CONT	SECT	JOB	HIGHWAY
0805	04	033	RM 3237
DIST	COUNTY		SHEET NO.
AUS	HAYS		1

STATE OF TEXAS
DEPARTMENT OF TRANSPORTATION

PLANS OF PROPOSED
STATE HIGHWAY IMPROVEMENT

STATE PROJECT NUMBER: C-805-4-33

CSJ: 0805-04-033

NET LENGTH OF PROJECT = 4360 FEET = 0.826 MILES
- ROADWAY = 4319.79 FEET = 0.818 MILES
- BRIDGE = 40.21 FEET = 0.008 MILES

TOTAL PROJECT LENGTH = 11,360.00 FT. = 2.152 MI.

HAYS COUNTY
RM 3237

FROM: RM 150
TO: RM 12

FOR THE CONSTRUCTION OF SAFETYIMPROVEMENTS CONSISTING OF
CONSTRUCT TURN-LANES AT MULTIPLE INTERSECTIONS

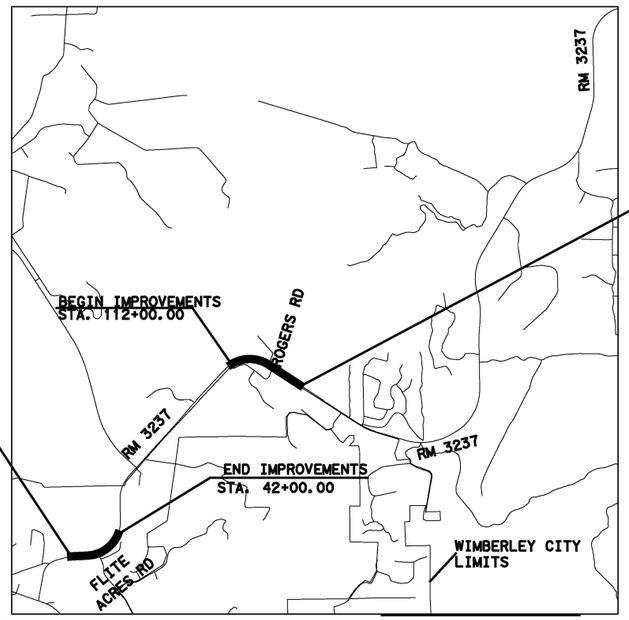
DESIGN SPEED

MAIN LANES: 45 MPH
SIDE STREETS: 15 MPH

A. D. T.

2022: 4950 VPD
2042: 11000 VPD

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com



BEGIN PROJECT
BEGIN IMPROVEMENTS
CSJ: 0805-04-033
STA. 23+60.00
REF MARKER NO.: 514.366
MILE POINT: 11.391
DFO = 0.391

END PROJECT
END IMPROVEMENTS
CSJ: 0805-04-033
STA. 137+20.00
REF MARKER NO.: 516.30
MILE POINT: 13.52
DFO = 2.519

LOCATION MAP NOT TO SCALE

EXCEPTIONS: STA. 42+00.00 - STA. 112+00.00 (1.326 MILES)
EQUATIONS: NONE
RAILROAD CROSSINGS: NONE

FINAL PLANS

DATE OF LETTING: _____

DATE WORK BEGAN: _____

DATE WORK COMPLETED AND ACCEPTED: _____

FINAL CONTRACT COST: $_____

CONTRACTOR: _____

LIST OF APPROVED CHANGE ORDERS:

I CERTIFY THAT THIS PROJECT WAS CONSTRUCTED IN SUBSTANTIAL COMPLIANCE WITH THE FINAL AS-BUILT PLANS AND SPECIFICATIONS.

_____ P.E.
AREA ENGINEER

_____
DATE

CORRECT:

CONSULTING ENG. (TBPE FIRM REG. F-)

RECOMMENDED FOR LETTING: 1/3/2024

DocuSigned by:
Susana Ceballos P.E.
E1816167B5C7414...
DISTRICT DESIGN ENGINEER

SUBMITTED FOR LETTING: 1/3/2024

DocuSigned by:
E1816167B5C7414...
917B7C376B3C4D5...
AREA ENGINEER

APPROVED FOR LETTING: 1/4/2024

DocuSigned by:
8912AF18F45A416...
DIRECTOR OF TRANSPORTATION PLANNING & DEVELOPMENT

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED PROFESSIONAL ENGINEER

_____ P.E.
ADAM M. PFEIFFER, P.E.

11/20/2023
DATE

SPECIFICATIONS ADOPTED BY THE TEXAS DEPARTMENT OF TRANSPORTATION ON NOVEMBER 1, 2014 AND SPECIFICATION ITEMS LISTED AND DATED AS FOLLOWS, SHALL GOVERN ON THIS PROJECT:
SPECIAL LABOR PROVISIONS FOR STATE PROJECTS (000--008)

Texas Department of Transportation

DATE: 11/20/2023 12:31:07 PM
FILE: P:\2016\01252\D. Drawings\0805-04-033_Rogers-Smith-Flite\Sheets\General\20160125 2_RD. TTL. dgn

STATE OF TEXAS
RAHUL M. RAJBHARA
128825
LICENSED PROFESSIONAL ENGINEER
1/26/2024

TRAFFIC STANDARDS

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

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED PROFESSIONAL ENGINEER
1/26/2024

TRAFFIC CONTROL / ROADWAY / DRAINAGE / ENVIRONMENTAL STANDARDS

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

STATE OF TEXAS
DANIEL A. ROGERS
88794
LICENSED PROFESSIONAL ENGINEER
1/26/2024

PAVEMENT MARKINGS & SIGNING STANDARDS

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

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC
TBPE FIRM NO. F-10069
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BUILDING ONE, SUITE 350
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TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

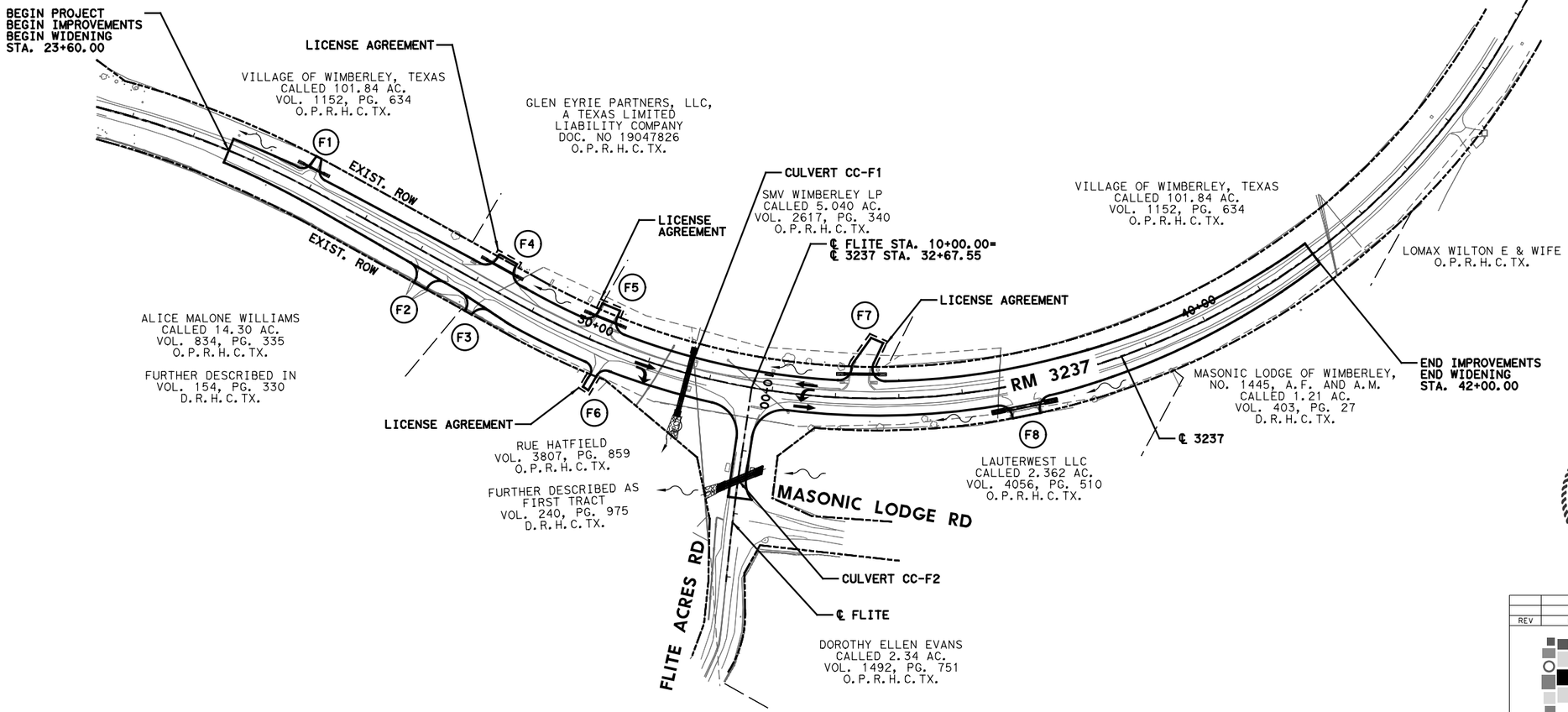
Texas Department of Transportation

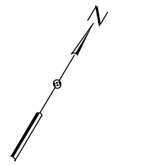
RM 3237 SAFETY IMPROVEMENTS

INDEX OF SHEETS

SHEET 1 OF 1

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS				
HNS	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK	TX	AUS	HAYS	
AMP	CONTROL	SECTION	JOB	2
CHECK	0805	04	033	
AMP				





LEGEND:

- DIRECTION OF TRAFFIC
- DIRECTION OF FLOW
- DRIVEWAY
- PROPOSED RIPRAP

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED PROFESSIONAL ENGINEER

11/17/2023

REV	DATE	DESCRIPTION	APPROVED

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Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

PROJECT LAYOUT

FLITE ACRES RD

SHEET 1 OF 1

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	3
AMP	0805	04	033	
CHECK				
AMP				

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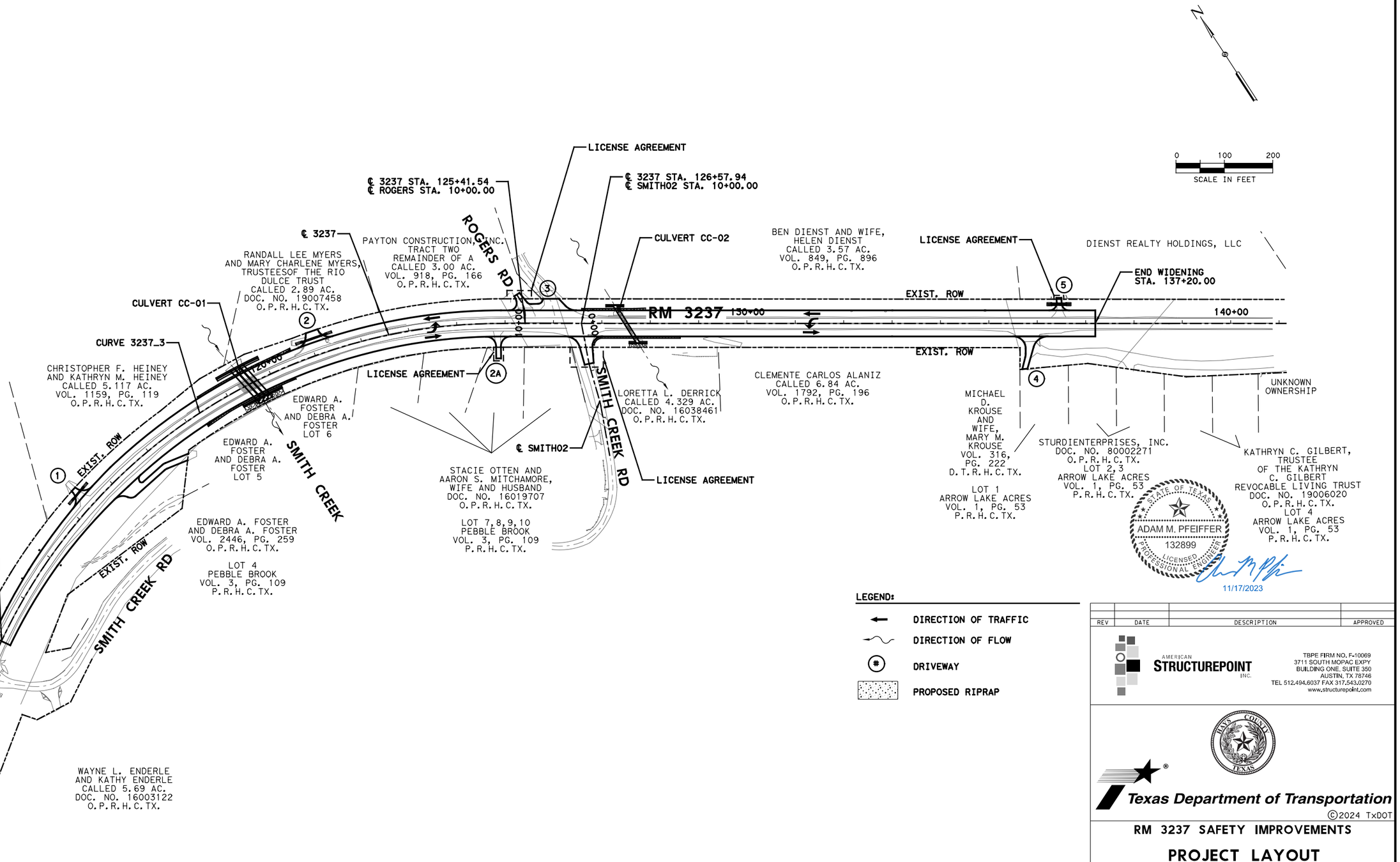

LEGEND:

- DIRECTION OF TRAFFIC
- DIRECTION OF FLOW
- (#) DRIVEWAY
- PROPOSED RIPRAP

REV	DATE	DESCRIPTION	APPROVED

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED PROFESSIONAL ENGINEER

11/17/2023

AMERICAN STRUCTUREPOINT INC.
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www.structurepoint.com

HAYS COUNTY TEXAS

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

PROJECT LAYOUT

ROGERS RD

SHEET 1 OF 1

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
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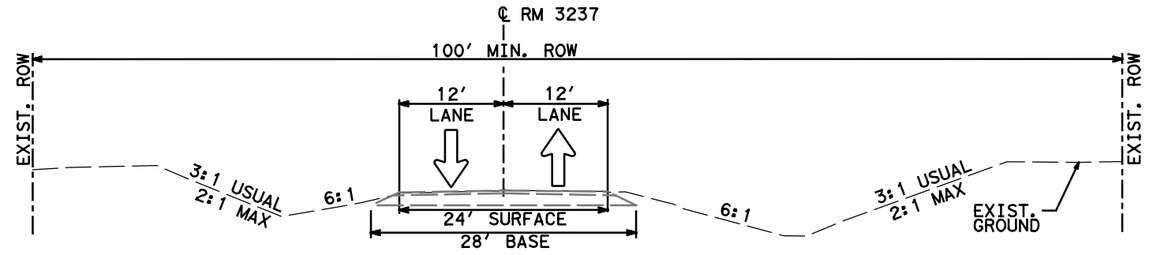
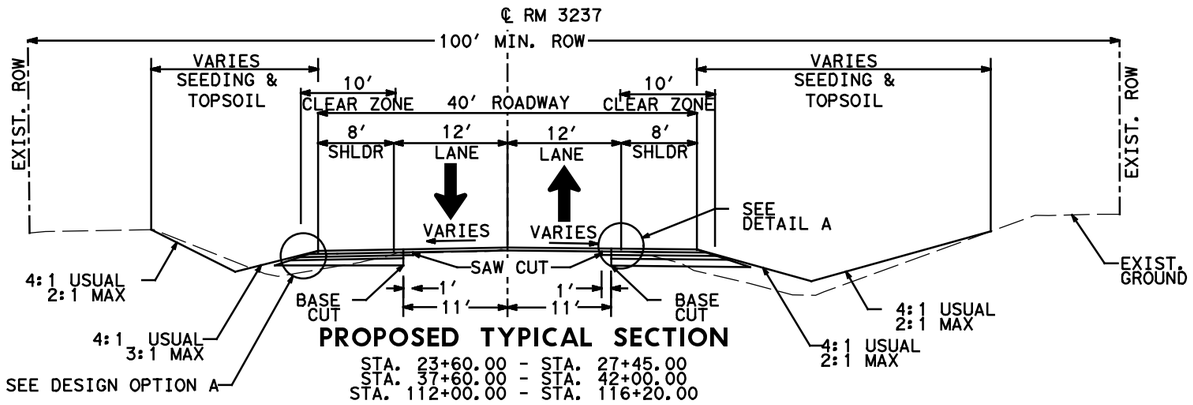
CHECK	CONTROL	SECTION	JOB	
AMP	0805	04	033	
CHECK				
AMP				



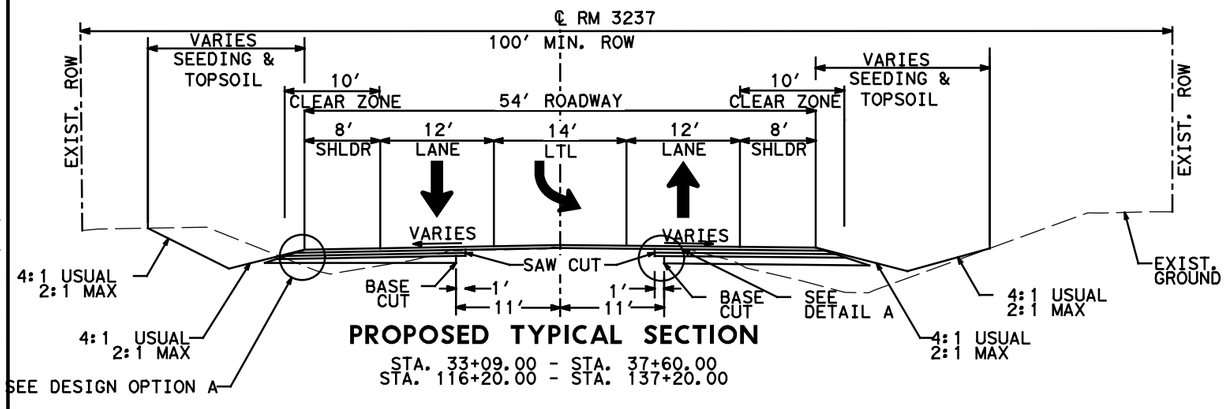
EXISTING TYPICAL SECTION

STA. 23+60.00 - STA. 42+00.00
STA. 112+00.00 - STA. 137+20.00



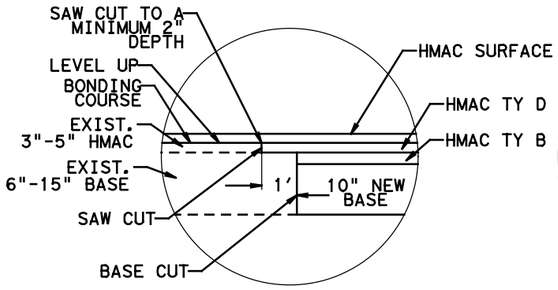
PROPOSED TYPICAL SECTION

STA. 23+60.00 - STA. 27+45.00
STA. 37+60.00 - STA. 42+00.00
STA. 112+00.00 - STA. 116+20.00

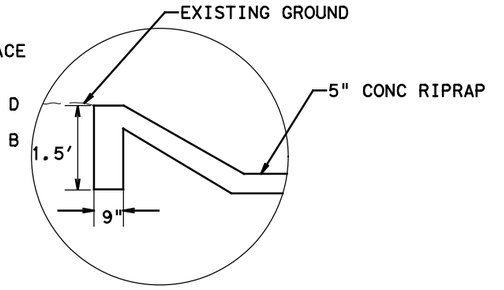


PROPOSED TYPICAL SECTION

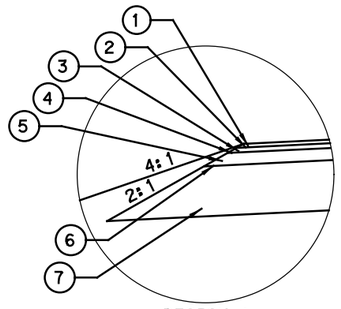
STA. 33+09.00 - STA. 37+60.00
STA. 116+20.00 - STA. 137+20.00



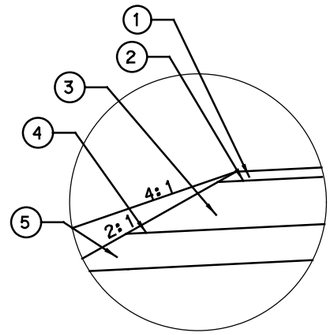
DETAIL A



RIP RAP DETAIL



DESIGN A



DESIGN B

NOTES

1. 4" HMAC TYPE B TO BE NOTCHED 1′ INTO EXISTING PAVEMENT.

2. SIDE STREETS TO BE PAID FOR UNDER ITEM 530-6005 DRIVEWAYS (ACP)

3. FOR SIDE STREETS 8" TY B (PG64-22) PLACE BONDING COURSE BETWEEN LIFTS

DESIGN OPTIONS

DESIGN A (RM 3237)

1. 1.5" PFC-C PG76-22 SAC-A (OVERLAY)
2. UNDERSEAL
3. 1.5" D-GR HMA TY-D
4. BONDING COURSE
5. 4" HMA TY-B PG64-22
6. PRIME COAT
7. 10" FLEXIBLE BASE

DESIGN B (SIDE STREETS)

1. 2" TY D PG76-22
2. BONDING COURSE
3. 8" TY B PG64-22
4. PRIME COAT
5. 6" FLEXBASE

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED PROFESSIONAL ENGINEER
11/17/2023

REV	DATE	DESCRIPTION	APPROVED

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TBPE FIRM NO. F-10069
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AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
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HAYS COUNTY TEXAS

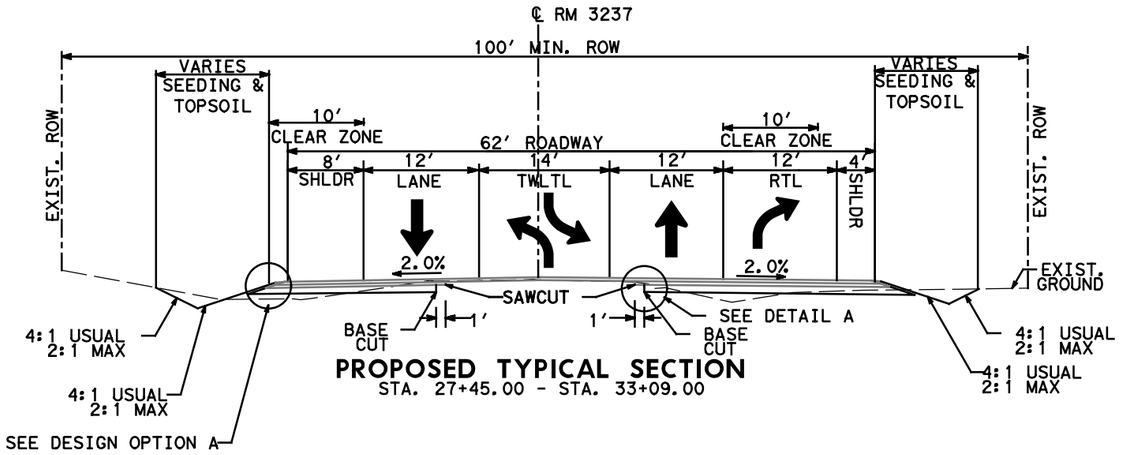
Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

TYPICAL SECTIONS

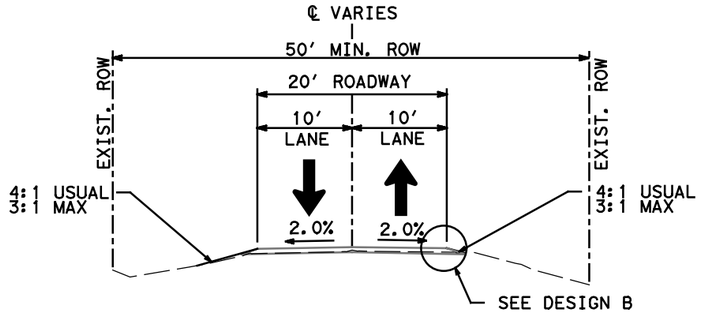
SHEET 1 OF 2

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS				
HNS	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK	TX	AUS	HAYS	
AMP	CONTROL	SECTION	JOB	5
CHECK	0805	04	033	
AMP				



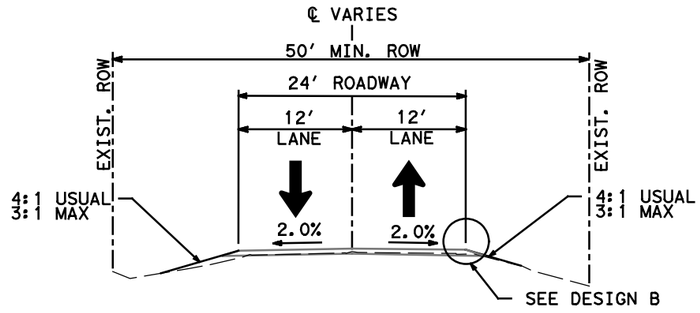
PROPOSED TYPICAL SECTION

STA. 27+45.00 - STA. 33+09.00



PROPOSED TYPICAL SECTION

ROGERS RD: STA. 10+27.07 - STA. 10+63.79
SMITH CREEK RD: STA. 10+27.45 - STA. 10+84.76



PROPOSED TYPICAL SECTION

FLITE ACRES RD: STA. 10+35.00 - STA. 11+75.00

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED PROFESSIONAL ENGINEER
11/21/2023

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
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AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

HAYS COUNTY TEXAS

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

TYPICAL SECTIONS

SHEET 2 OF 2

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	6
CHECK	CONTROL	SECTION	JOB	
AMP	0805	04	033	
CHECK				
AMP				

GENERAL NOTES: October 19, 2023

Item	Description	**Rate
247	**Flexible Base (CMP IN PLC)**	132 LB/CF
310	**Prime Coat**	0.20 GAL/SY
3076	**Dense-Graded Hot-Mix Asphalt and Superpave**	110 LB/SY/IN
3079	**Permeable Friction Course (PFC)**	90.0 LB/SY/IN
3084	**Bonding Course**	0.09 GAL/SY
3085	**UnderSeal Course**	0.20 GAL/SY
	Tack Coat	0.08 GAL/SY

** For Informational Purposes Only

The following standard detail sheet or sheets have been modified:

None

GENERAL
Contractor questions and requests for documents on this project are to be addressed to the following individual(s):

South Austin Mark.Baumann@txdot.gov
South Austin Shane.Swimm@txdot.gov
Traffic Mahendran.Thivakaran@txdot.gov
Traffic Cory.Jucius@txdot.gov

Questions and requests for documents will be accepted via the Letting Pre-Bid Q&A web page. All questions and any corresponding responses that are generated will be posted through the same Letting Pre-Bid Q&A web page. This webpage can be accessed from the Notice to Contractors dashboard located at the following Address:
https://tableau.txdot.gov/views/ProjectInformationDashboard/NoticetoContractors

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

References to manufacturer's trade name or catalog numbers are for the purpose of identification only. Similar materials from other manufacturers are permitted if they are of equal quality, comply with the specifications for this project, and are approved.

County: Hays
Highway: RM 3237

Sheet: 7
Control: 0805-04-033

If work is performed at Contractor's option, when inclement weather is impending, and the work is damaged by subsequent precipitation, the Contractor is responsible for all costs associated with replacing the work, if required.

The roadbed will be free of organic material prior to placing any section of the pavement structure.

Equip all construction equipment used in roadway work with highly visible omnidirectional flashing warning lights.

Provide a smooth, clean sawcut along the existing asphalt or concrete pavement structure, as directed. Consider subsidiary to the pertinent Items.

Construct all manholes/valves to final pavement elevations prior to the placement of final surface. If the manholes/valves are going to be exposed to traffic, place temporary asphalt around the manhole/valve to provide a 50:1 taper. The asphalt taper is subsidiary to the ACP work.

Supply litter barrels in enough numbers at locations as directed to control litter within the project. Consider subsidiary to pertinent Items.

Keep the roadway free of debris and sediment caused by construction activities. Dispose of all material in accordance with federal, state, and local regulations. This work is subsidiary.

Damage to existing pipes and SET's due to Contractor operations will be repaired at Contractor's expense.

All locations used for storing construction equipment, materials, and stockpiles of any type, within the right of way, will be as directed. Use of right of way for these purposes will be restricted to those locations where driver sight distance to businesses and side street intersections is not obstructed and at other locations where an unsightly appearance will not exist. The Contractor will not have exclusive use of right of way but will cooperate in the use of the right of way with the city/county and various public utility companies as required.

Coordinate and obtain approval for all bridgework over existing roadways.

ITEM 5 – CONTROL OF THE WORK
Place construction stakes at intervals of no more than 100 ft. This work is subsidiary.

Provide a 72 hour advance email notice to AUS_Locate@TxDOT.gov to request illumination, traffic signal, ITS, or toll equipment utility locates. Provide AUS_Locate@TxDOT.gov an electronic pdf of as-builts within 21 calendar days of illumination, traffic signal, ITS, or toll equipment being placed into operation. As-built shall include GPS coordinates of manholes and junction boxes. Include final version of RFI's and revised plan sheets.

Precast Alternate Proposals.

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 Alternate Precast Proposal Submission (txdot.gov). 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.

Thermoplastic Pipe Alternate Proposals
When a reinforced concrete or corrugated metal pipe is included in the plans, a thermoplastic polypropylene pipe alternate may be submitted in a 2-phase process. 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.

Phase 1 submit an official request to TxDOT PM with a summary of proposed locations, max depth of placement for each location, cover depth, and pipe diameters. TxDOT goal is to review and respond within 10 days. Phase 1 approval does not guarantee Phase 2 approval.
Phase 2 submit the following documents with all documents signed and sealed by a licensed Engineer in the state of Texas. 1-Provide a redline or revised set of drainage plans reflecting the revised locations. 2-Provide certification that the use of the alternate pipe and proposed bedding are adequate for the proposed application, depth, etc. 3-Provide a completed thermoplastic pipe installation drawing using the following,

https://ftp.txdot.gov/pub/txdot/brg/thermoplastic-pipe-installation-drawing.pdf
https://ftp.txdot.gov/pub/txdot/brg/thermoplastic-pipe-installation-drawing.dgn

For all uses of thermoplastic pipe as an alternate, furnish, install, and inspect the thermoplastic pipe in accordance with SS4216 or latest thermoplastic pipe special specification at time of letting. Minimum values, such as cover depth, required by the specification, installation drawing, etc. will not be waived. Use granular backfill unless flowable fill or CSB is required by the alternate design. Backfill locations shown in the bid plans using flowable fill or CSB must use the backfill per the bid plans.

Electronic Shop Drawing Submittals.
Submit electronic shop drawing submittals according to the current Guide to Electronic Shop Drawing Submittal, https://www.txdot.gov/business/resources/highway/bridge/shop-drawing-submittal-cycle.html. Pre-approved producers can be found online at https://www.txdot.gov/business/resources/materials/material-producer-list.html. Use the following contact list for all submittals that are not required to be sent to Bridge Division and to copy the Engineer for all submittals to the Bridge Division.

Submittal Contact List

South Austin	Mark.Baumann@txdot.gov	AUS_SA-ShopReview@txdot.gov
Signal Shop	Kevin.Plumlee@txdot.gov	
Signal Shop	Dave.Henry@txdot.gov	

Alignment and Profile.

Unless shown in the plans, profile and alignment data for roadways being overlaid or widened are for design verification only. Provide survey and construct the roadway in accordance with the typical section. Bid items and data may be provided to adjust cross slope and super elevations.

ITEM 6 - CONTROL OF MATERIALS
Give a minimum of 1 business day notice for materials, which require inspection at the Plant.

For structures with paint containing hazardous materials, provide locations of material removal 60 days prior to begin removal. For metal elements to be removed, mechanical shear or unbolting for removal and disposal does not require paint abatement but requires 60 day advance notice.

For removal, tie, or tap of asbestos concrete (AC) pipe, contact TxDOT and the local utility company 60 days prior to performing the work. Expose the AC pipe to provide a minimum of 1 ft. of clearance around the top and sides. A minimal amount of soil may remain around the AC pipe to avoid disturbance. The local utility company will be responsible for the demo notice to DSHS and removal of the AC pipe. Tie or tap into existing AC pipe may require removing an entire section of pipe from collar to collar and replacement of pipe with new pipe using existing bid items.

For Federally Funded Contracts, comply with the latest provisions of Build America, Buy America Act (BABA Act) of the Bipartisan Infrastructure Law, by submitting an original of the TxDOT Construction Material Buy America Certification Form for all items classified as construction materials. This form is not required for materials classified as a manufactured product. Refer to the Buy America Material Classification Sheet, located at the following link, for clarification on material categorization. Buy America material classification sheet (txdot.gov)

ITEM 7 – LEGAL RELATIONS AND RESPONSIBILITIES
TxDOT will coordinate with TDLR regarding pedestrian elements and sidewalks. The contractor will procure and provide all permits, licenses, and inspections; pay all charges, fees, and taxes regarding TDLR rules governing industrialized housing and buildings.

Roadway closures during key dates and/or special events are prohibited. See notes for Item 502 for the key dates and/or special events.

Refer to the Environmental Permits, Issues and Commitments (EPIC) plan sheets for additional requirements and permits.

PSL in Edwards Aquifer Recharge and Contributing Zone.
Obtain written approval from the Engineer for all on or off right of way PSLs not specifically addressed in the plans. Provide a signed sketch of the location 30 business days prior to use of the PSL. Include a list of materials, equipment and portable facilities that will be stored at the PSL. TxDOT will coordinate with the necessary agencies. Approval of the PSL is not guaranteed. Un approved PSL is not a compensable impact.

Work within a USACE Jurisdictional Area.
Do not initiate activities within a U.S. Army Corps of Engineers (USACE) jurisdictional area that have not been previously evaluated by the USACE as part of the permit review of this project. Such activities include, but are not limited to, haul roads, equipment staging areas, borrow and disposal sites. Obtain written approval from the Engineer for activities not specifically addressed in the plans. Provide a signed sketch and description of the location 60 business days prior to begin work at the location. Complete and return any forms provided by TxDOT. Approval of the work is not guaranteed. Un approved work is not a compensable impact.

Work over or near Bodies of Water (lakes, rivers, ponds, creeks, dry waterways, etc.).
Keep on site a universal spill kit adequate for the body of water and the work being performed. Debris is not allowed to fall into the ordinary high-water level (OHWL). Debris that falls into the OHWL must be removed at the end of each work day. Debris that falls into the floodway must be removed at the end of each work week or prior to a rain event. Install and maintain traffic control devices to maintain a navigable corridor for water traffic, except during bridge demo and beam placement. This work is subsidiary.
Obtain written approval from the Engineer for temporary fill or crossings not specifically addressed in the plans. Provide a signed sketch of the location 60 business days prior to begin work at the location. Complete and return any forms provided by TxDOT. Approval of the work is not guaranteed. Unapproved work is not a compensable impact.

DSHS Asbestos and Demolition Notification.
Complete and provide the Texas Department of State Health Services (DSHS) notification form to the Engineer and email to AUS_BRG_Notify@txdot.gov at least 30 calendar days prior to bridge removal or renovation for each phase or step of work. Notify the Engineer via email of any changes to the work start and end dates.

Migratory Birds and Bats.
Migratory birds and bats may be nesting within the project limits and concentrated on roadway structures such as bridges and culverts. Remove all old and unoccupied migratory bird nests from any structures, trees, etc. between September 16 and February 28. Prevent migratory birds from re-nesting between March 1 and September 15. Prevention shall include all areas within 25 ft. of proposed work. All methods used for the removal of old nesting areas and the prevention of re-nesting must be submitted to TxDOT 30 business days prior to begin work. This work is subsidiary.

If active nests are encountered on-site during construction, all construction activity within 25 ft. of the nest must stop. Contact the Engineer to determine how to proceed.

Tree and Brush Trimming and Removal.
Work will be conducted September 16 thru February 28. Work conducted outside this timeframe will require a bird survey. Submit a survey request to TxDOT 30 business days prior to begin work.

If within the removal time period, removal work may be conducted during delayed start period using proper traffic control per TCP standards.

Upon begin removal operations, all removal work for the project must be completed within 21 calendar days. Completion of removal includes removing from ROW or mulching of all debris.

No extension of time or compensation will be granted for a delay or suspension due to the above bird, bat, and tree/brush requirements.

Law Enforcement Personnel.
Submit charge summary and invoices using the Department forms.
Patrol vehicles must be clearly marked to correspond with the officer's agency and equipped with appropriate lights to identify them as law enforcement. For patrol vehicles not owned by a law enforcement agency, markings will be retroreflective and legible from 100 ft. from both sides and the rear of the vehicle. Lights will be high intensity and visible from all angles.

No payment will be made for law enforcement personnel needed for moving equipment or payment for drive time to/from the event site. A minimum number of hours is not guaranteed. Payment is for work performed. If the Contractor has a field office, provide an office location for a supervisory officer when event requires a supervising officer. This work is subsidiary.

A maximum combined rate of $70 per hour for the law enforcement personnel and the patrol vehicle will be allowed. Any scheduling fee is subsidiary per Standard Specification 502.4.2.
Cancel law enforcement personnel when the event is canceled. Cancellation, minimums or "show up" fees will not be paid when cancellation is made 12 hours prior to beginning of the event. Failure to cancel within 12 hours will not be cause for payment for cancellation, minimums, or "show up" time. Payment of actual "show up" time to the event site due to cancellation will be on a case-by-case basis at a maximum of 2 hours per officer.

Alterations to the cancellation and maximum rate must be approved by the Engineer or pre-determined by official policy of the officers governing authority.

Back Up Alarm.
For hours 9 P to 5 A, utilize a non-intrusive, self-adjusting noise level reverse signal alarm. This is not applicable to hotmix or seal coat operations. This is subsidiary.

ITEM 8 – PROSECUTION AND PROGRESS
Electronic versions of schedules will be saved in Primavera P6 format.

Working days will be charged in accordance with 8.3.1.1, "Five-Day Workweek."

ITEM 100 - PREPARING RIGHT OF WAY
Prep ROW must not begin until accessible trees designated for preservation have been protected, items listed in the EPIC have been addressed, and SW3P controls installed in accessible areas.
Backfill material will be Type B Embankment using ordinary compaction.

Follow Item 752.4 Work Methods and Item 752 general notes when removing or working on or near trees and brush.

Unless shown otherwise in the plans or a designated non-mow area, perform trimming or removal for areas within 30 ft. of edge of pavement under construction. Trim or remove to provide minimum of 5 ft. of horizontal clearance and 7 ft. of vertical clearance for the following: sidewalks, paths, guard fence, rails, signs, object markers, and structures. Trim to provide a minimum of 14 ft. vertical clearance under all trees. This work is subsidiary.

ITEM 110 – EXCAVATION
The Engineer will define unsuitable material.

ITEM 132 – ALL EMBANKMENT
At no time will the retaining wall backfill material exceed the adjacent embankment operation by more than one lift. At no time will the embankment adjacent to the retaining wall backfill exceed the wall backfill by any elevation. Embankment placed over the area of MSE backfill must meet the same backfill requirements for the type specified under Item 423.

The Engineer will define unsuitable material. Material which the Contractor might deem to be unsuitable due to moisture content will not be considered unsuitable material.

Prior to begin embankment of existing area, correct or replace unstable material to a depth of 6 in. below existing grade. Embankment areas will be inspected prior to beginning work.

Rock or broken concrete produced by the project is allowed in earth embankments. The size of the rock or broken concrete will not exceed the layer thickness requirements in Section 132.3.4., “Compaction Methods.” The material will not be placed vertically within 5 ft. of the finished subgrade elevation.

Embankment placed vertically within 5 ft. of the finished subgrade elevation or within the edges of the subgrade and treated with lime, cement, or other calcium based additives must have a sulfate content less than 3000 ppm. Allow 5 business days for testing. Treatment of sulfate material 3000 ppm to 7000 ppm requires 7 days of mellowing and continuous water curing, in accordance TxDOT guidelines for Treatment of Sulfate-Rich Soils and Bases in Pavement Structures (9/2005). Material over 7000 ppm is not allowed.

ITEM 160 - TOPSOIL
Off-site topsoil will have a minimum PI of 25.

No Sandy Loam allowed.
Obtain approval of the actual depth of the topsoil sources for both on-site and off-site sources.

Construct topsoil stockpiles of no more than five (5) feet in height.

It is permissible to use topsoil dikes for erosion control berms within the right of way, as directed.
Seed or track slopes within 14 days of placement.

Salvage topsoil from sites of excavation and embankment. Maximum salvage depth is 6 inches. Windrowing of topsoil obtained from the Right of Way (ROW) is not allowed.

ITEM 164 – SEEDING FOR EROSION CONTROL
Hydro mulch seeding will be allowed as a substitute for drill seeding if placed October 1 thru January 31. It may only be substituted in areas with a slope less than 1 in. vertical to 12 in. horizontal. It may not be used in the bottom of a ditch or channel. Payment will be made using the existing drill seed item.

ITEM 168 – VEGETATIVE WATERING
Water all areas of project to be seeded or sodded.

Maintain the seedbed in a condition favorable for the growth of grass. Watering can be postponed immediately after a rainfall on the site of ½ inch or greater, but will be resumed before the soil dries out. Continue watering until final acceptance.

Vegetative watering rates and quantities are based on ¼ inch of watering per week over a 3-month watering cycle. The actual rates used and paid for will be as directed and will be based on prevailing weather conditions to maintain the seedbed.

Obtain water at a source that is metered (furnish a current certification of the meter being used) or furnish the manufacturer’s specifications showing the tank capacity for each truck used. Notify the Engineer, each day that watering takes place, before watering, so that meter readings or truck counts can be verified.

ITEM 169 – SOIL RETENTION BLANKETS
Type A blankets containing straw fibers are not allowed. Type B and D blankets shall be a spray type blanket.

ITEM 180 – WILDFLOWER SEEDING

Wildflower Seed Mixture Table

Common Name	Scientific Name	lb. PLS/acre
Illinois Bundleflower	*Desmanthus Illinoensis*	6.0
Indian Blanket	*Gaillardia Pulchella*	6.0
Lemon Mint	*Mondarda Citriodora*	1.0
Bluebonnet	*Lupinus Texensis*	12.0
Pink Evening Primrose	*Oenothera Speciosa*	1.0
Black-Eyed Susan	*Rudbecia Hirta*	1.0
Indian Paintbrush	*Castilleja Miniata*	1.0
Partridge Pea	*Cassia (Chamaecrista)Fasiculata*	8.0
Plains Coreopsis	*Coreopsis Tinctoria*	1.0

ITEM 247 - FLEXIBLE BASE
The layer thickness will be 4 in. to 6 in. unless shown on the plans. Placing in a single layer is allowed when total thickness of base is 8 in. or less. When placed in multiple layers, compact the bottom and middle layers to at least 95% and 98% of the maximum dry density, respectively. When placed in a single layer or the final layer, compact to at least 100%.

Correction of subgrade soft spots is subsidiary.

Complete per plans the subgrade, ditches, slopes, and drainage structures prior to the placement of base.

Do not use a vibratory roller to compact base placed directly on top of a drainage structure.

Grade 4 will have the same material requirements as Grade 5 except minimum compressive strength at lateral pressure 3 psi will be **70** psi and at lateral pressure 15 psi will be 150 psi. Grade 4 does not have a minimum compressive strength at lateral pressure 0 psi.

ITEM 310 – PRIME COAT
Apply blotter material to all driveways and intersections. This work is subsidiary.

When Multi Option is allowed, provide MC 30, EC 30 or AE-P. MC 30 is not allowed in Travis County.

Rolling to ensure penetration is required.

ITEMS 341, 344, & 3076 THRU 348/3082 - HOT-MIX ASPHALT PAVEMENT
Core holes may be filled with an Asphaltic patching material meeting the requirements of DMS-9203 or with SCM meeting requirements of DMS-9202.

Remove and dispose of off the ROW the audible/profile markings, reflectorized markings, and raised markers.

Install transverse butt joints with 50 ft. H: 1 in. V transition from the new ACP to the existing surface. Install a butt joint with 24 in. H: 1 in. V transition from the new ACP to a driveway, pullout or intersection. Saw cut the existing pavement at the butt joints. This work is subsidiary.

Use a device to create a maximum 3H:1V notched wedge joint on all longitudinal joints of 2 in. or greater. This work is subsidiary.

Prior to milling, core the existing pavement to verify thickness. This work is subsidiary.

Ensure placement sequence to avoid excess distance of longitudinal joint lap back not to exceed one day's production rates.

Submit any proposed adjustments or changes to a JMF before production of the new JMF.

Tack every layer. Do not dilute tack coat. Apply it evenly through a distributor spray bar. Provide a minimum transition of 10' for intersections, 10' for commercial driveways, and 6' for residential driveways unless otherwise shown on the plans.

Irregularities will require the replacement of a full lane width using an asphalt paver. Replace the entire sublot if the irregularities are greater than 40% of the sublot area.

Lime or an approved anti-stripping agent must be used when crushed gravel is utilized to meet a SAC "A" requirement.

When using RAP or RAS, include the management methods of processing, stockpiling, and testing the material in the QCP submitted for the project. If RAP and RAS are used in the same mix, the QCP must document that both of these materials have dedicated feeder bins for each recycled material. Blending of RAP and RAS in one feeder bin or in a stockpile is not permitted.

Asphalt content and binder properties of RAP and RAS stockpiles must be documented when recycled asphalt content greater than 20% is utilized.

No RAS is allowed in surface courses.

Department approved warm-mix additives is required for all surface mix application when RAP is used. Dosage rates will be approved during JMF approval.

The Hamburg Wheel Test will have a minimum rut depth of 3mm except for SMA with HPG or PG 76.

ITEMS 341/3076 - DENSE-GRADED HOT-MIX ASPHALT
Use the SGC for design and production testing of all mixtures. Design all Type D mixtures as a surface mix, maximum 15% RAP and no RAS. Contractor may not use a substitute PG binder for 76-22. When using substitute binders, mold specimens for mix design and production at the temperature required for the substitute binder used to produce the HMA.

The Hamburg Wheel minimum number of passes for PG 64 or lower is reduced to 7,000. The Engineer may accept Hamburg Wheel test results for production and placement if no more than 1 of the 5 most recent tests is below the specified number of passes and the failing test is no more than 2,000 passes below the specified number of passes.

ITEM 342/3079 - PERMEABLE FRICTION COURSE (PFC)
For SAC A, blending SAC B aggregate with an RSSM greater than the SAC A rating or 10, whichever is greater, is prohibited.
The use of RAP is prohibited.

Submit the A-R binder design to the District Laboratory for approval.

Permeability test shall not exceed 20 seconds.

Install a butt joint when the edge is adjacent to a driveway or intersection. The taper for the butt joint shall be 24H:1V beyond the normal edge line of the PFC. This work is subsidiary.

ITEM 351 – FLEXIBLE PAVEMENT STRUCTURE REPAIR
Use materials and lift thickness per SS3076. Type C and D mixes will receive an underseal per SS 3085 if the repair surface is the final surface. This work is subsidiary.

Unless otherwise shown on the plans, use the following for repairs:
Type C and D mix will use PG 76 -22 and will be placed with a paver.
Type B mix will use PG 64 -22 and may use a blade to place the mix.
For up to 2 in. deep repairs use Type D PG 76-22 SAC B.
For up to 6 in. deep repairs use Type C PG 76-22 SAC B.
For greater than 6 in. deep repairs use 2 in. Type C or D surface and Type B for the bottom lifts.
For greater than 6 in. deep repairs will be milled then overlaid, adjust the depth of the Type C or D to provide Type C or D to a depth 1.5 in. below the bottom of the milling.

ITEM 400 - EXCAVATION AND BACKFILL FOR STRUCTURES
Unless shown on the plans, the following backfill will apply to cutting and restoring flexible pavement. Backfill with cement-stabilized backfill. The cement-stabilized backfill is subsidiary.

Cap the backfill with Type B hot-mix to a depth equal to the adjacent hot-mix. At locations where the backfill surface is final, place 1-1/2 in. Type D for the surface. The minimum hot-mix depth will be 4 in.

Unless shown on the plans, flowable fill option 1 item will be used for pavement widening.

Saw-cut the pavement at the edge of the excavation. This work is subsidiary.

Backfill the bridge ends in accordance with the limits shown on TxDOT “CSAB” Standard. Use material in accordance with “CSAB” or Item 423, Type BS. The “CSAB” optional bond breaker materials are allowed. This work is subsidiary.

ITEM 423 - RETAINING WALLS
Mow strip shall be 2 ft. wide unless otherwise shown on the plans. Immediately backfill the face of the retaining wall after the wall height gets above the finish grade in front of the wall. Retaining wall coping gap from the face of the wall panel to the inside face of coping shall not be more than 1.5 in.

Provide a sample for approval of the surface finish prior to beginning fascia work and precast operations. Unless otherwise shown on the plans, the wall fascia shall receive an ashlar stone finish. This work is subsidiary.

Type BS backfill will use modified gradation limits as shown below.

Type	Sieve Size	Percent Retained
BS MOD	3 in.	0
	No. 4	85-100

ITEM 432 - RIPRAP
Mow strip riprap will be 4 in. and all other riprap will be 5 in. unless otherwise shown on the plans. Mow strip for cable barrier may be placed monolithically with the barrier foundations if using concrete in accordance with Item 543. Fiber reinforcement is not allowed except in mow strip for cable barrier if foundation and mow strip are placed monolithically. GFRP is allowed reinforcement for all applications.

Saw-cut existing riprap then epoxy 12 in. long No. 3 or No. 4 bars 6 in. deep at a maximum spacing of 18 in. in each direction to tie new riprap to existing riprap. This work is subsidiary.

Provide Type A Grade 3 or 5 flexible base for cement stabilized riprap. Compressive strengths for flexible base are waived.

SGT approach taper, paid for using mow strip item, will be installed using concrete, flexible base coated with SS-1 at a rate of 0.12 GAL/SY, or HMA Type B/C/D. Placement will be ordinary compaction and does not require placement using an asphalt paver.

ITEM 460 - CORRUGATED METAL PIPE
Field adjust pipe end to maintain the necessary slope. Field cutting of pipe end is allowed. Coat all field cuts with asphalt paint. Cut ditches to grade before laying pipe.

ITEM 466 - HEADWALLS AND WINGWALLS
Remove all loose formwork and materials from the waterway at the end of each work week or prior to a rain event. Debris that falls into the waterway must be removed at the end of each work day. Upon completion of the structure, stencil the National Bridge Inventory (NBI) number (structure number) using black paint and 4 in. tall numbers at 4 locations designated by TxDOT. This work is subsidiary.

ITEM 467 - SAFETY END TREATMENT
Field adjust pipe end to maintain the necessary slope. Field cutting of pipe end is allowed. Coat all metal field cuts or exposed reinforcement with asphalt paint.

For all Type II SETs, provide riprap apron shown in the cast-in-place standards and precast riprap detail standard. This work is subsidiary.

Cast-in-place or precast will be allowed unless stated otherwise.

ITEM 502 - BARRICADES, SIGNS, AND TRAFFIC HANDLING

Table 1

Roadway	Limits	Allowable Closure Time
All	Within 200’ of a signalized intersection	9 P to 5 A
All	All (Full Closure, see allowable work below)	11 P to 4 A

Table 2

Roadway	Limits	Allowable Closure Time

N/A N/A N/A

Table 3 (Mobile Operations)

Roadway	Allowable Sun Night thru Fri Noon	Allowable Sat thru Sun Morn
Outside Austin City Limits	9 A to 3 P and 7 P to 7 A	6 P to 11 A

For roadways without defined allowable closure times, nighttime lane closures will be allowed from 8 P to 6 A.

Daytime or Friday night lane closures will not be allowed unless otherwise shown on the plans. One lane in each direction will remain open at all times for all roadways unless otherwise shown on the plans.

Full closures only allowed Friday night thru Monday morning for bridge beam installation, bridge demolition, or OSB truss removal/installation. Full closures only allowed for roadways with frontage roads or if a designated detour route is provided in the plans.

No closures will be allowed on the weekends, working day prior, and working day after the National Holidays defined in the Standard Specifications, Good Friday, and Easter weekend.
No closures will be allowed 1 P.M. to 11 P.M. the Sunday of the Super Bowl.

To account for directional traffic volumes, begin and end times of closures may be shifted equally by the Engineer. The closure duration will remain. Added compensation is not allowed.

One-way traffic control, including work performed under Item 510, must be set up to provide a maximum of 20 minutes of delay to the traveling public.

Submit an emailed request for a lane closure (LCN) to TxDOT. The email will be submitted in the format provided. Receive concurrence prior to implementation. Submit a cancellation of lane closures a minimum of 18 hours prior to implementation. Blanket requests for extended periods are not allowed. Max duration of a request is 2 weeks prior to requiring resubmittal.

Provide 2-hour notice prior to implementation and immediately upon removal of the closure.

For roadways listed in Table 1: Submit the request 96 hours prior to implementation.

For roadways not listed in Table 1: Submit the request a minimum of 48 hours prior to the closure and by the following deadline immediately prior to the closure: 11A on Tuesday or 11A on Friday.
For all roadways: Submit request for traffic detours and full roadway closures 168 hours prior to implementation. Submit request for nighttime work 96 hours to implementation date.

Cancellations of accepted closures (not applicable to full closures or detours) due to weather will not require resubmission in accordance with the above restrictions if the work is completed during the next allowable closure time.

Closures that conflict with adjacent contractor will be prioritized according to critical path work per latest schedule. Conflicting critical path or non-critical work will be approved for first LCN submitted. Denial of a closure due to prioritization or other reasons will not be reason for time suspension, delay, overhead, etc.

Meet with the Engineer prior to lane closures to ensure that sufficient equipment, materials, devices, and workers will be used. Take immediate action to modify current and future traffic control, if at any time the queue becomes greater than 20 minutes.

Consider inclement weather prior to implementing the lane closures. Do not set up traffic control when the pavement is wet.

Cover, relocate, or remove existing small, large, and overhead signs that conflict with traffic control. Cover large and overhead signs to remain using latest standard TS-CD. This work is subsidiary.

Install all permanent signs, delineation, and object markers required for the operation of the roadway before opening to traffic. Use of temporary mounts is allowed or may be required until the permanent mounts are installed or not impacted by construction. Maintain the temporary mounts. This work is subsidiary.

Place a 28-inch cone, meeting requirements of BC (10) and Ty III barricades, on top of foundations that have protruding studs. This work is subsidiary.

Vertical panels used on roadways with speed limit 55mph or greater must be round in shape or have a self-righting mechanism. The “flat” or “oblong” shaped vertical panels are not allowed.

A series of sequential flashing warning lights, per BC(7), must be installed in a merging taper for long term stationary TCP. This includes all TCP setups, such as those shown on the plans or TCP setups per the standards.

Edge condition treatment types must be in accordance with the TxDOT standard. Installation and removal of a safety slope is subsidiary.

To determine a speed limit or an advisory speed limit, submit a request to TxDOT 60 business days prior to manufacture of the sign.

For non-site-specific signal projects, 2 months of barricades will be paid per work order location.

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.

ITEM 506 - TEMPORARY EROSION, SEDIMENTATION, AND ENV CONTROLS
If SW3P plan sheets are not provided, place the control measures as directed.
Install, maintain, remove control measures in areas of the right of way utilized by the Contractor that are outside the limits of disturbance required for construction. Permanently stabilize the area. This work is subsidiary.

Erosion control measures must be initiated immediately in areas where construction activities have ceased and will not resume for a period exceeding 14 calendar days. Vertical track all exposed soil, stockpiles, and slopes. Re-track after each rain event or every 14 days, whichever occurs first. Sheep foot roller is allowed for vertical tracking. This work is subsidiary.

For routine or anticipated dewatering, notify the engineer 72 hours before beginning dewatering. Notify the Engineer within 1 hour of beginning emergency or recent rainfall dewatering. Water located within the ROW that will leave the ROW must appear free of pollutants such as suspended sediment, oil sheen, floating solids, etc. Dirty water must pass thru adequate BMPs prior to leaving the ROW to prevent discharge of dirty water. Bypass pumping of water found in a navigable waterway that enters from outside the ROW and is discharged downstream of the ROW will not require the use of BMPs. Dewatering BMPs will be paid for in conformance with the applicable bid items. However, if the necessary BMP item is not included in the Contract, payment for the BMP will be in accordance with Article 9.7., "Payment for Extra Work and Force Account Method." The act of dewatering and the equipment used to dewater will not be paid for directly but will be subsidiary to pertinent bid items.

Unless a specific pay item is provided in the plans, the installation of the 6:1 or flatter for RFD side slopes in the safety zone will be subsidiary to pertinent bid items.

ITEM 508 – CONSTRUCTING DETOURS
Detour typical section must match the adjacent roadway section, unless shown on the plans.

Flexible base will be Type A Grade 5 placed using ordinary compaction. Base compressive strengths are waived for roadways not listed in Item 502, Table 1.

ITEM 512 – PORTABLE TRAFFIC BARRIER
Designated source barrier stockpile locations: SH 45 just west of US 183 South, SH 130 @ Harold Green, or SH 130 @ Greg Manor Rd. Upon completion of the project, designated source PTB deemed unsalvageable by the Engineer will become the property of the contractor and paid for removal using Item 104. Connection hardware is NOT available for designated source, furnish and retain all hardware to install the PTB.

In lieu of a crash cushion, place 25:1 Class C concrete transition where concrete PTB terminates adjacent to existing concrete barrier. Installation and removal will be paid using existing Item 512 bid items.

If bid item allows concrete or steel, the steel barrier must provide a maximum deflection of 2 ft. 3 in. Pinning and other work to obtain the required deflection is subsidiary.

Any increase in temporary barrier quantities that occur due to Contractor changes in the sequence of work or the traffic control plan will not be paid.

ITEMS 528, 529, 530, 531, & 536 – MISCELLANEOUS CONSTRUCTION
Reinforcement will be in accordance with Section 432.3.1 unless shown on the plans. Fiber reinforcement is not allowed. GFRP is allowed reinforcement for all applications. Class A and B Concrete are allowed to use Coarse Aggregate Grades 1-8.

Unless shown on the plans, all concrete will be 5 in. thick and have 2 in. sand, base, or RAP bedding. Furnish base meeting the requirement for any type or grade in accordance with Item 247. Compressive strengths for flexible base are waived. RAP must be 100% passing a 1 in. sieve. Bedding and flexible base must be placed using ordinary compaction.

Expansion joints will be placed every 40 ft. Expansion joints must be 1 in. wide asphalt board and flush with the surface. The bottom of the asphalt board will be at half the depth of the concrete. The reinforcement will be continuous thru the expansion joint.
Sidewalk cross slope must not exceed 1.5%.

If roots are encountered verify with the Engineer before accommodating or removing 2 in. diameter or larger roots. Root removal must be in accordance with Section 752.4.2. Roots may remain in the bedding or base. For improvements within 6 in. of a root, the concrete thickness may be reduced by 1 in. and the bedding increased by 1 in. to minimize impacts to the roots. Adjust bedding and surface profile to provide a 1 in. bedding cushion around the roots. The surface profile may be adjusted to the extent allowed by ADA. This work is subsidiary.

ITEM 530 – INTERSECTIONS, DRIVEWAYS, AND TURNOUTS
Notify property owners at least 48 hr. before beginning work on their driveway. Use a means and methods to construct the driveway while maintaining access to the property at all times. Full closure of a driveway is allowed for reconstruction if duration and alternate access are approved by Engineer. Install and maintain material across a work zone as temporary access. This work is subsidiary.

The following typical section notes apply to all driveways and turnouts:
For ACP or SURF TREAT, the pavement structure will match the adjacent roadway unless detailed on the plans. HMA, including surface, may use a maximum allowable quantity of 40% RAP and 5% RAS for private driveways, public driveways for 2-lane roadways or smaller, and turnouts. Blending of 2 or more sources is allowed.

For CONC, the pavement structure will be 6 in. thick and have 3 in. flexible base bedding unless detailed on the plans.

Driveways that are public (county road and city street) the pavement structure will match the adjacent roadway.

ITEMS 540, 542, & 544 - METAL BEAM GUARD FENCE AND GUARDRAIL END TREATMENTS

Furnish round timber posts for guard fence. Steel posts for low fill culvert applications is subsidiary including use of low fill culvert application due to other concrete structures such as inlets. Long span application at inlets may be used as an alternate to low fill culvert. Unless otherwise specified on the plans, use of low fill culvert or long span at inlets will be subsidiary to pertinent items. Stake the locations for approval before installation. Adjust the limits of the fence to meet field conditions. Install delineators before opening the road to traffic.

Retain all materials. Existing materials that are structurally sound and dent free may be reused. All reused material will be from this project and in compliance with current standards. Structurally sound rust spots with the largest dimension of 4 in. may be cleaned and repaired in accordance with Section 540.3.5. Punch or field drill holes in the metal rail element to accommodate post spacing. Additional holes for splice or connections are not allowed. Space the field holes in accordance with the latest standard but no closer than the minimum spacing shown on the current standard.

Remove, replace, and install mow strip block out material. Construct new block outs and backfill unused block outs with class B concrete. This work is subsidiary.

Repair of mow strip damage, not caused by contractor negligence, and installation of new mow strip will be paid with appropriate bid items. Backfill and shoulder up of area around fence and mow strip will be paid using embankment item.

ITEM 545 - CRASH CUSHION ATTENUATORS

Use a coring machine or saw cut to remove the mounting hardware/bolts from the existing pavement. Cutting the hardware flush with the surface is not allowed. Refill voids in accordance with the pavement specification. This work is subsidiary.

Install and maintain three 42 in. cones, vertical panels, or plastic drums in advance of the attenuator. Place at spacing per channelizing devices on BC (9). This work is subsidiary.

ITEM 560 – MAILBOX ASSEMBLIES

All wedge anchor sockets must be set in a concrete foundation per Type 4 support/foundation detail on MB standards.

ITEMS 600s & 6000s – ITS, TOLLING, LIGHTING, SIGNING, MARKINGS, AND SIGNALS

Meet the requirements of the NEC, Texas MUTCD, TxDOT standards, and TxDOT Standard Specifications. Notify the Engineer if existing elements to remain do not meet code or specification.

Contractor shall provide all service, equipment and material required to provide a functional item and interface with existing equipment and software.

For signal shop contact Charles Vaughn Jr (Charles.Vaughn@txdot.gov) and Robert Bolin (Robert.Bolin@txdot.gov)

Use the TxDOT provided form to submit an electrical, illumination, and signal checklist prior to request for signal activation or a punch list.

Provide a 7-day advance email notice to the Engineer to request illumination or traffic signal punch list inspection.

Provide a 14-day advance email notice to the Engineer with signal technician contact information and signal locations prior to working or assuming operations of illumination or traffic signal.

Provide a 60-day advance email notice to the Engineer to request signal timing if timing is not provided in the plans.

Provide a 180-day advance email notice to the Engineer for equipment to be provided by TxDOT.
Provide equipment that requires TxDOT programming, etc. to TxDOT 180 day in advance.

Prior to relief of maintenance, a 30-day Test Period is required for signals and ITS equipment in accordance with Item 680.3.1.8. Response time to reported trouble calls shall be less than 2 hours. Complete repairs within 24 hours. Notify the Engineer and maintain a logbook in the controller cabinet of each trouble call. Do not clear the error log in the conflict monitor without approval.

Maintain the existing ITS equipment and HUB buildings operational during construction. ITS downtime is allowed from 12A to 4A. Downtime is restricted to one time per HUB or equipment.

Definitions of abbreviations used to designate ITS equipment, material, etc. can be provided by the Engineer.

Provide email notice to TxDOT and toll road owner 60 business days prior to begin work that impacts tolling equipment. Attend a pre-construction meeting with TxDOT and toll road owner prior to begin work.

Coordinate with toll road owner during construction that impacts or installs tolling equipment. Toll owner will assist with inspection to ensure tolling equipment will operate correctly. Provide email notice to TxDOT and toll road owner 30 business days in advance of completion of toll equipment work. Once toll equipment work is complete, allow 60 calendar days for toll road owner to complete their portion of the work and testing.

Stakes or other physical method shall be installed to hold down conduit prior to placement of concrete/flow fill encasement.

Minimum distance between HDPE joints will be 200 ft.

For conduit mounted to bridges in hangers, fiberglass can be substituted for RMC. Furnish and install per Special Specification 6390.

ITEM 618 - CONDUIT
Shift the locations of conduit and ground boxes to accommodate field conditions. Install conduit not exceeding 2 feet in any direction from a straight line. Install conduit at a minimum depth of 2 ft. below finished grade. Installation of the conduit by jacking or boring method will be at a depth of at least 1 ft. below subgrade.

Install a high tension, non-metallic pull rope in all empty conduit runs. This work is subsidiary. Use a coring device, not a hammer drill, when drilling holes through concrete structures.

Structurally mounted junction boxes will be as shown on the plans. When used for traffic signal installations, these boxes will be 12" x 12" x 8". This work is subsidiary.

For underground conduit, smooth wall schedule 40 equivalent HDPE can be substituted for schedule 40 PVC. Schedule 80 bore can be replaced with a schedule 40 equivalent HDPE carrier pipe of adequate size to carry the proposed conduits. HDPE must transition to RMC/PVC per ED (11)-14.

When using existing conduit, ensure that all conduits have bushings and cleaned of dirt, mud, grease, and other debris. Re-strap existing or relocated conduit per the specification. This work is subsidiary.
Abandoned underground conduit must have all conductors removed.

ITEM 620 - ELECTRICAL CONDUCTORS
Provide 10-amp time delay fuses.

For Flashing Beacons (Item 685) and Pedestal Poles (Item 687), provide single-pole breakaway disconnects.

Install a minimum size 8 AWG equipment grounding conductor (EGC) in all conduits including loop detectors and traffic signal cables. Payment and the size of the EGC will be in accordance with standard ED (3)-14 note 12.

Permanently mark “Illumination” on the luminaire conductors installed inside a traffic signal pole. Make the marks easily visible from the hand hole.

ITEM 624 – GROUND BOXES
Aggregate for fill under the box will be crushed, have a maximum size of 2 in., minimum size of ½ in., and requirements per Item 302 are waived.

ITEM 644 – SMALL ROADSIDE SIGN ASSEMBLIES

Triangular slip base must be the clamp style to secure the post to the slip base. Set screw style slip base will not be allowed.

ITEM 658 – DELINEATOR AND OBJECT MARKER ASSEMBLIES
Installation and maintenance of portable CTB reflectors will be subsidiary to the barrier.

Flexible posts YFLX and WFLX must be tubular in shape. The “flat” flexible posts are not allowed.

CTB delineators must be placed on top of the CTB.

ITEM 662 - WORK ZONE PAVEMENT MARKINGS
Notify the Engineer at least 24 hours in advance of work for this item.
Maintain removable and short-term markings daily. Remove within 48 hours after permanent striping has been completed.

Item 668 is not allowed for use as Item 662.

Roadways with existing profile pavement markings or rumble strips must supplement work zone solid lines with traffic buttons spaced at 12 in. Traffic buttons used to supplement the work zone markings will be paid by the each in addition to the work zone item.

ITEM 666 - RETROREFLECTORIZED PAVEMENT MARKINGS
Notify the Engineer at least 24 hr. before beginning work.
The center-to-center minimum width for double yellow solid stripes must be 18 in. for all roadways.

Place longitudinal markings nightly for IH 35 main lanes or roadways with AADT greater than 100,000. Use of temporary flexible reflective roadway marker tabs is subsidiary and at the Contractor’s option. Replace missing or damaged tabs nightly. If using tabs, place longitudinal markings weekly by 5 AM Friday for all weekday work and by 5 AM Monday for all weekend work. Failure to maintain tabs or place longitudinal markings by deadline will require nightly placement of longitudinal markings.

Place longitudinal markings no later than 7 calendar days after placement of the surface for roadways with AADT greater than 20,000.

When the raised portion of a profile marking is placed as a separate operation from the pavement marking, the raised portion must be placed first then covered with TY I.

When using black shadow to cover existing stripe apply a non-retroreflective angular abrasive bead drop. The marking color shall be adjusted to resemble the pavement color. If Item 677 is not used prior to placement of black shadow, scrape the top of the marking with a blade or large piece of equipment unless surface is a seal coat. The scraping of the marking is subsidiary.

ITEM 677 - ELIMINATING EXISTING PAVEMENT MARKINGS AND MARKERS
Dispose of removed materials and debris at locations off the right of way.
Elimination using a pavement marking will not be allowed in lieu of methods listed in specification.

Remove pavement markings on concrete surfaces by a blasting method. Flail milling will be allowed when total quantity of removal on concrete surfaces is less than 1000 ft.

Strip seal is only method allowed on seal coat surface unless project includes placement of a new surface. If total quantity of removal on a seal coat surface is less than 2000 ft., elimination using a pavement marking is allowed if a test section is approved by the Engineer. Test section shall demonstrate the thermo marking color matches the existing pavement color.

Remove pavement markings outside the limits of the new surface by a blasting method.

Use a TRAIL or a non-retroreflective paint to cover stripe remnants that remain after elimination.

The test requirements for these materials are waived. The paint color shall be adjusted to resemble the existing pavement color. Installation and maintenance is subsidiary.

ITEM 680 - HIGHWAY TRAFFIC SIGNALS
For traffic signal head installation use Austin District MAD-14 detail.

Luminaire arms shall be aligned with the signal head support. If multiple signal head supports, the luminaire arm shall be aligned with the support over the higher volume roadway.
Install 250W EQ LED illumination fixtures as shown in the plans. Test in accordance with Item 616. This work is subsidiary.

Furnish all materials and install signs mounted on the traffic signal wire, traffic signal poles, mast arms, and pedestal pole assemblies. Remove all conflicting signs and sign foundations when signal is placed into operation. This work is subsidiary.

Use a Vulcan swinger sign mounting bracket or equivalent for all signs mounted on span wires.

Place the traffic signal into operation after the traffic signal and installation of striping have been completed. The timing Engineer will be present to program the controller and assist with detection setup. Have a qualified technician and a representative from the controller supplier on the project site to place the traffic signals in operation.

If shown on the plans, install the Emergency Response Detection equipment supplied by the City.

Upon removal, contact signal shop to stockpile salvage materials that meet the current TxDOT standards at the Austin District Headquarters located at 7901 North IH 35, 78753. If signal shop declines receipt of material, Contractor will be responsible for disposal. All poles/arms will be

stripped of components but must include all hardware including bolts. Contact signal shop 48 hours before delivery.

For city operated signals, the city may assist in determining how the detector loop lead-in cables are to be connected, and will also program the controller for operation, the video detection, hook up the conflict monitor, detector units and other equipment, and turn on the controller.

ITEM 684 – TRAFFIC SIGNAL CABLES
For Type A cables, cables meeting the requirements of IMSA 19-1 can be substituted for IMSA 20-1. For all types of cables, an increase of one size larger wire diameter and thickness can be substituted for plan size without additional cost to the Department. For example, 12 AWG can be substituted for 14 AWG.

For each cable run, coil an extra 2 ft. of cable in each steel pole and 5 ft. in the controller cabinet. Provide a separate multi-conductor signal cable (14 AWG) inside pedestal poles and mast-arm signal poles from the terminal strip to each signal head as shown on the plans.

ITEM 686 - TRAFFIC SIGNAL POLE ASSEMBLIES (STEEL)
Provide and install damping plates on all mast arms 40 ft. or greater. For mast arms less than 40 ft., refer to SMA and DMA vibration notes for guidance. This work is subsidiary.

When luminaires are installed on mast arm poles, install a separate terminal strip in the signal pole access compartment. Provide a 10-amp time-delay fuse for traffic signal poles with luminaires.

ITEM 3084 – BONDING COURSE
The minimum application rates are listed in Table BC. Miscellaneous Tack is allowed for use with dense-graded Type B HMA. If a tack bid item is not provided, use bonding course item.

The target shear bond strengths are listed in Table BCS. The informational test cores shall be taken once a shift for first 5 lots of placement or a change to placement method of bonding course, bonding material, or hot mix material. The remaining informational test cores shall be taken once every 3 lots for surface mix. Informational tests are not required for non-surface mix beyond the first 5 lots unless there is a change to placement method of bonding course, bonding material, or hot mix material. Results from these informational tests will not be used for specification compliance.

Table BC

Material	Minimum Application Rate (gal. per square yard)
TRAIL – Emulsified Asphalt	0.06
TRAIL – Hot Asphalt	0.12
Spray Applied Underseal Membrane	0.10

Table BCS (For Informational Tests)

Material	Target Shear Bond Strength (Tex-249-F psi)
SMA – Stone-Matrix Asphalt	60.0
PFC – Permeable Friction Course	N/A
All Other Materials	40.0

ITEM 3085 – UNDERSEAL COURSE
No emulsified asphalt material allowed under PFC or SMA, except for use with Item 316, on roadways with ADT greater than 100,000.

The minimum application rates are listed in Table UC. The target shear bond strengths are listed in Table UCS. The informational test cores shall be taken once a shift for first 5 lots of placement or a change to placement method of bonding course, bonding material, or hot mix material. The remaining informational test cores shall be taken once every 3 lots for surface mix. Informational tests are not required for non-surface mix beyond the first 5 lots unless there is a change to placement method of bonding course, bonding material, or hot mix material. Results from these informational tests will not be used for specification compliance.

Table UC

Material	Minimum Application Rate (mat >1" gal. per square yard)	Minimum Application Rate (mat <= 1" gal. per square yard)
TRAIL – Hot Asphalt	0.15	0.10
Spray Applied Underseal Membrane	0.15	0.15
Seal Coat – Tier II emulsion	0.25	0.25
Seal Coat – Tier II asphalt	0.23	0.23

Table UCS

Material	Minimum Shear Strength (psi)
SMA – Stone-Matrix Asphalt	60.0
PFC – Permeable Friction Course	40.0
All Other Materials	40.0

ITEM 6056 – PREFORMED IN-LANE/CENTERLINE RUMBLE STRIPS
For centerline applications, use option 3 for all roadways. For edge line applications, use option 7 unless option 8 required due to shoulder width.

ITEM 6185 – TRUCK MOUNTED ATTENUATOR AND TRAILER ATTENUATOR
The TMA/TA used for installation/removal of traffic control for a work area will be subsidiary to the TMA/TA used to perform the work.

The contractor will be responsible for determining if one or more operations will be ongoing at the same time to determine the total number of TMA/TA required for the work. TMA/TAs paid by the day is full compensation for all worksite locations during an entire day.

TMA/TAs used to protect damaged attenuators will be paid by the day using the force account item for the repair.

Estimate & Quantity Sheet

CONTROLLING PROJECT ID 0805-04-033 **DISTRICT** Austin **COUNTY** Hays
HIGHWAY RM 3237

						TOTAL EST.	TOTAL FINAL
		CONTROL SECTION JOB		**0805-04-033**			
		PROJECT ID		**A00128800**			
		COUNTY		**Hays**			
		HIGHWAY		**RM 3237**			
ALT	**BID CODE**	**DESCRIPTION**	**UNIT**	EST.	FINAL		
	100-6002	PREPARING ROW	STA	43.600		43.600	
	110-6001	EXCAVATION (ROADWAY)	CY	10,245.000		10,245.000	
	132-6003	EMBANKMENT (FINAL)(ORD COMP)(TY B)	CY	5,308.000		5,308.000	
	160-6003	FURNISHING AND PLACING TOPSOIL (4")	SY	24,207.000		24,207.000	
	164-6003	BROADCAST SEED (PERM) (RURAL) (CLAY)	SY	24,207.000		24,207.000	
	164-6071	BROADCAST SEED (TEMP)(WARM OR COOL)	SY	24,207.000		24,207.000	
	168-6001	VEGETATIVE WATERING	MG	968.000		968.000	
	169-6001	SOIL RETENTION BLANKETS (CL 1) (TY A)	SY	24,207.000		24,207.000	
	180-6001	WILDFLOWER SEEDING	AC	5.000		5.000	
	247-6366	FL BS (CMP IN PLC)(TY A GR 5)(FNAL POS)	CY	4,396.000		4,396.000	
	310-6001	PRIME COAT (MULTI OPTION)	GAL	3,165.000		3,165.000	
	351-6002	FLEXIBLE PAVEMENT STRUCTURE REPAIR(6")	SY	2,664.000		2,664.000	
	400-6005	CEM STABIL BKFL	CY	15.000		15.000	
	400-6008	CUT & RESTORE ASPH PAVING	SY	155.000		155.000	
	402-6001	TRENCH EXCAVATION PROTECTION	LF	172.000		172.000	
	403-6001	TEMPORARY SPL SHORING	SF	1,612.000		1,612.000	
	416-6004	DRILL SHAFT (36 IN)	LF	26.000		26.000	
	423-6003	RETAINING WALL (TEMP WALL)	SF	665.000		665.000	
	432-6006	RIPRAP (CONC)(CL B)	CY	213.000		213.000	
	432-6024	RIPRAP (STONE COMMON)(DRY)(12 IN)	CY	3.000		3.000	
	432-6025	RIRRAP (STONE COMMON)(DRY)(15 IN)	CY	121.000		121.000	
	432-6042	RIPRAP (CONC)(DISSIPATER)	CY	8.000		8.000	
	432-6045	RIPRAP (MOW STRIP)(4 IN)	CY	36.000		36.000	
	462-6021	CONC BOX CULV (8 FT X 6 FT)	LF	240.000		240.000	
	464-6003	RC PIPE (CL III)(18 IN)	LF	208.000		208.000	
	464-6005	RC PIPE (CL III)(24 IN)	LF	342.000		342.000	
	464-6007	RC PIPE (CL III)(30 IN)	LF	168.000		168.000	
	464-6008	RC PIPE (CL III)(36 IN)	LF	68.000		68.000	
	464-6014	RC PIPE (CL III)(72 IN)	LF	92.000		92.000	
	466-6140	HEADWALL (CH - PW - S) (DIA= 72 IN)	EA	2.000		2.000	
	466-6171	WINGWALL (PW - 1) (HW=10 FT)	EA	1.000		1.000	
	466-6172	WINGWALL (PW - 1) (HW=11 FT)	EA	1.000		1.000	
	467-6363	SET (TY II) (18 IN) (RCP) (6: 1) (P)	EA	10.000		10.000	
	467-6388	SET (TY II) (24 IN) (RCP) (3: 1) (C)	EA	4.000		4.000	
	467-6395	SET (TY II) (24 IN) (RCP) (6: 1) (P)	EA	6.000		6.000	
	467-6408	SET (TY II) (30 IN) (CMP) (4: 1) (C)	EA	6.000		6.000	
	467-6454	SET (TY II) (36 IN) (RCP) (6: 1) (P)	EA	2.000		2.000	

Estimate & Quantity Sheet

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HIGHWAY RM 3237

						TOTAL EST.	TOTAL FINAL
		CONTROL SECTION JOB		**0805-04-033**			
		PROJECT ID		**A00128800**			
		COUNTY		**Hays**			
		HIGHWAY		**RM 3237**			
ALT	**BID CODE**	**DESCRIPTION**	**UNIT**	EST.	FINAL		
	500-6001	MOBILIZATION	LS	1.000		1.000	
	502-6001	BARRICADES, SIGNS AND TRAFFIC HANDLING	MO	12.000		12.000	
	506-6002	ROCK FILTER DAMS (INSTALL) (TY 2)	LF	109.000		109.000	
	506-6003	ROCK FILTER DAMS (INSTALL) (TY 3)	LF	305.000		305.000	
	506-6011	ROCK FILTER DAMS (REMOVE)	LF	412.000		412.000	
	506-6020	CONSTRUCTION EXITS (INSTALL) (TY 1)	SY	672.000		672.000	
	506-6024	CONSTRUCTION EXITS (REMOVE)	SY	672.000		672.000	
	506-6038	TEMP SEDMT CONT FENCE (INSTALL)	LF	10,210.000		10,210.000	
	506-6039	TEMP SEDMT CONT FENCE (REMOVE)	LF	10,210.000		10,210.000	
	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	
	508-6003	CONSTRUCTING DETOURS (TY 1)	SY	1,394.000		1,394.000	
	512-6089	PTB(FRN&INSTL)(SSCB OR CSB)(TY1)OR(STL)	LF	1,590.000		1,590.000	
	512-6090	PTB(MOVE)(SSCB OR CSB)(TY1)OR(STL)	LF	660.000		660.000	
	512-6091	PTB(REMOVE)(SSCB OR CSB)(TY1)OR(STL)	LF	1,590.000		1,590.000	
	530-6004	DRIVEWAYS (CONC)	SY	138.000		138.000	
	530-6005	DRIVEWAYS (ACP)	SY	2,337.000		2,337.000	
	540-6001	MTL W-BEAM GD FEN (TIM POST)	LF	525.000		525.000	
	540-6002	MTL W-BEAM GD FEN (STEEL POST)	LF	50.000		50.000	
	540-6014	SHORT RADIUS	LF	25.000		25.000	
	540-6016	DOWNSTREAM ANCHOR TERMINAL SECTION	EA	5.000		5.000	
	542-6001	REMOVE METAL BEAM GUARD FENCE	LF	1,065.000		1,065.000	
	542-6002	REMOVE TERMINAL ANCHOR SECTION	EA	6.000		6.000	
	544-6001	GUARDRAIL END TREATMENT (INSTALL)	EA	3.000		3.000	
	545-6003	CRASH CUSH ATTEN (MOVE & RESET)	EA	4.000		4.000	
	545-6005	CRASH CUSH ATTEN (REMOVE)	EA	10.000		10.000	
	545-6007	CRASH CUSH ATTEN (INSTL)(L)(N)(TL3)	EA	10.000		10.000	
	552-6005	GATE (TY 1)	EA	1.000		1.000	
	560-6011	MAILBOX INSTALL-S (TWW-POST) TY 4	EA	3.000		3.000	
	618-6046	CONDT (PVC) (SCH 80) (2")	LF	458.000		458.000	
	620-6007	ELEC CONDR (NO.8) BARE	LF	239.000		239.000	
	620-6008	ELEC CONDR (NO.8) INSULATED	LF	1,408.000		1,408.000	
	620-6009	ELEC CONDR (NO.6) BARE	LF	244.000		244.000	
	620-6010	ELEC CONDR (NO.6) INSULATED	LF	488.000		488.000	
	624-6010	GROUND BOX TY D (162922)W/APRON	EA	1.000		1.000	
	624-6028	REMOVE GROUND BOX	EA	1.000		1.000	
	644-6001	IN SM RD SN SUP&AM TY10BWG(1)SA(P)	EA	17.000		17.000	

Estimate & Quantity Sheet

CONTROLLING PROJECT ID 0805-04-033 **DISTRICT** Austin **COUNTY** Hays
HIGHWAY RM 3237

						TOTAL EST.	TOTAL FINAL
		CONTROL SECTION JOB		**0805-04-033**			
		PROJECT ID		**A00128800**			
		COUNTY		**Hays**			
		HIGHWAY		**RM 3237**			
ALT	**BID CODE**	**DESCRIPTION**	**UNIT**	EST.	FINAL		
	644-6004	IN SM RD SN SUP&AM TY10BWG(1)SA(T)	EA	3.000		3.000	
	644-6076	REMOVE SM RD SN SUP&AM	EA	11.000		11.000	
	662-6004	WK ZN PAV MRK NON-REMOV (W)4"(SLD)	LF	21,664.000		21,664.000	
	662-6034	WK ZN PAV MRK NON-REMOV (Y)4"(SLD)	LF	21,664.000		21,664.000	
	662-6050	WK ZN PAV MRK REMOV (REFL) TY II-A-A	EA	1,083.000		1,083.000	
	666-6035	REFL PAV MRK TY I (W)8"(SLD)(090MIL)	LF	1,883.000		1,883.000	
	666-6047	REFL PAV MRK TY I (W)24"(SLD)(090MIL)	LF	33.000		33.000	
	666-6053	REFL PAV MRK TY I (W)(ARROW)(090MIL)	EA	10.000		10.000	
	666-6077	REFL PAV MRK TY I (W)(WORD)(090MIL)	EA	8.000		8.000	
	666-6174	REFL PAV MRK TY II (W) 6" (SLD)	LF	8,856.000		8,856.000	
	666-6178	REFL PAV MRK TY II (W) 8" (SLD)	LF	1,883.000		1,883.000	
	666-6182	REFL PAV MRK TY II (W) 24" (SLD)	LF	33.000		33.000	
	666-6184	REFL PAV MRK TY II (W) (ARROW)	EA	10.000		10.000	
	666-6192	REFL PAV MRK TY II (W) (WORD)	EA	8.000		8.000	
	666-6208	REFL PAV MRK TY II (Y) 6" (BRK)	LF	222.000		222.000	
	666-6210	REFL PAV MRK TY II (Y) 6" (SLD)	LF	12,523.000		12,523.000	
	666-6289	REF PROF PAV MRK TY I(Y)6"(SLD)(090MIL)	LF	12,523.000		12,523.000	
	666-6293	REF PROF PAV MRK TY I(Y)6"(BRK)(090MIL)	LF	222.000		222.000	
	666-6308	RE PM W/RET REQ TY I (W)6"(SLD)(090MIL)	LF	8,856.000		8,856.000	
	672-6007	REFL PAV MRKR TY I-C	EA	94.000		94.000	
	672-6009	REFL PAV MRKR TY II-A-A	EA	604.000		604.000	
	677-6001	ELIM EXT PAV MRK & MRKS (4")	LF	43,328.000		43,328.000	
	680-6001	INSTALL HWY TRF SIG (FLASH BEACON)	EA	1.000		1.000	
	680-6004	REMOVING TRAFFIC SIGNALS	EA	1.000		1.000	
	684-6031	TRF SIG CBL (TY A)(14 AWG)(5 CONDR)	LF	646.000		646.000	
	686-6020	INS TRF SIG PL AM (S)STR(TY D)LUM	EA	2.000		2.000	
	690-6016	REMOVAL OF SPAN CABLE ASSM	LF	130.000		130.000	
	690-6025	REPLACE OF SIGNAL HEAD ASSM	EA	6.000		6.000	
	690-6044	REMOVAL OF FLASHER CABINET	EA	1.000		1.000	
	690-6046	INSTALL OF FLASHER CABINET	EA	1.000		1.000	
	690-6066	INSTALL OF LUMINAIRE HEAD	EA	2.000		2.000	
	690-6067	REMOVAL OF LUMINAIRE MAST ARMS	EA	2.000		2.000	
	690-6069	INSTALL OF LUMINAIRE MAST ARMS	EA	2.000		2.000	
	3076-6001	D-GR HMA TY-B PG64-22	TON	3,360.000		3,360.000	
	3076-6048	D-GR HMA TY-D PG76-22	TON	1,305.000		1,305.000	
	3076-6051	D-GR HMA TY-D PG76-22 (LEVEL-UP)	TON	1,000.000		1,000.000	
	3079-6011	PFC-C PG76-22 SAC-A	TON	1,719.000		1,719.000	

Estimate & Quantity Sheet

CONTROLLING PROJECT ID 0805-04-033 **DISTRICT** Austin **COUNTY** Hays
HIGHWAY RM 3237

						TOTAL EST.	TOTAL FINAL
		CONTROL SECTION JOB		**0805-04-033**			
		PROJECT ID		**A00128800**			
		COUNTY		**Hays**			
		HIGHWAY		**RM 3237**			
ALT	**BID CODE**	**DESCRIPTION**	**UNIT**	EST.	FINAL		
	3084-6001	BONDING COURSE	GAL	3,212.000		3,212.000	
	3085-6001	UNDERSEAL COURSE	GAL	5,103.000		5,103.000	
	6056-6002	PREFORMED CENTERLINE RUMBLE STRIP	LF	8,043.000		8,043.000	
	6185-6002	TMA (STATIONARY)	DAY	467.000		467.000	
	6185-6005	TMA (MOBILE OPERATION)	DAY	114.000		114.000	
	7251-6001	Subsurface Util Locate (Outside Rdbed)	EA	20.000		20.000	
	08	CONTRACTOR FORCE ACCOUNT SAFETY CONTINGENCY (NON-PARTICIPATING)	LS	1.000		1.000	
		CONTRACTOR FORCE ACCOUNT LAW ENFORCEMENT (NON-PARTICIPATING)	LS	1.000		1.000	
		CONTRACTOR FORCE ACCOUNT EROSION CONTROL MAINTENANCE (NON-PARTICIPATING)	LS	1.000		1.000	

SUMMARY OF ROADWAY ITEMS

LOCATION	100 6002	110 6001	132 6003	247 6366	310 6001	351 6002	432 6006	432 6024	432 6025	432 6045	530 6004	530 6005	540 6001	540 6002
	PREPARING ROW	EXCAVATION (ROADWAY)	EMBANKMENT (FINAL) (ORD COMP) (TY B)	FL BS (CMP IN PLC) (TY A GR 5) (FNAL POS)	PRIME COAT (MULTI OPTION)	FLEXIBLE PAVEMENT STRUCTURE REPAIR (6")	RIPRAP (CONC) (CL B)	RIPRAP (STONE COMMON) (DRY) (12 IN)	RIRRAP (STONE COMMON) (DRY) (15 IN)	RIPRAP (MOW STRIP) (4 IN)	DRIVEWAYS (CONC)	DRIVEWAYS (ACP)	MTL W-BEAM GD FEN (TIM POST)	MTL W-BEAM GD FEN (STEEL POST)
	STA	CY	CY	CY	GAL	SY	CY	CY	CY	CY	SY	SY	LF	LF
Flite	18.4	4681	1840	1853	1334	1124	139	1	54		138	1235		
Rogers	25.2	5564	3468	2543	1831	1540	74	2	67	36		1102	525	50
PROJECT TOTALS	**43.6**	**10245**	**5308**	**4396**	**3165**	**2664**	**213**	**3**	**121**	**36**	**138**	**2337**	**525**	**50**

SUMMARY OF ROADWAY ITEMS

LOCATION	540 6014	540 6016	544 6001	552 6005	560 6011	3076 6001	3076 6048	3076 6051	3079 6011	3084 6001	3085 6001	7251 6001
	SHORT RADIUS	DOWNSTREAM ANCHOR TERMINAL SECTION	GUARDRAIL END TREATMENT (INSTALL)	GATE (TY 1)	MAILBOX INSTALL-S (TWW-POST) TY 4	D-GR HMA TY-B PG64-22	D-GR HMA TY-D PG76-22	D-GR HMA TY-D PG76-22 (LEVEL-UP)	PFC-C PG76-22 SAC A	BONDING COURSE	UNDERSEAL COURSE	SUBSURFACE UTIL LOCATE (OUTSIDE RDBED)
	LF	EA	EA	EA	EA	TON	TON	TON	TON	GAL	GAL	EA
Flite						1418	550	500	723	1365	2152	20
Rogers	25	5	3	1	3	1942	755	500	996	1847	2951	
PROJECT TOTALS	**25**	**5**	**3**	**1**	**3**	**3360**	**1305**	**1000**	**1719**	**3212**	**5103**	**20**

SUMMARY OF REMOVAL ITEMS

LOCATION	542 6001	542 6002
	REMOVE METAL BEAM GUARD FENCE	REMOVE TERMINAL ANCHOR SECTION
	LF	EA
Flite		
Rogers	1065	6
PROJECT TOTALS	**1065**	**6**

NOTES

1. ITEM 351-6002 TO BE USED AT THE DIRECTION OF THE ENGINEER. QUANTITY IS OBTAINED BY TREATING 25% OF EXISTING ROADWAY.
2. PAVEMENT REMOVAL TO BE SUBSIDIARY TO ITEM 110 6001 EXCAVATION (ROADWAY)

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

HAYS COUNTY TEXAS

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

ROADWAY SUMMARY OF QUANTITIES

SHEET 1 OF 1

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	9
CHECK	CONTROL	SECTION	JOB	
AMP	0805	04	033	
CHECK				
AMP				

SUMMARY OF WORKZONE TRAFFIC CONTROL ITEMS

LOCATION	403 6001	423 6003	460 6022	464	502 6001	508 6003	512 6089	512 6090	512 6091	545 6003	545 6005	545 6007
	TEMPORARY SPL SHORING	RETAINING WALL (TEMP WALL)	CMP (GAL STL 72 IN) *	RC PIPE (96 IN) *	BARRICADES, SIGNS AND TRAFFIC HANDLING	CONSTRUCTING DETOURS (TY 1)	PTB(FRN&INSTL)(SSCB OR CSB)(TY1)OR(STL)	PTB(MOVE)(SSCB OR CSB)(TY1)OR(STL)	PTB(REMOVE)(SSCB OR CSB)(TY1)OR(STL)	CRASH CUSH ATTEN (MOVE & RESET)	CRASH CUSH ATTEN (REMOVE)	CRASH CUSH ATTEN (INSTL)(L)(N)(TL3)
	SF	SF	LF	LF	MO	SY	LF	LF	LF	EA	EA	EA
Flite					6							
Phase 0						292						
Phase 1												
Phase 2												
Phase 3												
Rogers					6							
Phase 0												
Phase 1		665	16	16		1102						
Phase 2	1612						1590	660	930	4	6	10
Phase 3									660		4	
PROJECT TOTALS	**1612**	**665**	**16**	**16**	**12**	**1394**	**1590**	**660**	**1590**	**4**	**10**	**10**

SUMMARY OF WORKZONE TRAFFIC CONTROL ITEMS

LOCATION	662 6004	662 6034	662 6050	677 6001	6185 6002	6185 6005
	WK ZN PAV MRK NON-REMOV (W)4"(SLD)	WK ZN PAV MRK NON-REMOV (Y)4"(SLD)	WK ZN PAV MRK REMOV (REFL) TY II-A-A	ELIM EXT PAV MRK & MRKS (4")	TMA (STATIONARY)	TMA (MOBILE OPERATION)
	LF	LF	EA	LF	DAY	DAY
Flite					467	114
Phase 0						
Phase 1	3682	3682	184	7364		
Phase 2	4077	4077	204	8154		
Phase 3						
Rogers						
Phase 0						
Phase 1	5038	5038	252	10076		
Phase 2	3854	3854	193	7708		
Phase 3	5013	5013	251	10026		
PROJECT TOTALS	**21664**	**21664**	**1083**	**43328**	**467**	**114**

NOTE:

*1. EXISTING CULVERT EXTENSIONS ARE SUBSIDIARY TO ITEM 508-6003.

2. TEMPORARY SSCB TO BE USED FOR ITEMS 512.

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

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RM 3237 SAFETY IMPROVEMENTS

TRAFFIC CONTROL SUMMARY OF QUANTITIES

SHEET 1 OF 1

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
AMP				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	10
DN	0805	04	033	
CHECK				
DN				

SUMMARY OF DRAINAGE ITEMS

LOCATION	400 6005	400 6008	402 6001	432 6042	462 6021	464 6003	464 6005	464 6007	464 6008	464 6014	466 6140	466 6171	466 6172
	CEM STABIL BKFL	CUT & RESTORE ASPH PAVING	TRENCH EXCAVATION PROTECTION	RIPRAP (CONC)(DISSIPATER)	CONC BOX CULV (8 FT X 6 FT)	RC PIPE (CL III)(18 IN)	RC PIPE (CL III)(24 IN)	RC PIPE (CL III)(30 IN)	RC PIPE (CL III)(36 IN)	RC PIPE (CL III)(72 IN)	HEADWALL (CH - PW - S) (DIA= 72 IN)	WINGWALL (PW - 1) (HW=10 FT)	WINGWALL (PW - 1) (HW=11 FT)
	CY	SY	LF	CY	LF	LF	LF	LF	LF	LF	EA	LF	EA
Flite	15	20	36			144	238	168	68				
Rogers		135	136	8	240	64	104			92	2	1	1
PROJECT TOTALS	**15**	**155**	**172**	**8**	**240**	**208**	**342**	**168**	**68**	**92**	**2**	**1**	**1**

SUMMARY OF DRAINAGE ITEMS

LOCATION	467 6363	467 6388	467 6395	467 6419	467 6454
	SET (TY II) (18 IN) (RCP) (6: 1) (P)	SET (TY II) (24 IN) (RCP) (3: 1) (C)	SET (TY II) (24 IN) (RCP) (6: 1) (P)	SET (TY II) (30 IN) (RCP) (4: 1) (C)	SET (TY II) (36 IN) (RCP) (6: 1) (P)
	EA	EA	EA	EA	EA
Flite	6	4	2	6	2
Rogers	4		4		
PROJECT TOTALS	**10**	**4**	**6**	**6**	**2**

REV	DATE	DESCRIPTION	APPROVED

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BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

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RM 3237 SAFETY IMPROVEMENTS

DRAINAGE SUMMARY OF QUANTITIES

SHEET 1 OF 1

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
AMP				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	11
CHECK	CONTROL	SECTION	JOB	
DN	0805	04	033	
CHECK				
DN				

SUMMARY OF TRAFFIC SIGNAL ITEMS

LOCATION	416 6004	618 6046	620 6009	620 6010	624 6010	624 6028	680 * 6001	680 6004	684 6031	686 6020	690 6016	690 6025	690 6044	690 ** 6046
	DRILL SHAFT (36 IN)	CONDT (PVC) (SCH 80) (2")	ELEC CONDR (NO.6) BARE	ELEC CONDR (NO.6) INSULATED	GROUND BOX TY D (162922)W/APRON	REMOVE GROUND BOX	INSTALL HWY TRF SIG (FLASH BEACON)	REMOVING TRAFFIC SIGNALS	TRF SIG CBL (TY A)(14 AWG)(5 CONDR)	INS TRF SIG PL AM (S)STR(TY D)LUM	REMOVAL OF SPAN CABLE ASSM	REPLACE OF SIGNAL HEAD ASSM	REMOVAL OF FLASHER CABINET	INSTALL OF FLASHER CABINET
	LF	LF	LF	LF	EA	EA	EA	EA	LF	EA	LF	EA	EA	EA
Flite	26	229	244	488	1	1	1	1	646	2	130	6	1	1
PROJECT TOTALS	**26**	**229**	**244**	**488**	**1**	**1**	**1**	**1**	**646**	**2**	**130**	**6**	**1**	**1**

*INSTALL NEW SPAN CABLE ASSEMBLY, ELECTRICAL CONDUCTORS AND CONDUITS AS INDICATED ON THE PLAN
**RELOCATE/RESET EXISTING CABINET

SUMMARY OF ILLUMINATION ITEMS

LOCATION	618 6046	620 6007	620 6008	690 6066	690 6067	690 6069
	CONDT (PVC) (SCH 80) (2")	ELEC CONDR (NO.8) BARE	ELEC CONDR (NO.8) INSULATED	INSTALL OF LUMINAIRE HEAD	REMOVAL OF LUMINAIRE MAST ARMS	INSTALL OF LUMINAIRE MAST ARMS
	LF	LF	LF	EA	EA	EA
Flite	229	239	1408	2	2	2
PROJECT TOTALS	**229**	**239**	**1408**	**2**	**2**	**2**

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3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

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RM 3237 SAFETY IMPROVEMENTS

TRAFFIC SUMMARY OF QUANTITIES

SHEET 1 OF 1

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
AMP				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	12
CHECK	CONTROL	SECTION	JOB	
DN	0805	04	033	
CHECK				
DN				

	SUMMARY OF PAVEMENT MARKING ITEMS									
LOCATION	666	666	666	666	666	666	666	666	666	666
	6035	6047	6053	6077	6174	6178	6182	6184	6192	6208
	REFL PAV MRK TY I (W)8"(SLD)(090MIL)	REFL PAV MRK TY I (W)24"(SLD)(090MIL)	REFL PAV MRK TY I (W)(ARROW)(090MIL)	REFL PAV MRK TY I (W)(WORD)(090MIL)	REFL PAV MRK TY II (W) 6" (SLD)	REFL PAV MRK TY II (W) 8" (SLD)	REFL PAV MRK TY II (W) 24" (SLD)	REFL PAV MRK TY II (W) (ARROW)	REFL PAV MRK TY II (W) (WORD)	REFL PAV MRK TY II (Y) 6" (BRK)
	LF	LF	EA	EA	LF	LF	LF	EA	EA	LF
SHEET 1 OF 3	653	17	6	4	3948	653	17	6	4	222
SHEET 2 OF 3	1005	16	3	3	3468	1005	16	3	3	
SHEET 3 OF 3	225		1	1	1440	225		1	1	
PROJECT TOTALS	**1883**	**33**	**10**	**8**	**8856**	**1883**	**33**	**10**	**8**	**222**

	SUMMARY OF PAVEMENT MARKING ITEMS						
LOCATION	666	666	666	666	672	672	6056
	6210	6289	6293	6308	6007	6009	6002
	REFL PAV MRK TY II (Y) 6" (SLD)	REF PROF PAV MRK TY I(Y)6"(SLD)(090MIL)	REF PROF PAV MRK TY I(Y)6"(BRK)(090MIL)	RE PM W/RET REQ TY I (W)6"(SLD)(090MIL)	REFL PAV MRKR TY I-C	REFL PAV MRKR TY II-A-A	PREFORMED CENTERLINE RUMBLE STRIP
	LF	LF	LF	LF	EA	EA	LF
SHEET 1 OF 3	5681	5681	222	3948	33	262	3135
SHEET 2 OF 3	4430	4430		3468	50	222	3468
SHEET 3 OF 3	2412	2412		1440	11	120	1440
PROJECT TOTALS	**12523**	**12523**	**222**	**8856**	**94**	**604**	**8043**

SUMMARY OF SIGNING ITEMS			
LOCATION	644	644	644
	6001	6004	6076
	IN SM RD SN SUP&AM TY10BWG(1)SA(P)	IN SM RD SN SUP&AM TY10BWG(1)SA(T)	REMOVE SM RD SN SUP&AM
	EA	EA	EA
SHEET 1 OF 3	11	3	7
SHEET 2 OF 3	3		2
SHEET 3 OF 3	3		2
PROJECT TOTALS	**17**	**3**	**11**

DATE	DESCRIPTION	APPROVED

WSB & ASSOCIATES, INC.
FIRM # 16849

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. 10069
3711 SOUTH MOPAC EXPRESSWAY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

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RM 3237 SAFETY IMPROVEMENTS

SIGNING AND PAVEMENT MARKING SUMMARY OF QUANTITIES

SHEET 1 OF 1

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
MGD				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
MGD	TX	AUS	HAYS	13
CHECK	CONTROL	SECTION	JOB	
BG	0805	04	033	
CHECK				
DAR				

SUMMARY OF EROSION CONTROL ITEMS

LOCATION	160 6003	164 6003	164 6071	168 6001	169 6001	180 6001	506 6002	506 6003	506 6011	506 6020	506 6024	506 6038	506 6039	506 6041	506 6043
	FURNISHING AND PLACING TOPSOIL (4")	BROADCAST SEED (PERM) (RURAL) (CLAY)	BROADCAST SEED (TEMP) (WARM OR COOL)	VEGETATIVE WATERING	SOIL RETENTION BLANKETS (CL 1) (TY A)	WILDFLOWER SEEDING	ROCK FILTER DAMS (INSTALL) (TY 2)	ROCK FILTER DAMS (INSTALL) (TY 3)	ROCK FILTER DAMS (REMOVE)	CONSTRUCTION EXITS (INSTALL) (TY 1)	CONSTRUCTION EXITS (REMOVE)	TEMP SEDMT CONT FENCE (INSTALL)	TEMP SEDMT CONT FENCE (REMOVE)	BIODEG EROSN CONT LOGS (INSTL) (12")	BIODEG EROSN CONT LOGS (REMOVE)
	SY	SY	SY	MG	SY	AC	LF	LF	LF	SY	SY	LF	LF	LF	LF
Flite	9477	9477	9477	379	9477	1.96		142	142	336	336	5126	5126	**100**	**100**
Rogers	14730	14730	14730	589	14730	3.04	109	163	272	336	336	5084	5084		
PROJECT TOTALS	**24207**	**24207**	**24207**	**968**	**24207**	**5.00**	**109**	**305**	**412**	**672**	**672**	**10210**	**10210**	**100**	**100**

NOTES:

1. **ITEM 506 TEMP SEDMT CONTROL FENCE IS PAID FOR TWICE TO ACCOUNT FOR REPLACEMENT DURING CONSTRUCTION**

REV	DATE	DESCRIPTION	APPROVED

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3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

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RM 3237 SAFETY IMPROVEMENTS

EROSION CONTROL SUMMARY OF QUANTITIES

SHEET 1 OF 1

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
AMP				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	14
CHECK	CONTROL	SECTION	JOB	
DN	0805	04	033	
CHECK				
DN				

TCP NOTES:
1. STATIONING IS BASED ON RM3237 ALIGNMENT UNLESS OTHERWISE NOTED.
2. MAINTAIN DRIVEWAY ACCESS TO ADJOINING PROPERTIES AT ALL TIMES.
3. SIDE STREETS SHALL BE CONSTRUCTED IN HALVES, ALLOWING ACCESS TO THROUGH TRAFFIC AT ALL TIMES.
4. LANE CLOSURES ARE ONLY PERMITTED DURING OFF-PEAK HOURS, AS DIRECTED BY THE ENGINEER.
5. CONTRACTOR SHALL WORK ON ONE SIDE OF THE ROAD AT A TIME.
6. PLACE FLEX BASE AND TYPE B HMAC ON EACH INTERSECTION BEFORE MOVING TO NEXT INTERSECTION.
7. AT THE END OF THE DAY, SIDE STREETS SHALL HAVE ONE LANE OPEN IN EACH DIRECTION. COST FOR MAINTAINING THE ACCESS IS SUBSIDIARY TO ITEM 502.
8. CONTRACTOR TO PROVIDE SURVEY OF EXISTING ROADWAY WITHIN PROJECT LIMITS BEFORE LEVEL UP. ELEVATIONS SHOULD BE TAKEN AT 3 LOCATIONS EVERY 50 FEET. ONE ELEVATION SHOT ON EACH EDGE LINE AND A SHOT TO CENTERLINE. THESE ELEVATIONS WILL BE SUBMITTED TO THE ENGINEER IN MS-EXCEL FORMAT OR SPREADSHEET FOR REVIEW. INFORMATION WILL BE USED TO DEVELOP PROFILE AND CROSS SLOPE FOR LEVEL UP OF ROADWAY. PROVIDE ENGINEER 10 WORKING DAYS TO PROVIDE RESPONSES TO CONTRACTOR.
9. CROSS CULVERTS F1 AND F2 SHALL BE CONSTRUCTED AT ONCE DURING A WEEKEND, OR AS DIRECTED BY THE ENGINEER, UTILIZING STANDARD TCP(2-2)-18.

SEQUENCE OF WORK

PHASE 0: CONSTRUCT CROSS CULVERTS AND TEMPORARY PAVEMENT

CROSS CULVERTS CC-F1-CCF2

STEP 1:

1. INSTALL TEMPORARY MARKINGS AND SHIFT TRAFFIC.
2. INSTALL TEMPORARY PIPE EXTENSION, DITCH AND CONSTRUCT TEMPORARY PAVEMENT WIDENING

STEP 2:

1. INSTALL TEMPORARY MARKINGS AND SHIFT TRAFFIC.
2. EXCAVATE AND REMOVE EXITING STRUCTURE.
3. PROVIDE TRENCH EXCAVATION PROTECTION, IF NEEDED, AND INSTALL PROPOSED STRUCTURE.
4. PLACE FLOWABLE BACKFILL AND TEMPORARY PAVEMENT.

STEP 3:

1. INSTALL TEMPORARY MARKINGS AND SHIFT TRAFFIC.
2. EXCAVATE AND REMOVE EXITING STRUCTURE.
3. PROVIDE TRENCH EXCAVATION PROTECTION, IF NEEDED, AND INSTALL PROPOSED STRUCTURE.
4. PLACE FLOWABLE BACKFILL AND TEMPORARY PAVEMENT.

PHASE 1: CONSTRUCTION OF PAVEMENT WIDENING ON LEFT SIDE, TEMPORARY WALLS, AND EXTEND EXISTING CULVERTS

1. INSTALL TEMPORARY EROSION CONTROL AND TCP DEVICES.
2. PLACE TEMPORARY EXTENSION OF EXISTING CULVERTS AT CC-01 AND CC-02.
3. PERFORM PAVEMENT REPAIRS AND LEVEL UP.
4. SAW CUT 11′ LEFT OF CENTERLINE.
5. EXCAVATE, BUILD EMBANKMENT, AND PLACE EQUAL LIFTS OF FLEX BASE.
6. PULL TOPSOIL UP TO FLEX BASE EDGE.
7. REPAIR ANY DAMAGED OR FAILED PAVEMENT, AS DIRECTED BY THE ENGINEER, AND PRIME FLEX BASE.
8. PLACE HMAC TY B. CUT 1′ NOTCH INTO EXISTING ASPHALT AND PLACE 1.5" HMAC TY D.
9. INSTALL SIGNING MOUNTS.
10. PLACE WORK ZONE PAVEMENT MARKINGS FOR NEXT PHASE.
11. INSTALL TEMPORARY BARRIER.

PHASE 2: CONSTRUCTION OF PAVEMENT WIDENING ON RIGHT SIDE

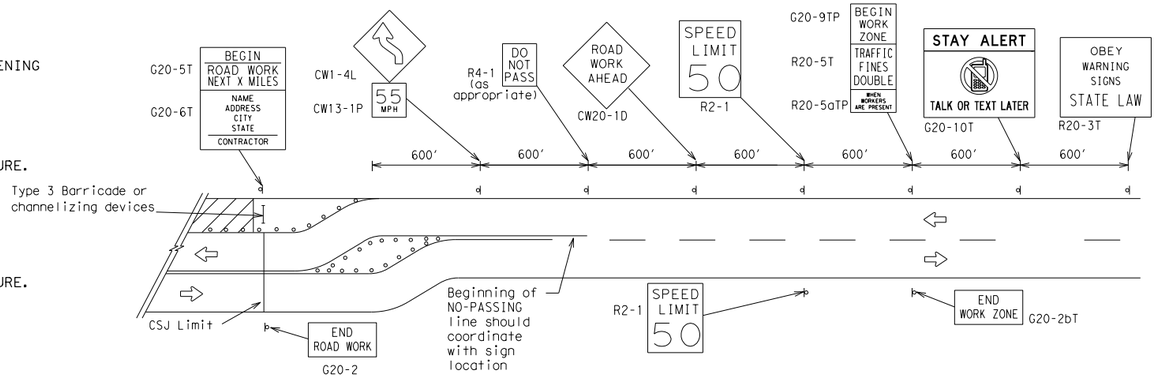
1. SHIFT TRAFFIC ONTO TEMPORARY LANES INSTALLED IN PREVIOUS PHASE.
2. CONSTRUCT TEMPORARY SPECIAL SHORING AND RIGHT SIDE OF CULVERTS CC-01 AND CC-02, AS SHOWN IN PLANS.
3. PERFORM PAVEMENT REPAIRS AND LEVEL UP.
4. SAW CUT 11′ RIGHT OF CENTERLINE.
5. EXCAVATE, BUILD EMBANKMENT, AND PLACE EQUAL LIFTS OF FLEX BASE.
6. PULL TOPSOIL UP TO FLEX BASE EDGE.
7. REPAIR ANY DAMAGED OR FAILED PAVEMENT, AS DIRECTED BY THE ENGINEER, AND PRIME FLEX BASE.
8. PLACE HMAC TY B. CUT 1′ NOTCH INTO EXISTING ASPHALT AND PLACE 1.5" HMAC TY D.
9. INSTALL SIGNING MOUNTS.
10. PLACE WORK ZONE PAVEMENT MARKINGS FOR NEXT PHASE.
11. MOVE AND RESET TEMPORARY BARRIER.

PHASE 3: CONSTRUCTION OF CULVERTS ON LEFT SIDE

1. SHIFT TRAFFIC ONTO TEMPORARY LANES INSTALLED IN PREVIOUS PHASE.
2. EXCAVATE, PLACE SHORING AROUND CULVERTS AND INSTALL REMAINING CULVERT.
3. REMOVE TEMPORARY PAVEMENT AND BUILD PERMANENT PAVEMENT BACK UP TO GRADE AS SHOWN IN PLANS.
4. PLACE TEMPORARY PAVEMENT MARKINGS AND SHIFT TRAFFIC.

PHASE 4: FINAL HMAC OVERLAY AND PROJECT CLEAN UP

1. PLACE FINAL 1.5" HMAC PFC-C SURFACE COURSE.
2. PLACE PERMANENT PAVEMENT MARKINGS AND SIGNAGE.
3. REMOVE TEMPORARY EROSION CONTROLS AND PLACE ALL PERMANENT EROSION CONTROL AS SHOWN IN PLANS.



ADVANCED SIGN LAYOUT

SEE TCP STANDARDS FOR ADDITIONAL SPACING

* SPEED LIMIT MAY VARY THROUGHOUT PROJECT. INSTALL SIGNS AS DIRECTED BY ENGINEER

TCP DETOUR TABLE

CULVERT ID	PROPOSED CULVERT STATION	BEGIN PAVEMENT WIDENING STATION	END PAVEMENT WIDENING STATION	PAVEMENT WIDENING WIDTH/SIDE(FT)	TOTAL(BOTH SIDES) PAVEMENT WIDENING (SY)
CC-F1	32+65.00	31+47.50	33+82.50	5	186
CC-F2	11+29.32	10+81.82	11+76.82	5	106

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED PROFESSIONAL ENGINEER
11/21/2023

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

HAYS COUNTY TEXAS

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RM 3237 SAFETY IMPROVEMENTS

TRAFFIC CONTROL SEQUENCE OF WORK

SHEET 1 OF 1

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	15
CHECK	CONTROL	SECTION	JOB	
AMP	0805	04	033	
CHECK				
AMP				

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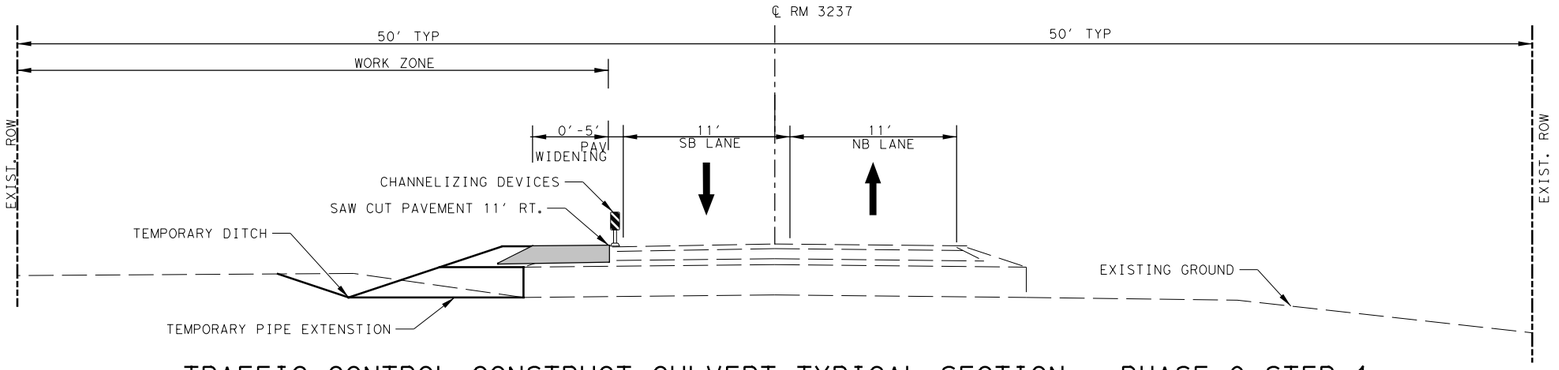
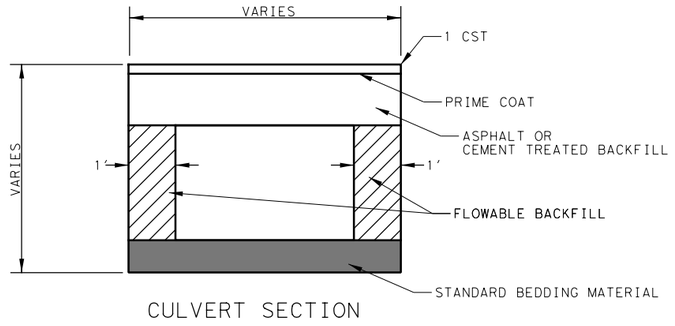
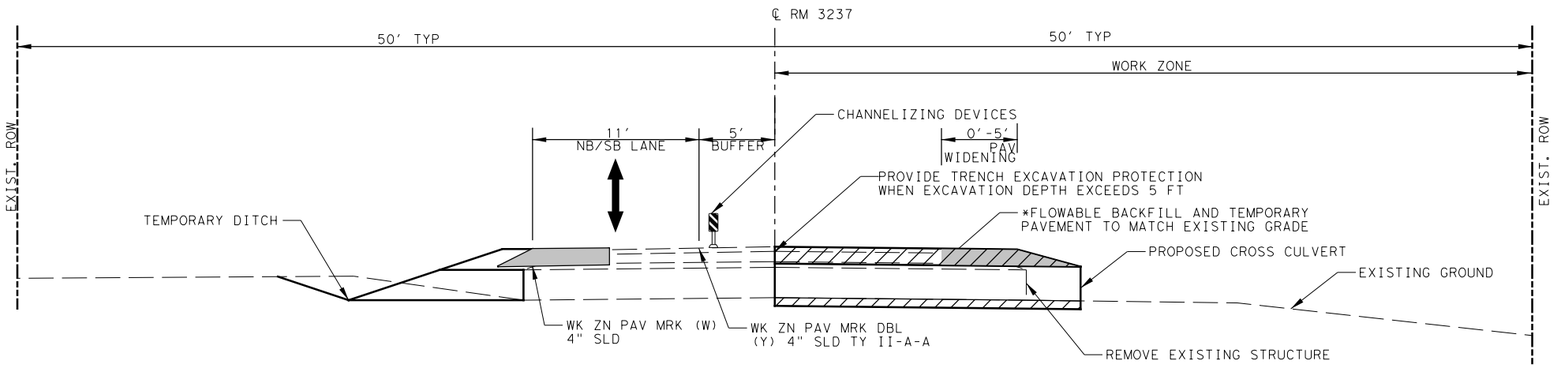


TRAFFIC CONTROL CONSTRUCT CULVERT TYPICAL SECTION - PHASE 0 STEP 1

CC-F1 AND CC-F2

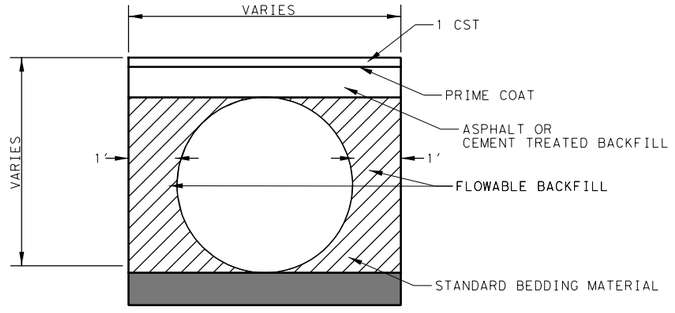


CULVERT SECTION



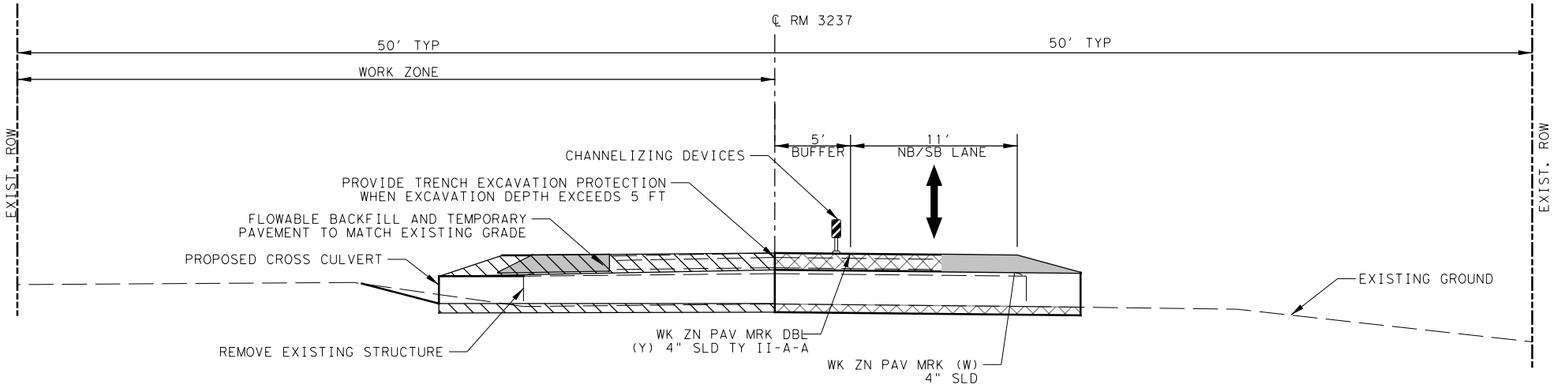
TRAFFIC CONTROL CONSTRUCT CULVERT TYPICAL SECTION - PHASE 0 STEP 2

CC-F1 AND CC-F2



CULVERT SECTION

*CONTRACTOR MAY USE ITEM 401-6001 IN LARGE FILL LOCATIONS AS DIRECTED BY THE ENGINEER.



TRAFFIC CONTROL CONSTRUCT CULVERT TYPICAL SECTION - PHASE 0 STEP 3

CC-F1 AND CC-F2

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED PROFESSIONAL ENGINEER
11/21/2023

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
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HAYS COUNTY TEXAS

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

TRAFFIC CONTROL TYPICAL SECTIONS

SHEET 1 OF 3

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	16
AMP	0805	04	033	
CHECK				
AMP				

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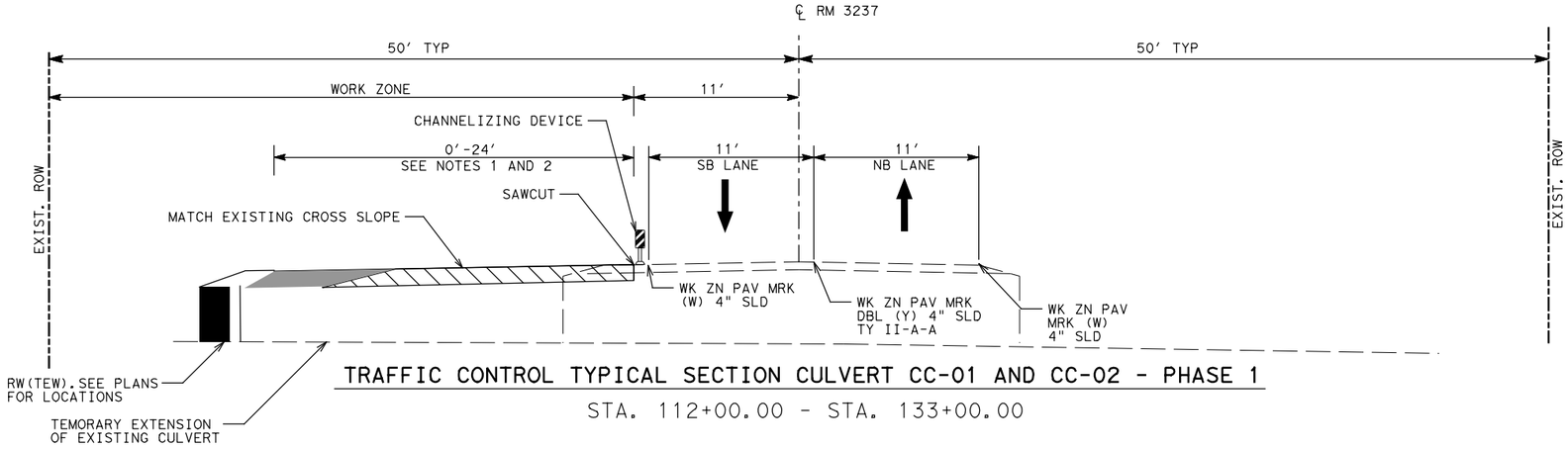
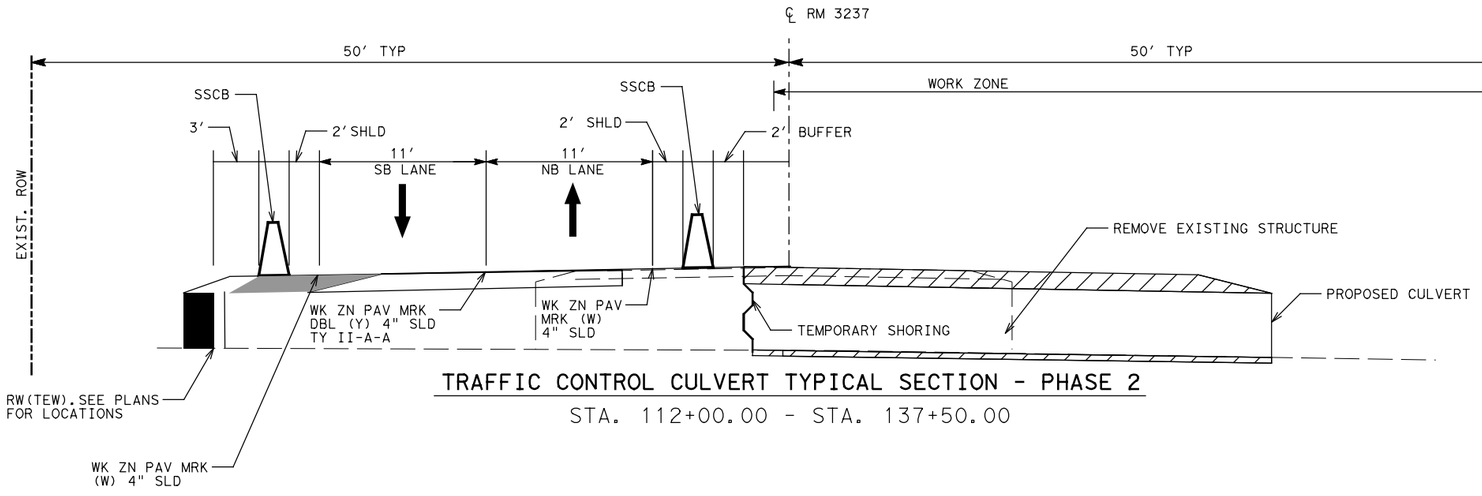


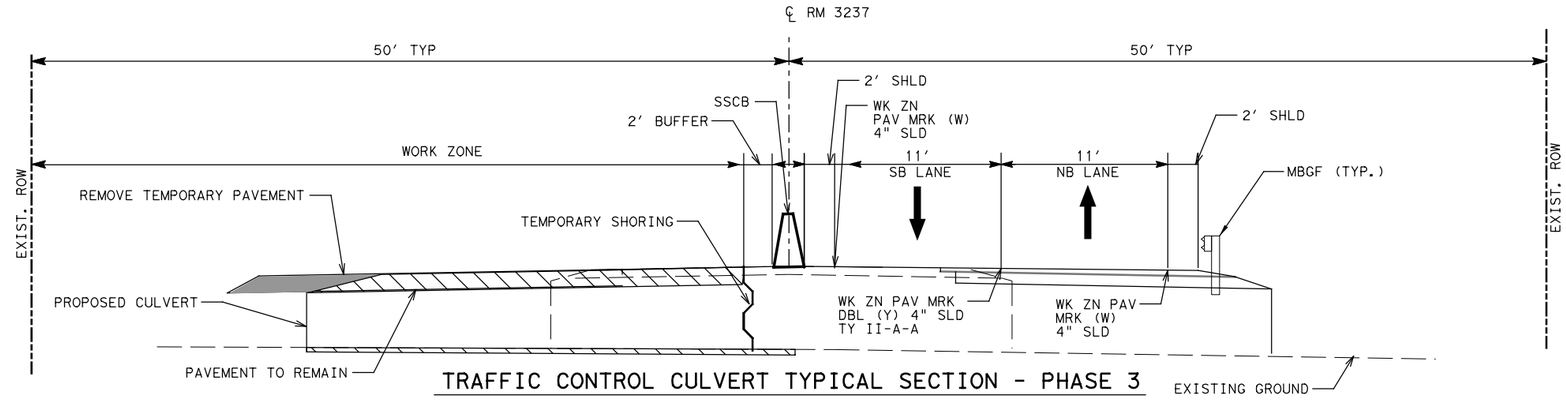
TRAFFIC CONTROL TYPICAL SECTION CULVERT CC-01 AND CC-02 - PHASE 1

STA. 112+00.00 - STA. 133+00.00



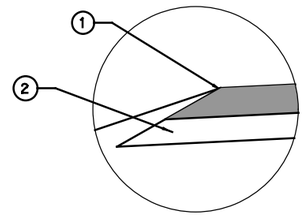
TRAFFIC CONTROL CULVERT TYPICAL SECTION - PHASE 2

STA. 112+00.00 - STA. 137+50.00



TRAFFIC CONTROL CULVERT TYPICAL SECTION - PHASE 3

STA. 112+00.00 - STA. 137+50.00



CONSTRUCTING DETOURS TY 1

(1) 9" D-GR HMA TY-B

(2) SUBGRADE

NOTES

1. PERMANENT PAVEMENT WILL BE USED UP TO PROPOSED EDGE OF PAVEMENT. SEE DESIGN A ON TYPICAL SECTIONS.
2. TEMPORARY PAVEMENT TO BE USED OUTSIDE OF PROPOSED EDGE OF PAVEMENT LIMITS. SEE DETAIL ABOVE FOR CONSTRUCTING DETOURS TY 1.

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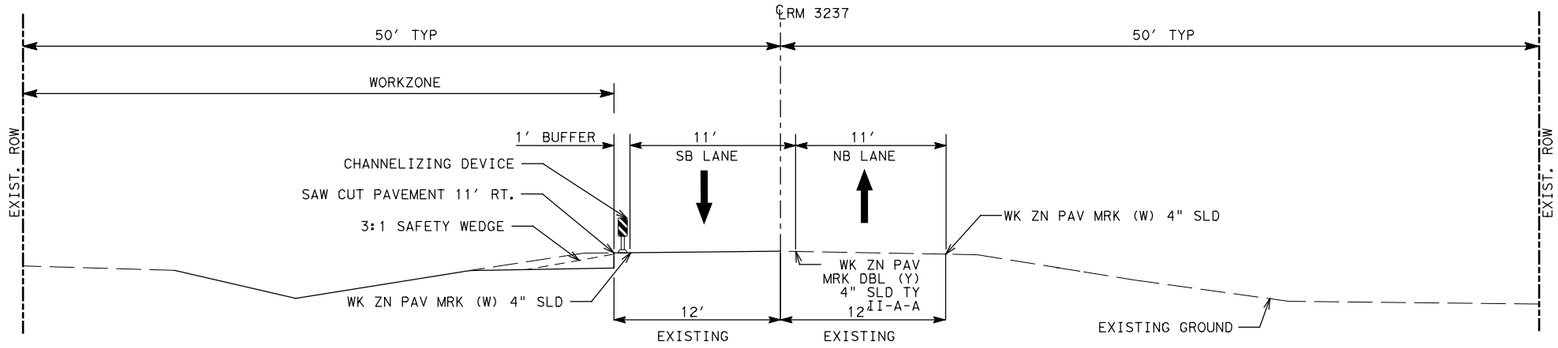
RM 3237 SAFETY IMPROVEMENTS

TRAFFIC CONTROL TYPICAL SECTIONS

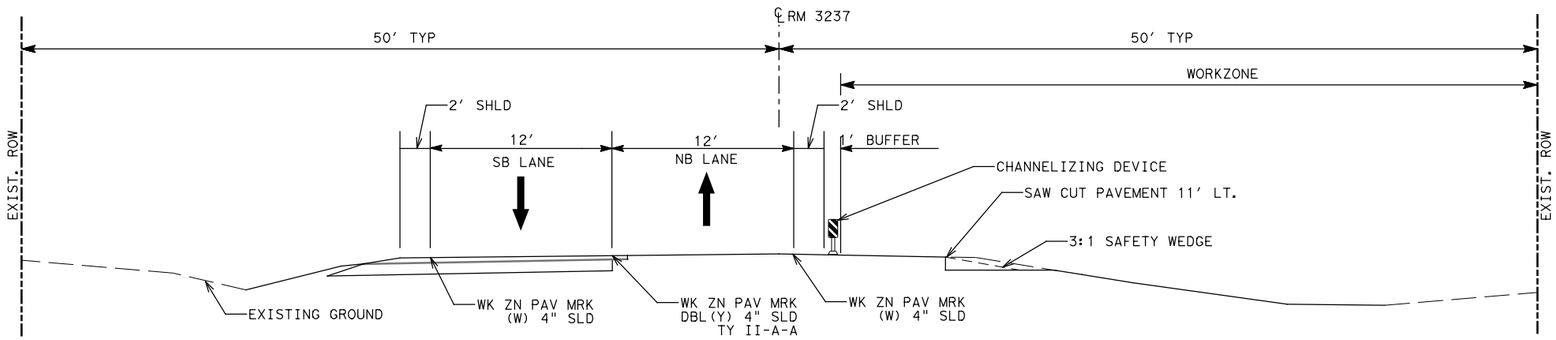
SHEET 2 OF 3

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS				
HNS	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK	TX	AUS	HAYS	
AMP	CONTROL	SECTION	JOB	17
CHECK	0805	04	033	
AMP				



TRAFFIC CONTROL TYPICAL SECTION - PHASE 1

STA. 23+60.00 - STA. 42+00.00



TRAFFIC CONTROL TYPICAL SECTION - PHASE 2

STA. 23+60.00 - STA. 42+00.00

STATE OF TEXAS
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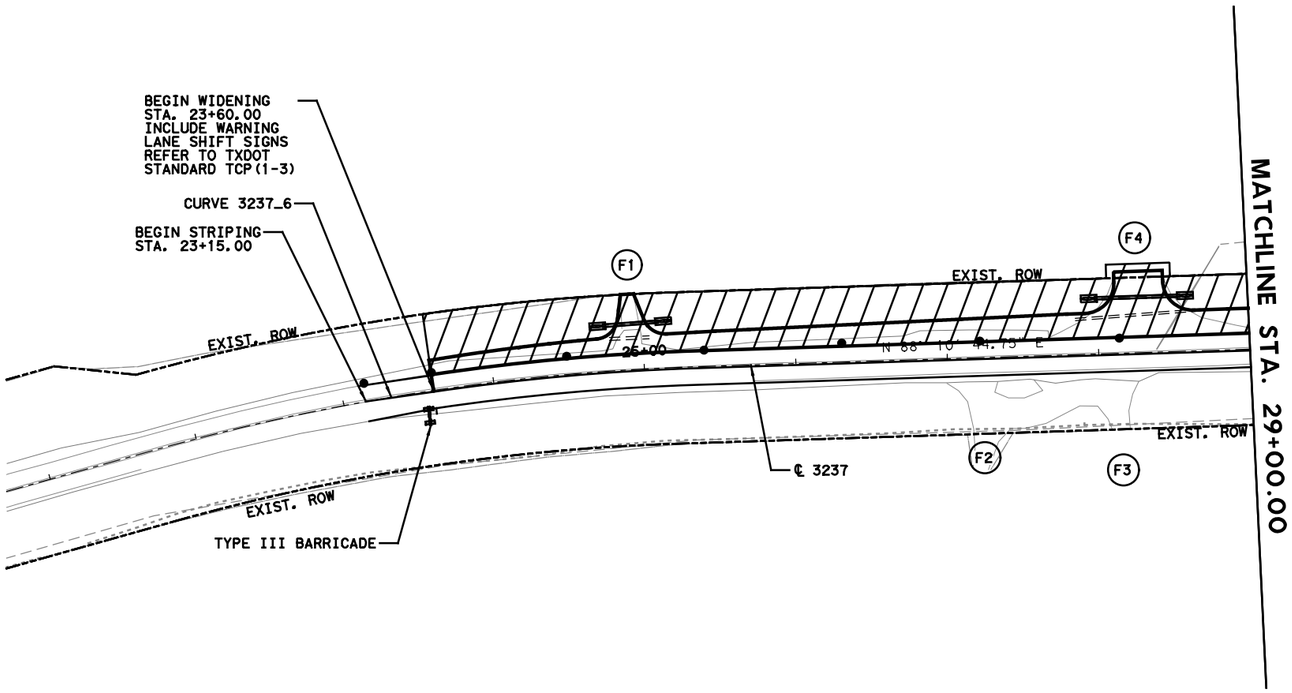
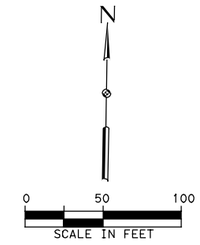
RM 3237 SAFETY IMPROVEMENTS

TRAFFIC CONTROL TYPICAL SECTIONS

SHEET 3 OF 3

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	18
AMP	0805	04	033	
CHECK				
AMP				





NOTES:
1. SEE TCP TYPICAL SECTIONS FOR LANE WIDTHS.
2. SEE TCP STANDARDS FOR ADVANCED SIGN LAYOUT.

LEGEND:

- DIRECTION OF TRAFFIC
- WORK AREA
- CHANNELIZING DEVICES
  55' C-C SPACING ON TAPER
  90' C-C SPACING ON TANGENT
- TYPE III BARRICADE
- DRIVEWAY
- TEMPORARY SHORING
- SINGLE SLOPE CONCRETE BARRIER
- TEMPORARY PAVEMENT

11/21/2023

REV	DATE	DESCRIPTION	APPROVED

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RM 3237 SAFETY IMPROVEMENTS

RM 3237
TRAFFIC CONTROL PLAN
PHASE 1

SHEET 1 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	19
AMP	0805	04	033	
CHECK				
AMP				

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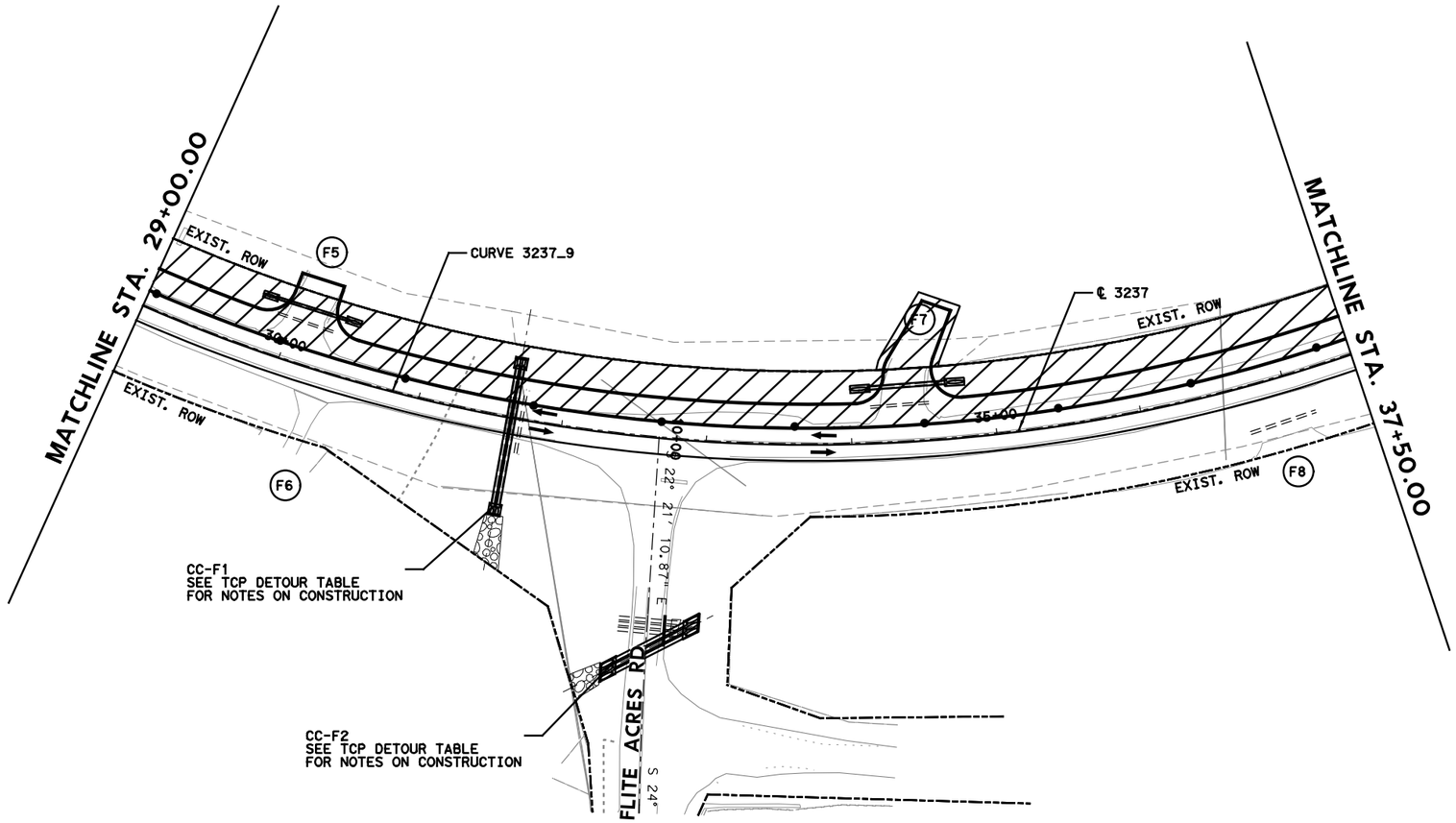

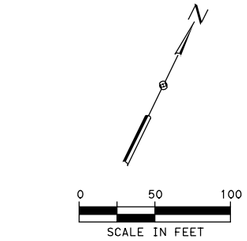

NOTES:
1. SEE TCP TYPICAL SECTIONS FOR LANE WIDTHS.
2. SEE TCP STANDARDS FOR ADVANCED SIGN LAYOUT.

LEGEND:

- DIRECTION OF TRAFFIC
- WORK AREA
- CHANNELIZING DEVICES
  55' C-C SPACING ON TAPER
  90' C-C SPACING ON TANGENT
- TYPE III BARRICADE
- (#) DRIVEWAY
- TEMPORARY SHORING
- SINGLE SLOPE CONCRETE BARRIER
- TEMPORARY PAVEMENT

REV	DATE	DESCRIPTION	APPROVED

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RM 3237 SAFETY IMPROVEMENTS

RM 3237
TRAFFIC CONTROL PLAN
PHASE 1

SHEET 2 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	20
CHECK	CONTROL	SECTION	JOB	
AMP	0805	04	033	
CHECK				
AMP				

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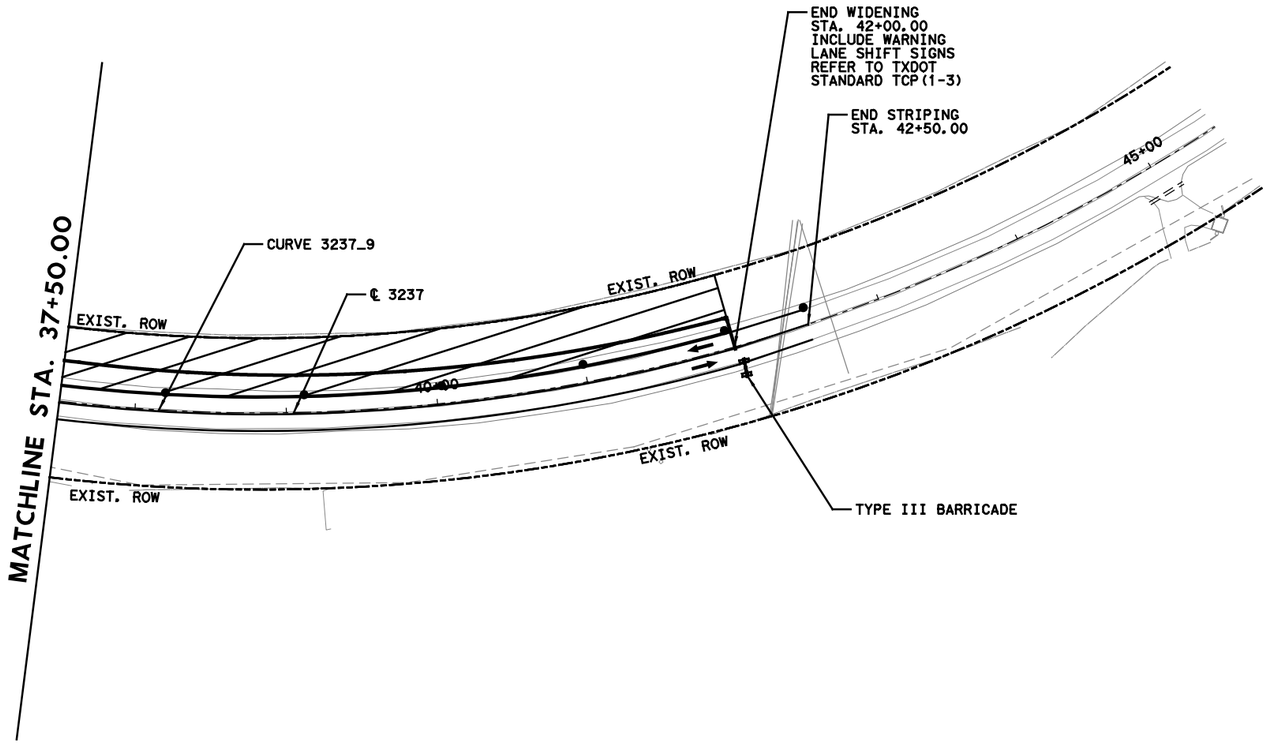

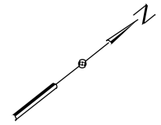

NOTES:
1. SEE TCP TYPICAL SECTIONS FOR LANE WIDTHS.
2. SEE TCP STANDARDS FOR ADVANCED SIGN LAYOUT.

LEGEND:

- DIRECTION OF TRAFFIC
- WORK AREA
- CHANNELIZING DEVICES
  55' C-C SPACING ON TAPER
  90' C-C SPACING ON TANGENT
- TYPE III BARRICADE
- DRIVEWAY
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11/21/2023

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RM 3237 SAFETY IMPROVEMENTS

RM 3237
TRAFFIC CONTROL PLAN
PHASE 1

SHEET 3 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	21
CHECK	CONTROL	SECTION	JOB	
AMP	0805	04	033	
CHECK				
AMP				

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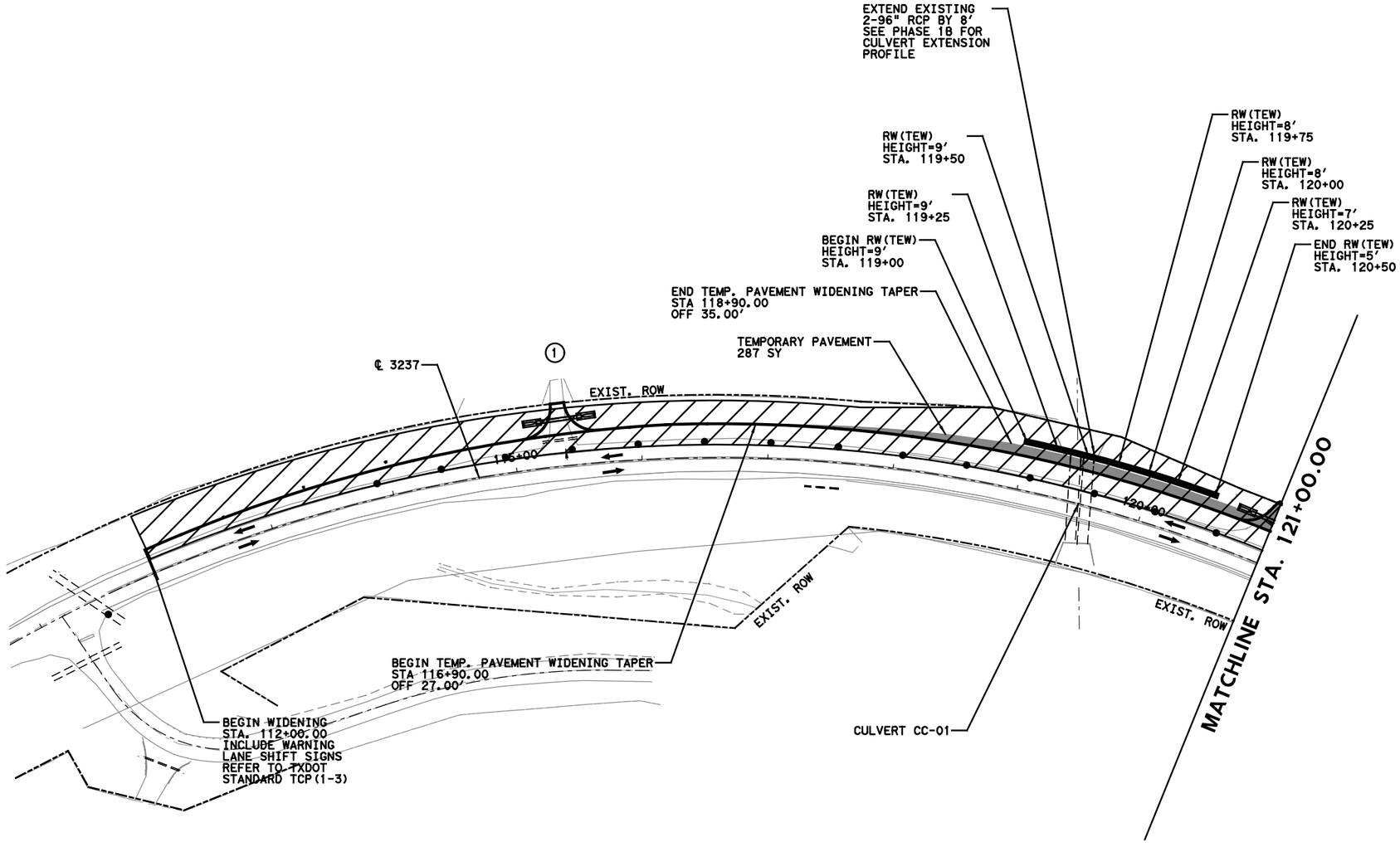

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SCALE IN FEET

NOTES:
1. SEE TCP TYPICAL SECTIONS FOR LANE WIDTHS.
2. SEE TCP STANDARDS FOR ADVANCED SIGN LAYOUT.

LEGEND:

- DIRECTION OF TRAFFIC
- WORK AREA
- CHANNELIZING DEVICES
  55' C-C SPACING ON TAPER
  90' C-C SPACING ON TANGENT
- TYPE III BARRICADE
- DRIVEWAY
- TEMPORARY SHORING
- SINGLE SLOPE CONCRETE BARRIER
- TEMPORARY PAVEMENT

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED PROFESSIONAL ENGINEER
11/17/2023

REV	DATE	DESCRIPTION	APPROVED

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AUSTIN, TX 78746
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Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

RM 3237
TRAFFIC CONTROL PLAN
PHASE 1

SHEET 4 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	22
CHECK	CONTROL	SECTION	JOB	
AMP	0805	04	033	
CHECK				
AMP				

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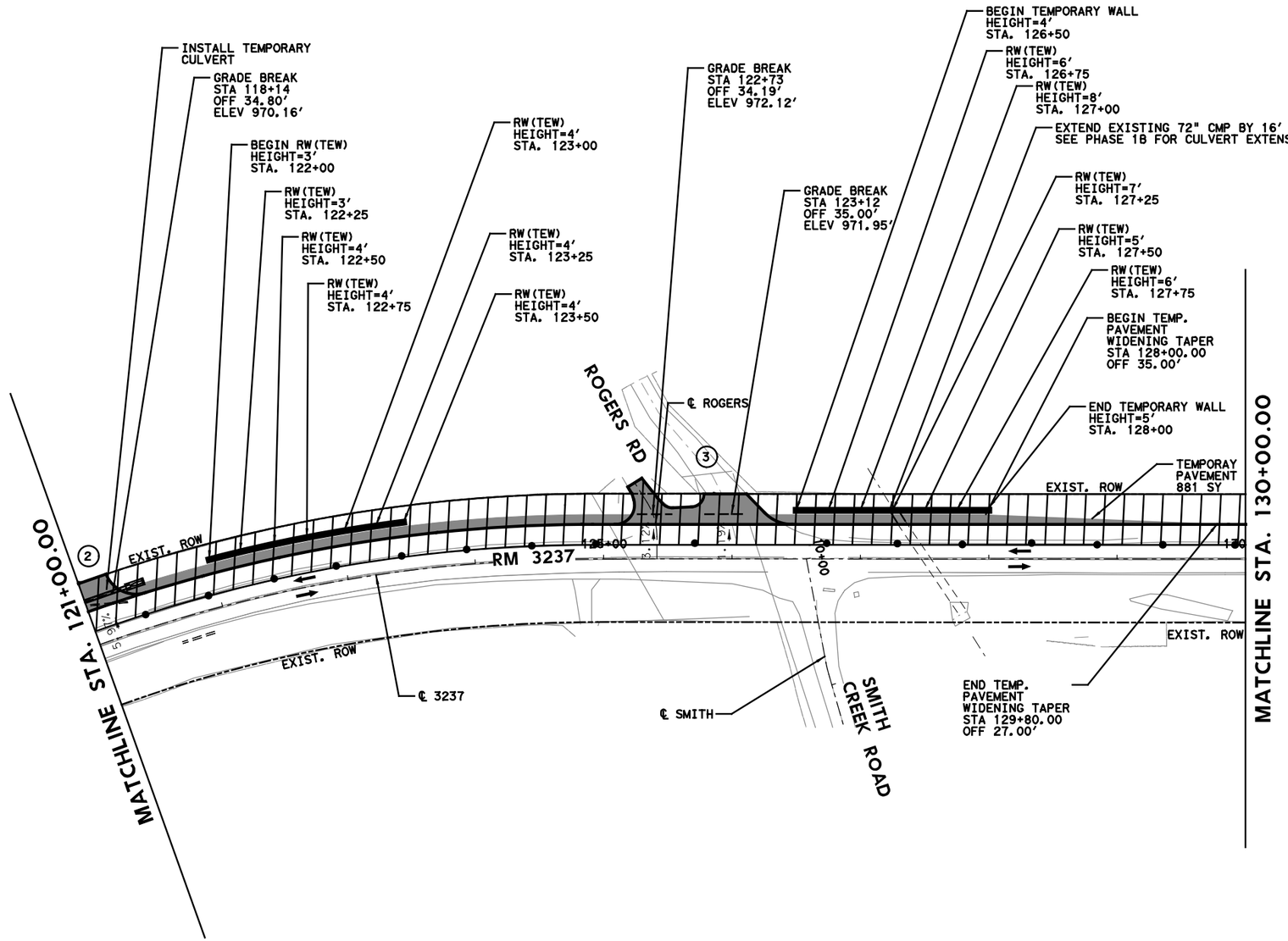

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SCALE IN FEET

NOTES:
1. SEE TCP TYPICAL SECTIONS FOR LANE WIDTHS.
2. SEE TCP STANDARDS FOR ADVANCED SIGN LAYOUT.

LEGEND:

- DIRECTION OF TRAFFIC
- WORK AREA
- CHANNELIZING DEVICES 55' C-C SPACING ON TAPER 90' C-C SPACING ON TANGENT
- TYPE III BARRICADE
- (#) DRIVEWAY
- TEMPORARY SHORING
- SINGLE SLOPE CONCRETE BARRIER
- TEMPORARY PAVEMENT

STATE OF TEXAS
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REV	DATE	DESCRIPTION	APPROVED

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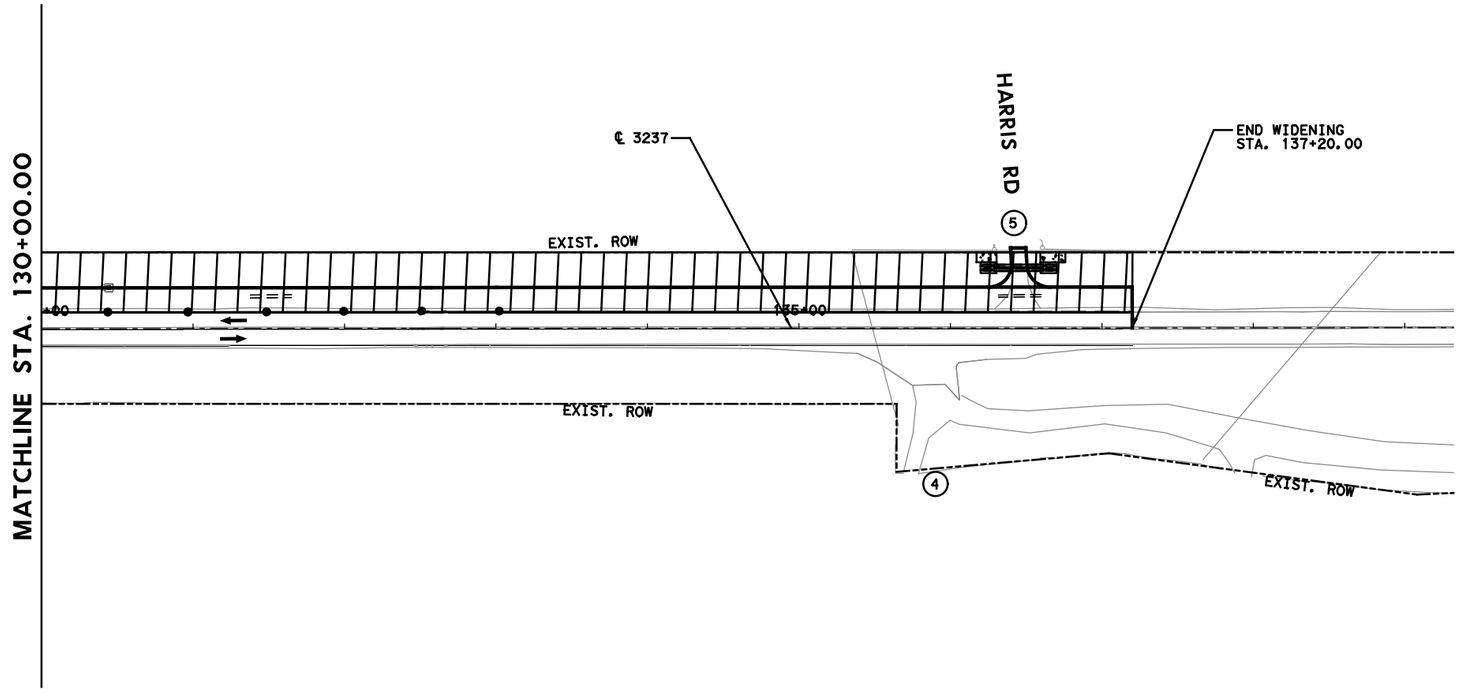
RM 3237 SAFETY IMPROVEMENTS

RM 3237
TRAFFIC CONTROL PLAN
PHASE 1

SHEET 5 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	23
CHECK	CONTROL	SECTION	JOB	
AMP	0805	04	033	
CHECK				
AMP				



0 50 100
SCALE IN FEET

NOTES:
1. SEE TCP TYPICAL SECTIONS FOR LANE WIDTHS.
2. SEE TCP STANDARDS FOR ADVANCED SIGN LAYOUT.

