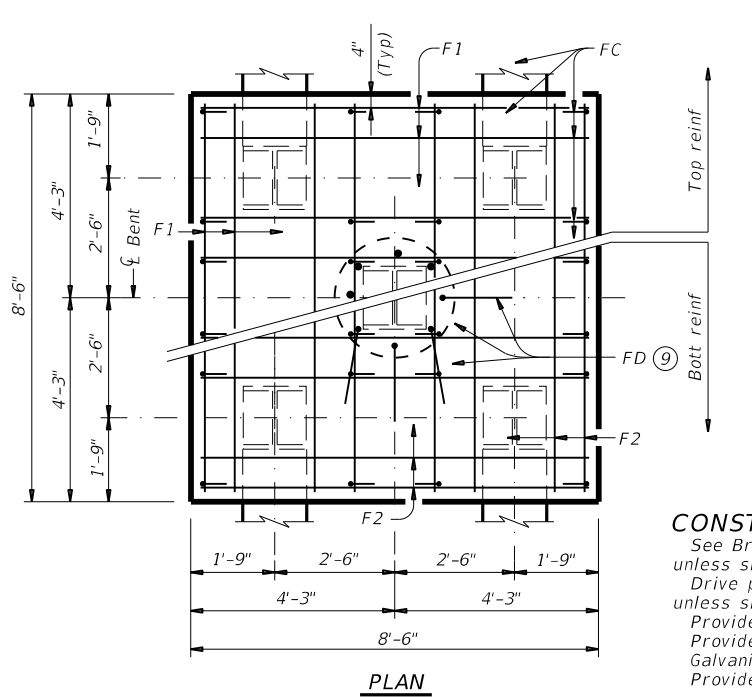
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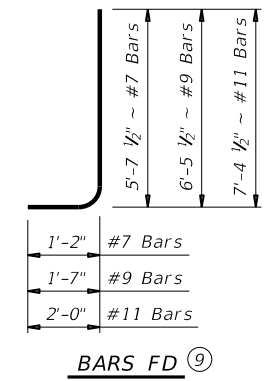
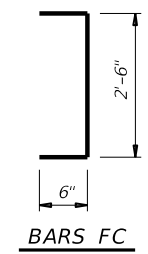
**THREE PILE FOOTING<sup>⑧</sup>**  
 For 36" Dia and smaller columns.



**FOUR PILE FOOTING<sup>⑧</sup>**  
 For 42" Dia and smaller columns.



**FIVE PILE FOOTING<sup>⑧</sup>**  
 For 42" Dia and smaller columns.



- ③ Min lap with column reinforcing:  
 #7 Bars = 2'-11"  
 #9 Bars = 3'-9"  
 #11 Bars = 4'-8"
- ⑥ 1'-0" Min, unless shown otherwise on plans.
- ⑦ Or as shown on plans.
- ⑧ See Bridge Layout for type, size and length of piling.
- ⑨ Number and size of FD bars must match column reinforcing. Tie FD bars to the top of the bottom reinforcing mat.
- ⑩ Adjust FD quantity, size and weight as needed to match column reinforcing.

TABLE OF FOOTING QUANTITIES FOR 30" COLUMNS					
ONE 3 PILE FOOTING					
Bar	No.	Size	Length	Weight	
F1	11	#4	3'- 2"	23	
F2	6	#4	8'- 2"	33	
F3	6	#4	6'- 11"	28	
F4	8	#9	3'- 2"	86	
F5	4	#9	6'- 11"	94	
F6	4	#9	8'- 2"	111	
FC	12	#4	3'- 6"	28	
FD <sup>⑩</sup>	8	#9	8'- 1"	220	
Reinforcing Steel				Lb	623
Class "C" Concrete				CY	4.8
ONE 4 PILE FOOTING					
Bar	No.	Size	Length	Weight	
F1	20	#4	7'- 2"	96	
F2	16	#8	7'- 2"	306	
FC	16	#4	3'- 6"	37	
FD <sup>⑩</sup>	8	#9	8'- 1"	220	
Reinforcing Steel				Lb	659
Class "C" Concrete				CY	6.3
ONE 5 PILE FOOTING					
Bar	No.	Size	Length	Weight	
F1	20	#4	8'- 2"	109	
F2	16	#9	8'- 2"	444	
FC	24	#4	3'- 6"	56	
FD <sup>⑩</sup>	8	#9	8'- 1"	220	
Reinforcing Steel				Lb	829
Class "C" Concrete				CY	8.0

**CONSTRUCTION NOTES:**  
 See Bridge Layout for foundation type required. Use these foundation details unless shown otherwise.  
 Drive piling under abutment wingwalls to a minimum resistance of 10 Tons/Pile unless shown otherwise.  
 Provide Class C Concrete ( $f'_c = 3,600$  psi), unless shown otherwise.  
 Provide Grade 60 reinforcing steel.  
 Galvanize reinforcing if shown elsewhere in the plans.  
 Provide bar laps for drilled shaft reinforcing, where required, as follows:  
 Uncoated or galvanized (#6) ~ 2'-6"  
 Uncoated or galvanized (#7) ~ 2'-11"  
 Uncoated or galvanized (#9) ~ 3'-9"

**GENERAL NOTES:**  
 Designed according to AASHTO LRFD Bridge Design Specifications.  
 Cover dimensions are clear dimensions, unless noted otherwise.  
 Reinforcing bar dimensions shown are out-to-out of bar.

**DESIGNER NOTES:**  
 Do not use the drilled shaft details shown on this standard for retaining wall, noise wall, barrier, or sign foundations without structural evaluation.  
 Do not use the footings shown on this standard in direct contact with salt water or exposed to salt water spray.  
 Maximum allowable pile loads for the footings shown are:  
 72 Tons/Pile with 24" Dia Columns  
 80 Tons/Pile with 30" Dia Columns  
 100 Tons/Pile with 36" Dia Columns  
 120 Tons/Pile with 42" Dia Columns



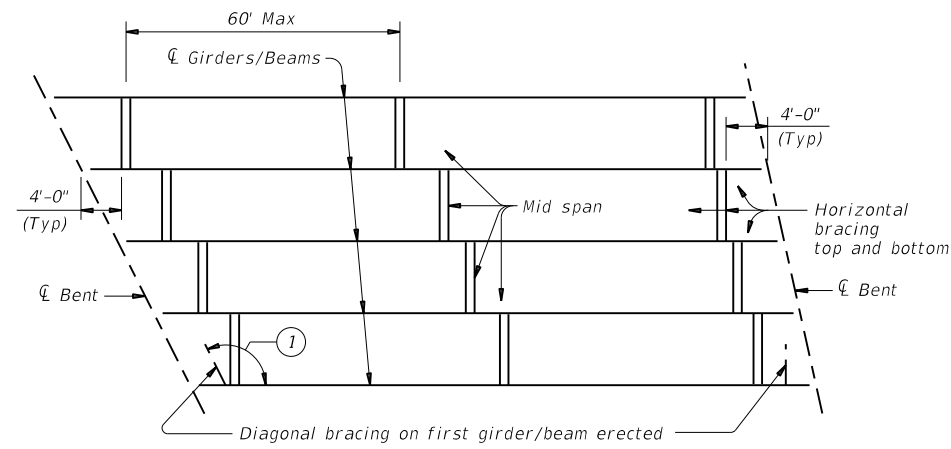
**COMMON FOUNDATION DETAILS**

FD

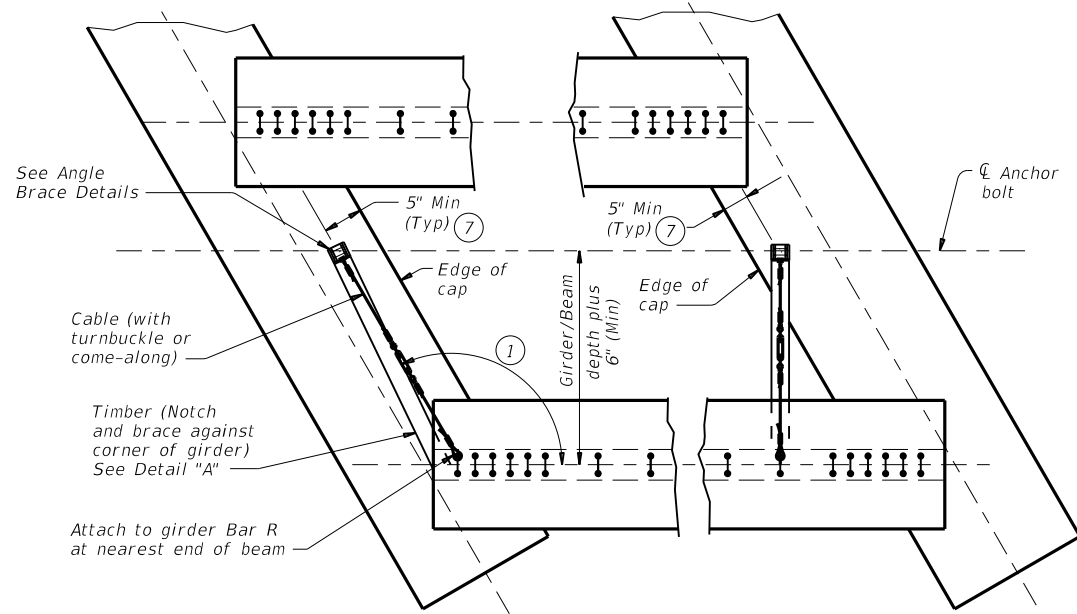
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©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	1780	001	009	FM 1047
01-20: Added #11 bars to the FD bars.	DIST	COUNTY	SHEET NO.	
	BWD	MILLS	88	

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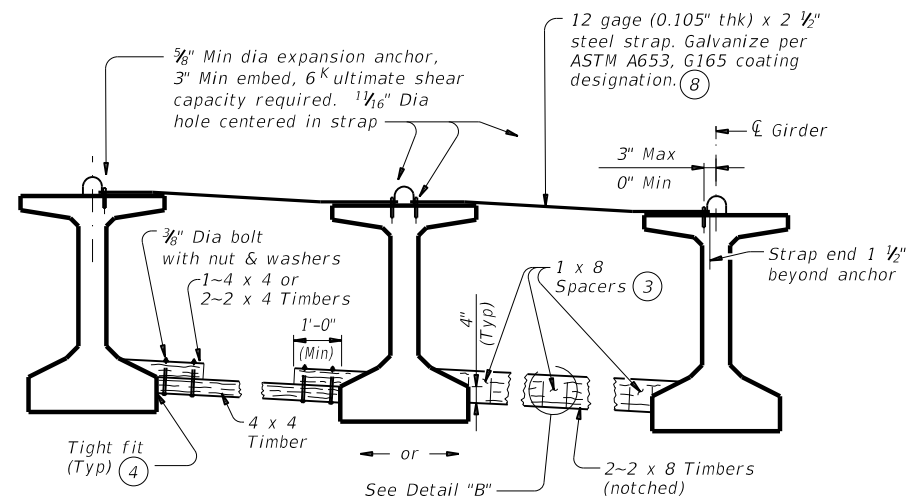
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**ERECTION BRACING**

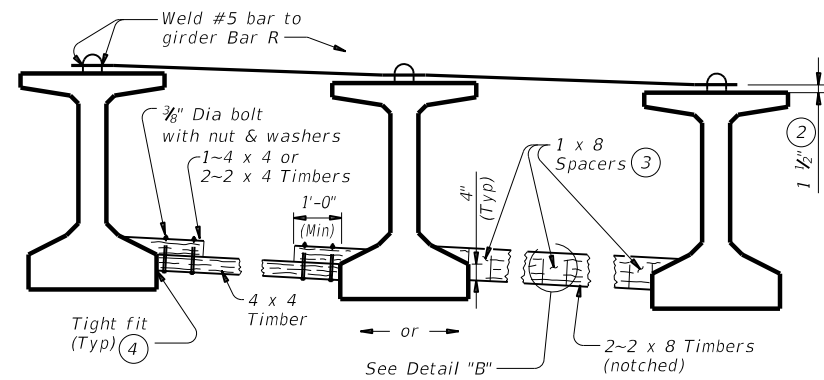


**PLAN**



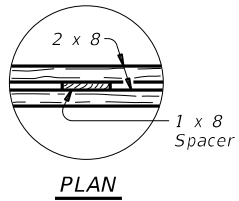
**FOR ERECTION BRACING, OPTION 1**

(This option is not allowed when slab is formed with PMDF or plywood.)

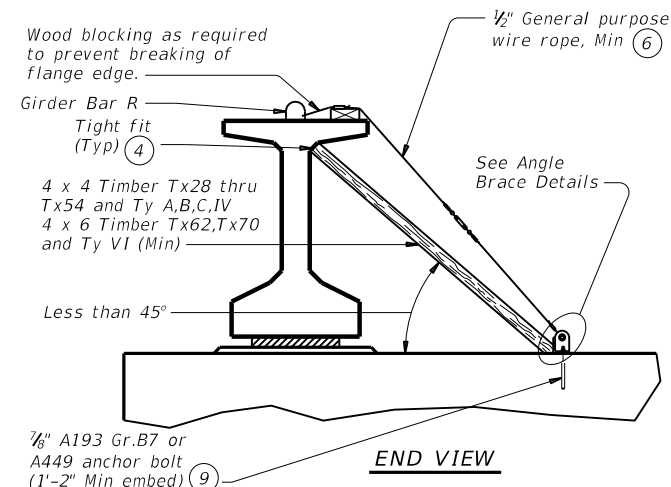


**FOR ERECTION BRACING, OPTION 2**

**HORIZONTAL BRACING DETAILS**



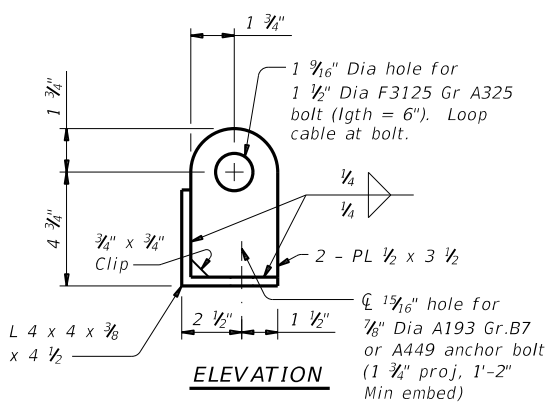
**PLAN**  
**DETAIL "B"**



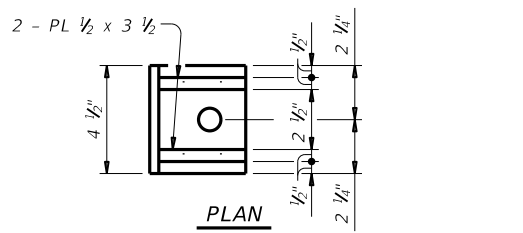
**END VIEW**

**DIAGONAL BRACING DETAILS**

(To be used on both ends of the first girder/beam erected in the span in each phase.)



**ELEVATION**



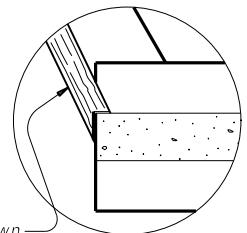
**PLAN**

**ANGLE BRACE DETAILS**

**HAULING & ERECTION:**  
 The Contractor's attention is directed to the possible lateral instability of prestressed concrete girders and beams over 130' long, especially during hauling and erection. The use of the following methods to improve stability is encouraged: Locate lifting devices at the maximum practical distance from girder ends; use external lateral stiffening devices during hauling and erection; lift with vertical lines using two machines; and take care in handling to minimize inertial and impact forces.

**ERECTION BRACING:**  
 Erection bracing details shown are considered the minimum for fulfilling the bracing requirements of Item 425. Required erection bracing must be placed immediately after erection of each girder and remain in place until additional bracing as required for slab placement is in place. This standard is needed in all cases to meet requirements for Slab Placement Bracing.

**PHASED CONSTRUCTION:**  
 Place erection and slab placement bracing for all girders in a phase as shown in these details. For phases after first, also place erection and slab placement bracing between outer girder of completed phase and adjacent girder of current phase. When the phase construction joint is between girders, top bracing can be omitted.



**DETAIL "A"**

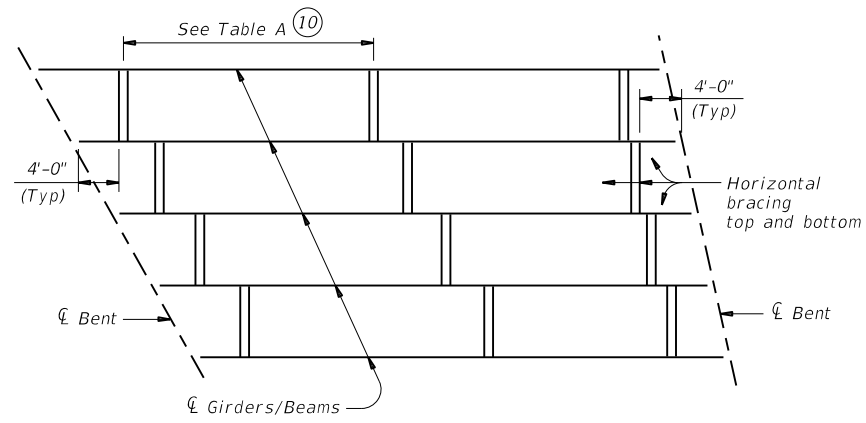
- ① If angle shown exceeds 120 degrees, move diagonal brace to other side of girder/beam and place square to girder/beam. This may prevent exterior girder from being erected first.
- ② Place and weld #5 bars as shown during erection. If forming deck with prestressed panels, bars can be temporarily removed, one at a time, during panel erection. Re-install bar prior to additional panel erection. Bars can rest on panels and be bent down and welded to girder Bars R (See Sheet 2 of 2).
- ③ Clear distance between spacers must not exceed 3'. Nail together with 16d nails.
- ④ Use wedges as necessary to obtain tight fit. Nail wedges to timbers.
- ⑤ Pressure treated landscape timbers can not be used.
- ⑥ All hardware used with cable must be able to develop a minimum 25 kips breaking strength. Use thimbles at all loops in cable. Install cable clamps with saddles bearing against the live end and U-bolts bearing against the dead end.
- ⑦ It is acceptable to tie anchor bolts to cap reinforcement.
- ⑧ Prior to installing, field bend strap to lay flush on both girders' top flange and slope between flange tips.
- ⑨ Anchor bolt may be drilled and epoxied in place. Provide 25k minimum pullout. Core drill hole.

SHEET 1 OF 2

		<b>Bridge Division Standard</b>	
<b>MINIMUM ERECTION AND BRACING REQUIREMENTS PRESTRESSED CONCRETE I-GIRDERS AND I-BEAMS</b>			
<b>MEBR(C)</b>			
FILE: mebcsts1-17.dgn	DN: TxDOT	CK: TxDOT	OW: TxDOT
©TxDOT August 2017	CONTRACT NO. 1780 01	SECTION NO. 009	HIGHWAY NO. FM 1047
REVISIONS	DIST. BWD	COUNTY. MILLS	SHEET NO. 89

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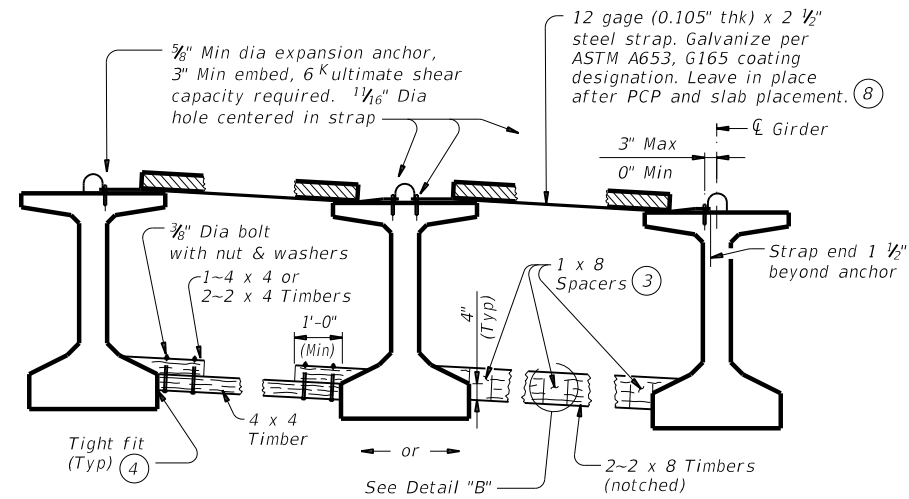


**SLAB PLACEMENT BRACING**

TABLE A		
OPTION 1-RIGID BRACING (STEEL STRAP)		
Girder or Beam Type	Maximum Bracing Spacing	
	Slab Overhang less than 4'-0" (11)	Slab Overhang 4'-0" and greater (11)
Tx28	1/4 points	1/4 points
Tx34	1/4 points	1/4 points
Tx40	1/4 points	1/8 points
Tx46	1/4 points	1/8 points
Tx54	1/4 points	1/8 points
Tx62	1/4 points	1/8 points
Tx70	1/4 points	1/8 points
A	1/8 points	1/8 points
B	1/8 points	1/8 points
C	1/8 points	1/8 points
IV	1/4 points	1/8 points
VI	1/4 points	1/8 points

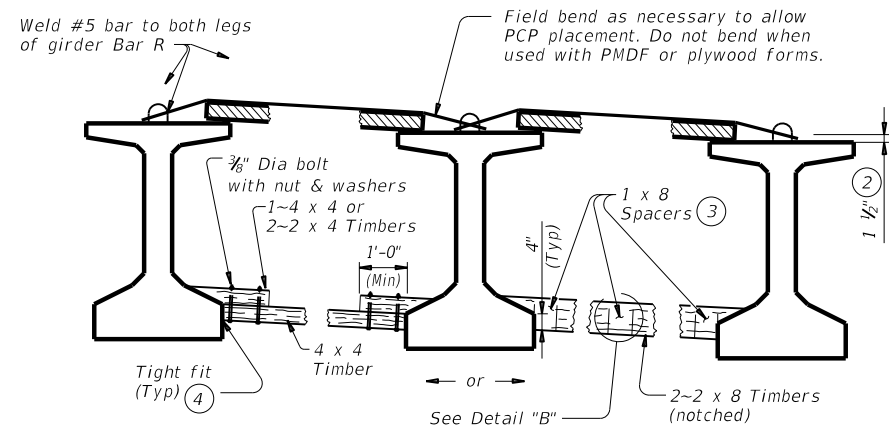
  

OPTION 2-FLEXIBLE BRACING (NO. 5 OVER PCP)		
Girder or Beam Type	Maximum Bracing Spacing	
	Slab Overhang less than 4'-0" (11)	Slab Overhang 4'-0" and greater (11)
Tx28	1/4 points	1/8 points
Tx34	1/4 points	1/8 points
Tx40	1/4 points	1/8 points
Tx46	1/4 points	1/8 points
Tx54	1/4 points	1/8 points
Tx62	1/4 points	1/8 points
Tx70	1/4 points	1/8 points
A	2.0 ft	1.5 ft
B	3.0 ft	2.0 ft
C	4.5 ft	2.0 ft
IV	1/4 points	4.0 ft
VI	1/4 points	4.0 ft



**FOR SLAB PLACEMENT BRACING, OPTION 1 - RIGID**

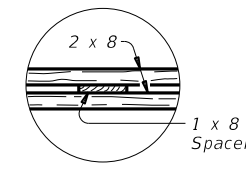
(Showing slab formed with PCP. This option is not allowed when slab is formed with PMDF or plywood.)



**FOR SLAB PLACEMENT BRACING, OPTION 2 - FLEXIBLE**

(Showing slab formed with PCP.)

**HORIZONTAL BRACING DETAILS (5)**



**PLAN  
 DETAIL "B"**

- (2) Place and weld #5 bars as shown during erection. If forming deck with prestressed panels, bars can be temporarily removed, one at a time, during panel erection. Re-install bar prior to additional panel erection. Bars can rest on panels and be bent down and welded to girder Bars R.
- (3) Clear distance between spacers must not exceed 3'. Nail together with 16d nails.
- (4) Use wedges as necessary to obtain tight fit. Nail wedges to timbers.
- (5) Pressure treated landscape timbers can not be used.
- (8) Prior to installing, field bend strap to lay flush on both girders' top flange and slope between flange tips.
- (10) Bracing spacing (1/4 and 1/8 points) measured between first and last typical brace location.
- (11) Measure slab overhang from centerline of girder or beam. When overhang varies in span, determine bracing spacing based on largest overhang.

**SLAB PLACEMENT BRACING:**

The details for slab placement bracing are considered minimum for fulfilling the requirements of Specification Items 422 and 425. Required slab placement bracing must remain in place until slab concrete has attained a compressive strength of 3000 psi.

**GENERAL NOTES:**

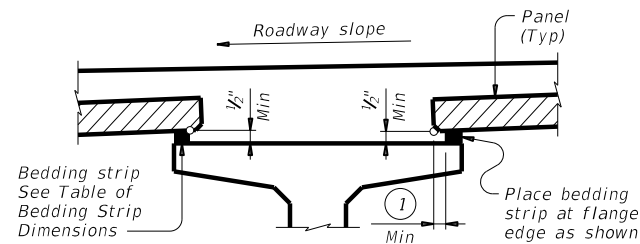
Bracing details for spans longer than 150' are not provided. The Contractor must submit proposed bracing details for such conditions to the Engineer for approval prior to erection. Systems equal to or better than those shown may be used provided details of such systems are submitted to and approved by the Engineer prior to erection. Use of these systems or details does not relieve the Contractor of the responsibility for the adequacy of the bracing and the safety of the structure. Removal of bracing for short periods of time to align girders and beams is permissible. All turn-buckles, come-alongs, anchors and other connections must be capable of developing the full strength of the cable shown. Furnish anchor bolts and nuts in accordance with Item 449, "Anchor Bolts".

SHEET 2 OF 2

		<b>Bridge Division Standard</b>	
<b>MINIMUM ERECTION AND BRACING REQUIREMENTS          PRESTRESSED CONCRETE I-GIRDERS AND I-BEAMS</b>			
<b>MEBR(C)</b>			
FILE: mebcsts1-17.dgn	DN: TxDOT	CK: TxDOT	OW: TxDOT
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	BWD	MILLS	FM 1047
			SHEET NO.
			90

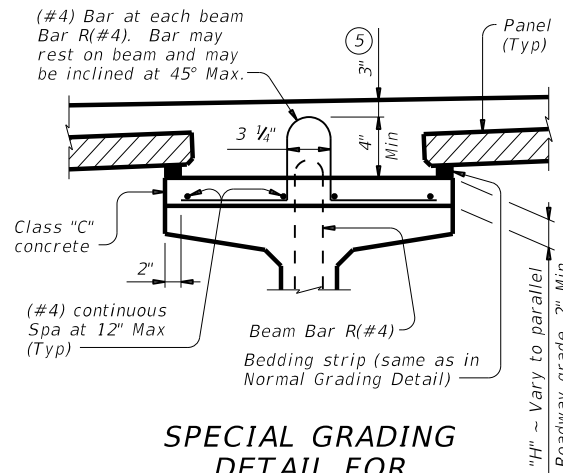


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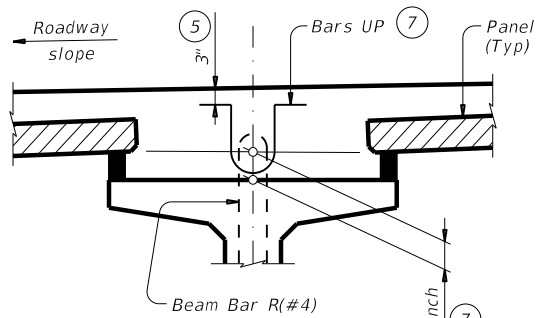
**NORMAL GRADING DETAIL** ③

Showing prestressed concrete I-girders.  
(Other beam types similar)



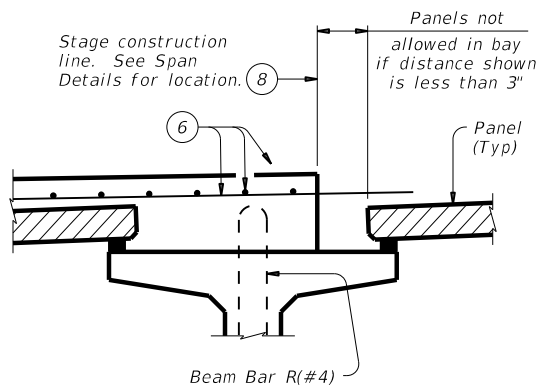
**SPECIAL GRADING DETAIL FOR CONCRETE BEAMS**

Showing prestressed concrete I-girders.  
(Other beam types similar)



**HAUNCH REINFORCING DETAIL**

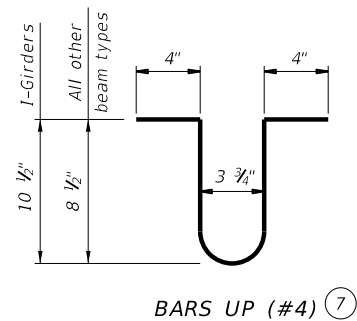
Showing prestressed concrete I-girders.  
(Other beam types similar)



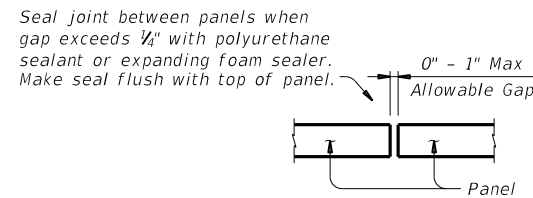
**PRESTR CONC I-GIRDERS**

WIDTH	HEIGHT ④	
	Min	Max
1" (Min)	1/2"	2"
1 1/4"	1/2"	2 1/2"
1 1/2"	1/2"	3"
1 3/4"	1/2"	3 1/2"
2"	1/2"	4"
2 1/4"	1/2"	4 1/2" ②
2 1/2"	1/2"	5" ②
2 3/4"	1/2"	5 1/2" ②
3" (Max)	1/2"	6" ②

- ① 2" Min for I-girders, 1 1/2" Min for all other beam types.
- ② Allowed for I-girders, not allowed on other beam types.
- ③ To reduce the quantity of cast-in-place concrete, bedding strip thickness may be increased in 1/4" increments. Bedding strips must be comprised of one layer. Bond bedding strips to the beams with an adhesive compatible with bedding strips. Bedding strips over 2.5" high may need to be bonded to panels. The same thickness strip must be used under any one panel edge and the maximum change in thickness between adjacent panels is 1/4". Alternatively, bedding strips may be cut to grade. Panels may be supported by an alternate method, using a commercial product, if approved by the Engineer of Bridge Design, Bridge Division. If bedding strips exceed 6" high for I-Girders, 4" high for all other beam types, use Special Grading Detail for Concrete Beams or submit an alternate method to the Bridge Division for approval.
- ④ Height must not exceed twice the width.
- ⑤ Provide clear cover as indicated unless otherwise shown on Span Details.
- ⑥ See Span Details and Thickened Slab End Details for top slab reinforcement and clear cover. Transverse top slab reinforcement may rest on top of prestressed concrete panels if necessary to maintain clear cover.
- ⑦ Space Bars UP(#4) with Beam Bars R(#4) in all areas where measured haunch exceeds 3 1/2" with I-girders, and 3" for all other beam types. Epoxy coating for Bars UP is not required.
- ⑧ Do not locate construction joints on top of a panel.
- ⑨ Butt adjacent bedding strips together with adhesive. Cut v-notches, approx 1/4" deep, in the top of the bedding strips at 8" o.c..

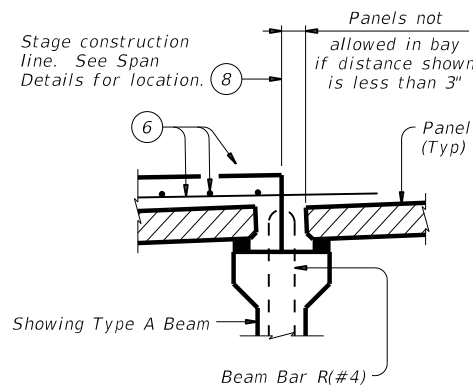


**BARS UP (#4) ⑦**

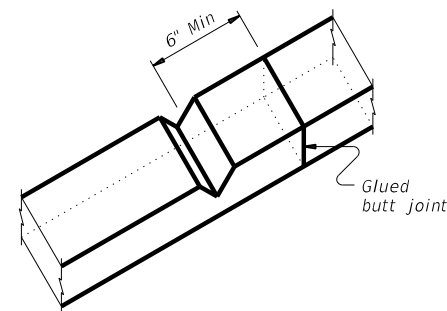


**PANEL JOINTS**

(Panel reinforcing not shown for clarity.  
The gap cannot be considered as a panel fabrication tolerance. Adjust panel placement to minimize joint openings.)



**PRESTR CONC I-BEAMS**



**BEDDING STRIP DETAIL** ⑨

**CONSTRUCTION NOTES:**  
 Erected panels must bear uniformly on bedding strips of extruded polystyrene placed along top flange edges. Placing panels to minimize joint openings is recommended. If additional blocking is needed, special grading details for supporting the panels and extra reinforcing between beam and slab will be considered subsidiary to deck construction. Bars U, shown on PCP-FAB, may be bent over or cut off if necessary. Care must be taken to ensure proper cleaning of construction debris and consolidation of concrete material under the edges of the panels. Bedding strips must be placed at beam flange edges so that adequate space is provided for the mortar to flow a minimum of 1 1/2" under the panels as the slab concrete is placed. To allow the proper amount of mortar to flow between beam and panel, the minimum vertical opening must be at least 1/2". Roadway cross-slope reduces the opening available for entry of the mortar. Bedding strips varying in thickness across the beam are therefore required. For clear span between U-beams less than or equal to 18", see Permissible Slab Forming Detail on Miscellaneous Slab Detail sheets, UBMS.

**MATERIAL NOTES:**  
 Provide Grade 60 reinforcing steel in the cast-in-place slab. See Table of Reinforcing Steel for size and spacing of reinforcement. If the top and bottom layer of reinforcing steel is shown on the Span Details to be epoxy coated, then the D, E, P, & Z bars must be epoxy coated. Provide bar Laps, where required, as follows:  
 Uncoated ~ #4 = 1'-7"  
 Epoxy Coated ~ #4 = 2'-5"

**GENERAL NOTES:**  
 Designed according to AASHTO LRFD Bridge Design Specifications. Panel placement may follow either Option 1 or Option 2 except Option 1 must be used if the skew exceeds 45 degrees. Use of Prestressed Concrete Panels is not permitted for horizontally curved steel top plate or tub girders. See Span Details for other possible restrictions on their use. These details are to be used in conjunction with the Span Details, PCP-FAB and other applicable standard drawings. When panel support (bedding strips) deviates from what is shown herein, provide details signed and sealed by a professional Engineer. Any additional reinforcing or concrete required on this standard is considered subsidiary to the bid item "Reinforced Concrete Slab".

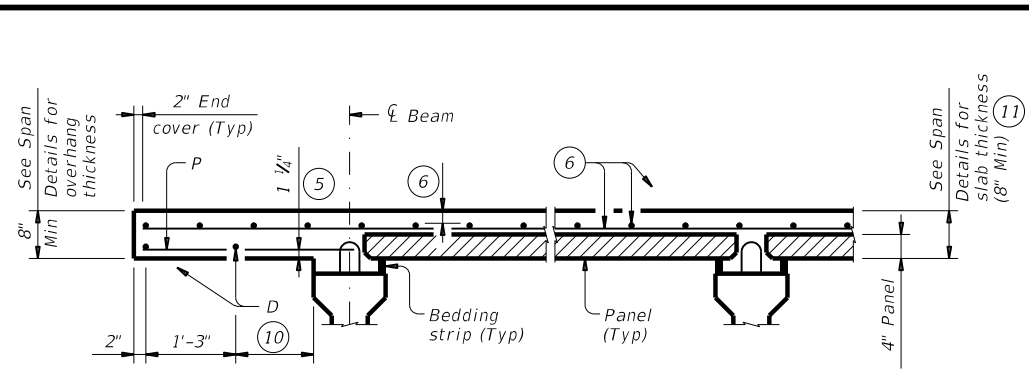
Cover dimensions are clear dimensions, unless noted otherwise.  
 Reinforcing bar dimensions shown are out-to-out of bar.

HL93 LOADING SHEET 1 OF 4

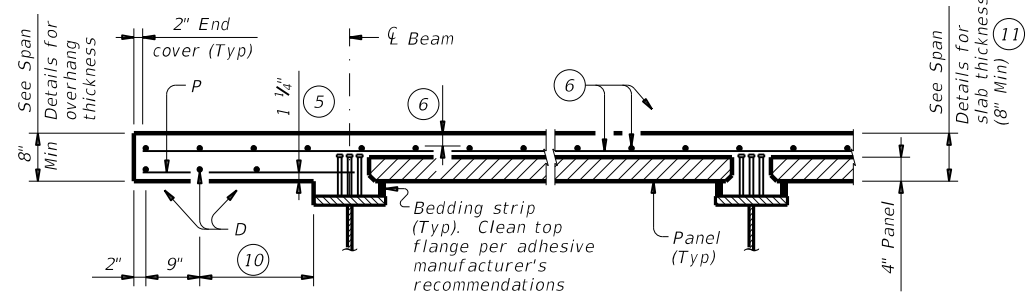
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<b>PRESTRESSED CONCRETE PANELS DECK DETAILS</b>			
<b>PCP</b>			
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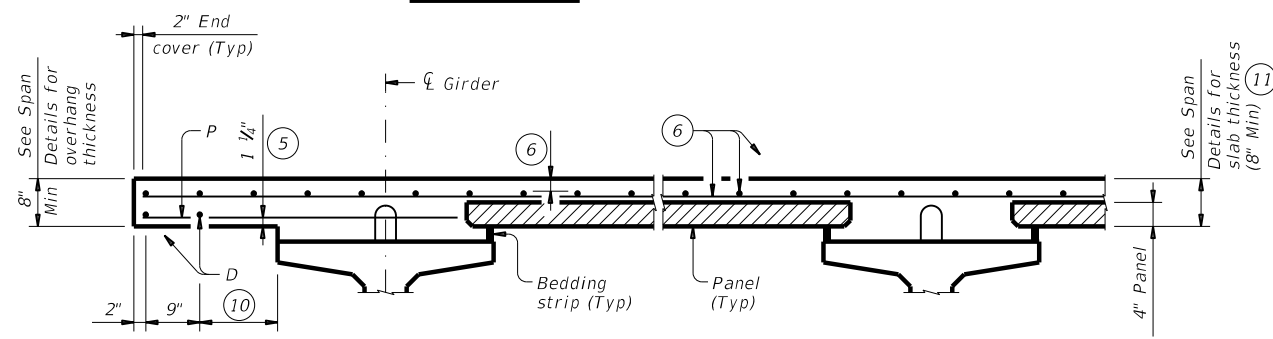
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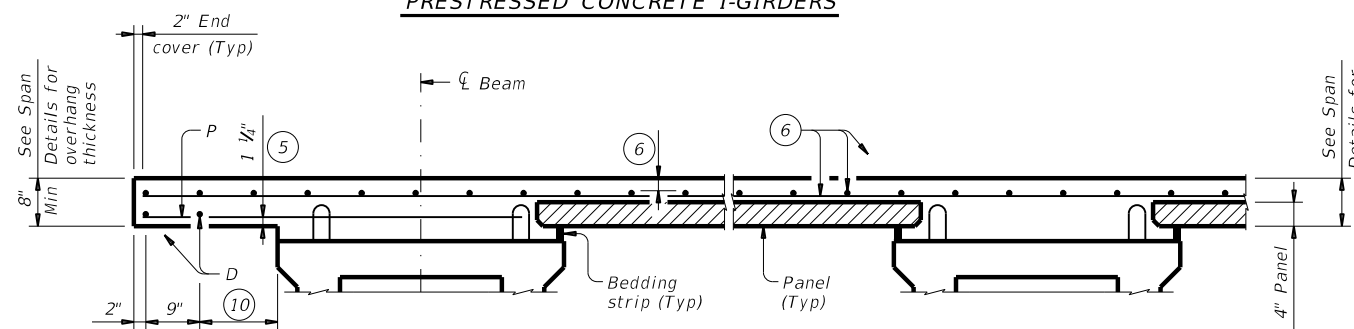
**PRESTRESSED CONCRETE I-BEAMS**



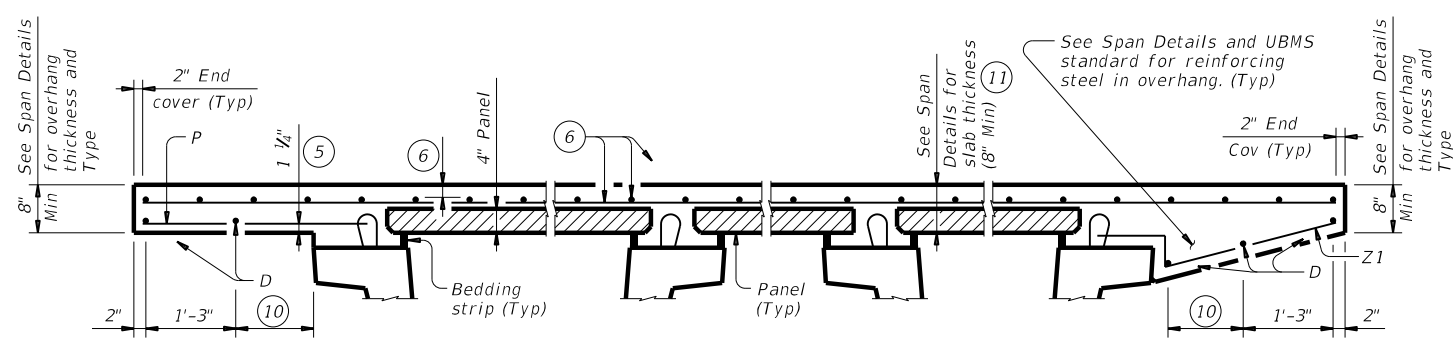
**STEEL BEAMS**



**PRESTRESSED CONCRETE I-GIRDERS**



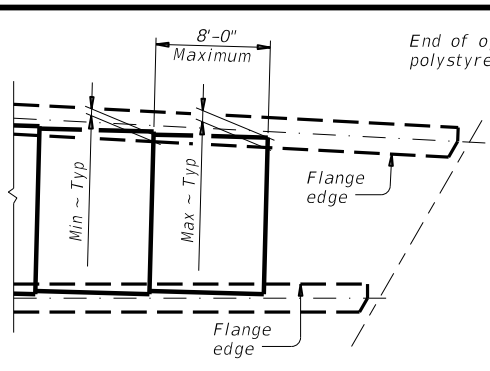
**PRESTRESSED CONCRETE X-BEAMS**



**NORMAL OVERHANG WITH PRESTR CONC U-BEAMS**

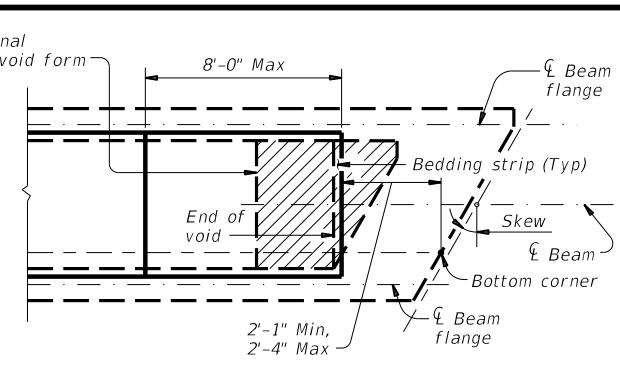
**TYPICAL PART TRANSVERSE SECTIONS**

**SLOPED OVERHANG WITH PRESTR CONC U-BEAMS**



**AT FLARED BEAMS OR GIRDERS**

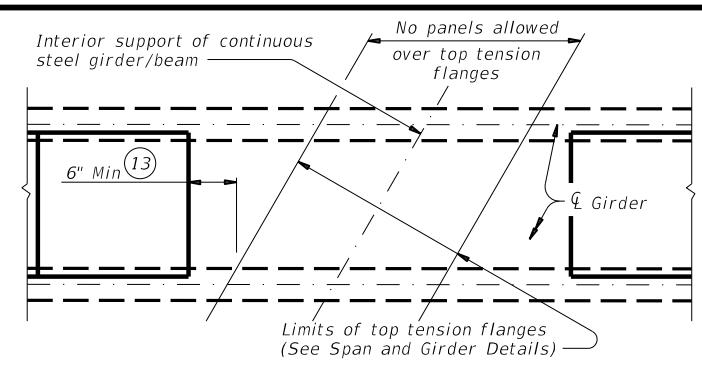
See PCP-FAB standard for Min and Max dimensions based on beam/girder type.



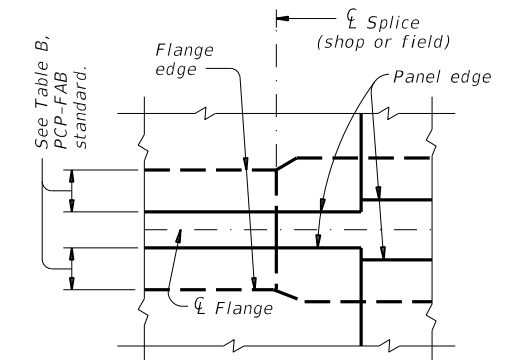
**OVER CONC U-BEAMS**

**PART PLANS OF PANEL PLACEMENT**

- 5 Provide clear cover as indicated unless otherwise shown on Span Details.
- 6 See Span Details and Thickened Slab End Details for top slab reinforcement and clear cover. Transverse top slab reinforcement may rest on top of prestressed concrete panels if necessary to maintain clear cover.
- 9 Butt adjacent bedding strips together with adhesive. Cut v-notches, approx 1/4" deep, in the top of the bedding strips at 8' o.c..
- 10 Equally space additional bar if more than 1'-3" Max.
- 11 The actual thickness constructed may exceed the slab thickness shown on the Span Details but the extra thickness may be no more than 2" (1" for prestressed concrete U-beams and steel beams). Bearing seat elevations or finished grade may be adjusted.
- 12 Field adjust Bars Z1(#4) to match actual slope of slab overhangs. Width of slab overhang will vary along span with curved slab edges. Adjust Bar Z1(#4) dimensions to maintain proper cover. Bars Z2(#4) are located at Inverted-Tee stems only.
- 13 Location of concrete placement sequence boundaries and bolted field splices should be considered by the contractor in determining panel limits.



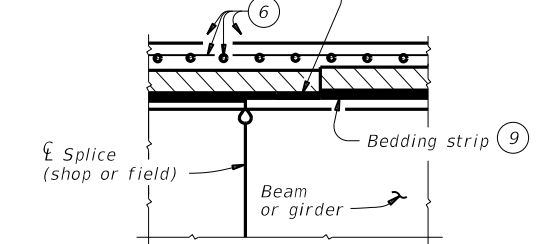
**AT INT SUPPORTS OF CONTINUOUS STEEL GIRDERS**



**PLAN AT SPLICE**

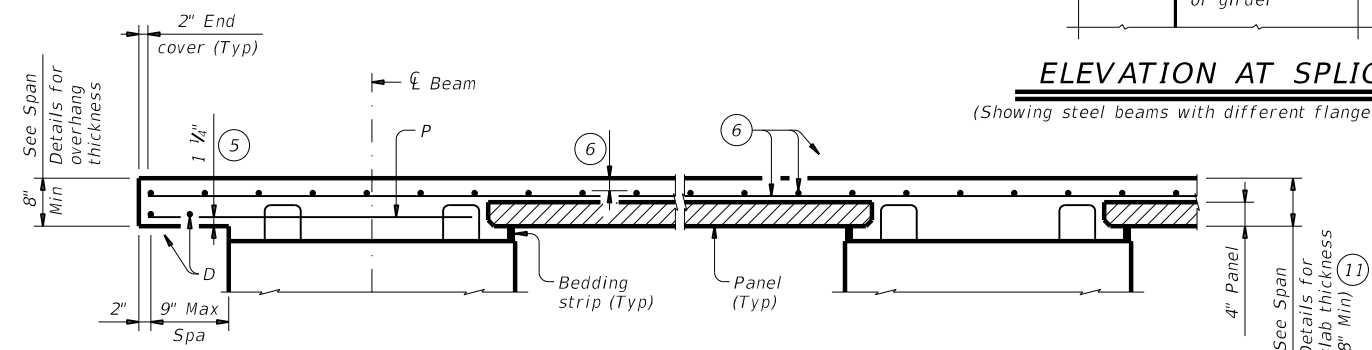
(Showing steel beams with flange width transition)

Cut bedding strip to adjust for difference in flange thickness.



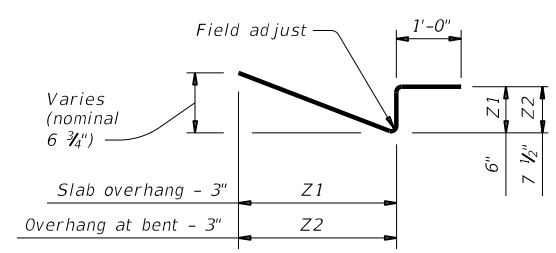
**ELEVATION AT SPLICE**

(Showing steel beams with different flange thickness)



**PRESTRESSED CONCRETE SPREAD SLAB BEAMS**

Bars P over exterior beams are still required when no overhang is used. In this case, only one Bar D, 2" from slab edge, is required.



**BARS Z (#4) 12**

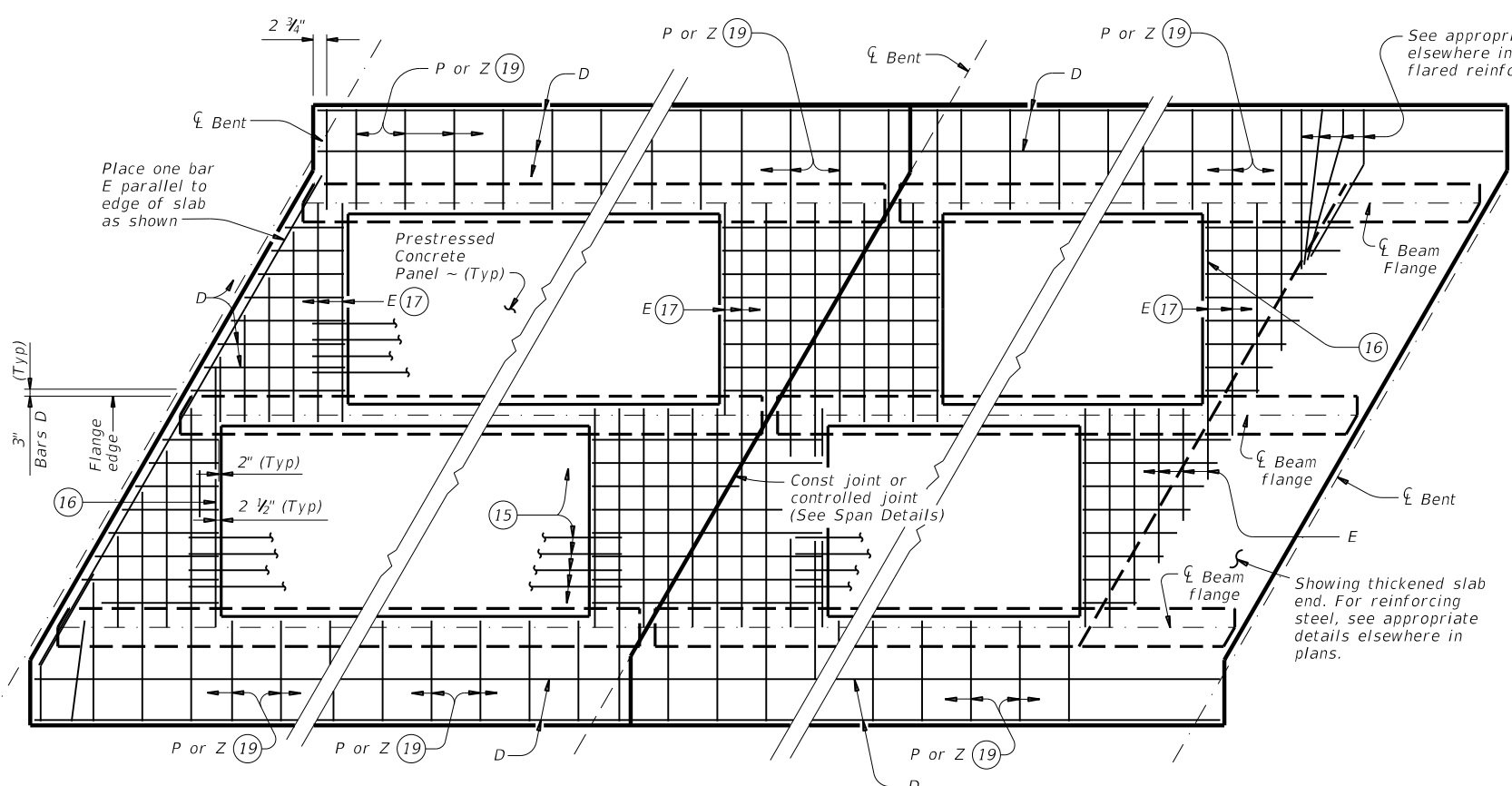
**PRESTRESSED CONCRETE PANELS DECK DETAILS**

PCP

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	BWD	MILLS	92	

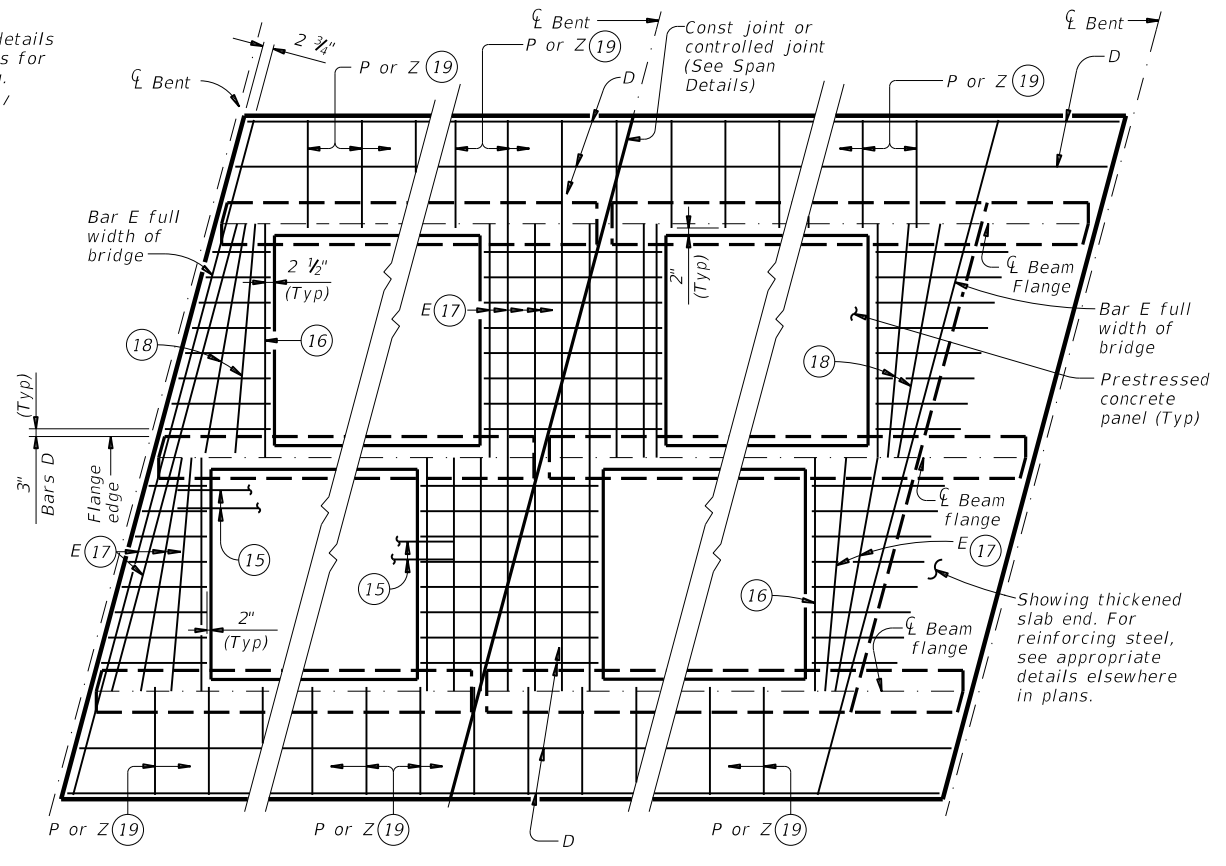
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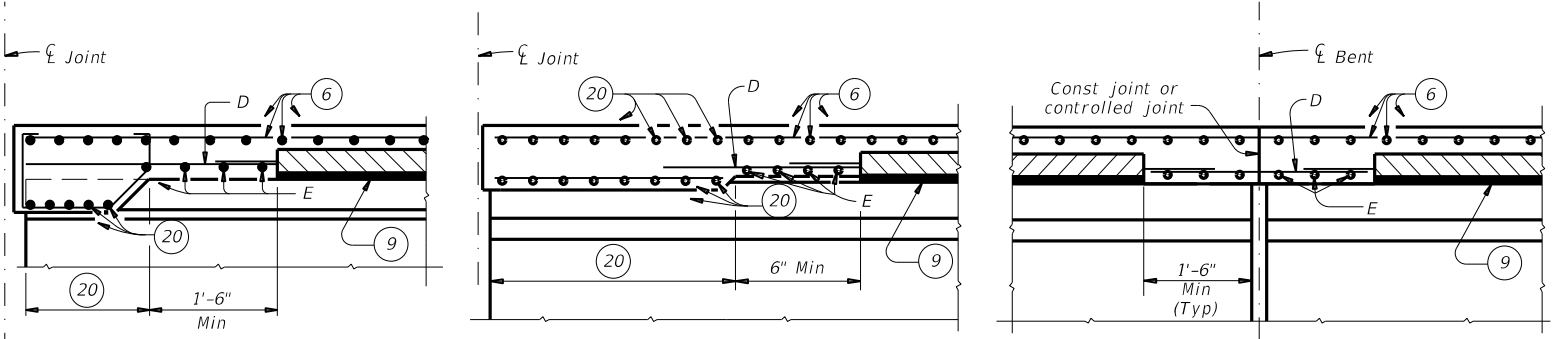
AT ALL SPAN ENDS UNLESS NOTED OTHERWISE  
 AT INTERIOR BENTS  
 AT THICKENED END SLABS

**OPTION 1 ~ PLAN OF SLABS WITH NORMAL REINFORCEMENT**

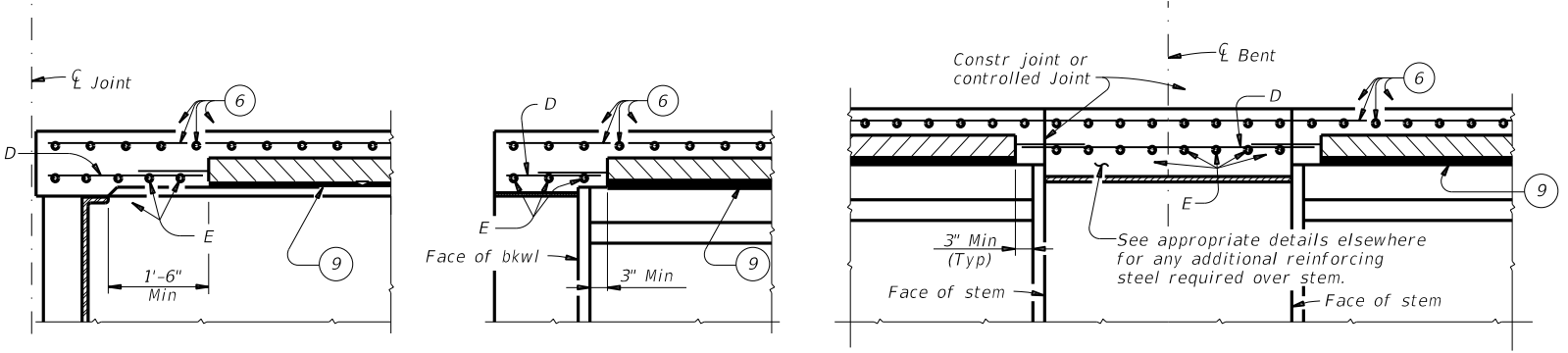


AT ALL SPAN ENDS UNLESS NOTED OTHERWISE  
 AT INTERIOR BENTS  
 AT THICKENED END SLABS

**OPTION 1 ~ PLAN OF SLABS WITH SKEWED REINFORCEMENT**



AT THICKENED SLAB ENDS FOR PRESTR CONC U-BMS  
 AT THICKENED SLAB ENDS FOR PRESTR CONC I-BMS AND STEEL BMS  
 AT SLAB CONTINUOUS OVER CONVENTIONAL INTERIOR BENTS FOR ALL SIMPLE SPAN BMS



AT CONVENTIONAL END DIAPHRAGMS FOR STEEL BMS  
 AT SLAB OVER ABUTMENT BACKWALL FOR ALL BMS  
 AT SLAB CONTINUOUS OVER INVERTED-T BENTS FOR ALL BMS

**OPTION 1 ~ ELEVATIONS AT BEAM ENDS**

- 6 See Span Details and Thickened Slab End Details for top slab reinforcement and clear cover. Transverse top slab reinforcement may rest on top of prestressed concrete panels if necessary to maintain clear cover.
- 9 Butt adjacent bedding strips together with adhesive. Cut v-notches, approx 1/4" deep, in the top of the bedding strips at 8' o.c.
- 14 Max Spacing as listed unless otherwise shown.
- 15 At connection with cast-in-place slab, extend longitudinal panel reinforcement. See PCP-FAB for details.
- 16 Maintain one Bar E(#4) parallel to panel ends (Typ).
- 17 Bars E(#4) not continuous over beam flanges must overlap beam flange 6" Min.
- 18 Add flared Bars E(#4) (Min Spa = 6", Max Spa = 12") as required at panel ends.
- 19 Where possible, Bars E(#4) may be extended into overhangs to replace Bars P(#4). Bars Z(#4) are required for sloped overhangs with U-Beams.
- 20 See appropriate thickened slab end details for reinforcing and limits of thickened slab end.

TABLE OF REINFORCING STEEL (14)		
BAR	SIZE	Max Spa (in.)
D	#4	9
E	#4	9
P	#4	18
UP	#4	~
Z	#4	18

HL93 LOADING SHEET 3 OF 4



**PRESTRESSED CONCRETE PANELS DECK DETAILS**

PCP

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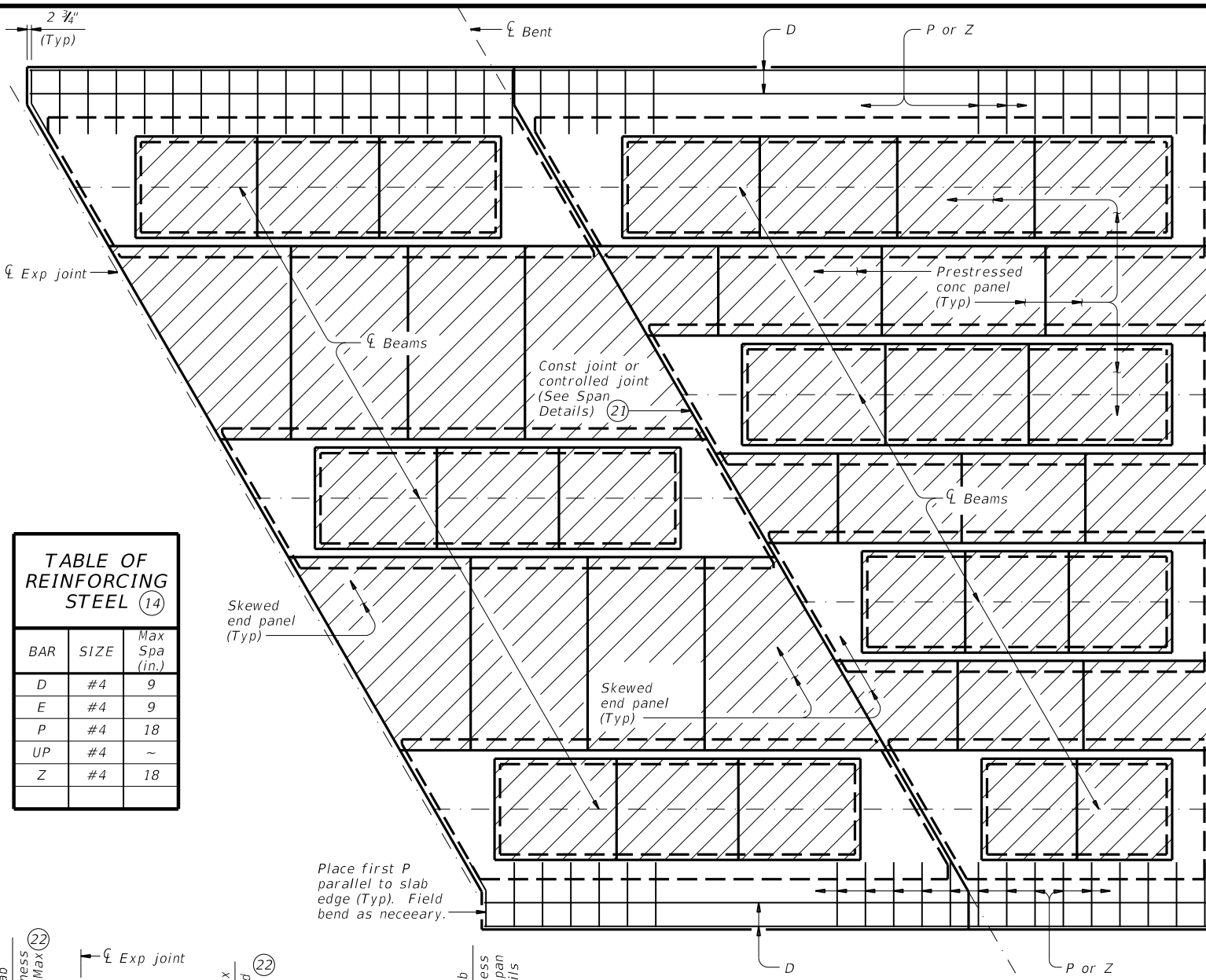
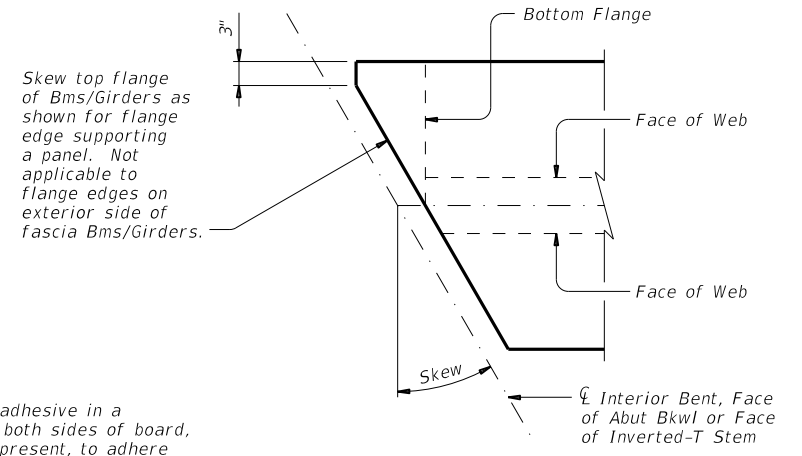
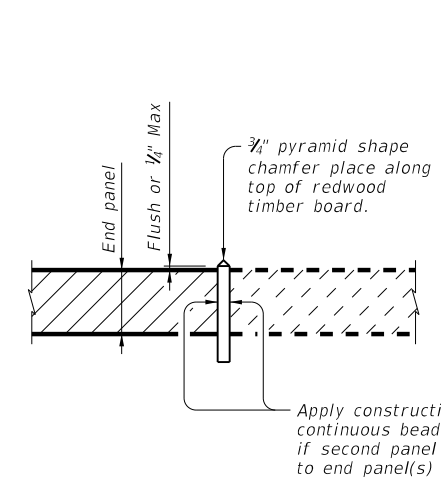


TABLE OF REINFORCING STEEL (14)		
BAR	SIZE	Max Spa (in.)
D	#4	9
E	#4	9
P	#4	18
UP	#4	~
Z	#4	18



**ELEVATION EXAMPLE OF END PANEL AND TIMBER BOARD (23)**

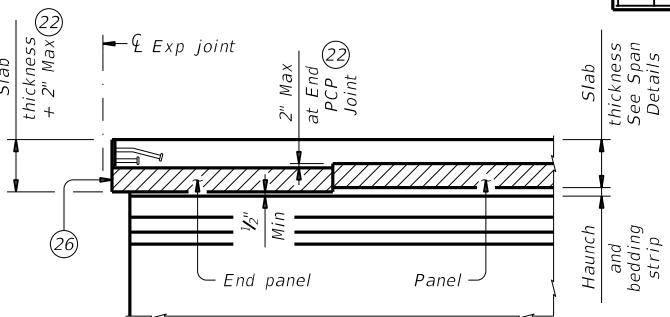
See "Option 2 ~ Elevation At Beam Ends".

**OPTION 2 ~ SHOWING MODIFICATION TO BEAM/GIRDER TOP FLANGE FOR SKEWS OVER 5°**

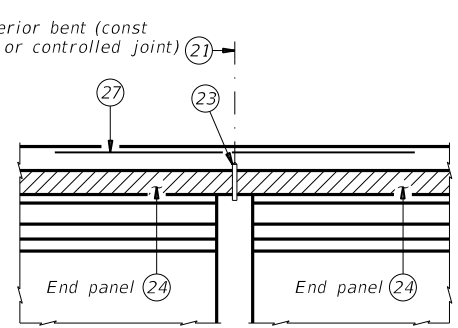
Showing I-Bm/I-Girder, U-Bms and Steel Bms similar.

**OPTION 2 ~ PLAN OF SLAB**

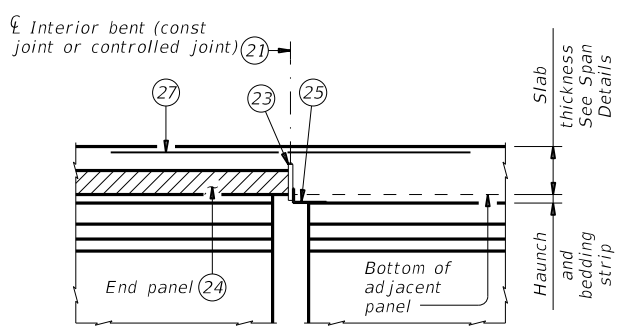
(Showing U-Beams; other beams similar)



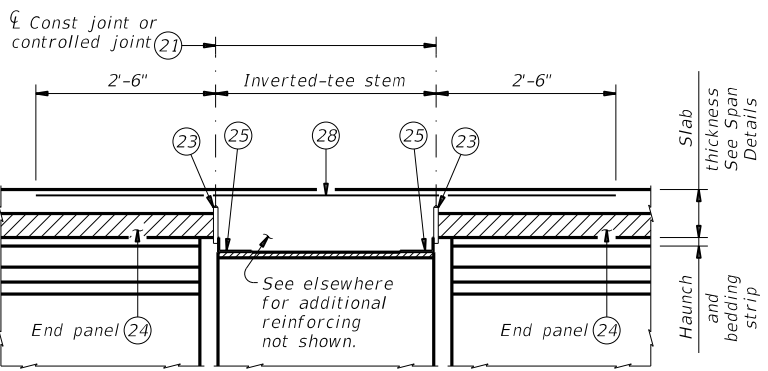
**JOINTS (BETWEEN BEAMS/GIRDERS OR AT INV-T STEM)**  
 For SEJ-A, SEJ-S(0), AJ, and Type A expansion joints only.



**CONVENTIONAL INTERIOR BENT**  
 Panel against panel between beams/girders.



**CONVENTIONAL INTERIOR BENT**  
 Panel against beam/girder end in adjacent span.



**INVERTED-T BENT**  
 Panels against inverted-tee stem

**OPTION 2 ~ ELEVATIONS AT BEAM ENDS (6)**

- (6) See Span Details and Thickened Slab End Details for top slab reinforcement and clear cover. Transverse top slab reinforcement may rest on top of prestressed concrete panels if necessary to maintain clear cover.
- (14) Max Spacing as listed unless otherwise shown.
- (21) 1 1/2" Vinyl or plastic joint former at controlled joints (Stress Cap, Zip Strip, Stress Lock, or equal as approved by the Engineer.)
- (22) End panel may be set up to 2" lower to accommodate expansion joint hardware, provided bedding strip is not less than 1/2" thick.
- (23) 3/4" thick redwood timber board, leave in place. Redwood timber board placed flush with top of panel or within 1/4" Max above panel. Place 3/4" pyramid shape chamfer along top of timber board. See "Elevation Example of End Panel and Timber Board". Place straight, within 1/4" of centerline of bent or face of inverted-tee, across bridge width and end board at exterior flange edge of fascia beams/girders. Do not extend into overhang.
- (24) Place panel within 1/2" of 3/4" thick board.
- (25) Permanent galvanized steel sheet form. Removable formwork is acceptable.
- (26) Place end panel within 1/2" of expansion joint opening. End panel cannot encroach on required expansion joint opening.
- (27) Place additional (#4) bar 5'-0" in length between every slab bars T. Center (#4) bar on joint.
- (28) Place additional (#4) bar continuous 2'-6" beyond each side of Inverted-T Stem between every slab bars T.

**SPECIAL OPTION 2 CONSTRUCTION NOTES:**

When Option 2 is chosen bottom mat of thickened end slab reinforcing is not required. Use the same top mat as shown on the Thickened Slab End Details sheet.  
 Placing panels adjacent to expansion joints and bent centerlines prior to completing interior panel placement is recommended. Saw cutting panels to fit is acceptable when approved by the Engineer. Minimum distance from a saw cut edge to a panel strand is 1 1/2".  
 Do not extend the longitudinal panel reinforcement into the cast-in-place slab.  
 Top flanges of beams and girders on skewed bridges must be modified as shown on this drawing. The Contractor is responsible for coordinating this modification with the beam fabricator prior to submitting shop drawings for approval.  
 Fabricator may optionally skew the whole end. When electing to skew whole end, girder end details and bearing type at conventional interior bent must be changed to use condition at abutment. Fabricator must coordinate change in bearing type, bearing centerline location, and dowel location with Engineer and Contractor. Show appropriate changes on girder and bearing shop drawings.  
 Bending of anchor studs of expansion joints shown on standards AJ, SEJ-A and SEJ-S(0) is permissible if necessary to clear top of end panels. The Contractor is responsible for coordinating modifications with the joint fabricator. Submit shop drawings for approval when modifications to expansion joint hardware are made.  
 Bedding strips under skewed end panels must conform to the requirements of Item 422 except their minimum compressive strength must be 60 psi.  
 Provide Bars AA, G, K and OA from standard IGTS in the slab.