LEGEND:

- DIRECTION OF TRAFFIC
- WORK AREA
- CHANNELIZING DEVICES
  55′ C-C SPACING ON TAPER
  90′ C-C SPACING ON TANGENT
- TYPE III BARRICADE
- (#) DRIVEWAY
- TEMPORARY SHORING
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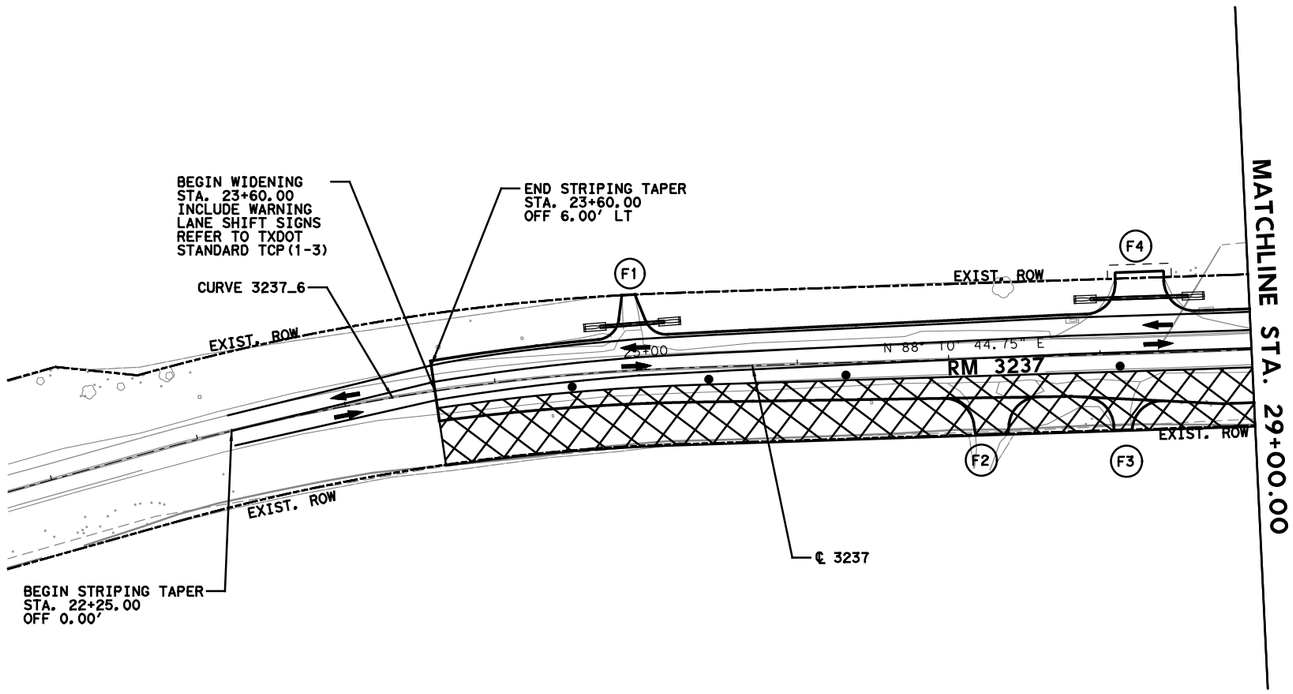
RM 3237 SAFETY IMPROVEMENTS

RM 3237
TRAFFIC CONTROL PLAN
PHASE 1

SHEET 6 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	24
CHECK	CONTROL	SECTION	JOB	
AMP	0805	04	033	
CHECK				
AMP				



N

0 50 100
SCALE IN FEET

LEGEND:

- DIRECTION OF TRAFFIC
- WORK AREA
- CHANNELIZING DEVICES
  55' C-C SPACING ON TAPER
  90' C-C SPACING ON TANGENT
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RM 3237 SAFETY IMPROVEMENTS

RM 3237
TRAFFIC CONTROL PLAN
PHASE 2

SHEET 1 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	25
AMP	0805	04	033	
CHECK				
AMP				

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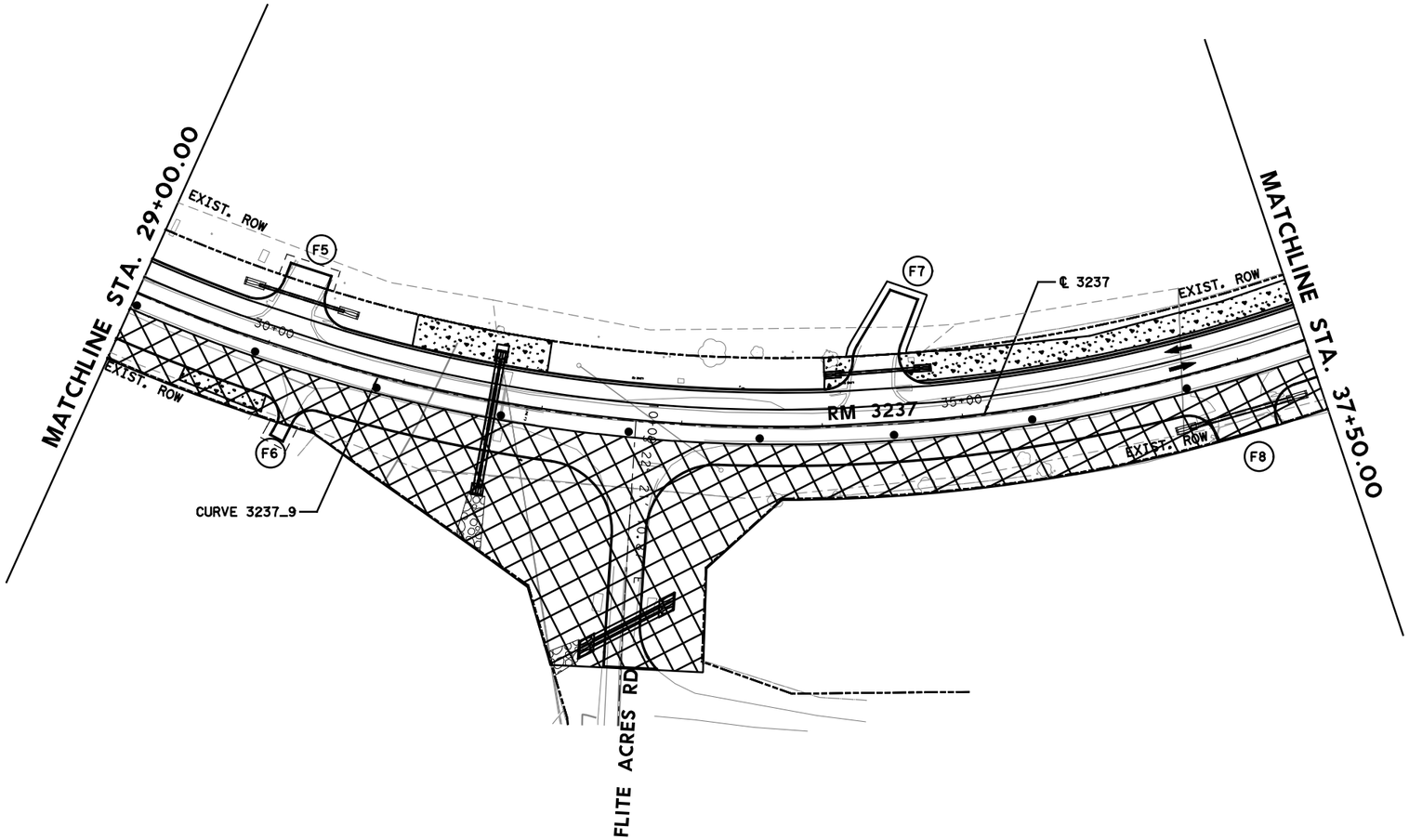

0 50 100
SCALE IN FEET

LEGEND:

- DIRECTION OF TRAFFIC
- WORK AREA
- CHANNELIZING DEVICES
  55' C-C SPACING ON TAPER
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RM 3237
TRAFFIC CONTROL PLAN
PHASE 2

SHEET 2 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS				
HNS	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK	TX	AUS	HAYS	
AMP	CONTROL	SECTION	JOB	26
CHECK	0805	04	033	
AMP				

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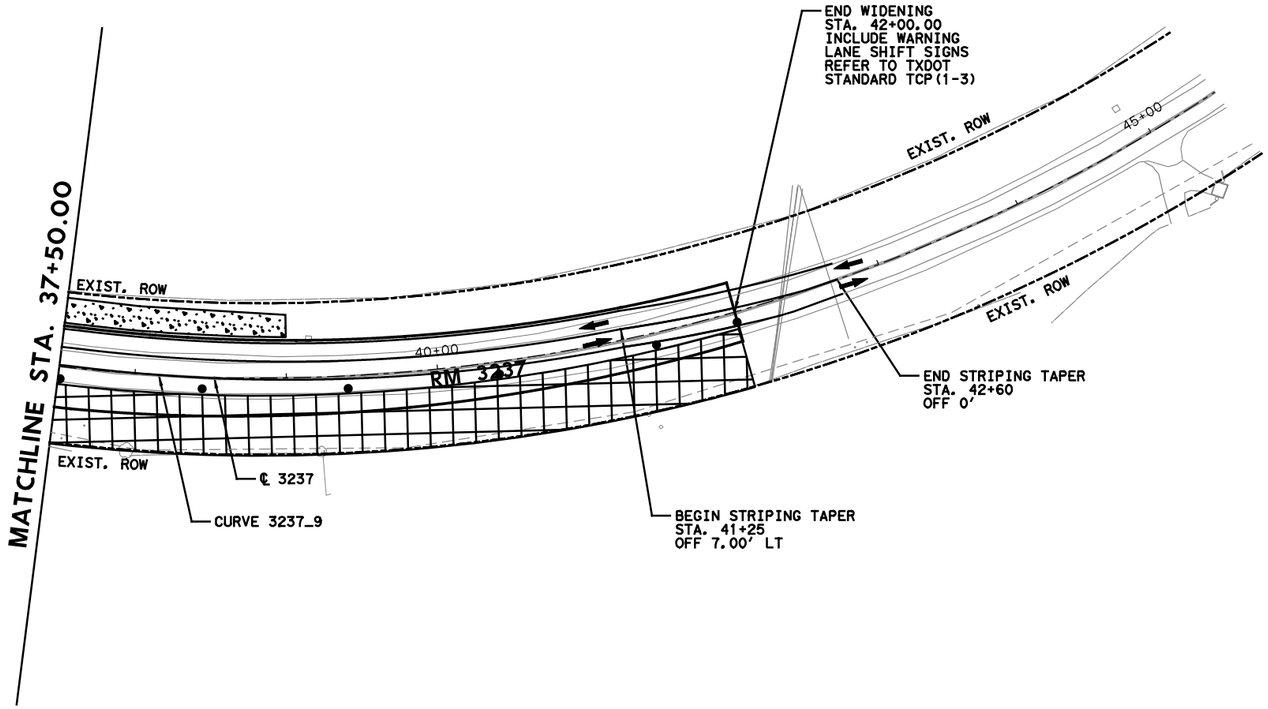

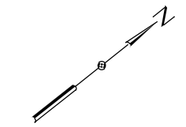

LEGEND:

- DIRECTION OF TRAFFIC
- WORK AREA
- CHANNELIZING DEVICES
  55' C-C SPACING ON TAPER
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132899
LICENSED PROFESSIONAL ENGINEER

11/17/2023

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

HAYS COUNTY TEXAS

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

RM 3237
TRAFFIC CONTROL PLAN
PHASE 2

SHEET 3 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	27
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CHECK				
AMP				

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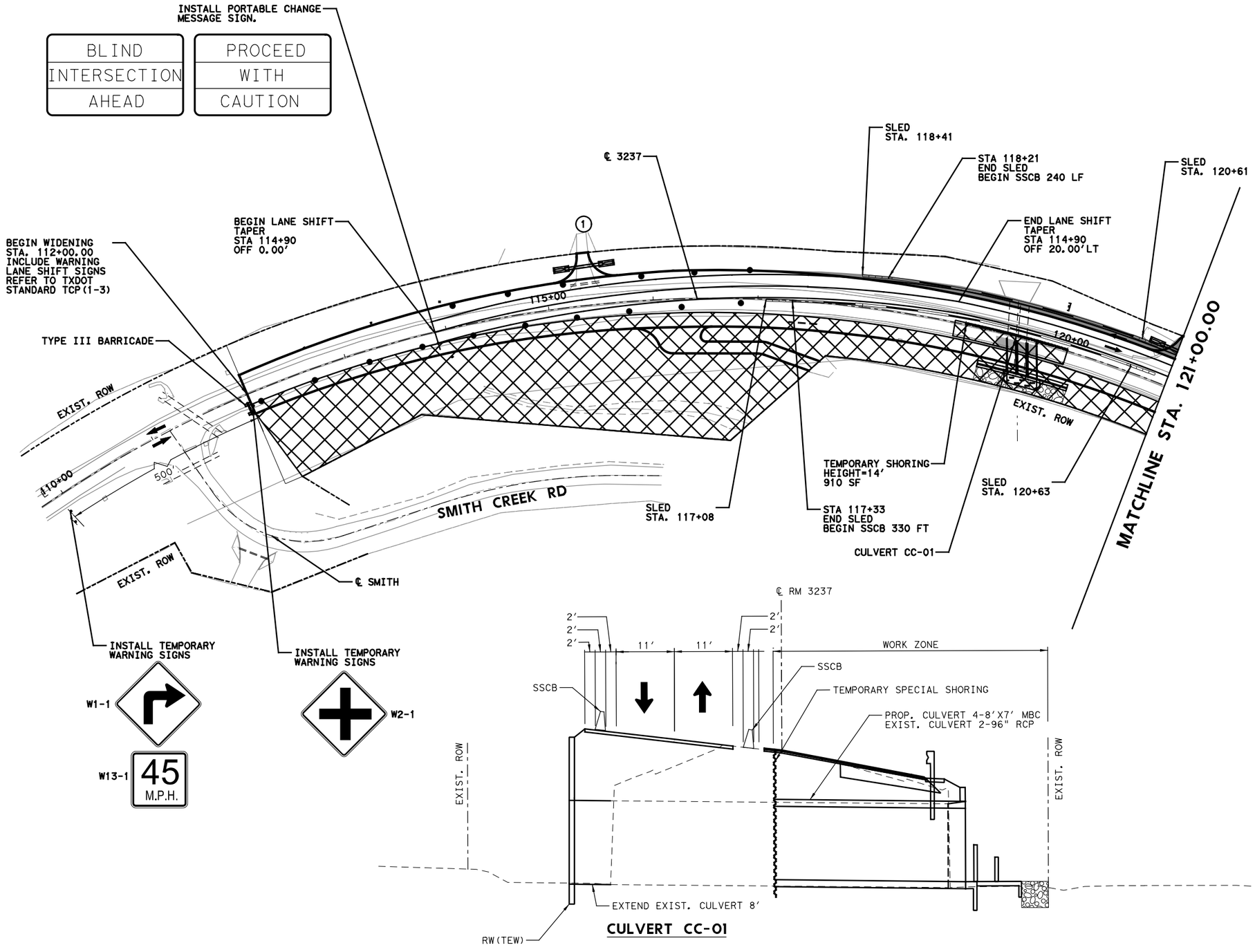

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED PROFESSIONAL ENGINEER
11/17/2023

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RM 3237 SAFETY IMPROVEMENTS

RM 3237 TRAFFIC CONTROL PLAN PHASE 2

SHEET 4 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS				
HNS	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK	TX	AUS	HAYS	
AMP	CONTROL	SECTION	JOB	28
CHECK	0805	04	033	
AMP				

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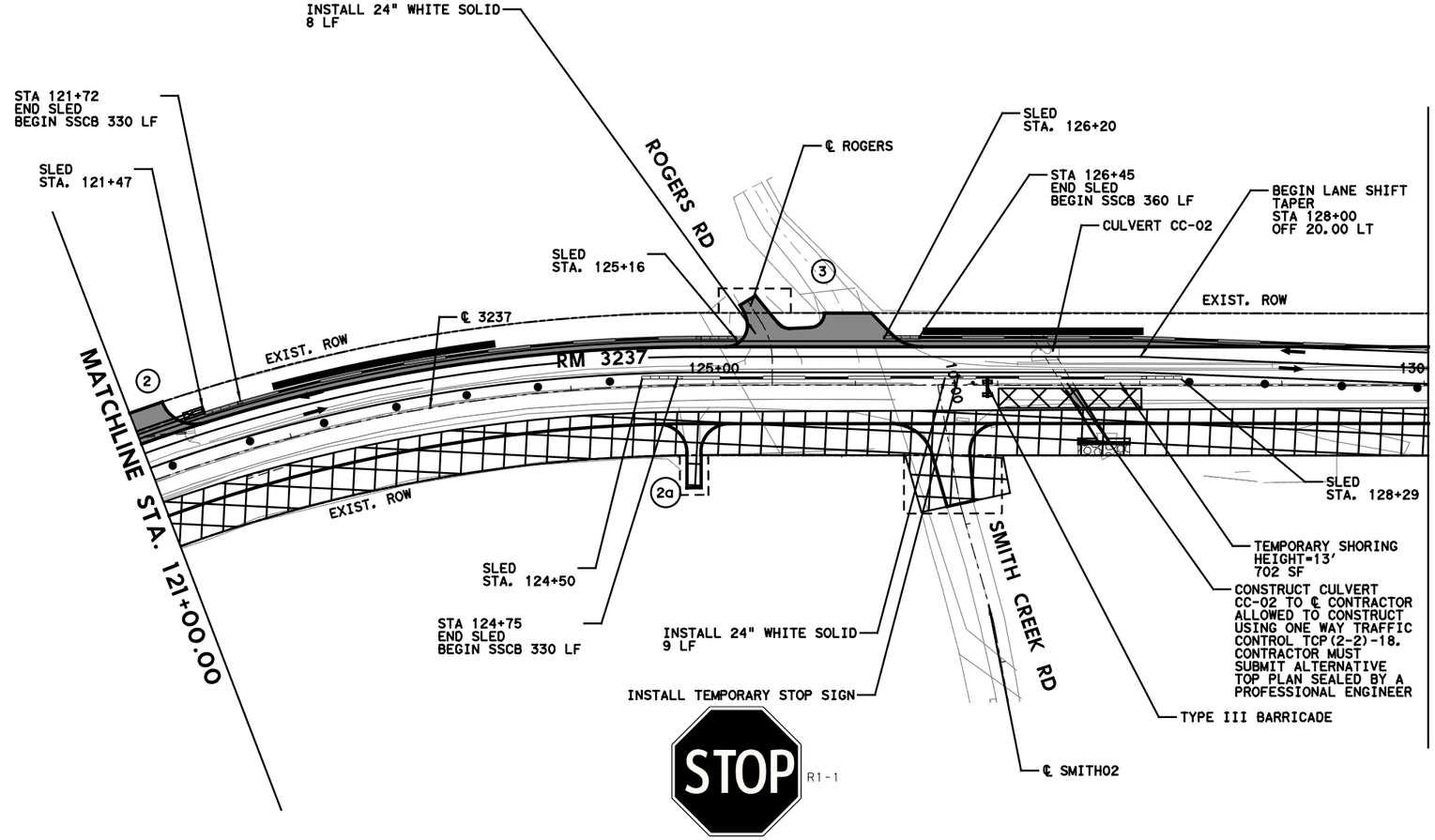

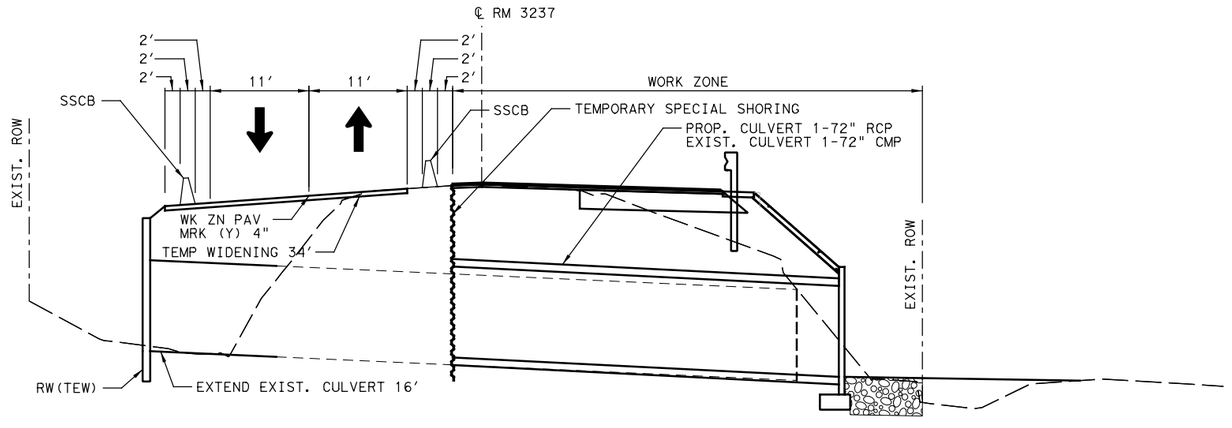

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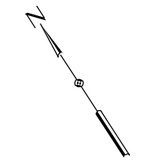

LEGEND:

- DIRECTION OF TRAFFIC
- WORK AREA
- CHANNELIZING DEVICES
  55' C-C SPACING ON TAPER
  90' C-C SPACING ON TANGENT
- TYPE III BARRICADE
- DRIVEWAY
- TEMPORARY SHORING
- SINGLE SLOPE CONCRETE BARRIER
- TEMPORARY PAVEMENT

11/17/2023

REV	DATE	DESCRIPTION	APPROVED

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RM 3237 SAFETY IMPROVEMENTS

RM 3237
TRAFFIC CONTROL PLAN
PHASE 2

SHEET 5 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
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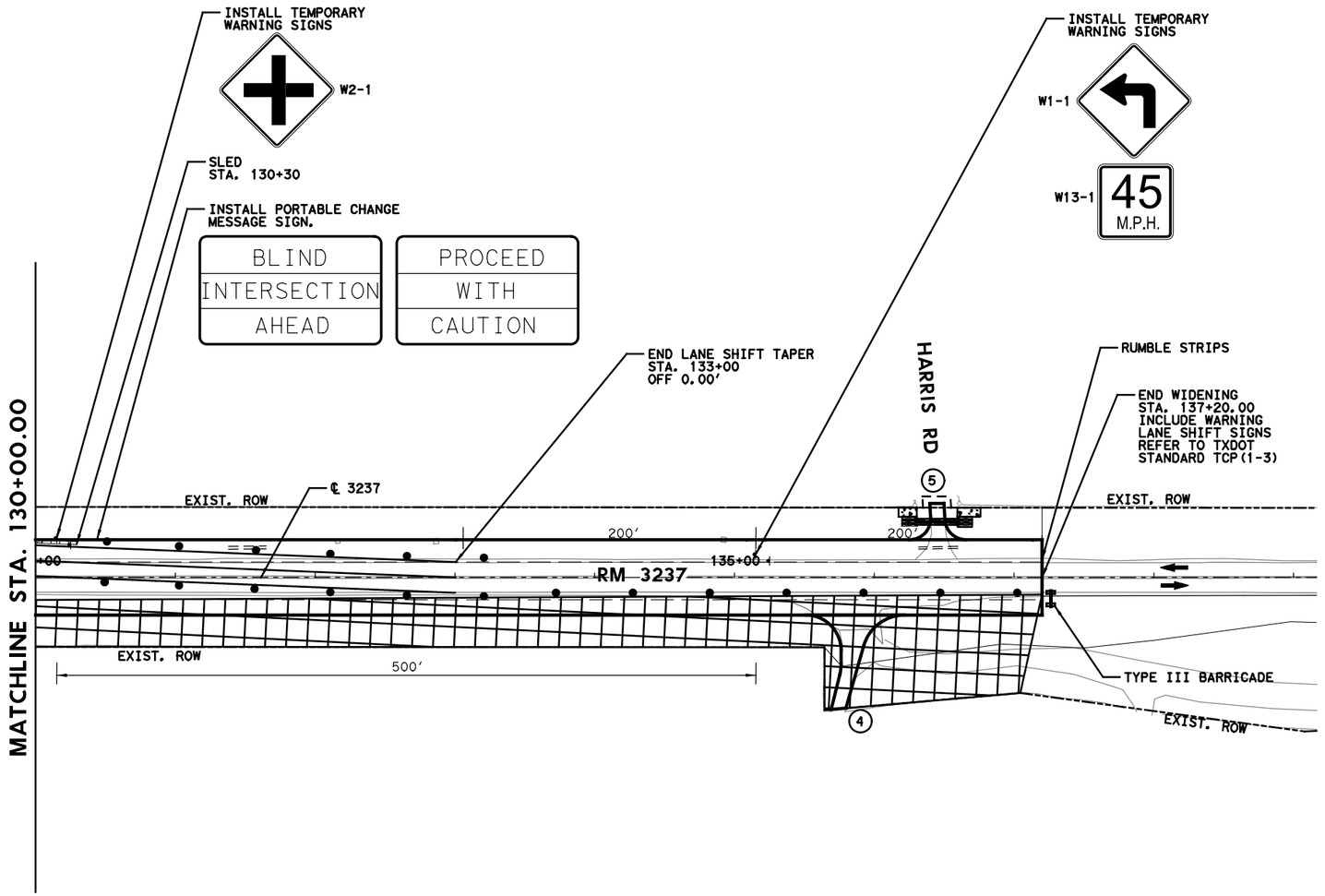

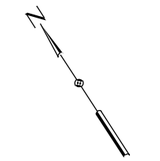

NOTES:
1. SEE TCP TYPICAL SECTIONS FOR LANE WIDTHS.
2. SEE TCP STANDARDS FOR ADVANCED SIGN LAYOUT.

LEGEND:

- DIRECTION OF TRAFFIC
- WORK AREA
- CHANNELIZING DEVICES
  55' C-C SPACING ON TAPER
  90' C-C SPACING ON TANGENT
- TYPE III BARRICADE
- DRIVEWAY
- TEMPORARY SHORING
- SINGLE SLOPE CONCRETE BARRIER
- TEMPORARY PAVEMENT

11/17/2023

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RM 3237 SAFETY IMPROVEMENTS

RM 3237
TRAFFIC CONTROL PLAN
PHASE 2

SHEET 6 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
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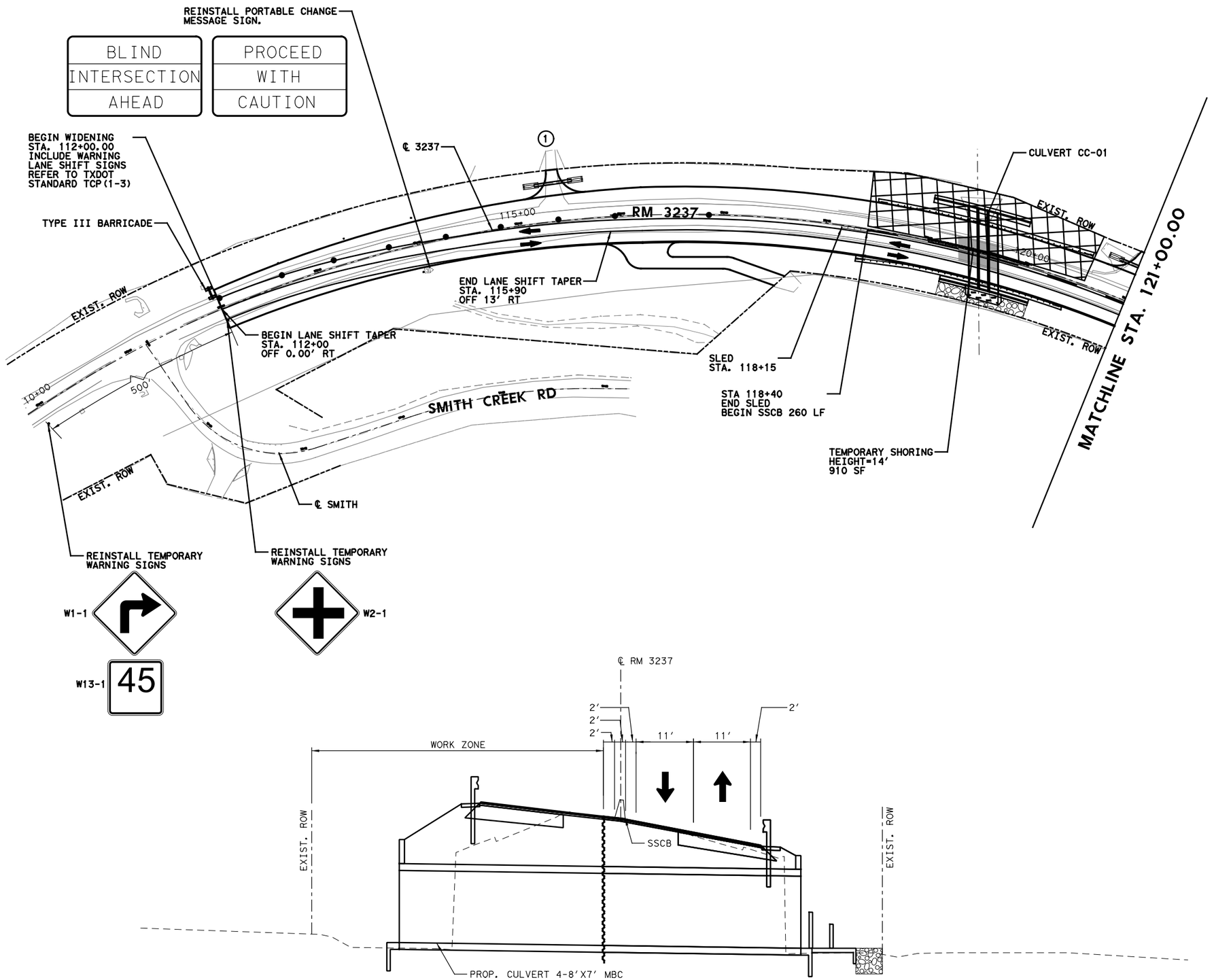

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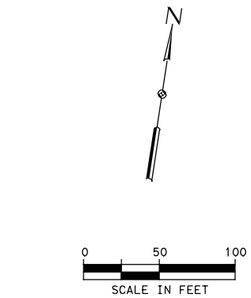

LEGEND:

- DIRECTION OF TRAFFIC
- WORK AREA
- CHANNELIZING DEVICES 55' C-C SPACING ON TAPER 90' C-C SPACING ON TANGENT
- TYPE III BARRICADE
- DRIVEWAY
- TEMPORARY SHORING
- SINGLE SLOPE CONCRETE BARRIER

11/17/2023

REV	DATE	DESCRIPTION	APPROVED

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HAYS COUNTY TEXAS

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

RM 3237 TRAFFIC CONTROL PLAN PHASE 3

SHEET 1 OF 3

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
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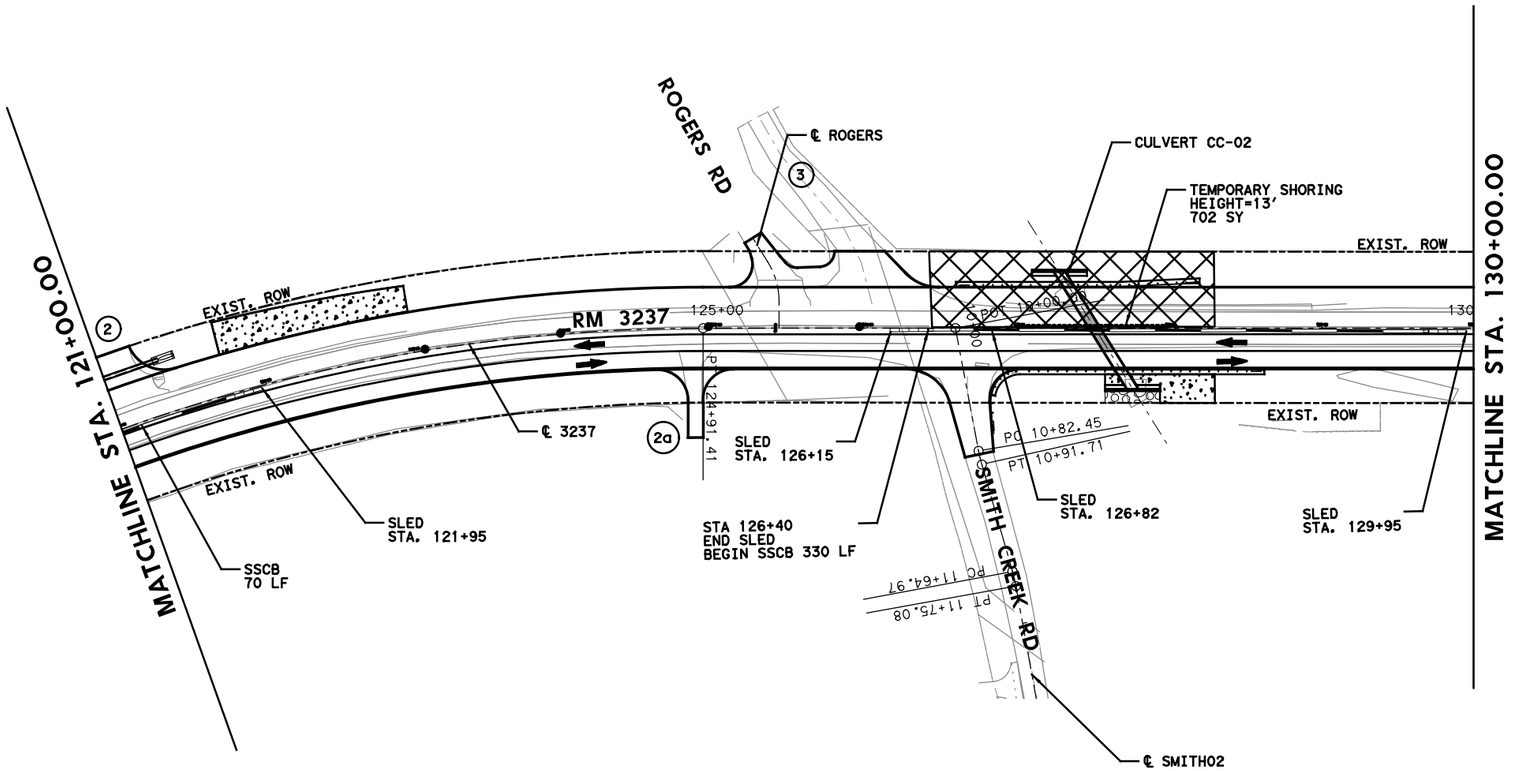

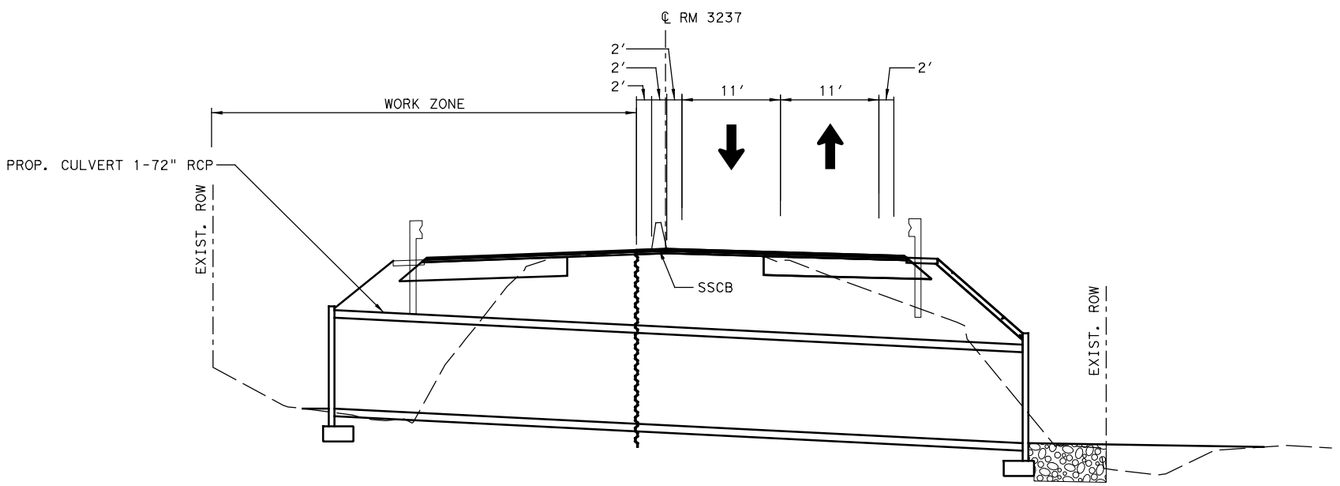

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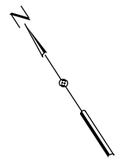

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SCALE IN FEET

LEGEND:

- DIRECTION OF TRAFFIC
- WORK AREA
- CHANNELIZING DEVICES
  55' C-C SPACING ON TAPER
  90' C-C SPACING ON TANGENT
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RM 3237 SAFETY IMPROVEMENTS

RM 3237
TRAFFIC CONTROL PLAN
PHASE 3

SHEET 2 OF 3

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
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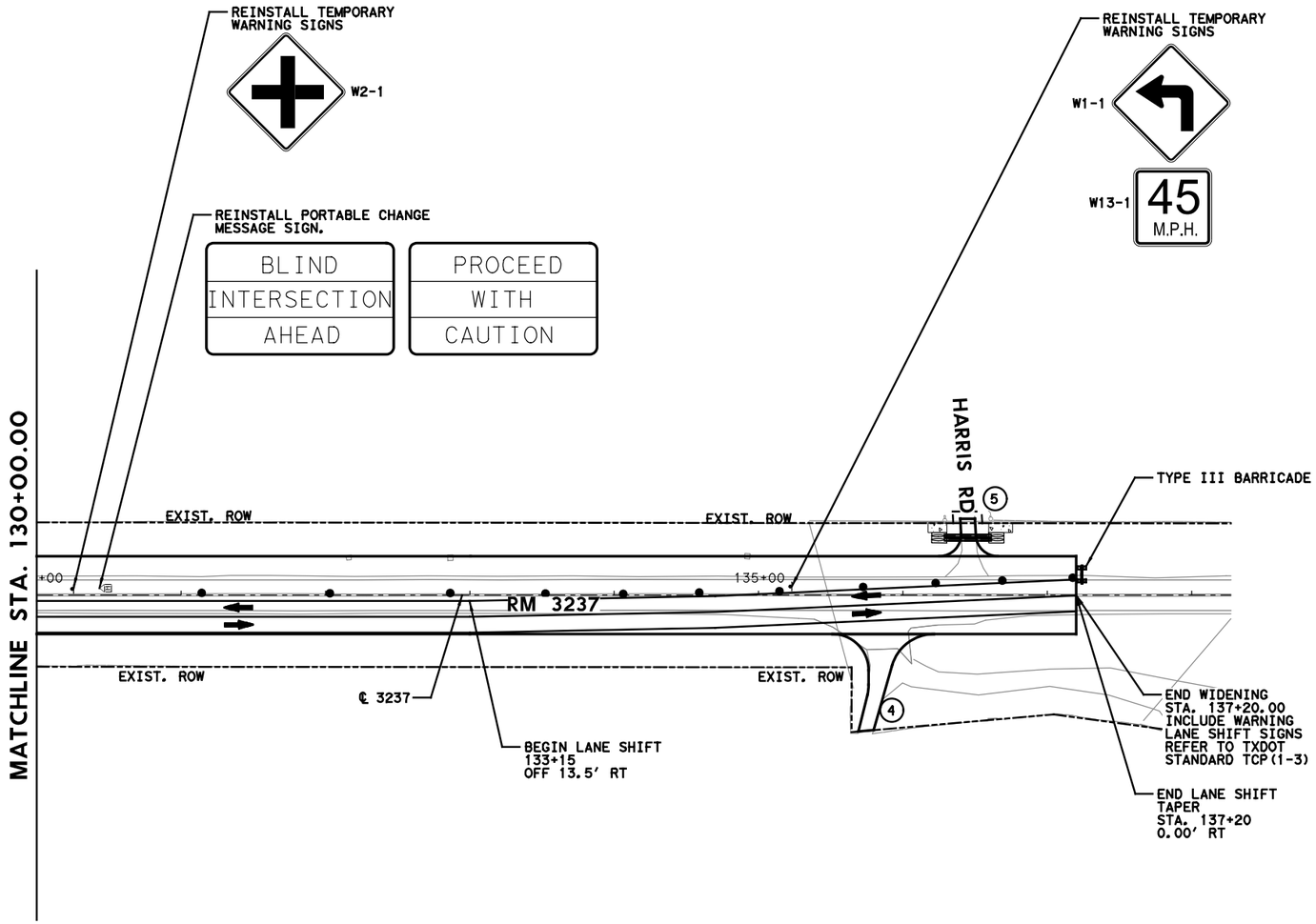

LEGEND:

- DIRECTION OF TRAFFIC
- WORK AREA
- CHANNELIZING DEVICES
  55' C-C SPACING ON TAPER
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RM 3237 SAFETY IMPROVEMENTS

RM 3237
TRAFFIC CONTROL PLAN
PHASE 3

SHEET 3 OF 3

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS				
HNS	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK	TX	AUS	HAYS	
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BARRICADE AND CONSTRUCTION (BC) STANDARD SHEETS GENERAL NOTES:

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

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

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

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

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

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

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

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

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

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

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

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

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

WORKER SAFETY NOTES:

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

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

COMPLIANT WORKZONE TRAFFIC CONTROL DEVICES

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

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

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

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION GENERAL NOTES AND REQUIREMENTS

BC(1)-21

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©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS 4-03 7-13	0805	04	033	RM 3237
9-07 8-14	DIST	COUNTY		SHEET NO.
5-10 5-21	AUS	HAYS		34

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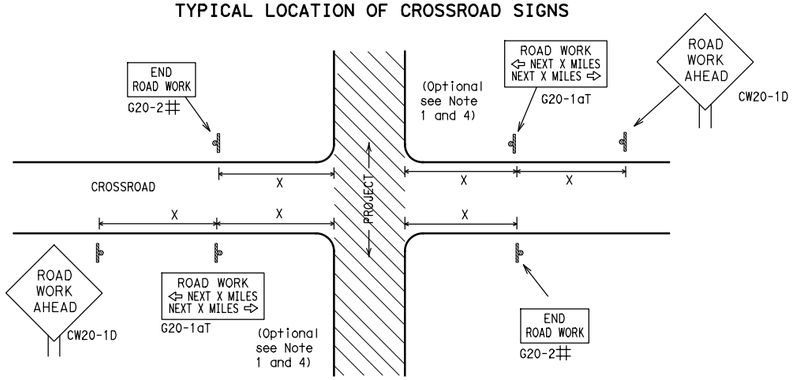
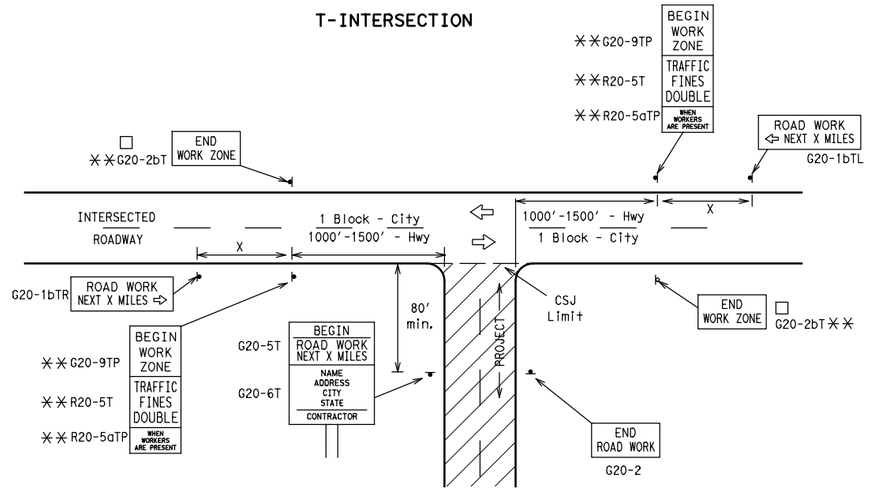
TYPICAL LOCATION OF CROSSROAD SIGNS



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

1. The typical minimum signing on a crossroad approach should be a "ROAD WORK AHEAD" (CW20-1D)sign and a (G20-2) "END ROAD WORK" sign, unless noted otherwise in plans.
2. The Engineer may use the reduced size 36" x 36" ROAD WORK AHEAD (CW20-1D) sign mounted back to back with the reduced size 36" x 18" "END ROAD WORK"(G20-2) sign on low volume crossroads (see Note 4 under "Typical Construction Warning Sign Size and Spacing"). See the "Standard Highway Sign Designs for Texas" manual for sign details. The Engineer may omit the advance warning signs on low volume crossroads. The Engineer will determine whether a road is low volume as per TMUTCD Part 5. This information shall be shown in the plans.
3. Based on existing field conditions, the Engineer/Inspector may require additional signs such as FLAGGER AHEAD, LOOSE GRAVEL, or other appropriate signs. When additional signs are required, these signs will be considered part of the minimum requirements. The Engineer/Inspector will determine the proper location and spacing of any sign not shown on the BC sheets, Traffic Control Plan sheets or the Work Zone Standard Sheets.
4. The "ROAD WORK NEXT X MILES"(G20-1aT)sign shall be required at high volume crossroads to advise motorists of the length of construction in either direction from the intersection. The Engineer will determine whether a roadway is considered high volume.
5. Additional traffic control devices may be shown elsewhere in the plans for higher volume crossroads.
6. When work occurs in the intersection area, appropriate traffic control devices, as shown elsewhere in the plans or as determined by the Engineer/Inspector, shall be in place.

T-INTERSECTION



CSJ LIMITS AT T-INTERSECTION

1. The Engineer will determine the types and location of any additional traffic control devices, such as a flagger and accompanying signs, or other signs, that should be used when work is being performed at or near an intersection.
2. If construction closes the road at a T-intersection, the Contractor shall place the "CONTRACTOR NAME"(G20-6T) sign behind the Type 3 Barricades for the road closure (see BC(10) also). The "ROAD WORK NEXT X MILES" left arrow(G20-1bTL) and "ROAD WORK NEXT X MILES" right arrow (G20-1bTR)" signs shall be replaced by the detour signing called for in the plans.

TYPICAL CONSTRUCTION WARNING SIGN SIZE AND SPACING[1,5,6]

SIZE

Sign Number or Series	Conventional Road	Expressway/ Freeway
CW20[4] CW21 CW22 CW23 CW25	48" x 48"	48" x 48"
CW1, CW2, CW7, CW8, CW9, CW11, CW14	36" x 36"	48" x 48"
CW3, CW4, CW5, CW6, CW8-3, CW10, CW12	48" x 48"	48" x 48"

SPACING

Posted Speed	Sign △ Spacing "X"
MPH	Feet (Apprx.)
30	120
35	160
40	240
45	320
50	400
55	500[2]
60	600[2]
65	700[2]
70	800[2]
75	900[2]
80	1000[2]
✳	✳[3]

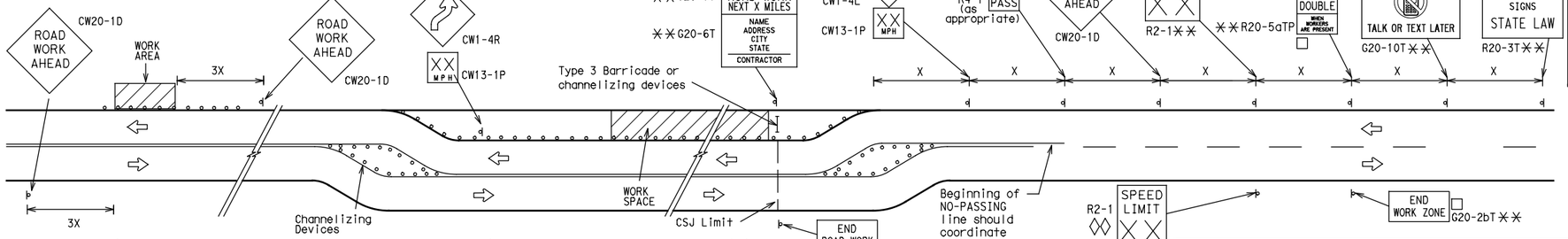
✳ For typical sign spacings on divided highways, expressways and freeways, see Part 6 of the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD) typical application diagrams or TCP Standard Sheets.

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

GENERAL NOTES

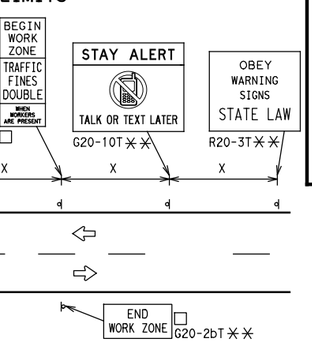
1. Special or larger size signs may be used as necessary.
2. Distance between signs should be increased as required to have 1500 feet advance warning.
3. Distance between signs should be increased as required to have 1/2 mile or more advance warning.
4. 36" x 36" "ROAD WORK AHEAD" (CW20-1D)signs may be used on low volume crossroads at the discretion of the Engineer as per TMUTCD Part 5. See Note 2 under "Typical Location of Crossroad Signs".
5. Only diamond shaped warning sign sizes are indicated.
6. See sign size listing in "TMUTCD", Sign Appendix or the "Standard Highway Sign Designs for Texas" manual for complete list of available sign design sizes.

WORK AREAS IN MULTIPLE LOCATIONS WITHIN CSJ LIMITS

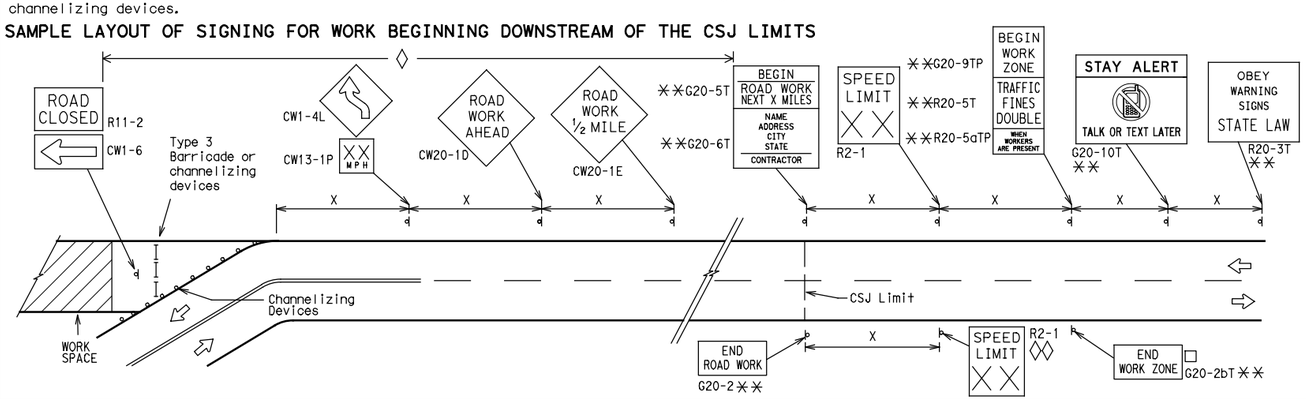


When extended distances occur between minimal work spaces, the Engineer/Inspector should ensure additional "ROAD WORK AHEAD"(CW20-1D)signs are placed in advance of these work areas to remind drivers they are still within the project limits. See the applicable TCP sheets for exact location and spacing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

SAMPLE LAYOUT OF SIGNING FOR WORK BEGINNING AT THE CSJ LIMITS



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



NOTES

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

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

✳✳ 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.

Texas Department of Transportation — Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PROJECT LIMIT

BC(2)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
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9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	AUS	HAYS		35

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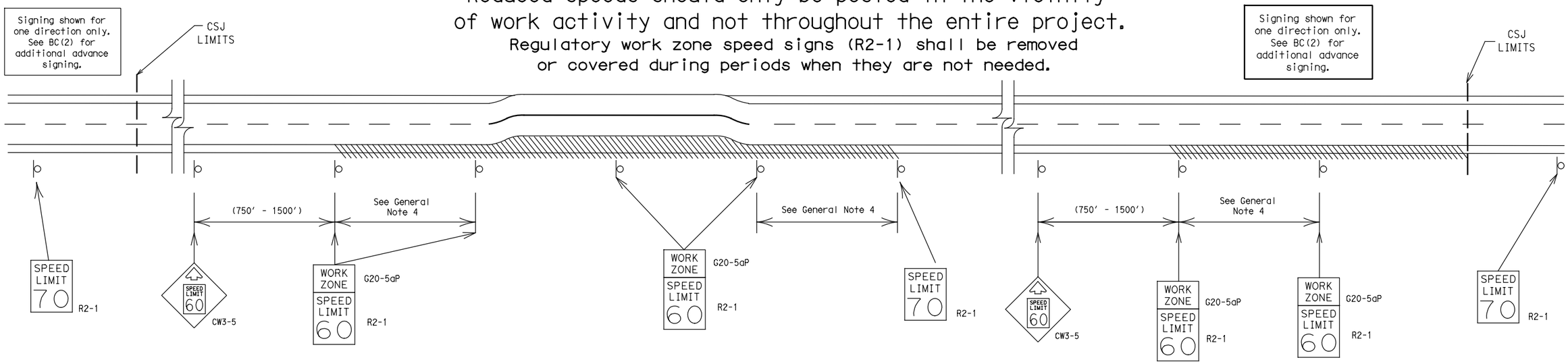
TYPICAL APPLICATION OF WORK ZONE SPEED LIMIT SIGNS

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

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

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



GUIDANCE FOR USE:

LONG/INTERMEDIATE TERM WORK ZONE SPEED LIMITS

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

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

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

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

SHORT TERM WORK ZONE SPEED LIMITS

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

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

GENERAL NOTES

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

Texas Department of Transportation | Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION WORK ZONE SPEED LIMIT

BC(3)-21

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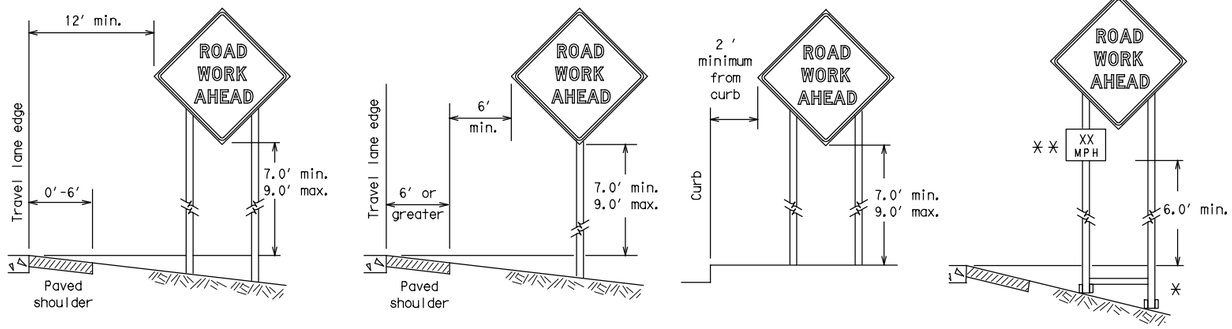
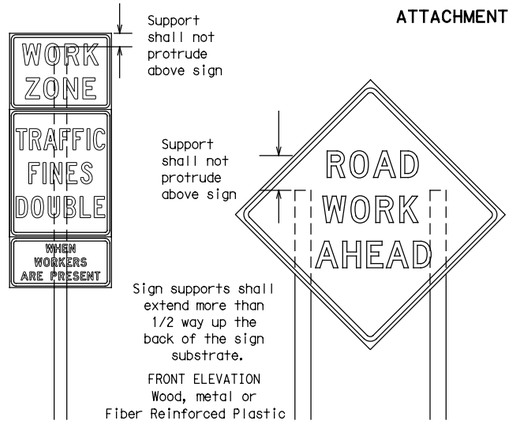
TYPICAL MINIMUM CLEARANCES FOR LONG TERM AND INTERMEDIATE TERM SIGNS

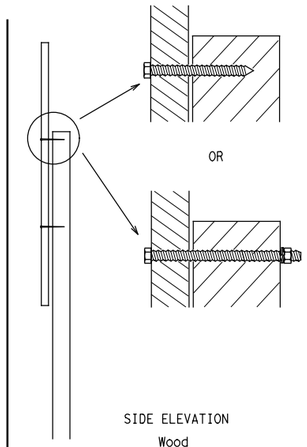


⚹ When placing skid supports on unlevel ground, the leg post lengths must be adjusted so the sign appears straight and plumb. Objects shall NOT be placed under skids as a means of leveling.

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

ATTACHMENT FOR SIGN SUPPORTS





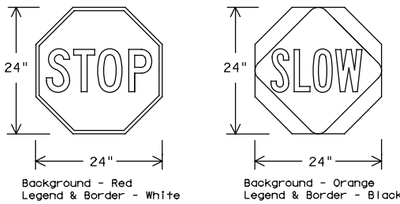
Attachment to wooden supports will be by bolts and nuts or screws. Use TxDOT's or manufacturer's recommended procedures for attaching sign substrates to other types of sign supports

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

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

STOP/SLOW PADDLES

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



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

CONTRACTOR REQUIREMENTS FOR MAINTAINING PERMANENT SIGNS WITHIN THE PROJECT LIMITS

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

GENERAL NOTES FOR WORK ZONE SIGNS

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

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

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

SIGN MOUNTING HEIGHT

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

SIZE OF SIGNS

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

SIGN SUBSTRATES

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

REFLECTIVE SHEETING

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

SIGN LETTERS

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

REMOVING OR COVERING

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

SIGN SUPPORT WEIGHTS

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

FLAGS ON SIGNS

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

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION TEMPORARY SIGN NOTES

BC(4)-21

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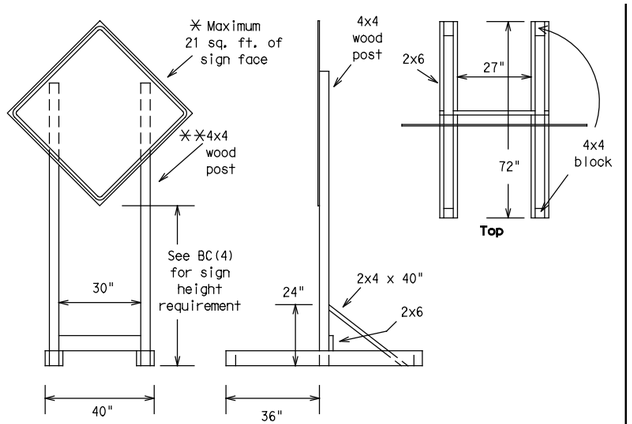
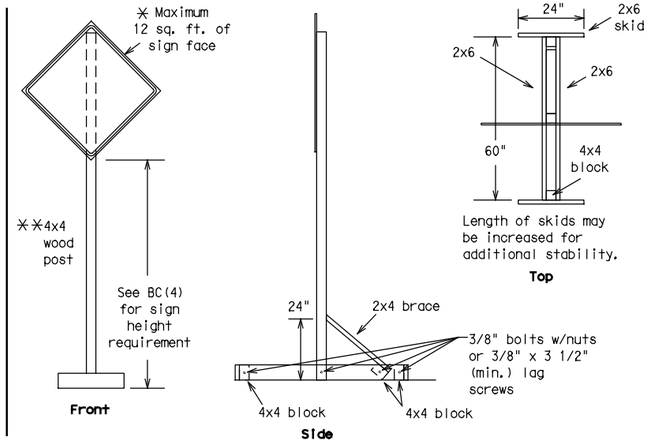
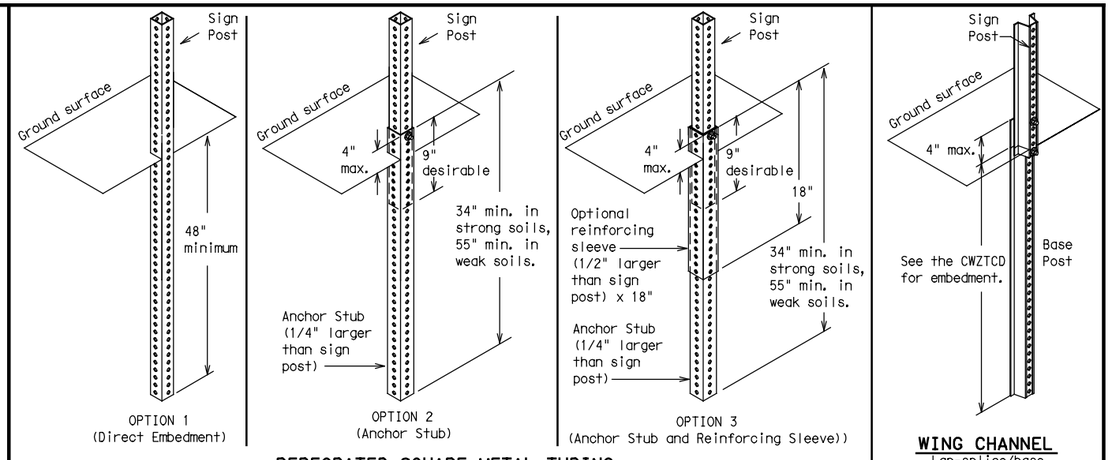




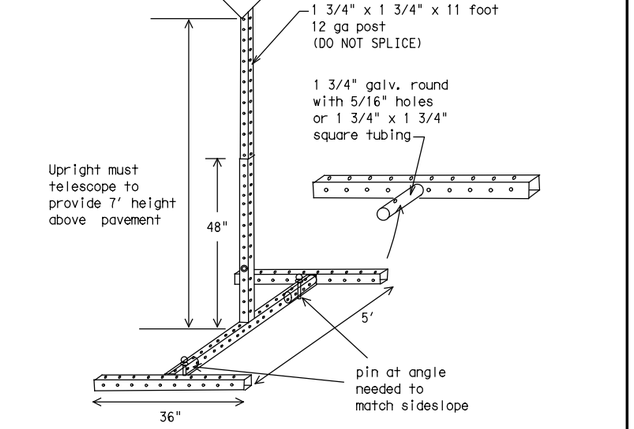
SKID MOUNTED WOOD SIGN SUPPORTS

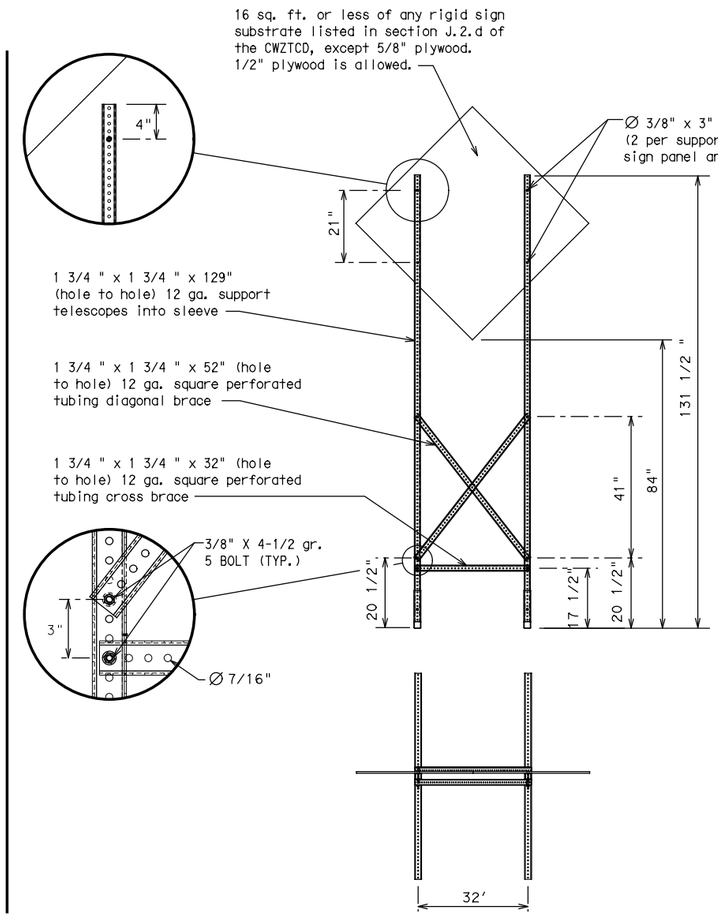
✳ LONG/INTERMEDIATE TERM STATIONARY - PORTABLE SKID MOUNTED SIGN SUPPORTS

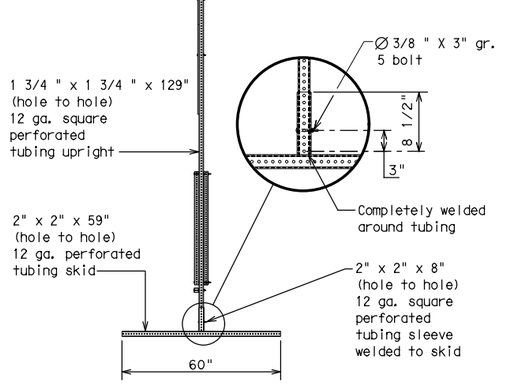


GROUND MOUNTED SIGN SUPPORTS

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







SKID MOUNTED PERFORATED SQUARE STEEL TUBING SIGN SUPPORTS

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

WEDGE ANCHORS

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

OTHER DESIGNS

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

GENERAL NOTES

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

✳ See BC(4) for definition of "Work Duration."

✳✳ Wood sign posts MUST be one piece. Splicing will NOT be allowed. Posts shall be painted white.

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

SHEET 5 OF 12

Texas Department of Transportation | Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION TYPICAL SIGN SUPPORT

BC(5)-21

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

PORTABLE CHANGEABLE MESSAGE SIGNS

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

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

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

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

RECOMMENDED PHASES AND FORMATS FOR PCMS MESSAGES DURING ROADWORK ACTIVITIES

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

Phase 1: Condition Lists

Road/Lane/Ramp Closure List

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

Other Condition List

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

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

Phase 2: Possible Component Lists

Action to Take/Effect on Travel List

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

Location List

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

Warning List

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

⚹⚹ Advance Notice List

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

⚹⚹ See Application Guidelines Note 6.

APPLICATION GUIDELINES

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

WORDING ALTERNATIVES

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

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

FULL MATRIX PCMS SIGNS

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

Texas Department of Transportation — Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PORTABLE CHANGEABLE MESSAGE SIGN (PCMS)

BC(6)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	0805	04	033	RM 3237
9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	AUS	HAYS		39

100

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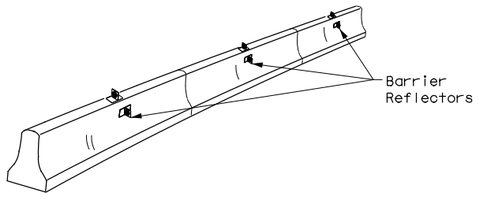
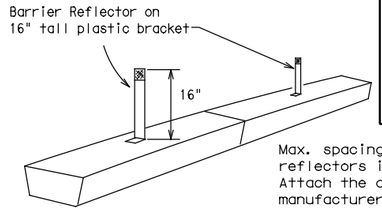
1. Barrier Reflectors shall be pre-qualified, and conform to the color and reflectivity requirements of DMS-8600. A list of prequalified Barrier Reflectors can be found at the Material Producer List web address shown on BC(1).
2. Color of Barrier Reflectors shall be as specified in the TMUTCD. The cost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



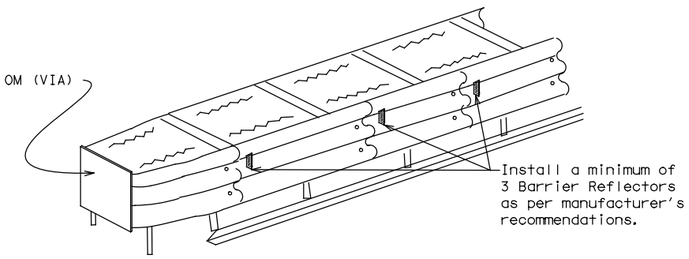
CONCRETE TRAFFIC BARRIER (CTB)

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



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

LOW PROFILE CONCRETE BARRIER (LPCB)



DELINEATION OF END TREATMENTS

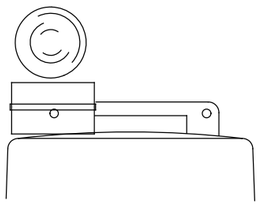
LOW PROFILE CONCRETE BARRIER (LPCB) USED IN WORK ZONES

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

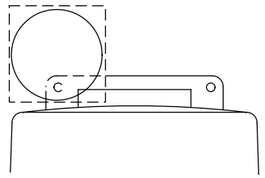
END TREATMENTS FOR CTB'S USED IN WORK ZONES

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

BARRIER REFLECTORS FOR CONCRETE TRAFFIC BARRIER AND ATTENUATORS



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



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

WARNING LIGHTS

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

WARNING LIGHTS MOUNTED ON PLASTIC DRUMS

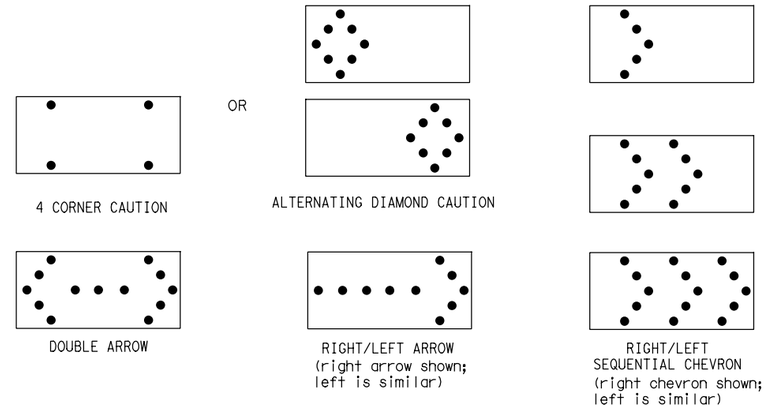
1. Type A flashing warning lights are intended to warn drivers that they are approaching or are in a potentially hazardous area.
2. Type A random flashing warning lights are not intended for delineation and shall not be used in a series.
3. A series of sequential flashing warning lights placed on channelizing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

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

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

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

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



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

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

ATTENTION

Flashing Arrow Boards shall be equipped with automatic dimming devices.

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

FLASHING ARROW BOARDS

TRUCK-MOUNTED ATTENUATORS

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

Texas Department of Transportation

Traffic Safety Division Standard

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

BC(7)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	0805	04	033	RM 3237
9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	AUS	HAYS		40

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GENERAL NOTES

1. For long term stationary work zones on freeways, drums shall be used as the primary channelizing device.
2. For intermediate term stationary work zones on freeways, drums should be used as the primary channelizing device but may be replaced in tangent sections by vertical panels, or 42" two-piece cones. In tangent sections, one-piece cones may be used with the approval of the Engineer but only if personnel are present on the project at all times to maintain the cones in proper position and location.
3. For short term stationary work zones on freeways, drums are the preferred channelizing device but may be replaced in tapers, transitions and tangent sections by vertical panels, two-piece cones or one-piece cones as approved by the Engineer.
4. Drums and all related items shall comply with the requirements of the current version of the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD) and the "Compliant Work Zone Traffic Control Devices List" (CWZTCD).
5. Drums, bases, and related materials shall exhibit good workmanship and shall be free from objectionable marks or defects that would adversely affect their appearance or serviceability.
6. The Contractor shall have a maximum of 24 hours to replace any plastic drums identified for replacement by the Engineer/Inspector. The replacement device must be an approved device.

GENERAL DESIGN REQUIREMENTS

Pre-qualified plastic drums shall meet the following requirements:

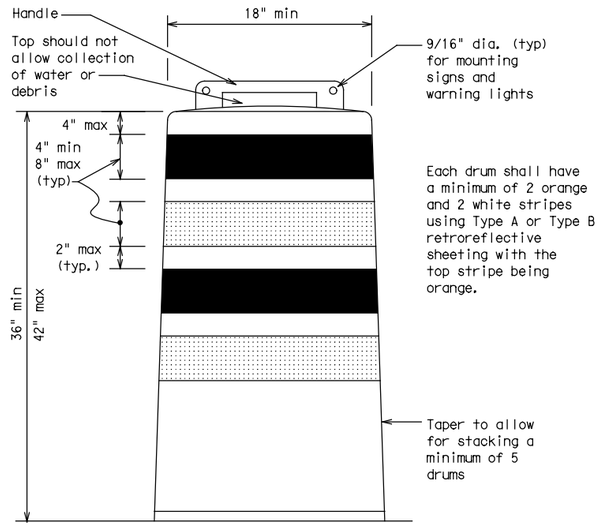
1. Plastic drums shall be a two-piece design; the "body" of the drum shall be the top portion and the "base" shall be the bottom.
2. The body and base shall lock together in such a manner that the body separates from the base when impacted by a vehicle traveling at a speed of 20 MPH or greater but prevents accidental separation due to normal handling and/or air turbulence created by passing vehicles.
3. Plastic drums shall be constructed of lightweight flexible, and deformable materials. The Contractor shall NOT use metal drums or single piece plastic drums as channelization devices or sign supports.
4. Drums shall present a profile that is a minimum of 18 inches in width at the 36 inch height when viewed from any direction. The height of drum unit (body installed on base) shall be a minimum of 36 inches and a maximum of 42 inches.
5. The top of the drum shall have a built-in handle for easy pickup and shall be designed to drain water and not collect debris. The handle shall have a minimum of two widely spaced 9/16 inch diameter holes to allow attachment of a warning light, warning reflector unit or approved compliant sign.
6. The exterior of the drum body shall have a minimum of four alternating orange and white retroreflective circumferential stripes not less than 4 inches nor greater than 8 inches in width. Any non-reflectorized space between any two adjacent stripes shall not exceed 2 inches in width.
7. Bases shall have a maximum width of 36 inches, a maximum height of 4 inches, and a minimum of two footholds of sufficient size to allow base to be held down while separating the drum body from the base.
8. Plastic drums shall be constructed of ultra-violet stabilized, orange, high-density polyethylene (HDPE) or other approved material.
9. Drum body shall have a maximum unballasted weight of 11 lbs.
10. Drum and base shall be marked with manufacturer's name and model number.

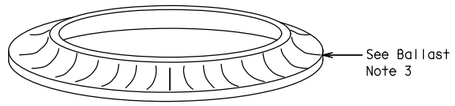
RETROREFLECTIVE SHEETING

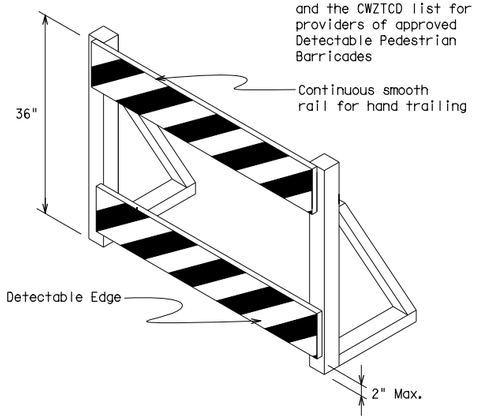
1. The stripes used on drums shall be constructed of sheeting meeting the color and retroreflectivity requirements of Departmental Materials Specification DMS-8300, "Sign Face Materials," Type A or Type B reflective sheeting shall be supplied unless otherwise specified in the plans.
2. The sheeting shall be suitable for use on and shall adhere to the drum surface such that, upon vehicular impact, the sheeting shall remain adhered in-place and exhibit no delaminating, cracking, or loss of retroreflectivity other than that loss due to abrasion of the sheeting surface.

BALLAST

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

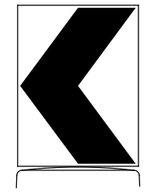




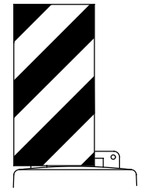


DETECTABLE PEDESTRIAN BARRICADES

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



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



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

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

SIGNS, CHEVRONS, AND VERTICAL PANELS MOUNTED ON PLASTIC DRUMS

1. Signs used on plastic drums shall be manufactured using substrates listed on the CWZTCD.
2. Chevrons and other work zone signs with an orange background shall be manufactured with Type B_{FL} or Type C_{FL} Orange sheeting meeting the color and retroreflectivity requirements of DMS-8300, "Sign Face Material," unless otherwise specified in the plans.
3. Vertical Panels shall be manufactured with orange and white sheeting meeting the requirements of DMS-8300 Type A or Type B. Diagonal stripes on Vertical Panels shall slope down toward the intended traveled lane.
4. Other sign messages (text or symbolic) may be used as approved by the Engineer. Sign dimensions shall not exceed 18 inches in width or 24 inches in height, except for the R9 series signs discussed in note 8 below.
5. Signs shall be installed using a 1/2 inch bolt (nominal) and nut, two washers, and one locking washer for each connection.
6. Mounting bolts and nuts shall be fully engaged and adequately torqued. Bolts should not extend more than 1/2 inch beyond nuts.
7. Chevrons may be placed on drums on the outside of curves, on merging tapers or on shifting tapers. When used in these locations, they may be placed on every drum or spaced not more than on every third drum. A minimum of three (3) should be used at each location called for in the plans.
8. R9-9, R9-10, R9-11 and R9-11a Sidewalk Closed signs which are 24 inches wide may be mounted on plastic drums, with approval of the Engineer.

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC(8)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
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4-03 8-14	DIST	COUNTY		SHEET NO.
9-07 5-21	AUS	HAYS		41
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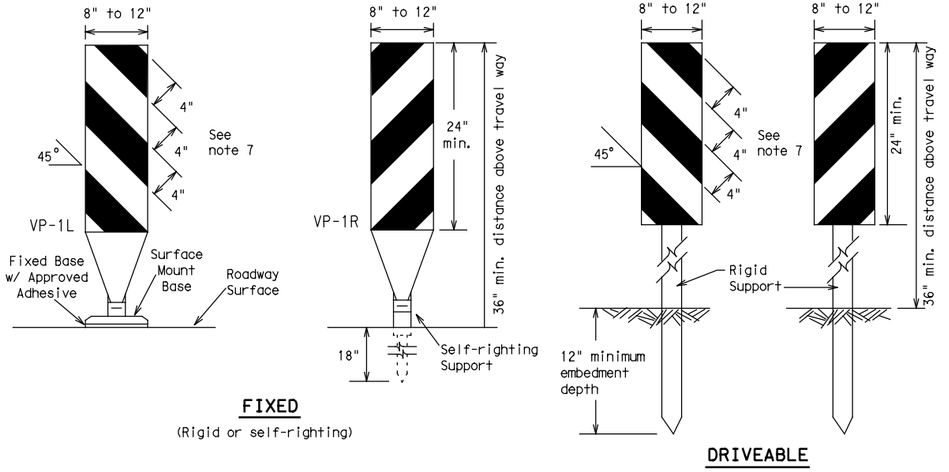
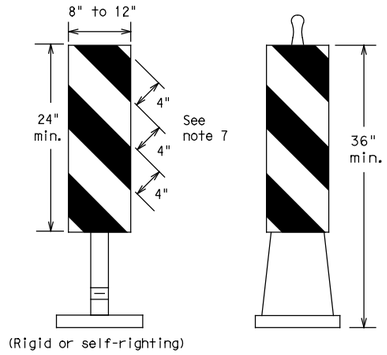


FIXED
(Rigid or self-righting)

DRIVEABLE

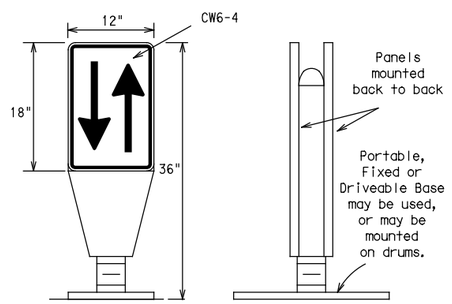


(Rigid or self-righting)

PORTABLE

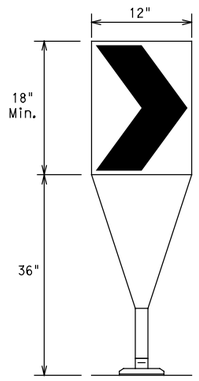
1. Vertical Panels (VP's) are normally used to channelize traffic or divide opposing lanes of traffic.
2. VP's may be used in daytime or nighttime situations. They may be used at the edge of shoulder drop-offs and other areas such as lane transitions where positive daytime and nighttime delineation is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

VERTICAL PANELS (VPs)



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

OPPOSING TRAFFIC LANE DIVIDERS (OTLD)



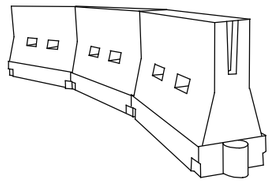
Fixed Base w/ Approved Adhesive (Driveable Base, or Flexible Support can be used)

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

CHEVRONS

GENERAL NOTES

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



LONGITUDINAL CHANNELIZING DEVICES (LCD)

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

WATER BALLASTED SYSTEMS USED AS BARRIERS

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

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

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

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

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

SUGGESTED MAXIMUM SPACING OF CHANNELIZING DEVICES AND MINIMUM DESIRABLE TAPER LENGTHS

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Texas Department of Transportation | Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC(9)-21

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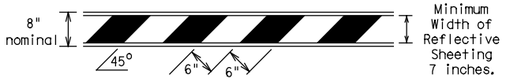
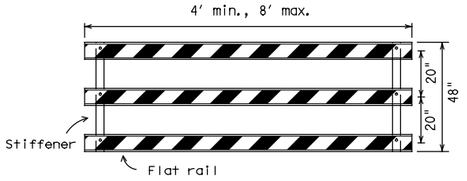
TYPE 3 BARRICADES

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

Barricades shall NOT be used as a sign support.



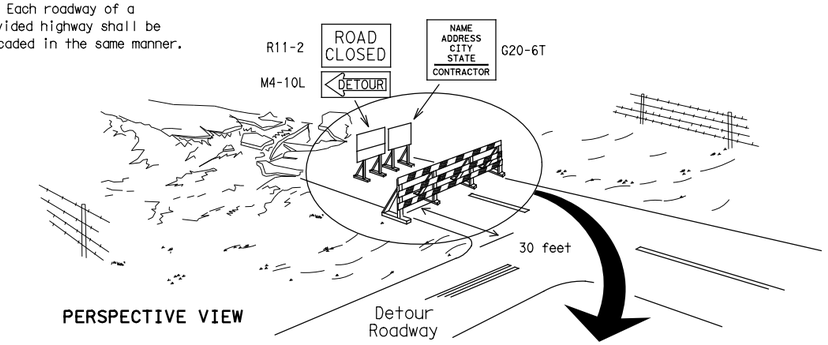
TYPICAL STRIPING DETAIL FOR BARRICADE RAIL



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

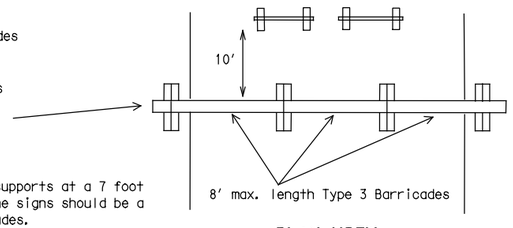
TYPICAL PANEL DETAIL FOR SKID OR POST TYPE BARRICADES

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



PERSPECTIVE VIEW

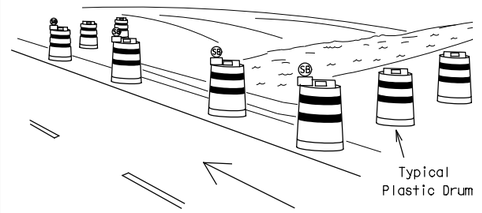
The three rails on Type 3 barricades shall be reflectorized orange and reflective white stripes on one side facing one-way traffic and both sides for two-way traffic.
Barricade striping should slant downward in the direction of detour.



PLAN VIEW

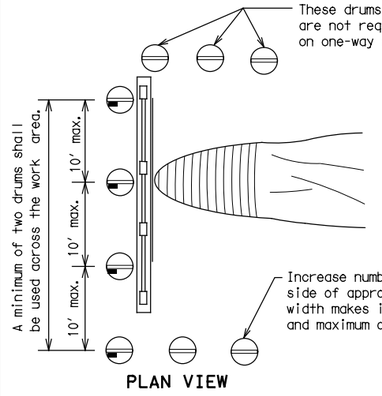
1. Signs should be mounted on independent supports at a 7 foot mounting height in center of roadway. The signs should be a minimum of 10 feet behind Type 3 Barricades.
2. Advance signing shall be as specified elsewhere in the plans.

TYPE 3 BARRICADE (POST AND SKID) TYPICAL APPLICATION



PERSPECTIVE VIEW

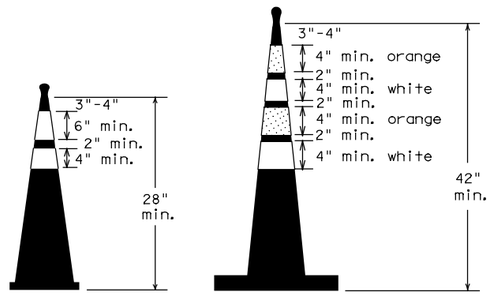
1. Where positive redirectional capability is provided, drums may be omitted.
2. Plastic construction fencing may be used with drums for safety as required in the plans.
3. Vertical Panels on flexible support may be substituted for drums when the shoulder width is less than 4 feet.
4. When the shoulder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



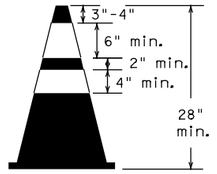
PLAN VIEW

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

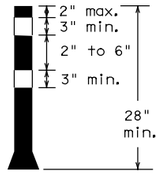
CULVERT WIDENING OR OTHER ISOLATED WORK WITHIN THE PROJECT LIMITS



Two-Piece cones



One-Piece cones

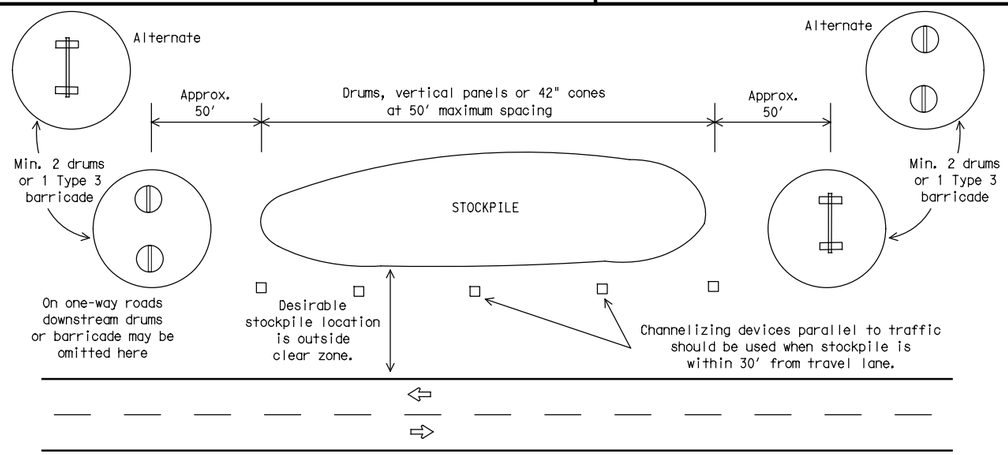


Tubular Marker

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.



TRAFFIC CONTROL FOR MATERIAL STOCKPILES

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC(10)-21

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WORK ZONE PAVEMENT MARKINGS

GENERAL

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

RAISED PAVEMENT MARKERS

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

PREFABRICATED PAVEMENT MARKINGS

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

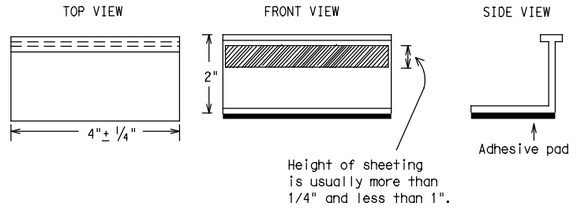
MAINTAINING WORK ZONE PAVEMENT MARKINGS

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

REMOVAL OF PAVEMENT MARKINGS

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

Temporary Flexible-Reflective Roadway Marker Tabs



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

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

RAISED PAVEMENT MARKERS USED AS GUIDEMARKS

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

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

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

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

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BARRICADE AND CONSTRUCTION PAVEMENT MARKINGS

BC(11)-21

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11-02 8-14				

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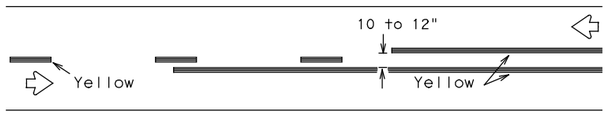
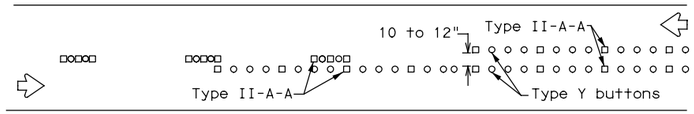
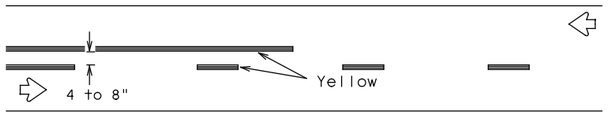
PAVEMENT MARKING PATTERNS



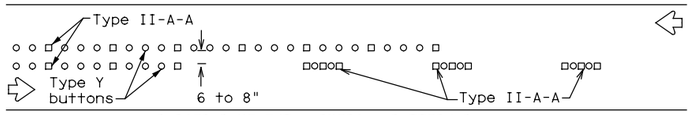
REFLECTORIZED PAVEMENT MARKINGS - PATTERN A



RAISED PAVEMENT MARKERS - PATTERN A



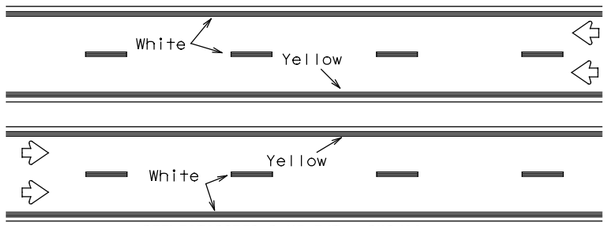
REFLECTORIZED PAVEMENT MARKINGS - PATTERN B



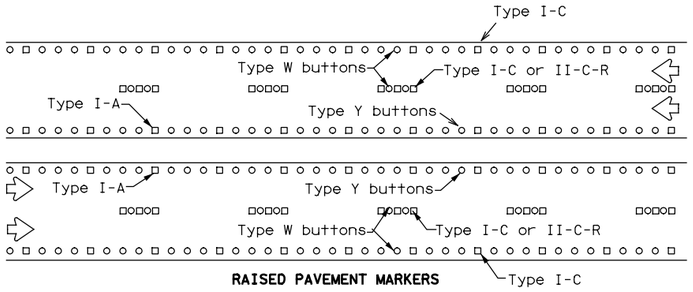
RAISED PAVEMENT MARKERS - PATTERN B

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

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



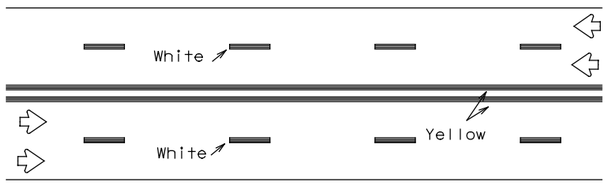
REFLECTORIZED PAVEMENT MARKINGS



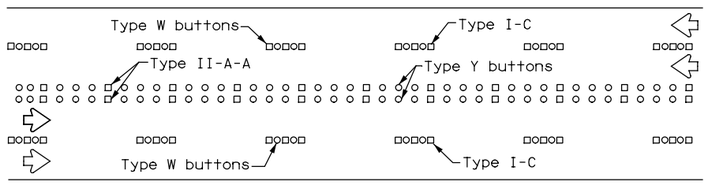
RAISED PAVEMENT MARKERS

Prefabricated markings may be substituted for reflectorized pavement markings.

EDGE & LANE LINES FOR DIVIDED HIGHWAY



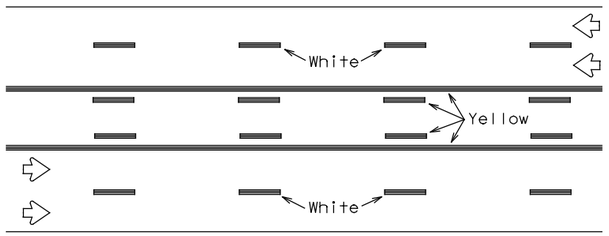
REFLECTORIZED PAVEMENT MARKINGS



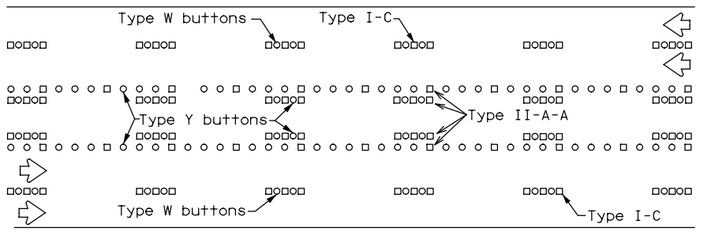
RAISED PAVEMENT MARKERS

Prefabricated markings may be substituted for reflectorized pavement markings.

LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



REFLECTORIZED PAVEMENT MARKINGS



RAISED PAVEMENT MARKERS

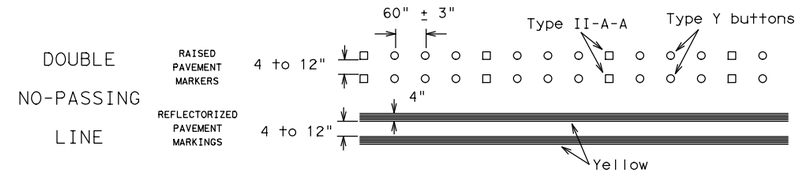
Prefabricated markings may be substituted for reflectorized pavement markings.

TWO-WAY LEFT TURN LANE

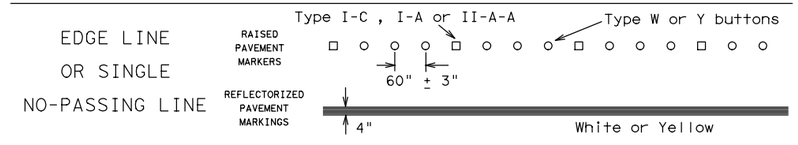
STANDARD WORK ZONE PAVEMENT MARKINGS DETAILS

SOLID LINES

DOUBLE NO-PASSING LINE

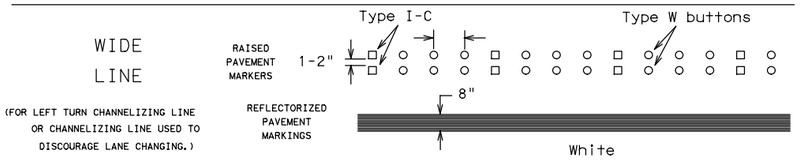


EDGE LINE OR SINGLE NO-PASSING LINE



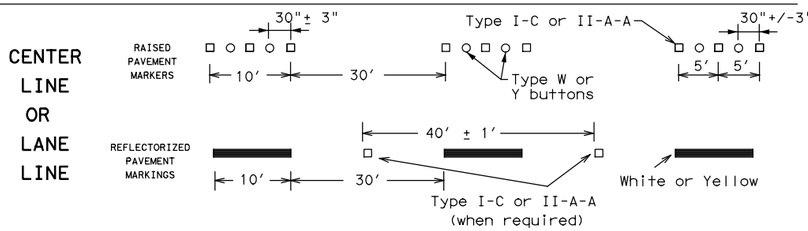
WIDE LINE

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

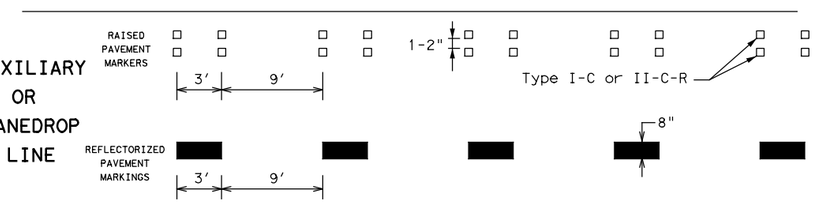


BROKEN LINES

CENTER LINE OR LANE LINE

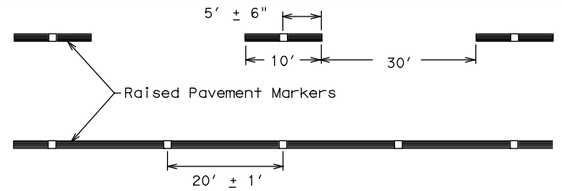


AUXILIARY OR LANEDROP LINE



REMOVABLE MARKINGS WITH RAISED PAVEMENT MARKERS

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



Centerline only - not to be used on edge lines

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

SHEET 12 OF 12

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PAVEMENT MARKING PATTERNS

BC(12)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS 1-97 9-07 5-21 2-98 7-13 11-02 8-14	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		45

106

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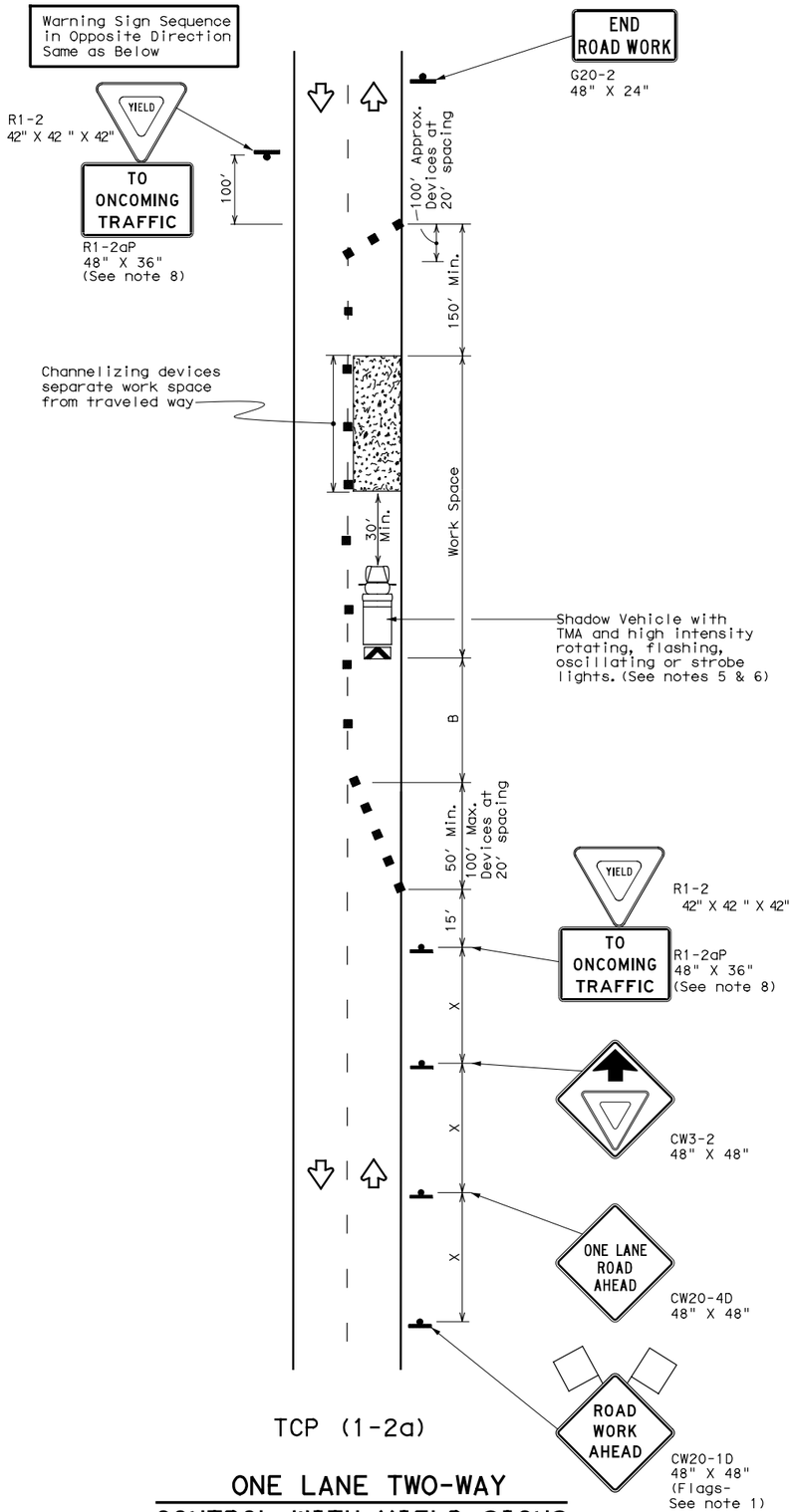
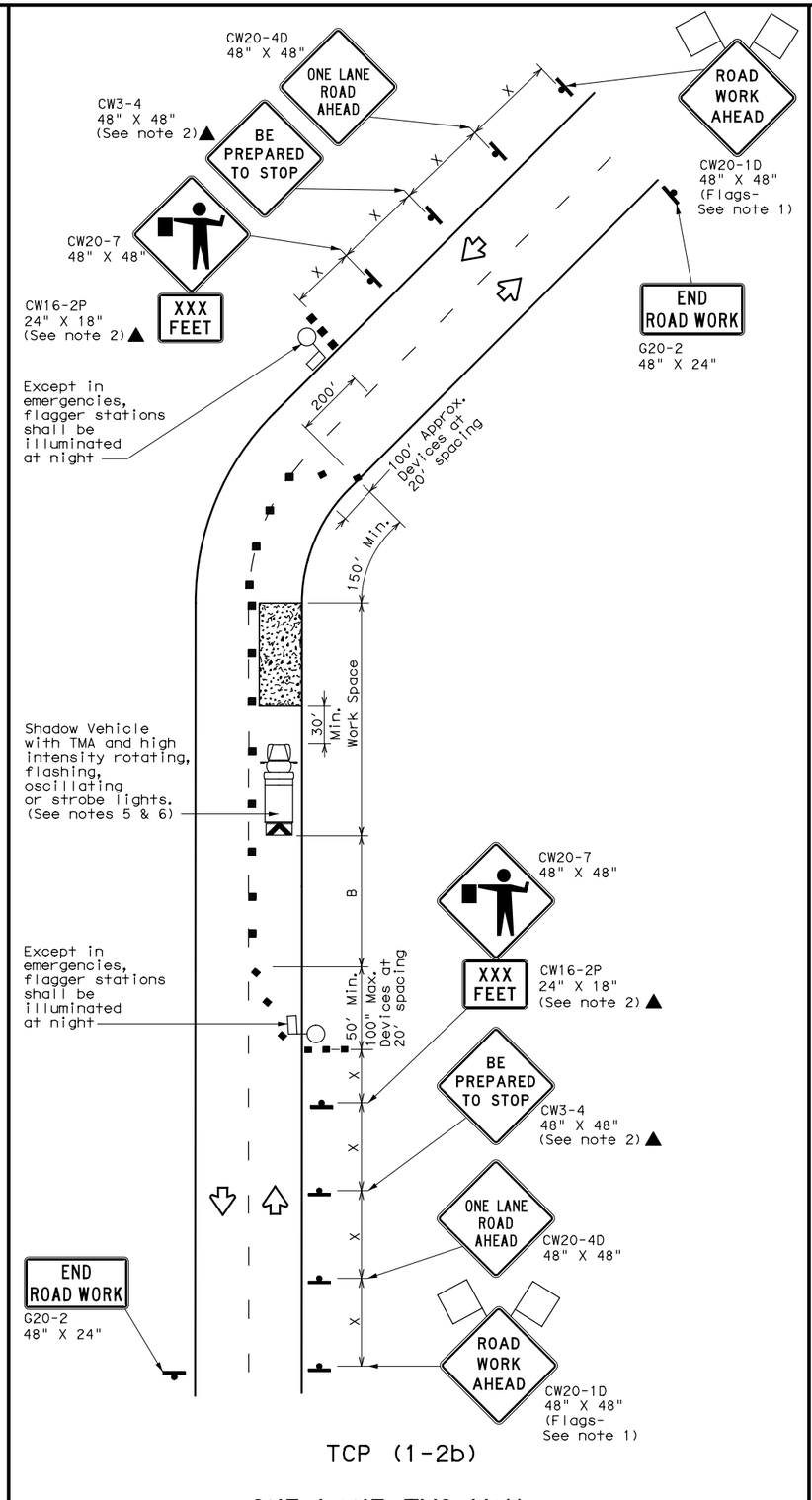


TCP (1-2a)

ONE LANE TWO-WAY CONTROL WITH YIELD SIGNS

(Less than 2000 ADT - See note 7)



TCP (1-2b)

ONE LANE TWO-WAY CONTROL WITH FLAGGERS

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

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

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

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

GENERAL NOTES

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

TCP (1-2a)

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

TCP (1-2b)

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

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL PLAN ONE-LANE TWO-WAY TRAFFIC CONTROL

TCP(1-2)-18

FILE: tcp1-2-18.dgn	DN:	CK:	DW:	CK:
© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS 4-90 4-98 2-94 2-12 1-97 2-18	0805	04	033	RM 3237
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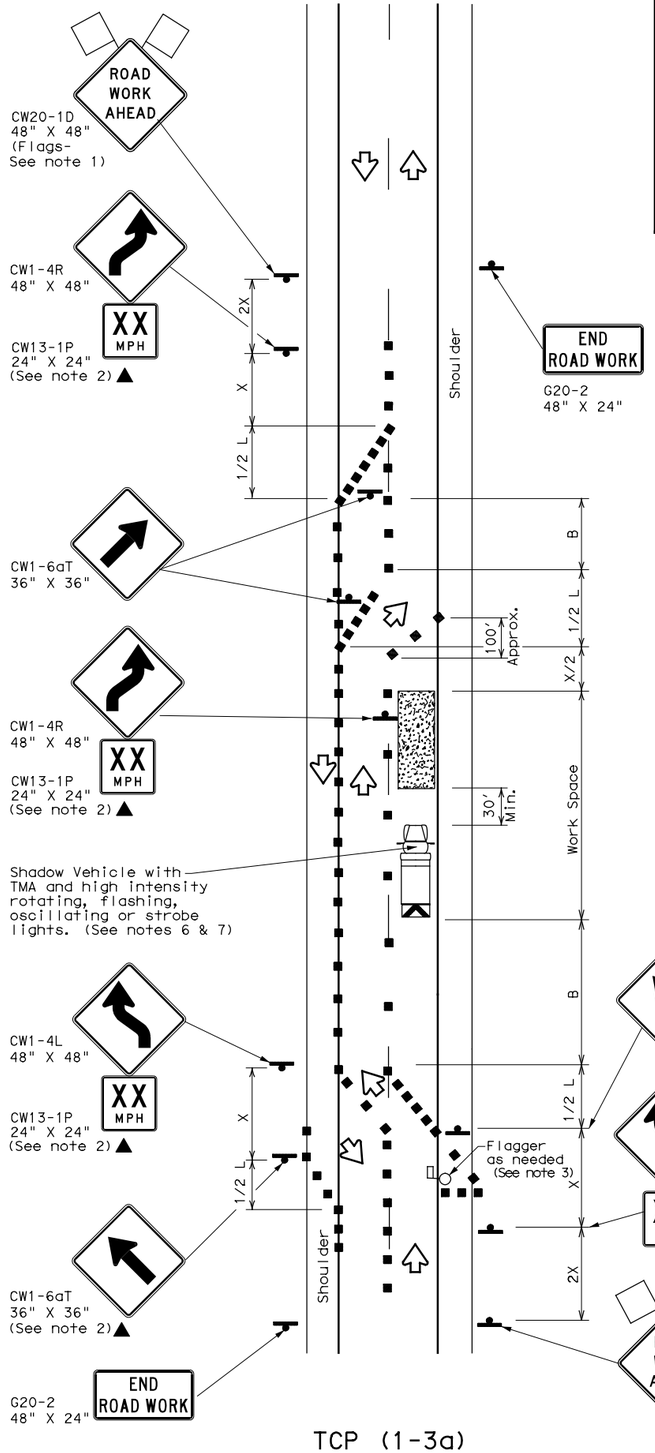


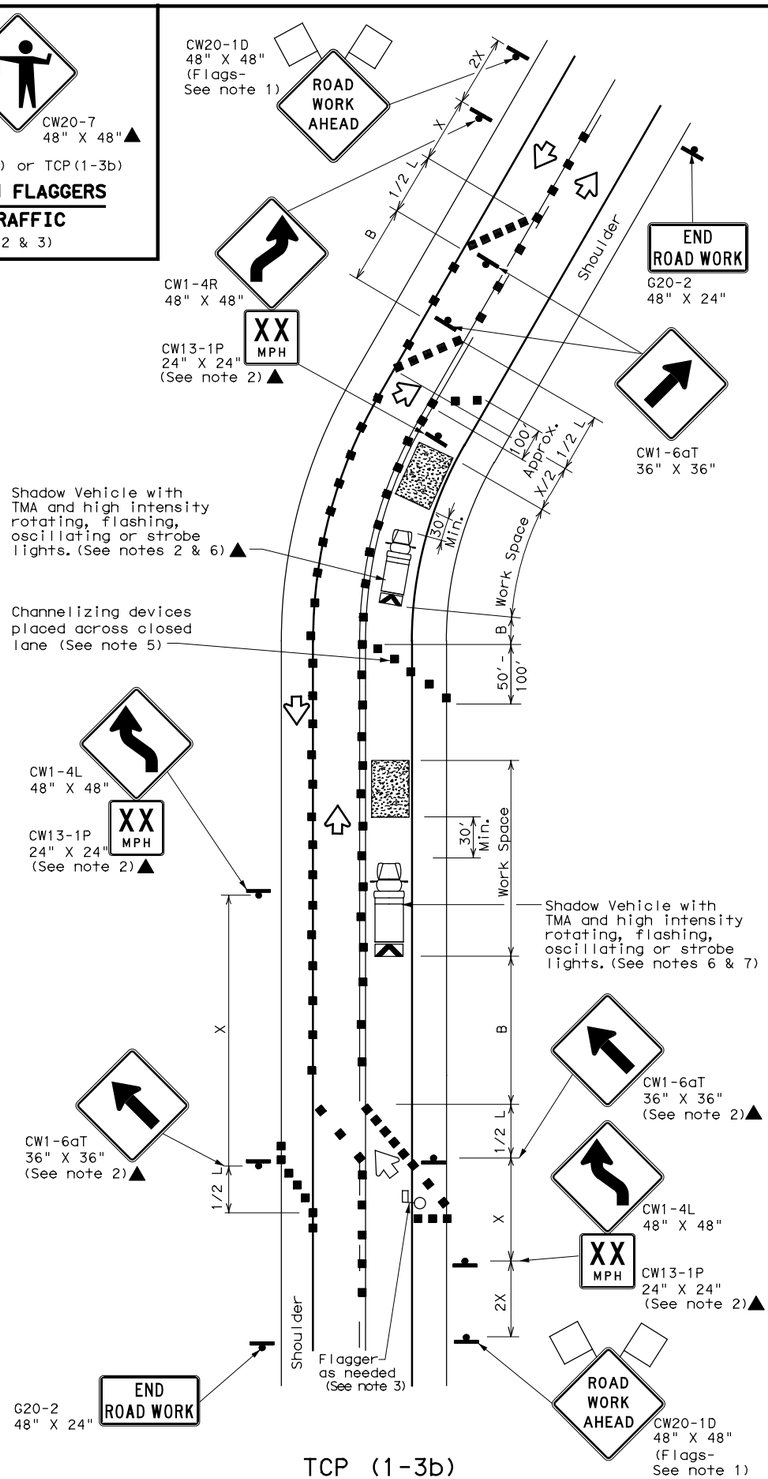
TCP (1-3a)
2-LANE ROADWAY WITH PAVED SHOULDERS

ONE LANE CLOSED
ADEQUATE FIELD OF VIEW

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

USE ONLY WHEN FLAGGERS CONTROL TRAFFIC

(See Notes 2 & 3)



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

ONE LANE CLOSED
INADEQUATE FIELD OF VIEW

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

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

* Conventional Roads Only

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

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

GENERAL NOTES

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

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL PLAN TRAFFIC SHIFTS ON TWO LANE ROADS

TCP(1-3)-18

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© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS	0805	04	033	RM 3237
2-94 4-98	DIST	COUNTY		SHEET NO.
8-95 2-12	AUS	HAYS		47
1-97 2-18				

153

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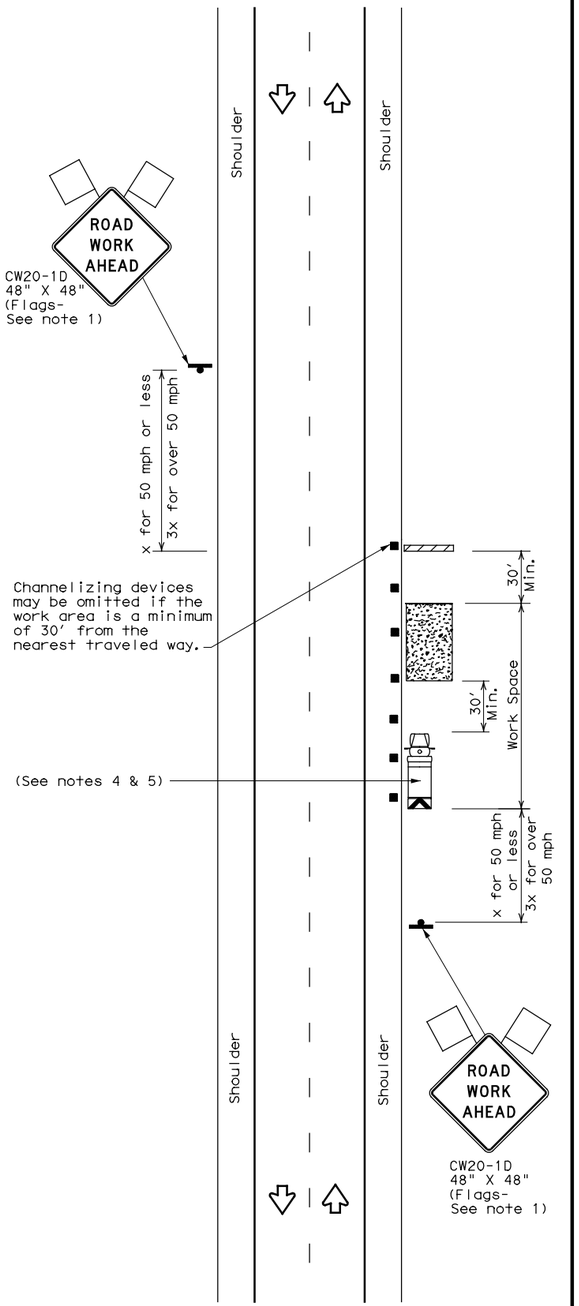
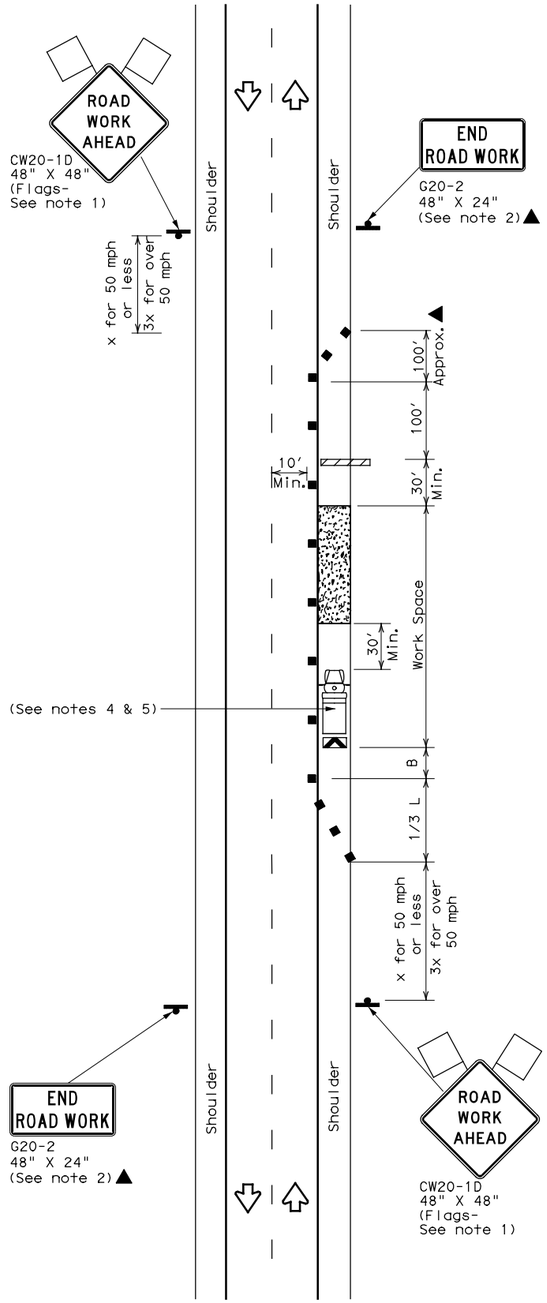


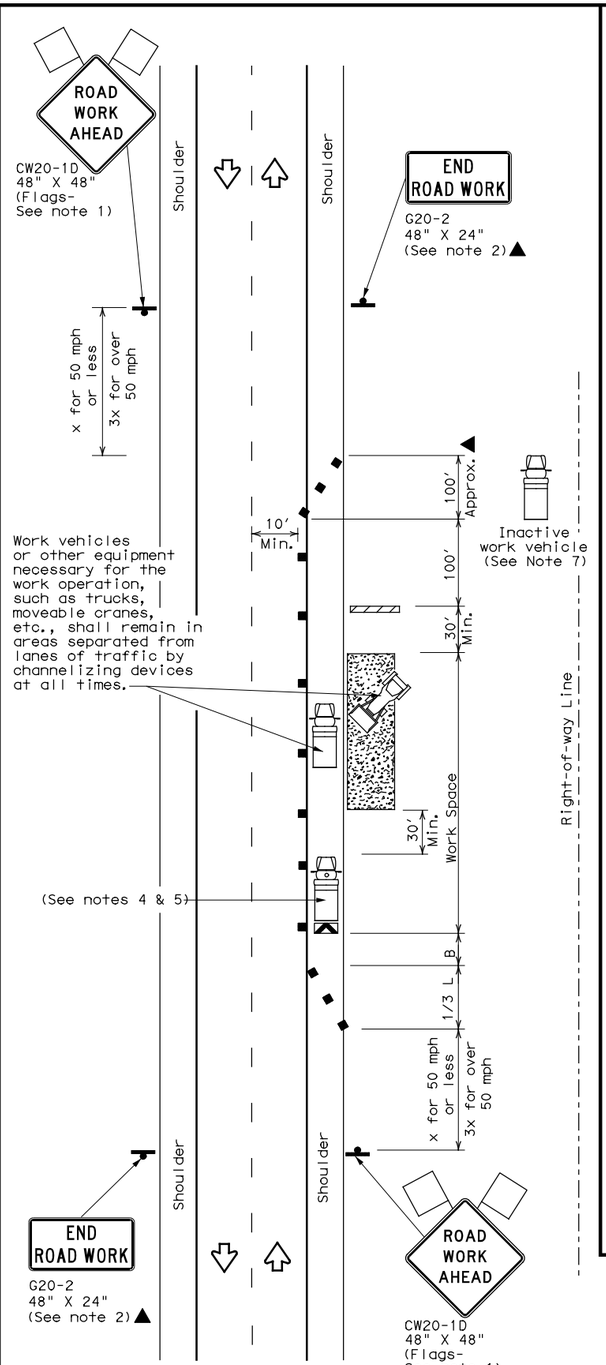
TCP (2-1a)

WORK SPACE NEAR SHOULDER
Conventional Roads



TCP (2-1b)

WORK SPACE ON SHOULDER
Conventional Roads



TCP (2-1c)

WORK VEHICLES ON SHOULDER
Conventional Roads

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

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

* Conventional Roads Only

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

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

GENERAL NOTES

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

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL PLAN CONVENTIONAL ROAD SHOULDER WORK

TCP(2-1)-18

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© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
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2-94 4-98	DIST	COUNTY		SHEET NO.
8-95 2-12	AUS	HAYS		48
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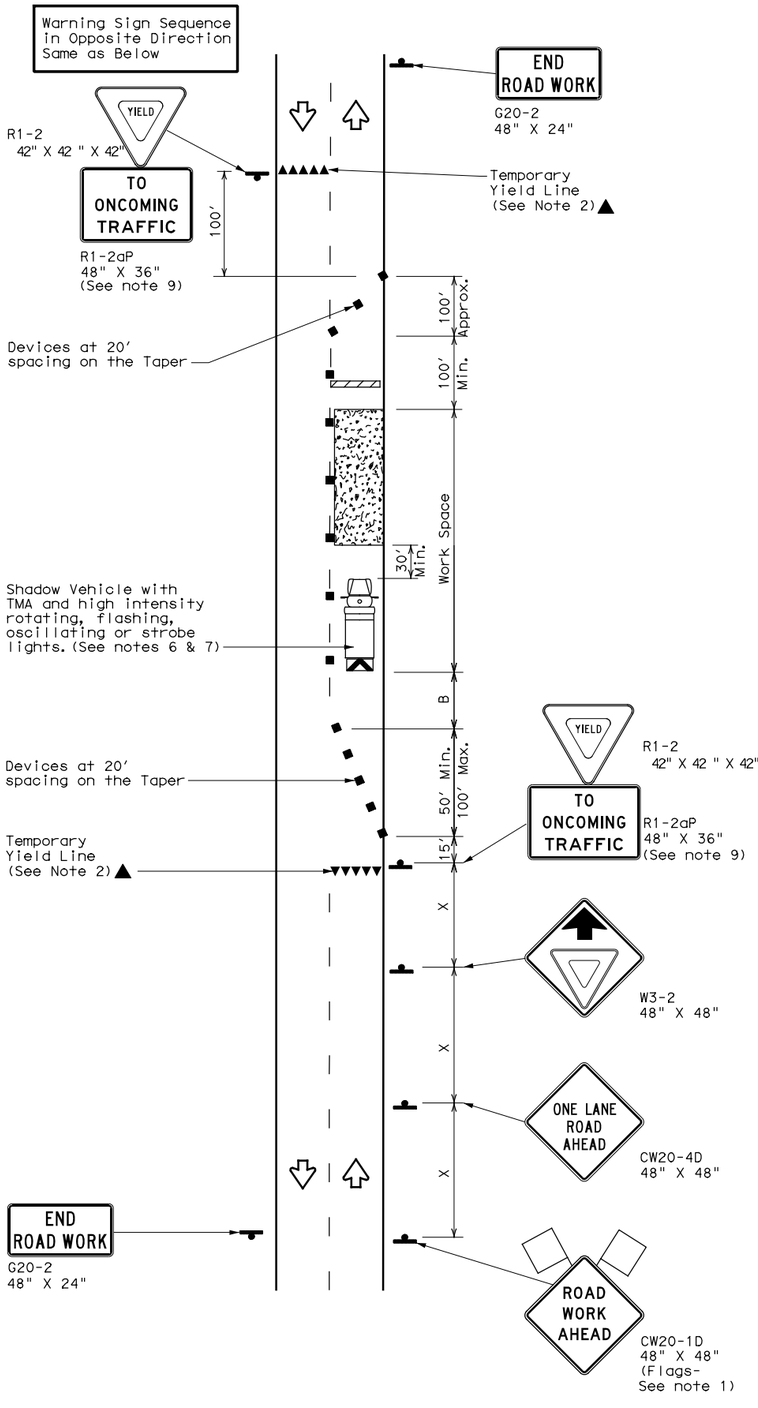
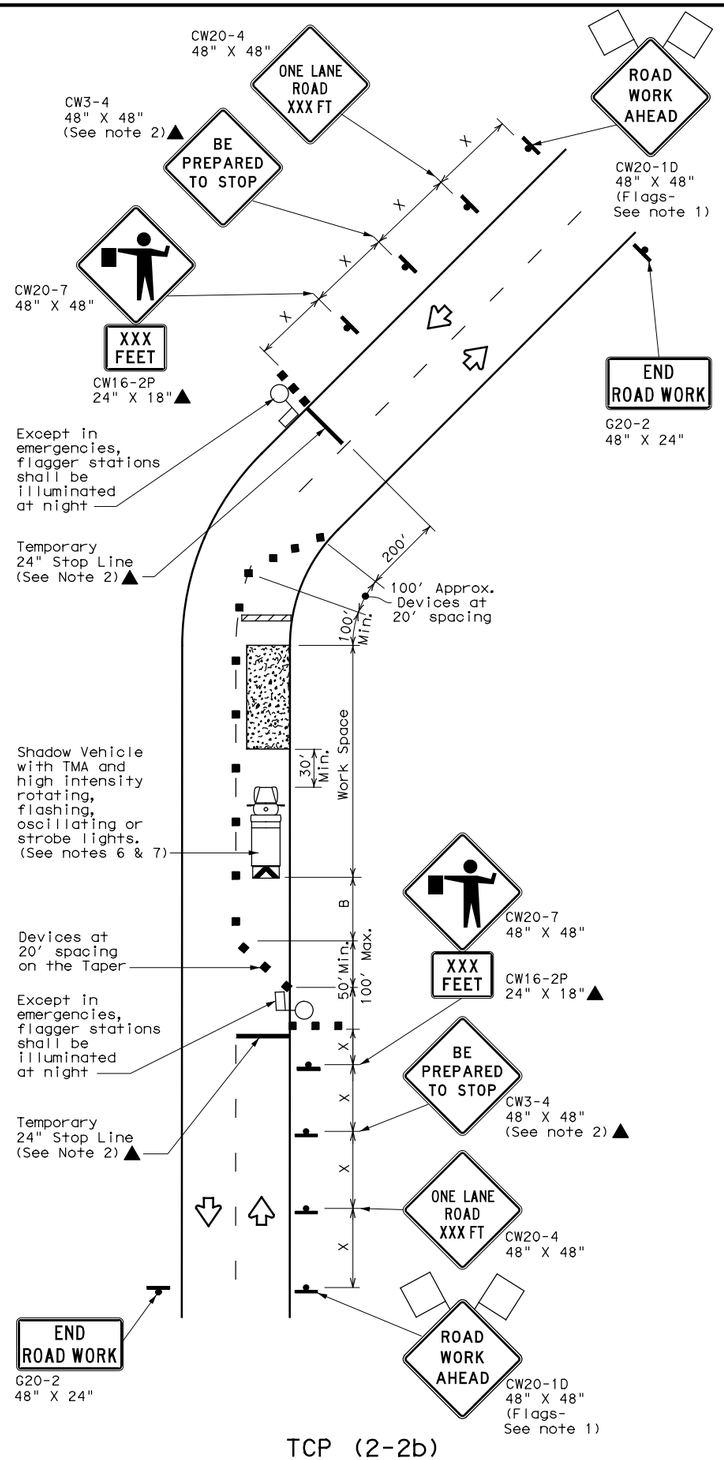


TCP (2-2a)
2-LANE ROADWAY WITHOUT PAVED SHOULDERS
ONE LANE TWO-WAY
CONTROL WITH YIELD SIGNS
(Less than 2000 ADT - See Note 9)



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

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

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

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

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

GENERAL NOTES

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

TCP (2-2a)

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

TCP (2-2b)

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

Texas Department of Transportation
Traffic Operations Division Standard

TRAFFIC CONTROL PLAN
ONE-LANE TWO-WAY
TRAFFIC CONTROL

TCP(2-2)-18

FILE: tcp2-2-18.dgn	DN:	CK:	DW:	CK:
© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS 8-95 3-03 1-97 2-12 4-98 2-18	0805	04	033	RM 3237
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	AUS	HAYS		49

DATE: 11/17/2023
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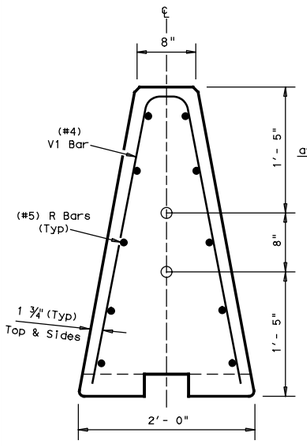
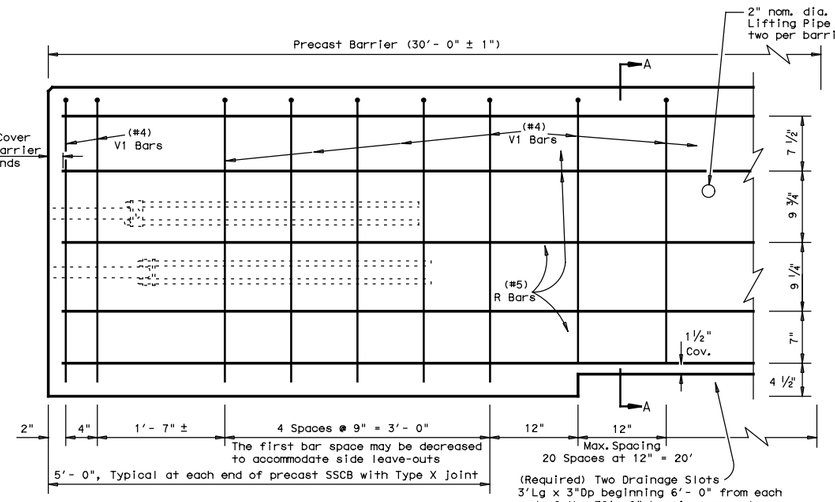


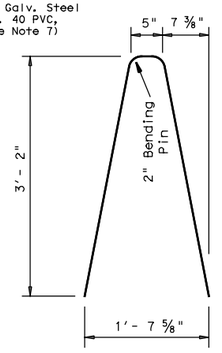
End View Precast Barrier

Pipe locations for Joint Type X connection



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

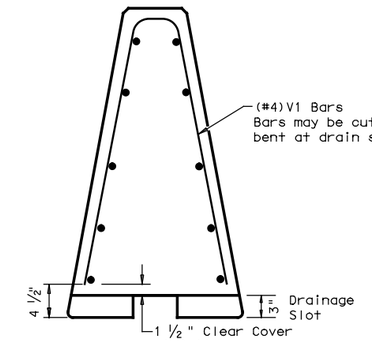
Showing reinforcement for Joint Connection (Type X)



V1 Bar

#4 Rebar

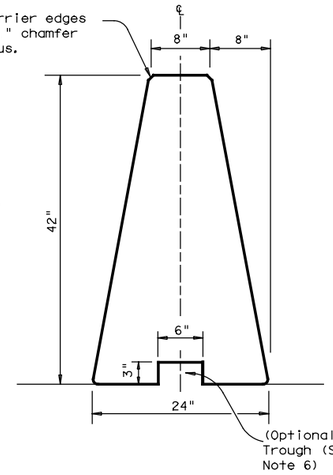
Note:
V1 Bars above the drainage slots may bent to accomadate 1 ½" clear cover as directed by the Engineer.



Section A-A

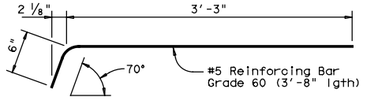
Steel Placement at (Required) Drainage Slots

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



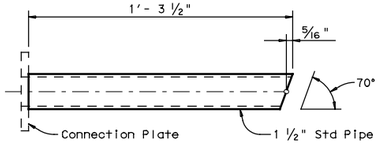
Single Slope Concrete Traffic Barrier

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



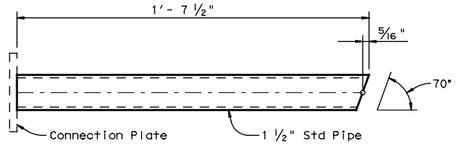
DEFORMED BAR ANCHOR DETAILS

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



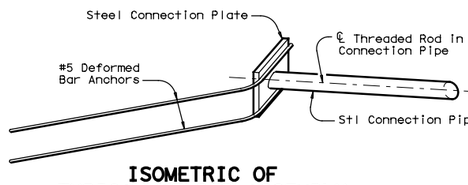
UPPER CONNECTION PIPE DETAILS

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



LOWER CONNECTION PIPE DETAILS

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

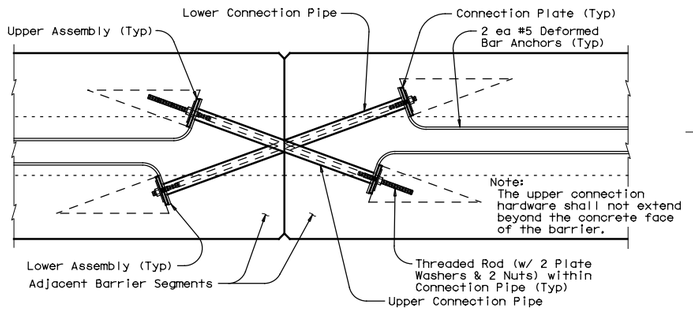


ISOMETRIC OF TYPICAL WELDED ASSEMBLY

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

General Notes

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



TYPE X JOINT INSTALLATION DETAIL

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

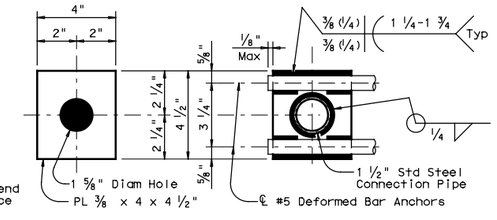
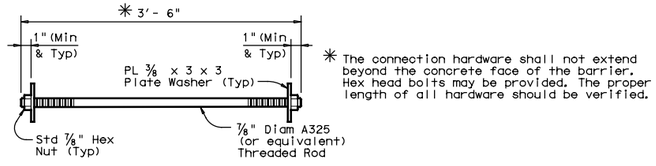


PLATE DIMENSIONS

WELDING DETAILS

CONNECTION PLATE DETAILS

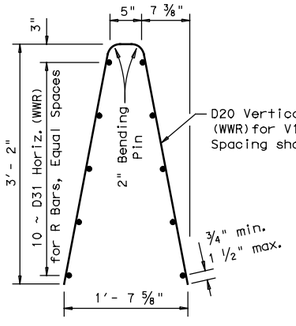
One (1) Plate required per assembly.
Four (4) required per Joint. All steel fittings for joint Type X shall be galvanized after fabrication in accordance with Item 445.



CONNECTION BOLT OR THREADED ROD DETAIL

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

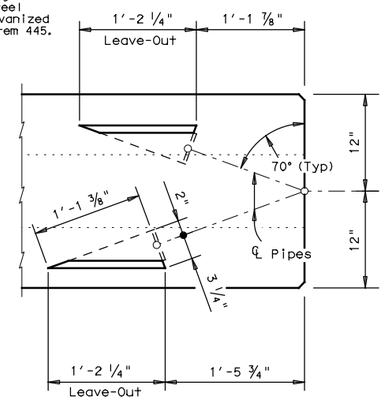
Weight of one precast 30 ft. (SSCB) segment = Approx. 10.5 Tons or 717 lbs per ft.



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

(WWR) General Notes

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



BARRIER PLAN AT JOINT

SHEET 1 OF 2

Texas Department of Transportation — Design Division Standard

SINGLE SLOPE CONCRETE BARRIER

PRECAST BARRIER
(TYPE 1)

SSCB(2)-10

FILE: sscb210.dgn	DN: TxDOT	CK: AM	DW: BD	CK:
©TxDOT December 2010	CONT	SECT	JOB	HIGHWAY
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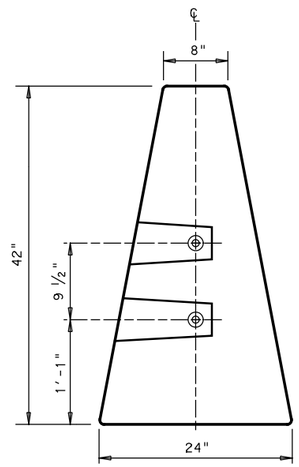
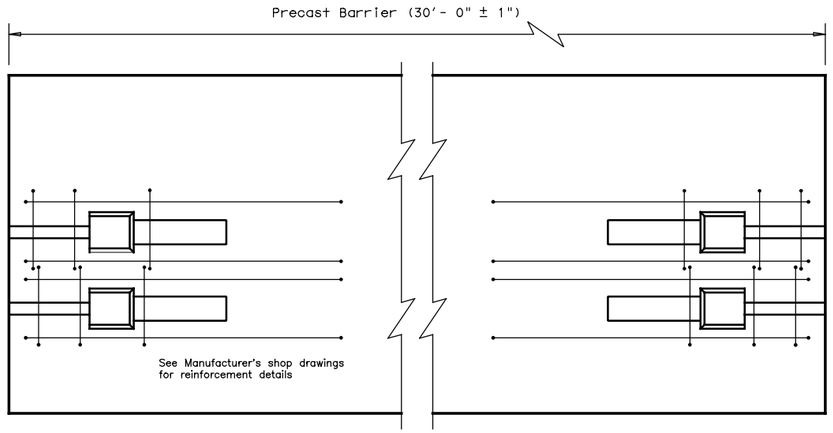
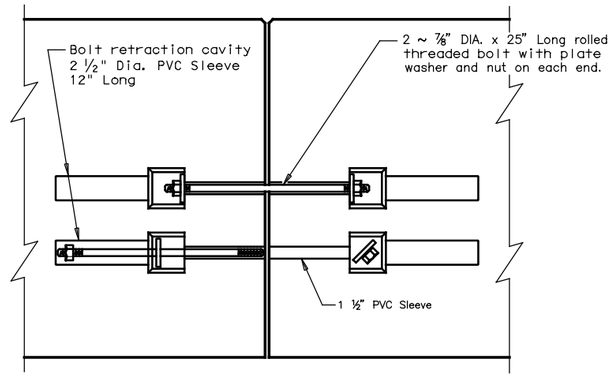


END VIEW
"QUICK-BOLT" POCKET LOCATIONS



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



ELEVATION VIEW SHOWING JOINT CONNECTION
"QUICK-BOLT"

Joint Connection (Type Q)

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

VIEW FROM ABOVE
J-J HOOK CONNECTION

END VIEW

Proprietary Joint Connections (SSCB)

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

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

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

SECTION A-A
Showing (Type R) Rebar Grid

ELEVATION
V1 Bars (See Sheet 1)

TOP VIEW
JOINT CONNECTION
Typical at both ends of barrier segment

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

WELDED REBAR GRID

Joint Connection (Type R)

SHEET 2 OF 2

Texas Department of Transportation — Design Division Standard

SINGLE SLOPE CONCRETE BARRIER

PRECAST BARRIER
(TYPE 1)

SSCB(2)-10

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©TxDOT December 2010	CONT	SECT	JOB	HIGHWAY
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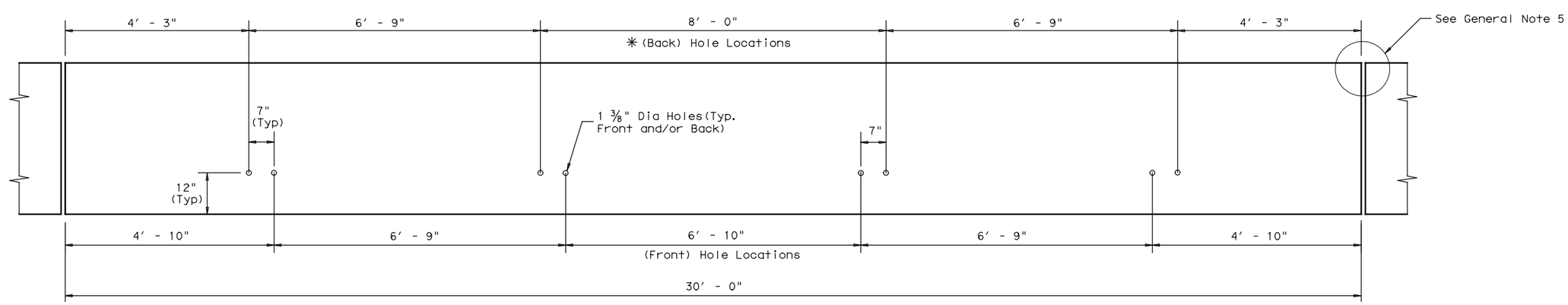
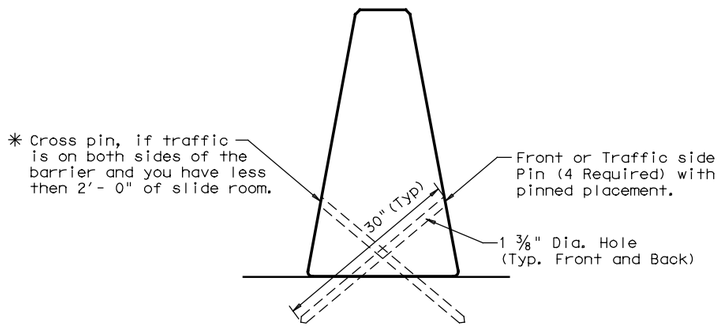


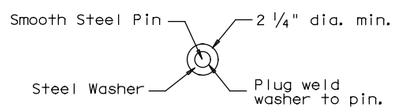
DETAIL 1

Precast SSCB(42")
Showing hole locations

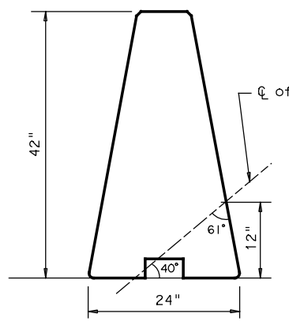


DETAIL 2

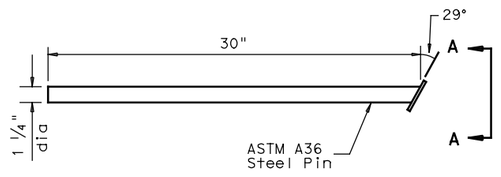
Placement on (ACP)
Asphalt Conc. Pavement
or Treated Base Material
(30" Pin required)



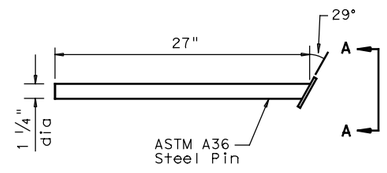
VIEW A-A



HOLE LOCATION DETAIL



(30") PIN DETAIL
See Detail 2

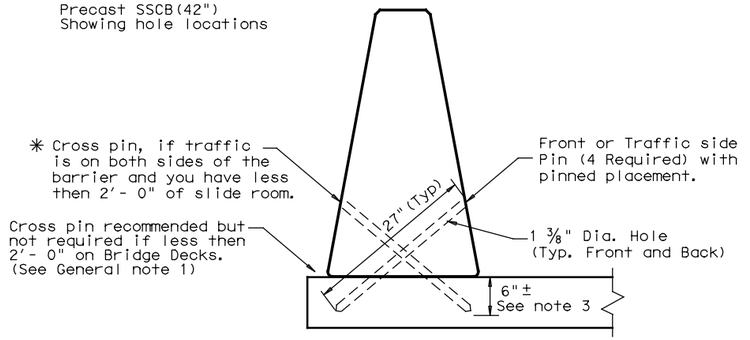


(27") PIN DETAIL
See Detail 3

Note:
Steel washer welded to pin at 29° angle so that the washer is flush with barrier surface. (See View A-A)

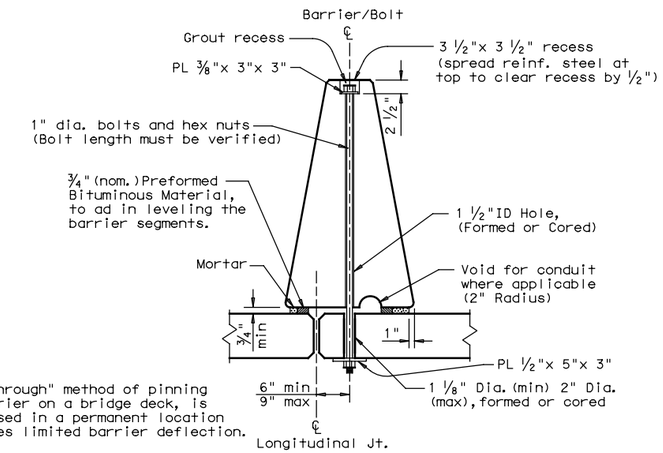
DETAIL 3

Bridge Deck or CRCP
(27" Pin required).



CORE DRILLING EXISTING BARRIER

Core drilling existing concrete barrier is permitted. Holes shall be drilled with coring or masonry drilling type equipment. Percussion (star) drilling shall not be used. A special drill bit (to cut through existing reinforcing) will likely be required. Spalls in the concrete exceeding ½" shall be patched.



Note:
The "Bolt Through" method of pinning precast barrier on a bridge deck, is primarily used in a permanent location that requires limited barrier deflection.

PRECAST SSCB (BOLT THROUGH) PLACEMENT OVER LONGITUDINAL EXPANSION JOINT

For bolt through locations, use the (Front) hole locations shown on Detail 1.

GENERAL NOTES

1. These details provide a method of laterally restraining precast concrete barrier to limit deflections under normally expected passenger vehicle impacts. These details are intended for use in work zones, primarily on bridge decks, or pavement where temporary barrier must be placed less then 2 ft. from the longitudinal edge of the deck or dropoff and parallel to the direction of travel. Other applications of these details are acceptable as directed by the Engineer.
2. Each precast concrete barrier section shall have a minimum of four or total of eight 1 ⅜ in. ID holes formed or cored through the barrier. The center lines of the holes are shown in the hole location detail. If rebar is encountered, the entry point may be shifted 2" plus or minus longitudinally along the barrier. The eight holes are spaced along the length of the barrier as shown in Detail 1.
3. The drilling of the travel surface is accomplished by placing the pre-drilled barrier section on the travel surface in the desired position. Then the hole is drilled with the bit passing though the hole in the barrier. The bit is to be inserted into the hole in the barrier so that the travel surface is drilled to a point which is slightly more than the pin length.
4. Note that steel washers have been welded to the top of the steel pins to aid in the removal of the pins, when the barrier is removed.
5. See SSCB(2) standard sheet for reinforcement requirements and joint connection types.
6. The forming or coring of holes in the barrier, drilling of holes in bridge deck or pavement, fabrication and materials for the 1 ¼ in. pins, installation of pins, and any repair to the barrier shall be considered as subsidiary to the barrier bid items.
7. The barrier and travel surface will be repaired as directed by the Engineer in accordance with Item 429, "Concrete Structure Repair."
8. All steel pins shall be galvanized after fabrication in accordance with Item 445, "Galvanizing."
9. Weight of barrier is approx. 700 lbs per foot.

Texas Department of Transportation

Design Division Standard

SINGLE SLOPE CONCRETE BARRIER

PRECAST BARRIER
(TYPE 1)
PINNED PLACEMENT

SSCB(5)-10

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©TxDOT December 2010	CONT	SECT	JOB	HIGHWAY
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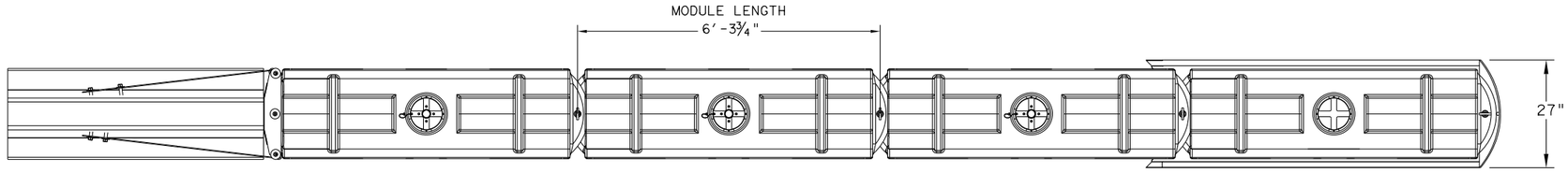
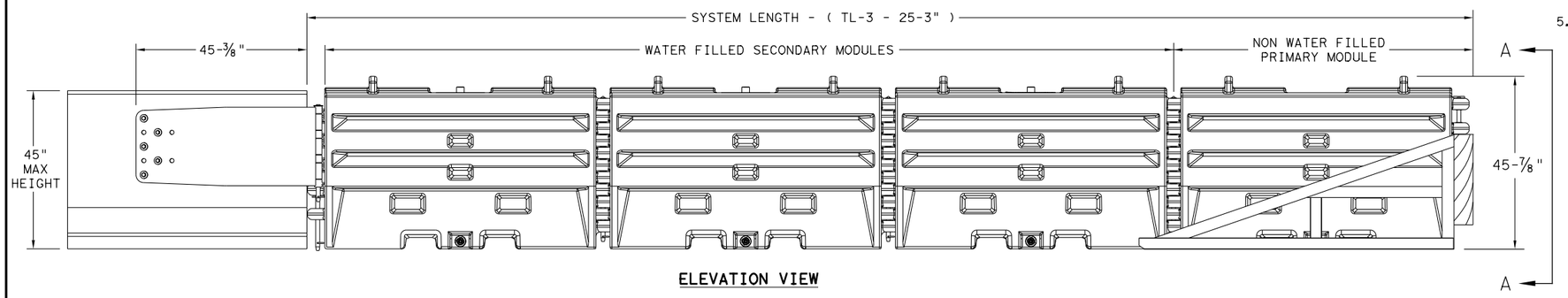


PLAN VIEW



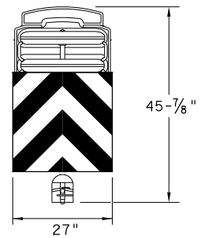
ELEVATION VIEW

GENERAL NOTES

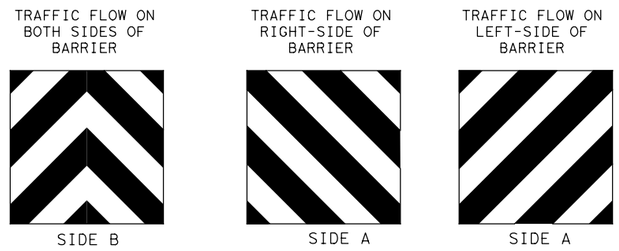
1. REFER TO THE INSTALLATION MANUAL FOR SPECIFIC SYSTEM ASSEMBLY AND MODULE ORIENTATION. FOR ADDITIONAL INFORMATION, CONTACT TRAFFIX, INC. AT (949) 361-5663.
2. THE SLED SYSTEM IS A MASH APPROVED TEST LEVEL 3 (TL-3) CRASH CUSHION APPROVED FOR USE IN TEMPORARY WORK ZONES. THE SLED SYSTEM IS A NON-REDIRECTIVE,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

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

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

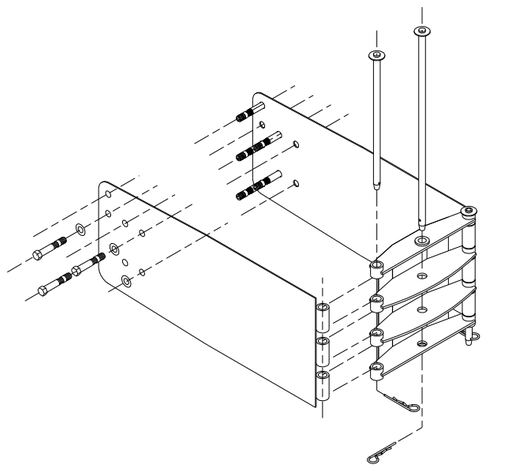


SECTION A-A



NOSE SHEETING PANEL DELINEATION

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



SLED TRANSITION COMPONENTS FOR ATTACHMENT TO CMB

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

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

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

SACRIFICIAL

BILL OF MATERIAL

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

Texas Department of Transportation

Design Division Standard

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

FILE: sled19.dgn	DN: TxDOT	CK: KM	DW: VP	CK:
©TxDOT: DECEMBER 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0805	04	033	RM 3237
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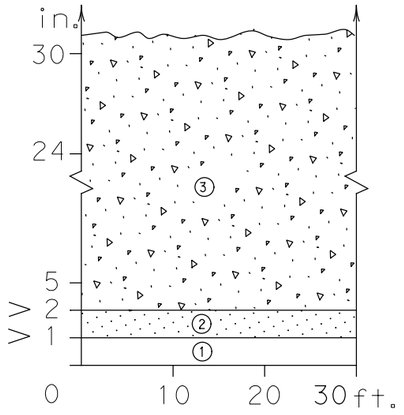
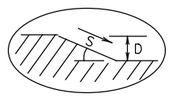
	AUS	RM 3237		53

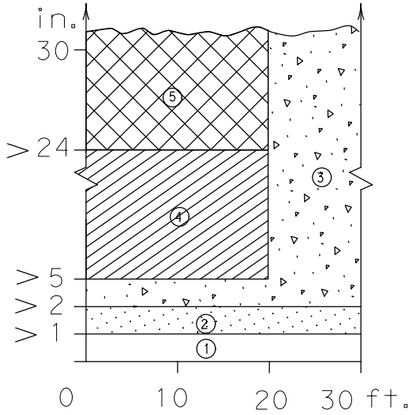
DEFINITION OF TREATMENT ZONES FOR VARIOUS EDGE CONDITIONS

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

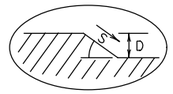


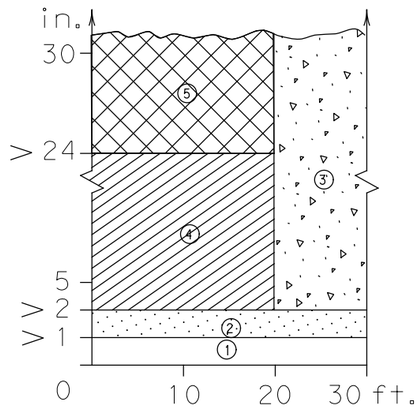
Edge Condition I
S = (3:1) (or flatter)



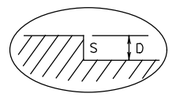


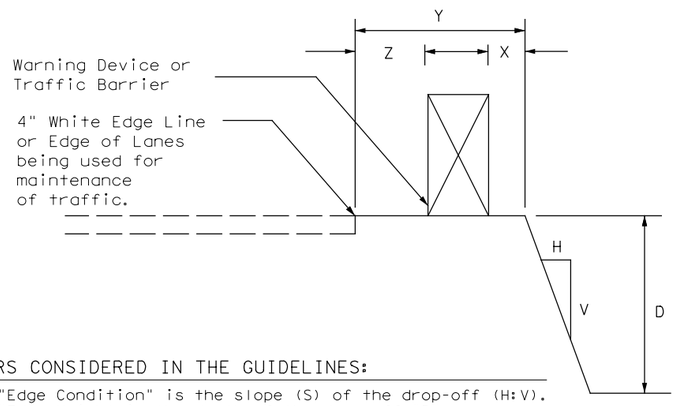
Edge Condition II
S = ((2.99):1) to (1:1)





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





FACTORS CONSIDERED IN THE GUIDELINES:

1. The "Edge Condition" is the slope (S) of the drop-off (H:V). The "Edge Height is the depth of the drop-off "D".

2. 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.

3. 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.

4. 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.

5. 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.

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.

Edge Condition Notes:

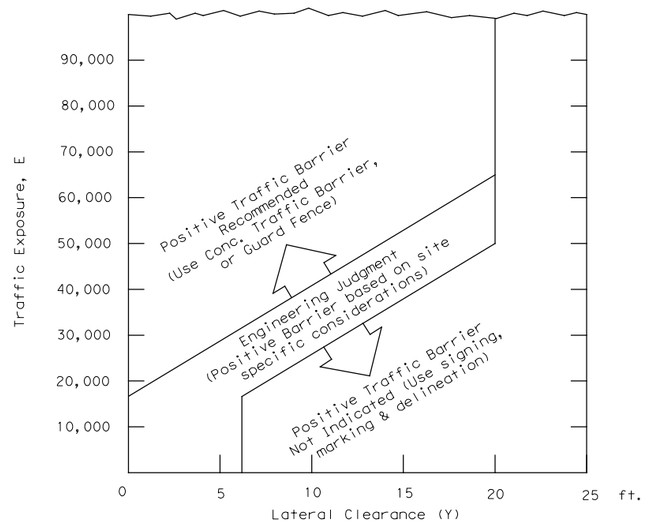
1. Edge Condition I: Most vehicles are able to traverse an edge condition with a slope rate of (3 to 1) or flatter. The slope must be constructed with a compacted material capable of supporting vehicles.

2. 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" exeeds 24 inches, the possibility for rollover is greater in most vehicles.

3. 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.

4. 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 (▨)



1. E = ADT x 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.

2. 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.

3. 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

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED
PROFESSIONAL ENGINEER

Date 11/17/2023

Texas Department of Transportation

Traffic Safety Division Standard

TREATMENT FOR VARIOUS EDGE CONDITIONS

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©TxDOT August 2000	CONT	SECT	JOB	HIGHWAY
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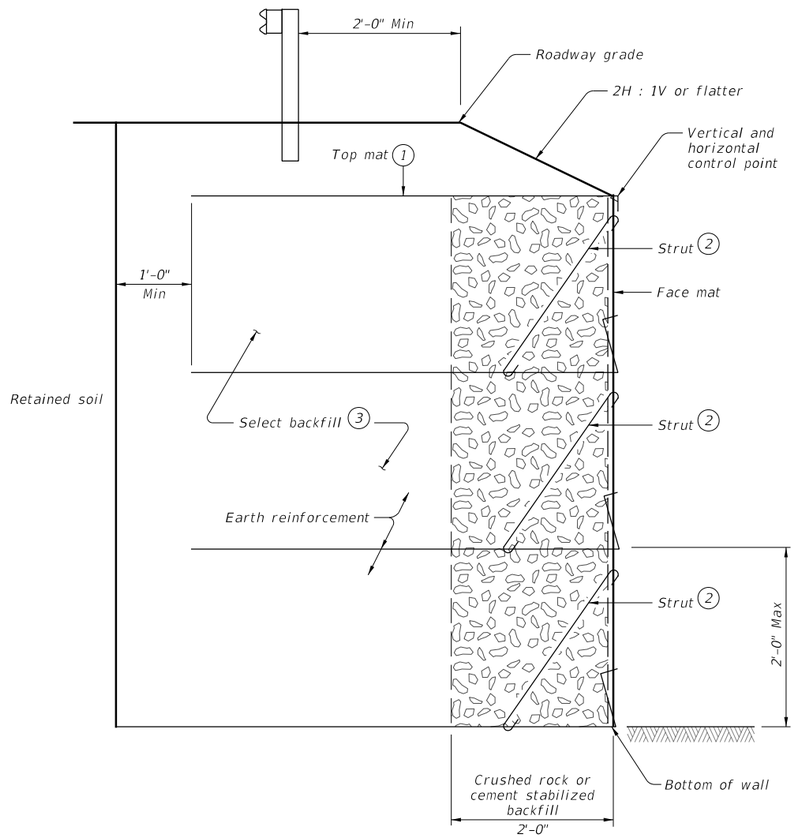
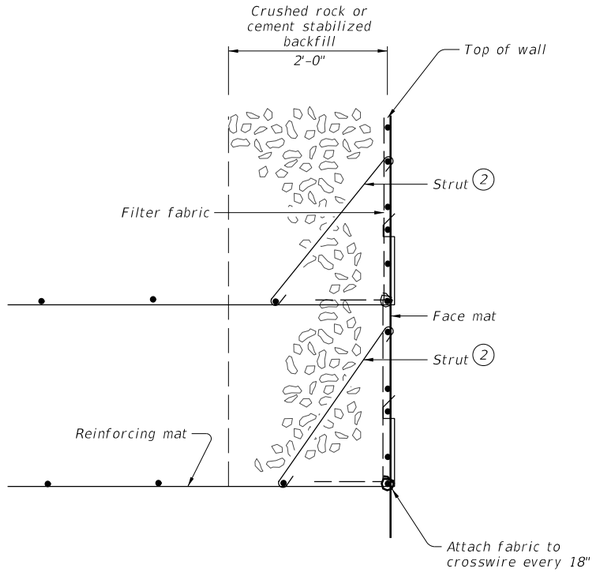


TYPICAL SECTION

(Showing top mat option.)



DETAIL OF WALL FACE

(Showing strut option.)

(1) Provide top mat to stabilize top of wall. Contractor may propose alternate method to stabilize top of wall for review.

(2) Provide intermediate struts to stabilize face. Wall supplier may propose alternate methods of face stabilization for review.

(3) Shop drawings must include drainage provisions and details for backfill composed of:
Cement stabilized sand,
Crushed concrete, or
Type CS fill with a fines content greater than 15%.

SPECIAL NOTE - FACE CONSTRUCTION

When constructing wire faced walls, it is critical that the area immediately behind the face mat be completely filled. Failure to fill and compact this area will result in bulging of the face mats and settlement of the top of wall. The filter fabric shall closely follow the contours of the face unit, with particular attention paid to the lower corner of the basket. Pull the fabric into the corner and attach to the basket with hog rings or tie wire. Extend the coarse rock or cement stabilized backfill in the 2-foot zone behind the face completely to the top of the face mat. Take particular care not to leave a gap or void below the next layer of earth reinforcement.

DESIGN CRITERIA NOTES:

Design Parameters:
Base design of retaining walls on the following design parameters unless stated elsewhere in the plans:

Random Backfill (Embankment or Existing Soils)	Unit Weight = 120 pcf ϕ = 30° C = 0 psf
Select Backfill	Unit Weight = 120 pcf ϕ = 30° C = 0 psf

Limit allowable stresses and pullout of earth reinforcement in accordance with current AASHTO Standard Specifications for Highway Bridges and Interim Specifications.

Stability Criteria:
Base design on the following factors of safety:

Sliding along the base of the structure	Factor of Safety ≥ 1.5
Overturning	Factor of Safety ≥ 2.0
Pullout of Earth Reinforcement	Factor of Safety ≥ 1.5

Design the wall such that the base pressure resultant falls within the middle third of the retaining wall.

EARTH REINFORCEMENT:

Space vertical earth reinforcement at 24 inch maximum.
Provide earth reinforcement lengths adhering to the following:
6-foot minimum for walls 6 feet and shorter
8-foot minimum for walls over 6 feet tall,
or as shown elsewhere in the plans.
Utilize a minimum W4.5 wire size for welded wire earth reinforcement. Space longitudinal wire at maximum of 12 inches and transverse wire at a maximum of 24 inches.
Geogrid earth reinforcement is permissible. If geogrid is to be used, provide a detail showing the connection between the welded wire face basket and the geogrid earth reinforcement.
Provide non-metallic or galvanized reinforcement for any temporary earth wall reinforcement that will be placed in the reinforced volume of a permanent MSE wall.

WALL FACE:

Provide welded wire in facing with a minimum W4.5 wire size. Space wire at 6 inches maximum in both the horizontal and vertical directions. Design the facing to maintain a vertical position during wall backfilling. Utilize wire struts, external bracing, or other means which provide acceptable performance. Stop construction if the face does not remain vertical during wall backfilling until the system is modified to meet this requirement.
Provide angled struts or a top mat to stabilize the top basket face. Space struts at 24 inch maximum.

GENERAL NOTES:

Sections shown are for informational purposes only. Determine specific geometry based on wall layouts and other plan information.
Extend the select backfill specified for use within the temporary earth wall select volume a minimum of 1 foot horizontally beyond the end of the earth reinforcement from the back of the 2-foot backfill zone.