HL93 LOADING SHEET 4 OF 4

Texas Department of Transportation Bridge Division Standard

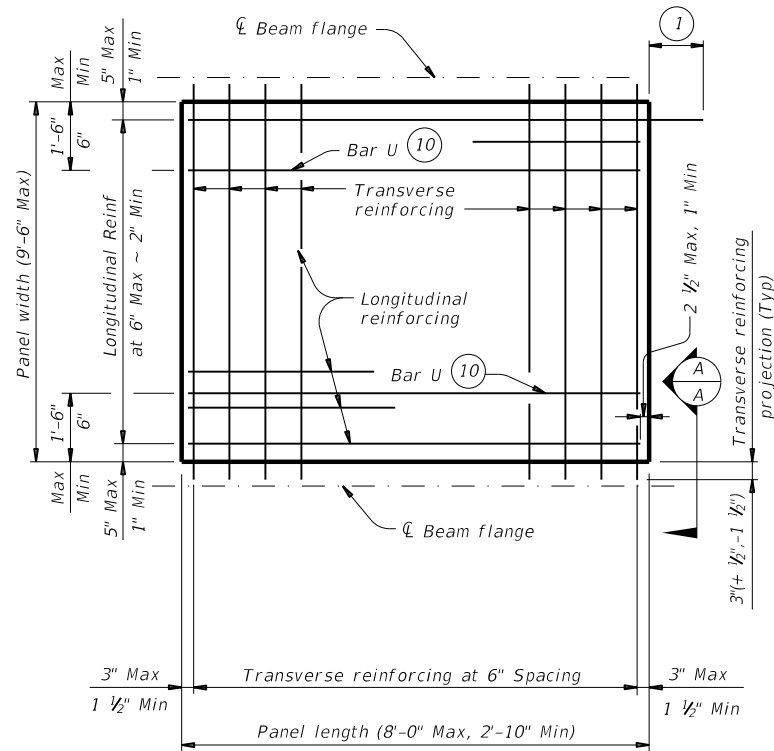
**PRESTRESSED CONCRETE PANELS DECK DETAILS**

PCP

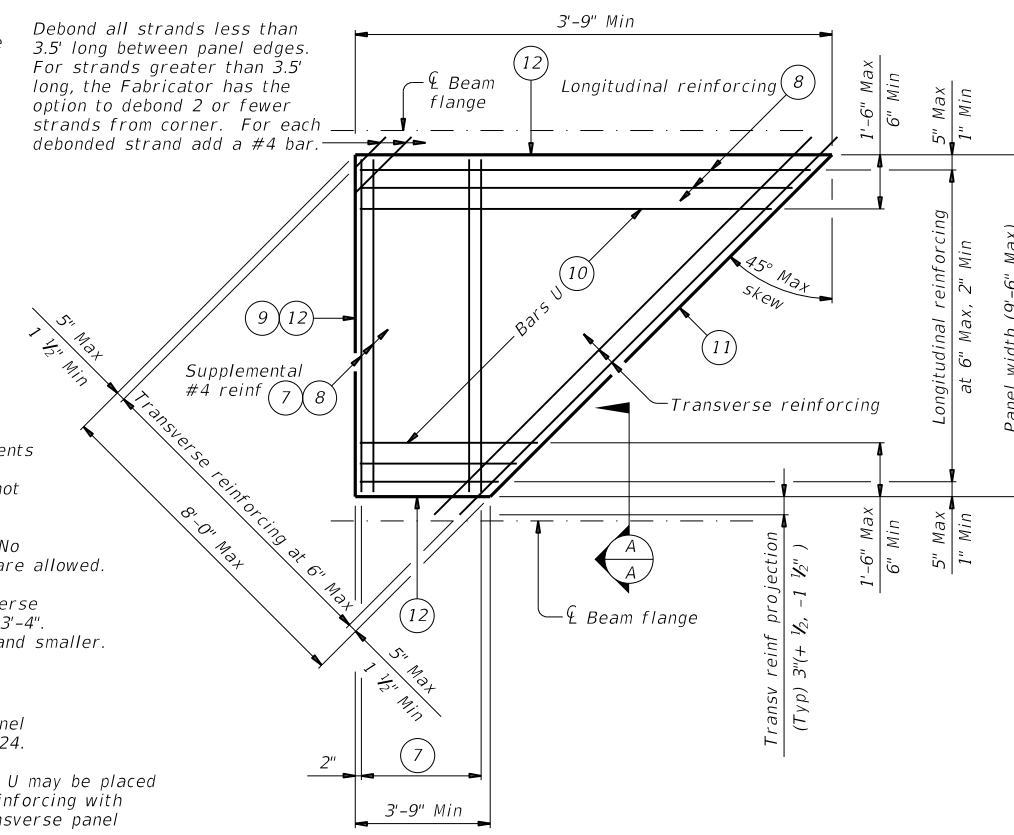
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©TxDOT April 2019	CONTRACT	SECTION	JOB	HIGHWAY
REVISIONS	1780	01	009	FM 1047
DIST	COUNTY	SHEET NO.		
BWD	MILLS	94		

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**TYPICAL NON-SKEWED PANEL PLAN**



**TYPICAL SKEWED END PANEL PLAN**

(Only to be used with details shown elsewhere in the plans.)

- 1 At connection with cast-in-place slab, extend longitudinal panel reinforcement 1'-0" (+2", -0") past panel end. Alternatively, provide (#3) x 2'-0" dowels at 6" Max Spacing and extend dowels 1'-0" past panel end.
- 2 Four loops required per panel.
- 3 Four loops required per panel. 3/8" or 1/2" strands may be used.
- 4 Normal dimensions must be used on spans with parallel beams. Maximum and Minimum dimensions apply only to spans with flared beams.
- 5 See Normal Grading Detail on PCP standard for lap requirements and bedding strip dimensions. Some laps shown in tables cannot utilize all bedding strip widths.
- 6 One Splice allowed per panel. No more than two sheets of WWR are allowed.
- 7 Provide (#4) bars under transverse reinforcing, 10 Spaces at 4" = 3'-4". Omit for 5 degree (1:12) skew and smaller.
- 8 End Cover 2 1/2" Max, 1" Min.
- 9 Recess strands on indicated panel edge in accordance with Item 424.
- 10 At the fabricator's option, Bars U may be placed parallel to transverse panel reinforcing with horizontal legs in plane of transverse panel reinforcing.
- 11 Use length of indicated panel edge as panel width for purpose of determining type of transverse reinforcing.
- 12 Timber form work permissible this edge.

TABLE A (4) (5)			
Beam Type	Normal (In.)	Min (In.)	Max (In.)
A	3	2 1/2	3 1/2
B	3	2 1/2	3 1/2
C	4	3	4 1/2
IV	6	4	7 1/2
VI	6 1/2	4 1/2	8 1/2
U40 - 54	5 1/2	5 1/2	7
Tx28-70	6	5	7 1/2
XB20 - 40	4	3	4 1/2
XSB12 - 15	4	3	4 1/2

TABLE B (4) (5)			
Top Flange Width	Normal (In.)	Min (In.)	Max (In.)
11" to 12"	2 3/4	2 1/2	2 3/4
Over 12" to 15"	3 1/4	3	3 1/4
Over 15" to 18"	4	3	4 1/4
Over 18"	5	3 1/2	6 1/4

**GENERAL NOTES:**

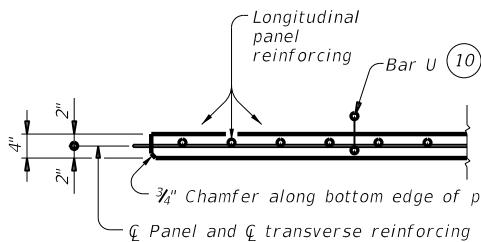
Provide Class H concrete for panels. Release strength  $f'_{ci}=3,500$  psi. Minimum 28 day strength  $f'_{c}=5,000$  psi.  
 Provide 3/4" chamfer along bottom edge of panel on beam side. Do not use epoxy-coated reinforcing steel bar or strand in panels. Remove laitance from top panel surface. Finish top of panel to a roughness between a No. 6 and No. 9 concrete surface profile, inclusive, as specified by the International Concrete Repair Institute (ICRI).  
 Shop drawings for the fabrication of panels will not require the Engineer's approval if fabrication is in accordance with the details shown on this standard.  
 A panel layout which identifies location of each panel must be developed by the Fabricator. Permanently mark each panel in accordance with the panel layout. A copy of the layout is to be provided to the Engineer.

**TRANSVERSE PANEL REINFORCEMENT:**

For panel widths over 5', use 3/8" or 1/2" Dia (270k) prestressing strands with a tension of 14.4 kips per strand.  
 For panel widths over 3'-6" up to and including 5', use 3/8" or 1/2" Dia (270k) prestressing strands with a tension of 14.4 kip per strand. Optionally, (#4) Grade 60 reinforcing bars may be used in lieu of prestressed strands.  
 For panel widths up to 3'-6", use (#4) Grade 60 reinforcing bars (prestressed strands alone are not allowed).  
 Place transverse panel reinforcement at panel centroid and space at 6" Max.

**LONGITUDINAL PANEL REINFORCEMENT:**

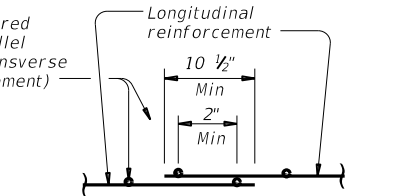
Any of the following options may be used for longitudinal panel reinforcement:  
 1. (#3) Grade 60 reinforcing steel at 6" Max Spacing. No splices allowed.  
 2. 3/8" Dia prestressing strands at 4 1/2" Max Spacing (unstressed). No splices allowed.  
 3. 1/2" Dia prestressing strands at 6" Max Spacing (unstressed). No splices allowed.  
 4. Deformed Welded Wire Reinforcement (WWR) (ASTM A1064) providing 0.22 sq in per foot of panel width. Wires larger than D11 not permitted. Provide transverse wires to ensure proper handling of reinforcing. One splice per panel is allowed. See WWR Splice Detail.  
 No combination of longitudinal reinforcement options in a panel is allowed. Place longitudinal panel reinforcement above or below transverse panel reinforcement. Must be placed above transverse panel reinforcement for skewed end panels with supplemental (#4) reinforcement.



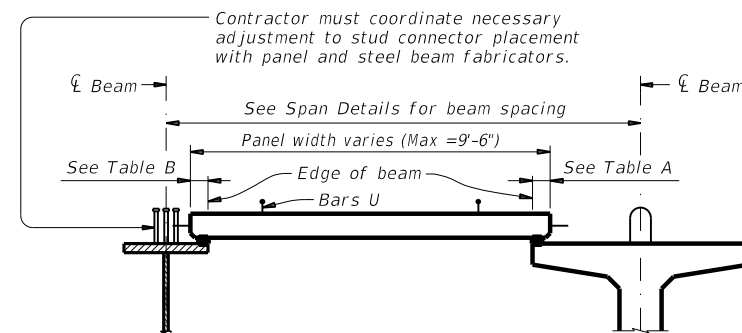
**SECTION A-A**

(Not showing supplemental #4 bars for skewed end panels.)

No splice required for wires parallel to strands (transverse panel reinforcement)

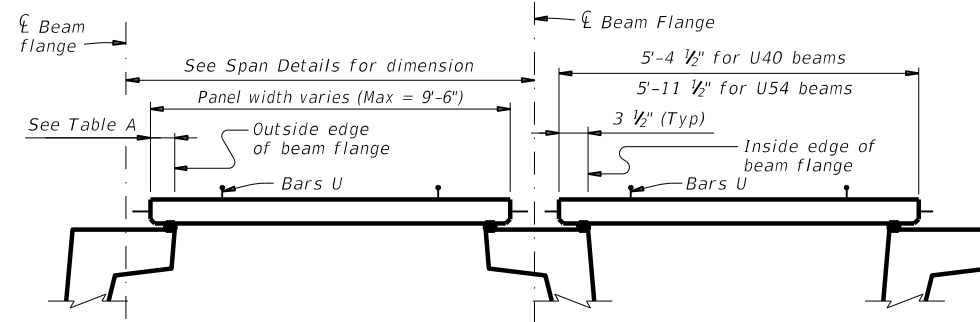


**WELDED WIRE REINFORCEMENT (WWR) SPLICE DETAIL**



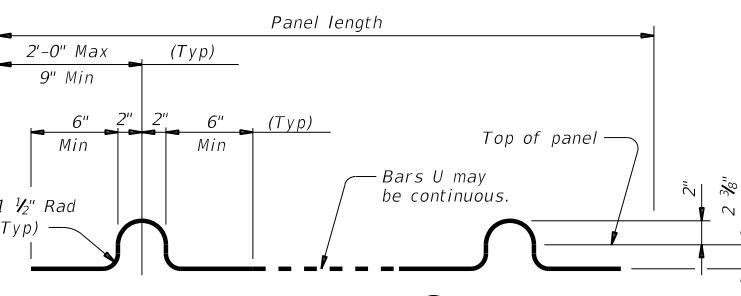
**STEEL BEAMS**

**PRESTRESSED CONCRETE BEAMS OR GIRDERS**  
 Typ unless noted otherwise

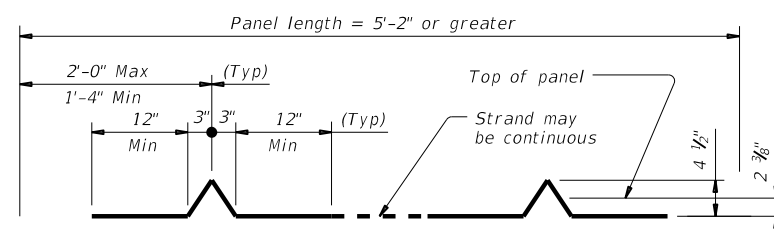


**PRESTRESSED CONCRETE U-BEAMS**

**TYPICAL SECTIONS FOR DETERMINING PANEL WIDTH**



**BARS U (#3)**

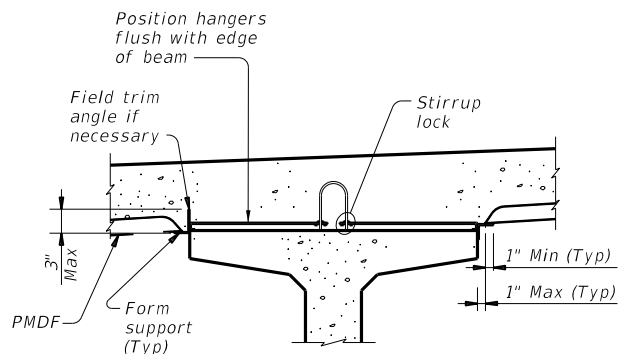


**OPTIONAL STRAND FOR BARS U**

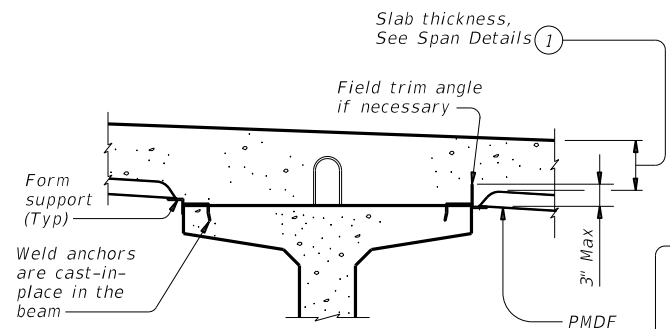
HL93 LOADING

		<b>Bridge Division Standard</b>	
<b>PRESTRESSED CONCRETE PANEL FABRICATION DETAILS</b>			
<b>PCP-FAB</b>			
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	BWD	MILLS	95

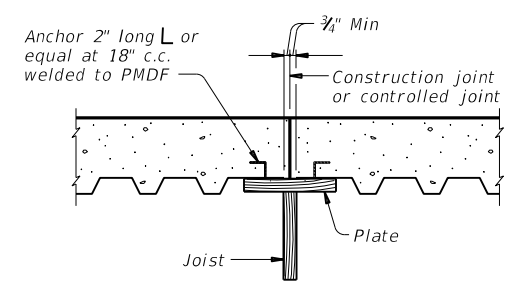
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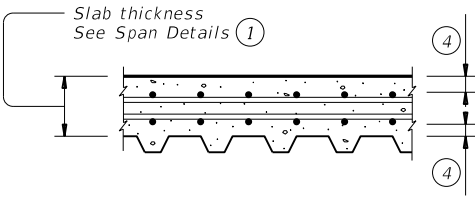
**PRESTR CONC I-BEAMS AND I-GIRDERS WITH STIRRUP LOCKS**



**PRESTR CONC I-BEAMS AND I-GIRDERS WITH WELD ANCHORS**



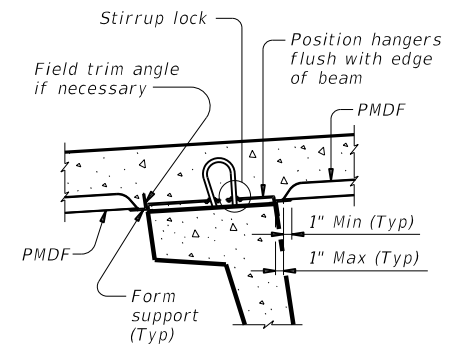
Note: In spans where PMD forms are used, timber forms must be used at construction joints. Adequate provision must be made to support edge of metal form and to provide anchorage of metal form to slab concrete where joined to wood forms.



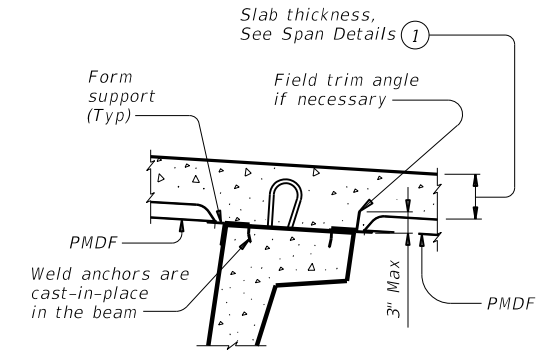
**TYP LONGITUDINAL SLAB SECTION**

**SECTION THRU CONSTRUCTION JOINT**

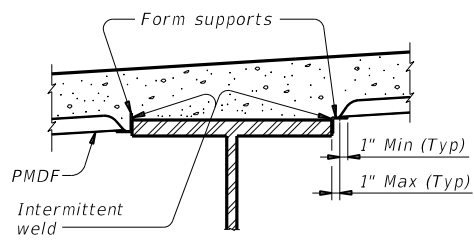
**FOR PRESTR CONC U-BEAM AND STEEL GIRDER BRIDGES:**  
 Unless shown elsewhere in the plans, size, spacing, and orientation of bottom mat of slab reinforcement must match the top mat of reinforcing shown on the span details except all bottom mat bars are to be #5. Bottom mat reinforcement and additional concrete is subsidiary to Item 422 "Concrete Superstructures."  
**FOR PRESTR CONC TX-GIRDER BRIDGES:**  
 See Miscellaneous Slab Details, Prestr Concrete I-Girders (IGMS) standard sheet for bottom mat reinforcing.



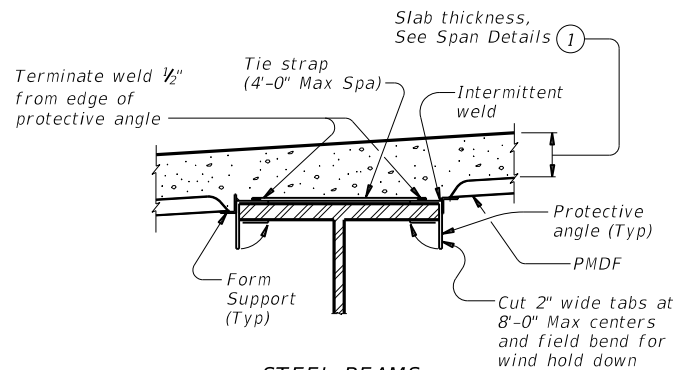
**U-BEAMS WITH STIRRUP LOCKS**



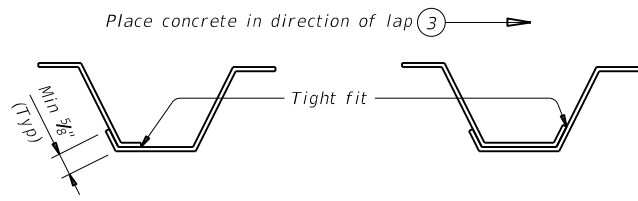
**U-BEAMS WITH WELD ANCHORS**



**STEEL BEAMS AT COMPRESSION FLANGES**



**STEEL BEAMS AT TENSION FLANGES**



**SIDE LAP DETAILS**

- Slab thickness minus 5/8" if corrugations match reinforcing bars.
- Welding of form supports to tension flanges will not be permitted. Other methods of providing wind hold down resistance for PMDF in tension flange zones will be considered. At least one layer of sheet metal must be provided between the flange and the weld joint.
- The direction of concrete placement will be such that the upper layer of the form overlap is loaded first.
- See Span details for cover requirements.

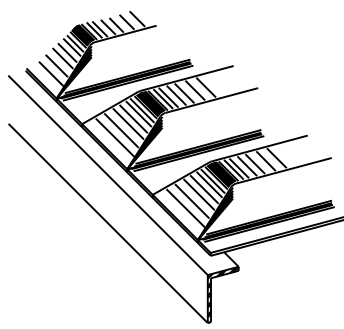
**GENERAL NOTES:**  
 Steel for Permanent Metal Deck Forms (PMDF) and support angles shall conform to ASTM A653, structural steel (SS), with coating designation G165. Steel must have a minimum yield strength of 33 ksi. Minimum thickness of PMDF is 20 gage and that of support angles and protective angles is 12 gage.  
 Submit two copies of forming plans for PMDF to the Engineer. These plans must show all essential details of proposed form sheets, closures, fasteners, supports, connectors, special conditions and size and location of welds. These plans must clearly show areas of tension flanges for steel beams and provisions for protecting the tension flanges from welding notch effects by inclusion of separating sheet metal or other positive method. These plans must be designed, signed, and sealed by a licensed professional engineer. Department approval of these plans is not required, but the Department reserves the right to require modifications to the plans. The Contractor is responsible for the adequacy of these plans. The details and notes shown on this standard are to be used as a guide in preparation of the forming plans.  
 All material, labor, tools and incidentals necessary to form a bridge deck with Permanent Metal Deck Forms is considered subsidiary to Item 422, "Concrete Superstructures".

**DESIGN NOTES:**  
 As a minimum, PMDF and support angles must be designed for the dead load of the form, reinforcement and concrete plus 50 psf for construction loads. Flexural stresses due to these design loads must not exceed 75 percent of the yield strength of the steel. Allowable stress for weld metal must be 12,400 psi.  
 Maximum deflection under the weight of forms, reinforcement and concrete or 120 psf, whichever is greater, shall not exceed the following:

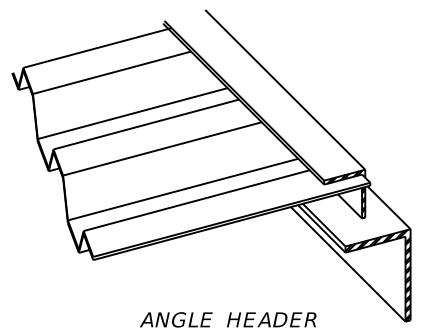
- 1/180 of the form design span, but not more than 0.50", for design spans of 10' or less.
  - 1/240 of the form design span, but not more than 0.75", for design spans greater than 10'.
- The form design span must not be less than the clear distance between beam flanges, measured parallel to the form flutes, minus 2".

**CONSTRUCTION NOTES:**  
 Form sheets must not be permitted to rest directly on the top of beam flanges. Form sheets must be securely fastened to form supports and must have a minimum bearing length of one inch at each end. Form supports must be placed in direct contact with beam flanges.  
 All attachments must be made by permissible welds, screws, bolts, clips or other means shown on the the forming plans. All sheet metal assembly screws must be installed with torque-limiting devices to prevent stripping. Only welds or bolts must be used to support vertical loads.  
 Welding and welds must be in accordance with the provisions of Item 448, "Structural Field Welding", pertaining to fillet welds. All welds must be made by a qualified welder in accordance with Item 448.  
 All permanently exposed form metal, where the galvanized coating has been damaged, must be thoroughly cleaned and repaired in accordance with Item 445, "Galvanizing". Minor heat discoloration in areas of welds need not be touched up.  
 Flutes must line up uniformly across the entire width of the structure where main reinforcing steel is located in the flute.  
 Construction joints will not be permitted unless shown on the plans. The location of and forming details for any construction joint used must be shown on the forming plans. Forms below a construction joint must be removed after curing of the slab.  
 A sequence for uniform vibration of concrete must be approved by the Engineer prior to concrete placement. Attention must be given to prevent damage to the forms, yet provide proper vibration to prevent voids or honeycomb in the flutes and at headers and/or construction joints.

				<b>Bridge Division Standard</b>	
<b>PERMANENT METAL DECK FORMS</b>					
<b>PMDF</b>					
FILE: pmdfste1-20.dgn	DN: TxDOT	CK: TxDOT	OW: TxDOT	CK: TxDOT	
©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY	
REVISIONS	1780	01	009	FM 1047	
02-20: Modified box note by adding steel beams/girders and subsidiary.	DIST	COUNTY	SHEET NO.		
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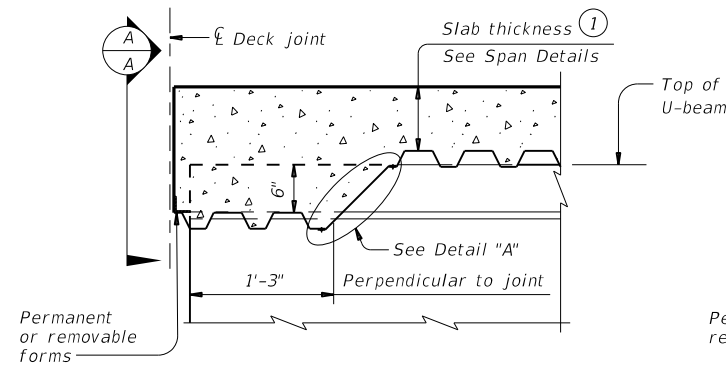
**ANGLE HEADER**

NOTE: This type is to be used for skewed ends only.

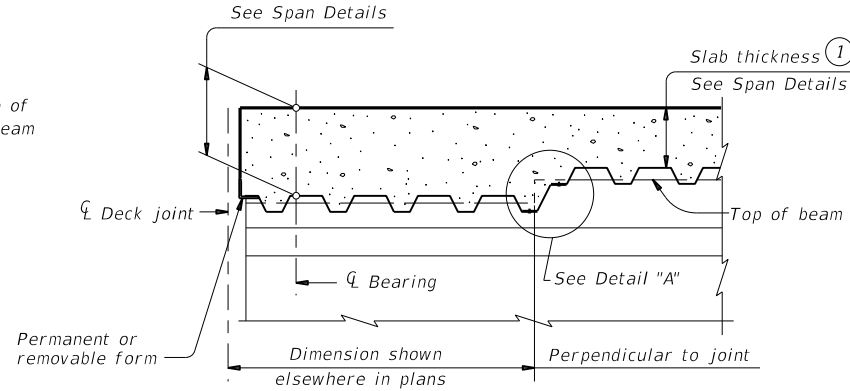
**TYPES OF END CLOSURES**

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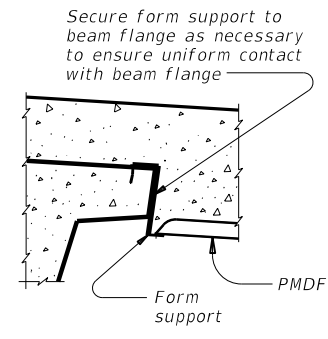
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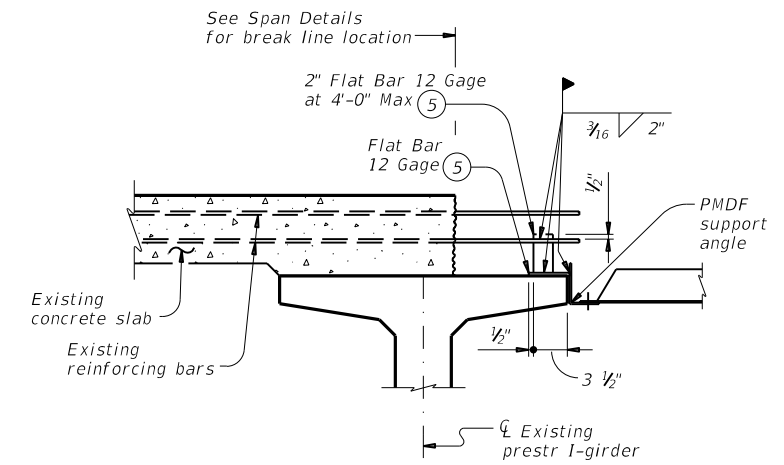
**AT THICKENED SLAB END FOR U-BEAMS**



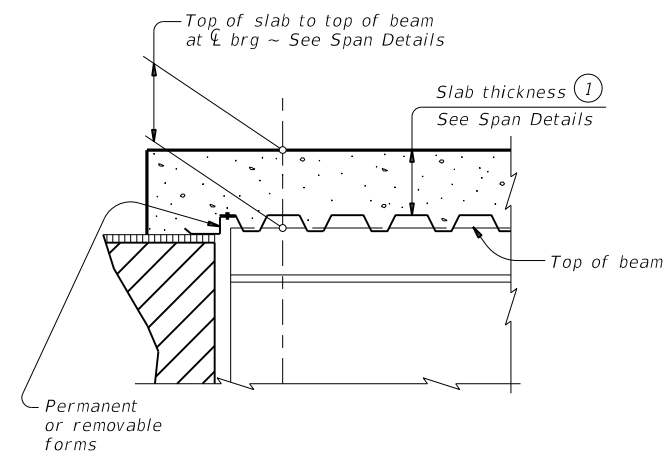
**AT THICKENED SLAB END FOR PRESTRESSED I-BEAMS, I-GIRDERS AND STEEL BEAMS**  
 Showing I-beam block-out. No block-out for I-girders or steel beams.



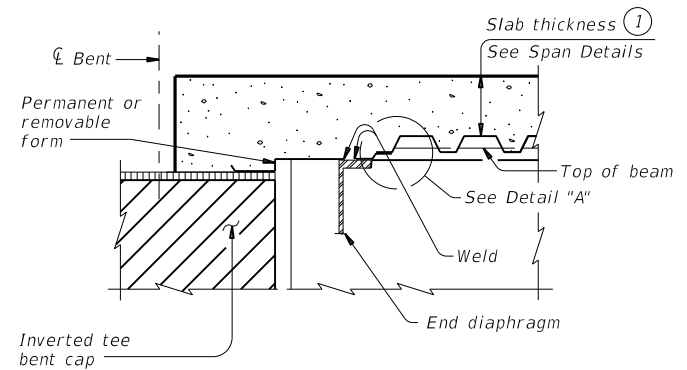
**SECTION A-A**



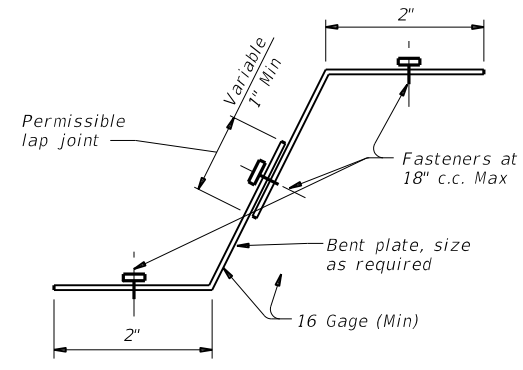
**SHOWING PRESTRESSED CONCRETE I-BEAMS, I-GIRDERS AND U-BEAMS**



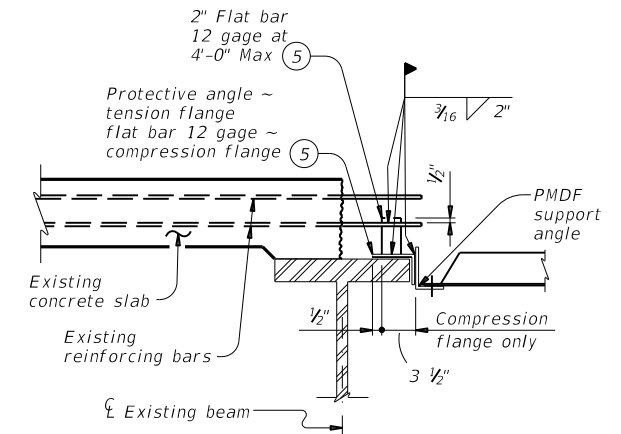
**AT SLAB OVER ABUT BKWL OR INV TEE STEM FOR CONC BEAMS WITHOUT THICKENED SLAB END**



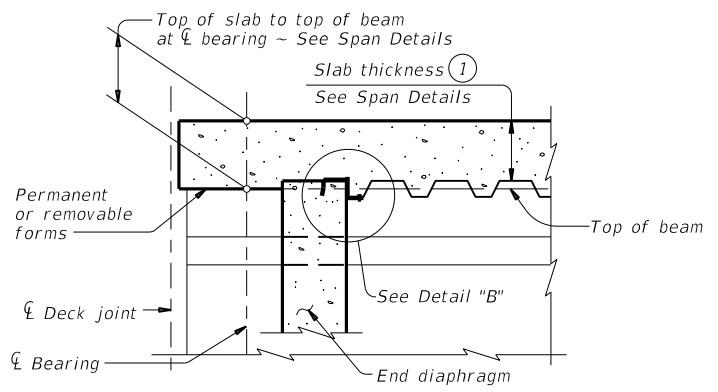
**AT SLAB OVER INV TEE STEM FOR STEEL BEAMS WITHOUT THICKENED SLAB END**



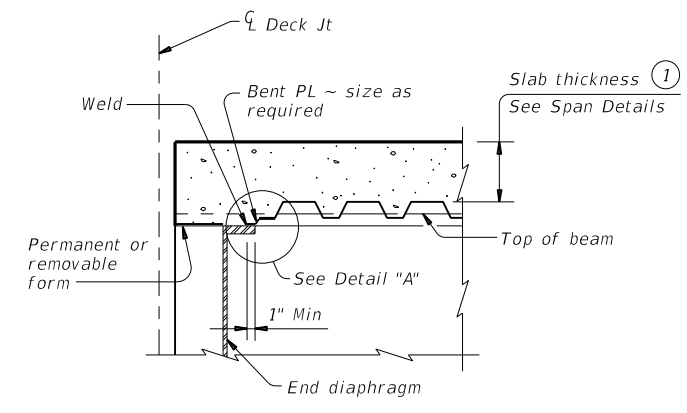
**DETAIL "A"**



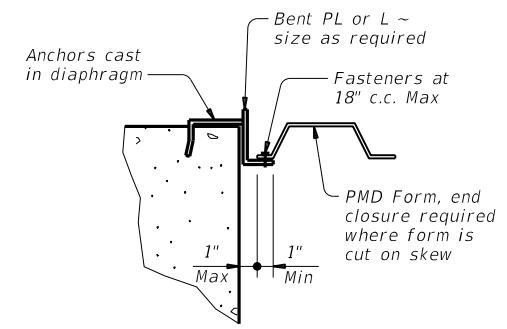
**SHOWING STEEL BEAMS**



**AT CONC END DIAPHRAGM FOR PRESTRESSED I-BEAMS AND STEEL BEAMS**



**AT END DIAPHRAGM FOR STEEL BEAMS WITHOUT THICKENED SLAB END**



**DETAIL "B"**

**WIDENING DETAILS**

**DETAILS AT ENDS OF BEAMS**

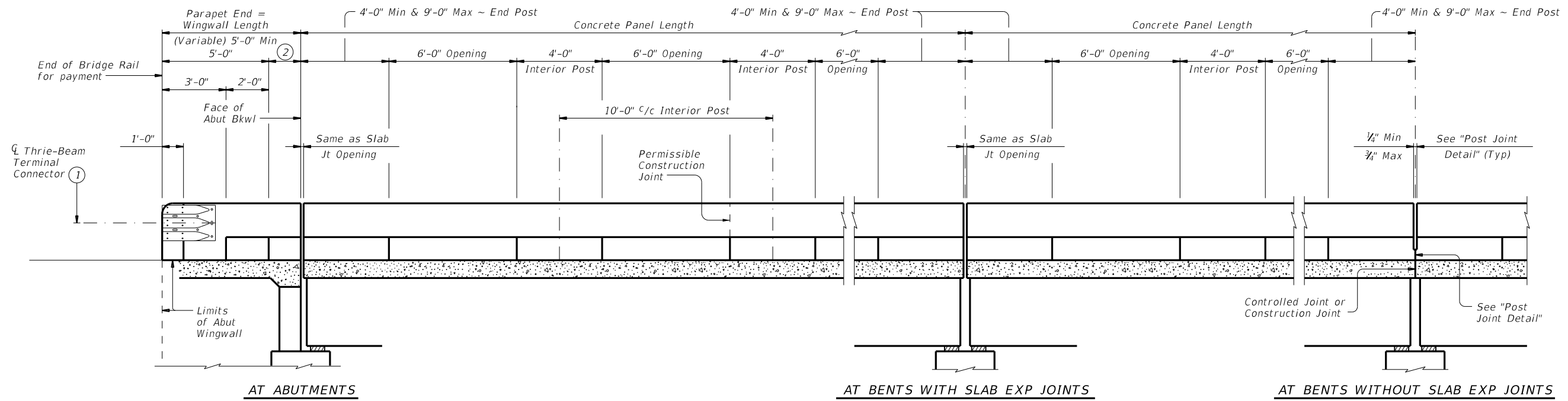
- ① Slab thickness minus 5/16" if corrugations match reinforcing bars
- ⑤ Minimum yield stress of 12 gage bars shall be 40 ksi

SHEET 2 OF 2

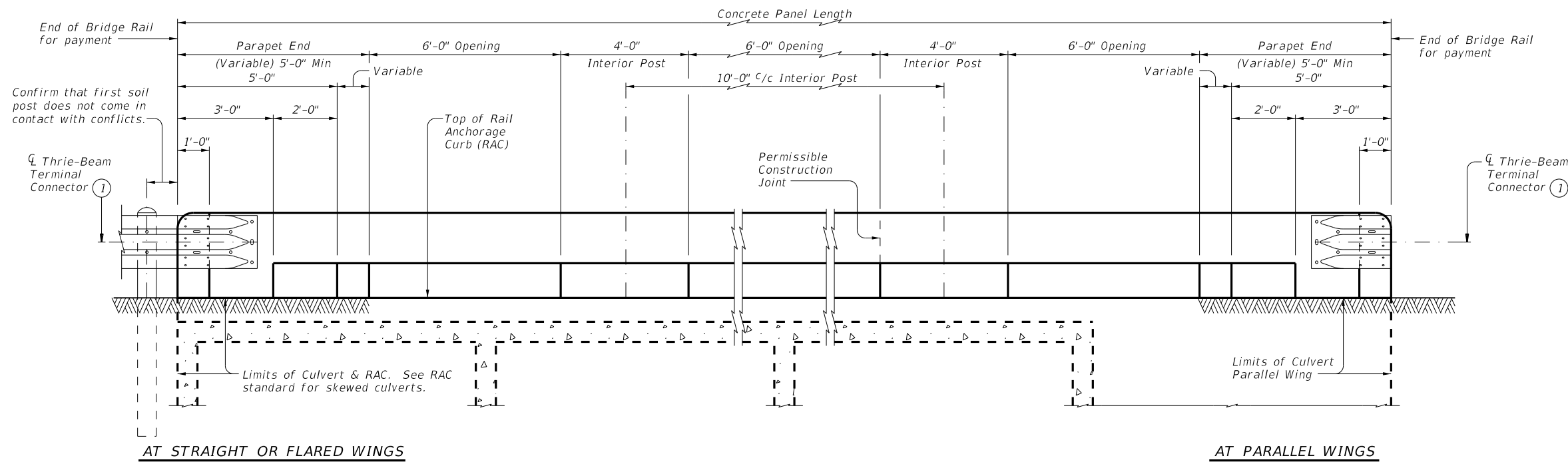
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<b>PERMANENT METAL DECK FORMS</b>			
<b>PMDF</b>			
FILE: pmfstste1-20.dgn	DN: TxDOT	CK: TxDOT	OW: TxDOT
©TxDOT April 2019	CONT	SECT	JOB
REVISIONS	1780	01	009
02-20: Modified box note by adding steel beams/girders and subsidiary.	DIST	COUNTY	SHEET NO.
	BWD	MILLS	97

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**ROADWAY ELEVATION OF RAIL ON BRIDGE**



**ROADWAY ELEVATION OF RAIL ON BOX CULVERTS**

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

- ① Terminal Connectors and associated hardware are to be paid for under the Item "Metal Beam Guard Fence". Attach Metal Beam Guard Fence Transitions to the bridge rail and extend along the embankment unless otherwise shown in the plans.
- ② Wingwall Length minus 5'-0" (Varies)

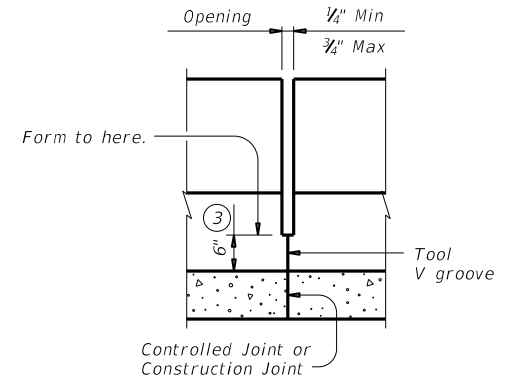
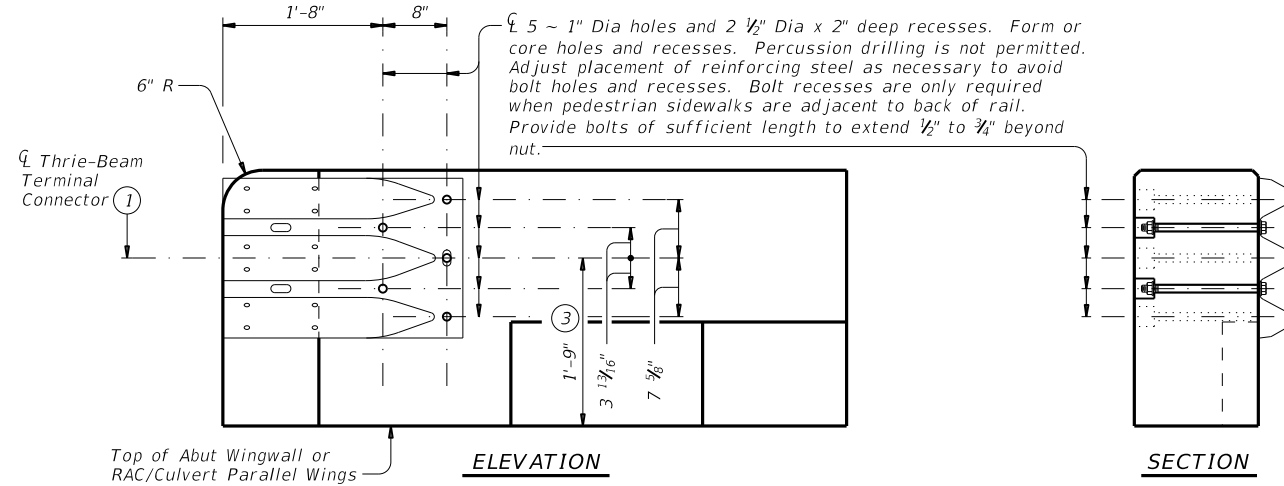
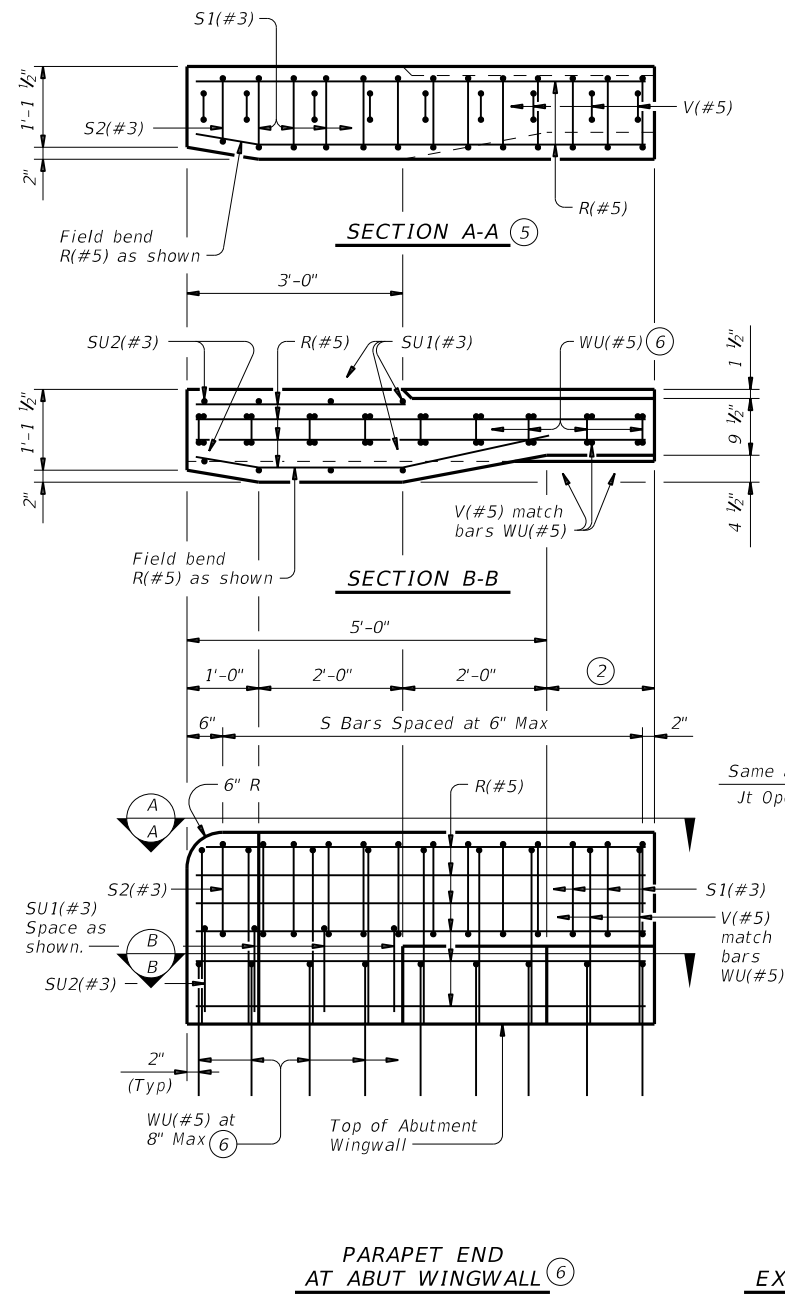
SHEET 1 OF 3

		<b>Bridge Division Standard</b>	
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<h3>TYPE T223</h3>			
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REVISIONS	1780	01	009
DIST	COUNTY		SHEET NO.
BWD	MILLS		98

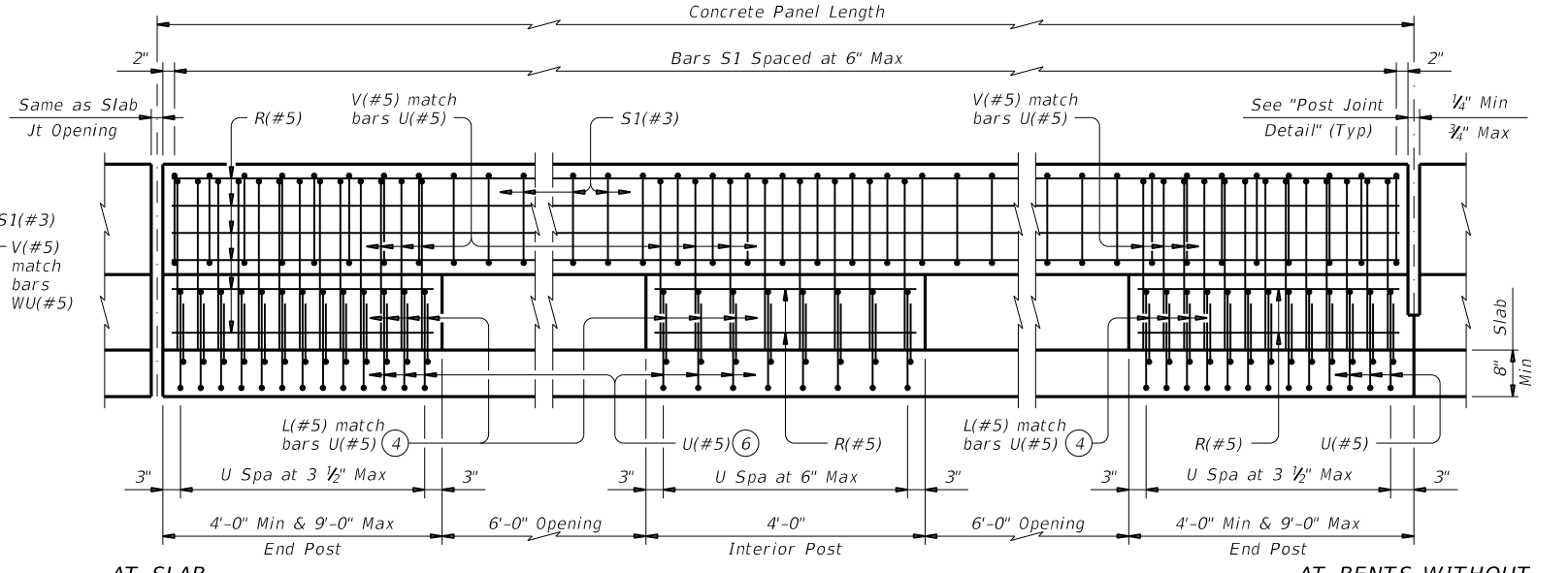


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DATE: 1/1/2022 10:49:33 AM  
FILE: T:\BWDSDGTEAM\Design Projects\Mills\1780-01-009 FM 1047 Bennett Branch\Standards\TYPE T223.dgn



**POST JOINT DETAIL**  
Provide at all interior bents without slab expansion joints.



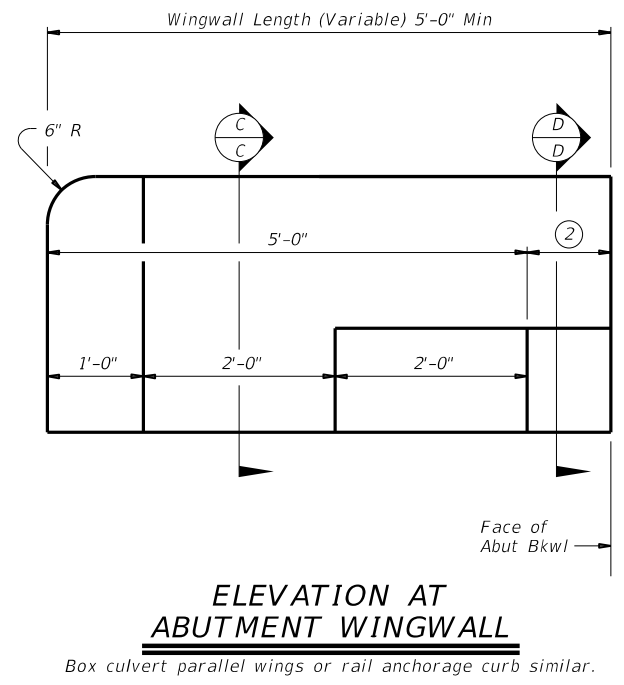
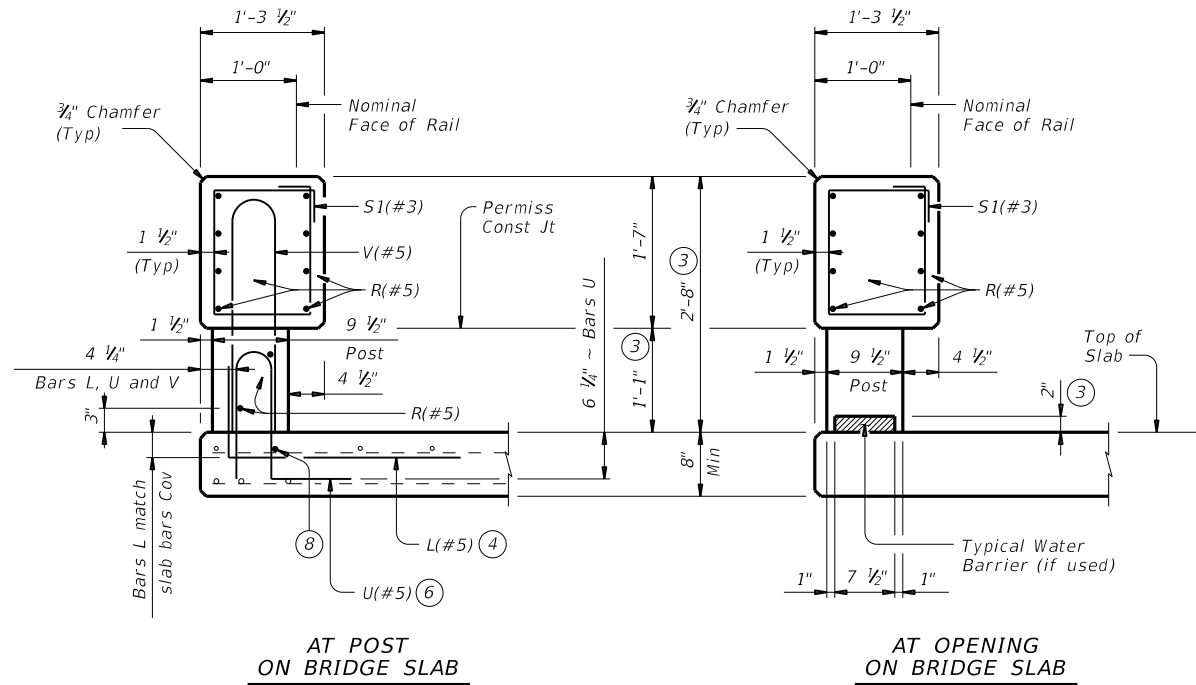
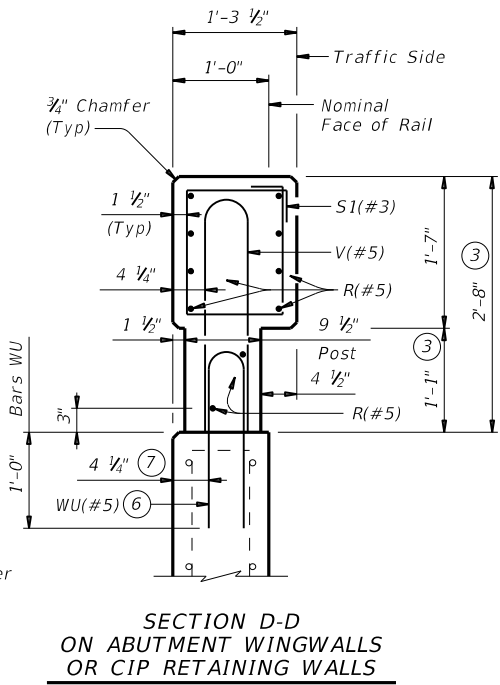
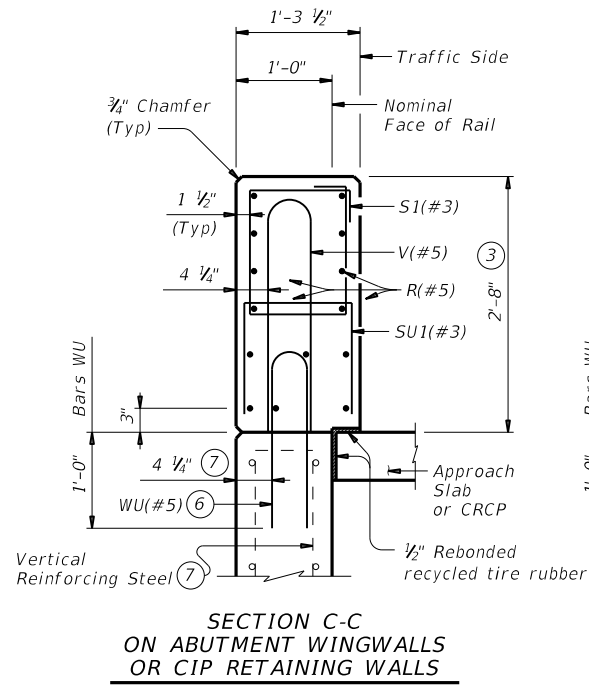
**ELEVATION SHOWING TYPICAL REINFORCING PLACEMENT**  
Showing rail on slab. Rail on box culvert similar.

- ① Terminal Connectors and associated hardware are to be paid for under the Item "Metal Beam Guard Fence". Attach Metal Beam Guard Fence Transitions to the bridge rail and extend along the embankment unless otherwise shown in the plans.
- ② Wingwall Length minus 5'-0" (Varies)
- ③ Increase 2" for structures with overlay.
- ④ Bars L(#5) are part of rail reinforcing and are included in unit price bid for railing. Space with Bars U. Bars L match slab bar cover. Bars L may be bundled with top slab reinforcing if spacing is equivalent.
- ⑤ Bars SU1(#3), SU2(#3) and WU(#5) not shown for clarity.
- ⑥ Substitute Bars U(#5) for Bars WU(#5) when parapet end is located on anchorage curb over culvert top slab. Use Bars WU(#5) in culvert parallel wings.

		Bridge Division Standard	
<h1>TRAFFIC RAIL</h1>			
<h2>TYPE T223</h2>			
FILE: r1std005-19.dgn	DN: TxDOT	CK: TxDOT	DW: JTR
©TxDOT September 2019	CONT	SECT	JOB
REVISIONS	1780	01	009
	DIST	COUNTY	HIGHWAY
	BWD	MILLS	FM 1047
			SHEET NO.
			99

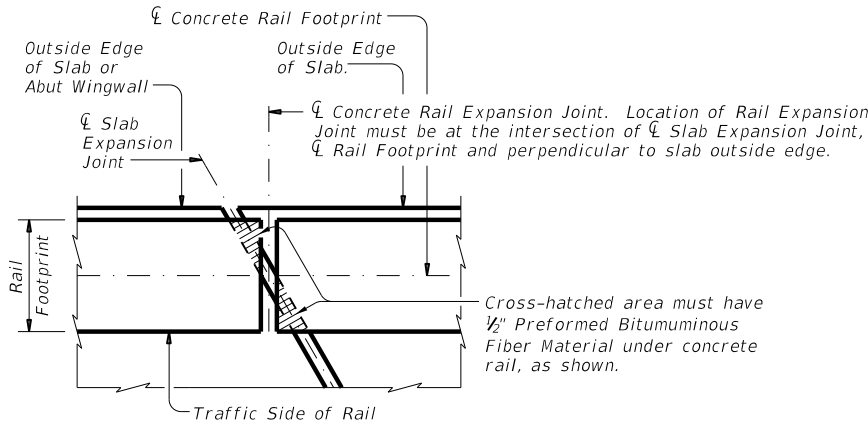
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DATE: 1/11/2022 10:49:34 AM  
 FILE: T:\BWDSD\TEAM\Design Projects\Mi11s\1780-01-009 FM 1047 Bennett Branch\Standards\TYPE T223.dgn



**SECTIONS THRU RAIL**  
 Sections on box culverts similar.

- ② Wingwall Length minus 5'-0" (Varies)
- ③ Increase 2" for structures with overlay.
- ④ Bars L(#5) are part of rail reinforcing and are included in unit price bid for railing. Space with Bars U. Bars L match slab bar cover. Bars L may be bundled with top slab reinforcing if spacing is equivalent.
- ⑥ Substitute Bars U(#5) for Bars WU(#5) when parapet end is located on anchorage curb over culvert top slab. Use Bars WU(#5) in culvert parallel wings.
- ⑦ When vertical reinforcing has closer clear cover over horizontal reinforcing in abutment wingwalls on traffic side of wall, move the horizontal wingwall/retaining wall reinforcing to the inside of Bars WU where bars conflict.
- ⑧ Top longitudinal slab bar may be adjusted laterally 3" plus or minus to tie reinforcing.
- ⑨ At the Contractor's option, Bars V may be replaced by extending Bars U to 2'-5 1/4" above the roadway surface without overlay.



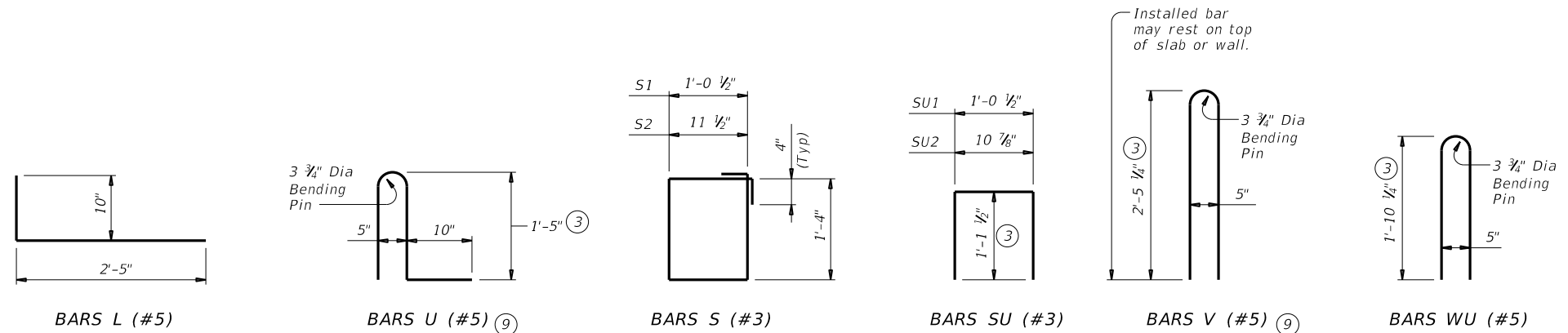
**PLAN OF RAIL AT EXPANSION JOINTS**  
 Example showing Slab Expansion Joints without breakbacks.

**CONSTRUCTION NOTES:**  
 Face of rail and parapet must be vertical transversely unless otherwise shown in the plans or approved by the Engineer.  
 Provide water barriers at openings draining onto undercrossing roadways and sidewalks. They may be cast-in-place or precast in convenient lengths and bonded to the bridge deck with an approved epoxy cement.  
 Chamfer all exposed corners.

**MATERIAL NOTES:**  
 Provide Class "C" concrete. Provide Class "C" (HPC) if required elsewhere.  
 Provide Grade 60 reinforcing steel.  
 Epoxy coat or galvanize all reinforcing steel if slab bars are epoxy coated or galvanized.  
 Deformed Welded Wire Reinforcing (WWR) (ASTM A1064) of equal size and spacing may be substituted for Bars U, V, and WU unless noted otherwise. Provide the same laps as required for reinforcing bars.  
 Provide bar laps, where required, as follows:  
 Uncoated or galvanized ~ #5 = 2'-0"  
 Epoxy coated ~ #5 = 3'-0"

**GENERAL NOTES:**  
 This rail has been evaluated by full-scale crash test to meet MASH TL-3 criteria. This rail can be used for speeds of 50 mph and greater when a TL-3 rated guard fence transition is used. When a TL-2 rated guard fence transition is used, this rail can be used for speeds of 45 mph and less.  
 Do not use this railing on bridges with expansion joints providing more than 5" movement.  
 Rail anchorage details shown on this standard may require modification for select structure types. See appropriate details elsewhere in plans for these modifications.  
 Shop drawings are not required for this rail.  
 Average weight of railing with no overlay is 358 plf.

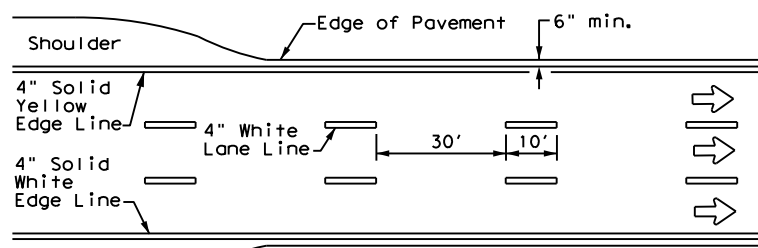
Cover dimensions are clear dimensions, unless noted otherwise. Reinforcing bar dimensions shown are out-to-out of bar.



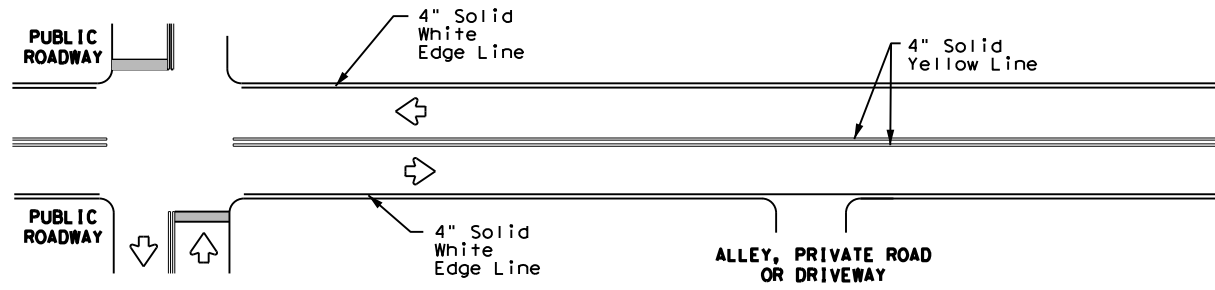
SHEET 3 OF 3

		<b>Bridge Division Standard</b>	
<h1>TRAFFIC RAIL</h1>			
<h2>TYPE T223</h2>			
FILE: r1std005-19.dgn	DN: TxDOT	CK: TxDOT	DW: JTR
©TxDOT September 2019	CONT	SECT	JOB
REVISIONS	1780	01	009
	DIST	COUNTY	SHEET NO.
	BWD	MILLS	100

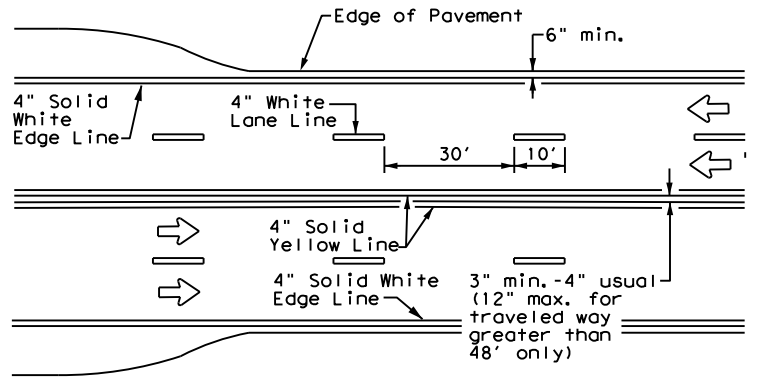
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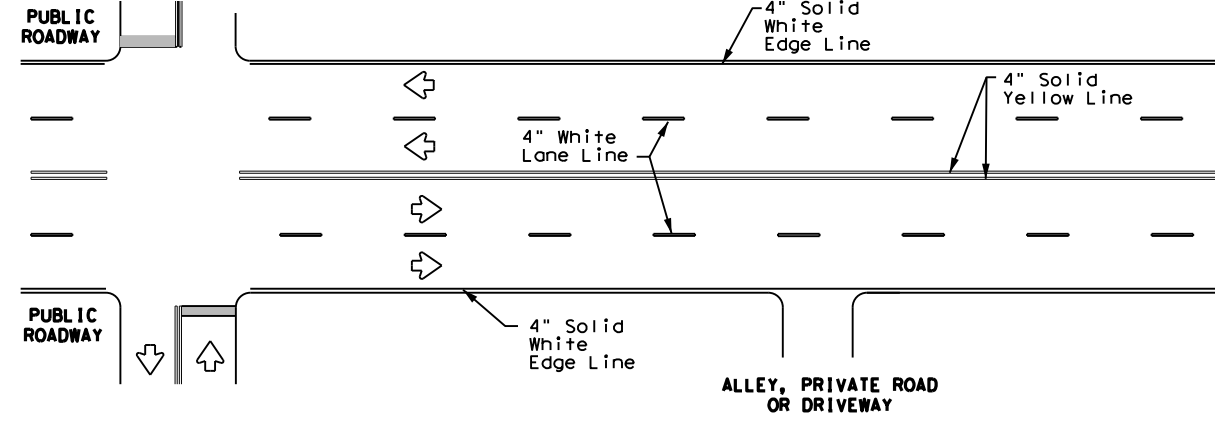
**EDGE LINE AND LANE LINES  
ONE-WAY ROADWAY  
WITH OR WITHOUT SHOULDERS**



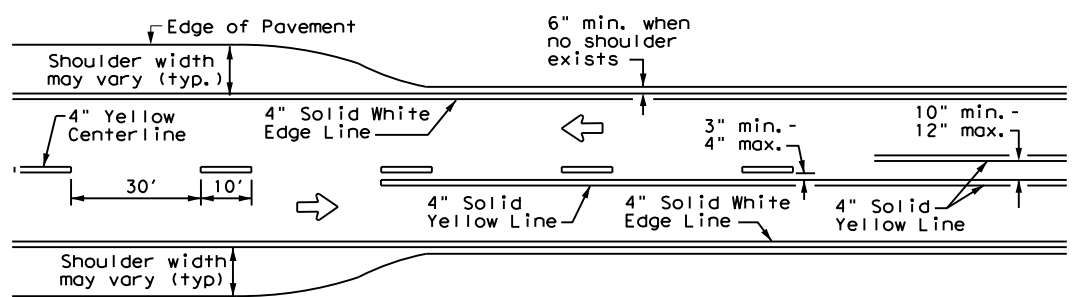
**TYPICAL TWO-LANE, TWO-WAY PAVEMENT  
MARKINGS THROUGH INTERSECTIONS**



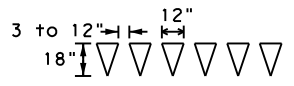
**CENTERLINE AND LANE LINES  
FOUR LANE TWO-WAY ROADWAY  
WITH OR WITHOUT SHOULDERS**



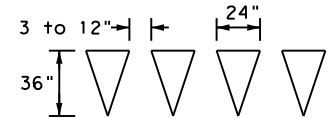
**TYPICAL MULTI-LANE, TWO-WAY PAVEMENT  
MARKINGS THROUGH INTERSECTIONS**



**TWO LANE TWO-WAY ROADWAY  
WITH OR WITHOUT SHOULDERS**

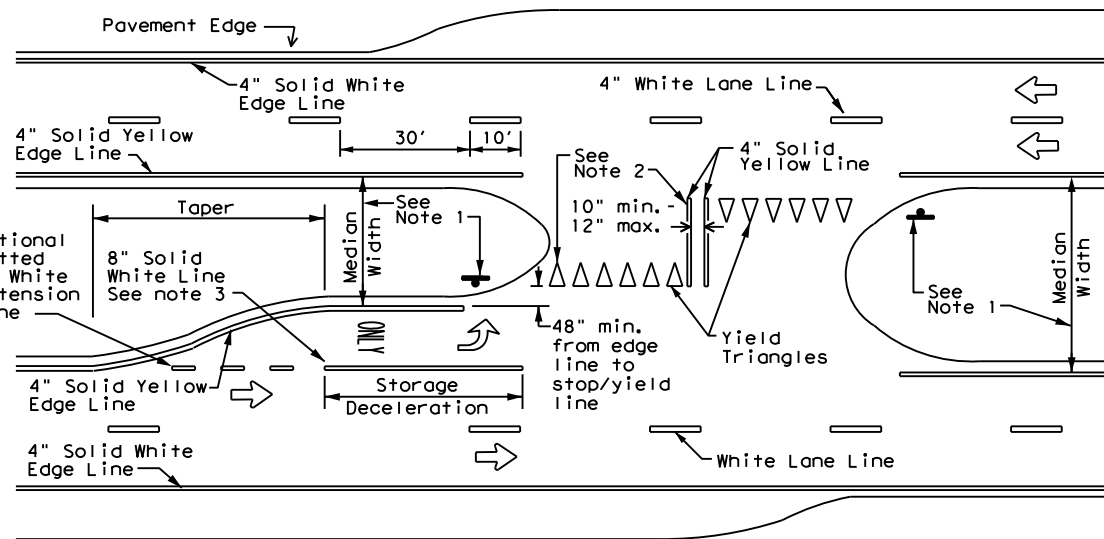


For posted speed on road being marked equal to or less than 40 MPH.



For posted speed on road being marked equal to or greater than 45 MPH.

**YIELD LINES**



**FOUR LANE DIVIDED ROADWAY CROSSOVERS**

**NOTES**

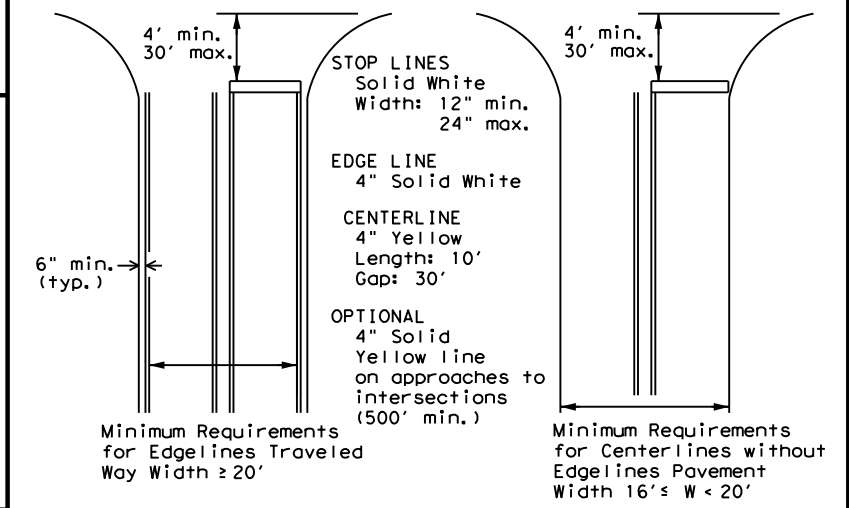
- Where divided highways are separated by median widths at the median opening itself of 30 feet or more, median openings shall be signed as two separate intersections. Each median opening has two width measurements, with one measurement for each approach. The narrow median width will be the controlling width to determine if signs are required. Yield signs are the typical intersection control. Stop signs are optional as determined by the Engineer.
- Install median striping (double yellow centerlines and stop bars/yield triangles) when a 50' or greater median centerline can be placed. Stop bars shall only be used with stop signs. Yield triangles shall only be used with yield signs.
- Length of turn bays, including taper, deceleration, and storage lengths shall be as shown on the plans or as directed by the Engineer.

**GENERAL NOTES**

- Edgeline striping shall be as shown in the plans or as directed by the Engineer. The edgeline should not be placed less than 6 inches from the edge of pavement. This distance may vary due to pavement raveling or other conditions. Edgelines are not required in curb and gutter sections of roadways.
- The traveled way includes only that portion of the roadway used for vehicular travel. It does not include the parking lanes, sidewalks, berms and shoulders. The traveled ways shall be measured from the inside of edgeline to the inside of edgeline of a two lane roadway.