Texas Department of Transportation

Bridge Division Standard

TEMPORARY EARTH RETAINING WALL

RW(TEW)

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©TxDOT June 2022	CONT	SECT	JOB	HIGHWAY
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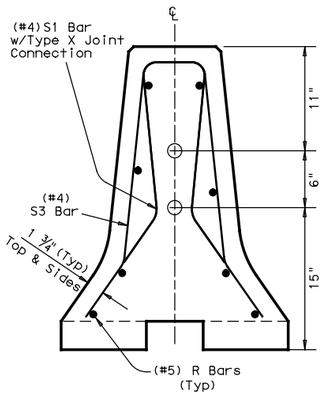
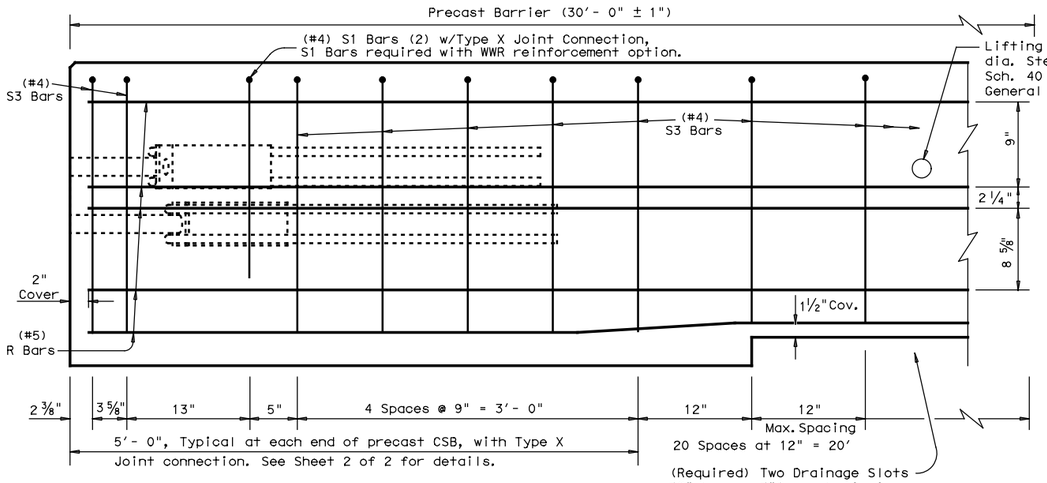


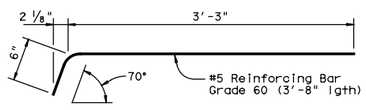
End View Precast Barrier

See sheet 2 of 3 for Joint connection Type X



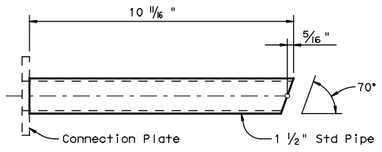
Reinforcement for Precast (CSB) Concrete Safety Barrier (Type 1)

Showing reinforcement for Joint Type X



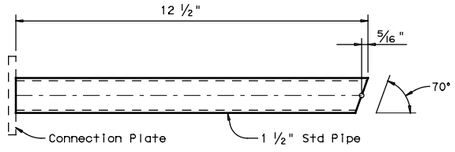
DEFORMED BAR ANCHOR DETAILS

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



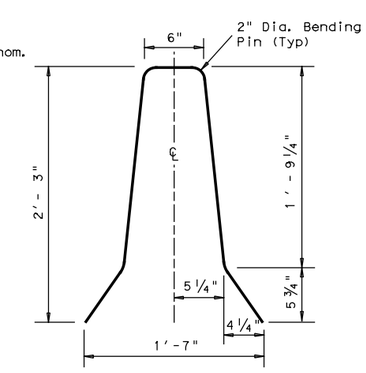
UPPER CONNECTION PIPE DETAILS

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



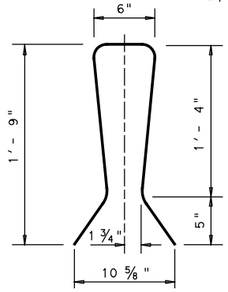
LOWER CONNECTION PIPE DETAILS

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



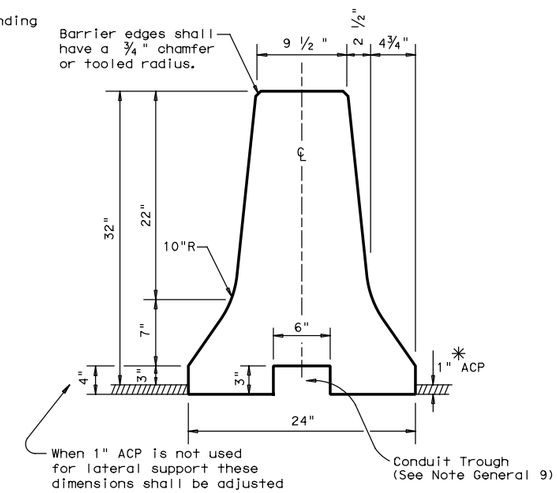
S3 Bar

#4 Bar



S1 Bar

#4 Bar (2)
(Joint Type X)

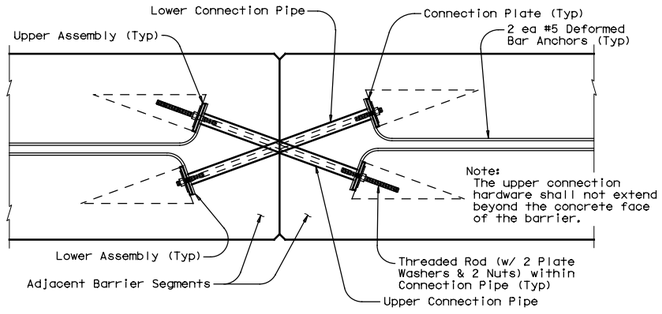


Concrete Safety Barrier

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

GENERAL NOTES

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



TYPE X JOINT INSTALLATION DETAIL

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

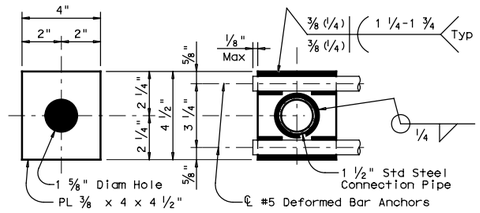
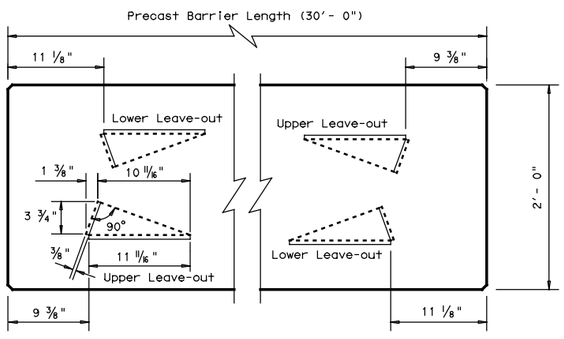


PLATE DIMENSIONS

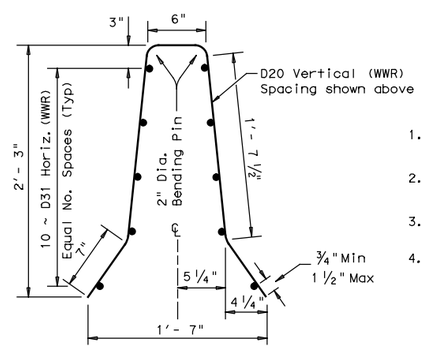
WELDING DETAILS

CONNECTION PLATE DETAILS

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



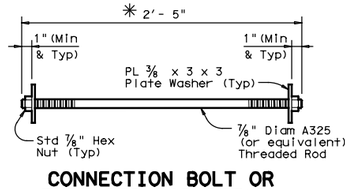
BARRIER PLAN AT END JOINTS



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

(WWR) General Notes

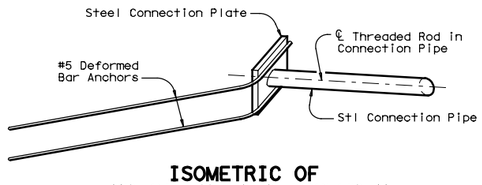
1. Deformed Welded Wire Reinforcement (WWR) shall conform to ASTM A497.
2. Welded wire cage may be cut or bent to accommodate the Type X joint connection and drainage slots, as directed by the Engineer.
3. All reinforcement shall comply with Item 440, "Reinforcing Steel."
4. Combinations of reinforcing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



CONNECTION BOLT OR THREADED ROD DETAIL

Two (2) Threaded Rods (Or Equivalent Hex Hd. Bolts)
(w/ Two (2) PL 3/8 x 3 x 3 Plate Washers & Two (2) Std Hex Nuts)
required per Joint.

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



ISOMETRIC OF TYPICAL WELDED ASSEMBLY

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

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

SHEET 1 OF 2

Texas Department of Transportation

Design Division Standard

CONCRETE SAFETY BARRIER (F-SHAPE)

PRECAST BARRIER (TYPE 1)

CSB(1)-10

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©TxDOT December 2010	CONT	SECT	JOB	HIGHWAY
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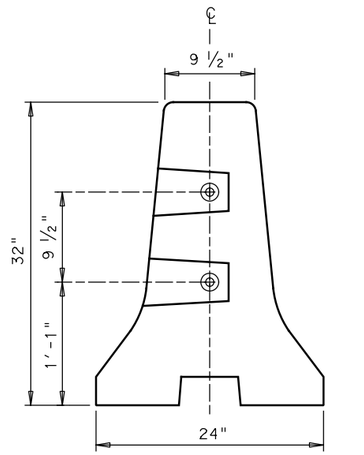
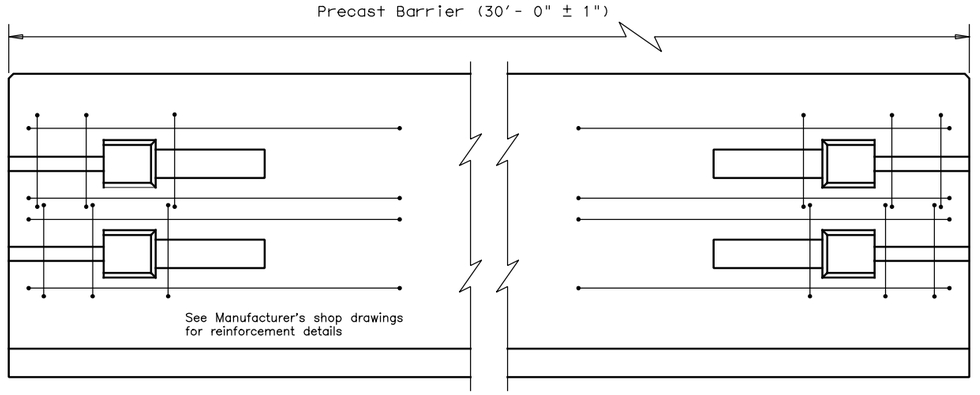
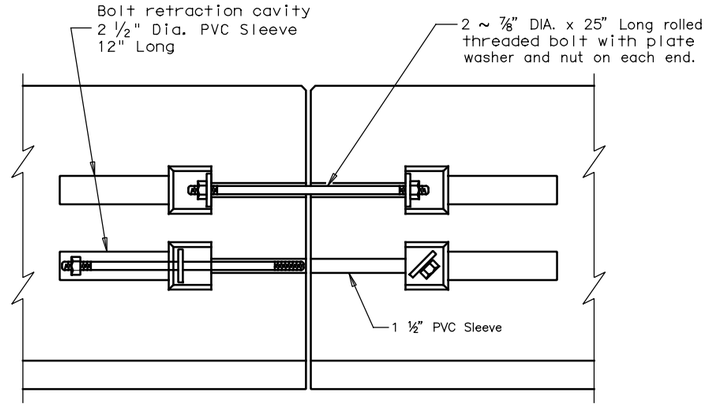


END VIEW (CSB) QUICK-BOLT
QUICK-BOLT POCKET LOCATIONS

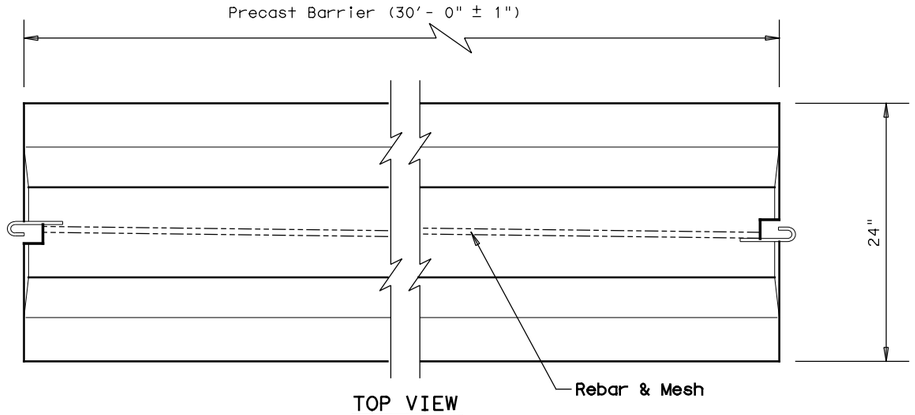


ELEVATION (CSB) QUICK-BOLT
See Manufacturer's shop drawing for additional details

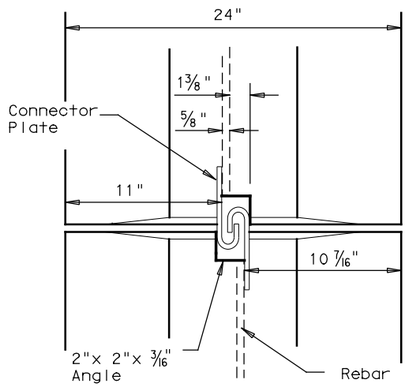


ELEVATION VIEW SHOWING JOINT CONNECTION
"QUICK-BOLT"

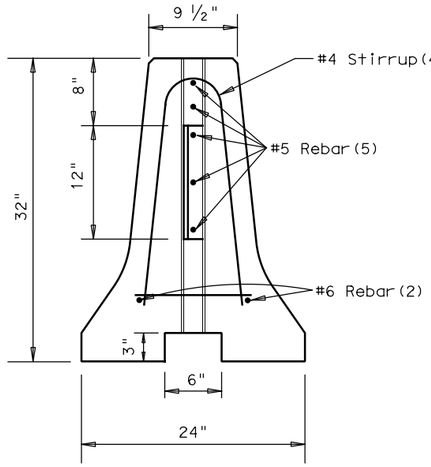
Joint Connection (Type Q)



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



VIEW FROM ABOVE
J-J HOOK CONNECTION



END VIEW
J-J HOOK CONNECTION

Joint Connection (Type J)

Proprietary Joint Connections (CSB)

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

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

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

Texas Department of Transportation | Design Division Standard

CONCRETE SAFETY BARRIER (F-SHAPE)

PRECAST BARRIER
(TYPE 1)

CSB(1)-10

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©TxDOT December 2010	CONT	SECT	JOB	HIGHWAY
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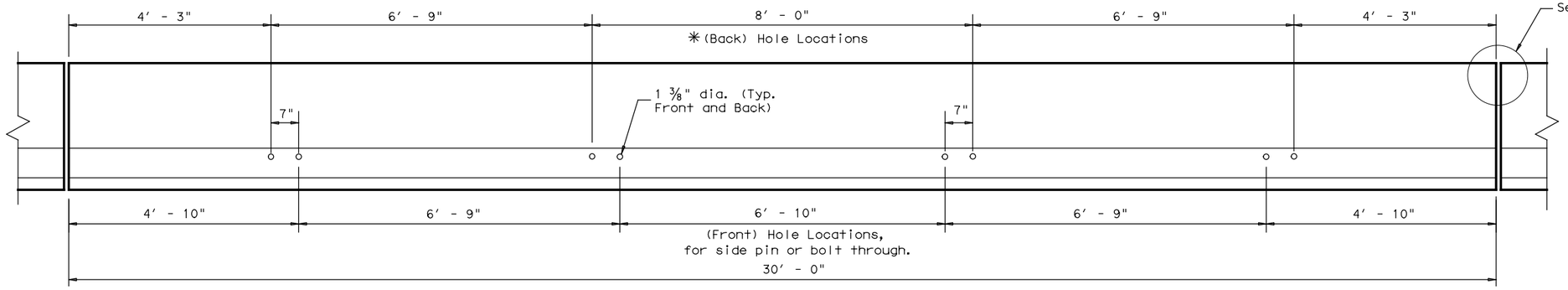
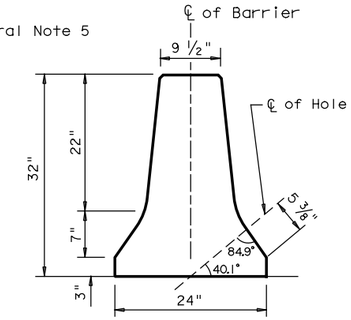
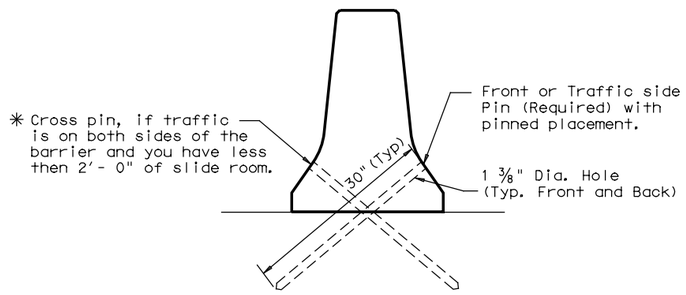


DETAIL 1

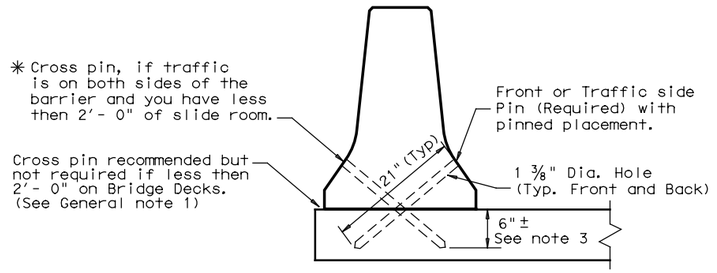


HOLE LOCATION DETAIL



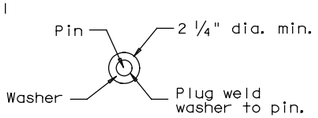
DETAIL 2

Placement on (ACP)
Asphalt Concete Pavement
or Treated Base Material
(30" Pin required)

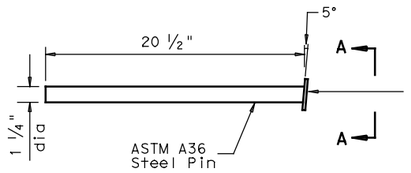


DETAIL 3

Bridge Deck or CRCP
(21" pin required)



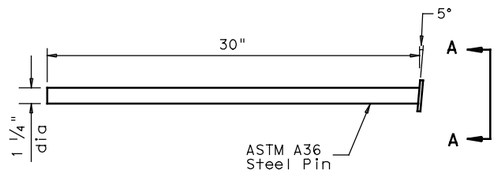
VIEW A-A



Steel washer welded to pin at 5° angle so that the washer is flush to the barrier surface. (See View A-A)

(21") PIN DETAIL

See Detail 3

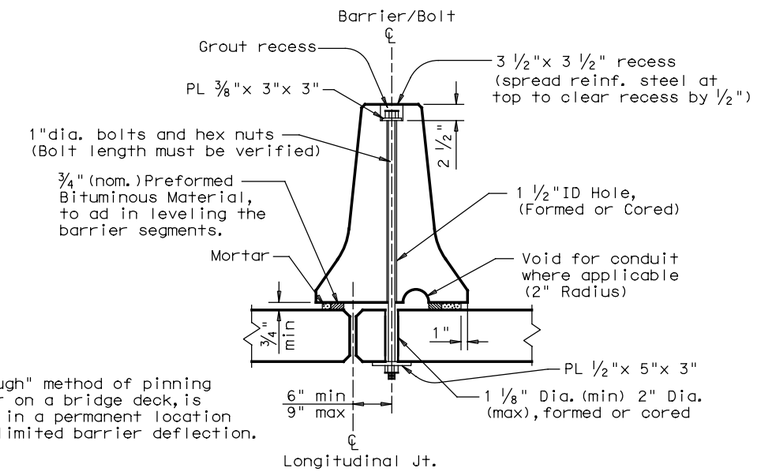


(30") PIN DETAIL

See Detail 2

CORE DRILLING EXISTING BARRIER

Core drilling existing concrete barrier is permitted. Holes shall be drilled with coring or masonry drilling type equipment. Percussion (star) drilling shall not be used. A special drill bit (to cut through existing reinforcing) will likely be required. Spalls in the concrete exceeding ½" shall be patched.



Note:
The "Bolt Through" method of pinning precast barrier on a bridge deck, is primarily used in a permanent location that requires limited barrier deflection.

PRECAST CSB (BOLT THROUGH) PLACEMENT OVER LONGITUDINAL EXPANSION JOINT

For bolt through locations, use the (Front) hole locations shown on Detail 1.

GENERAL NOTES

1. These details provide a method of laterally restraining precast concrete barrier to limit deflections under normally expected passenger vehicle impacts. These details are intended for use in work zones, primarily on bridge decks, or pavement where temporary barrier must be placed less then 2 ft. from the longitudinal edge of the deck or dropoff and parallel to the direction of travel. Other applications of these details are acceptable as directed by the Engineer.
2. Each precast concrete barrier section shall have a minimum of four or total of eight 1 ⅜" ID, holes formed or cored through the barrier. The center lines of the holes are shown in the hole location detail. If rebar is encountered, the entry point may be shifted 2" plus or minus longitudinally along the barrier. The eight holes are spaced along the length of the barrier as shown in Detail 1.
3. The drilling of the travel surface is accomplished by placing the pre-drilled barrier section on the travel surface in the desired position. Then the hole is drilled with the bit passing though the hole in the barrier. The bit is to be inserted into the hole in the barrier so that the travel surface is drilled to a point which is slightly more than the pin length.
4. Note that steel washers have been welded to the top of the steel pins to aid in the removal of the pins, when the barrier is removed.
5. See CSB(1) standard sheets for reinforcement requirements and joint connection types.
6. The forming or coring of holes in the barrier, drilling of holes in bridge deck or pavement, fabrication and materials for the 1 ¼" pins, installation of pins, and any repair to the barrier shall be considered as subsidiary to the barrier bid items.
7. The barrier and travel surface will be repaired as directed by the Engineer in accordance with Item 429, "Concrete Structure Repair."
8. Provide galvanized bolts, nuts, and plate washers. All steel pins shall be galvanized after fabrication in accordance with Item 445, "Galvanizing."
9. Weight of barrier is approx. 440 lbs per foot.

Texas Department of Transportation

Design Division Standard

CONCRETE SAFETY BARRIER (F-SHAPE)

PRECAST BARRIER
(TYPE 1)
PINNED PLACEMENT

CSB(7)-10

FILE: csb710.dgn	DN: TxDOT	CK: AM	DW: BD	CK:
©TxDOT December 2010	CONT	SECT	JOB	HIGHWAY
REVISIONS	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		58

DATE: 11/17/2023
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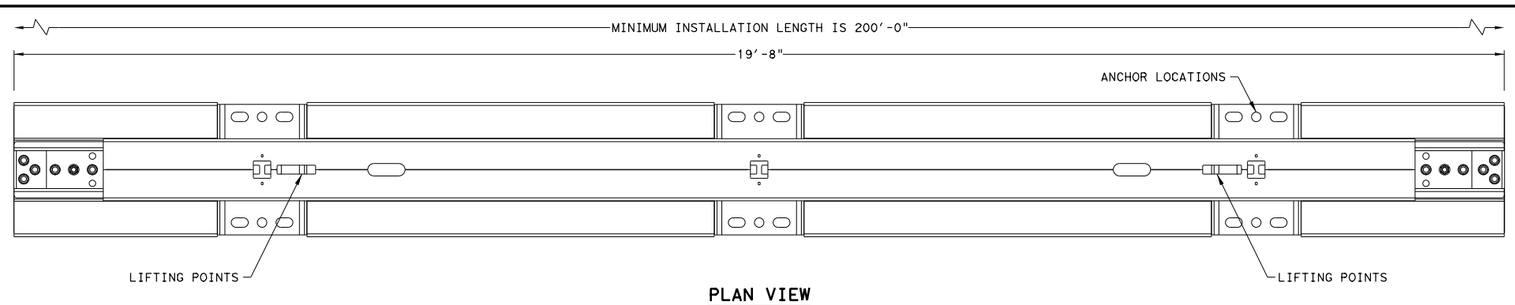
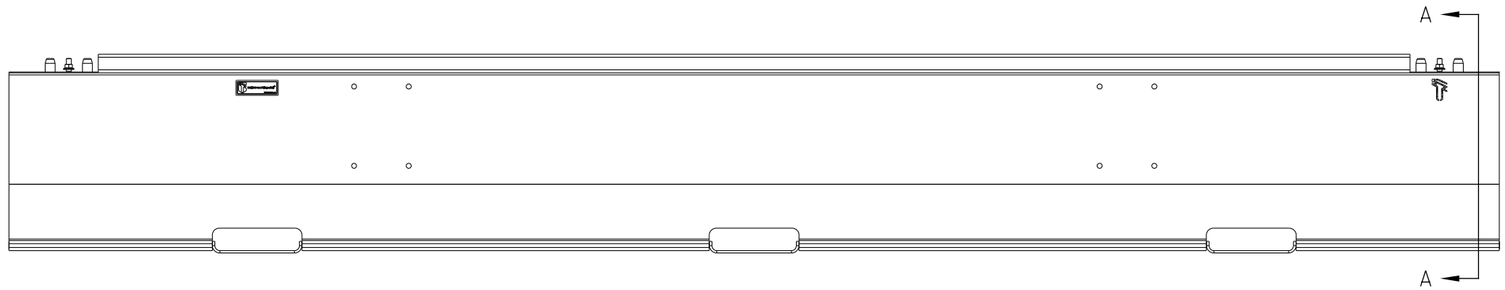
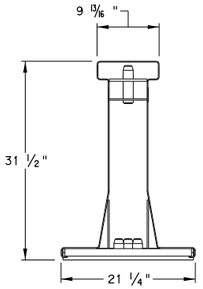


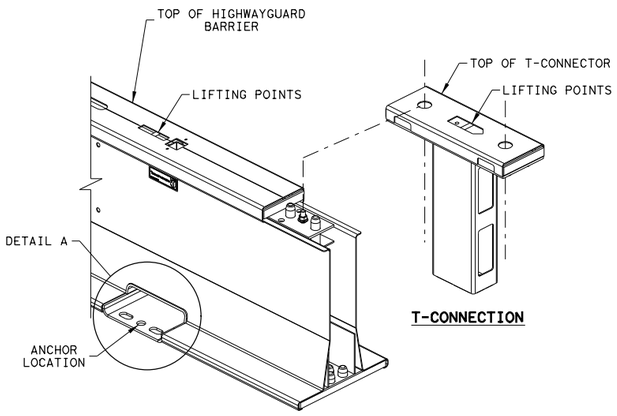
PLAN VIEW



ELEVATION VIEW
LEFT SIDE

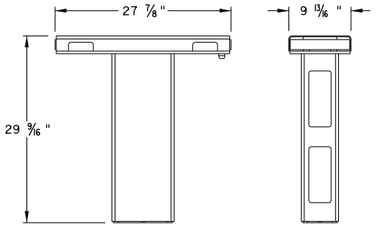


VIEW A-A



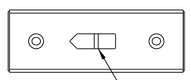
ISOMETRIC VIEW

T-CONNECTION



ELEVATION VIEW

SIDE VIEW

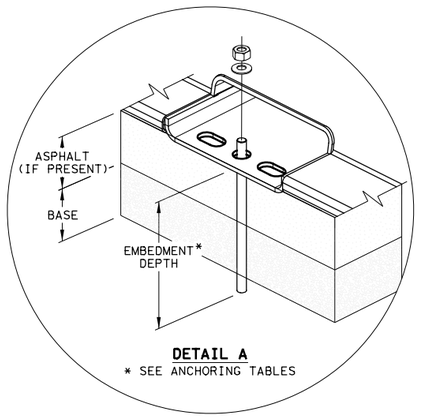


PLAN VIEW

T-CONNECTOR DETAILS

HIGHWAYGUARD BARRIER T-CONNECTOR TABLE ✳		
METHOD	DESCRIPTION	APPROX. RADIUS (FT)
1	20FT BARRIER SECTION WITH STANDARD T-CONNECTIONS AT MAXIMUM ANGLE	581
2	20FT BARRIER SECTION WITH 2.5° T-CONNECTION	460
3	20FT BARRIER SECTION WITH 5° T-CONNECTION	230
4	20FT BARRIER SECTION WITH 10° T-CONNECTION	115
5	20FT BARRIER SECTION WITH 10° BARRIER SECTION AND STANDARD T-CONNECTION	135
6	10° BARRIER SECTION WITH STANDARD T-CONNECTIONS	22
7	10° BARRIER SECTION WITH 10° T-SECTION	12

✳ SEE PRODUCT MANUAL OR CONTACT HIGHWAY CARE LTD. FOR MORE INFORMATION ON ANGLE T-CONNECTORS



DETAIL A
* SEE ANCHORING TABLES

STANDARD ANCHORING REQUIREMENTS (ASPHALT) ✳✳				
	ANCHOR OPTIONS	ANCHOR LENGTH	EMBEDMENT DEPTH (MIN.)	DRILL DIAMETER
1	1" GALV. RESIN THREADED ANCHOR (WITH 1" GALV. WASHER & NUT)	1'-1"	11 3/4"	1 1/8"
2	1 3/16" GALV. DROP IN PIN (NOT DRIVEN PIN)	1'-2 3/8"	1'-1 3/4"	1 1/4"
3	1" GALV. RESIN THREADED ANCHOR (WITH 1" GALV. WASHER & NUT)	1'-6"	1'-4 1/2"	1 1/4"
4	1" GALV. CHEMICAL THREADED "LEFTY" KELKEN REMOVABLE ANCHOR (WITH 1" GALV. WASHER & NUT)	NA	1'-0"	1 1/4"

✳✳ 2" MIN. ASPHALT DEPTH ABOVE AN APPROPRIATELY COMPACTED DGA SUBBASE AND 2" MIN. ASPHALT DEPTH ABOVE A MIN. OF 6" REINFORCED CONCRETE SUBBASE.

NOTE:
ANCHORS ARE TO BE POSITIONED A MINIMUM OF 5 3/4" AWAY FROM THE EDGE OF AN EXCAVATION FOR RESIN ANCHORS OR 7 3/4" FOR DROP IN PINS.

STANDARD ANCHORING REQUIREMENTS (CONCRETE) ✳✳✳				
	ANCHOR OPTIONS	ANCHOR LENGTH	EMBEDMENT DEPTH (MIN.)	DRILL DIAMETER
1	1" GALV. RESIN THREADED ANCHOR (WITH 1" GALV. WASHER & NUT)	9"	6"	1 1/8"
2	1" HILTI HSL-3 MECHANICAL ANCHOR	9 1/4"	✳✳✳✳	✳✳✳✳
3	1" GALV. CHEMICAL THREADED "LEFTY" KELKEN REMOVABLE ANCHOR (WITH 1" GALV. WASHER & NUT)	NA	6"	1 1/4"
4	1 3/16" GALV. DROP IN PIN (NOT DRIVEN PIN)	1'-2 3/8"	1'-1 3/4"	1 1/4"

✳✳✳ 7 7/8" MINIMUM REINFORCED CONCRETE DEPTH.
10" MINIMUM UNREINFORCED CONCRETE DEPTH.
✳✳✳✳ CONTACT: HIGHWAY CARE LTD. FOR SPECIFIC APPLICATION.

NOTE:
ANCHORS ARE TO BE POSITIONED A MINIMUM OF 11 7/8" FROM THE EDGE OF THE CONCRETE PAD.

GENERAL NOTES

1. THE SYSTEM SHOWN ON THIS DRAWING IS A PROPRIETARY BARRIER TRADED AS HIGHWAYGUARD AND HIGHWAYGUARD LDS AND HAS BEEN DESIGNED AND MANUFACTURED BY HIGHWAY CARE LTD. FOR TECHNICAL ASSISTANCE AND APPLICATION SUPPORT CONTACT AT (888) 323-6374 OR engineering@highwaycare.com
2. THE HIGHWAYGUARD HAS BEEN CRASH TESTED TO MASH AND HAS FHWA APPROVAL AS A TL-3 & TL-4 BARRIER. THE DEFLECTION TABLE OUTLINES BASIC SYSTEM PERFORMANCE AND COMPONENT ANCHORING REQUIREMENTS.
3. THIS DRAWING PACKAGE PROVIDES THE RELEVANT INFORMATION AND GENERAL GRAPHICS REQUIRED TO IDENTIFY THE COMPONENT PARTS OF HIGHWAYGUARD AND THEIR INCORPORATION AS A WHOLE SYSTEM FOR DEPARTMENTAL STANDARD APPLICATIONS.
4. INSTALLATION OF HIGHWAYGUARD BARRIER OR HIGHWAYGUARD LDS BARRIER, NORMALLY STARTS WITH AN END CAP THAT MUST BE PROTECTED WITH A SUITABLE CRASH CUSHION END TREATMENT IF EXPOSED TO ONCOMING TRAFFIC. THE CRASH CUSHION CONNECTIONS ARE NOT DETAILED WITHIN THESE DRAWINGS, PLEASE CONTACT HIGHWAY CARE LTD. FOR MORE DETAILS.
5. THE FULL HEIGHT OF HIGHWAYGUARD BARRIER 20FT SEGMENT IS 31.5". EACH SEGMENT IS LOWERED INTO POSITION WITH THE T-CONNECTION ALREADY ATTACHED TO THE END OF THE BARRIER THAT IS BEING JOINED TO THE RUN OF BARRIER. ENSURE ORIENTATION OF T-CONNECTOR ALLOWS ALIGNMENT PINS TO BE LOWERED ONTO NEXT SECTION. THE T-CONNECTOR ALLOWS THE BARRIER FOR ADJUSTMENTS, QUICK INSTALLATION, QUICK REMOVAL AND REPLACEMENT OF DAMAGED BARRIERS. MINIMUM INSTALLATION LENGTH OF HIGHWAYGUARD BARRIER IS 200'-0".
6. THERE ARE SEVERAL METHODS OF ACHIEVING RADIUS IN A LENGTH OF HIGHWAYGUARD BARRIER. RADIUS CAN BE ACHIEVED USING VARIOUS T-CONNECTORS AND THUS ALLOWING THE HIGHWAYGUARD BARRIER TO FOLLOW THE DESIRED CURVATURE IN THE INSTALLATION, THESE TYPE OF T-CONNECTORS ARE, 2.5°, 5° AND 10° ANGLES. FOR FURTHER INFORMATION AND ADVICE CONTACT HIGHWAY CARE LTD.
7. USING HIGHWAYGUARD BARRIER OR HIGHWAYGUARD BARRIER LDS ON BRIDGE STRUCTURES, POSSIBLE ANCHORING SHOULD TAKE PLACE OFF BRIDGE DECKS. ANY ANCHORING ON BRIDGE DECKS NEEDS TO BE AGREED IN ADVANCE WITH THE TECHNICAL EXPERT RESPONSIBLE FOR THE BRIDGE TO ENSURE IT IS NOT DAMAGED. IF ANCHORING EITHER SIDE OF A BRIDGE DECK EXPANSION JOINT, THEN THIS MOVEMENT MUST BE MIRRORED IN THE BARRIER. FOR FURTHER INFORMATION AND ADVICE CONTACT HIGHWAY CARE LTD.
8. THE HIGHWAYGUARD BARRIER SECTIONS CAN BE EQUIPPED WITH OPTIONAL WHEELSETS THAT ALLOW THE BARRIERS TO BE MANEUVERED WITHOUT LIFTING THE MACHINERY/ EQUIPMENT SUCH AS INSTALLING IN TUNNELS OR AREAS WITH OVERHEAD RESTRICTIONS. THE WHEELSETS CAN BE RAISED AND LOWERED FROM THE TOP OF THE BARRIER USING A MANUAL WRENCH AND 1" SOCKET.
9. THE HIGHWAYGUARD BARRIER HAS BEEN MASH TESTED, USING 1 3/16" DIA. DROP IN PIN ANCHORS AND EMBEDDED 1'-6" INTO ASPHALT. ALTERNATIVE GROUND EMBEDMENT CONDITIONS MAY BE ACCEPTABLE BUT MIGHT REQUIRE DIFFERENT ANCHOR SOLUTIONS, PLEASE CONTACT HIGHWAY CARE LTD. FOR FURTHER INFORMATION.
10. ALL COMPONENTS ARE FULLY GALVANIZED.
11. HIGHWAYGUARD BARRIER SYSTEMS SHALL BE ASSEMBLED AND INSTALLED IN ACCORDANCE WITH THE MANUFACTURERS DETAILED DRAWINGS, PROCEDURES AND SPECIFICATIONS. FOR ANY INSTALLATIONS OUTSIDE OF THE SCOPE OF THESE DRAWINGS, PLEASE CONTACT HIGHWAY CARE LTD. FOR DETAILS.
12. FOR ANCHORING LAYOUTS FOR HIGHWAYGUARD AND HIGHWAYGUARD LDS, PLEASE SEE MANUFACTURER'S PRODUCT MANUAL OR CONTACT HIGHWAY CAR LTD. FOR INFORMATION.

HIGHWAYGUARD DEFLECTION TABLE		
	STANDARD SYSTEM	MINIMUM DEFLECTION SYSTEMS (LDS)
DESCRIPTION	ONLY ANCHORED AT THE FIRST AND ENDS OF THE BARRIER LENGTH	ANCHORS ARE STAGGERED EVERY 39'-4 1/2"
DEFLECTION AT MASH TL-3	64"	2'-3"
DEFLECTION AT MASH TL-4	71"	2'-7"

NOTE:
SEE PRODUCT MANUAL OR CONTACT HIGHWAY CARE LTD. FOR MORE INFORMATION ON ANCHOR REQUIREMENTS FOR THE LENGTH OF BARRIER.

Texas Department of Transportation

Design Division Standard

HIGHWAYGUARD SYSTEM
STEEL BARRIER
MASH TL-3 & TL-4
HIGHWAYGUARD-21

FILE: highwayguard21.dgn	DN: TXDOT	CK: KM	DW: SS	CK: XX
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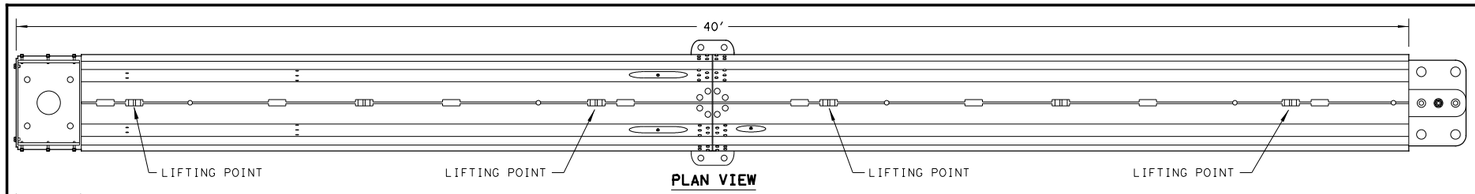
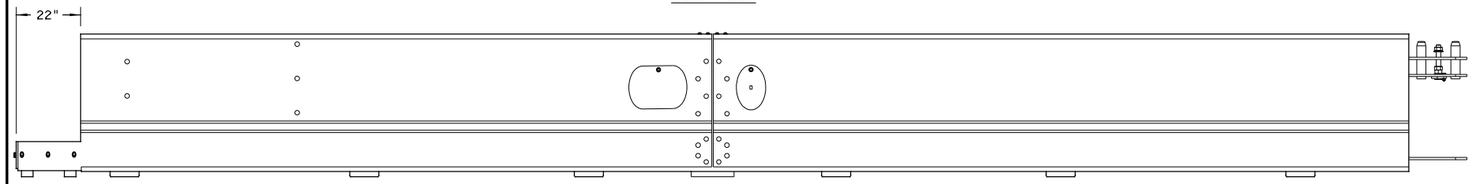
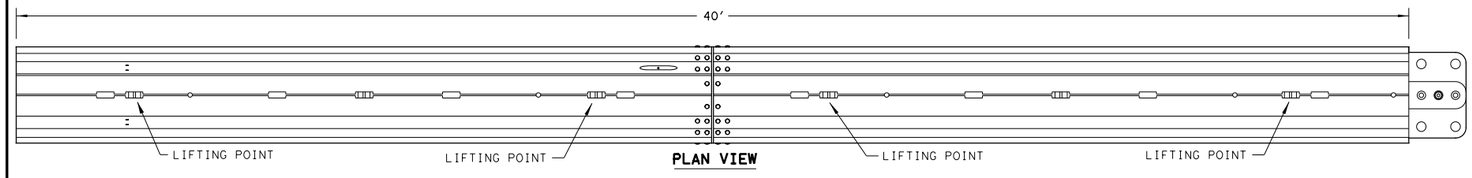


PLAN VIEW

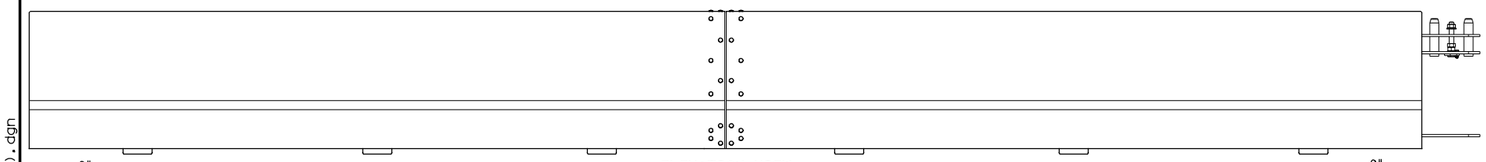


ELEVATION VIEW

BARRIERGUARD END SECTION - 40 FT. MALE OR FEMALE END SECTION

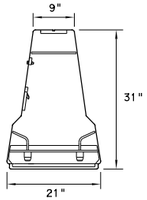


PLAN VIEW

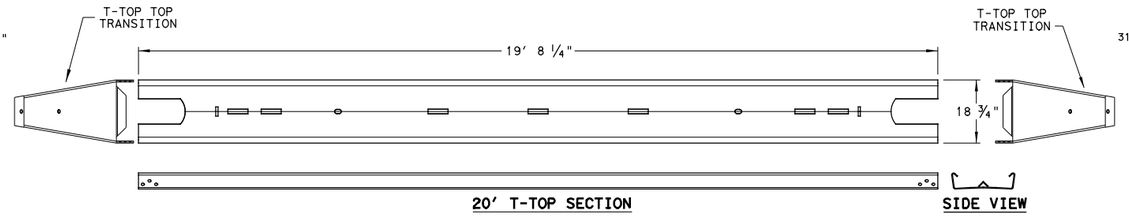


ELEVATION VIEW

BARRIERGUARD STANDARD SECTION - 40 FT.

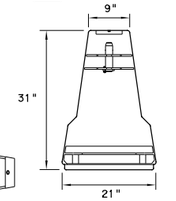


FEMALE END CROSS SECTION

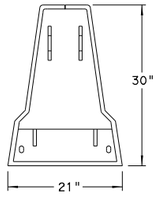


20' T-TOP SECTION

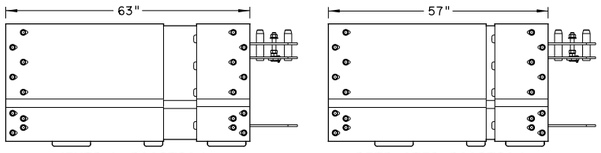
SIDE VIEW



MALE END CROSS SECTION



FULL HEIGHT TERMINAL COVER



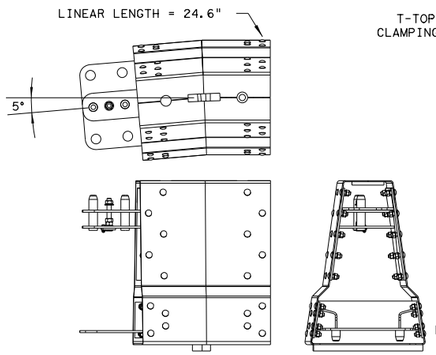
NEUTRAL POSITION

RETRACTED POSITION

EXTENDED POSITION

SIDE VIEW

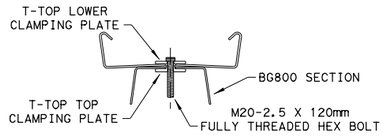
VARIABLE LENGTH BARRIER



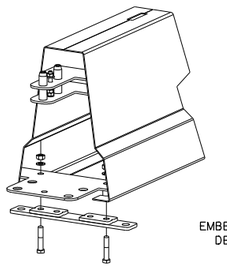
5° (LH) LEFT HAND ANGLE SECTION

NOTE: ADDITIONAL ANGLE SECTION AVAILABLE

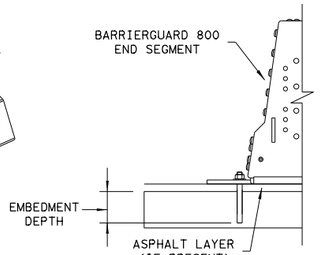
5° (RH) RIGHT HAND ANGLE SECTION
10° (LH) LEFT HAND ANGLE SECTION
10° (RH) RIGHT HAND ANGLE SECTION



T-TOP MOUNTING DETAIL



INTERMEDIATE ANCHOR AT QUICKLINK



SEE ANCHORING TABLE

GENERAL NOTES

1. THE SYSTEM SHOWN ON THIS DRAWING IS A PROPRIETARY BARRIER TRADED AS BARRIERGUARD 800 AND BARRIERGUARD 800 MDS AND HAS BEEN DESIGNED AND MANUFACTURED BY LAURA METAAL ROAD SAFETY INC. FOR TECHNICAL ASSISTANCE AND APPLICATION SUPPORT CONTACT LEE STUART AT LAURA METAAL ROAD SAFETY INC. AT (702) 664-2009 OR lstuart.lauraметaal@outlook.com
2. THE BARRIERGUARD 800 SYSTEM HAS BEEN CRASH TESTED TO MASH AND HAS FHWA APPROVAL AS A TL-3 BARRIER. THE DEFLECTION TABLE OUTLINES BASIC SYSTEM PERFORMANCE AND COMPONENT ANCHORING REQUIREMENTS.
3. THIS DRAWING PACKAGE PROVIDES THE RELEVANT INFORMATION AND GENERAL GRAPHICS REQUIRED TO IDENTIFY THE COMPONENT PARTS OF BARRIERGUARD 800 AND THEIR INCORPORATION AS A WHOLE SYSTEM FOR DEPARTMENTAL STANDARD APPLICATIONS.
4. BARRIERGUARD 800 REQUIRES ANCHORING (PINNING) AT EACH END OF THE INSTALLED LENGTH. (INTERMEDIATE ANCHORS CAN BE USED TO REDUCE DEFLECTION).
5. INSTALLATION OF BARRIERGUARD 800 OR BARRIERGUARD 800 MDS, NORMALLY STARTS WITH A MALE TERMINAL SECTION AND IS FINISHED WITH A FEMALE TERMINAL SECTION. STANDARD SECTIONS ARE USED BETWEEN THE TERMINAL SECTIONS TO OBTAIN THE REQUIRED LENGTH OF POSITIVE BARRIER PROTECTION.
6. THE FULL HEIGHT TERMINAL (FHT) SECTIONS MAY BE CAPPED WITH A FHT COVER, HOWEVER IF EXPOSED TO ON-COMING TRAFFIC THE END SHOULD BE PROTECTED WITH A SUITABLE CRASH CUSHION. THE BARRIERGUARD 800 RANGE IS COMPATIBLE WITH MOST COMMONLY USED CRASH CUSHION END TREATMENTS. FOR DETAILS OF BARRIERGUARD 800 CRASH CUSHION CONNECTIONS THAT ARE NOT DETAILED WITHIN THESE DRAWINGS, PLEASE CONTACT LAURA METAAL ROAD SAFETY INC. FOR MORE DETAILS. THE FULL HEIGHT TERMINAL COVER IS SUITABLE FOR THE "DOWN STREAM" END OF A SYSTEM THAT DOES NOT HAVE EXPOSURE TO ON-COMING TRAFFIC.
7. WHEN INSTALLING THE MINIMUM DEFLECTION SYSTEM (MDS),THE SYSTEM CAN BE INSTALLED WITH ADDITIONAL INTERMEDIATE ANCHORS ALONG THE LENGTH OF THE BARRIER RUN AT INTERVALS SHOWN IN THE DEFLECTION TABLE. EACH BARRIER RUN CAN BE MADE UP OF ANY MIXTURE OF THE SYSTEMS BY THE INTRODUCTION OF INTERMEDIATE ANCHORS AND/OR T-TOP AS REQUIRED.
8. THERE ARE SEVERAL METHODS OF ACHIEVING RADIUS IN A LENGTH OF BARRIERGUARD 800. RADIUS CAN BE ACHIEVED USING VARIOUS METHODS AND THUS ALLOWING THE BARRIERGUARD TO FOLLOW THE DESIRED CURVATURE IN THE INSTALLATION, THESE METHODS ARE, THE MOVEMENT IN THE QUICKLINK, ADJUSTABLE 20FT. SECTIONS OR SHORT ANGLED SECTIONS WHICH ALLOW A RADIUS AS LOW AS 12FT. FOR FURTHER INFORMATION AND ADVICE CONTACT LAURA METAAL ROAD SAFETY INC.
9. A BARRIERGUARD 800 VARIABLE LENGTH BARRIER (VLB) SECTION SHOULD BE USED WHEN BARRIERGUARD 800 OR BARRIERGUARD 800 MDS IS ANCHORED ACROSS A BRIDGE EXPANSION JOINT. IF T-TOP IS TO BE USED IN CONJUNCTION WITH THE VLB, THE T-TOP SHOULD BE USED FOR MINIMUM 40FT ON EITHER SIDE OF THE VLB AND TERMINATED WITH TRANSITIONS. THE VLB SECTION PROVIDES APPROXIMATELY 7in OF EXTENSION AND 7in OF CONTRACTION. MULTIPLE VLB'S CAN BE LINKED TOGETHER TO PROVIDE MORE EXPANSION OR CONTRACTION. THE VLB'S SHOULD BE PLACED IN THE VICINITY OF THE EXPANSION JOINT. THE VLB DOES NOT NEED TO BE PLACED DIRECTLY OVER THE EXPANSION JOINT BUT MUST BE BETWEEN THE NEAREST ANCHORS ON EACH SIDE OF THE JOINT. IT IS RECOMMENDED THAT THE VLB IS PLACED WITHIN 40FT OF THE JOINT.
10. THE T-TOP CAN BE INSTALLED EITHER BEFORE OR AFTER THE BARRIERGUARD 800 HAS BEEN FULLY ASSEMBLED AND ANCHORED IN PLACE. T-TOP IS REQUIRED WHEN THE BARRIERGUARD 800 IS USED AS A MDS, ANCHORED EVERY 20FT, GATE SECTIONS AND VARIABLE LENGTH BARRIERS. THE T-TOP SHOULD EXTEND 40FT ON EITHER SIDE OF THESE CONDITIONS AND BE TERMINATED WITH TRANSITIONS.
11. THE BARRIERGUARD 800 RANGE HAS BEEN DESIGNED TO BE USED ON AND HAS BEEN TESTED ANCHORED ON ASPHALT, CONCRETE AND COMPACTED SUBBASE. CONTACT LAURA METAAL ROAD SAFETY INC. FOR FURTHER INFORMATION.
12. BARRIERGUARD 800 COMPONENTS ARE MANUFACTURED IN SI [METRIC] UNITS. ENGLISH UNITS SHOWN ARE APPROXIMATE. ALL COMPONENTS ARE FULLY GALVANIZED.
13. BARRIERGUARD 800 SYSTEMS SHALL BE ASSEMBLED AND INSTALLED IN ACCORDANCE WITH THE MANUFACTURERS DETAILED DRAWINGS, PROCEDURES AND SPECIFICATIONS. FOR ANY INSTALATIONS OUTSIDE OF THE SCOPE OF THESE DRAWINGS PLEASE CONTACT LAURA METAAL ROAD SAFETY INC. FOR DETAILS.

BARRIERGUARD 800 DEFLECTION TABLE

	STANDARD SYSTEM	MINIMUM DEFLECTION SYSTEMS (MDS)
DESCRIPTION	ONLY ANCHORED AT THE EXTREME ENDS OF THE BARRIER LENGTH	ANCHORED EVERY 20 FT.
DEFLECTION AT MASH TL-3	5'-6"	18 ½"
T-TOP REQUIREMENTS	NONE REQUIRED	REQUIRED FOR MDS SECTIONS

STANDARD ANCHORING REQUIREMENTS (TABLE)

	RESIN STUD ANCHORS			DRIVEN ANCHORS		Hilti HSL-3 SHALLOW MECHANICAL
	CONCRETE *	UNREINFORCED CONCRETE *	ASPHALT	ASPHALT	SUBBASE/SOIL	CONCRETE
ANCHOR DIAMETER	1 in.	1 in.	1 in.	1-3/16 in.	5-1/2 in.	* *
EMBEDMENT DEPTH	6 in.	8 in.	16 in.	16 in.	32 in.	* *
DRILL DIAMETER	1-1/8 in.	1-1/8 in.	1-1/8 in.	1-3/16 in.	DRIVEN	* *
PULL OUT CAPACITY (MIN)	17500 lb	17500 lb	N/A	N/A	N/A	* *
SHEAR CAPACITY (MIN)	25000 lb	25000 lb	N/A	N/A	N/A	* *

* ALTERNATIVE ANCHORS INCLUDING MECHANICAL ANCHORS FOR CONCRETE MAYBE USED IF THEY MEET THE STRENGTH REQUIREMENTS LISTED, DETAILS WILL BE MANUFACTURER SPECIFIC.

* * CONTACT: LAURA METAAL ROAD SAFETY INC. FOR SPECIFIC APPLICATION.

Texas Department of Transportation

Design Division Standard

BARRIERGUARD 800 SYSTEM
STEEL BARRIER
MASH TL-3
BARRIERGUARD-19

FILE: barrierguard19.dgn	DN: TxDOT	CK: KM	DW: VP	CK:	
© TxDOT: JULY 2019	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0805	04	033	RM 3237	
	DIST	COUNTY		SHEET NO.	
	AUS	HAYS		60	

DATE: 11/17/2023
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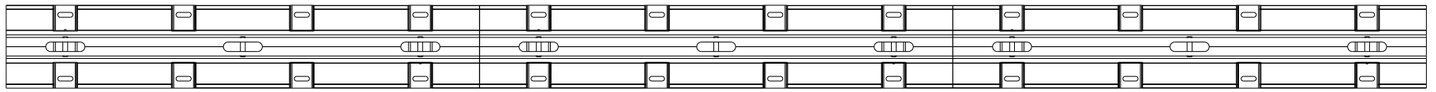
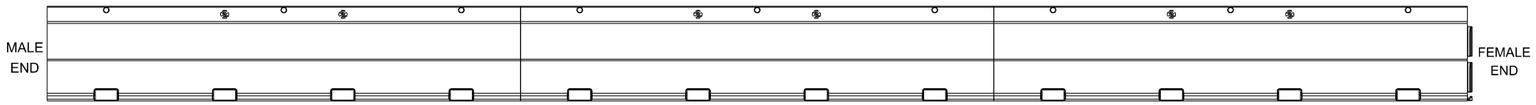
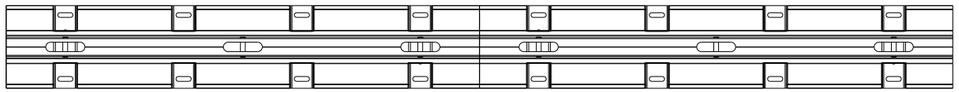


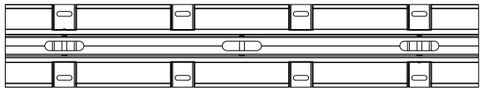
PLAN VIEW



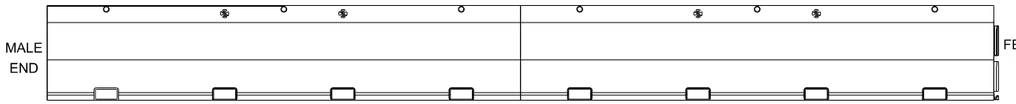
ELEVATION VIEW
ZONEGUARD STANDARD UNIT x 50'–0"



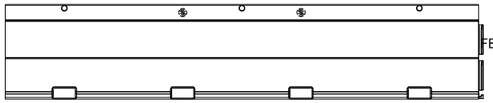
PLAN VIEW



PLAN VIEW

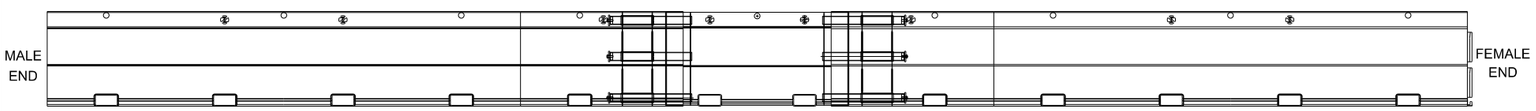


ELEVATION VIEW
ZONEGUARD STANDARD UNIT x 33'–4"

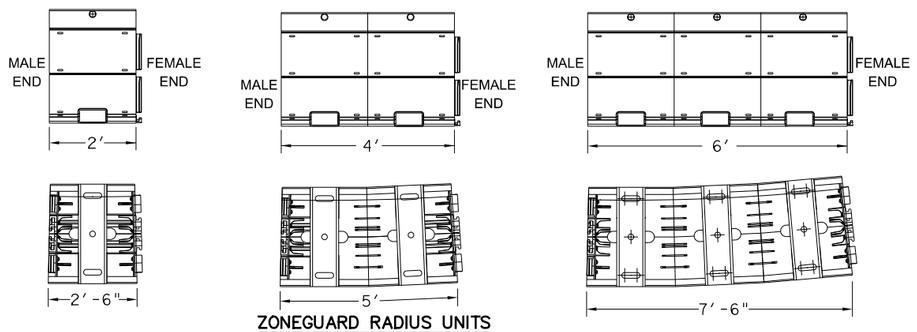


ELEVATION VIEW
ZONEGUARD STANDARD UNIT x 16'–8"

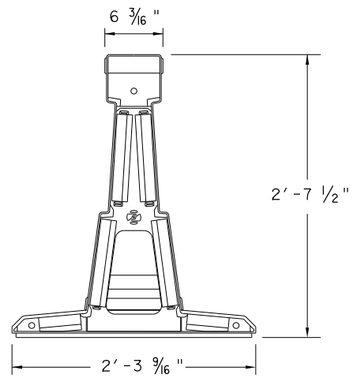
PLAN VIEW



ELEVATION VIEW
ZONEGUARD EXPANSION UNIT x 46'–5½"
(SEE GENERAL NOTE 5)



ZONEGUARD RADIUS UNITS



ZONEGUARD TYPICAL SECTION

GENERAL NOTES

1. FOR TECHNICAL AND APPLICATION SUPPORT PLEASE CONTACT HILL & SMITH INC. AT 614-340-6294.
2. ZONEGUARD HAS BEEN ACCEPTED BY FHWA AS A MASH TL-3 LONGITUDINAL BARRIER.
3. STANDARD INSTALLATIONS REQUIRE ANCHORING AT EACH END OF THE RUN. MINIMUM DEFLECTION INSTALLATIONS REQUIRE ANCHORING AT 33'-4 CENTERS. NO MODIFICATIONS ARE NECESSARY OTHER THAN INCREASED ANCHORING.
4. 50-0' UNITS CAN BE USED TO ACHIEVE DOWN TO AN 800' RADIUS CURVE. 16'-8" UNITS CAN BE USED TO ACHIEVE CURVES DOWN TO 250' RADIUS. SPECIAL SHORT UNITS (SHOWN) IN 2.5 DEGREE INCREMENTS CAN BE USED TO ACHIEVE DIRECTION CHANGES OR AT A FIXED RADIUS OF 47'-0".
5. HILL & SMITH OFFERS AN EXPANSION UNIT THAT CAN BE USED ACROSS A BRIDGE EXPANSION JOINT OR TO ACCOMMODATE THERMAL EXPANSION. THE UNIT IS ANCHORED IN THE MIDDLE, AND ADJUSTED ACCORDING TO THE TEMPERATURE AT THE TIME OF INSTALLATION. THE EXPANSION JOINT CAN BE USED WITH ENGINEER APPROVAL. THE EXPANSION UNIT HAS NOT BEEN ASSESSED TO MASH CRITERIA.
6. ANCHOR PINS ARE 1 ¼" DIAMETER. LENGTH IS 1'-8" FOR ASPHALT AND 1'-0" FOR CONCRETE. SEE ANCHORING TABLE FOR ADDITIONAL DETAILS.

	STANDARD INSTALLATION	MINIMUM DEFLECTION INSTALLATION CONCRETE	MINIMUM DEFLECTION INSTALLATION ASPHALT
	FOUR ANCHORS AT END OF THE RUN	TWO ANCHORS (ONE EACH SIDE) EVERY 33'-4"	TWO ANCHORS (ONE EACH SIDE) EVERY 33'-4"
MASH TL-3 DEFLECTION (2270 KG TRUCK @ 25° & 100 KM/HR)	6'-10"	5"	2'-0"

EXPECTED DEFLECTION TABLE

DESCRIPTION	ASPHALT	CONCRETE
1 1/4" PIN ANCHOR	1'–8" LONG, MINIMUM ASPHALT COVER OF 3"	1'–0" LONG, MINIMUM CONCRETE COVER OF 6"
1 1/4" ALL THREAD ANCHOR	-	1'–0" LONG, MINIMUM EMBEDMENT OF 6"

ANCHORING TABLE

ALTERNATE ANCHORING METHODS CERTIFIED BY HILL & SMITH, INC. ARE AVAILABLE PER FHWA APPROVAL LETTER.

Texas Department of Transportation

Design Division Standard

ZONEGUARD SYSTEM
STEEL BARRIER
MASH TL-3
ZONEGUARD-19

FILE: zoneguard19	DN: TxDOT	CK: KM	DW: VP	CK: CGL	
© TxDOT: JULY 2019	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0805	04	033	RM 3237	
	DIST	COUNTY		SHEET NO.	
	AUS	HAYS		61	

DATE: 11/17/2023
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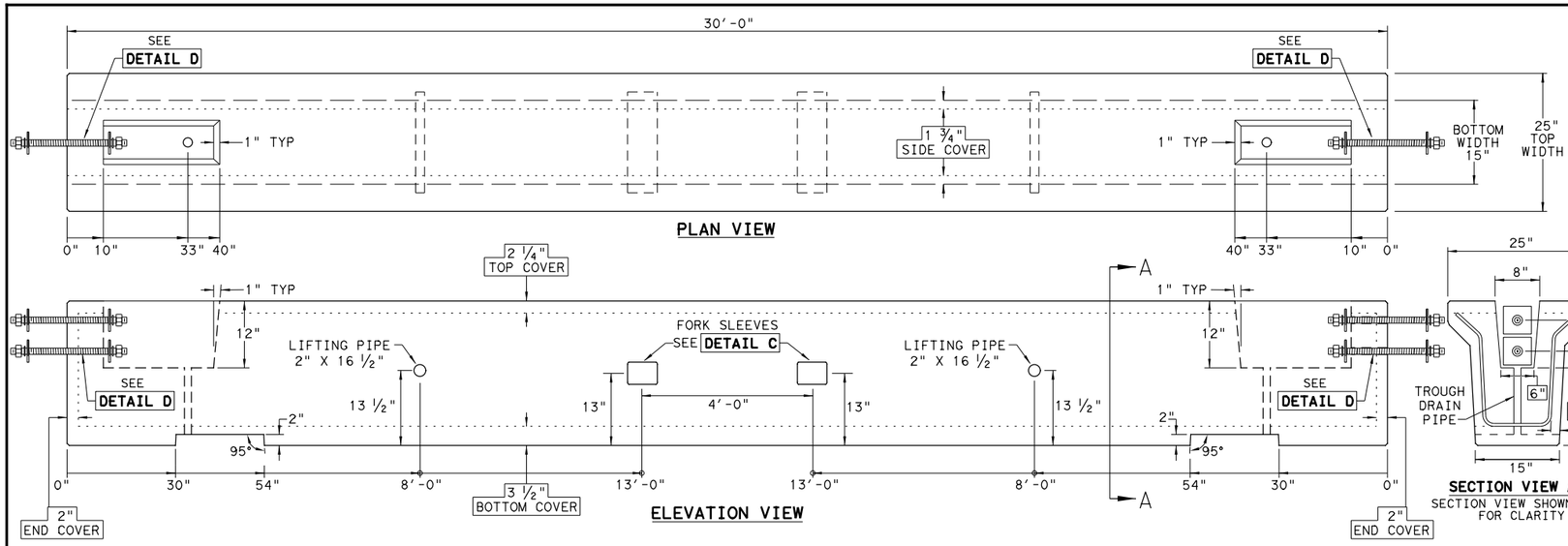
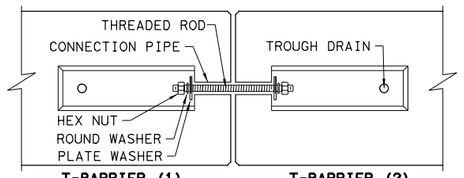


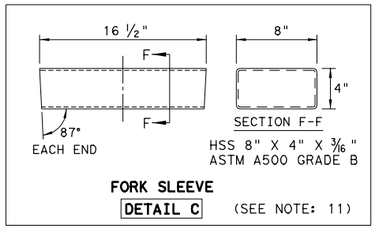
GENERAL NOTES

1. THE TL-3 LOW PROFILE CONCRETE BARRIER IS APPROVED FOR USE WITHIN TEMPORARY WORK ZONE LOCATIONS FOR HIGH-SPEED CONDITIONS.
2. PRECAST LOW PROFILE T-BARRIER (LPTB), LENGTH SHALL BE 30 FT.
3. CONCRETE SHALL BE CLASS H WITH A MINIMUM COMPRESSIVE STRENGTH OF 3,600 PSI. CHAMFER EXPOSED EDGES ¾" AS SHOWN ON DETAIL.
4. JOINT CONNECTION HARDWARE SHALL BE IN ACCORDANCE WITH ITEM 449, "ANCHOR BOLTS." AND IS CONSIDERED SUBSIDIARY.
5. ALL STEEL HARDWARE USED FOR JOINT CONNECTION SHALL BE IN ACCORDANCE WITH ITEM 445, GALVANIZING.
6. PVC PIPE REQUIRED FOR THE JOINT CONNECTION, LIFTING PIPES AND TROUGH DRAINAGE PIPES SHALL BE IN ACCORDANCE WITH ITEM 481, AND MEET THE REQUIREMENTS OF ASTM D1785.
7. WELDED WIRE CAGE MAY BE CUT OR BENT, IF NECESSARY, BUT MUST BE APPROVED BY THE ENGINEER.
8. DEFORMED WELDED WIRE SHALL CONFORM TO ASTM A1064.
9. WHERE USED, REBAR REINFORCEMENT SHALL BE GRADE 60 AND CONFORM TO ASTM A615.
10. THE BARRIER SYSTEM IS DESIGNED TO HAVE APPROXIMATELY 25" OF DYNAMIC OR PERMANENT DEFLECTION AS IT CONTAINS AND REDIRECTS A TL-3 ERRANT PICKUP TRUCK. A MINIMUM LENGTH OF 180 FT. OF BARRIER RUN IS RECOMMENDED; SHORTER RUNS MAY BE CONSIDERED BUT DEFLECTIONS WOULD BE GREATER.
11. THE FORK SLEEVES ARE OPTIONAL. ADDITIONALLY, THE FORK SLEEVES MAY BE MADE OF PVC.
12. THE TL-3 LOW PROFILE BARRIER SHOULD NEVER BE ANCHORED IN ANY WAY.
13.

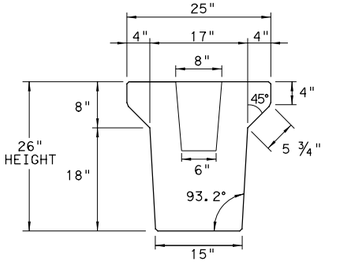
CONNECTION ROD HARDWARE (SEE DETAIL D)		
QTY	PART NAME	SIZE
2	THREADED ROD (ASTM A193 GR.B7)	⅞" X (26" LENGTH)
4	ROUND WASHER (ASTM F436)	⅞"
4	PLATE WASHER (A36)	5" X 5" X ½" THICK WITH 1" DIA. HOLE
4	HEAVY HEX NUT (ASTM A563)	⅞"
2	TROUGH DRAIN	1 ½" X 12" PVC PIPE
4	CONNECTION PIPE	1 ½" X 10" PVC PIPE



DETAIL D



FORK SLEEVE
DETAIL C (SEE NOTE: 11)



END VIEW
BARRIER SLOPE 1:18

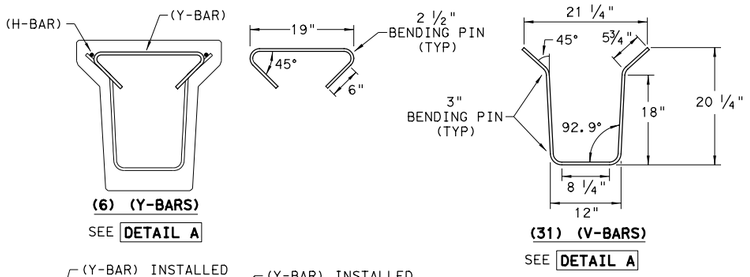
WWR & REBAR INFORMATION TABLE			
QTY	WWR - BAR	SIZE	DETAIL
31	WWR V	#4 - WWR D20	DETAIL A
6	WWR H	#5 - WWR D31	
6	BAR Y	#4	
2	BAR U1	#6 X 20" X 60"	DETAIL B
2	BAR U2	#6 X 13" X 60"	
2	BAR U3	#6 X 12" X 60"	
2	BAR U4	#6 X 11" X 60"	

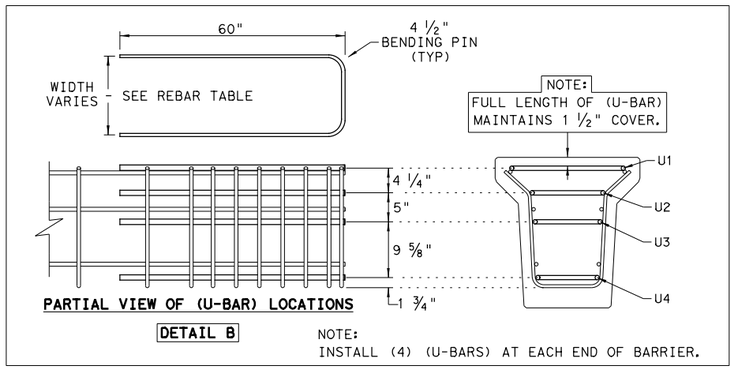
RIGID PVC PIPE (SCH 40) TABLE		
QTY	PART NAME	SIZE
4	CONNECTION ROD PIPE	1 ½" X 10" LENGTH
2	TROUGH DRAIN	1 ½" X 12" LENGTH
2	LIFTING PIPE	2" X 16 ½" LENGTH

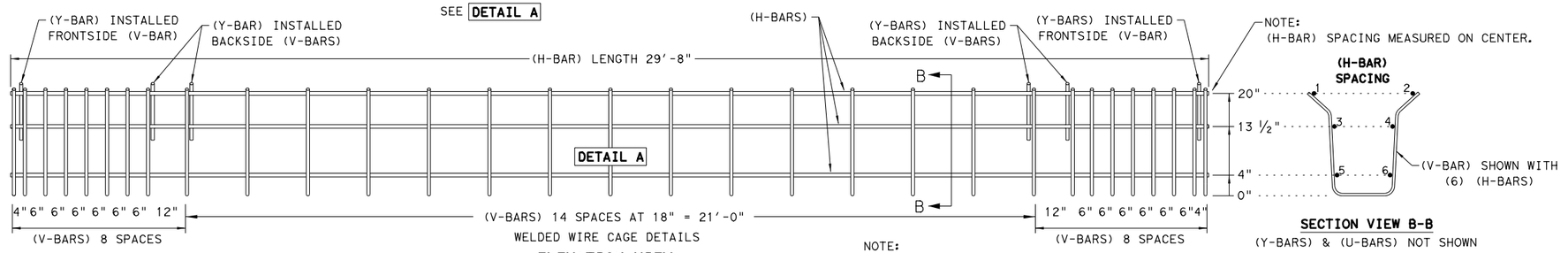
COVER DIMENSIONS TABLE	
BARRIER TOP	2 ¼"
BARRIER TOP FULL LENGTH U-BAR	1 ½"
BARRIER BOTTOM	3 ½"
BARRIER SIDE	1 ¾"
BARRIER END	2"

WORKING WIDTH IS APPOXIMATELY 51 INCHES.

THE WEIGHT OF ONE T-SHAPE 30 FT. PRECAST BARRIER IS APPROX. 7.4 TONS OR 500 LBS PER FOOT.







Texas Department of Transportation

Design Division Standard

LOW PROFILE T-BARRIER PRECAST CONCRETE MASH - TL-3 LPTB-22

FILE: lptb21.dgn	DN: TxDOT	CK: KM	DW: CES	CK: CGL
©TxDOT: JULY 2022	CONT	SECT	JOB	HIGHWAY
REVISIONS	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		62

LOC NO.	TCP PHASE	PLAN SHEET NUMBER	LOCATION	STA	TEST LEVEL	DIRECTION OF TRAFFIC (UNI/BI)	FOUNDATION PAD		BACKUP SUPPORT			AVAILABLE SITE LENGTH	CRASH CUSHION									
															MOVE / RESET		L	L	R	R	S	S
							PROPOSED MATERIAL	PROPOSED THICKNESS	DESCRIPTION	WIDTH	HEIGHT		INSTALL	REMOVE	MOVE/ RESET	FROM LOC.#	N	W	N	W	N	W
1	2	28	RM 3237	117+33	TL-3	UNI			SSCB	24"	42"	>50'	X								X	
2	2	28	RM 3237	118+21	TL-3	UNI			SSCB	24"	42"	>50'	X								X	
3	2	28	RM 3237	120+61	TL-3	UNI			SSCB	24"	42"	>50'	X								X	
4	2	28	RM 3237	120+63	TL-3	UNI			SSCB	24"	42"	>50'	X								X	
5	2	29	RM 3237	121+72	TL-3	UNI			SSCB	24"	42"	>50'	X								X	
6	2	29	RM 3237	124+75	TL-3	UNI			SSCB	24"	42"	>50'	X								X	
7	2	29	RM 3237	125+16	TL-3	UNI			SSCB	24"	42"	>50'	X								X	
8	2	29	RM 3237	126+45	TL-3	UNI			SSCB	24"	42"	>50'	X								X	
9	2	29	RM 3237	128+29	TL-3	UNI			SSCB	24"	42"	>50'	X								X	
10	2	30	RM 3237	130+30	TL-3	UNI			SSCB	24"	42"	>50'	X								X	
11	3	31	RM 3237	118+15	TL-3	UNI			SSCB	24"	42"	>50'			X	1					X	
12	3	31	RM 3237	121+95	TL-3	UNI			SSCB	24"	42"	>50'			X	5					X	
13	3	32	RM 3237	126+15	TL-3	UNI			SSCB	24"	42"	>50'			X	8					X	
14	3	32	RM 3237	129+95	TL-3	UNI			SSCB	24"	42"	>50'			X	10					X	
												TOTALS										

LEGEND:

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

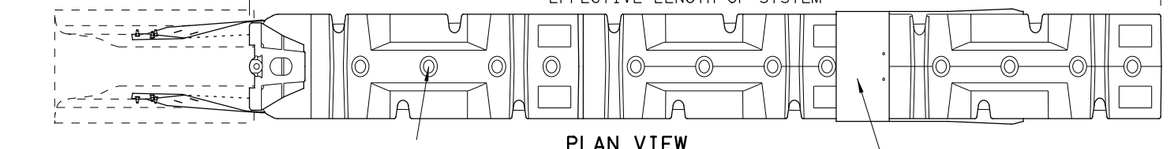
FOR DEFINITIONS SEE THE "CRASH CUSHION CATEGORIZATION CHART.PDF" AT THE DESIGN DIVISION (ROADWAY STANDARDS) WEBSITE. USE QUICK LINKS TO ACCESS ATTENUATORS / CRASH CUSHIONS SECTION.
http://www.dot.state.tx.us/insdtdot/orgchart/cmd/cserve/standard/rdwylse.htm

CRASH CUSHION SUMMARY SHEET

FILE: ccss.dgn	DN:TxDOT	CK:		CK:
© TxDOT	CONT	SECT	JOB	HIGHWAY
REVISIONS	0805	04	033	RM 3237
	DIST	COUNTY		
	AUS	HAYS		
	FEDERAL AID PROJECT			SHEET NO.
				63

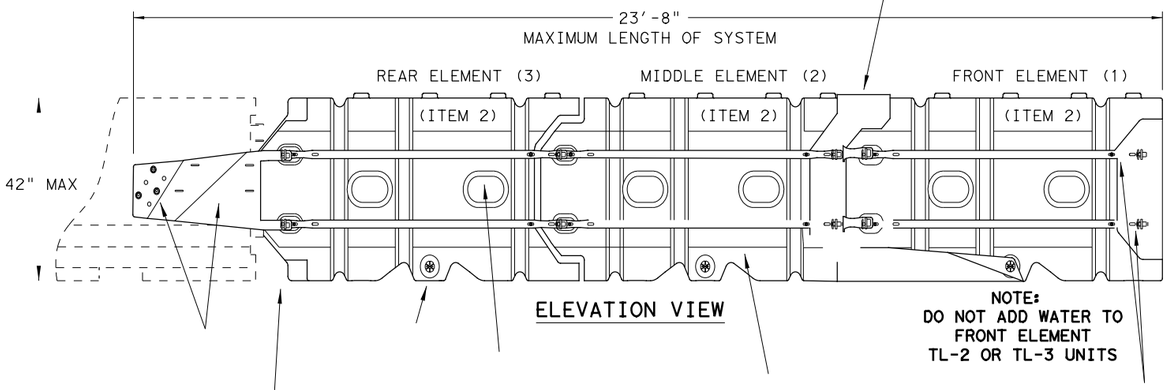
DATE: 11/17/2023
FILE: T:\Road Dept\Department\Team Texas\txdot cadd standards\roadway\ABSORB(M)-19.dgn

SYSTEM SHOWN - ABSORB-M TL-3



PLAN VIEW

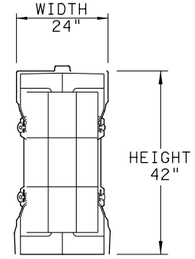
TRAFFIC FLOW



ELEVATION VIEW

NOTE:
DO NOT ADD WATER TO
FRONT ELEMENT
TL-2 OR TL-3 UNITS

TRAFFIC FLOW



SECTION A-A

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

GENERAL NOTES

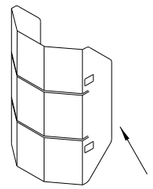
1. FOR SPECIFIC INFORMATION REGARDING THE INSTALLATION AND TECHNICAL GUIDANCE, CONTACT: LINDSAY TRANSPORTATION SOLUTIONS (LTS) - BARRIER SYSTEMS, INC. AT (707) 374-6800. 180 RIVER ROAD, RIO VISTA, CA 94571
2. THE ABSORB-M SYSTEM IS ONLY APPROVED FOR USE IN (TEMPORARY WORK ZONE) LOCATIONS.
3. THE ABSORB-M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

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

*COMPONENTS PRE-ASSEMBLED WITH ELEMENT ASSEMBLY

DELINEATION DECAL PLACEMENT GUIDE

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



NOSE PLATE

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

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

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

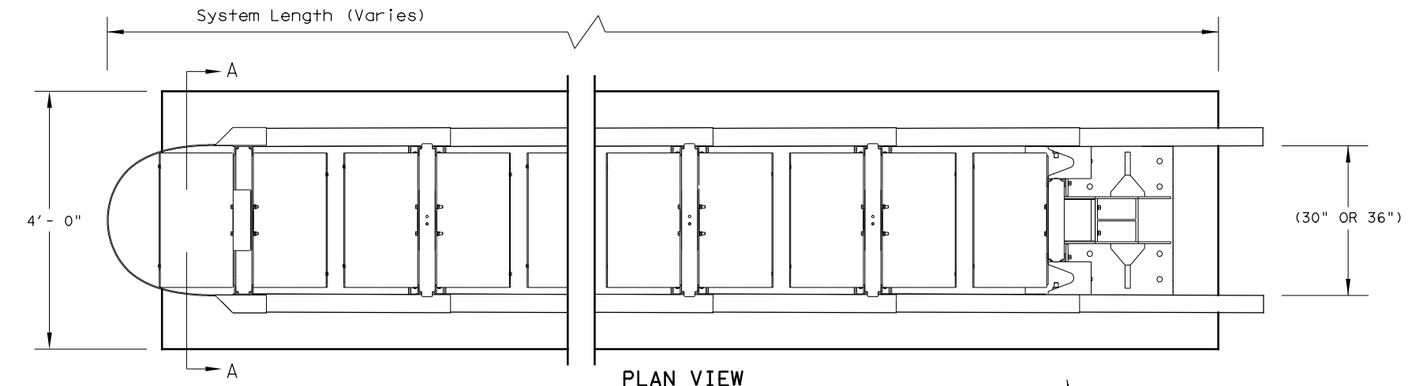
SACRIFICIAL

Texas Department of Transportation | Design Division Standard

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

FILE: absorbm19	DN: TxDOT	CK: KM	DW: VP	CK:
© TxDOT: JULY 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		64

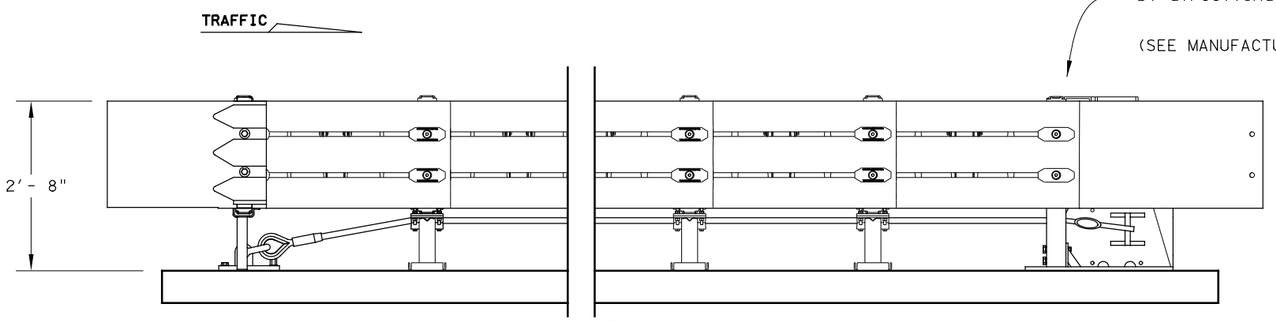
DATE: 1/26/2024
FILE: T:\Road Dept\Department\Team Texas\txdot cadd standards\roadway\TAU-II-R(N)-16.dgn



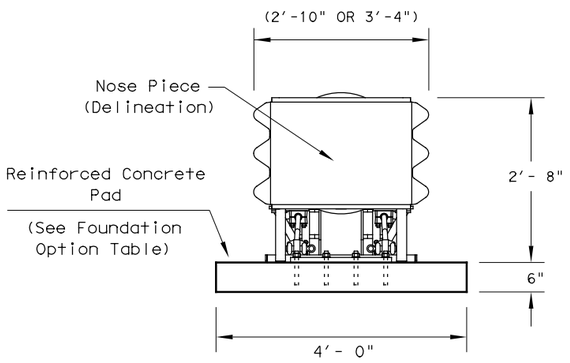
PLAN VIEW

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

(SEE MANUFACTURER'S PRODUCT MANUAL)



ELEVATION VIEW



SECTION A-A

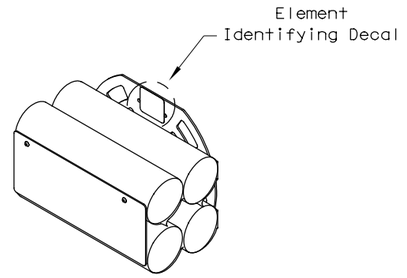
Nose Piece delineation orientation, is shown elsewhere on the plans.

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

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

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

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



ENERGY ABSORBING ELEMENTS (EAE)

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

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

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

Note: System lengths are ± 2"

GENERAL NOTES

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

BILL OF MATERIAL

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

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

(See manufacturer's product manual for details)

LOW MAINTENANCE

Texas Department of Transportation

Design Division Standard

LTS-BARRIER SYSTEMS CRASH CUSHION (R-NARROW)

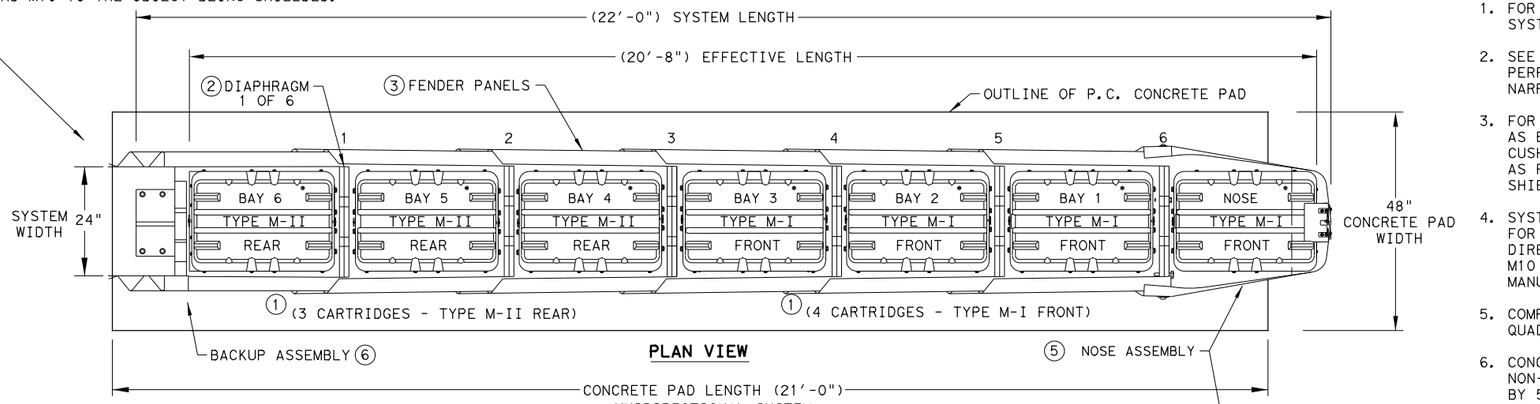
TAU-II-R(N)-16

FILE: tauiirn16.dgn	DN: TxDOT	CK: KM	DW: VP	CK: CGL
©TxDOT: January 2013	CONT	SECT	JOB	HIGHWAY
REVISIONS	0805	04	033	RM 3237
REVISED 06,2013 (VP)	DIST	COUNTY		SHEET NO.
REVISED 03,2016 (VP)	AUS	HAYS		65

DATE: 12/19/2023
FILE: T:\Road Dept\Department\Team Texas\txdot odd standards\roadway\QGUARD(M10)(N)-20.dgn

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

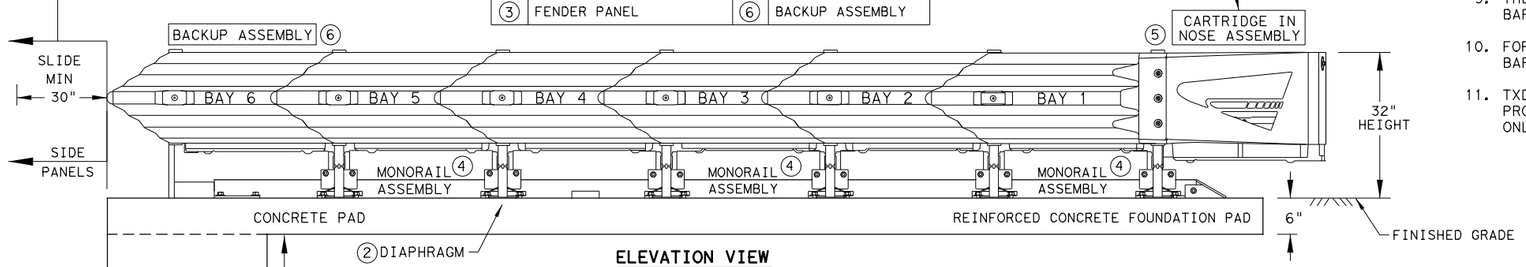
QUADGUARD M10 24" WIDE 6-BAY SYSTEM



PLAN VIEW

KEY		KEY	
(1)	QUADGUARD CARTRIDGE	(4)	MONORAILS
(2)	DIAPHRAGM	(5)	NOSE ASSEMBLY
(3)	FENDER PANEL	(6)	BACKUP ASSEMBLY

NOTE:
PROVISION SHALL BE MADE FOR REAR FENDER SIDE PANELS TO SLIDE REARWARD UPON IMPACT, 30" MIN.



ELEVATION VIEW
LEFT SIDE

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

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

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

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

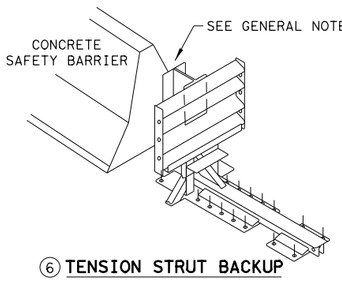
CONCRETE PAD AND ANCHOR BLOCK COMBINATIONS SHALL BE CONFIRMED WITH THE MANUFACTURER BASED UPON SITE SPECIFIC DATA (SSD).

NOTE:
THE QUADGUARD M10 24" WIDE 6-BAY - NARROW SYSTEM HAS BEEN TESTED TO MASH TEST LEVEL 3.

TL-3 MODEL #	QM10024	CARTRIDGE TYPES IN BAYS		
BAYS	6	TYPE-MII	TYPE-MI	TYPE-MI
DIAPHRAGMS	6	3	3	1
WIDTH	24"	REAR	FRONT	NOSE

TL-2 MODEL #	QM7024	CARTRIDGE TYPES IN BAYS		
BAYS	3	TYPE-MII	TYPE-MI	TYPE-MI
DIAPHRAGMS	3	1	2	1
WIDTH	24"	REAR	FRONT	NOSE

BACKUP ASSEMBLY TYPES FOR SYSTEM TRANSITIONS



(6) TENSION STRUT BACKUP

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

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

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

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

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

REUSABLE

GENERAL NOTES

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

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

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

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

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

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

Texas Department of Transportation

Design Division Standard

TRINITY HIGHWAY ENERGY ABSORPTION QUADGUARD M10 (MASH TL-3 & TL-2 NARROW-24"ONLY)

QGUARD(M10)(N)-20

FILE: qguardm10n20.dgn	DN: TxDOT	CK: KM	DW: VP	CK: AG
	CONT	SECT	JOB	HIGHWAY
REVISIONS	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		66

DATE: 12/20/2023
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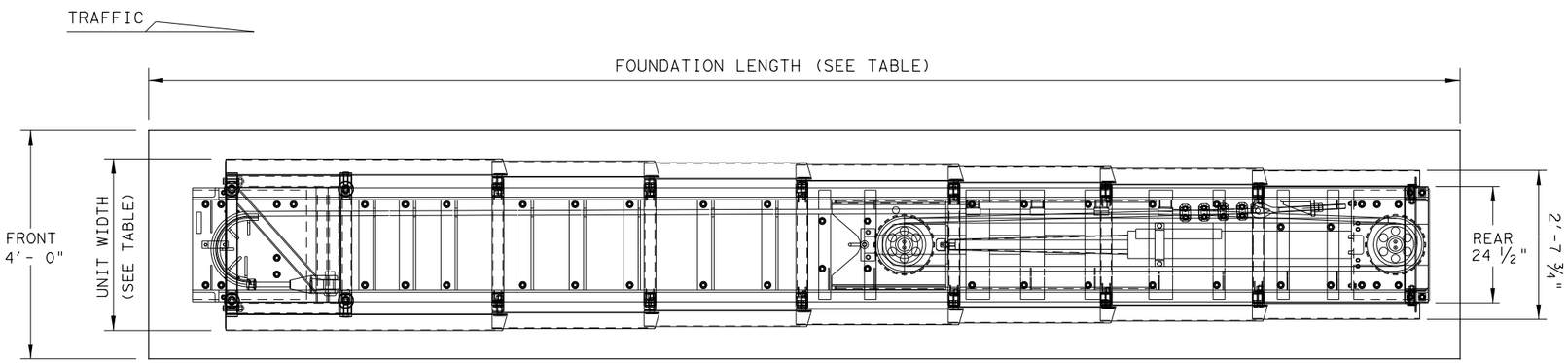
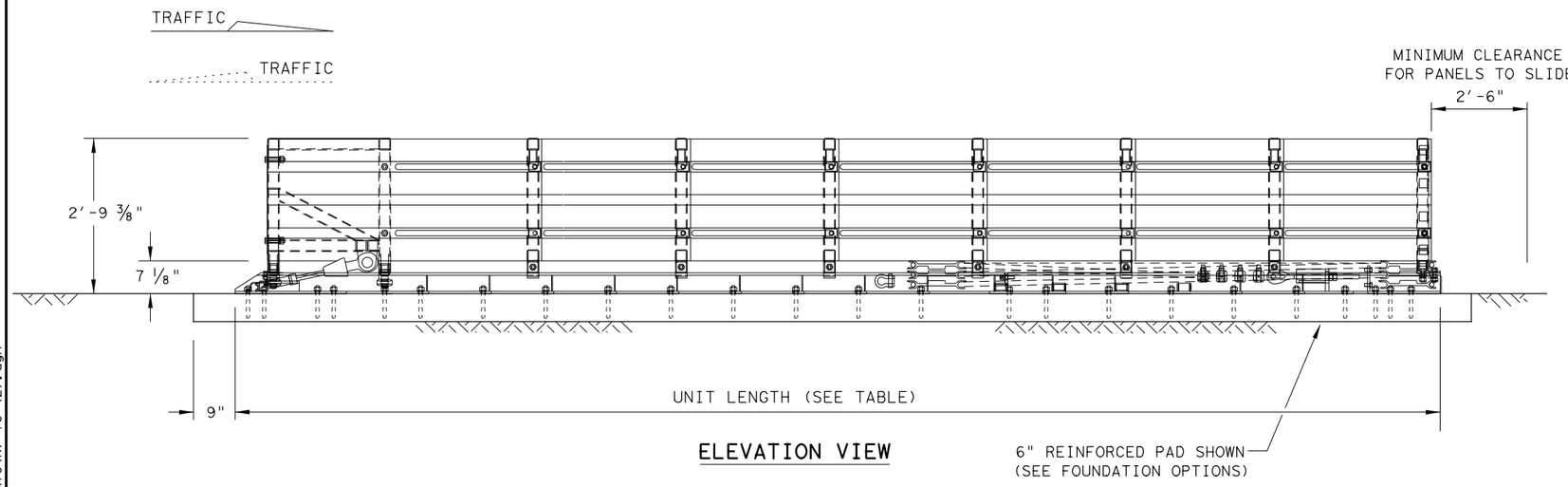


PLAN VIEW



ELEVATION VIEW

MODEL	TEST LEVEL	UNIT LENGTH (approx.)	UNIT WIDTH	FOUNDATION LENGTH	OBSTACLE WIDTH
SCI70GM	TL-2	13′-6"	2′-10 ⅝"	15′- 6 ¼"	24"to 36"
SCI100GM	TL-3	21′-6"	3′-1 ½"	23′- 0"	24"to 36"

SYSTEM AND PAD LENGTHS VARY DEPENDING ON BACKUP TYPE.

FOUNDATION OPTIONS
6" REINFORCED CONCRETE (5 ½" ANCHOR EMBEDMENT)
8" UNREINFORCED CONCRETE (5 ½" ANCHOR EMBEDMENT)
3" MIN. ASPHALT OVER 3" MIN. CONCRETE (16 ½" ANCHOR EMBED.)
6" ASPHALT OVER 6" COMPACT SUBBASE (16 ½" ANCHOR EMBED.)
8" MINIMUM ASPHALT (16 ½" ANCHOR EMBEDMENT)

FOR STEEL PLACEMENT IN CONCRETE FOUNDATIONS, SEE MANUFACTURER'S PRODUCT MANUAL.

TRANSITION OPTIONS
CONCRETE VERTICAL WALL
CONCRETE TRAFFIC BARRIERS
GUARDRAIL (W-BEAM)
GUARDRAIL (THRIE-BEAM)

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

FOR BI-DIRECTIONAL TRANSITION PANEL AND END SHOE DETAILS, SEE MANUFACTURER'S PRODUCT MANUAL.

GENERAL NOTES

1. FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: WORK AREA PROTECTION, CORP. AT (800) 327-4417, OR (630) 377-9100.
2. FOR BI-DIRECTIONAL TRAFFIC, APPROPRIATE TRANSITION PANELS WILL BE REQUIRED.
3. ADDITIONAL DETAILS FOR THE TRANSITION OPTION AND FOUNDATION OPTION WILL BE SHOWN ON THE MANUFACTURER'S SHOP DRAWINGS FURNISHED TO THE ENGINEER.
4. CONCRETE SHALL BE CLASS "S" WITH A MINIMUM COMPRESSIVE STRENGTH OF 4,000 PSI.
5. MAXIMUM PERMISSIBLE CROSS-SLOPE IS 8%.
6. THE INSTALLATION AREA SHOULD BE FREE FROM CURBS, ELEVATED OBJECTS, OR DEPRESSIONS.
7. THE SCI100GM & SCI70GM SYSTEMS SHOULD BE APPROXIMATELY PARALLEL WITH THE BARRIER OR CENTERLINE OF MERGING BARRIERS.

NOTE:
FOR ATTACHMENT AND TRANSITIONS TO OTHER SHAPES, BARRIERS, RAILINGS AND BI-DIRECTIONAL TRAFFIC FLOWS ARE AVAILABLE. (SEE MANUFACTURER'S PRODUCT MANUAL)

NOTE:
SIDE PANELS CAN TRAVEL 30" BEYOND THE LAST TERMINAL BRACE AT THE REAR OF THE CUSHION. ALL OBJECTS THAT MAY INTERFERE WITH THIS MOTION CAN AFFECT PERFORMANCE OF AND MAY CAUSE UNDUE DAMAGE TO THE CRASH CUSHION.

Texas Department of Transportation

Design Division Standard

WORK AREA PROTECTION CORP (SMART-NARROW)

SMTC(N)-16

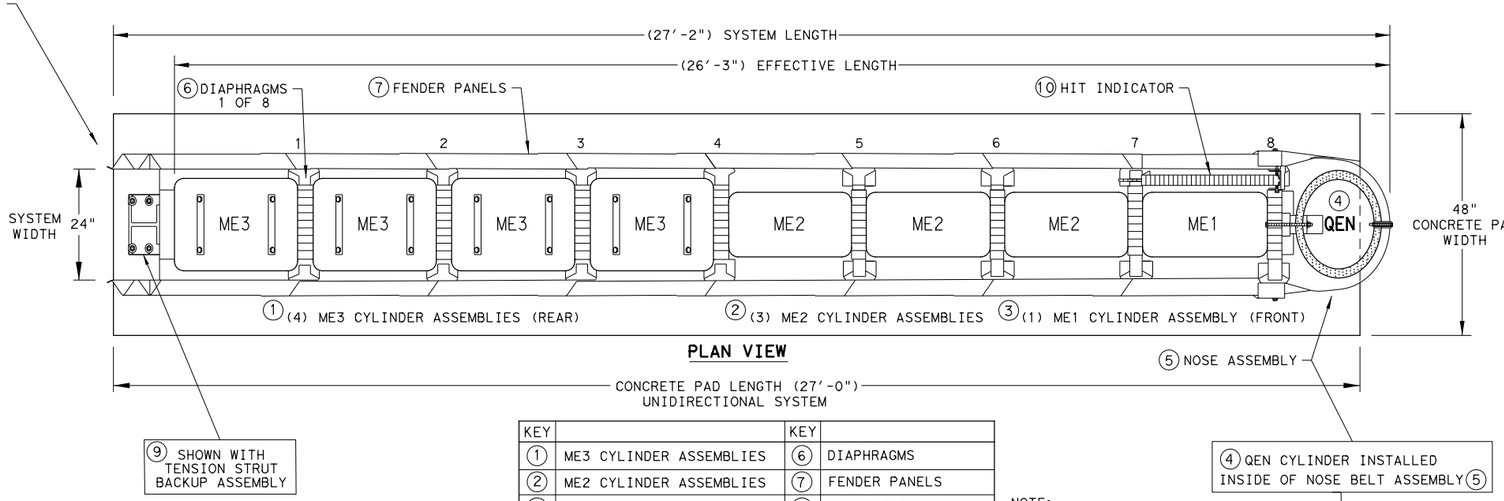
FILE: smtcn16.dgn	DN: TxDOT	CK: KM	DW: VP	CK: VP
©TxDOT: February 2006	CONT	SECT	JOB	HIGHWAY
REVISIONS REVISED 06, 2013 (VP) REVISED 03, 2016 (VP)	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		67

LOW MAINTENANCE

DATE: 12/20/2023
FILE: T:\Road Dept\Department\Team Texas\txdot odd standards\roadway\QGELITE(M10)(N)-20.dgn

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

QUADGUARD EITE M10 24" WIDE (8 BAY) SYSTEM



PLAN VIEW

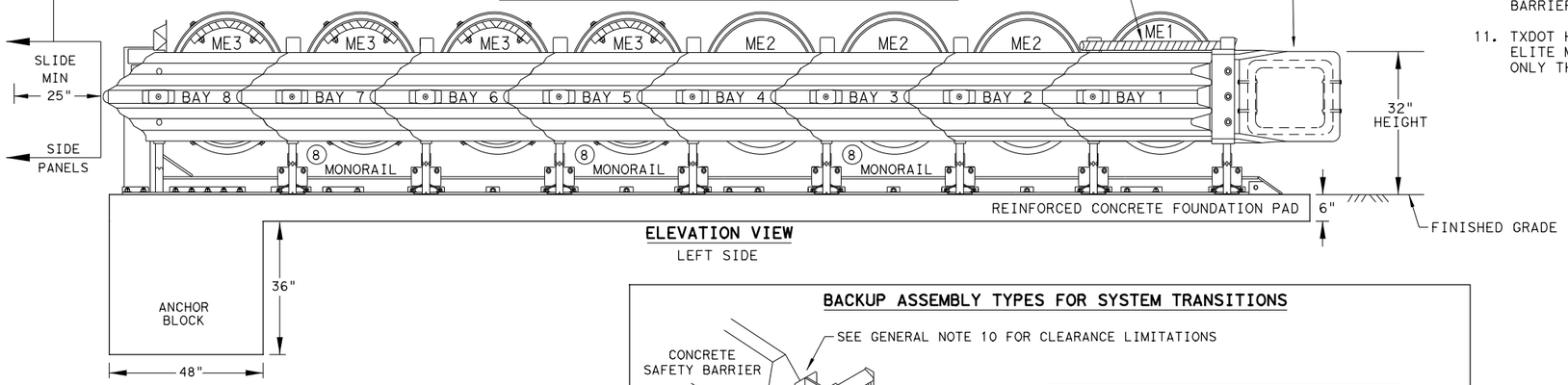
⑨ SHOWN WITH TENSION STRUT BACKUP ASSEMBLY

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

④ QEN CYLINDER INSTALLED INSIDE OF NOSE BELT ASSEMBLY ⑤

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

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



ELEVATION VIEW
LEFT SIDE

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

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

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

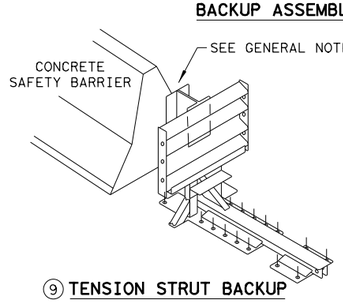
8" NON-REINFORCED CONCRETE PAD MAY NOT REQUIRE AN ANCHOR BLOCK, IF THE PAD IS INSTALLED AGAINST AN IMMOVABLE CONCRETE BACKUP.

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

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

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

BACKUP ASSEMBLY TYPES FOR SYSTEM TRANSITIONS

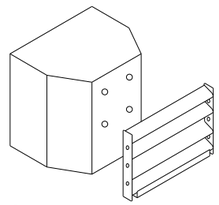


⑨ TENSION STRUT BACKUP

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

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

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



⑨ CONCRETE BACKUP

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

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

GENERAL NOTES

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

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

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

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

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

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

LOW MAINTENANCE

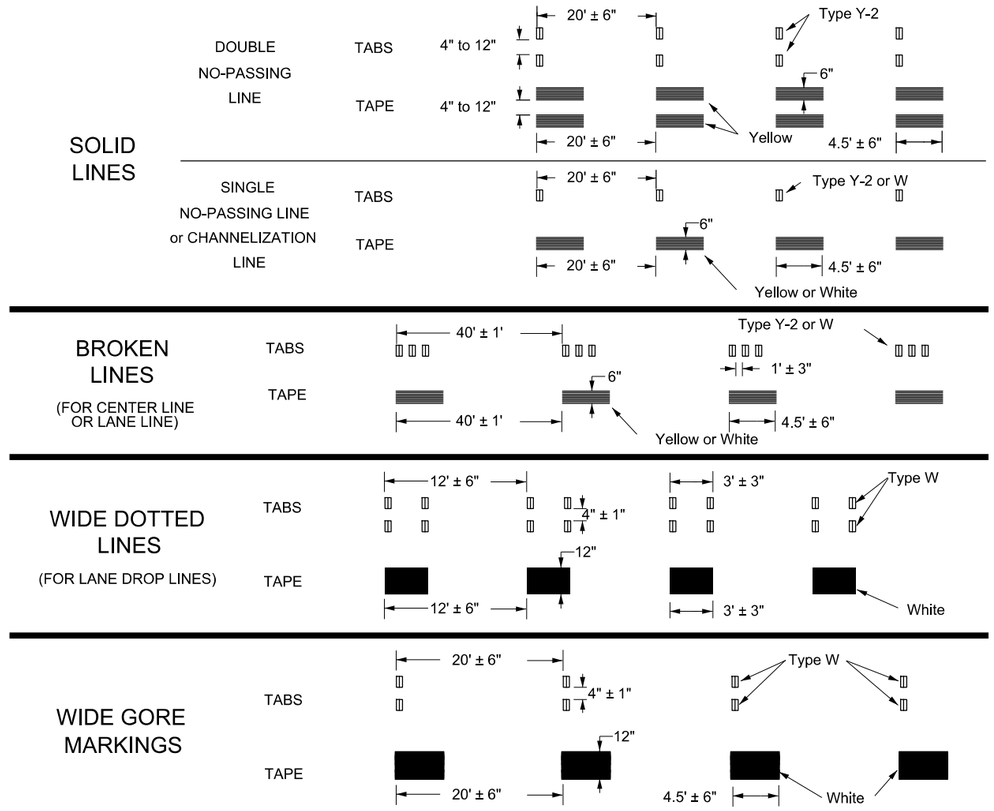
Texas Department of Transportation
Design Division Standard

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

QGELITE(M10)(N)-20

FILE: qgelitem10n20.dgn	DN: TxDOT	CK: KM	DW: VP	CK: AG
©TxDOT: NOVEMBER 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		67A

WORK ZONE SHORT TERM PAVEMENT MARKINGS DETAILS



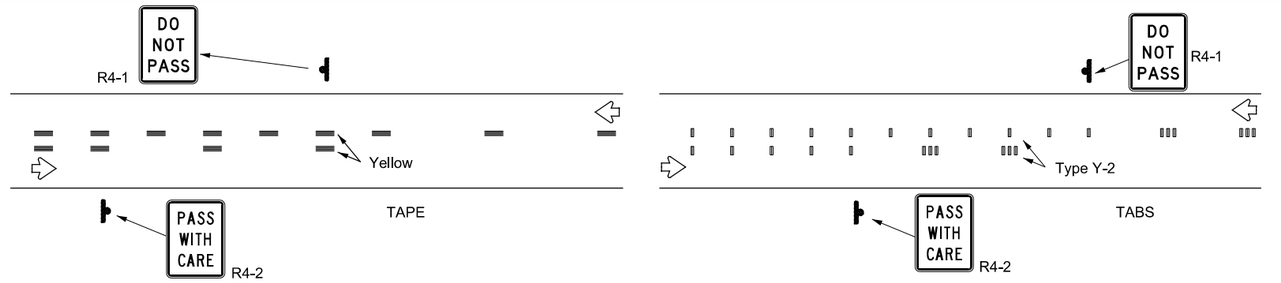
NOTES:

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

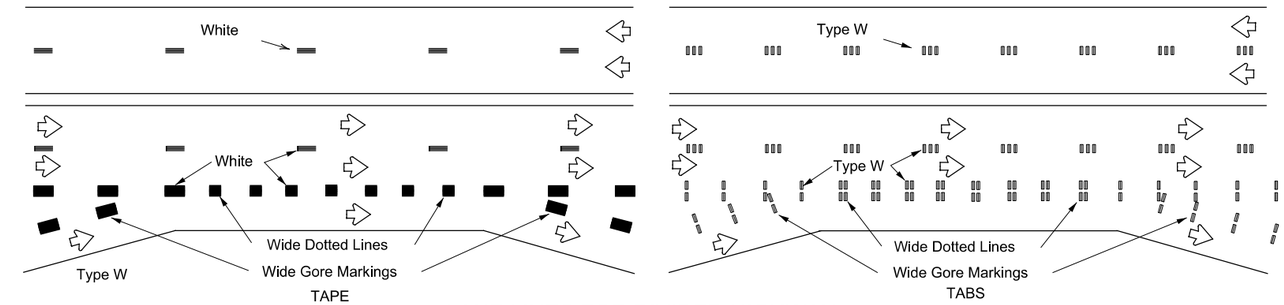
TEMPORARY FLEXIBLE, REFLECTIVE ROADWAY MARKER TABS (TABS)

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

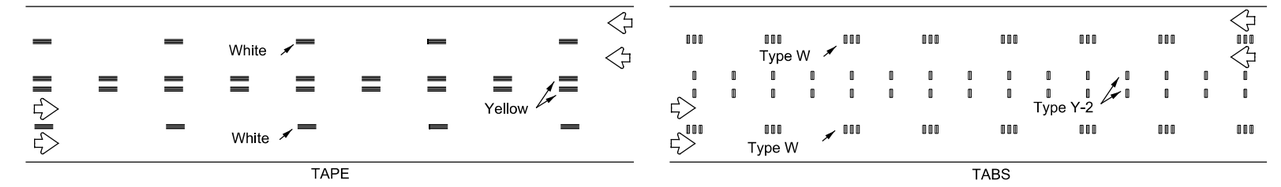
WORK ZONE SHORT TERM PAVEMENT MARKINGS PATTERNS



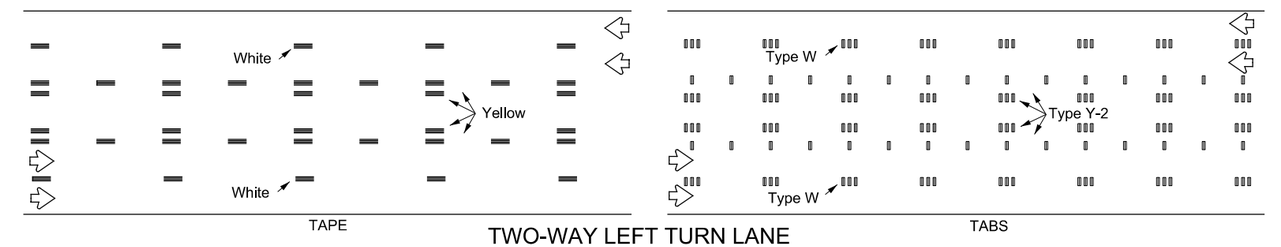
CENTER LINE & NO-PASSING ZONE BARRIER LINES FOR TWO LANE TWO-WAY HIGHWAYS



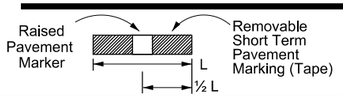
LANE LINES FOR DIVIDED HIGHWAY



LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



TWO-WAY LEFT TURN LANE



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

PREFABRICATED PAVEMENT MARKINGS

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

RAISED PAVEMENT MARKERS

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

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

1. DMSs referenced above can be found along with embedded links to their respective MPLs at the following website:

http://www.txdot.gov/business/contractors_consultants/material_specifications/default.htm

Texas Department of Transportation

Traffic Safety Division Standard

WORK ZONE SHORT TERM PAVEMENT MARKINGS

WZ(STPM)-23

FILE: wzstpm-23.dgn	DN:	CK:	DW:	CK:
© TxDOT February 2023	CONT	SECT	JOB	HIGHWAY
REVISIONS 4-92 7-13 1-97 2-23 3-03	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		68

111

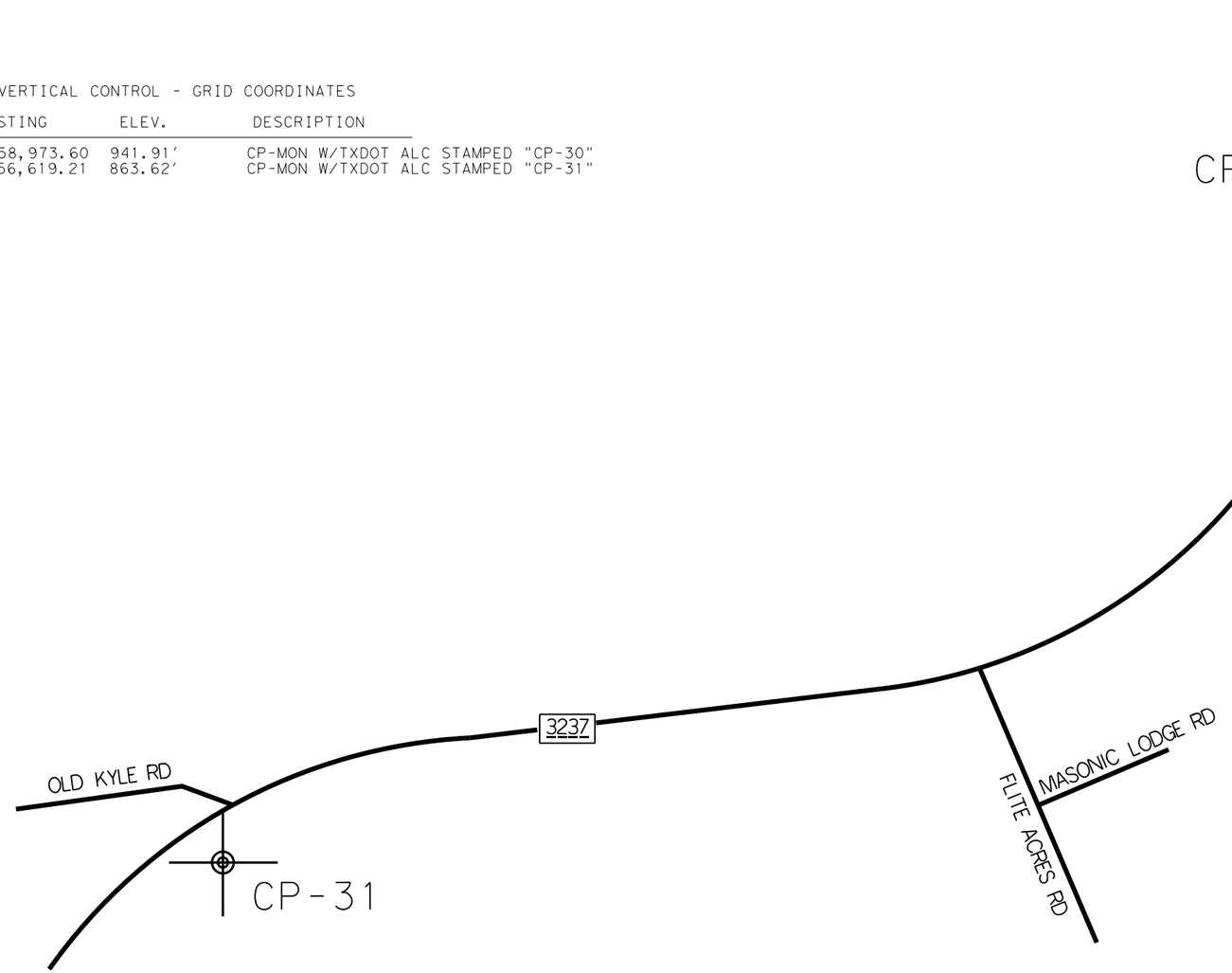
DATE: 11/17/2023 5:06:14 PM
FILE: T:\Road Dept\Department\Team Texas\txdot cadd standards\traffic control\wz(stpm)-23.dgn

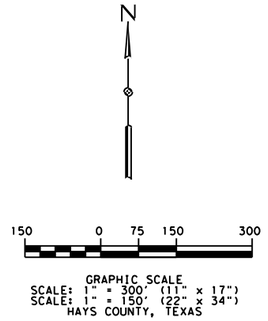
HORIZONTAL / VERTICAL CONTROL - SURFACE COORDINATES

PT	NORTHING	EASTING	ELEV.	DESCRIPTION
CP-30	13,914,527.39	2,259,222.09	941.91′	CP-MON W/TXDOT ALC STAMPED "CP-30"
CP-31	13,913,002.96	2,256,867.43	863.62′	CP-MON W/TXDOT ALC STAMPED "CP-31"

HORIZONTAL / VERTICAL CONTROL - GRID COORDINATES

PT	NORTHING	EASTING	ELEV.	DESCRIPTION
CP-30	13,912,996.96	2,258,973.60	941.91′	CP-MON W/TXDOT ALC STAMPED "CP-30"
CP-31	13,911,472.70	2,256,619.21	863.62′	CP-MON W/TXDOT ALC STAMPED "CP-31"





11/8/21

NOTES:

1) ALL PROJECT COORDINATES ARE BASED ON THE TEXAS COORDINATE SYSTEM, TEXAS SOUTH CENTRAL ZONE, NAD 83(2011) (EPOCH 2010)/NAVD88(GEIOD12A). ALL COORDINATES SHOWN HEREIN ARE ADJUSTED TO SURFACE BY MULTIPLYING BY A SURFACE ADJUSTMENT FACTOR OF 1.00011. UNITS: U.S. SURVEY FEET.

2) PRIMARY CONTROL POINTS WERE SET UTILIZING THE WDS VRS NETWORK. CONTROL POINT 30 WAS HELD AS A BASIS OF ELEVATION AND DIGITAL LEVELS WERE RUN TO ESTABLISH ELEVATIONS OF CONTROL POINTS 30 & 31.

RM 3237
FROM: APPROXIMATELY 250′ NORTHEAST OF THE INTERSECTION OF OLD KYLE ROAD/RM 3237
TO: APPROXIMATELY 1,900′ SOUTH OF WINTERS MILL PKWY AND APPROXIMATELY 400′ SOUTH OF THE INTERSECTION OF FLITE ACRES ROAD/RM 3237
CONTRACT NO. 2015.02837
SWA No. 2
MAY, 2020

REV.	DATE	DESCRIPTION	APPROVED

SAM SURVEYING · AERIAL MAPPING · ENGINEERING
4801 Southwest Parkway
Building Two, Suite 100
Austin, Texas 78735
(512) 447-0575
Fax: (512) 326-3029
Texas Firm Registration No. 10064300

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

RM 3237 SAFETY IMPROVEMENTS

CONTROL INDEX LAYOUT

SHEET 1 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
JIA				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
JIA	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	69
FG	0805	04	033	
CHECK				
RJZ				

$SCRIPT$

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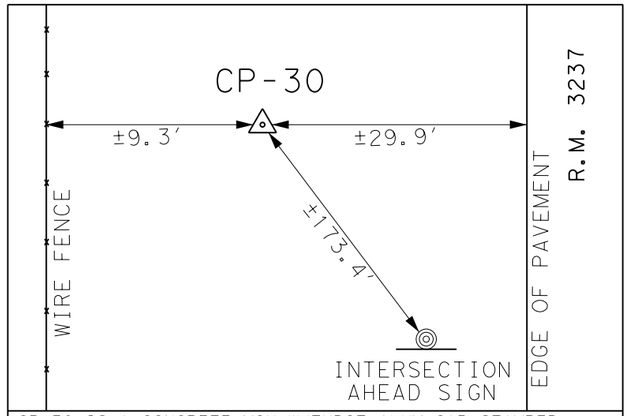
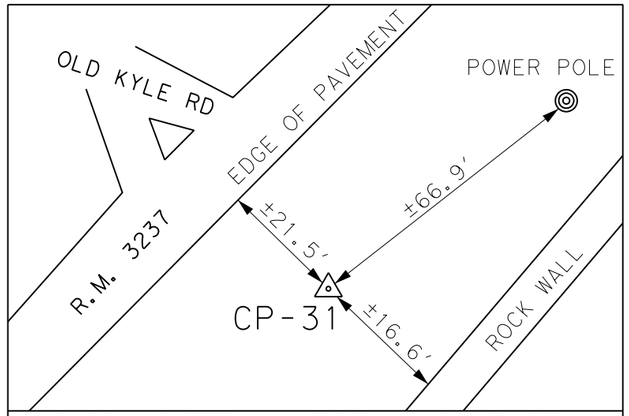


CP-30 IS A CONCRETE MON W/TXDOT ALUM CAP STAMPED "CP-30" LOCATED IN THE RIGHT-OF-WAY OF SOUTHBOUND R.M. 3237, 0.3 MILES SOUTH OF THE INTERSECTION OF R.M. 3237 AND WINTERS MILL RD, ±29.9 FEET WEST OF EDGE OF PAVEMENT, ±9.3 FEET EAST OF A WIRE FENCE, AND ±173.4 FEET NORTHWEST OF INTERSECTION AHEAD SIGN.

SURFACE COORDINATES	GRID COORDINATES
N = 13,914,527.39	N = 13,912,996.96
E = 2,259,222.09	E = 2,258,973.60
ELEV = 941.91'	ELEV = 941.91'



CP-31 IS A CONCRETE MON W/TXDOT ALUM CAP STAMPED "CP-31" LOCATED IN THE RIGHT-OF-WAY SOUTH OF THE INTERSECTION OF R.M. 3237 AND OLD KYLE RD, ±21.5 FEET SOUTHEAST OF THE EDGE OF PAVEMENT, ±16.6 FEET NORTHWEST OF A ROCK WALL, AND ±66.9 FEET SOUTHWEST OF A POWER POLE.

SURFACE COORDINATES	GRID COORDINATES
N = 13,913,002.96	N = 13,911,472.70
E = 2,256,867.43	E = 2,256,619.21
ELEV = 863.62'	ELEV = 863.62'

N

NOT TO SCALE

STATE OF TEXAS
REGISTERED
SCOTT C. BRASHEAR
6660
PROFESSIONAL
LAND SURVEYOR

11/8/21

REV	DATE	DESCRIPTION	APPROVED

SAM
SURVEYING · AERIAL MAPPING · ENGINEERING
4801 Southwest Parkway
Building Two, Suite 100
Austin, Texas 78735
(512) 447-0575
Fax: (512) 326-3029
Texas Firm Registration No. 10064300

AMERICAN STRUCTUREPOINT INC.
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3711 SOUTH MOPAC EXPY
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www.structurepoint.com

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

CONTROL INDEX LAYOUT

SHEET 2 OF 6

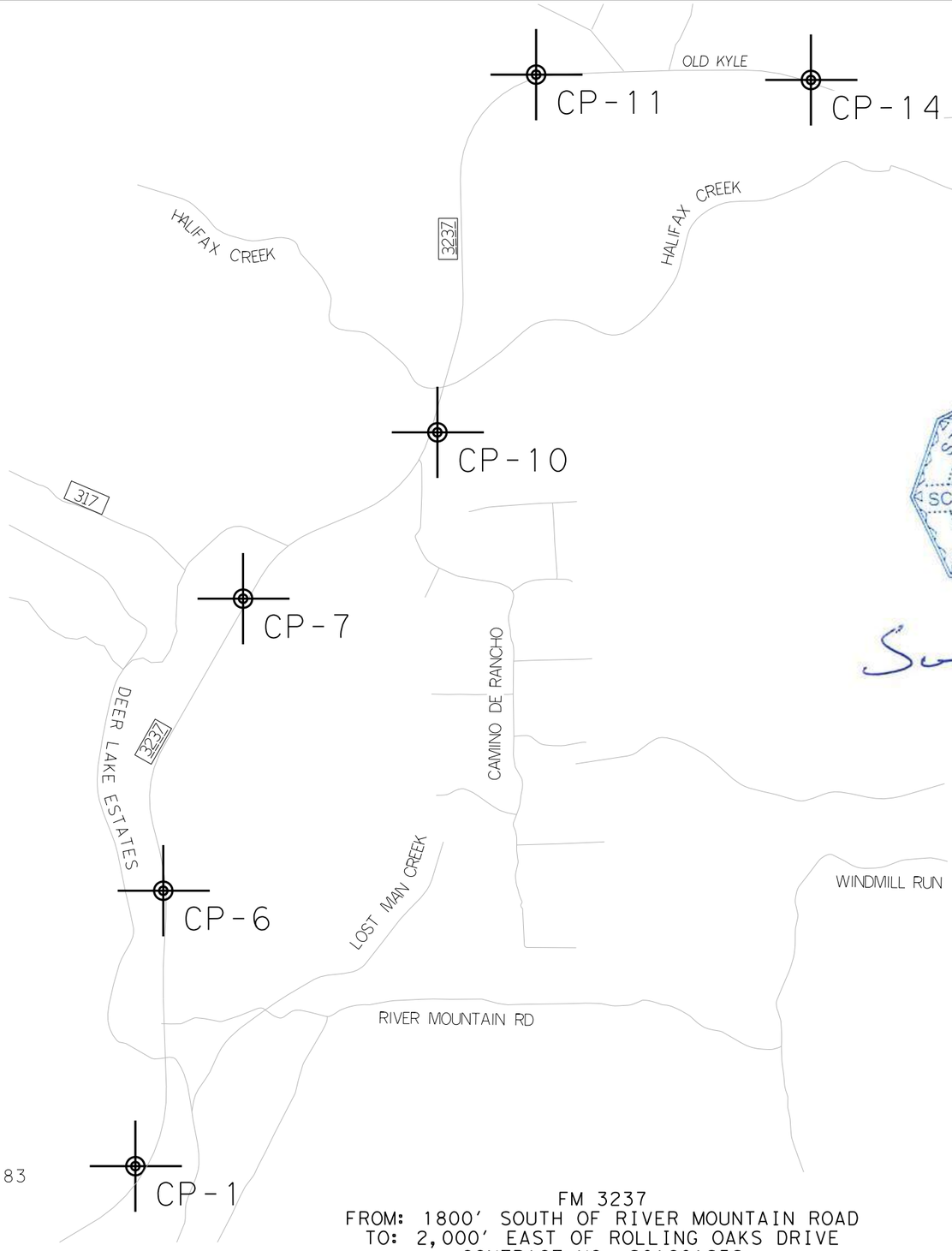
DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
JIA				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
JIA	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	70
FG	0805	04	033	
CHECK				
RJZ				

HORIZONTAL / VERTICAL CONTROL - SURFACE COORDINATES

PT	NORTHING	EASTING	ELEV.	DESCRIPTION
CP-1	13917990.53	2270810.21	940.29'	MON-SET TYPEII
CP-6	13921387.29	2271154.51	969.19'	MON-SET TYPEII
CP-7	13924988.90	2272138.89	1081.33'	MON-SET TYPEII
CP-10	13927040.30	2274535.56	1053.29'	MON-SET TYPEII
CP-11	13931451.51	2275753.29	1102.21'	MON-SET TYPEII
CP-14	13931385.70	2279143.76	1018.44'	MON-SET TYPEII

HORIZONTAL / VERTICAL CONTROL - GROUND COORDINATES

PT	NORTHING	EASTING	ELEV.	DESCRIPTION
CP-1	13916459.72	2270560.45	940.29'	MON-SET TYPEII
CP-6	13919856.11	2270904.71	969.19'	MON-SET TYPEII
CP-7	13923457.32	2271888.98	1081.33'	MON-SET TYPEII
CP-10	13925508.49	2274285.39	1053.29'	MON-SET TYPEII
CP-11	13929919.22	2275502.99	1102.21'	MON-SET TYPEII
CP-14	13929853.41	2278893.08	1018.44'	MON-SET TYPEII



STATE OF TEXAS
REGISTERED
SCOTT C. BRASHEAR
6660
PROFESSIONAL
LAND SURVEYOR

11/8/21

NOTES:

1. ALL PROJECT COORDINATES ARE BASED ON THE TEXAS STATE PLANE COORDINATE SYSTEM, SOUTH CENTRAL ZONE, NAD 83 (93)/NAVD 88, GEOID MODEL 12A. ALL COORDINATES SHOWN HEREON ARE ADJUSTED TO SURFACE BY MULTIPLYING BY A COMBINED ADJUSTMENT FACTOR OF 1.0001100. UNITS: U.S. SURVEY FEET.

2. A SITE CALIBRATION SHOULD BE PERFORMED WHEN UTILIZING THE CONTROL SHOWN HEREIN.

FM 3237
FROM: 1800' SOUTH OF RIVER MOUNTAIN ROAD
TO: 2,000' EAST OF ROLLING OAKS DRIVE
CONTRACT NO. 201601252
WA No. 1
OCTOBER, 2018

REV	DATE	DESCRIPTION	APPROVED

SAM SURVEYING AERIAL MAPPING ENGINEERING
4801 Southwest Parkway
Building Two, Suite 100
Austin, Texas 78735
(512) 447-0575
FAX (512) 326-3029
Texas Firm Registration No. 10064300

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

Texas Department of Transportation

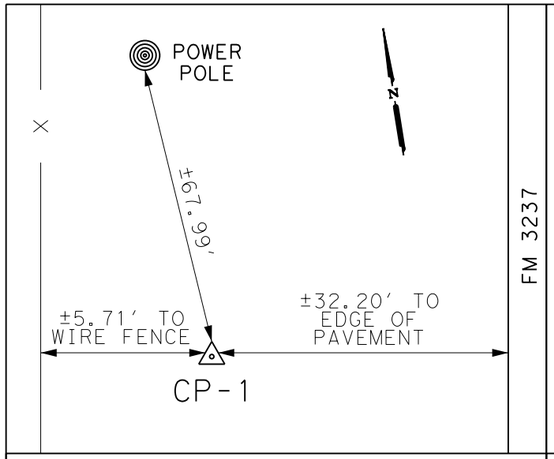
RM 3237 SAFETY IMPROVEMENTS

CONTROL INDEX LAYOUT

SHEET 3 OF 6

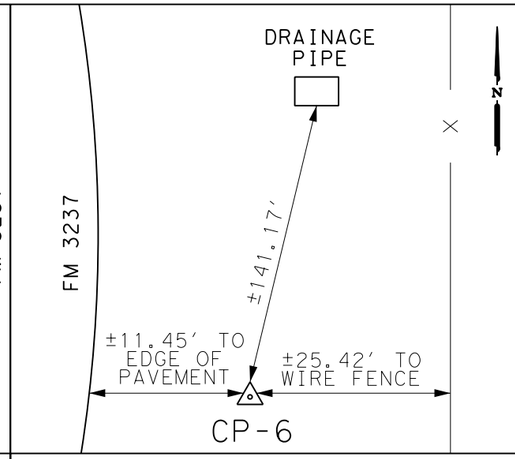
DESIGN	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
JIA				RM 3237
GRAPHICS				
JIA	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK	TX	AUS	HAYS	
FG	CONTROL	SECTION	JOB	71
CHECK	0805	04	033	
RJZ				

NOT TO SCALE



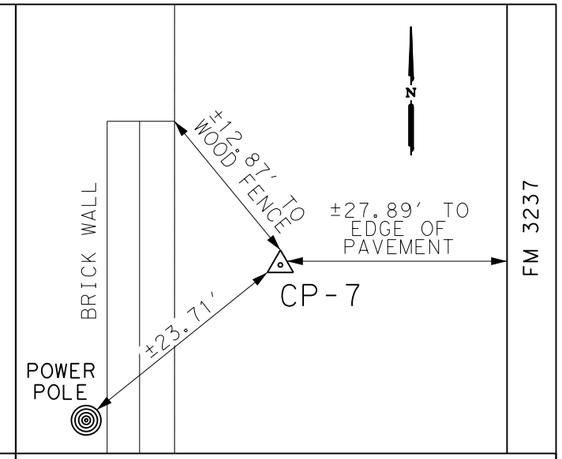
CP-1 IS A TYPE II MON W/TXDOT ALUM CAP LOCATED IN THE RIGHT-OF-WAY OF F.M. 3237, ±5.71 FEET EAST OF A WIRE FENCE, ±32.20 FEET WEST OF THE EDGE OF PAVEMENT, AND ±67.99 FEET SOUTHEAST OF A POWER POLE.

SURFACE COORDINATES	GRID COORDINATES
N = 13917990.53	N = 13916459.72
E = 2270810.21	E = 2270560.45
ELEV. = 940.29'	ELEV. = 940.29'



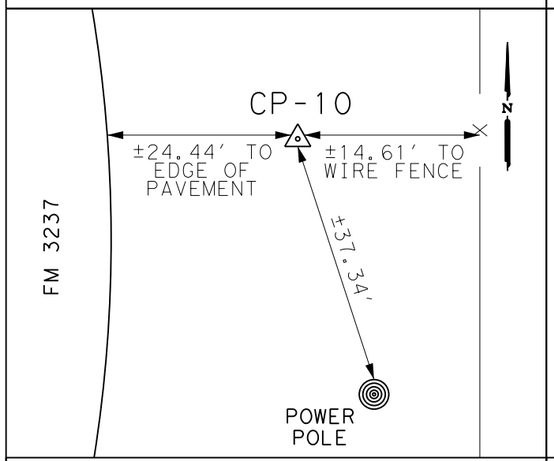
CP-6 IS A TYPE II MON W/TXDOT ALUM CAP LOCATED IN THE RIGHT-OF-WAY OF F.M. 3237, ±11.45 FEET EAST OF THE EDGE OF PAVEMENT, ±25.42 FEET WEST OF A WIRE FENCE, AND ±141.17 FEET SOUTHWEST OF A DRAINAGE PIPE.

SURFACE COORDINATES	GRID COORDINATES
N = 13921387.29	N = 13919856.11
E = 2271154.51	E = 2270904.71
ELEV. = 969.19'	ELEV. = 969.19'



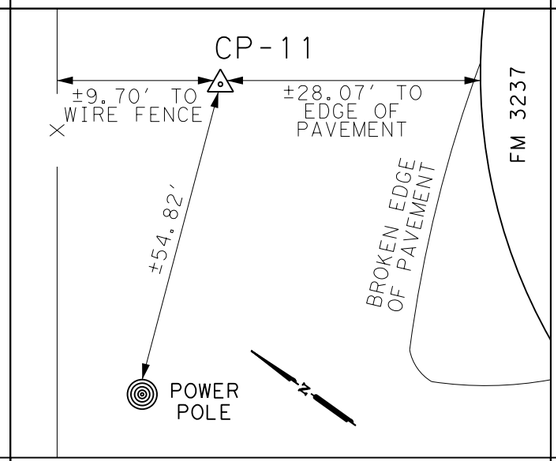
CP-7 IS A TYPE II MON W/TXDOT ALUM CAP LOCATED IN THE RIGHT-OF-WAY OF F.M. 3237, ±27.89 WEST OF THE EDGE OF PAVEMENT, ±12.87 FEET SOUTHEAST OF A WOOD FENCE, AND ±23.71 FEET NORTHEAST OF A POWER POLE.

SURFACE COORDINATES	GRID COORDINATES
N = 13924988.90	N = 13923457.32
E = 2272138.89	E = 2271888.98
ELEV. = 1081.33'	ELEV. = 1081.33'



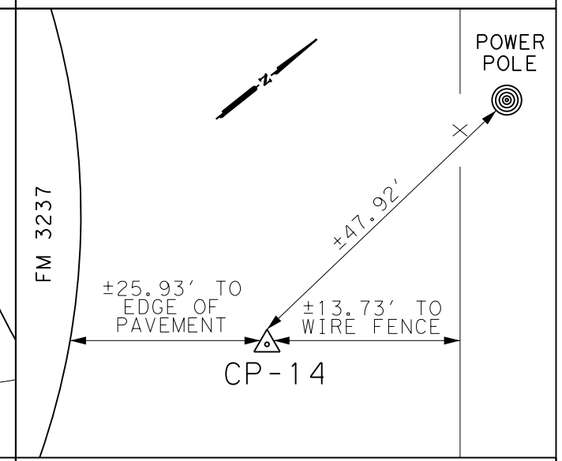
CP-10 IS A TYPE II MON W/TXDOT ALUM CAP LOCATED IN THE RIGHT-OF-WAY OF F.M. 3237, ±24.44 FEET EAST OF THE EDGE OF PAVEMENT, ±14.61 FEET WEST OF A WIRE FENCE, AND ±37.34 FEET NORTHWEST OF A POWER POLE.

SURFACE COORDINATES	GRID COORDINATES
N = 13927040.30	N = 13925508.49
E = 2274535.56	E = 2274285.39
ELEV. = 1053.29'	ELEV. = 1053.29'



CP-11 IS A TYPE II MON W/TXDOT ALUM CAP LOCATED IN THE RIGHT-OF-WAY OF F.M. 3237, ±9.70 FEET SOUTHEAST OF A WIRE FENCE, ±28.07 NORTHWEST OF THE EDGE OF PAVEMENT, AND ±54.82 FEET SOUTHEAST OF A POWER POLE.

SURFACE COORDINATES	GRID COORDINATES
N = 13931451.51	N= 13929919.22
E = 2275753.29	E = 2275502.99
ELEV. = 1102.21'	ELEV. = 1102.21'



CP-14 IS A TYPE II MON W/TXDOT ALUM CAP LOCATED IN THE RIGHT-OF-WAY OF F.M. 3237, ±25.93 FEET NORTHEAST OF THE EDGE OF PAVEMENT, ±13.73 FEET SOUTHWEST OF A WIRE FENCE, AND ±47.92 FEET SOUTH A POWER POLE.

SURFACE COORDINATES	GRID COORDINATES
N = 13931385.70	N = 13929853.41
E = 2279143.76	E = 2278893.08
ELEV. = 1018.44'	ELEV. = 1018.44'

NOTES:

1. ALL PROJECT COORDINATES ARE BASED ON THE TEXAS STATE PLANE COORDINATE SYSTEM, SOUTH CENTRAL ZONE, NAD 83 (93)/NAVD 88, GEOID MODEL 12A. ALL COORDINATES SHOWN HEREON ARE ADJUSTED TO SURFACE BY MULTIPLYING BY A COMBINED ADJUSTMENT FACTOR OF 1.00011. UNITS: U.S. SURVEY FEET.

2. A SITE CALIBRATION SHOULD BE PERFORMED WHEN UTILIZING THE CONTROL SHOWN HEREIN.

STATE OF TEXAS
REGISTERED
SCOTT C. BRASHEAR
6660
PROFESSIONAL
LAND SURVEYOR

11/8/21

REV	DATE	DESCRIPTION	APPROVED

SAM SURVEYING AERIAL MAPPING ENGINEERING
4801 Southwest Parkway
Building Two, Suite 100
Austin, Texas 78735
(512) 447-0575
Fax: (512) 326-3029
Texas Firm Registration No. 100643-00

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

HAYS COUNTY TEXAS

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

CONTROL INDEX LAYOUT

FM 3237
FROM: 1800' SOUTH OF RIVER MOUNTAIN ROAD
TO: 2,000' EAST OF ROLLING OAKS DRIVE
CONTRACT NO. 201601252
WA No. 1
OCTOBER, 2018

SHEET 4 OF 6

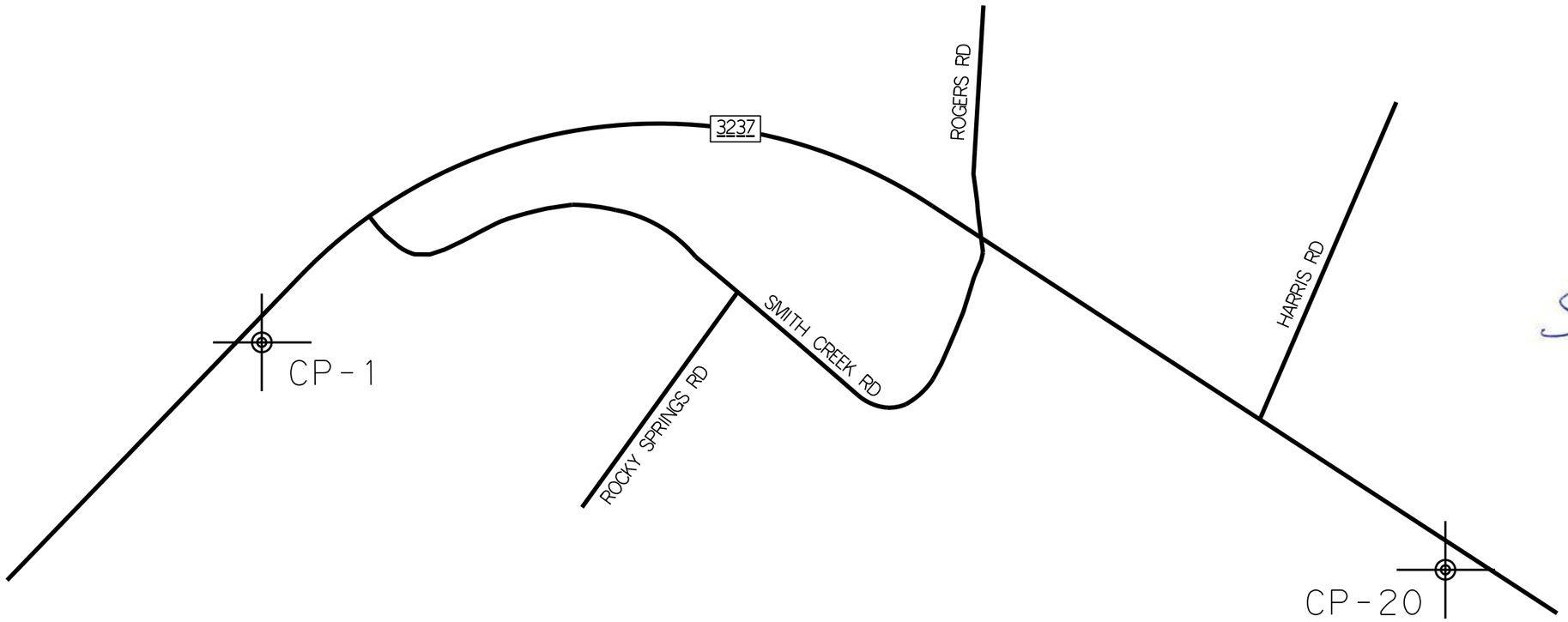
DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
JIA				RM 3237
GRAPHICS				
JIA	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK	TX	AUS	HAYS	
FG	CONTROL	SECTION	JOB	72
CHECK	0805	04	033	
RJZ				

HORIZONTAL / VERTICAL CONTROL - SURFACE COORDINATES

PT	NORTHING	EASTING	ELEV.	DESCRIPTION
CP-1	13,919,330.95	2,262,606.38	993.88′	MON W/TXDOT ALC
CP-20	13,918,806.14	2,265,337.23	968.85′	MON W/TXDOT ALC

HORIZONTAL / VERTICAL CONTROL - GRID COORDINATES

PT	NORTHING	EASTING	ELEV.	DESCRIPTION
CP-1	13,917,799.99	2,262,357.52	993.88′	MON W/TXDOT ALC
CP-20	13,917,275.24	2,265,088.07	968.85′	MON W/TXDOT ALC



N

150 0 75 150 300

GRAPHIC SCALE
SCALE: 1" = 300' (11" x 17")
SCALE: 1" = 150' (22" x 34")
HAYS COUNTY, TEXAS

STATE OF TEXAS
REGISTERED
SCOTT C. BRASHEAR
6660
PROFESSIONAL
LAND SURVEYOR

11/8/21

NOTES:

1) ALL PROJECT COORDINATES ARE BASED ON THE TEXAS COORDINATE SYSTEM, TEXAS SOUTH CENTRAL ZONE, NAD 83(2011) (EPOCH 2010)/NAVD88(GEIOD12A). ALL COORDINATES SHOWN HEREIN ARE ADJUSTED TO SURFACE BY MULTIPLYING BY A SURFACE ADJUSTMENT FACTOR OF 1.00011. UNITS: U.S. SURVEY FEET.

2) PRIMARY CONTROL POINTS WERE SET UTILIZING THE WDS VRS NETWORK. CONTROL POINT 20 WAS HELD AS A BASIS OF ELEVATION AND DIGITAL LEVELS WERE RUN TO ESTABLISH ELEVATIONS OF CONTROL POINTS 1 & 20.

FM 3237 SUPPLEMENTAL
FROM: 200′ WEST OF FM 3237 AND SMITH CREEK ROAD
TO: 400′ EAST OF FM 3237 AND HARRIS ROAD
CONTRACT NO. 2015.02837
SWA No. 1
APRIL, 2019

REV	DATE	DESCRIPTION	APPROVED

SAM SURVEYING · AERIAL MAPPING · ENGINEERING
4801 Southwest Parkway
Building Two, Suite 100
Austin, Texas 78735
(512) 447-0575
Fax: (512) 326-3029
Texas Firm Registration No. 10064300

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

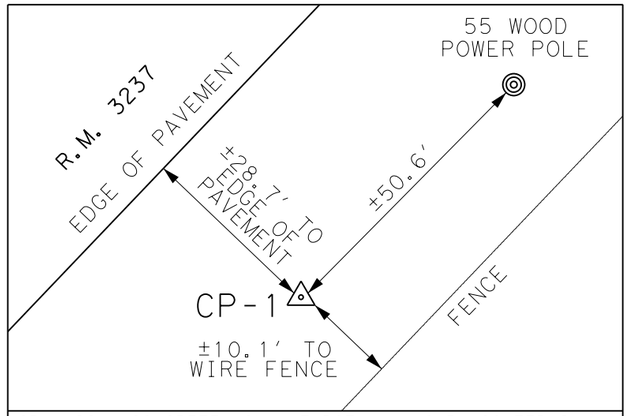
Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

CONTROL INDEX LAYOUT

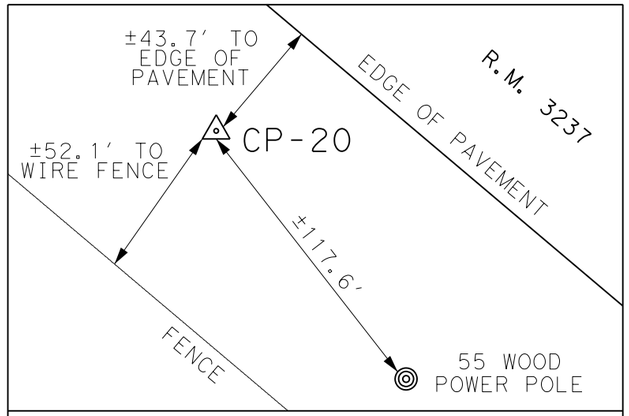
SHEET 5 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
JIA				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
JIA	TX	AUS	HAYS	73
CHECK	CONTROL	SECTION	JOB	
FG	0805	04	033	
CHECK				
RJZ				



CP-1 IS A CONCRETE MON W/TXDOT ALUM CAP LOCATED IN THE SOUTH RIGHT-OF-WAY OF R.M. 3237, ±10.1 FEET NORTHWEST OF A WIRE FENCE, ±28.7 FEET SOUTHEAST OF THE EDGE OF PAVEMENT, AND ±50.6 FEET SOUTHWEST OF A WOOD POWER POLE.

SURFACE COORDINATES	GRID COORDINATES
N = 13,919,330.95	N = 13,917,799.99
E = 2,262,606.38	E = 2,262,357.52
ELEV = 993.88'	ELEV = 993.88'



CP-20 IS A CONCRETE MON W/TXDOT ALUM CAP LOCATED IN THE SOUTH RIGHT-OF-WAY OF R.M. 3237, ±117.6 FEET NORTHWEST OF A WOOD POWER POLE, ±52.1 FEET NORTHEAST OF A WIRE FENCE, AND ±43.7 FEET SOUTHWEST OF THE EDGE OF PAVEMENT.

SURFACE COORDINATES	GRID COORDINATES
N = 13,918,806.14	N = 13,917,275.24
E = 2,265,337.23	E = 2,265,088.07
ELEV = 968.85'	ELEV = 968.85'

N

NOT TO SCALE

STATE OF TEXAS
REGISTERED
SCOTT C. BRASHEAR
6660
PROFESSIONAL
LAND SURVEYOR

11/8/21

REV	DATE	DESCRIPTION	APPROVED

SAM
SURVEYING · AERIAL MAPPING · ENGINEERING
4801 Southwest Parkway
Building Two, Suite 100
Austin, Texas 78735
(512) 447-0575
Fax: (512) 326-3029
Texas Firm Registration No. 10064500

AMERICAN
STRUCTUREPOINT
INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

HAYS COUNTY TEXAS

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

CONTROL INDEX LAYOUT

SHEET 6 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
JIA				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
JIA	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	74
FG	0805	04		
CHECK				
RJZ				

$SCRIPT$

ALIGNMENT (3237)
RM 3237

Beginning chain 3237 description
Feature: Geom_Centerline

Point 32371 X 2,256,675.6974 Y 13,912,552.3105 Sta 9+79.43

Course from 32371 to PC 3237_3 N 9° 50′ 12.16" E Dist 219.9474

Curve Data						
Curve 3237_3						
P.I. Station		15+46.74	X	2,256,772.6176	Y	13,913,111.2831
Delta	=	64° 33′ 03.05" (RT)				
Degree	=	10° 25′ 02.69"				
Tangent	=	347.3655				
Length	=	619.6436				
Radius	=	550.0000				
External	=	100.5096				
Long Chord	=	587.3887				
Mid. Ord.	=	84.9800				
P.C. Station		11+99.38	X	2,256,713.2734	Y	13,912,769.0243
P.T. Station		18+19.02	X	2,257,107.1667	Y	13,913,204.7692
C.C.			X	2,257,255.1876	Y	13,912,675.0619
Back	= N	9° 50′ 12.16" E				
Ahead	= N	74° 23′ 15.21" E				
Chord Bear	= N	42° 06′ 43.69" E				

Course from PT 3237_3 to PC 3237_6 N 74° 23′ 15.21" E Dist 353.8326

Curve Data						
Curve 3237_6						
P.I. Station		23+54.26	X	2,257,622.6587	Y	13,913,348.8178
Delta	=	13° 47′ 29.54" (RT)				
Degree	=	3° 49′ 10.99"				
Tangent	=	181.4076				
Length	=	361.0616				
Radius	=	1,500.0000				
External	=	10.9297				
Long Chord	=	360.1906				
Mid. Ord.	=	10.8507				
P.C. Station		21+72.85	X	2,257,447.9443	Y	13,913,299.9957
P.T. Station		25+33.91	X	2,257,803.9746	Y	13,913,354.5821
C.C.			X	2,257,851.6377	Y	13,911,855.3395
Back	= N	74° 23′ 15.21" E				
Ahead	= N	88° 10′ 44.75" E				
Chord Bear	= N	81° 16′ 59.98" E				

Course from PT 3237_6 to PC 3237_9 N 88° 10′ 44.75" E Dist 352.2520

Curve Data						
Curve 3237_9						
P.I. Station		40+28.25	X	2,259,297.5520	Y	13,913,402.0651
Delta	=	89° 51′ 13.29" (LT)				
Degree	=	5° 00′ 14.39"				
Tangent	=	1,142.0799				
Length	=	1,795.6380				
Radius	=	1,145.0000				
External	=	472.2110				
Long Chord	=	1,617.2058				
Mid. Ord.	=	334.3297				
P.C. Station		28+86.17	X	2,258,156.0488	Y	13,913,365.7750
P.T. Station		46+81.80	X	2,259,264.1769	Y	13,914,543.6572
C.C.			X	2,258,119.6659	Y	13,914,510.1968
Back	= N	88° 10′ 44.75" E				
Ahead	= N	1° 40′ 28.54" W				
Chord Bear	= N	43° 15′ 08.10" E				

Course from PT 3237_9 to 323712 N 1° 40′ 28.54" W Dist 182.9675

Point 323712 X 2,259,258.8301 Y 13,914,726.5466 Sta 48+64.77

Course from 323712 to PC 3237_14 N 1° 21′ 01.10" W Dist 487.9616

Curve Data						
Curve 3237_14						
P.I. Station		57+89.20	X	2,259,237.0457	Y	13,915,650.7217
Delta	=	43° 17′ 07.72" (RT)				
Degree	=	5° 12′ 31.35"				
Tangent	=	436.4702				
Length	=	831.0215				
Radius	=	1,100.0000				
External	=	83.4299				
Long Chord	=	811.3996				
Mid. Ord.	=	77.5482				
P.C. Station		53+52.73	X	2,259,247.3312	Y	13,915,214.3727
P.T. Station		61+83.75	X	2,259,528.7341	Y	13,915,975.4125
C.C.			X	2,260,347.0257	Y	13,915,240.2943
Back	= N	1° 21′ 01.10" W				
Ahead	= N	41° 56′ 06.62" E				
Chord Bear	= N	20° 17′ 32.76" E				

Course from PT 3237_14 to PC 3237_17 N 41° 56′ 06.62" E Dist 1,887.6055

Curve Data						
Curve 3237_17						
P.I. Station		80+80.87	X	2,260,796.5594	Y	13,917,386.6830
Delta	=	0° 02′ 10.84" (RT)				
Degree	=	0° 11′ 27.55"				
Tangent	=	9.5148				
Length	=	19.0295				
Radius	=	30,000.0000				
External	=	0.0015				
Long Chord	=	19.0295				
Mid. Ord.	=	0.0015				
P.C. Station		80+71.36	X	2,260,790.2008	Y	13,917,379.6050
P.T. Station		80+90.39	X	2,260,802.9225	Y	13,917,393.7571
C.C.			X	2,283,107.2442	Y	13,897,330.9250
Back	= N	41° 56′ 06.62" E				
Ahead	= N	41° 58′ 17.46" E				
Chord Bear	= N	41° 57′ 12.04" E				

Course from PT 3237_17 to PC 3237_20 N 41° 58′ 17.46" E Dist 328.0860

Curve Data						
Curve 3237_20						
P.I. Station		87+53.39	X	2,261,246.3115	Y	13,917,886.6830
Delta	=	1° 16′ 45.22" (LT)				
Degree	=	0° 11′ 27.55"				
Tangent	=	334.9147				
Length	=	669.8015				
Radius	=	30,000.0000				
External	=	1.8694				
Long Chord	=	669.7876				
Mid. Ord.	=	1.8693				
P.C. Station		84+18.48	X	2,261,022.3336	Y	13,917,637.6816
P.T. Station		90+88.28	X	2,261,464.6747	Y	13,918,140.6228
C.C.			X	2,238,718.0118	Y	13,937,700.5136
Back	= N	41° 58′ 17.46" E				
Ahead	= N	40° 41′ 32.24" E				
Chord Bear	= N	41° 19′ 54.85" E				

Course from PT 3237_20 to PC 3237_23 N 40° 41′ 32.24" E Dist 212.4344

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED
PROFESSIONAL ENGINEER
11/17/2023

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

HAYS COUNTY TEXAS

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

HORIZONTAL ALIGNMENT DATA

SHEET 1 OF 3

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	75
CHECK	CONTROL	SECTION	JOB	
AMP	0805	04	033	
CHECK				
AMP				

Curve Data

Curve 3237_23					
P.I. Station	94+12.10	X	2,261,675.8057	Y	13,918,386.1520
Delta =	1° 03′ 49.13" (RT)				
Degree =	0° 28′ 38.87"				
Tangent =	111.3879				
Length =	222.7695				
Radius =	12,000.0000				
External =	0.5170				
Long Chord =	222.7663				
Mid. Ord. =	0.5169				
P.C. Station	93+00.71	X	2,261,603.1811	Y	13,918,301.6952
P.T. Station	95+23.48	X	2,261,749.9855	Y	13,918,469.2462
C.C.		X	2,270,701.8463	Y	13,910,477.7389
Back = N	40° 41′ 32.24" E				
Ahead = N	41° 45′ 21.36" E				
Chord Bear = N	41° 13′ 26.80" E				

Course from PT 3237_23 to PC 3237_26 N 41° 45′ 21.37" E Dist 23.6716

Curve Data

Curve 3237_26					
P.I. Station	97+03.93	X	2,261,870.1592	Y	13,918,603.8614
Delta =	1° 29′ 49.41" (RT)				
Degree =	0° 28′ 38.87"				
Tangent =	156.7806				
Length =	313.5434				
Radius =	12,000.0000				
External =	1.0241				
Long Chord =	313.5344				
Mid. Ord. =	1.0240				
P.C. Station	95+47.15	X	2,261,765.7498	Y	13,918,486.9049
P.T. Station	98+60.70	X	2,261,977.5886	Y	13,918,718.0502
C.C.		X	2,270,717.6106	Y	13,910,495.3976
Back = N	41° 45′ 21.36" E				
Ahead = N	43° 15′ 10.78" E				
Chord Bear = N	42° 30′ 16.07" E				

Course from PT 3237_26 to PC 3237_29 N 43° 15′ 10.78" E Dist 69.9134

Curve Data

Curve 3237_29					
P.I. Station	100+16.71	X	2,262,084.4952	Y	13,918,831.6834
Delta =	0° 19′ 44.01" (LT)				
Degree =	0° 11′ 27.55"				
Tangent =	86.1042				
Length =	172.2079				
Radius =	30,000.0000				
External =	0.1236				
Long Chord =	172.2077				
Mid. Ord. =	0.1236				
P.C. Station	99+30.61	X	2,262,025.4948	Y	13,918,768.9706
P.T. Station	101+02.82	X	2,262,143.1346	Y	13,918,894.7337
C.C.		X	2,240,175.4398	Y	13,939,325.6021
Back = N	43° 15′ 10.78" E				
Ahead = N	42° 55′ 26.76" E				
Chord Bear = N	43° 05′ 18.77" E				

Course from PT 3237_29 to PC 3237_32 N 42° 55′ 26.76" E Dist 727.9817

Curve Data

Curve 3237_32					
P.I. Station	108+61.31	X	2,262,659.6890	Y	13,919,450.1437
Delta =	2° 54′ 46.10" (RT)				
Degree =	4° 46′ 28.73"				
Tangent =	30.5094				
Length =	61.0056				
Radius =	1,200.0000				
External =	0.3878				
Long Chord =	60.9991				
Mid. Ord. =	0.3877				
P.C. Station	108+30.80	X	2,262,638.9112	Y	13,919,427.8030
P.T. Station	108+91.80	X	2,262,681.5752	Y	13,919,471.3997
C.C.		X	2,263,517.6190	Y	13,918,610.5683
Back = N	42° 55′ 26.76" E				
Ahead = N	45° 50′ 12.86" E				
Chord Bear = N	44° 22′ 49.81" E				

Course from PT 3237_32 to 323735 N 45° 50′ 12.86" E Dist 23.1178

Point 323735 X 2,262,698.1590 Y 13,919,487.5060 Sta 109+14.92

Course from 323735 to PC 3237_37 N 45° 50′ 12.86" E Dist 39.0156

Curve Data

Curve 3237_37					
P.I. Station	118+65.12	X	2,263,379.7955	Y	13,920,149.5147
Delta =	77° 15′ 43.12" (RT)				
Degree =	5° 01′ 30.89"				
Tangent =	911.1864				
Length =	1,537.4759				
Radius =	1,140.1582				
External =	319.3696				
Long Chord =	1,423.6066				
Mid. Ord. =	249.4861				
P.C. Station	109+53.94	X	2,262,726.1472	Y	13,919,514.6883
P.T. Station	124+91.41	X	2,264,143.1231	Y	13,919,651.9289
C.C.		X	2,263,520.4990	Y	13,918,696.7849
Back = N	45° 50′ 12.86" E				
Ahead = S	56° 54′ 04.02" E				
Chord Bear = N	84° 28′ 04.42" E				

Course from PT 3237_37 to PC 3237_40 S 56° 54′ 04.02" E Dist 3,456.0758

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED PROFESSIONAL ENGINEER
11/17/2023

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

HAYS COUNTY TEXAS

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

HORIZONTAL ALIGNMENT DATA

SHEET 2 OF 3

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	76
CHECK	CONTROL	SECTION	JOB	
AMP	0805	04	033	
CHECK				
AMP				

ALIGNMENT (FLITE)
FLITE ACRES RD

Beginning chain FLITE description
Feature: Geom_Centerline

Point FLITE1 X 2,258,528.2266 Y 13,913,440.5693 Sta 10+00.00

Course from FLITE1 to PC FLITE_3 S 22° 21′ 10.87" E Dist 123.1673

Curve FLITE_3						
		Curve Data				
P.I. Station	11+88.30	X	2,258,599.8388	Y	13,913,266.4199	
Delta =	2° 19′ 55.26"	(LT)				
Degree =	1° 47′ 25.78"					
Tangent =	65.1312					
Length =	130.2443					
Radius =	3,200.0000					
External =	0.6628					
Long Chord =	130.2353					
Mid. Ord. =	0.6626					
P.C. Station	11+23.17	X	2,258,575.0686	Y	13,913,326.6570	
P.T. Station	12+53.41	X	2,258,627.0395	Y	13,913,207.2406	
C.C.		X	2,261,534.6149	Y	13,914,543.6558	
Back = S	22° 21′ 10.87" E					
Ahead = S	24° 41′ 06.12" E					
Chord Bear = S	23° 31′ 08.49" E					

Course from PT FLITE_3 to FLITE5 S 24° 41′ 06.12" E Dist 53.4725

Point FLITE5 X 2,258,649.3712 Y 13,913,158.6545 Sta 13+06.88

Ending chain FLITE description

ALIGNMENT (ROGERS)
ROGERS RD

Beginning chain ROGERS description

Point ROGERS11 X 2,264,185.1194 Y 13,919,624.5530 Sta 10+00.00

Course from ROGERS11 to PC ROGERS1_3 N 33° 05′ 55.98" E Dist 17.4015

Curve ROGERS1_3						
		Curve Data				
P.I. Station	10+31.84	X	2,264,202.5063	Y	13,919,651.2257	
Delta =	32° 12′ 45.29"	(LT)				
Degree =	114° 35′ 29.61"					
Tangent =	14.4377					
Length =	28.1108					
Radius =	50.0000					
External =	2.0427					
Long Chord =	27.7420					
Mid. Ord. =	1.9626					
P.C. Station	10+17.40	X	2,264,194.6221	Y	13,919,639.1308	
P.T. Station	10+45.51	X	2,264,202.7296	Y	13,919,665.6616	
C.C.		X	2,264,152.7356	Y	13,919,666.4351	
Back = N	33° 05′ 55.98" E					
Ahead = N	0° 53′ 10.69" E					
Chord Bear = N	16° 59′ 33.34" E					

Course from PT ROGERS1_3 to ROGERS15 N 0° 53′ 10.69" E Dist 18.2752

Point ROGERS15 X 2,264,203.0123 Y 13,919,683.9346 Sta 10+63.79

Ending chain ROGERS description

ALIGNMENT (SMITH02)
SMITH CREEK RD

Beginning chain SMITH02 description

Point SMITH021 X 2,264,282.6294 Y 13,919,560.9898 Sta 10+00.00

Course from SMITH021 to PC SMITH02_3 S 22° 23′ 59.90" W Dist 82.4489

Curve SMITH02_3						
		Curve Data				
P.I. Station	10+87.08	X	2,264,249.4443	Y	13,919,480.4766	
Delta =	5° 18′ 27.46"	(LT)				
Degree =	57° 17′ 44.81"					
Tangent =	4.6351					
Length =	9.2636					
Radius =	100.0000					
External =	0.1074					
Long Chord =	9.2602					
Mid. Ord. =	0.1072					
P.C. Station	10+82.45	X	2,264,251.2106	Y	13,919,484.7619	
P.T. Station	10+91.71	X	2,264,248.0820	Y	13,919,476.0462	
C.C.		X	2,264,343.6653	Y	13,919,446.6549	
Back = S	22° 23′ 59.90" W					
Ahead = S	17° 05′ 32.45" W					
Chord Bear = S	19° 44′ 46.17" W					

Course from PT SMITH02_3 to PC SMITH02_6 S 17° 05′ 32.45" W Dist 73.2570

Curve SMITH02_6						
		Curve Data				
P.I. Station	11+70.03	X	2,264,225.0643	Y	13,919,401.1902	
Delta =	5° 47′ 27.75"	(RT)				
Degree =	57° 17′ 44.81"					
Tangent =	5.0579					
Length =	10.1073					
Radius =	100.0000					
External =	0.1278					
Long Chord =	10.1030					
Mid. Ord. =	0.1277					
P.C. Station	11+64.97	X	2,264,226.5509	Y	13,919,406.0248	
P.T. Station	11+75.08	X	2,264,223.0975	Y	13,919,396.5304	
C.C.		X	2,264,130.9676	Y	13,919,435.4160	
Back = S	17° 05′ 32.45" W					
Ahead = S	22° 53′ 00.19" W					
Chord Bear = S	19° 59′ 16.32" W					

Course from PT SMITH02_6 to SMITH028 S 22° 53′ 00.19" W Dist 103.9559

Point SMITH028 X 2,264,182.6735 Y 13,919,300.7560 Sta 12+79.03

Ending chain SMITH02 description

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED
PROFESSIONAL ENGINEER
11/17/2023

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

HAYS COUNTY TEXAS

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

HORIZONTAL ALIGNMENT DATA

SHEET 3 OF 3

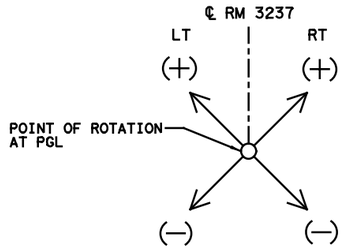
DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	77
AMP	0805	04	033	
CHECK				
AMP				

RM 3237 AT
FLITE ACRES

STATION	CROSS SLOPE (%)	
	LEFT	RIGHT
23+60	+6.82	-8.63
24+00	+6.30	-8.35
25+00	+5.25	-5.29
26+00	+2.01	-4.45
27+00	-2.00	-2.00
28+00	-3.79	+2.65
29+00	-7.68	+6.31
30+00	-8.50	+7.76
31+00	-8.53	+7.10
32+00	-8.62	+5.88
33+00	-7.95	+4.66
34+00	-9.44	+6.67
35+00	-8.66	+7.86
36+00	-7.48	+7.35
37+00	-9.70	+7.83
38+00	-8.62	+7.42
39+00	-7.31	+7.06
40+00	-8.32	+7.75
41+00	-8.65	+8.08
42+00	-7.86	+8.09

RM 3237 AT
ROGERS RD

STATION	CROSS SLOPE (%)	
	LEFT	RIGHT
112+00	+8.14	-9.85
113+00	+7.61	-10.00
114+00	+6.84	-9.64
115+00	+6.82	-9.23
116+00	+7.48	-9.80
117+00	+7.58	-8.91
118+00	+7.82	-9.84
119+00	+6.32	-9.69
120+00	+5.80	-9.92
121+00	+5.73	-10.00
122+00	+6.97	-10.00
123+00	+6.93	-9.17
124+00	+6.97	-9.16
125+00	+4.58	-7.31
126+00	+1.98	-4.86
127+00	-2.00	-2.00
128+00	-2.00	-2.00
129+00	-2.00	-2.00
130+00	-2.00	-2.00
131+00	-2.00	-2.00
132+00	-2.00	-2.00
133+00	-2.00	-2.00
134+00	-2.00	-2.00
135+00	-2.38	-2.37
136+00	-2.61	-2.59
137+00	-2.89	-2.86
137+20	-2.96	-2.92



CROSS SLOPE SIGN CONVENTION

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED
PROFESSIONAL ENGINEER
11/17/2023

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

HAYS COUNTY TEXAS

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

TABLE OF CROSS SLOPES

SHEET 1 OF 1

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	78
CHECK	CONTROL	SECTION	JOB	
AMP	0805	04	033	
CHECK				
AMP				

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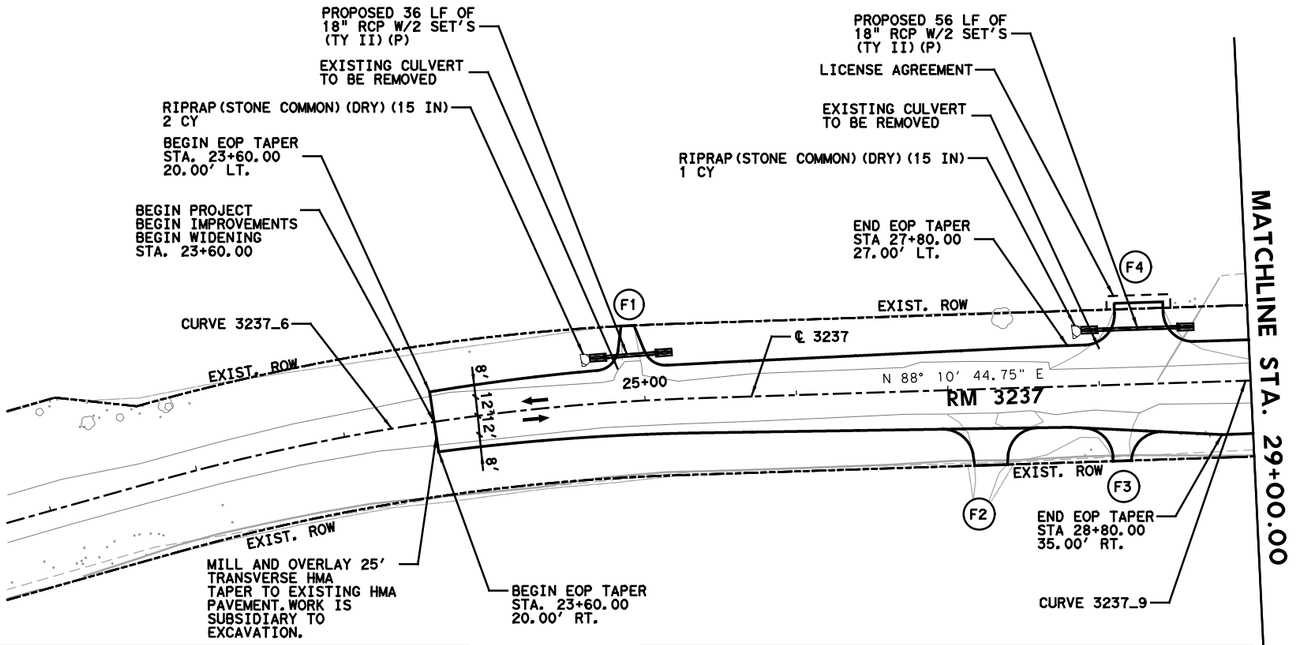
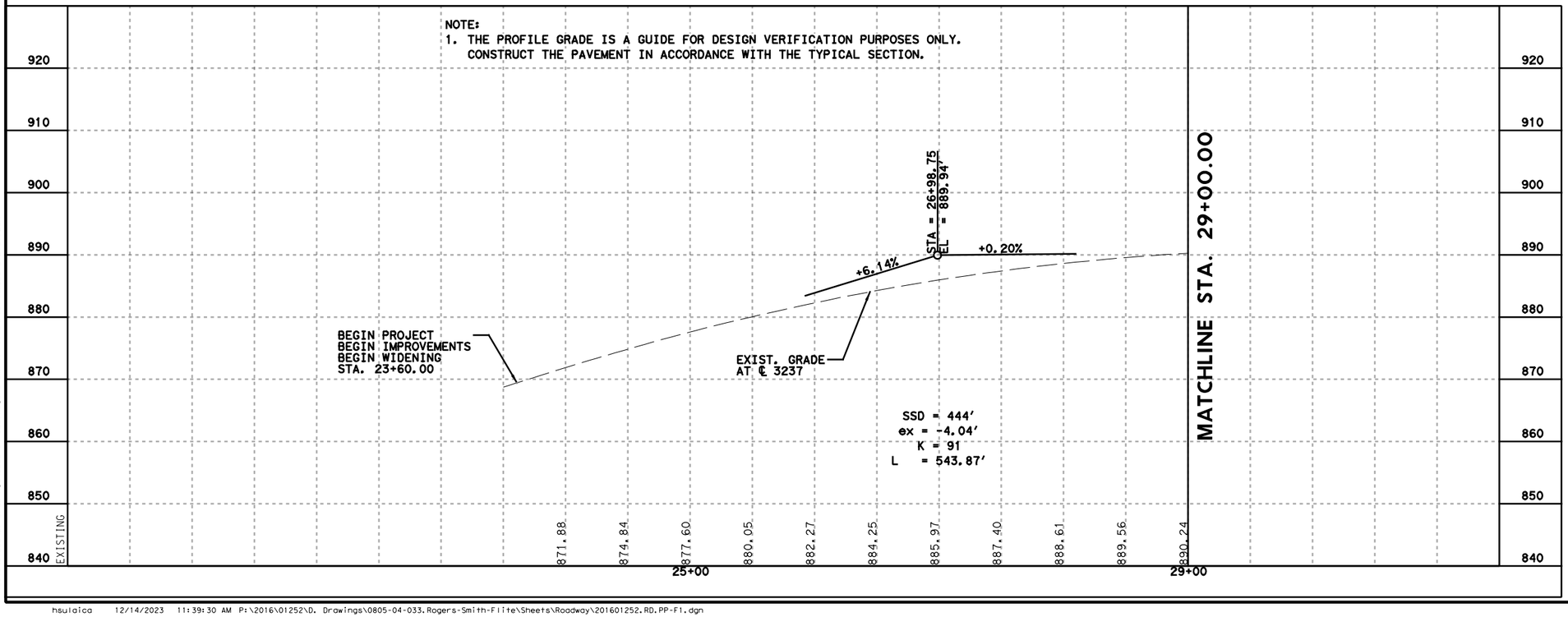
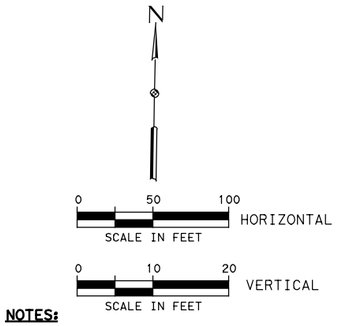


QUANTITY SUMMARY				
ITEM	CODE	DESCRIPTION	UNIT	QTY
100	6002	PREPARING ROW	STA	5.4
110	6001	EXCAVATION (ROADWAY)	CY	1367
132	6003	EMBANKMENT (FINAL) (ORD COMP) (TY B)	CY	144
247	6366	FL BS (CMP IN PLC) (TY A GR 5) (FNAL POS)	CY	412
310	6001	PRIME COAT (MULTI OPTION)	GAL	296
351	6002	FLEXIBLE PAVEMENT STRUCTURE REPAIR (6")	SY	375
432	6025	RIRRAP (STONE COMMON) (DRY) (15 IN)	CY	3

QUANTITY SUMMARY				
ITEM	CODE	DESCRIPTION	UNIT	QTY
530	6005	DRIVEWAYS (ACP)	SY	297
3076	6001	D-GR HMA TY-B PG64-22	TON	375
3076	6048	D-GR HMA TY-D PG76-22	TON	146
3076	6051	D-GR HMA TY-D PG76-22 (LEVEL-UP)	TON	167
3079	6011	PFC-C PG76-22 SAC A	TON	201
3084	6001	BONDING COURSE	GAL	355
3085	6001	UNDERSEAL COURSE	GAL	595





NOTES:

1. STATIONING BASED ON ℄ RM 3237 UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS ARE TO EDGE OF PAVEMENT UNLESS OTHERWISE NOTED.
3. SEE DRIVEWAY CONSTRUCTION DETAIL SHEET FOR MORE INFORMATION.
4. CONTRACTOR TO PROTECT POLES IN PLACE DURING CONSTRUCTION OF DITCH CUTS AND RIPRAP.