MATERIAL SPECIFICATIONS	
PAVEMENT MARKERS (REFLECTORIZED)	DMS-4200
EPOXY AND ADHESIVES	DMS-6100
BITUMINOUS ADHESIVE FOR PAVEMENT MARKERS	DMS-6130
TRAFFIC PAINT	DMS-8200
HOT APPLIED THERMOPLASTIC	DMS-8220
PERMANENT PREFABRICATED PAVEMENT MARKINGS	DMS-8240

All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



**GUIDE FOR PLACEMENT OF STOP LINES,  
EDGE LINE & CENTERLINE**

Based on Traveled Way and Pavement Widths for Undivided Highways



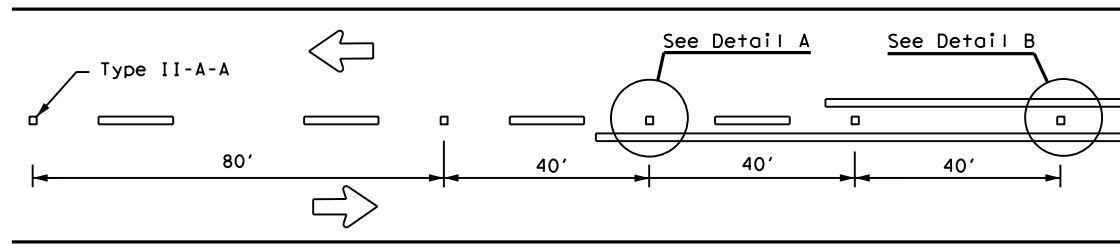
**TYPICAL STANDARD  
PAVEMENT MARKINGS**

**PM(1)-20**

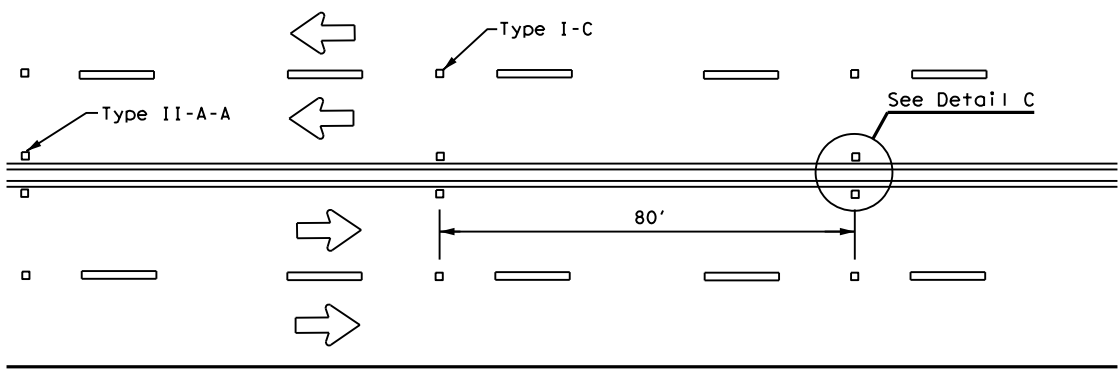
FILE: pm1-20.dgn	DN:	CK:	DW:	CK:
© TxDOT November 1978	CONT	SECT	JOB	HIGHWAY
8-95 3-03 REVISIONS	1780	01	009	FM 1047
5-00 2-12	DIST	COUNTY	SHEET NO.	
8-00 6-20	BWD	MILLS	101	

# REFLECTIVE RAISED PAVEMENT MARKERS FOR VEHICLE POSITIONING GUIDANCE

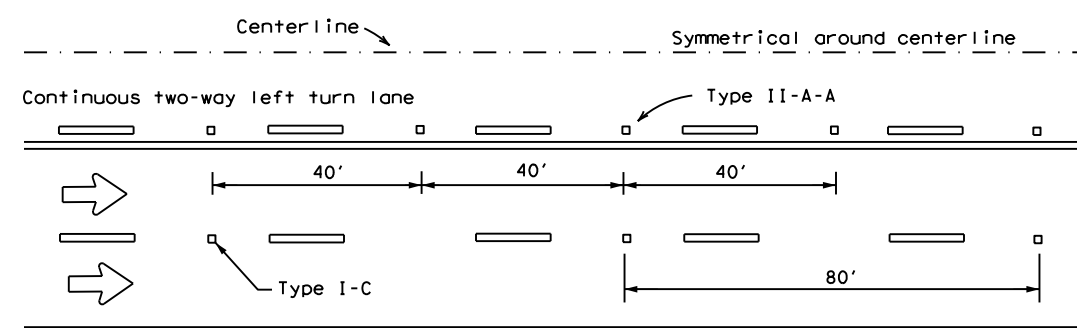
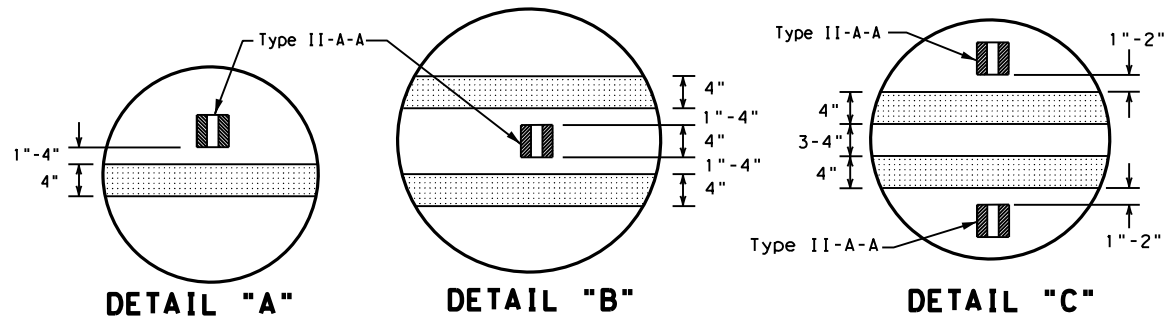
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 DATE: 1/11/2022 10:49:36 AM  
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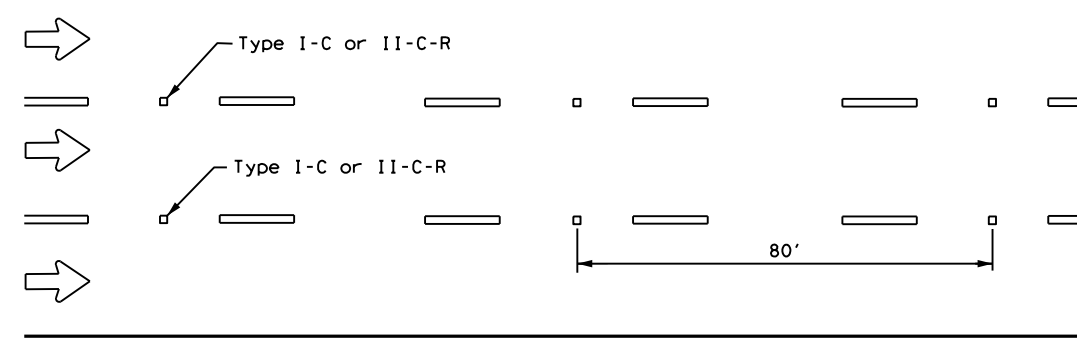
**CENTERLINE FOR ALL TWO LANE ROADWAYS**



**CENTERLINE & LANE LINES  
FOR FOUR LANE TWO-WAY HIGHWAYS**



**CENTERLINE AND LANE LINES FOR TWO-WAY LEFT TURN LANE**

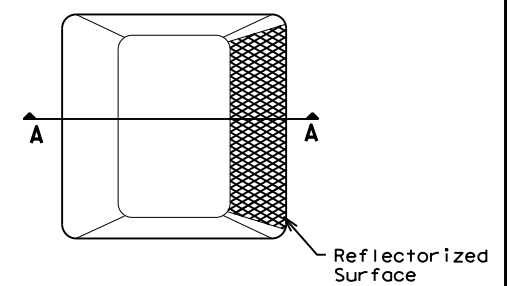


**LANE LINES FOR ONE-WAY ROADWAY (NON-FREEWAY FACILITIES)**

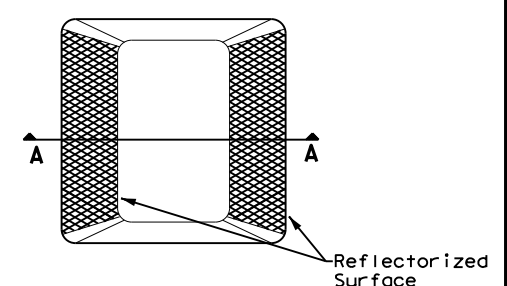
Raised pavement markers Type II-C-R shall have clear face toward normal traffic and red face toward wrong-way traffic.

MATERIAL SPECIFICATIONS	
PAVEMENT MARKERS (REFLECTORIZED)	DMS-4200
EPOXY AND ADHESIVES	DMS-6100
BITUMINOUS ADHESIVE FOR PAVEMENT MARKERS	DMS-6130
TRAFFIC PAINT	DMS-8200
HOT APPLIED THERMOPLASTIC	DMS-8220
PERMANENT PREFABRICATED PAVEMENT MARKINGS	DMS-8240

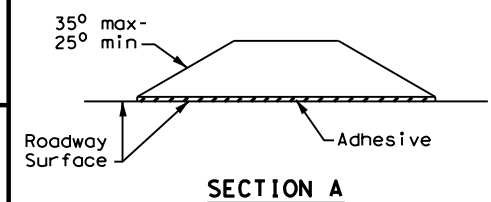
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



**Type I (Top View)**



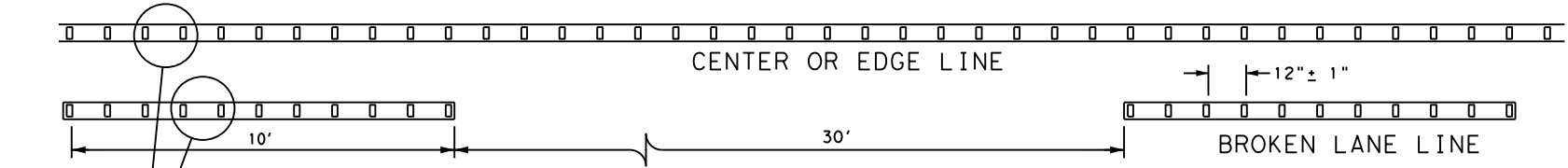
**Type II (Top View)**



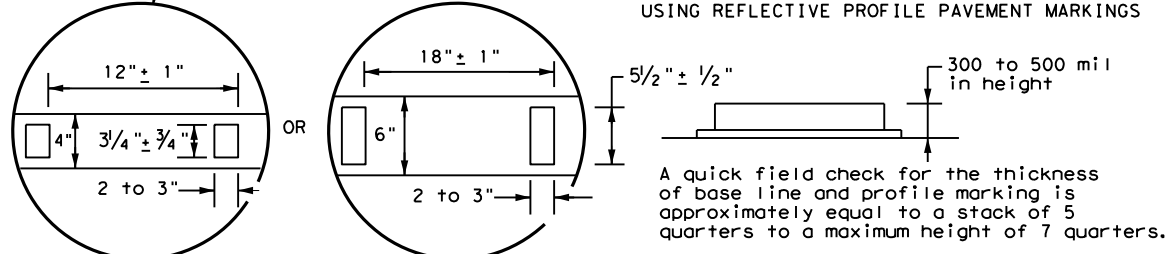
**RAISED PAVEMENT MARKERS**

**GENERAL NOTES**

- All raised pavement markers placed in broken lines shall be placed in line with and midway between the stripes.
- On concrete pavements the raised pavement markers should be placed to one side of the longitudinal joints.



**REFLECTORIZED PROFILE  
PATTERN DETAIL**  
USING REFLECTIVE PROFILE PAVEMENT MARKINGS



**NOTE**  
Profile markings shall not be placed on roadways with a posted speed limit of 45 MPH or less.



## POSITION GUIDANCE USING RAISED MARKERS REFLECTORIZED PROFILE MARKINGS PM(2) - 20

FILE: pm2-20.dgn	DN:	CK:	DW:	CK:
© TxDOT April 1977	CONT	SECT	JOB	HIGHWAY
4-92 2-10 REVISIONS	1780	01	009	FM 1047
5-00 2-12	DIST	COUNTY		SHEET NO.
8-00 6-20	BWD	MILLS		102

## SUMMARY OF SMALL SIGNS

STA.	SIGN NO.	SIGN NOMENCLATURE	SIGN	DIMENSIONS	FLAT ALUMINUM (TYPE A)	EXAL ALUMINUM (TYPE G)	SM RD SGN ASSM TY XXXXX (X) XX (X-XXXX)				BRIDGE MOUNT CLEARANCE SIGNS (See Note 2)	
							POST TYPE	POSTS	ANCHOR TYPE	MOUNTING DESIGNATION		
										PREFABRICATED		1EXT or 2EXT = # of Ext BM = Extruded Wind Beam WC = 1.12 #/ft Wing Channel EXAL= Extruded Alum Sign Panels
STA. 162+51	1	W1-8	CHEVRON	18"X24"	X		10 BWG	1	SA	P		
STA. 163+71	2	W1-8	CHEVRON	18"X24"	X		10 BWG	1	SA	P		
STA. 164+65	3	W1-8	CHEVRON	18"X24"	X		10 BWG	1	SA	P		
STA. 165+59	4	W1-8	CHEVRON	18"X24"	X		10 BWG	1	SA	P		
STA. 166+53	5	W1-8	CHEVRON	18"X24"	X		10 BWG	1	SA	P		
STA. 169+50	6	W1-8	CHEVRON	18"X24"	X		10 BWG	1	SA	P		
STA. 170+38	7	W1-8	CHEVRON	18"X24"	X		10 BWG	1	SA	P		
STA. 171+26	8	W1-8	CHEVRON	18"X24"	X		10 BWG	1	SA	P		
STA. 172+15	9	W1-8	CHEVRON	18"X24"	X		10 BWG	1	SA	P		
STA. 173+35	10	W1-8	CHEVRON	18"X24"	X		10 BWG	1	SA	P		
STA. 154+20			NARROW BRIDGE (REMOVE ONLY)									
STA. 158+04			LOAD ZONE (REMOVE ONLY)									
STA. 164+96			WEIGHT LIMIT (REMOVE ONLY)									
STA. 171+00			WEIGHT LIMIT (REMOVE ONLY)									
STA. 177+81			LOAD ZONE (REMOVE ONLY)									
STA. 179+70			NARROW BRIDGE (REMOVE ONLY)									

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 DATE: 1/1/2022 10:49:42 AM  
 FILE: T:\BWDDSGTEAM\Design Projects\Mills\1780-01-009 FM 1047 Bennett Branch\MasterReferenceFiles\SIGNS\Signs\0644-6001.dgn


Square Feet	Minimum Thickness
Less than 7.5	0.080"
7.5 to 15	0.100"
Greater than 15	0.125"

The Standard Highway Sign Designs for Texas (SHSD) can be found at the following website:  
<http://www.txdot.gov/>

- NOTE:**
1. Sign supports shall be located as shown on the plans, except that the Engineer may shift the sign supports, within design guidelines, where necessary to secure a more desirable location or to avoid conflict with utilities. Unless otherwise shown on the plans, the Contractor shall stake and the Engineer will verify all sign support locations.
  2. For installation of bridge mount clearance signs, see Bridge Mounted Clearance Sign Assembly (BMCS) Standard Sheet.
  3. For Sign Support Descriptive Codes, see Sign Mounting Details Small Roadside Signs General Notes & Details SMD(GEN).

CSJ: 1780-01-009

ITEM	DESCRIPTION	TOTAL
0644-6001	INS SM RD SN SUP & AM TY 10BWG (1)SA(P)	10
0644-6076	REMOV SM RD SN SUP & AM	12



**Texas Department of Transportation**

*Traffic Operations Division Standard*

### SUMMARY OF SMALL SIGNS

#### SOSS

FILE: sum16.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT May 1987	CONT 1780	SECT 01	JOB 009	HIGHWAY FM 1047
4-16 8-16	DIST BWD	COUNTY MILLS	SHEET NO. 103	

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DATE: 1/1/2022 10:49:43 AM  
 FILE: T:\BWDSD\TEAM\Design Projects\Mills\1780-01-009 FM 1047 Bennett Branch\Standards\SMD(GEN)-08.dgn

### SIGN SUPPORT DESCRIPTIVE CODES

(Descriptive Codes correspond to project estimate and quantities sheets)

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

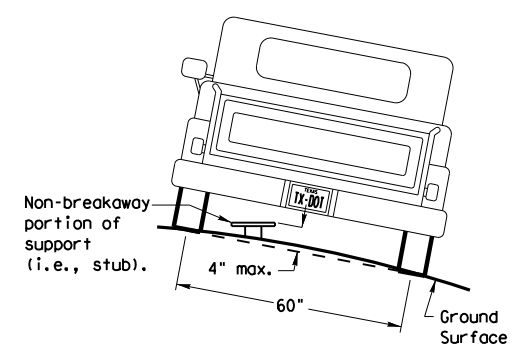
**Post Type**  
 FRP = Fiberglass Reinforced Plastic Pipe (see SMD(FRP))  
 TWT = Thin-Walled Tubing (see SMD(TWT))  
 10BWG = 10 BWG Tubing (see SMD(SLIP-1) to (SLIP-3))  
 S80 = Schedule 80 Pipe (see SMD(SLIP-1) to (SLIP-3))

**Number of Posts (1 or 2)**

**Anchor Type**  
 UA = Universal Anchor - Concreted (see SMD(FRP) and (TWT))  
 UB = Universal Anchor - Bolted down (see SMD(FRP) and (TWT))  
 WS = Wedge Anchor Steel - (see SMD(TWT))  
 WP = Wedge Anchor Plastic (see SMD(TWT))  
 SA = Slipbase - Concreted (see SMD(SLIP-1) to (SLIP-3))  
 SB = Slipbase - Bolted Down (see SMD(SLIP-1) to (SLIP-3))

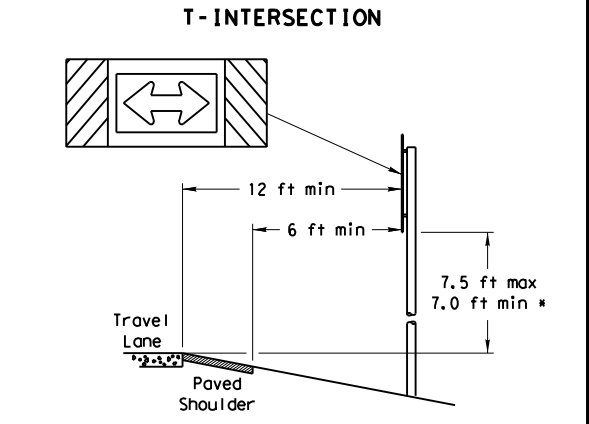
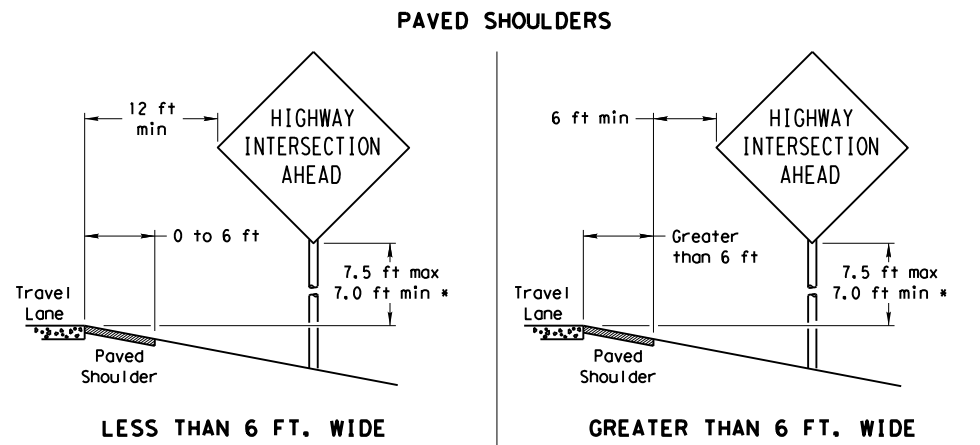
**Sign Mounting Designation**  
 P = Prefab. "Plain" (see SMD(SLIP-1) to (SLIP-3), (TWT), (FRP))  
 T = Prefab. "T" (see SMD(SLIP-1) to (SLIP-3), (TWT))  
 U = Prefab. "U" (see SMD(SLIP-1) to (SLIP-3))  
 IF REQUIRED  
 1EXT or 2EXT = Number of Extensions (see SMD(SLIP-1) to (SLIP-3), (TWT))  
 BM = Extruded Wind Beam (see SMD(SLIP-1) to (SLIP-3))  
 WC = 1.12 #/ft Wing Channel (see SMD(SLIP-1) to (SLIP-3))  
 EXAL = Extruded Aluminum Sign Panels (see SMD(SLIP-3))

### REQUIRED CLEARANCE FOR BREAKAWAY SUPPORT



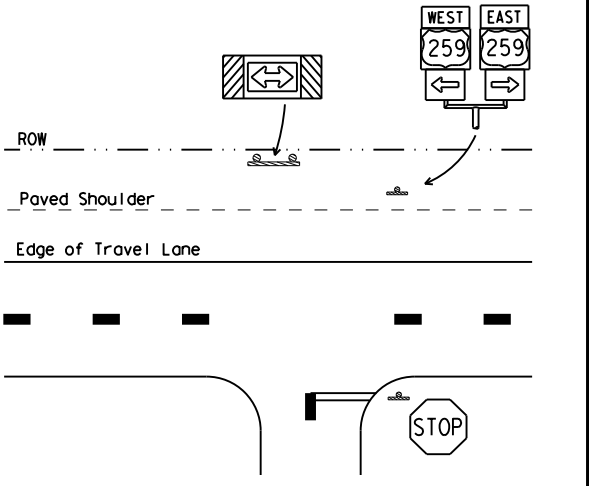
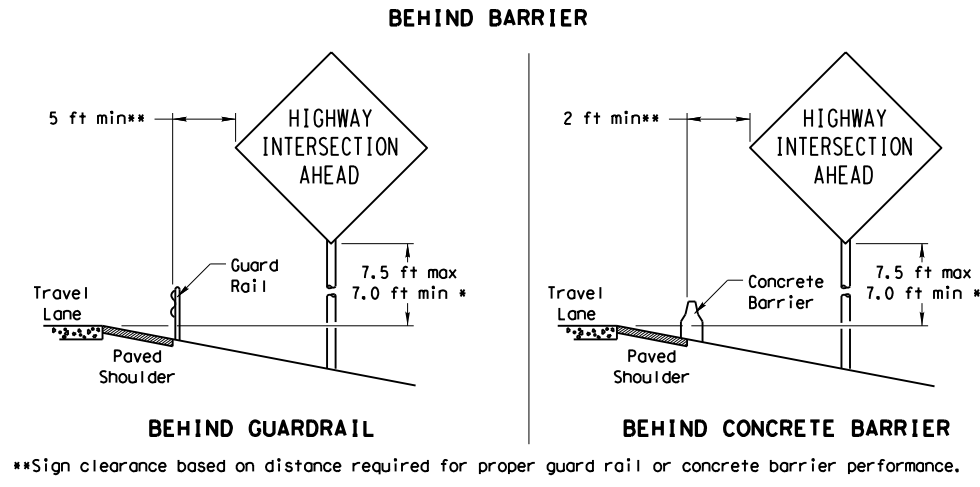
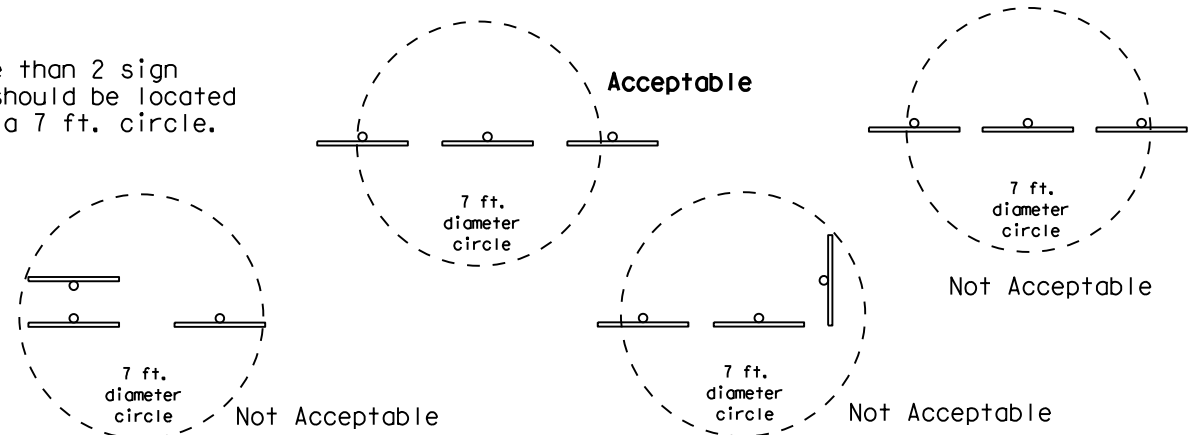
To avoid vehicle undercarriage snagging, any substantial remains of a breakaway support, when it is broken away, should not project more than 4 inches above a 60-inch chord (i.e., typical space between wheel paths).

### SIGN LOCATION



When this sign is needed at the end of a two-lane, two way roadway, the right edge of the sign should be in line with the centerline of the roadway. Place as close to ROW as practical.

No more than 2 sign posts should be located within a 7 ft. circle.



\* Signs shall be mounted using the following condition that results in the greatest sign elevation:

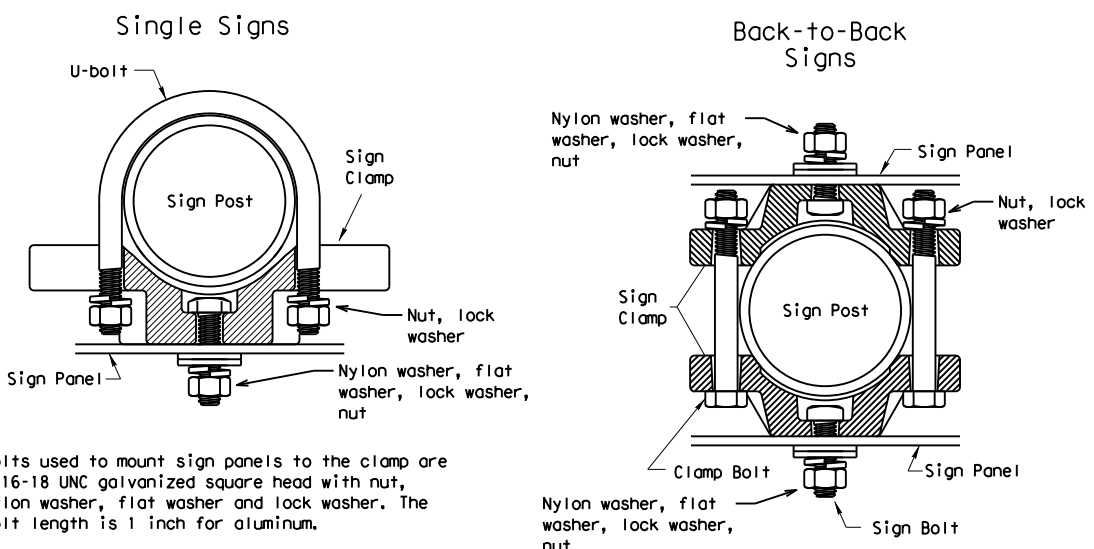
- (1) a minimum of 7 to a maximum of 7.5 feet above the edge of the travel lane or
- (2) a minimum of 7 to a maximum of 7.5 feet above the grade at the base of the support when sign is installed on the backslope.

The maximum values may be increased when directed by the Engineer.

See the Traffic Operations Division website for detailed drawings of sign clamps, Triangular Slipbase System components and Wedge Anchor System components.

The website address is:  
<http://www.txdot.gov/publications/traffic.htm>

### TYPICAL SIGN ATTACHMENT DETAIL



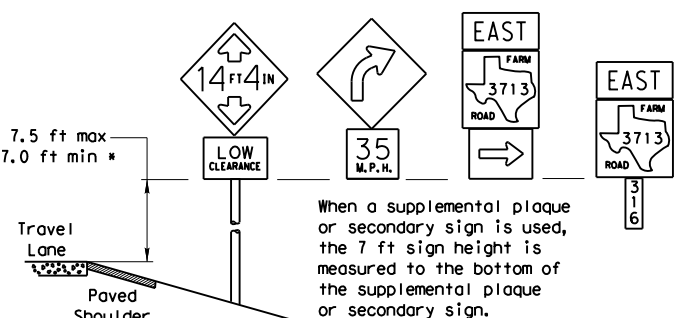
Bolts used to mount sign panels to the clamp are 5/16-18 UNC galvanized square head with nut, nylon washer, flat washer and lock washer. The bolt length is 1 inch for aluminum.

When two sign clamps are used to mount signs back-to-back, use a 5/16-18 UNC galvanized hex head per ASTM A307 with nut and helical-spring lock washer. The approximate bolt lengths for various post sizes and sign clamp types are given in the table at right. The bolt length may need to be adjusted depending upon field conditions.

Sign clamps may be either the specific size clamp or the universal clamp.

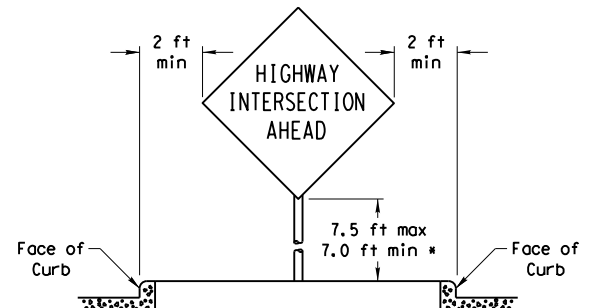
Pipe Diameter	Approximate Bolt Length	
	Specific Clamp	Universal Clamp
2" nominal	3"	3 or 3 1/2"
2 1/2" nominal	3 or 3 1/2"	3 1/2 or 4"
3" nominal	3 1/2 or 4"	4 1/2"

### SIGNS WITH PLAQUES

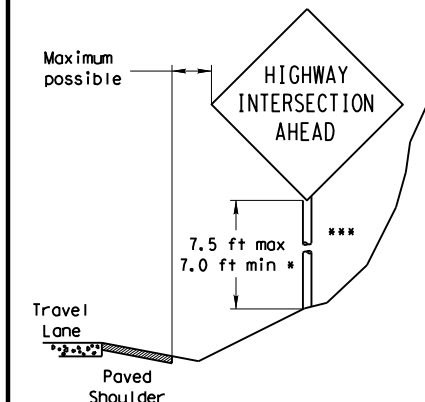


When a supplemental plaque or secondary sign is used, the 7 ft sign height is measured to the bottom of the supplemental plaque or secondary sign.

### CURB & GUTTER OR RAISED ISLAND



### RESTRICTED RIGHT-OF-WAY (When 6 ft min. is not possible.)



Right-of-way restrictions may be created by rocks, water, vegetation, forest, buildings, a narrow island, or other factors.

In situations where a lateral restriction prevents the minimum horizontal clearance from the edge of the travel lane, signs should be placed as far from the travel lane as practical.

\*\*\* Post may be shorter if protected by guardrail or if Engineer determines the post could not be hit due to extreme slope.



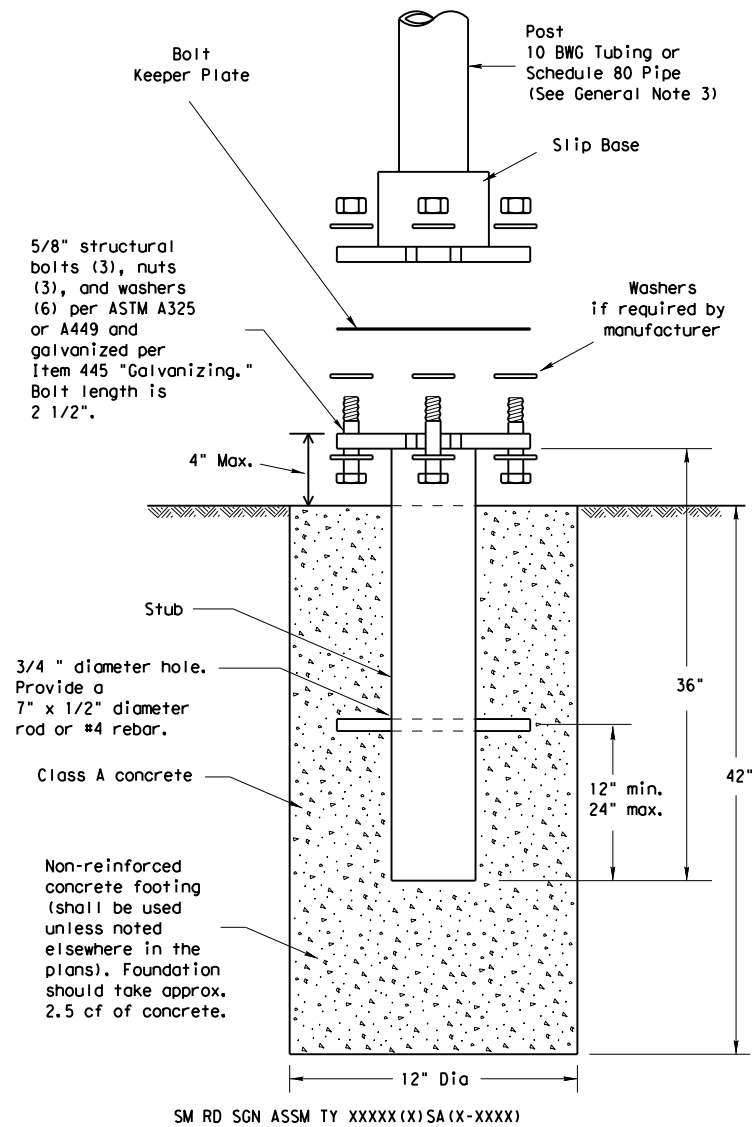
## SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS GENERAL NOTES & DETAILS

SMD(GEN)-08

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		DIST	COUNTY		SHEET NO.
		BWD	MILLS		104

DATE: 1/11/2022 10:49:44 AM  
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## TRIANGULAR SLIPBASE INSTALLATION GENERAL REQUIREMENTS



### NOTE

There are various devices approved for the Triangular Slipbase System. Please reference the Material Producer List for approved slip base systems. [http://www.txdot.gov/business/producer\\_list.htm](http://www.txdot.gov/business/producer_list.htm)  
 The devices shall be installed per manufacturers' recommendations. Installation procedures shall be provided to the Engineer by Contractor.

### GENERAL NOTES:

- Slip base shall be permanently marked to indicate manufacturer. Method, design, and location of marking are subject to approval of the TxDOT Traffic Standards Engineer.
- Material used as post with this system shall conform to the following specifications:
  - 10 BWG Tubing (2.875" outside diameter)
    - 0.134" nominal wall thickness
    - Seamless or electric-resistance welded steel tubing or pipe
    - Steel shall be HSLAS Gr 55 per ASTM A1011 or ASTM A1008
    - Other steels may be used if they meet the following:
      - 55,000 PSI minimum yield strength
      - 70,000 PSI minimum tensile strength
      - 20% minimum elongation in 2"
    - Wall thickness (uncoated) shall be within the range of 0.122" to 0.138"
    - Outside diameter (uncoated) shall be within the range of 2.867" to 2.883"
    - Galvanization per ASTM A123 or ASTM A653 G210. For precoated steel tubing (ASTM A653), recoat tube outside diameter weld seam by metallizing with zinc wire per ASTM B833.
  - Schedule 80 Pipe (2.875" outside diameter)
    - 0.276" nominal wall thickness
    - Steel tubing per ASTM A500 Gr C
    - Other seamless or electric-resistance welded steel tubing or pipe with equivalent outside diameter and wall thickness may be used if they meet the following:
      - 46,000 PSI minimum yield strength
      - 62,000 PSI minimum tensile strength
      - 21% minimum elongation in 2"
    - Wall thickness (uncoated) shall be within the range of 0.248" to 0.304"
    - Outside diameter (uncoated) shall be within the range of 2.855" to 2.895"
    - Galvanization per ASTM A123
- See the Traffic Operations Division website for detailed drawings of sign clamps and Texas Universal Triangular Slipbase System components. The website address is: <http://www.txdot.gov/publications/traffic.htm>
- Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.

### ASSEMBLY PROCEDURE

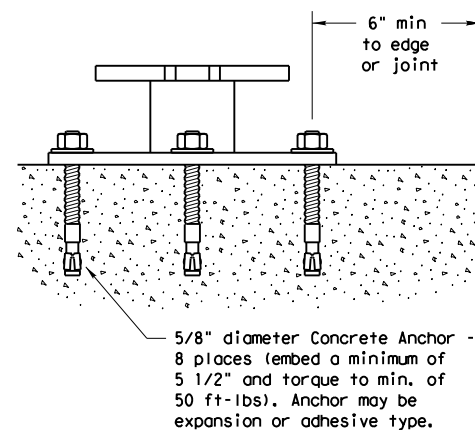
#### Foundation

- Prepare 12-inch diameter by 42-inch deep hole. If solid rock is encountered, the depth of the foundation may be reduced such that it is embedded a minimum of 18 inches into the solid rock.
- The Engineer may permit batches of concrete less than 2 cubic yards to be mixed with a portable, motor-driven concrete mixer. For small placements less than 0.5 cubic yards, hand mixing in a suitable container may be allowed by Engineer. Concrete shall be Class A.
- Push the pipe end of the slip base stub into the center of the concrete. Rotate the stub back and forth while pushing it down into the concrete to assure good contact between the concrete and stub. Continue to work the stub into the concrete until it is between 2 to 4 inches above the ground.
- Plumb the stub. Allow a minimum of 4 days to set, unless otherwise directed by the Engineer.
- The triangular slipbase system is multidirectional and is designed to release when struck from any direction.

#### Support

- Cut support so that the bottom of the sign will be 7 to 7.5 feet above the edge of the travelway (i.e., edge of the closest lane) when slip plate is below the edge of pavement or 7 to 7.5 feet above slip plate when the slip plate is above the edge of the travelway. The cut shall be plumb and straight.
- Attach sign to support using connections shown. When multiple signs are installed on the same support, ensure the minimum clearance between each sign is maintained. See SMD(SLIP-2) for clearances based on sign types.

### CONCRETE ANCHOR



Concrete anchor consists of 5/8" diameter stud bolt with UNC series bolt threads on the upper end. Heavy hex nut per ASTM A563, and hardened washer per ASTM F436. The stud bolt shall have a minimum yield and ultimate tensile strength of 50 and 75 KSI, respectively. Nuts, bolts and washers shall be galvanized per Item 445, "Galvanizing." Adhesive type anchors shall have stud bolts installed with Type III epoxy per DMS-6100, "Epoxyes and Adhesives." Adhesive anchors may be loaded after adequate epoxy cure time per the manufacturer's recommendations. Top of bolt shall extend at least flush with top of the nut when installed. The anchor, when installed in 4000 psi normal-weight concrete with a 5 1/2" minimum embedment, shall have a minimum allowable tension and shear of 3900 and 3100 psi, respectively.



## SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS TRIANGULAR SLIPBASE SYSTEM

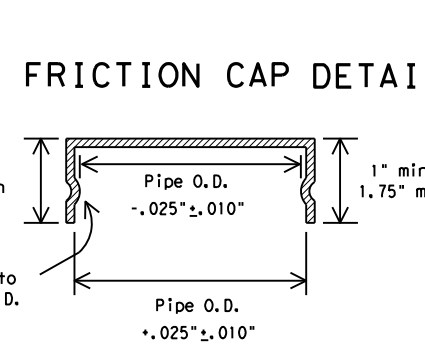
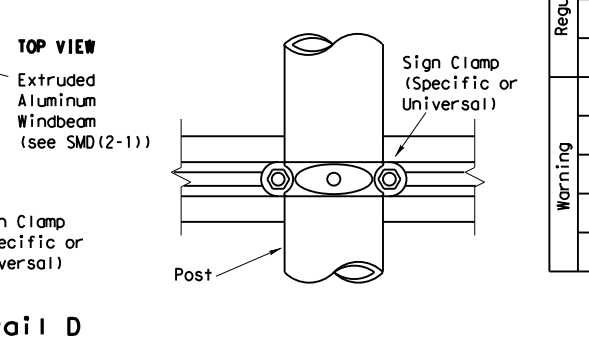
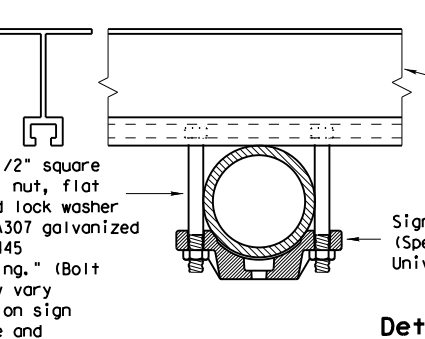
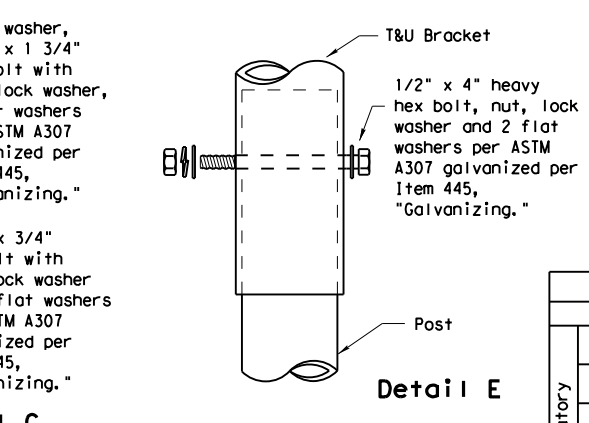
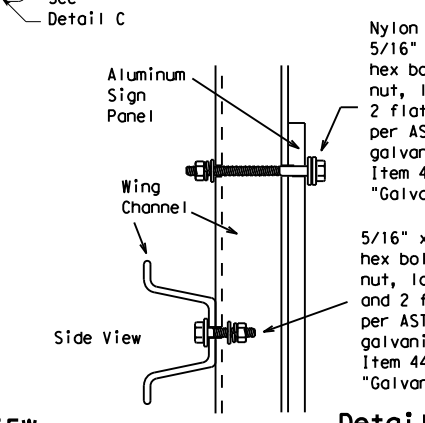
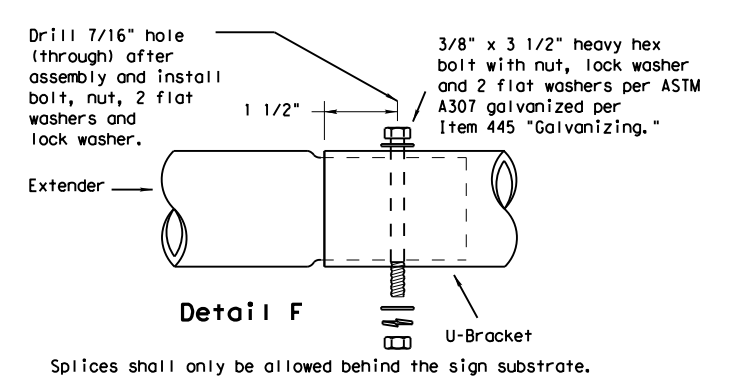
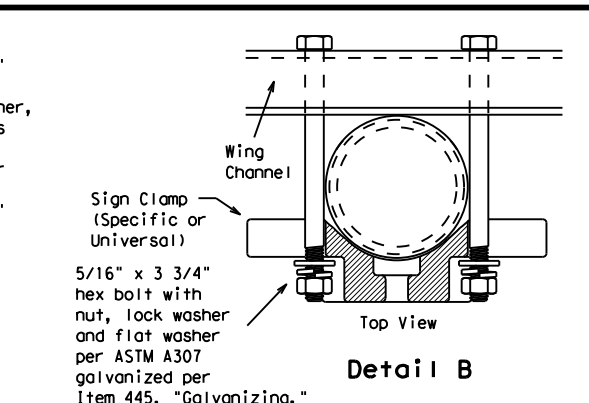
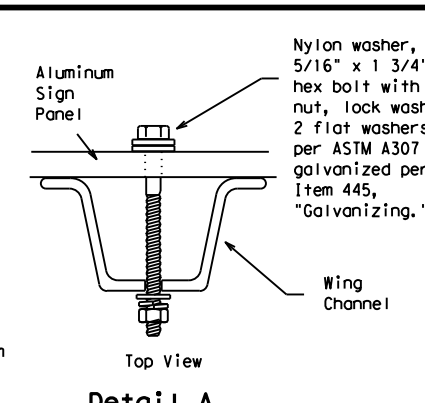
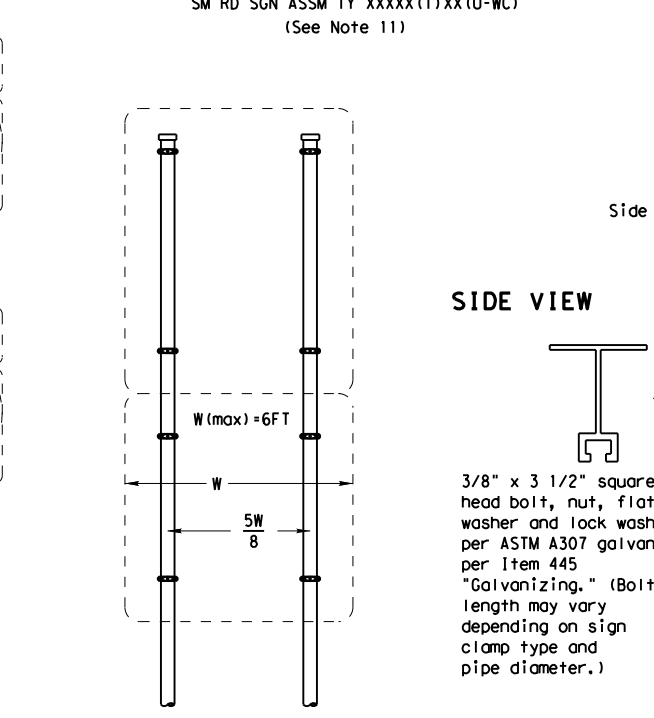
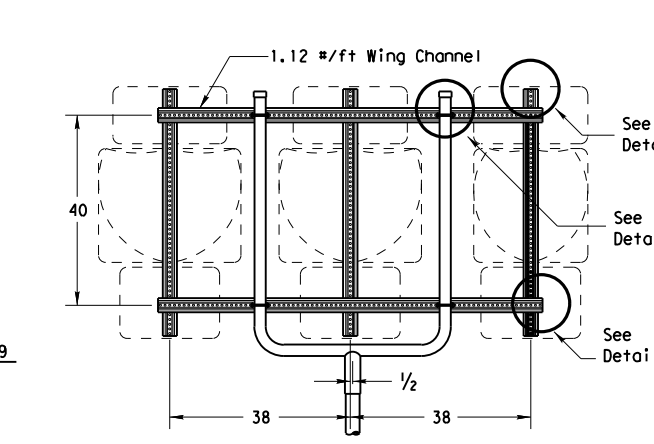
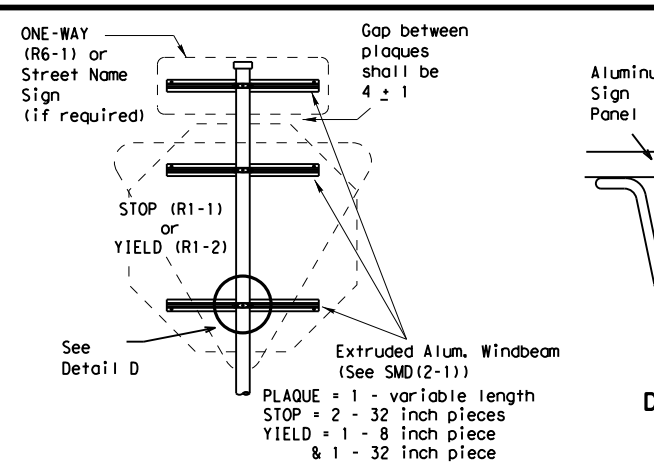
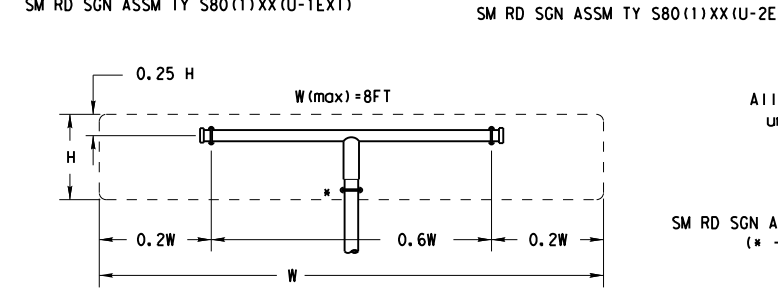
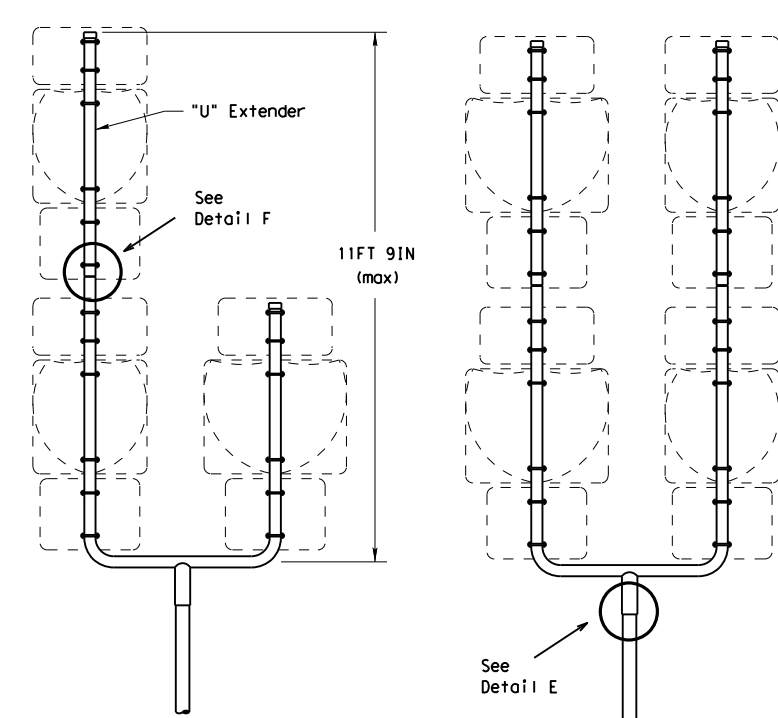
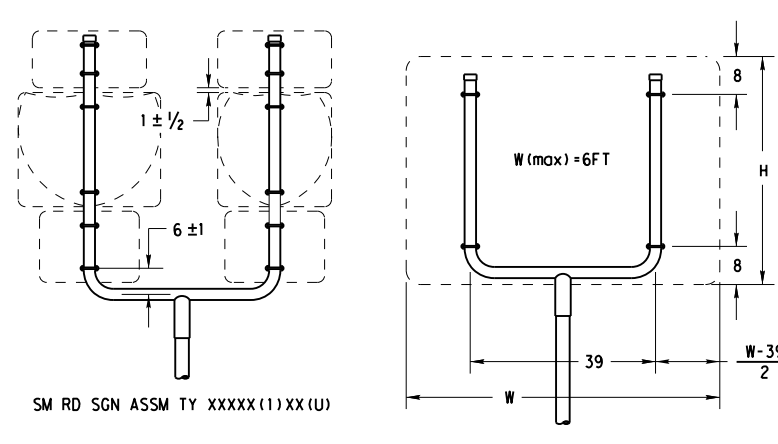
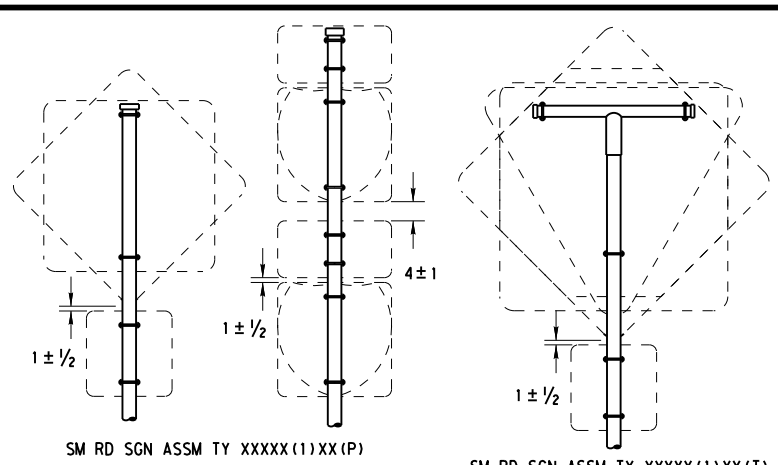
SMD(SLIP-1)-08

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All dimensions are in english unless detailed otherwise.

Friction caps may be manufactured from hot rolled or cold rolled steel sheets. The minimum sheet metal thickness shall be 24 gauge for all cap sizes. The rim edges shall be reasonably straight and smooth. Caps shall be sized and formed in such a manner as to produce a drive-on friction fit and have no tendency to rock when seated on the pipe. The depth shall be sufficient to give positive protection against entrance of rainwater. They shall be free of sharp creases or indentations and show no evidence of metal fracture. Caps shall have an electrodeposited coating of zinc in accordance with the requirements of ASTM B633 Class FE/ZN 8.

- GENERAL NOTES:**
1. SIGN SUPPORT # OF POSTS MAX. SIGN AREA

10 BWG	1	16 SF
10 BWG	2	32 SF
Sch 80	1	32 SF
Sch 80	2	64 SF

  2. The Engineer may require that a Schedule 80 post be used in place of a 10 BWG where a sign height is abnormally high due to a fill slope.
  3. Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.
  4. Aluminum sign blanks shall conform to Departmental Material Specifications DMS-7110 and shall have the following minimum thicknesses: 0.080 for signs less than 7.5 sq. ft., 0.100 for signs 7.5 to 15 sq. ft., and 0.125 for signs greater than 15 sq. ft.
  5. Signs that require specific supports due to reasons in addition to windloading are indicated on the "REQUIRED SUPPORT" table on this sheet.
  6. For horizontal rectangular signs fabricated from flat aluminum, T-brackets are used for signs 24 inches or less in height. U-brackets are used for signs of greater height.
  7. When two triangular slipbase supports are used to support a single sign, they shall not be "rigidly" connected to each other except through the sign panel. This will allow each support to act independently when impacted by an errant vehicle.
  8. Wing channel shall meet ASTM A 1011 SS Gr 50 and be galvanized per ASTM A 123.
  9. Excess pipe, wing channel, or windbeam shall be cut off so that it does not extend beyond the sign panel (i.e., excess support shall not be visible when the sign is viewed from the front.) Repair galvanized coating at cut support ends per Item 445, "Galvanizing."
  10. Additional route markers may be added vertically, provided the total sign area does not exceed the maximum allowable amount per Note 1.
  11. Additional sign clamp required on the "T-bracket" post for 24 inch height signs. Place the clamp 3 inches above bottom of sign when possible.
  12. Post open ends shall be fitted with Friction Caps.
  13. Sign blanks shall be the sizes and shapes shown on the plans.

REQUIRED SUPPORT		
SIGN DESCRIPTION	SUPPORT	
Regulatory	48-inch STOP sign (R1-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	60-inch YIELD sign (R1-2)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	48x16-inch ONE-WAY sign (R6-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
Warning	36x48, 48x36, and 48x48-inch signs	TY 10BWG(1)XX(T)
	48x60-inch signs	TY S80(1)XX(T)
	48x48-inch signs (diamond or square)	TY 10BWG(1)XX(T)
	48x60-inch signs	TY S80(1)XX(T)
	48-inch Advance School X-ing sign (S1-1)	TY 10BWG(1)XX(T)
48-inch School X-ing sign (S2-1)	TY 10BWG(1)XX(T)	
Large Arrow sign (W1-6 & W1-7)	TY 10BWG(1)XX(T)	

Texas Department of Transportation  
Traffic Operations Division

**SIGN MOUNTING DETAILS  
SMALL ROADSIDE SIGNS  
TRIANGULAR SLIPBASE SYSTEM**

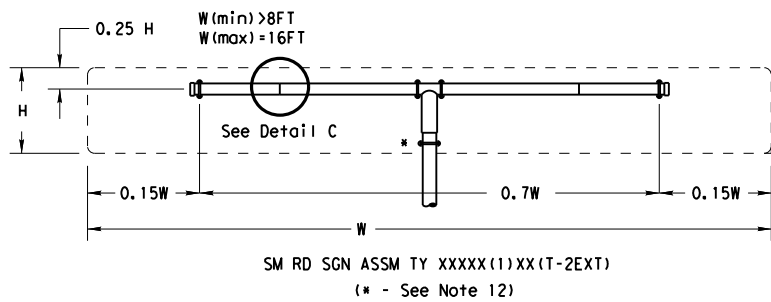
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		DIST: BWD	COUNTY: MILLS	SHEET NO. 106	

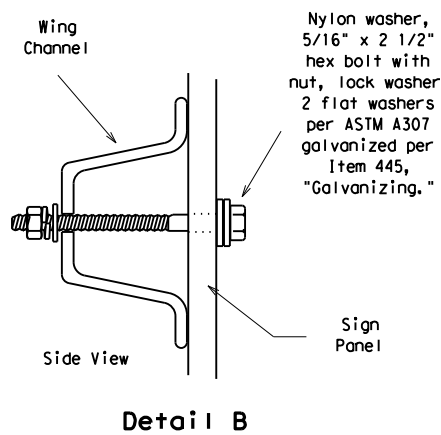


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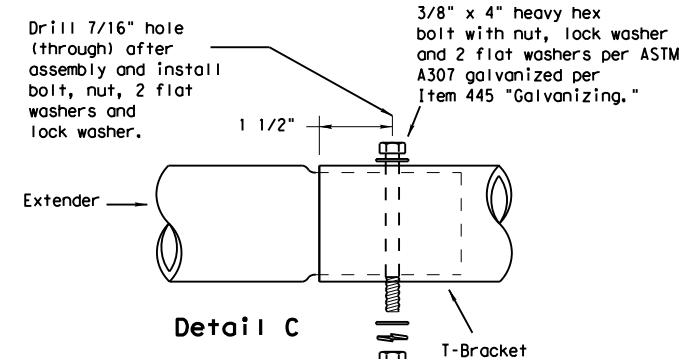
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SM RD SGN ASSM TY XXXX(1)XX(T-2EXT)  
 (\* - See Note 12)

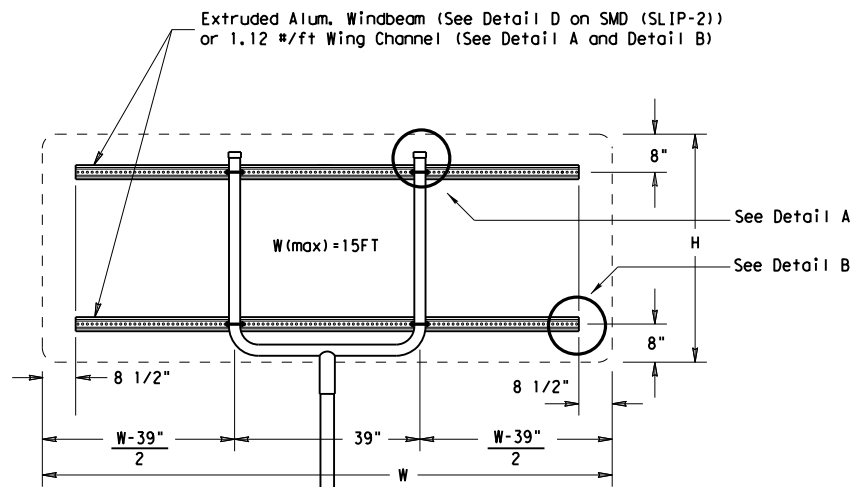


Detail B

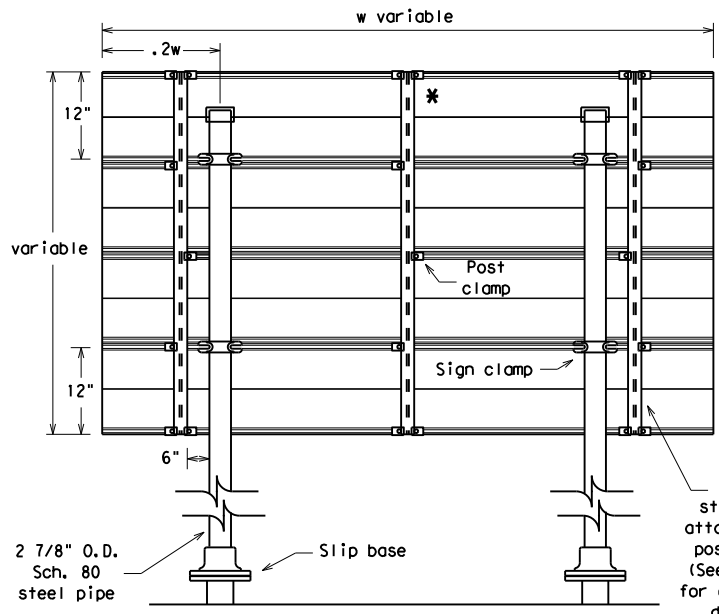


Detail C

Splices shall only be allowed behind the sign substrate.

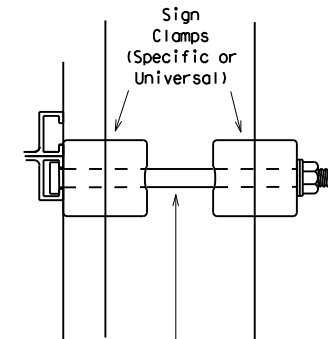


SM RD SGN ASSM TY XXXX(1)XX(U-XX)

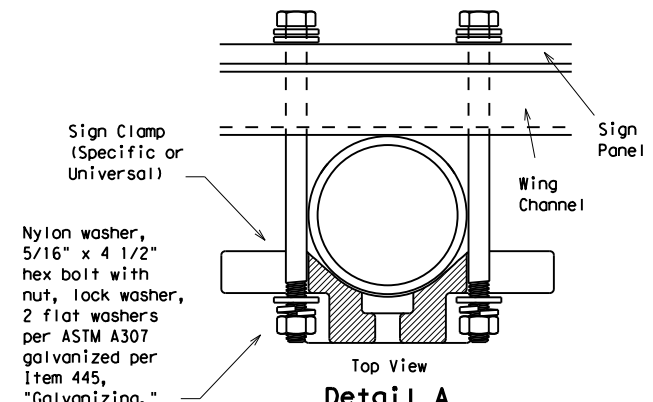


Typical Sign Mount

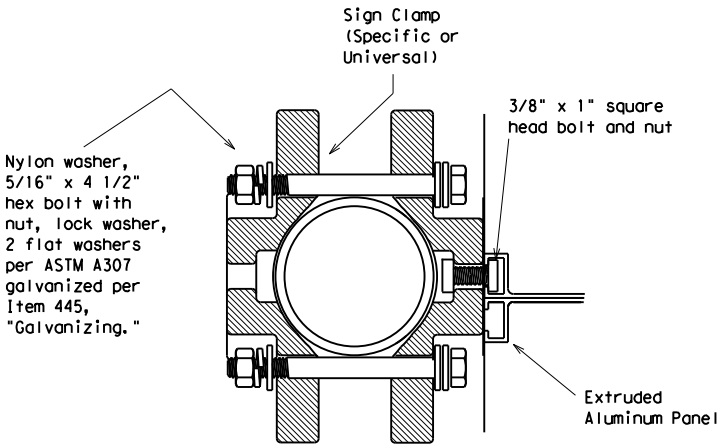
SM RD SGN ASSM TY S80(2)XX(IP-EXAL)  
 \* Additional stiffener placed at approximate center of signs when sign width is greater than 10'.



Detail E

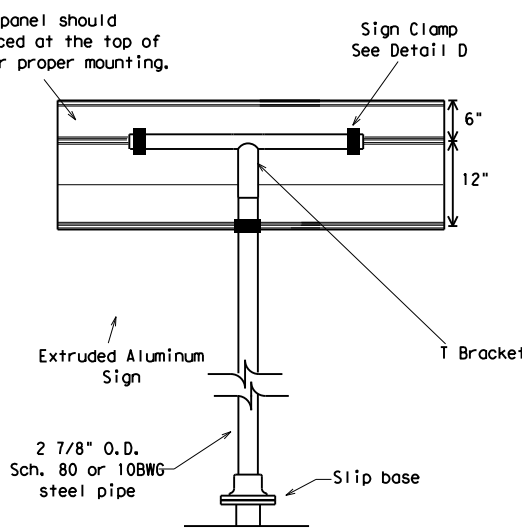


Detail A

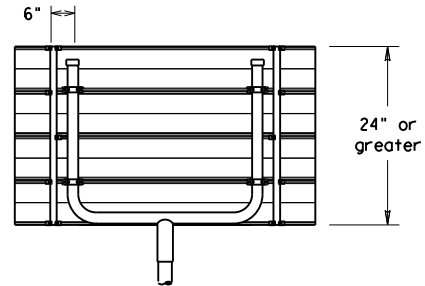


Detail D

EXTRUDED ALUMINUM SIGN WITH T BRACKET



EXTRUDED ALUMINUM SIGN WITH T BRACKET



Use Extruded Alum. Windbeam as stiffeners See SMD (2-1) for additional details  
 See Detail E for clamp installation

GENERAL NOTES:

- | SIGN SUPPORT | # OF POSTS | MAX. SIGN AREA |
|--------------|------------|----------------|
| 10 BWG       | 1          | 16 SF          |
| 10 BWG       | 2          | 32 SF          |
| Sch 80       | 1          | 32 SF          |
| Sch 80       | 2          | 64 SF          |
- The Engineer may require that a Schedule 80 post be used in place of a 10 BWG where a sign height is abnormally high due to a fill slope.
- Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.
- Aluminum sign blanks shall conform to Departmental Material Specifications DMS-7110 and shall have the following minimum thicknesses: 0.080 for signs less than 7.5 sq. ft., 0.100 for signs 7.5 to 15 sq. ft., and 0.125 for signs greater than 15 sq. ft.
- Signs that require specific supports due to reasons in addition to windloading are indicated on the "REQUIRED SUPPORT" table on this sheet.
- For horizontal rectangular signs fabricated from flat aluminum, T-brackets are used for signs 24 inches or less in height. U-brackets are used for signs of greater height.
- When two triangular slipbase supports are used to support a single sign, they shall not be "rigidly" connected to each other except through the sign panel. This will allow each support to act independently when impacted by an errant vehicle.
- Wing channel shall meet ASTM A 1011 SS Gr 50 and be galvanized per ASTM A 123.
- Excess pipe, wing channel, or windbeam shall be cut off so that it does not extend beyond the sign panel (i.e., excess support shall not be visible when the sign is viewed from the front.) Repair galvanized coating at cut support ends per Item 445, "Galvanizing."
- Sign blanks shall be the sizes and shapes shown on the plans.
- Additional sign clamp required on the "T-bracket" post for 24 inch high signs. Place the clamp 3 inches above bottom of sign when possible.
- Post open ends shall be fitted with Friction Caps.

REQUIRED SUPPORT

	SIGN DESCRIPTION		SUPPORT
Regulatory	48-inch STOP sign (R1-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)	
	60-inch YIELD sign (R1-2)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)	
	48x16-inch ONE-WAY sign (R6-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)	
	36x48, 48x36, and 48x48-inch signs	TY 10BWG(1)XX(T)	
Warning	48x60-inch signs	TY S80(1)XX(T)	
	48x48-inch signs (diamond or square)	TY 10BWG(1)XX(T)	
	48x60-inch signs	TY S80(1)XX(T)	
	48-inch Advance School X-ing sign (S1-1)	TY 10BWG(1)XX(T)	
	48-inch School X-ing sign (S2-1)	TY 10BWG(1)XX(T)	
	Large Arrow sign (W1-6 & W1-7)	TY 10BWG(1)XX(T)	



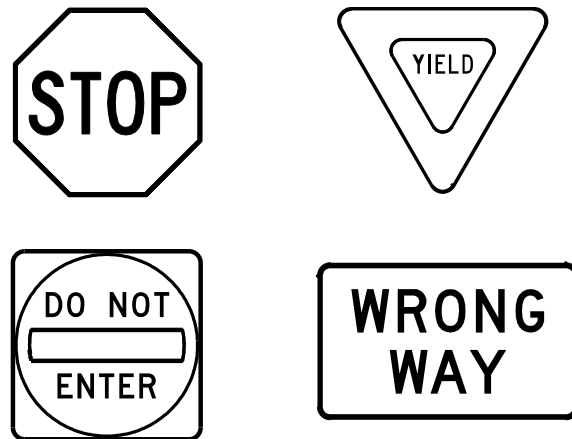
SIGN MOUNTING DETAILS  
 SMALL ROADSIDE SIGNS  
 TRIANGULAR SLIPBASE SYSTEM  
 SMD(SLIP-3)-08

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		1780	01	009	FM 1047
		DIST	COUNTY		SHEET NO.
		BWD	MILLS		107

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### REQUIREMENTS FOR RED BACKGROUND REGULATORY SIGNS

(STOP, YIELD, DO NOT ENTER AND WRONG WAY SIGNS)



#### REQUIREMENTS FOR FOUR SPECIFIC SIGNS ONLY

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	RED	TYPE B OR C SHEETING
BACKGROUND	WHITE	TYPE B OR C SHEETING
LEGEND & BORDERS	WHITE	TYPE B OR C SHEETING
LEGEND	RED	TYPE B OR C SHEETING

### REQUIREMENTS FOR WHITE BACKGROUND REGULATORY SIGNS

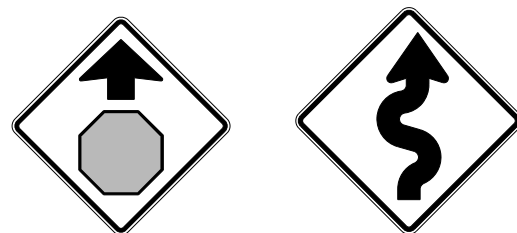
(EXCLUDING STOP, YIELD, DO NOT ENTER AND WRONG WAY SIGNS)



#### TYPICAL EXAMPLES

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	WHITE	TYPE A SHEETING
BACKGROUND	ALL OTHERS	TYPE B OR C SHEETING
LEGEND, BORDERS AND SYMBOLS	BLACK	ACRYLIC NON-REFLECTIVE FILM
LEGEND, BORDERS AND SYMBOLS	ALL OTHER	TYPE B OR C SHEETING

### REQUIREMENTS FOR WARNING SIGNS



#### TYPICAL EXAMPLES

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	FLOURESCENT YELLOW	TYPE B <sub>FL</sub> OR C <sub>FL</sub> SHEETING
LEGEND & BORDERS	BLACK	ACRYLIC NON-REFLECTIVE FILM
LEGEND & SYMBOLS	ALL OTHER	TYPE B OR C SHEETING

### REQUIREMENTS FOR SCHOOL SIGNS



#### TYPICAL EXAMPLES

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	WHITE	TYPE A SHEETING
BACKGROUND	FLOURESCENT YELLOW GREEN	TYPE B <sub>FL</sub> OR C <sub>FL</sub> SHEETING
LEGEND, BORDERS AND SYMBOLS	BLACK	ACRYLIC NON-REFLECTIVE FILM
SYMBOLS	RED	TYPE B OR C SHEETING

### GENERAL NOTES

- Signs to be furnished shall be as detailed elsewhere in the plans and/or as shown on sign tabulation sheet. Standard sign designs and arrow dimensions can be found in the "Standard Highway Sign Designs for Texas" (SHSD).
- Sign legend shall use the Federal Highway Administration (FHWA) Standard Highway Alphabets (B, C, D, E, Emod or F).
- Lateral spacing between letters and numerals shall conform with the SHSD, and any approved changes thereto. Lateral spacing of legend shall provide a balanced appearance when spacing is not shown.
- Black legend and borders shall be applied by screening process or cut-out acrylic non-reflective black film to background sheeting, or combination thereof.
- White legend and borders shall be applied by screening process with transparent colored ink, transparent colored overlay film to white background sheeting or cut-out white sheeting to colored background sheeting, or combination thereof.
- Colored legend shall be applied by screening process with transparent colored ink, transparent colored overlay film or colored sheeting to background sheeting, or combination thereof.
- Sign substrate shall be any material that meets the Departmental Material Specification requirements of DMS-7110 or approved alternative.
- Mounting details for roadside mounted signs are shown in the "SMD series" Standard Plan Sheets.

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

DEPARTMENTAL MATERIAL SPECIFICATIONS	
ALUMINUM SIGN BLANKS	DMS-7110
SIGN FACE MATERIALS	DMS-8300

The Standard Highway Sign Designs for Texas (SHSD) can be found at the following website:  
<http://www.txdot.gov/>

		<i>Traffic Operations Division Standard</i>	
<h2>TYPICAL SIGN REQUIREMENTS</h2>			
<h3>TSR(4) - 13</h3>			
FILE:	tsr4-13.dgn	DN:	TxDOT
©TxDOT	October 2003	CK:	TxDOT
REVISIONS		DW:	TxDOT
12-03	7-13	CK:	TxDOT
9-08		CON:	1780
		SECT:	01
		JOB:	009
		HIGHWAY:	FM 1047
		DIST:	
		COUNTY:	
		SHEET NO.:	108
		BWD:	MILLS

**SITE DESCRIPTION**

**PROJECT LIMITS:**

CSJ 1780-01-009 On FM 1047 at Bennett Creek  
 Latitude = 31.424396  
 Longitude = -98.307673

**LOCATION MAPS:**

Refer to title sheet for project location map.

**PROJECT DESCRIPTION:**

CSJ 1780-01-009  
 Replace bridge and approaches.

**MAJOR SOIL DISTURBING ACTIVITIES:**

The major soil disturbing activities for this project will consist of preparation of R.O.W., removing existing structure, excavation work, embankment work for the construction of the bridge and roadway, and placement and removal of erosion controls.

TOTAL PROJECT AREA:	0.54 AC.
TOTAL AREA TO BE DISTURBED:	3.98 AC.

**EXISTING CONDITION OF SOIL & VEGETATIVE COVER AND % OF EXISTING VEGETATIVE COVER:**

CSJ 1780-01-009  
 Surrounding land is used as pasture rangeland. 85% of the R.O.W. vegetative cover is predominantly comprised of various native grasses and wild flowers.

**NAME OF RECEIVING WATERS:**

CSJ 1780-01-009  
 Runoff from project ultimately flows into stream segment Number 1217 of the Brazos River Basin.

**EROSION AND SEDIMENT CONTROLS**

**OTHER EROSION AND SEDIMENT CONTROLS:**

**MAINTENANCE:**  
 All erosion controls will be maintained in good working order. If a repair is necessary, it will be made at the earliest possible date, but no later than seven (7) calendar days after the ground has dried sufficiently to prevent further damage from equipment. The areas around creeks and drainage ways shall have priority over other areas on the project site.

**INSPECTION:**  
 An inspection will be performed by a TxDOT inspector at least once every seven (7) calendar days. An inspection and maintenance report will be made per each inspection. Stormwater controls will be modified as directed by the Engineer based on these reports.

**WASTE MATERIALS:**  
 Any waste materials generated during construction will be disposed of in accordance with existing federal, state, and local laws.

**HAZARDOUS WASTE (INCLUDING SPILL REPORTING):**  
 At a minimum, any products in the following categories are considered to be hazardous: Fuels, Lubricating products, Asphalt products, or Concrete curing compounds and any additives. In the event of a spill which may be hazardous, clean-up will be done in accordance with federal, state, and local regulations.

**SANITARY WASTE:**  
 Sanitary waste from portable units will be collected by a licensed sanitary waste management contractor.

- OFF SITE VEHICLE TRACKING AND DUST CONTROL:**
- DUST CONTROL AS NEEDED- PER ENGINEER
  - HAUL ROADS DAMPENED FOR DUST CONTROL
  - LOADED HAUL TRUCKS TO BE COVERED WITH TARPULIN
  - EXCESS DIRT ON ROAD REMOVED DAILY
  - STABILIZED CONSTRUCTION ENTRANCE

**REMARKS:**  
 Disposal areas, stockpiles, and haul roads shall be constructed in a manner that will minimize and control the amount of sediment that may enter receiving waters. Disposal areas shall not be located in any wetland, water body or stream bed. Construction staging area and vehicle maintenance area shall be constructed by the contractor in a manner to minimize the runoff pollutants. All waterways shall be cleared as soon as practicable of temporary embankment, temporary bridges, matting, false work, piling, debris or other obstructions placed during construction operations that are not a part of the finished work.

For off R.O.W. facilities the contractor shall comply with TCEQ requirements.

The contractor is responsible for ensuring that all subcontractors are aware of and comply with all components for the SW3P.

Furnish one SW3P permit posting sign and sign support as detailed on the SW3P Sheet. Install this sign in a location selected by the Engineer. The sign and support should be removed upon completion of the project and is the property of the Contractor. The purchase of the sign and support, installation, relocation(s) if determined necessary by the Engineer and removal at project end shall be subsidiary to Item 506.

Sedimentation Basins - Since the area disturbed is less than 10 acres per drainage area; a sedimentation basin is not required.

**Best Management Practices:**

- |   |   |  |
|---|---|--|
| <b>Erosion</b>  | <b>Sedimentation</b>  | <b>Post-Construction TSS</b>                                 |
| <input checked="" type="checkbox"/> Temporary Vegetation        | <input checked="" type="checkbox"/> Silt Fence                  | <input checked="" type="checkbox"/> Vegetative Filter Strips |
| <input checked="" type="checkbox"/> Blankets/Matting            | <input checked="" type="checkbox"/> Rock Berm                   | <input type="checkbox"/> Retention/Irrigation Systems        |
| <input type="checkbox"/> Mulch                                  | <input type="checkbox"/> Triangular Filter Dike                 | <input type="checkbox"/> Extended Detention Basin            |
| <input type="checkbox"/> Sodding                                | <input type="checkbox"/> Sand Bag Berm                          | <input type="checkbox"/> Constructed Wetlands                |
| <input type="checkbox"/> Interceptor Swale                      | <input type="checkbox"/> Straw Bale Dike                        | <input type="checkbox"/> Wet Basin                           |
| <input type="checkbox"/> Diversion Dike                         | <input type="checkbox"/> Brush Berms                            | <input type="checkbox"/> Erosion Control Compost             |
| <input type="checkbox"/> Erosion Control Compost                | <input type="checkbox"/> Erosion Control Compost                | <input type="checkbox"/> Mulch Filter Berm and Socks         |
| <input checked="" type="checkbox"/> Mulch Filter Berm and Socks | <input checked="" type="checkbox"/> Mulch Filter Berm and Socks | <input type="checkbox"/> Compost Filter Berm and Socks       |
| <input type="checkbox"/> Compost Filter Berm and Socks          | <input type="checkbox"/> Compost Filter Berm and Socks          | <input type="checkbox"/> Vegetation Lined Ditches            |
|   | <input type="checkbox"/> Stone Outlet Sediment Traps            | <input type="checkbox"/> Sand Filter Systems                 |
|   | <input type="checkbox"/> Sediment Basins                        |  |

**NARRATIVE - SEQUENCE OF CONSTRUCTION (STORM WATER MANAGEMENT) ACTIVITIES:**

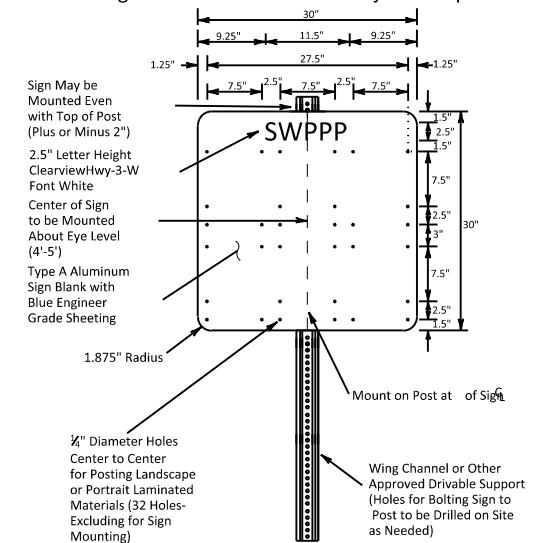
- The order of activities will be as follows:
1. Preserve existing vegetative cover as much as possible.
  2. Install temporary sediment control fencing and other items as shown on plans prior to any soil disturbing activities.
  3. Perform bridge work, roadway work, and perform any necessary excavation, embankment and grading, temporary seeding, and signage.
  4. Place permanent seeding as shown in the plans and as directed by the Engineer.