LEGEND:

- (#) DRIVEWAY
- ← DIRECTION OF TRAFFIC
- -------- EXISTING ROW
- PROPOSED RIPRAP
- - - - - - LICENSE AGREEMENT
- VEGETATIVE FILTER STRIPS

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS
RM 3237
BEGIN PROJECT TO STA. 29+00
PLAN AND PROFILE
FLITE ACRES RD

SHEET 1 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	79
AMP	0805	04	033	
CHECK				
AMP				

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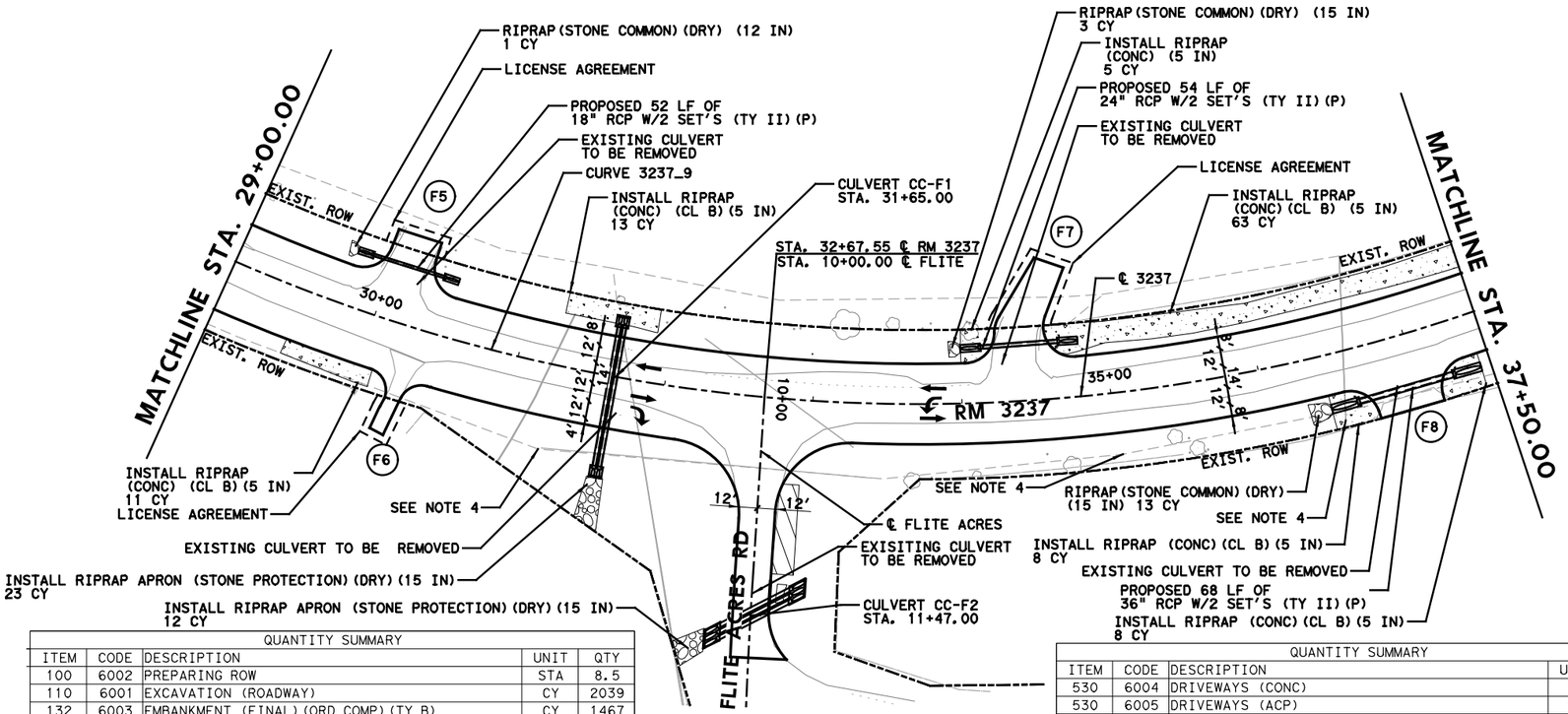
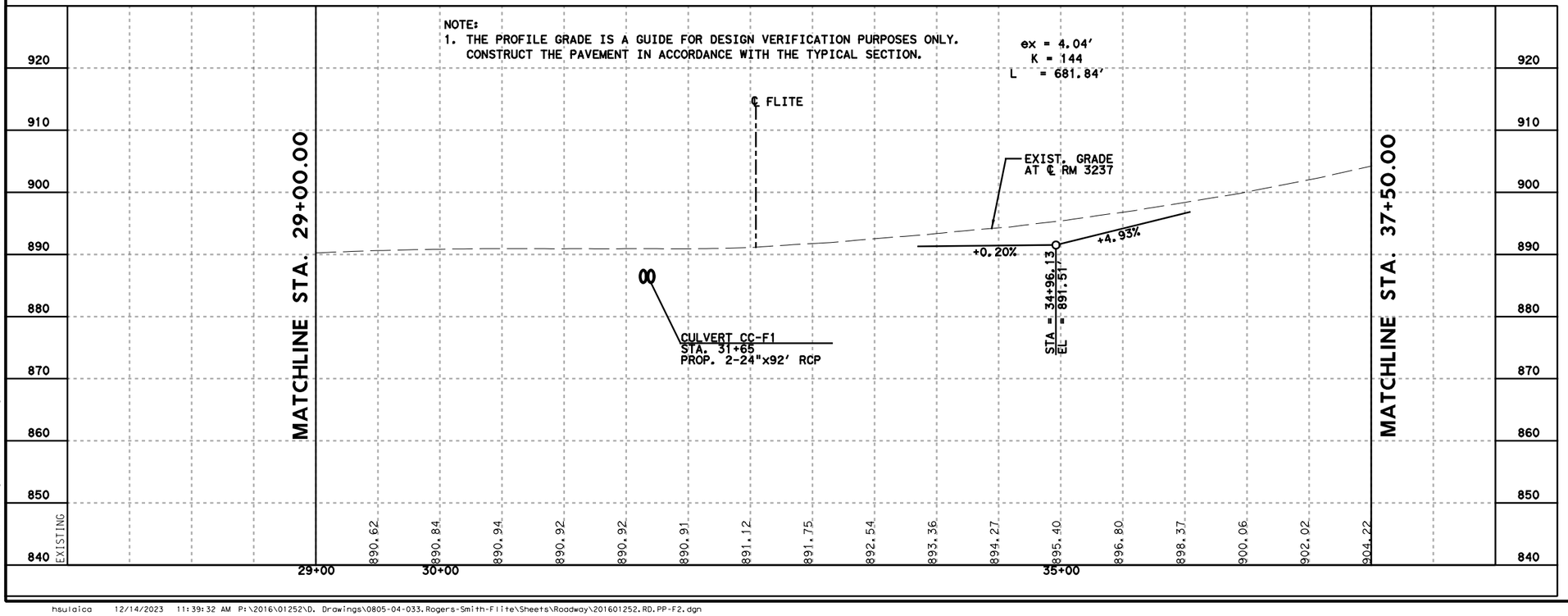
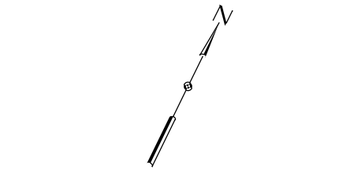


QUANTITY SUMMARY				
ITEM	CODE	DESCRIPTION	UNIT	QTY
100	6002	PREPARING ROW	STA	8.5
110	6001	EXCAVATION (ROADWAY)	CY	2039
132	6003	EMBANKMENT (FINAL) (ORD COMP) (TY B)	CY	1467
247	6366	FL BS (CMP IN PLC) (TY A GR 5) (FNAL POS)	CY	981
310	6001	PRIME COAT (MULTI OPTION)	GAL	706
351	6002	FLEXIBLE PAVEMENT STRUCTURE REPAIR (6")	SY	375
432	6006	RIPRAP (CONC) (CL B)	CY	108
432	6024	RIPRAP (STONE COMMON) (DRY) (12 IN)	CY	1
432	6025	RIRRAP (STONE COMMON) (DRY) (15 IN)	CY	51

QUANTITY SUMMARY				
ITEM	CODE	DESCRIPTION	UNIT	QTY
530	6004	DRIVEWAYS (CONC)	SY	138
530	6005	DRIVEWAYS (ACP)	SY	938
3076	6001	D-GR HMA TY-B PG64-22	TON	757
3076	6048	D-GR HMA TY-D PG76-22	TON	292
3076	6051	D-GR HMA TY-D PG76-22 (LEVEL-UP)	TON	167
3079	6011	PFC-C PG76-22 SAC A	TON	366
3084	6001	BONDING COURSE	GAL	707
3085	6001	UNDERSEAL COURSE	GAL	1085





NOTES:

1. STATIONING BASED ON ℄ RM 3237 UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS ARE TO EDGE OF PAVEMENT UNLESS OTHERWISE NOTED.
3. SEE DRIVEWAY CONSTRUCTION DETAIL SHEET FOR MORE INFORMATION.
4. CONTRACTOR TO PROTECT POLES IN PLACE DURING CONSTRUCTION OF DITCH CUTS AND RIPRAP.

LEGEND:

- (#) DRIVEWAY
- DIRECTION OF TRAFFIC
- EXISTING ROW
- PROPOSED RIPRAP
- LICENSE AGREEMENT
- VEGETATIVE FILTER STRIPS

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

RM 3237
STA. 29+00 TO STA. 37+50
PLAN AND PROFILE
FLITE ACRES RD

SHEET 2 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	80
CHECK	CONTROL	SECTION	JOB	
AMP	0805	04	033	
CHECK				
AMP				

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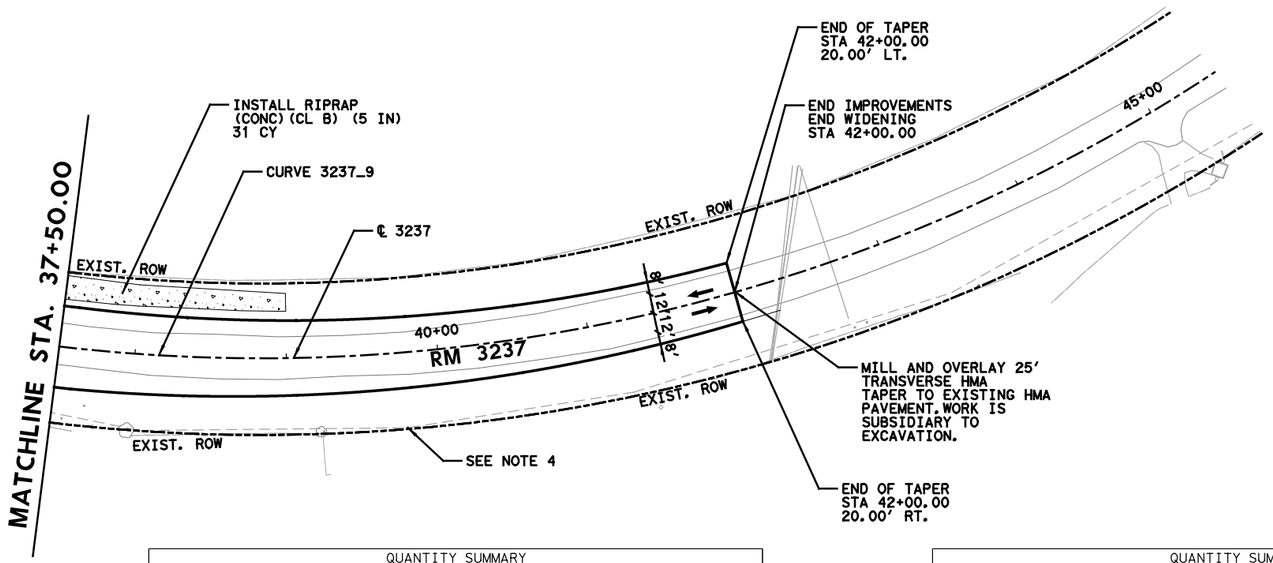
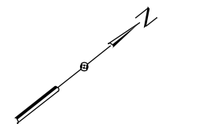


QUANTITY SUMMARY				
ITEM	CODE	DESCRIPTION	UNIT	QTY
100	6002	PREPARING ROW	STA	4.5
110	6001	EXCAVATION (ROADWAY)	CY	1275
132	6003	EMBANKMENT (FINAL)(ORD COMP)(TY B)	CY	229
247	6366	FL BS (CMP IN PLC)(TY A GR 5)(FNAL POS)	CY	460
310	6001	PRIME COAT (MULTI OPTION)	GAL	332
351	6002	FLEXIBLE PAVEMENT STRUCTURE REPAIR(6")	SY	375
432	6006	RIPRAP (CONC)(CL B)	CY	31

QUANTITY SUMMARY				
ITEM	CODE	DESCRIPTION	UNIT	QTY
3076	6001	D-GR HMA TY-B PG64-22	TON	286
3076	6048	D-GR HMA TY-D PG76-22	TON	112
3076	6051	D-GR HMA TY-D PG76-22 (LEVEL-UP)	TON	167
3079	6011	PFC-C PG76-22 SAC A	TON	159
3084	6001	BONDING COURSE	GAL	272
3085	6001	UNDERSEAL COURSE	GAL	472



NOTES:

1. STATIONING BASED ON ℄ RM 3237 UNLESS OTHERWISE NOTED.
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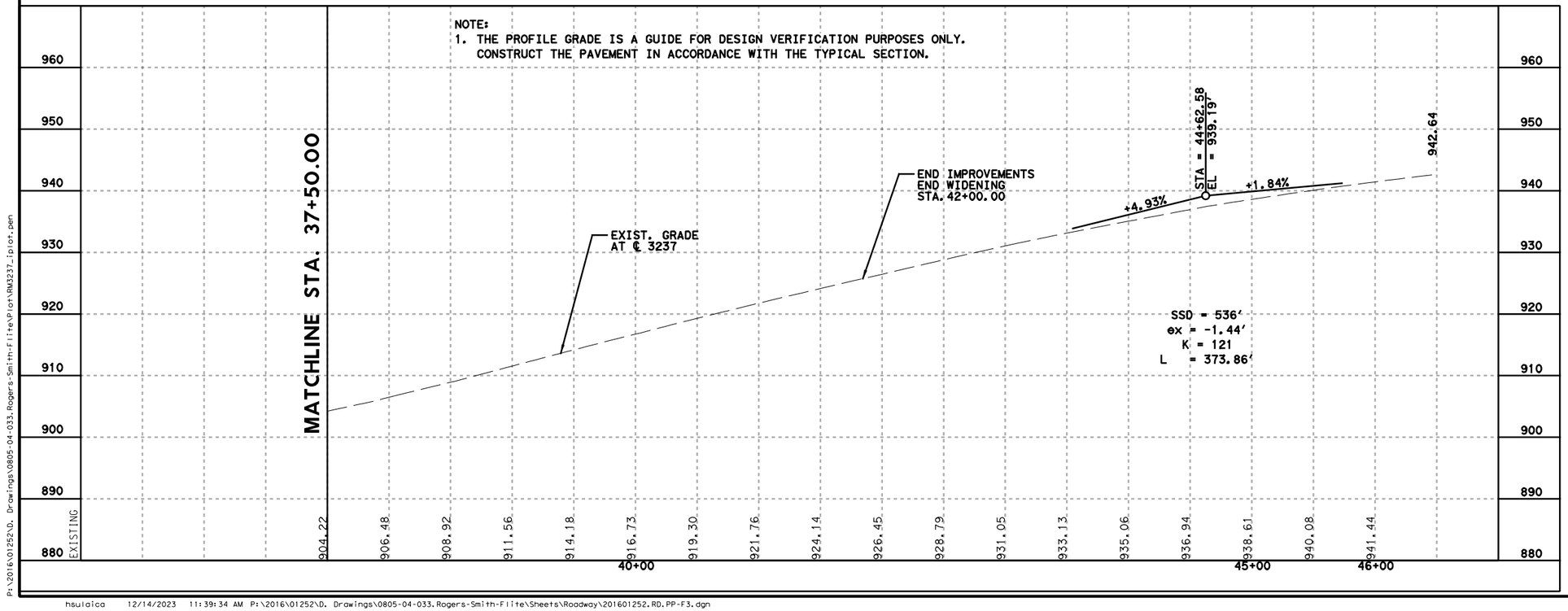
3. SEE DRIVEWAY CONSTRUCTION DETAIL SHEET FOR MORE INFORMATION.
4. CONTRACTOR TO PROTECT POLES IN PLACE DURING CONSTRUCTION OF DITCH CUTS AND RIPRAP.

LEGEND:

- (#) DRIVEWAY
- ← DIRECTION OF TRAFFIC
- -------- EXISTING ROW
- PROPOSED RIPRAP
- - - - - LICENSE AGREEMENT
- VEGETATIVE FILTER STRIPS



ADAM M. PFEIFFER
132899
LICENSED PROFESSIONAL ENGINEER
STATE OF TEXAS
12/14/2023

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS
RM 3237
SAT. 37+50 TO END PROJECT
PLAN AND PROFILE
FLITE ACRES RD

SHEET 3 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	81
CHECK	CONTROL	SECTION	JOB	
AMP	0805	04	033	
CHECK				
AMP				

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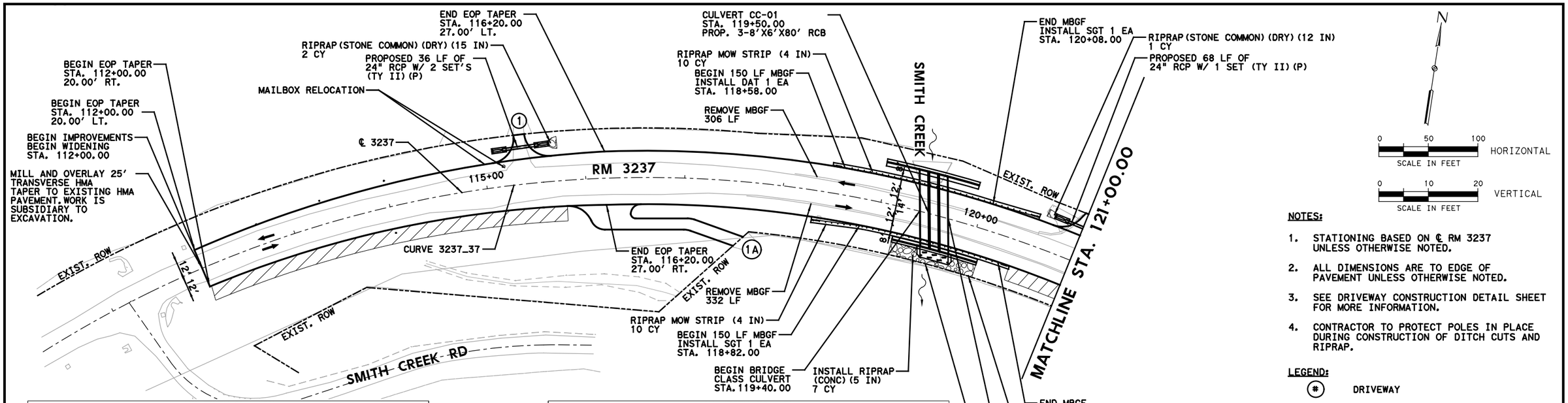


QUANTITY SUMMARY

ITEM	CODE	DESCRIPTION	UNIT	QTY
100	6002	PREPARING ROW	STA	9.0
110	6001	EXCAVATION (ROADWAY)	CY	1272
132	6003	EMBANKMENT (FINAL) (ORD COMP) (TY B)	CY	936
247	6366	FL BS (CMP IN PLC) (TY A GR 5) (FNAL POS)	CY	846
310	6001	PRIME COAT (MULTI OPTION)	GAL	613
351	6002	FLEXIBLE PAVEMENT STRUCTURE REPAIR(6")	SY	513
432	6024	RIPRAP (STONE COMMON) (DRY) (12 IN)	CY	1
432	6025	RIRRAP (STONE COMMON) (DRY) (15 IN)	CY	51
432	6045	RIPRAP (MOW STRIP) (4 IN)	CY	20
530	6005	DRIVEWAYS (ACP)	SY	327
540	6001	MTL W-BEAM GD FEN (TIM POST)	LF	300
540	6002	MTL W-BEAM GD FEN (STEEL POST)	LF	50

QUANTITY SUMMARY

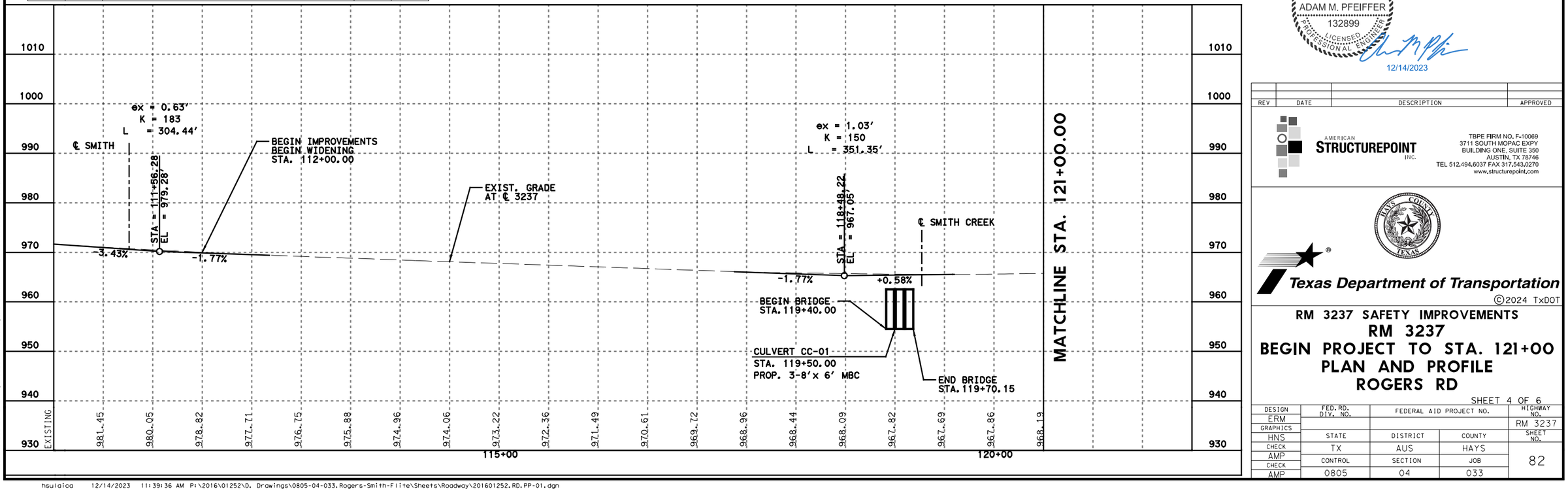
ITEM	CODE	DESCRIPTION	UNIT	QTY
540	6016	DOWNSTREAM ANCHOR TERMINAL SECTION	EA	2
542	6001	REMOVE METAL BEAM GUARD FENCE	LF	638
542	6002	REMOVE TERMINAL ANCHOR SECTION	EA	2
544	6001	GUARDRAIL END TREATMENT (INSTALL)	EA	2
560	6011	MAILBOX INSTALL-S (TWW-POST) TY 4	EA	1
3076	6001	D-GR HMA TY-B PG64-22	TON	642
3076	6048	D-GR HMA TY-D PG76-22	TON	250
3076	6051	D-GR HMA TY-D PG76-22 (LEVEL-UP)	TON	167
3079	6011	PFC-C PG76-22 SAC A	TON	340
3084	6001	BONDING COURSE	GAL	607
3085	6001	UNDERSEAL COURSE	GAL	1007

NOTES:

1. STATIONING BASED ON ℄ RM 3237 UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS ARE TO EDGE OF PAVEMENT UNLESS OTHERWISE NOTED.
3. SEE DRIVEWAY CONSTRUCTION DETAIL SHEET FOR MORE INFORMATION.
4. CONTRACTOR TO PROTECT POLES IN PLACE DURING CONSTRUCTION OF DITCH CUTS AND RIPRAP.

LEGEND:

- (#) DRIVEWAY
- ← DIRECTION OF TRAFFIC
- -------- EXISTING ROW
- PROPOSED RIPRAP
- - - - - LICENSE AGREEMENT
- VEGETATIVE FILTER STRIPS



STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED PROFESSIONAL ENGINEER
12/14/2023

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

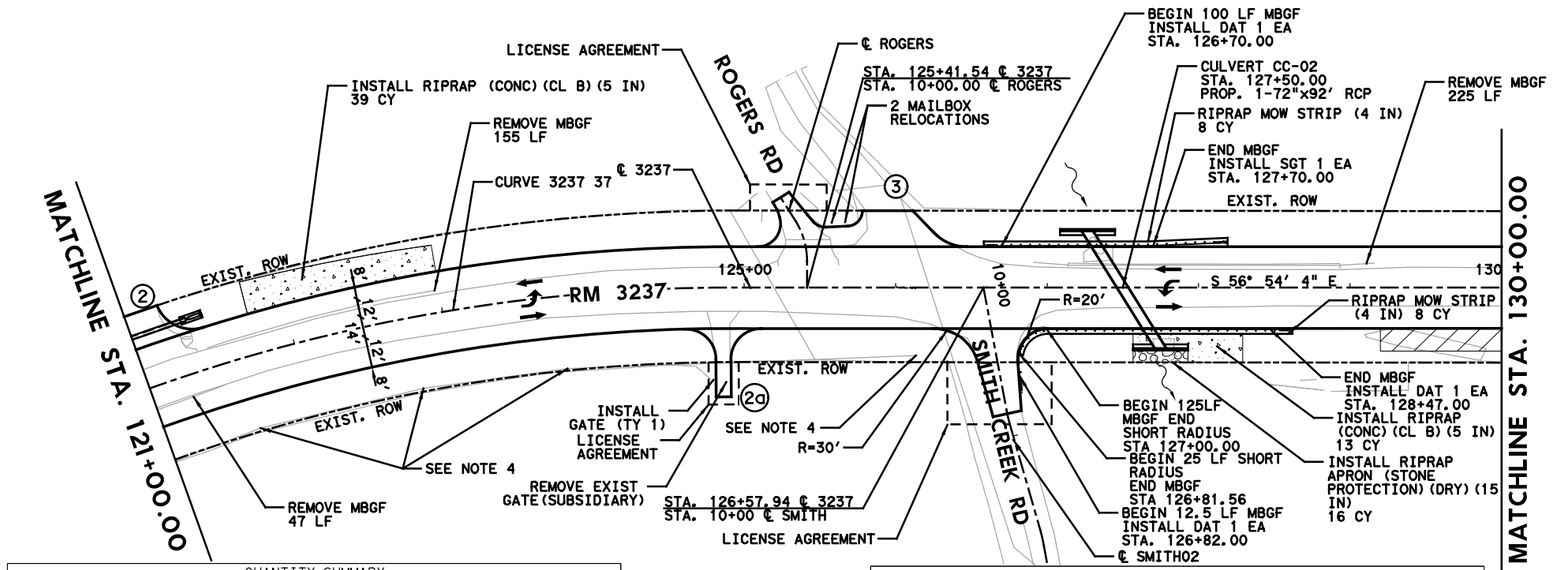
Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

RM 3237
BEGIN PROJECT TO STA. 121+00
PLAN AND PROFILE
ROGERS RD

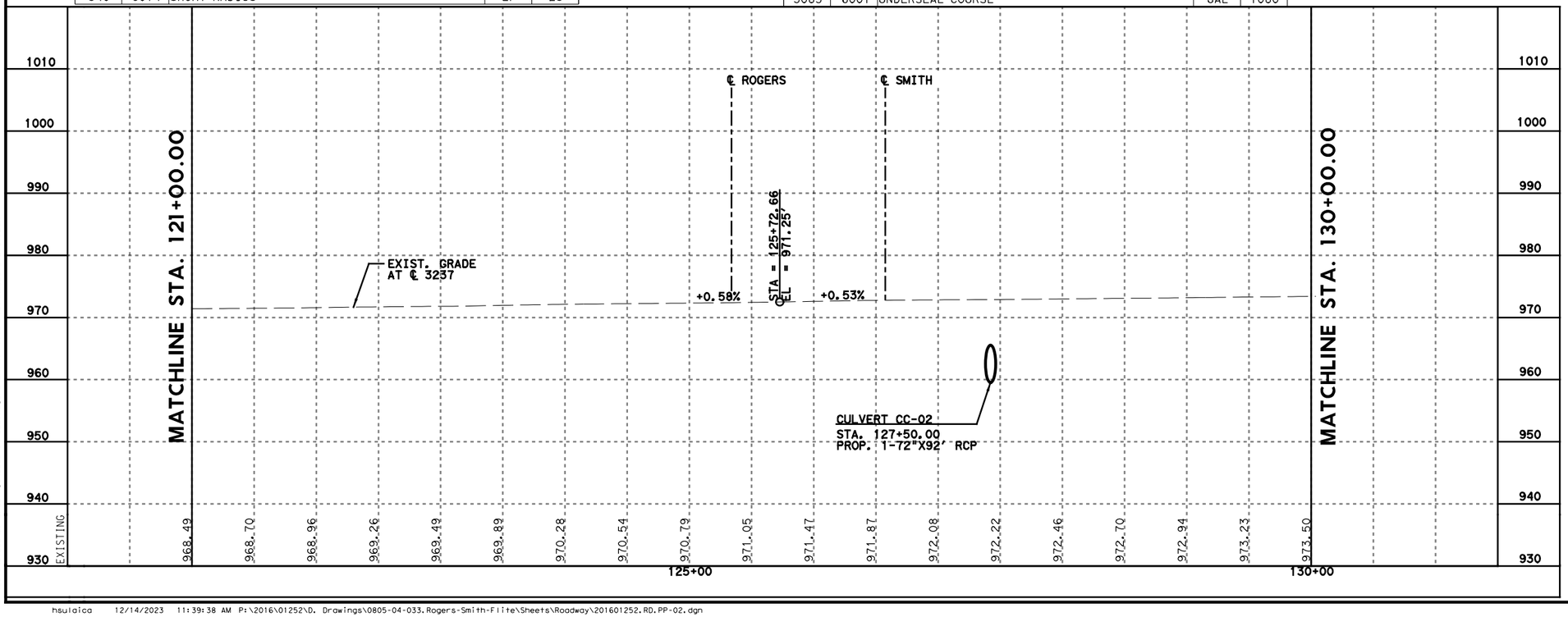
SHEET 4 OF 6

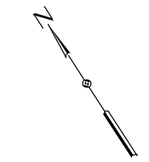
DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	82
AMP	0805	04	033	
CHECK				
AMP				



QUANTITY SUMMARY				
ITEM	CODE	DESCRIPTION	UNIT	QTY
100	6002	PREPARING ROW	STA	9.0
110	6001	EXCAVATION (ROADWAY)	CY	2470
132	6003	EMBANKMENT (FINAL) (ORD COMP) (TY B)	CY	1313
247	6366	FL BS (CMP IN PLC) (TY A GR 5) (FNAL POS)	CY	948
310	6001	PRIME COAT (MULTI OPTION)	GAL	677
351	6002	FLEXIBLE PAVEMENT STRUCTURE REPAIR (6")	SY	513
432	6006	RIPRAP (CONC) (CL B)	CY	52
432	6025	RIRRAP (STONE COMMON) (DRY) (15 IN)	CY	16
432	6045	RIPRAP (MOW STRIP) (4 IN)	CY	16
530	6005	DRIVEWAYS (ACP)	SY	602
540	6001	MTL W-BEAM GD FEN (TIM POST)	LF	225
540	6014	SHORT RADIUS	LF	25

QUANTITY SUMMARY				
ITEM	CODE	DESCRIPTION	UNIT	QTY
540	6016	DOWNSTREAM ANCHOR TERMINAL SECTION	EA	3
542	6001	REMOVE METAL BEAM GUARD FENCE	LF	427
542	6002	REMOVE TERMINAL ANCHOR SECTION	EA	6
544	6001	GUARDRAIL END TREATMENT (INSTALL)	EA	1
552	6005	GATE (TY 1)	EA	1
560	6011	MAILBOX INSTALL-S (TWW-POST) TY 4	EA	2
3076	6001	D-GR HMA TY-B PG64-22	TON	723
3076	6048	D-GR HMA TY-D PG76-22	TON	280
3076	6051	D-GR HMA TY-D PG76-22 (LEVEL-UP)	TON	167
3079	6011	PFC-C PG76-22 SAC A	TON	364
3084	6001	BONDING COURSE	GAL	680
3085	6001	UNDERSEAL COURSE	GAL	1080





0 50 100 HORIZONTAL
SCALE IN FEET

0 10 20 VERTICAL
SCALE IN FEET

NOTES:

1. STATIONING BASED ON ℄ RM 3237 UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS ARE TO EDGE OF PAVEMENT UNLESS OTHERWISE NOTED.
3. SEE DRIVEWAY CONSTRUCTION DETAIL SHEET FOR MORE INFORMATION.
4. CONTRACTOR TO PROTECT POLES IN PLACE DURING CONSTRUCTION OF DITCH CUTS AND RIPRAP.

LEGEND:

- (#) DRIVEWAY
- ← DIRECTION OF TRAFFIC
- -------- EXISTING ROW
- PROPOSED RIPRAP
- - - - - LICENSE AGREEMENT
- VEGETATIVE FILTER STRIPS

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
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Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

RM 3237
STA. 121+00 TO STA. 130+00
PLAN AND PROFILE
ROGERS RD

SHEET 5 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	83
CHECK	CONTROL	SECTION	JOB	
AMP	0805	04	033	
CHECK				
AMP				

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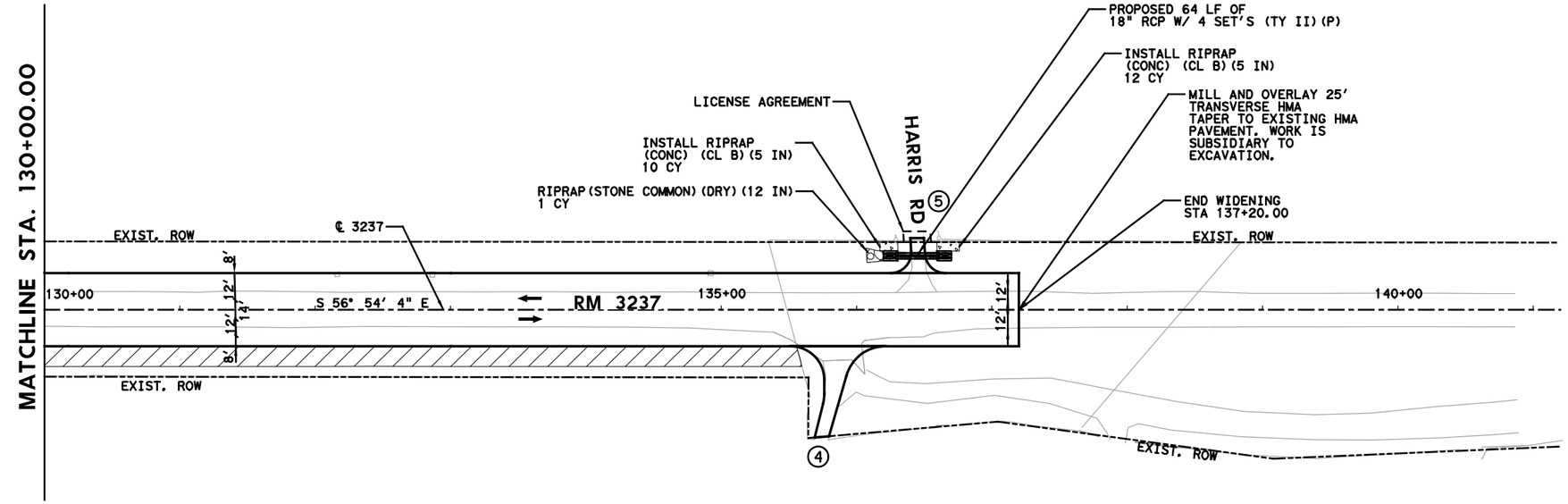
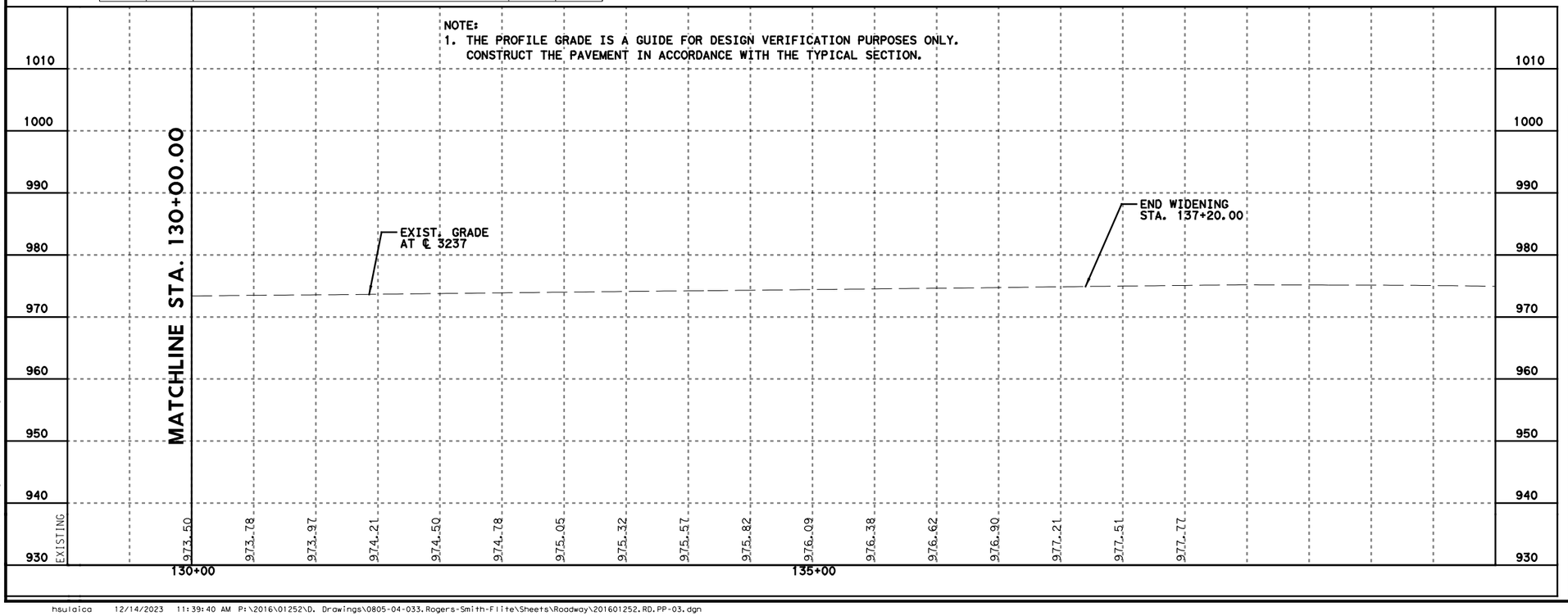
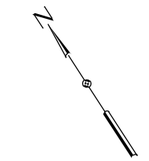


QUANTITY SUMMARY				
ITEM	CODE	DESCRIPTION	UNIT	QTY
100	6002	PREPARING ROW	STA	7.2
110	6001	EXCAVATION (ROADWAY)	CY	1823
132	6003	EMBANKMENT (FINAL) (ORD COMP) (TY B)	CY	1219
247	6366	FL BS (CMP IN PLC) (TY A GR 5) (FNAL POS)	CY	749
310	6001	PRIME COAT (MULTI OPTION)	GAL	541
351	6002	FLEXIBLE PAVEMENT STRUCTURE REPAIR (6")	SY	513
530	6005	DRIVEWAYS (ACP)	SY	173
432	6006	RIPRAP (CONC) (CL B)	CY	22

QUANTITY SUMMARY				
ITEM	CODE	DESCRIPTION	UNIT	QTY
432	6024	RIPRAP (STONE COMMON) (DRY) (12 IN)	CY	1
3076	6001	D-GR HMA TY-B PG64-22	TON	578
3076	6048	D-GR HMA TY-D PG76-22	TON	224
3076	6051	D-GR HMA TY-D PG76-22 (LEVEL-UP)	TON	167
3079	6011	PFC-C PG76-22 SAC A	TON	292
3084	6001	BONDING COURSE	GAL	544
3085	6001	UNDERSEAL COURSE	GAL	864





0 50 100 SCALE IN FEET HORIZONTAL

0 10 20 SCALE IN FEET VERTICAL

NOTES:

1. STATIONING BASED ON ℄ RM 3237 UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS ARE TO EDGE OF PAVEMENT UNLESS OTHERWISE NOTED.
3. SEE DRIVEWAY CONSTRUCTION DETAIL SHEET FOR MORE INFORMATION.
4. CONTRACTOR TO PROTECT POLES IN PLACE DURING CONSTRUCTION OF DITCH CUTS AND RIPRAP.

LEGEND:

- (#) DRIVEWAY
- DIRECTION OF TRAFFIC
- EXISTING ROW
- PROPOSED RIPRAP
- LICENSE AGREEMENT
- VEGETATIVE FILTER STRIPS

12/14/2023

REV	DATE	DESCRIPTION	APPROVED

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Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS
RM 3237
STA. 130+00 TO STA. 137+50
PLAN AND PROFILE
ROGERS RD

SHEET 6 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	84
AMP	0805	04	033	
CHECK				
AMP				

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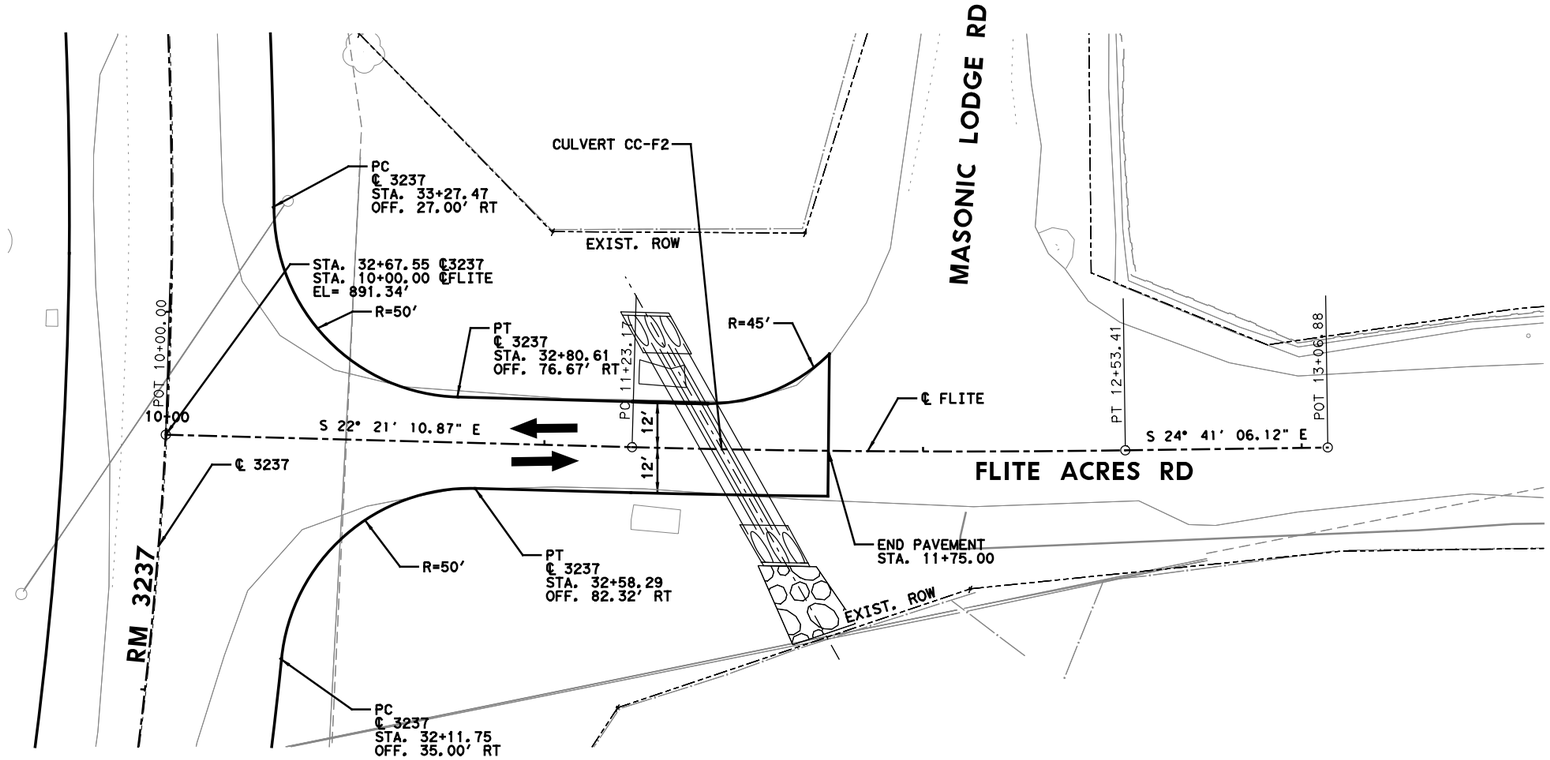

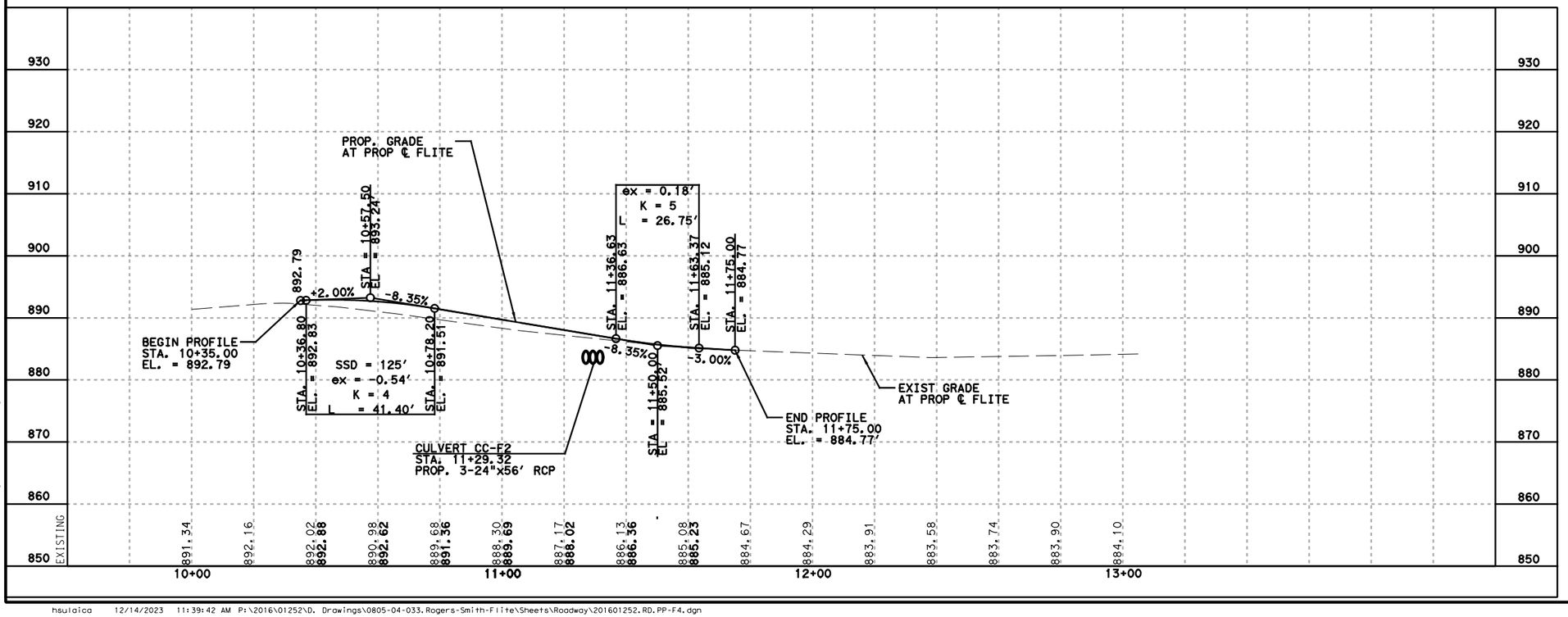

0 20 40 HORIZONTAL
SCALE IN FEET

0 10 20 VERTICAL
SCALE IN FEET

NOTES:

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STATE OF TEXAS
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HAYS COUNTY TEXAS

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

FLITE ACRES RD
PLAN AND PROFILE

SHEET 1 OF 1

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS				
HNS	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK	TX	AUS	HAYS	
AMP	CONTROL	SECTION	JOB	85
CHECK	0805	04	033	
AMP				

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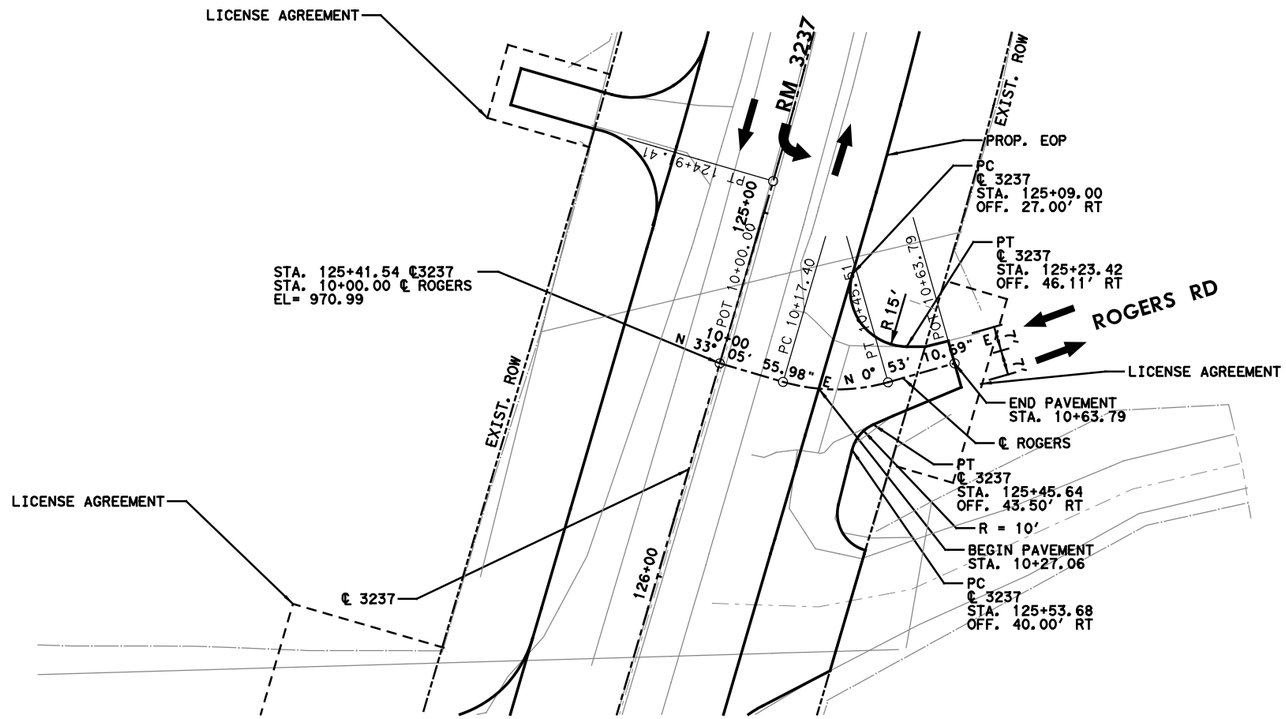

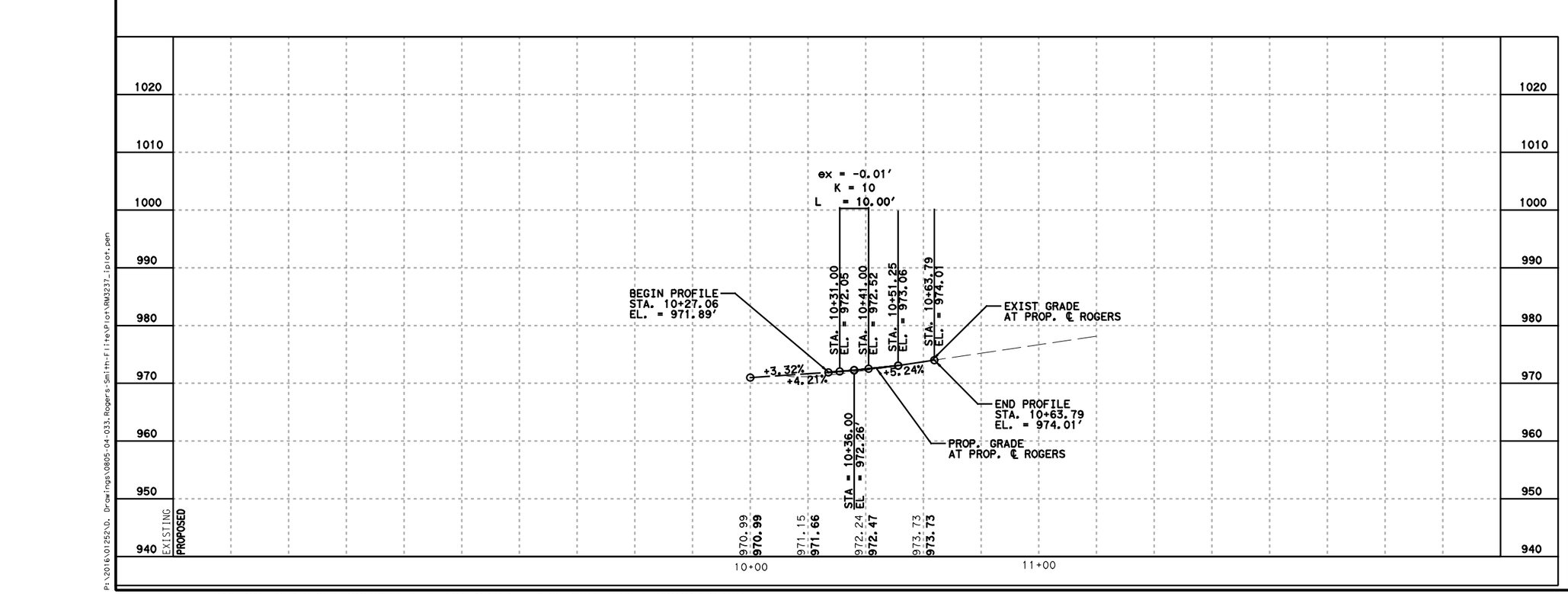

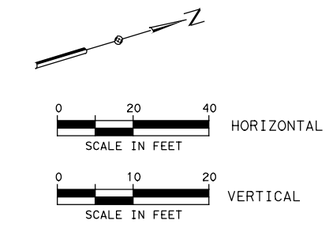

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LEGEND:

- (#) DRIVEWAY
- DIRECTION OF TRAFFIC
- EXISTING ROW
- PROPOSED RIPRAP
- LICENSE AGREEMENT
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REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
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AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

HAYS COUNTY TEXAS

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

ROGERS ROAD PLAN AND PROFILE

SHEET 1 OF 1

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS				
HNS	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK	TX	AUS	HAYS	
AMP	CONTROL	SECTION	JOB	86
CHECK	0805	04	033	
AMP				

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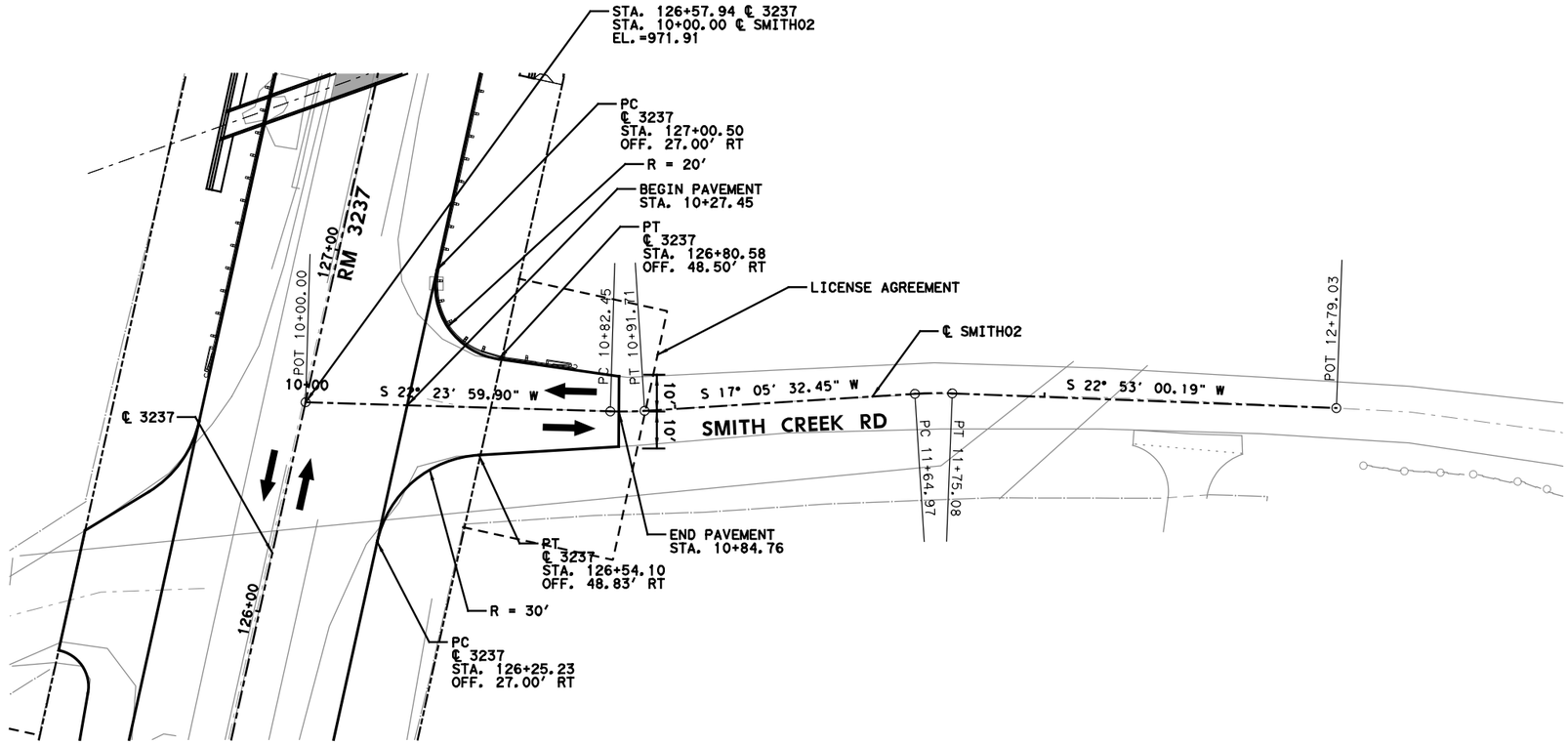

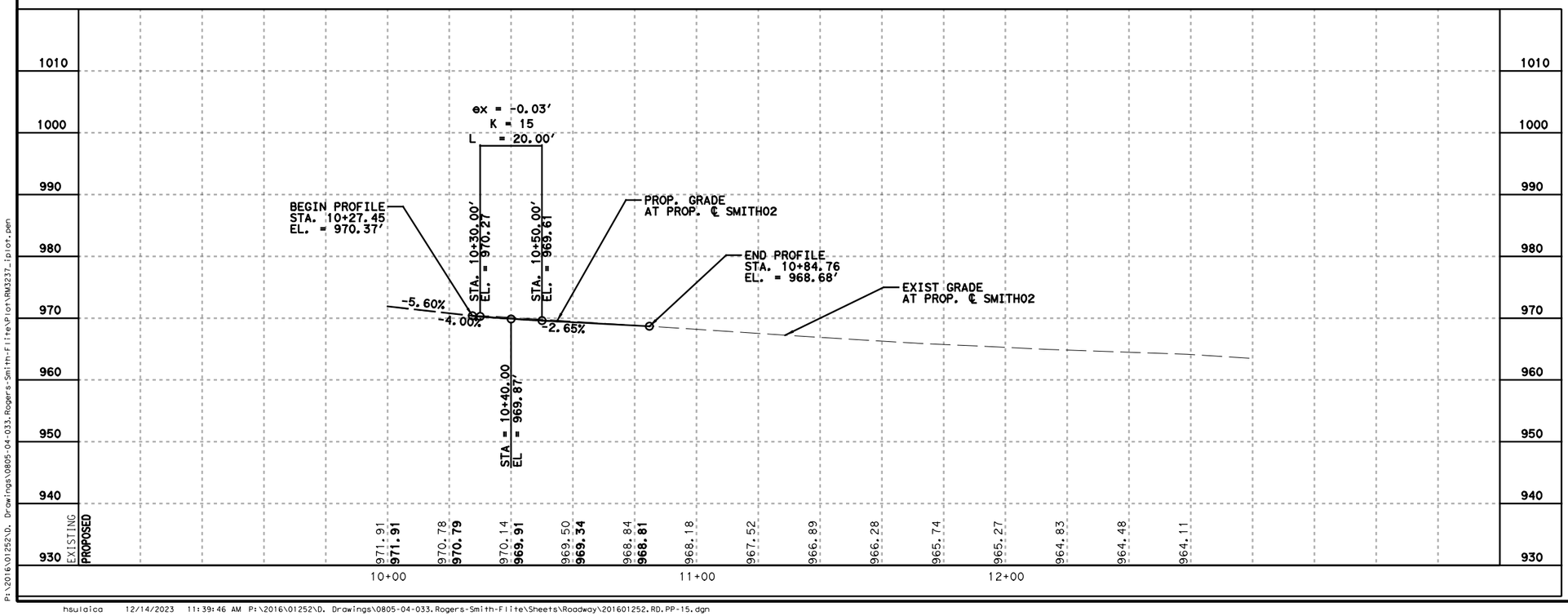

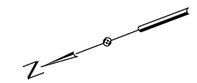

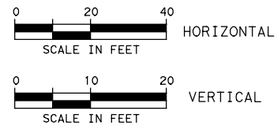

NOTES:

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3. SEE DRIVEWAY CONSTRUCTION DETAIL SHEET FOR MORE INFORMATION.
4. CONTRACTOR TO PROTECT POLES IN PLACE DURING CONSTRUCTION OF DITCH CUTS AND RIPRAP.

LEGEND:

- (#) DRIVEWAY
- ← DIRECTION OF TRAFFIC
- -------- EXISTING ROW
- PROPOSED RIPRAP
- - - - - LICENSE AGREEMENT
- VEGETATIVE FILTER STRIPS

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
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AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

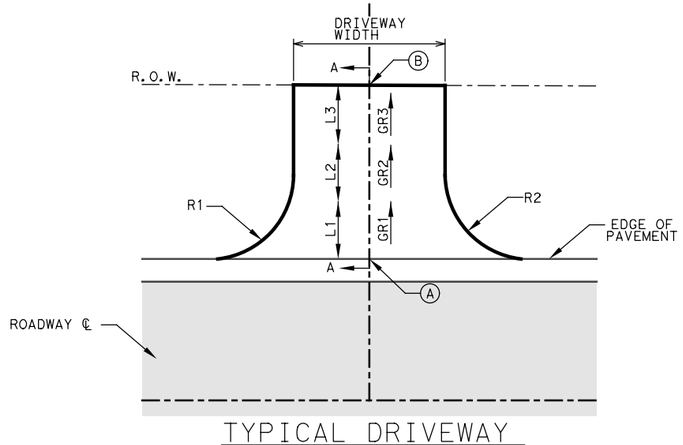
SMITH CREEK ROAD PLAN AND PROFILE

SHEET 1 OF 1

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	87
AMP	0805	04	033	
CHECK				
AMP				

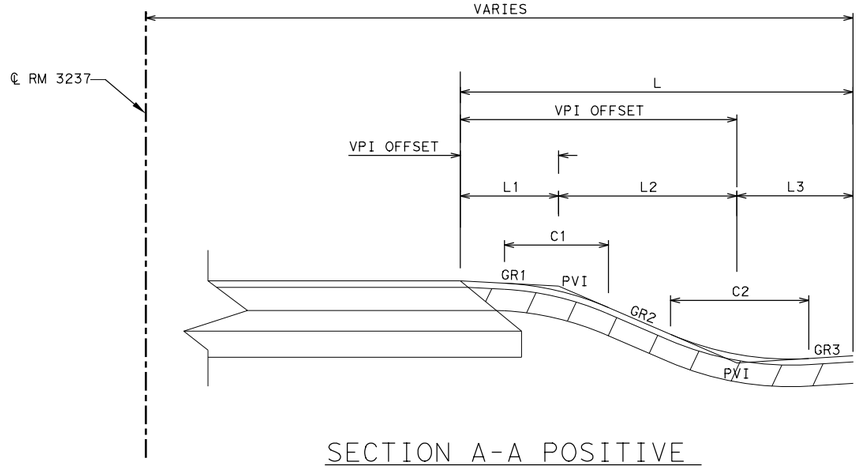
DRIVEWAY ID.	TYPE	STATION	RT/LT	WIDTH	RADIUS (R1) (FT)	RADIUS (R2) (FT)	LENGTH (L) (FT)	LENGTH (L1) (FT)	LENGTH (L2) (FT)	LENGTH (L3) (FT)	LENGTH (L4) (FT)	LENGTH (L5) (FT)	DRIVEWAY GRADE (GR1) (%)	DRIVEWAY GRADE (GR2) (%)	DRIVEWAY GRADE (GR3) (%)	DRIVEWAY GRADE (GR4) (%)	DRIVEWAY GRADE (GR5) (%)
F1	RESID.	24+90.61	LT	16	15	15	28.1	2.5	9.9	15.7			5.5	-1.0	3.0		
F2	RESID.	27+27.16	RT	22	20	20	16.9	3.5	13.4				-1.5	8.0	1.0		
F3	RESID.	28+13.39	RT	12	20	20	16.1	4.0	12.1				3.0	-13.0	-3.0		
F4	COMM.	28+27.54	LT	32	20	20	27.1	8.0	11.9	7.2			-3.0	21.0	4.0		
F5	COMM.	30+12.75	LT	30	20	20	33.4	9.8	14.8	8.8			-8.0	19.0	3.5		
F6	RESID.	30+27.06	RT	10	15	15	39.3	7.5	20.3	11.6			5.0	-30.0	-4.4		
F7	COMM.	34+40.06	LT	28	20	20	68.9	9.5	47.6	11.9			-9.0	17.0	8.5		
F8	COMM.	36+92.62	RT	44	20	20	23.4	2.0	14.3	7.1			7.5	-2.0	15.0		
1	COMM.	115+37.80	LT	11	25	25	23.2	3.5	13.8	6.0			7.0	-3.0	4.5		
1A	RESID.	115+37.80	RT	48	25	10	26.4	4.0	18.1	4.3			-9.5	-2.0	-3.5		
2	COMM.	121+09.68	LT	26	25	25	23.1	5.0	8.6	9.5			6.0	2.0	7.5		
2a	RESID.	124+85.24	RT	10	20	20	45.1	9.0	26.5	9.6			-7.5	17.5	-5.5		
3	COMM.	126+06.99	LT	33	10	30	25.1	5.0	11.2	8.9			1.4	-2.0	3.0		
4	RESID.	135+91.61	RT	30	15	15	74.6	5.0	6.0	19.3	20	24.29	-1.4	-11.4	-17	-7.5	
5	COMM.	136+48.54	LT	10	20	30	26	13.7	12.3				-2.7	28.0			

DRIVEWAY ID.	A ELEV	B ELEV	C_1		C_2		SURFACE TYPE	0530 6005 DRIVEWAYS (ACP) (SY)	0530 6005 DRIVEWAYS (CONC) (SY)
			ELEV	CURVE LENGTH	ELEV	CURVE LENGTH			
F1	878.50	879.00	878.63	5	878.53	7	Asphalt	55	
F2	886.46	887.56	886.46	7	887.49	5	Asphalt	80	
F3	889.98	888.39	890.10	8	888.52	7	Asphalt	47	
F4	888.02	890.56	887.77	16	890.27	7	Asphalt	115	
F5	888.68	891.05	887.90	19	890.71	9	Asphalt	129	
F6	893.54	887.33	893.91	15	887.84	22	Asphalt	55	
F7	891.77	900.00	890.91	19	898.99	5	Asphalt	233	
F8	903.82	904.75	903.97	4	903.68	12	Concrete		138
1	974.40	974.50	974.65	7	974.23	5	Asphalt	61	
1A	968.51	967.61	968.13	8	967.76	8	Asphalt	266	
2	970.14	971.32	970.44	10	970.61	5	Asphalt	97	
2a	968.67	972.11	967.99	18	972.64	18	Asphalt	69	
3	971.88	972.00	971.96	10	971.74	10	Asphalt	148	
4	976.26	967.54	976.26	5	975.94	6	Asphalt	133	
5	976.34	980.80	975.97	20			Asphalt	40	



TYPICAL DRIVEWAY WITH RADIUS LAYOUT

NTS



SECTION A-A POSITIVE

NTS

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED PROFESSIONAL ENGINEER

12/14/2023

REV.	DATE	DESCRIPTION	APPROVED

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HAYS COUNTY TEXAS

Texas Department of Transportation

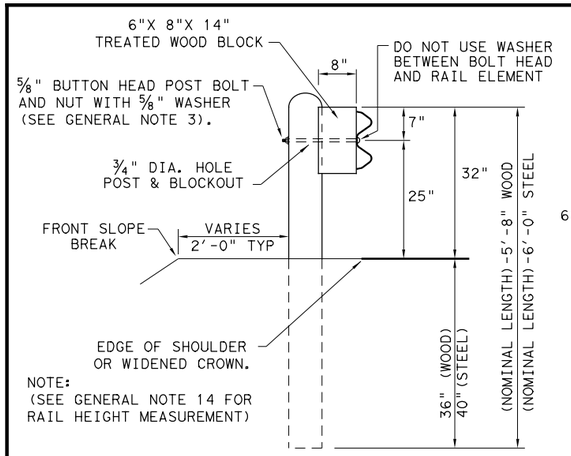
RM 3237 SAFETY IMPROVEMENTS

DRIVEWAY CONTRUCTION DETAILS

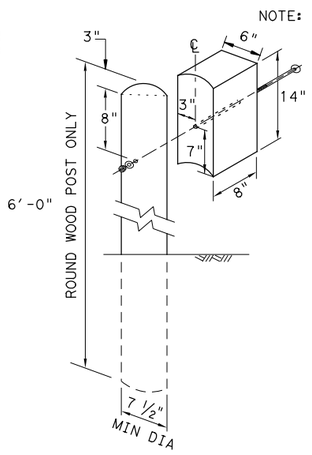
SHEET 1 OF 1

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	88
AMP	0805	04	033	
CHECK				
AMP				

DATE: 11/17/2023
FILE: T:\Road Dept\Department\Team Texas\txdot cadd standards\roadway\GF(31)-19.dgn

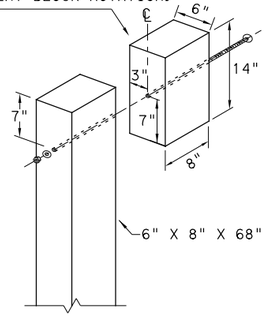


TYPICAL POST PLACEMENT

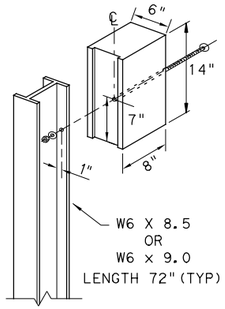


WOOD BLOCK TO ROUND WOOD POST

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

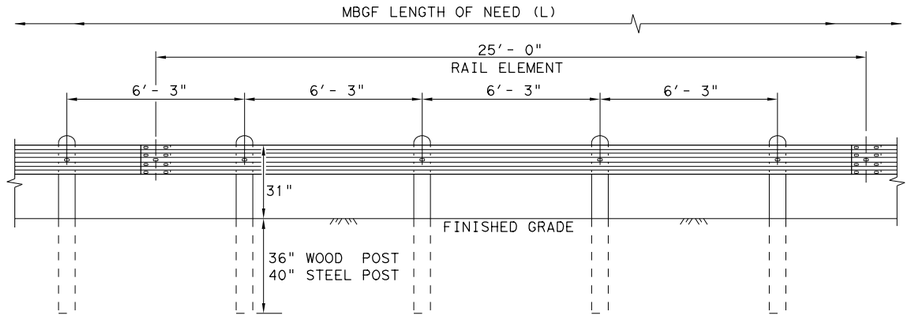


WOOD BLOCK TO RECTANGULAR WOOD POST



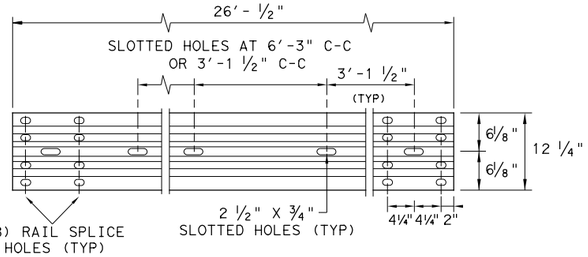
ROUTED WOOD BLOCK TO I-BEAM STEEL POST

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



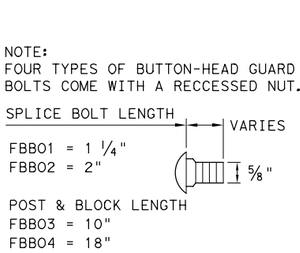
ELEVATION
MID-SPAN RAIL SPLICE

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



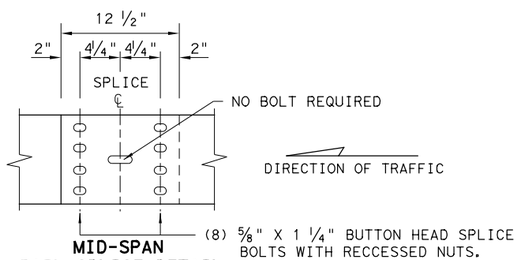
ELEVATION 25'- 0" (NOM.) W-BEAM SECTION

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



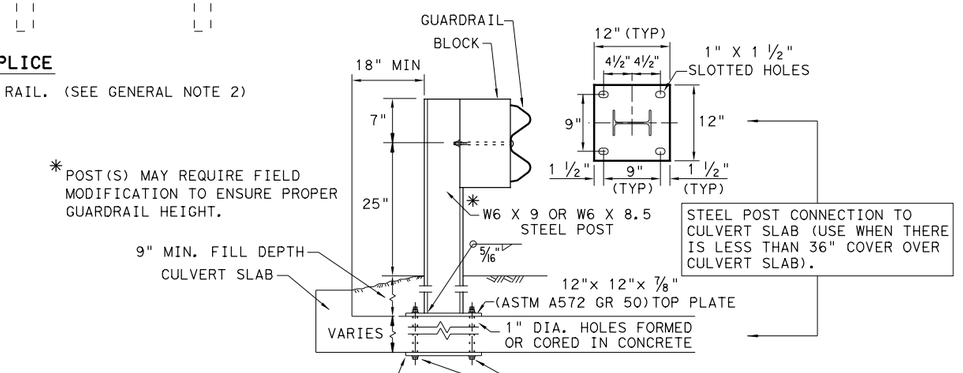
BUTTON HEAD BOLT

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



MID-SPAN RAIL SPLICE DETAIL

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



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

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

LOW FILL CULVERT POST

NOTE: TWO INSTALLATION OPTIONS.

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

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

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

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

GENERAL NOTES

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

Texas Department of Transportation

Design Division Standard

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

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©TxDOT: NOVEMBER 2019	CONT	SECT	JOB	HIGHWAY	
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	DIST	COUNTY		SHEET NO.	
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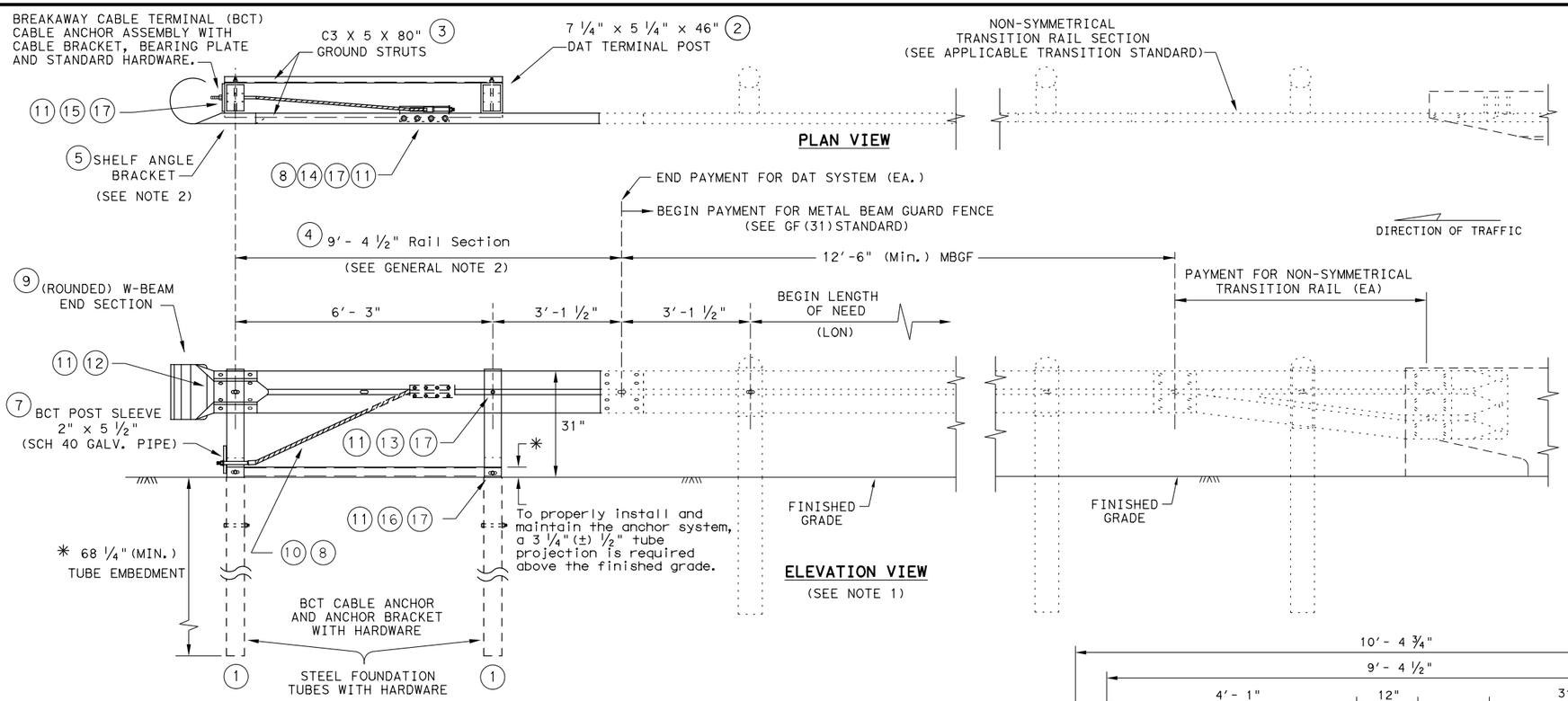


DOWNSTREAM ANCHOR TERMINAL (DAT)

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

GENERAL NOTES

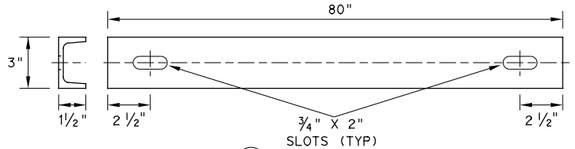
1. THE DETAIL SHOWN IS THE MINIMUM LENGTH OF NEED (LON) FOR A DOWNSTREAM ANCHOR TERMINAL (DAT) CONNECTED TO A CONCRETE RAIL.
2. THE RAIL SECTION AT THE END POST IS SUPPORTED BY THE SHELF ANGLE BRACKET. THE RAIL ELEMENT IS NOT ATTACHED TO THE END POST.
3. THE FOUNDATION TUBES SHALL NOT PROJECT MORE THAN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

MOW STRIP INSTALLATION

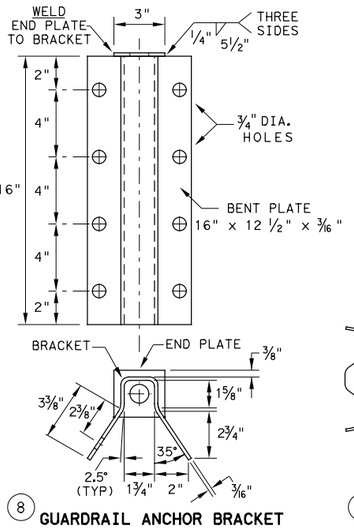
IF A MOW STRIP IS REQUIRED WITH THE DAT INSTALLATION THE LEAVE-OUT AREA AROUND THE STEEL FOUNDATION TUBES AND THE TWO CHANNEL STRUTS MAY BE OMITTED. THIS WILL REQUIRE A FULL POUR AT THE FOUNDATION TUBES.

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

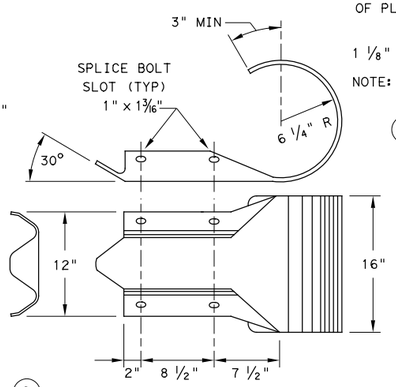
(4) TERMINAL RAIL ELEMENT FOR DAT



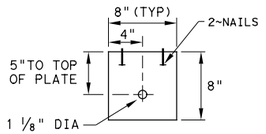
(3) CHANNEL STRUT
C3 X 5 X 80", GRADE A36



(8) GUARDRAIL ANCHOR BRACKET

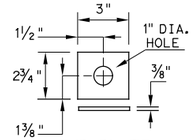


(9) W-BEAM END SECTION (ROUNDED) (12 GA.)

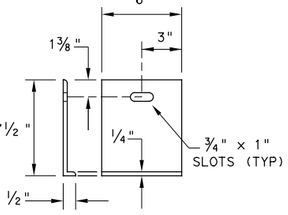


NOTE: DRIVE NAILS AND BEND OVER TO PREVENT PLATE ROTATION

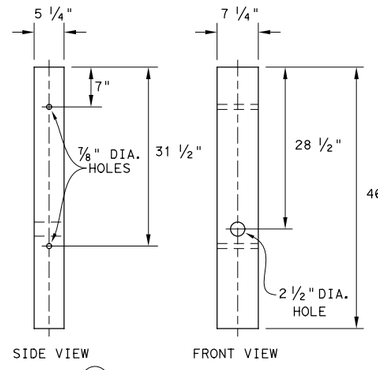
(6) BEARING PLATE
8"x 8"x 5/8" PL



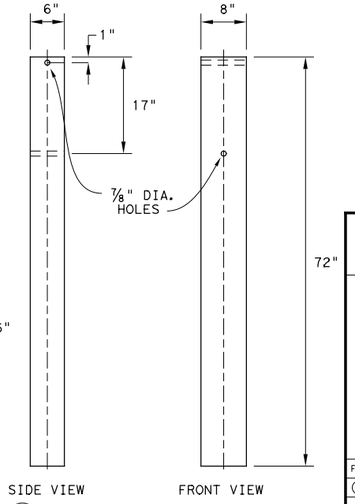
END PLATE



(5) SHELF ANGLE BRACKET



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



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

Texas Department of Transportation — Design Division Standard

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

GF(31)DAT-19

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	DIST	COUNTY		SHEET NO.
	AUS	HAYS		90

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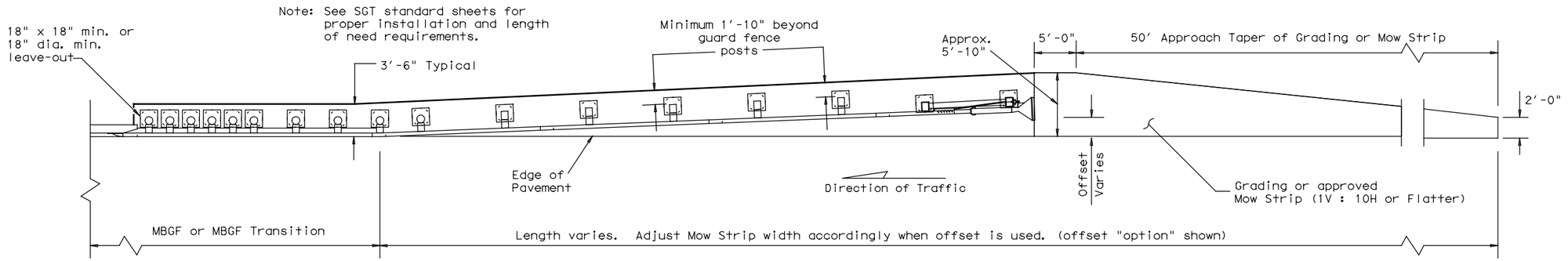
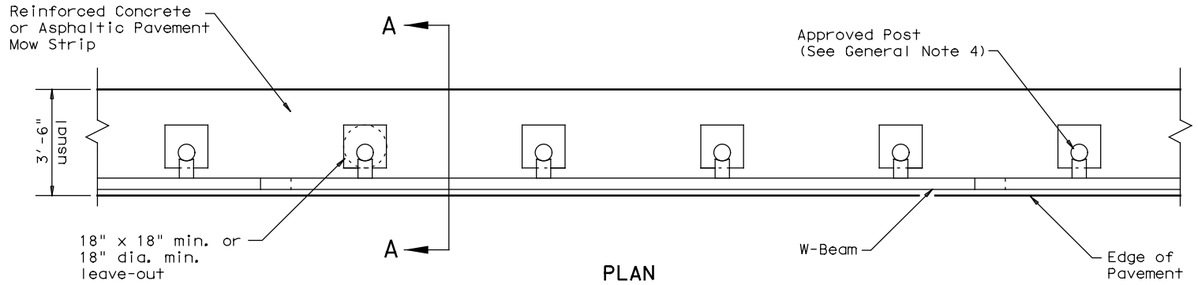


GRADING AND MOW STRIP AT GUARDRAIL END TREATMENTS



PLAN

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

SECTION A-A

Typical

MOW STRIP DETAIL

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

CURB OPTION (1)

This option will increase the post embedment throughout the system.

CURB OPTION (2)

Curb shown on top of mow strip

CURB OPTION (3)

Note: Site Condition(s)

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

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

GENERAL NOTES

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

Texas Department of Transportation

Design Division Standard

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

GF(31)MS-19

FILE: gf31ms19.dgn	DN: TxDOT	CK: KM	DW: VP	CK: CGL/AG		
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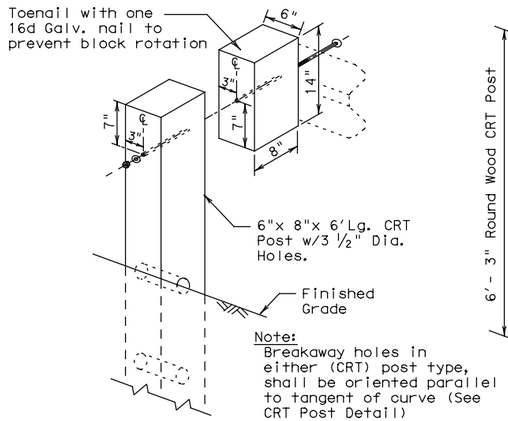
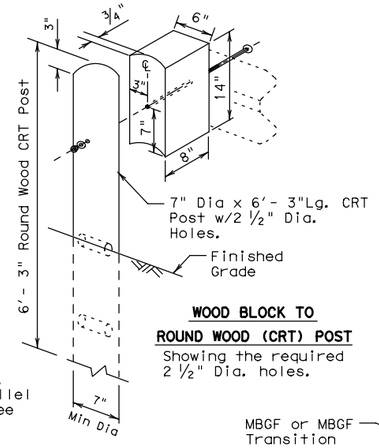
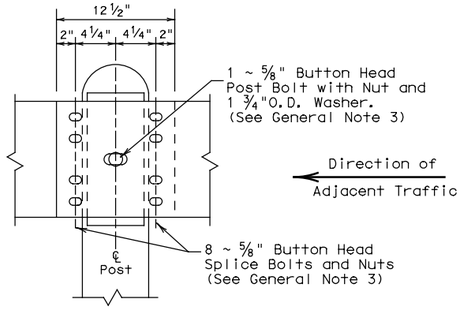


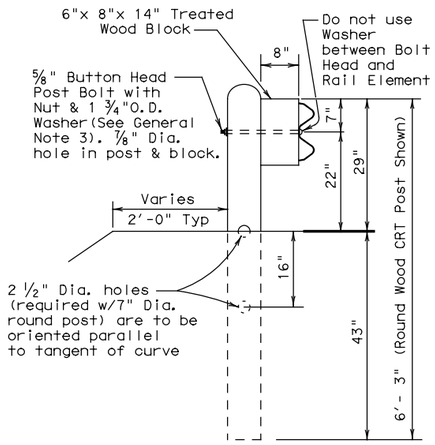
WOOD BLOCK TO RECTANGULAR WOOD (CRT) POST
Showing the required 3 1/2" Dia. holes.



WOOD BLOCK TO ROUND WOOD (CRT) POST
Showing the required 2 1/2" Dia. holes.

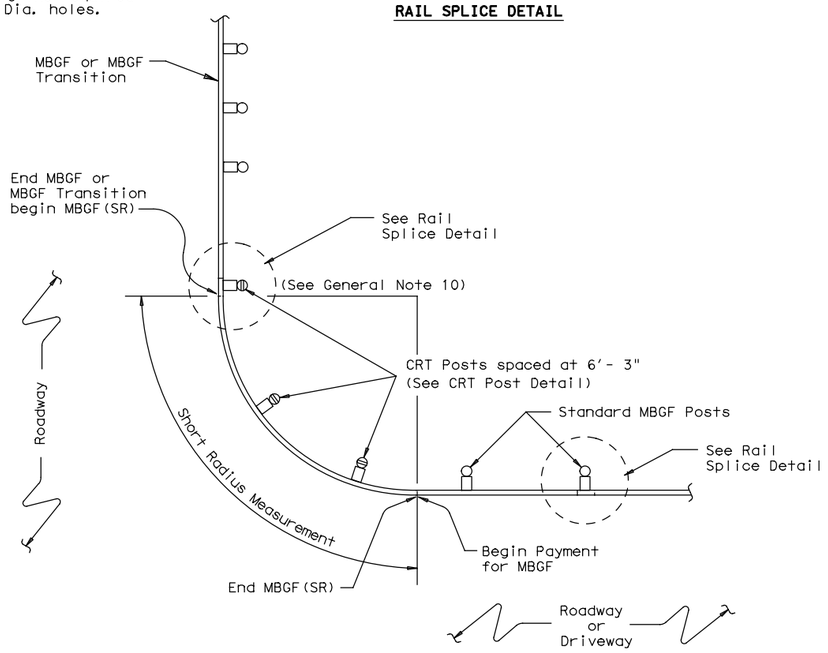


RAIL SPLICE DETAIL



(CRT) POST DETAIL
CONTROLLED RELEASE TERMINAL POST

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



PLAN VIEW
SHOWING TYPICAL RADIUS

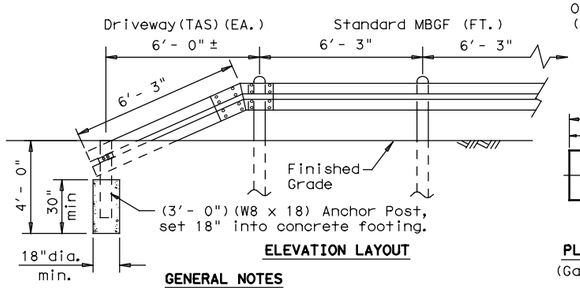
The required radius is shown elsewhere on the plans.

GENERAL NOTES

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

"DRIVEWAY" TERMINAL ANCHOR SECTION

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



ELEVATION LAYOUT

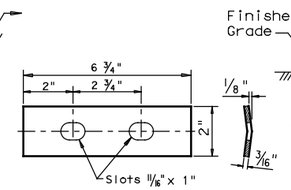
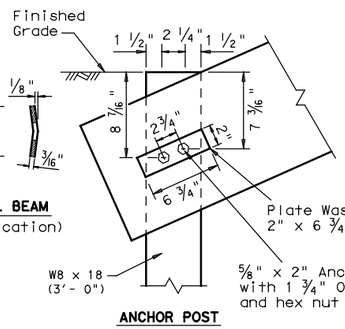
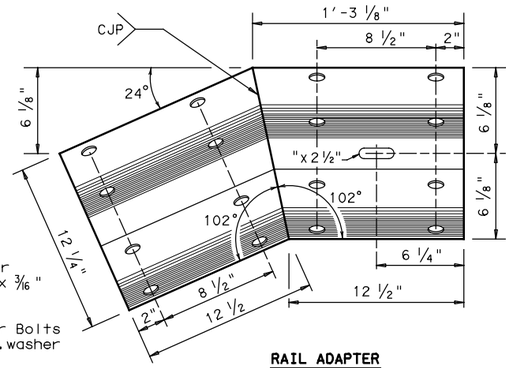


PLATE WASHER FOR METAL BEAM
(Galvanized after fabrication)



ANCHOR POST



RAIL ADAPTER
Rail - 10 gauge
(Galvanized after fabrication)

GENERAL NOTES

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

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

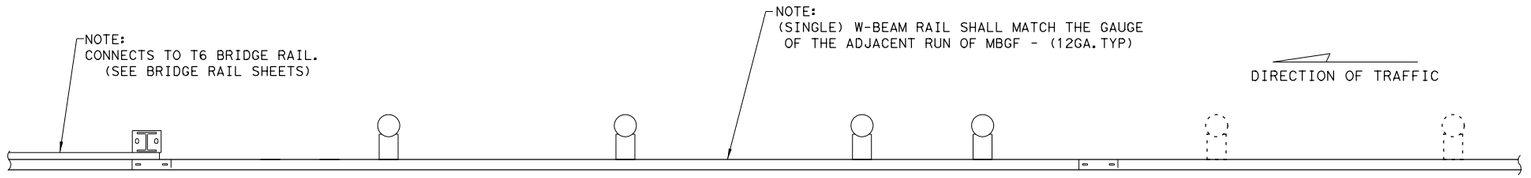
Texas Department of Transportation

Design Division Standard

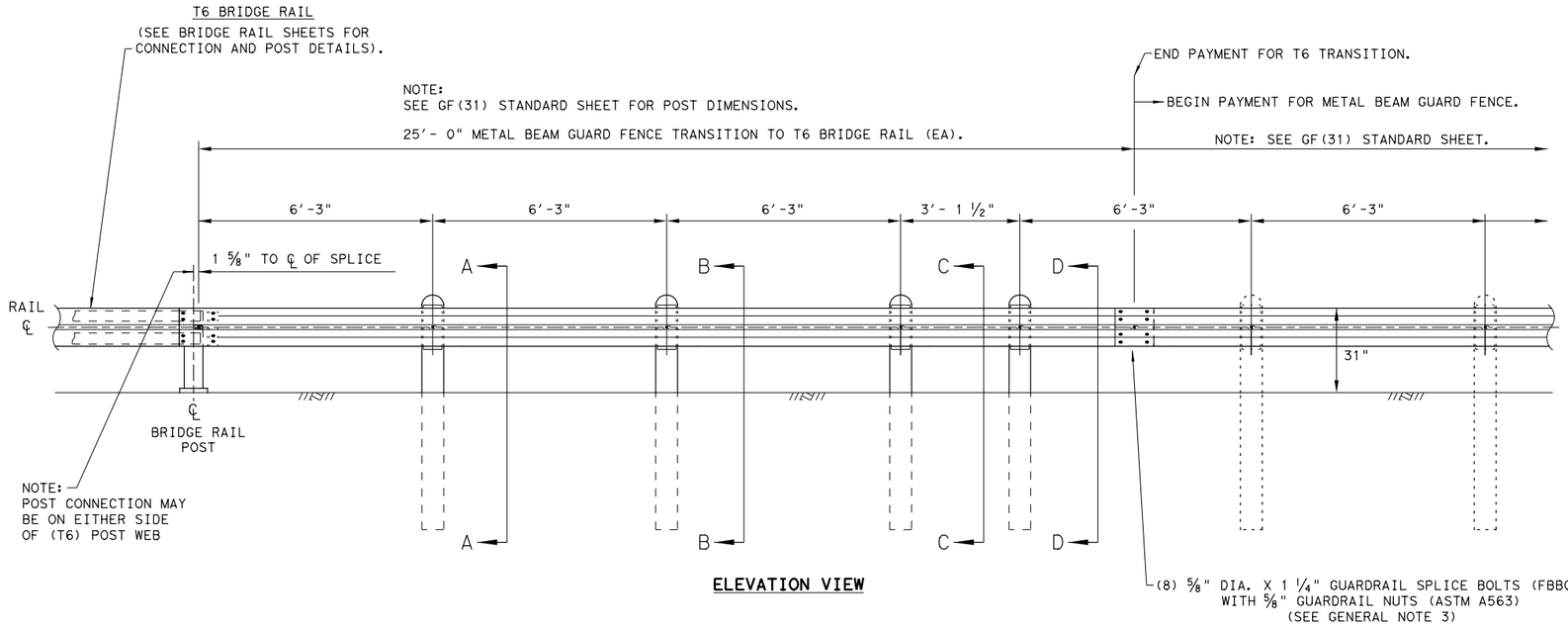
METAL BEAM GUARD FENCE
(SHORT RADIUS)
MBGF(SR)-19

FILE: mbgfsr19.dgn	DN: TxDOT	CK: KM	DW: BD	CK: VP	
©TxDOT NOVEMBER 2019	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0805	04	033	RM 3237	
	DIST	COUNTY		SHEET NO.	
	AUS	HAYS		92	

DATE: 11/17/2023
FILE: T:\Road Dept\Department\Team Texas\txdot cadd standards\roadway\GF(31)T6-19.dgn



PLAN VIEW

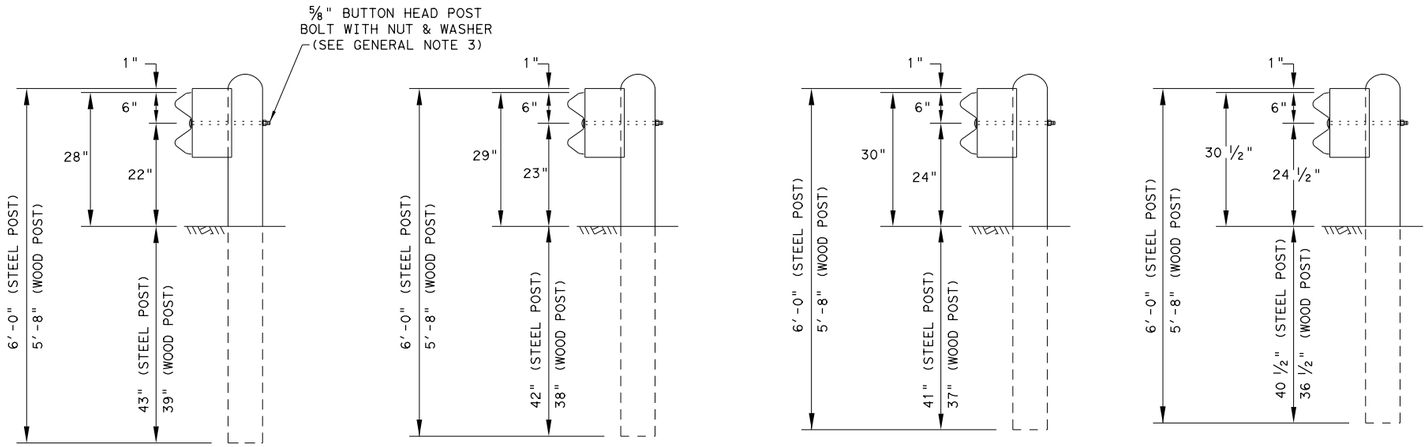


ELEVATION VIEW

GENERAL NOTES

1. THE TYPE OF POST (ROUND WOOD POST, RECTANGULAR WOOD POST, OR STEEL POST) WILL BE AS SHOWN IN THE PLANS. THE EXACT POSITION OF MBGF SHALL BE SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER. STEEL POSTS TO BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING."
2. RAIL ELEMENT SHALL MEET THE REQUIREMENTS OF ITEM 540,"METAL BEAM GUARD FENCE" EXCEPT AS MODIFIED IN THE PLANS. THE CONTRACTOR MAY FURNISH RAIL ELEMENTS OF 25'- 0", OR 12'- 6" (NOM.) LENGTHS. RAIL ELEMENTS MAY HAVE SLOTTED HOLES AT 3'- 1 1/2" C-C OR 6'-3" C-C. A SPECIAL LENGTH OF RAIL MAY BE MANUFACTURED TO ACCOMMODATE THE TRANSITION SECTIONS OF GUARDRAIL.
3. BUTTON HEAD "POST" BOLTS (ASTM A307 GR.A) SHALL BE OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT (ASTM A563) AND 5/8" ROUND WASHER (ASTM F436) AND NOT MORE THAN 1" BEYOND IT. BUTTON HEAD "SPLICE" BOLTS (ASTM A307) ARE 5/8" X 1- 1/4" WITH 5/8" NUTS (ASTM A563).
4. FITTINGS (BOLTS, NUTS, AND WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING." FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM REQUIRING CONSTRUCTION OF THE TRANSITION.
5. CROWN SHALL BE WIDENED TO ACCOMMODATE THE METAL BEAM GUARD FENCE.
6. WHERE SOLID ROCK IS ENCOUNTERED. CONTACT THE DESIGN DIVISION FOR ADDITIONAL GUIDANCE. (512) 416-2678
7. POSTS SHALL NOT BE SET IN CONCRETE.
8. UNLESS OTHERWISE SHOWN IN THE PLANS, A COMPOSITE MATERIAL BLOCK THAT MEETS THE REQUIREMENTS OF DMS-7210,"COMPOSITE MATERIAL POSTS AND BLOCKS FOR METAL BEAM GUARD FENCE" MAY BE SUBSTITUTED FOR BLOCKS OF SIMILAR DIMENSIONS. THE CONSTRUCTION DIVISION, TXDOT MAINTAINS A MATERIAL PRODUCER LIST (MPL) FOR PRODUCERS OF MATERIALS CONFORMING TO DMS-7210. ONLY PRODUCERS ON THE MPL MAY FURNISH COMPOSITE MATERIAL BLOCKS.
9. REFER TO STANDARD GF(31) & APPLICABLE BRIDGE RAILING STANDARD FOR ADDITIONAL DETAILS.

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



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

Texas Department of Transportation — Design Division Standard

METAL BEAM GUARD FENCE TRANSITION (T6)

GF(31)T6-19

FILE: gf31t619.dgn	DN: TxDOT	CK: KM	DW: VP	CK: CGL/AG	
©TxDOT: NOVEMBER 2019	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0805	04	033	RM 3237	
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DATE: 11/20/2023
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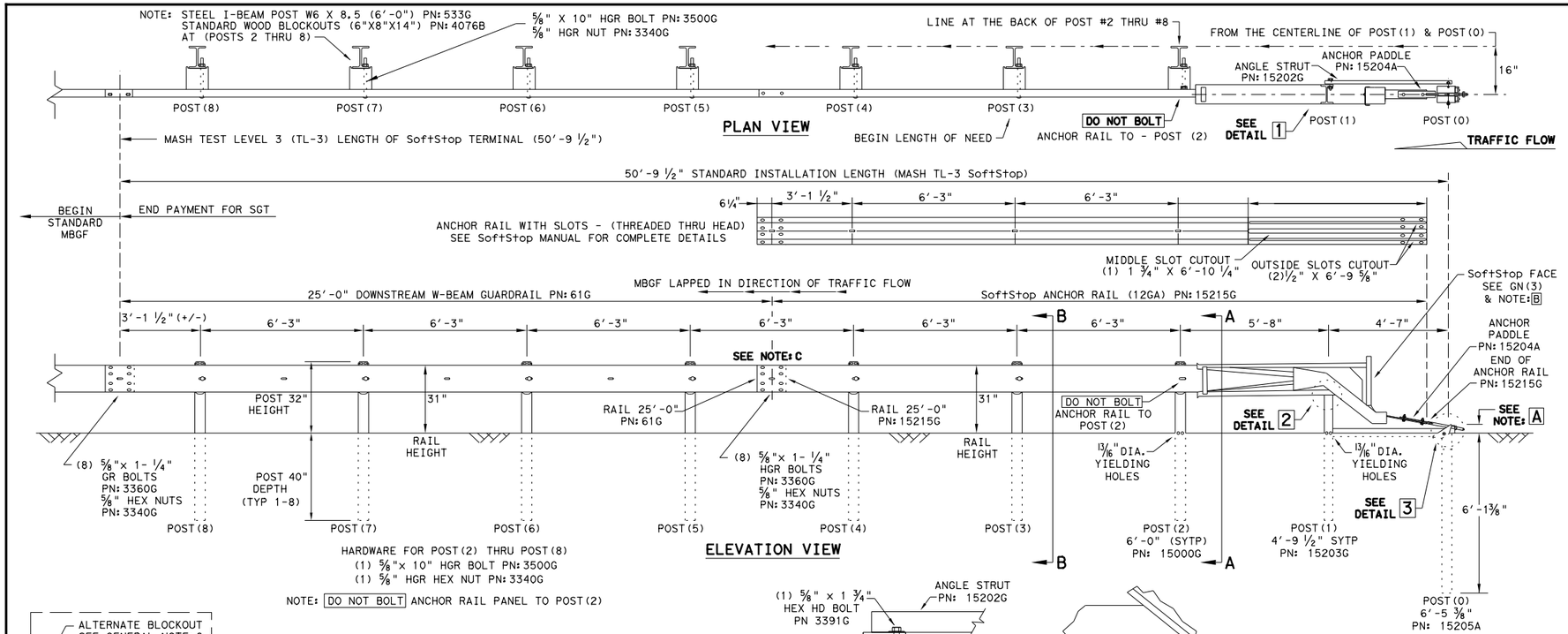

GENERAL NOTES

1. FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: TRINITY HIGHWAY AT 1(888)323-6374. 2525 N. STEMMONS FREEWAY, DALLAS, TX 75207
2. FOR INSTALLATION, REPAIR AND MAINTENANCE REFER TO THE; SoftStop END TERMINAL, PRODUCT DESCRIPTION ASSEMBLY MANUAL. PN: 620237B
3. APPLY HIGH INTENSITY REFLECTIVE SHEETING, "OBJECT MARKER" ON THE FRONT FACE OF THE DEVICE PER MANUFACTURER'S RECOMMENDATIONS. OBJECT MARKER SHALL CONFORM TO THE STANDARDS REQUIRED IN TEXAS MUTCD.
4. FOR POST (LEAVE-OUT) INSTALLATION AND GUIDANCE SEE TXDOT'S LATEST ROADWAY MOW STRIP STANDARD.
5. HARDWARE (BOLTS, NUTS, & WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445,"GALVANIZING". FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
6. A COMPOSITE MATERIAL BLOCKOUT THAT MEETS THE REQUIREMENTS OF DMS-7210, MAY BE SUBSTITUTED FOR BLOCKOUTS OF SIMILAR DIMENSIONS. SEE CONSTRUCTION DIVISION MATERIAL PRODUCER LIST (MPL) FOR CERTIFIED PRODUCERS.
7. IF SOLID ROCK IS ENCOUNTERED SEE THE MANUFACTURER'S INSTALLATION MANUAL AND REFER TO THE LATEST ROADWAY MBGF STANDARD FOR INSTALLATION GUIDANCE.
8. POSTS SHALL NOT BE SET IN CONCRETE.
9. IT IS ACCEPTABLE TO INSTALL THE SoftStop IMPACT HEAD PARALLEL TO THE GRADE LINE OR WITH AN UPWARD TILT.
10. DO NOT ATTACH THE SoftStop SYSTEM DIRECTLY TO A RIGID BARRIER.
11. UNDER NO CIRCUMSTANCES SHALL THE GUARDRAIL WITHIN THE SoftStop SYSTEM BE CURVED.
12. A FLARE RATE OF UP TO 25:1 MAY BE USED TO PREVENT THE TERMINAL HEAD FROM ENCROACHING ON THE SHOULDER. THE FLARE MAY BE DECREASED OR ELIMINATED FOR SPECIFIC INSTALLATIONS, IF DIRECTED BY THE ENGINEER.

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

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

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

Texas Department of Transportation

Design Division Standard

TRINITY HIGHWAY SOFTSTOP END TERMINAL MASH - TL-3

SGT(10S)31-16

FILE: sgt10s3116	DN: TxDOT	CK: KM	DW: VP	CK: MB/VP		
©TxDOT: JULY 2016	CONT	SECT	JOB		HIGHWAY	
REVISIONS	0805	04	033		RM 3237	
	DIST	COUNTY			SHEET NO.	
	AUS	HAYS			94	

DATE: 11/17/2023
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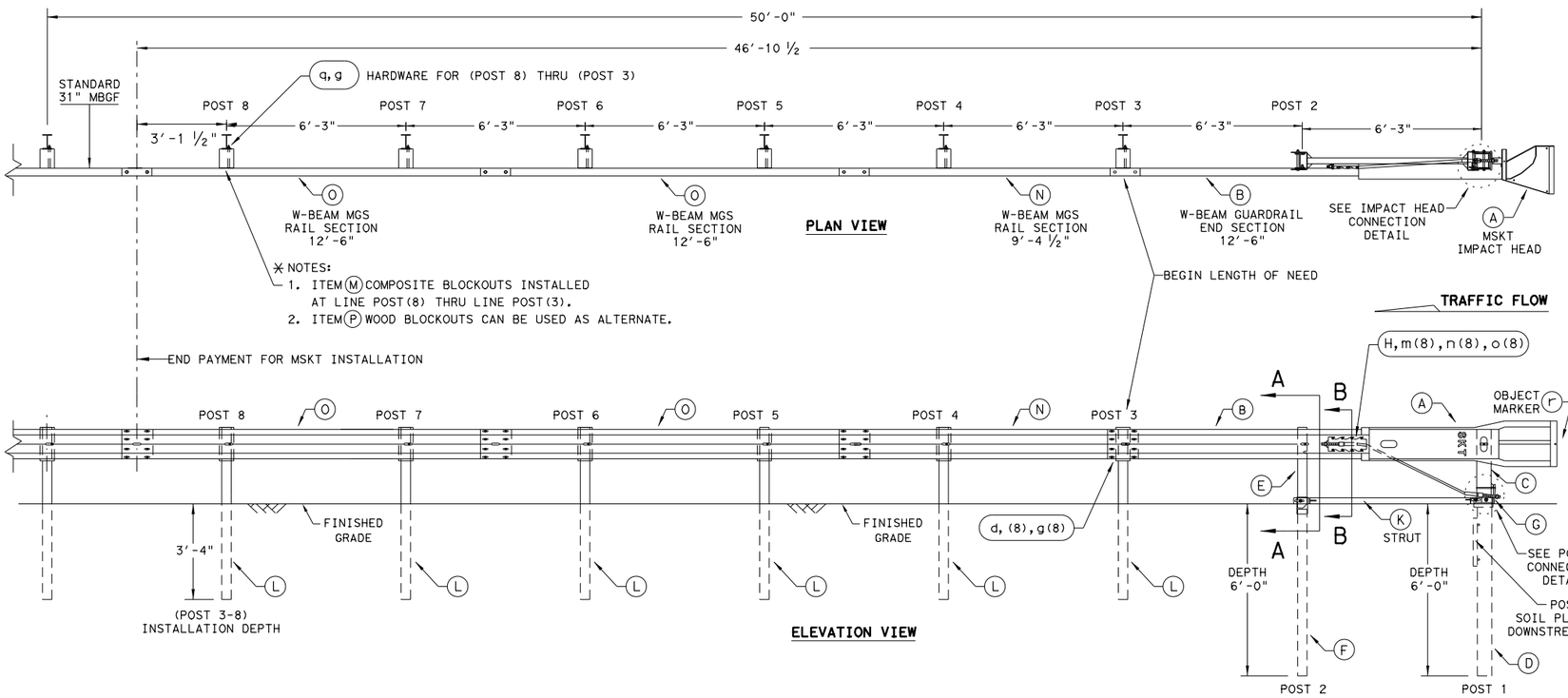


NOTE: SEE (GENERAL NOTE 14) FOR DRIVING CAP INFORMATION.

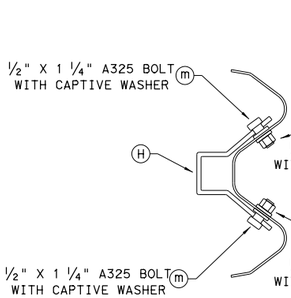
GENERAL NOTES

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

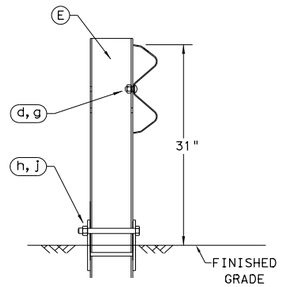
ITEM	QTY	MAIN SYSTEM COMPONENTS	ITEM NUMBERS
A	1	MSKT IMPACT HEAD	MS3000
B	1	W-BEAM GUARDRAIL END SECTION, 12 Ga.	SF1303
C	1	POST 1 - TOP (6" X 6" X 1/8" TUBE)	MTPHP1A
D	1	POST 1 - BOTTOM (6' W6X15)	MTPHP1B
E	1	POST 2 - ASSEMBLY TOP	UHP2A
F	1	POST 2 - ASSEMBLY BOTTOM (6' W6X9)	HP2B
G	1	BEARING PLATE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

SEE NOTES: ✳

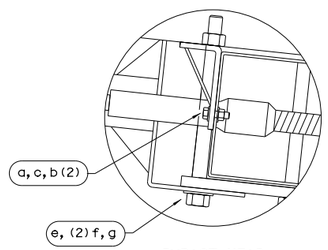
ALTERNATIVE ITEMS NOT SHOWN. ✳✳
✳ ITEM(P) 8" WOOD-BLOCKOUT
✳✳ ITEM(Q) 25'GUARD FENCE PANEL



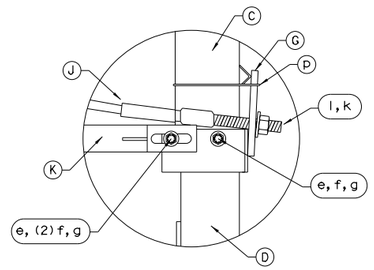
SECTION B-B
ANCHOR BRACKET



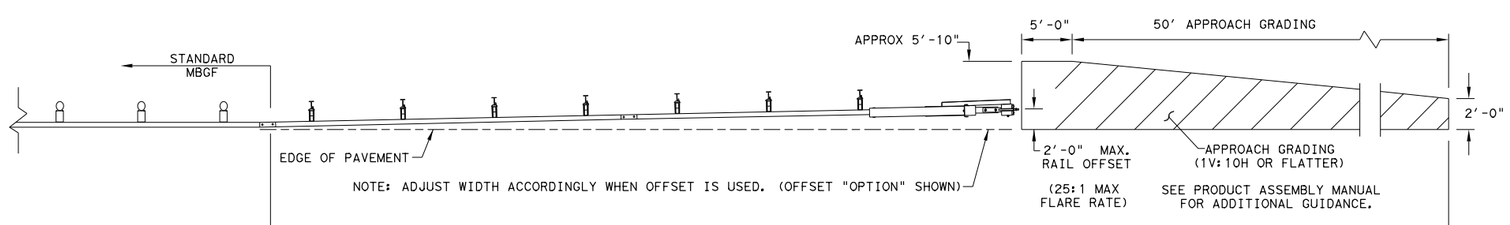
POST 2
SECTION A-A



IMPACT HEAD
CONNECTION DETAIL



POST 1
CONNECTION DETAIL



APPROACH GRADING AT GUARDRAIL END TREATMENTS

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

TRAFFIC FLOW

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

Texas Department of Transportation

Design Division Standard

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

FILE: sgt12s3118.dgn	DN:TxDOT	CK:KM	DW:VP	CK:CL	
© TxDOT: APRIL 2018	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0805	04	033	RM 3237	
	DIST	COUNTY		SHEET NO.	
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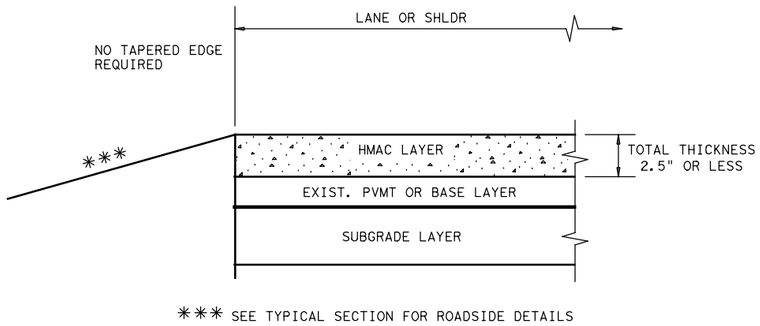
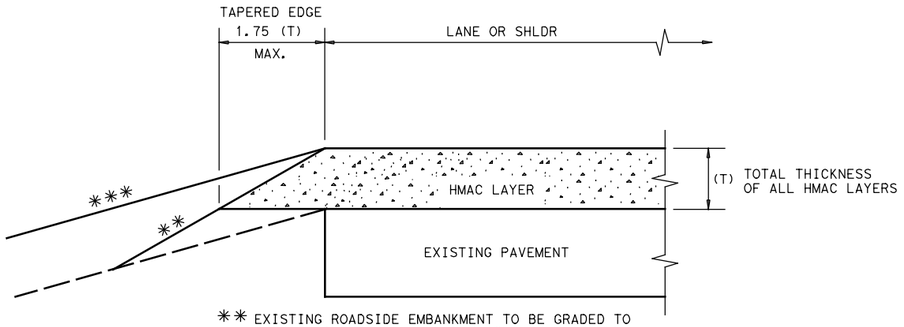


*** SEE TYPICAL SECTION FOR ROADSIDE DETAILS

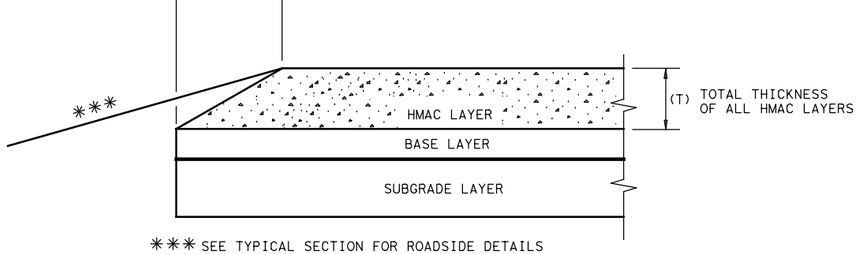
CONDITION - 1
THIN HMAC SURFACES OR HMAC OVERLAY WITH THICKNESS OF 2.5" OR LESS



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

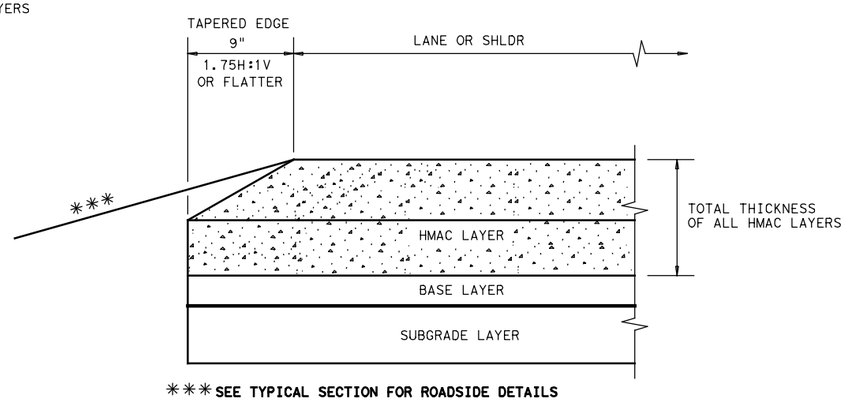
*** SEE TYPICAL SECTION FOR ROADSIDE DETAILS

CONDITION - 2
OVERLAY OF EXISTING PAVEMENT HMAC THICKNESS 2.5" TO 5"



*** SEE TYPICAL SECTION FOR ROADSIDE DETAILS

CONDITION - 3
NEW OR RECONSTRUCTED PAVEMENT HMAC THICKNESS 2.5" TO 5"



*** SEE TYPICAL SECTION FOR ROADSIDE DETAILS

CONDITION - 4
NEW OR RECONSTRUCTED PAVEMENT HMAC THICKNESS 5" OR GREATER

(NOT TO SCALE)

GENERAL NOTES

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

Texas Department of Transportation

Design Division Standard

TAPERED EDGE DETAILS HMAC PAVEMENT

TE(HMAC)-11

FILE: tehmac11.dgn	DN: TxDOT	CK: RL	DW: KB	CK:
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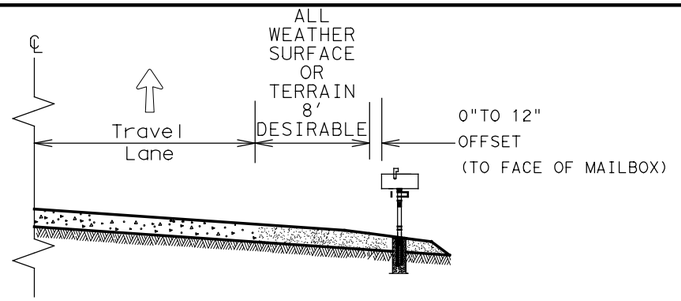
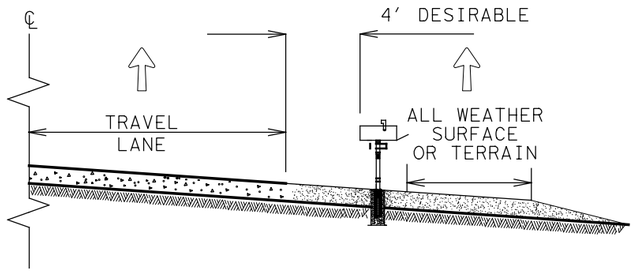
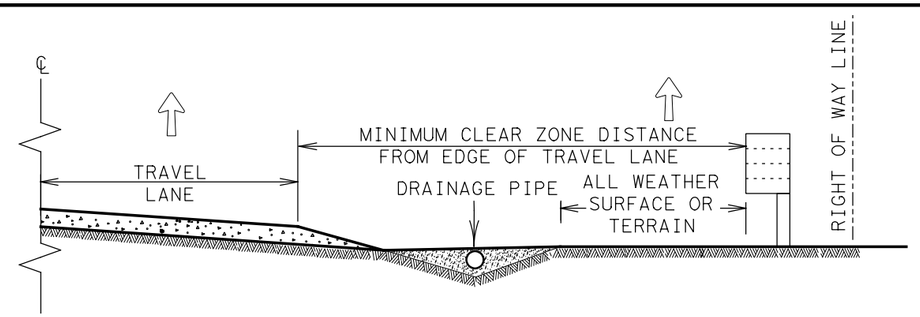


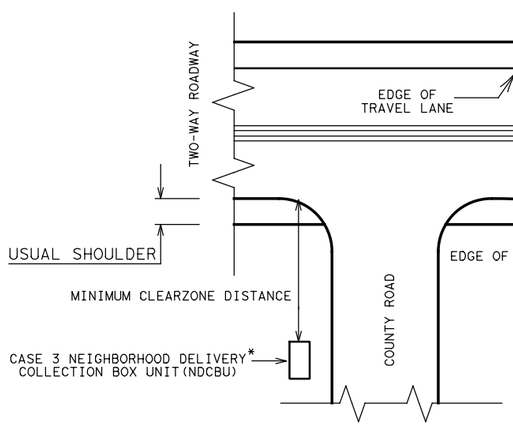
CASE 1. OFF TRAVEL WAY DELIVERY

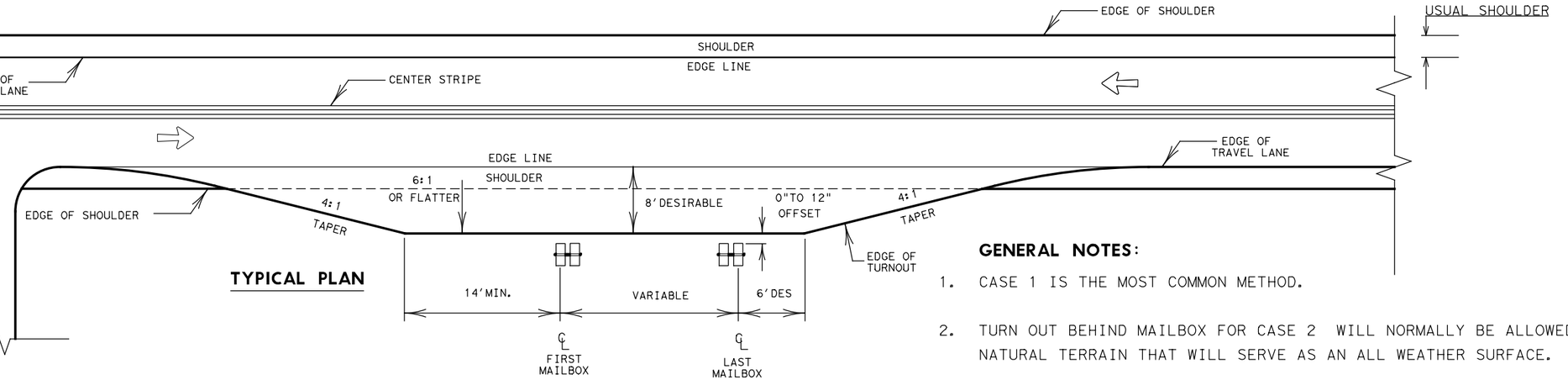


CASE 2. BACK SIDE DELIVERY

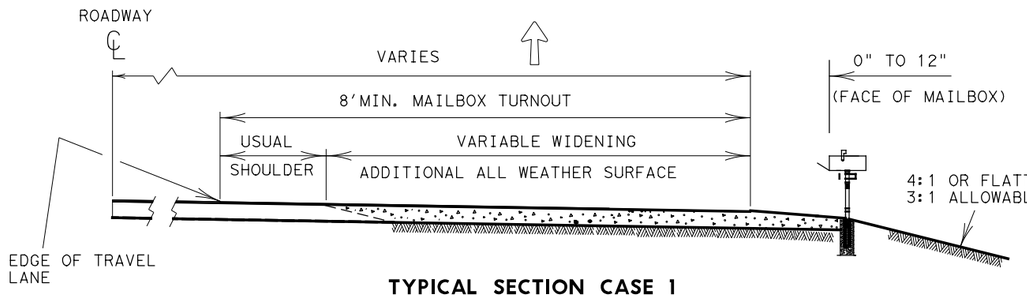


CASE 3. DELIVERY NEAR RIGHT OF WAY LINE





TYPICAL PLAN



TYPICAL SECTION CASE 1

GENERAL NOTES:

1. CASE 1 IS THE MOST COMMON METHOD.
2. TURN OUT BEHIND MAILBOX FOR CASE 2 WILL NORMALLY BE ALLOWED FOR NATURAL TERRAIN THAT WILL SERVE AS AN ALL WEATHER SURFACE.
3. ALL WEATHER DRIVEWAYS FOR CASE 3 MAILBOXES LOCATED AT THE RIGHT OF WAY LINE SHOULD NORMALLY BE PLACED IN CONJUNCTION WITH COUNTY ROADS OR OTHER CONNECTING COMMUNITY ROADS OR STREETS. WHEN 3 OR MORE MULTI-RACKS ARE ANTICIPATED, THE USE OF AN NDCBU IS RECOMMENDED. ONLY RURAL PATRONS LOCATED ON STATE MAINTAINED HIGHWAYS MAY HAVE A MAILBOX OR NDCBU SLOT ON TXDOT RIGHT OF WAY.

* NDCBU MAY BE INSTALLED ON COUNTY ROAD ROW WITH APPROVAL OF COUNTY.

MAIL DELIVERY VEHICLE TRAVEL DIRECTION

Texas Department of Transportation | Maintenance Division Standard

Guideline

MAILBOX SIDE ROAD PLACEMENT AND TURNOUTS

MBP(1)-22

FILE: MBP-22.DGN	DN: VS	CK:	DW: VS	CK:
© TxDOT OCTOBER 2022	CONT	SECT	JOB	HIGHWAY
REVISIONS 12/2012 5/2014	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		97

DATE: 11/20/2023 3:13:45 PM
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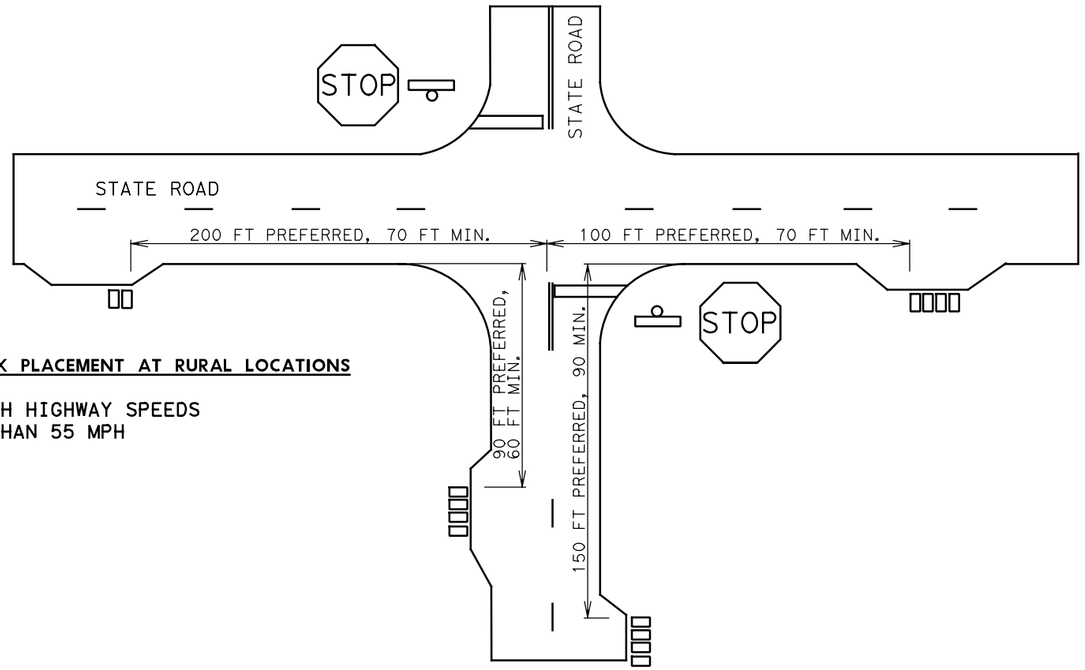
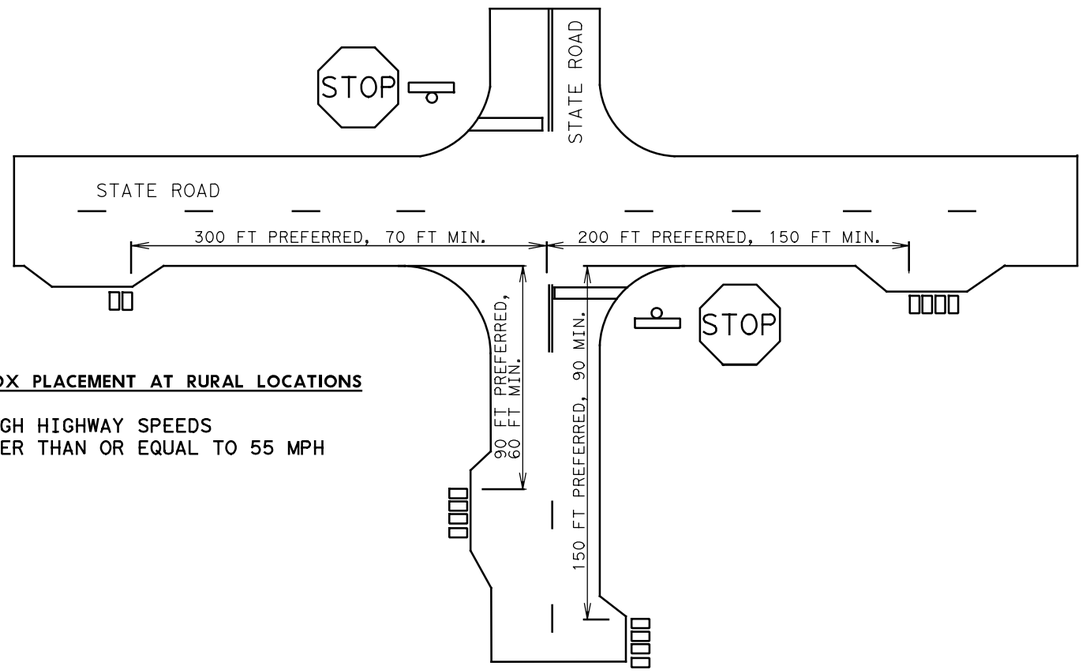


MAILBOX PLACEMENT AT RURAL LOCATIONS

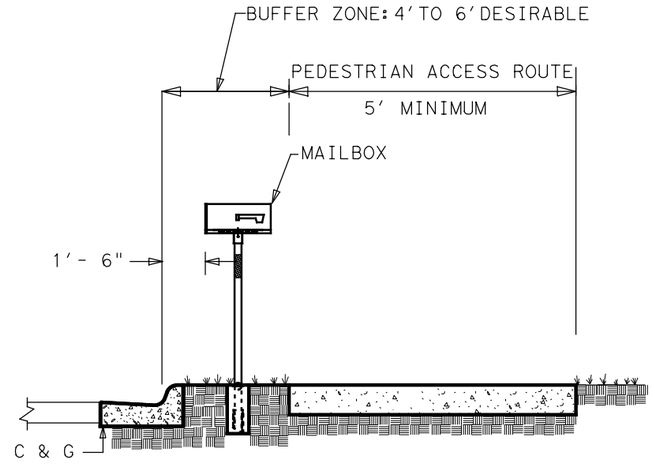
THROUGH HIGHWAY SPEEDS
LESS THAN 55 MPH



MAILBOX PLACEMENT AT RURAL LOCATIONS

THROUGH HIGHWAY SPEEDS
GREATER THAN OR EQUAL TO 55 MPH

CURB AND GUTTER MAILBOX INSTALLATION



NOTES:
1. A NON-TRAVERSABLE SURFACE MUST BE INSTALLED NEAR THE MAILBOX (NATURAL VEGETATION OR OTHER) IN THE BUFFER ZONE. ALTERNATIVELY, A BASE WITH A MINIMUM HEIGHT OF 2.5 INCHES MAY BE INSTALLED SO THAT THE EDGE OF THE MAILBOX DOES NOT EXTEND OUT MORE THAN 4 INCHES HORIZONTALLY BEYOND THE BASE.

2. THE SIDEWALK WIDTH MAY BE REDUCED TO 4 FOOT FOR SHORT DISTANCES AROUND THE MAILBOX IF NEEDED.

3. MAINTAIN A MINIMUM OF 5 FEET BETWEEN OBSTRUCTIONS IN THE PEDESTRIAN ACCESS ROUTE.

Texas Department of Transportation

Maintenance Division Standard

MAILBOX PLACEMENT CURBS & INTERSECTIONS

MBP(2)-22

FILE: MBP-22.DGN	DN: VS	CK:	DW: VS	CK:
© TxDOT OCTOBER 2022	CONT	SECT	JOB	HIGHWAY
REVISIONS 12/2012 5/2014	0805	04	033	RM 3237
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	AUS	HAYS		98

DATE: 11/17/2023 5:06:58 PM
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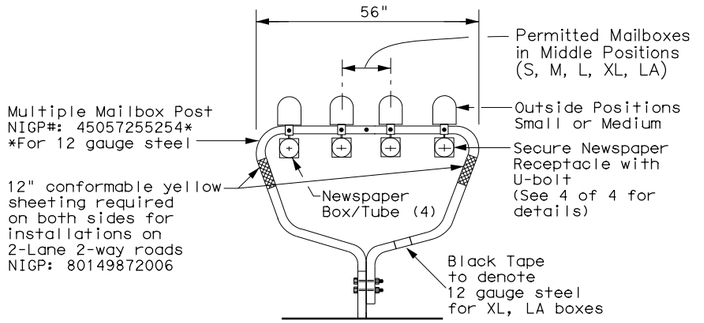
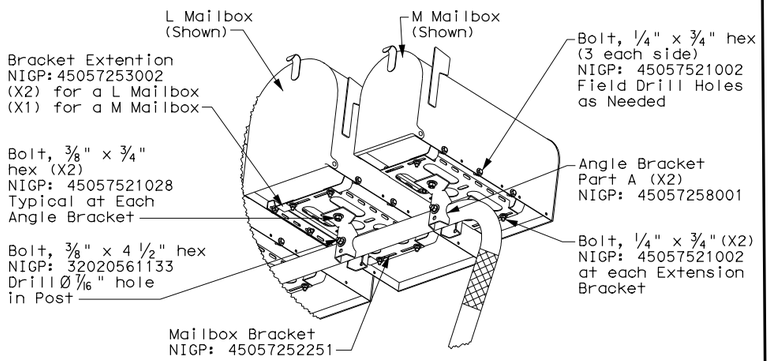
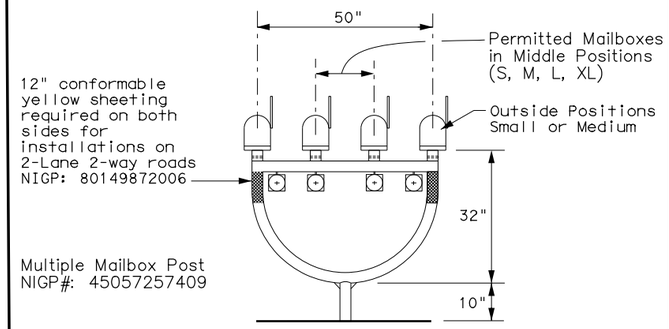
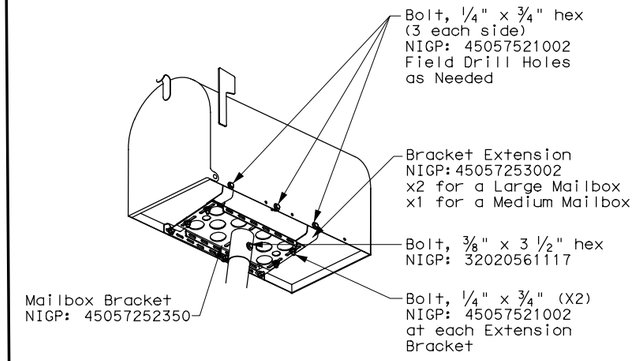
TYPE 1 - MULTIPLE





TYPE 4 - MULTIPLE





MAILBOX SIZES

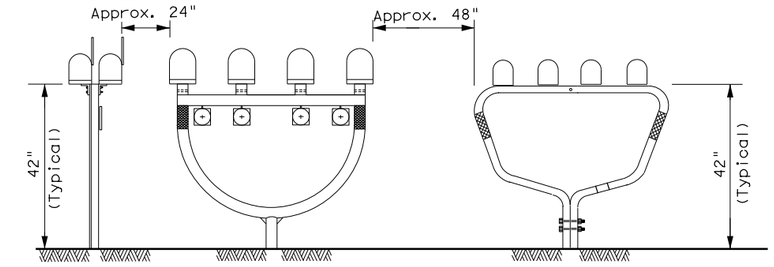
MAILBOX SIZE	TYPICAL DIMENSIONS			MAX **
	LENGTH	WIDTH	HEIGHT	WEIGHT
SMALL	19 1/2"	6"	7"	6 LBS
MEDIUM	22 1/2" *	8" *	11 1/2" *	8 LBS
LARGE	23 1/2"	11 1/2"	13 1/2"	11 LBS
EXTRA LARGE	18"	14"	12"	13 LBS
LOCKABLE	18"	11 1/2"	15"	23 LBS

* See Note 1.
** Excluding Molded Plastic on 4 X 4 Post

GENERAL NOTES:

1. Dimensions shown (length, width, and height) are typical, not maximums. However, anytime a medium size mailbox is mounted on a single/double mount or on the outside position on a multi mount, the dimensions shown are maximums.
2. Mailboxes shall be made of light weight sheet metal or light weight plastic. Heavy steel, cast iron or decorative mailboxes shall not be used on the state highway system.

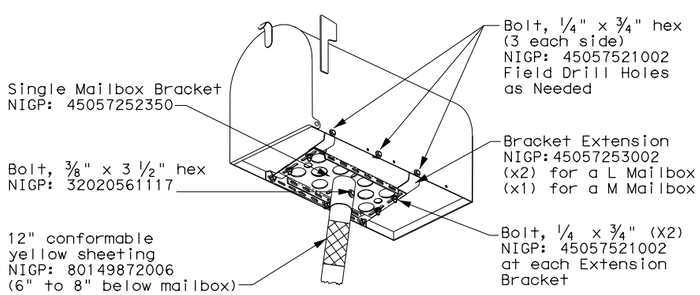
TYPICAL INSTALLATION MEASUREMENTS

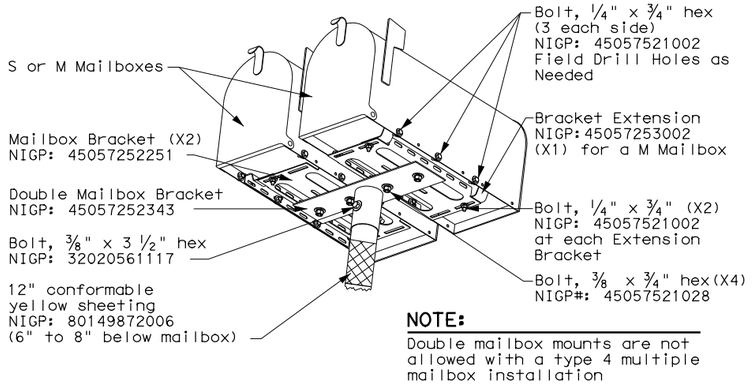


NOTE:

Mailbox installations in sidewalk areas shall be in accordance with the latest TxDOT Design Standard sheets PED-Pedestrian Facilities Curb Ramps.

TYPE 2 and 4 - SINGLE/DOUBLE

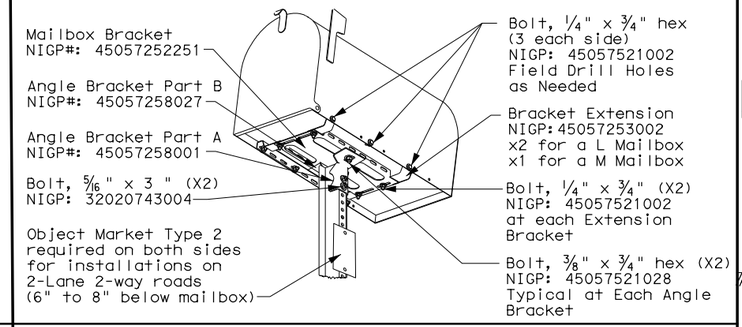


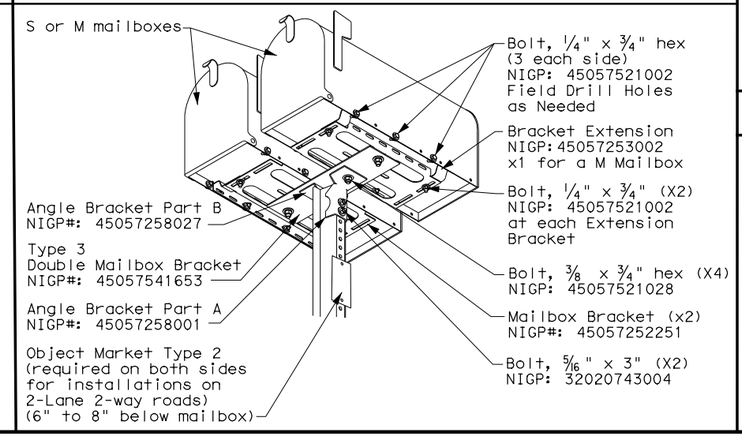


NOTE:

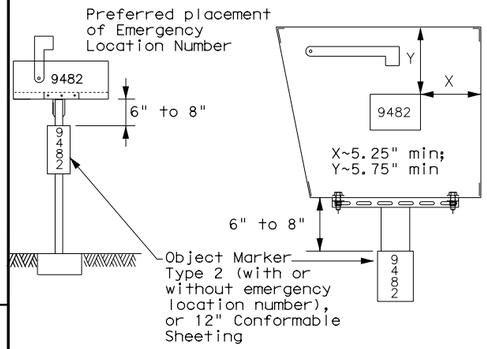
Double mailbox mounts are not allowed with a type 4 multiple mailbox installation

TYPE 3 - SINGLE/DOUBLE





PLACEMENT OF EMERGENCY LOCATION NUMBER

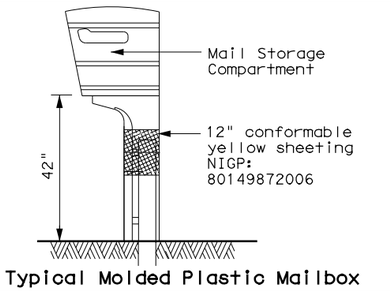


NOTES:

1. Location numbers are provided by homeowner. Minimum size 1" height.
2. Location number is typically placed on the mailbox in a contrasting color.
3. Black numbers may be placed on the Type 2 object marker if the numbers cannot be placed on the mailbox.
4. Alternatively, a green or blue plate with white numbers attached may be mounted below the object marker. Other contrasting color configuration, as approved, may be used.
5. See 3 of 4 for Foundation details.
6. See 4 of 4 for Hardware details.

SHEET 1 OF 4

TYPE 5



Typical Molded Plastic Mailbox

Texas Department of Transportation — Maintenance Division Standard

MAILBOX MOUNTING AND ASSEMBLY

MB(1)-21

FILE: MB-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT March 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS 2/2005 11/2009 4/2015 6/2005 1/2011 11/2006 7/2014	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		99

DATE: 11/17/2023 5:06:59 PM
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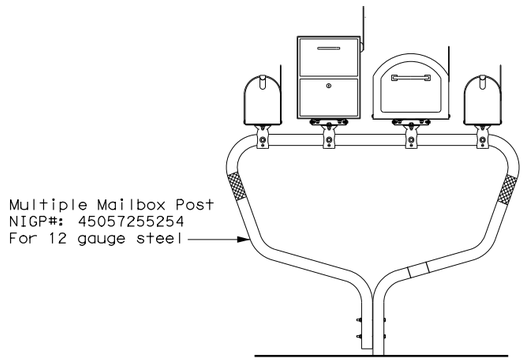
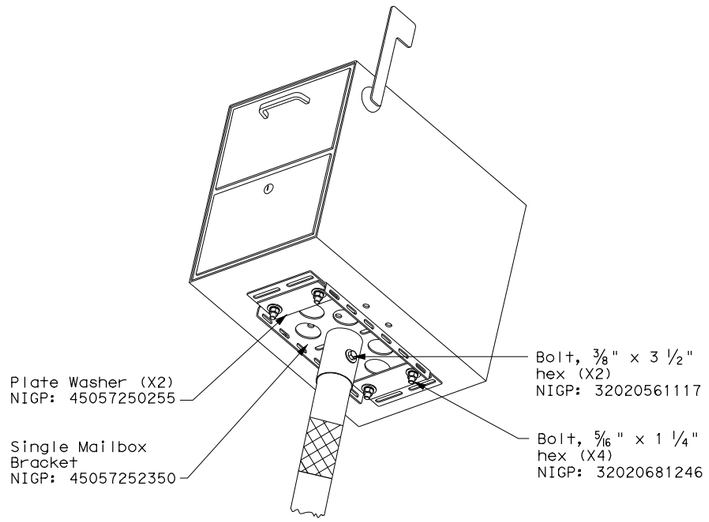
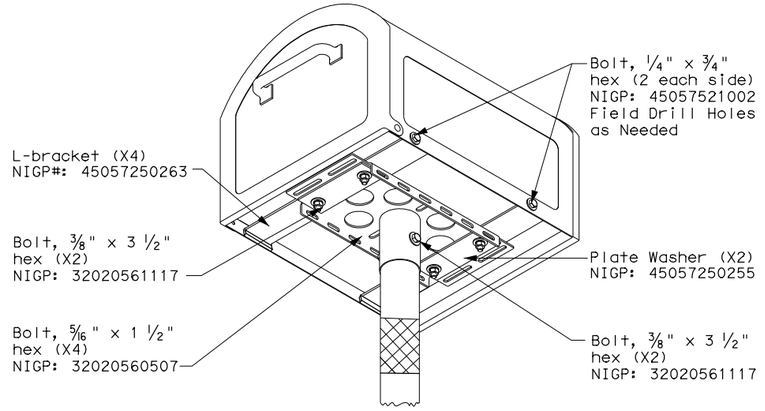
TYPE 1- MULTI LOCKABLE AND XL MAILBOX



TYPE 2/4 - SINGLE LOCKABLE MAILBOX

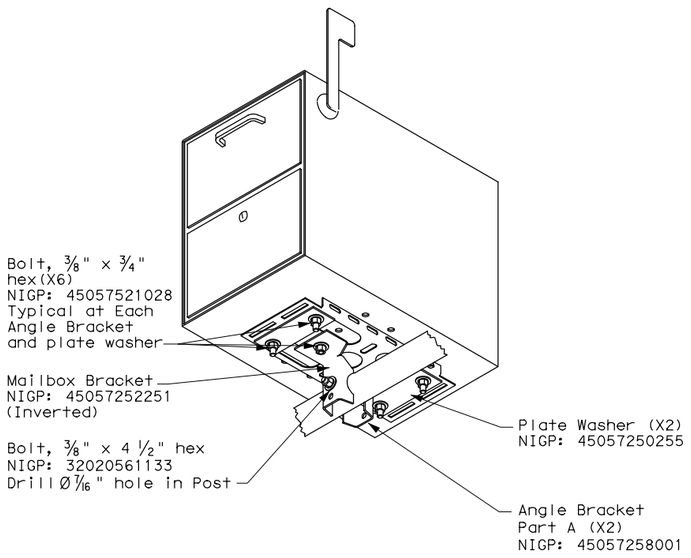


TYPE 2/4 - SINGLE XL MAILBOX

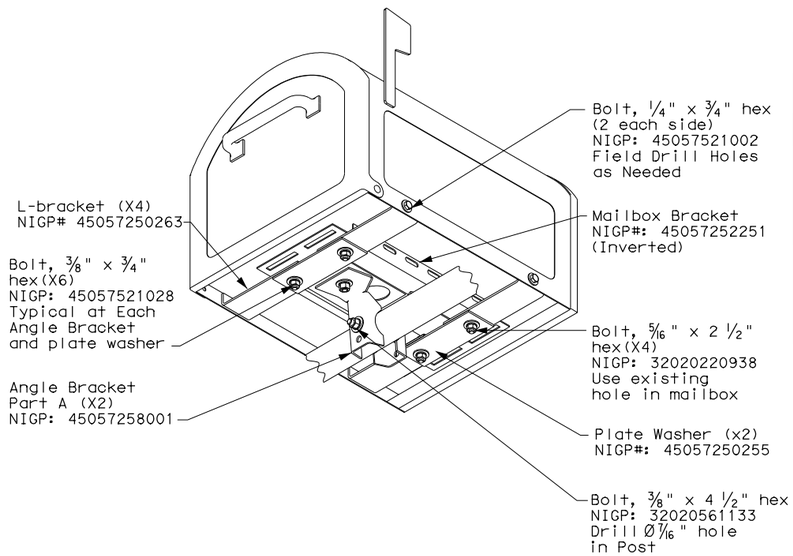


NOTE:
Follow same configuration when mounting an XL mailbox on a Type 4 multi post.

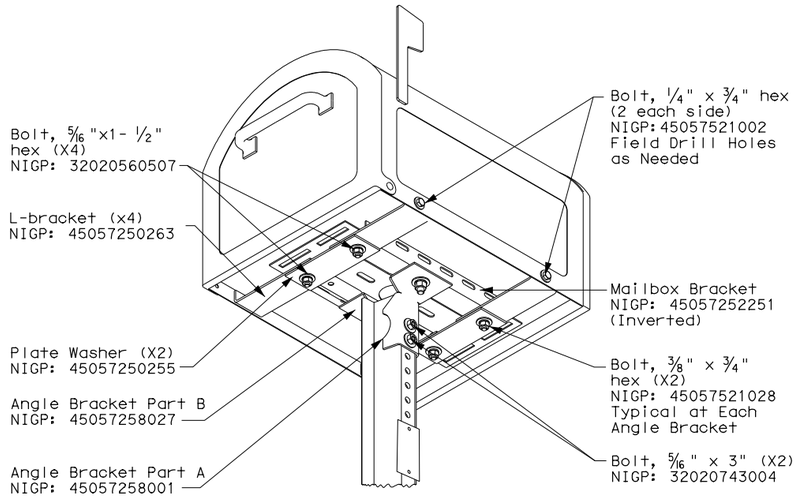
TYPE 1 MULTI – LOCKABLE ARCHITECTURAL (LA)



TYPE 1 MULTI – XL MAILBOX



TYPE 3 - XL MAILBOX MOUNTING



Texas Department of Transportation — Maintenance Division Standard

XL AND LOCKABLE ARCHITECTURAL MAILBOX ASSEMBLY

MB(2)-21

FILE: MB-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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	AUS	HAYS		100

DATE: 11/17/2023 5:06:59 PM
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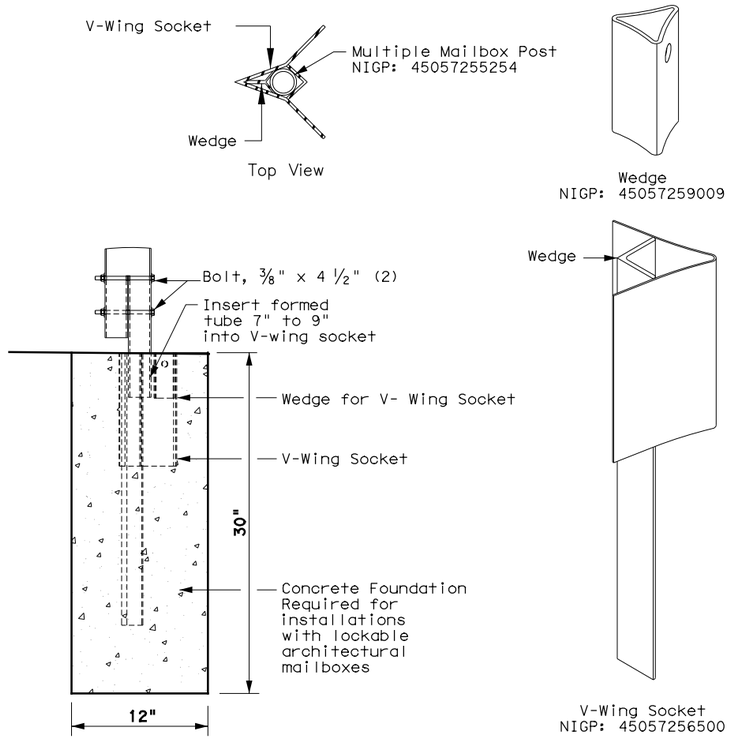
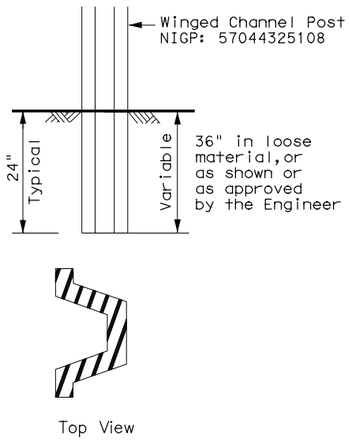
TYPE 1 - SUPPORT/FOUNDATION

Thin Wall Tube w/ V-LOC Anchorage



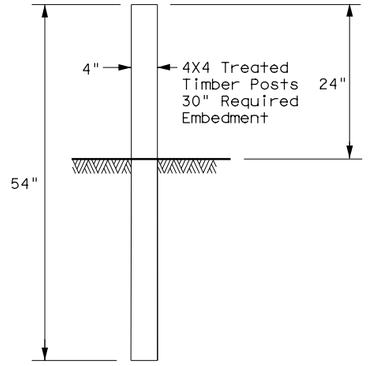
TYPE 3 - SUPPORT/FOUNDATION



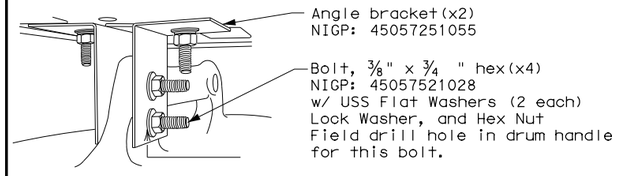
NOTES:

1. Attach Object Marker(OM) facing direction of traffic.
2. OM will also be required on opposite side if installed on a 2-Lane, 2-Way roadway.

TYPE 5 - SUPPORT/FOUNDATION



TYPE 6 - TEMPORARY MAILBOX SUPPORT



Plastic Drum NIGP: 55093383655
Rubber Collar NIGP: 55093387102

NOTES:

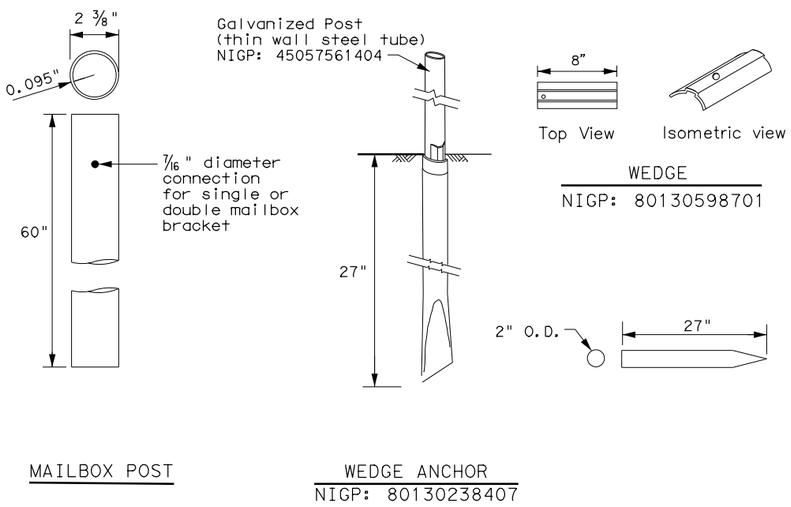
1. Place on approved plastic drum as shown in the Compliant Work Zone Traffic Control Devices (CWZTCD).
2. Existing attachment hardware shall be used unless damaged. Damaged hardware shall be replaced.

GENERAL NOTES:

1. Erect post plumb or vertical.
2. When galvanized part is required galvanize in accordance with Item 445.
3. Use a concrete footing as shown or when directed. Concrete footing will be required when soils do not hold the support/foundations in a stable condition, only on Type 1, Type 2, and Type 4

TYPE 2 - SUPPORT/FOUNDATION

Thin Wall Steel Tube w/Wedge Anchor System

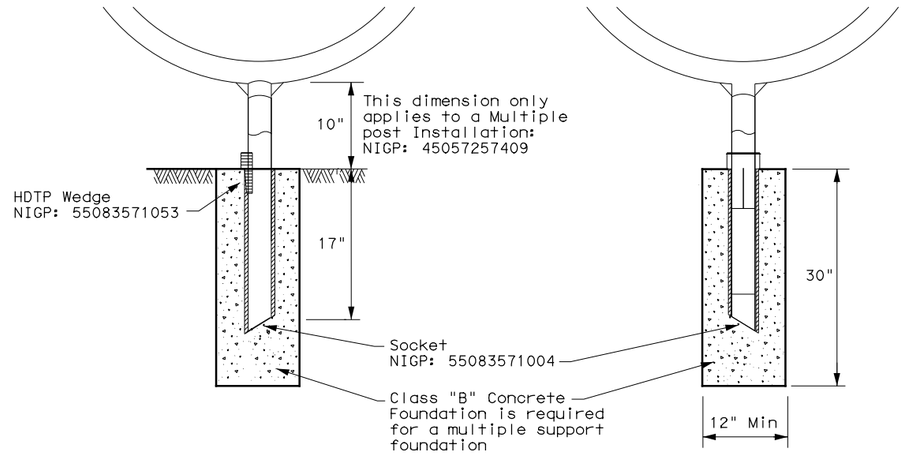


MAILBOX POST

WEDGE ANCHOR
NIGP: 80130238407

TYPE 4 - SUPPORT/FOUNDATION

Whitecoated steel post NIGP: 45057561107
Multiple post NIGP: 45057257409
Recycled Rubber post (RR) NIGP: 45057561057



SHEET 3 OF 4

Texas Department of Transportation | Maintenance Division Standard

MAILBOX SUPPORT AND FOUNDATION

MB(3)-21

FILE: MB-21.dgn	DN:	CK:	DW:	CK:
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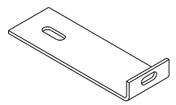
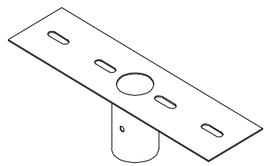
REVISIONS 2/2005 11/2009 4/2015 6/2005 1/2011 11/2006 7/2014	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		101

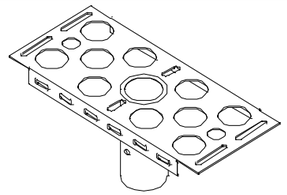
TYPE	TYPE 1	TYPE 2	TYPE 3	TYPE 4			TYPE 5	TYPE 6
Configuration	Multiple	Single or Double	Single or Double	Single	Double	Multiple	Single	Single
Mailbox Size NIGP #	Outside Position: S or M Inside Position: S, M, L, XL, or LA	Single: S, M, L, XL, or LA Double: SS, SM, MM	Single: S, M, L, or XL Double: SS, SM, MM	S, M, L, XL, or LA	SS, SM, or MM	Outside Position: S or M Inside Position: S, M, L, or XL	Molded Plastic	S, or M
Mailbox Post NIGP #	45057255254 (Galvanized Multiple)	45057561404 (Thin Walled Gavanize)	57044325108 (Wing Channel Post)	45057561107 (Thin walled white powder coated) 45057561057 (Recycled Rubber Post: S or M only)	45057561107 (Thin Walled White Powder Coated)	45057257409 (White Powder Coated Multiple)	4x4 Timber	Construction Barrel
Post and Mailbox Hardware NIGP #	45057259009 (Wedge) 45057256500 (V-Wing Socket) 45057253002 (Bracket Extension) 45057252251 (Mailbox Bracket) 45057258001 (Part A Angle Bracket x2) 45057250255 (Plate Washer for XL/LA x2) 45057250263 (L-Bracket for XL x4)	80130598701 (Wedge) 80130238407 (Wedge Anchor) 45057253002 (Bracket Extension) 45057252343 (Double MB Bracket) 45057252350 (S. Mailbox Bracket) 45057252251 (Mailbox Bracket) 45057250255 (Plate Washer for XL/LA x2) 45057250263 (L-Bracket forXL x4)	45057541653 (Type 3 Double Mailbox Bracket) 45057252251 (Mailbox Bracket) 45057253002 (Bracket Extension) 45057258001 (Part A Angle Bracket) 45057258027 (Part B Angle Bracket) 45057250255 (Plate Washer for XL x2) 45057250263 (L-Bracket for XL x4)	55083571053 (Wedge) 55083571004 (Socket) 45057252350 (Single Mailbox Bracket) 45057253002 (Bracket Extension) 45057250255 (Plate Washer for XL/LA x2) 45057250263 (L-Bracket for XL x4)	55083571053 (Wedge) 55083571004 (Socket) 45057253002 (Bracket Extension) 45057252343 (Double Mount Bracket) 45057252251 (Mailbox Bracket x2)	55083571053 (Wedge) 55083571004 (Socket) 45057253002 (Bracket Extension) 45057252350 (Single Mount Bracket) 45057250255 (Plate Washer for XL x2) 45057250263 (L-Bracket for XL x4)	None	45057251055 Angle Bracket (x2)
Foundation Used	Class B Concrete (Required for LA Mailboxes)	Class B Concrete (Required for LA Mailboxes)	None	Class B Concrete (not used with recycled rubber post, required for LA Mailboxes)	Class B Concrete (not required)	Class B Concrete	None	None



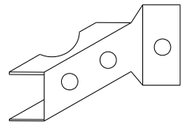
NIGP: 45057250263
L-Bracket x4 for
XL sized mailboxes



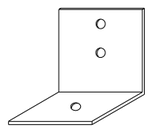
NIGP: 45057252343
Double Mailbox Bracket
For Type 2 and Type 4
double mount



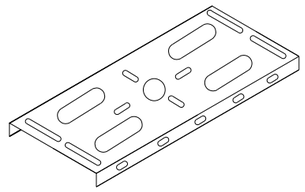
NIGP: 45057252350
Single Mailbox Bracket
For Type 2 single and for
Type 4 single and multi mount



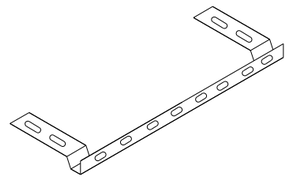
NIGP: 45057258001
Part "A" Angle Bracket
For Type 1 multi (2 per mailbox)
and Type 3 single and double



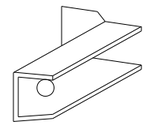
NIGP: 45057251055
Type 6 Angle Bracket
(2 per mailbox)



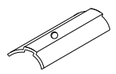
NIGP: 45057252251
Mailbox Bracket
For Type 1 multi and
any double mount (use 2)



NIGP: 45057253002
Bracket Extension
Use 1 for a medium Mailbox
Use 2 for a Large Mailbox

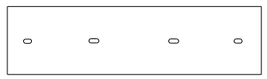


NIGP: 45057258027
Part "B" Angle Bracket
For Type 3 single
and double

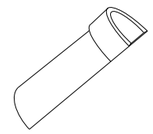


NIGP: 80130598701
Wedge for Type 2

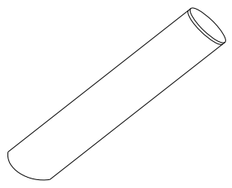
NIGP: 45057250255
Plate Washer for Architecural
and XL Mailboxes



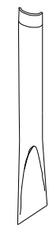
NIGP: 45057541653
Type 3 double mailbox bracket



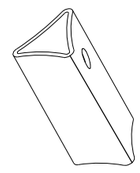
NIGP: 55083571053
Type 4 Mailbox Wedge



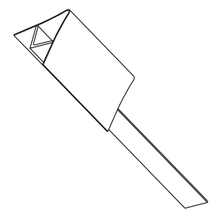
NIGP: 55083571004
Type 4 Mailbox Socket



NIGP: 80130238407
Type 2 Wedge Anchor



NIGP: 45057259009
Wedge for Type 1 V-wing Socket



NIGP: 45057256500
V-wing Socket for
Type 1 Foundation

NIGP #	OBJECT MARKERS AND CONFORMABLE SHEETING
55008311759	Type 2 OM 4"x4" (3 Needed) for Type 3 Wing Channel Post
55008312906	Type 2 OM 6"x12" (1 needed) for Type 3 Wing Channel Post
80149872006	12" Conformable Reflective Yellow Sheeting for Flexible Posts

NOTES:

1. Type 2 object marker in accordance with Traffic Engineering Standard Delineators & Object Markers.
2. A light weight receptacle for newspaper delivery can be attached to mailbox posts if the receptacle does not touch the mailbox, present a hazard to traffic or delivery of the mail, extend beyond the front of the mailbox, or display advertising, except the publication title.

BID CODES FOR CONTRACTS

MB-(X) ASSM TY (XXX) (X)

Type of Mailbox
- S = Single
- D = Double
- M = Multiple
- MP = Molded Plastic

Type of Post
- WC = Winged Channel Post
- RR = Recycled Rubber
- TWW = Thin Walled White Tubing
- TWG = Thin Walled Galvanized Tubing
- TIM = Timber

Type of Foundation
- Ty 1 = V-Loc
- Ty 2 = Wedge Anchor Steel System
- Ty 3 = Winged Channel post
- Ty 4 = Wedge Anchor Plastic System
- Ty 5 = 4 X 4 Post

DATE: 11/17/2023 5:06:59 PM
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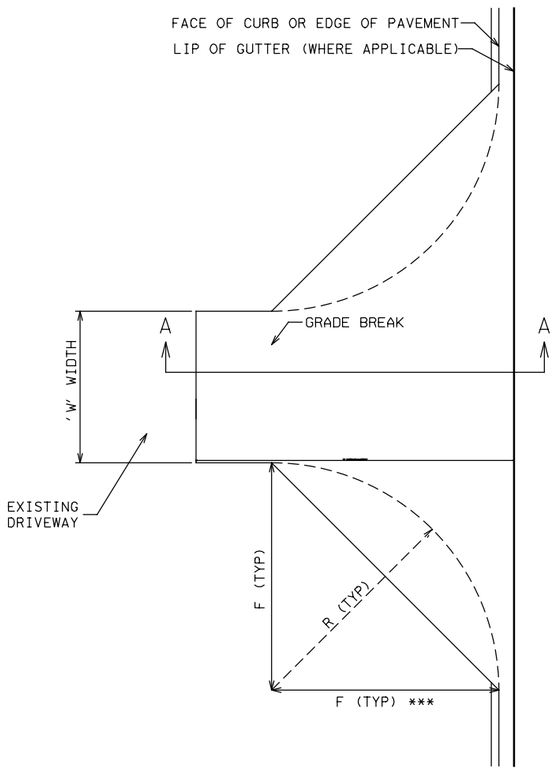
Texas Department of Transportation — Maintenance Division Standard

NIGP PARTS LIST AND COMPATIBILITY

MB(4)-21

FILE: MB-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT March 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS 2/2005 11/2009 4/2015 6/2005 1/2011 11/2006 7/2014	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		102



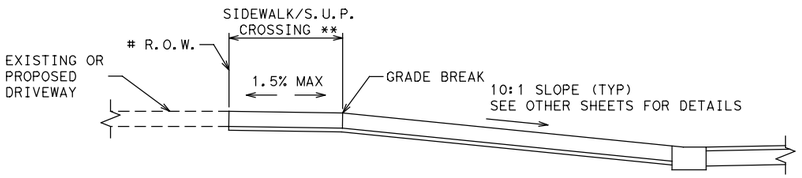
DRIVEWAY PLAN

FLARE OR RADIUS	FARM/RANCH	RESIDENTIAL	COMMERCIAL
"F" OR "R" (FT)	25	25	25

THESE ARE STANDARD DIMENSIONS UNLESS OTHERWISE SHOWN ELSEWHERE ON THE PLANS.

FLARES ARE TYPICALLY USED FOR SUBURBAN/URBAN (CURBED) ROADWAYS. RADII ARE TYPICALLY USED FOR RURAL OR UNCURBED ROADWAYS.

*** THIS 'F' DIMENSION MAY BE REDUCED TO KEEP WORK WITHIN THE ROW.

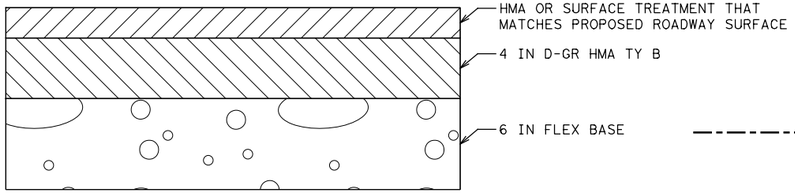


ACTUAL TIE-IN SHOWN ELSEWHERE IN PLANS OR AS DIRECTED

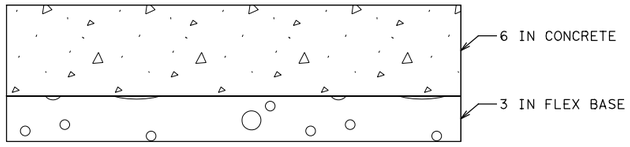
DRIVEWAY WITH GUTTER SECTION A-A

ENSURE GRADE BREAK DOES NOT EXCEED 8% UNLESS OTHERWISE DIRECTED. PROVIDE ABSOLUTE MINIMUM SIDEWALK CROSSING WIDTH OF 4' FOR DRIVEWAYS WIDTH OF 20' OR LESS

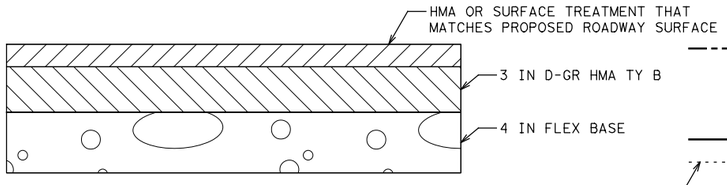
** LOCATE SIDEWALK CROSSING TO ALIGN WITH ADJACENT SIDEWALK; SIDEWALK/S.U.P. WIDTH AND LOCATION SHOWN ELSEWHERE ON THE PLANS.



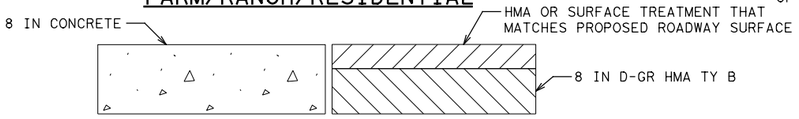
HMA OR SURFACE TREATEMENT - COMMERCIAL



CONCRETE - ALL DRIVEWAY TYPES

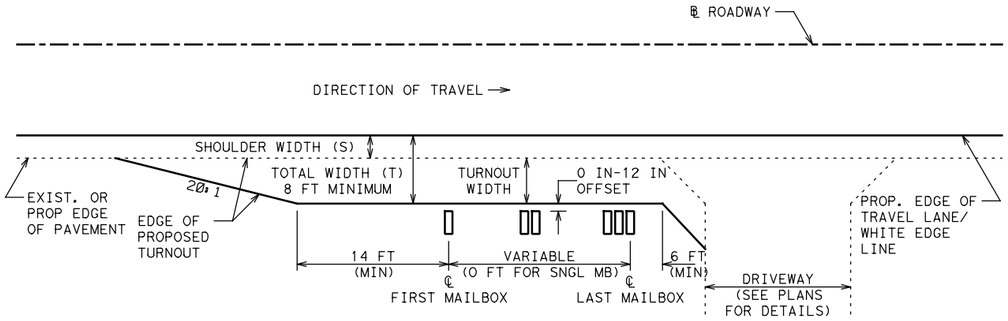


HMA OR SURFACE TREATMENT - FARM/RANCH/RESIDENTIAL

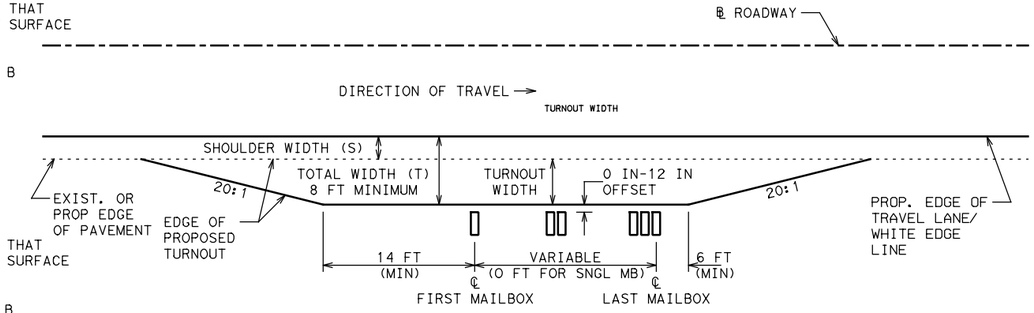


FAST TRACK ACP (TYPE 3) OR CONCRETE

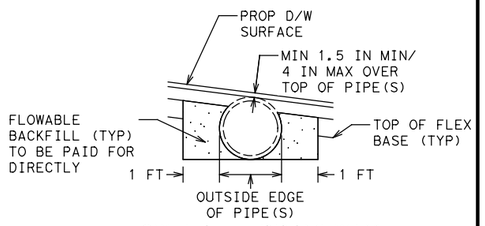
DRIVEWAY AND TURNOUT TYPICAL SECTIONS



MAILBOX TURNOUT PLAN WITH DRIVEWAY



MAILBOX TURNOUT PLAN WITHOUT DRIVEWAY



LOW FILL DRIVEWAY

ONLY ONE PIPE SHOWN
SEE ELSEWHERE ON THE PLANS FOR SPECIFIC DRIVEWAY DETAILS

GENERAL NOTES

PROVIDE EXPANSION 20 FT C-C FOR WIDTH OR LENGTH OVER 25 FT. EXPANSION JOINT PER AUS STANDARD FOR SIDEWALK (MCPSWMD).

REINFORCEMENT WILL BE IN ACCORDANCE WITH ITEM 432.3.1 USING NO. 3 OR NO. 4 BARS.

FIBER REINFORCEMENT IS NOT ALLOWED. CLASS A CONCRETE IS ALLOWED TO USE COARSE AGGREGATE GRADES 1-8.

IN LIEU OF PFC OR TOM, SURFACE MUST BE 1.5" D-GR HMA TY D. IF SURFACE IS A MULTIPLE COURSE SURFACE TREATEMENT, ALL COURSES MUST BE PLACED ON DRIVEWAY. SURFACE HMA IS PG 76-22. NON SURFACE HMA IS PG 64-22 AND MAY BE BLADE LAID.

FURNISH BASE MEETING THE REQUIREMENTS FOR ANY TYPE OR GRADE IN ACCORDANCE WITH ITEM 247. BASE COMPRESSIVE STRENGTHS ARE WAIVED.

THE BASE UNDER THE CONCRETE MAY BE REPLACED WITH CONCRETE AT A RATIO OF 3 INCHES OF BASE EQUALS 2 INCHES OF CONCRETE.

FAST TRACK DRIVEWAYS MUST BE CLOSED, CONSTRUCTED, AND REOPENED WITHIN 24 HOURS.

IF ROOTS ARE ENCOUNTERED VERIFY WITH THE ENGINEER PRIOR TO ACCOMMODATING OR REMOVING 2 IN. DIAMETER OR LARGER ROOTS. ROOT REMOVAL MUST BE IN ACCORDANCE WITH ITEM 752.4.2. ROOTS MAY REMAIN IN THE BASE. FOR IMPROVEMENTS WITHIN 6 IN. OF A ROOT, THE CONCRETE THICKNESS MAY BE REDUCED BY 1 IN. AND THE BASE INCREASED BY 1 IN. TO MINIMIZE IMPACTS TO THE ROOTS. ADJUST BASE AND SURFACE PROFILE TO PROVIDE A 1 IN. BASE CUSHION AROUND THE ROOTS. THE SURFACE PROFILE MAY BE ADJUSTED TO THE EXTENT ALLOWED BY ADA. THIS WORK IS SUBSIDIARY.

Texas Department of Transportation

Austin District Standard

DRIVEWAYS AND MAILBOX TURNOUTS

DWMB-22 (AUS)

©TxDOT®YEAR®

REVISIONS
01/16: SHEET CREATED
04/19: APPROVED
11/20: TABLE REVISED, GN ADDED, PLAN & PROFILE MODIFIED
01/22: ADDED TURNOUT INFO

CONT	SECT	JOB	HIGHWAY
0805	04	033	RM 3237
DIST	COUNTY		SHEET NO.
AUS	HAYS		103

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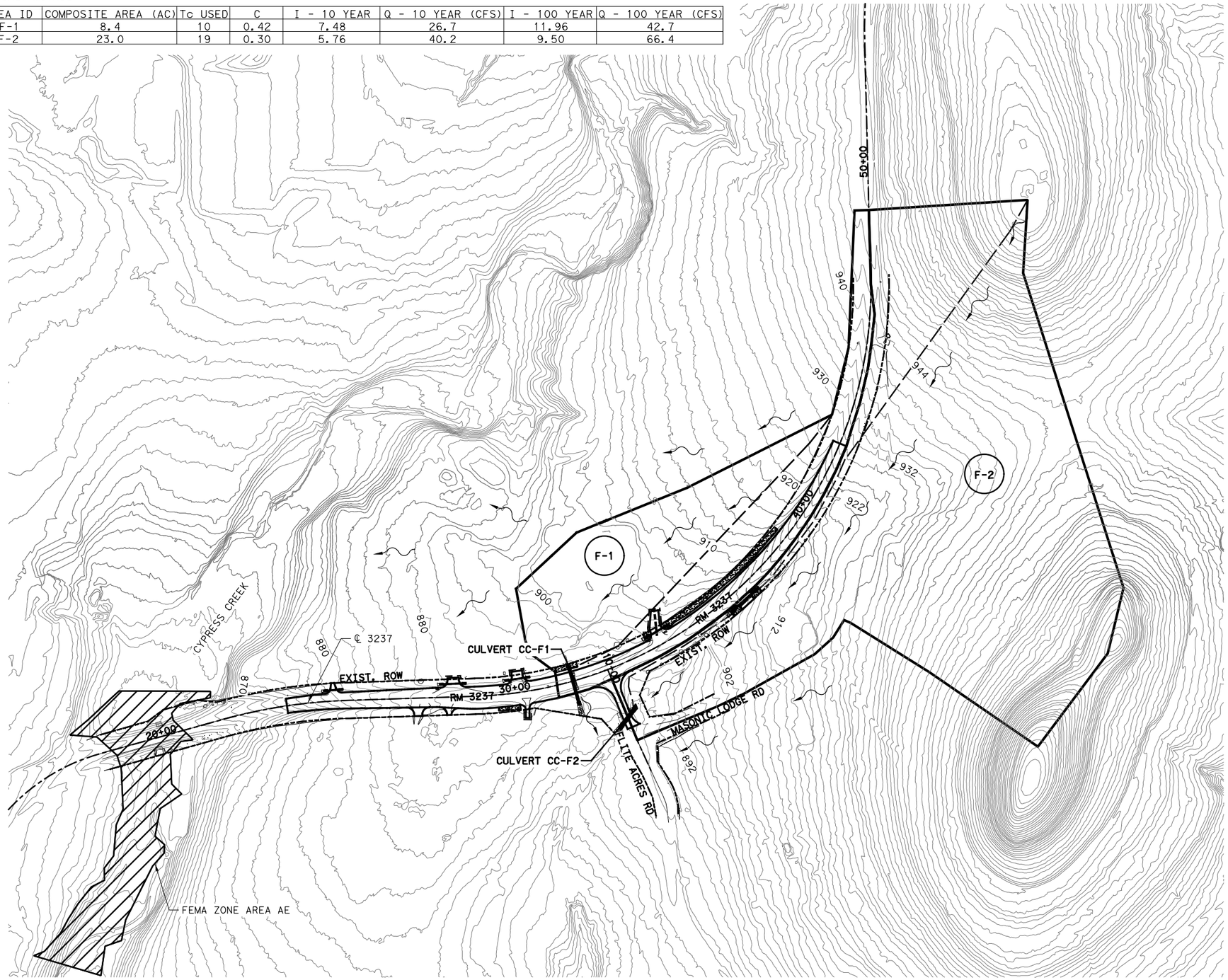
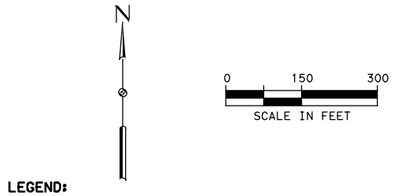
Rational Method

AREA ID	COMPOSITE AREA (AC)	Tc USED	C	I - 10 YEAR	Q - 10 YEAR (CFS)	I - 100 YEAR	Q - 100 YEAR (CFS)
F-1	8.4	10	0.42	7.48	26.7	11.96	42.7
F-2	23.0	19	0.30	5.76	40.2	9.50	66.4





LEGEND:

- XX — XX = D = DRAINAGE AREA ID; XX = CC-XX = CROSS CULVERT AREA
- DIRECTION OF FLOW
- DRAINAGE AREA BOUNDARY
- 2-FT CONTOURS
- FLOW PATH
- FEMA FLOOD PLAIN

GENERAL NOTES:

1. C-VALUE AND TIME OF CONCENTRATION METHODOLOGY WERE OBTAINED FROM THE TxDOT HYDRAULIC DESIGN MANUAL 2019.
2. CONTOURS ARE SHOWN AT 2' INTERVALS.
3. NOAA ATLAS 14 INTENSITIES USED
4. PROJECT HAS 2 FEMA CROSSING ON PANELS 48209C0355F AND 48209C0239F EFFECTIVE DATE 9/2/2005. H&H FILES AND PLANS WERE SENT TO THE LOCAL FLOODPLAIN ADMINISTRATOR ERIC VAN GASS BEEK ON 12/15/2023.

12/13/2023

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

HAYS COUNTY TEXAS

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

FLITE ACRES DRAINAGE AREA MAP

SHEET 1 OF 2

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS				
HNS	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK	TX	AUS	HAYS	
AMP	CONTROL	SECTION	JOB	104
CHECK	0805	04	033	
AMP				

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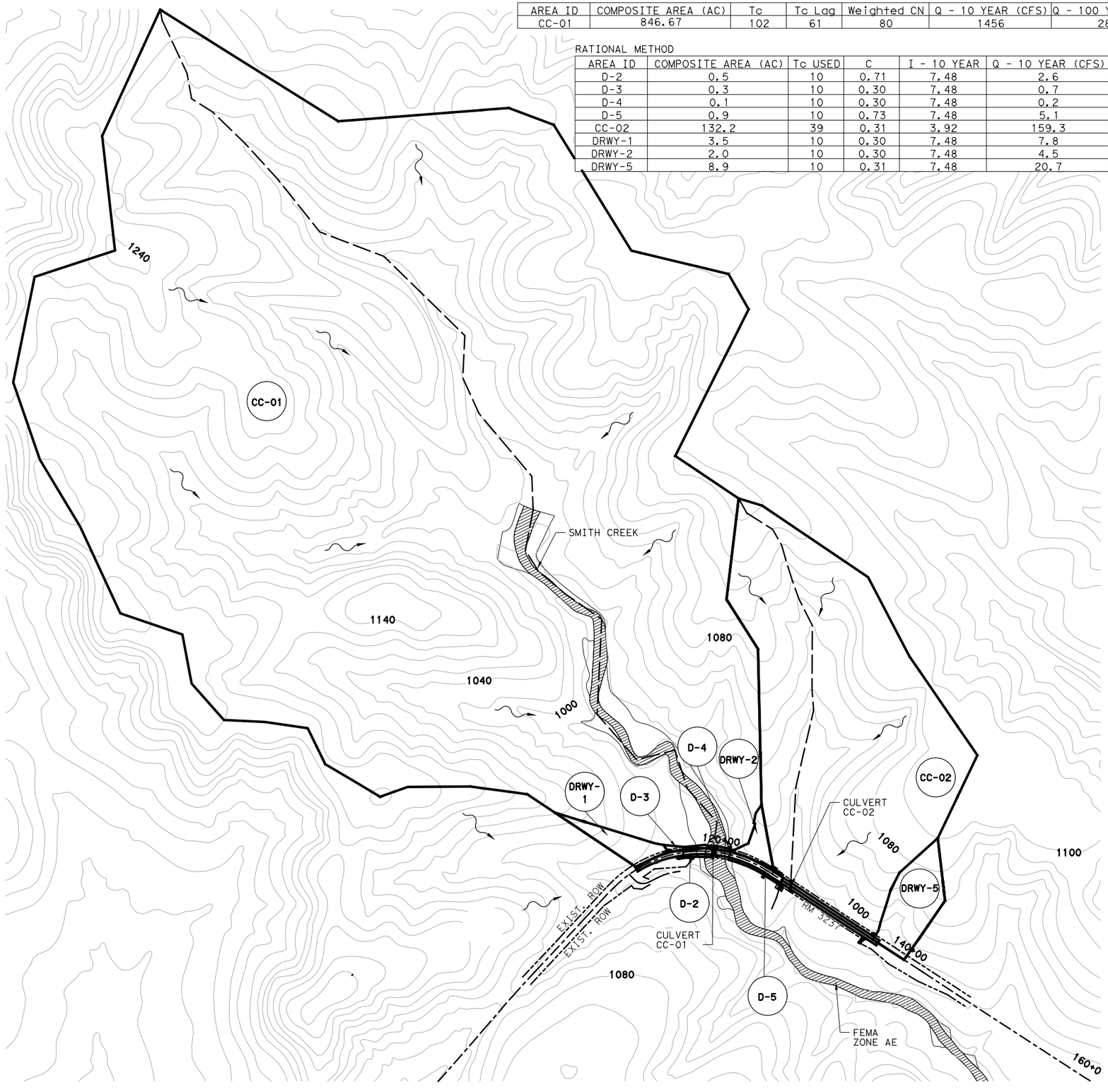
UNIT HYDROGRAPH METHOD

AREA ID	COMPOSITE AREA (AC)	Tc	Tc Lag	Weighted CN	Q - 10 YEAR (CFS)	Q - 100 YEAR (CFS)
CC-01	846.67	102	61	80	1456	2896

RATIONAL METHOD

AREA ID	COMPOSITE AREA (AC)	Tc USED	C	I - 10 YEAR	Q - 10 YEAR (CFS)	I - 100 YEAR	Q - 100 YEAR (CFS)
D-2	0.5	10	0.71	7.48	2.6	11.96	4.2
D-3	0.3	10	0.30	7.48	0.7	11.96	1.1
D-4	0.1	10	0.30	7.48	0.2	11.96	0.3
D-5	0.9	10	0.73	7.48	5.1	11.96	8.2
CC-02	132.2	39	0.31	3.92	159.3	6.68	271.5
DRWY-1	3.5	10	0.30	7.48	7.8	11.96	12.4
DRWY-2	2.0	10	0.30	7.48	4.5	11.96	7.2
DRWY-5	8.9	10	0.31	7.48	20.7	11.96	33.0



N

0 500 1000
SCALE IN FEET

LEGEND:

XX = XX = D = DRAINAGE AREA ID
XX = CC-XX = CROSS CULVERT AREA
XX = DRWY-X = DRIVEWAY PIPE AREA

DIRECTION OF FLOW

DRAINAGE AREA BOUNDARY

20-FT CONTOURS

FLOW PATH

FEMA FLOOD PLAIN

GENERAL NOTES:

1. RUNOFF CURVE NUMBER, C-VALUE AND TIME OF CONCENTRATION METHODOLOGY WERE OBTAINED FROM THE TxDOT HYDRAULIC MANUAL 2019.
2. CONTOURS ARE SHOWN AT 20' INTERVALS.
3. NOAA ATLAS 14 INTESITIES USED
4. FOR AREA CC-01 FREQUENCY STORM METHOD WAS USED TO DETERMINE PEAK DISCHARGE. HEC-HMS 4.3 WAS USED FOR HYDROLOGIC MODELING.
4. DRWY-1, D-3, D-4 AND DRWY-2 FLOWS ARE INCLUDED IN CC-01
5. DRWY-5 FLOW INCLUDED IN CC-02
6. PROJECT HAS 2 FEMA CROSSING ON PANELS 48209C0355F AND 48209C0239F EFFECTIVE DATE 9/2/2005. H&H FILES AND PLANS WERE SENT TO THE LOCAL FLOODPLAIN ADMINISTRATOR ERIC VAN GASS BEEK ON 12/15/2023.

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED PROFESSIONAL ENGINEER
12/13/2023

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

HAYS COUNTY TEXAS

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

ROGERS ROAD DRAINAGE AREA MAP

SHEET 2 OF 2

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	105
AMP	0805	04	033	
CHECK				
AMP				

Culvert Summary Table: CC-F1

	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
	0.00	0.00	885.09	0.00	0.00	0-NF	0.00	0.00	0.00	0.00
	4.27	4.27	885.84	0.75	0.0*	1-S2n	0.34	0.27	5.96	3.23
	8.54	8.54	886.18	1.09	0.0*	1-S2n	0.46	0.41	7.89	4.03
	12.81	12.81	886.45	1.36	0.0*	1-S2n	0.56	0.51	8.90	4.57
	17.08	17.08	886.68	1.60	0.0*	1-S2n	0.63	0.59	10.18	4.98
	21.35	21.35	886.92	1.83	0.0*	1-S2n	0.72	0.67	10.41	5.32
10-YR	26.70	26.70	887.26	2.17	0.0*	5-S2n	0.82	0.75	11.08	5.67
	29.89	29.89	887.49	2.40	0.0*	5-S2n	0.87	0.80	11.39	5.86
	34.16	34.16	887.84	2.75	0.0*	5-S2n	0.94	0.86	11.81	6.08
	38.43	38.43	888.25	3.16	0.0*	5-S2n	1.00	0.91	12.17	6.29
100-YR	42.70	41.75	888.59	3.50	0.0*	5-S2n	1.05	0.96	12.46	6.47

****
Single Broken-back Culvert
Inlet Elevation (invert): 885.09 ft,
Break Elevation (invert): 882.19 ft,
Culvert Length: 92.00 ft,
Upper Culvert Section Slope: 0.0382
Steep Culvert Section Slope: 0.0050
****

Site Data

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 885.09 ft
Break Station: 76.00 ft
Break Elevation: 882.19 ft
Outlet Station: 92.00 ft
Outlet Elevation: 882.08 ft
Number of Barrels: 2

Culvert Data Summary

Barrel Shape: Circular
Barrel Diameter: 2.00 ft
Barrel Material: Concrete
Embedment: 0.00 in
Barrel Manning's n: 0.0120
Culvert Type: Straight
Inlet Configuration: Mitered to Conform to Slope
Inlet Depression: None
Inlet Depression: None

Tailwater Channel Data

Tailwater Channel Option: Trapezoidal Channel
Side Slope (H:V): 3.00 (_:1)
Bottom Width: 4.000 ft
Channel Slope: 0.0300
Channel Manning's n: 0.0300
Channel Invert Elevation: 882.08 ft

Roadway Data for Crossing

Roadway Profile Shape: Irregular Roadway Shape (coordinates)		
Irregular Roadway Cross-Section:		
Coord No.	Sta. (ft)	Elev. (ft)
0	0	891.06
1	50	891.07
2	100	891.1

Roadway Surface: Paved
Roadway Top Width: 62.00 ft

Culvert Summary Table: EXIST CC-F1

	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
	0.00	0.00	887.19	0.00	0.00	0-NF	0.00	0.00	0.00	0.00
	4.27	4.27	888.26	1.07	0.0*	1-S2n	0.67	0.61	4.66	2.86
	8.54	8.54	888.77	1.58	0.59	1-S2n	0.98	0.79	5.61	3.40
	12.81	12.81	889.27	2.08	1.32	5-S2n	1.26	0.92	6.16	3.76
	17.08	14.66	889.63	2.34	2.44	7-M2c	1.38	1.03	6.34	4.04
	21.35	15.17	889.68	2.42	2.49	7-M2c	1.40	1.12	6.44	4.27
10-YR	26.70	15.66	889.72	2.50	2.54	7-M2c	1.43	1.22	6.53	4.52
	29.89	15.92	889.75	2.54	2.56	7-M2c	1.44	1.27	6.58	4.64
	34.16	16.19	889.78	2.59	2.59	7-M2c	1.45	1.33	6.64	4.80
	38.43	16.36	889.80	2.61	2.60	7-M2c	1.46	1.39	6.67	4.95
100-YR	42.70	16.50	889.83	2.64	2.62	7-M2c	1.47	1.45	6.70	5.08

****
Straight Culvert
Inlet Elevation (invert): 887.19 ft, Outlet Elevation (invert): 886.35 ft
Culvert Length: 40.00 ft, Culvert Slope: 0.0210
****

Site Data

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 887.19 ft
Outlet Station: 40.00 ft
Outlet Elevation: 886.35 ft
Number of Barrels: 1

Culvert Data Summary

Barrel Shape: Circular
Barrel Diameter: 2.00 ft
Barrel Material: Corrugated Steel
Embedment: 0.00 in
Barrel Manning's n: 0.0240
Culvert Type: Straight
Inlet Configuration: Mitered to Conform to Slope
Inlet Depression: None

Tailwater Channel Data

Tailwater Channel Option: Triangular Channel
Side Slope (H:V): 4.00 (_:1)
Channel Slope: 0.0168
Channel Manning's n: 0.0300
Channel Invert Elevation: 886.35 ft

Roadway Data for Crossing

Roadway Profile Shape: Irregular Roadway Shape (coordinates)		
Irregular Roadway Cross-Section:		
Coord No.	Sta. (ft)	Elev. (ft)
0	0	889.85
1	50	889.56
2	100	889.58

Roadway Surface: Paved
Roadway Top Width: 26.00 ft

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED
PROFESSIONAL ENGINEER
12/13/2023

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

HAYS COUNTY TEXAS

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

HYDRAULIC DATA
CC-F1

SHEET 1 OF 1

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	106
AMP	0805	04	033	
CHECK				
AMP				

Culvert Summary Table: CC-F2

	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
	0.00	0.00	881.50	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
	6.64	6.64	882.19	0.69	0.0*	1-S2n	0.36	0.49	0.36	0.34	4.99	2.75
	13.28	13.28	882.50	1.00	0.07	1-S2n	0.51	0.69	0.52	0.51	5.97	3.45
	19.92	19.92	882.74	1.24	0.26	1-S2n	0.63	0.85	0.64	0.64	6.64	3.92
	26.56	26.56	882.96	1.46	0.45	1-S2n	0.73	0.99	0.75	0.75	7.13	4.29
	33.20	33.20	883.15	1.65	0.63	1-S2n	0.82	1.11	0.85	0.85	7.54	4.58
10-YR	40.20	40.20	883.34	1.84	0.83	1-S2n	0.90	1.23	0.94	0.94	7.89	4.85
	46.48	46.48	883.50	2.00	1.01	1-S2n	0.98	1.33	1.03	1.02	8.17	5.06
	53.12	53.12	883.68	2.18	1.21	1-S2n	1.05	1.42	1.11	1.09	8.43	5.26
	59.76	59.76	883.86	2.36	1.41	1-S2n	1.12	1.51	1.19	1.16	8.67	5.44
100-YR	66.40	66.40	884.06	2.56	1.62	5-S2n	1.19	1.60	1.26	1.22	8.90	5.60

****

Straight Culvert

Inlet Elevation (invert): 881.50 ft, Outlet Elevation (invert): 880.85 ft

Culvert Length: 56.00 ft, Culvert Slope: 0.0116

****

Site Data - CC_F2

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 881.50 ft

Outlet Station: 56.00 ft

Outlet Elevation: 880.85 ft

Number of Barrels: 3

Culvert Data Summary

Barrel Shape: Circular

Barrel Diameter: 2.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Mitered to Conform to Slope

Inlet Depression: None

Inlet Depression: None

Tailwater Channel Data

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 6.00 ft

Side Slope (H:V): 3.00 (_:1)

Channel Slope: 0.0156

Channel Manning's n: 0.0300

Channel Invert Elevation: 880.85 ft

Roadway Data for Crossing

Roadway Profile Shape: Irregular Roadway Shape (coordinates)		
Irregular Roadway Cross-Section:		
Coord No.	Sta. (ft)	Elev. (ft)
0	0	889.51
1	50	886.53
2	100	885.6

Roadway Surface: Paved

Roadway Top Width: 24.00 ft

Culvert Summary Table: EXIST CC-F2

	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
	0.00	0.00	882.90	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
	6.64	6.64	883.60	0.71	0.0*	1-S2n	0.43	0.49	0.43	0.49	3.92	3.44
	13.28	13.22	883.91	1.01	0.0*	1-S2n	0.61	0.69	0.61	0.68	4.79	4.13
	19.92	18.44	884.11	1.21	0.0*	1-S2n	0.72	0.82	0.72	0.82	5.27	4.59
	26.56	22.06	884.23	1.33	0.10	1-S2n	0.79	0.90	0.79	0.94	5.55	4.95
	33.20	24.96	884.33	1.43	0.23	1-S2n	0.84	0.96	0.84	1.03	5.74	5.24
10-YR	40.20	27.59	884.41	1.51	0.35	1-S2n	0.89	1.01	0.89	1.12	5.90	5.50
	46.48	29.74	884.47	1.57	0.45	1-S2n	0.92	1.05	0.92	1.20	6.02	5.71
	53.12	31.77	884.53	1.63	0.54	1-S2n	0.96	1.09	0.96	1.27	6.11	5.91
	59.76	33.71	884.58	1.69	0.64	1-S2n	0.99	1.12	0.99	1.34	6.21	6.09
100-YR	66.40	35.49	884.63	1.73	0.73	1-S2n	1.02	1.15	1.02	1.40	6.32	6.25

****

Straight Culvert

Inlet Elevation (invert): 882.90 ft, Outlet Elevation (invert): 881.96 ft

Culvert Length: 40.00 ft, Culvert Slope: 0.0235

****

Site Data - CC_F2

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 882.90 ft

Outlet Station: 40.00 ft

Outlet Elevation: 881.96 ft

Number of Barrels: 3

Culvert Data Summary

Barrel Shape: Circular

Barrel Diameter: 2.50 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Mitered to Conform to Slope

Inlet Depression: None

Tailwater Channel Data

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 2.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0220

Channel Manning's n: 0.0300

Channel Invert Elevation: 881.96 ft

Roadway Data for Crossing

Roadway Profile Shape: Irregular Roadway Shape (coordinates)		
Irregular Roadway Cross-Section:		
Coord No.	Sta. (ft)	Elev. (ft)
0	0	885.37
1	50	883.89
2	100	885.73

Roadway Surface: Paved

Roadway Top Width: 24.00 ft

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED PROFESSIONAL ENGINEER

12/13/2023

REV	DATE	DESCRIPTION	APPROVED

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BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

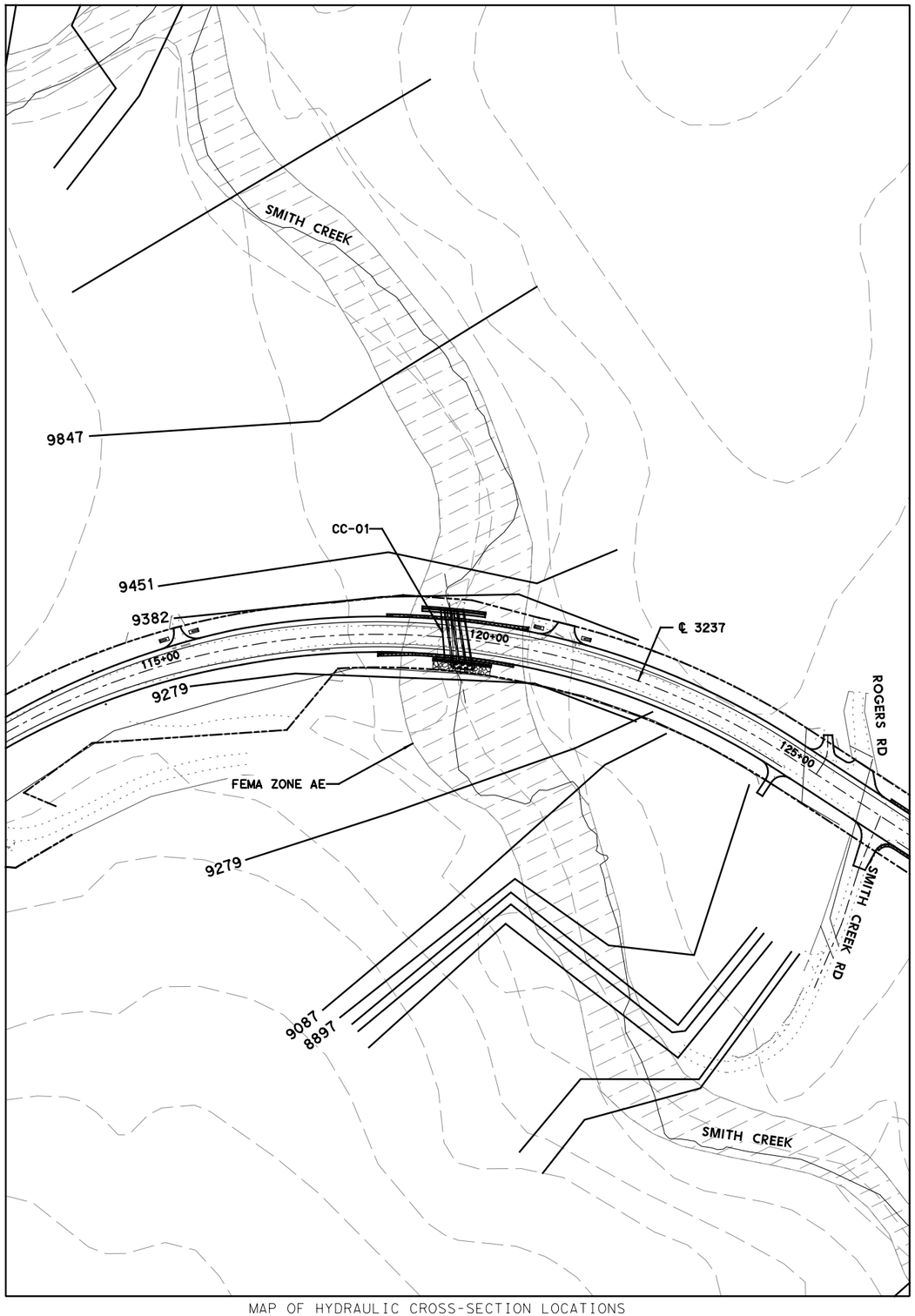
Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

HYDRAULIC DATA
CC-F2

SHEET 1 OF 1

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	107
CHECK	CONTROL	SECTION	JOB	
AMP	0805	04	033	
CHECK				
AMP				



MAP OF HYDRAULIC CROSS-SECTION LOCATIONS

River	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Smith	9847	10 YR	EXIST	1456	956.06	968.60		968.61	0.000132	1.09	1678.97	303.72	0.07
Smith	9847	10 YR	P3-8X7	1456	956.06	964.15		964.29	0.003379	3.1	504.09	198.82	0.31
Smith	9847	100 YR	EXIST	2896	956.06	970.83		970.87	0.000201	1.6	2380.33	346	0.09
Smith	9847	100 YR	P3-8X7	2896	956.06	970.53		970.56	0.000219	1.64	2280.07	320.27	0.09
Smith	9451	10 YR	EXIST	1456	953.95	968.57	959.4	968.58	0.000046	0.72	2327.7	354.31	0.04
Smith	9451	10 YR	P3-8X7	1456	953.95	963.66	959.41	963.71	0.000763	1.74	854.5	252.48	0.15
Smith	9451	100 YR	EXIST	2896	953.95	970.80	960.64	970.82	0.000079	1.09	3187.28	413.32	0.06
Smith	9451	100 YR	P3-8X7	2896	953.95	970.49	960.63	970.51	0.000088	1.13	3059.4	407.34	0.06
Smith	9382	10 YR	EXIST	1456	954.38	968.57	958.53	968.58	0.000057	1	2364.48	337.29	0.05
Smith	9382	10 YR	P3-8X7	1456	954.38	963.56	958.53	963.65	0.000728	2.54	659.4	238.26	0.16
Smith	9382	100 YR	EXIST	2896	954.38	970.78	960.07	970.81	0.000116	1.59	3252.68	483.6	0.07
Smith	9382	100 YR	P3-8X7	2896	954.38	970.47	960.02	970.5	0.000128	1.65	3103.86	466.06	0.08
Smith	9327	RM 3237 Culvert											
Smith	9279	10 YR	EXIST	1456	951.94	958.44	956.26	958.99	0.006865	5.94	253.8	72.39	0.48
Smith	9279	10 YR	P3-8X7	1456	951.94	958.44	956.26	958.99	0.006865	5.94	253.8	72.39	0.48
Smith	9279	100 YR	EXIST	2896	951.94	959.33	958.45	960.77	0.014713	9.76	327.85	97.89	0.73
Smith	9279	100 YR	P3-8X7	2896	951.94	959.33	958.45	960.77	0.014713	9.76	327.85	97.89	0.73
Smith	9087	10 YR	EXIST	1456	952.65	956.71	956.43	957.04	0.019139	5.23	376.76	280.91	0.71
Smith	9087	10 YR	P3-8X7	1456	952.65	956.71	956.43	957.04	0.019139	5.23	376.76	280.91	0.71
Smith	9087	100 YR	EXIST	2896	952.65	958.22	957.05	958.49	0.006985	4.87	817.03	296.86	0.48
Smith	9087	100 YR	P3-8X7	2896	952.65	958.22	957.05	958.49	0.006985	4.87	817.03	296.86	0.48
Smith	8897	10 YR	EXIST	1456	950.03	955.69	954.00	955.94	0.002909	4.04	364.56	122.11	0.38
Smith	8897	10 YR	P3-8X7	1456	950.03	955.69	954.00	955.94	0.002909	4.04	364.56	122.11	0.38
Smith	8897	100 YR	EXIST	2896	950.03	957.2	955.12	957.66	0.003331	5.5	562.8	176.96	0.44
Smith	8897	100 YR	P3-8X7	2896	950.03	957.2	955.12	957.66	0.003331	5.5	562.8	176.96	0.44

Plan: P3-8X7 Smith 1 RS: 9327 Culv Group: Culvert #1 Profile: 10 YR			
Q Culv Group (cfs)	1456	Culv Full Len (ft)	80
# Barrels	3	Culv Vel US (ft/s)	12.50
Q Barrel (cfs)	485.33	Culv Vel DS (ft/s)	13.01
E.G. US. (ft)	963.66	Culv Inv El Up (ft)	955.16
W.S. US. (ft)	963.56	Culv Inv El Dn (ft)	954.66
E.G. DS (ft)	958.99	Culv Frctn Ls (ft)	0.49
W.S. DS (ft)	958.44	Culv Exit Loss (ft)	2.96
Delta EG (ft)	4.67	Culv Entr Loss (ft)	1.21
Delta WS (ft)	5.12	Q Weir (cfs)	
E.G. IC (ft)	963.55	Weir Sta Lft (ft)	
E.G. OC (ft)	963.66	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	960.01	Weir Max Depth (ft)	
Culv WS Outlet (ft)	959.32	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	4.65	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	4.85	Min El Weir Flow (ft)	969.47

Plan: P3-8X7 Smith 1 RS: 9327 Culv Group: Culvert #1 Profile: 100 YR			
Q Culv Group (cfs)	2734.07	Culv Full Len (ft)	80
# Barrels	3	Culv Vel US (ft/s)	18.99
Q Barrel (cfs)	911.36	Culv Vel DS (ft/s)	18.99
E.G. US. (ft)	970.5	Culv Inv El Up (ft)	955.16
W.S. US. (ft)	970.47	Culv Inv El Dn (ft)	954.66
E.G. DS (ft)	960.77	Culv Frctn Ls (ft)	1.43
W.S. DS (ft)	959.33	Culv Exit Loss (ft)	5.49
Delta EG (ft)	9.73	Culv Entr Loss (ft)	2.8
Delta WS (ft)	11.14	Q Weir (cfs)	161.93
E.G. IC (ft)	970.9	Weir Sta Lft (ft)	104.18
E.G. OC (ft)	970.5	Weir Sta Rgt (ft)	446.33
Culvert Control	Outlet	Weir Submerg	0
Culv WS Inlet (ft)	961.16	Weir Max Depth (ft)	1.05
Culv WS Outlet (ft)	960.66	Weir Avg Depth (ft)	0.59
Culv Nml Depth (ft)	6	Weir Flow Area (sq ft)	75.11
Culv Crt Depth (ft)	6	Min El Weir Flow (ft)	969.47

STATE OF TEXAS
ADAM M. PFEIFFER
132899
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12/13/2023

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www.structurepoint.com

HAYS COUNTY TEXAS

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

HYDRAULIC DATA
SMITH CREEK
CC-01

SHEET 1 OF 2

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
AMP				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	108
DN	0805	04	033	
CHECK				
DN				

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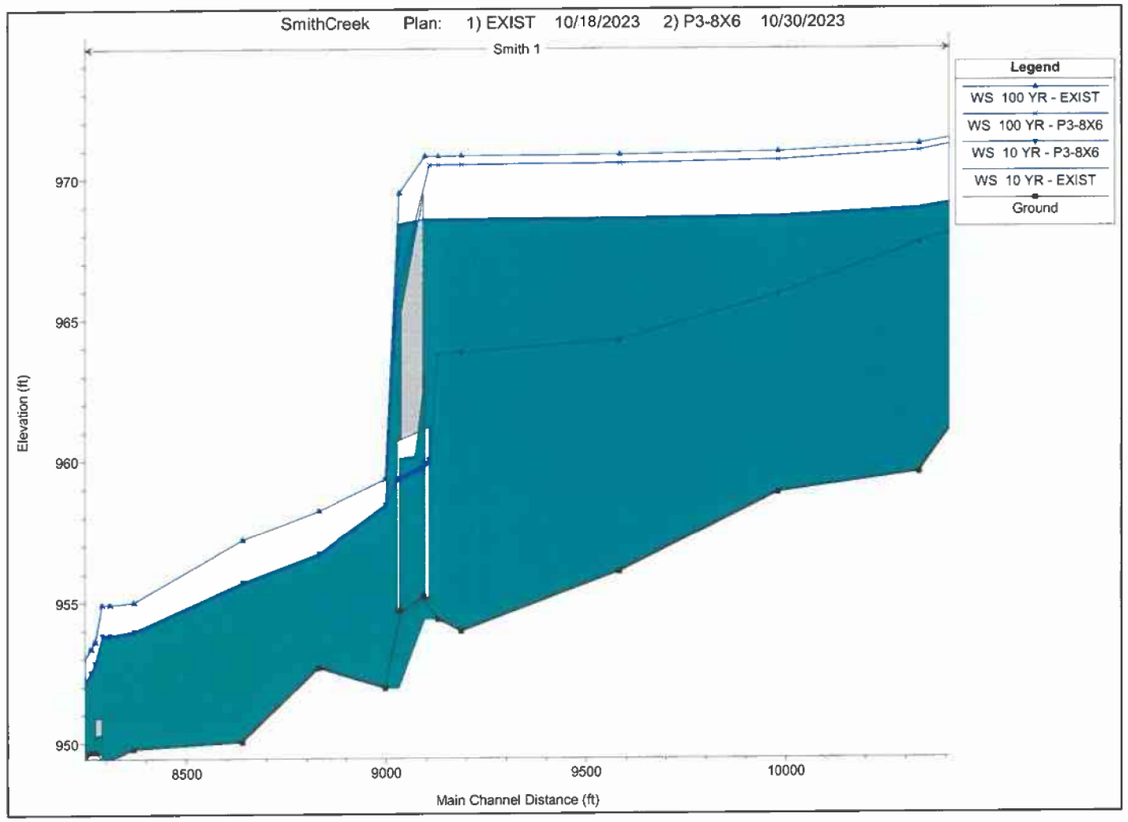
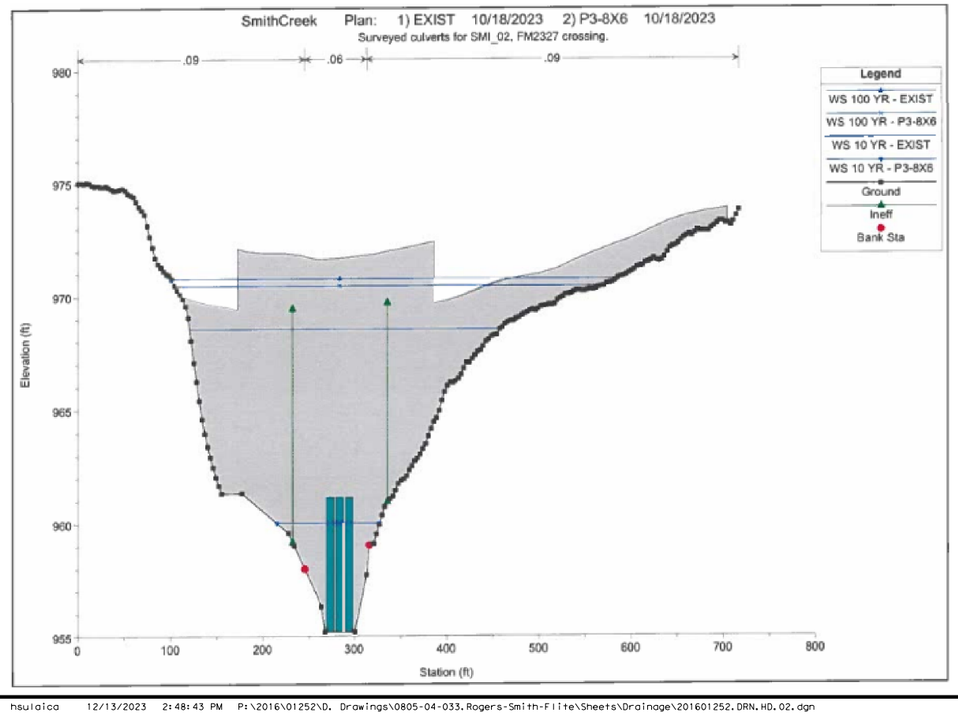


Plan: EXIST Smith 1 RS: 9327 Culv Group: Culvert #1 Profile: 10 YR			
Q Culv Group (cfs)	1446.77	Culv Full Len (ft)	
# Barrels	2	Culv Vel US (ft/s)	14.39
Q Barrel (cfs)	723.38	Culv Vel DS (ft/s)	19.81
E.G. US. (ft)	968.58	Culv Inv El Up (ft)	955
W.S. US. (ft)	968.57	Culv Inv El Dn (ft)	954.6
E.G. DS (ft)	958.99	Culv Frctn Ls (ft)	0.81
W.S. DS (ft)	958.44	Culv Exit Loss (ft)	7.16
Delta EG (ft)	9.59	Culv Entr Loss (ft)	1.61
Delta WS (ft)	10.12	Q Weir (cfs)	9.23
E.G. IC (ft)	968.58	Weir Sta Lft (ft)	120.59
E.G. OC (ft)	967.57	Weir Sta Rgt (ft)	458.44
Culvert Control	Inlet	Weir Submerg	0
Culv WS Inlet (ft)	963	Weir Max Depth (ft)	0.22
Culv WS Outlet (ft)	960.06	Weir Avg Depth (ft)	0.15
Culv Nml Depth (ft)	8	Weir Flow Area (sq ft)	8.93
Culv Crt Depth (ft)	6.78	Min El Weir Flow (ft)	968.45

Plan: EXIST Smith 1 RS: 9327 Culv Group: Culvert #1 Profile: 100 YR			
Q Culv Group (cfs)	1630.78	Culv Full Len (ft)	
# Barrels	2	Culv Vel US (ft/s)	16.22
Q Barrel (cfs)	815.39	Culv Vel DS (ft/s)	22.20
E.G. US. (ft)	970.81	Culv Inv El Up (ft)	955
W.S. US. (ft)	970.78	Culv Inv El Dn (ft)	954.60
E.G. DS (ft)	960.77	Culv Frctn Ls (ft)	1.02
W.S. DS (ft)	959.33	Culv Exit Loss (ft)	6.97
Delta EG (ft)	10.04	Culv Entr Loss (ft)	2.04
Delta WS (ft)	11.46	Q Weir (cfs)	1265.22
E.G. IC (ft)	970.81	Weir Sta Lft (ft)	100.98
E.G. OC (ft)	969.01	Weir Sta Rgt (ft)	584.78
Culvert Control	Inlet	Weir Submerg	0
Culv WS Inlet (ft)	963	Weir Max Depth (ft)	2.42
Culv WS Outlet (ft)	960.08	Weir Avg Depth (ft)	0.89
Culv Nml Depth (ft)	8	Weir Flow Area (sq ft)	429.13
Culv Crt Depth (ft)	7.1	Min El Weir Flow (ft)	968.45



GENERAL NOTES:

1. HEC-RAS 5.0.7 WAS USED FOR HYDRAULIC ANALYSIS.
2. FEMA FLOOD ZONE AE FIRM PANEL #48209C0239F (9/26/2008).
3. THE MANNING'S N VALUES WERE DETERMINED BY FIELD OBSERVATIONS AND AVAILABLE MAPPING.
4. BOUNDARY CONDITION BASED ON NORMAL DEPTH. THE TAILWATER CONVERGENCE POINT IS DOWNSTREAM OF THE CULVERT CROSSING AND ANY VARIATION IN TAILWATER DOES NOT HAVE AN IMPACT ON THE DESIGN OF THE CULVERT.

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED PROFESSIONAL ENGINEER
12/13/2023

REV	DATE	DESCRIPTION	APPROVED

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HAYS COUNTY TEXAS

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

HYDRAULIC DATA
SMITH CREEK
CC-01

SHEET 2 OF 2

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
AMP				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	109
DN	0805	04	033	
CHECK				
DN				

Culvert Summary Table: PROP CC-02

	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
	0.00	0.00	961.81	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
	27.15	27.15	963.65	1.84	0.0*	1-S2n	0.79	1.37	0.84	0.36	11.25	5.27
	54.30	54.30	964.46	2.65	0.0*	1-S2n	1.11	1.96	1.23	0.53	13.08	6.72
	81.45	81.45	965.17	3.36	0.36	1-S2n	1.36	2.42	1.54	0.67	14.15	7.70
	108.60	108.60	965.84	4.03	0.92	1-S2n	1.57	2.81	1.83	0.79	14.94	8.46
	135.75	135.75	966.44	4.63	1.49	1-S2n	1.76	3.16	2.08	0.90	15.58	9.09
10-YR	159.30	159.30	966.92	5.12	2.00	1-S2n	1.91	3.43	2.29	0.98	16.08	9.56
	190.05	190.05	967.56	5.75	2.69	1-S2n	2.10	3.76	2.55	1.09	16.64	10.11
	217.20	217.20	968.14	6.33	3.33	5-S2n	2.25	4.03	2.76	1.17	17.11	10.53
	244.35	244.35	968.76	6.95	4.00	5-S2n	2.40	4.28	2.96	1.25	17.55	10.92
100-YR	271.50	271.50	969.44	7.63	5.44	5-S2n	2.55	4.51	3.16	1.32	17.99	11.27

****
Straight Culvert
Inlet Elevation (invert): 961.81 ft, Outlet Elevation (invert): 959.53 ft
Culvert Length: 92.00 ft, Culvert Slope: 0.0248
****

Site Data

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 961.81 ft
Outlet Station: 92.00 ft
Outlet Elevation: 959.53 ft
Number of Barrels: 1

Culvert Data Summary

Barrel Shape: Circular
Barrel Diameter: 6.00 ft
Barrel Material: Concrete
Embedment: 0.00 in
Barrel Manning's n: 0.0120
Culvert Type: Straight
Inlet Configuration: Square Edge with Headwall
Inlet Depression: None

Tailwater Channel Data

Tailwater Channel Option: Trapezoidal Channel
Bottom Width: 13.00 ft
Side Slope (H:V): 4.00 (_:1)
Channel Slope: 0.0696
Channel Manning's n: 0.0350
Channel Invert Elevation: 959.53 ft

Roadway Data for Crossing: STA 127+50.00

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	-250	972.86
1	-200	972.57
2	-150	972.45
3	-100	972.21
4	-50	971.61
5	0	971.37
6	50	971.48
7	100	971.85
8	150	972.23
9	200	972.59
10	250	972.81

Roadway Surface: Paved
Roadway Top Width: 68.00 ft

Culvert Summary Table: EXIST CC-02

	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
	0.00	0.00	960.85	0.00	0.00	0-NF	0.00	0.00	0.24	0.00	0.00	0.00
	27.15	27.15	962.83	1.99	0.0*	1-S2n	1.20	1.37	1.20	0.36	6.77	5.27
	54.30	54.30	963.71	2.86	0.54	1-S2n	1.70	1.96	1.70	0.53	8.27	6.72
	81.45	81.45	964.44	3.59	1.18	1-S2n	2.09	2.42	2.09	0.67	9.27	7.70
	108.60	108.60	965.05	4.20	1.83	1-S2n	2.45	2.81	2.45	0.79	10.03	8.46
	135.75	135.75	965.63	4.78	2.50	1-S2n	2.77	3.16	2.78	0.90	10.57	9.09
10-YR	159.30	159.30	966.13	5.28	3.12	1-S2n	3.04	3.43	3.04	0.98	11.08	9.56
	190.05	190.05	966.84	5.99	3.98	1-S2n	3.39	3.76	3.40	1.09	11.51	10.11
	217.20	217.20	967.54	6.70	4.79	5-S2n	3.69	4.03	3.69	1.17	11.91	10.53
	244.35	244.35	968.34	7.49	5.65	5-S2n	4.00	4.28	4.01	1.25	12.17	10.92
100-YR	271.50	271.50	969.23	8.38	7.31	5-S2n	4.34	4.51	4.34	1.32	12.39	11.27

****
Straight Culvert
Inlet Elevation (invert): 960.85 ft, Outlet Elevation (invert): 959.29 ft
Culvert Length: 85.00 ft, Culvert Slope: 0.0184
****

Site Data

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 960.85 ft
Outlet Station: 85.00 ft
Outlet Elevation: 959.29 ft
Number of Barrels: 1

Culvert Data Summary

Barrel Shape: Circular
Barrel Diameter: 6.00 ft
Barrel Material: Corrugated Steel
Embedment: 0.00 in
Barrel Manning's n: 0.0240
Culvert Type: Straight
Inlet Configuration: Mitered to Conform to Slope
Inlet Depression: None

Tailwater Channel Data

Tailwater Channel Option: Trapezoidal Channel
Bottom Width: 13.00 ft
Side Slope (H:V): 4.00 (_:1)
Channel Slope: 0.0696
Channel Manning's n: 0.0350
Channel Invert Elevation: 959.53 ft

Roadway Data for Crossing: STA 127+50.00

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Sta. (ft)	Elev. (ft)
0	-250	972.86
1	-200	972.57
2	-150	972.45
3	-100	972.21
4	-50	971.61
5	0	971.37
6	50	971.48
7	100	971.85
8	150	972.23
9	200	972.59
10	250	972.81

Roadway Surface: Paved
Roadway Top Width: 36.00 ft

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED
PROFESSIONAL ENGINEER
12/13/2023

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

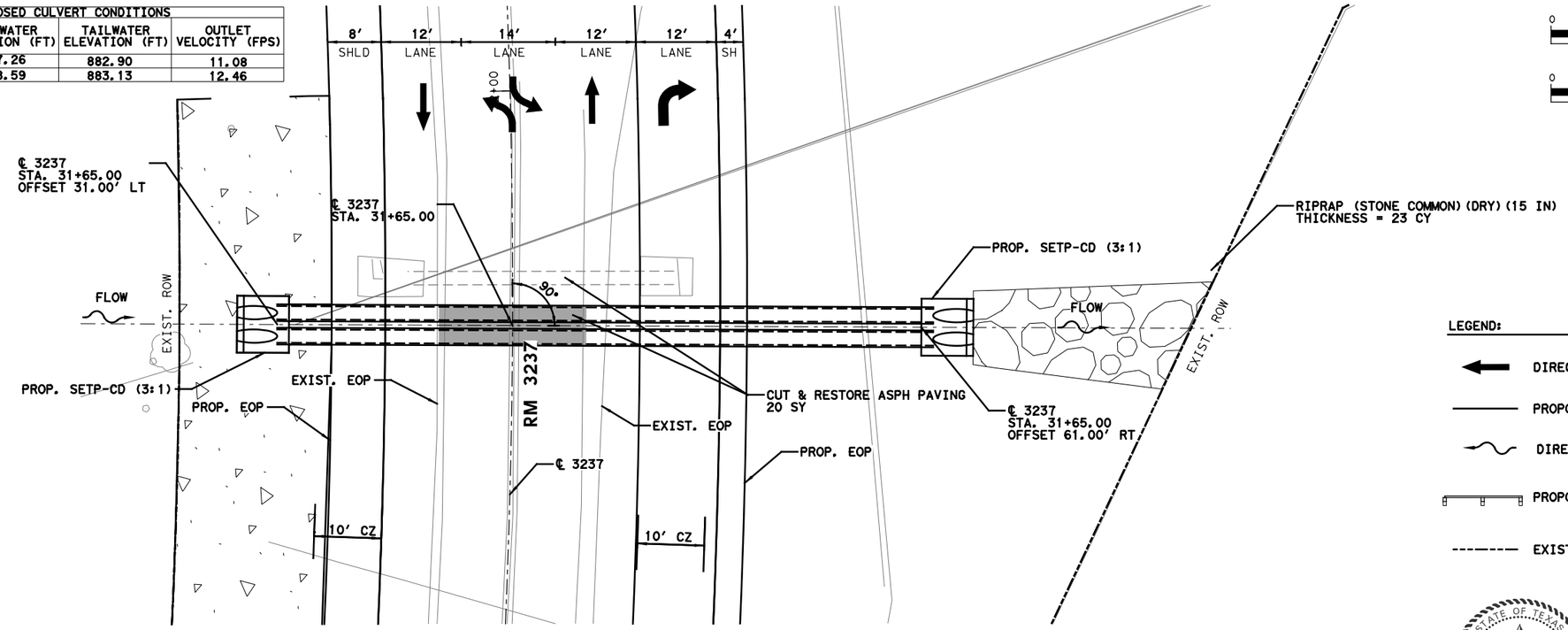
HYDRAULIC DATA
CC-02

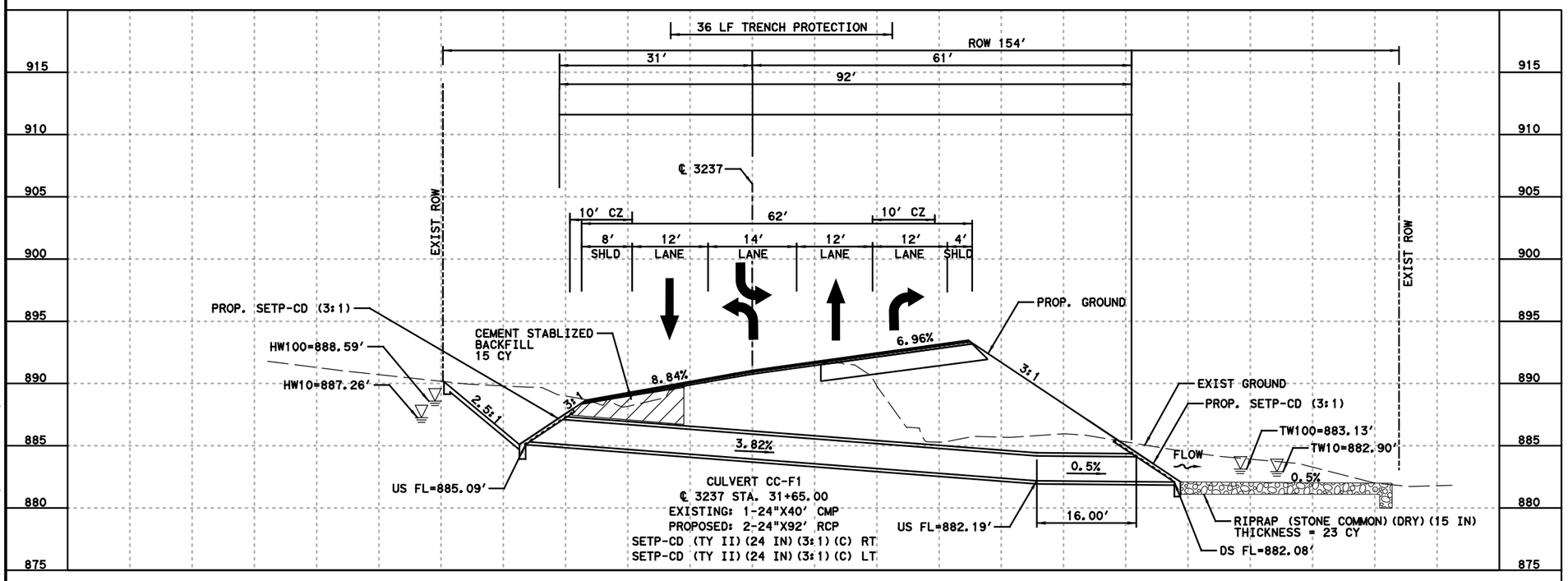
SHEET 1 OF 1

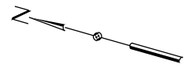
DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	110
AMP	0805	04	033	
CHECK				
AMP				

HYDRAULIC DATA - EXISTING CULVERT CONDITIONS				
DESCRIPTION	DISCHARGE (CFS)	HEADWATER ELEVATION (FT)	TAILWATER ELEVATION (FT)	OUTLET VELOCITY (FPS)
10-YR	26.7	889.72	887.78	6.53
100-YR	42.7	889.83	887.82	6.70

HYDRAULIC DATA - PROPOSED CULVERT CONDITIONS				
DESCRIPTION	DISCHARGE (CFS)	HEADWATER ELEVATION (FT)	TAILWATER ELEVATION (FT)	OUTLET VELOCITY (FPS)
10-YR	26.7	887.26	882.90	11.08
100-YR	42.7	888.59	883.13	12.46







LEGEND:

- DIRECTION OF TRAFFIC
- PROPOSED EDGE OF PAVEMENT
- DIRECTION OF FLOW
- PROPOSED METAL BEAM GUARD FENCE
- EXISTING ROW

NBI# TBD

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

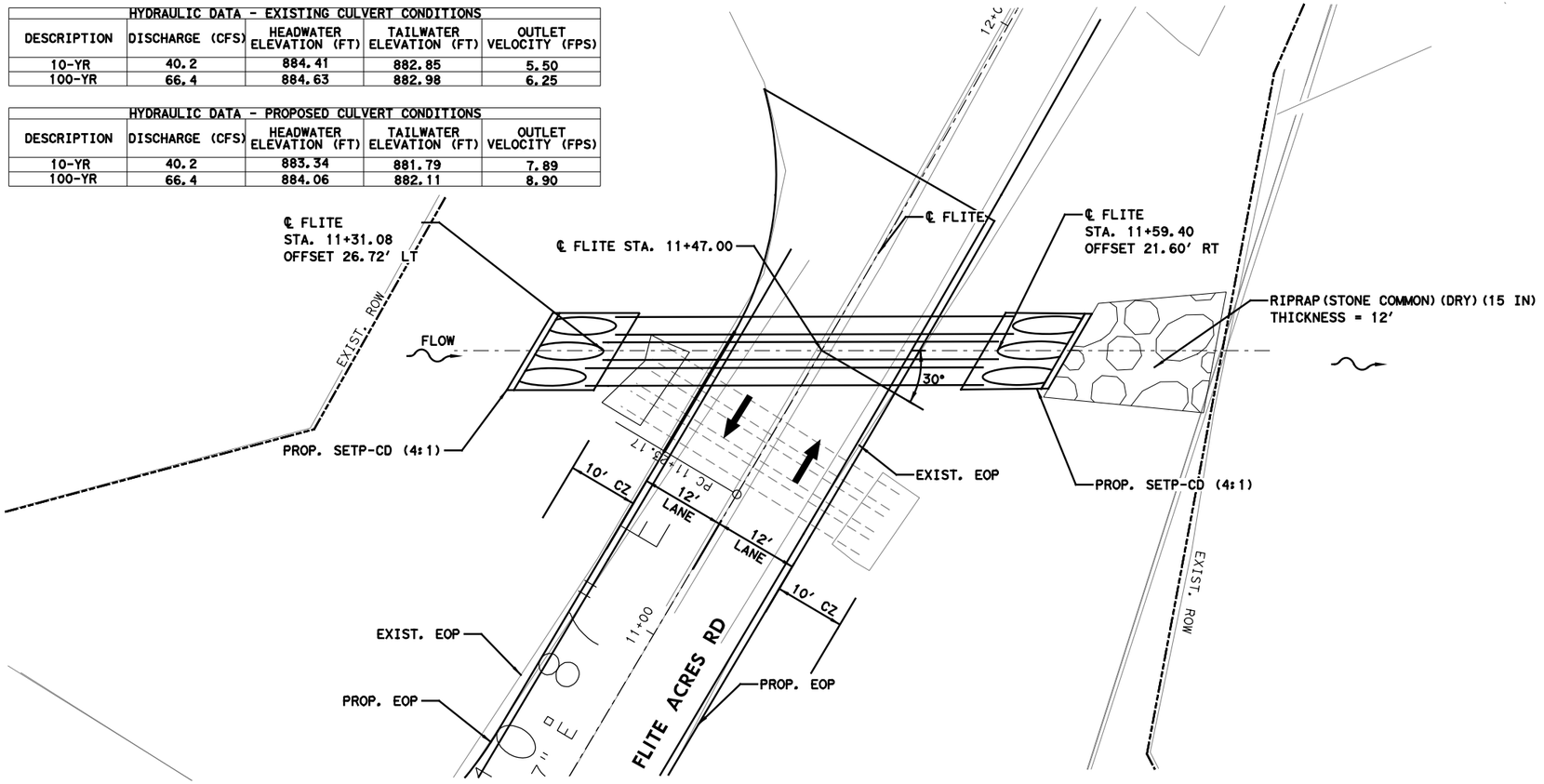
CULVERT CC-F1 PLAN AND PROFILE STA. 31+65

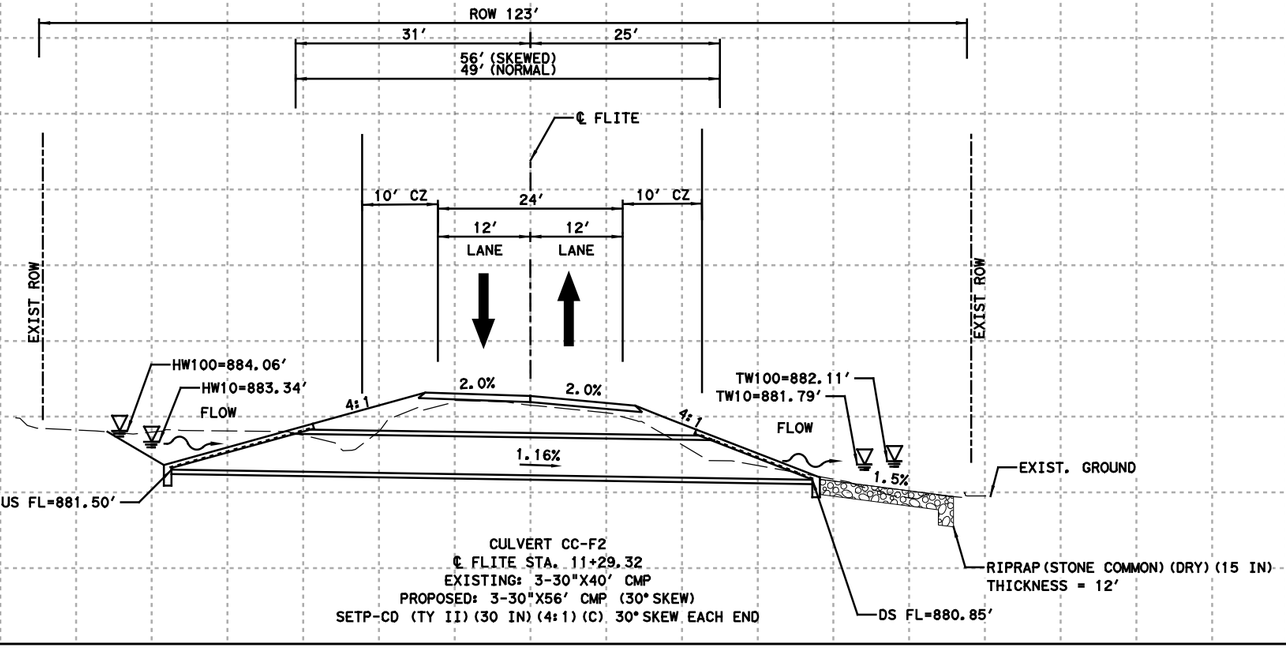
SHEET 1 OF 4

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
AMP				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	111
DN	0805	04	033	
CHECK				
DN				

HYDRAULIC DATA - EXISTING CULVERT CONDITIONS				
DESCRIPTION	DISCHARGE (CFS)	HEADWATER ELEVATION (FT)	TAILWATER ELEVATION (FT)	OUTLET VELOCITY (FPS)
10-YR	40.2	884.41	882.85	5.50
100-YR	66.4	884.63	882.98	6.25

HYDRAULIC DATA - PROPOSED CULVERT CONDITIONS				
DESCRIPTION	DISCHARGE (CFS)	HEADWATER ELEVATION (FT)	TAILWATER ELEVATION (FT)	OUTLET VELOCITY (FPS)
10-YR	40.2	883.34	881.79	7.89
100-YR	66.4	884.06	882.11	8.90





CULVERT CC-F2
℄ FLITE STA. 11+29.32
EXISTING: 3-30"X40' CMP
PROPOSED: 3-30"X56' CMP (30° SKEW)
SETP-CD (TY II) (30 IN) (4:1) (C) 30° SKEW EACH END

RIPRAP (STONE COMMON) (DRY) (15 IN)
THICKNESS = 12'

0 10 20
SCALE IN FEET
HORIZONTAL

0 5 10
SCALE IN FEET
VERTICAL

LEGEND:

- DIRECTION OF TRAFFIC
- PROPOSED EDGE OF PAVEMENT
- DIRECTION OF FLOW
- PROPOSED METAL BEAM GUARD FENCE
- EXISTING ROW

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED PROFESSIONAL ENGINEER
12/13/2023

NBI# TBD

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

HAYS COUNTY TEXAS

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

CULVERT CC-F2
PLAN AND PROFILE
STA. 11+47.00

SHEET 2 OF 4

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
AMP				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	112
DN	0805	04	033	
CHECK				
DN				

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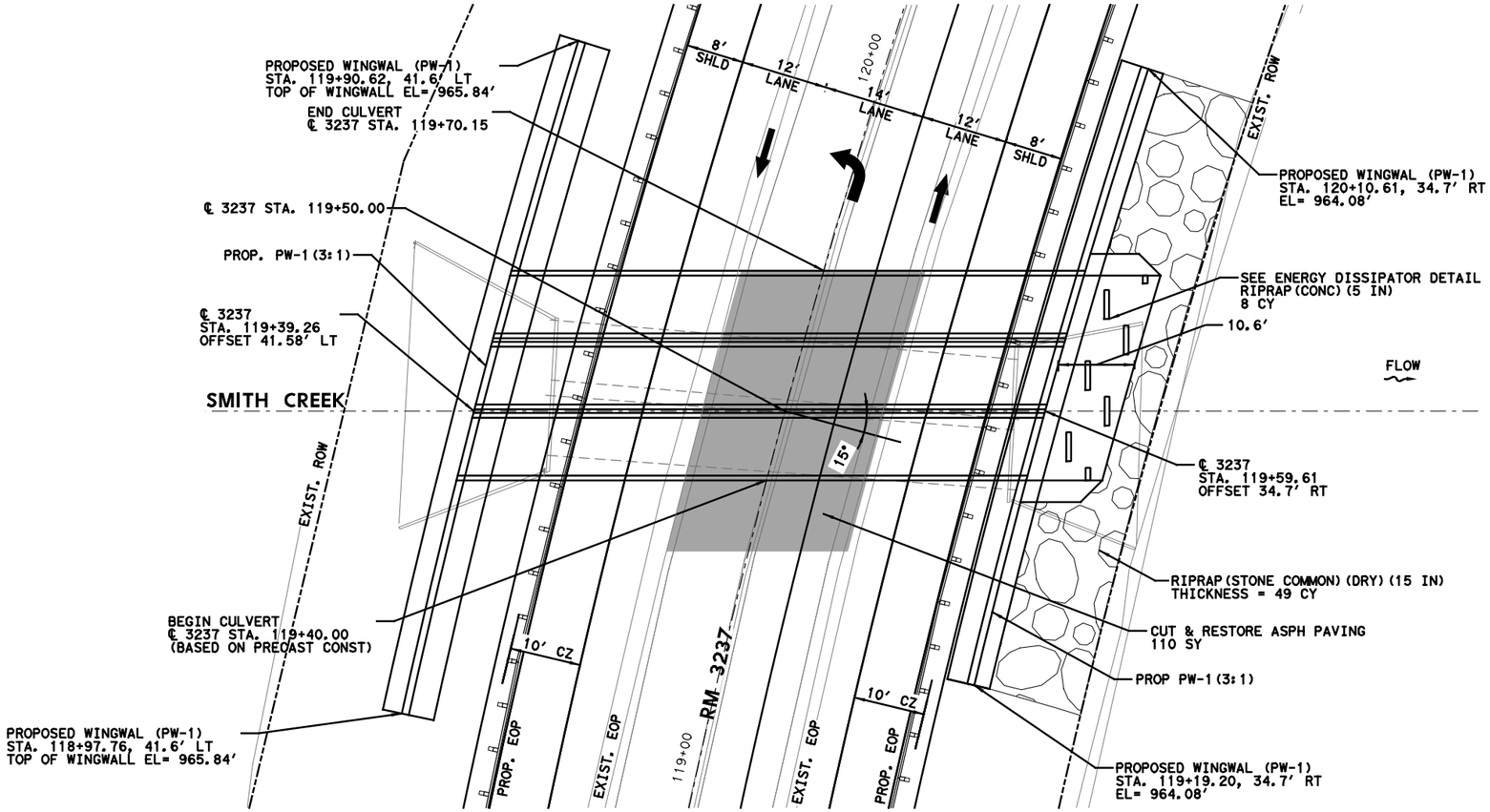


HYDRAULIC DATA - EXISTING CULVERT CONDITIONS				
DESCRIPTION	DISCHARGE (CFS)	HEADWATER ELEVATION (FT)	TAILWATER ELEVATION (FT)	OUTLET VELOCITY (FPS)
10-YR	1456	968.57	958.44	19.81
100-YR	2896	970.78	959.33	22.20

HYDRAULIC DATA - PROPOSED CULVERT CONDITIONS				
DESCRIPTION	DISCHARGE (CFS)	HEADWATER ELEVATION (FT)	TAILWATER ELEVATION (FT)	OUTLET VELOCITY (FPS)
10-YR	1456	963.59	958.44	13.01
100-YR	2896	970.47	959.33	18.99

NOTE:

1. PAINT NBI NUMBER IN ACCORDANCE WITH PSN (AUS). THIS WORK IS SUBSIDARY TO ITEM 462.

0 10 20
SCALE IN FEET HORIZONTAL

0 5 10
SCALE IN FEET VERTICAL

LEGEND:

- DIRECTION OF TRAFFIC
- PROPOSED EDGE OF PAVEMENT
- DIRECTION OF FLOW
- PROPOSED METAL BEAM GUARD FENCE
- EXISTING ROW

BRIDGE STRUCTURE NUMBER:
14-106-0-0805-04-013

CULVERT CC-01
℄ 3237 STA. 119+50.00
EXISTING: 2-96"X64' CMP
PROPOSED: 3-8'x6'X80' RCP
PW-1 @ 15° RFS EACH END

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED PROFESSIONAL ENGINEER
12/13/2023

NBI# 14-106-0-0805-04-013

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

HAYS COUNTY TEXAS

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

BRIDGE-CLASS CULVERT CC-01 LAYOUT STA. 119+50

SHEET 3 OF 4

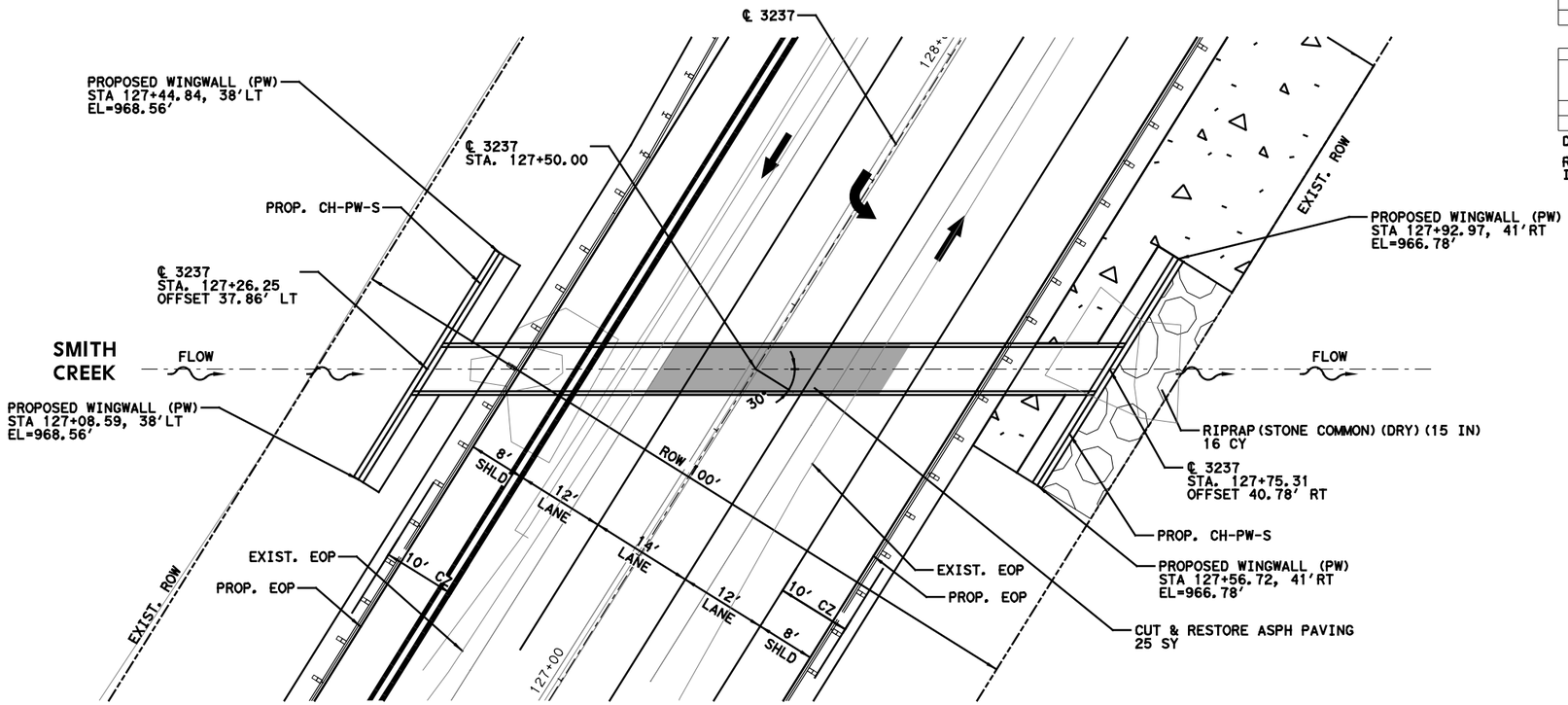
DESIGN	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
AMP				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	113
DN	0805	04	033	
CHECK				
DN				

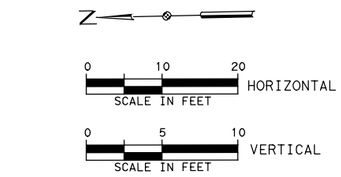
HYDRAULIC DATA - EXISTING CULVERT CONDITIONS				
DESCRIPTION	DISCHARGE (CFS)	HEADWATER ELEVATION (FT)	TAILWATER ELEVATION (FT)	OUTLET VELOCITY (FPS)
10-YR	159.3	966.13	962.33	11.08
100-YR	271.5	969.23	963.63	12.39

HYDRAULIC DATA - PROPOSED CULVERT CONDITIONS				
DESCRIPTION	DISCHARGE (CFS)	HEADWATER ELEVATION (FT)	TAILWATER ELEVATION (FT)	OUTLET VELOCITY (FPS)
10-YR	159.3	966.92	961.82	16.08
100-YR	271.5	969.44	962.69	17.99

DRAINAGE AREAS FLOWING TO CULVERT INCLUDE CC-02 AND DRWY-5.

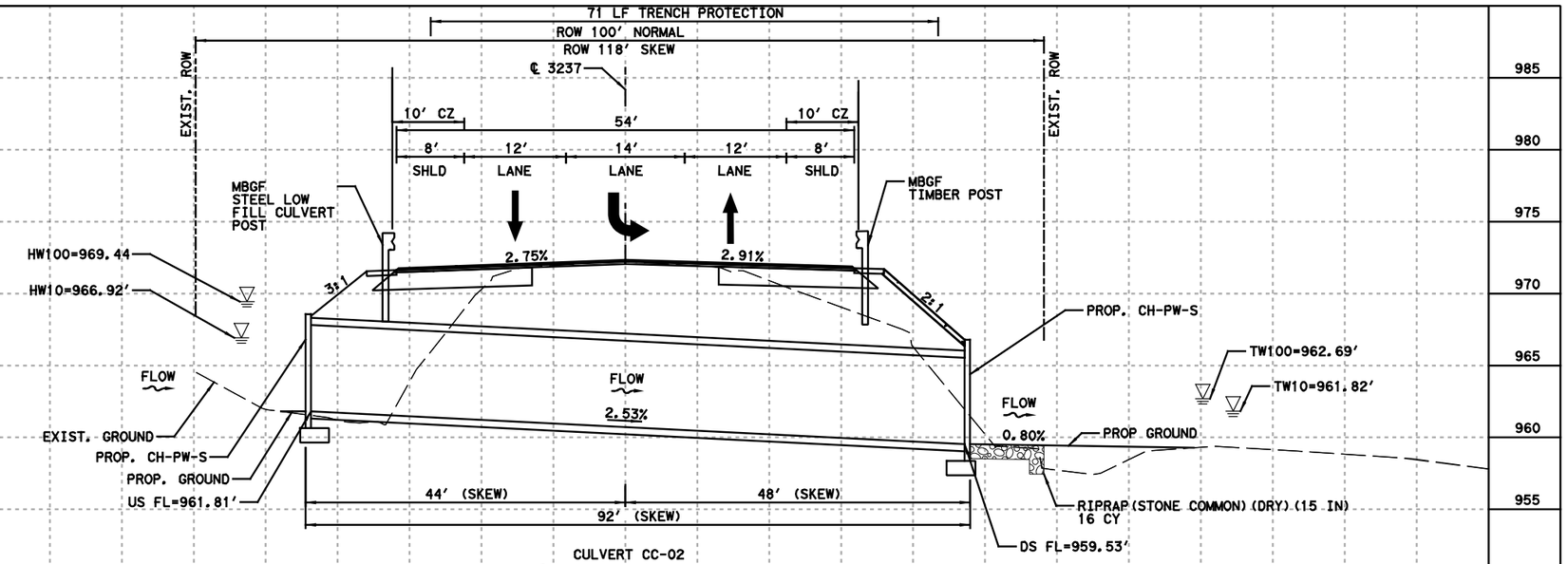
RAISE IN HEADWATER ELEVATION HAS BEEN ANALYZED AND RESULTS IN NO ADVERSE IMPACTS TO ADJACENT STRUCTURES.





LEGEND:

- DIRECTION OF TRAFFIC
- PROPOSED EDGE OF PAVEMENT
- DIRECTION OF FLOW
- PROPOSED METAL BEAM GUARD FENCE
- EXISTING ROW



CULVERT CC-02
℄ 3237 STA. 127+50.00
EXISTING: 1-72"X85' CMP @ 30° SKEW
PROPOSED: 1-72"X92' RCP @ 30° SKEW
CH-PW-S (30° SKEW) EACH END

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED PROFESSIONAL ENGINEER
12/13/2023

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

HAYS COUNTY TEXAS

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

CULVERT CC-02
PLAN AND PROFILE
STA. 127+50.00

SHEET 4 OF 4

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	114
AMP	0805	04	033	
CHECK				
AMP				

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ROADSIDE DITCH HYDRAULIC CALCULATIONS - LEFT DITCHES

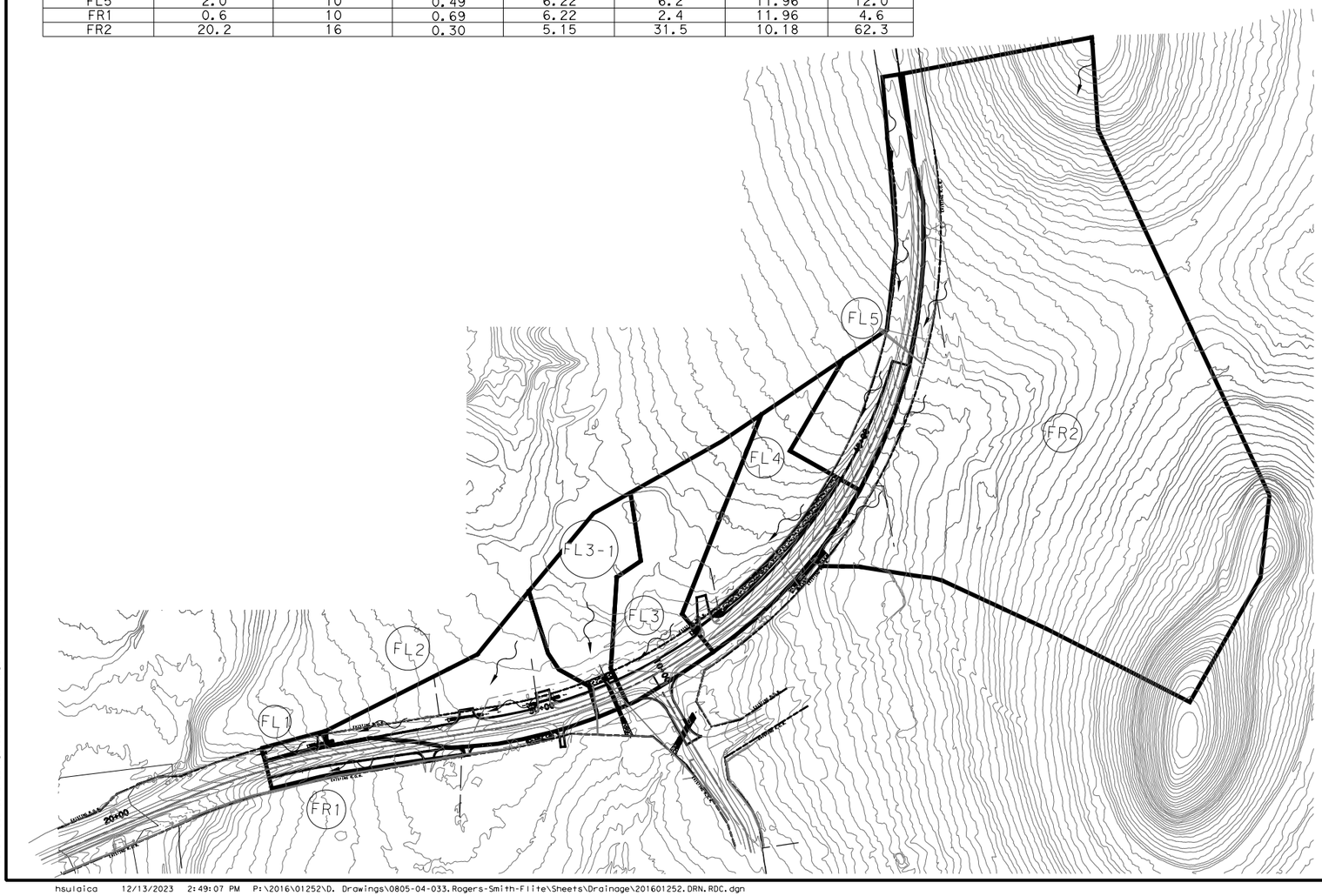
	DITCH	FROM STA. (RM 3237)	TO STA. (RM3237)	FROM ELEV.	TO ELEV.	LENGTH (ft)	GRADE (ft/ft)	FRONT SLOPE (X:1)	BACK SLOPE (X:1)	BOTTOM WIDTH (ft)	MANNINGS n	VELOCITY 5 -YR (ft/s)	AVG SHEAR STRESS 5-YR (lb/ft^2)	MAX SHEAR STRESS 5 -YR (lb/ft^2)	NORMAL DEPTH 5-YR (ft)	Q-5YR (cfs)	ALLOWABLE DEPTH	VELOCITY 100 -YR (ft/s)	NORMAL DEPTH 100-YR (ft)	Q-100YR (cfs)
	DITCH F-L1	23+60	25+00	868.82	876.17	140	-0.052	3.0	3.0	0.0	0.030	5.2	1.0	2.1	0.7	6.8	2.0	6.1	0.8	13.1
	DITCH F-L2	25+00	31+20	876.17	885.21	620	-0.015	3.0	3.0	0.0	0.030	3.2	0.4	0.8	0.8	6.6	2.0	3.8	1.1	12.6
*	DITCH F-L3-1	31+20	31+70	885.21	885.51	50	-0.006	2.0	2.0	0.0	0.012	4.2	0.1	0.2	0.6	3.4	2.0	4.9	0.8	6.5
	DITCH F-L3	31+70	34+00	885.51	888.62	230	-0.014	3.0	3.0	0.0	0.030	4.2	0.5	1.1	1.3	19.8	2.0	4.9	1.6	38.1
*	DITCH F-L4	34+00	39+00	888.62	907.85	500	-0.038	2.0	2.0	0.0	0.012	11.9	0.8	1.8	0.8	14.2	2.0	14.0	1.0	27.3
	DITCH F-L5	39+00	42+00	907.85	944.00	300	-0.121	3.0	3.0	0.0	0.030	7.0	2.0	4.1	0.5	6.2	2.0	8.2	0.7	12.0

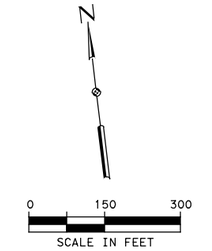
ROADSIDE DITCH HYDROLAUIC CALCULATIONS - RIGHT DITCHES

DITCH	FROM STA. (RM 3237)	TO STA. (RM3237)	FROM ELEV.	TO ELEV.	LENGTH (ft)	GRADE (ft/ft)	FRONT SLOPE (X:1)	BACK SLOPE (X:1)	BOTTOM WIDTH (ft)	MANNINGS n	VELOCITY (ft/sec)	AVG SHEAR STRESS 5-YR (lb/ft^2)	MAX SHEAR STRESS 5 -YR (lb/ft^2)	NORMAL DEPTH 5-YR (ft)	Q-5YR (cfs)	ALLOWABLE DEPTH	VELOCITY 100 -YR (ft/s)	NORMAL DEPTH 100-YR (ft)	Q-100YR (cfs)
DITCH FR1	23+60	28+00	891.85	925.26	440	-0.076	3.0	3.0	0.0	0.030	4.6	0.9	2.0	0.4	2.4	1.0	5.4	0.5	4.6
DITCH FR2	36+00	42+00	886.67	925.26	600	-0.064	3.0	3.0	0.0	0.030	8.2	2.1	4.5	1.1	31.5	2.0	9.8	1.5	62.3

DITCH DRAINAGE AREAS RATIONAL METHOD HYDROLOGY

AREA ID	COMPOSITE AREA (AC)	Tc USED	C	I5 (IN/HR)	Q5 (CFS)	I100 (IN/HR)	Q100 (CFS)
FL1	0.1	10	0.36	6.22	0.2	11.96	0.5
FL2	2.2	10	0.49	6.22	6.6	11.96	12.6
FL3-1	1.5	10	0.35	6.22	3.4	11.96	6.5
FL3	2.3	10	0.39	6.22	5.6	11.96	10.7
FL4	2.6	10	0.50	6.22	8.0	11.96	15.3
FL5	2.0	10	0.49	6.22	6.2	11.96	12.0
FR1	0.6	10	0.69	6.22	2.4	11.96	4.6
FR2	20.2	16	0.30	5.15	31.5	10.18	62.3





NOTES:

* CHANNEL LINED WITH CONC RIPRAP

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED PROFESSIONAL ENGINEER
12/13/2023

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

TEXAS COUNTY ENGINEERS

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

ROADSIDE DITCH CALCULATIONS FLITE ACRES

SHEET 1 OF 1

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	
CHECK AMP	CONTROL	SECTION	JOB	115
CHECK AMP	0805	04	033	

ROADSIDE DITCH HYDRAULIC CALCULATIONS - LEFT DITCHES

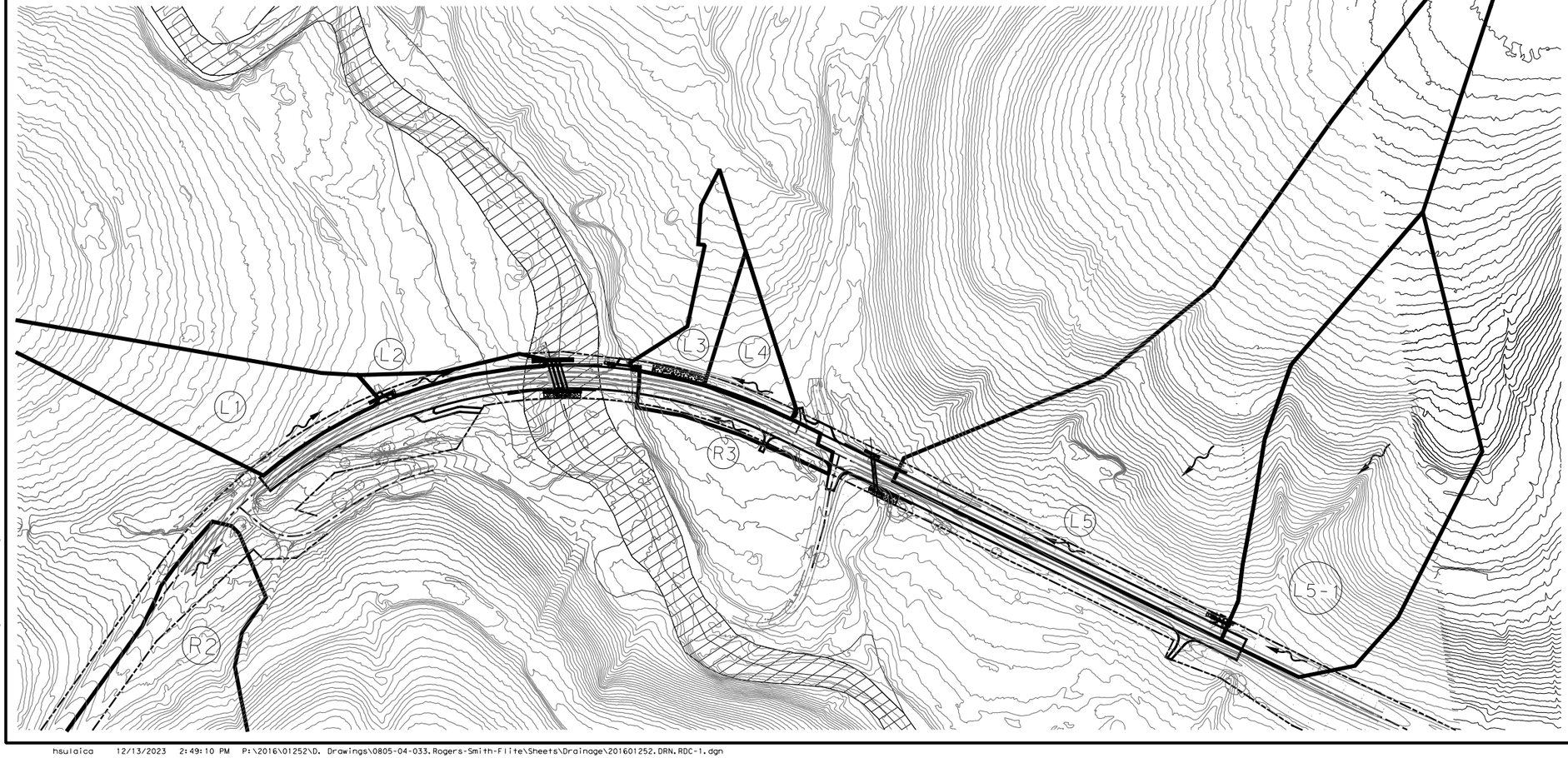
	DITCH	FROM STA. (RM 3237)	TO STA. (RM3237)	FROM ELEV.	TO ELEV.	LENGTH (ft)	GRADE (ft/ft)	FRONT SLOPE (X:1)	BACK SLOPE (X:1)	BOTTOM WIDTH (ft)	MANNINGS n	VELOCITY (ft/sec)	AVG SHEAR STRESS 5-YR (lb/ft^2)	MAX SHEAR STRESS 5 -YR	NORMAL DEPTH 5-YR (ft)	Q-5YR (cfs)	ALLOWABLE DEPTH	VELOCITY 100 -YR (ft/s)	NORMAL DEPTH 100-YR	Q-100YR (cfs)
	DITCH L1	112+00	115+00	979.38	971.44	300	0.026	4.0	3.0	0.0	0.030	3.8	0.5	1.1	0.7	6.5	2.0	4.5	0.9	12.4
	DITCH L2	115+90	118+60	970.61	960.56	270	0.037	3.0	3.0	0.0	0.030	4.6	0.8	1.7	0.7	7.1	2.0	5.5	0.9	13.6
*	DITCH L3	121+50	123+00	966.88	970.48	150	-0.024	4.0	2.0	0.0	0.012	6.7	0.3	0.7	0.4	3.8	1.0	7.8	0.6	7.2
	DITCH L4	123+00	125+00	970.48	971.15	200	-0.003	4.0	3.0	0.0	0.030	1.2	0.1	0.1	0.6	1.7	1.0	1.4	0.8	3.3
	DITCH L5	128+00	137+20	967.72	974.67	920	-0.008	3.0	3.0	0.0	0.030	4.3	0.5	1.0	2.0	49.4	2.3	5.0	2.6	94.9

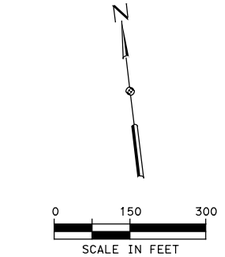
ROADSIDE DITCH HYDRAULIC CALCULATIONS - RIGHT DITCHES

DITCH	FROM STA. (RM 3237)	TO STA. (RM3237)	FROM ELEV.	TO ELEV.	LENGTH (ft)	GRADE (ft/ft)	FRONT SLOPE (X:1)	BACK SLOPE (X:1)	BOTTOM WIDTH (ft)	MANNINGS n	VELOCITY (ft/sec)	AVG SHEAR STRESS 5-YR (lb/ft^2)	MAX SHEAR STRESS 5 -YR	NORMAL DEPTH 5-YR (ft)	Q-5YR (cfs)	ALLOWABLE DEPTH	VELOCITY 100 -YR (ft/s)	NORMAL DEPTH 100-YR	Q-100YR (cfs)
DITCH R2	112+00	113+00	970.45	968.67	100	0.018	3.0	3.0	0.0	0.030	7.9	1.5	3.0	2.7	174.8	5.0	9.4	3.5	355.3
DITCH R3	122+00	126+50	964.86	969.22	450	-0.010	3.0	2.0	0.0	0.030	2.5	0.2	0.5	0.8	3.7	1.5	2.9	1.0	7.1

DITCH DRAINAGE AREAS RATIONAL METHOD HYDROLOGY

AREA ID	COMPOSITE AREA (AC)	Tc USED	C	I5 (IN/HR)	Q5 (CFS)	I100 (IN/HR)	Q100 (CFS)
DITCH L1	3.5	10	0.30	6.22	6.5	11.96	12.4
DITCH L2	0.3	10	0.30	6.22	0.6	11.96	1.1
DITCH L3	2.0	10	0.30	6.22	3.8	11.96	7.2
DITCH L4	0.9	10	0.30	6.22	1.7	11.96	3.3
DITCH L5	14.8	10	0.35	6.22	32.2	11.96	61.9
DITCH L5-1	8.9	10	0.31	6.22	17.2	11.96	33.0
DITCH R2	93.9	24	0.44	4.23	174.8	8.56	355.3
DITCH R3	0.9	10	0.65	6.22	3.7	11.96	7.1





NOTES:

* CHANNEL LINED WITH CONC RIPRAP

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED PROFESSIONAL ENGINEER
12/13/2023

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

HAYS COUNTY TEXAS

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

ROADSIDE DITCH CALCULATIONS ROGERS

SHEET 1 OF 1

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS				
HNS	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK	TX	AUS	HAYS	
AMP	CONTROL	SECTION	JOB	116
CHECK	0805	04	033	
AMP				

SUMMARY OF DRIVEWAY CULVERTS

Intersection	Drwy ID	℄ RM3237 Station	RT/LT	Material	Size (in)	No. of Culverts	US FL ELEV			DS FL ELEV			Culvert Pay Length (FT)	Upstream End Treatment	Downstream End Treatment	Culvert Slope (%)
							Sta.	Offset	Elev.	Sta.	Offset	Elev.				
Flite Acres	F1	24+91.39	LT	RCP	18"	1	25+18.90	31.2	876.36	24+65.90	30.1	875.07	36	1-S.E.T. TY II-PD (6:1)	1-S.E.T. TY II-PD (6:1)	2.43
	F4	28+27.54	LT	RCP	18"	1	28+63.41	36.8	885.68	27+89.33	36.7	885.20	56	1-S.E.T. TY II-PD (6:1)	1-S.E.T. TY II-PD (6:1)	0.65
	F5	30+12.75	LT	RCP	18"	1	30+48.04	38.2	885.90	29+75.37	37.6	885.65	52	1-S.E.T. TY II-PD (6:1)	1-S.E.T. TY II-PD (6:1)	0.35
	F7	34+41.01	LT	RCP	24"	1	34+81.03	37.7	888.30	33+99.72	36.8	888.05	54	1-S.E.T. TY II-PD (6:1)	1-S.E.T. TY II-PD (6:1)	0.32
	F8	36+92.62	RT	RCP	36"	1	37+42.75	36.5	900.61	36+41.98	36.4	898.09	68	1-S.E.T. TY II-PD (6:1)	1-S.E.T. TY II-PD (6:1)	2.50
Rogers	1	115+37.80	LT	RCP	24"	1	115+09.45	36.7	971.23	115+65.51	38.6	970.92	36	1-S.E.T. TY II-PD (6:1)	1-S.E.T. TY II-PD (6:1)	0.55
	2	121+09.68	LT	RCP	24"	1	121+54.99	35.7	966.88	120+59.16	35.8	966.55	68	1-S.E.T. TY II-PD (6:1)	1-S.E.T. TY II-PD (6:1)	0.34
	5	136+48.54	LT	RCP	18"	2	136+68.97	39.8	974.12	136+20.97	39.8	973.98	64	1-S.E.T. TY II-PD (6:1)	1-S.E.T. TY II-PD (6:1)	0.29

Intersection	Drwy ID	℄ RM3237 Station	RT/LT	DRIVEWAY CLEARENCE PROVIDED (FT)	V5 (ft/s)	Q5 (CFS)	5-YEAR HEADWATER ELEVATION	5-YEAR DESIGN YEAR OVERFLOW (CFS)	Q100 (CFS)	V100 (ft/s)	100-YEAR HEADWATER ELEVATION	CRITICAL EOP ELEVATION
Flite Acres	F1	24+91.39	LT	1.2	9.6	6.6	878.01	0.00	12.6	10.6	879.30	879.10
	F4	28+27.54	LT	1.1	6.3	6.6	887.30	0.00	12.6	6.8	888.47	888.40
	F5	30+12.75	LT	1.2	5.3	6.6	887.61	0.00	12.6	6.9	888.80	888.73
	F7	34+41.01	LT	1.1	8.0	14.2	890.94	0.00	27.3	8.7	891.87	891.51
	F8	36+92.62	RT	1.2	13.6	31.5	903.50	0.00	62.3	15.1	905.32	904.87
Rogers	1	115+37.80	LT	1.0	6.1	6.5	972.56	0.00	12.4	7.1	973.24	974.40
	2	121+09.68	LT	1.3	4.1	3.8	968.29	0.00	7.8	5.0	968.96	970.50
	5	136+48.54	LT	1.3	5.2	17.2	976.23	0.00	33.0	9.1	976.64	976.27

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED PROFESSIONAL ENGINEER
1/8/2024

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

HAYS COUNTY TEXAS

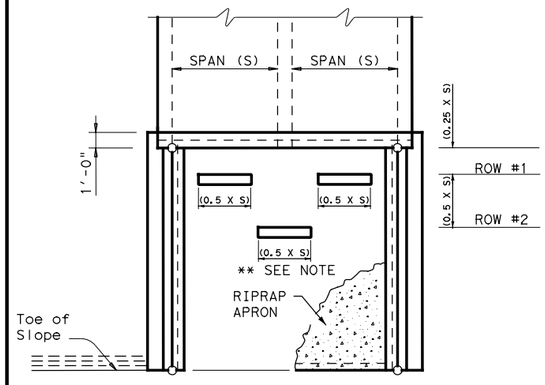
Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

SUMMARY OF DRIVEWAY CULVERTS

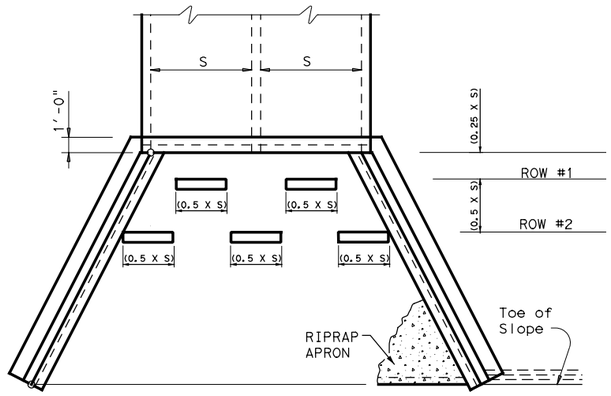
SHEET 1 OF 1

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	117
AMP	0805	04	033	
CHECK				
AMP				

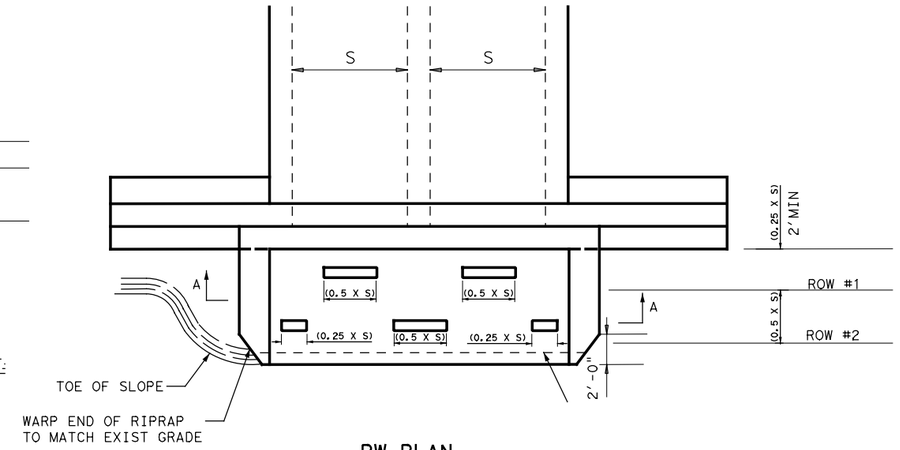


SW-0 PLAN

**NOTE: FOR SBC OR MBC WITH ODD # OF BARRELS, THE OUTSIDE DISSIPATORS ON THE SECOND ROW SHALL HAVE A WIDTH = (0.25 X S).

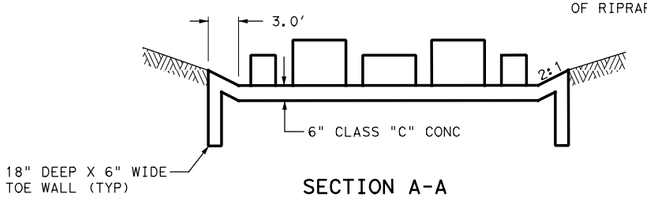


CH-FW-0/FW-0 PLAN

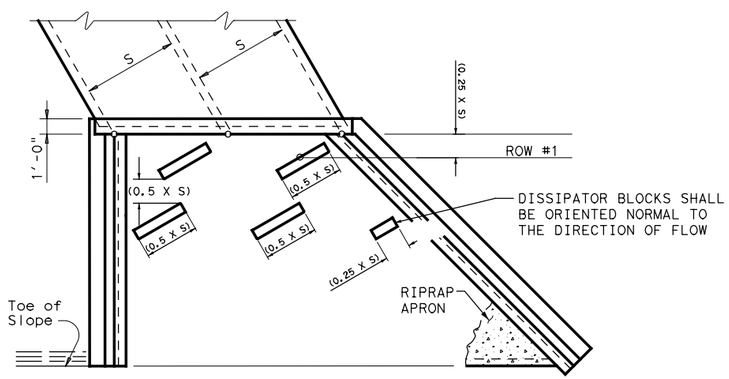


PW PLAN

18" DEEP X 6" WIDE TOE WALL @ END OF RIPRAP CONC



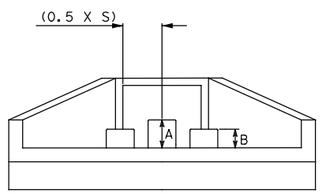
SECTION A-A



FW-S PLAN

(Showing dimensions and 30° Skew.)

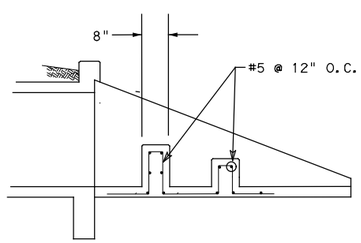
EXISTING



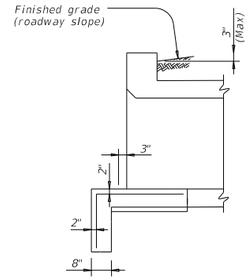
FRONT VIEW

"A" IS EQUAL TO ONE-HALF THE STRUCTURE HEIGHT/PIPE DIAMETER, BUT NO HIGHER THAN 30".

"B" IS EQUAL TO ONE-THIRD THE STRUCTURE HEIGHT/PIPE DIAMETER, BUT NO HIGHER THAN 30".



SIDE VIEW

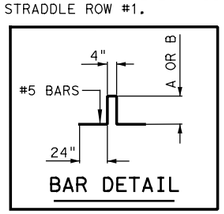


SIDE VIEW

(Showing wing reinforcement.)

NOTES:

1. AS SHOWN IN THE APPLICABLE END TREATMENT STANDARD AND BCS SHEET, A CONCRETE RIPRAP APRON SHALL BE PROVIDED ON THE DOWNSTREAM END OF CULVERTS THAT REQUIRE DISSIPATOR BLOCKS. WHERE DISSIPATOR BLOCKS ARE REQUIRED, ALL CONCRETE FOR RIPRAP APRON AND DISSIPATOR BLOCKS SHALL BE CLASS "C". RIPRAP SHALL BE PAID FOR UNDER ITEM 432, "RIPRAP".
2. ALL EXTERNAL VISIBLE CORNERS SHALL BE CHAMFERED.
3. ROW #1 ENERGY DISSIPATORS SHALL BE LOCATED AT MID-SPAN. ROW #2 ENERGY DISSIPATORS SHALL STRADDLE ROW #1.



BAR DETAIL

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED PROFESSIONAL ENGINEER
12/13/2023

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AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

HAYS COUNTY TEXAS

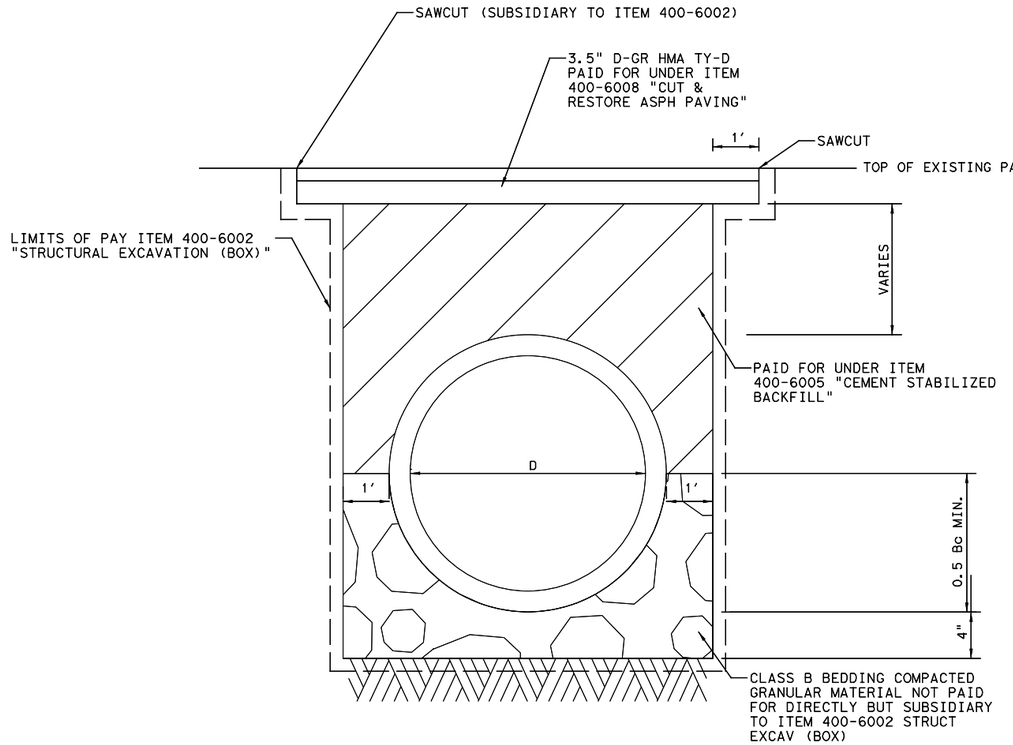
Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

ENERGY DISSIPATOR DETAILS

SHEET 1 OF 1

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	118
CHECK	CONTROL	SECTION	JOB	
AMP	0805	04	033	
CHECK				
AMP				



CEMENT STABILIZED BACKFILL DETAIL

D - DIAMETER OF CULVERT PIPE

LEGEND

CEMENT STABILIZED BACKFILL

COMPACTED GRANULAR MATERIAL

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED PROFESSIONAL ENGINEER

12/13/2023

REV	DATE	DESCRIPTION	APPROVED

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TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

HAYS COUNTY TEXAS

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

MISCELLANEOUS DRAINAGE DETAILS

SHEET 1 OF 1

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	119
CHECK	CONTROL	SECTION	JOB	
AMP	0805	04	033	
CHECK				
AMP				

Culvert Station and/or Creek Name followed by applicable end (Lt, Rt or Both)	Description of Box Culvert No. Spans ~ Span X Height	Max Fill Height (Ft)	Applicable Box Culvert Standard (4)	Applicable Wingwall or End Treatment Standard	Skew Angle (0°,15°, 30° or 45°)	Side Slope or Channel Slope Ratio (SL:1)	T Culvert Top Slab Thickness (In)	U Culvert Wall Thickness (In)	C Estimated Curb Height (Ft)	Hw (1) Height of Wingwall (Ft)	A Curb to End of Wingwall (Ft)	B Offset of End of Wingwall (Ft)	Lw Length of Longest Wingwall (Ft)	Ltw Culvert Toewall Length (Ft)	Atw Anchor Toewall Length (Ft)	Riprap Apron (CY)	Class "C" Conc (Curb) (2) (CY)	Class "C" Conc (Wingwall) (3) (CY)	Total Wingwall Area (SF)
STA. 119+50.00, CC-01, LT	3 ~ 8' X 6'	6.3'	SCP-8	PW-1	15	3:1	8"	8"	4.000'	10.667'	N/A	N/A	33.129'	40.203'	N/A	0.0	4.5	53.3	707
STA. 119+50.00, CC-01, RT	3 ~ 8' X 6'	2.6'	SCP-8	PW-1	15	3:1	8"	8"	2.750'	9.417'	N/A	N/A	29.247'	40.203'	N/A	0.0	2.6	37.6	551

NOTES:
Skew = 0° on SW-0, FW-0, SETB-CD, SETB-SW-0, and SETB-FW-0 standard sheets;
30° maximum for safety end treatment

SL:1 = Horizontal : 1 Vertical
- Side slope at culvert for flared or straight wingwalls.
- Channel slope for parallel wingwalls.
- Slope must be 3:1 or flatter for safety end treatments.

T = Box culvert top slab thickness. Dimension can be found on the applicable box culvert standard sheet.

U = Box culvert wall thickness. Dimension can be found on the applicable box culvert standard sheet.

C = Curb height

See applicable wing or end treatment standard sheets for calculations of Hw, A, B, Lw, Ltw, Atw, and Total Wingwall Area.

Hw = Height of wingwall

A = Distance from face of curb to end of wingwall (not applicable to parallel or straight wingwalls)

B = Offset of end of wingwall (not applicable to parallel or straight wingwalls)

Lw = Length of longest wingwall.

Ltw = Length of culvert toewall (not applicable when using riprap apron)

Atw = Length of anchor toewall (applicable to safety end treatment only)
Total Wingwall Area = Wingwall area in sq. ft. for two wingwalls (one structure end) if Lt or Rt.
Area for four wingwalls (two structure ends) if Both.

(1) Round the wall heights shown to the nearest foot for bidding purposes.

(2) Concrete volume shown is for box culvert curb only. For curbs using the Box Culvert Rail Mounting Details (RAC) standard sheet quantities shown must be increased by a factor of 2.25. If Class S concrete is required for the top slab of the culvert, also provide Class S concrete for the curb. Curb concrete is considered part of the Box Culvert for payment.

(3) Concrete volume shown is total of wings, footings, culvert toewall (if any), anchor toewalls (if any) and wingwall toewalls. Riprap aprons, culverts, and curb quantities are not included.

(4) Regardless of the type of culvert shown on this sheet, the Contractor has the option of furnishing cast-in-place or precast culverts unless otherwise shown elsewhere on the plans. If the Contractor elects to provide culverts of a different type than those shown on this sheet, it is the Contractor's responsibility to make the necessary adjustments to the dimensions and quantities shown.

SPECIAL NOTE:

This sheet is a supplement to the box culvert standards. It is to be filled out by the culvert specifier and provides dimensions for the construction of the box culvert wingwalls and safety end treatments.

An Excel 2010 spreadsheet to assist in completing this table can be downloaded from the Bridge Standards (English) web page on the TxDOT web site. The completed sheet must be signed, sealed, and dated by a licensed Professional Engineer.

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED PROFESSIONAL ENGINEER
11/17/2023

Texas Department of Transportation

Bridge Division Standard

BOX CULVERT SUPPLEMENT
WINGS AND END TREATMENTS

BCS

FILE: bcsstde1-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		120

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FILE:

DATE: 11/17/2023 5:08:12 PM
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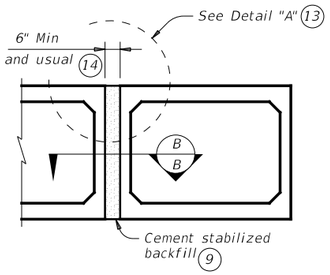
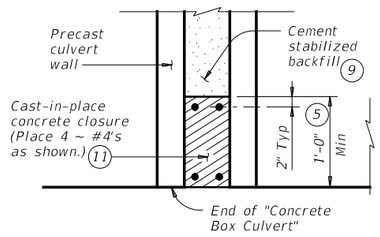
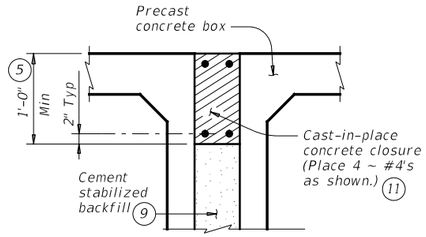


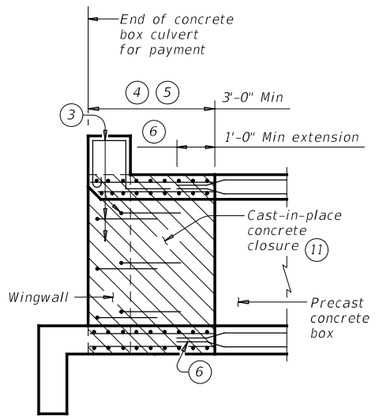
MULTIPLE UNIT PLACEMENT



SECTION B-B

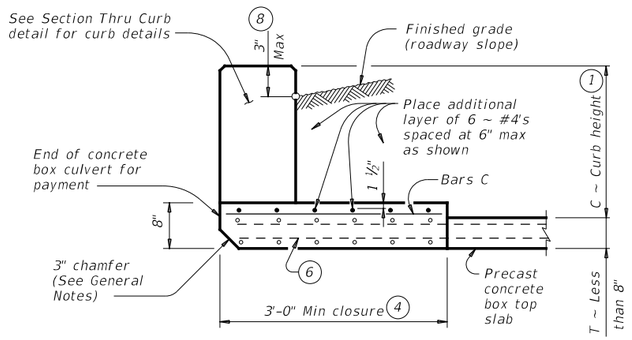


DETAIL "A" (13)

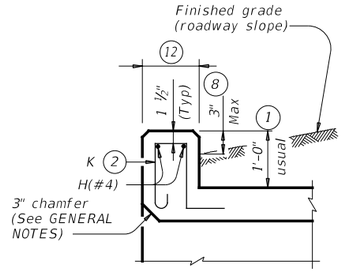


WINGWALL CONNECTION

(Also applies to safety end treatment.)

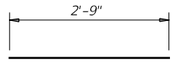


SECTION THRU TOP SLABS LESS THAN 8"

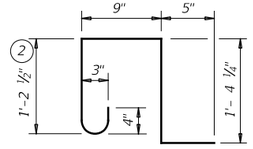


SECTION THRU CURB

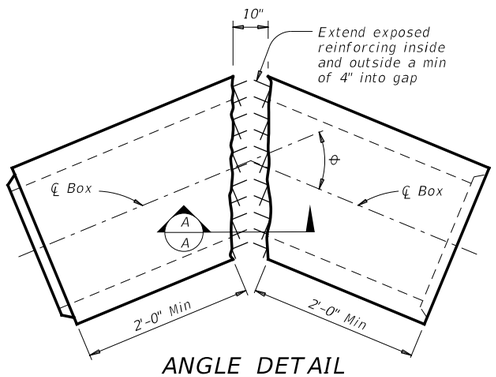
QUANTITIES PER FOOT OF CURB (10)	
Reinforcing Steel	4.12 Lb
Concrete	0.037 CY



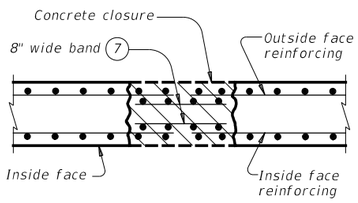
BARS C (#4)
(Spa = 1'–0" Max)



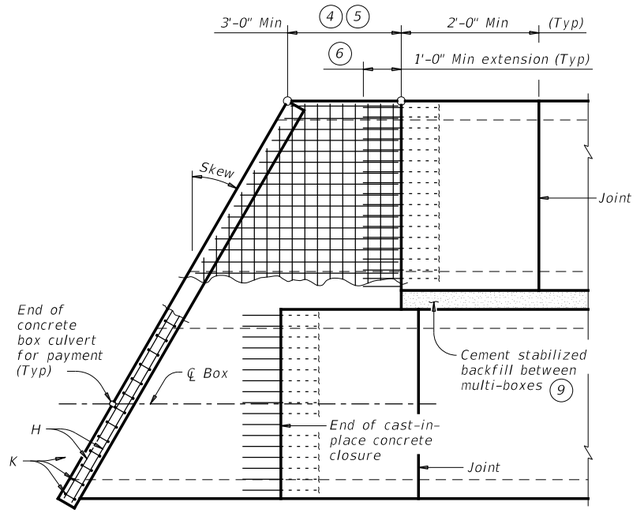
BARS K (#4)
(Spa = 1'–0" Max)
(Length = 4'–2")



ANGLE DETAIL



SECTION A-A



PLAN OF SKEWED ENDS

(Showing multi-box placement.)

1. 0" Min to 5'–0" Max. Estimated curb heights are shown elsewhere in the plans. For structures with pedestrian rail, bicycle rail, or curbs taller than 1'–0, refer to the Extended Curb Details (ECD) standard sheet. For structures with T631 or T631LS bridge rail, refer to the Mounting Details for T631 & T631LS Rails (T631–CM) standard sheet. Refer to the Box Culvert Rail Mounting Details (RAC) standard sheet for structures with bridge rail other than T631 or T631LS.
2. For curbs less than 1'–0" high, tilt Bars K or reduce bar height as necessary to maintain cover. For curbs less than 3" high, Bars K may be omitted.
3. Extend curb, wingwall, or safety end treatment reinforcing into concrete closure. Bend or trim, as necessary, any reinforcing that does not fit into closure area.
4. Provide a 3'–0" Min cast–in–place concrete closure. Break back boxes in the field or cast boxes short. Provide bands of reinforcing in the closure that are the same size and spacing as in the precast box section. Provide #4 longitudinal reinforcement spaced at 12 inches Max within the closure. Except where shown otherwise, construct the cast–in–place closure flush with the inside and outside faces of the precast box section.
5. For multiple unit placements, adjust the length of the closure for the interior walls as necessary. Provide a 3'–0" Min cast–in–place closure in the top slab, bottom slab, and exterior wall. See Section B–B detail when interior walls are cast full length.
6. Extend precast box reinforcing a minimum of 1'–0" into concrete closure (Typ).
7. Place bands of reinforcing matching the inside and outside face reinforcing in the gaps of the top and bottom slabs. Place a band matching the outside face reinforcing of the wall in the gaps of the walls (placed in the outside face only). Tack weld the bands to the exposed reinforcing at each point of contact.
8. For vehicle safety, the following requirements must be met:
   - For structures without bridge rail, construct curbs no more than 3" above finished grade.
   - For structures with bridge rail, construct curbs flush with finished grade.

   Reduce curb heights, if necessary, to meet the above requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.
9. Cement stabilized backfill between boxes is considered part of the box culvert for payment.
10. All curb concrete and reinforcing is considered part of the box culvert for payment.
11. Any additional concrete and reinforcing required for the closures will be considered subsidiary to the box culvert for payment.
12. 1'–0" typical. 2'–3" when the Box Culvert Rail Mounting Details (RAC) standard sheet is referred to elsewhere in the plans.
13. For multiple unit placement with overlay, with 1 to 2 course surface treatment, or with the top slab as the final riding surface, provide wall closure as shown in Detail "A".
14. This dimension may be increased with approval of the Engineer to allow the precast boxes to be tunneled or jacked in accordance with Item 476, "Jacking, Boring, or Tunneling Pipe or Box". No payment will be made for any additional material in the gap between adjacent boxes.

MATERIAL NOTES:

Provide Grade 60 reinforcing steel.
Provide ASTM A1064 welded wire reinforcement.
Provide Class C concrete (f'c = 3,600 psi) for the closures.
Provide cement stabilized backfill meeting the requirements of Item 400, "Excavation and Backfill for Structures."
Any additional concrete required for the closures will be considered subsidiary to the box culvert.

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.
Refer to the Single Box Culverts Precast (SCP) standard sheets for details and notes not shown.
Chamfer the bottom edge of the top slab closure 3 inches at culvert closure ends.

Cover dimensions are clear dimensions, unless noted otherwise.
Reinforcing bars dimensions are out–to–out of bars.

HL93 LOADING

Texas Department of Transportation

Bridge Division Standard

BOX CULVERTS PRECAST MISCELLANEOUS DETAILS

SCP-MD

FILE: scpmdsts-20.dgn	DN: GAF	CK: LMW	DW: BWH/TxDOT	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		121

DATE: 11/17/2023 5:08:14 PM
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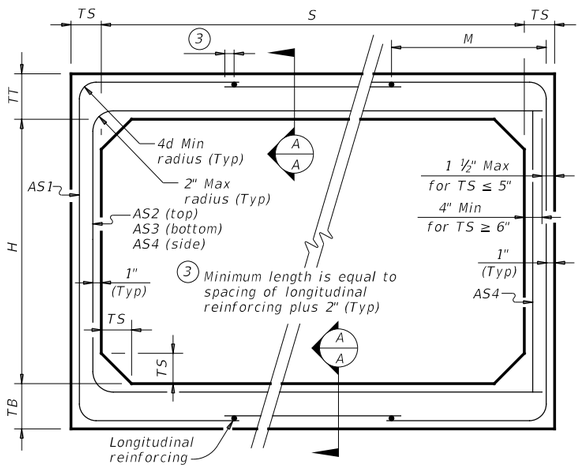
BOX DATA

SECTION DIMENSIONS					Fill Height	M (Min)	REINFORCING (sq. in. / ft.) (2)							(1) Lift Weight
S (ft.)	H (ft.)	TT (in.)	TB (in.)	TS (in.)	(ft.)	(in.)	AS1	AS2	AS3	AS4	AS5	AS7	AS8	(tons)
8	3	8	8	8	< 2	–	0.31	0.35	0.25	0.19	0.19	0.19	0.19	10.4
8	3	8	8	8	2 < 3	55	0.35	0.29	0.28	0.19	–	–	–	10.4
8	3	8	8	8	3 – 5	50	0.28	0.23	0.24	0.19	–	–	–	10.4
8	3	8	8	8	10	45	0.29	0.25	0.26	0.19	–	–	–	10.4
8	3	8	8	8	15	45	0.39	0.33	0.34	0.19	–	–	–	10.4
8	3	8	8	8	20	45	0.51	0.43	0.44	0.19	–	–	–	10.4
8	3	8	8	8	25	45	0.63	0.53	0.54	0.19	–	–	–	10.4
8	4	8	8	8	< 2	–	0.27	0.38	0.29	0.19	0.19	0.19	0.19	11.2
8	4	8	8	8	2 < 3	50	0.31	0.34	0.32	0.19	–	–	–	11.2
8	4	8	8	8	3 – 5	50	0.25	0.27	0.27	0.19	–	–	–	11.2
8	4	8	8	8	10	45	0.26	0.28	0.29	0.19	–	–	–	11.2
8	4	8	8	8	15	41	0.34	0.37	0.38	0.19	–	–	–	11.2
8	4	8	8	8	20	41	0.44	0.48	0.49	0.19	–	–	–	11.2
8	5	8	8	8	< 2	–	0.24	0.40	0.32	0.19	0.19	0.19	0.19	12.0
8	5	8	8	8	2 < 3	50	0.28	0.37	0.35	0.19	–	–	–	12.0
8	5	8	8	8	3 – 5	45	0.23	0.29	0.30	0.19	–	–	–	12.0
8	5	8	8	8	10	45	0.23	0.31	0.32	0.19	–	–	–	12.0
8	5	8	8	8	15	41	0.30	0.41	0.42	0.19	–	–	–	12.0
8	5	8	8	8	20	41	0.39	0.52	0.54	0.19	–	–	–	12.0
8	6	8	8	8	< 2	–	0.22	0.42	0.35	0.19	0.19	0.19	0.19	12.8
8	6	8	8	8	2 < 3	50	0.25	0.40	0.38	0.19	–	–	–	12.8
8	6	8	8	8	3 – 5	50	0.21	0.32	0.33	0.19	–	–	–	12.8
8	6	8	8	8	10	45	0.22	0.33	0.34	0.19	–	–	–	12.8
8	6	8	8	8	15	41	0.28	0.43	0.45	0.19	–	–	–	12.8
8	6	8	8	8	20	41	0.36	0.55	0.57	0.19	–	–	–	12.8
8	7	8	8	8	< 2	–	0.20	0.44	0.37	0.19	0.19	0.19	0.19	13.6
8	7	8	8	8	2 < 3	55	0.23	0.43	0.41	0.19	–	–	–	13.6
8	7	8	8	8	3 – 5	55	0.19	0.34	0.35	0.19	–	–	–	13.6
8	7	8	8	8	10	50	0.20	0.34	0.36	0.19	–	–	–	13.6
8	7	8	8	8	15	41	0.26	0.45	0.47	0.19	–	–	–	13.6
8	7	8	8	8	20	41	0.33	0.57	0.60	0.19	–	–	–	13.6
8	8	8	8	8	< 2	–	0.20	0.45	0.40	0.19	0.19	0.19	0.19	14.4
8	8	8	8	8	2 < 3	65	0.21	0.45	0.44	0.19	–	–	–	14.4
8	8	8	8	8	3 – 5	65	0.19	0.36	0.38	0.19	–	–	–	14.4
8	8	8	8	8	10	55	0.19	0.35	0.38	0.19	–	–	–	14.4
8	8	8	8	8	15	45	0.24	0.46	0.49	0.19	–	–	–	14.4
8	8	8	8	8	20	45	0.31	0.59	0.62	0.19	–	–	–	14.4

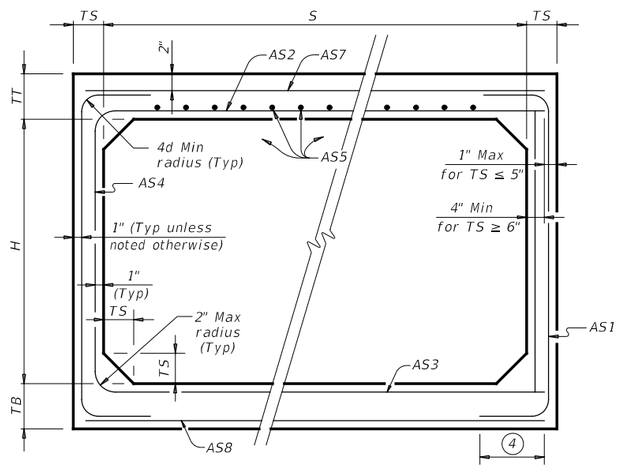
(1) For box length = 8'-0"

(2) AS1 thru AS4, AS7 and AS8 are minimum required areas of reinforcement per linear foot of box length. AS5 is minimum required area of reinforcement per linear foot of box width.



CORNER OPTION "A" CORNER OPTION "B"

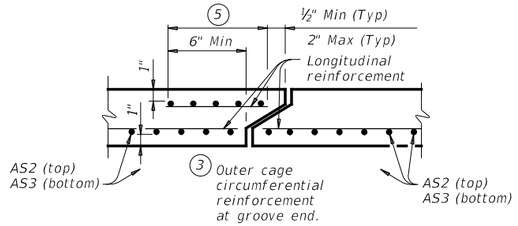
FILL HEIGHT 2 FT AND GREATER



CORNER OPTION "A" CORNER OPTION "B"

FILL HEIGHT LESS THAN 2 FT

(4) Length is equal to spacing of longitudinal reinforcing plus 2". (10" Min) (Typ)



SECTION A-A

(Showing top and bottom slab joint reinforcement.)

MATERIAL NOTES:

Provide 0.03 sq. in./ft. minimum longitudinal reinforcement at each face in slabs and walls. This minimum requirement may be met by the transverse wires when wire mesh reinforcement is used.

Provide Class H concrete (f`c = 5,000 psi).

GENERAL NOTES:

Designs shown conform to ASTM C1577. Refer to ASTM C1577 for information or details not shown.

See Box Culverts Precast Miscellaneous Details (SCP-MD) standard sheet for details and notes not shown.

In lieu of furnishing the designs shown on this sheet, the contractor may furnish an alternate design that is equal to or exceeds the box design for the design fill height in the table. Submit shop plans for alternate designs in accordance with Item "Precast Concrete Structural Members (Fabrication)".

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Texas Department of Transportation

Bridge Division Standard

SINGLE BOX CULVERTS PRECAST

8'-0" SPAN

SCP-8

FILE: scp08sts-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
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DATE: 11/17/2023 5:08:16 PM
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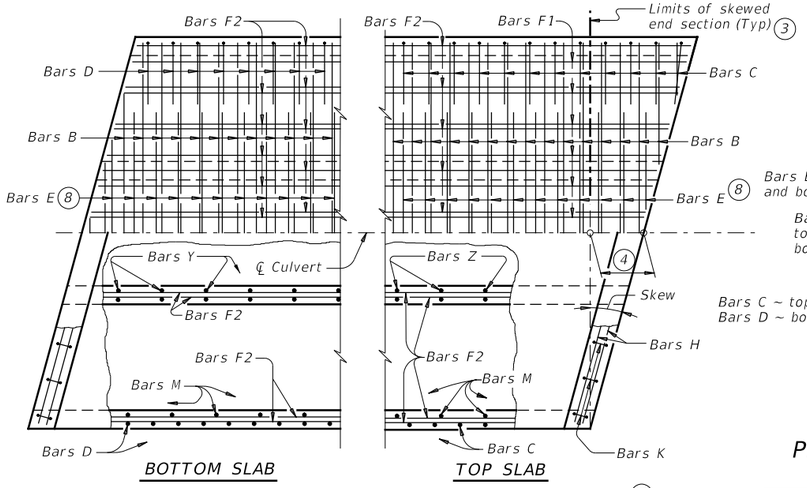
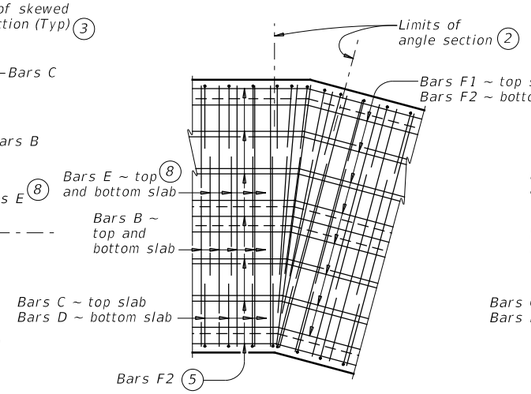
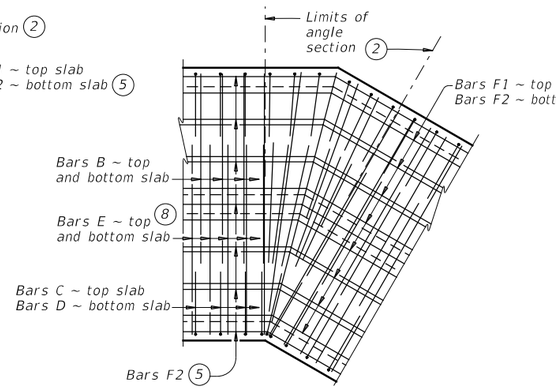


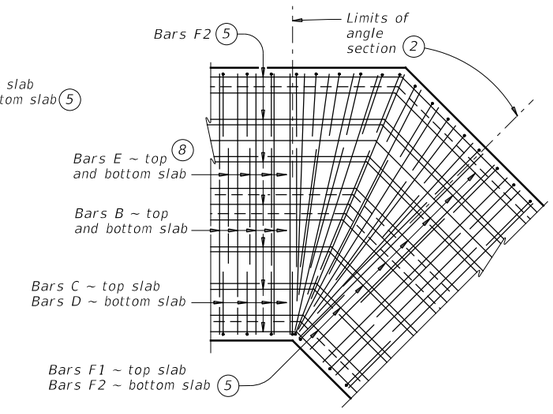
PLAN OF SKEWED ENDS ~ FROM 0° TO 15° 7



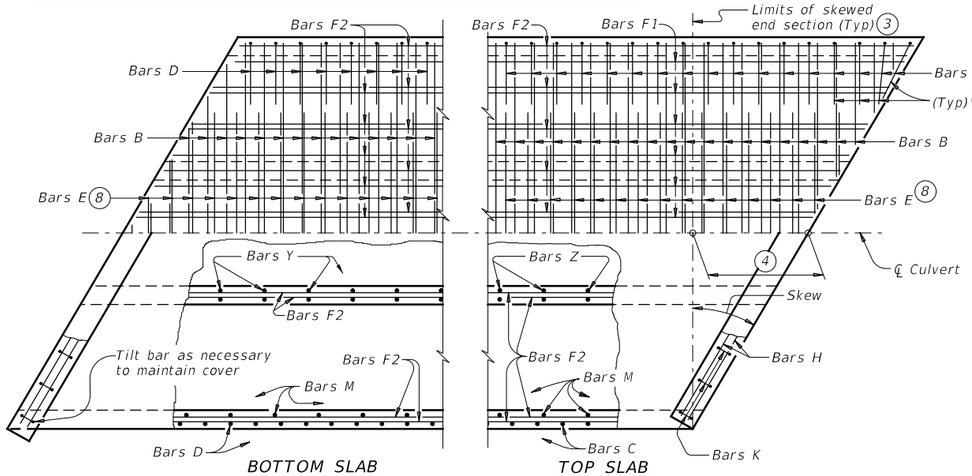
PLAN OF ANGLE SECTION ~ FROM 0° TO 15°



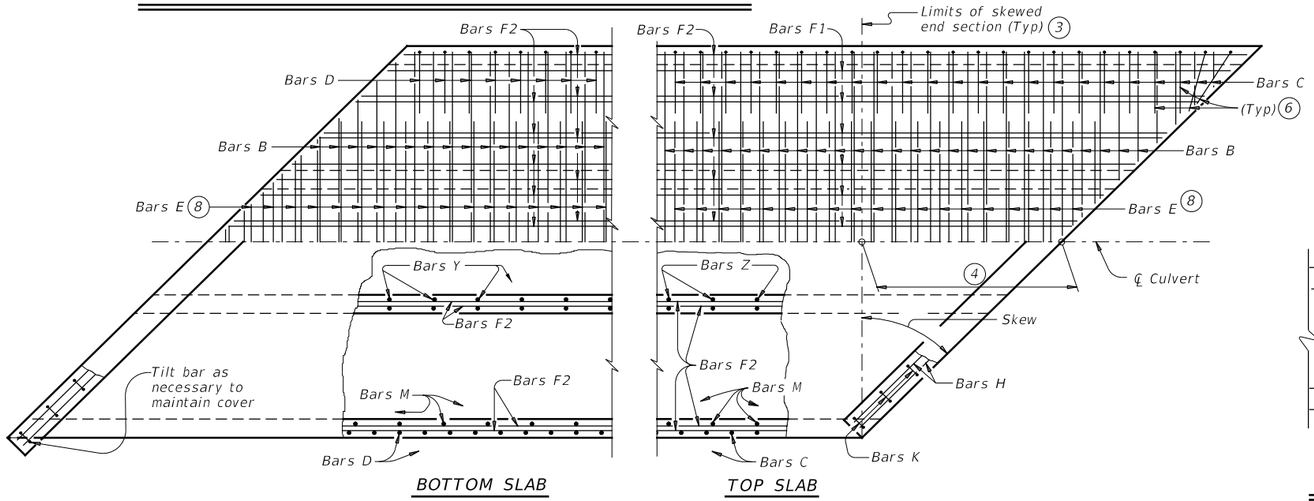
PLAN OF ANGLE SECTION ~ OVER 15° TO 30°



PLAN OF ANGLE SECTION ~ OVER 30° TO 45°

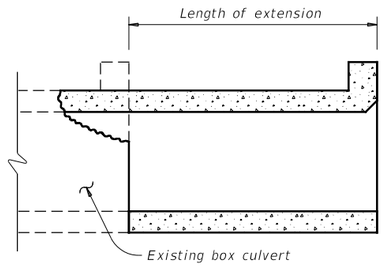


PLAN OF SKEWED ENDS ~ OVER 15° TO 30°



PLAN OF SKEWED ENDS ~ OVER 30° TO 45°

1. For skewed box culverts with less than 2'-0" of fill, break back the top slab to provide a 1'-10" minimum lap of the existing longitudinal bars with the longitudinal bars in the extension.
   For non-skewed box culverts with less than 2'-0" of fill and for skewed or non-skewed culverts with a fill depth of 2'-0" or greater, break back the top slab to provide a 1'-10" minimum lap of the existing longitudinal bars with the longitudinal bars in the extension. Alternatively, if the box is non-skewed, embed #6 anchor bars with a Type III, Class C, D, E, or F anchor adhesive into the existing walls, top and bottom slab at 1'-6" center-to-center spacing. Minimum embedment depth is 8". Anchor adhesive chosen must be able to achieve a basic bond strength in tension, Nba, of 26.4 kips. Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use. Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing." Test adhesive anchors in accordance with Item 450.3.3, "Tests." Test 3 anchors per 100 anchors installed.
   Break back wings and apron as necessary to install the extension. Clean and extend the exposed wingwall and apron reinforcing into the extension. When lengthening existing box culverts with dimensions different than current standard dimensions, form horizontal and vertical transitions as directed by the Engineer. Match bottom slabs to maintain an uninterrupted flow line. Field bend existing and new reinforcing into transitions and maintain specified cover requirements. For top slabs of culverts with overlay, with 1-to-2 course surface treatment, or with the top slab as the final riding surface, adjust the "H" dimension to provide a smooth riding surface.
2. When the spacing between Bars B or Bars E becomes less than half of the normal spacing, cut bars to avoid conflict.
3. The length of Bars B and Bars E will vary in the skewed end sections.
4. [One half of overall width] x [tangent of the skew angle]
5. Place Bars F1 and F2 continuously through the angle section. Bend Bars F1 and F2 to remain parallel to the walls of the box culvert.
6. When necessary to avoid conflict in acute corners, shorten the slab extension leg of Bars C and Bars D to a minimum of 1'-6" for skews of 30° thru 45°.
7. At the Contractor's option, for skews of 15° or less, place Bars B, C, D, and E parallel to the skewed end while maintaining spacing along centerline of box. Increase lengths of Bars B and Bars E shown on the Multiple Box Culverts Cast-In-Place (MC) standard sheets to accommodate the skew.
8. Extend Bars E as shown on the MC standard sheet for direct traffic culverts.