**STORM WATER MANAGEMENT:**

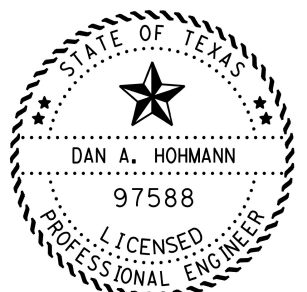
Storm water will be carried to cross drainage structures by side road ditches and culverts which will empty into the various natural runoff channels.

**STORM WATER POLLUTION PREVENTION PLAN PERMIT POSTING**

No Permanent Installation Allowed.  
 Sign to be Removed After Project Completion.



Texas Department of Transportation  
 Brownwood District Office  
 2495 Highway 183 North  
 Brownwood Texas, 76802



Dan A. Hohmann, P.E.

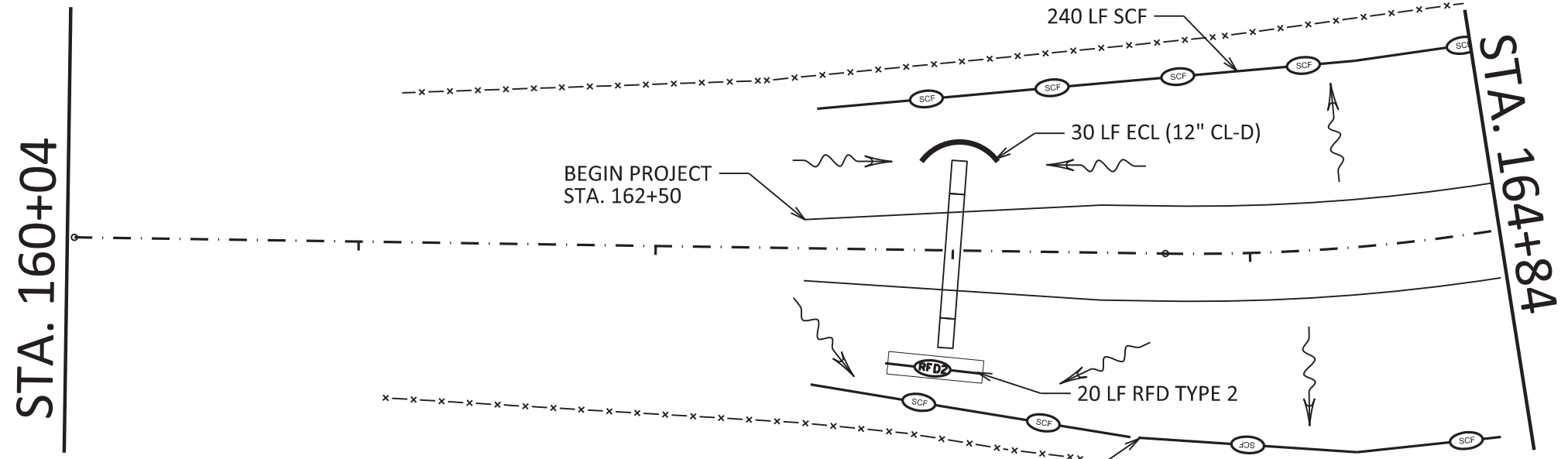
01/26/2022  
 FM 1047  
 BROWNWOOD DIST.  
 STORM WATER  
 POLLUTION  
 PREVENTION PLAN



CONT	SECT	JOB	HIGHWAY
1780	01	009	FM 1047
DIST	COUNTY	SHEET NO.	
BWD	MILLS	109	

DATE: 1/1/2022 10:49:52 AM  
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C6:  
 DW:  
 C6:  
 DW:



LEGEND	
DIRECTION OF FLOW	
SILT FENCE	
ROCK FILTER DAM	
EROSION CONTROL LOG	



*Dan A. Hohmann, P.E.*

01/02/2022

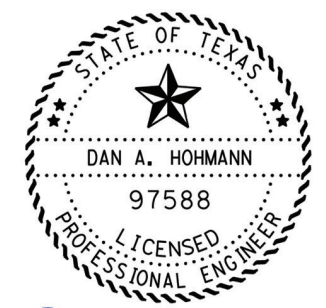
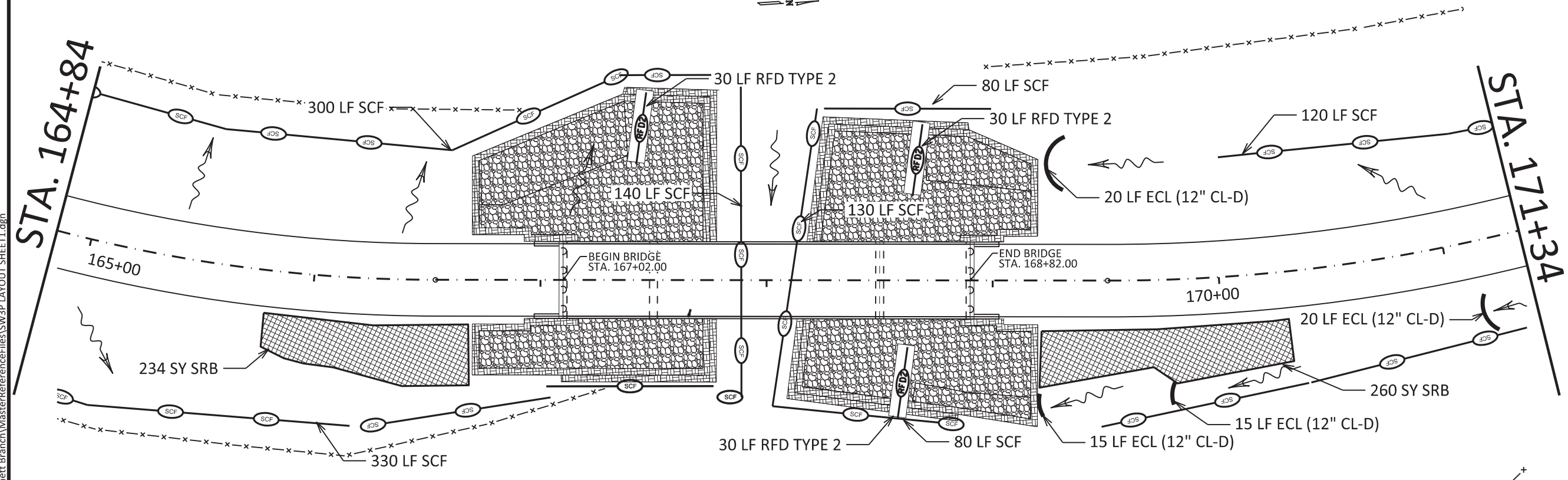
FM 1047  
 SW3P LAYOUT

SHEET 1 OF 3

CONT	SECT	JOB	HIGHWAY
1780	01	009	FM 1047
DIST	COUNTY	SHEET NO.	
BWD	MILLS	110	

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Dan A. Hohmann, P.E.

01/02/2022

FM 1047  
 SW3P LAYOUT

SHEET 2 OF 3



CONT	SECT	JOB	HIGHWAY
1780	01	009	FM 1047
DIST	COUNTY	SHEET NO.	
BWD	MILLS	111	

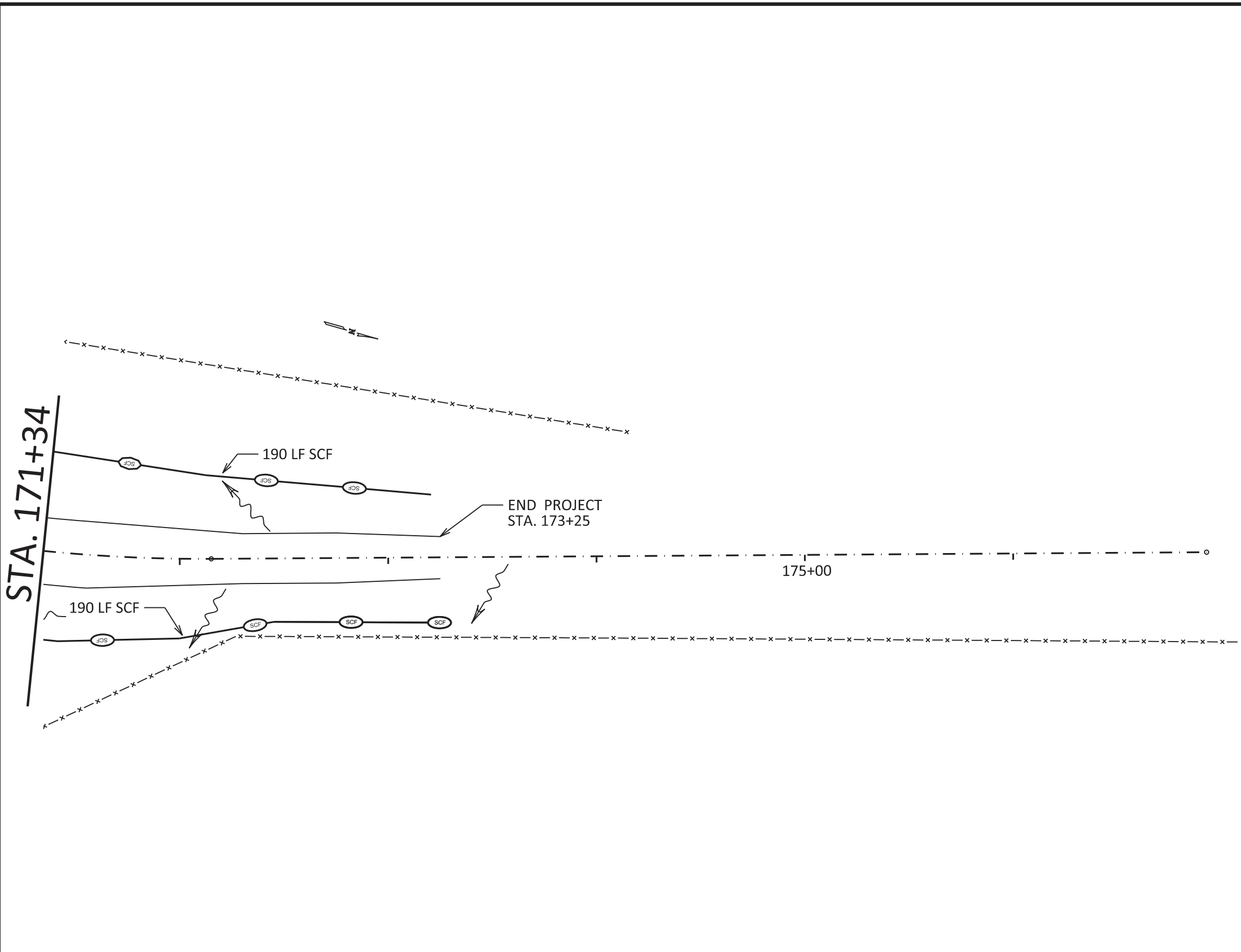
**LEGEND**

DIRECTION OF FLOW	
SILT FENCE	
ROCK FILTER DAM	
EROSION CONTROL LOG	

ITEM CODE	DESCRIPTION	UNIT	QTY
164 6003	BROADCAST SEED (PERM)(RURAL)(CLAY)	SY	4710
164 6009	BROADCAST SEED (TEMP)(WARM)	SY	2355
164 6011	BROADCAST SEED (TEMP)(COOL)	SY	2355
168 6001	VEGETATIVE WATERING	MG	106
169 6007	SOIL RETENTION BLANKETS (CL 2) (TY G)	SY	494
506 6002	ROCK FILTER DAMS (INSTALL)(TY 2)	LF	110
506 6011	ROCK FILTER DAMS (REMOVE)	LF	110
506 6038	TEMP SEDIMENT CONT FENCE (INSTALL)	LF	2240
506 6039	TEMP SEDIMENT CONT FENCE (REMOVE)	LF	2240
506 6041	BIODEG EROSION CONT LOGS (INSTALL)	LF	100
506 6043	BIODEG EROSION CONT LOGS (REMOVE)	LF	100

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LEGEND	
DIRECTION OF FLOW	
SILT FENCE	
ROCK FILTER DAM	
EROSION CONTROL LOG	

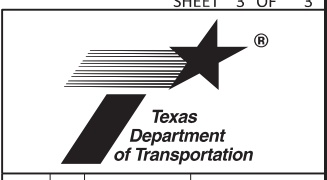


*Dan A. Hohmann, P.E.*

01/02/2022

FM 1047  
 SW3P LAYOUT

SHEET 3 OF 3



CONT	SECT	JOB	HIGHWAY
1780	01	009	FM 1047
DIST	COUNTY		SHEET NO.
BWD	MILLS		112

UPDATED 6/1/2017  
 Prepared by \*\*\*\*\*  
 DATE: 1/26/2022 2:25:00 PM  
 FILE: I:\BWD\SGTEAM\Design Projects\Mi11s\1780-01-009 FM 1047 Bennett Branch\MasterReferenceFiles\EPIC.dgn

During the planning phase of project development the following environmental permits, issues, and commitments have been developed during coordination with resource agencies, local governmental entities, and the general public. Any change orders and/or deviations from the final design must be reported to the Engineer prior to the commencement of construction activities, as additional environmental clearances may be required.

### I. Clean Water Act, Sec. 402 Texas Pollutant Discharge Elimination System

(Addresses CGP and MS4 Storm Water requirements for the project.)  
 (In the event that the Contractor implements a PSL on or within one mile of the project, a Site Notice and/or a NOI will apply.)

No Action Required  Required Action

**Action No. 1**  
 The project disturbs more than one acre but less than five acres of surface area. The contractor is responsible for the PSL as defined in the Standard Specifications for Construction and Maintenance of Highways, Street, and Bridges (2014 Edition, Section 7.7.6, Page 42). The total disturbed acreage is the combined acreage to be disturbed on the project and the contractor's PSL.

This EPIC must be updated if the disturbed area increases to five or more acres during the course of construction (refer to following section). It may become necessary to post a site notice and NOI for the project and/or PSL. The EPIC must be updated if the disturbed area increases to one or more

**Identify all MS4 Permit holders that may be impacted by the project:**

**Commitment No. 1**  
 Comply with TPDES CGP. TxDOT must post a Small Site Notice and send a copy to any non-TxDOT MS4 operator that receives discharge from the project. Refer to the SW3P Plan Sheet, BMPs and Detail.

**Commitment No. 2**  
 The contractor must stabilize the project site as stated in the SW3P.

MS4 operators that receives discharge from the project: -N/A-

### II. Clean Water Act, Section 401 and 404 Compliance

(Addresses Nationwide Permits, Individual Permits, and Wetlands.)  
 (Filling, dredging, or excavating in any water bodies, rivers, creeks, streams, wetlands, or wet area is prohibited unless specified in the USACE permit and approved by the Engineer.)  
 (When temporary fills implemented, only stated TxDOT standards will be used unless written authorization for an alternative is obtained from the Engineer. No equipment is allowed in any stream channel below the Ordinary High Water Mark except on temporary stream crossings or drill pads.)

No Action Required  404 Permit and 401 Certification Required

Permit	Required Action	Waters of the US	App. Plan Sheet(s)
NWP# 14	Comply with general conditions of the permit; no preconstruction notification is required.	Bennett Branch	Culvert/SW3P Layouts

#### Best Management Practices for applicable 401 General Conditions:

##### General Condition 12 - Categories I and II BMPs required

###### Category I (Erosion Control)

- Temporary Vegetation
- Mulch
- Interceptor Swale
- Erosion Control Compost
- Compost Filter Berms and Socks
- Blankets, Matting
- Sod
- Diversion Dike
- Mulch Filter Berms and Socks
- Compost Blankets

###### Category II (Sedimentation Control)

- Sand Bag Berm
- Silt Fence
- Triangular Filter Dike
- Stone Outlet Sediment Traps
- Erosion Control Compost
- Compost Filter Berms and Socks
- Rock Berm
- Hay Bale Dike
- Brush Berms
- Sediment Basins
- Mulch Filter Berms and Socks

##### General Condition 25 - Category III BMPs required

###### Category III (Post-Construction TSS Control)

- Retention/Irrigation
- Extended Detention Basin
- Vegetative Filter Strips
- Grassy Swales
- Erosion Control Compost
- Compost Filter Berms and Socks
- Constructed Wetlands
- Wet Basins
- Vegetation-Lined Ditches
- Sand Filter Systems
- Mulch filter Berms and Socks
- Sedimentation Chambers

### III. Cultural Resources

(Addresses any special circumstances associated with cultural resources, such as archeological or historic sites.)  
 (Upon discovery of archeological artifacts (bones, burnt rock, flint, pottery, etc.) cease work in the immediate area and contact the Engineer immediately.)

No Action Required  Required Action

Action No.	Station (Rt/Lt)	Commitment
1.	---	---

### IV. Vegetation Resources

(Addresses any special circumstances associated with vegetation, such as large trees to be avoided, or mitigation that will occur as part of the project.)

No Action Required  Required Action

Action No.	Station (Rt/Lt)	Commitment
1.	All	Avoid non-mow locations for stockpiles and equipment parking/storage.
2.	Project Limits	Preserve native vegetation to the extent practical. Contractor must adhere to Construction Specification Requirements Specs 162, 164, 192, 506, 730, 751, 752 in order to comply with requirements for invasive species, beneficial landscaping, and tree/brush removal commitments.

### V. Federal Listed, Proposed, Threatened, Endangered Species, Critical Habitat, State Listed Species, Candidate Species, and Migratory Bird Treaty Act (MBTA)

(Addresses any special habitat that may need to be avoided, lists any threatened or endangered species where habitat was observed and might be impacted within the project area, and lists any precautions such as nesting seasons for migratory birds.)

No Action Required  Required Action

Species Potentially within Project Area & Description	Habitat Description
---	---

The Migratory Bird Treaty Act of 1918 states that it is unlawful to kill, capture, collect, possess, buy, sell, trade, or transport any migratory bird, nest, young, feather, or egg in part or in whole, without a federal permit issued in accordance within the Act's policies and regulations. Migration patterns would not be affected by the proposed project. The contractor will remove all old migratory bird nests from any structure where work would be done from September 1 through the end of February. In addition, the contractor will be prepared to prevent migratory birds from building nests between March 1 and August 31, per the Environmental Permits, Issues, and Commitments (EPIC) plans. In the event that migratory birds are encountered on-site during project construction, adverse impacts on protected birds, active nests, eggs, and/or young shall be avoided.

### VI. Hazardous Material or Contamination Issues

(Addresses any previously identified high risk sites associated with hazardous materials that may be encountered during construction.)

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

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

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

Contractor will follow all applicable storage and management requirements for liquid oil products, liquid petroleum products, and other chemical liquids as per 40 CFR 112 (a.k.a. SPCC) and/or TCEQ Construction General Permit for storm water management.

Contact the Engineer if any of the following are detected:  
 Dead or distressed vegetation (not identified as normal)  
 Trash piles, drums, canisters, barrels, etc.  
 Undesirable smells/odors  
 Underground storage tanks  
 Evidence of leaching or seepage of substances  
 Any other evidence indicating possible hazardous materials or contamination discovered on-site

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

Yes  No

If "No", then no further action is required.  
 If "Yes", then TxDOT is responsible for completing an asbestos assessment/inspection. Are the results of the asbestos inspection positive (is asbestos present)?

Yes  No

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

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

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

Bridges on this project may contain Lead-Containing Paint (LCP) or other items that contain lead. The location of (LCP) is identified in the General Notes. Item 6.10.1.2 in the 2014 TxDOT Standard Specifications shall be utilized for this project.

### VII. Other Environmental Issues

(Addresses any other environmental issues that may not have been covered in other sections.)

No Action Required  Required Action

Action No.	Station (Rt/Lt)	Commitment
1.	---	---

#### LIST OF ABBREVIATIONS

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

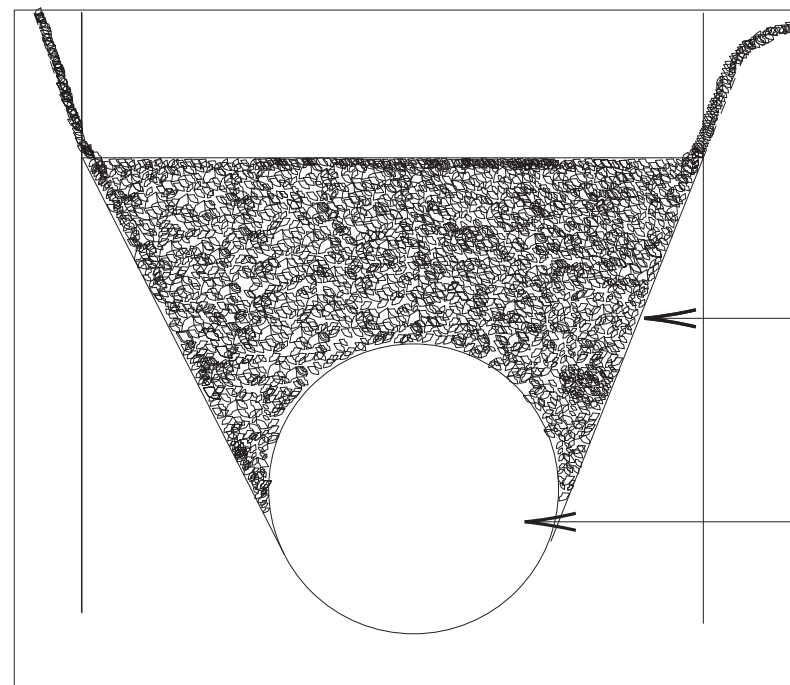
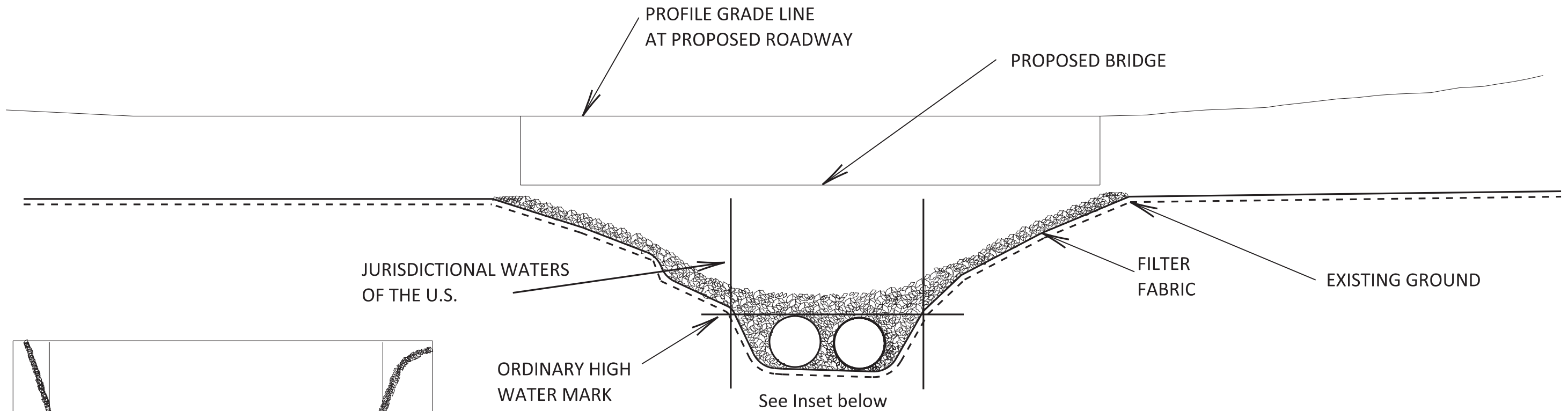
## FM 1047 ENVIRONMENTAL PERMITS, ISSUES, AND COMMITMENTS (EPIC)

©2022		Texas Department of Transportation	
BROWNWOOD DISTRICT			
CONT	SECT	JOB	HIGHWAY
1780	01	009	FM 1047
DIST	COUNTY		SHEET NO.
BWD	MILLS		113

# TEMPORARY CROSSING

## FOR CONSTRUCTION TRAFFIC ONLY

DRAWING NOT TO SCALE



Inset

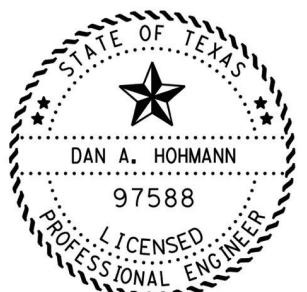
ORDINARY HIGH WATER MARK

NON-ERODIBLE MATERIAL (4" to 6" rock)

TEMPORARY CULVERT(S)

CAPACITY OF CULVERT(S) SHALL BE ADEQUATE TO CONVEY THE LOW FLOW OF WATER

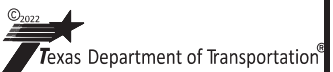
Note: Temporary crossing will not be paid for directly but will be considered subsidiary to pertinent items.



*Dan A. Hohmann, P.E.*

01/02/2022

FM 1047  
TEMPORARY  
CROSSING DETAIL

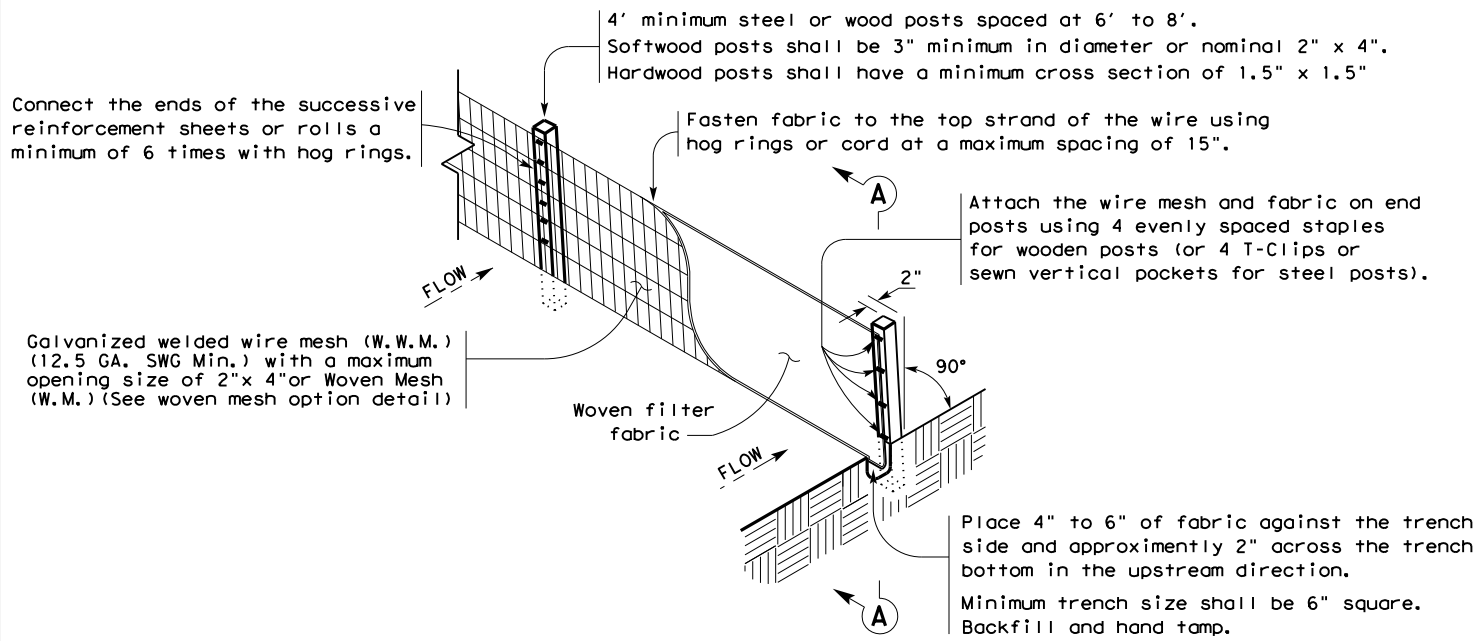


CONT	SECT	JOB	HIGHWAY
1780	01	009	FM 1047
DIST	COUNTY	SHEET NO.	
BWD	MILLS	114	

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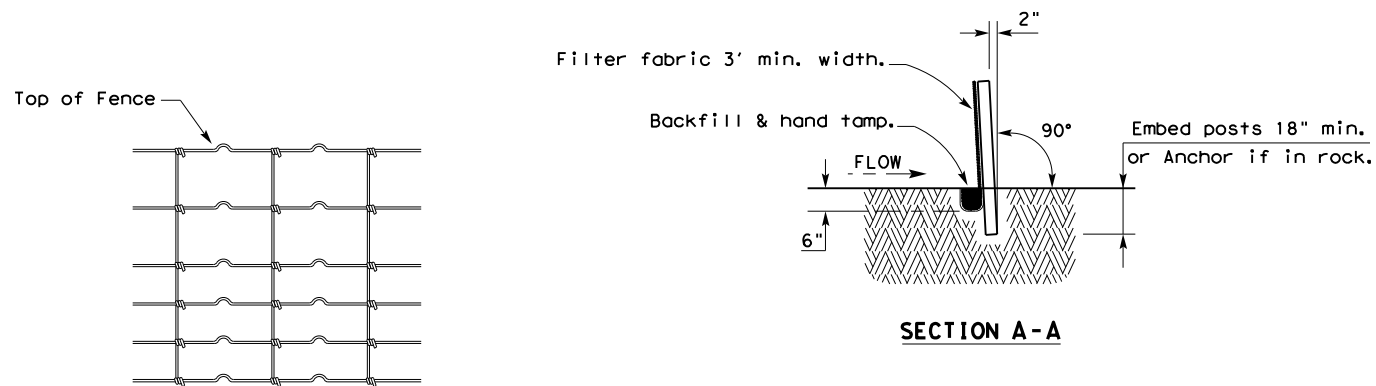


10/17/2022  
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 DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.



**TEMPORARY SEDIMENT CONTROL FENCE**

SCF



**HINGE JOINT KNOT WOVEN MESH (OPTION) DETAIL**

Galvanized hinge joint knot woven mesh (12.5 GA. SWG Min.) requires a minimum of five horizontal wires spaced at a maximum of 12 inches apart and all vertical wires spaced at a maximum of 12 inches apart.

**SEDIMENT CONTROL FENCE USAGE GUIDELINES**

A sediment control fence may be constructed near the downstream perimeter of a disturbed area along a contour to intercept sediment from overland runoff. A 2 year storm frequency may be used to calculate the flow rate to be filtered.

Sediment control fence should be sized to filter a maximum flow through rate of 100 GPM/FT<sup>2</sup>. Sediment control fence is not recommended to control erosion from a drainage area larger than 2 acres.

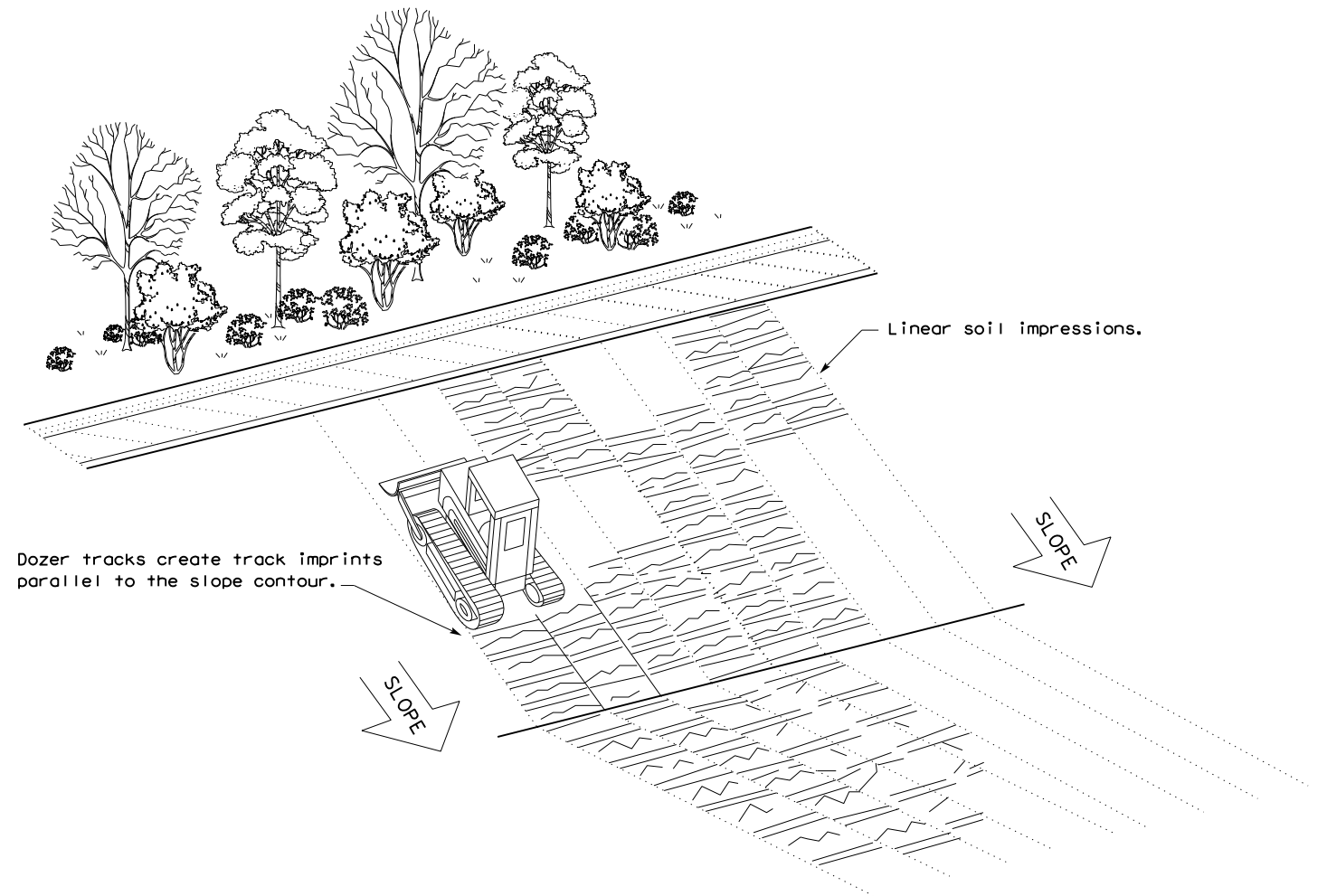
**LEGEND**

Sediment Control Fence

SCF

**GENERAL NOTES**

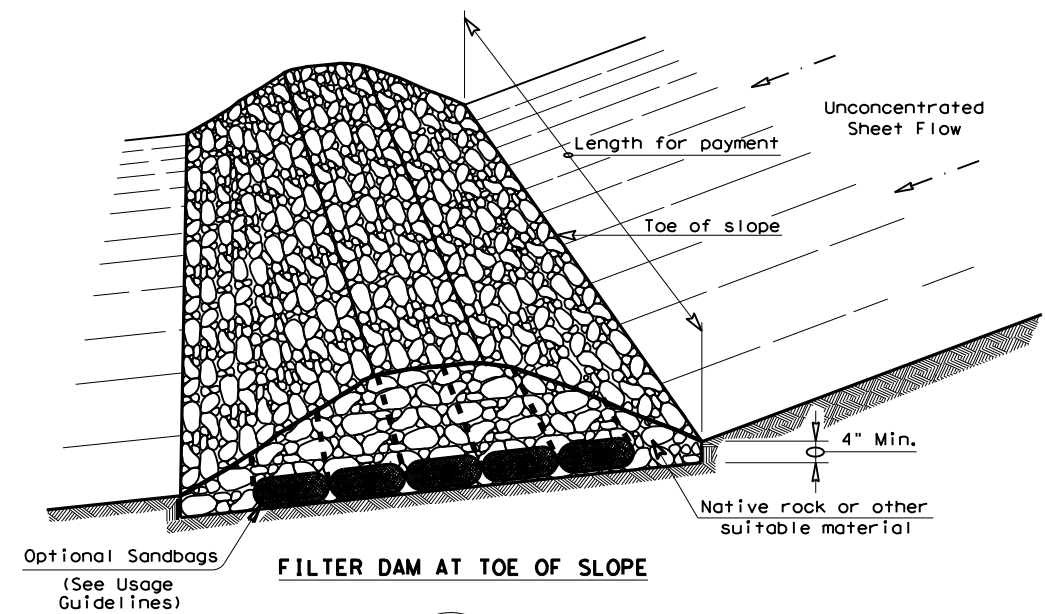
1. Vertical tracking is required on projects where soil distributing activities have occurred unless otherwise approved.
2. Perform vertical tracking on slopes to temporarily stabilize soil.
3. Provide equipment with a track undercarriage capable of producing linear soil impressions measuring a minimum of 12" in length by 2" to 4" in width by 1/2" to 2" in depth.
4. Do not exceed 12" between track impressions.
5. Install continuous linear track impressions where the minimum 12" length impressions are perpendicular to the slope or direction of water flow.