LENGTHENING DETAIL 1

CONSTRUCTION NOTES:
Do not use permanent forms.
When required, lap Bars H 1'-8" for uncoated or galvanized bars.
Provide a minimum of 1 ½" clear cover.

MATERIAL NOTES:
Provide Grade 60 reinforcing steel.
Provide galvanized reinforcing steel, if required elsewhere in the plans.
Provide Class C concrete (f'c = 3,600 psi) with these exceptions: provide Class S concrete (f'c = 4,000 psi) for top slabs of culverts with overlay, with 1-to-2 course surface treatment, or with the top slab as the final riding surface.

GENERAL NOTES:
Designed according to AASHTO LRFD Bridge Design Specifications.
Refer to Multiple Box Culverts Cast-in-Place (MC) standard sheets for details of straight sections of culvert.
For skewed sections and angle sections, refer to Multiple Box Culverts Cast-in-Place (MC) standard sheets for slab and wall dimensions, bar sizes, maximum bar spacing, and any other details not shown.
For skewed ends with curbs, adjust length of Bars H, number of Bars K, curb concrete volume, and reinforcing steel weight by dividing the values shown on the Multiple Box Culverts Cast-In-Place (MC) standard sheets by the cosine of the skew angle.

Cover dimensions are clear dimensions, unless noted otherwise.

HL93 LOADING

Texas Department of Transportation

Bridge Division Standard

MULTIPLE BOX CULVERTS CAST-IN-PLACE MISCELLANEOUS DETAILS

MC-MD

FILE: mc-mdste-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
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	AUS	HAYS		123

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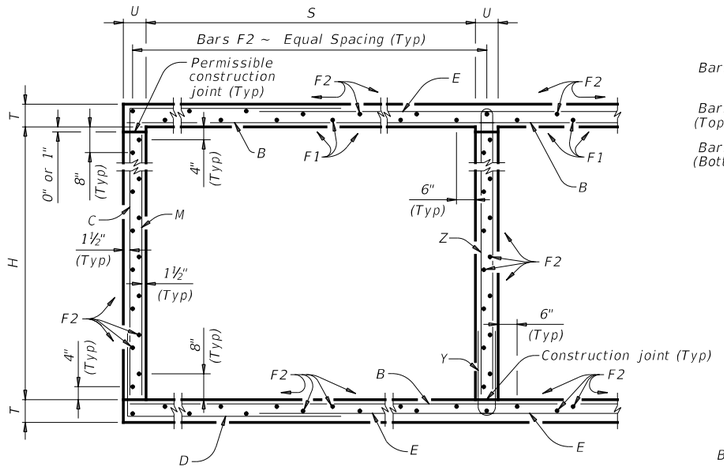
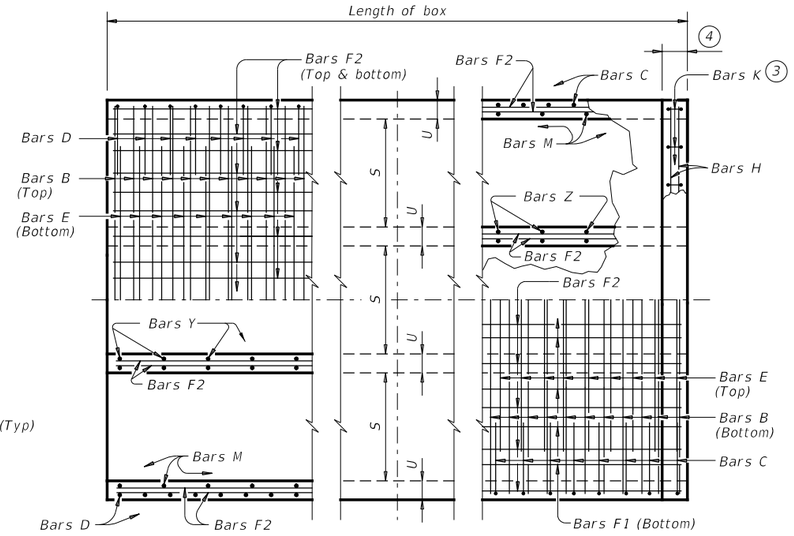
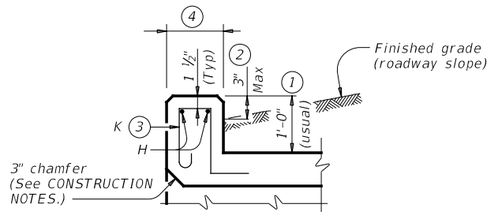


TYPICAL SECTION



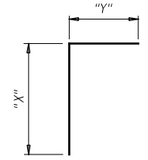
BOTTOM SLAB TOP SLAB

PART PLANS

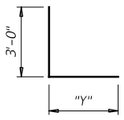


SECTION THRU CURB

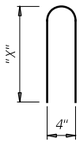
TABLE OF BAR DIMENSIONS		
H	"X"	"Y"
3'-0"	3'-6 ½"	5'-1"
4'-0"	4'-6 ½"	5'-1"
5'-0"	5'-6 ½"	5'-1"
6'-0"	6'-6 ½"	5'-1"
7'-0"	7'-6 ½"	5'-1"
8'-0"	8'-6 ½"	5'-1"



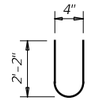
BARS C



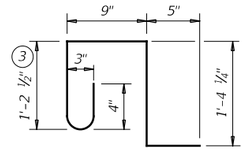
BARS D



BARS Z



BARS Y



BARS K (#4)
(Spa = 1'-0" Max)
(Length = 4'-2")

1 0" Min to 5'-0" Max. Estimated curb heights are shown elsewhere in the plans. For structures with pedestrian rail or curbs taller than 1'-0", refer to the Extended Curb Details (ECD) standard sheet. For structures with T631 or T631LS bridge rail, refer to the Mounting Details for T631 & T631LS Rails (T631-CM) standard sheet. Refer to the Rail Anchorage Curb (RAC) standard sheet for structures with bridge rail other than T631 or T631LS.

2 For vehicle safety, the following requirements must be met:
- For structures without bridge rail, construct curbs no more than 3" above finished grade.
- For structures with bridge rail, construct curbs flush with finished grade.

Reduce curb heights, if necessary, to meet the above requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.

3 For curbs less than 1'-0" high, tilt Bars K or reduce bar height as necessary to maintain cover. For curbs less than 3" high, Bars K may be omitted.

4 1'-0" typical. 2'-3" when the Rail Anchorage Curb (RAC) standard sheet is referred to elsewhere in the plans.

The Contractor may replace Bars B, C, D, E, F1, F2, M, Y, and/or Z with deformed welded wire reinforcement (WWR) meeting the requirements of ASTM A1064. The area of required reinforcement may be reduced by the ratio of 60 ksi / 70 ksi. Spacing of WWR is limited to 4" Min and 18" Max. When required, provide lap splices in the WWR of the same length required for the equivalent bar size, rounded up for wire sizes between conventional bar sizes. The lap length required for WWR is never less than the lap length required for uncoated #4 bars.

Example conversion: Replacing No. 6 Gr 60 at 6" Spacing with WWR
Required WWR = (0.44 sq. in. per 0.5 ft.) x (60 ksi / 70 ksi) = 0.755 sq. in. per ft.
If D30.6 wire is used to meet the 0.755 sq. in. per ft. requirement in this example, the required spacing = (0.306 sq. in.) / (0.755 sq. in. per ft.) x (12 in. per ft.) = 4.86" Max spacing. Required lap length for the provided D30.6 wire is 2'-1" (the same minimum lap length required for uncoated #5 bars, as listed under MATERIAL NOTES).

CONSTRUCTION NOTES:

Do not use permanent forms.
Chamfer the bottom edge of the top slab 3" at the entrance.
Optionally, raise construction joints shown at the flow line by a maximum of 6". If this option is taken, Bars M may be cut off or raised, Bars C and D may be reversed, and Bars Y and Z may be reversed.

MATERIAL NOTES:

Provide Grade 60 reinforcing steel.
Provide galvanized reinforcing steel if required elsewhere in the plans.
Provide Class C concrete (f'c = 3,600 psi) for culvert barrel and curb, with the following exceptions: provide Class S concrete (f'c = 4,000 psi) for top slabs of:
- culverts with overlay,
- culverts with 1-to-2 course surface treatment, or
- culverts with the top slab as the final riding surface.

Provide bar laps, where required, as follows:
- Uncoated or galvanized ~ #4 = 1'-8" Min
- Uncoated or galvanized ~ #5 = 2'-1" Min
- Uncoated or galvanized ~ #6 = 2'-6" Min

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications for the range of fill heights shown.
See the Multiple Box Culverts Cast-In-Place Miscellaneous Detail (MC-MD) standard sheet for details pertaining to skewed ends, angle sections, and lengthening.

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

HL93 LOADING

Texas Department of Transportation

Bridge Division Standard

MULTIPLE BOX CULVERTS CAST-IN-PLACE
8'-0" SPAN
0' TO 13' FILL

MC-8-13

FILE: mc813ste-20.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		124

NUMBER OF SPANS	SECTION DIMENSIONS				BILLS OF REINFORCING STEEL (For Box Length = 40 feet)																														QUANTITIES					
					Bars B					Bars C & D							Bars E					Bars F1 ~ #4				Bars F2 ~ #4				Bars M ~ #4				Bars Y & Z ~ #4							Bars H 4 ~ #4		Bars K		Per Foot of Barrel		Curb		Total	
	S	H	T	U	No.	Size	Spa	Length	Wt	No.	Size	Spa	Bars C Length	Bars C Wt	Bars D Length	Bars D Wt	No.	Size	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Bars Y Length	Bars Y Wt	Bars Z Length	Bars Z Wt	Length	Wt	No.	Wt	Conc (CY)	Renf (Lb)	Conc (CY)	Renf (Lb)	Conc (CY)	Renf (Lb)
2	8' – 0"	3' – 0"	8"	7"	162	#6	6"	17' – 6"	4,258	108	#6	9"	8' – 8"	1,406	8' – 2"	1,325	162	#6	6"	12' – 9"	3,102	12	18"	39' – 9"	319	56	18"	39' – 9"	1,487	108	9"	3' – 0"	216	54	9"	4' – 7"	165	7' – 3"	262	17' – 6"	47	38	106	1.071	313.5	1.3	153	44.2	12,693
3	8' – 0"	3' – 0"	8"	7"	162	#6	6"	26' – 1"	6,347	108	#6	9"	8' – 8"	1,406	8' – 2"	1,325	162	#6	6"	21' – 4"	5,191	18	18"	39' – 9"	478	80	18"	39' – 9"	2,124	108	9"	3' – 0"	216	108	9"	4' – 7"	331	7' – 3"	523	26' – 1"	70	56	156	1.560	448.5	1.9	226	64.3	18,167
4	8' – 0"	3' – 0"	8"	7"	162	#6	6"	34' – 8"	8,435	108	#6	9"	8' – 8"	1,406	8' – 2"	1,325	162	#6	6"	29' – 11"	7,279	24	18"	39' – 9"	637	104	18"	39' – 9"	2,762	108	9"	3' – 0"	216	162	9"	4' – 7"	496	7' – 3"	785	34' – 8"	93	72	200	2.048	583.5	2.6	293	84.5	23,634
5	8' – 0"	3' – 0"	8"	7"	162	#6	6"	43' – 3"	10,524	108	#6	9"	8' – 8"	1,406	8' – 2"	1,325	162	#6	6"	38' – 6"	9,368	30	18"	39' – 9"	797	128	18"	39' – 9"	3,399	108	9"	3' – 0"	216	216	9"	4' – 7"	661	7' – 3"	1,046	43' – 3"	116	90	251	2.537	718.6	3.2	367	104.7	29,109
6	8' – 0"	3' – 0"	8"	7"	162	#6	6"	51' – 10"	12,612	108	#6	9"	8' – 8"	1,406	8' – 2"	1,325	162	#6	6"	47' – 1"	11,457	36	18"	39' – 9"	956	152	18"	39' – 9"	4,036	108	9"	3' – 0"	216	270	9"	4' – 7"	827	7' – 3"	1,308	51' – 10"	138	106	295	3.026	853.6	3.8	433	124.9	34,576
2	8' – 0"	4' – 0"	8"	7"	162	#6	6"	17' – 6"	4,258	108	#6	9"	9' – 8"	1,568	8' – 2"	1,325	162	#6	6"	12' – 9"	3,102	12	18"	39' – 9"	319	56	18"	39' – 9"	1,487	108	9"	4' – 0"	289	54	9"	4' – 7"	165	9' – 3"	334	17' – 6"	47	38	106	1.136	321.2	1.3	153	46.8	13,000
3	8' – 0"	4' – 0"	8"	7"	162	#6	6"	26' – 1"	6,347	108	#6	9"	9' – 8"	1,568	8' – 2"	1,325	162	#6	6"	21' – 4"	5,191	18	18"	39' – 9"	478	80	18"	39' – 9"	2,124	108	9"	4' – 0"	289	108	9"	4' – 7"	331	9' – 3"	667	26' – 1"	70	56	156	1.646	458.0	1.9	226	67.8	18,546
4	8' – 0"	4' – 0"	8"	7"	162	#6	6"	34' – 8"	8,435	108	#6	9"	9' – 8"	1,568	8' – 2"	1,325	162	#6	6"	29' – 11"	7,279	24	18"	39' – 9"	637	104	18"	39' – 9"	2,762	108	9"	4' – 0"	289	162	9"	4' – 7"	496	9' – 3"	1,001	34' – 8"	93	72	200	2.156	594.8	2.6	293	88.8	24,085
5	8' – 0"	4' – 0"	8"	7"	162	#6	6"	43' – 3"	10,524	108	#6	9"	9' – 8"	1,568	8' – 2"	1,325	162	#6	6"	38' – 6"	9,368	30	18"	39' – 9"	797	128	18"	39' – 9"	3,399	108	9"	4' – 0"	289	216	9"	4' – 7"	661	9' – 3"	1,335	43' – 3"	116	90	251	2.667	731.7	3.2	367	109.9	29,633
6	8' – 0"	4' – 0"	8"	7"	162	#6	6"	51' – 10"	12,612	108	#6	9"	9' – 8"	1,568	8' – 2"	1,325	162	#6	6"	47' – 1"	11,457	36	18"	39' – 9"	956	152	18"	39' – 9"	4,036	108	9"	4' – 0"	289	270	9"	4' – 7"	827	9' – 3"	1,668	51' – 10"	138	106	295	3.177	868.5	3.8	433	130.9	35,171
2	8' – 0"	5' – 0"	8"	7"	162	#6	6"	17' – 6"	4,258	108	#6	9"	10' – 8"	1,730	8' – 2"	1,325	162	#6	6"	12' – 9"	3,102	12	18"	39' – 9"	319	62	18"	39' – 9"	1,646	108	9"	5' – 0"	361	54	9"	4' – 7"	165	11' – 3"	406	17' – 6"	47	38	106	1.201	332.8	1.3	153	49.4	13,465
3	8' – 0"	5' – 0"	8"	7"	162	#6	6"	26' – 1"	6,347	108	#6	9"	10' – 8"	1,730	8' – 2"	1,325	162	#6	6"	21' – 4"	5,191	18	18"	39' – 9"	478	88	18"	39' – 9"	2,337	108	9"	5' – 0"	361	108	9"	4' – 7"	331	11' – 3"	812	26' – 1"	70	56	156	1.733	472.8	1.9	226	71.3	19,138
4	8' – 0"	5' – 0"	8"	7"	162	#6	6"	34' – 8"	8,435	108	#6	9"	10' – 8"	1,730	8' – 2"	1,325	162	#6	6"	29' – 11"	7,279	24	18"	39' – 9"	637	114	18"	39' – 9"	3,027	108	9"	5' – 0"	361	162	9"	4' – 7"	496	11' – 3"	1,217	34' – 8"	93	72	200	2.264	612.7	2.6	293	93.1	24,800
5	8' – 0"	5' – 0"	8"	7"	162	#6	6"	43' – 3"	10,524	108	#6	9"	10' – 8"	1,730	8' – 2"	1,325	162	#6	6"	38' – 6"	9,368	30	18"	39' – 9"	797	140	18"	39' – 9"	3,717	108	9"	5' – 0"	361	216	9"	4' – 7"	661	11' – 3"	1,623	43' – 3"	116	90	251	2.796	752.7	3.2	367	115.1	30,473
6	8' – 0"	5' – 0"	8"	7"	162	#6	6"	51' – 10"	12,612	108	#6	9"	10' – 8"	1,730	8' – 2"	1,325	162	#6	6"	47' – 1"	11,457	36	18"	39' – 9"	956	166	18"	39' – 9"	4,408	108	9"	5' – 0"	361	270	9"	4' – 7"	827	11' – 3"	2,029	51' – 10"	138	106	295	3.328	892.6	3.8	433	137.0	36,138
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3	8' – 0"	6' – 0"	8"	7"	162	#6	6"	26' – 1"	6,347	108	#6	9"	11' – 8"	1,893	8' – 2"	1,325	162	#6	6"	21' – 4"	5,191	18	18"	39' – 9"	478	96	18"	39' – 9"	2,549	108	9"	6' – 0"	433	108	9"	4' – 7"	331	13' – 3"	956	26' – 1"	70	56	156	1.819	487.6	1.9	226	74.7	19,729
4	8' – 0"	6' – 0"	8"	7"	162	#6	6"	34' – 8"	8,435	108	#6	9"	11' – 8"	1,893	8' – 2"	1,325	162	#6	6"	29' – 11"	7,279	24	18"	39' – 9"	637	124	18"	39' – 9"	3,293	108	9"	6' – 0"	433	162	9"	4' – 7"	496	13' – 3"	1,434	34' – 8"	93	72	200	2.372	630.6	2.6	293	97.5	25,518
5	8' – 0"	6' – 0"	8"	7"	162	#6	6"	43' – 3"	10,524	108	#6	9"	11' – 8"	1,893	8' – 2"	1,325	162	#6	6"	38' – 6"	9,368	30	18"	39' – 9"	797	152	18"	39' – 9"	4,036	108	9"	6' – 0"	433	216	9"	4' – 7"	661	13' – 3"	1,912	43' – 3"	116	90	251	2.926	773.7	3.2	367	120.3	31,316
6	8' – 0"	6' – 0"	8"	7"	162	#6	6"	51' – 10"	12,612	108	#6	9"	11' – 8"	1,893	8' – 2"	1,325	162	#6	6"	47' – 1"	11,457	36	18"	39' – 9"	956	180	18"	39' – 9"	4,780	108	9"	6' – 0"	433	270	9"	4' – 7"	827	13' – 3"	2,390	51' – 10"	138	106	295	3.479	916.8	3.8	433	143.0	37,106
2	8' – 0"	7' – 0"	8"	7"	162	#6	6"	17' – 6"	4,258	108	#6	9"	12' – 8"	2,055	8' – 2"	1,325	162	#6	6"	12' – 9"	3,102	12	18"	39' – 9"	319	68	18"	39' – 9"	1,806	108	9"	7' – 0"	505	54	9"	4' – 7"	165	15' – 3"	550	17' – 6"	47	38	106	1.330	352.1	1.3	153	54.5	14,238
3	8' – 0"	7' – 0"	8"	7"	162	#6	6"	26' – 1"	6,347	108	#6	9"	12' – 8"	2,055	8' – 2"	1,325	162	#6	6"	21' – 4"	5,191	18	18"	39' – 9"	478	96	18"	39' – 9"	2,549	108	9"	7' – 0"	505	108	9"	4' – 7"	331	15' – 3"	1,100	26' – 1"	70	56	156	1.905	497.0	1.9	226	78.1	20,107
4	8' – 0"	7' – 0"	8"	7"	162	#6	6"	34' – 8"	8,435	108	#6	9"	12' – 8"	2,055	8' – 2"	1,325	162	#6	6"	29' – 11"	7,279	24	18"	39' – 9"	637	124	18"	39' – 9"	3,293	108	9"	7' – 0"	505	162	9"	4' – 7"	496	15' – 3"	1,650	34' – 8"	93	72	200	2.480	641.9	2.6	293	101.8	25,968
5	8' – 0"	7' – 0"	8"	7"	162	#6	6"	43' – 3"	10,524	108	#6	9"	12' – 8"	2,055	8' – 2"	1,325	162	#6	6"	38' – 6"	9,368	30	18"	39' – 9"	797	152	18"	39' – 9"	4,036	108	9"	7' – 0"	505	216	9"	4' – 7"	661	15' – 3"	2,200	43' – 3"	116	90	251	3.056	786.8	3.2	367	125.5	31,838
6	8' – 0"	7' – 0"	8"	7"	162	#6	6"	51' – 10"	12,612	108	#6	9"	12' – 8"	2,055	8' – 2"	1,325	162	#6	6"	47' – 1"	11,457	36	18"	39' – 9"	956	180	18"	39' – 9"	4,780	108	9"	7' – 0"	505	270	9"	4' – 7"	827	15' – 3"	2,750	51' – 10"	138	106	295	3.631	931.7	3.8	433	149.1	37,700
2	8' – 0"	8' – 0"	8"	7"	162	#6	6"	17' – 6"	4,258	108	#6	9"	13' – 8"	2,217	8' – 2"	1,325	162	#6	6"	12' – 9"	3,102	12	18"	39' – 9"	319	74	18"	39' – 9"	1,965	108	9"	8' – 0"	577	54	9"	4' – 7"	165	17' – 3"	622	17' – 6"	47	38	106	1.395	363.8	1.3	153	57.1	14,703
3	8' – 0"	8' – 0"	8"	7"	162	#6	6"	26' – 1"	6,347	108	#6	9"	13' – 8"	2,217	8' – 2"	1,325	162	#6	6"	21' – 4"	5,191	18	18"	39' – 9"	478	104	18"	39' – 9"	2,762	108	9"	8' – 0"	577	108	9"	4' – 7"	331	17' – 3"	1,244	26' – 1"	70	56	156	1.992	511.8	1.9	226	81.6	20,698
4	8' – 0"	8' – 0"	8"	7"	162	#6	6"	34' – 8"	8,435	108	#6	9"	13' – 8"	2,217	8' – 2"	1,325	162	#6	6"	29' – 11"	7,279	24	18"	39' – 9"	637	134	18"	39' – 9"	3,558	108	9"	8' – 0"	577	162	9"	4' – 7"	496	17' – 3"	1,867	34' – 8"	93	72	200	2.588	659.8	2.6	293	106.1	26,684
5	8' – 0"	8' – 0"	8"	7"	162	#6	6"	43' – 3"	10,524	108	#6	9"	13' – 8"	2,217	8' – 2"	1,325	162	#6	6"	38' – 6"	9,368	30	18"	39' – 9"	797	164	18"	39' – 9"	4,355	108	9"	8' – 0"	577	216	9"	4' – 7"	661	17' – 3"	2,489	43' – 3"	116	90	251	3.185	807.8	3.2	367	130.6	32,680
6	8' – 0"	8' – 0"	8"	7"	162	#6	6"	51' – 10"	12,612	108	#6	9"	13' – 8"	2,217	8' – 2"	1,325	162	#6	6"	47' – 1"	11,457	36	18"	39' – 9"	956	194	18"	39' – 9"	5,151	108	9"	8' – 0"	577	270	9"	4' – 7"	827	17' – 3"	3,111	51' – 10"	138	106	295	3.782	955.8	3.8	433	155.1	38,666

DATE: 11/17/2023 5:08:19 PM
FILE: T:\Road Dept\Department\Team Texas\txdot odd standards\drainage\MC-8-13.dgn

HL93 LOADING SHEET 2 OF 2

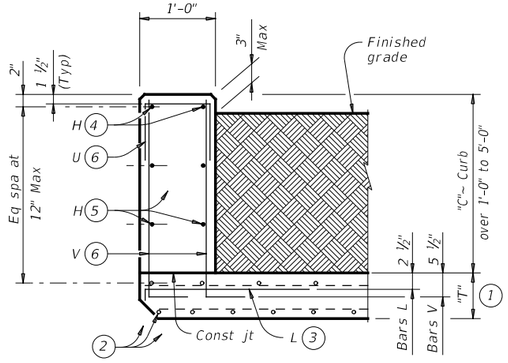
Texas Department of Transportation

Bridge Division Standard

MULTIPLE BOX CULVERTS CAST-IN-PLACE
8'-0" SPAN
0' TO 13' FILL

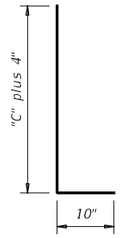
MC-8-13

FILE: mc813ste-20.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		125

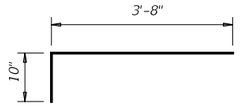


TYPICAL SECTION

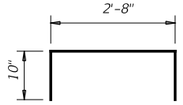
Used for curbs over 1'-0" to 5'-0"



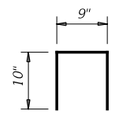
BARS V (#5) (6)
Spaced at 12" Max



BARS L (#5) (3)
Spaced at 12" Max



OPTIONAL BARS L (#5) (3) (7)
Spaced at 12" Max



BARS U (#4) (6)
Spaced at 12" Max

(1) "T" is equal to the culvert top slab thickness. For precast boxes with slabs less than 8" thick, see SCP-MD standard for additional details.

(2) Adjust normal culvert slab bars as necessary to clear obstructions.

(3) Place bars L as shown. Tilt hook as necessary to maintain cover.

(4) Place normal culvert curb bars H(#4) as shown. Adjust as necessary to clear obstructions.

(5) Additional bars H(#4) as required to maintain 12" Max spacing.

(6) Replace normal culvert curb bars K with one bar U and two bars V as shown spaced at 12" Max. Adjust length of bars V as necessary to maintain clear cover.

(7) Optional bars L are to be used only for precast box culverts with 3'-0" closure pour.

(8) Quantities shown are for Contractor's information only. Quantities are per linear foot of curb length. The value in table can be interpolated for intermediate values of curb height, "C". Quantity includes bars K (when applicable).

TABLE OF ESTIMATED CURB QUANTITIES (8)

Curb Height "C"	Conc (CY/LF)	Reinf Steel (Lb/LF)
1'-0"	0.037	10.4
1'-6"	0.056	14.5
2'-0"	0.074	15.6
2'-6"	0.093	18.0
3'-0"	0.111	19.0
3'-6"	0.130	21.3
4'-0"	0.148	22.4
4'-6"	0.167	24.8
5'-0"	0.185	25.9

CONSTRUCTION NOTES:

Adjust reinforcing steel as necessary to provide 1 ¼" cover.

For vehicle safety, top of the curb must not project more than 3" above the finished grade.

MATERIAL NOTES:

Provide Grade 60 reinforcing steel.

Provide galvanized reinforcing steel if required elsewhere in the plans.

Provide Class "C" concrete (f'_c = 3,600 psi) minimum for curbs.

Provide bar laps, where required, as follows:

- Uncoated or galvanized ~ #4 = 1'-8" Min

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.

These extended curb details have sufficient strength to allow for future retrofit of Type T631 or T631LS railing. These details are suitable for use with PR11, PR22 and PR3 type rails. These details are not suitable for the mounting of other rail types. For new construction using T631 or T631LS railing, use the T631-CM standard.

This Curb is considered as part of the Box Culvert for payment.

Cover dimensions are clear dimensions, unless noted otherwise.

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

Texas Department of Transportation

Bridge Division Standard

EXTENDED CURB DETAILS

FOR BOX CULVERTS WITH CURBS OVER 1'-0" TO 5'-0" TALL

ECD

FILE: ecdstde1-20.dgn	DN: GAF	CK: TxDOT	DW: TxDOT	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		126

DATE: 11/17/2023 5:08:21 PM
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DATE: 11/17/2023 5:08:23 PM
FILE: I:\Road Dept\Department\Team Texas\txdot cadd standards\drainage\PW.dgn

TABLE OF DIMENSIONS AND REINFORCING STEEL
(Wings for one structure end)

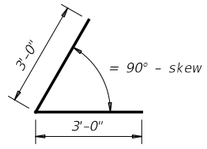
Dimensions					Variable Reinforcing				Estimated Quantities per ft of wing (2~wings) (4)		Estimated Quantities per ft of Toewall (1~toewall)	
					Bars J1		Bars J2					
Maximum Wingwall Height Hw	W	X	Y	Z	Size	Spa	Size	Spa	Reinf (Lb/Ft)	Conc (CY/Ft)	Reinf (Lb/Ft)	Conc (CY/Ft)
2'-6"	2'-10"	10"	1'-0"	7"	#4	1'-0"	#4	1'-0"	48.64	0.406	6.85	0.071
2'-9"	2'-10"	10"	1'-0"	7"	#4	1'-0"	#4	1'-0"	49.31	0.424	6.85	0.071
3'-0"	2'-10"	10"	1'-0"	7"	#4	1'-0"	#4	1'-0"	49.98	0.444	6.85	0.071
3'-3"	2'-10"	10"	1'-0"	7"	#4	1'-0"	#4	1'-0"	53.32	0.462	6.85	0.071
3'-6"	2'-10"	10"	1'-0"	7"	#4	1'-0"	#4	1'-0"	53.98	0.480	6.85	0.071
4'-0"	3'-2"	1'-2"	1'-0"	7"	#4	1'-0"	#4	1'-0"	55.77	0.532	6.85	0.071
4'-6"	3'-2"	1'-2"	1'-0"	7"	#4	1'-0"	#4	1'-0"	59.77	0.568	6.85	0.071
5'-0"	3'-9"	1'-7"	1'-2"	7"	#4	1'-0"	#4	1'-0"	63.45	0.632	6.96	0.075
5'-6"	3'-9"	1'-7"	1'-2"	7"	#4	1'-0"	#4	1'-0"	67.46	0.668	6.96	0.075
6'-0"	4'-4"	2'-0"	1'-4"	7"	#5	1'-0"	#5	1'-0"	80.67	0.730	7.07	0.078
6'-6"	4'-4"	2'-0"	1'-4"	7"	#5	1'-0"	#5	1'-0"	85.05	0.768	7.07	0.078
7'-0"	5'-0"	2'-3"	1'-9"	8"	#5	1'-0"	#5	1'-0"	92.15	0.864	8.07	0.093
7'-6"	5'-0"	2'-3"	1'-9"	8"	#5	1'-0"	#5	1'-0"	96.54	0.902	8.07	0.093
8'-0"	5'-6"	2'-8"	1'-10"	8"	#5	6"	#5	6"	139.04	0.962	8.13	0.095
8'-6"	5'-6"	2'-8"	1'-10"	8"	#5	6"	#5	6"	144.47	1.000	8.13	0.095
9'-6"	6'-0"	2'-10"	2'-2"	9"	#5	6"	#5	6"	156.93	1.136	8.41	0.110
10'-6"	6'-5"	3'-0"	2'-5"	9"	#6	6"	#5	6"	196.27	1.234	8.57	0.117
11'-6"	7'-2"	3'-6"	2'-8"	11"	#6	6"	#6	6"	230.13	1.438	9.52	0.140
12'-6"	7'-8"	3'-9"	2'-11"	1'-0"	#7	6"	#6	6"	283.41	1.592	9.74	0.157
13'-6"	8'-2"	4'-0"	3'-2"	1'-2"	#8	6"	#6	6"	348.72	1.804	10.02	0.186
14'-6"	8'-10"	4'-5"	3'-5"	1'-4"	#9	6"	#6	6"	432.94	2.046	10.30	0.218
15'-6"	9'-6"	4'-10"	3'-8"	1'-6"	#9	6"	#7	6"	489.52	2.302	11.24	0.253
16'-0"	9'-11"	5'-0"	3'-11"	1'-7"	#9	6"	#7	6"	505.72	2.448	11.47	0.279

TABLE OF WINGWALL REINFORCING
(2~wings)

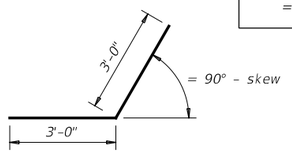
Bar	Size	No.	Spa
D1	#6	~	1'-0"
D2	#6	~	1'-0"
E1	#4	~	1'-0"
F	#4	~	1'-0"
G	#6	~	8"
M1	#4	4	~
P	#4	~	1'-0"
V	#4	~	1'-0"

TABLE OF TOEWALL REINFORCING

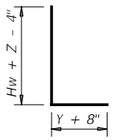
Bar	Size	No.	Spa
J3	#4	~	1'-0"
M2	#4	2	~
E2	#4	~	1'-0"



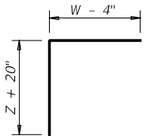
BARS D1



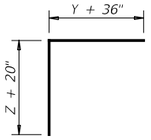
BARS D2



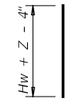
BARS J1



BARS J2



BARS J3



BARS V

WING DIMENSION FORMULAS:
(All values are in feet.)

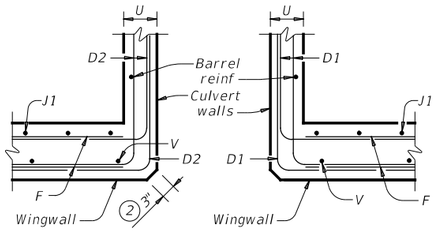
Hw = H + T + C
Lw = (Hw) (SL) ÷ cosine (θ) for Type PW-1
= (Hw - 1') (SL) ÷ cosine (θ) for Type PW-2 and Hw ≥ 4'
= (Hw - 0.5') (SL) ÷ cosine (θ) for Type PW-2 and Hw < 4'

For cast-in-place culverts:
Ltw = [(N) (S) + (N + 1) (U)] ÷ cosine (θ)

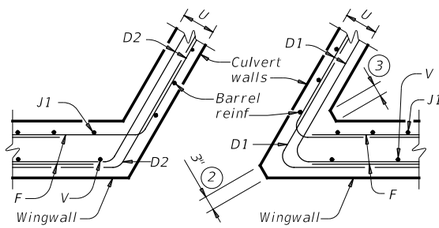
For precast culverts:
Ltw = [(N) (2 U + S) + (N - 1) (0.5')] ÷ cosine (θ)
Total Wingwall Area (two wings ~ SF)
= (2)(Hw)(Lw) for Type PW-1
= (2)(Hw)(Lw) - 6 SF for Type PW-2 and Hw ≥ 4'
= (2)(Hw)(Lw) - 1.5 SF for Type PW-2 and Hw < 4'

Hw = Height of wingwall
Lw = Length of wingwall
Ltw = Culvert toewall length
N = Number of culvert spans
SL:1 = Channel slope ratio. (horizontal: 1 vertical, usual value is 2:1)
θ = Culvert skew

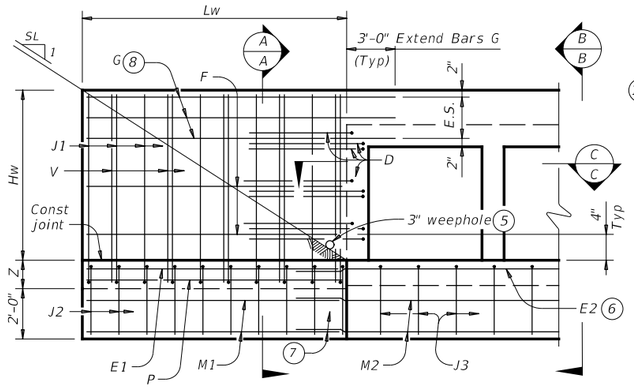
See applicable box culvert standard sheet for S, H, T, and U values.



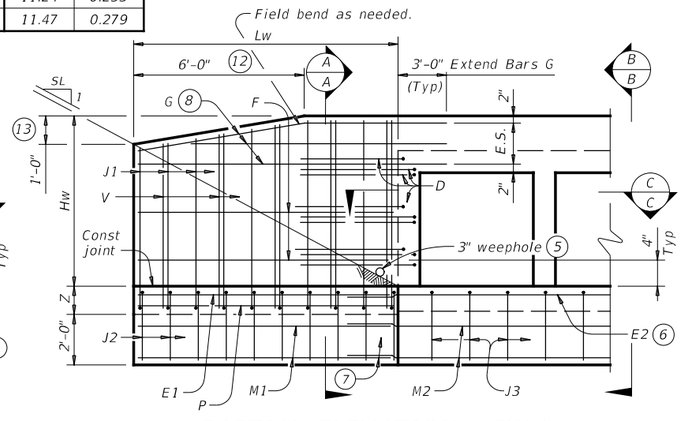
SECTION C-C - PW-1



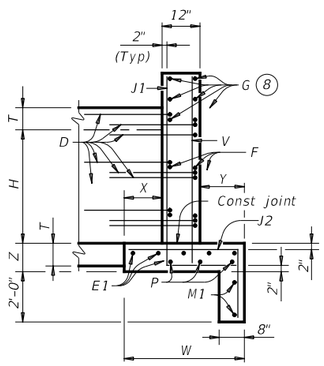
SECTION C-C - PW-2



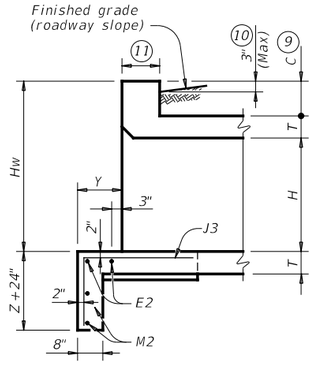
PARTIAL ELEVATION - PW-1



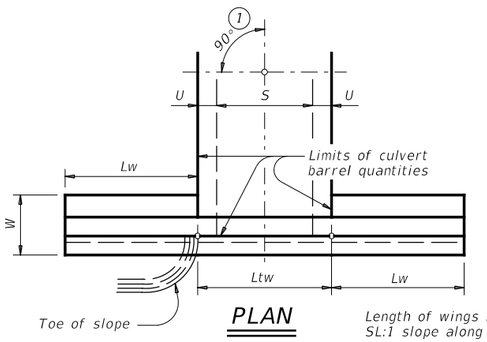
PARTIAL ELEVATION - PW-2



SECTION A-A
(Showing wing reinforcement.)

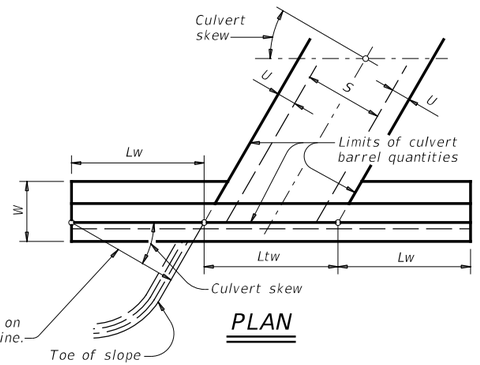


SECTION B-B
(Showing wing reinforcement.)



PLAN

DETAILS FOR NON-SKEWED BOX CULVERTS



PLAN

DETAILS FOR SKEWED BOX CULVERTS
(Showing 30° skew.)

1. Skew = 0°
2. At discharge end, chamfer may be ¾" minimum.
3. For 15° skew ~ 1"
   For 30° skew ~ 2"
   For 45° skew ~ 3"
4. Quantities shown are for two Type PW-1 wings. Adjust concrete volume for Type PW-2 wings. To determine estimated quantities for two wings, multiply the tabulated values by Lw. Quantities shown do not include weight of Bars D.
5. Provide weepholes for Hw = 5'-0" and greater. Fill around weepholes with coarse gravel.
6. Extend Bars E2 1'-6" minimum into the wingwall footing.
7. Lap Bars M1 1'-6" minimum with Bars M2.
8. Place Bars G as shown, equally spaced at 8" maximum. Provide at least two pairs of Bars G per wing.
9. 0" Min to 5'-0" Max. Estimated curb heights are shown elsewhere in the plans. For structures with pedestrian rail or curbs taller than 1'-0, refer to the Extended Curb Details (ECD) standard sheet. For structures with T631 or T631LS bridge rail, refer to the Mounting Details for T631 & T631LS Rails (T631-CM) standard sheet. Refer to the Box Culvert Rail Mounting Details (RAC) standard sheet for structures with bridge rail other than T631 or T631LS.
10. For vehicle safety, the following requirements must be met:
    - For structures without bridge rail, construct curbs no more than 3" above finished grade.
    - For structures with bridge rail, construct curbs flush with finished grade.

    Reduce curb heights, if necessary, to meet the above requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.
11. 1'-0" typical. 2'-3" when the Box Culvert Rail Mounting Details (RAC) standard sheet is referred to elswhere in the plans.
12. 3'-0" for Hw < 4'.
13. 6" for Hw < 4'.

DESIGNER NOTES:
Type PW-1 can be used for all applications and must be used if railing is to be mounted to the wingwall.
Type PW-2 can only be used for applications without a railing mounted to the wingwall.

MATERIAL NOTES:
Provide Class C concrete (f'c=3,600 psi).
Provide Grade 60 reinforcing steel.
Provide galvanized reinforing steel if required elsewhere in the plans.

GENERAL NOTES:
Designed in accordance with AASHTO LRFD Bridge Design Specifications.
Depth of toewalls for wingwalls and culverts may be reduced or eliminated when founded on solid rock, when directed by the Engineer.
See Box Culvert Supplement (BCS) standard sheet for wingwall type and additional dimensions and information.
Quantities for concrete and reinforcing steel resulting from the formulas given on this sheet are for the Contractor's information only.

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

Texas Department of Transportation
Bridge Division Standard

CONCRETE WINGWALLS
WITH PARALLEL WINGS FOR BOX CULVERTS
TYPES PW-1 AND PW-2

PW

FILE: pwstde01-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		127

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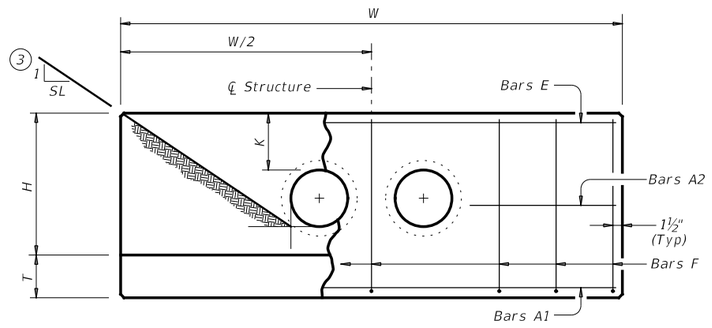
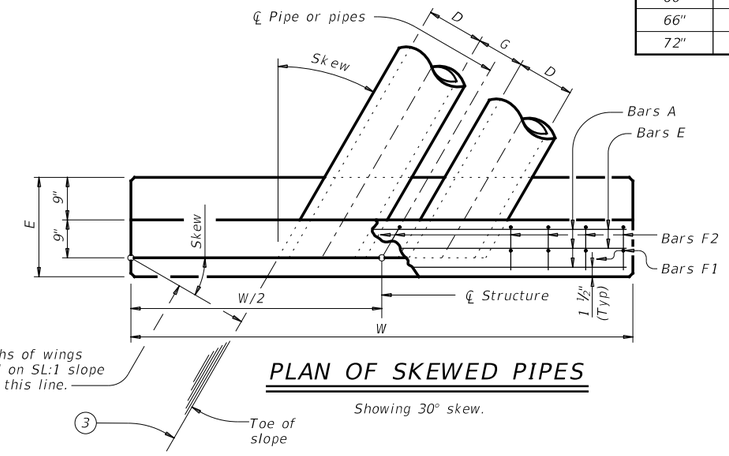
TABLE OF VARIABLE DIMENSIONS AND QUANTITIES FOR ONE HEADWALL (5)

Slope	Dia of Pipe (D)	15° Skew						30° Skew						45° Skew					
		Values for One Pipe			Values To Be Added for Each Addt'l Pipe			Values for One Pipe			Values To Be Added for Each Addt'l Pipe			Values for One Pipe			Values To Be Added for Each Addt'l Pipe		
		W	Reinf (Lbs) (1)	Conc (CY) (2)	W	Reinf (Lbs) (1)	Conc (CY) (2)	W	Reinf (Lbs) (1)	Conc (CY) (2)	W	Reinf (Lbs) (1)	Conc (CY) (2)	W	Reinf (Lbs) (1)	Conc (CY) (2)	W	Reinf (Lbs) (1)	Conc (CY) (2)
2:1	12"	9' – 4"	124	1.1	1' – 9 3/4"	15	0.2	10' – 5"	130	1.2	2' – 0"	16	0.2	12' – 9"	159	1.5	2' – 5 3/4"	17	0.3
	15"	10' – 7"	136	1.3	2' – 3"	17	0.2	11' – 10"	159	1.5	2' – 6"	18	0.2	14' – 6"	191	1.8	3' – 0 3/4"	20	0.3
	18"	11' – 11"	165	1.5	2' – 9"	19	0.3	13' – 3"	174	1.7	3' – 1"	29	0.3	16' – 3"	207	2.1	3' – 9 1/4"	33	0.4
	21"	13' – 2"	203	1.9	3' – 2 1/4"	31	0.4	14' – 9"	233	2.1	3' – 6 3/4"	33	0.4	18' – 0"	276	2.6	4' – 4 1/4"	36	0.5
	24"	14' – 6"	240	2.1	3' – 8 1/4"	34	0.4	16' – 2"	251	2.4	4' – 1 3/4"	36	0.5	19' – 10"	318	2.9	5' – 0 3/4"	39	0.6
	27"	15' – 9"	258	2.5	4' – 0 3/4"	38	0.5	17' – 7"	292	2.8	4' – 6 1/4"	39	0.6	21' – 7"	342	3.4	5' – 6 1/4"	44	0.7
	30"	17' – 1"	297	2.8	4' – 5 3/4"	40	0.6	19' – 1"	311	3.1	5' – 0"	42	0.6	23' – 4"	388	3.8	6' – 1 3/4"	47	0.8
	33"	18' – 5"	320	3.3	4' – 9 3/4"	43	0.6	20' – 6"	358	3.6	5' – 4 3/4"	46	0.7	25' – 1"	439	4.4	6' – 7 1/4"	51	0.9
	36"	19' – 8"	401	4.0	5' – 3"	47	0.9	21' – 11"	422	4.5	5' – 10 3/4"	50	0.9	26' – 10"	517	5.5	7' – 2 1/4"	55	1.2
	42"	22' – 3"	476	5.0	6' – 0 3/4"	53	1.1	24' – 10"	528	5.6	6' – 8 3/4"	56	1.2	30' – 5"	634	6.9	8' – 3"	76	1.4
	48"	25' – 11"	577	6.6	6' – 9 3/4"	60	1.3	28' – 10"	637	7.3	7' – 7 1/4"	79	1.5	35' – 4"	791	9.0	9' – 3 3/4"	88	1.8
	54"	28' – 6"	711	7.8	7' – 9"	83	1.6	31' – 9"	781	8.7	8' – 8"	81	1.8	38' – 11"	958	10.7	10' – 7 1/4"	97	2.2
	60"	31' – 1"	805	9.2	8' – 6 1/4"	91	1.9	34' – 8"	881	10.2	9' – 6 1/4"	97	2.1	42' – 5"	1,113	12.5	11' – 8"	124	2.6
	66"	33' – 8"	907	10.6	9' – 0 3/4"	98	2.1	37' – 6"	1,028	11.8	10' – 1 1/4"	102	2.4	46' – 0"	1,235	14.5	12' – 4 1/4"	132	2.9
	72"	36' – 3"	1,071	12.1	9' – 8"	105	2.4	40' – 5"	1,207	13.5	10' – 9 1/4"	110	2.6	49' – 6"	1,446	16.6	13' – 2 1/4"	141	3.2
3:1	12"	13' – 6"	178	1.6	1' – 9 3/4"	15	0.2	15' – 0"	189	1.8	2' – 0"	15	0.2	18' – 5"	237	2.2	2' – 5 3/4"	17	0.2
	15"	15' – 3"	212	1.9	2' – 3"	17	0.2	17' – 0"	223	2.1	2' – 6"	17	0.3	20' – 10"	276	2.6	3' – 0 3/4"	20	0.3
	18"	17' – 1"	231	2.3	2' – 9"	19	0.3	19' – 1"	259	2.5	3' – 1"	29	0.3	23' – 4"	318	3.1	3' – 9 1/4"	32	0.4
	21"	18' – 11"	306	2.7	3' – 2 1/4"	31	0.4	21' – 1"	339	3.0	3' – 6 3/4"	33	0.4	25' – 10"	413	3.7	4' – 4 1/4"	36	0.5
	24"	20' – 8"	345	3.1	3' – 8 3/4"	35	0.4	23' – 1"	384	3.5	4' – 1 3/4"	36	0.5	28' – 3"	462	4.2	5' – 0 3/4"	40	0.6
	27"	22' – 6"	376	3.7	4' – 0 3/4"	38	0.5	25' – 1"	438	4.1	4' – 6 1/4"	39	0.6	30' – 9"	522	5.0	5' – 6 1/4"	44	0.7
	30"	24' – 4"	422	4.1	4' – 5 3/4"	40	0.6	27' – 2"	466	4.6	5' – 0"	42	0.6	33' – 3"	578	5.6	6' – 1 3/4"	47	0.8
	33"	26' – 2"	476	4.8	4' – 10"	43	0.6	29' – 2"	522	5.3	5' – 4 3/4"	46	0.7	35' – 9"	644	6.5	6' – 7 1/4"	51	0.9
	36"	27' – 11"	590	5.9	5' – 3"	47	0.8	31' – 2"	645	6.6	5' – 10 3/4"	50	0.9	38' – 2"	787	8.0	7' – 2 1/4"	56	1.2
	42"	31' – 7"	684	7.3	6' – 0 1/4"	53	1.1	35' – 3"	776	8.2	6' – 8 3/4"	56	1.2	43' – 2"	933	10.0	8' – 3"	79	1.4
	48"	36' – 9"	880	9.6	6' – 9 3/4"	61	1.3	41' – 0"	953	10.7	7' – 7 1/4"	81	1.5	50' – 2"	1,166	13.1	9' – 3 3/4"	88	1.8
	54"	40' – 5"	1,065	11.4	7' – 9"	85	1.6	45' – 0"	1,185	12.7	8' – 8"	89	1.8	55' – 2"	1,435	15.5	10' – 7 1/4"	97	2.2
	60"	44' – 0"	1,224	13.3	8' – 6 1/4"	93	1.9	49' – 1"	1,356	14.8	9' – 6 1/4"	96	2.1	60' – 1"	1,635	18.2	11' – 8"	124	2.6
	66"	47' – 7"	1,357	15.4	9' – 1"	98	2.1	53' – 1"	1,497	17.2	10' – 1 1/4"	103	2.3	65' – 1"	1,892	21.1	12' – 4 1/4"	130	2.9
	72"	51' – 3"	1,624	17.7	9' – 8"	105	2.3	57' – 2"	1,787	19.7	10' – 9 1/4"	109	2.6	70' – 0"	2,218	24.1	13' – 2 1/4"	139	3.2
4:1	12"	17' – 7"	232	2.1	1' – 9 3/4"	15	0.2	19' – 8"	259	2.4	2' – 0"	16	0.2	24' – 0"	314	2.9	2' – 5 3/4"	18	0.2
	15"	19' – 11"	272	2.5	2' – 3"	17	0.2	22' – 3"	301	2.8	2' – 6"	18	0.3	27' – 3"	361	3.5	3' – 0 3/4"	21	0.3
	18"	22' – 3"	313	3.0	2' – 9"	19	0.3	24' – 10"	344	3.3	3' – 1"	29	0.3	30' – 5"	427	4.0	3' – 9 1/4"	32	0.4
	21"	24' – 7"	407	3.6	3' – 2 1/4"	31	0.4	27' – 5"	446	4.0	3' – 6 3/4"	33	0.4	33' – 7"	549	4.9	4' – 4 1/4"	36	0.5
	24"	26' – 11"	455	4.1	3' – 8 3/4"	35	0.4	30' – 0"	499	4.5	4' – 1 3/4"	36	0.5	36' – 9"	609	5.6	5' – 0 3/4"	40	0.6
	27"	29' – 3"	514	4.8	4' – 0 3/4"	38	0.5	32' – 7"	562	5.4	4' – 6 1/4"	40	0.6	39' – 11"	703	6.6	5' – 6 1/4"	43	0.7
	30"	31' – 7"	568	5.4	4' – 5 3/4"	40	0.6	35' – 3"	620	6.0	5' – 0"	42	0.6	43' – 2"	768	7.4	6' – 1 3/4"	49	0.8
	33"	33' – 11"	634	6.2	4' – 10"	43	0.7	37' – 10"	710	7.0	5' – 4 3/4"	46	0.7	46' – 4"	848	8.5	6' – 7 1/4"	52	0.9
	36"	36' – 3"	776	7.7	5' – 3"	48	0.9	40' – 5"	868	8.6	5' – 10 3/4"	49	0.9	49' – 6"	1,058	10.6	7' – 2 1/4"	56	1.1
	42"	40' – 11"	921	9.6	6' – 0 1/4"	53	1.0	45' – 7"	1,022	10.7	6' – 8 3/4"	57	1.2	55' – 10"	1,262	13.1	8' – 3"	78	1.4
	48"	47' – 7"	1,152	12.6	6' – 10"	61	1.3	53' – 1"	1,268	14.0	7' – 7 1/4"	80	1.5	65' – 1"	1,587	17.2	9' – 3 3/4"	86	1.8
	54"	52' – 3"	1,416	14.9	7' – 9 1/4"	86	1.6	58' – 4"	1,589	16.6	8' – 8"	89	1.8	71' – 5"	1,924	20.4	10' – 7 1/4"	95	2.2
	60"	56' – 11"	1,606	17.5	8' – 6 3/4"	92	1.9	63' – 6"	1,806	19.5	9' – 6 1/4"	95	2.1	77' – 9"	2,192	23.9	11' – 8"	122	2.6
	66"	61' – 7"	1,819	20.2	9' – 0 3/4"	97	2.1	68' – 8"	2,019	22.5	10' – 1 1/4"	101	2.4	84' – 2"	2,472	27.6	12' – 4 1/4"	131	2.9
	72"	66' – 3"	2,150	23.2	9' – 8"	104	2.4	73' – 11"	2,379	25.9	10' – 9 1/4"	108	2.6	90' – 6"	2,937	31.7	13' – 2 1/4"	138	3.2
6:1	12"	25' – 11"	342	3.1	1' – 9 3/4"	15	0.2	28' – 10"	374	3.5	2' – 0"	16	0.2	35' – 4"	456	4.3	2' – 5 3/4"	17	0.2
	15"	29' – 3"	390	3.7	2' – 3"	17	0.2	32' – 7"	442	4.2	2' – 6"	18	0.2	39' – 11"	549	5.1	3' – 0 3/4"	20	0.3
	18"	32' – 7"	459	4.4	2' – 9"	20	0.3	36' – 4"	515	4.9	3' – 1"	29	0.3	44' – 7"	629	6.0	3' – 9 1/4"	33	0.4
	21"	36' – 0"	608	5.3	3' – 2 1/4"	31	0.4	40' – 2"	660	5.9	3' – 6 3/4"	33	0.4	49' – 2"	823	7.2	4' – 4 1/4"	38	0.5
	24"	39' – 4"	672	6.0	3' – 8 3/4"	35	0.4	43' – 11"	748	6.7	4' – 1 3/4"	36	0.5	53' – 9"	920	8.2	5' – 0 3/4"	42	0.6
	27"	42' – 8"	770	7.1	4' – 0 3/4"	38	0.5	47' – 8"	852	8.0	4' – 6 1/4"	41	0.5	58' – 4"	1,039	9.7	5' – 6 1/4"	45	0.7
	30"	46' – 1"	839	8.0	4' – 5 3/4"	40	0.6	51' – 5"	949	8.9	5' – 0"	44	0.6	62' – 11"	1,162	10.9	6' – 1 3/4"	48	0.8
	33"	49' – 5"	947	9.2	4' – 10"	45	0.7	55' – 2"	1,040	10.3	5' – 4 3/4"	48	0.7	67' – 6"	1,292	12.6	6' – 7 1/4"	50	0.9
	36"	52' – 10"	1,151	11.4	5' – 3"	49	0.8	58' – 11"	1,287	12.7	5' – 10 3/4"	51	1.0	72' – 1"	1,583	15.6	7' – 2 1/4"	55	1.1
	42"	59' – 6"	1,365	14.2	6' – 0 1/4"	55	1.0	66' – 5"	1,530	15.8	6' – 8 3/4"	57	1.2	81' – 4"	1,875	19.4	8' – 3"	76	1.4
	48"	69' – 4"	1,737	18.5	6' – 10"	59	1.3	77' – 4"	1,942	20.7	7' – 7 1/4"	79	1.5	94' – 9"	2,368	25.3	9' – 3 3/4"	86	1.8
	54"	76' – 1"	2,138	22.0	7' – 9 1/4"	83	1.6	84' – 10"	2,378	24.6	8' – 8"	87	1.8	103' – 11"	2,912	30.1	10' – 7 1/4"	95	2.2
	60"	82' – 10"	2,426	25.8	8' – 6 3/4"	90	1.9	92' – 5"	2,681	28.8	9' – 6 1/4"	94	2.1	113' – 2"	3,294	35.3	11' – 8"	122	2.6
	66"	89' – 7"	2,730	29.9	9' – 0 3/4"	96	2.1	99' – 11"	3,038	33.3	10' – 1 1/4"	101	2.4	122' – 4"	3,697	40.8	12' – 4 1/4"	130	2.9
	72"	96' – 3"	3,218	34.2	9' – 8"	102	2.4	107' – 5"	3,580	38.2	10' – 9 1/4"	108	2.6	131' – 6"	4,372	46.8	13' – 2 1/4"	139	3.2

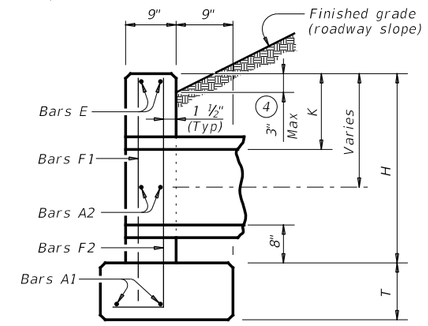


ELEVATION



PLAN OF SKEWED PIPES

Showing 30° skew.



SECTION AT CENTER OF PIPE

(1) Total quantites include one 3'–1" lap for bars over 60' in length.

(2) Quantities shown are for concrete pipe and will increase slightly for metal pipe installations.

(3) Indicated slope is perpendicular to centerline pipe or pipes.

(4) For vehicle safety, construct curbs no more than 3" above finished grade. Reduce curb heights, if necessary, to meet these requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.

(5) Dimensions shown are usual and maximum.

(6) Quantities shown are for one structure end only (one headwall).

TABLE OF CONSTANT DIMENSIONS

Dia of Pipe (D)	G	K (5)	H	T	E
12"	0' – 9"	1' – 0"	2' – 8"	0' – 9"	1' – 9"
15"	0' – 11"	1' – 0"	2' – 11"	0' – 9"	1' – 9"
18"	1' – 2"	1' – 0"	3' – 2"	0' – 9"	1' – 9"
21"	1' – 4"	1' – 0"	3' – 5"	0' – 9"	2' – 0"
24"	1' – 7"	1' – 0"	3' – 8"	0' – 9"	2' – 0"
27"	1' – 8"	1' – 0"	3' – 11"	0' – 9"	2' – 3"
30"	1' – 10"	1' – 0"	4' – 2"	0' – 9"	2' – 3"
33"	1' – 11"	1' – 0"	4' – 5"	0' – 9"	2' – 6"
36"	2' – 1"	1' – 0"	4' – 8"	1' – 0"	2' – 6"
42"	2' – 4"	1' – 0"	5' – 2"	1' – 0"	2' – 9"
48"	2' – 7"	1' – 3"	5' – 11"	1' – 0"	3' – 0"
54"	3' – 0"	1' – 3"	6' – 5"	1' – 0"	3' – 3"
60"	3' – 3"	1' – 3"	6' – 11"	1' – 0"	3' – 6"
66"	3' – 3"	1' – 3"	7' – 5"	1' – 0"	3' – 9"
72"	3' – 4"	1' – 3"	7' – 11"	1' – 0"	4' – 0"

TABLE OF (6) REINFORCING STEEL

Bar	Size	Spa	No.
A1	#5	~	2
A2	#5	1' – 6"	~
E	#5	~	2
F	#5	1' – 0"	~

BARS F2

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

GENERAL NOTES:
Designed according to AASHTO LRFD Bridge Design Specifications.
Do not mount bridge rails of any type directly to these culvert headwalls.
This standard may not be used for wall heights, H, exceeding the values shown.

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

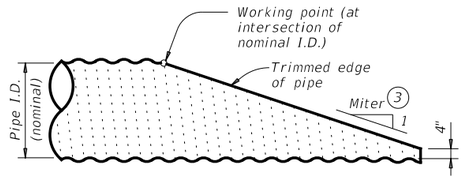
Texas Department of Transportation

Bridge Division Standard

CONCRETE HEADWALLS WITH PARALLEL WINGS FOR SKEWED PIPE CULVERTS

CH-PW-S

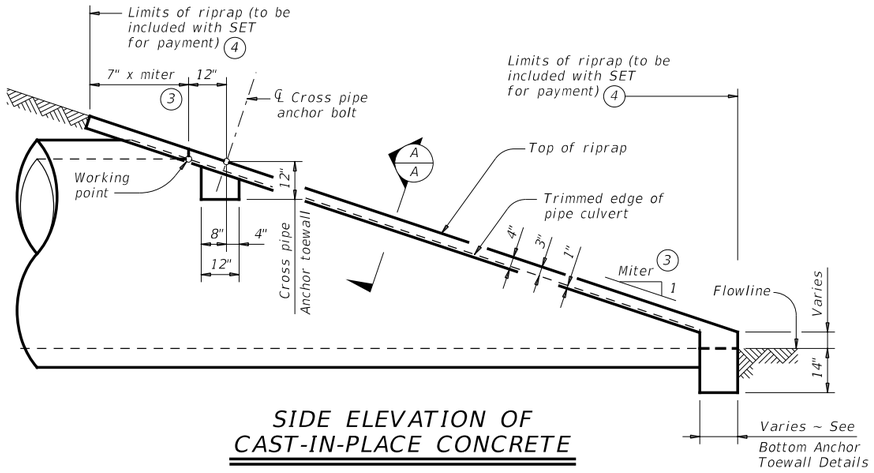
FILE: chpwsste-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020 REVISIONS	CONT	SECT	JOB	HIGHWAY
	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		128



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.

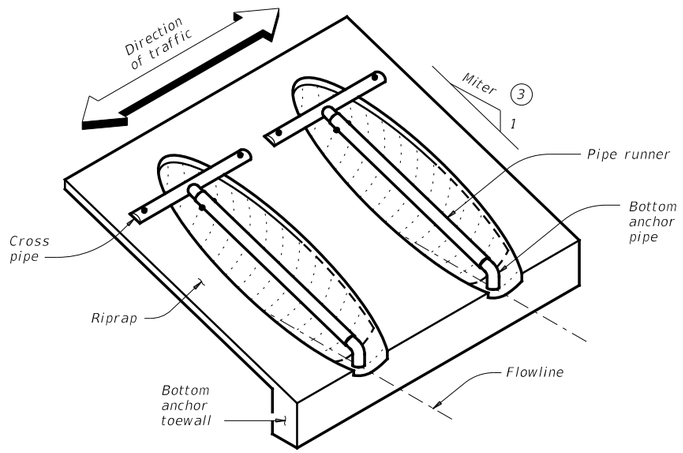
SIDE ELEVATION OF TYPICAL PIPE CULVERT MITER

(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.

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SHEET 1 OF 2

Texas Department of Transportation

Bridge Division Standard

SAFETY END TREATMENT

FOR 12" DIA TO 60" DIA
PIPE CULVERTS
TYPE II ~ CROSS DRAINAGE

SETP-CD

FILE: setpcdse-20.dgn	DN: GAF	CK: CAT	DW: JRP	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
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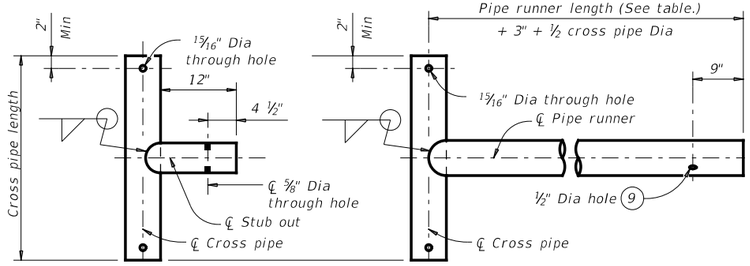
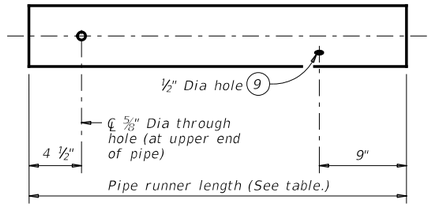


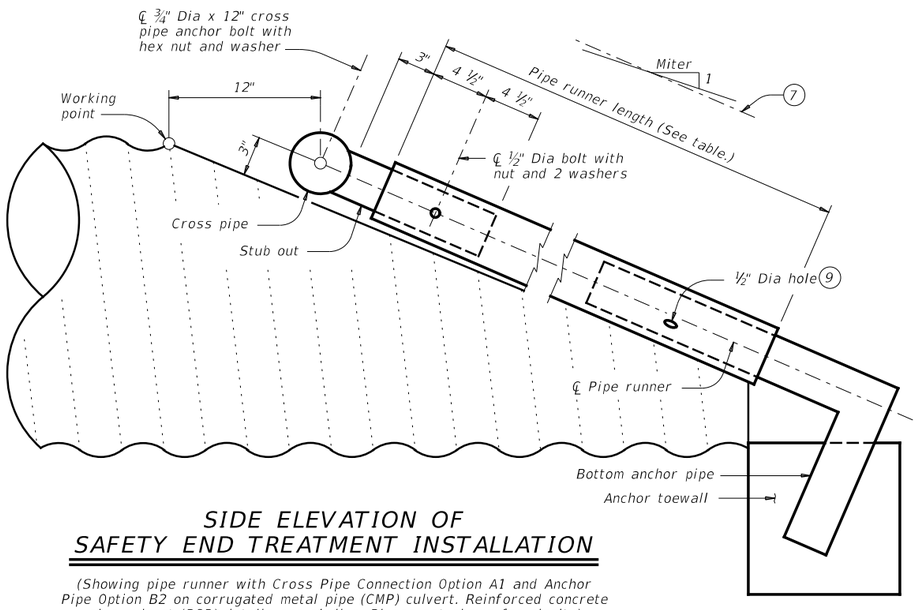
OPTION A1 OPTION A2

CROSS PIPE AND CONNECTIONS DETAILS



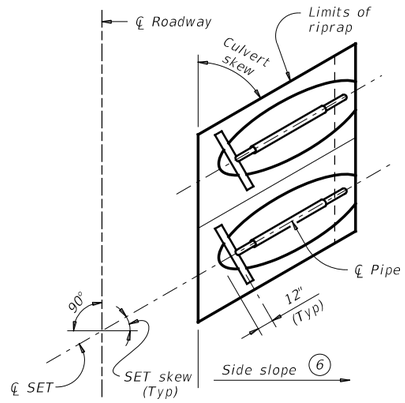
NOTE: The separate pipe runner shown is required when Cross Pipe Connection Option A1 is used.

PIPE RUNNER DETAILS

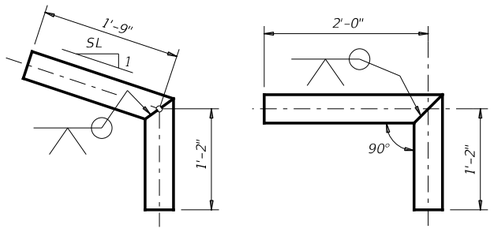


SIDE ELEVATION OF SAFETY END TREATMENT INSTALLATION

(Showing pipe runner with Cross Pipe Connection Option A1 and Anchor Pipe Option B2 on corrugated metal pipe (CMP) culvert. Reinforced concrete pipe culvert (RCP) details are similar. Riprap not shown for clarity)

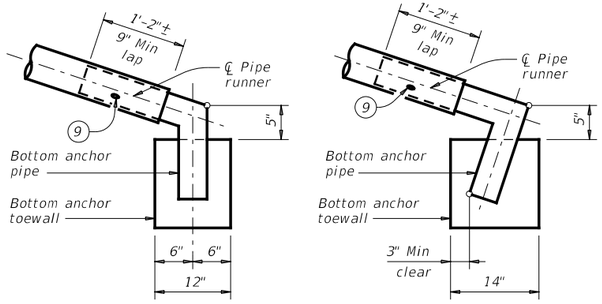


PLAN OF SKEWED INSTALLATION



OPTION B1 OPTION B2

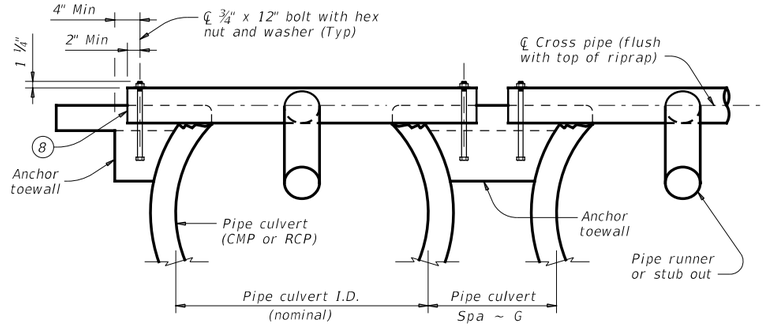
BOTTOM ANCHOR PIPE DETAILS (10)



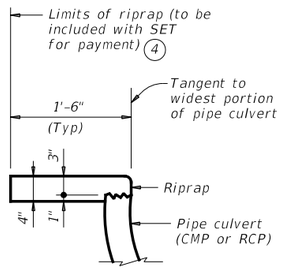
OPTION B1 OPTION B2

BOTTOM ANCHOR TOEWALL DETAILS

(Culvert and riprap not shown for clarity.)



SHOWING CROSS PIPE AND ANCHOR TOEWALL



SHOWING TYPICAL PIPE CULVERT AND RIPRAP

SECTION A-A

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

(6) Recommended values of side slope are 3:1, 4:1, and 6:1. All quantities, calculations, and dimensions shown herein are based on these recommended values. Slope of 3:1 or flatter is required for vehicle safety.

(7) Note that actual slope of pipe runner may vary slightly from side slope of riprap and trimmed culvert pipe edge.

(8) Ensure that riprap concrete does not flow into the cross pipe so as to permit disassembly of the bolted connection to allow cleanout access.

(9) After installation, inspect the 1/2" hole to ensure that the lap of the pipe runner with the bottom anchor pipe is adequate.

(10) At fabricator's option, a heat bend to a smooth 5" radius or a manufactured elbow (of the same material as the runner) may be substituted for the mitered and welded joint in the bottom anchor pipe.

MATERIAL NOTES:

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

Provide pipe runners, cross pipes, and anchor pipes conforming to the requirements of ASTM A53 (Type E or S, Gr B), ASTM A500 Gr B, or API 5LX52.

Provide ASTM A307 bolts and nuts.

Galvanize all steel components, except concrete reinforcing, after fabrication.

Repair galvanizing damaged during transport or construction in accordance with the specifications.

GENERAL NOTES:

Pipe runners are designed for a traversing load of 1,800 pounds at yield as recommended by Research Report 280-1, "Safety Treatment of Roadside Cross-Drainage Structures", Texas Transportation Institute, March 1981.

Safety end treatments (SET) shown herein are intended for use in those installations where out of control vehicles are likely to traverse the openings approximately perpendicular to the pipe runners.

Payment for riprap and toewall is included in the price bid for each safety end treatment.

Construct concrete riprap and all necessary inverts in accordance with the requirements of Item 432, "Riprap".

SHEET 2 OF 2

Texas Department of Transportation — Bridge Division Standard

SAFETY END TREATMENT

FOR 12" DIA TO 60" DIA PIPE CULVERTS
TYPE II ~ CROSS DRAINAGE

SETP-CD

FILE: setpcdse-20.dgn	DN: GAF	CK: CAT	DW: JRP	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
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	AUS	HAYS		130

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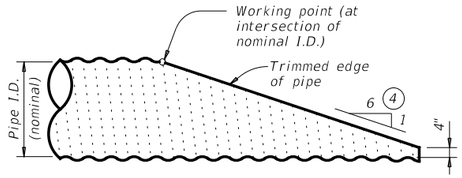
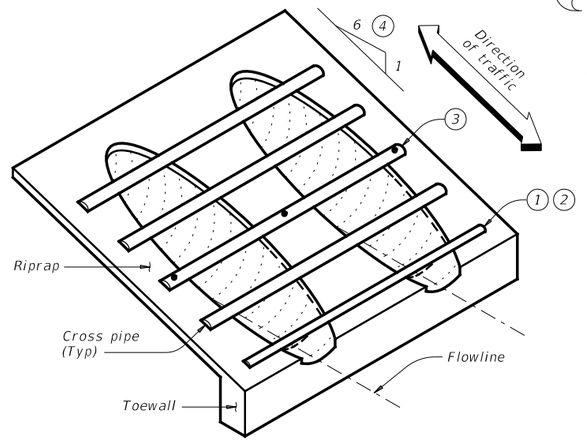


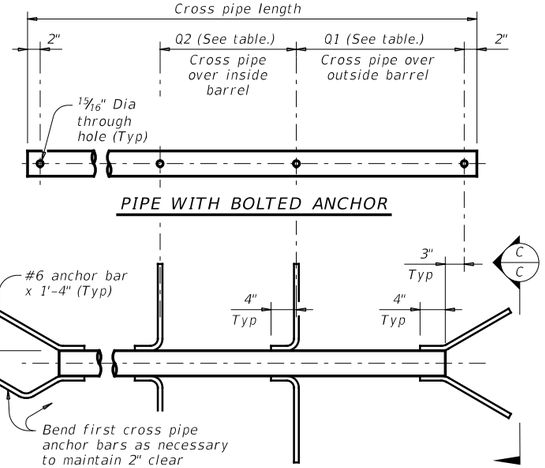
NOTE: All cross pipes, calculations, and dimensions are based on the pipe culverts mitered as shown in this detail. Alternate styles of mitered ends will require that appropriate adjustments be made to the values presented on this standard.

SIDE ELEVATION OF TYPICAL PIPE CULVERT MITER

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

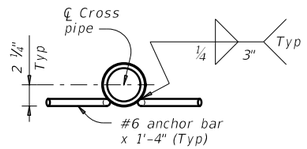


ISOMETRIC VIEW OF TYPICAL INSTALLATION



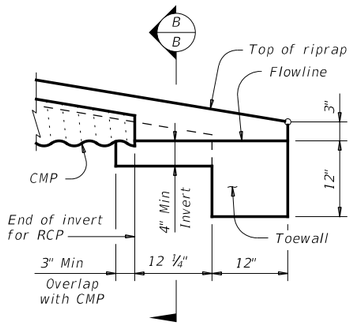
PIPE WITH BOLTED ANCHOR

PIPE WITH ANCHOR BARS



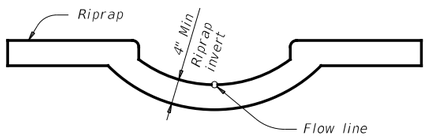
SECTION C-C

CROSS PIPE DETAILS



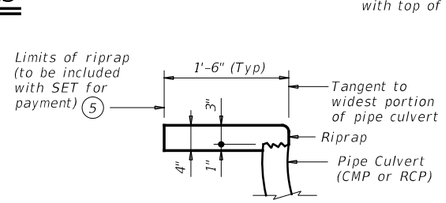
DETAIL "A"

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

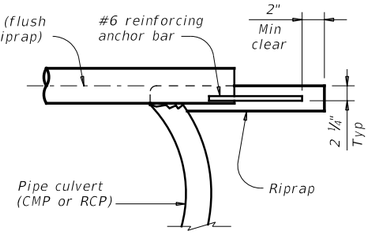


SECTION B-B

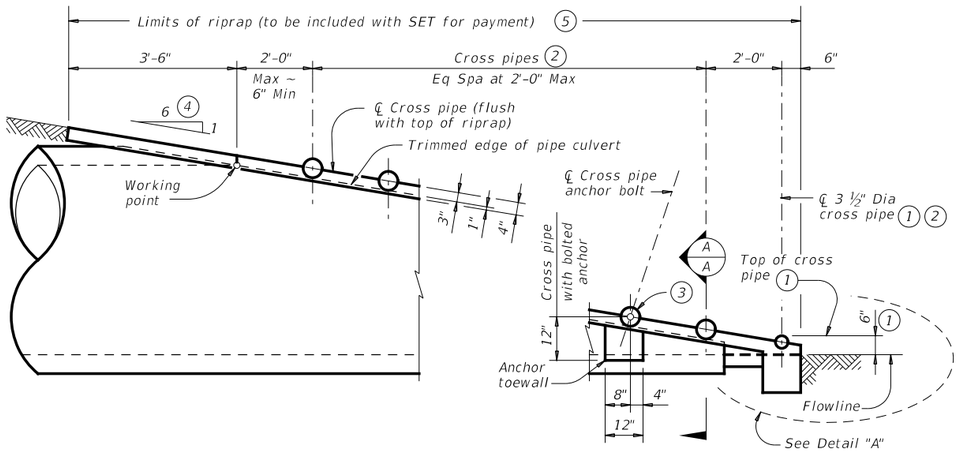
(Cross pipes not shown for clarity.)



SHOWING TYPICAL PIPE CULVERT AND RIPRAP

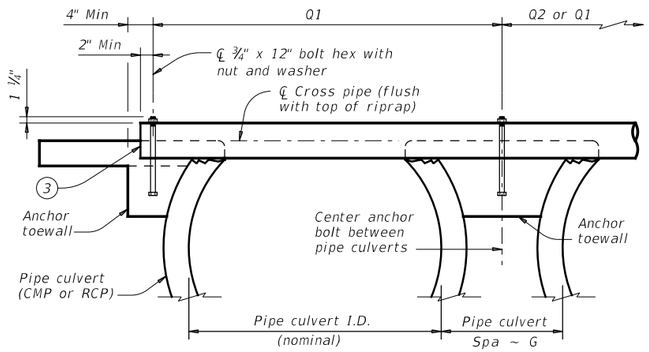


SHOWING CROSS PIPE WITH ANCHOR BAR



SIDE ELEVATION OF CAST-IN-PLACE CONCRETE

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



SHOWING CROSS PIPE WITH BOLTED ANCHOR

SECTION A-A

CROSS PIPE LENGTHS, REQUIRED PIPE SIZES, AND RIPRAP QUANTITIES (2)

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

(1) The proper installation of the first cross pipe is critical for vehicle safety. Place the top of the first cross pipe no more than 6" above the flow line.

(2) Provide cross pipes, except the first bottom pipe, of the size shown in the table. Provide a 3 1#2" standard pipe (4" O.D.) for the first bottom pipe.

(3) Install the third cross pipe from the bottom of the culvert using a bolted connection. Ensure that riprap concrete does not flow into the cross pipe so as to permit disassembly of the bolted connection to allow cleanout access. At the Contractor's option, install all other cross pipes using the bolted connection details.

(4) Match cross slope as shown elsewhere in the plans. Cross slope of 6:1 or flatter is required for vehicle safety.

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

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

MATERIAL NOTES:

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

Provide cross pipes that meet the requirements of ASTM A53 (Type E or S, Gr B), ASTM A500 (Gr B), or API 5LX52.

Provide ASTM A307 bolts and nuts.

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

GENERAL NOTES:

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

Safety end treatments (SET) shown herein are intended for use in those installations where out of control vehicles are likely to traverse the openings approximately perpendicular to the cross pipes.

Construct concrete riprap and all necessary inverts in accordance with the requirements of Item 432, "Riprap".

Payment for riprap and toewall is included in the Price Bid for each Safety End Treatment.

Texas Department of Transportation

Bridge Division Standard

SAFETY END TREATMENT

FOR 12" DIA TO 72" DIA PIPE CULVERTS TYPE II ~ PARALLEL DRAINAGE

SETP-PD

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©TxDOT February 2020 REVISIONS	CONT	SECT	JOB	HIGHWAY
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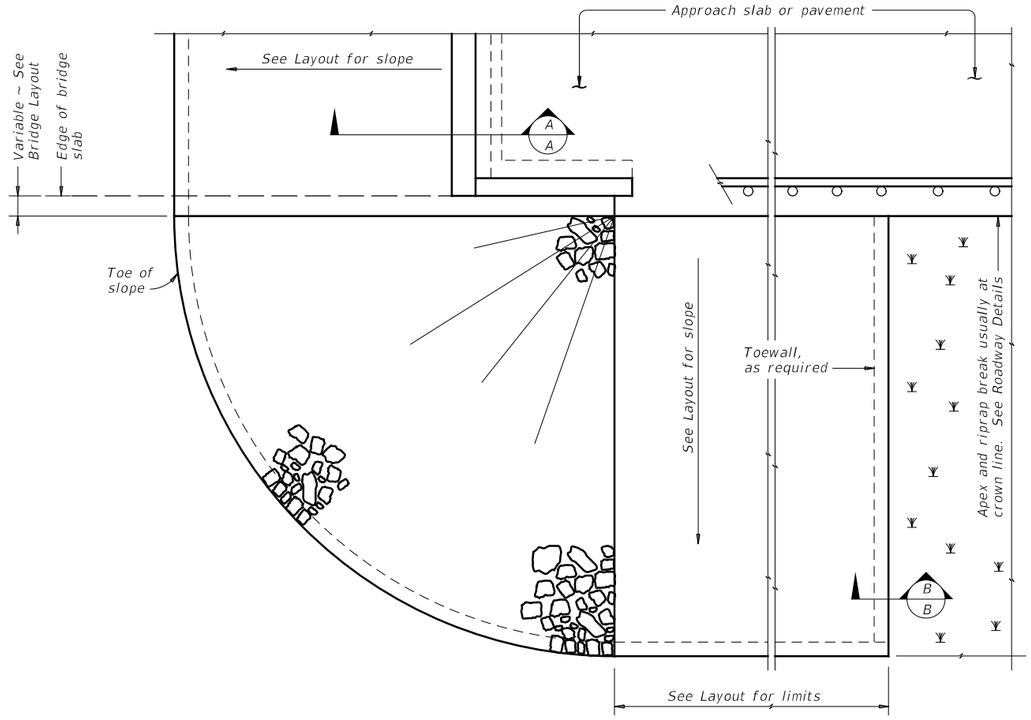
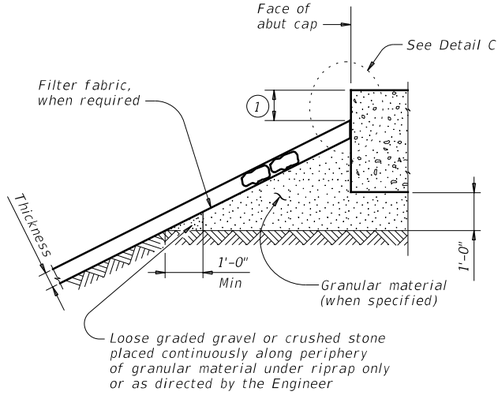
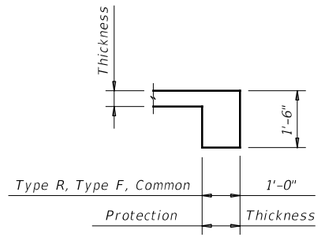


PLAN

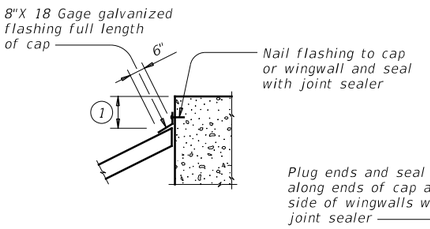


SECTION A-A AT CAP

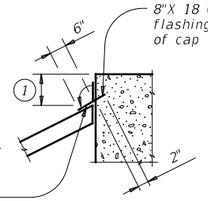


SECTION B-B

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

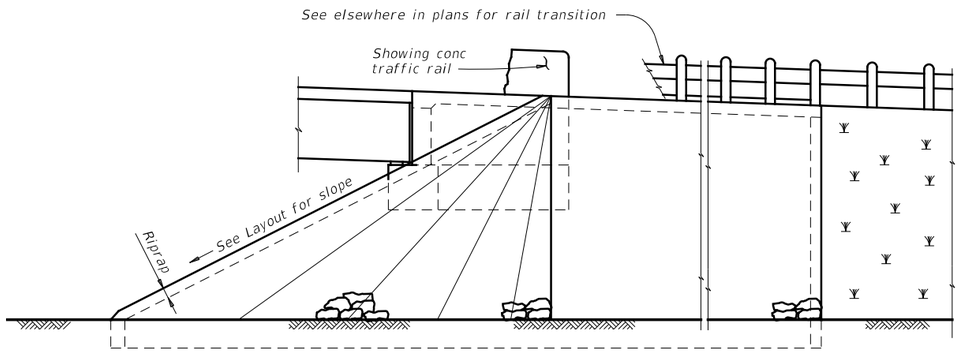


CAP OPTION A



CAP OPTION B

DETAIL C



ELEVATION

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

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

Texas Department of Transportation

Bridge Division Standard

STONE RIPRAP

SRR

FILE: srrstde1-19.dgn	DN: AES	CK: JGD	DW: BWH	CK: AES
©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY
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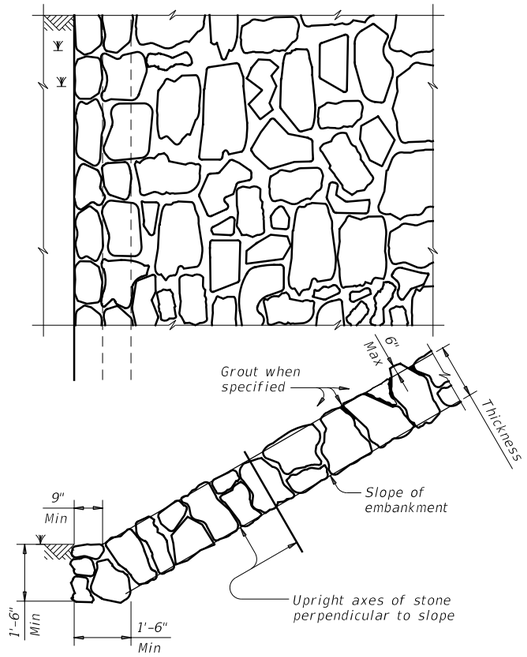


FIGURE 1 ~ TYPE R STONE RIPRAP

dry or grouted

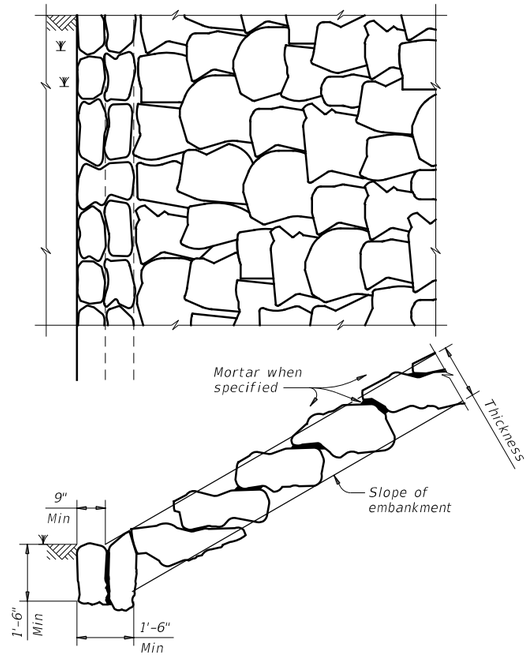


FIGURE 2 ~ TYPE F STONE RIPRAP

dry or mortared

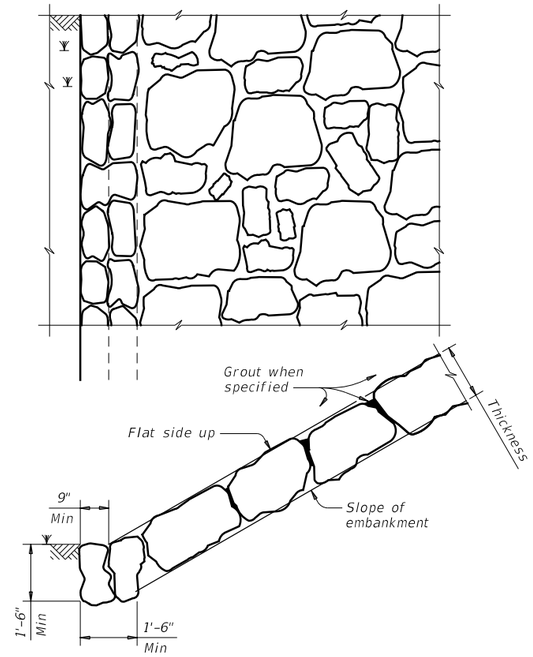


FIGURE 3 ~ TYPE F STONE RIPRAP

grouted

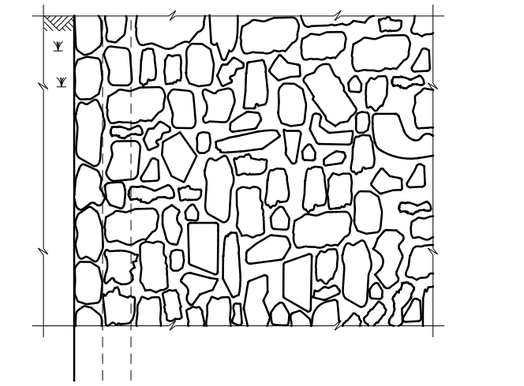


FIGURE 4 ~ COMMON STONE RIPRAP

dry or grouted

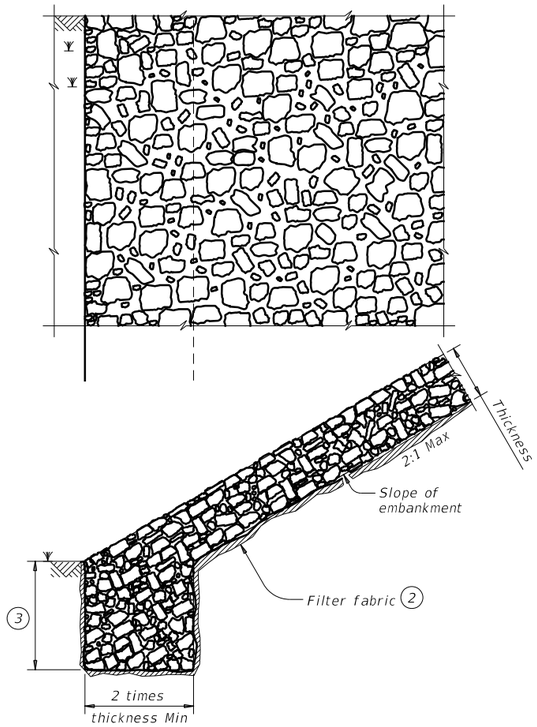


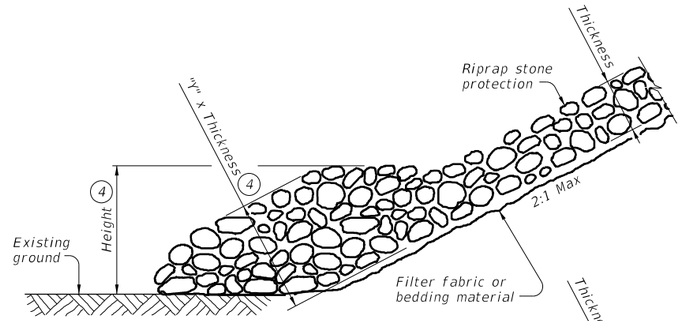
FIGURE 5 ~ PROTECTION STONE RIPRAP (5)

(2) Provide bedding material instead of filter fabric if shown elsewhere in plans. See Layout for thickness of bedding material.

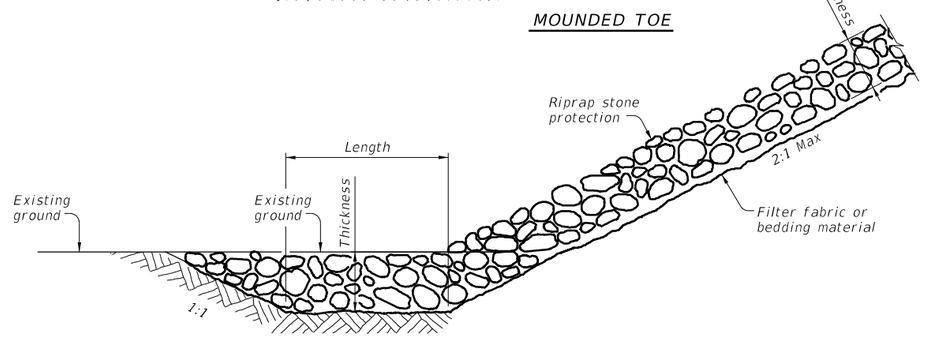
(3) Minimum toe depth is the larger of the maximum scour depth or 2 times the riprap thickness.

(4) "Y" and Height need to be defined. See layout or detail sheet for values if this option is used.

(5) List Stone Protection as size (XX inch) and thickness (YY inch) on the layout.
Example: Riprap (Stone Protection) XX inch, Thickness = YY inch.



MOUNDED TOE



EXTENDED ROCK FILLED TRENCH

PROTECTION STONE RIPRAP TOE OPTIONS (5)

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SHEET 2 OF 2

Texas Department of Transportation

Bridge Division Standard

STONE RIPRAP

SRR

FILE: srrstde1-19.dgn	DN: AES	CK: JGD	DW: BWH	CK: AES
©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY
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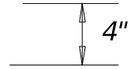
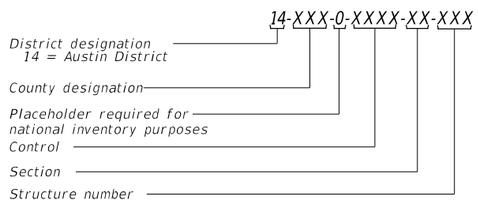
14-XXX-0-XXXX-XX-XXX

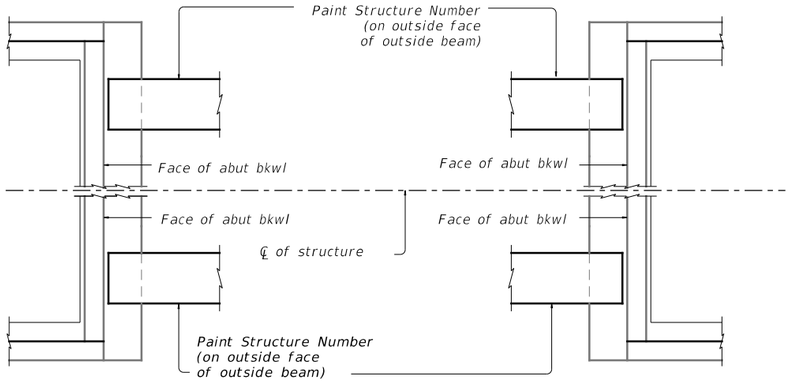


District designation	County designation	Placeholder	Control	Section	Structure number

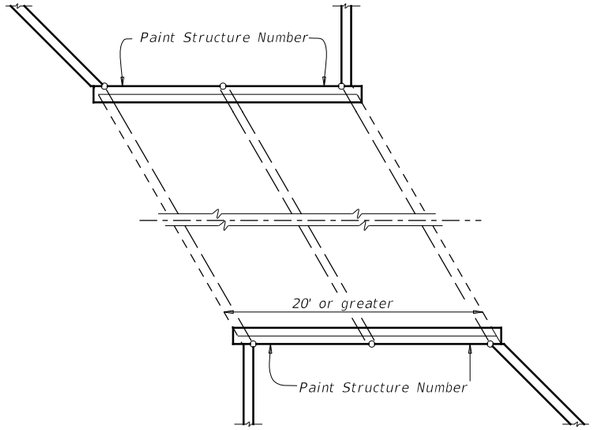
PAINTED STRUCTURE NUMBER LEGEND



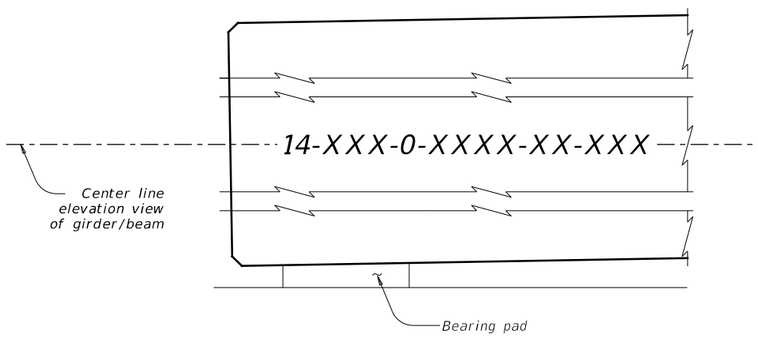
011 = Bastrop
016 = Blanco
027 = Burnet
028 = Caldwell
087 = Gillespie
106 = Hays
144 = Lee
150 = Llano
157 = Mason
227 = Travis
246 = Williamson



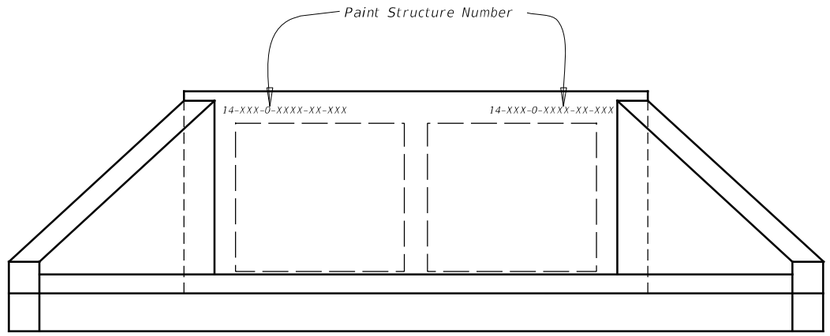
AT BRIDGE LOCATIONS



AT CULVERT LOCATIONS



ELEVATION VIEW DETAIL



ELEVATION VIEW DETAIL

GENERAL NOTES:

Permanently mark each structure with the painted structure number in accordance with the plans.

Each Structure shall have 4 (four) Structure numbers painted per structure.

Painting structure number work will not be measured or paid for directly but will be considered subsidiary to other pertinent items.

MATERIAL:

Provide black, lead free, CFC free, and CFHC free paint that is water proof, weather resistant, and dries instantly on all surfaces without smearing, smudging, or rippling

Texas Department of Transportation

Austin District Standard

PAINTING STRUCTURE NUMBERS

PSN-19 (AUS)

©TxDOT®YEAR®	CONT	SECT	JOB	HIGHWAY
	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		134

DATE: 11/17/2023 5:08:35 PM
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DATE: 11/17/2023 5:08:37 PM
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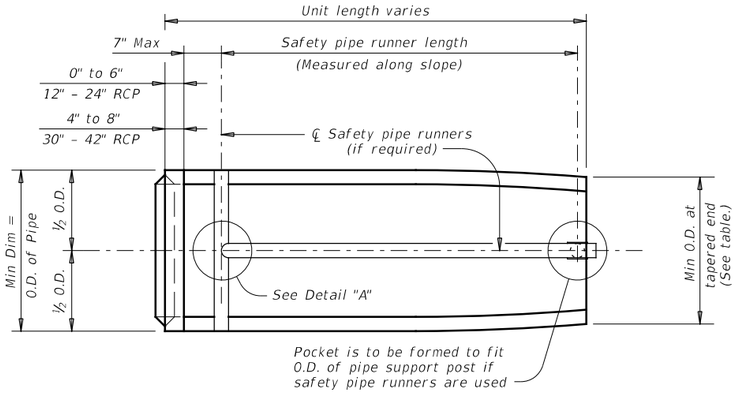
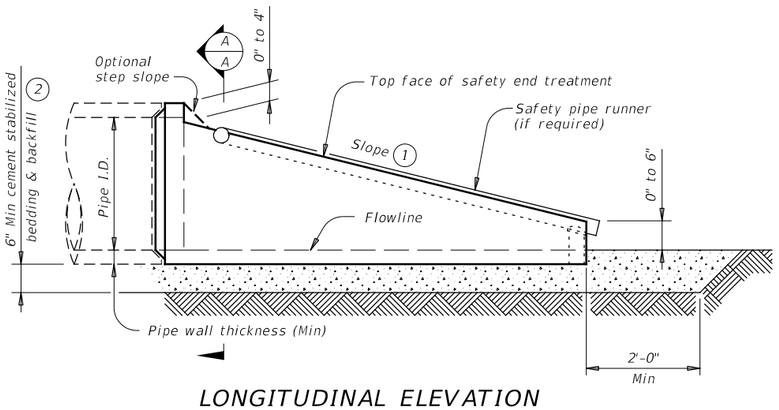


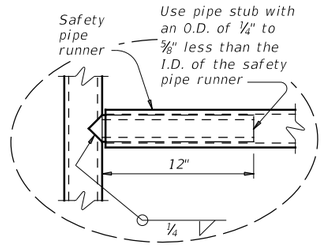
PLAN VIEW

(Showing spigot end connection.)

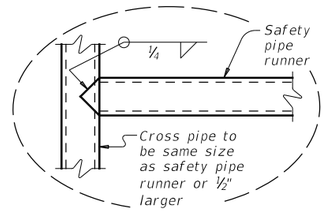


LONGITUDINAL ELEVATION

(Showing spigot end connection.)

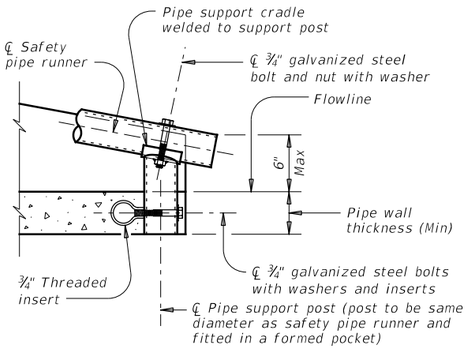


OPTION A



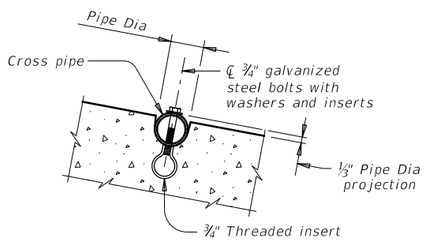
OPTION B

DETAIL A



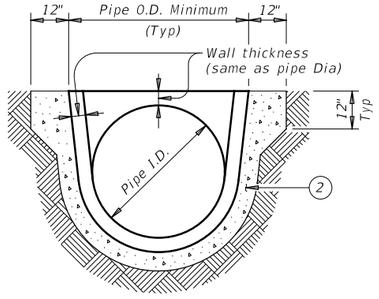
END DETAIL FOR INSTALLATION OF SAFETY PIPE RUNNERS

(If required)

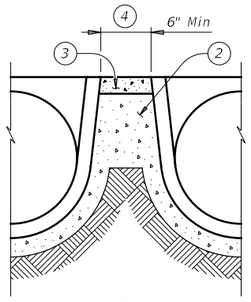


INSTALLATION DETAIL FOR SAFETY PIPE RUNNERS

(If required)



SECTION A-A



MULTIPLE PIPE INSTALLATION

MAX SAFETY PIPE RUNNER LENGTHS AND REQUIRED SAFETY PIPE RUNNER SIZES

Max Safety Pipe Runner Length	Required Pipe Runner Size		
	Pipe Size	Pipe O.D.	Pipe I.D.
11' – 2"	3" STD	3.500"	3.068"
15' – 6"	3 ½" STD	4.000"	3.548"
20' – 10"	4" STD	4.500"	4.026"
35' – 4"	5" STD	5.563"	5.047"

(1) Slope as shown elsewhere in the plans. Slope of 3:1 or flatter is required for vehicle safety.

(2) Provide cement stabilized bedding and backfill in accordance with the Item, "Excavation and Backfill for Structures". Bedding and backfill is considered subsidiary to the Item "Safety End Treatment". When concrete riprap is specified around the safety end treatment, backfill as directed by Engineer.

(3) Fill the top 4" of void between precast end treatments with concrete riprap. Concrete riprap be considered subsidiary to the Item "Safety End Treatment".

(4) Adjust clear distance between pipes to provide for the minimum distance between safety end treatments.

REQUIREMENTS FOR CULVERT PIPES AND SAFETY PIPE RUNNERS

Pipe I.D.	Min Wall Thickness	Min O.D.	Min O.D. at Tapered End	Min Reinf Requirements (sq. in. / ft. of pipe)	Slope	Minimum Length of Unit	Single Pipe		Multiple Pipe	
							Skew	Pipe Runners Required	Skew	Pipe Runners Required
12"	2"	16"	16"	0.07 Circ.	3:1	2' – 0"	≤ 45°	No	≤ 45°	No
					4:1	2' – 8"				
					6:1	4' – 0"				
15"	2 ¼"	19 ½"	19"	0.07 Circ.	3:1	2' – 10"	≤ 45°	No	≤ 45°	No
					4:1	3' – 9"				
					6:1	5' – 8"				
18"	2 ½"	23"	21 ½"	0.07 Circ.	3:1	3' – 8"	≤ 45°	No	≤ 45°	No
					4:1	4' – 10"				
					6:1	7' – 3"				
24"	3"	30"	27"	0.07 Circ.	3:1	5' – 3"	≤ 45°	No	≤ 30°	No
					4:1	7' – 0"			> 30°	Yes
					6:1	10' – 6"				
30"	3 ½"	37"	31"	0.18 Circ.	3:1	6' – 3"	≤ 15°	No	≤ 15°	No
					4:1	8' – 2"	> 15°	Yes	> 15°	Yes
					6:1	12' – 1"				
36"	4"	44"	36"	0.19 Ellip.	3:1	7' – 10"	= 0°	No	≥ 0°	Yes
					4:1	10' – 4"	> 0°	Yes		
					6:1	15' – 4"				
42"	4 ½"	51"	41 ½"	0.23 Ellip.	3:1	9' – 6"	≥ 0°	Yes	≥ 0°	Yes
					4:1	12' – 6"				
					6:1	18' – 7"				

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 safety pipe runners, cross pipes, pipe support posts, and pipe stubs meeting the requirements of ASTM A53 (Type E or S, Gr B), ASTM A500 Gr B, or API 5LX52.

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

GENERAL NOTES:

Precast safety end treatment for reinforced concrete pipe (CRP) may be used for TYPE II end treatment as specified in Item 467, "Safety End Treatment".

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

Manufacture precast concrete end sections in accordance with Item 464, "Reinforced Concrete Pipe" and in accordance with ASTM Specification C-76, Class III, Wall B for circular pipe.

Provide precast concrete end sections with a spigot or bell end for compatibility to upstream or downstream end conditions with sufficient annular space to allow for grout, mortar, cold applied asphalt joint compound or pre-formed plastic gasket material.

Methods of lifting shall be provided by the manufacturer for ease of loading, unloading, and installation.

Pipe runners are designed for a traversing load of 1,800 Lbs at yield as recommended by Research Report 280-1, "Safety Treatment of Roadside Cross-Drainage Structures", Texas Transportation Institute, March 1981.

Texas Department of Transportation

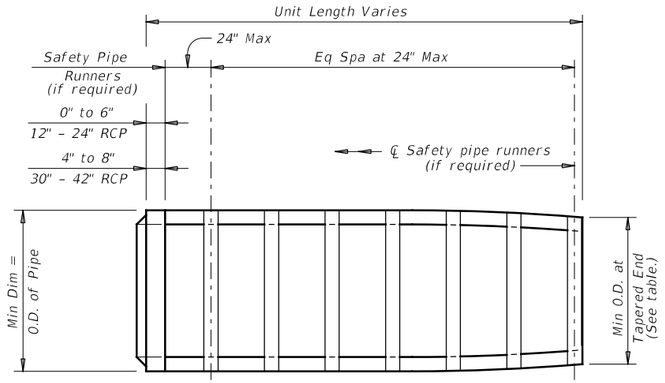
Bridge Division Standard

PRECAST SAFETY END TREATMENT

TYPE II ~ CROSS DRAINAGE

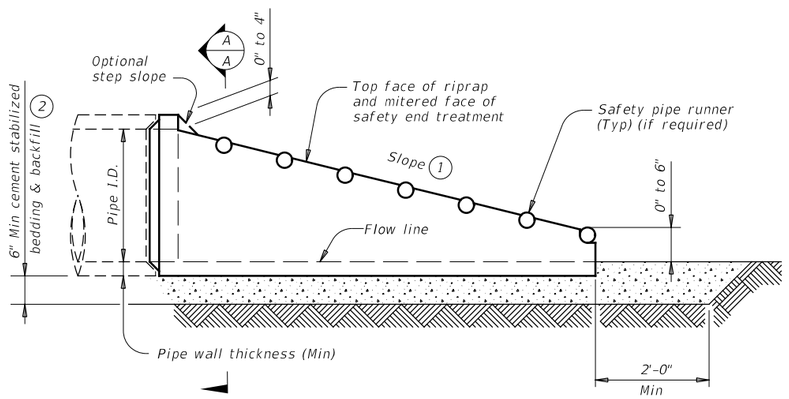
PSET-RC

FILE: psetrcss-20.dgn	DN: RLW	CK: KLR	DW: JTR	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		135



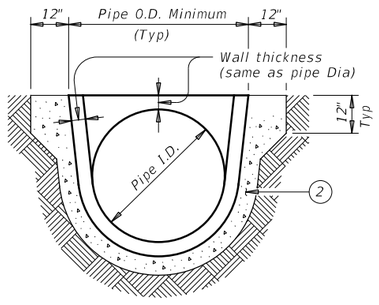
PLAN VIEW – 12" THRU 24"

(Showing spigot end connection.)

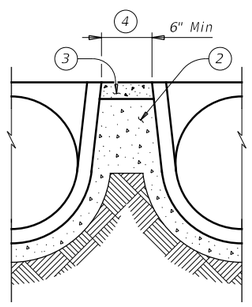


LONGITUDINAL ELEVATION - 12" THRU 24"

(Showing spigot end connection.)



SECTION A-A



MULTIPLE PIPE INSTALLATION

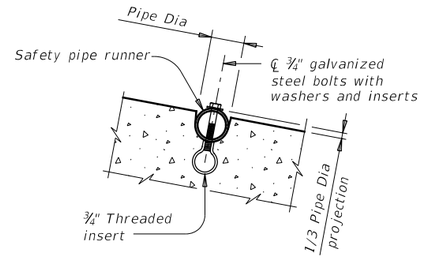
(1) Slope as shown elsewhere in the plans. Slope of 6:1 or flatter is required for vehicle safety.

(2) Provide cement stabilized bedding and backfill in accordance with the Item, "Excavation and Backfill for Structures". Bedding and backfill is considered subsidiary to the Item 467, "Safety End Treatment". When concrete riprap is specified around the safety end treatment, backfill as directed by Engineer.

(3) Fill the top 4" of void between precast end treatments with concrete riprap. Concrete riprap is considered subsidiary to the Item 467, "Safety End Treatment".

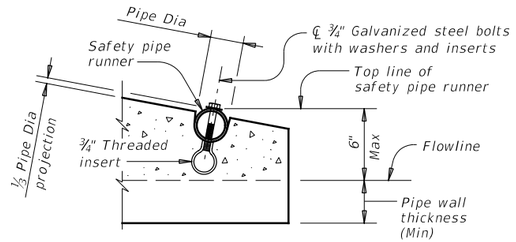
(4) Adjust clear distance between pipes to provide for the minimum distance between safety end treatments.

(5) Safety pipe runners are required for multiple pipe culverts with more than two pipes.

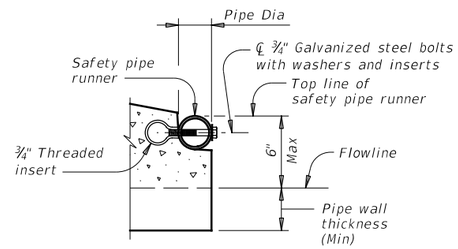


INSTALLATION DETAIL FOR SAFETY PIPE RUNNERS

(If required)



OPTION A



OPTION B

END DETAILS FOR INSTALLATION OF SAFETY PIPE RUNNERS

(If required)

REQUIREMENTS FOR CULVERT PIPES AND SAFETY PIPE RUNNERS

Pipe I.D.	Min Wall Thickness	Min O.D.	Min O.D. at Tapered End	Min Reinf Requirements (sq. in. per ft. of Pipe)	Max Slope	Min Length of Unit	Pipe Runner Requirements		Required Pipe Runner Sizes		
							Single Pipe	Multiple Pipe	Nominal Dia	O.D.	I.D.
12"	2"	16"	16"	0.07 Circ.	6:1	4'-0"	No	(5)	3" STD	3.500"	3.068"
15"	2 ¼"	19 ½"	19"	0.07 Circ.	6:1	5'-8"	No	(5)	3" STD	3.500"	3.068"
18"	2 ½"	23"	21 ½"	0.07 Circ.	6:1	7'-3"	No	(5)	3" STD	3.500"	3.068"
24"	3"	30"	27"	0.07 Circ.	6:1	10'-6"	No	(5)	3" STD	3.500"	3.068"
30"	3 ½"	37"	31"	0.18 Circ.	6:1	12'-1"	No	Yes	4" STD	4.500"	4.026"
36"	4"	44"	36"	0.19 Ellip.	6:1	15'-4"	Yes	Yes	4" STD	4.500"	4.026"
42"	4 ½"	51"	41 ½"	0.23 Ellip.	6:1	18'-7"	Yes	Yes	4" STD	4.500"	4.026"

MATERIAL NOTES:

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

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

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

GENERAL NOTES:

Precast safety end treatment for reinforced concrete pipe (RCP) may be used for TYPE II end treatment as specified in Item 467, "Safety End Treatment".

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

Manufacture precast concrete end sections in accordance with Item 464, "Reinforced Concrete Pipe" and in accordance with ASTM Specification C-76, Class III, Wall B for circular pipe.

Provide precast concrete end sections with a spigot or bell end for compatibility to upstream or downstream end conditions with sufficient annular space to allow for grout, mortar, cold applied asphalt joint compound or pre-formed plastic gasket material.

Methods of lifting shall be provided by the manufacturer for ease of loading, unloading and installation.

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

Texas Department of Transportation

Bridge Division Standard

PRECAST SAFETY END TREATMENT

TYPE II ~ PARALLEL DRAINAGE

PSET-RP

FILE: psetrpss-20.dgn	DN: RLW	CK: KLR	DW: JTR	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		136

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DATE: 11/17/2023 5:08:42 PM
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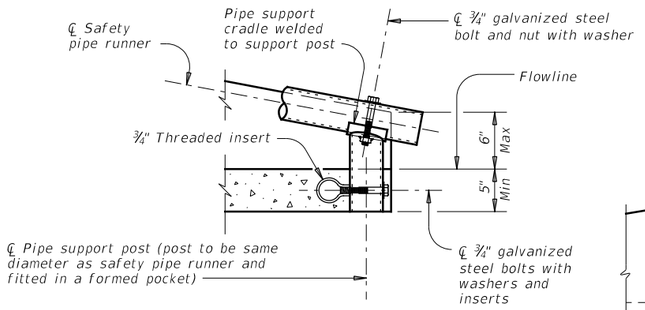
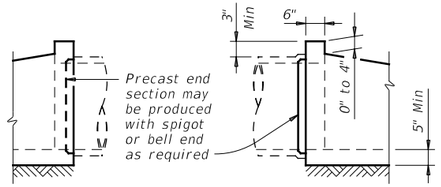
REQUIREMENTS FOR CULVERT PIPES AND SAFETY PIPE RUNNERS

Pipe I.D.	RCP Wall "B" Thickness	TP Wall Thickness (8)	"D" (1)	Slope	Min Length of Unit	Single Pipe		Multiple Pipes	
						Skew	Pipe Runners Required	Skew	Pipe Runners Required
12"	2"	1.15"	17.00"	3:1	2' – 11"	≤ 45°	No	≤ 45°	No
				4:1	3' – 6"				
				6:1	4' – 9"				
15"	2 ¼"	1.30"	20.50"	3:1	3' – 8"	≤ 45°	No	≤ 45°	No
				4:1	4' – 7"				
				6:1	6' – 5"				
18"	2 ½"	1.60"	24.00"	3:1	4' – 6"	≤ 45°	No	≤ 45°	No
				4:1	5' – 8"				
				6:1	8' – 0"				
24"	3"	1.95"	31.00"	3:1	6' – 2"	≤ 45°	No	= 30°	No
				4:1	7' – 10"			> 30°	Yes
				6:1	11' – 3"				
30"	3 ½"	2.65"	38.50"	3:1	7' – 10"	= 15°	No	= 15°	No
				4:1	10' – 1"	> 15°	Yes	> 15°	Yes
				6:1	14' – 8"				
36"	4"	2.75"	45.50"	3:1	9' – 5"	= 0°	No	≥ 0°	Yes
				4:1	12' – 3"	> 0°	Yes		
				6:1	17' – 11"				
42"	4 ½"	2.7"	52.50"	3:1	11' – 1"	≥ 0°	Yes	≥ 0°	Yes
				4:1	14' – 5"				
				6:1	21' – 2"				



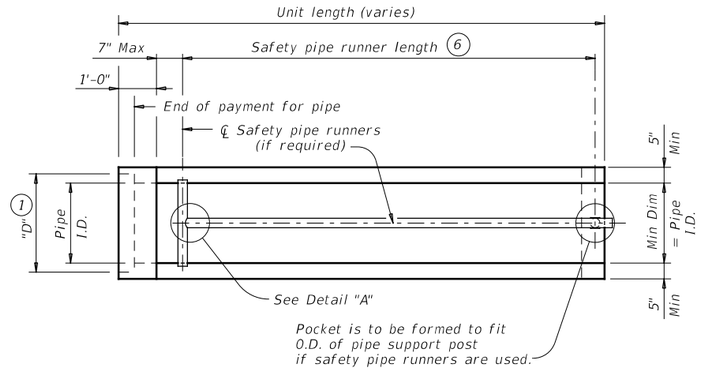
END DETAIL FOR INSTALLATION OF SAFETY PIPE RUNNERS

(If required)



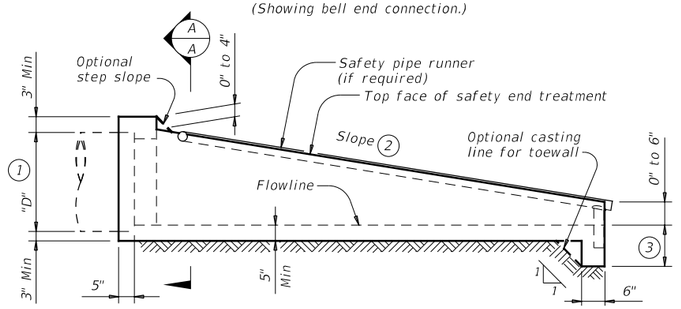
OPTIONAL JOINT FOR RCP

(Showing joint between RCP and precast safety end treatment)



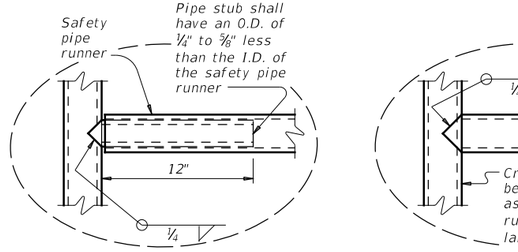
PLAN

(Showing bell end connection.)



LONGITUDINAL ELEVATION

(Showing bell end connection.)

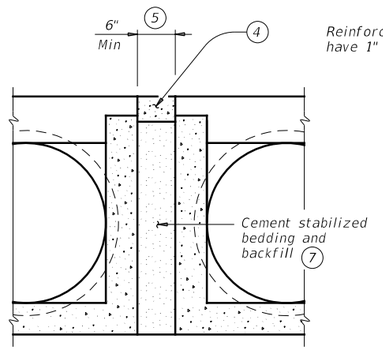


OPTION A

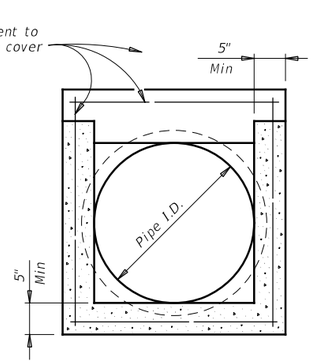
DETAIL A

(If required)

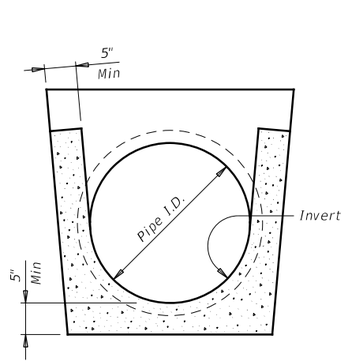
OPTION B



MULTIPLE PIPE INSTALLATION

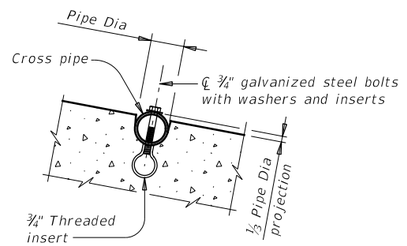


OPTION WITH SQUARE BOTTOM



OPTION WITH INVERT BOTTOM

SECTION A-A



INSTALLATION DETAIL FOR SAFETY PIPE RUNNERS

(If required)

SAFETY PIPE RUNNER DIMENSIONS

Max Safety Pipe Runner Length	Required Pipe Runner Size		
	Pipe Size	Pipe O.D.	Pipe I.D.
11' – 2"	3" STD	3.500"	3.068"
15' – 6"	3 ½" STD	4.000"	3.548"
20' – 10"	4" STD	4.500"	4.026"
35' – 4"	5" STD	5.563"	5.047"

(1) Dimension "D" is based on reinforced concrete pipe (RCP) meeting the requirements of ASTM C-76, Class III, (RCP Wall "B" thickness). Adjust "D" for any other wall thickness used. For thermoplastic pipe (TP) take into account the annular space requirements for grouted connections.

(2) Slope as shown elsewhere in plans. Slope of 3:1 or flatter is required for vehicle safety.

(3) Toewall to be used only when dimension is shown elsewhere in the plans.

(4) Fill the top 4" of void between precast end treatments with concrete riprap. Concrete riprap is considered subsidiary to the Item 467, "Safety End Treatment".

(5) Adjust clear distance between pipes to provide for the minimum distance between safety end treatments.

(6) Measured along slope.

(7) Provide cement stabilized bedding and backfill in accordance with the Item 400, "Excavation and Backfill for Structures". Bedding and backfill is considered subsidiary to the Item 467, "Safety End Treatment". When concrete riprap is specified around the safety end treatment, backfill as directed by Engineer.

(8) Thermoplastic pipe wall thickness may vary. Adjust accordingly. Thermoplastic pipe requires the safety end treatments to have a bell end for grouted connections.

GENERAL NOTES:

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

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

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

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

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

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

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

Pipe runners are designed for a traversing load of 1,800 Lbs at yield as recommended by Research Report 280-1, "Safety Treatment of Roadside Cross-Drainage Structures", Texas Transportation Institute, March 1981.

Provide safety pipe runners, cross pipes, pipe support posts, and pipe stubs meeting the requirements of ASTM A53 (Type E or S, Grade B), ASTM A500 (Grade B), or API 5LX52.

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

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

Texas Department of Transportation

Bridge Division Standard

PRECAST SAFETY END TREATMENT

TYPE II ~ CROSS DRAINAGE

PSET-SC

FILE: psetscss-21.dgn	DN: RLW	CK: KLR	DW: JTR	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS 12-21: Added 42" TP	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		137

DATE: 11/17/2023 5:08:44 PM
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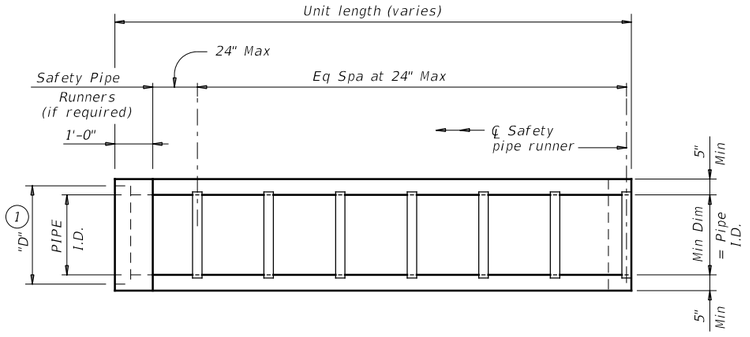
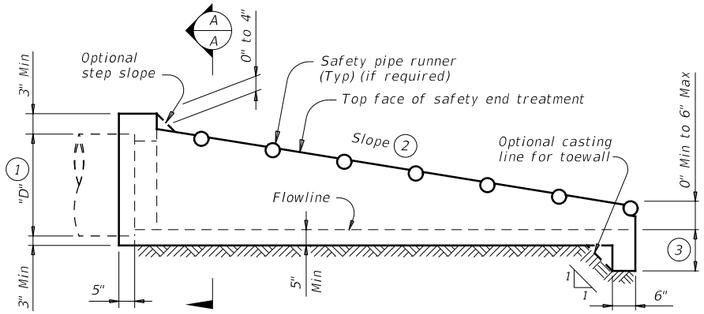


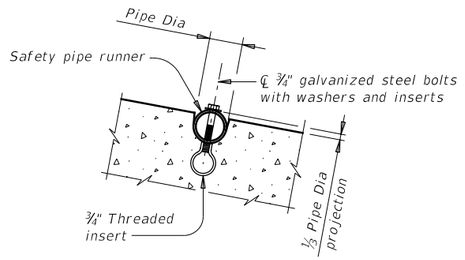
PLAN

(Showing bell end connection.)



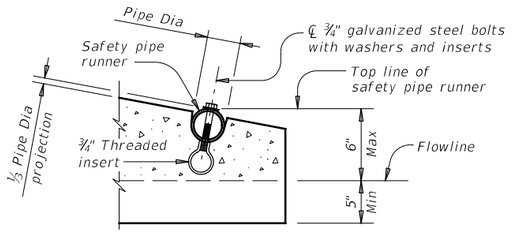
LONGITUDINAL ELEVATION

(Showing bell end connection.)

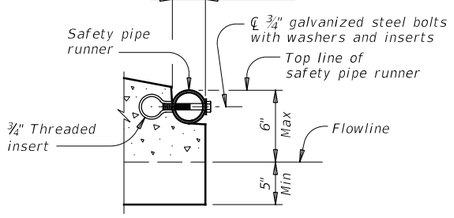


INSTALLATION DETAIL FOR SAFETY PIPE RUNNERS

(If required)



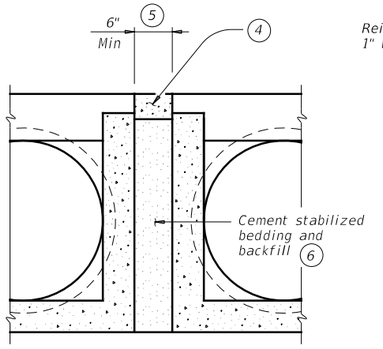
OPTION A



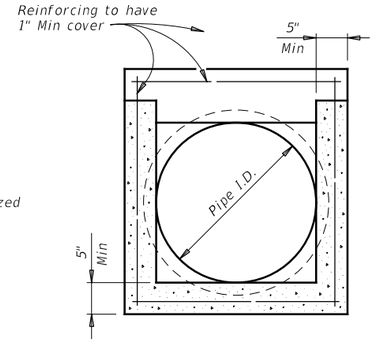
OPTION B

END DETAILS FOR INSTALLATION OF SAFETY PIPE RUNNERS

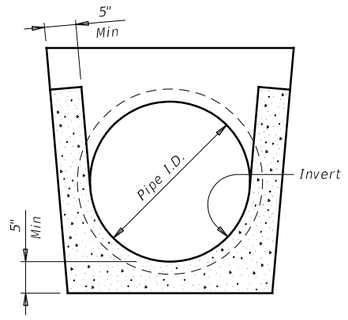
(If required)



MULTIPLE PIPE INSTALLATION

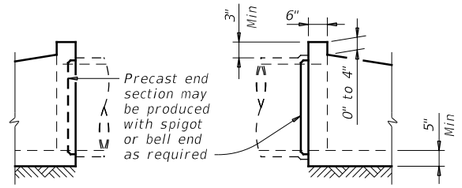


OPTION WITH SQUARE BOTTOM



OPTION WITH INVERT BOTTOM

SECTION A-A



OPTIONAL JOINT FOR RCP

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

REQUIREMENTS FOR CULVERT PIPES AND SAFETY PIPE RUNNERS

Pipe I.D.	RCP Wall "B" Thickness	TP Wall Thickness (7)	"D" (1)	Slope	Min Length	Pipe Runners Required		Required Pipe Runner Size		
						Single Pipe	Multiple Pipe	Nominal Dia.	O.D.	I.D.
12"	2"	1.15"	17.00"	6:1	4' – 9"	No	Yes, for > 2 pipes	3" STD	3.500"	3.068"
15"	2 ¼"	1.30"	20.50"	6:1	6' – 5"	No	Yes, for > 2 pipes	3" STD	3.500"	3.068"
18"	2 ½"	1.60"	24.00"	6:1	8' – 0"	No	Yes, for > 2 pipes	3" STD	3.500"	3.068"
24"	3"	1.95"	31.00"	6:1	11' – 3"	No	Yes, for > 2 pipes	3" STD	3.500"	3.068"
30"	3 ½"	2.65"	38.50"	6:1	14' – 8"	No	Yes	4" STD	4.500"	4.026"
36"	4"	2.75"	45.50"	6:1	17' – 11"	Yes	Yes	4" STD	4.500"	4.026"
42"	4 ½"	2.7"	52.50"	6:1	21' – 2"	Yes	Yes	4" STD	4.500"	4.026"

(1) Dimension "D" is based on reinforced concrete pipe (RCP) meeting the requirements of ASTM C-76, Class III, (RCP Wall "B" thickness). Adjust "D" for any other wall thickness used. For thermoplastic pipe (TP) take into account the annular space requirements for grouted connections.

(2) Slope as shown elsewhere in the plans. Slope of 6:1 or flatter is required for vehicle safety.

(3) Toewall to be used only when dimension is shown elsewhere in the plans.

(4) Fill the top 4" of void between precast end treatments with concrete riprap. Concrete riprap is considered subsidiary to the Item 467, "Safety End Treatment".

(5) Adjust clear distance between pipes to provide for the minimum distance between safety end treatments.

(6) Provide cement stabilized bedding and backfill in accordance with the Item 400, "Excavation and Backfill for Structures". Bedding and backfill is considered subsidiary to the Item 467, "Safety End Treatment". When concrete riprap is specified around the safety end treatment, backfill as directed by Engineer.

(7) Thermoplastic pipe wall thickness may vary. Adjust accordingly. Thermoplastic pipe requires the safety end treatments to have a bell end for grouted connections.

GENERAL NOTES:

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

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

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

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

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

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

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

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

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

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

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

Texas Department of Transportation

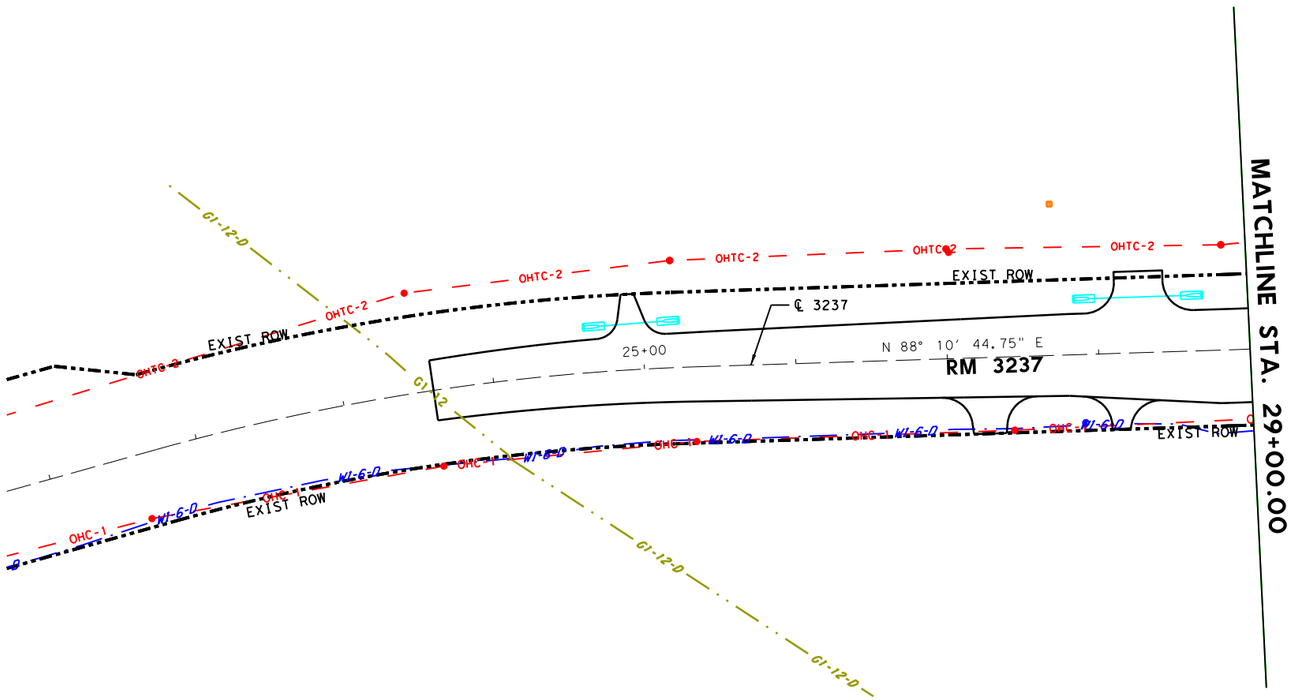
Bridge Division Standard

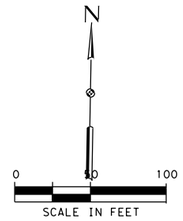
PRECAST SAFETY END TREATMENT

TYPE II ~ PARALLEL DRAINAGE

PSET-SP

FILE: psetspss-21.dgn	DN: RLW	CK: KLR	DW: JTR	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS 12-21: Added 42" TP	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		138





LEGEND

- EXISTING ROW
- EXISTING ROADWAY/DRAINAGE
- PROPOSED ROADWAY
- PROPOSED DRAINAGE
- PROPOSED ROW
- REMOVAL

LVL B	LVL C/D	
		OVERHEAD UTILITIES:
OHE-1	OHE-1	PEC
OHET-1	OHET-1	PEC/UNKNOWN
OHET-2	OHET-2	PEC/FRONTIER
OHETC-1	OHETC-1	PEC/FRONTIER/ZAYO
OHETC-2	OHETC-2	PEC/FRONTIER/ZAYO /CHARTER/SPECTRUM
OHT-1	OHT-1	FRONTIER
OHT-2	OHT-2	UNKNOWN TELECOM
OHTC-1	OHTC-1	FRONTIER/ZAYO
OHTC-2	OHTC-2	FRONTIER/CHARTER/SPECTRUM
OHC-1	OHC-1	ZAYO
		TELECOMMUNICATION:
T1-1	T1-1-D	FRONTIER
		GAS:
G1-12	G1-12-D	SHELL 12"
		WATER:
W1-2	W1-2-D	CITY OF WIMBERLEY 2"
W1-6	W1-6-D	CITY OF WIMBERLEY 6"

DATE	DESCRIPTION	APPROVED

CobbFendley
Texas Registration No. 274
505 East Huntland Drive, Suite 100
Austin, Texas 78752
512.834.9798 | fax 512.832.7727 | www.cobbfendley.com

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. 10069
3711 SOUTH MOPAC EXPRESSWAY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

Texas Department of Transportation

QUALITY LEVELS

Quality Level "D"- Existing Records: Utilities are plotted from review of available records.

Quality Level "C"- Surface Visible Feature Survey: Quality Level "D" information from existing records is correlated with surveyed surface-visible features.

Quality Level "B"- Designate: Two-dimensional horizontal mapping.This information is obtained through the application and interpretation of appropriate non-destructive surface geophysical methods. Utility indications are referenced to appropriate survey control. Utility exhibits are for information only.

RM 3237
SAFETY IMPROVEMENTS
EXISTING UTILITY LAYOUT

SHEET 1 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
JIA				RM 3237
GRAPHICS				
JIA	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK	TX	AUS	HAYS	
FG	CONTROL	SECTION	JOB	139
CHECK				
RJZ	0805	04	033	

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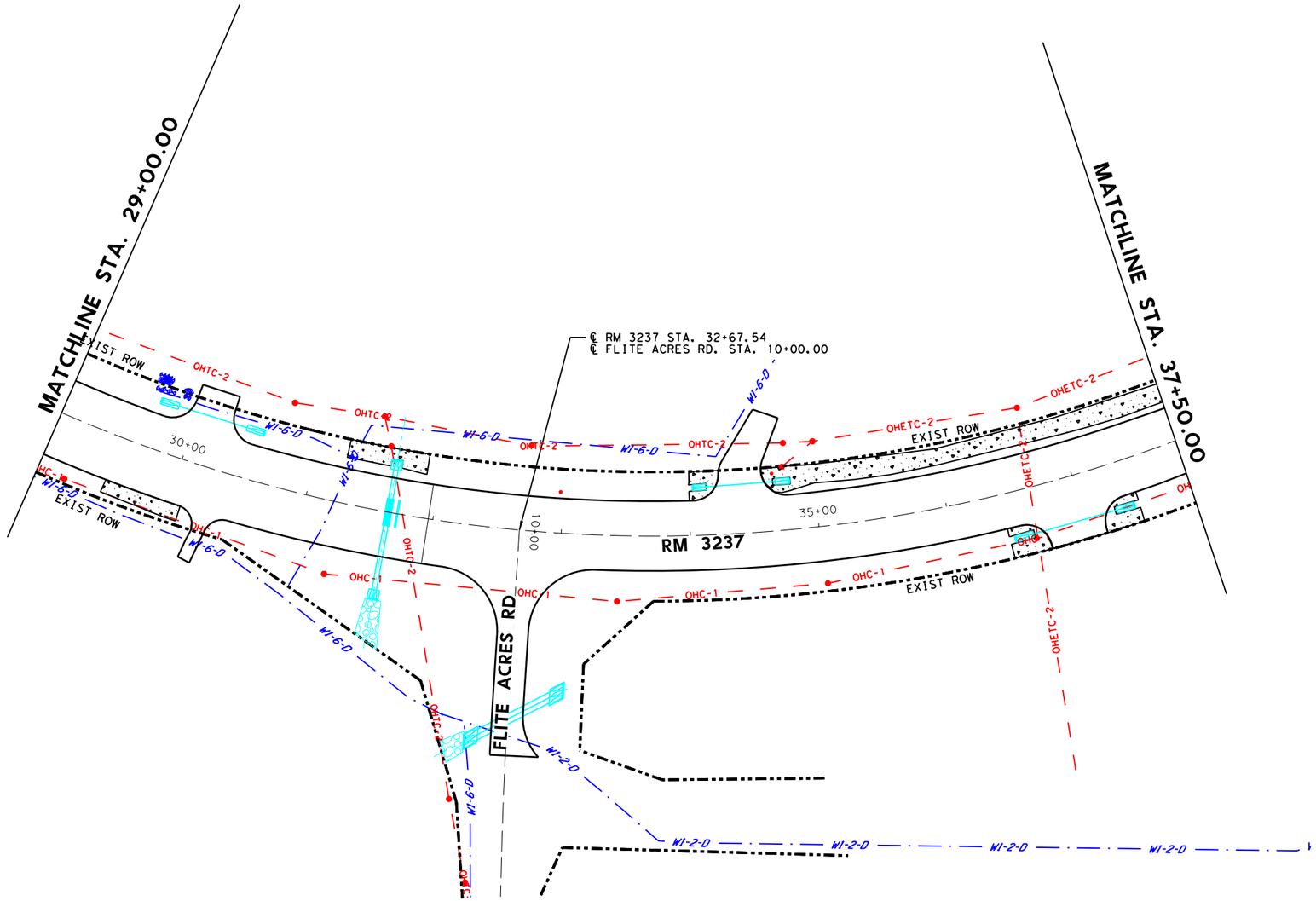

0 50 100

SCALE IN FEET

LEGEND

- EXISTING ROW
- EXISTING ROADWAY/DRAINAGE
- PROPOSED ROADWAY
- PROPOSED DRAINAGE
- PROPOSED ROW
- REMOVAL

LVL B	LVL C/D	
		OVERHEAD UTILITIES:
OHE-1	OHE-1	PEC
OHET-1	OHET-1	PEC/UNKNOWN
OHET-2	OHET-2	PEC/FRONTIER
OHETC-1	OHETC-1	PEC/FRONTIER/ZAYO
OHETC-2	OHETC-2	PEC/FRONTIER/ZAYO /CHARTER/SPECTRUM
OHT-1	OHT-1	FRONTIER
OHT-2	OHT-2	UNKNOWN TELECOM
OHTC-1	OHTC-1	FRONTIER/ZAYO
OHTC-2	OHTC-2	FRONTIER/CHARTER/SPECTRUM
OHC-1	OHC-1	ZAYO
		TELECOMMUNICATION:
T1-1	T1-1-D	FRONTIER
		GAS:
G1-12	G1-12-D	SHELL 12"
		WATER:
WI-2	WI-2-D	CITY OF WIMBERLEY 2"
WI-6	WI-6-D	CITY OF WIMBERLEY 6"

STATE OF TEXAS
DERRICK A. HORVATH
140327
LICENSED PROFESSIONAL ENGINEER
11/14/2023

DATE	DESCRIPTION	APPROVED

CobbFendley
Texas Registration No. 274
505 East Huntland Drive, Suite 100
Austin, Texas 78752
512.834.9798 | fax 512.832.7727 | www.cobbfendley.com

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. 10069
3711 SOUTH MOPAC EXPRESSWAY
BUILDING ONE, SUITE 350
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TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

Texas Department of Transportation

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RM 3237 SAFETY IMPROVEMENTS EXISTING UTILITY LAYOUT

SHEET 2 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
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GRAPHICS				
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CHECK	0805	04	033	
RJZ				

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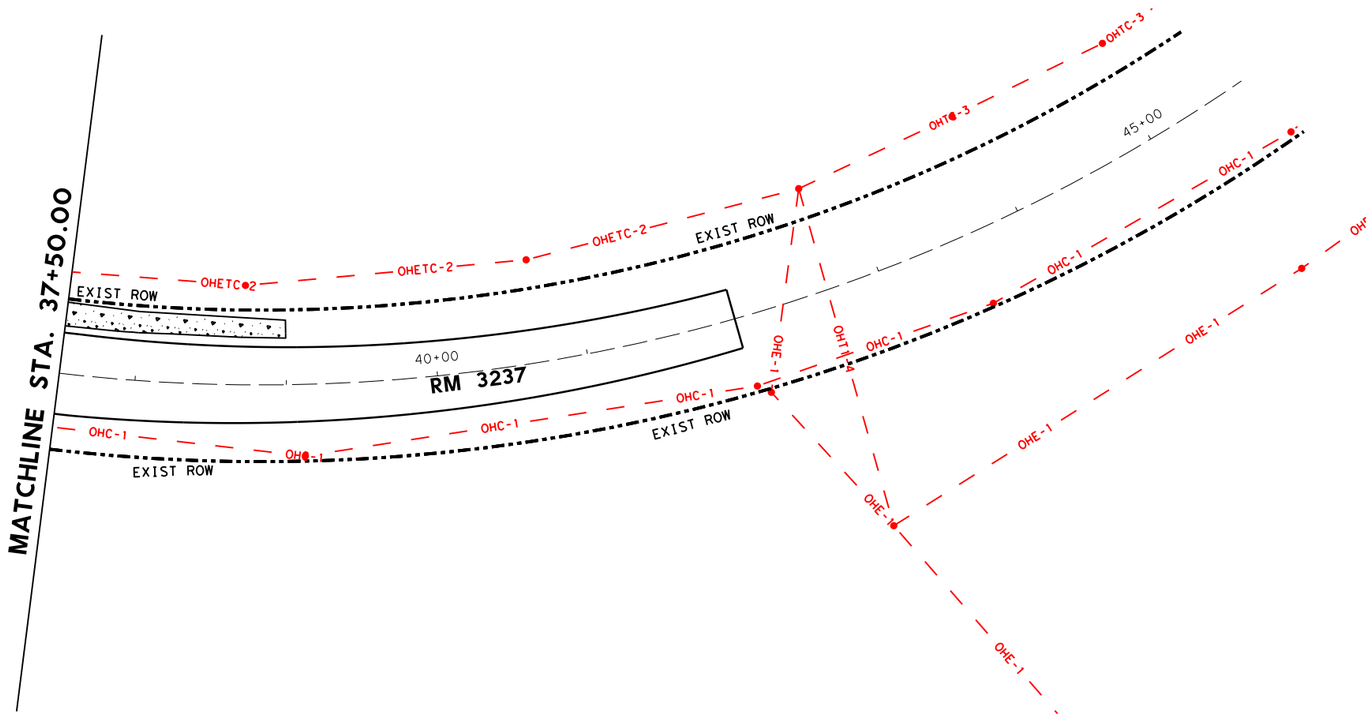

0 50 100

SCALE IN FEET

LEGEND

- EXISTING ROW
- EXISTING ROADWAY/DRAINAGE
- PROPOSED ROADWAY
- PROPOSED DRAINAGE
- PROPOSED ROW
- REMOVAL

LVL B	LVL C/D	
		OVERHEAD UTILITIES:
OHE-1	OHE-1	PEC
OHET-1	OHET-1	PEC/UNKNOWN
OHET-2	OHET-2	PEC/FRONTIER
OHETC-1	OHETC-1	PEC/FRONTIER/ZAYO
OHETC-2	OHETC-2	PEC/FRONTIER/ZAYO /CHARTER/SPECTRUM
OHT-1	OHT-1	FRONTIER
OHT-2	OHT-2	UNKNOWN TELECOM
OHTC-1	OHTC-1	FRONTIER/ZAYO
OHTC-2	OHTC-2	FRONTIER/CHARTER/SPECTRUM
OHC-1	OHC-1	ZAYO
		TELECOMMUNICATION:
T1-1	T1-1-D	FRONTIER
		GAS:
G1-12	G1-12-D	SHELL 12"
		WATER:
W1-2	W1-2-D	CITY OF WIMBERLEY 2"
W1-6	W1-6-D	CITY OF WIMBERLEY 6"

STATE OF TEXAS
DERRICK A. HORVATH
140327
LICENSED
PROFESSIONAL ENGINEER

11/14/2023

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Texas Department of Transportation

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RM 3237
SAFETY IMPROVEMENTS
EXISTING UTILITY LAYOUT

SHEET 3 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
JIA				RM 3237
GRAPHICS				
JIA	STATE	DISTRICT	COUNTY	SHEET NO.
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FG	CONTROL	SECTION	JOB	141
CHECK	0805	04	033	
RJZ				

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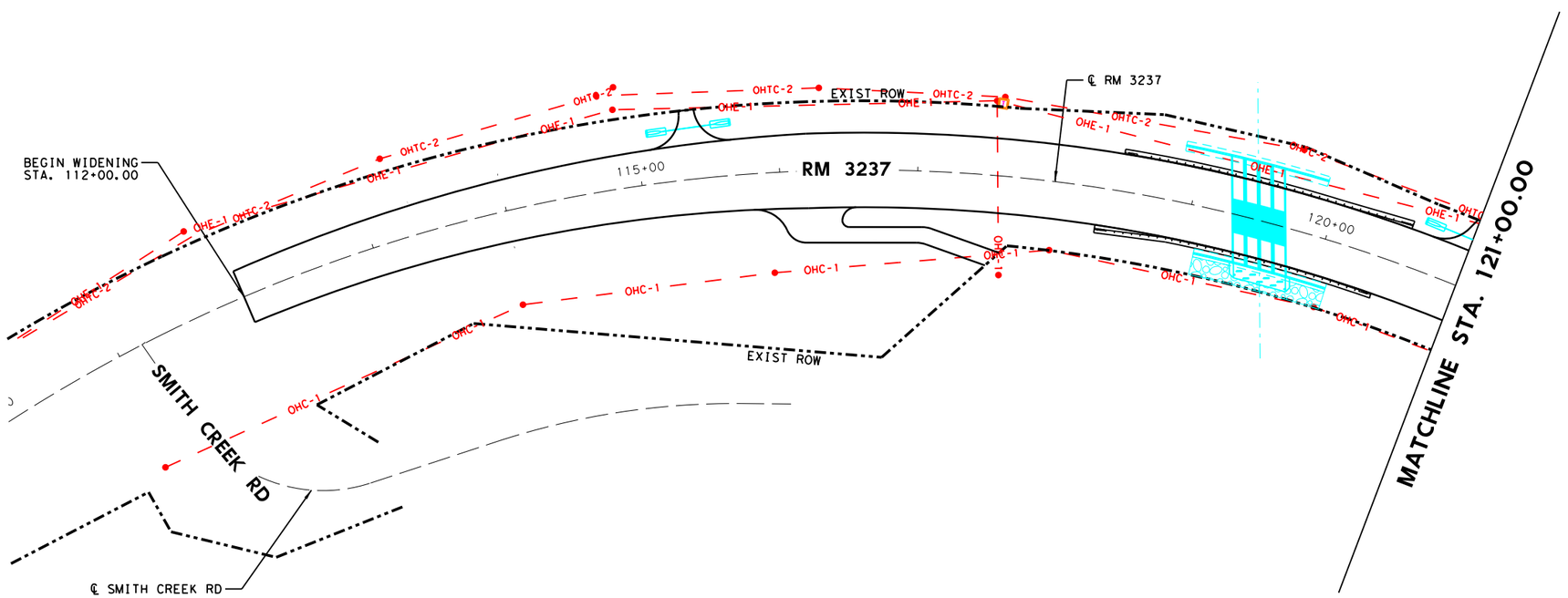

N

0 50 100

SCALE IN FEET

LEGEND

- EXISTING ROW
- EXISTING ROADWAY/DRAINAGE
- PROPOSED ROADWAY
- PROPOSED DRAINAGE
- PROPOSED ROW
- REMOVAL

LVL B	LVL C/D	
		OVERHEAD UTILITIES:
OHE-1	OHE-1	PEC
OHET-1	OHET-1	PEC/UNKNOWN
OHET-2	OHET-2	PEC/FRONTIER
OHETC-1	OHETC-1	PEC/FRONTIER/ZAYO
OHETC-2	OHETC-2	PEC/FRONTIER/ZAYO /CHARTER/SPECTRUM
OHT-1	OHT-1	FRONTIER
OHT-2	OHT-2	UNKNOWN TELECOM
OHTC-1	OHTC-1	FRONTIER/ZAYO
OHTC-2	OHTC-2	FRONTIER/CHARTER/SPECTRUM
OHC-1	OHC-1	ZAYO
		TELECOMMUNICATION:
T1-1	T1-1-D	FRONTIER
		GAS:
G1-12	G1-12-D	SHELL 12"
		WATER:
W1-2	W1-2-D	CITY OF WIMBERLEY 2"
W1-6	W1-6-D	CITY OF WIMBERLEY 6"

STATE OF TEXAS
DERRICK A. HORVATH
140327
LICENSED
PROFESSIONAL ENGINEER

11/14/2023

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CobbFendley
Texas Registration No. 274
505 East Huntland Drive, Suite 100
Austin, Texas 78752
512.834.9798 | fax 512.832.7727 | www.cobbfendley.com

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. 10069
3711 SOUTH MOPAC EXPRESSWAY
BUILDING ONE, SUITE 350
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Texas Department of Transportation

QUALITY LEVELS

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Quality Level "B"- Designate: Two-dimensional horizontal mapping.This information is obtained through the application and interpretation of appropriate non-destructive surface geophysical methods. Utility indications are referenced to appropriate survey control. Utility exhibits are for information only.

RM 3237
SAFETY IMPROVEMENTS
EXISTING UTILITY LAYOUT

SHEET 4 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
JIA				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
JIA	TX	AUS	HAYS	142
CHECK	CONTROL	SECTION	JOB	
FG	0805	04	033	
CHECK				
RJZ				

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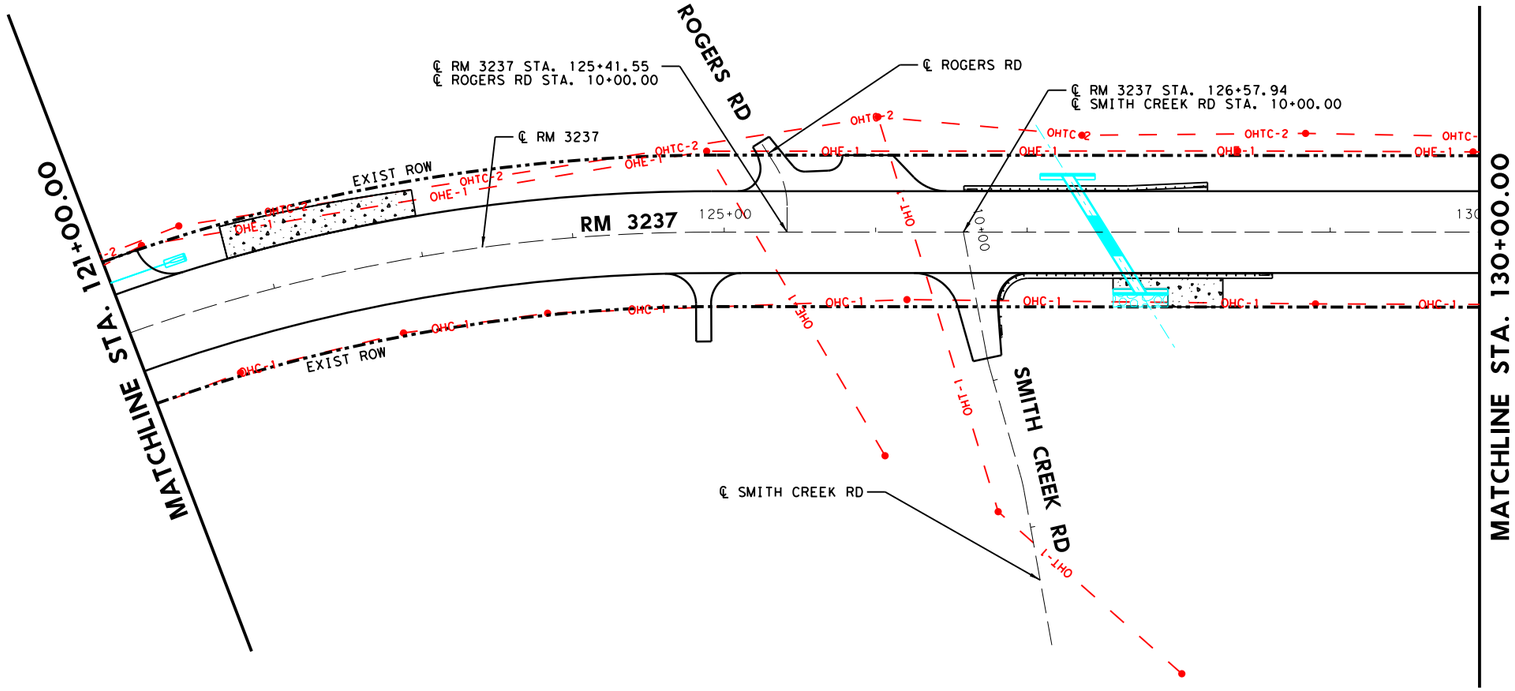

0 50 100

SCALE IN FEET

LEGEND

- EXISTING ROW
- EXISTING ROADWAY/DRAINAGE
- PROPOSED ROADWAY
- PROPOSED DRAINAGE
- PROPOSED ROW
- REMOVAL

LVL B	LVL C/D	
		OVERHEAD UTILITIES:
OHE-1	OHE-1	PEC
OHET-1	OHET-1	PEC/UNKNOWN
OHET-2	OHET-2	PEC/FRONTIER
OHETC-1	OHETC-1	PEC/FRONTIER/ZAYO
OHETC-2	OHETC-2	PEC/FRONTIER/ZAYO /CHARTER/SPECTRUM
OHT-1	OHT-1	FRONTIER
OHT-2	OHT-2	UNKNOWN TELECOM
OHTC-1	OHTC-1	FRONTIER/ZAYO
OHTC-2	OHTC-2	FRONTIER/CHARTER/SPECTRUM
OHC-1	OHC-1	ZAYO
		TELECOMMUNICATION:
T1-1	T1-1-D	FRONTIER
		GAS:
G1-12	G1-12-D	SHELL 12"
		WATER:
W1-2	W1-2-D	CITY OF WIMBERLEY 2"
W1-6	W1-6-D	CITY OF WIMBERLEY 6"

STATE OF TEXAS
DERRICK A. HORVATH
140327
LICENSED
PROFESSIONAL ENGINEER

11/14/2023

DATE	DESCRIPTION	APPROVED

CobbFendley
Texas Registration No. 274
505 East Huntland Drive, Suite 100
Austin, Texas 78752
512.834.9798 | fax 512.832.7727 | www.cobbfendley.com

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. 10069
3711 SOUTH MOPAC EXPRESSWAY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

Texas Department of Transportation

QUALITY LEVELS

Quality Level "D"- Existing Records: Utilities are plotted from review of available records.

Quality Level "C"- Surface Visible Feature Survey: Quality Level "D" information from existing records is correlated with surveyed surface-visible features.

Quality Level "B"- Designate: Two-dimensional horizontal mapping.This information is obtained through the application and interpretation of appropriate non-destructive surface geophysical methods. Utility indications are referenced to appropriate survey control. Utility exhibits are for information only.

RM 3237 SAFETY IMPROVEMENTS EXISTING UTILITY LAYOUT

SHEET 5 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
JIA				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
JIA	TX	AUS	HAYS	143
CHECK	CONTROL	SECTION	JOB	
FG	0805	04	033	
CHECK				
RJZ				

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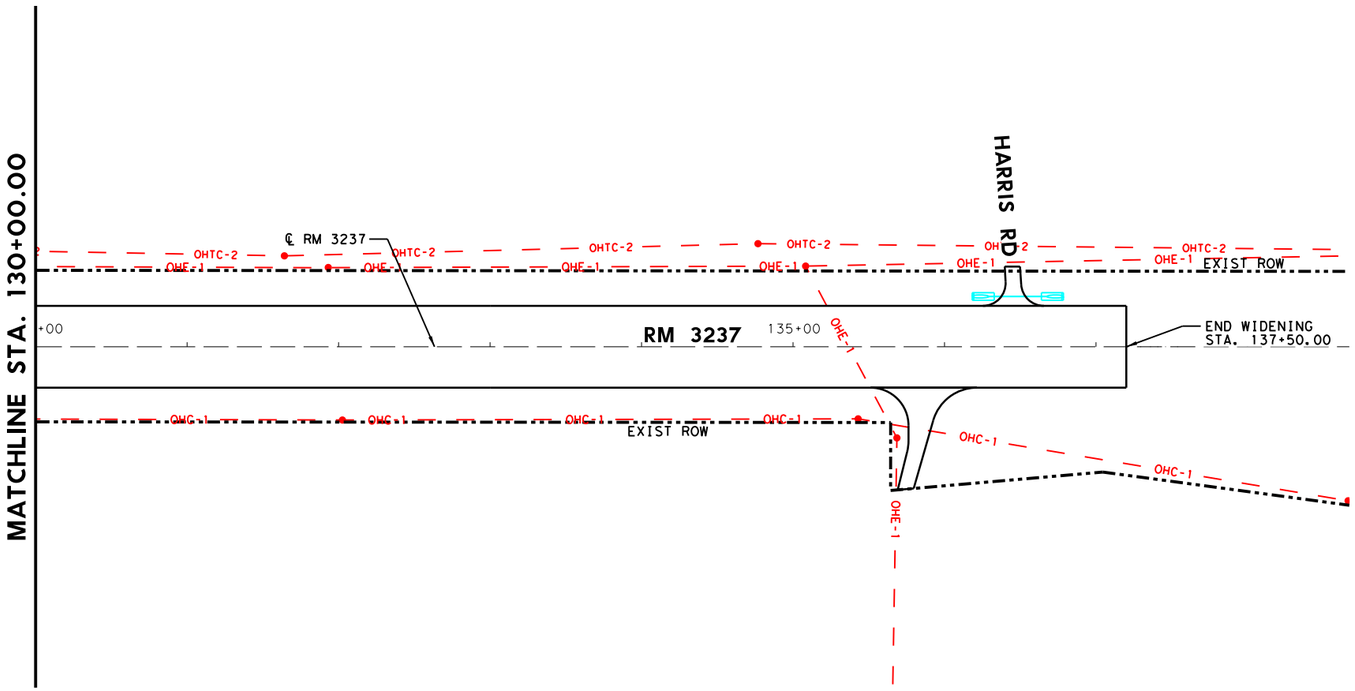

0 50 100

SCALE IN FEET

LEGEND

- EXISTING ROW
- EXISTING ROADWAY/DRAINAGE
- PROPOSED ROADWAY
- PROPOSED DRAINAGE
- PROPOSED ROW
- REMOVAL

LVL B	LVL C/D	
		OVERHEAD UTILITIES:
OHE-1	OHE-1	PEC
OHET-1	OHET-1	PEC/UNKNOWN
OHET-2	OHET-2	PEC/FRONTIER
OHETC-1	OHETC-1	PEC/FRONTIER/ZAYO
OHETC-2	OHETC-2	PEC/FRONTIER/ZAYO /CHARTER/SPECTRUM
OHT-1	OHT-1	FRONTIER
OHT-2	OHT-2	UNKNOWN TELECOM
OHTC-1	OHTC-1	FRONTIER/ZAYO
OHTC-2	OHTC-2	FRONTIER/CHARTER/SPECTRUM
OHC-1	OHC-1	ZAYO
		TELECOMMUNICATION:
T1-1	T1-1-D	FRONTIER
		GAS:
G1-12	G1-12-D	SHELL 12"
		WATER:
W1-2	W1-2-D	CITY OF WIMBERLEY 2"
W1-6	W1-6-D	CITY OF WIMBERLEY 6"

STATE OF TEXAS
DERRICK A. HORVATH
140327
LICENSED
PROFESSIONAL ENGINEER

11/14/2023

DATE	DESCRIPTION	APPROVED

QUALITY LEVELS

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3711 SOUTH MOPAC EXPRESSWAY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

Texas Department of Transportation

RM 3237
SAFETY IMPROVEMENTS
EXISTING UTILITY LAYOUT

SHEET 6 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
JIA				RM 3237
GRAPHICS				
JIA	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK	TX	AUS	HAYS	
FG	CONTROL	SECTION	JOB	144
CHECK	0805	04	033	
RJZ				

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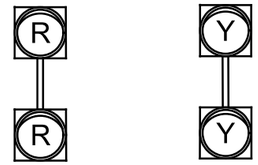
NOTES:

1. REUSE EXISTING ELECTRIC SERVICE.
2. RELOCATE EXISTING FLASHER CABINET ON POLE P-2
3. RELOCATE EXISTING FLASHER BEACONS ON NEW GAL. MESS. STRAND
4. REMOVE AND SALVAGE EXISTING SIGNAL STRAIN POLES, SPAN CABLE ASSEMBLY, AND GROUND BOX AS NOTED ON THE PLAN

PROPOSED POLE NOTES
[A] INS TRF SIG PL AM(S) STR(TY D) LUM (0686-6020)

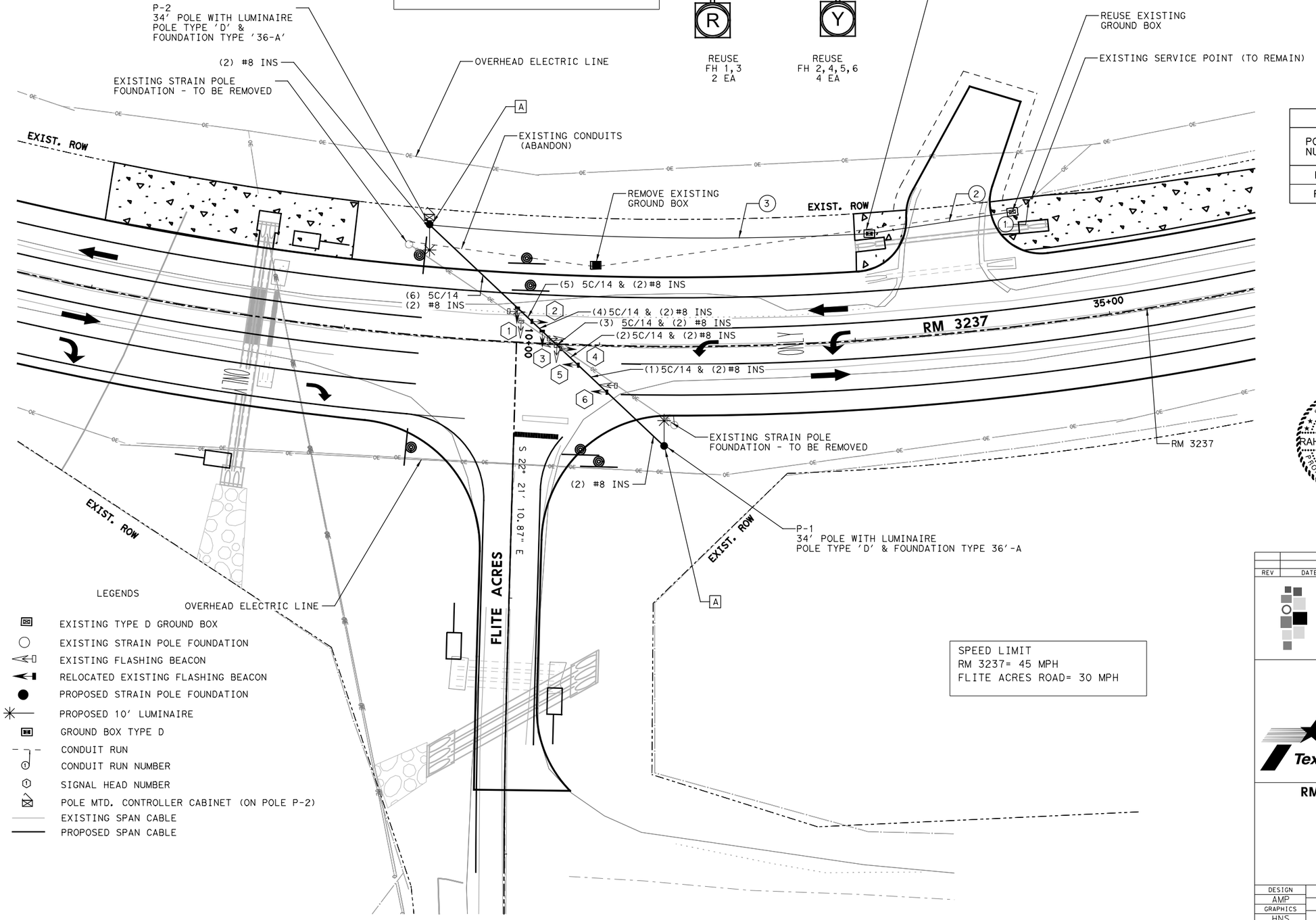
EXISTING SIGNALS



REUSE
FH 1,3
2 EA

REUSE
FH 2,4,5,6
4 EA

0 20 40
SCALE IN FEET



LEGENDS

- EXISTING TYPE D GROUND BOX
- EXISTING STRAIN POLE FOUNDATION
- EXISTING FLASHING BEACON
- RELOCATED EXISTING FLASHING BEACON
- PROPOSED STRAIN POLE FOUNDATION
- PROPOSED 10' LUMINAIRE
- GROUND BOX TYPE D
- CONDUIT RUN
- CONDUIT RUN NUMBER
- SIGNAL HEAD NUMBER
- POLE MTD. CONTROLLER CABINET (ON POLE P-2)
- EXISTING SPAN CABLE
- PROPOSED SPAN CABLE

POLE LOCATION			
POLE NUMBER	BASELINE	STATION	OFFSET
P-1	RM 3237	32+29.73	43.3' RT
P-2	RM 3237	33+25.40	38.9' LT

SPEED LIMIT
RM 3237= 45 MPH
FLITE ACRES ROAD= 30 MPH

STATE OF TEXAS
RAHUL M. RAJBHARA
128825
LICENSED
PROFESSIONAL ENGINEER
11/17/2023

REV	DATE	DESCRIPTION	APPROVED

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TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

HAYS COUNTY TEXAS

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

TRAFFIC SIGNAL LAYOUT

SHEET 1 OF 1

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
AMP				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	145
CHECK	CONTROL	SECTION	JOB	
DN	0805	04	033	
CHECK				
DN				

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SUMMARY OF CONDUITS AND CABLES - SIGNAL					
RUN NO.	CONDUIT (SCH 80)			POWER	
	2"		LENGTH (FT)	#6 AWG (BARE)	#6 AWG (INS)
	T	B			
1	EXISTING	--	10	1	2
2	--	1	57	1	2
3	1	--	172	1	2
TOTAL	172	57		239	478

SUMMARY OF CONDUITS AND CABLES - ILLUMINATION						
RUN NO.	CONDUIT (SCH 80)			POWER		PULL STRING
	2"		LENGTH (FT)	#8 AWG (BARE)	#8 AWG (INS)	
	T	B				
1	EXISTING	--	10	1	4	1
2	--	1	57	1	4	1
3	1	--	172	1	4	1
TOTAL	172	57		239	956	239

GROUND BOXES

TYPE	EA.
D	1

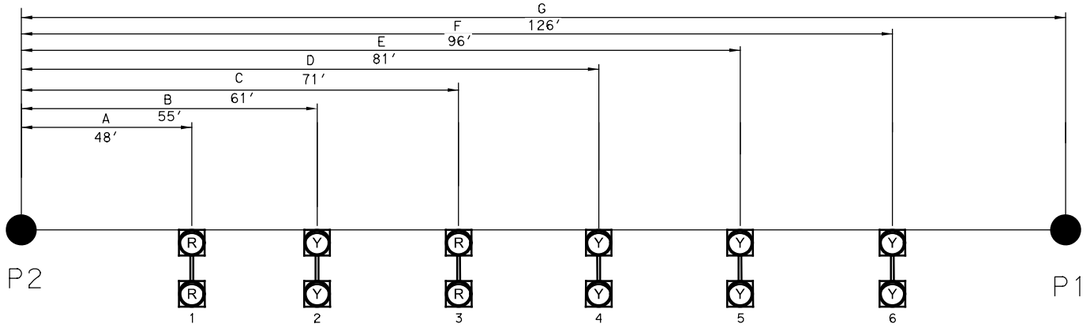
CNDR/CABLE SUMMARY		
TYPE	SIZE	TOTAL (LF)
POWER	1/C #6 AWG (INS)	488
ILLUMINATION	1/C #8 AWG (INS)	1408
GROUND BARE	#6 BARE COPPER	244
	#8 BARE COPPER	239
SIGNAL	5C/ #14 AWG	646

NOTES
1. "T'" = TRENCHED; "B" = BORED
2. TOTALS DO NOT INCLUDE QUANTITIES INSIDE THE SIGNAL POLE.
3. FOR QUANTITIES INSIDE SIGNAL POLE SEE INSIDE POLES TABLE.

INSIDE POLES	#14 AWG	#8 AWG
	5/C	1/C (INS)
POLE 1	-	43
POLE 2	204	156
TOTAL (LF)	204	199

INSIDE CABINET	#14 AWG	#6 AWG (INS)	# 6 AWG (BARE)
	5/C		
TOTAL	30	10	5

SIGNAL SPAN CONDUCTOR QUANTITIES (LF)			
CABLE RUN	SPAN	14 AWG 5/C	8 AWG 1/C
		LFT	LFT
A	POLE 2 TO FH 1	48	-
B	POLE 2 TO FH 2	55	-
C	POLE 2 TO FH 3	61	-
D	POLE 2 TO FH 4	71	-
E	POLE 2 TO FH 5	81	-
F	POLE 2 TO FH 6	96	-
G	POLE 2 TO POLE 1	-	253
TOTAL (LF)		412	253



CABLE TERMINATION CHART								
FUNCTION	CONDR	CNDR COLOR	CABLE 1 FROM CNTRL TO P-2	CABLE 2 FROM CNTRL TO P-2	CABLE 3 FROM CNTRL TO P-2	CABLE 4 FROM CNTRL TO P-2	CABLE 5 FROM CNTRL TO P-2	CABLE 6 FROM CNTRL TO P-2
SPARE	1	BLACK	SPARE	SPARE	SPARE	SPARE	SPARE	SPARE
NEUTRAL	2	WHITE	NEUTRAL	NEUTRAL	NEUTRAL	NEUTRAL	NEUTRAL	NEUTRAL
FLASHER BALL (TOP)	3	RED	FH 1R	FH 2Y	FH 3R	FH 4Y	FH 5Y	FH 6Y
FLASHER BALL (BOTTOM)	4	GREEN	FH 1R	FH 2Y	FH 3R	FH 4Y	FH 5Y	FH 6Y
SPARE	5	ORANGE	SPARE	SPARE	SPARE	SPARE	SPARE	SPARE

STATE OF TEXAS
RAHUL M. RAJBHARA
128825
LICENSED PROFESSIONAL ENGINEER

11/17/2023

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TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

HAYS COUNTY TEXAS

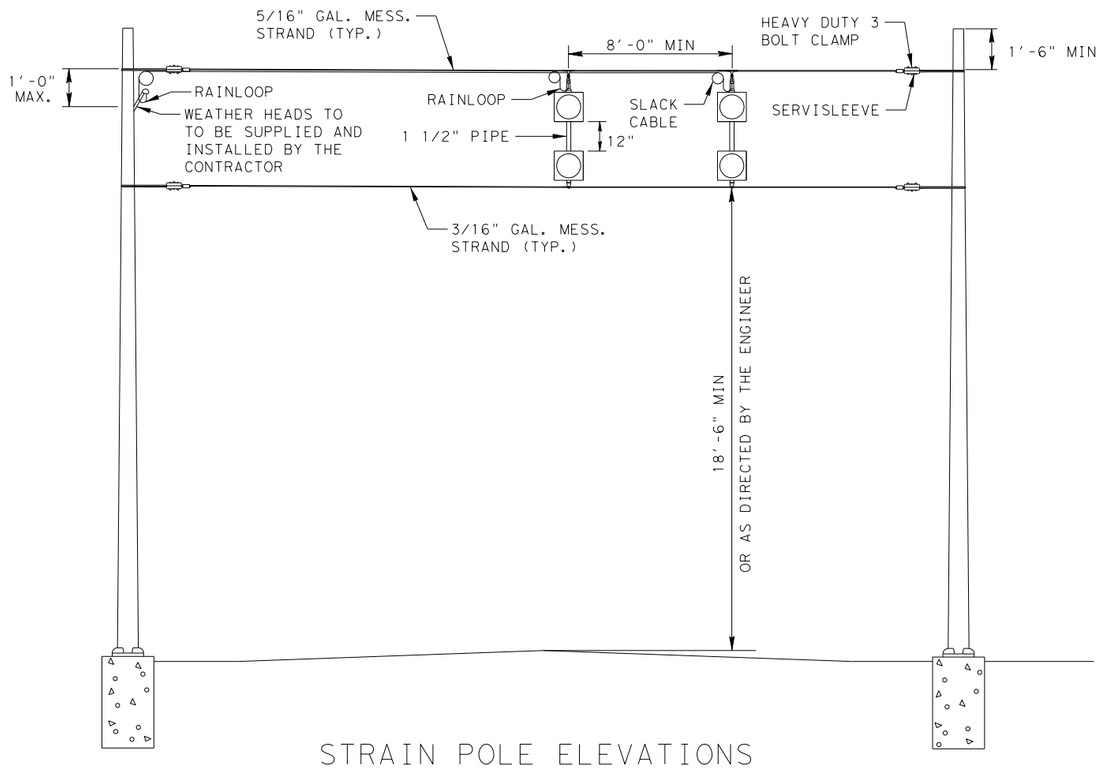
Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

TRAFFIC SIGNAL SUMMARY

SHEET 1 OF 1

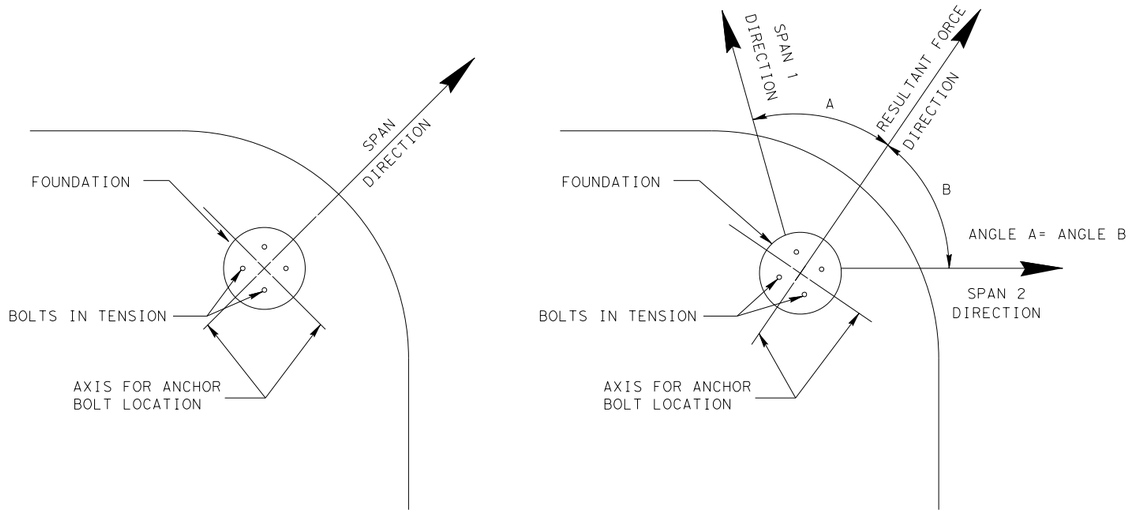
DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
AMP				RM 3237
GRAPHICS				
HNS	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK	TX	AUS	HAYS	
DN	CONTROL	SECTION	JOB	146
CHECK	0805	04	033	
DN				



STRAIN POLE ELEVATIONS
FLASHING BEACONS

NOTES:

1. 5/16" AND 3/16" MESSENGER CABLE SHALL BE USED FOR SPANS.
2. ALL LOOSE ENDS OF MESSENGER CABLE SHALL BE SERVED WITH SERVISLEEVE.
3. SIGNAL CABLE AND DETECTOR CABLE SHALL BE ATTACHED TO MESSENGER (SPAN) CABLE WITH LASHING WIRE USING THE CABLE SPINNING METHOD WITH A MINIMUM OF ONE TURN PER FOOT.
4. DETERMINE THE MOUNTING HEIGHT OF THE SIGNAL SPAN AND THE PLACEMENT OF THE WEATHER HEADS.
5. ALL SLACK CABLE COILS SHALL BE A MINIMUM OF 6"IN DIAMETER AND SHALL HAVE A MINIMUM OF TWO TURNS.
6. WEATHER HEADS INSTALLED ON THE STRAIN POLE SHALL EQUAL THE SIZE AND NUMBER OF CONDUIT INSTALLED IN THE SIGNAL POLE FOUNDATION.



TYPICAL ANCHOR BOLT ALIGNMENT

STATE OF TEXAS
RAHUL M. RAJBHARA
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HAYS COUNTY TEXAS

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RM 3237 SAFETY IMPROVEMENTS

FLASHING BEACON STEEL POLE

SHEET 1 OF 1

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	147
CHECK	CONTROL	SECTION	JOB	
AMP	0805	04	033	
CHECK				
AMP				

LEVELS DISPLAYED ACC:

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

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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 & application of this standard to other formats or for incorrect results or damages resulting from its use.

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NOTE: Structures north of ice line to be designed for ice.

ZONE 2
(90 MPH WIND)

ZONE 3
(80 MPH WIND)

ZONE 4
(70 MPH WIND)

ICE LINE

ZONE 4
(70 MPH WIND)

ICE LINE

ZONE 3
(80 MPH WIND)

ZONE 1
(100 MPH WIND)

LEGEND

ZONE 1 - = (100 MPH WIND)
ZONE 2 - = (90 MPH WIND)
ZONE 3 - = (80 MPH WIND)
ZONE 4 - = (70 MPH WIND)
= (ICE LINE)
= (DISTRICT LINES)

APPLICABLE STANDARDS SHEETS

OVERHEAD SIGN BRIDGE STANDARDS:

OSB-SE
OSB-Z#
OSB-Z#1
HOSB-Z#
HOSB-Z1L
HOSB-Z#1
OSBT
OSBC
OSBC-SC-Z#
OSBS-SC
OSB-FD
OSB-FD-SC

CANTILEVER OVERHEAD SIGN SUPPORT STANDARDS:

COSS-SE
COSS-Z#-10
HCOSS-Z#-10
COSS-Z21-10
COSS-Z#&Z#1-10
COSSD
COSSF
COSS-FD

Note: # = Wind Zone number 1, 2, 3 or 4

HIGH MAST ILLUMINATION POLE STANDARDS:

HMIP-98
HMIF-98

WALKWAYS AND BRACKETS STANDARDS:

SWW
SB(SWL-1)

TRAFFIC SIGNAL POLE STANDARDS:

SP-80
SP-100
SMA-80
SMA-100
DMA-80
DMA-100
MA-C
MAC(ILSN)
MAD-D
TS-FD
LUM-A
CFA
LMA
TS-C
MA-DPD

FOR HARRIS CO. ONLY
Zone line is just North of US 90, around on the North, West and South sides of IH 610 and down the West side of SH 288.

FOR JACKSON CO. ONLY
Zone line is just North of SH 616.

WIND VELOCITY & ICE ZONES FOR APPLICABLE OVERHEAD SIGN SUPPORTS, HIGH MAST POLES, AND TRAFFIC SIGNAL POLES

Based on 50 Year Mean Recurrence Interval of Fastest Mile Wind Velocity at 33 feet height.

THIS SHEET TO BE INCLUDED IN ALL P.S.&E. PACKAGES CONTAINING ONE OR MORE OF THE APPLICABLE STANDARD SHEETS LISTED HEREON

Texas Department of Transportation

Traffic Operations Division Standard

WIND VELOCITY AND ICE ZONES

WV & IZ-14

FILE: windice.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT April 1996	CONT	SECT	JOB	HIGHWAY
REVISIONS	0805	04	033	RM 3237
8-14-Added list of applicable standards, restricting use to structures designed for Fastest Mile wind speeds.	DIST	COUNTY		SHEET NO.
	AUS	HAYS		148

DATE: 11/17/2023 5:08:59 PM
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GENERAL NOTES FOR ALL ELECTRICAL WORK

1. The location of all conduits, junction boxes, ground boxes, and electrical services is diagrammatic and may be shifted to accommodate field conditions.

2. Provide new and unused materials. Ensure that all materials and installations comply with the applicable articles of the National Electrical Code (NEC), TxDOT standards and specifications, National Electrical Manufacturers Association (NEMA), and are listed by Underwriters Laboratories (UL) or a Nationally Recognized Testing Lab (NRTL). NRTLs such as Canadian Standard Association (CSA), Intertek Testing Services NA Inc., or FM Approvals LLC can be considered equivalent to UL. Where reference is made to NEMA listed devices, International Electrotechnical Commission (IEC) listed devices will not be considered an acceptable equal to a NEMA listed device. Acceptable devices may have both a NEMA and IEC listing. Faulty fabrication or poor workmanship in any material, equipment, or installation is justification for rejection. Replace or reinstall rejected material or equipment at no additional cost to the Department.

3. Miscellaneous nuts, bolts and hardware, except for high strength bolts, may be stainless steel when plans specify galvanized, provided the bolt size is ½ in. or less in diameter.

4. Provide the following test equipment as required by the Engineer to confirm compliance with the contract and the NEC: voltmeter, ammeter, megohm meter (1000 volt DC), ground resistance tester, torque wrenches, and torque screwdrivers. Ensure all equipment has been properly calibrated within the last year. Provide calibration certification to the Engineer upon request. Operate test equipment during inspection as requested by the Engineer.

5. Install grounding as shown on the plans and in accordance with the NEC. Ensure all metallic conduits; metal poles; luminaires; and metal enclosures are bonded to the equipment grounding conductor. Provide stranded bare copper or green insulated grounding conductors. Ground rods, connectors, and bonding jumpers are subsidiary to the various bid items.

6. When required by the Engineer, notify the Department in writing of materials from the Material Producers List (MPL) intended for use on each project. Prequalified materials are listed on the MPL on TxDOT's website under "Roadway Illumination and Electrical Supplies." No substitutions will be allowed for materials on this list.

CONDUIT

A. MATERIALS

1. Provide conduit, junction boxes, fittings, and hardware as per TxDOT Departmental Material Specification (DMS) 11030 "Conduit" and Item 618 "Conduit" of TxDOT's "Standard Specifications For Construction And Maintenance Of Highways, Streets, And Bridges," latest edition. Provide conduits listed under Item 618 on the MPL under "Roadway Illumination and Electrical Supplies." Provide conduit types according to the descriptive code or as shown on the plans. Do not substitute other types of conduits for those shown. Provide liquidtight flexible metal conduit (LFMC) when flexible conduit is called for on galvanized steel rigid metallic conduit (RMC) systems. Provide liquidtight flexible nonmetallic conduit (LFNC) when flexible conduit is called for on polyvinyl chloride (PVC) systems.

2. Provide galvanized steel RMC for all exposed conduits, unless otherwise shown on the plans. Properly bond all metal conduits.

3. Unless otherwise shown on the plans, provide junction boxes with a minimum size as shown in the following table, which applies to the greatest number of conductors entering the box through one conduit with no more than four conduits per box. When a mixture of conductor sizes is present, count the conductors as if all are of the larger size. For situations not applicable to the table, size junction boxes in accordance with NEC.

AWG	3 CONDUCTORS	5 CONDUCTORS	7 CONDUCTORS
#1	10" x 10" x 4"	12" x 12" x 4"	16" x 16" x 4"
#2	8" x 8" x 4"	10" x 10" x 4"	12" x 12" x 4"
#4	8" x 8" x 4"	10" x 10" x 4"	10" x 10" x 4"
#6	8" x 8" x 4"	8" x 8" x 4"	10" x 10" x 4"
#8	8" x 8" x 4"	8" x 8" x 4"	8" x 8" x 4"

4. Junction boxes with an internal volume of less than 100 cu. in. and supported by entering raceways must have threaded entries or hubs identified for the intended purpose and supported by connection of two or more rigid metal conduits. Secure conduit within 3 ft. of the enclosure or within 18 in. of the enclosure if all conduit entries are on the same side. Mechanically secure all junction boxes with an internal volume greater than 100 cu. inches.

5. Provide hot dipped galvanized cast iron or sand cast aluminum outlet boxes for junction boxes containing only 10 AWG or 12 AWG conductors. Do not use die cast aluminum boxes. Size outlet boxes according to the NEC.

6. Do not use intermediate metal conduit (IMC) or electrical metallic tubing (EMT) unless specifically required by the plan sheets. When EMT is called for, provide junction boxes made from galvanized steel sheeting, listed and approved for outdoor use, unless otherwise noted on the plans. Size all galvanized steel junction boxes in accordance with the NEC. Provide junction boxes for IMC conduit systems that meet the same requirements for junction boxes used with RMC systems.

7. Provide PVC junction boxes intended for outdoor use on PVC conduit systems, unless otherwise noted on the plans.

8. Provide PVC elbows in PVC conduit systems, unless otherwise shown on the plans. Use only a flat, high tensile strength polyester fiber pull tape for pulling conductors through the PVC conduit system. When galvanized steel RMC elbows are specifically called for in the plans and any portion of the RMC elbow is buried less than 18 in., ground the RMC elbow by means of a grounding bushing on a rigid metal extension. Grounding of the rigid metal elbow is not required if the entire RMC elbow is encased in a minimum of 2 in. of concrete. PVC extensions are allowed on these concrete encased rigid metal elbows. RMC or PVC elbows are subsidiary to various bid items.

9. When required, provide High-Density Polyethylene (HDPE) conduit with factory installed internal conductors according to Item 622 "Duct Cable." At the Contractor's request and with approval by the Engineer, substitute HDPE conduit with no conductors for bored schedule 40 or schedule 80 PVC conduit bid under Item 618. Ensure bored HDPE substituted for PVC is schedule 40 and of the same size PVC called for in the plans. Ensure the substituted HDPE meets the requirements of Item 622, except that the conduit is supplied without factory-installed conductors. Make the transition of the HDPE conduit to PVC (or RMC elbow when required) at the bore pit. Provide conduit of the size and schedule as shown on the plans. Do not extend substituted conduit into ground boxes or foundations. Provide PVC or galvanized steel RMC elbows as called for at all ground boxes and foundations.

10. Use two-hole straps when supporting 2 in. and larger conduits. On electrical service poles, properly sized stainless steel or hot dipped galvanized one-hole standoff straps are allowed on the service riser conduit.

B. CONSTRUCTION METHODS

1. Provide and install expansion joint conduit fittings on all structure-mounted conduits at the structure's expansion joints to allow for movement of the conduit. In addition, provide and install expansion joint fittings on all continuous runs of galvanized steel RMC conduit externally exposed on structures such as bridges at maximum intervals of 150 ft. When requested by the project Engineer, supply manufacturer's specification sheet for expansion joint conduit fittings. Repair or replace expansion joint fittings that do not allow for movement at no additional cost to the Department. Provide the method of determining the amount of expansion to the Engineer upon request. Do not use LFMC or LFNC as a substitute for the required expansion conduit fittings.

2. Space all conduit supports at maximum intervals of 5 ft. Install conduit spacers when attaching metal conduit to surface of concrete structures. See "Conduit Mounting Options" on ED(2). Install conduit support within 3 ft. of all enclosures and conduit terminations.

3. Do not attach conduit supports directly to pre-stressed concrete beams except as shown specifically in the plans or as approved by the Engineer.

4. Unless otherwise shown on the plans, jack or bore conduit placed beneath existing roadways, driveways, sidewalks, or after the base or surfacing operation has begun. Backfill and compact the bore pits below the conduit per Item 476 "Jacking, Boring, or Tunneling Pipe or Box" prior to installing conduit or duct cable to prevent bending of the connections.

5. When placing conduit in the sub-grade of new roadways, backfill all trenches with excavated material unless otherwise noted on the plans. When placing conduit in the sub-base of new roadways, backfill all trenches with cement-stabilized base as per requirements of Items 110 "Excavation", 400 "Excavation and Backfill for Structures", 401 "Flowable Backfill", 402 "Trench Excavation Protection", and 403 "Temporary Special Shoring."

6. Provide and place warning tape approximately 10 in. above all trenched conduit as per Item 618.

7. During construction, temporarily cap or plug open ends of all conduit and raceways immediately after installation to prevent entry of dirt, debris and animals. Temporary caps constructed of durable duct tape are allowed. Tightly fix the tape to the conduit opening. Clean out the conduit and prove it clear in accordance with Item 618 prior to installing any conductors.

8. Ensure conduit entry into the top of any enclosure is waterproof by installing conduit sealing hubs or using boxes with threaded bosses. This includes surface mounted safety switches, meter cans, service enclosures, auxiliary enclosures and junction boxes. Grounding bushings on water tight sealing hubs are not required.

9. Fit the ends of all PVC conduit terminations with bushings or bell end fittings. Provide and install a grounding type bushing on all metal conduit terminations.

10. Install a bonding jumper from each grounding bushing to the nearest ground rod, grounding lug, or equipment grounding conductor. Ensure all bonding jumpers are the same size as the equipment grounding conductor. Bonding of conduit used as a casing under roadways for duct cable is not required, if the duct extends the full length through the casing.

11. At all electrical services, install a 6 AWG solid copper grounding electrode conductor.

12. Place conduits entering ground boxes so that the conduit openings are between 3 in. and 6 in. from the bottom of the box. See the ground box detail on sheet ED(4).

13. Seal ends of all conduits with duct seal, expandable foam, or by other methods approved by the Engineer. Seal conduit immediately after completion of conductor installation and pull tests. Do not use duct tape as a permanent conduit sealant. Do not use silicone caulk as a conduit sealant.

14. File smooth the cut ends of all mounting strut and conduit. Before installing, paint the field cut ends of all mounting strut and RMC (threaded or non-threaded) with zinc rich paint (94% or more zinc content) to alleviate overspray. Use zinc rich paint to touch up galvanized material as allowed under Item 445 "Galvanizing." Do not paint non-galvanized material with a zinc rich paint as an alternative for materials required to be galvanized.

Texas Department of Transportation

Traffic Operations Division Standard

ELECTRICAL DETAILS CONDUITS & NOTES

ED(1)-14

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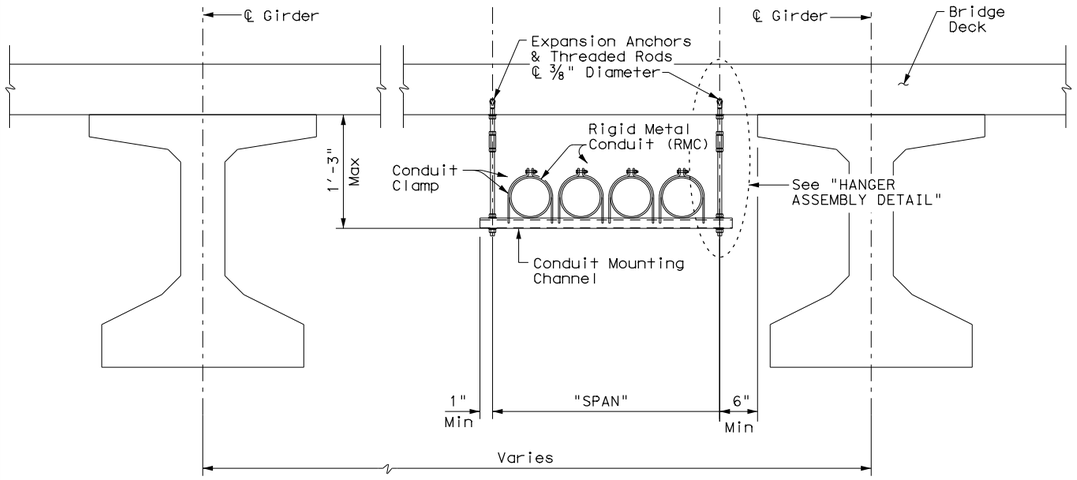
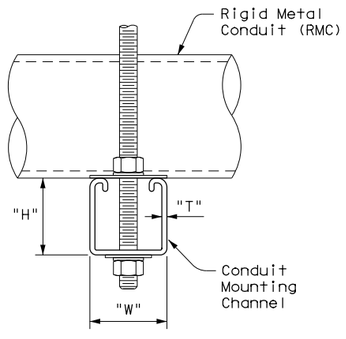
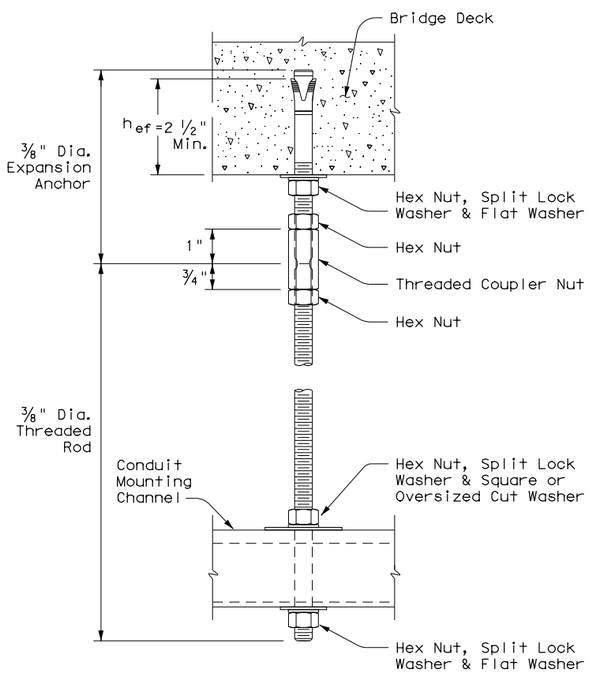


CONDUIT HANGING DETAIL

CONDUIT MOUNTING CHANNEL		
"SPAN"	"W" x "H"	"T"
less than 2'	1 5/8" x 1 3/8"	12 Ga.
2'-0" to 2'-6"	1 5/8" x 1 5/8"	12 Ga.
>2'-6" to 3'-0"	1 5/8" x 2 7/16"	12 Ga.

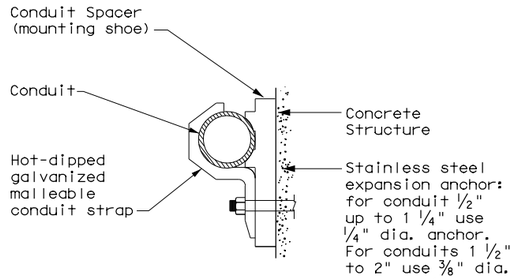
Channels with round or short slotted hole patterns are allowed, if the load carrying capacity is not reduced by more than 15%.

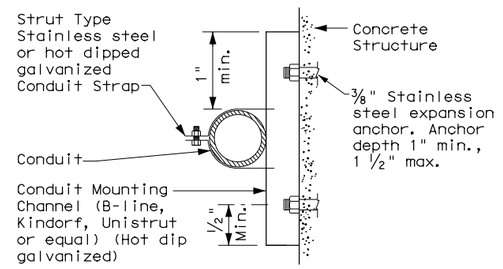




HANGER ASSEMBLY DETAIL

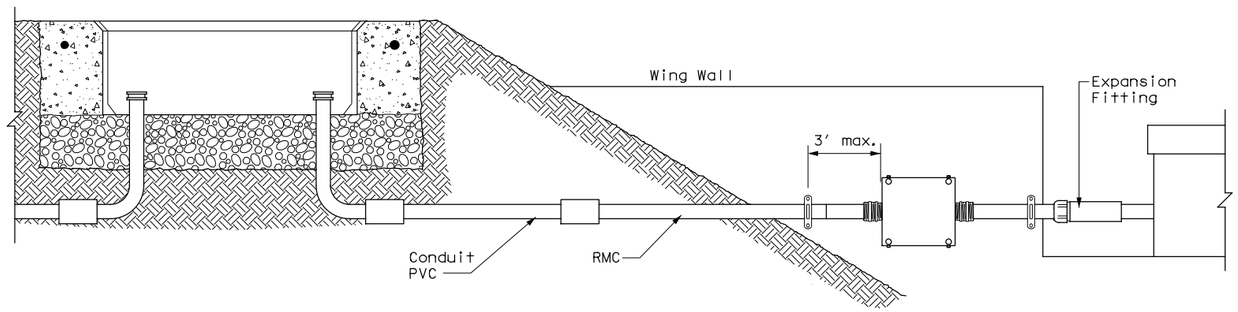
ELECTRIC CONDUIT TO BRIDGE DECK ATTACHMENT





CONDUIT MOUNTING OPTIONS

Attachment to concrete surfaces
See ED(1)B.2



TYPICAL CONDUIT ENTRY TO BRIDGE STRUCTURE DETAIL

EXPANSION ANCHOR NOTES FOR BRIDGE DECK ATTACHMENT

1. Use torque controlled mechanical expansion anchors that are approved for use in cracked concrete by the International Code Council, Evaluation Service (ICC-ES). The chosen anchor product shall have a designated ICC-ES Evaluation Report number, and its approval status shall be maintained on the ICC-ES website under Division 031600 for Concrete Anchors.
2. Unless otherwise approved by the Engineer: do not use adhesive anchors; do not use expansion anchors that are not included in the ICC-ES approval list; and do not use expansion anchors that are only approved for use in uncracked concrete.
3. Use anchors manufactured with stainless steel expansion wedges. Anchors manufactured with carbon steel expansion wedges are not allowed. Anchor bodies can be either zinc-plated carbon steel or stainless steel. For application in marine environment, both the anchor body and expansion wedge shall be stainless steel.
4. Install anchors as shown on the plans and in accordance with the anchor manufacturer's published installation instructions. Arrange a field demonstration test to evaluate the procedures and tools. The test shall be witnessed and approved by the Engineer prior to furnishing anchors on the structure.
5. Prior to hole drilling, use rebar locator to ensure clearing of existing deck strands or reinforcement. Install anchors to ensure a minimum effective embedment depth, (h_{ef}), as shown. Increase (h_{ef}) as needed to ensure sufficient thread length for proper torqueing and tightening of anchors.
6. Use anchors of minimum 1600 Lbs tensile capacity (minimum of steel, concrete breakout, and concrete pullout strengths as determined by ACI 318 Appendix D) at the required minimum embedment depth (h_{ef}). No lateral loads shall be introduced after conduit installation.

Texas Department of Transportation

Traffic Operations Division Standard

ELECTRICAL DETAILS CONDUIT SUPPORTS

ED(2)-14

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ELECTRICAL CONDUCTORS

A. MATERIAL INFORMATION

1. Provide Type XHHW insulated conductors in accordance with Departmental Material Specification (DMS)11040 "Conductors" and Item 620 "Electrical Conductors." Provide conductors as listed on the Material Producers List (MPL) on the Department web site under "Roadway Illumination and Electrical Supplies" Item 620. Color code insulated conductors in conformance with the NEC. Identify grounded (neutral) conductors with white insulation. Identify grounding conductors (ground wires) with green insulation or bare conductors. Identify ungrounded (hot) conductors with any color insulation except green, white, or gray. Keep color scheme consistent throughout the wiring system. Identify conductors 6 American Wire Gauge (AWG) and smaller by continuous color jacket. Identify electrical conductors 4 AWG and larger by continuous color jacket or by colored tape. When identifying conductors with colored tape, mark at least 6 in. of the conductor's insulation with half laps of tape.

2. Provide a solid copper 6 AWG grounding electrode conductor to bond the electrical service equipment to the concrete encased grounding electrode or the ground rod at the service location. Connect the grounding electrode conductor to the ground rod with a UL listed connector in accordance with DMS 11040. Connect the grounding electrode conductor to the concrete encased grounding electrode as shown in the plans.

3. Where two or more circuits are present in one conduit or enclosure, permanently identify the conductors of each branch circuit by attaching a non-metallic tag around both circuit conductors at each accessible location. Provide tags with two straps, large enough to indicate circuit number, letter, or other identification as shown in the plans. Print circuit identification on the tag with a permanent marker.

4. Use listed compression or screw type pressure connectors, terminal blocks, or split bolt connectors for splicing as specified in DMS 11040. Use hot melt adhesive tape to fill the gap and seal the ends of heat shrink tubing. Provide UL listed gel-filled insulating splice covers. Splicing materials, insulating materials, breakaway disconnects, splice covers, and fuse holders are subsidiary to various bid items.

B. CONSTRUCTION METHODS

1. Use only a flat, high tensile strength polyester fiber pull tape for pulling conductors through the conduit system. After installing conductors in conduit, perform conductor pull test. If a conductor cannot be freely pulled, make any needed alterations or repairs at no additional cost to the department. Perform insulation resistance tests in accordance with Item 620. Coordinate with the Engineer to witness the tests.

2. Leave 2 ft. minimum, 3 ft. maximum length for each conductor up to the splice in ground boxes. Leave 3 ft. minimum, 4 ft. maximum length of conductor in ground boxes when pulled through with no splice. Leave 1 ft. minimum, 1.5 ft. maximum length of conductor at enclosures, weatherheads and pole bases.

3. Make splices only in junction boxes, ground boxes, pole bases, or electrical enclosures and use only listed compression or screw type pressure connectors, terminal blocks, or split bolt connectors. Insulate splices with heavy wall heat shrink tubing or gel-filled insulating splice covers to provide a watertight splice. Overlap conductor insulation with heat shrink tubing a minimum of 2 in. past both sides of the splice. Where heat shrink tubing may not shrink sufficiently to provide a watertight seal around the individual conductors, prior to heating the tubing, increase the diameter of the conductor insulation using hot melt adhesive tape to provide a watertight seal between the individual conductors and the heat shrink tubing. Ensure the tape extends past the heat shrink tubing. Use hot melt adhesive tape to fill the gap and seal the ends of heat shrink tubing. Heat shrink tubing that appears to have been burned, or overheated, is considered defective and must be replaced.

4. Size and install gel-filled insulating splice covers according to manufacturer's specifications when used in place of heat shrink tubing.

5. Wire nuts with factory applied waterproof sealant may be used for 8 AWG or smaller conductors in above ground junction boxes, but not in pole bases or ground boxes. Install wire nuts in an upright position to prevent the accumulation of water.

6. Support conductors in illumination poles with a J-hook at the top of the pole.

7. When terminating conductors, remove the insulation and jacketing material without nicking the individual strands of the conductor. Conductors with nicked individual conductor strands or removed strands will be considered damaged.

8. Replace conductors and cables that are damaged beyond repair or that fail an insulation resistance test at no additional cost to the department.

9. Do not repair damaged conductors with duct tape, electrical tape, or wire nuts. Use only approved splicing methods.

10. Do not terminate more than one conductor under a single connector, unless the connector is rated for multiple conductors. Do not exceed the pressure connector's listing for maximum number and size of conductors allowed.

11. Install breakaway connectors on conductors bid under Item 620 whenever those conductors pass through a breakaway support device. Follow manufacturer's instructions when terminating conductors to breakaway connectors. Properly torque threaded connections. Proper terminations are critical to the safe operation of breakaway devices. Trim waterproofing boots on breakaway connectors to fit snugly around the conductor to ensure waterproof connection. Only one conductor may enter a single opening in a boot. Provide waterproof boots with the correct number of openings. Leave unused openings factory sealed. Use prequalified breakaway connectors as shown on the MPL.

12. Provide and install a separate stranded equipment grounding conductor (EGC) in all conduits that contain circuit wiring of 50 volts or more. Unless shown elsewhere, size the EGC to be the same size as the largest current carrying conductor contained in the conduit. Ensure all EGCs are bonded together at every accessible location. For traffic signal installations, provide a minimum size 8 AWG EGC. The EGC is paid for under Item 620.

C. TEMPORARY WIRING

1. Install temporary conductors and electrical equipment in accordance with the NEC article "Temporary Installations" and Department standard sheets.

2. Provide a ground fault circuit interrupter (GFCI) for power outlets for portable electrical equipment, power tools, ice machines, ice storage bins and refrigerators located outdoors at grade. GFCI may be any one of the following: molded cord and plug set, receptacle, or circuit breaker type.

3. Use listed wire nuts with factory applied sealant for temporary wiring where approved.

4. Enclose conductor splices within a listed enclosure or ground box, or ensure the splices are more than 10 ft. above grade vertically and more than 5 ft. horizontally from any metal structure. Where installing temporary conductors in areas subject to vehicle traffic or mobile construction equipment, ensure the vertical clearance to ground is at least 18 ft. when measured at the lowest point. Ground messenger wires that support power conductors in conformance with the NEC.

5. Protect and when necessary repair any existing electrical conduits uncovered during the construction process in a timely manner and in conformance with the NEC.

GROUND RODS & GROUNDING ELECTRODES

A. MATERIAL INFORMATION

1. Provide and install a grounding electrode at electrical services. Provide ground rods according to DMS 11040 and the plans. Larger diameter or longer length rods may be called for in some specific locations, see the individual plans sheets. Concrete encased grounding electrodes may be called for in specific locations including electrical service, see individual plan sheets.

B. CONSTRUCTION METHODS

1. Furnish auxiliary ground rods for lightning protection and install in soil, concrete, or both, as called for in the plans. For ground rods installed in concrete, ensure the connection of the conductor to the ground rod is readily accessible for inspection or repairs. For ground rods installed in soil, ensure that the upper end is between 2 to 4 in. below finished grade.

2. Do not place ground rods in the same drilled hole as a timber pole.

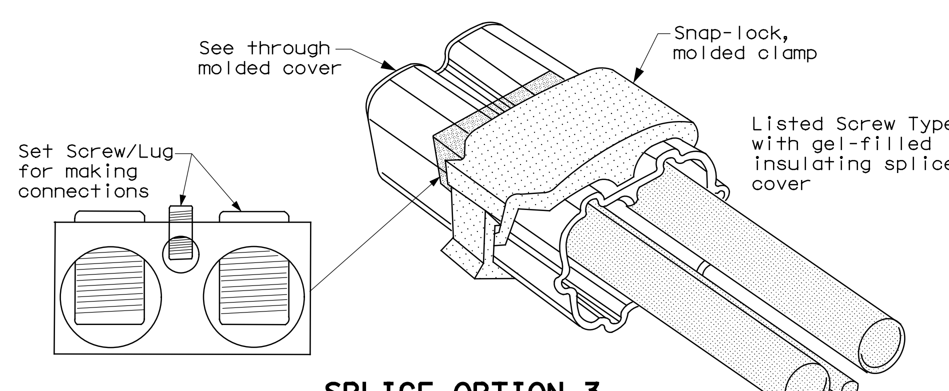
3. Install ground rods so the imprinted part number is at the upper end of the rod.

4. Remove all non-conductive coatings such as concrete splatter from the rod at the clamp location.

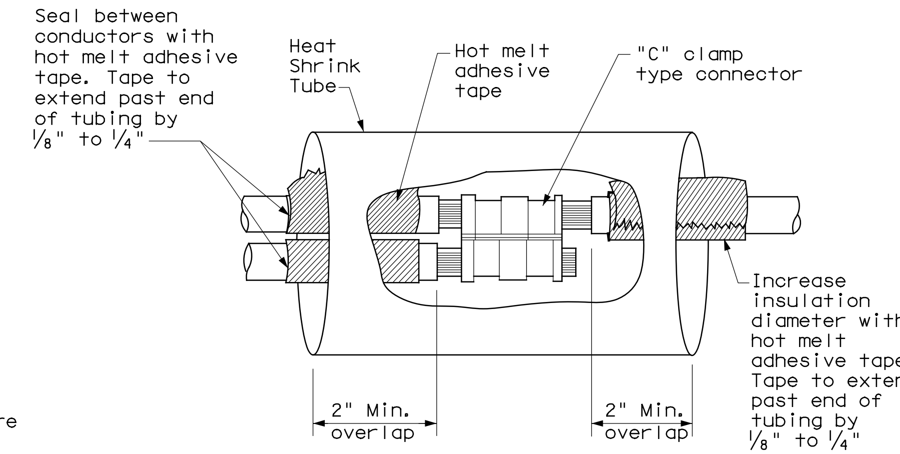
5. Route all conductors as short and straight as possible for connection to lightning protection ground rods. When a bend is required, ensure a minimum radius bend of four inches for these conductors.

6. Unless otherwise called for in the plans, protect grounding electrode conductors with non-metallic conduit. When protecting grounding electrode conductors with metal conduit, provide and install a grounding type bushing and properly sized bonding jumper on each end of the metal conduit.

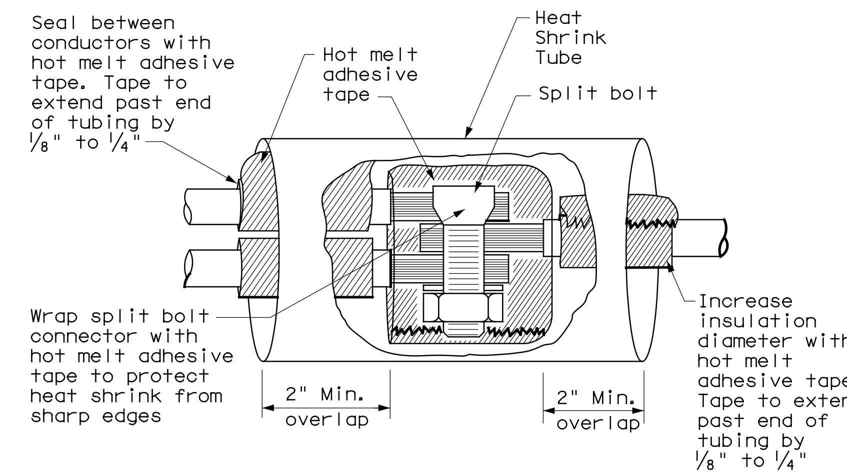
7. Written authorization is required before installing a ground rod in a horizontal trench for rocky soil or a solid rock bottom.



SPLICE OPTION 3
Listed Screw Type



SPLICE OPTION 1
Compression Type



SPLICE OPTION 2
Split Bolt Type

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ELECTRICAL DETAILS CONDUCTORS

ED(3)-14

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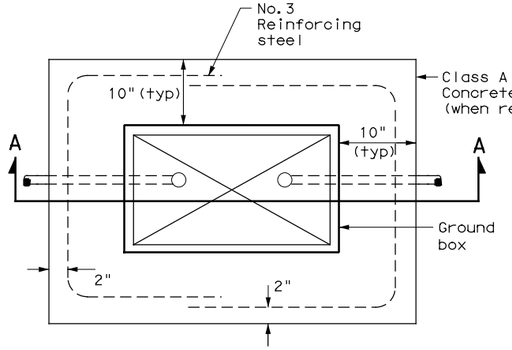
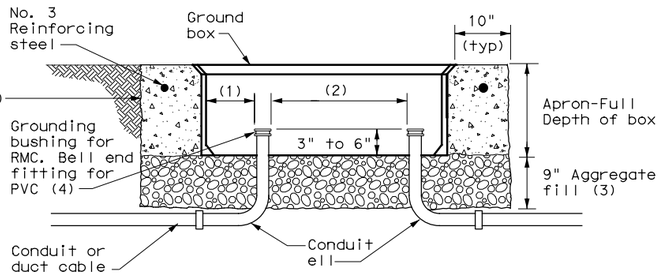


PLAN VIEW



SECTION A - A

APRON FOR GROUND BOX

(1) Uniformly space ends of conduits within the ground box. Position ends of conduits so that ground box walls do not interfere with the installation of grounding bushings or bell end fittings.

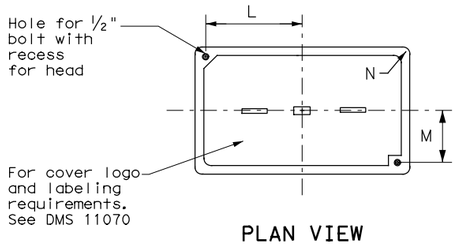
(2) Maintain sufficient space between conduits to allow for proper installation of bushing.

(3) Place aggregate under the box, not in the box. Aggregate should not encroach on the interior volume of the box.

(4) Install a grounding bushing on the upper end of all RMC terminating in a ground box. Ground RMC elbows when any part of the elbow is less than 18 in. below the bottom of the ground box. Install a PVC bushing or bell end fitting on the upper end of all PVC conduits terminating in a ground box.

GROUND BOX DIMENSIONS	
TYPE	OUTSIDE DIMENSIONS (INCHES) (Width x Length X Depth)
A	12 X 23 X 11
B	12 X 23 X 22
C	16 X 29 X 11
D	16 X 29 X 22
E	12 X 23 X 17

GROUND BOX COVER DIMENSIONS								
TYPE	DIMENSIONS (INCHES)							
	H	I	J	K	L	M	N	P
A, B & E	23 1/4	23	13 3/4	13 1/2	9 7/8	5 1/8	1 3/8	2
C & D	30 1/2	30 1/4	17 1/2	17 1/4	13 1/4	6 3/4	1 3/8	2



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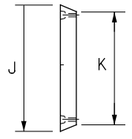

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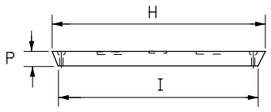

SIDE

GROUND BOX COVER

GROUND BOXES

A. MATERIALS

1. Provide polymer concrete ground boxes measuring 16x30x24 in. (WxLxD) or smaller in accordance with Departmental Material Specification (DMS) 11070 "Ground Boxes" and Item 624 "Ground Boxes."

2. Provide Type A, B, C, D, and E ground boxes as shown in the plans, and as listed on the Material Producers List (MPL) on the Department web site under "Roadway Illumination and Electrical Supplies," Item 624.

3. Ensure ground box cover is correctly labeled in accordance with DMS 11070.

4. Provide larger ground boxes in accordance with Item 624 and as shown in the plans.

B. CONSTRUCTION METHODS

1. Remove all gravel and dirt from conduit. Cap all conduits prior to placing aggregate and setting ground box. Provide Grade 3 or 4 coarse aggregate as shown on Table 2 of Item 302 "Aggregates for Surface Treatments." Ensure aggregate bed is in place and at least 9 inches deep, prior to setting the ground box. Install ground box on top of aggregate.

2. Cast ground box aprons in place. Reinforcing steel may be field bent. Ensure the depth of concrete for the apron extends from finished grade to the top of the aggregate bed under the box. Ground box aprons, including concrete and reinforcing steel, are subsidiary to ground boxes when called for by descriptive code.

3. Keep bolt holes in the box clear of dirt. Bolt covers down when not working in ground boxes.

4. Install all conduits and ells in a neat and workmanlike manner. Uniformly space conduits so grounding bushings and bell end fittings can easily be installed.

5. Temporarily seal all conduits in the ground box until conductors are installed.

6. Permanently seal conduits immediately after the completion of conductor installation and pull tests. Permanently seal the ends of all conduits with duct seal, expandable foam, or other method as approved. Do not use duct tape as a permanent conduit sealant. Do not use silicone caulk as a sealant.

7. When a ground rod is present in a ground box, bond all equipment grounding conductors together and to the ground rod with listed connectors.

8. When a type B or D ground box is stacked to meet volume requirements, it is allowable to cut an appropriately sized hole for conduit entry in the side wall at least 18 inches below grade.

9. If an existing ground box in the contract has a metal cover, bond the cover to the equipment grounding conductor with a 3 ft. long stranded bonding jumper the same size as the grounding conductor. The bonding jumper is subsidiary to various bid items. Verify existing ground boxes with metal covers are shown on the plans, with notes fully describing the work required.

10. If other ground boxes with metal covers are within the project limits but are not part of the contract, the Engineer may direct the Contractor to bond the metal covers, identifying the specific boxes in writing. This work will be paid for separately.

11. Bond metal ground box covers to the grounding conductor with a tank ground type lug.

Texas Department of Transportation

Traffic Operations Division Standard

ELECTRICAL DETAILS GROUND BOXES

ED(4)-14

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ELECTRICAL SERVICES NOTES

1. Provide new materials. Ensure installation and materials comply with the applicable provisions of the National Electrical Code (NEC) and National Electrical Manufacturers Association (NEMA) standards. Ensure material is Underwriters Laboratories (UL) listed. Provide and install electrical service conduits, conductors, disconnects, contactors, circuit breaker panels, and branch circuit breakers as shown on the Electrical Service Data chart in the plans. Faulty fabrication or poor workmanship in material, equipment, or installation is justification for rejection. Where manufacturers provide warranties and guarantees as a customary trade practice, furnish these to the State.

2. Provide electrical services in accordance with Electrical Details standard sheets, Departmental Material Specification (DMS) 11080 "Electrical Services,"DMS 11081 "Electrical Services-Type A," DMS 11082 "Electrical Services-Type C," DMS 11083 "Electrical Services-Type D," DMS 11084 "Electrical Services-Type T," DMS 11085 "Electrical Services-Pedestal (PS)", and Item 628 "Electrical Services" of the Standard Specifications. Provide electrical service types A, C, and D, as listed on the Material Producers List (MPL) on the Department web site under "Roadway Illumination and Electrical Supplies," Item 628. Provide other service types as detailed on the plans.

3. Provide all work, materials, services, and any incidentals needed to install a complete electrical service as specified in the plans.

4. Coordinate with the Engineer and the utility provider for metering and compliance with utility requirements. Primary line extensions, connection charges, meter charges, and other charges by the utility company to provide power to the location are paid for in accordance with Item 628. Get approval for the costs associated with these charges prior to engaging the utility company to do the work. Consult with the utility provider to determine costs and requirements, and coordinate the work as approved.

5. The enclosure manufacturer will provide Master Lock Type 2 with brass tumblers keyed #2195 for all custom electrical enclosures. Installing Contractor is to provide Master Lock #2195 Type 2 with brass tumblers for "off the shelf" enclosures. Master Lock #2195 keys and locks become property of the State. Unless otherwise approved, do not energize electrical service equipment until locks are installed.

6. Enclosures with external disconnects that de-energize all equipment inside the enclosure do not need a dead front trim. Protect incoming line terminations from incidental contact as required by the NEC.

7. When galvanized is specified for nuts, screws, bolts or miscellaneous hardware, stainless steel may be used.

8. Provide wiring and electrical components rated for 75°C. Provide red, black, and white colored XHHW service entrance conductors of minimum size 6 American Wire Gauge (AWG). Identify size 6 AWG conductors by continuous color jacket. Identify electrical conductors sized 4 AWG and larger by continuous color jacket or by colored tape. Mark at least 6 inches of the conductor's insulation with half laps of colored tape, when identifying conductors. Ensure each service entrance conductor exits through a separately bushed non-metallic opening in the weatherhead. The lengths of the conductors outside the weatherhead are to be 12 inches minimum, 18 inches maximum, or as required by utility.

9. All electrical service conduit and conductors attached to the electrical service including the riser or the elbow below ground are subsidiary to the electrical service. For an underground utility feed, all service conduit and conductors after the elbow, including service conduit and conductors for the utility pole riser when furnished by the Contractor, will be paid for separately.

10. Provide rigid metal conduit (RMC) for all conduits on service, except for the ½ in. PVC conduit containing the electrical service grounding electrode conductor. Size the service entrance conduit as shown in the plans. Ensure conduit for branch circuit entry to enclosure is the same size as that shown on the layout sheets for branch circuit conduit. Extend all rigid metal conduits a minimum of 6 inches underground and then couple to the type and schedule of the conduit shown on the layout for that particular branch circuit. Install a grounding bushing on the RMC where it terminates in the service enclosure.

11. Use of liquidtight flexible metal conduit (LFMC) is allowed between the meter and service enclosure when they are mounted 90 to 180 degrees to each other. Size the LFMC the same size as service entrance conduit. LFMC must not exceed 3 feet in length. Strap LFMC within 1 foot of each end. LFMC less than 12 inches in length need not be strapped. Each end of LFMC must have a grounding bushing or be terminated with a grounding fitting. The LFMC must contain a grounded (neutral) conductor. Ensure any bend in LFMC never exceeds 180 degrees. A pull test is required on all installed conductors, with at least six inches of free conductor movement demonstrated to the satisfaction of the Engineer.

12. Ensure all mounting hardware and installation details of services conform to utility company specifications.

13. For all electrical service enclosures listed under Item 628 on the MPL, the UL 508 enclosure manufacturers will prepare and submit a schematic drawing unique to each service. Before shipment to the job site, place the applicable laminated schematic drawings and the laminated plan sheet showing the electrical service data chart used to build the enclosure in the enclosure's data pocket. The installing contractor will copy and laminate the actual project plan sheets detailing all equipment and branch circuits supplied by that service. The laminated plan sheets are to be placed in the service enclosure's document pocket. Reduce 11 in. x 17 in. plan sheets to 8 ½ in. x 11 in. before laminating. If the installation differs from the plan sheets, the installing contractor is to redline plan sheets before laminating.

14. When providing an "Off The Shelf" Type D or Type T service, provide laminated plan sheets detailing equipment and branch circuits supplied by that service. Reduce 11 in. x 17 in. plan sheets to 8 ½ in. x 11 in before laminating. Deliver these drawings before completion of the work to the Engineer, instead of placing in enclosure that has no door pocket.

15. Do not install conduit in the back wall of a service enclosure where it would penetrate the equipment mounting panel inside the enclosure. Provide grounding bushings on all metal conduits, and terminate bonding jumpers to grounding bus. Grounding bushings are not required when the end of the metal conduit is fitted with a conduit sealing hub or threaded boss, such as a meter base hub.

SERVICE ASSEMBLY ENCLOSURE

1. Provide threaded hub for all conduit entries into the top of enclosure.

2. Type galvanized steel (GS) enclosures may be used for Type C panelboards and for Type D and T services that do not use an enclosure mounted photocell or lighting contactor. Provide GS enclosures in accordance with DMS 11080, 11082, 11083, and 11084.

3. Provide aluminum (AL) and stainless steel (SS) enclosures for Types A, C, and D in accordance with DMS 11080, 11081, 11082, 11083, and 11084. Do not paint stainless steel.

4. Provide pedestal service (PS) enclosures in accordance with ED(9) and DMS 11080 and 11085. Do not provide GS pedestal services. If GS is shown in the PS descriptive code, provide an AL enclosure.

MAIN DISCONNECT & BRANCH CIRCUIT BREAKERS

1. Field drill flange-mounted remote operator handle if needed, to ensure handle is lockable in both the "On" and "Off" positions.

2. When the utility company provides a transformer larger than 50 KVA, verify that the available fault current is less than the circuit breaker's ampere interrupting capacity (AIC) rating and provide documentation from the electric utility provider to the Engineer.

PHOTOELECTRIC CONTROL

1. Provide photocell as listed on the MPL. Move, adjust, or shield the photocell from stray or ambient night time light to ensure proper operation. Mount photocell facing north when practical. Mount top of pole photocells as shown on Top Mounted Photocell Detail.

* ELECTRICAL SERVICE DATA

Elec. Service ID	Plan Sheet Number	Electrical Service Description	Service Conduit **Size	Service Conductors No./Size	Safety Switch Amps	Main Ckt. Bkr. Pole/Amps	Two-Pole Contractor Amps	Panelbd/ Loadcenter Amp Rating	Branch Circuit ID	Branch Ckt. Bkr. Pole/Amps	Branch Circuit Amps	KVA Load
SB 183	289	ELC SRV TY A 240/480 100(SS)AL(E)SF(U)	2"	3/#2	100	2P/100	100	N/A	Lighting NB	2P/40	26	28.1
									Lighting SB	2P/40	25	
									Underpass	1P/20	15	
NB Access	30	ELC SRV TY D 120/240 060(NS)SS(E)TS(O)	1 ¼"	3/#6	N/A	2P/60		100	Sig. Controller	1P/30	23	5.3
							30		Luminaires	2P/20	9	
									CCTV	1P/20	3	
2nd & Main	58	ELC SRV TY T 120/240 000(NS)GS(N)SP(O)	1 ¼"	3/#6	N/A	N/A	N/A	70	Flashing Beacon 1	1P/20	4	1.0
									Flashing Beacon 2	1P/20	4	

* Example only, not for construction. All new electrical services must have electrical service data chart specific to that service as shown in the plans.

** Verify service conduit size with utility. Size may change due to utility meter requirements. Ensure conduit size meets the National ELectrical Code.

EXPLANATION OF ELECTRICAL SERVICE DESCRIPTIVE CODE

ELEC SERV TY X XXX/XXX XXX (XX) XX (X) XX (X)

Schematic Type

Service Voltage V / V

Disconnect Amp Rating
000 indicates main lug only/
Typically Type T

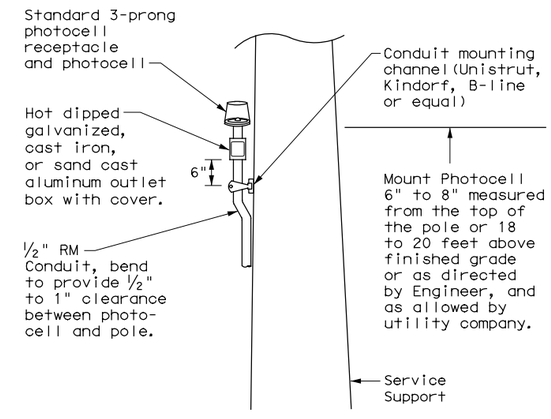
(SS)= Safety Switch Ahead of Meter-Check with Utility
(NS)= No safety Switch Ahead of Meter-Check with Utility

Enclosure Type
GS= Galvanized steel("off the shelf")
SS= Stainless steel(Custom Enclosure)See MPL
AL= Aluminum (Custom Enclosure)See MPL

Photocell Mounting Location
(E)= Inside Service/Enclosure Mounted
(T)= Top of pole
(L)= Luminaire mounted
(N)= None/No Photocell or Lighting Contactor Required

Service Support Type
GC= Granite concrete
OC= Other concrete
TP= Timber pole
SP= Steel pole
SF= Steel frame
OT= Pole by others or paid for separately
EX= Existing pole
TS= Service on traffic signal pole
PS= Pedestal Service

O= Overhead Service Feed from Utility
U= Underground Service Feed from Utility



TOP MOUNTED PHOTOCELL

Install conduit strap maximum 3 feet from box. 5 foot maximum spacing between straps supporting conduit.

Texas Department of Transportation

Traffic Operations Division Standard

ELECTRICAL DETAILS SERVICE NOTES & DATA

ED(5)-14

FILE: ed5-14.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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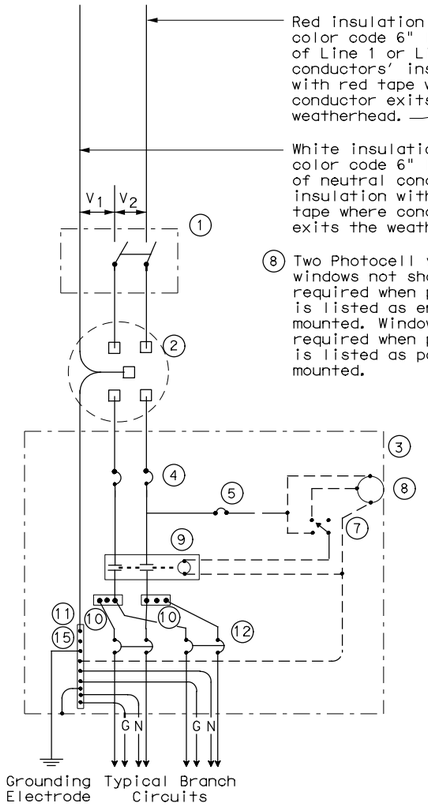
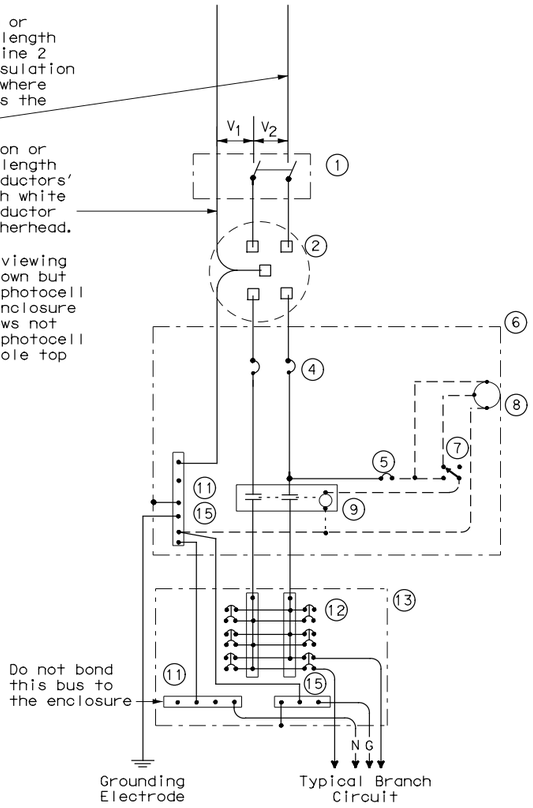
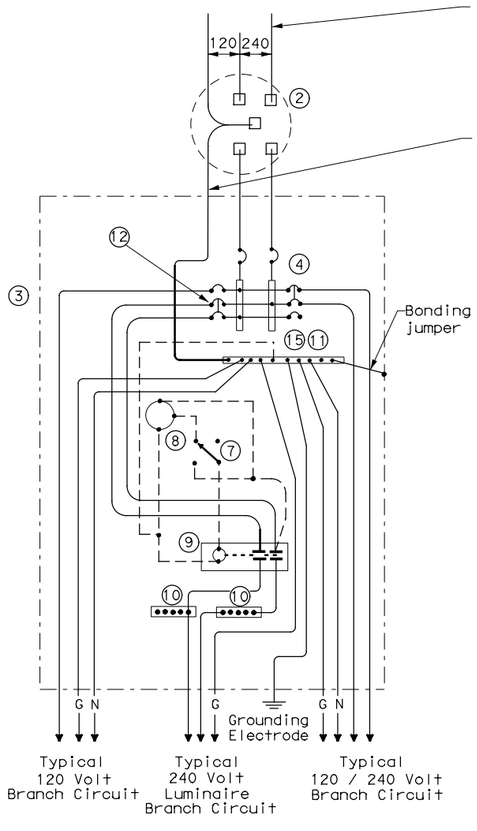


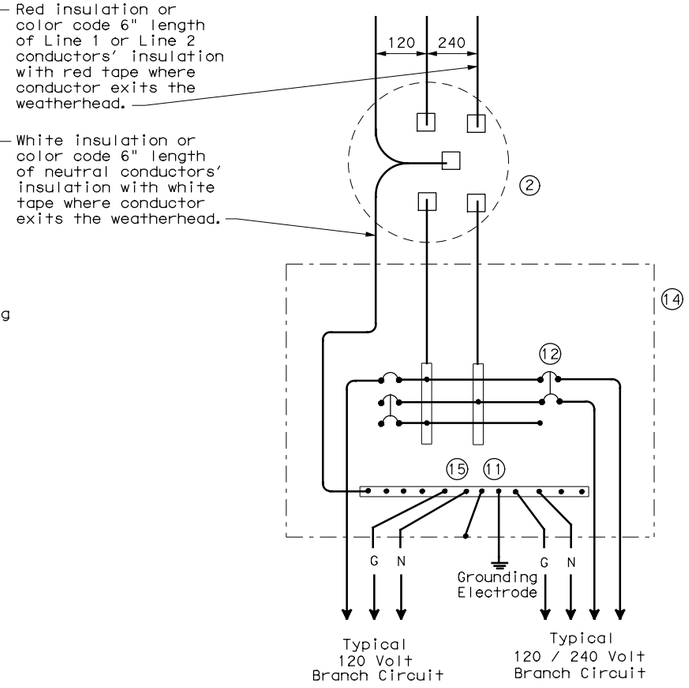
SCHEMATIC TYPE A
THREE WIRE



SCHEMATIC TYPE C
THREE WIRE



SCHEMATIC TYPE D - CUSTOM
120/240 VOLTS - THREE WIRE



SCHEMATIC TYPE T
120/240 VOLTS - THREE WIRE

Galvanized steel-"Buy Off The Shelf" only. When required install photocell top of the pole or on luminaire only, no lighting contractor will be installed.

WIRING LEGEND	
———	Power Wiring
· – – – –	Control Wiring
—N—	Neutral Conductor
—G—	Equipment grounding conductor-always required

SCHEMATIC LEGEND	
1	Safety Switch (when required)
2	Meter (when required-verify with electric utility provider)
3	Service Assembly Enclosure
4	Main Disconnect Breaker (See Electrical Service Data)
5	Circuit Breaker, 15 Amp (Control Circuit)
6	Auxiliary Enclosure
7	Control Station ("H-O-A" Switch)
8	Photo Electric Control (enclosure-mounted shown)
9	Lighting Contactor
10	Power Distribution Terminal Blocks
11	Neutral Bus
12	Branch Circuit Breaker (See Electrical Service Data)
13	Separate Circuit Breaker Panelboard
14	Load Center
15	Ground Bus

Texas Department of Transportation

Traffic Operations Division Standard

ELECTRICAL DETAILS SERVICE ENCLOSURE AND NOTES

ED(6)-14

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SUPPORT TYPE STEEL POLE (SP) AND STEEL FRAME (SF)

1. Provide steel pole and steel frame supports as per TxDOT Departmental Material Specification (DMS)11080 "Electrical Services." Mount all equipment and conduit on 12 gauge galvanized steel or stainless steel channel strut, 1 ½ in. or 1 ⅝ in. wide by 1 in. up to 3 ¾ in. deep Unistrut, Kindorf, B-line or equal. Bolt or weld all channel and hardware to vertical members as approved. Do not stack channel. File smooth and paint field cut ends of all channel with zinc-rich paint before installing.

2. Provide poles for overhead service with an eyebolt or similar fitting for attachment of the service drop to the pole in conformance with the electric utility provider's specifications.

3. Provide and install galvanized ¾ in. x 18 in. x 4 in. (dia. x length x hook length) anchor bolts for underground service supports. Provide and install galvanized ¾ in. x 56 in. x 4 in. anchor bolts for overhead service supports. Ensure anchor bolts have 3 in of thread, with 3 ¼ in. to 3 ½ in. of the exposed anchor bolt projecting above finished foundation. Provide and install leveling nuts for all anchor bolts.

4. Bond one of the anchor bolts to the rebar cage with 6 AWG bare stranded copper conductor. Use listed mechanical connectors rated for embedment in concrete. See Inset B.

5. Furnish and install rigid metallic ells in all steel pole and steel frame foundations for all conduits entering the service from underground.

6. Use class C concrete for foundations. Ensure reinforcing steel is Grade 60 with 3" of unobstructed concrete cover.

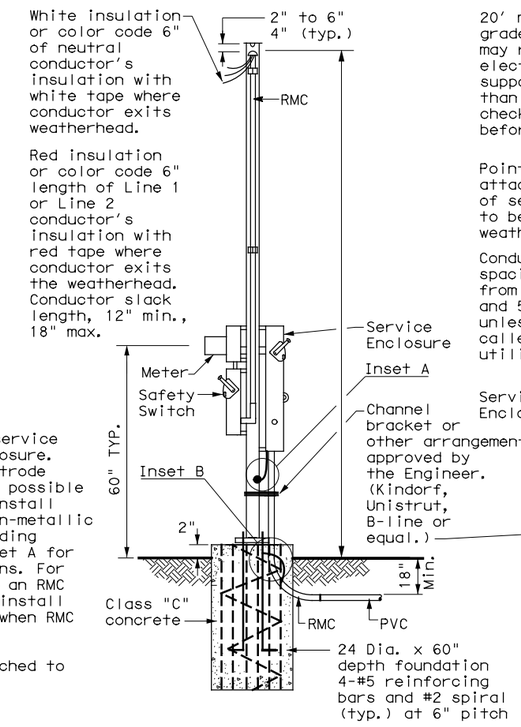
7. Drill and tap steel poles and frames for ½ in. X 13 UNC tank ground fitting. For steel pole service supports, provide and install tank ground fitting 4 in. to 6 in. below electrical service enclosure. Provide properly sized hole through the bottom of the enclosure for the service grounding electrode conductor. Ensure electrical service grounding electrode conductor is as short and straight as possible from the enclosure to the tank ground fitting. For steel frame service supports, provide and install tank ground fitting on steel frame post. Install service grounding electrode conductor in a non-metallic conduit or tubing from the enclosure to the steel frame post. Connect electrical service grounding electrode conductor to the tank ground fitting. See steel frame and steel pole details and Inset A for more information. Size service entrance conduit and branch circuit conduit as shown in the plans. For underground conduit runs from the electrical service, extend RMC from the service enclosure to an RMC elbow, and then connect the schedule type and size of conduit shown in the plans. Provide and install grounding bushings where RMC terminates in the enclosure. Grounding bushings are not required when RMC is fitted into a sealing hub or threaded boss.

8. If Steel pole or frame is painted, bond each separate painted piece with a bonding jumper attached to a tapped hole.

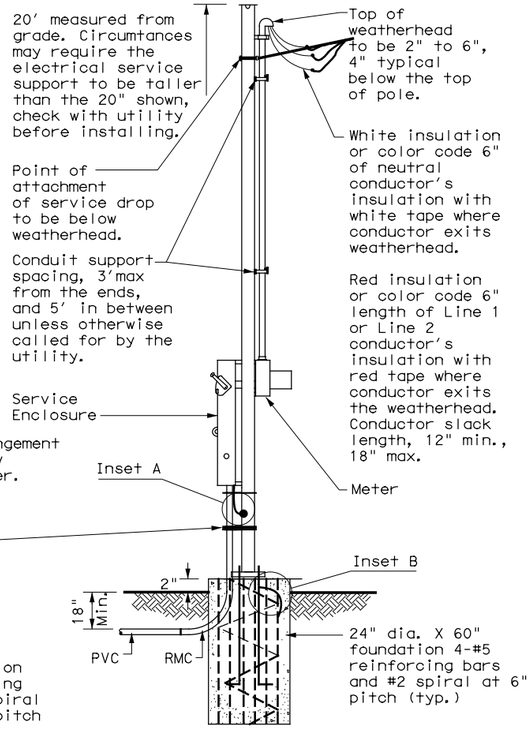
9. Provide ¼" - 20 machine screws for bonding. Do not use sheet metal screws. Remove all non-conductive material at contact points. Terminate bonding jumpers with listed devices. Install minimum size 6 AWG stranded copper bonding jumpers. Make up all threaded bonding connections wrench tight.

10. Avoid contact of the service drop and service entrance conductors with the metal pole to prevent abrasion of the insulated conductors.

11. Shop drawings are not required for service support structure unless specifically stated elsewhere or directed by the Engineer.

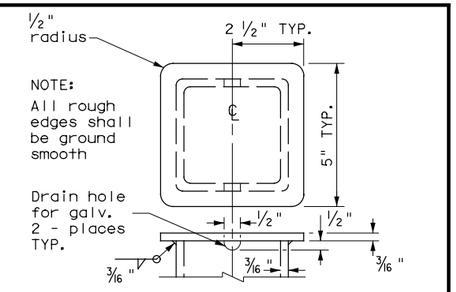


WITH SAFETY SWITCH

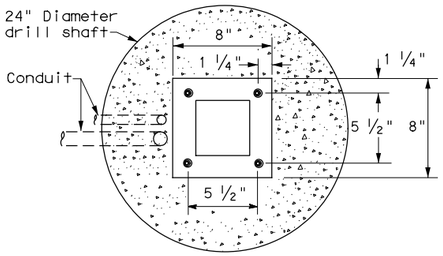


WITHOUT SAFETY SWITCH

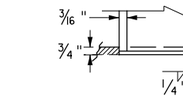
SERVICE SUPPORT TYPE SP (O) - OVERHEAD SERVICE



POLE TOP PLATE

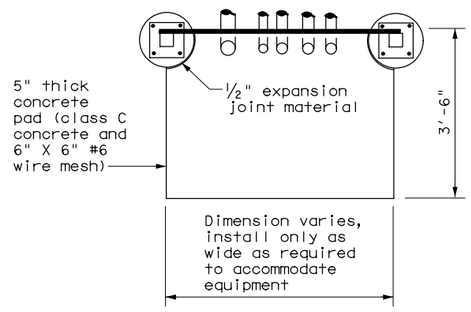


BASE PLATE DETAIL



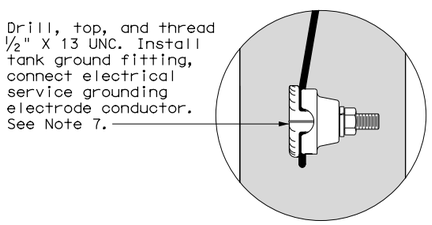
BOTTOM OF POLE

SERVICE SUPPORT TYPE SF & SP



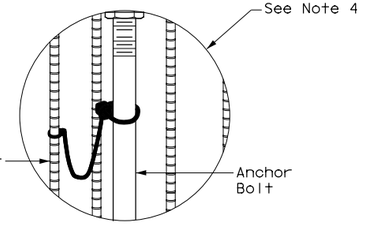
TOP VIEW

SERVICE SUPPORT TY SF (O) & SF (U)

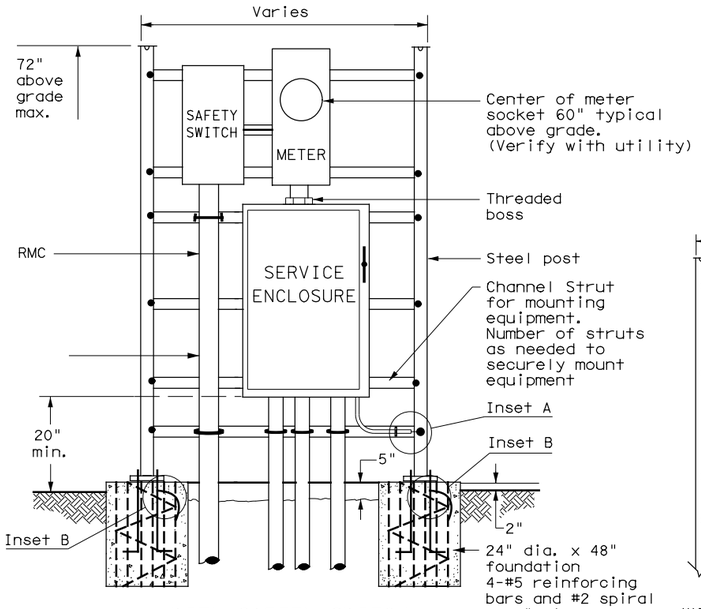


FRONT VIEW

INSET A

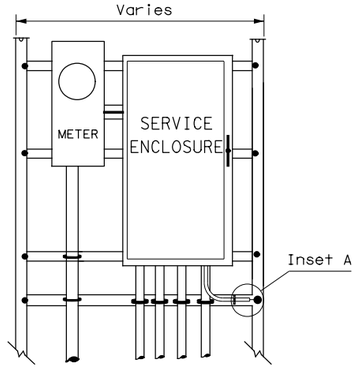


INSET B



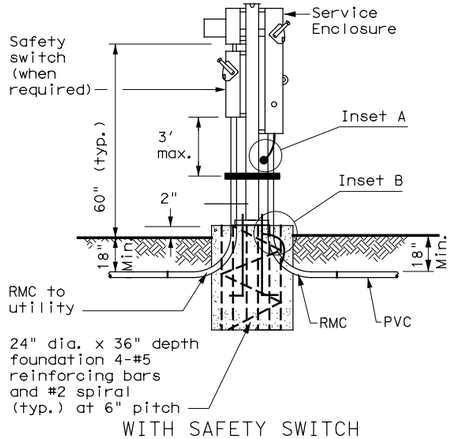
WITH SAFETY SWITCH

FRONT VIEW

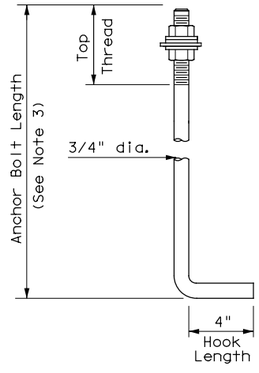


WITHOUT SAFETY SWITCH

SERVICE SUPPORT TYPE SF(U) - UNDERGROUND SERVICE



WITH SAFETY SWITCH



HOOKED ANCHOR DETAIL

SERVICE SUPPORT TYPE SP(U) - UNDERGROUND SERVICE

Texas Department of Transportation

Traffic Operations Division Standard

ELECTRICAL DETAILS SERVICE SUPPORT TYPES SF & SP

ED(7)-14

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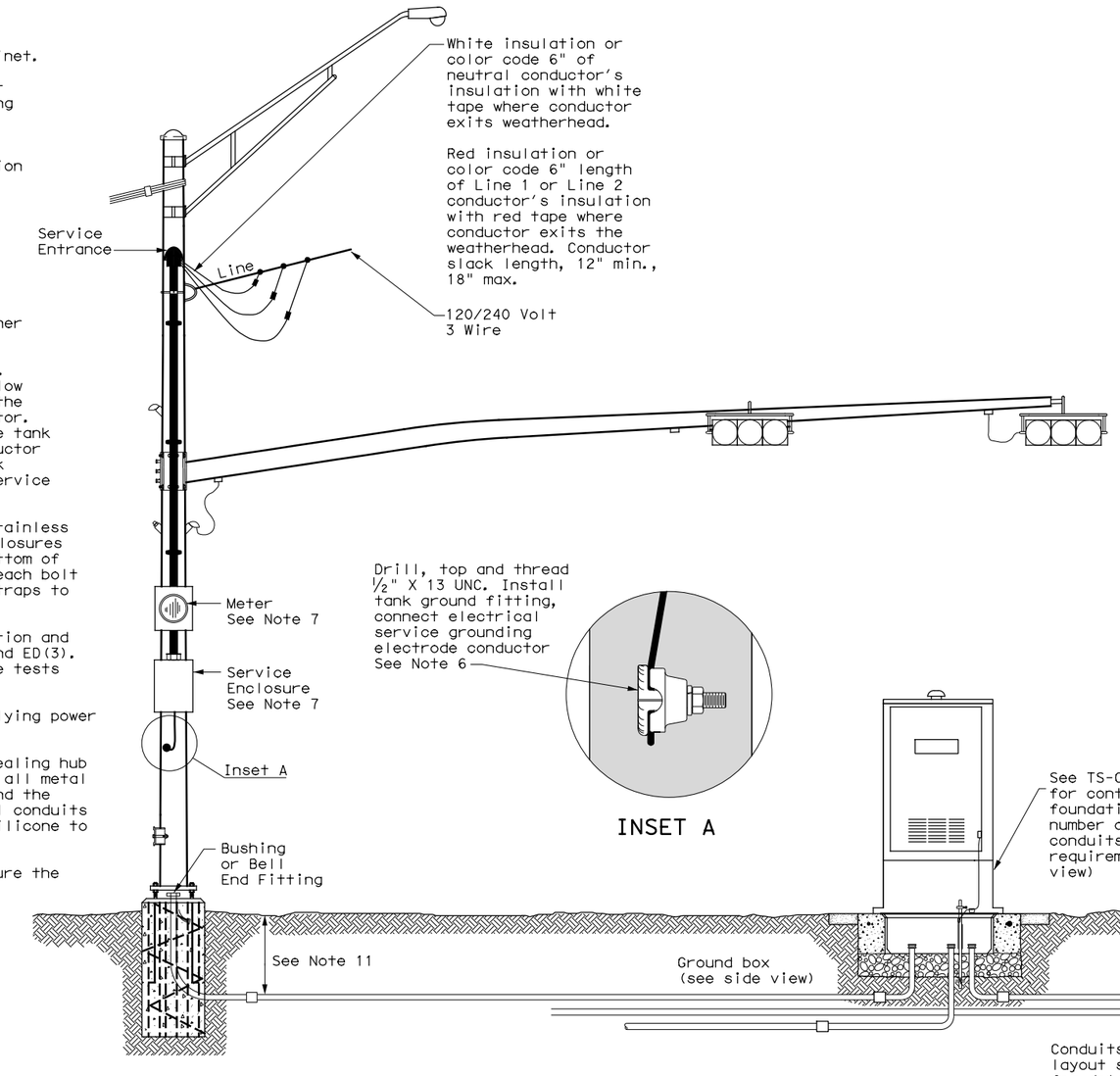
TRAFFIC SIGNAL NOTES

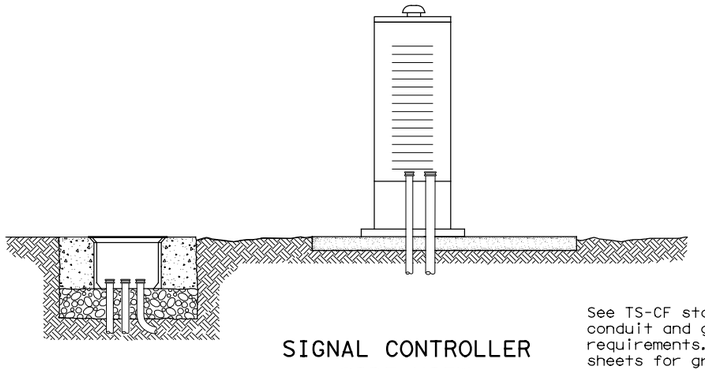
1. Do not pass luminaire conductors through the signal controller cabinet.
2. Include an equipment grounding conductor in all conduits throughout the electrical system. Bond all exposed metal parts to the grounding conductor.
3. Provide roadway luminaires, when required, in accordance with the material and construction sections of Item 610, "Roadway Illumination Assemblies," except for performance testing of luminaires. Test installed roadway luminaires for proper operation as a part of the associated traffic signal system test.
4. If internally illuminated street name signs are approved for use, ground the fixture to the pole with a 12 AWG green XHHW conductor.
5. Bond anchor bolts to rebar cage in two locations using #3 bars or 6 AWG stranded copper conductors. Use listed mechanical connectors rated for embedment in concrete. See TXDOT standard TS-FD for further details.
6. Drill and tap signal poles for ½ in. X 13 UNC tank ground fitting. Provide and install tank ground fitting 4 in. to 6 in. directly below electrical service enclosure. Provide properly sized hole through the bottom of the enclosure for the service grounding electrode conductor. Connect the electrical service grounding electrode conductor to the tank ground fitting. Ensure electrical service grounding electrode conductor is as short and straight as possible from the enclosure to the tank ground fitting. See Inset A detail for further information. Size service entrance conduit and branch circuit conduit as shown in the plans.
7. Mount electrical service enclosure and meter to signal pole with stainless steel bands. Ensure bands are a minimum width of ¾ in. Secure enclosures to bands using two-bolt brackets. Install brackets near top and bottom of each enclosure. Install properly sized stainless steel washers on each bolt in the enclosure. Band or drill and tap properly sized stand-off straps to signal pole for attaching conduit.
8. Conduct pull tests and insulation resistance tests on all illumination and power conductors as required in Item 620 "Electrical Conductors" and ED(3). To prevent electronics damage, do not conduct insulation resistance tests on traffic signal cables after termination.
9. Lock all enclosures and bolt down all ground box covers before applying power to the signal installation.
10. Terminate conduits entering the top of enclosures with a conduit-sealing hub or threaded boss such as meter hub. Install a grounding bushing on all metal conduits not connected to conduit-sealing hub or threaded boss. Bond the grounding bushing to the ground bus with a bonding jumper. Seal all conduits entering enclosures with duct seal or expanding foam. Do not use silicone to seal conduit ends.
11. For all conduits, ensure the burial depth is a minimum of 18". Ensure the minimum burial depth for conduit placed under a roadway is 24".



SIGNAL POLE WITH SERVICE

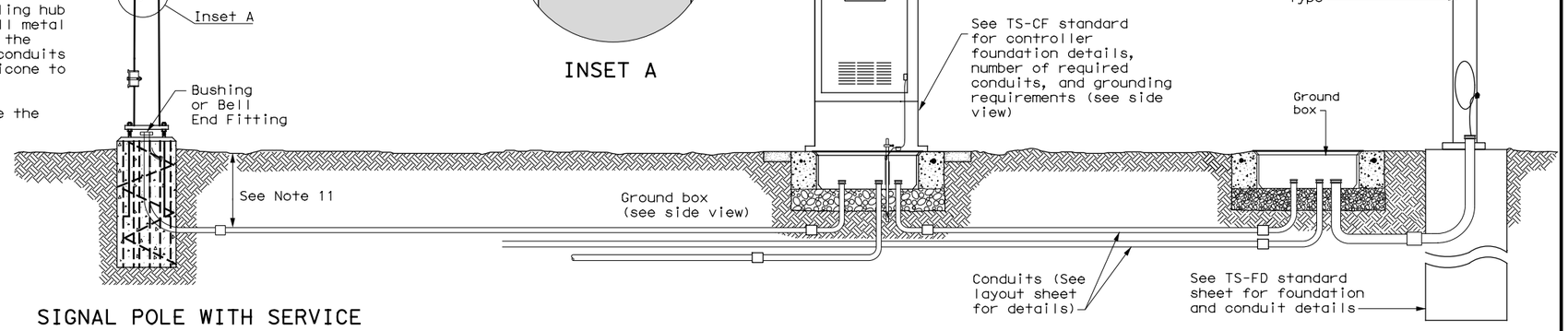
Type T electrical service mounted on signal pole shown as an example. See electrical details, layout sheets, and electrical service data chart for additional details.

INSET A



SIGNAL CONTROLLER SIDE VIEW

See TS-CF standard for conduit and grounding requirements. See layout sheets for ground box locations and any additional conduits that are required.



SIGNAL CONTROLLER FRONT VIEW

SIGNAL POLE

Texas Department of Transportation

Traffic Operations Division Standard

ELECTRICAL DETAILS TYPICAL TRAFFIC SIGNAL SYSTEM DETAILS

ED(8)-14

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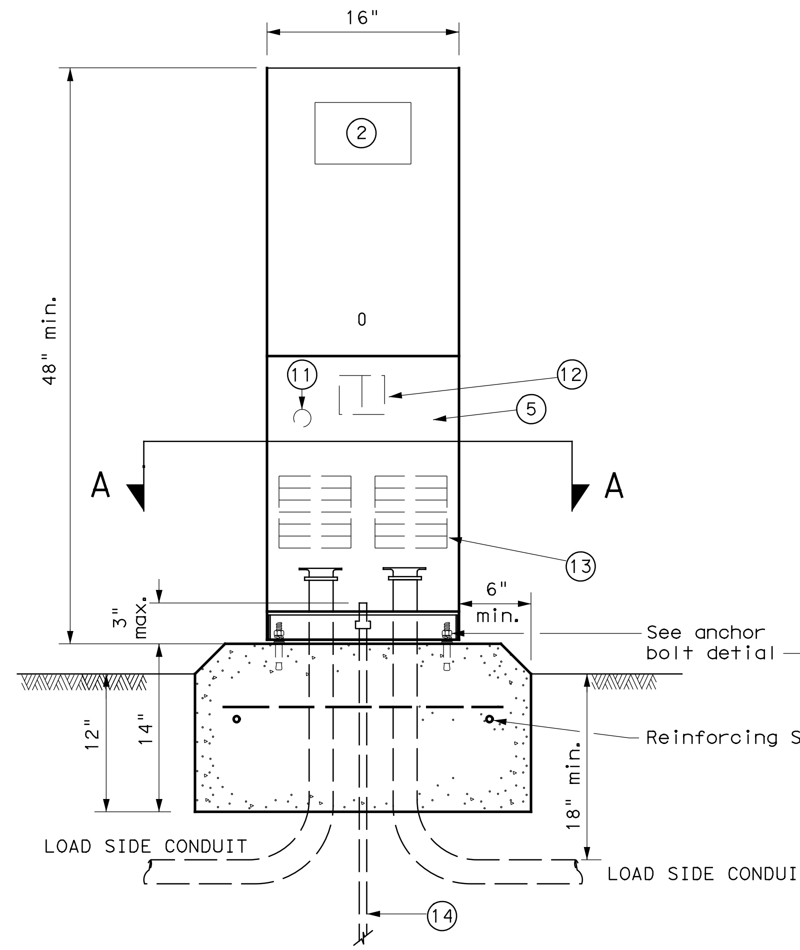
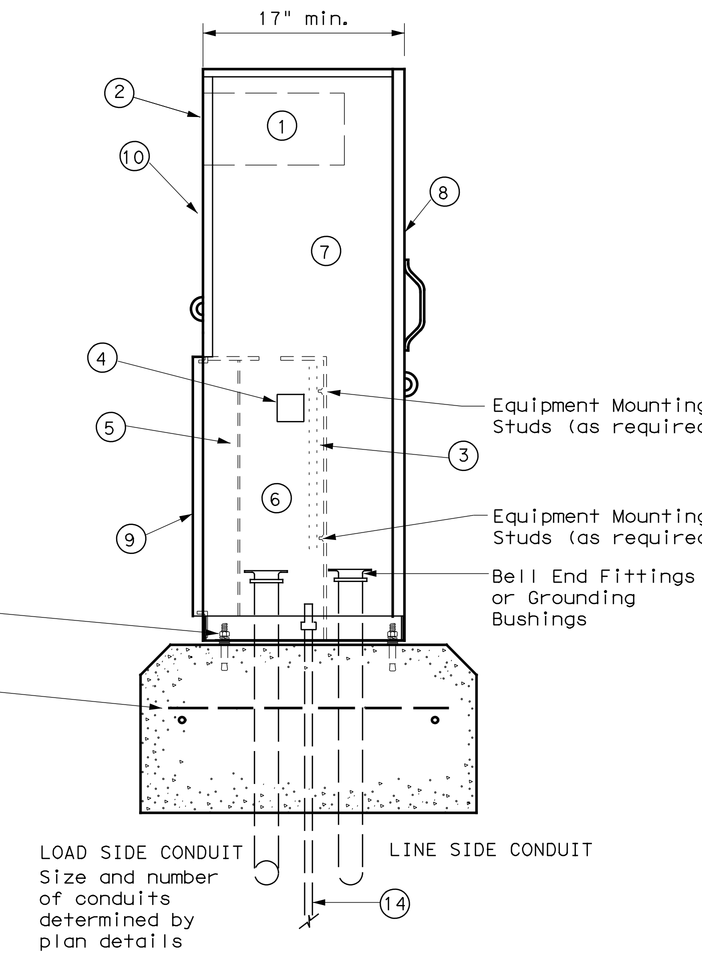
PEDESTAL SERVICE NOTES

1. Manufacture pedestal electrical services in accordance with Departmental Material Specifications (DMS)11080 "Electrical Services", 11085 "Electrical Services-Pedestal (PS)" and Item 628 "Electrical Services. "Provide pedestal electrical services as listed on the Material Producers list (MPL) on the Department's web site under "Roadway Illumination and Electrical Supplies," Item 628. Ensure all mounting hardware and installation details of services meet utility company specifications. Contact the local utility company for approval of pedestal details prior to installing the electrical pedestal service. Submit any changes required by the utility company prior to manufacturing the pedestal enclosure.
2. When a meter socket is required, provide a socket with a minimum 100 amp rating that complies with local utility requirements.
3. Provide Class A or C concrete for pedestal service foundations in accordance with Item 420, "Concrete Substructures," except that concrete will not be paid for directly but is considered subsidiary to Item 628.
4. Provide #4 reinforcing steel for foundations in accordance with Item 440, "Reinforcement for Concrete."
5. Install $\frac{1}{2}$ in. X 2 $\frac{1}{16}$ in. minimum length concrete single expansion type anchors for mounting pedestal enclosure to foundation. Anchor location to match mounting holes in each corner of enclosure. Secure each of the four corners of the pedestal enclosure to the anchors in the foundation with a $\frac{1}{2}$ in. galvanized or stainless steel machine thread bolt, a properly sized locknut and a flat washer.
6. Finish top of concrete foundation in a neat and workmanlike manner. If leveling washers are used, ensure no more than $\frac{1}{8}$ in. gap at any corner. Do not exceed a maximum dip or rise in the foundation of $\frac{1}{8}$ in. per foot. When properly installed, ensure the top of the service enclosure is level front to back and side to side within $\frac{1}{4}$ in. Repair rocking or movement of the service enclosure at no additional cost to the department.
7. Do not use liquidtight flexible metal conduit (LFMC) on pedestal type services.
8. Ensure all elbows in the foundation are sized as per utility provider's conduit requirements for underground conduit and feeders. PVC extensions may be installed provided the ends of the rigid metal conduits are more than 2 in. below the top of the concrete foundation. Where extension conduits are metal, grounding bushings must be installed with a bonding jumper properly terminated.

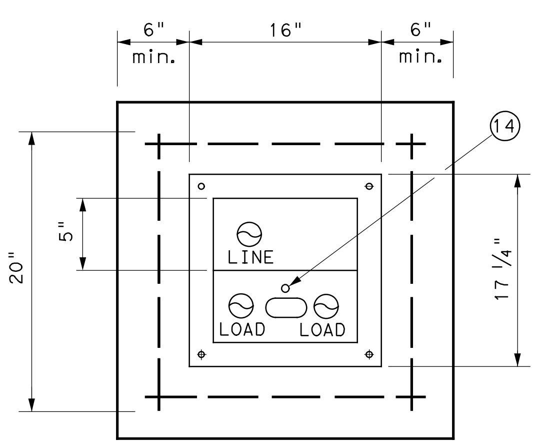


FRONT VIEW

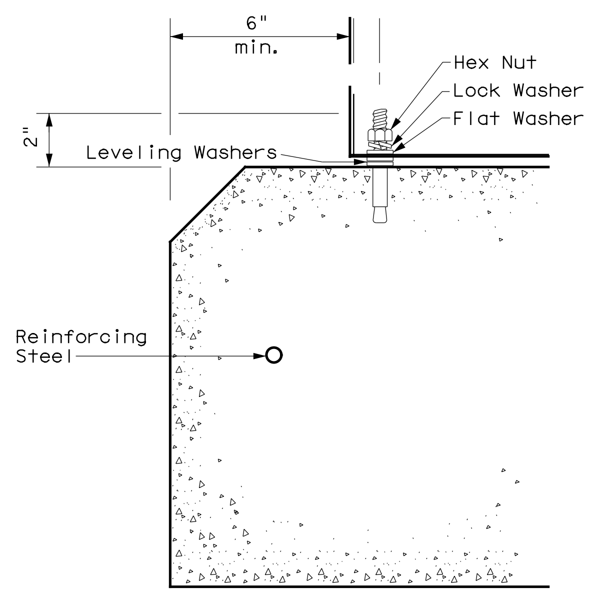
TYPE C shown, TYPE A similar except that TYPE A shall have individual circuit breakers (CB) mounted on an equipment mounting panel. CB Handles shall protrude through hinged deadfront trim.



SIDE VIEW



SECTION A-A



ANCHOR BOLT DETAIL

LEGEND	
1	Meter Socket, (when required)
2	Meter Socket Window, (when required)
3	Equipment Mounting Panel
4	Photo Electric Control Window, (When required)
5	Hinged Deadfront Trim
6	Load Side Conduit Trim
7	Line Side Conduit Area
8	Utility Access Door, with handle
9	Pedestal Door
10	Hinged Meter Access
11	Control Station (H-O-A Switch)
12	Main Disconnect
13	Branch Circuit Breakers
14	Copper Clad Ground Rod - 5/8" X 10'

Texas Department of Transportation

Traffic Operations Division Standard

ELECTRICAL DETAILS ELECTRICAL SERVICE SUPPORT PEDESTAL SERVICE TYPE PS

ED(9)-14

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TIMBER POLE (TP) SERVICE SUPPORT NOTES

1. Ensure electrical service support is a class 5 treated timber pole as per Item 627 "Treated Timber Poles." Embed timber pole to depth required in Item 627.
2. Conduit and electrical conductors attached to the electrical service pole and underground within 12 in. of service pole are not paid for directly but are subsidiary to the electrial service.
3. Install pole-top mounted photocell (T) on north side of pole, or in service enclosure (E) as required. See Electrical Service Data chart in plan set.
4. Gain pole as required to provide flat surface for each channel. Gain timber pole to 5/8 in. max. depth and 1 7/8 in. max. height. Gain pole in a neat and workmanlike manner.
5. Mount meter and service equipment on stainless steel or galvanized channel (Unistrut, Kindorf, or equal). Provide channel sized 1 in. to 3 3/4 in. maximum depth, and 1½ in. to 1⅝ in. maximum width. File smooth the cut ends of galvanized channel and paint with zinc rich paint before installing on pole. Secure each channel section to timber pole with two galvanized or SS lag bolts, ¼ in. minimum diameter by 1½ in. minimum length. Use a galvanized or SS flat washer on each lag bolt. Do not stack channel.
6. When excess length must be trimmed from poles, trim from the top end only.

(1) Class 5 pole, height as required

(2) Service drop from utility company (attached below weatherhead)

(3) Service conduit (RMC) and service entrance conductors - One Red, One Black, One White (See Electrical Service Data)

(4) Safety switch (when required)

(5) Meter (when required)

(6) Service enclosure

(7) 6 AWG bare grounding electrode conductor in ½ in. PVC to ground rod - extend ½ in. PVC 6 in. underground.

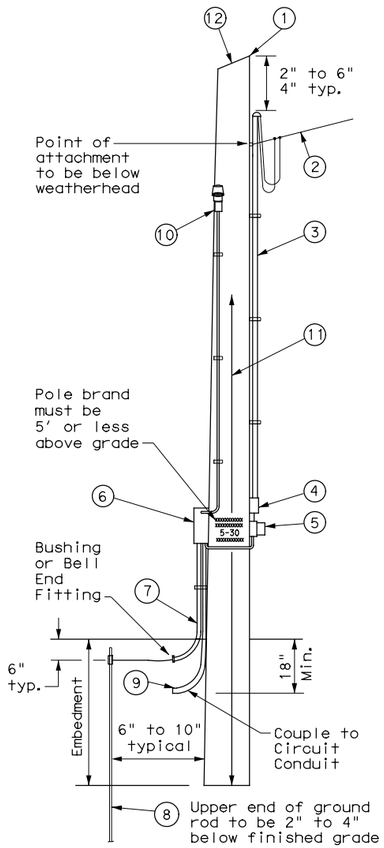
(8) ⅝ in. x 8 ft. Copper clad ground rod - drive ground rod to a depth of 2 in. to 4 in. below grade.

(9) RMC same size as branch circuit conduit.

(10) See pole-top mounted photocell detail on ED(5).

(11) When required by the serving utility provide bare 6 AWG copper conductor. Run wire from pole top to butt wrap or copper butt plate. Protect conductor with non-conductive material to a height of 8 ft. above finished grade.

(12) When required by utility, cut top of pole at an angle to enhance rain run off.

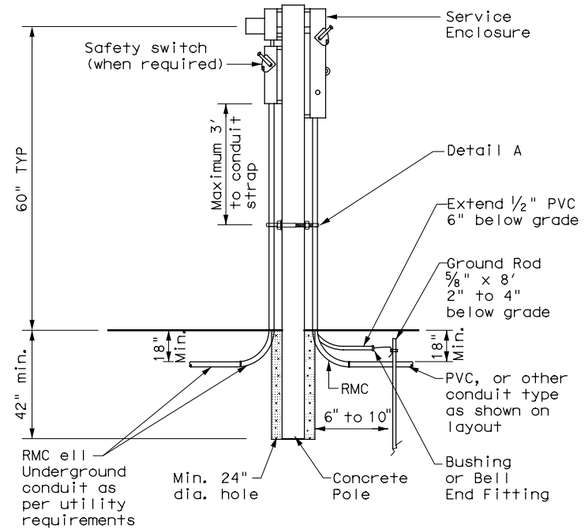


SERVICE SUPPORT TYPE TP (O)

GRANITE CONCRETE (GC) & OTHER CONCRETE (OC) NOTES

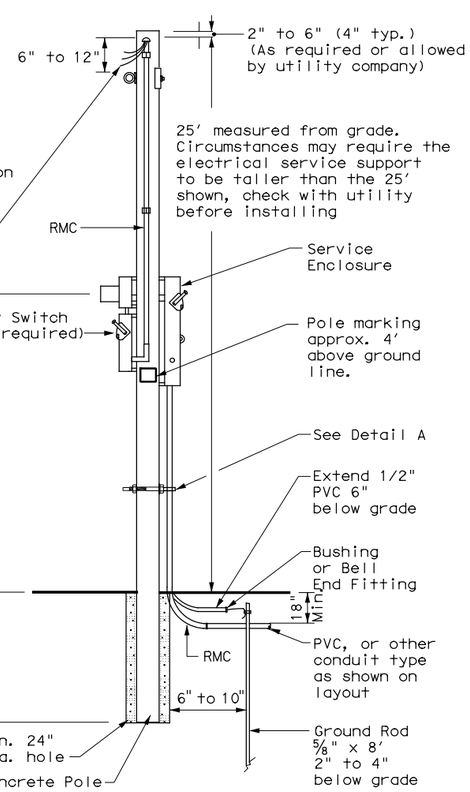
Ensure electrical service support structures bid as type Granite Concrete (GC) or Other Concrete (OC) meet the following requirements.

1. Provide GC and OC poles that meet the requirements of DMS 11080 "Electrical Services."
2. Provide prestressed concrete poles suitable for direct embedment into the ground without special foundations.
3. Verify poles are marked as required on DMS 11080. Location of marking should be approximately 4' above final grade. Use the two-point pickup locations when handling pole in horizontal position, and one-point pickup location for use in raising the pole to a vertical position. These marks are small but conspicuous.
4. Embed poles 42 in. or 10% of the length plus 2 ft., whichever is greater.
5. Ensure all installation details of services are in accordance with utility company specifications.
6. Install a one point rack or eye bolt bracket 6 inches to 12 inches below the weatherhead as an overhead service drop anchoring point for the electric utility.
7. Furnish and install galvanized or stainless steel channel strut 1 ½ in. or 1 ⅝ in. wide by 1 in. up to 3 ¾ in. deep (Unistrut, Kindorf, B-line or equal). Attach channel strut with stainless steel concrete anchors (max. 1" depth), square U-bolts or back to back channel strut with long bolts, or other secure mounting as approved by the Engineer. Ensure bolts are galvanized in accordance with ASTM A153. Do not stack channel struts.
8. Backfill the holes thoroughly by tamping in 6 in. lifts. After tamping to grade, place additional backfill material in a 6 inch high cone around the pole to allow for settling. Use material equal in composition and density to the surrounding area. Backfilling will not be paid for directly but is subsidiary to various bid items.



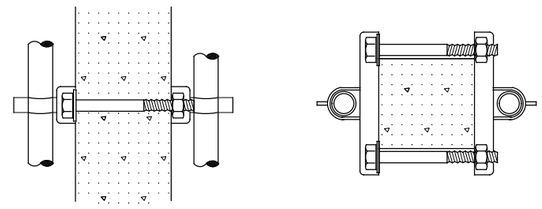
CONCRETE SERVICE SUPPORT

Underground (U)



CONCRETE SERVICE SUPPORT

Overhead (O)



DETAIL A

See Note 7. Before installing channel that has been cut, file sharp edges and paint with zinc-rich paint. Ensure there is no paint splatter on the pole.

Texas Department of Transportation

Traffic Operations Division Standard

ELECTRICAL DETAILS SERVICE SUPPORT TYPES GC, OC, & TP

ED(10)-14

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DUCT CABLE & HDPE CONDUIT NOTES

1. Provide duct cable in accordance with Departmental Material Specification (DMS) 11060 "Duct Cable" and Item 622 "Duct Cable." Provide duct cable as listed on the Material Producer List (MPL) on the Department web site under "Roadway Illumination and Electrical Supplies" Item 622.

2. Provide High-Density Polyethylene (HDPE) conduit in accordance with DMS 11060 and Item 618, "Conduit." Provide HDPE as listed on the MPL on the Department web site under "Roadway Illumination and Electrical Supplies," Item 618.

3. Supply duct cable with a minimum 2 in. diameter, unless otherwise shown in the plans. Provide duct cable and HDPE conduit as shown by descriptive code or on the plans. Bend duct cable and HDPE conduit as recommended by the manufacturer, with a minimum bending radius of 26 in. for 2 in. duct. Follow manufacturers' recommendations when handling duct cable and HDPE conduit reels and during installation of duct cable and HDPE conduit.

4. Do not splice conductors within duct cable or HDPE conduit. Couple duct cable and HDPE entering a ground box or foundation to a PVC elbow. When galvanized steel RMC elbows are called for in the plans and any portion of the RMC elbow is buried less than 18" from possible contact, ground the RMC elbow.

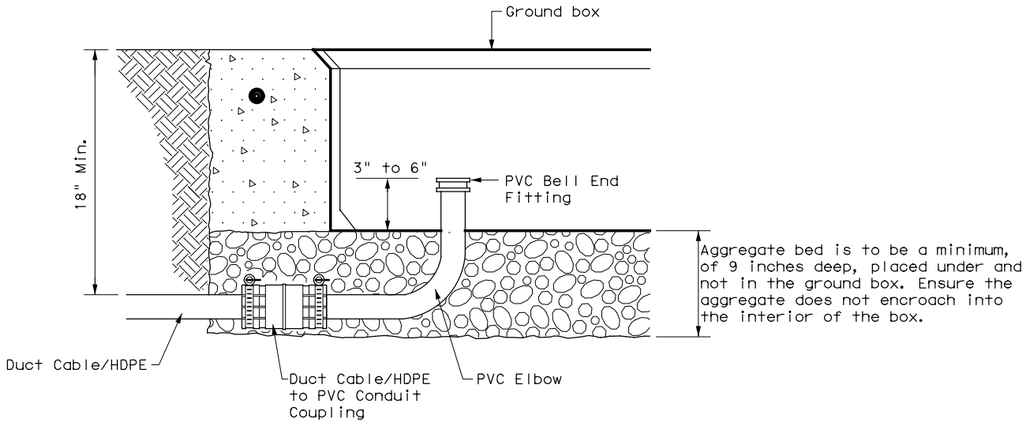
5. Furnish and install duct cable with factory installed conductors, sized as shown in the plans and as required by the National Electrical Code (NEC). The NEC contains specific requirements for duct cable in Article, "Nonmetallic Underground Conduit with Conductors: Type NUCC."

6. When conduit casing is called for in the plans, extend duct cable or HDPE conduit through the conduit casing in one continuous length without connection to the casing.

7. Seal the ends of duct cable or HDPE conduit with duct seal, expandable foam, or other approved method after completing the pull tests required by Item 622.

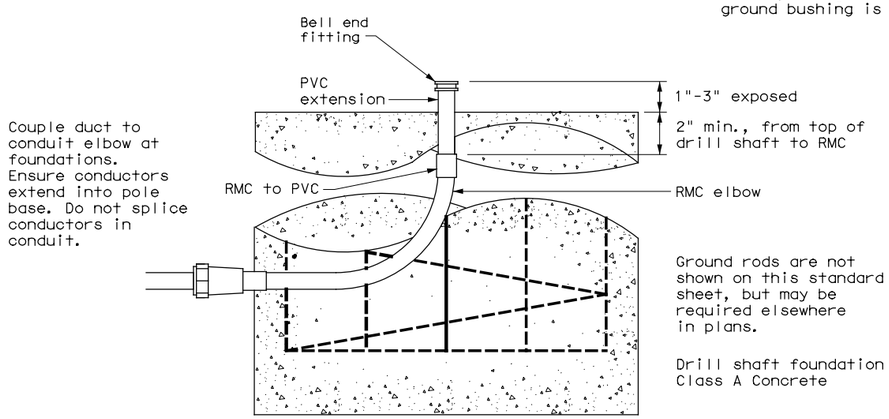
8. Provide minimum cover of 24 in. under roadways, 18 in. in other locations, or as shown on the plans.

9. Furnish and install listed fittings to couple duct cable or HDPE conduit to other types of conduit. Duct cable and HDPE conduit may be field-threaded and spliced with PVC or RMC threaded couplings; connected with listed tie-wrap fittings; connected using listed coupling made of HDPE with stainless steel external banding clamps and locking rings; connected with approved electrofusion conduit couplings; or connected using an approved chemical fusion method using an epoxy or adhesive specifically designed for HDPE couplings and connectors all installed in accordance with their manufacturer's instructions. Do not use PVC glue on HDPE. Do not use water pipe fittings, or connect conduit with heat shrink tubing.

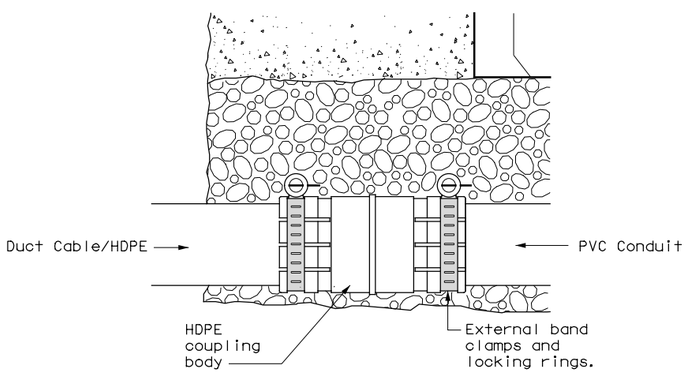


DUCT CABLE/HDPE AT GROUND BOX

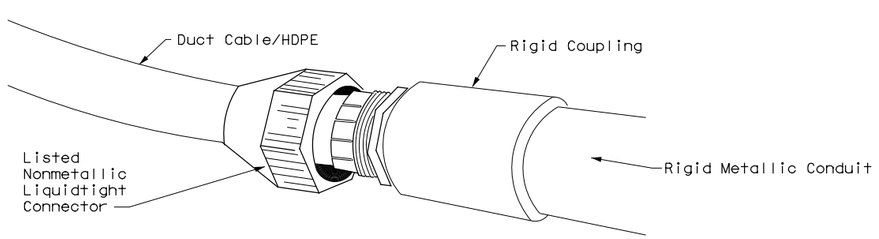
When the upper end of an RMC Ell does not enter the ground box, it may be extended with a SCH-40 PVC conduit nipple and bell end, provided there is a minimum of 18" of cover over all parts of the elbow. If not, a rigid extension and ground bushing is required.



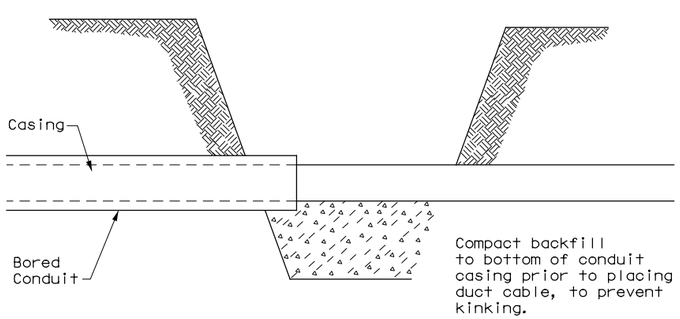
DUCT CABLE / HDPE AT FOUNDATION



DUCT CABLE/HDPE TO PVC



DUCT CABLE/HDPE TO RMC



BORE PIT DETAIL

Texas Department of Transportation

Traffic Operations Division Standard

ELECTRICAL DETAILS DUCT CABLE/ HDPE CONDUIT

ED(11)-14

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BATTERY BOX GROUND BOXES NOTES

A. MATERIALS

1. Provide polymer concrete or fiberglass reinforced plastic (FRP) battery box ground box and cover in accordance with Departmental Material Specification (DMS) 11071 "Battery Box Ground Boxes." Battery box will accommodate up to 4 batteries, each measuring 8 in. x 13.5 in. x 10 in. (W x L x D). Label battery box ground box cover in accordance with DMS 11071.

2. Supply a marine grade batteries with covers. Secure the marine grade batteries with covers to the stainless steel rack in the bottom of the ground box with tie down straps.

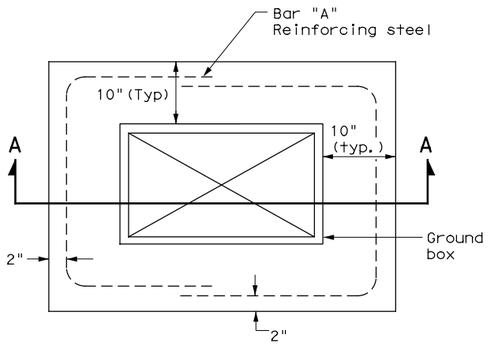
B. CONSTRUCTION METHODS

1. Ensure conduit entry will not interfere with placement of the batteries in the battery box ground box.

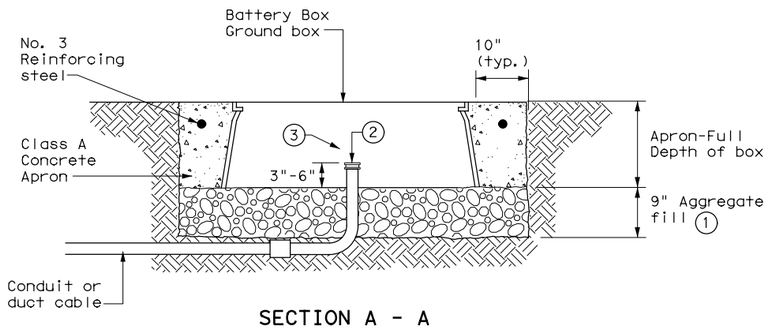
2. Remove all gravel and dirt from conduit. Cap all conduits prior to placing aggregate and setting battery box ground box. Provide Grade 3 or 4 coarse aggregate as shown on Table 2 of Item 302 "Aggregates for Surface Treatments." Ensure the aggregate bed is in place and is a minimum of 9 in. deep prior to setting the box. Install battery box ground box on top of aggregate.

3. Cast battery box aprons in place. Reinforcing steel may be field bent. Ensure the depth of concrete for the apron extends from finished grade to the top of the aggregate bed under the box. Battery box ground box aprons, including concrete and reinforcing steel, are subsidiary to battery box ground boxes when called for by descriptive code.

4. Bolt covers down when not working in battery box ground boxes. Keep bolt holes in the box clear of dirt.



PLAN VIEW



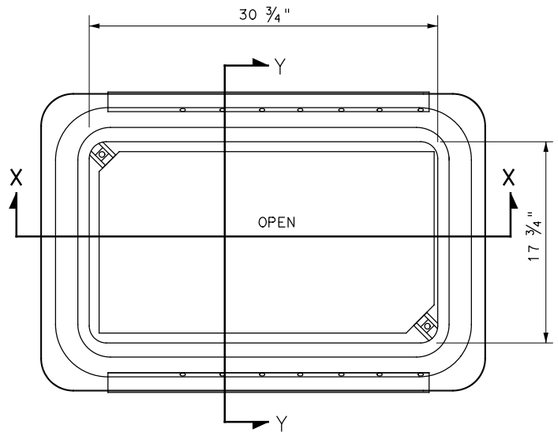
SECTION A - A

APRON FOR BATTERY BOX GROUND BOXES

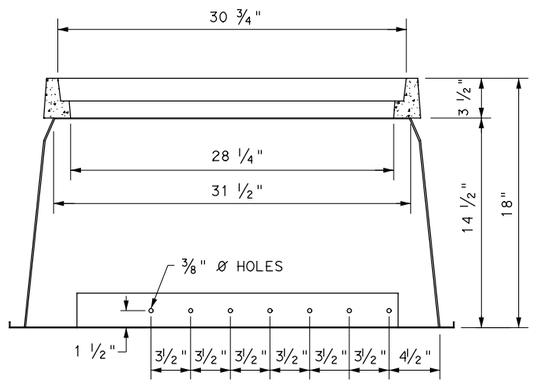
(1) Place aggregate under the box and not in the box. Aggregate should not encroach on the interior volume of the box.

(2) Install bushing or bell end fitting on the upper end of all ells.

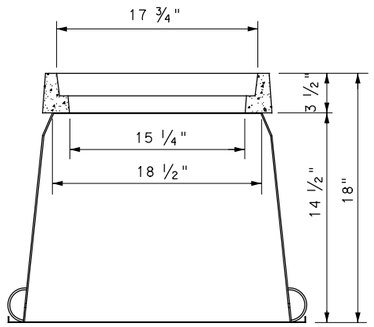
(3) Install all conduits in a neat and workmanlike manner.



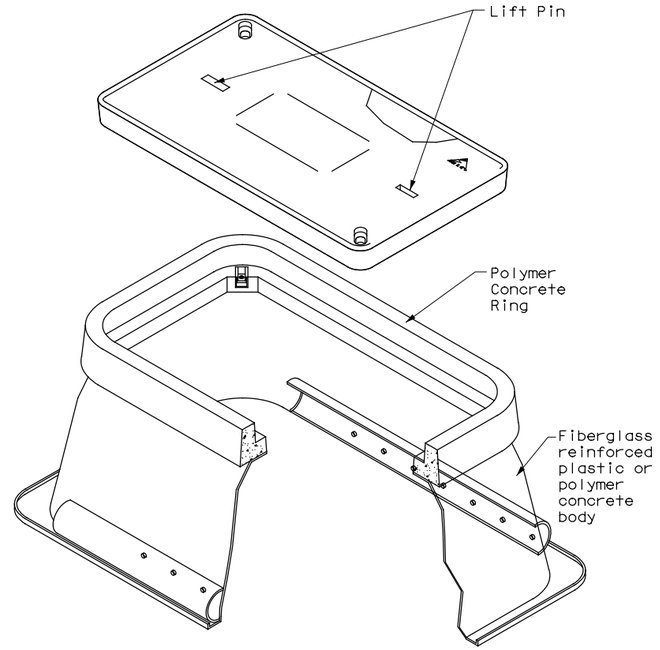
BATTERY BOX TOP VIEW



SECTION X-X



SECTION Y-Y



Texas Department of Transportation

Traffic Operations Division Standard

ELECTRICAL DETAILS BATTERY BOX GROUND BOXES

ED(12)-14

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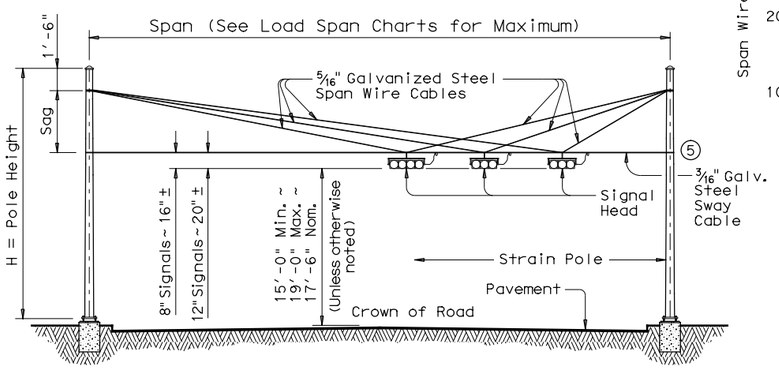
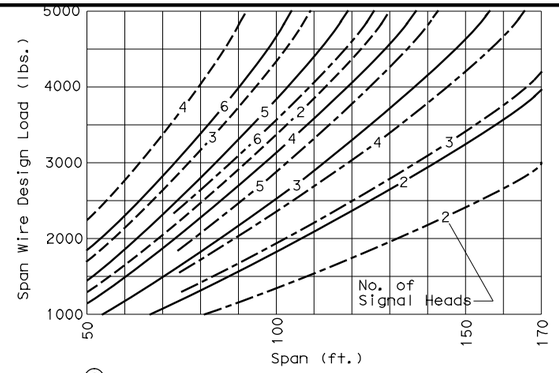
STRAIN POLE DESCRIPTION	Pole Type	Found-ation Type	Maximum Permissible Span Wire Load (lbs.)
26′ Pole	A	36-A	5200
30′ Pole	B	36-A	4600
30′ Pole with Lum.	B	36-A	4400
30′ Pole with 20′ Mast Arm	C	36-B	5600
30′ Pole with 24′ Mast Arm	C	36-B	5500
30′ Pole with 28′ Mast Arm	C	36-B	5300
30′ Pole with 32′ Mast Arm	C	36-B	5100
30′ Pole with 36′ Mast Arm	C	36-B	4900
30′ Pole with 20′ Mast Arm & Lum.	C	36-B	5300
30′ Pole with 24′ Mast Arm & Lum.	C	36-B	5200
30′ Pole with 28′ Mast Arm & Lum.	C	36-B	5000
30′ Pole with 32′ Mast Arm & Lum.	C	36-B	4800
30′ Pole with 36′ Mast Arm & Lum.	C	36-B	4500
34′ Pole	D	36-B	5600
34′ Pole with Lum.	D	36-B	5400

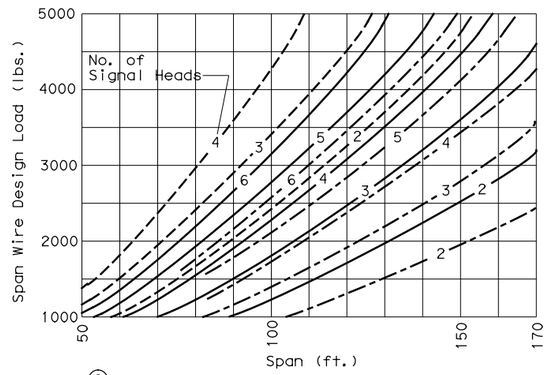
② Numbers on Load Span Charts indicate the number of signal heads on the span. The total span wire design load is based on one 5-section head and one or more additional 3-section head(s). Design wind pressures on cables are assumed as 1.0 lb/ft. Weight of span wire cables (one per signal head) is assumed as 0.65 lb/ft which includes an allowance for conductor cables and miscellaneous hardware. The effect of the sway cable on load distribution is ignored as it is assumed to break at design wind conditions. When a pole supports 2 spans, the span wire design loads for both spans should be added vectorially to determine the design load for that pole.



STRAIN POLE ELEVATIONS HORIZONTAL SIGNALS



② SIGNALS WITH 12-INCH LENS

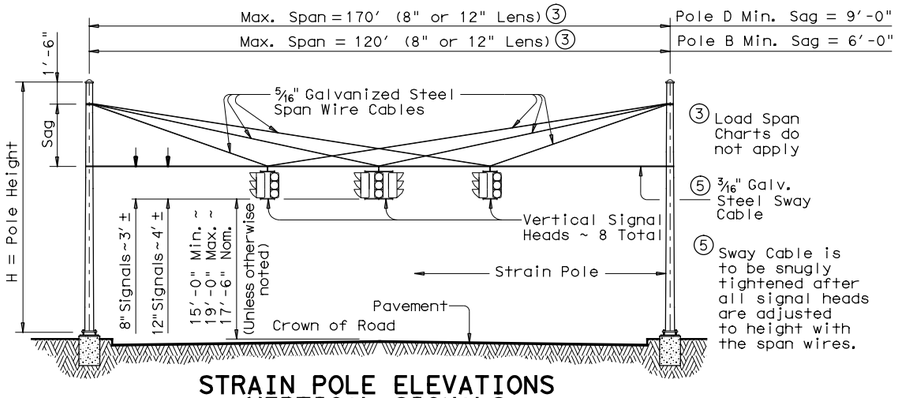


② SIGNALS WITH 8-INCH LENS

Signal Head Type	Wt. Per Head	Wind Area ⬙
5-Section, 12" Lens	125 lbs	9.6 sq. ft.
5-Section, 8" Lens	70 lbs	4.8 sq. ft.
3-Section, 12" Lens	75 lbs	5.64 sq. ft.
3-Section, 8" Lens	45 lbs	3.0 sq. ft.

⬙ Effective projected design wind area (actual area times drag coefficient)

– – – – – – – – Sag = 4′-6" (26′ or 30′ Pole)
———— Sag = 8′-0" (30′ or 34′ Pole)
— · — · — · — Sag = 11′-6" (34′ Pole)



STRAIN POLE ELEVATIONS VERTICAL SIGNALS

(Mast arms are not used with vertical signals)

Pole Type	ROUND POLES D_B in.	D_T in.	④thk in.	H ft.	POLYGONAL POLES D_B in.	D_T in.	④thk in.	H ft.
A	12.5	8.9	.239	26	13.0	9.0	.239	26
B	13.5	9.3	.239	30	14.0	9.0	.239	30
C	15.5	11.3	.239	30	16.0	11.0	.239	30
D	15.5	10.7	.239	34	16.0	11.0	.239	34

④ Thickness shown are minimum, thicker materials may be used.

D_B = Pole Base O.D. D_T = Pole Top O.D. H = Pole Height

SHIPPING PARTS LIST

Poles (Without Traffic Signal Arm)

Pole Type	Strain poles with Luminaire: Ship each pole with the following hardware attached: handhole at base, pole cap, 2 clamp-on simplex and 1 pipe plug.			Strain poles without Luminaire: Ship each pole with the following hardware attached: handhole at base, pole cap and 1 pipe plug.		
	Description	Designation	Quantity	Description	Designation	Quantity
A				26′ Strain Pole	SP 26 A-80	
B	30′ Strain Pole	SPL 30 B-80		30′ Strain Pole	SP 30 B-80	
D	34′ Strain Pole	SPL 34 D-80	2	34′ Strain Pole	SP 34 D-80	

Poles (With Traffic Signal Arm)

Pole Type	Strain poles with Luminaire: Ship each pole with the following hardware attached: handhole at base, pole cap, clamp-on simplex and 3 pipe plugs.			Strain poles without Luminaire: Ship each pole with the following hardware attached: handhole at base, pole cap and 3 pipe plugs.		
	Description	Designation	Quantity	Description	Designation	Quantity
C	30′ SPw/TS Arm	SPL 30 C-80		30′ SPw/TS Arm	SP 30 C-80	

Traffic Signal Arms (For Type C poles)

Nominal Arm Length	Type I Arm (1 Signal): Ship each Type I Arm with the following hardware attached: 2 CGB Connectors, 1 clamp with bolts and washers		Type II Arm (2 Signals): Ship each Type II Arm with the following hardware attached: ① 1 Bracket Assembly, 3 CGB Connectors and 1 clamp with bolts and washers		Type III Arm (3 Signals): Ship each Type III Arm with the following hardware attached: ① 2 Bracket Assemblies, 4 CGB Connectors and 1 clamp with bolts and washers	
ft.	Designation	Quantity	Designation	Quantity	Designation	Quantity
20	20I-80					
24	24I-80		24 II -80			
28	28I-80		28 II -80			
32			32 II -80		32 III -80	
36			36 II -80		36 III -80	

Anchor Bolt Assemblies (1 per pole)

Anchor Bolt Diameter	Anchor Bolt Length	Templates may be removed for shipment. Quantity
1 3/4"	3′-10"	2
2"	4′-3"	

Luminaire Arms

Nominal Arm Length	Quantity
8′ Arm	
10′ Arm	2

Each Anchor Bolt Assembly consists of the following: Top and Bottom templates, 4 anchor bolts, 8 nuts, 8 flat washers, and 4 nut anchor devices (Type 2) per Standard Drawing "TS-FD".

① See Sheet "DMA-80"

SHEET 1 OF 2

Texas Department of Transportation
Traffic Operations Division

TRAFFIC SIGNAL SUPPORT STRUCTURES STRAIN POLE ASSEMBLIES

(80 MPH WIND ZONE)

SP-80(1)-12

DN: MS | CK: JSY | DW: BR | CK: JSY

REVISIONS: 6-96, 1-12

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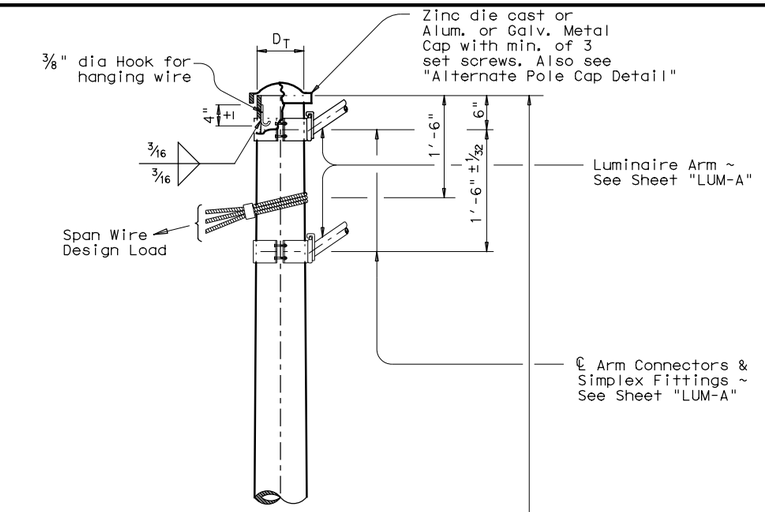
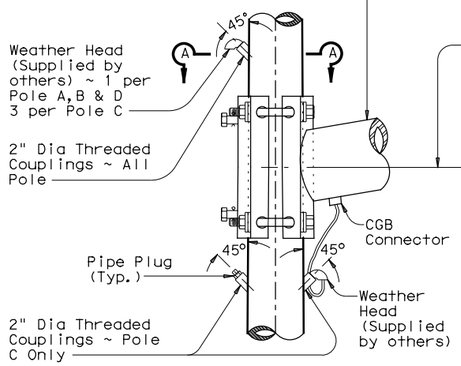
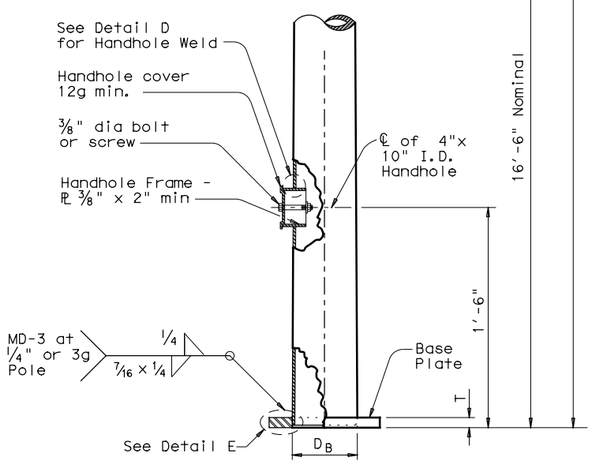


DETAIL A

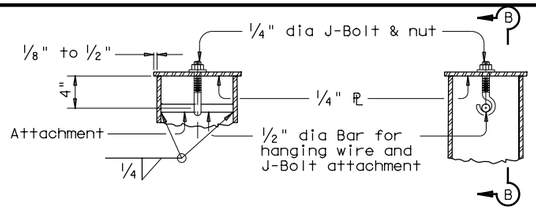


DETAIL B



DETAIL C

POLE ELEVATION



SECTION B-B

ALTERNATE POLE CAP DETAIL

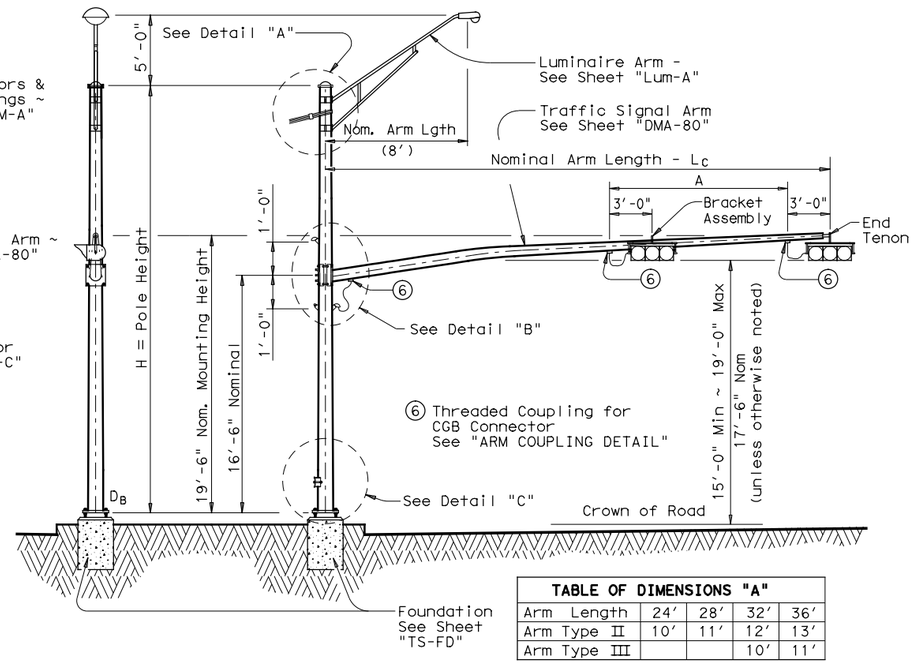
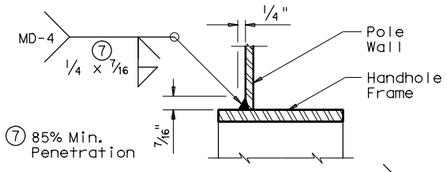
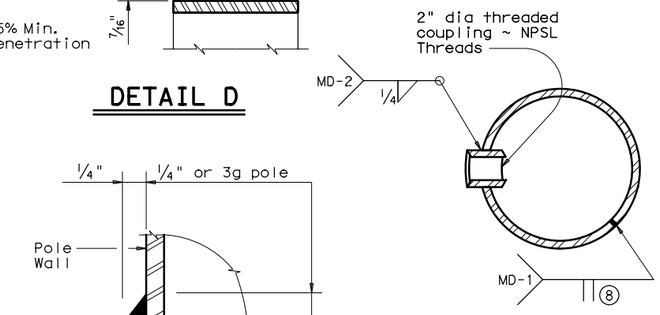


TABLE OF DIMENSIONS "A"				
Arm Length	24′	28′	32′	36′
Arm Type II	10′	11′	12′	13′
Arm Type III			10′	11′

STRUCTURE ASSEMBLY



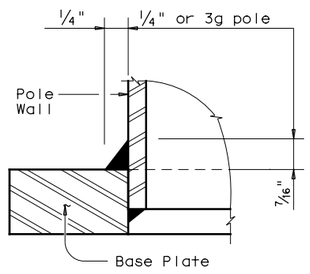
DETAIL D



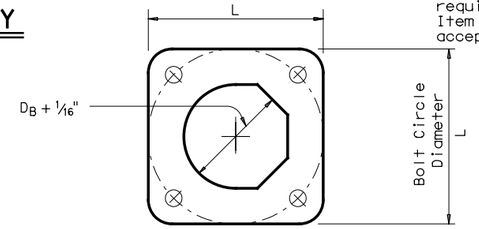
SECTION A-A

(Pole Coupling and Seam Weld Details)

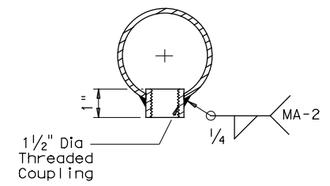
8 60% Min. penetration, except 100% penetration within 6" of circumferential base welds.



DETAIL E



BASE PLATE PLAN



ARM COUPLING DETAIL

MATERIALS	
Round Shafts or Polygonal Shafts (9)	ASTM A595 Gr.A, A588, A1008 HSLAS Gr.50 Class 2, A1011 HSLAS Gr.50 Class 2, A572 Gr.50 or A1011 SS Gr.50 (10)
Plates (9)	ASTM A36, A588, or A572 Gr.50
Connection Bolts	ASTM A325 except where noted
Pin Bolts	ASTM A325
Pipe (9)	ASTM A53 Gr.B, A501, A1008 HSLAS-F Gr.50, A1011 HSLAS-F Gr.50
Steel Cable	ASTM A475, 7 Wire Utilities Grade
Misc. Hardware	Galvanized steel or stainless steel or as noted

(9) ASTM A572, A1008 HSLAS, A1011 HSLAS, A1008 HSLAS-F, A1011 HSLAS-F, or A1011 SS may have higher yield strengths but shall not have less elongation than the grade indicated.

(10) ASTM A1011 SS Gr.50 shall also have a minimum elongation of 18 percent in 8 inches or 23 percent in 2 inches. Material thickness in excess of those stipulated under A1011 SS will be acceptable providing the material meets all other A1011 SS requirements and the requirements of this item.

GENERAL NOTES

Design conforms to 1994 AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals and Interim Specifications thereto. Design Wind Speed equals 80 mph plus a 1.3 gust factor. The maximum permissible span wire design loads tabulated are calculated at a stress load of 1.4 times the basic allowable stress. A simultaneous wind on the pole, mast arm, and luminaire is also included.

See standard sheet "DMA-80" for details of clamp-on traffic signal arms, sheet "MA-C" for traffic signal arm connection details, sheet "LUM-A" for luminaire arm and connection details, and sheet "TS-FD" for anchor bolt and foundation details.

Fabrication shall be in accordance with Item 686, "Traffic Signal Pole Assemblies (Steel)" and with the details, dimensions, and weld procedures shown herein. Weld references call for preapproved weld procedures which the Fabricator must obtain prior to fabrication. Materials, fabrication tolerances, and shipping practices shall meet the requirements of this sheet and Item 686, "Traffic Signal Pole Assemblies (Steel)".

Unless otherwise noted, all parts shall be galvanized in accordance with Item 445, "Galvanizing", after fabrication.

Deviation from the details and dimensions shown herein require submission of shop drawings in accordance with Item 441, "Steel Structures". Alternate designs are not acceptable.

Foundation Type	Anchor Bolt Diameter	Bolt Hole Diameter	Bolt Circle Diameter	Base ℄ Dim. L x T
36-A	1 3/4"	2"	19"	19" x 1 3/4"
36-B	2"	2 1/4"	21"	21" x 2"

Texas Department of Transportation
Traffic Operations Division

TRAFFIC SIGNAL SUPPORT STRUCTURES STRAIN POLE ASSEMBLIES

(80 MPH WIND ZONE)

SP-80(2)-12

DN: MS	CK: JSY	DW: BR	CK: JSY

REVISIONS
6-96
1-12

CONT	SECT	JOB	HIGHWAY
0805	04	033	RM 3237

DIST	COUNTY	SHEET NO.
AUS	HAYS	162

120B

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.

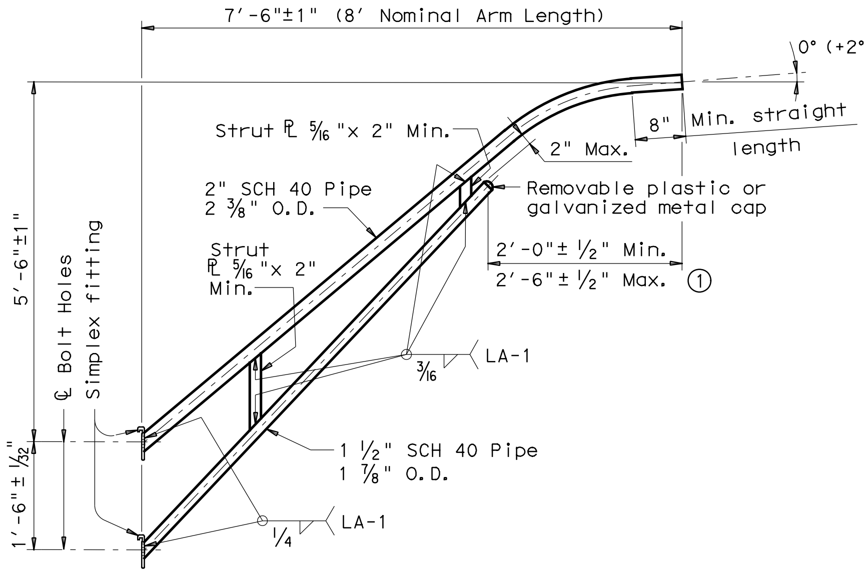
MATERIALS	
Pole or Arm Simplex	ASTM A27 Gr.65-35 or A148 Gr.80-50, A576 Gr.1021 (3), or A36 (Arm only)
Arm Pipes	ASTM A53 Gr.B, A501, A1008 HSLAS-F Gr.50 (4), or A1011 HSLAS-F Gr.50 (4)
Arm Strut Plates (2)	ASTM A36, A572 Gr.50 (4), or A588
Misc.	ASTM designations as noted

(1) Dimensional limits are given to show acceptable variation in design. All of a Fabricator's production of a particular arm length shall have the same dimensions within specified tolerances.

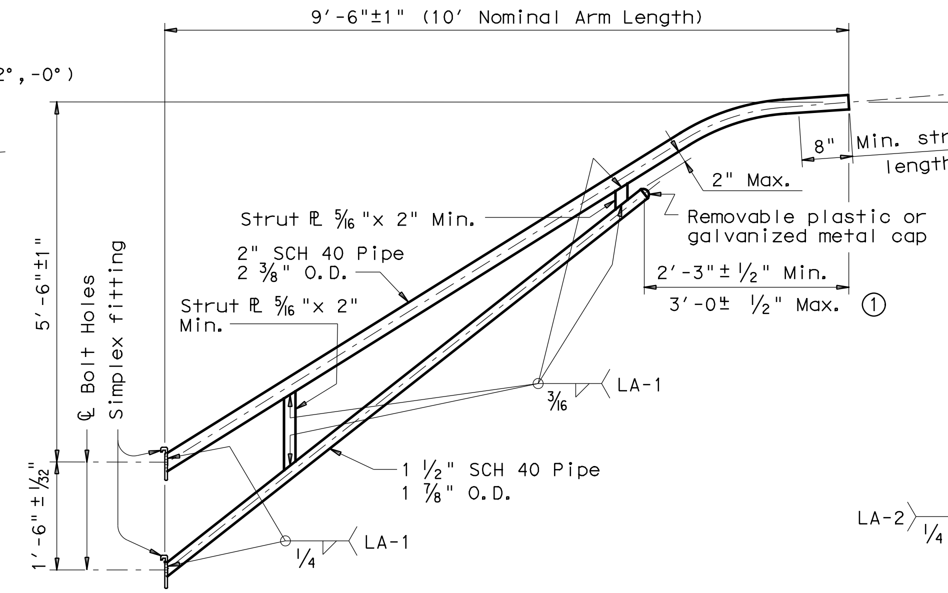
(2) Any of the materials listed for plates may be used where the drawings do not specify a particular ASTM designation.

(3) A576 must be suitable for forging and also meet minimum tensile strength of 65 ksi, minimum yield of 35 ksi, and elongation in 2 inches of 22 percent.

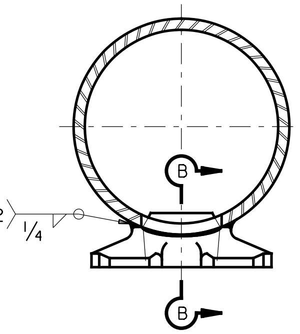
(4) ASTM A572, A1008 HSLAS-F, and A1011 HSLAS-F may have higher yield strengths but shall not have less elongation than the grade indicated.



8-FOOT LUMINAIRE ARM



10-FOOT LUMINAIRE ARM



DIRECT ATTACHMENT DETAIL

GENERAL NOTES:

Design conforms to 1994 AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals and Interim Revisions thereto. Design Wind Speed equals 90 mph plus a 1.3 gust factor. Arms are designed to support a 60 lb. luminaire having an effective projected area (actual area times drag coefficient) of 1.6 sq. ft.

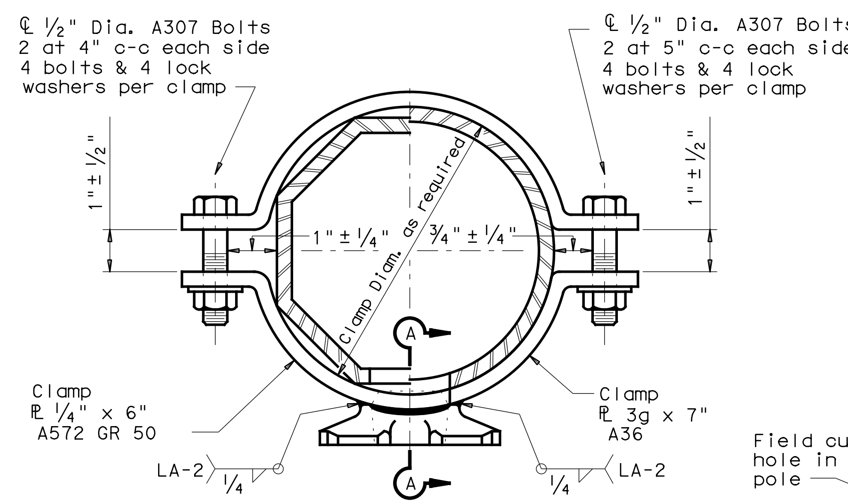
Materials and fabrication shall be in accordance with Item 686, "Traffic Signal Pole Assemblies (Steel)" and with the details, dimensions, and weld procedures shown herein. Weld references call for preapproved weld procedures which the Fabricator must obtain prior to fabrication. In the absense of specified Fabricaton tolerances, dimensions shall be within the tolerances generally obtainable in normal fabrication practice.

Unless otherwise noted, all parts shall be galvanized after fabrication in accordance with Item 445, "Galvanizing".

Deviation from the details and dimensions shown herein require submission of shop drawings in accordance with Item 441, "Steel Structures". Alternate designs are not acceptable.

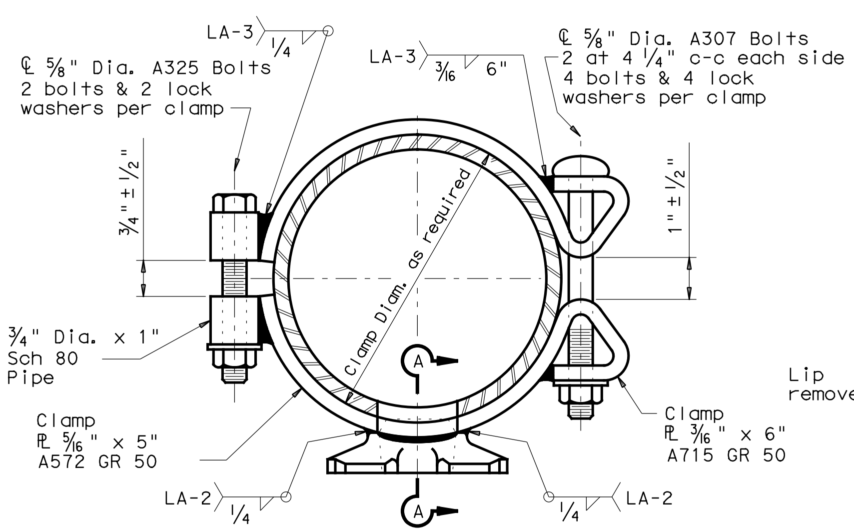
Each pole simplex fitting shall be supplied with 2 ASTM A325 bolts and 2 lock washers of the size specified. The bolts and lock washers shall be secured to the pole with the other hardware items called for in the plans. When clamp attachment is specified, the Fabricator shall ship the clamp assembly securely attached to the pole at the location shown on the plans.

If clamp assemblies are ordered without poles, the Fabricator shall ship one upper and one lower clamp assembly together in a single package, including all nuts and washers required for the clamps and simplex fittings.