**VERTICAL TRACKING**

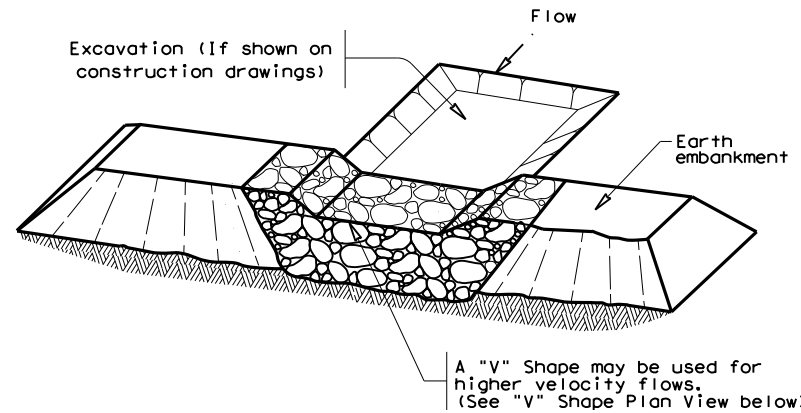
				Design Division Standard	
<b>TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES FENCE &amp; VERTICAL TRACKING EC(1)-16</b>					
FILE: ec116	DN: TxDOT	CK: KM	DW: VP	DN/CK: LS	
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY	
REVISIONS	1780	01	009	FM 1047	
	DIST	COUNTY		SHEET NO.	
	BWD	MILLS		115	

DATE: 1/1/2022  
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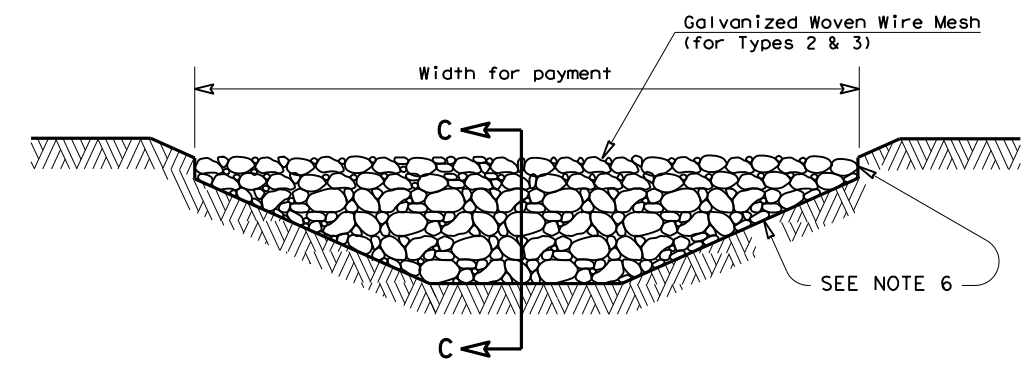
**FILTER DAM AT TOE OF SLOPE**

(RFD1)



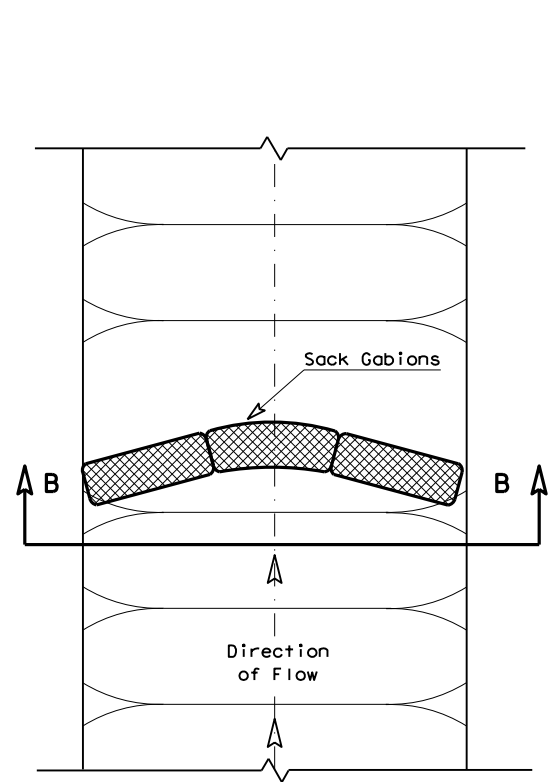
**FILTER DAM AT SEDIMENT TRAP**

(RFD1) OR (RFD2)

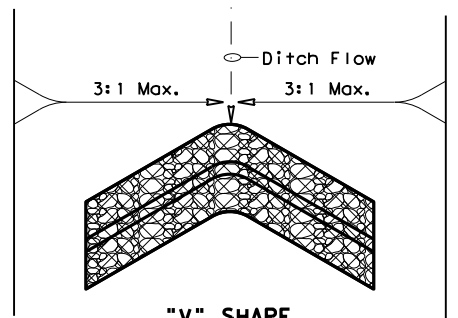


**FILTER DAM AT CHANNEL SECTIONS**

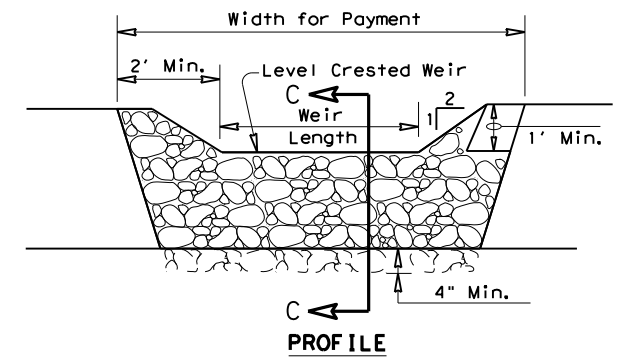
(RFD1) OR (RFD2) OR (RFD3)



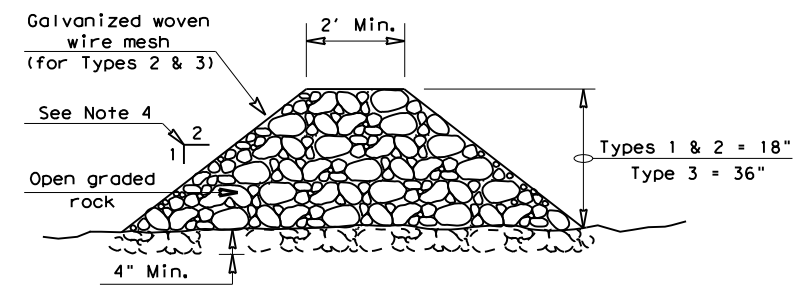
**PLAN VIEW**



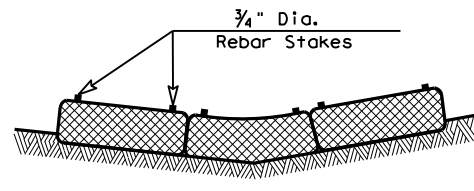
**"V" SHAPE PLAN VIEW**



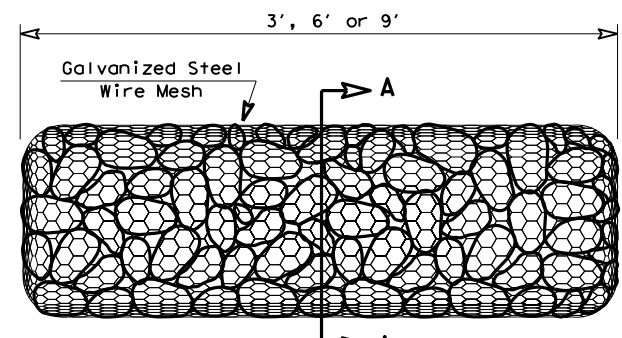
**PROFILE**



**SECTION C-C**

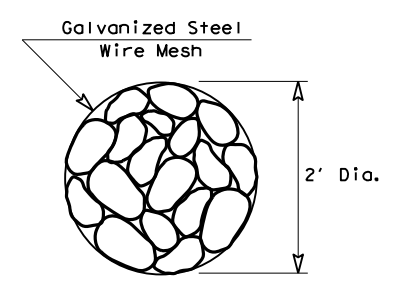


**SECTION B-B**



**TYPE 4 (SACK GABIONS)**

(RFD4)



**SECTION A-A**

**ROCK FILTER DAM USAGE GUIDELINES**

Rock Filter Dams should be constructed downstream from disturbed areas to intercept sediment from overland runoff and/or concentrated flow. The dams should be sized to filter a maximum flow through rate of 60 GPM/FT<sup>2</sup> of cross sectional area. A 2 year storm frequency may be used to calculate the flow rate.

Type 1 (18" high with no wire mesh) (3" to 6" aggregate): Type 1 may be used at the toe of slopes, around inlets, in small ditches, and at dike or swale outlets. This type of dam is recommended to control erosion from a drainage area of 5 acres or less. Type 1 may not be used in concentrated high velocity flows (approximately 8 Ft/Sec or more) in which aggregate wash out may occur. Sandbags may be used at the embedded foundation (4" deep min.) for better filtering efficiency of low flows if called for on the plans or directed by the Engineer.

Type 2 (18" high with wire mesh) (3" to 6" aggregate): Type 2 may be used in ditches and at dike or swale outlets.

Type 3 (36" high with wire mesh) (4" to 8" aggregate): Type 3 may be used in stream flow and should be secured to the stream bed.

Type 4 (Sack gabions) (3" to 6" aggregate): Type 4 May be used in ditches and smaller channels to form an erosion control dam.

Type 5: Provide rock filter dams as shown on plans.

**GENERAL NOTES**

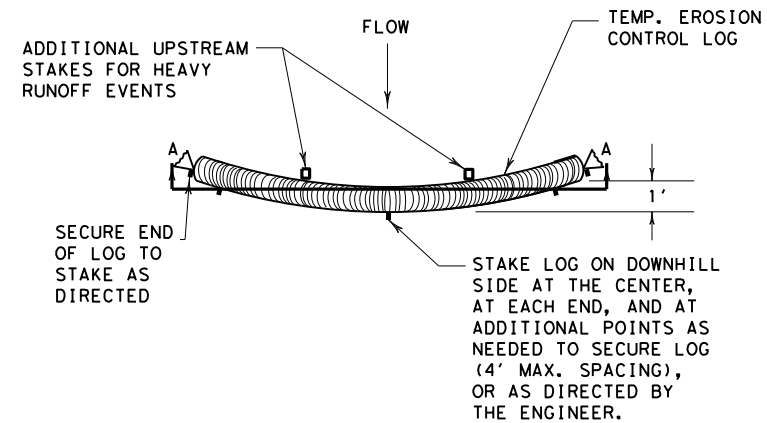
1. If shown on the plans or directed by the Engineer, filter dams should be placed near the toe of slopes where erosion is anticipated, upstream and/or downstream at drainage structures, and in roadway ditches and channels to collect sediment.
2. Materials (aggregate, wire mesh, sandbags, etc.) shall be as indicated by the specification for "Rock Filter Dams for Erosion and Sedimentation Control".
3. The rock filter dam dimensions shall be as indicated on the SW3P plans.
4. Side slopes should be 2:1 or flatter. Dams within the safety zone shall have sideslopes of 6:1 or flatter.
5. Maintain a minimum of 1' between top of rock filter dam weir and top of embankment for filter dams at sediment traps.
6. Filter dams should be embedded a minimum of 4" into existing ground.
7. The sediment trap for ponding of sediment laden runoff shall be of the dimensions shown on the plans.
8. Rock filter dam types 2 & 3 shall be secured with 20 gauge galvanized woven wire mesh with 1" diameter hexagonal openings. The aggregate shall be placed on the mesh to the height & slopes specified. The mesh shall be folded at the upstream side over the aggregate and tightly secured to itself on the downstream side using wire ties or hog rings. For in stream use, the mesh should be secured or staked to the stream bed prior to aggregate placement.
9. Sack Gabions should be staked down with 3/4" dia. rebar stakes, and have a double-twisted hexagonal weave with a nominal mesh opening of 2 1/2" x 3 1/4".
10. Flow outlet should be onto a stabilized area (vegetation, rock, etc.).
11. The guidelines shown hereon are suggestions only and may be modified by the Engineer.

**PLAN SHEET LEGEND**

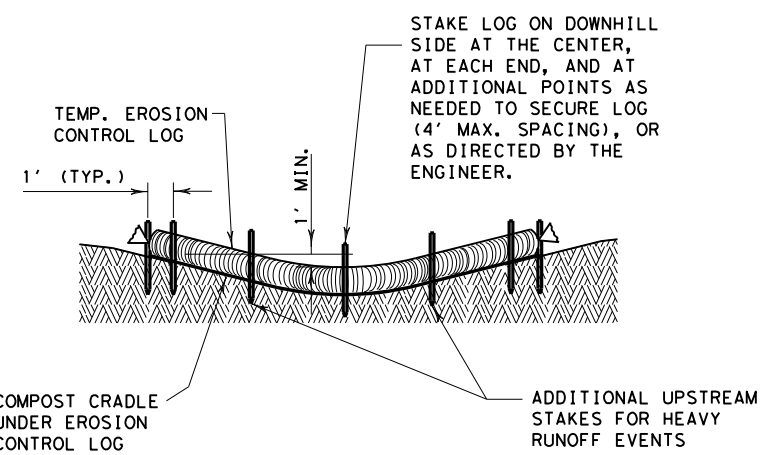
- Type 1 Rock Filter Dam (RFD1)
- Type 2 Rock Filter Dam (RFD2)
- Type 3 Rock Filter Dam (RFD3)
- Type 4 Rock Filter Dam (RFD4)

		<b>Design Division Standard</b>	
<b>TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES</b> <b>ROCK FILTER DAMS</b> <b>EC(2)-16</b>			
FILE: ec216	DN: TxDOT	CK: KM	DW: VP
© TxDOT: JULY 2016	CONT: 1780	SECT: 01	JOB: 009
REVISIONS			FM 1047
	DIST: BWD	COUNTY: MILLS	SHEET NO.: 116

DATE: 1/11/2022  
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PLAN VIEW

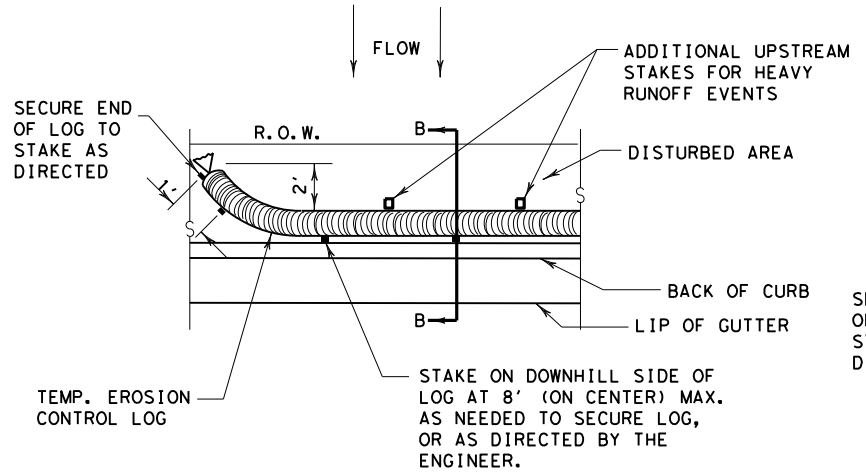


SECTION A-A  
EROSION CONTROL LOG DAM

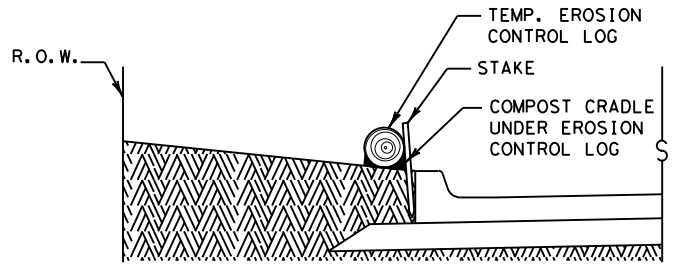
CL-D

LEGEND

- CL-D EROSION CONTROL LOG DAM
- CL-BOC EROSION CONTROL LOG AT BACK OF CURB
- CL-ROW EROSION CONTROL LOG AT EDGE OF RIGHT-OF-WAY
- CL-SST EROSION CONTROL LOGS ON SLOPES STAKE AND TRENCHING ANCHORING
- CL-SSL EROSION CONTROL LOGS ON SLOPES STAKE AND LASHING ANCHORING
- CL-DI EROSION CONTROL LOG AT DROP INLET
- CL-CI EROSION CONTROL LOG AT CURB INLET
- CL-GI EROSION CONTROL LOG AT CURB & GRATE INLET

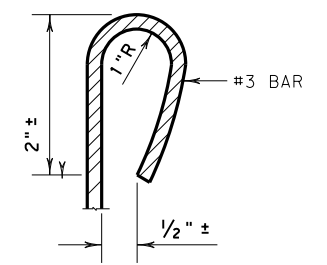


PLAN VIEW

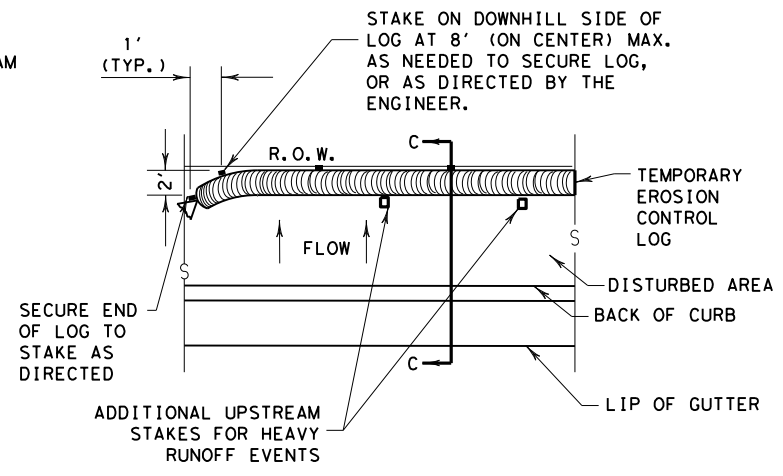


SECTION B-B  
EROSION CONTROL LOG AT BACK OF CURB

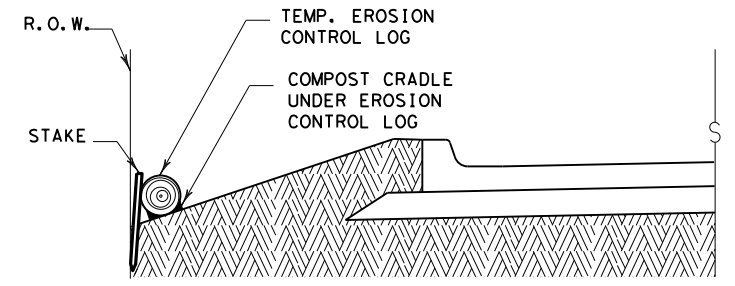
CL-BOC



REBAR STAKE DETAIL



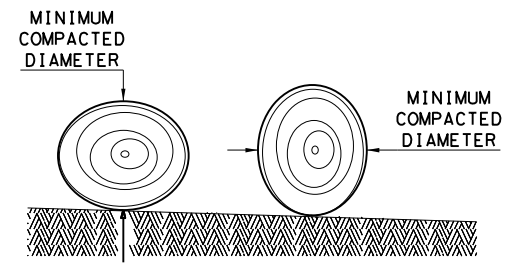
PLAN VIEW



SECTION C-C

EROSION CONTROL LOG AT EDGE OF RIGHT-OF-WAY

CL-ROW



DIAMETER MEASUREMENTS OF EROSION CONTROL LOGS SPECIFIED IN PLANS

**SEDIMENT BASIN & TRAP USAGE GUIDELINES**

An erosion control log sediment trap may be used to filter sediment out of runoff draining from an unstabilized area.

**Log Traps:** The drainage area for a sediment trap should not exceed 5 acres. The trap capacity should be 1800 CF/Acre (0.5" over the drainage area).

Control logs should be placed in the following locations:

1. Within drainage ditches spaced as needed or min. 500' on center
2. Immediately preceding ditch inlets or drain inlets
3. Just before the drainage enters a water course
4. Just before the drainage leaves the right of way
5. Just before the drainage leaves the construction limits where drainage flows away from the project.

The logs should be cleaned when the sediment has accumulated to a depth of 1/2 the log diameter.

Cleaning and removal of accumulated sediment deposits is incidental and will not be paid for separately.

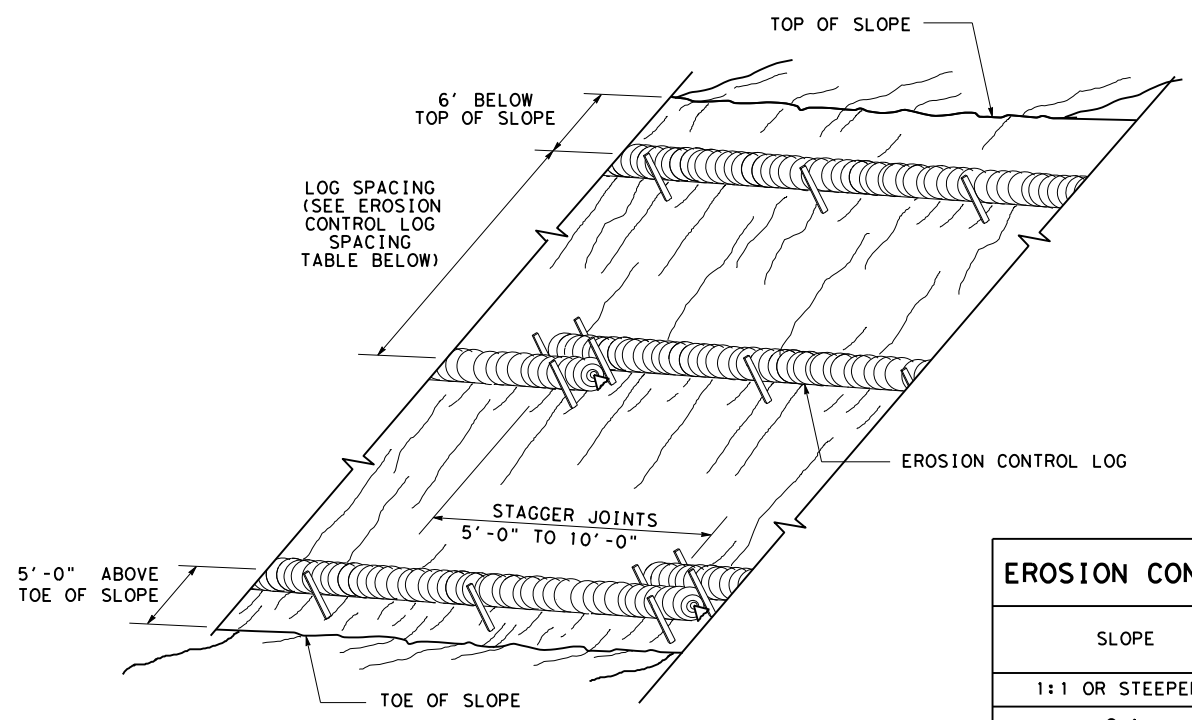
**GENERAL NOTES:**

1. EROSION CONTROL LOGS SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS, OR AS DIRECTED BY THE ENGINEER.
2. LENGTHS OF EROSION CONTROL LOGS SHALL BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND AS REQUIRED FOR THE PURPOSE INTENDED.
3. UNLESS OTHERWISE DIRECTED, USE BIODEGRADABLE OR PHOTODEGRADABLE CONTAINMENT MESH ONLY WHERE LOG WILL REMAIN IN PLACE AS PART OF A VEGETATIVE SYSTEM. FOR TEMPORARY INSTALLATIONS, USE RECYCLABLE CONTAINMENT MESH.
4. FILL LOGS WITH SUFFICIENT FILTER MATERIAL TO ACHIEVE THE MINIMUM COMPACTED DIAMETER SPECIFIED IN THE PLANS WITHOUT EXCESSIVE DEFORMATION.
5. STAKES SHALL BE 2" X 2" WOOD OR #3 REBAR, 2'-4' LONG, EMBEDDED SUCH THAT 2" PROTRUDES ABOVE LOG, OR AS DIRECTED BY THE ENGINEER.
6. DO NOT PLACE STAKES THROUGH CONTAINMENT MESH.
7. COMPOST CRADLE MATERIAL IS INCIDENTAL & WILL NOT BE PAID FOR SEPARATELY.
8. SANDBAGS USED AS ANCHORS SHALL BE PLACED ON TOP OF LOGS & SHALL BE OF SUFFICIENT SIZE TO HOLD LOGS IN PLACE.
9. TURN THE ENDS OF EACH ROW OF LOGS UPSLOPE TO PREVENT RUNOFF FROM FLOWING AROUND THE LOG.
10. FOR HEAVY RUNOFF EVENTS, ADDITIONAL UPSTREAM STAKES MAY BE NECESSARY TO KEEP LOG FROM FOLDING IN ON ITSELF.

SHEET 1 OF 3

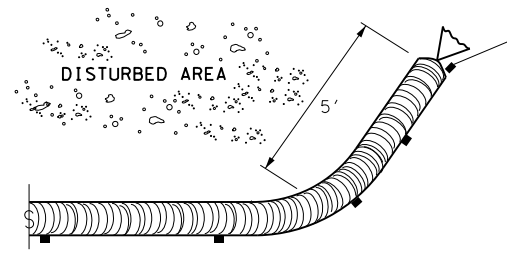
		<i>Design Division Standard</i>	
<b>TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES</b>			
<b>EROSION CONTROL LOG</b>			
<b>EC(9) - 16</b>			
FILE: ec916	DN: TxDOT	CK: KM	DW: LS/PT
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REVISIONS	1780 01	009	FM 1047
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	BWD	MILLS	117

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**EROSION CONTROL LOGS ON SLOPES  
STAKE AND TRENCHING ANCHORING**

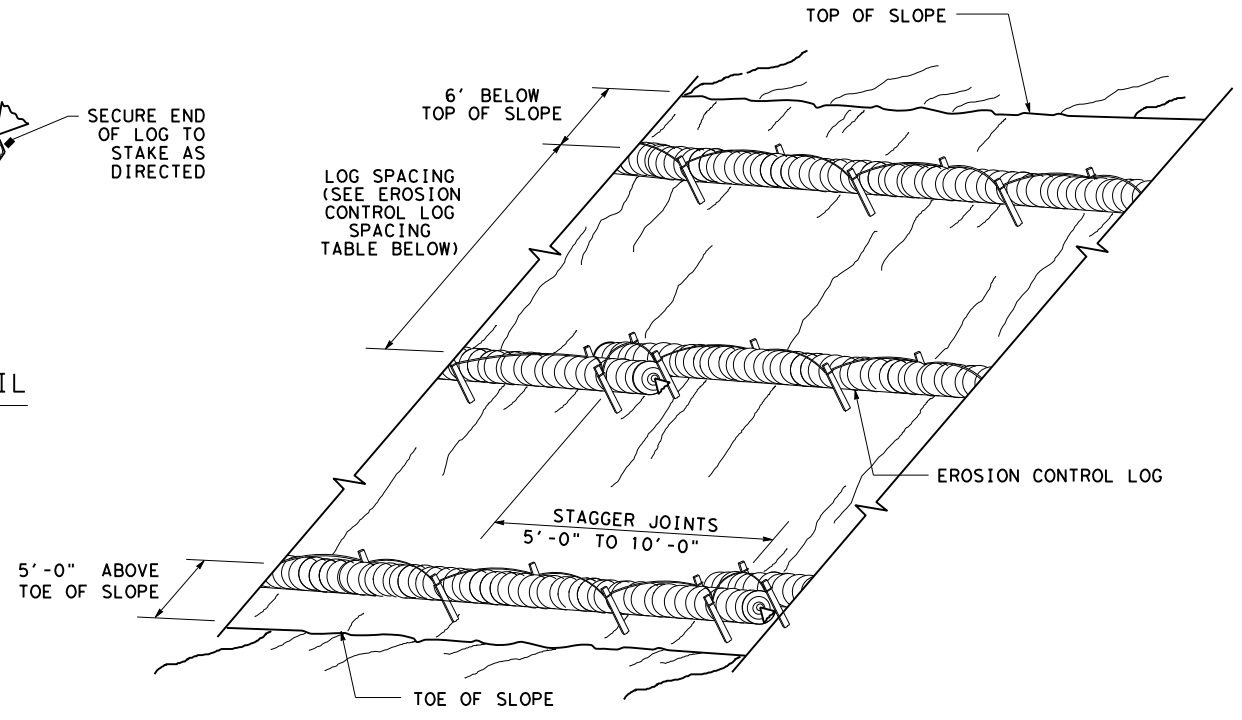
CL-SST



**END SECTION RAP DETAIL**

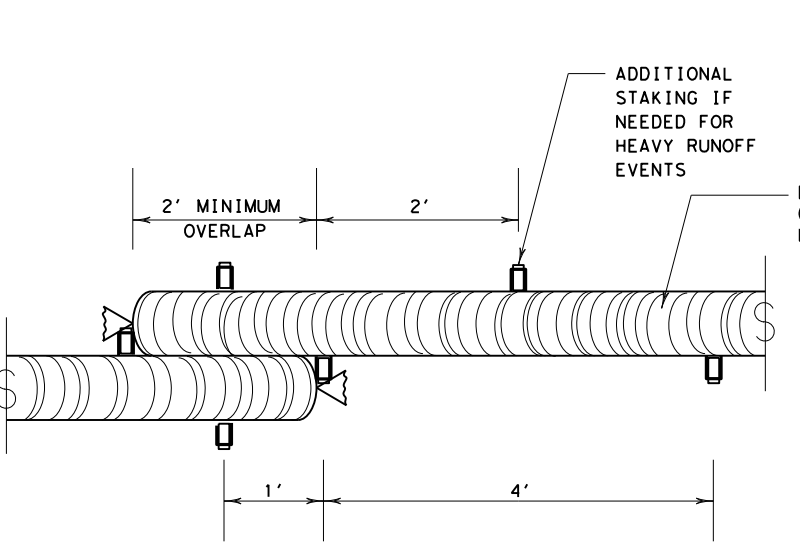
SLOPE	LOG DIAMETER			
	6"	8"	12"	18"
1:1 OR STEEPER	5'	10'	15'	20'
2:1	10'	20'	30'	40'
3:1	15'	30'	45'	60'
4:1 OR FLATTER	20'	40'	60'	80'

\* ADJUSTMENTS CAN BE MADE FOR SOIL TYPE:  
 SOFT, LOAMY SOILS-ADJUST ROWS CLOSER TOGETHER;  
 HARD, ROCKY SOILS- ADJUST ROWS FARTHER APART



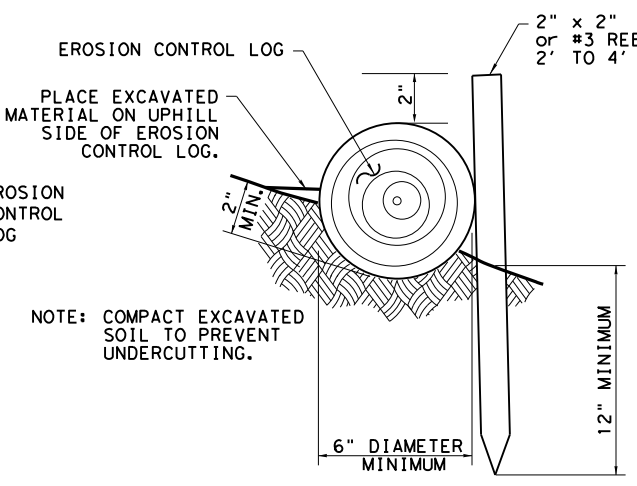
**EROSION CONTROL LOGS ON SLOPES  
STAKE AND LASHING ANCHORING**

CL-SSL



**STAKE AND TRENCHING ANCHORING DETAIL**

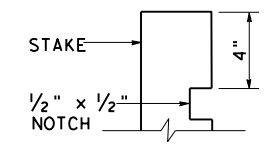
CL-SST



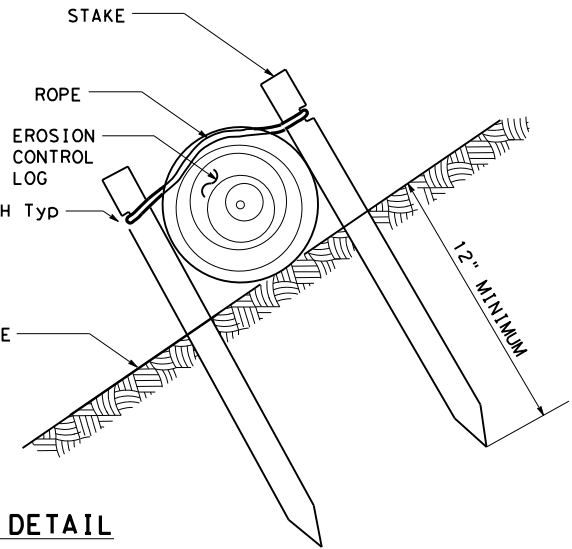
**STAKE AND LASHING ANCHORING DETAIL**

CL-SSL

LOG DIAMETER	DEPTH
6"	2"
8"	3"
12"	4"
18"	5"



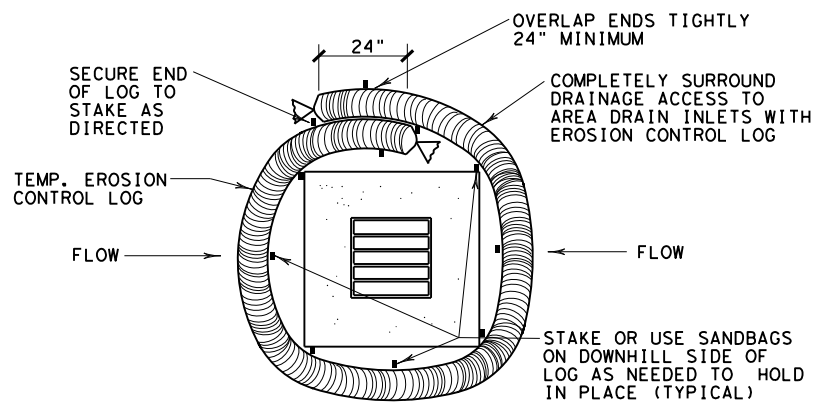
**STAKE NOTCH DETAIL**



SHEET 2 OF 3

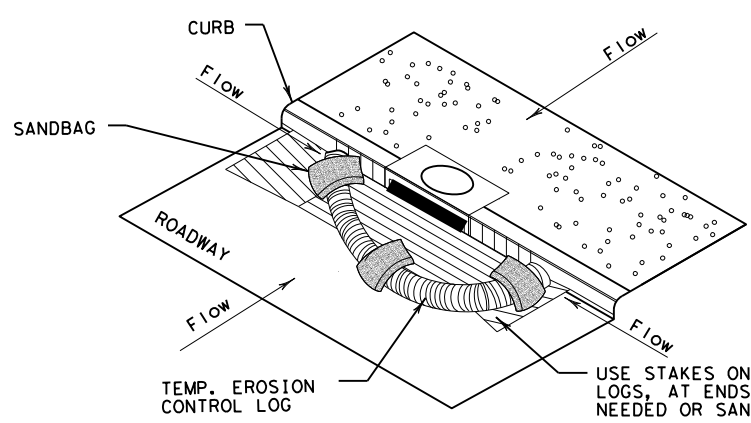
		Design Division Standard	
<b>TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES EROSION CONTROL LOG EC(9) - 16</b>			
FILE: ec116	DN: TxDOT	CK: KM	DW: LS/PT
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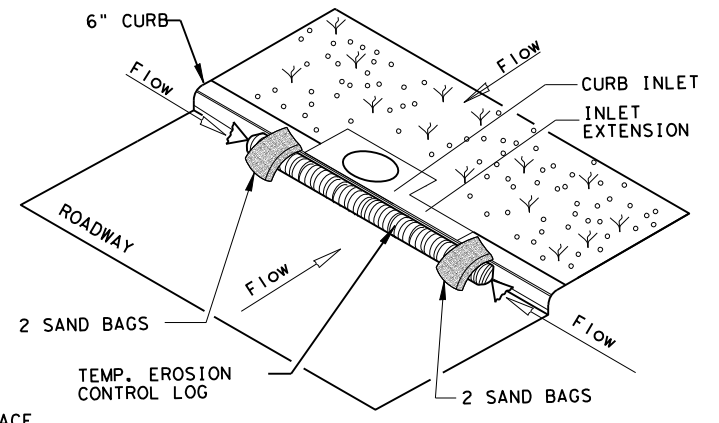
**EROSION CONTROL LOG AT DROP INLET**

CL-DI



**EROSION CONTROL LOG AT CURB INLET**

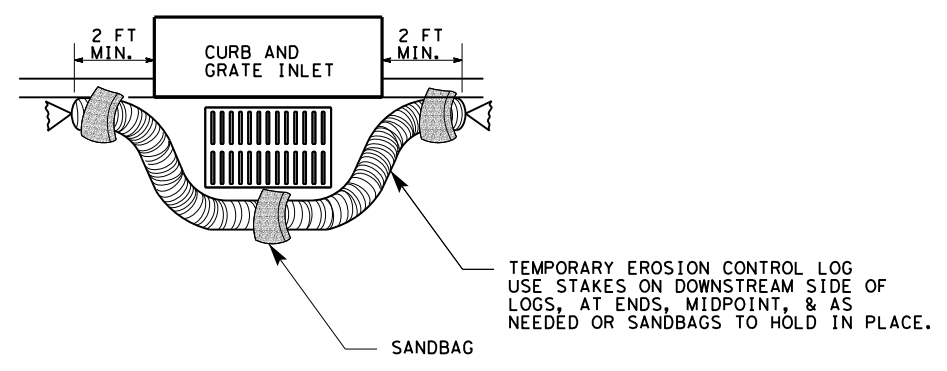
CL-CI



**EROSION CONTROL LOG AT CURB INLET**

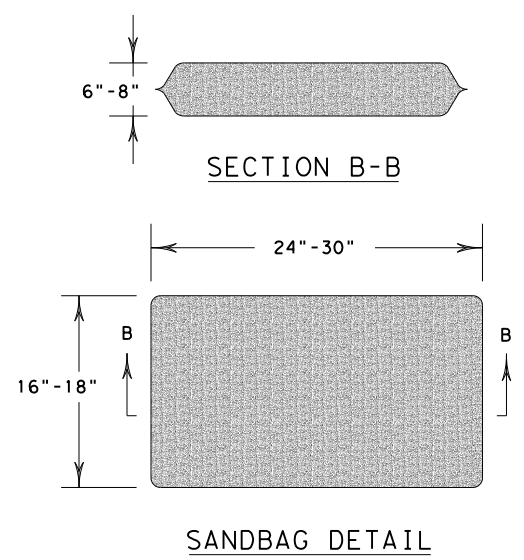
CL-CI

NOTE:  
 EROSION CONTROL LOGS USED AT CURB INLETS SHOULD ONLY BE USED IF THEY WILL NOT IMPEDE TRAFFIC OR FLOOD THE ROADWAY OR WHEN THE STORM SEWER SYSTEM IS NOT FULLY FUNCTIONAL.



**EROSION CONTROL LOG AT CURB & GRADE INLET**

CL-GI



SHEET 3 OF 3

		<i>Design Division Standard</i>	
<b>TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES</b> <b>EROSION CONTROL LOG</b> <b>EC(9) - 16</b>			
FILE: ec916	DN: TxDOT	CK: KM	DW: LS/PT
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REVISIONS	1780	01	009
	DIST	COUNTY	SHEET NO.
	BWD	MILLS	119