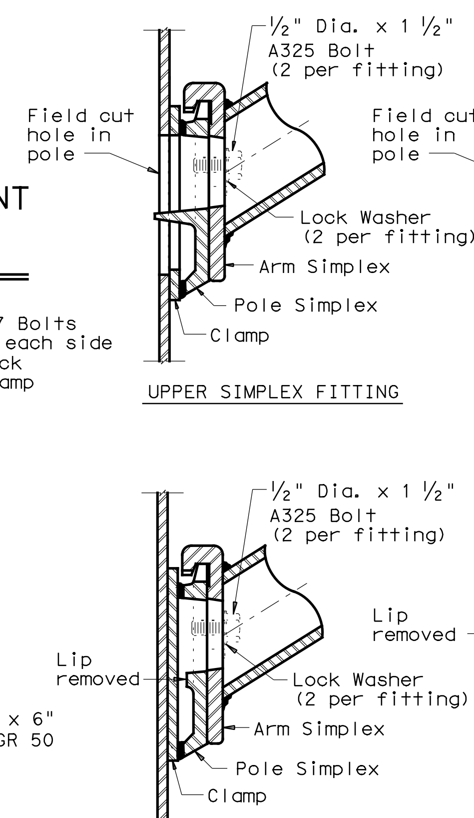
CLAMP ATTACHMENT DETAIL NO.1
(HALF SECTION)

CLAMP ATTACHMENT DETAIL NO.2
(HALF SECTION)

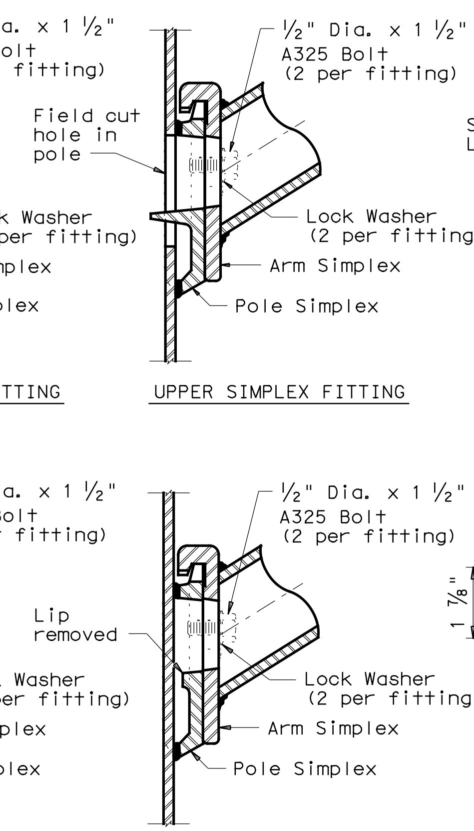


CLAMP ATTACHMENT DETAIL NO.3
(HALF SECTION)

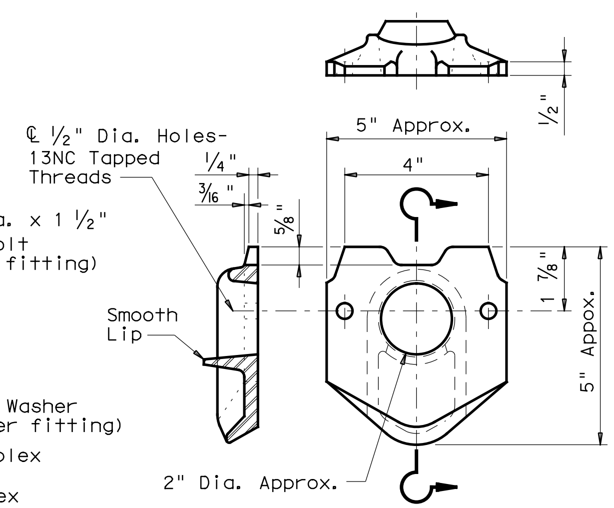
CLAMP ATTACHMENT DETAIL NO.4
(HALF SECTION)



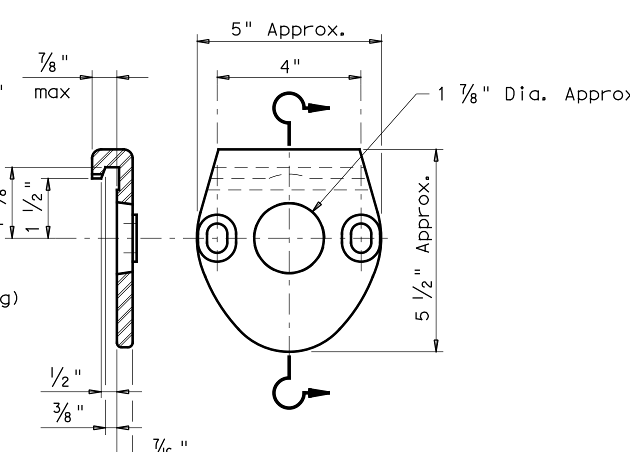
SECTON A-A



SECTON B-B



POLE SIMPLEX DETAIL



ARM SIMPLEX DETAIL

Texas Department of Transportation
Traffic Operations Division

STANDARD ASSEMBLY DRAWINGS FOR LUMINAIRE SUPPORT STRUCTURES

ARM DETAILS

LUM-A-12

©TxDOT August 1995	DN: LEH	CK: JSY	DW: LTT	CK: TEB
REVISIONS 5-96 1-99 1-12	CONT 0805	SECT 04	JOB 033	HIGHWAY RM 3237
	DIST AUS		COUNTY HAYS	SHEET NO. 163

129

DATE: 11/15/2023 5:09:23 PM
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FOUNDATION DESIGN TABLE

FDN TYPE	DRILLED SHAFT DIA	REINFORCING STEEL		EMBEDDED DRILLED SHAFT LENGTH-ft ④, ⑤, ⑥			ANCHOR BOLT DESIGN ①				FOUNDATION DESIGN LOAD ②		TYPICAL APPLICATION
		VERT BARS	SPIRAL & PITCH	TEXAS CONE PENETROMETER N blows/ft			ANCHOR BOLT DIA	Fy (ksi)	BOLT CIR DIA	ANCHOR TYPE	MOMENT K-ft	SHEAR Kips	
				10	15	40							
24-A	24"	4- #5	#2 at 12"	5.7	5.3	4.5	¾"	36	12 ¾"	1	10	1	Pedestal pole, pedestal mounted controller.
30-A	30"	8- #9	#3 at 6"	11.3	10.3	8.0	1 ½"	55	17"	2	87	3	Mast arm assembly. (see Selection Table)
36-A	36"	10- #9	#3 at 6"	13.2	12.0	9.4	1 ¾"	55	19"	2	131	5	Mast arm assembly. (see Selection Table) 30' strain pole with or without luminaire.
36-B	36"	12- #9	#3 at 6"	15.2	13.6	10.4	2"	55	21"	2	190	7	Mast arm assembly. (see Selection Table) Strain pole taller than 30' & strain pole with mast arm
42-A	42"	14- #9	#3 at 6"	17.4	15.6	11.9	2 ¼"	55	23"	2	271	9	Mast arm assembly. (see Selection Table)

NOTES:

① Anchor bolt design develops the foundation capacity given under Foundation Design Loads.

② Foundation Design Loads are the allowable moments and shears at the base of the structure.

③ Foundations may be listed separately or grouped according to similarity of location and type. Quantities are for the Contractor's information only.

④ Field Penetrometer readings at a depth of approximately 3 to 5 feet may be used to adjust shaft lengths.

⑤ If rock is encountered, the Drilled Shaft shall extend a minimum of two diameters into solid rock.

⑥ Decimal lengths in Design Table are to allow interpolation for other penetrometer values. Round to nearest foot for entry into Summary Table.

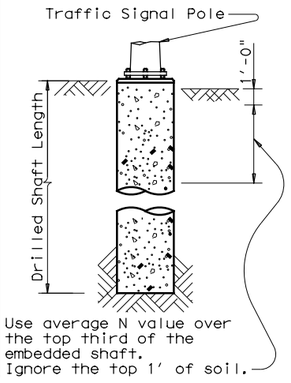
FOUNDATION SUMMARY TABLE ③

LOCATION IDENTIFICATION	AVG. N BLOW /ft.	FDN TYPE	NO. EA	DRILLED SHAFT LENGTH ⑥ (FEET)				
				24-A	30-A	36-A	36-B	42-A
P-1	10					13		
P-2	10					13		
TOTAL DRILLED SHAFT LENGTHS						26		

RM 3237 AT FLITE ACRES

FOUNDATION SELECTION TABLE FOR STANDARD MAST ARM PLUS ILSN SUPPORT ASSEMBLIES (ft)

		FDN 30-A	FDN 36-A	FDN 36-B	FDN 42-A
80 MPH DESIGN WIND SPEED	MAX SINGLE ARM LENGTH	32'	48'		
	MAXIMUM DOUBLE ARM LENGTH COMBINATIONS	24' X 24'			
		28' X 28'			
		32' X 28'	32' X 32'		
			36' X 36'		
			40' X 36'		
			44' X 28'	44' X 36'	
100 MPH DESIGN WIND SPEED	MAX SINGLE ARM LENGTH		36'	44'	
	MAXIMUM DOUBLE ARM LENGTH COMBINATIONS		24' X 24'		
			28' X 28'		
			32' X 24'	32' X 32'	
				36' X 36'	
				40' x24'	40' X 36'
					44' x 36'



Use average N value over the top third of the embedded shaft. Ignore the top 1' of soil.

ANCHOR BOLT & TEMPLATE SIZES

BOLT DIA IN.	⑦ BOLT LENGTH	TOP THREAD	BOTTOM THREAD	BOLT CIRCLE	R2	R1
¾"	1'-6"	3"	—	12 ¾"	7 ⅛"	5 ⅝"
1 ½"	3'-4"	6"	4"	17"	10"	7"
1 ¾"	3'-10"	7"	4 ½"	19"	11 ¼"	7 ¾"
2"	4'-3"	8"	5"	21"	12 ½"	8 ½"
2 ¼"	4'-9"	9"	5 ½"	23"	13 ¾"	9 ¼"

⑦ Min dimensions given, longer bolts are acceptable.

GENERAL NOTES:

Design conforms to 1994 AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals and interim revisions thereto.

Reinforcing steel shall conform to Item 440, "Reinforcing Steel".

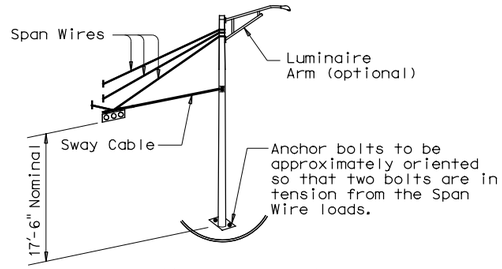
Concrete shall be Class "C".

Threads for anchor bolts and nuts shall be rolled or cut threads of 8UN series up to 2" in diameter or UNC series for all sizes. Bolts and nuts shall have Class 2A and 2B fit tolerances. Galvanized nuts shall be tapped after galvanizing.

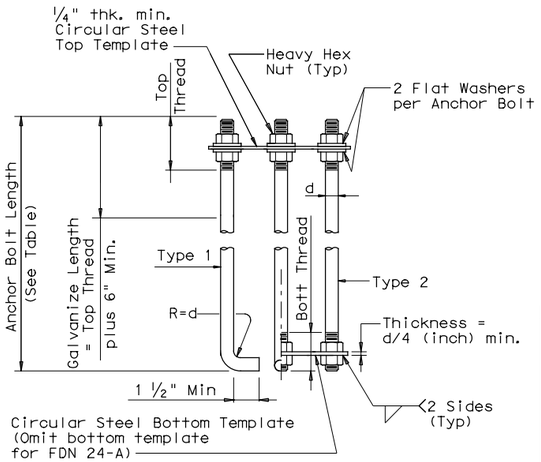
Anchor bolts that are larger than 1" in diameter shall conform to "alloy steel" or "medium-strength mild steel" per Item 449, "Anchor Bolts". Anchor bolts that are 1" in diameter or less shall conform to ASTM A36. Galvanize a minimum of the top end thread length plus 6" for all anchor bolts unless otherwise noted. Exposed washers and exposed nuts shall be galvanized. All galvanizing shall be in accordance with Item 445, "Galvanizing".

Templates and embedded nuts need not be galvanized. Lubricate and tighten anchor bolts when erecting the structure in accordance with Item 449, "Anchor Bolts".

EXAMPLE:
1. For 80mph design wind speed, foundation 30-A can support up to a 32' arm with another arm up to 28'
2. For 100mph design wind speed, foundation 36-A can support a single 36' mast arm.



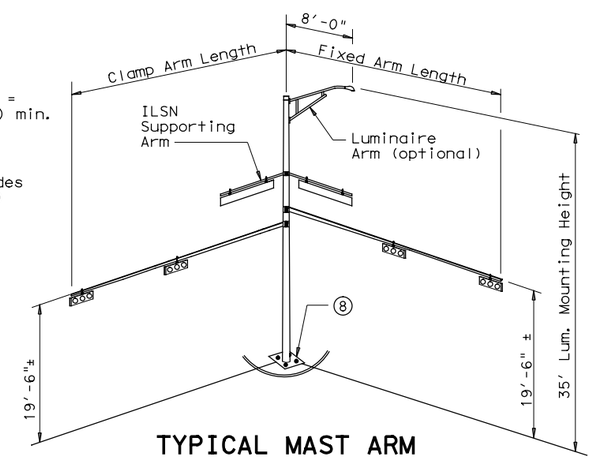
TYPICAL STRAIN POLE ASSEMBLY



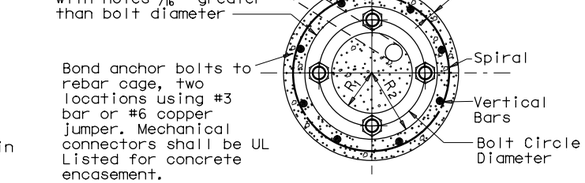
HOOKED ANCHOR (TYPE 1) NUT ANCHOR (TYPE 2)

ANCHOR BOLT ASSEMBLY

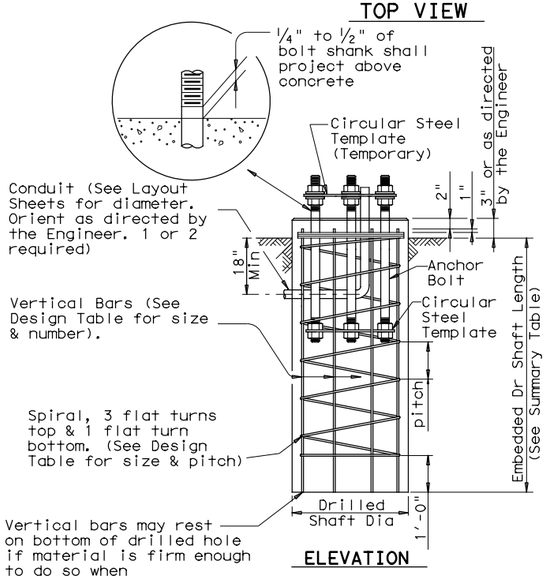
⑧ Orient anchor bolts orthogonal with the fixed arm direction to ensure that two bolts are in tension under dead load.



TYPICAL MAST ARM ASSEMBLY



TOP VIEW



ELEVATION

FOUNDATION DETAILS

STATE OF TEXAS
RAHUL M. RAJBHAR
128825
LICENSED PROFESSIONAL ENGINEER
11/17/2023

Texas Department of Transportation
Traffic Operations Division

TRAFFIC SIGNAL POLE FOUNDATION

TS-FD-12

© TxDOT August 1995	DN: MS	CK: JSY	DW: MAO/MMF	CK: JSY/TEB
REVISIONS	CONT	SECT	JOB	HIGHWAY
5-96 11-98 1-12	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		164

DATE: 11/17/2023 5:09:25 PM
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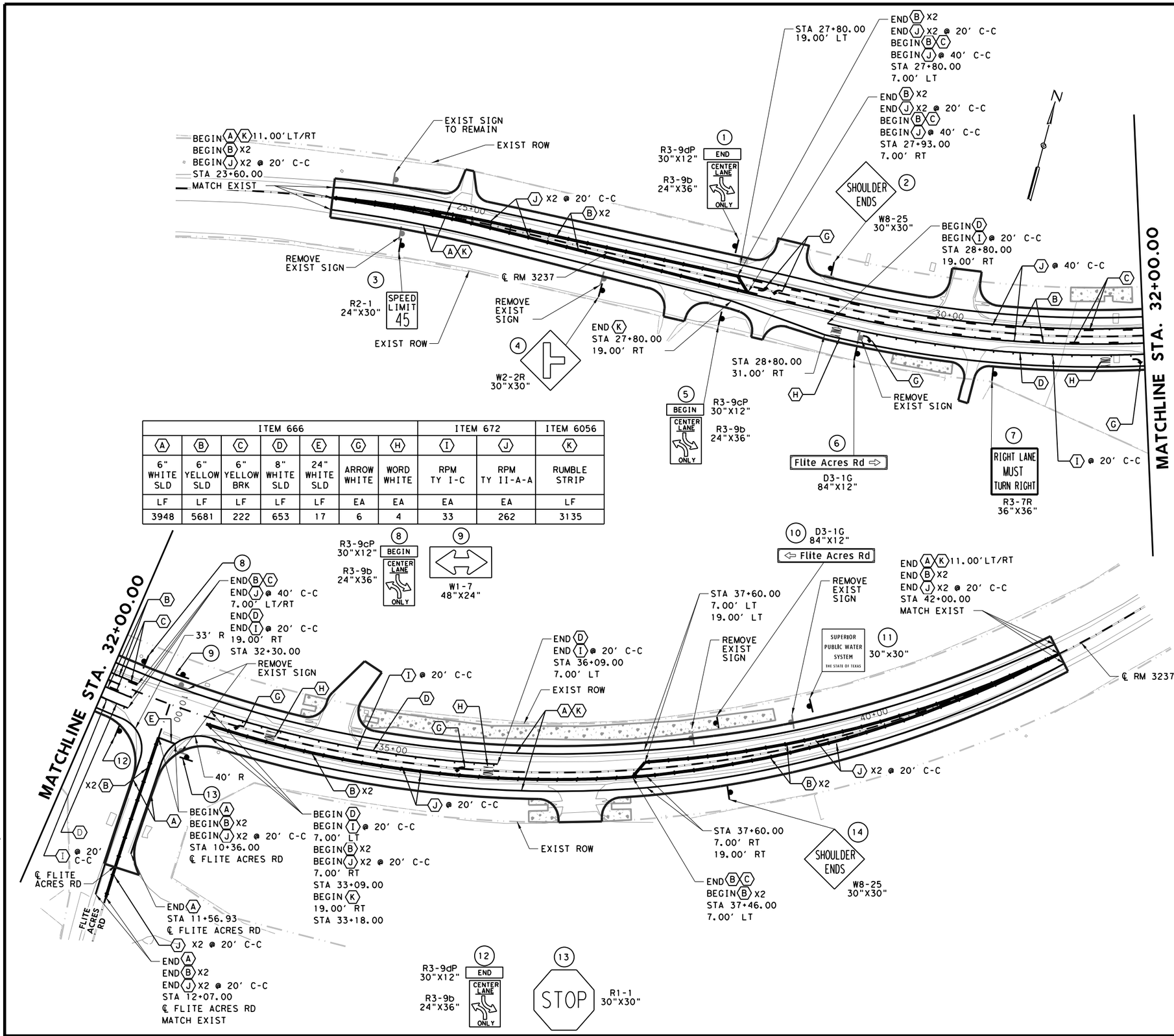

ITEM 666							ITEM 672		ITEM 6056
(A)	(B)	(C)	(D)	(E)	(G)	(H)	(I)	(J)	(K)
6" WHITE SLD	6" YELLOW SLD	6" YELLOW BRK	8" WHITE SLD	24" WHITE SLD	ARROW WHITE	WORD WHITE	RPM TY I-C	RPM TY II-A-A	RUMBLE STRIP
LF	LF	LF	LF	LF	EA	EA	EA	EA	LF
3948	5681	222	653	17	6	4	33	262	3135

DATE	DESCRIPTION	APPROVED

WSB & ASSOCIATES, INC.
FIRM # 16849

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. 10069
3711 SOUTH MOPAC EXPRESSWAY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

RM 3237 SAFETY IMPROVEMENTS

RM 3237 SIGNING AND PAVEMENT MARKINGS

SHEET 1 OF 3

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
MGD				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
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CHECK	CONTROL	SECTION	JOB	
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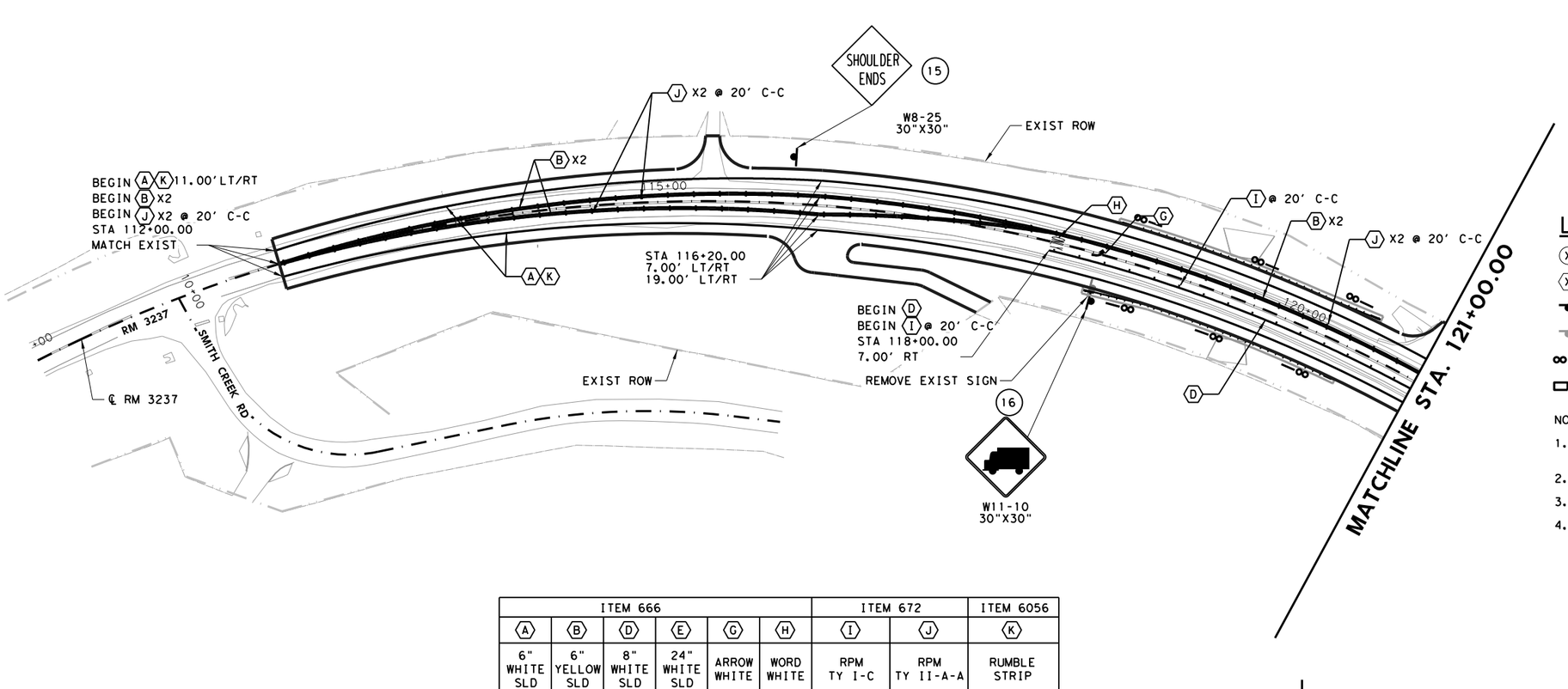
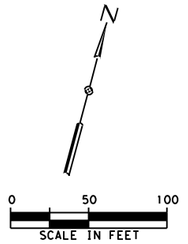
CHECK				
DAR				





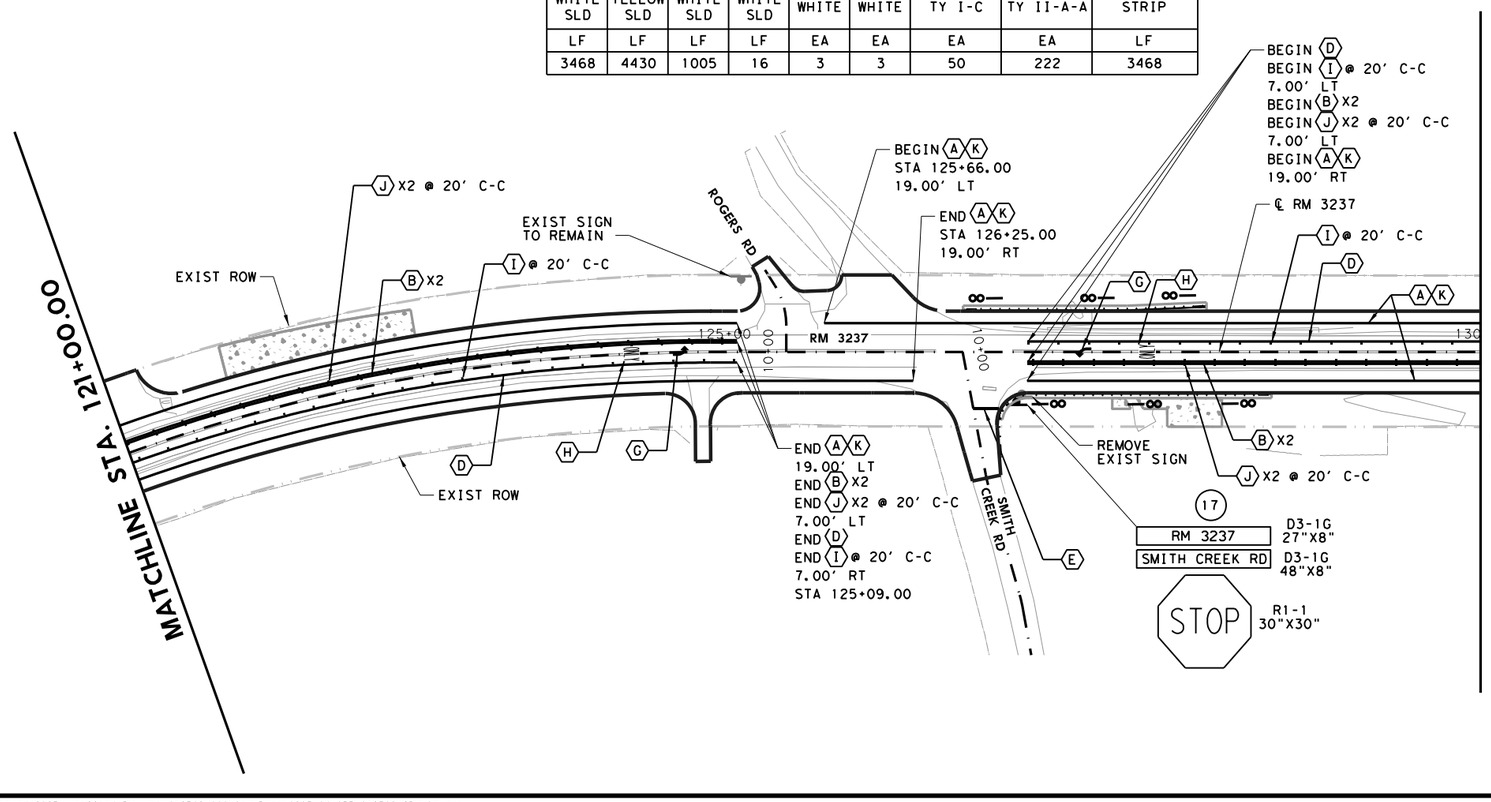
LEGEND:

- (X) SIGNING CALLOUT
- (X) STRIPING CALLOUT
- PROPOSED SIGN
- EXISTING SIGN
- DELINEATOR ASSEMBLY
- OBJECT MARKER ASSEMBLY

NOTES:

1. MBGF DELINEATORS WILL NOT BE PAID FOR DIRECTLY BUT WILL BE CONSIDERED SUBSIDIARY TO MBGF. REFER TO D&OM(5)-20 FOR PLACEMENT AND SPACING.
2. REFL PAV MRK TY II TO BE UTILIZED AS PAVEMENT SEALER FOR TY I MARKINGS.
3. STRIPING CALLOUTS ARE INDICATIVE OF TY I & TY II ITEMS. SEE QUANTITY SHEET FOR FULL QUANTITIES.
4. UTILIZE OPTION 4 FOR CENTERLINE MARKINGS. UTILIZE OPTION 7 FOR EDGE LINE MARKINGS.

ITEM 666						ITEM 672		ITEM 6056
A	B	D	E	G	H	I	J	K
6" WHITE SLD	6" YELLOW SLD	8" WHITE SLD	24" WHITE SLD	ARROW WHITE	WORD WHITE	RPM TY I-C	RPM TY II-A-A	RUMBLE STRIP
LF	LF	LF	LF	EA	EA	EA	EA	LF
3468	4430	1005	16	3	3	50	222	3468



DATE	DESCRIPTION	APPROVED

WSB & ASSOCIATES, INC.
FIRM # 16849

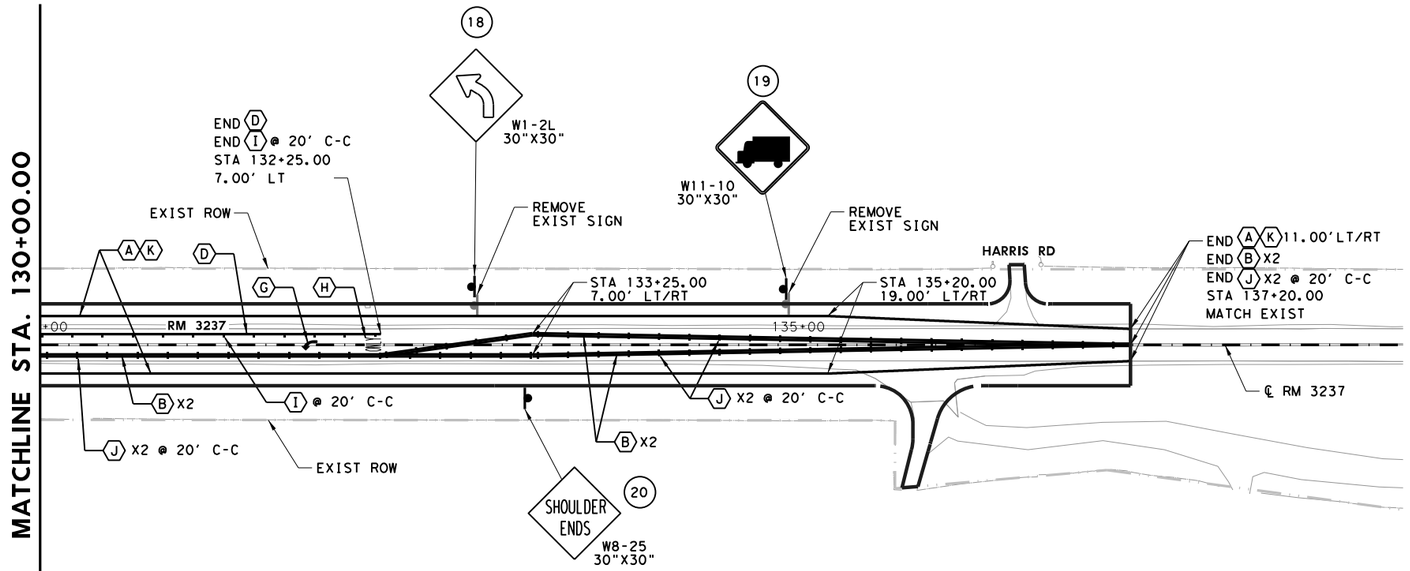
AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. 10069
3711 SOUTH MOPAC EXPRESSWAY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

Texas Department of Transportation

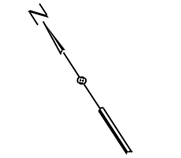
RM 3237 SAFETY IMPROVEMENTS

RM 3237 SIGNING AND PAVEMENT MARKINGS

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
MGD				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
MGD	TX	AUS	HAYS	166
CHECK	CONTROL	SECTION	JOB	
BG	0805	04	033	
CHECK				
DAR				



ITEM 666					ITEM 672		ITEM 6056
A	B	D	G	H	I	J	K
6" WHITE SLD	6" YELLOW SLD	8" WHITE SLD	ARROW WHITE	WORD WHITE	RPM TY I-C	RPM TY II-A-A	RUMBLE STRIP
LF	LF	LF	EA	EA	EA	EA	LF
1440	2412	225	1	1	11	120	1440



LEGEND:

- (X) SIGNING CALLOUT
- (X) STRIPING CALLOUT
- PROPOSED SIGN
- EXISTING SIGN
- DELINEATOR ASSEMBLY
- OBJECT MARKER ASSEMBLY

NOTES:

1. MBGF DELINEATORS WILL NOT BE PAID FOR DIRECTLY BUT WILL BE CONSIDERED SUBSIDIARY TO MBGF. REFER TO D&OM(5)-20 FOR PLACEMENT AND SPACING.
2. REFL PAV MRK TY II TO BE UTILIZED AS PAVEMENT SEALER FOR TY I MARKINGS.
3. STRIPING CALLOUTS ARE INDICATIVE OF TY I & TY II ITEMS. SEE QUANTITY SHEET FOR FULL QUANTITIES.
4. UTILIZE OPTION 4 FOR CENTERLINE MARKINGS. UTILIZE OPTION 7 FOR EDGE LINE MARKINGS.

	DATE	DESCRIPTION	APPROVED

WSB & ASSOCIATES, INC.
FIRM # 16849

TBPE FIRM NO. 10069
3711 SOUTH MOPAC EXPRESSWAY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

RM 3237 SIGNING AND PAVEMENT MARKINGS

SHEET 3 OF 3

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
MGD				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
MGD	TX	AUS	HAYS	167
CHECK	CONTROL	SECTION	JOB	
BG	0805	04	033	
CHECK				
DAR				

SUMMARY OF SMALL SIGNS

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

PLAN SHEET NO.	SIGN NO.	SIGN NOMENCLATURE	SIGN	DIMENSIONS	FLAT ALUMINUM (TYPE A)	EXAL ALUMINUM (TYPE G)	POST TYPE FRP = Fiberglass TWT = Thin-Wall 10BWG = 10 BWG S80 = Sch 80	POSTS 1 or 2	ANCHOR TYPE UA=Universal Conc UB=Universal Bolt SA=Slipbase-Conc SB=Slipbase-Bolt WS=Wedge Steel WP=Wedge Plastic	MOUNTING DESIGNATION PREFABRICATED P = "Plain" T = "T" U = "U"	1EXT or 2EXT = # of Ext BM = Extruded Wind Beam WC = 1.12 #/ft Wing Channel EXAL= Extruded Alum Sign Panels	BRIDGE MOUNT CLEARANCE SIGNS (See Note 2) TY = TYPE TY N TY S
		R3-9dP	END / CENTER LANE / ONLY	30"X12"	X							
175	1	R3-9b		24"X36"	X		10BWG	1	SA	P		
175	2	W8-25	SHOULDER ENDS	30"X30"	X		10BWG	1	SA	P		
175	3	R2-1	SPEED LIMIT 45	24"X30"	X		10BWG	1	SA	P		
175	4	W2-2R		30"X30"	X		10BWG	1	SA	P		
		R3-9cP	BEGIN / CENTER LANE / ONLY	30"X12"	X							
175	5	R3-9b		24"X36"	X		10BWG	1	SA	P		
175	6	D3-1G	Flite Acres Rd ⇨	84"X12"	X		10BWG	1	SA	T		
175	7	R3-7R	RIGHT LANE MUST TURN RIGHT	36"X36"	X		10BWG	1	SA	P		
175	8	R3-9cP	BEGIN / CENTER LANE / ONLY	30"X12"	X							
		R3-9b		24"X36"	X		10BWG	1	SA	P		
175	9	W1-7		48"X24"	X		10BWG	1	SA	T		
175	10	D3-1G	⇦ Flite Acres Rd	84"X12"	X		10BWG	1	SA	T		
175	11	XX-XX	SUPERIOR PUBLIC WATER SYSTEM / THE STATE OF TEXAS	30"X30"	X		10BWG	1	SA	P		
		R3-9dP	END / CENTER LANE / ONLY	30"X12"	X							
175	12	R3-9b		24"X36"	X		10BWG	1	SA	P		
175	13	R1-1	STOP	30"X30"	X		10BWG	1	SA	P		
175	14	W8-25	SHOULDER ENDS	30"X30"	X		10BWG	1	SA	P		

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

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

http://www.txdot.gov/

NOTE:

1. Sign supports shall be located as shown on the plans, except that the Engineer may shift the sign supports, within design guidelines, where necessary to secure a more desirable location or to avoid conflict with utilities. Unless otherwise shown on the plans, the Contractor shall stake and the Engineer will verify all sign support locations.
2. For installation of bridge mount clearance signs, see Bridge Mounted Clearance Sign Assembly (BMCS)Standard Sheet.
3. For Sign Support Descriptive Codes, see Sign Mounting Details Small Roadside Signs General Notes & Details SMD(GEN).

Texas Department of Transportation

Traffic Operations Division Standard

SUMMARY OF SMALL SIGNS

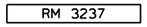
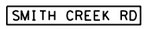
SOSS

SHEET 1 OF 2

FILE:	DN:	CK:	DW:	CK:
REVISIONS	CONT	SECT	JOB	HIGHWAY
	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		168

DATE: 11/14/2023 1:28:17 PM
FILE: K:\012309-000\CadPlan\0805-04-033\012309_SOSS.dgn

SUMMARY OF SMALL SIGNS

PLAN SHEET NO.	SIGN NO.	SIGN NOMENCLATURE	SIGN	DIMENSIONS	FLAT ALUMINUM (TYPE A)	EXAL ALUMINUM (TYPE G)	SM RD SGN ASSM TY XXXXX (X) XX (X-XXXX) POST TYPE FRP = Fiberglass TWT = Thin-Wall 10BWG = 10 BWG S80 = Sch 80	POSTS 1 or 2	ANCHOR TYPE UA=Universal Conc UB=Universal Bolt SA=Slipbase-Conc SB=Slipbase-Bolt WS=Wedge Steel WP=Wedge Plastic	MOUNTING DESIGNATION PREFABRICATED P = "Plain" T = "T" U = "U"	1EXT or 2EXT = # of Ext BM = Extruded Wind Beam WC = 1.12 #/ft Wing Channel EXAL= Extruded Alum Sign Panels	BRIDGE MOUNT CLEARANCE SIGNS (See Note 2) TY = TYPE TY N TY S
176	15	W8-25		30"X30"	X		10BWG	1	SA	P		
176	16	W11-10		30"X30"	X		10BWG	1	SA	P		
		D3-1G		27"X8"	X							
176	17	D3-1G		48"X8"	X		10BWG	1	SA	P		
		R1-1		30"X30"	X							
177	18	W1-2L		30"X30"	X		10BWG	1	SA	P		
177	19	W11-10		30"X30"	X		10BWG	1	SA	P		
177	20	W8-25		30"X30"	X		10BWG	1	SA	P		

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

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

http://www.txdot.gov/

NOTE:

1. Sign supports shall be located as shown on the plans, except that the Engineer may shift the sign supports, within design guidelines, where necessary to secure a more desirable location or to avoid conflict with utilities. Unless otherwise shown on the plans, the Contractor shall stake and the Engineer will verify all sign support locations.
2. For installation of bridge mount clearance signs, see Bridge Mounted Clearance Sign Assembly (BMCS)Standard Sheet.
3. For Sign Support Descriptive Codes, see Sign Mounting Details Small Roadside Signs General Notes & Details SMD(GEN).

Texas Department of Transportation

Traffic Operations Division Standard

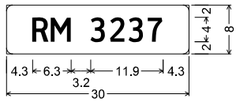
SUMMARY OF SMALL SIGNS

SOSS

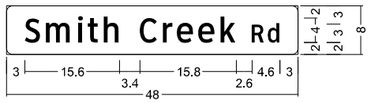
SHEET 2 OF 2

FILE:	DN:	CK:	DW:	CK:
REVISIONS	CONT	SECT	JOB	HIGHWAY
	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		169

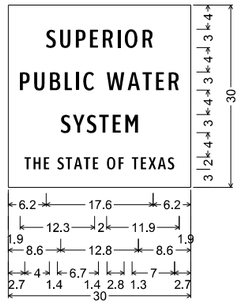
DATE: 11/14/2023 1:28:17 PM
FILE: K:\012309-000\Cad\Plan\0805-04-033\012309_SOSS.dgn



1.0" Radius, No border, White on, Green;
"RM 3237", ClearviewHwy-3-W;

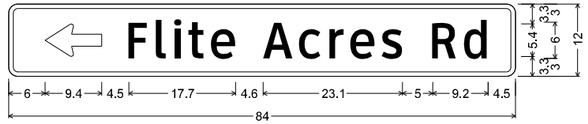


1.0" Radius, No border, White on, Green;
"Smith Creek Rd", ClearviewHwy-3-W;



No border, Black on, White;
"SUPERIOR", ClearviewHwy-2-W;
"PUBLIC WATER", ClearviewHwy-2-W;
"SYSTEM", ClearviewHwy-2-W;
"THE STATE OF TEXAS", ClearviewHwy-2-W;

1.5" Radius, 0.8" Border, White on, Green;
"Flite Acres Rd", ClearviewHwy-3-W; Standard Arrow Custom 9.4" X 5.4" 0';



1.5" Radius, 0.8" Border, White on, Green;
Standard Arrow Custom 9.4" X 5.4" 180'; "Flite Acres Rd", ClearviewHwy-3-W;

12/5/2023

	DATE	DESCRIPTION	APPROVED

WSB & ASSOCIATES, INC.
FIRM # 16849

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. 10069
3711 SOUTH MOPAC EXPRESSWAY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

Texas Department of Transportation

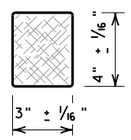
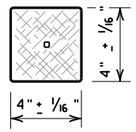
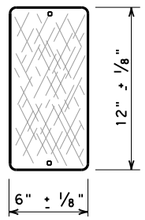
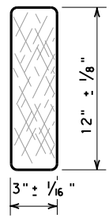
RM 3237 SAFETY IMPROVEMENTS

RM 3237
SIGN DETAILS

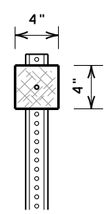
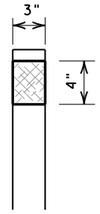
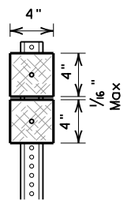
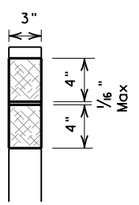
SHEET 1 OF 1

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
MGD				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
MGD	TX	AUS	HAYS	170
CHECK	CONTROL	SECTION	JOB	
BG	0805	04	033	
CHECK				
DAR				

REFLECTOR UNIT SIZES FOR DELINEATORS AND OBJECT MARKERS

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

DELINEATORS

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

D & OM DESCRIPTIVE CODES

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

NUMBER OF REFLECTORS
S = Single
D = Double

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

REFLECTOR UNIT SIZE
1 or 2

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

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

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

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

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

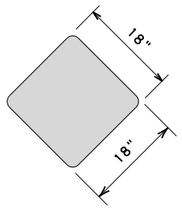
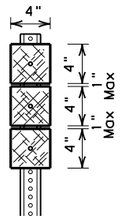
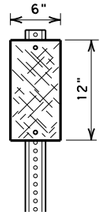
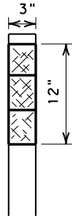
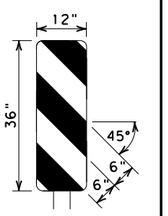
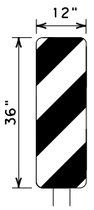
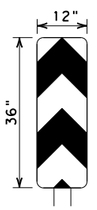
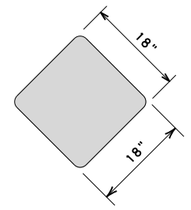
NUMBER OF REFLECTORS OR DIRECTION
X = 3-Size 2 reflector units (Type 2 only)
Y = 1-Size 3 reflector unit (Type 2 only)
Z = 3-Size 1 or 1-Size 4 reflector unit(s)(Type 2 only)
L = Left Side (Type 3 Object Marker only)
R = Right Side (Type 3 Object Marker only)
C = Center (Type 3 Object Marker only)

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

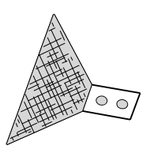
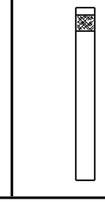
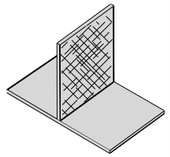
TYPE OF MOUNT
GND = Embedded (drivable)
SRF = Surface Mount
WAS = Wedge Anchor Steel
WAP = Wedge Anchor Plastic

DIRECTION
If Required
BI = Bi-Directional

OBJECT MARKERS

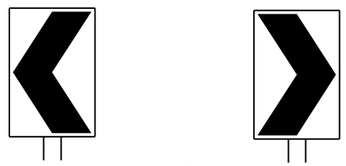
	Type 1 (OM-1)	Type 2 (OM-2)			Type 3 (OM-3)			Type 4 (OM-4)
	OM-1	OM-2X	OM-2Y	OM-2Z	OM-3L	OM-3R	OM-3C	OM-4
DEVICE								
		3-Size 2 reflector units	1-Size 3 reflector unit	3-Size 1 reflector units or 1-Size 4 reflector unit				
SHEETING	Yellow-Type B_{FL} or C_{FL} Sheeting	Yellow - Type B or C Sheeting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

BARRIER REFLECTORS (BRF)

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

CHEVRONS

DEVICE



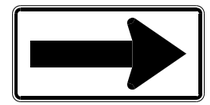
W1-8

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

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

ONE DIRECTION LARGE ARROW

DEVICE



W1-6

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

NOTE:

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

DEPARTMENTAL MATERIAL SPECIFICATIONS

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

Texas Department of Transportation

Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER MATERIAL DESCRIPTION

D & OM(1)-20

FILE: dom1-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
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REVISIONS	0805	04	033	RM 3237
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20A

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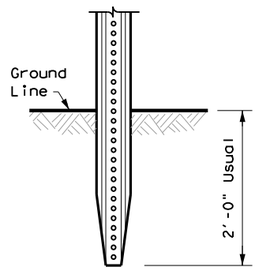
POST TYPE AND SUPPORT FOUNDATION DETAILS

WING CHANNEL (WC)

GND

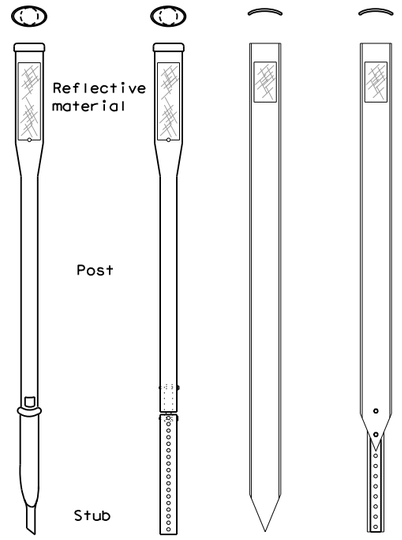


NOTES

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

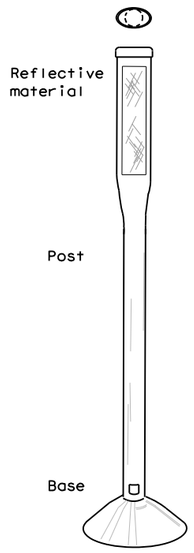
FLEXIBLE POSTS (YFLX, WFLX)

GND



EMBEDDED

SRF



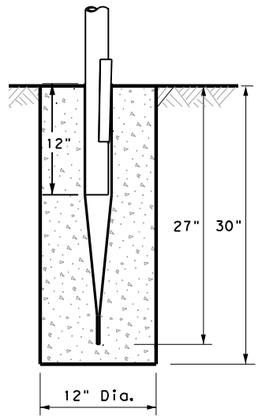
SURFACE MOUNT

NOTES

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

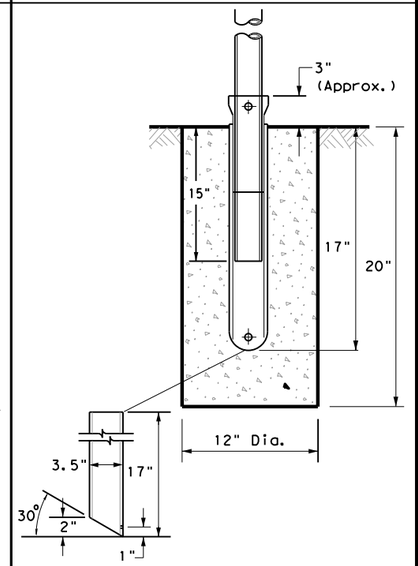
WEDGE ANCHOR SYSTEMS

WAS



STEEL

WAP



PLASTIC

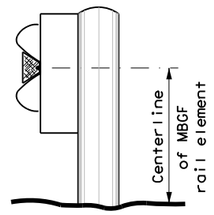
NOTE

1. Install per manufacturer's recommendations.

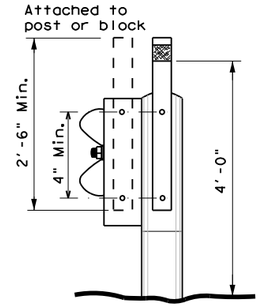
TYPE OF BARRIER MOUNTS

GUARD FENCE ATTACHMENT

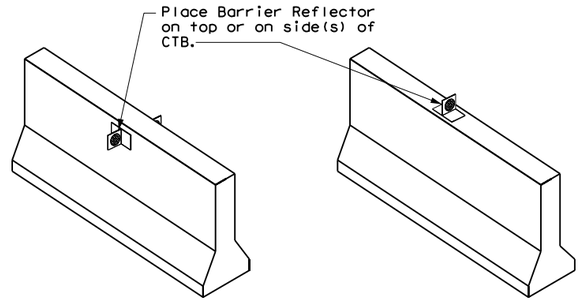
GF1



GF2



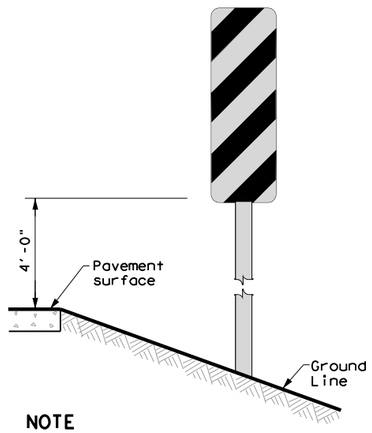
CONCRETE TRAFFIC BARRIER (CTB)



GENERAL NOTES

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

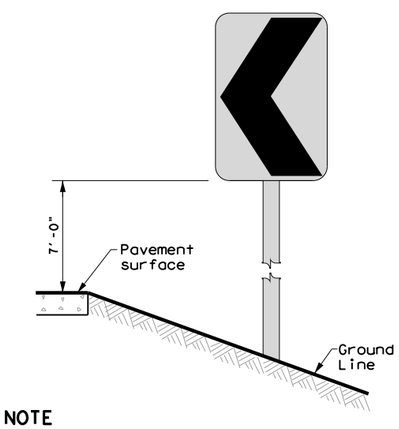
TYPES 1, 3, AND 4 OBJECT MARKERS AND CHEVRONS



NOTE

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

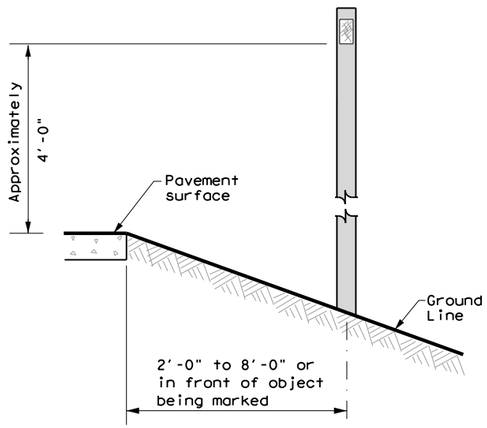
CHEVRONS AND ONE DIRECTION LARGE ARROW SIGN



NOTE

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

DELINEATORS AND TYPE 2 OBJECT MARKERS



See general notes 1, 2 and 3.

Texas Department of Transportation — Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER INSTALLATION

D & OM(2)-20

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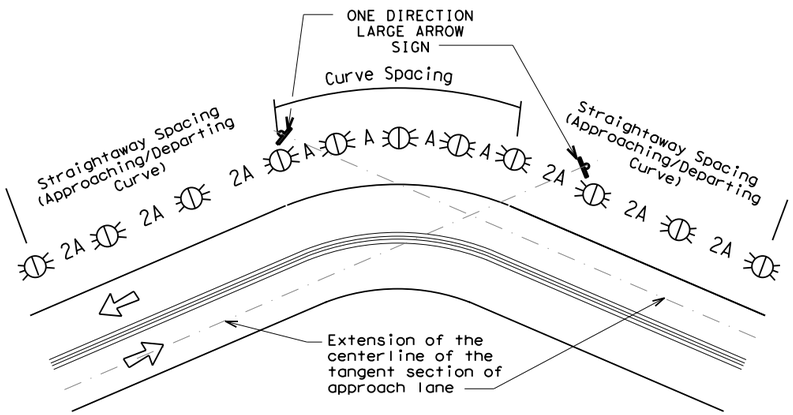
MINIMUM WARNING DEVICES AT CURVES WITH ADVISORY SPEEDS

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

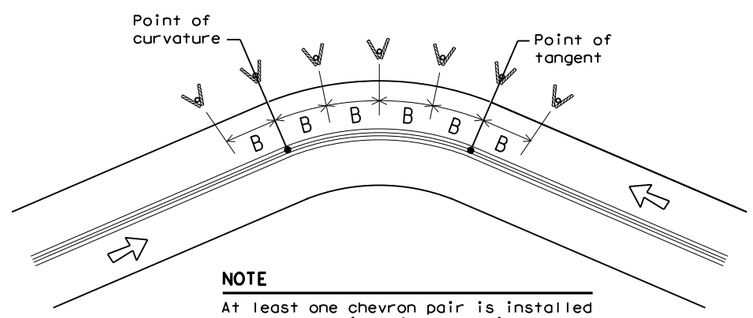
SUGGESTED SPACING FOR DELINEATORS ON HORIZONTAL CURVES



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

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

LEGEND

	Bi-directional Delineator
	Delineator
	Sign

Texas Department of Transportation — Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

D & OM(3)-20

FILE: dom3-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
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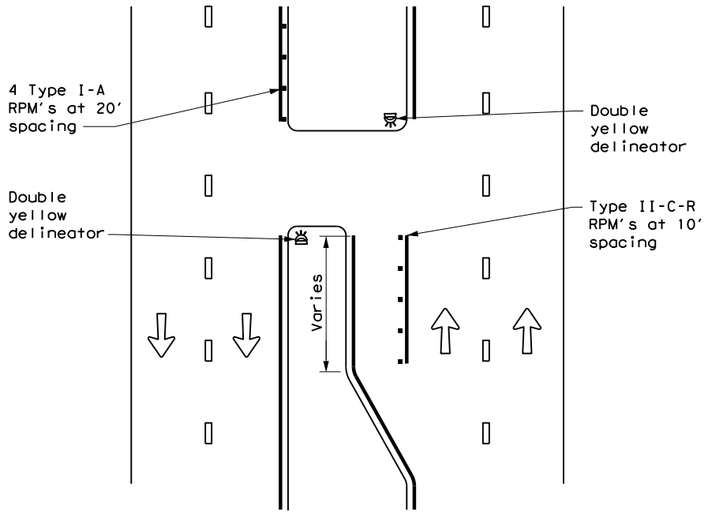
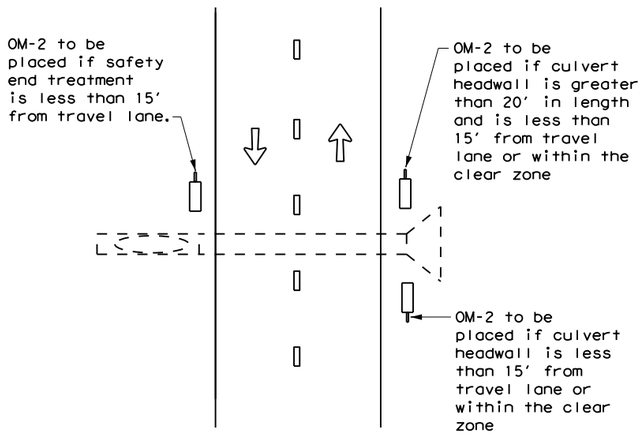
CROSSOVERS



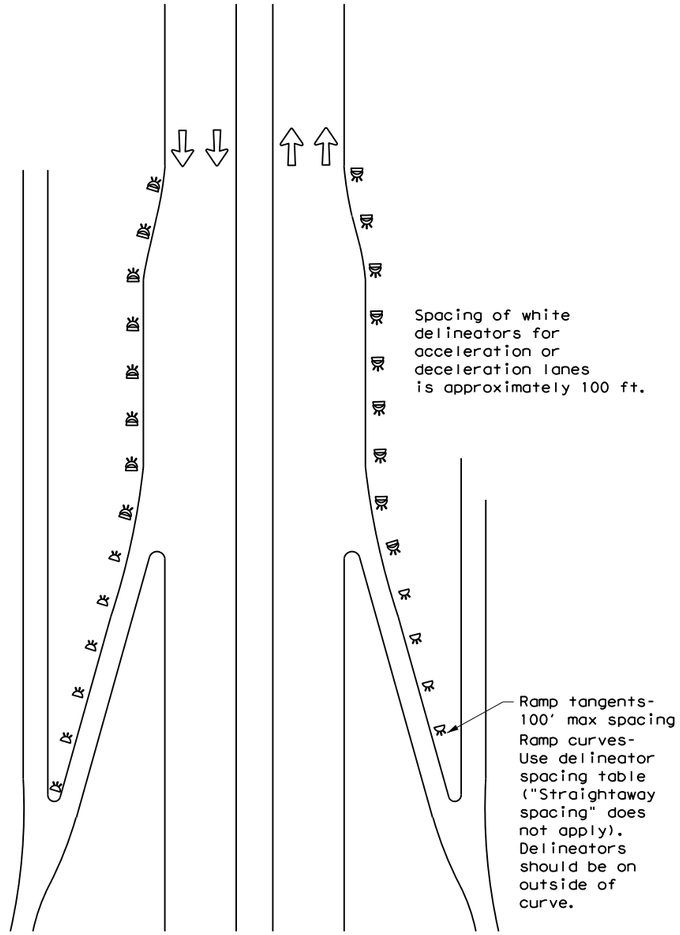
DETAIL 1

FOR CULVERTS WITHOUT MBGF



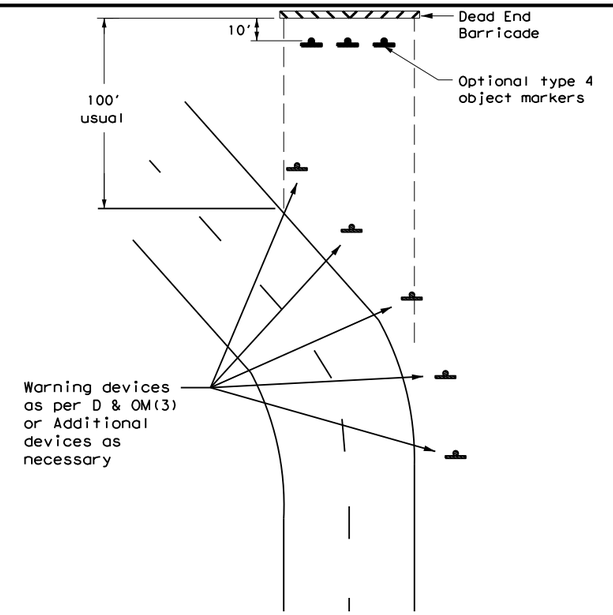
DETAIL 2

FREEWAY DELINEATION FOR RAMPS AND ACCELERATION/DECELERATION LANES



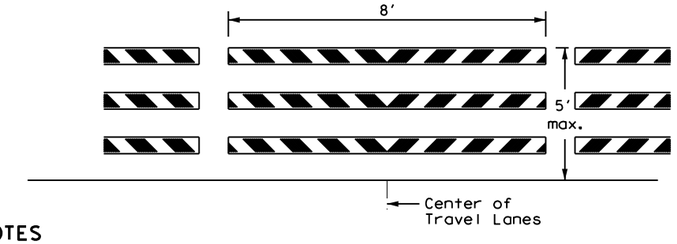
DETAIL 3

TYPICAL APPLICATION OF DEAD END BARRICADE



DETAIL 4

TYPICAL DEAD END BARRICADE INSTALLATION



NOTES

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

DETAIL 5

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

Texas Department of Transportation

Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

D & OM(4)-20

FILE: dom4-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
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3-15	DIST	COUNTY		SHEET NO.
7-20	AUS	HAYS		174

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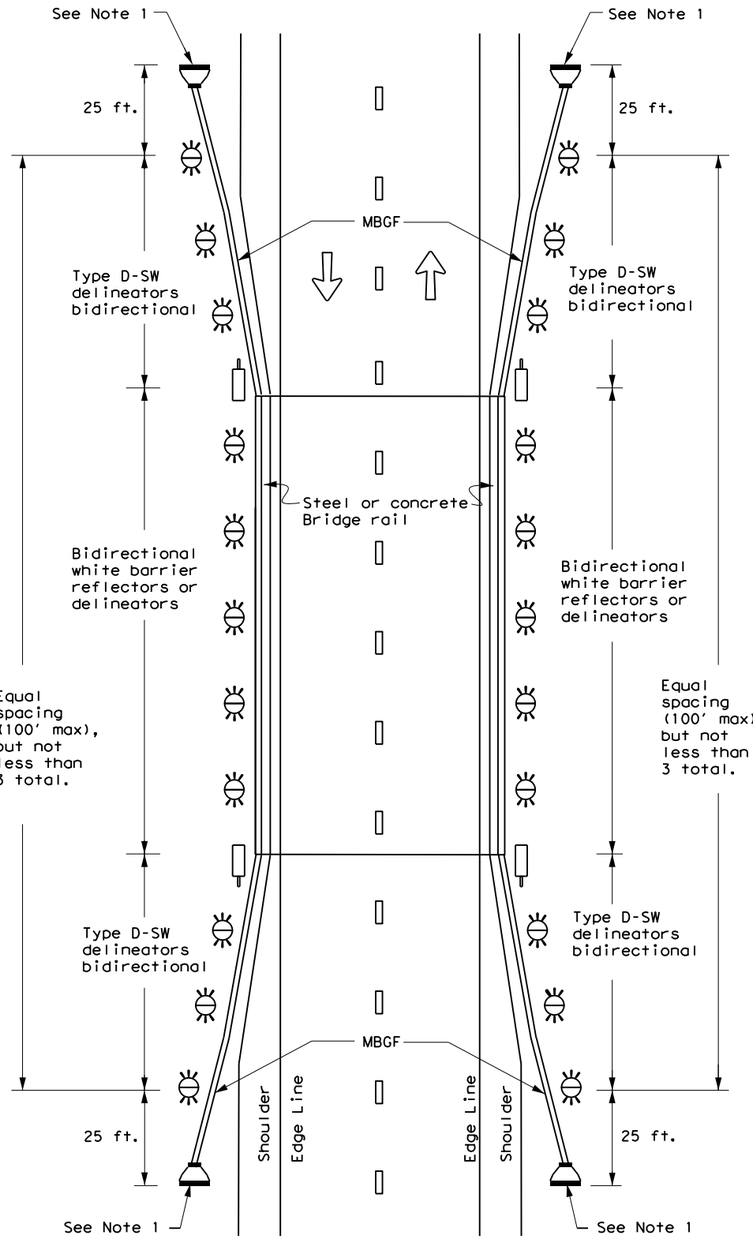
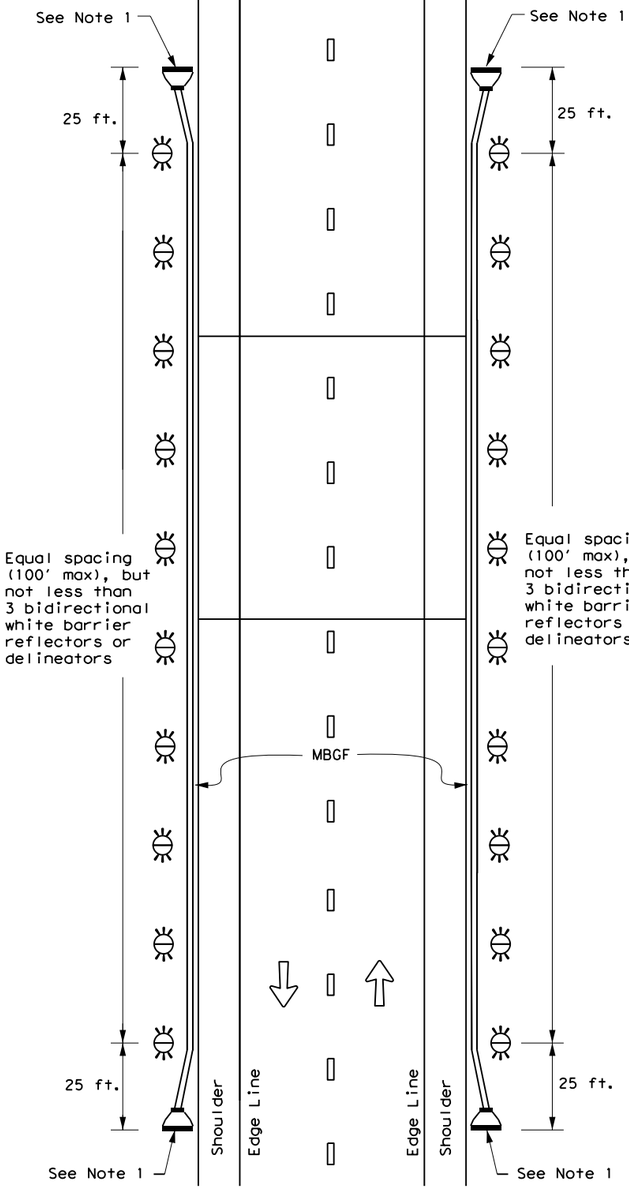
TWO-WAY, TWO LANE ROADWAY WITH REDUCED WIDTH APPROACH RAIL



NOTE:

1. Terminal ends require reflective sheeting provided by manufacturer per D & OM (VIA) or a Type 3 Object Marker (OM-3) in front of the terminal end.

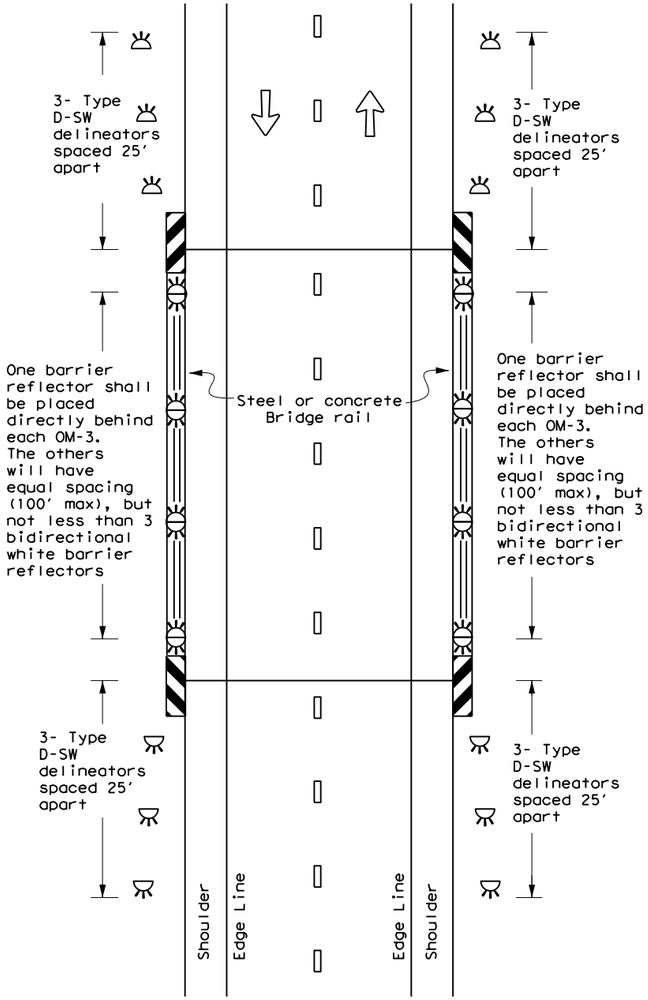
TWO-WAY, TWO LANE ROADWAY WITH METAL BEAM GUARD FENCE (MBGF)



NOTE:

1. Terminal ends require reflective sheeting provided by manufacturer per D & OM (VIA) or a Type 3 Object Marker (OM-3) in front of the terminal end.

TWO-WAY, TWO LANE ROADWAY BRIDGE WITH NO APPROACH RAIL



LEGEND

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

Texas Department of Transportation

Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

D & OM(5)-20

FILE: dom5-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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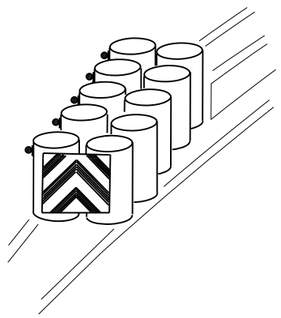
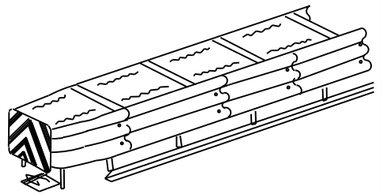
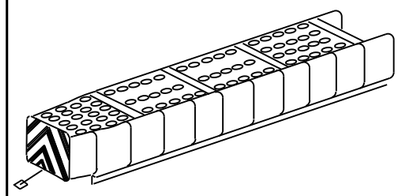
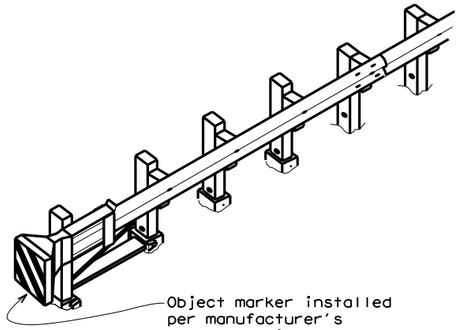
7-20	DIST	COUNTY		SHEET NO.
	AUS	HAYS		175

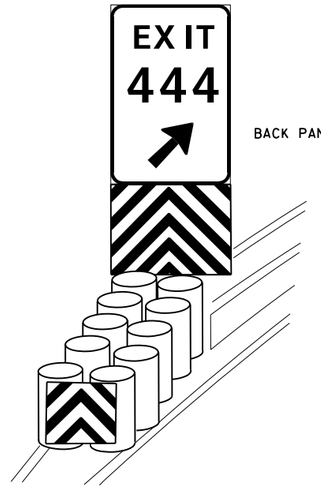
20E

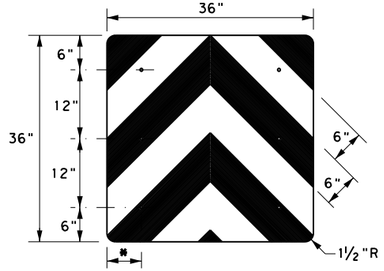


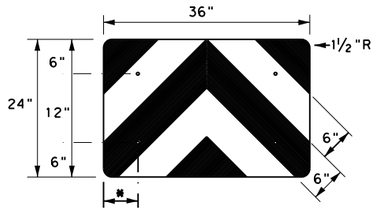




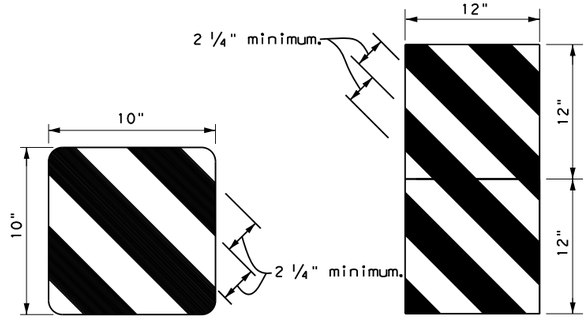




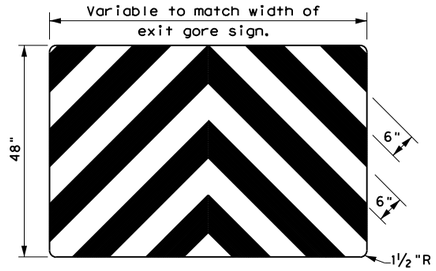


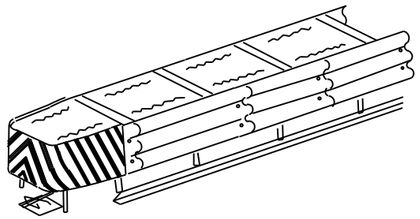


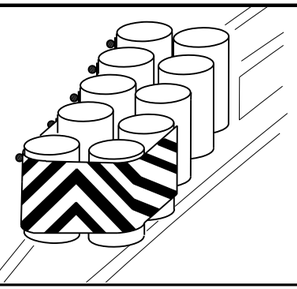
* Adjust to fit attenuator per manufacturer's recommendation, or as directed by the Engineer

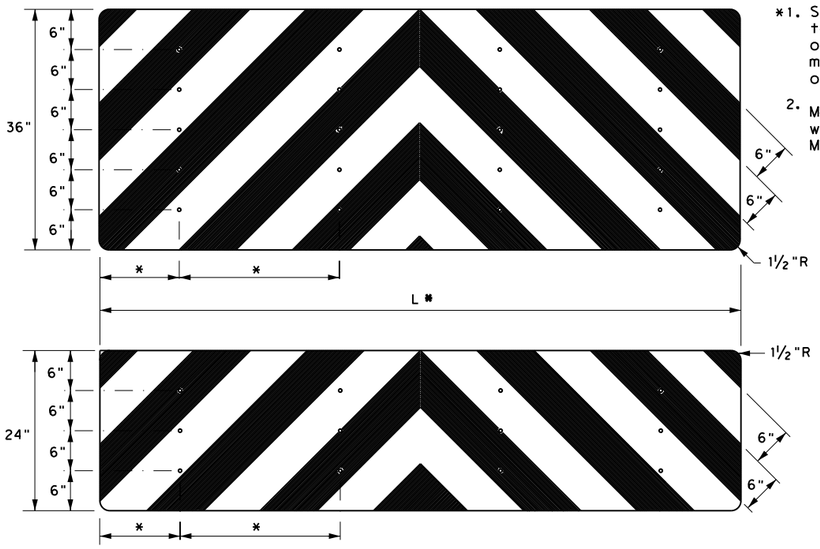


OBJECT MARKERS SMALLER THAN 3 FT^2









NOTES

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

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

NOTES

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

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

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

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

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

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

Texas Department of Transportation

Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER FOR VEHICLE IMPACT ATTENUATORS

D & OM(VIA)-20

FILE: domvia20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
© TxDOT December 1989	CONT	SECT	JOB	HIGHWAY
REVISIONS	0805	04	033	RM 3237
4-92 8-04	DIST	COUNTY		SHEET NO.
8-95 3-15	AUS	HAYS		176
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20G

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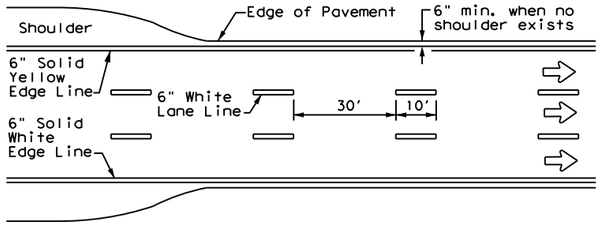
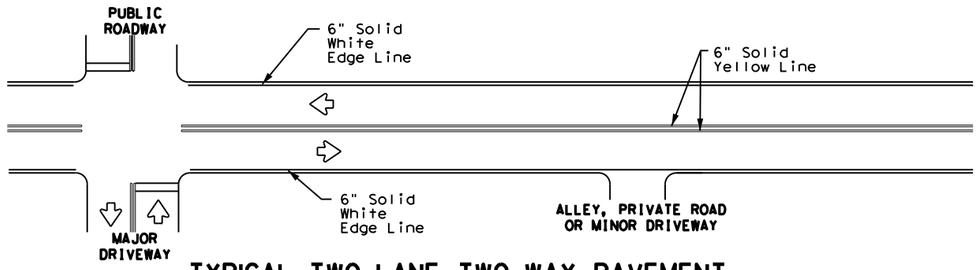
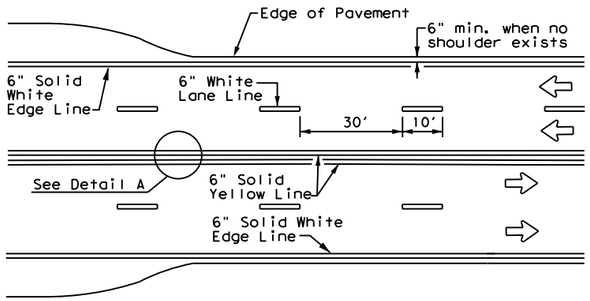
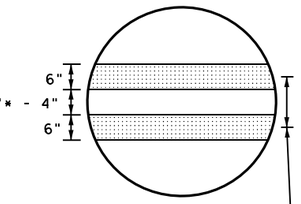


EDGE LINE AND LANE LINES ONE-WAY ROADWAY WITH OR WITHOUT SHOULDERS



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

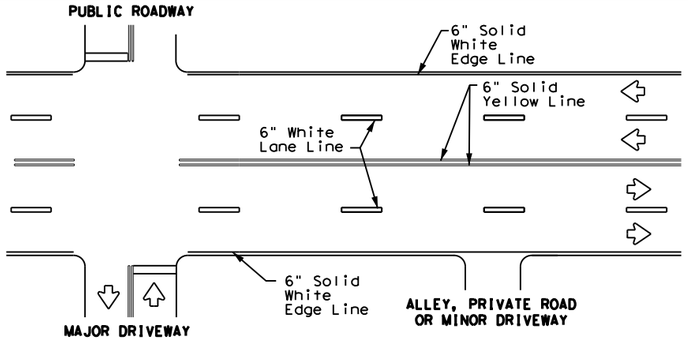




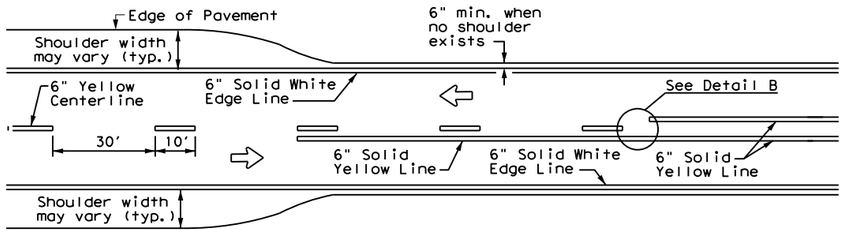
CENTERLINE AND LANE LINES FOUR LANE TWO-WAY ROADWAY WITH OR WITHOUT SHOULDERS

* 2" minimum for restripe projects when approved by the Engineer.

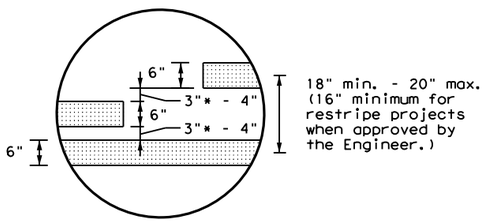
** 8" minimum for restripe projects when approved by the Engineer.



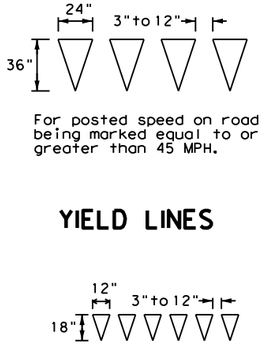
TYPICAL MULTI-LANE, TWO-WAY PAVEMENT MARKINGS THROUGH INTERSECTIONS

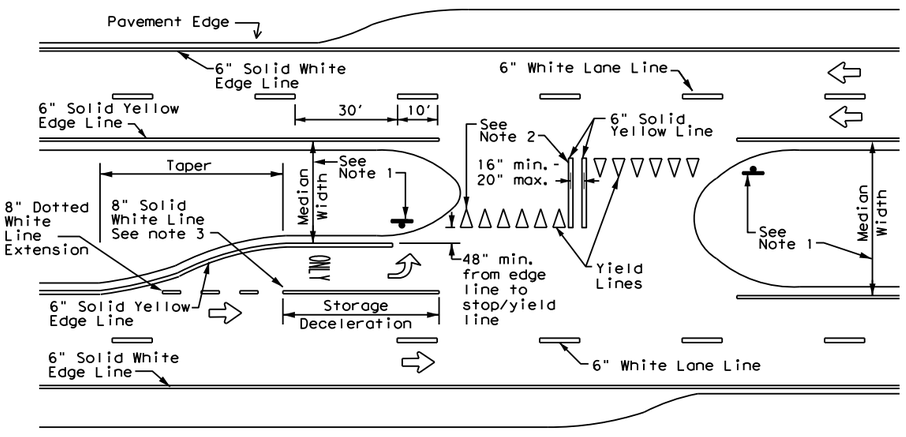


TWO LANE TWO-WAY ROADWAY WITH OR WITHOUT SHOULDERS



* 2" minimum for restripe projects when approved by the Engineer.





FOUR LANE DIVIDED ROADWAY CROSSOVERS

NOTES

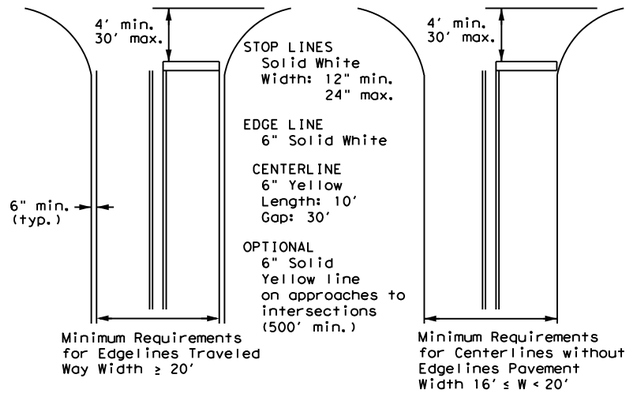
1. Where divided highways are separated by median widths at the median opening itself of 30 feet or more, median openings shall be signed as two separate intersections. Each median opening has two width measurements, with one measurement for each approach. The narrow median width will be the controlling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

GENERAL NOTES

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

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

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



NOTE: Traveled way is exclusive of shoulder widths. Refer to General Note 2 for additional details.

GUIDE FOR PLACEMENT OF STOP LINES, EDGE LINE & CENTERLINE

Based on Traveled Way and Pavement Widths for Undivided Roadways

Texas Department of Transportation

Traffic Safety Division Standard

TYPICAL STANDARD PAVEMENT MARKINGS

PM(1)-22

FILE: pm1-22.dgn	DN:	CK:	DW:	CK:
© TxDOT December 2022	CONT	SECT	JOB	HIGHWAY
REVISIONS 11-78 8-00 6-20	0805	04	033	RM 3237
8-95 3-03 12-22	DIST	COUNTY		SHEET NO.
5-00 2-12	AUS	HAYS		177

22A

DATE: 11/14/2023 1:28:23 PM
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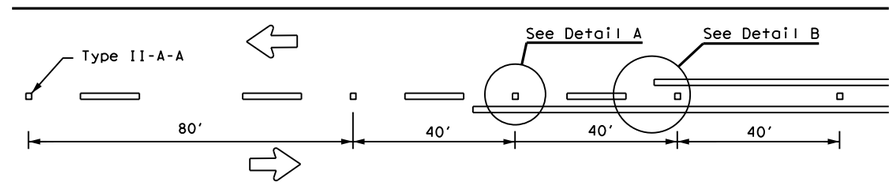
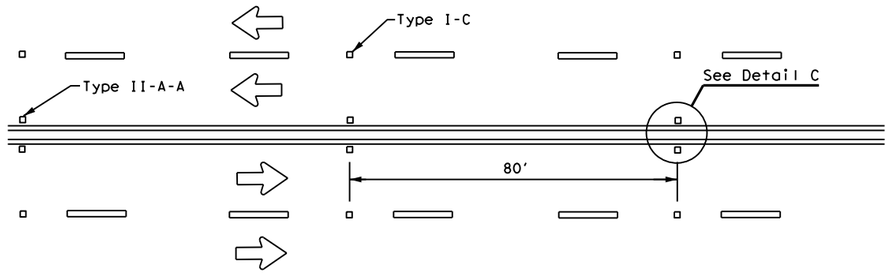
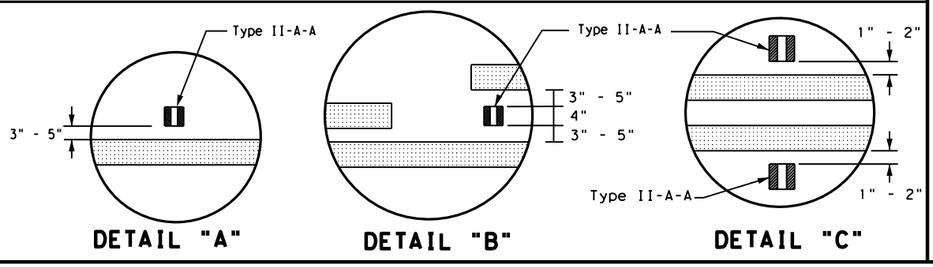
REFLECTIVE RAISED PAVEMENT MARKERS FOR VEHICLE POSITIONING GUIDANCE



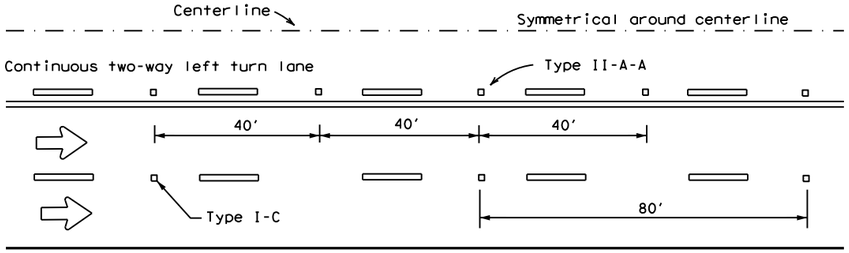
CENTERLINE FOR ALL TWO LANE TWO-WAY ROADWAYS



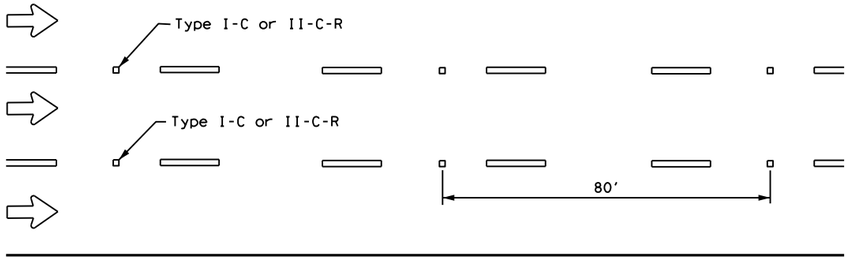
CENTERLINE & LANE LINES FOR FOUR LANE TWO-WAY ROADWAYS



DETAIL "A" **DETAIL "B"** **DETAIL "C"**



CENTERLINE AND LANE LINES FOR TWO-WAY LEFT TURN LANE



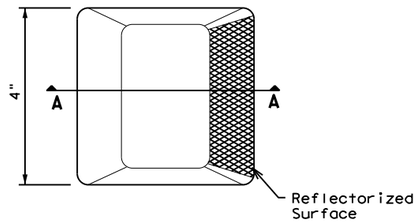
LANE LINES FOR ONE-WAY ROADWAY (NON-FREEWAY FACILITIES)

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

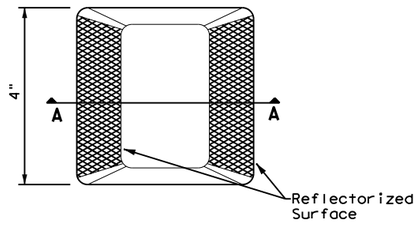
See Note 3.

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

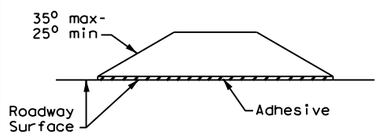
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



Type I (Top View)

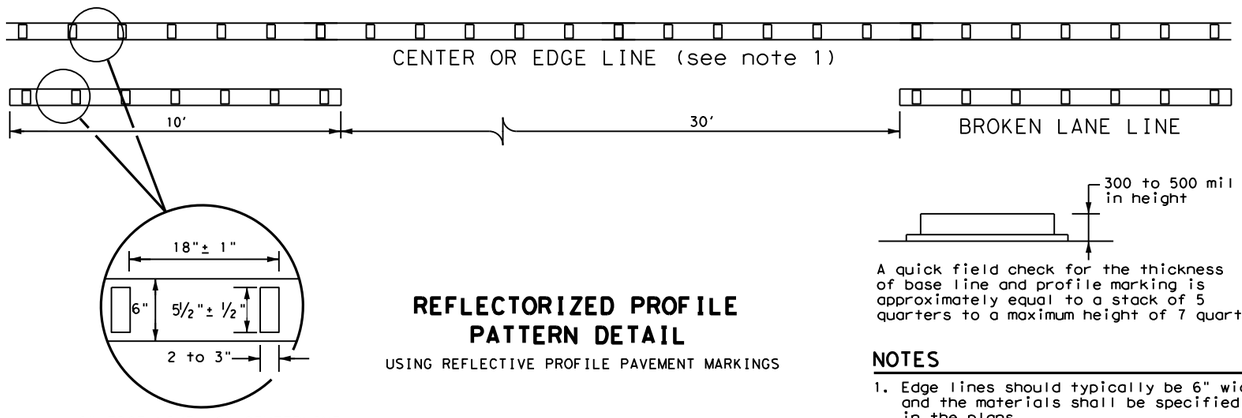


Type II (Top View)



SECTION A

RAISED PAVEMENT MARKERS



6" EDGE LINE, 6" CENTERLINE OR 6" LANE LINE

REFLECTORIZED PROFILE PATTERN DETAIL

USING REFLECTIVE PROFILE PAVEMENT MARKINGS

A quick field check for the thickness of base line and profile marking is approximately equal to a stack of 5 quarters to a maximum height of 7 quarters.

NOTES

1. Edge lines should typically be 6" wide and the materials shall be specified in the plans.
2. Profile markings shall not be placed on roadways with a posted speed limit of 45 MPH or less.

GENERAL NOTES

1. All raised pavement markers placed along broken lines shall be placed in line with and midway between the stripes.
2. On concrete pavements the raised pavement markers should be placed to one side of the longitudinal joints.
3. Use raised pavement marker Type I-C with undivided roadways, flush medians and two way left turn lanes. Use raised pavement marker Type II-C-R with divided highways and raised medians.

Texas Department of Transportation

Traffic Safety Division Standard

POSITION GUIDANCE USING RAISED MARKERS RELECTORIZED PROFILE MARKINGS PM(2)-22

FILE: pm2-22.dgn	DN:	CK:	DW:	CK:
©TxDOT December 2022	CONT	SECT	JOB	HIGHWAY
REVISIONS 4-77 8-00 6-20 4-92 2-10 12-22 5-00 2-12	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		178

22B

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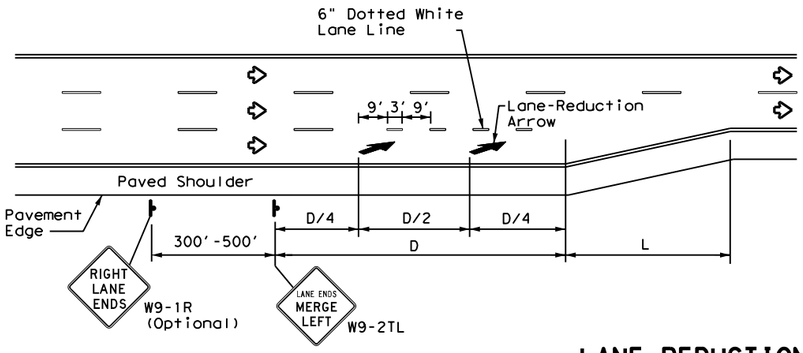
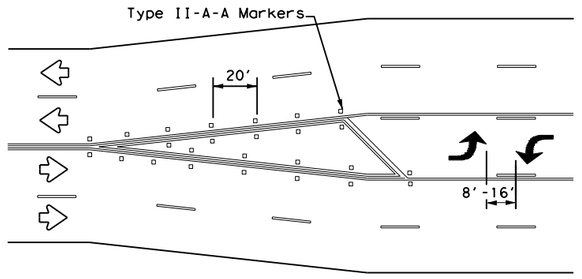


LANE REDUCTION

NOTES

1. Lane reduction pavement markings are used where the number of through lanes is reduced because of narrowing of the roadway or because of a section of on-street parking in what would otherwise be a through lane. For Texas Super 2 Passing Lanes, see TS2(PL) standard sheets.
2. On divided highways, an additional RIGHT LANE ENDS (W9-1R) sign may be installed in the median aligned with the W9-1R sign on the right side of the highway.
3. Lane reduction arrows are required for speeds of 45 mph or greater. An optional third lane reduction arrow may be added based on engineering judgement. If used, the optional third lane reduction arrow should be centered between the first and last lane reduction arrows.
4. For lane reductions on Freeways and Expressways, signing shall conform to the TxDOT Freeway Signing Handbook.

ADVANCED WARNING SIGN DISTANCE (D)		
Posted Speed	D (ft)	L (ft)
30 MPH	460	$L=\frac{WS^2}{60}$
35 MPH	565	
40 MPH	670	
45 MPH	775	L=WS
50 MPH	885	
55 MPH	990	
60 MPH	1,100	
65 MPH	1,200	
70 MPH	1,250	
75 MPH	1,350	



A two-way left-turn (TWLT) lane-use arrow pavement marking should be used at or just downstream from the beginning of a two-way left-turn lane within a corridor. Repeating the marking after each intersection or dedicated turn bay is not required unless stated elsewhere in the plans.

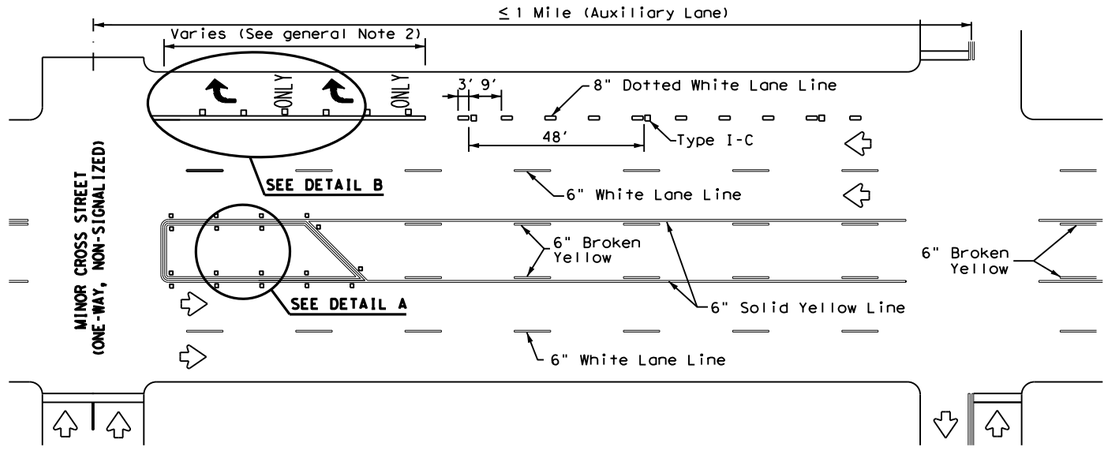
TYPICAL TRANSITION FOR TWLTL AND DIVIDED HIGHWAY

GENERAL NOTES

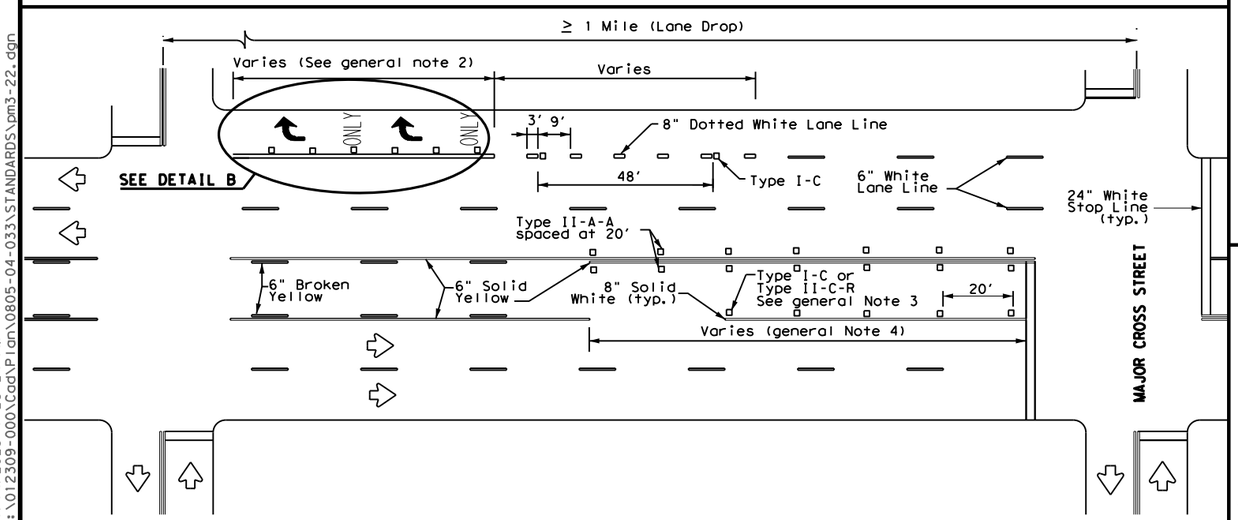
1. Lane use word and arrow markings shall be used where through lanes approaching an intersection become mandatory turn lanes. Lane use word and arrow markings should be used in auxiliary lanes of substantial length. Lane use arrow markings or word and arrow markings may be used in other lanes and turn bays for emphasis. Details for words and arrows are as shown in the Standard Highway Sign Designs for Texas.
2. When lane-use words and arrow markings are used, two sets of arrows should be used if the length of the bay is greater than 180 feet. When a single lane use arrow or word and arrow marking is used for a short turn lane, it should be located at or near the upstream end of the full-width turn lane.
3. Use raised pavement marker Type I-C with undivided highways, flush medians and two way left turn lanes. Use raised pavement marker Type II-C-R with divided highways and raised medians.
4. Length of turn bays, including taper, deceleration, and storage lengths shall be as shown on the plans or as directed by the Engineer. See Chapter 3 of the Roadway Design Manual for additional information on turning lanes or storage lengths.

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

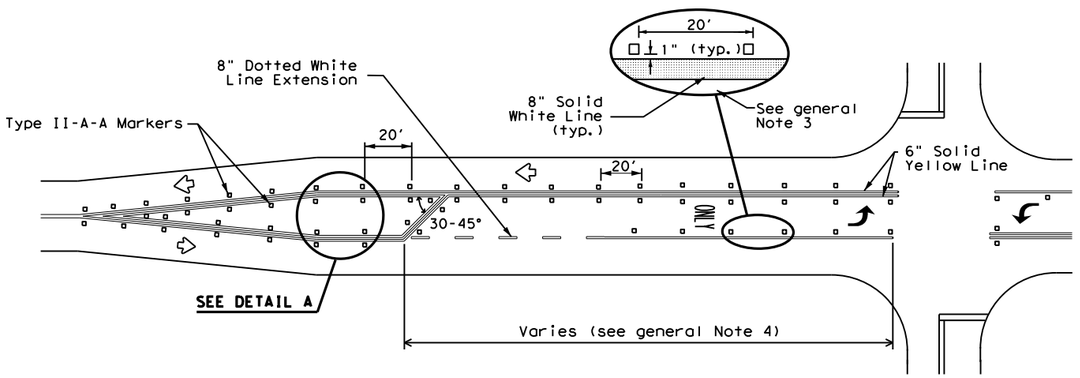
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



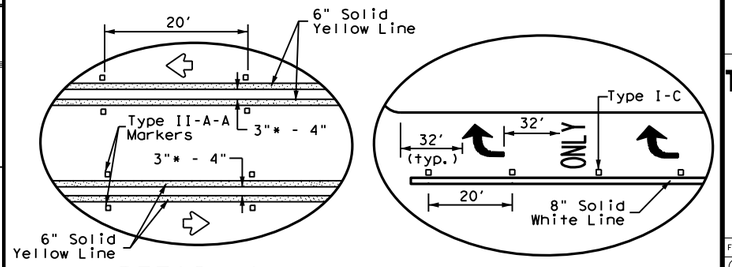
TYPICAL TWLTL AT ONE-WAY STREET AND RIGHT TURN AUXILIARY LANE



TYPICAL TWLTL AT TWO-WAY CROSS STREET AND RIGHT TURN LANE DROP



TYPICAL TWO-LANE ROADWAY INTERSECTION WITH LEFT TURN BAYS



* 2" minimum allowed for restripe projects when approved by the Engineer.

Texas Department of Transportation

Traffic Safety Division Standard

TWO-WAY LEFT TURN LANES, RURAL LEFT TURN BAYS, AND LANE REDUCTION PAVEMENT MARKINGS

PM(3)-22

FILE: pm3-22.dgn	DN:	CK:	DW:	CK:
© TxDOT December 2022	CONT	SECT	JOB	HIGHWAY
REVISIONS 4-98 3-03 6-20	0805	04	033	RM 3237
5-00 2-10 12-22	DIST	COUNTY		SHEET NO.
8-00 2-12	AUS	HAYS		179

22C

DATE: 11/14/2023 1:28:24 PM
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SIGN SUPPORT DESCRIPTIVE CODES

(Descriptive Codes correspond to project estimate and quantities sheets)

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

Post Type

FRP = Fiberglass Reinforced Plastic Pipe (see SMD(FRP))
TWT = Thin-Walled Tubing (see SMD(TWT))
10BWG = 10 BWG Tubing (see SMD(SLIP-1) to (SLIP-3))
S80 = Schedule 80 Pipe (see SMD(SLIP-1) to (SLIP-3))

Number of Posts (1 or 2)

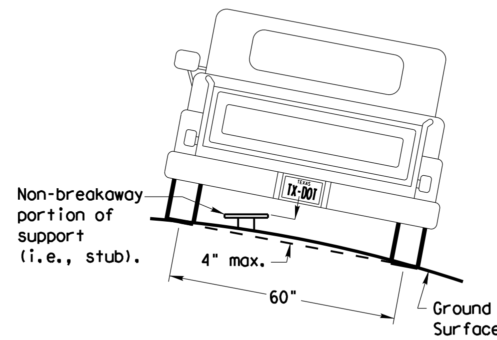
Anchor Type

UA = Universal Anchor - Concreted (see SMD(FRP) and (TWT))
UB = Universal Anchor - Bolted down (see SMD(FRP) and (TWT))
WS = Wedge Anchor Steel - (see SMD(TWT))
WP = Wedge Anchor Plastic (see SMD(TWT))
SA = Slipbase - Concreted (see SMD(SLIP-1) to (SLIP-3))
SB = Slipbase - Bolted Down (see SMD(SLIP-1) to (SLIP-3))

Sign Mounting Designation

P = Prefab. "Plain" (see SMD(SLIP-1) to (SLIP-3), (TWT), (FRP))
T = Prefab. "T" (see SMD(SLIP-1) to (SLIP-3), (TWT))
U = Prefab. "U" (see SMD(SLIP-1) to (SLIP-3))
IF REQUIRED
1EXT or 2EXT = Number of Extensions (see SMD(SLIP-1) to (SLIP-3), (TWT))
BM = Extruded Wind Beam (see SMD(SLIP-1) to (SLIP-3))
WC = 1.12 #/ft Wing Channel (see SMD(SLIP-1) to (SLIP-3))
EXAL = Extruded Aluminum Sign Panels (see SMD(SLIP-3))

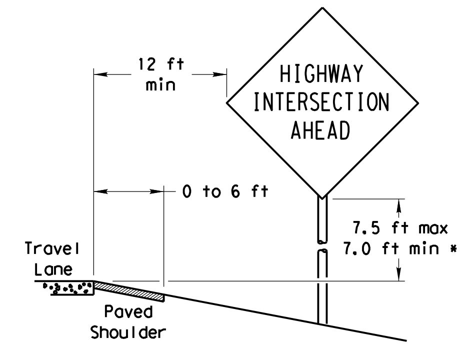
REQUIRED CLEARANCE FOR BREAKAWAY SUPPORT



To avoid vehicle undercarriage snagging, any substantial remains of a breakaway support, when it is broken away, should not project more than 4 inches above a 60-inch chord (i.e., typical space between wheel paths).

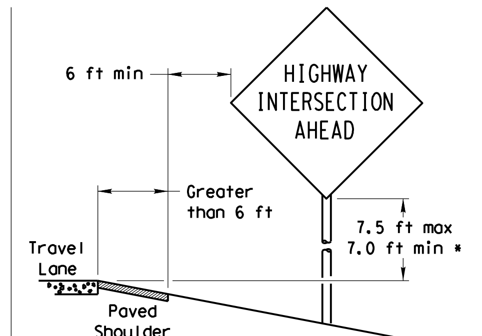
SIGN LOCATION

PAVED SHOULDERS



LESS THAN 6 FT. WIDE

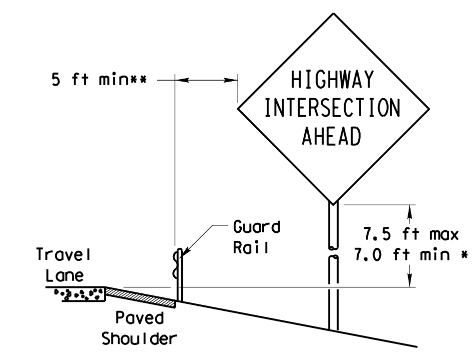
When the shoulder is 6 ft. or less in width, the sign must be placed at least 12 ft. from the edge of the travel lane.



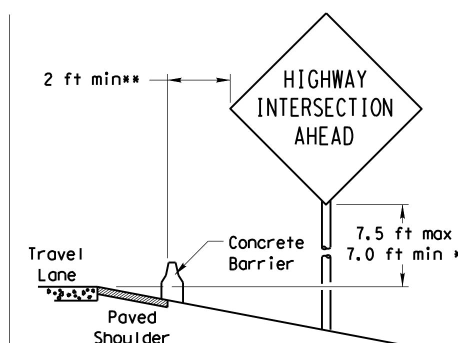
GREATER THAN 6 FT. WIDE

When the shoulder is greater than 6 ft in width, the sign must be placed at least 6 ft. from the edge of the shoulder.

BEHIND BARRIER



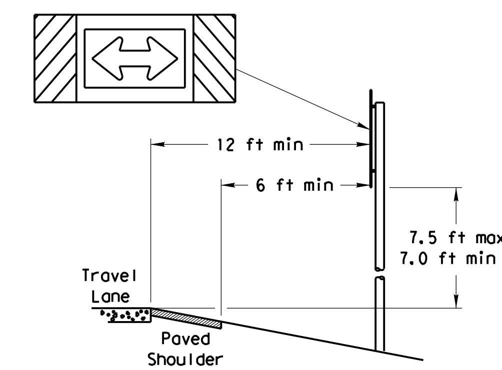
BEHIND GUARDRAIL



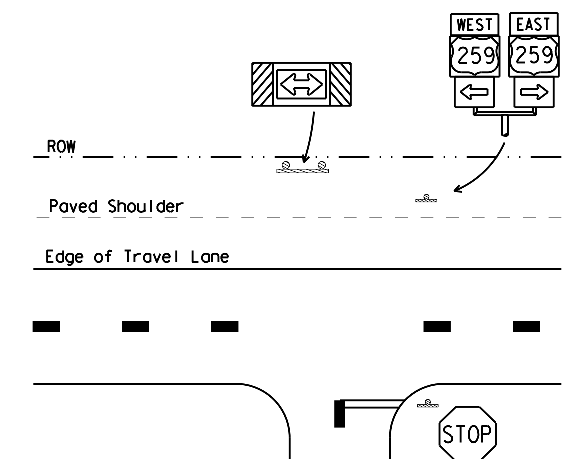
BEHIND CONCRETE BARRIER

**Sign clearance based on distance required for proper guard rail or concrete barrier performance.

T-INTERSECTION



When this sign is needed at the end of a two-lane, two way roadway, the right edge of the sign should be in line with the centerline of the roadway. Place as close to ROW as practical.



* Signs shall be mounted using the following condition that results in the greatest sign elevation:

(1) a minimum of 7 to a maximum of 7.5 feet above the edge of the travel lane or

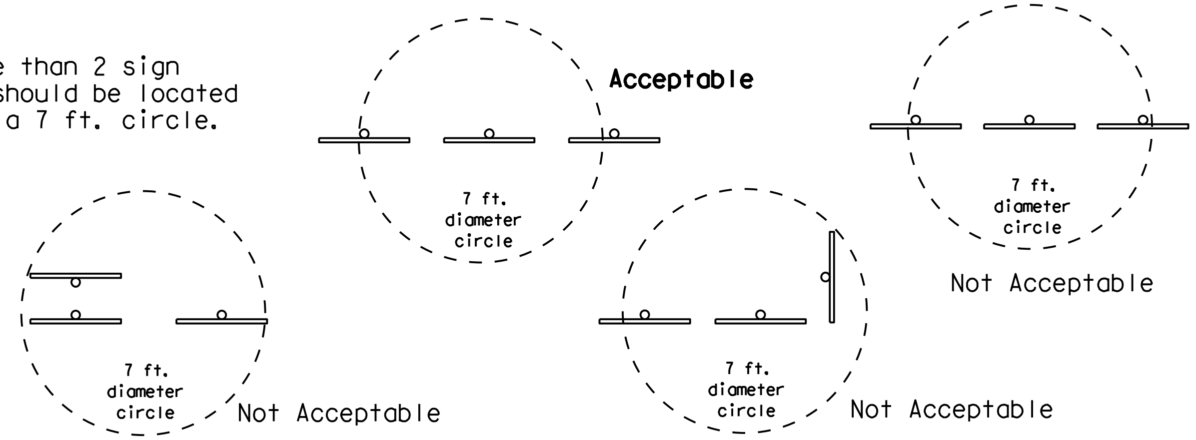
(2) a minimum of 7 to a maximum of 7.5 feet above the grade at the base of the support when sign is installed on the backslope.

The maximum values may be increased when directed by the Engineer.

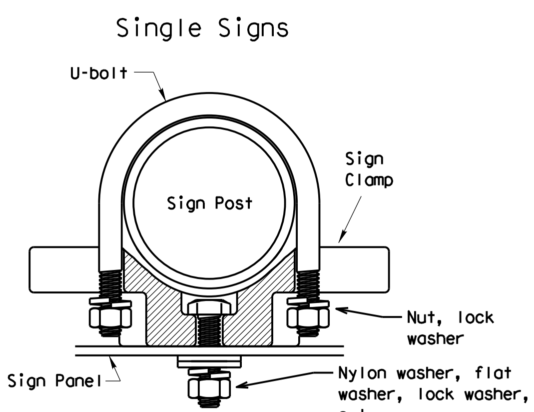
See the Traffic Operations Division website for detailed drawings of sign clamps, Triangular Slipbase System components and Wedge Anchor System components.

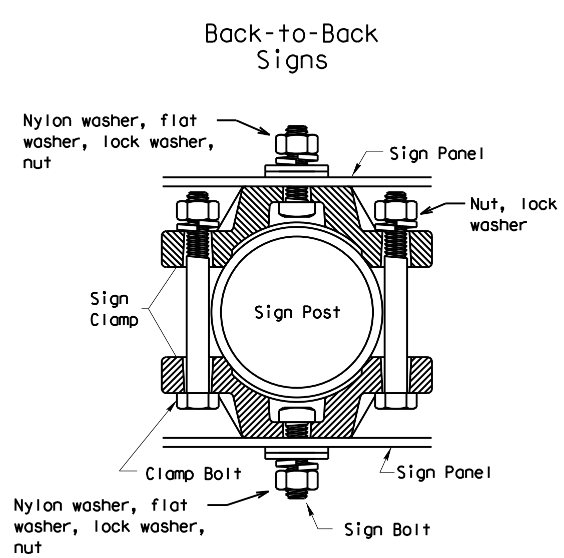
The website address is:
http://www.txdot.gov/publications/traffic.htm

No more than 2 sign posts should be located within a 7 ft. circle.



TYPICAL SIGN ATTACHMENT DETAIL





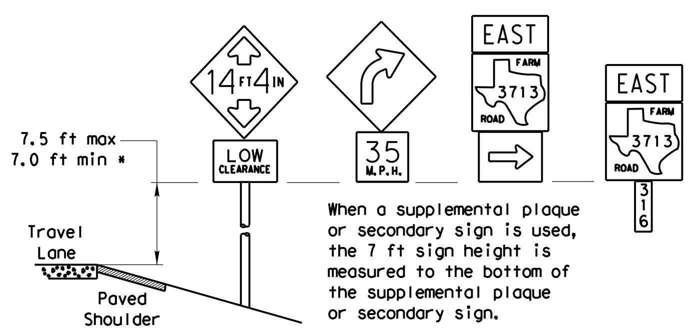
Bolts used to mount sign panels to the clamp are 5/16-18 UNC galvanized square head with nut, nylon washer, flat washer and lock washer. The bolt length is 1 inch for aluminum.

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.

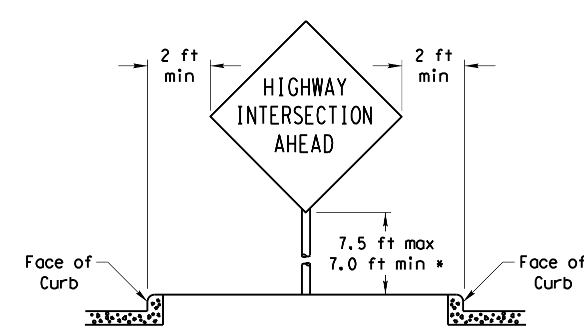
Pipe Diameter	Approximate Bolt Length	
	Specific Clamp	Universal Clamp
2" nominal	3"	3 or 3 1/2"
2 1/2" nominal	3 or 3 1/2"	3 1/2 or 4"
3" nominal	3 1/2 or 4"	4 1/2"

SIGNS WITH PLAQUES



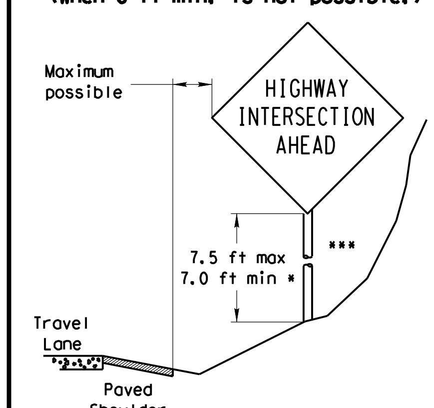
When a supplemental plaque or secondary sign is used, the 7 ft sign height is measured to the bottom of the supplemental plaque or secondary sign.

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.

Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS GENERAL NOTES & DETAILS

SMD(GEN)-08

	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
REVISIONS	CONT	SECT	JOB	HIGHWAY
9-08	0805	04	033	RM 3237
	DIST		COUNTY	SHEET NO.
	AUS		HAYS	180

26A

DATE: 11/14/2023
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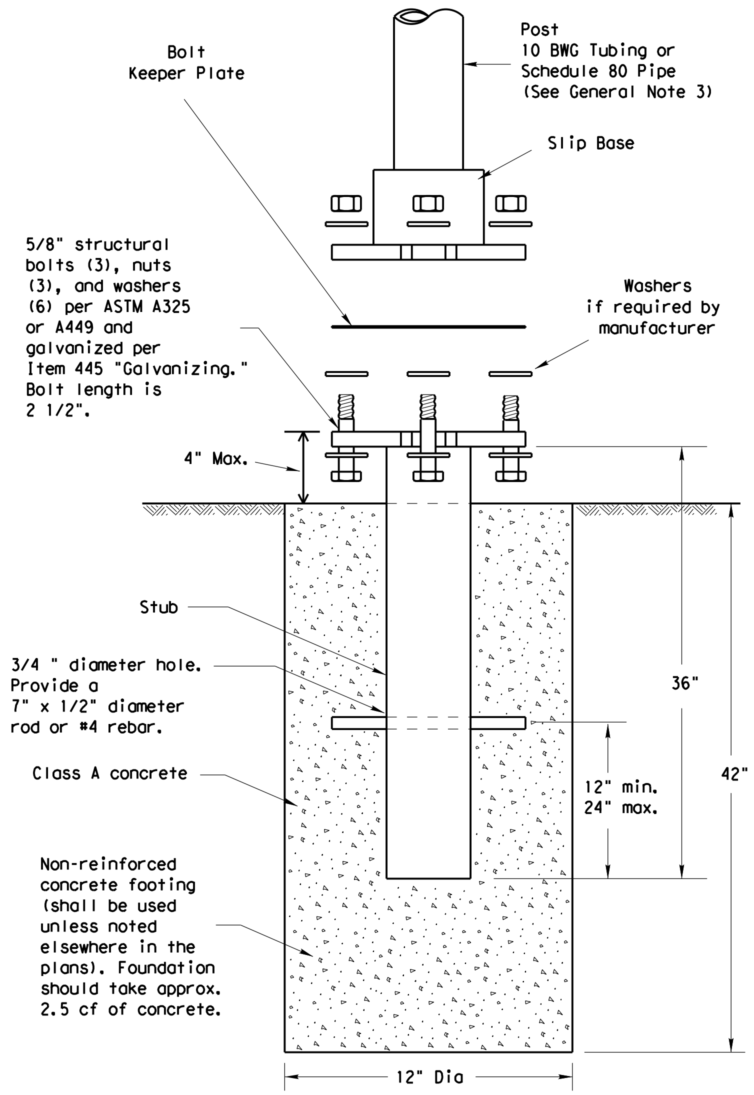
TRIANGULAR SLIPBASE INSTALLATION GENERAL REQUIREMENTS



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

NOTE

There are various devices approved for the Triangular Slipbase System. Please reference the Material Producer List for approved slip base systems. http://www.txdot.gov/business/producer_list.htm The devices shall be installed per manufacturers' recommendations. Installation procedures shall be provided to the Engineer by Contractor.

GENERAL NOTES:

1. Slip base shall be permanently marked to indicate manufacturer. Method, design, and location of marking are subject to approval of the TxDOT Traffic Standards Engineer.
2. Material used as post with this system shall conform to the following specifications:
   10 BWG Tubing (2.875" outside diameter)
   - 0.134" nominal wall thickness
   - Seamless or electric-resistance welded steel tubing or pipe
   - Steel shall be HSLAS Gr 55 per ASTM A1011 or ASTM A1008
   - Other steels may be used if they meet the following:
     - 55,000 PSI minimum yield strength
     - 70,000 PSI minimum tensile strength
     - 20% minimum elongation in 2"
   - Wall thickness (uncoated) shall be within the range of 0.122" to 0.138"
   - Outside diameter (uncoated) shall be within the range of 2.867" to 2.883"
   - Galvanization per ASTM A123 or ASTM A653 G210. For precoated steel tubing (ASTM A653), recoat tube outside diameter weld seam by metallizing with zinc wire per ASTM B833.

   Schedule 80 Pipe (2.875" outside diameter)
   - 0.276" nominal wall thickness
   - Steel tubing per ASTM A500 Gr C
   - Other seamless or electric-resistance welded steel tubing or pipe with equivalent outside diameter and wall thickness may be used if they meet the following:
     - 46,000 PSI minimum yield strength
     - 62,000 PSI minimum tensile strength
     - 21% minimum elongation in 2"
   - Wall thickness (uncoated) shall be within the range of 0.248" to 0.304"
   - Outside diameter (uncoated) shall be within the range of 2.855" to 2.895"
   - Galvanization per ASTM A123
3. See the Traffic Operations Division website for detailed drawings of sign clamps and Texas Universal Triangular Slipbase System components. The website address is: http://www.txdot.gov/publications/traffic.htm
4. Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.

ASSEMBLY PROCEDURE

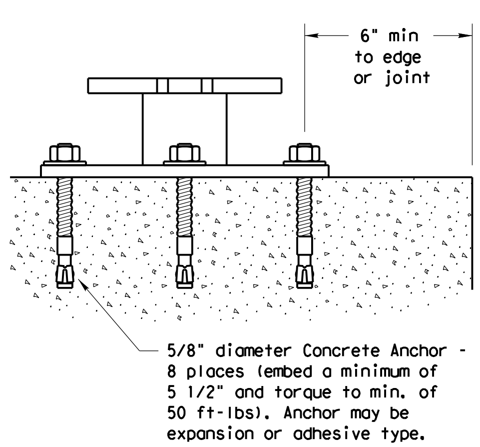
Foundation

1. Prepare 12-inch diameter by 42-inch deep hole. If solid rock is encountered, the depth of the foundation may be reduced such that it is embedded a minimum of 18 inches into the solid rock.
2. The Engineer may permit batches of concrete less than 2 cubic yards to be mixed with a portable, motor-driven concrete mixer. For small placements less than 0.5 cubic yards, hand mixing in a suitable container may be allowed by Engineer. Concrete shall be Class A.
3. Push the pipe end of the slip base stub into the center of the concrete. Rotate the stub back and forth while pushing it down into the concrete to assure good contact between the concrete and stub. Continue to work the stub into the concrete until it is between 2 to 4 inches above the ground.
4. Plumb the stub. Allow a minimum of 4 days to set, unless otherwise directed by the Engineer.
5. The triangular slipbase system is multidirectional and is designed to release when struck from any direction.

Support

1. Cut support so that the bottom of the sign will be 7 to 7.5 feet above the edge of the travelway (i.e., edge of the closest lane) when slip plate is below the edge of pavement or 7 to 7.5 feet above slip plate when the slip plate is above the edge of the travelway. The cut shall be plumb and straight.
2. Attach sign to support using connections shown. When multiple signs are installed on the same support, ensure the minimum clearance between each sign is maintained. See SMD(SLIP-2) for clearances based on sign types.

CONCRETE ANCHOR



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

Concrete anchor consists of 5/8" diameter stud bolt with UNC series bolt threads on the upper end. Heavy hex nut per ASTM A563, and hardened washer per ASTM F436. The stud bolt shall have a minimum yield and ultimate tensile strength of 50 and 75 KSI, respectively. Nuts, bolts and washers shall be galvanized per Item 445, "Galvanizing." Adhesive type anchors shall have stud bolts installed with Type III epoxy per DMS-6100, "Epoxies and Adhesives." Adhesive anchors may be loaded after adequate epoxy cure time per the manufacturer's recommendations. Top of bolt shall extend at least flush with top of the nut when installed. The anchor, when installed in 4000 psi normal-weight concrete with a 5 1/2" minimum embedment, shall have a minimum allowable tension and shear of 3900 and 3100 psi, respectively.

Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS TRIANGULAR SLIPBASE SYSTEM

SMD(SLIP-1)-08

© TxDOT July 2002	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
REVISIONS	CONT	SECT	JOB	HIGHWAY
9-08	0805	04	033	RM 3237
	DIST		COUNTY	SHEET NO.
	AUS		HAYS	181

26B

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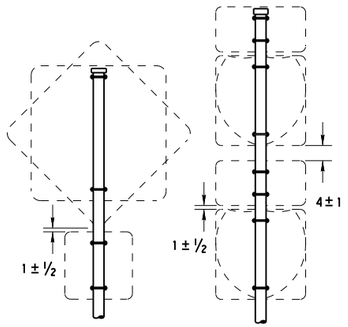

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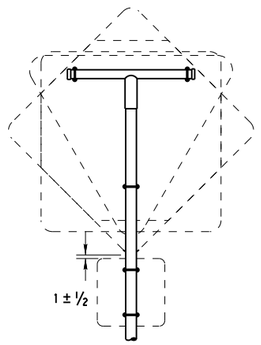

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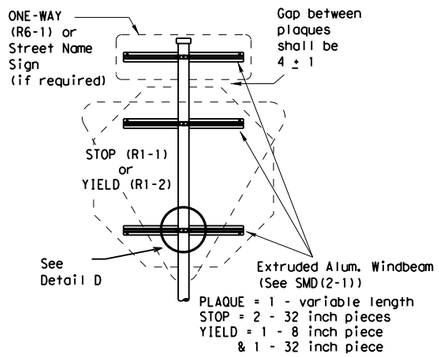

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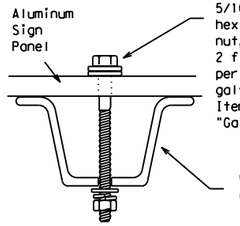
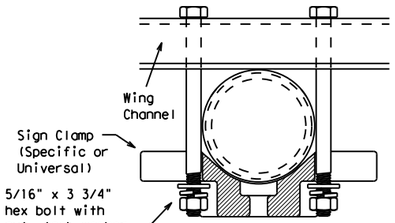


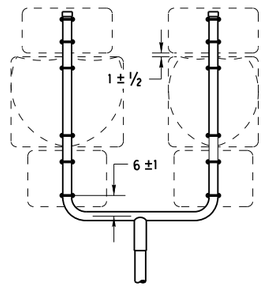
Top View

Detail A



Top View

Detail B



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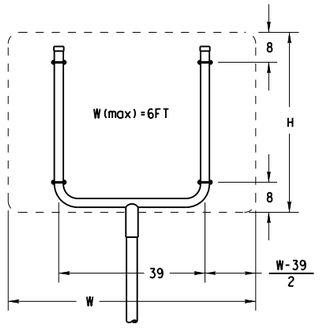

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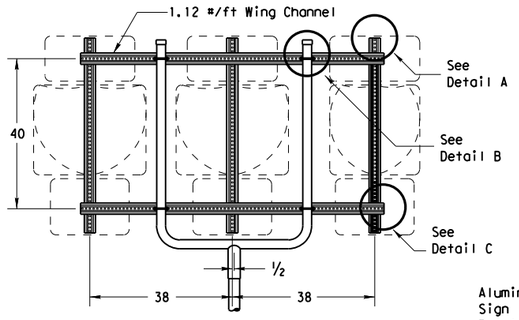
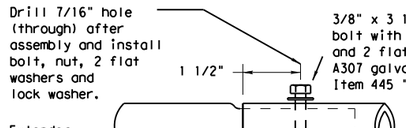
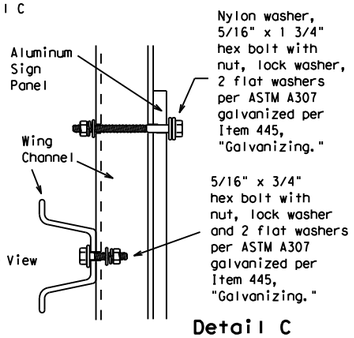


SM RD SGN ASSM TY XXXXX(1)XX(U-WC)
(See Note 11)

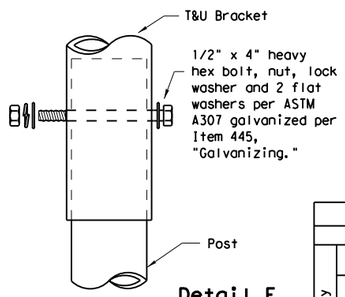


Detail F

Splices shall only be allowed behind the sign substrate.



Detail C



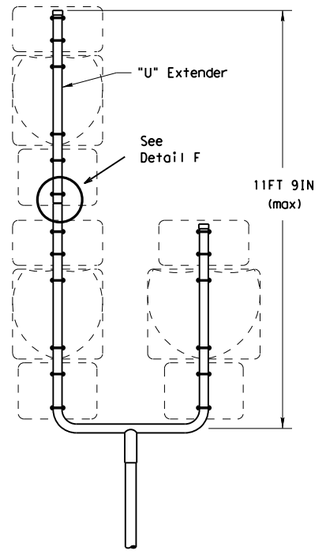
Detail E

GENERAL NOTES:

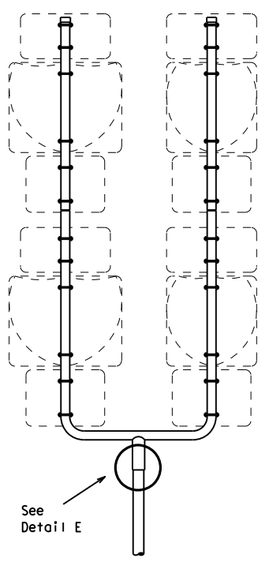
1.

SIGN SUPPORT	# OF POSTS	MAX. SIGN AREA
10 BWG	1	16 SF
10 BWG	2	32 SF
Sch 80	1	32 SF
Sch 80	2	64 SF

2. The Engineer may require that a Schedule 80 post be used in place of a 10 BWG where a sign height is abnormally high due to a fill slope.
3. Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.
4. Aluminum sign blanks shall conform to Departmental Material Specifications DMS-7110 and shall have the following minimum thicknesses: 0.080 for signs less than 7.5 sq. ft., 0.100 for signs 7.5 to 15 sq. ft., and 0.125 for signs greater than 15 sq. ft.
5. Signs that require specific supports due to reasons in addition to windloading are indicated on the "REQUIRED SUPPORT" table on this sheet.
6. For horizontal rectangular signs fabricated from flat aluminum, T-brackets are used for signs 24 inches or less in height. U-brackets are used for signs of greater height.
7. When two triangular slipbase supports are used to support a single sign, they shall not be "rigidly" connected to each other except through the sign panel. This will allow each support to act independently when impacted by an errant vehicle.
8. Wing channel shall meet ASTM A 1011 SS Gr 50 and be galvanized per ASTM A 123.
9. Excess pipe, wing channel, or windbeam shall be cut off so that it does not extend beyond the sign panel (i.e., excess support shall not be visible when the sign is viewed from the front.) Repair galvanized coating at cut support ends per Item 445, "Galvanizing."
10. Additional route markers may be added vertically, provided the total sign area does not exceed the maximum allowable amount per Note 1.
11. Additional sign clamp required on the "T-bracket" post for 24 inch height signs. Place the clamp 3 inches above bottom of sign when possible.
12. Post open ends shall be fitted with Friction Caps.
13. Sign blanks shall be the sizes and shapes shown on the plans.



SM RD SGN ASSM TY S80(1)XX(U-1EXT)



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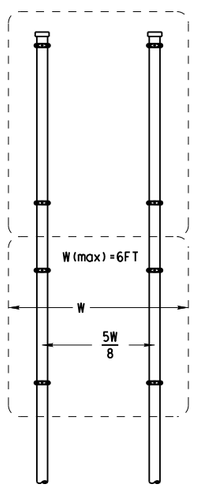

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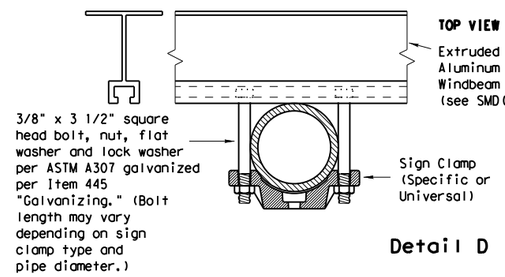
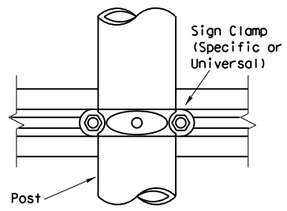
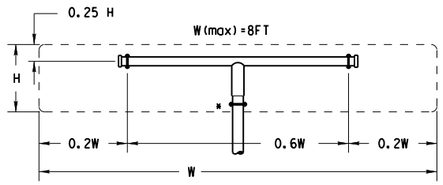


Detail D



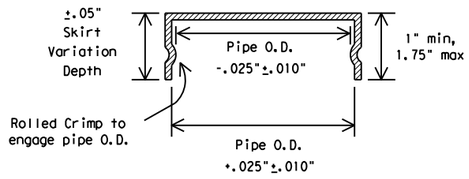
REQUIRED SUPPORT		
	SIGN DESCRIPTION	SUPPORT
Regulatory	48-inch STOP sign (R1-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	60-inch YIELD sign (R1-2)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	48x16-inch ONE-WAY sign (R6-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	36x48, 48x36, and 48x48-inch signs	TY 10BWG(1)XX(T)
	48x60-inch signs	TY S80(1)XX(T)
Warning	48x48-inch signs (diamond or square)	TY 10BWG(1)XX(T)
	48x60-inch signs	TY S80(1)XX(T)
	48-inch Advance School X-ing sign (S1-1)	TY 10BWG(1)XX(T)
	48-inch School X-ing sign (S2-1)	TY 10BWG(1)XX(T)
	Large Arrow sign (W1-6 & W1-7)	TY 10BWG(1)XX(T)



All dimensions are in english unless detailed otherwise.

SM RD SGN ASSM TY XXXXX(1)XX(T)
(* - See Note 12)

FRICTION CAP DETAIL



Friction caps may be manufactured from hot rolled or cold rolled steel sheets. The minimum sheet metal thickness shall be 24 gauge for all cap sizes.

The rim edges shall be reasonably straight and smooth. Caps shall be sized and formed in such a manner as to produce a drive-on friction fit and have no tendency to rock when seated on the pipe. The depth shall be sufficient to give positive protection against entrance of rainwater. They shall be free of sharp creases or indentations and show no evidence of metal fracture.

Caps shall have an electrodeposited coating of zinc in accordance with the requirements of ASTM B633 Class FE/ZN 8.

Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS TRIANGULAR SLIPBASE SYSTEM

SMD(SLIP-2)-08

DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
CONT	SECT	JOB	HIGHWAY
0805	04	033	RM 3237
DIST	COUNTY		SHEET NO.
AUS	HAYS		182

9-08 REVISIONS

26C

DATE: 11/14/2023
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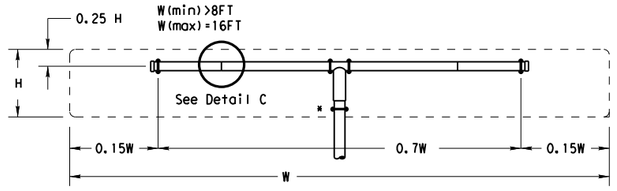
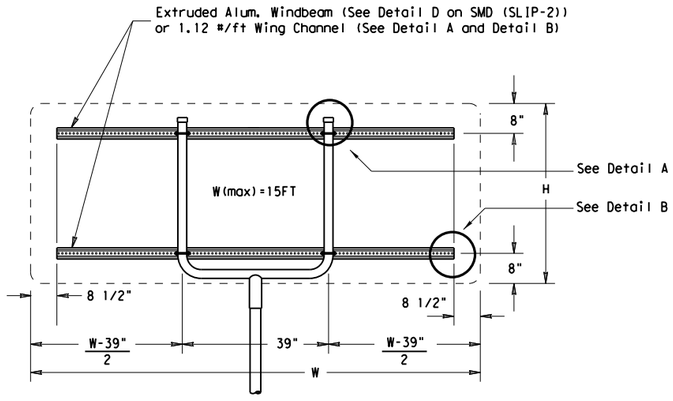
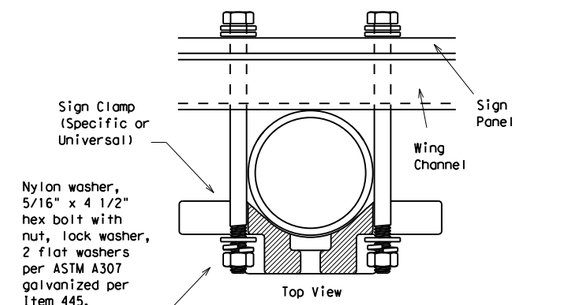


SM RD SGN ASSM TY XXXXX(1)XX(T-2EXT)

(* - See Note 12)

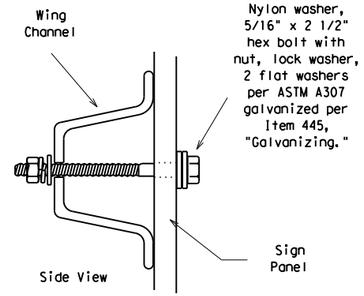


SM RD SGN ASSM TY XXXXX(1)XX(U-XX)

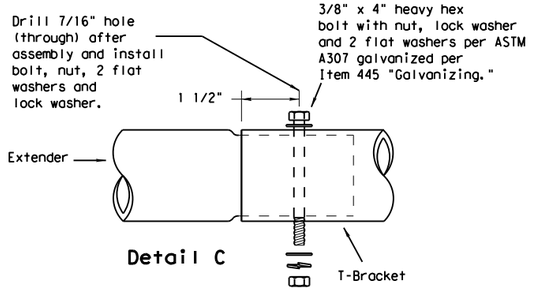


Top View

Detail A

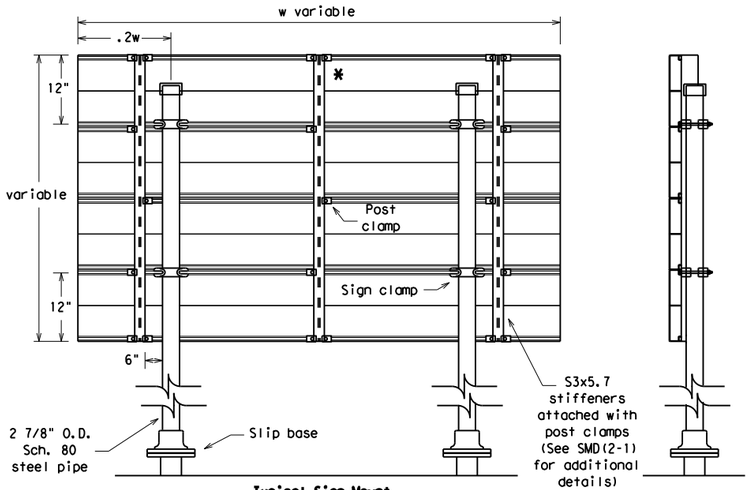


Detail B



Detail C

Splices shall only be allowed behind the sign substrate.

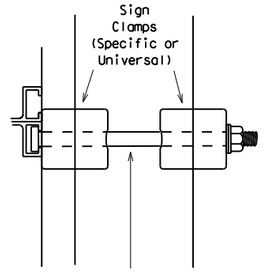


Typical Sign Mount

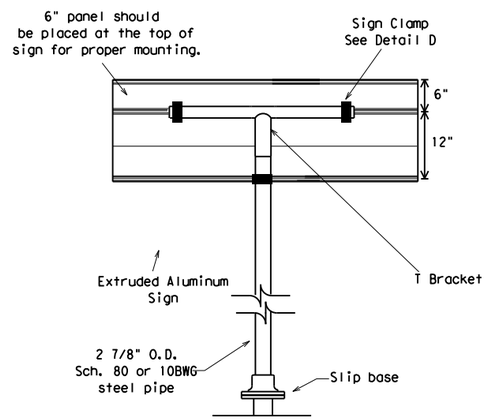
SM RD SGN ASSM TY S80(2)XX(P-EXAL)

* Additional stiffener placed at approximate center of signs when sign width is greater than 10'.

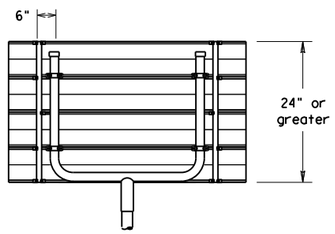
See Detail E
for clamp installation



Detail E



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

Detail D
EXTRUDED ALUMINUM SIGN WITH T BRACKET

GENERAL NOTES:

SIGN SUPPORT	# OF POSTS	MAX. SIGN AREA
10 BWG	1	16 SF
10 BWG	2	32 SF
Sch 80	1	32 SF
Sch 80	2	64 SF

1. The Engineer may require that a Schedule 80 post be used in place of a 10 BWG where a sign height is abnormally high due to a fill slope.
2. Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.
3. Aluminum sign blanks shall conform to Departmental Material Specifications DMS-7110 and shall have the following minimum thicknesses: 0.080 for signs less than 7.5 sq. ft., 0.100 for signs 7.5 to 15 sq. ft., and 0.125 for signs greater than 15 sq. ft.
4. Signs that require specific supports due to reasons in addition to windloading are indicated on the "REQUIRED SUPPORT" table on this sheet.
5. For horizontal rectangular signs fabricated from flat aluminum, T-brackets are used for signs 24 inches or less in height. U-brackets are used for signs of greater height.
6. When two triangular slipbase supports are used to support a single sign, they shall not be "rigidly" connected to each other except through the sign panel. This will allow each support to act independently when impacted by an errant vehicle.
7. Wing channel shall meet ASTM A 1011 SS Gr 50 and be galvanized per ASTM A 123.
8. Excess pipe, wing channel, or windbeam shall be cut off so that it does not extend beyond the sign panel (i.e., excess support shall not be visible when the sign is viewed from the front.) Repair galvanized coating at cut support ends per Item 445, "Galvanizing."
9. Sign blanks shall be the sizes and shapes shown on the plans.
10. Additional sign clamp required on the "T-bracket" post for 24 inch high signs. Place the clamp 3 inches above bottom of sign when possible.
11. Post open ends shall be fitted with Friction Caps.

REQUIRED SUPPORT

	SIGN DESCRIPTION	SUPPORT
Regulatory	48-inch STOP sign (R1-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	60-inch YIELD sign (R1-2)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	48x16-inch ONE-WAY sign (R6-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	36x48, 48x36, and 48x48-inch signs	TY 10BWG(1)XX(T)
	48x60-inch signs	TY S80(1)XX(T)
Warning	48x48-inch signs (diamond or square)	TY 10BWG(1)XX(T)
	48x60-inch signs	TY S80(1)XX(T)
	48-inch Advance School X-ing sign (S1-1)	TY 10BWG(1)XX(T)
	48-inch School X-ing sign (S2-1)	TY 10BWG(1)XX(T)
	Large Arrow sign (W1-6 & W1-7)	TY 10BWG(1)XX(T)

Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS TRIANGULAR SLIPBASE SYSTEM

SMD(SLIP-3)-08

REVISIONS
9-08

DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
CONT	SECT	JOB	HIGHWAY
0805	04	033	RM 3237
DIST	COUNTY		SHEET NO.
AUS	HAYS		183

26D

DATE: 11/14/2023
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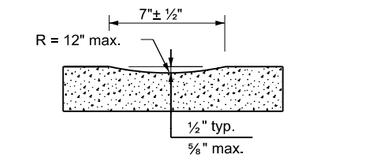
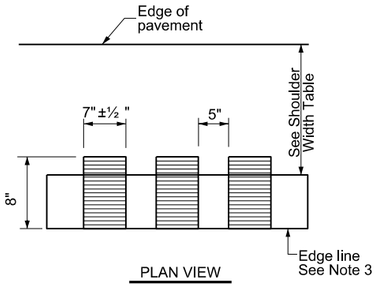
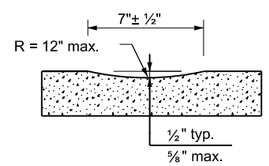


PROFILE VIEW
OPTION 1

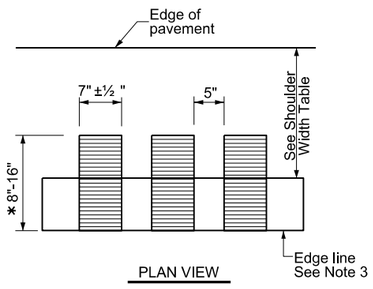


PLAN VIEW

CONTINUOUS MILLED DEPRESSIONS (Rumble Strips)



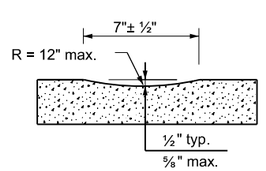
PROFILE VIEW
OPTION 2



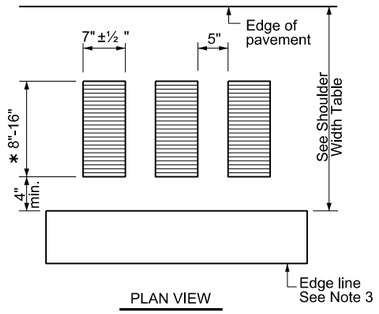
PLAN VIEW

∗ This distance may vary based on width of shoulder

CONTINUOUS MILLED DEPRESSIONS (Rumble Strips)



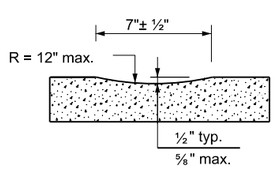
PROFILE VIEW
OPTION 3



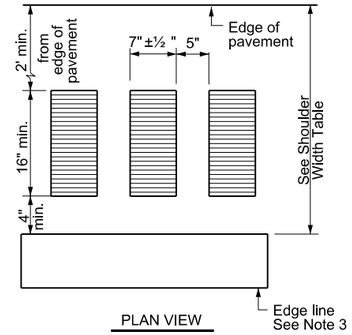
PLAN VIEW

∗ This distance may vary based on width of shoulder

CONTINUOUS MILLED DEPRESSIONS (Rumble Strips)

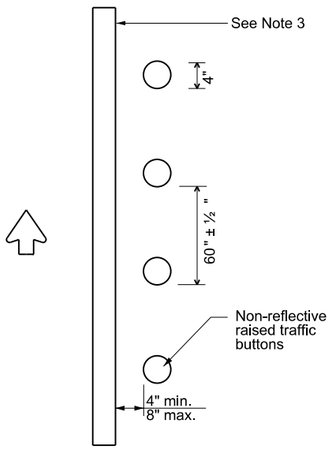


PROFILE VIEW
OPTION 4



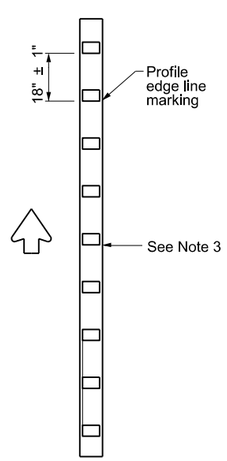
PLAN VIEW

CONTINUOUS MILLED DEPRESSIONS (Rumble Strips)



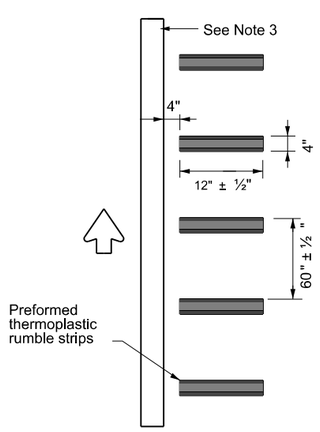
PLAN VIEW
OPTION 5

RAISED EDGE LINE (Rumble Strips)



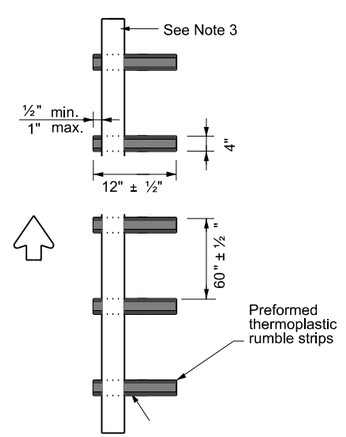
PLAN VIEW
OPTION 6

PROFILE EDGE LINE MARKINGS (Rumble Strips)



PLAN VIEW
OPTION 7

PREFORMED THERMOPLASTIC EDGE LINE (Rumble Strips)



PLAN VIEW
OPTION 8

PREFORMED THERMOPLASTIC EDGE LINE (Rumble Strips)

SHOULDER WIDTH TABLE		
EQUAL TO OR LESS THAN 2 FEET	GREATER THAN 2 FEET LESS THAN 4 FEET	EQUAL TO OR GREATER THAN 4 FEET
Option 1, 5, 6 or 8	Option 1, 2, 3 5, 6 or 7	Option 2, 4, 5 6 or 7

GENERAL NOTES

1. Rumble strips and profile markings shall not be placed on roadways with a posted speed limit of 45 MPH or less.
2. Milled rumble strips are preferred when adequate pavement depth is available. If pavement thickness is less than 2 inches, milled rumble strips shall not be used. Rumble strips shall not be milled or depressed into bridge decks.
3. Use Standard Sheet PM(2) and FPM(1) for positioning, dimensioning, and spacing of all reflective raised pavement markers, pavement markings, and profile markings.
4. See the Shoulder Width Table below for determining what options may be used for edge line rumble strips.
5. Breaks in edge line rumble strips shall occur at least 50 feet and no more than 150 feet in advance of bridges, railroad crossings, intersections, or driveways with high usage of large trucks when installed on conventional highways.
6. Rumble strips shall not be placed across exit or entrance ramps, acceleration or deceleration lanes, crossovers, gore areas, or intersections with other roadways.
7. Consideration should be given to noise levels when edgeline rumble strips are to be installed near residential areas, schools, churches, etc. A 3/8 inch deep (minimum) milled rumble strip may be considered in these areas.
8. Consideration shall be given to bicyclists. See RS(6).

WHEN INSTALLING MILLED DEPRESSION EDGE LINE RUMBLE STRIPS:

9. See dimensions for milled rumble strips. Other shapes and dimensions may be used if approved by the Traffic Safety Division.
10. Pavement markings can be applied over milled shoulder rumble strips to create an edge line rumble strip.

WHEN INSTALLING RAISED OR PROFILE EDGE LINE RUMBLE STRIPS:

11. Raised rumble strips consisting of non-reflective raised traffic buttons may be used. Non-reflective raised traffic buttons can be affixed to asphalt or concrete with bitumen or adhesives, as per the manufacturer's recommendations.
12. Non-reflective traffic buttons shall be placed adjacent to the pavement marking delineating the edge line when used as a rumble strip. The color of the button should match the color of the adjacent edge line marking (white or yellow). The buttons will be paid for under Item 672, "Raised Pavement Markers." Non-reflective traffic buttons must meet the requirements of DMS-4300.
13. Non-reflective traffic buttons shall not be placed across exit or entrance ramps, acceleration and deceleration lanes, crossovers, gore areas or intersections with other roadways.
14. The minimum distance between the edge line and the buttons should be used if the shoulder is less than 8 feet in width.
15. Raised profile thermoplastic markings used as edge lines may substitute for buttons.

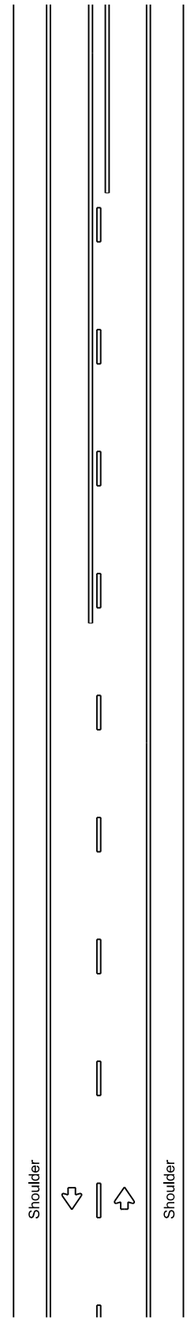
Texas Department of Transportation

Traffic Safety Division Standard

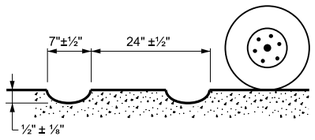
EDGE LINE RUMBLE STRIPS ON UNDIVIDED OR TWO LANE HIGHWAYS RS(2)-23

FILE: rs(2)-23.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT January 2023	CONT	SECT	JOB	HIGHWAY
REVISIONS 10-13 1-23	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		184

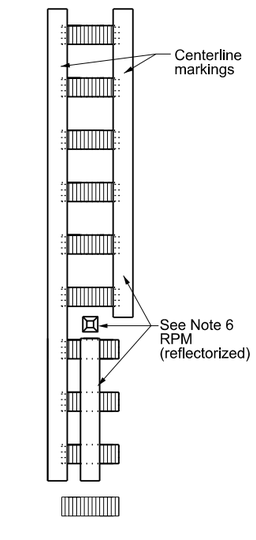
CENTERLINE RUMBLE STRIPS

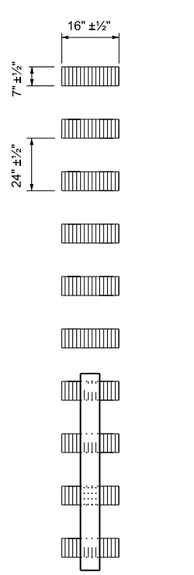


TWO LANE TWO-WAY HIGHWAYS



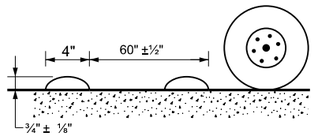
PROFILE VIEW



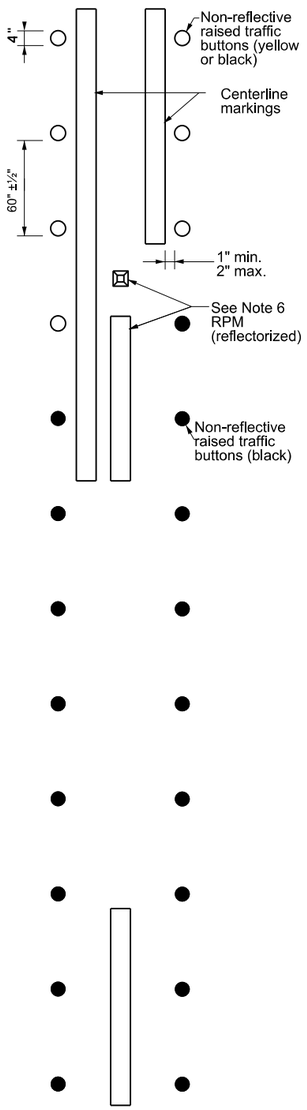


PLAN VIEW
OPTION 1

MILLED CENTERLINE RUMBLE STRIPS

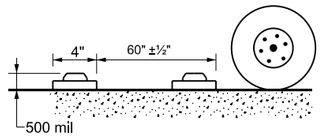


PROFILE VIEW



PLAN VIEW
OPTION 2

RAISED CENTERLINE RUMBLE STRIPS



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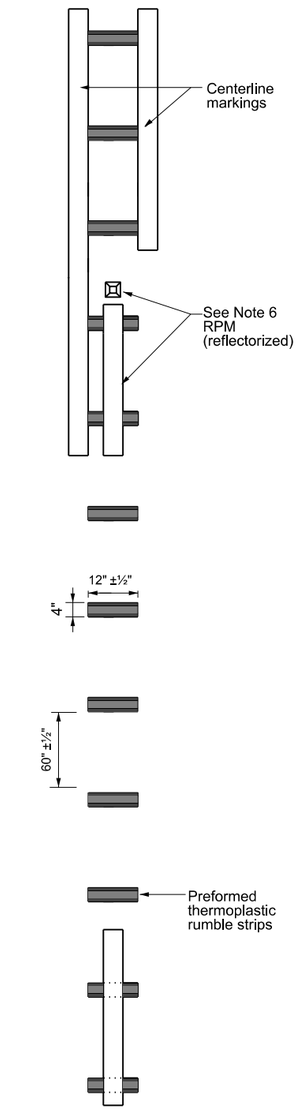
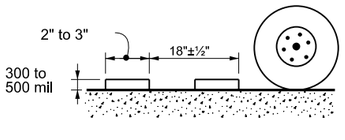
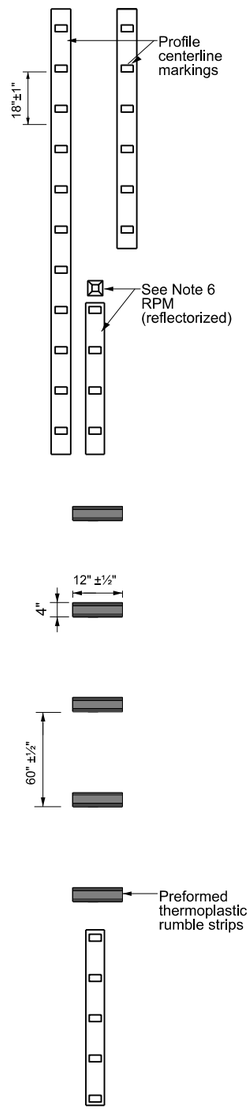


PLAN VIEW
OPTION 3

PREFORMED THERMOPLASTIC RUMBLE STRIPS



PROFILE VIEW



PLAN VIEW
OPTION 4

PROFILE CENTERLINE MARKINGS AND PREFORMED THERMOPLASTIC RUMBLE STRIPS

GENERAL NOTES

1. This standard sheet provides guidelines for installing centerline rumble strips on two-lane highways with or without shoulders.
2. Centerline and edge line rumble strips or profile markings shall not be placed on roadways with a posted speed limit of 45 MPH or less.
3. Milled rumble strips are preferred when adequate pavement depth is available. If pavement thickness is less than 2 inches, milled rumble strips shall not be used. Rumble strips shall not be milled or depressed into bridge decks.
4. See dimensions for milled rumble strips. Other shapes and dimensions may be used if approved by the Traffic Safety Division.
5. Breaks in milled centerline rumble strips shall occur at least 50 feet and no more than 150 feet in advance of bridges, railroad crossings, intersections or driveways with high usage of large trucks.
6. Use standard sheet PM(2) for positioning, dimensioning, and spacing of all reflective raised pavement markers, pavement markings and profile markings.
7. Consideration should be given to noise levels when centerline rumble strips are to be installed near residential areas, schools, churches, etc. A 3/8 inch deep (minimum) milled rumble strip may be considered in these areas.
8. Pavement markings must be applied over milled centerline rumble strips.

WHEN INSTALLING CENTERLINE RUMBLE STRIPS:

9. Raised rumble strips consisting of non-reflective raised traffic buttons may be used. Non-reflective raised traffic buttons can be affixed to asphalt or concrete with bitumen or adhesives, as per manufacturer's recommendations.
10. When using non-reflective raised traffic buttons as a centerline rumble strip, the button shall be placed adjacent to the pavement marking delineating the centerline. The buttons will be paid for under Item 672, "Raised Pavement Markers." Non-reflective traffic buttons must meet the requirements of DMS-4300.
11. The color of the button should be yellow for a continuous no passing roadway. Black buttons should be used in areas where passing is allowed.
12. Consideration shall be given to bicyclists. See RS(6).

WHEN INSTALLING EDGE LINE RUMBLE STRIPS WITH OR WITHOUT CENTERLINE RUMBLE STRIPS ON UNDIVIDED HIGHWAYS:

13. See standard sheet RS(2).

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Texas Department of Transportation

Traffic Safety Division Standard

CENTERLINE RUMBLE STRIPS ON TWO LANE TWO-WAY HIGHWAYS RS(4)-23

FILE: rs(4)-23.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT January 2023	CONT	SECT	JOB	HIGHWAY
REVISIONS	0805	04	033	RM 3237
10-13 1-23	DIST	COUNTY		SHEET NO.
	AUS	HAYS		185

GENERAL NOTES:

1. Details show a typical warning sign with two flashing beacon heads, other arrangements are possible. When only one beacon is required, install the upper beacon.

2. See Item 685, "Roadside Flashing Beacon Assemblies" for further requirements.

3. See SMD standard sheets for lateral and vertical clearances and sign mounting details. Install signs as shown on the sign layout sheets.

4. Use either a Screw-In Type Anchor Foundation or a Drilled Shaft Foundation as shown elsewhere in the plans. When plans require a Drilled Shaft Foundation, see standard sheet TS-FD. Install the Screw-In Type Anchor Foundation as per manufacturer's recommendations. On a slope, install one edge at ground level. Screw-In/Drilled Shaft Foundation is subsidiary to Item 685. Installation of a ground rod is not required for solar powered flashing beacon assemblies.

5. When used, provide Screw-In Type Anchor Foundations as shown on TxDOT's Material Producer List (MPL) in the file "Highway Traffic Signals".

6. Install beacon heads as shown here, as shown elsewhere on the plans, or as directed. Use hardware specifically designed for mounting beacon heads on poles.

7. Conduit in foundation and within 6 in. of foundation is subsidiary to the Item 685, "Roadside Flashing Beacon Assemblies."

8. Unless otherwise shown on the plans, pole shaft shall be one piece, Schedule 40 Aluminum pipe, ASTM B429 or B221 (Alloy 6061-T6 only). Aluminum conduit will not develop the necessary strength and will not be allowed.

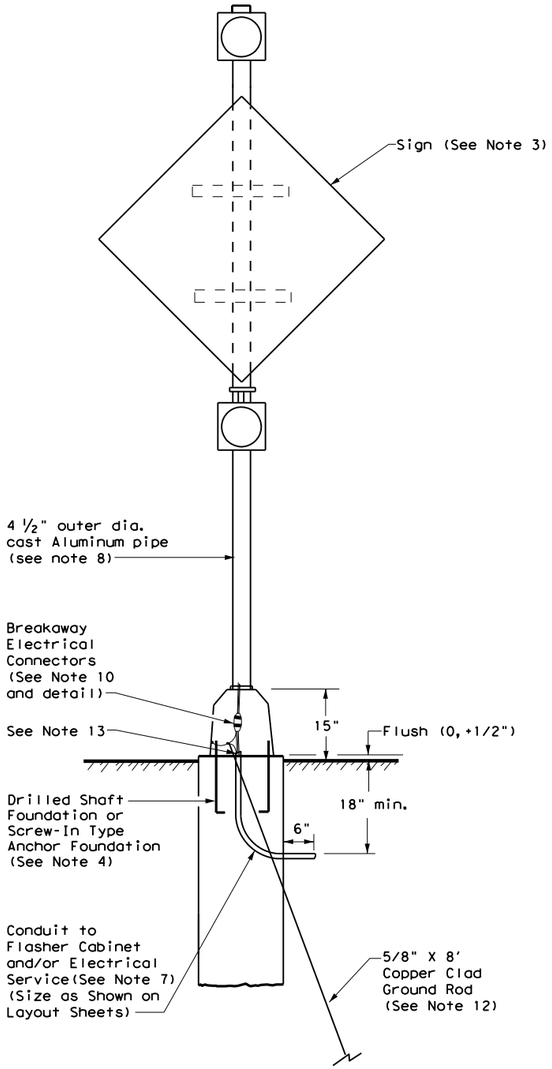
9. Per manufacturer's recommendations, engage all threads on the pedestal pole base and pipe unless the pipe is fully seated into base. In high winds, use a pole and base collar assembly to add strength and prevent loosening of connection.

10. Provide single pole non-fused watertight breakaway electrical connectors for frangible pedestal pole bases, as shown on TxDOT's MPL in the file "Roadway Illumination and Electrical Supplies." Approved models are listed under Item 685. For ungrounded (hot) conductors, install a breakaway connector with a dummy fuse slug). For grounded (neutral) conductors, install a breakaway connector with a white colored marking and a permanently installed dummy fuse (slug).

11. Provide clearance as shown above the sidewalk or pavement grade at the edge of the road. When a bottom beacon is not used, mount the bottom of the sign at least 7 ft. above the sidewalk or pavement grade at the edge of the road.

12. Make connections to ground rods according to NEC. Ground rod clamps shall be listed for their intended purpose.

13. Ensure height of conduit and ground rod is below top of anchor bolts.



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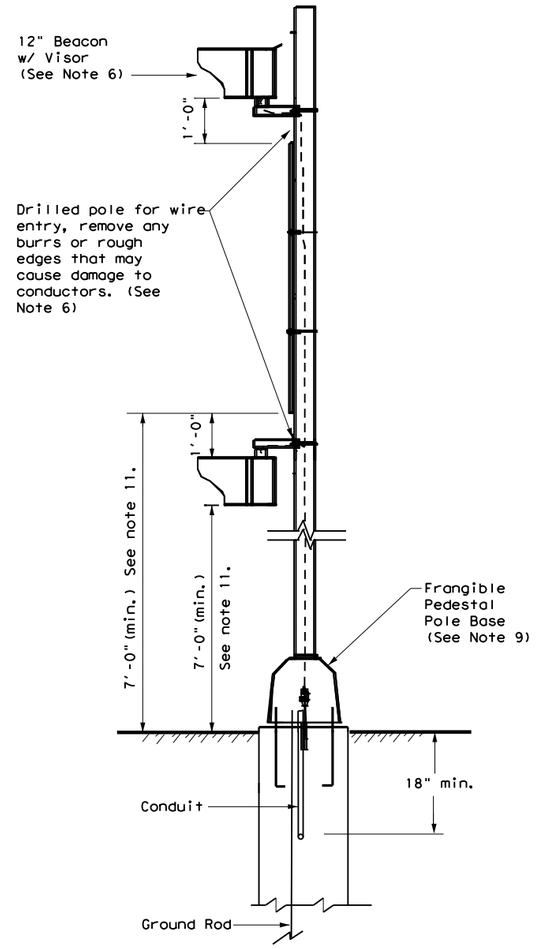

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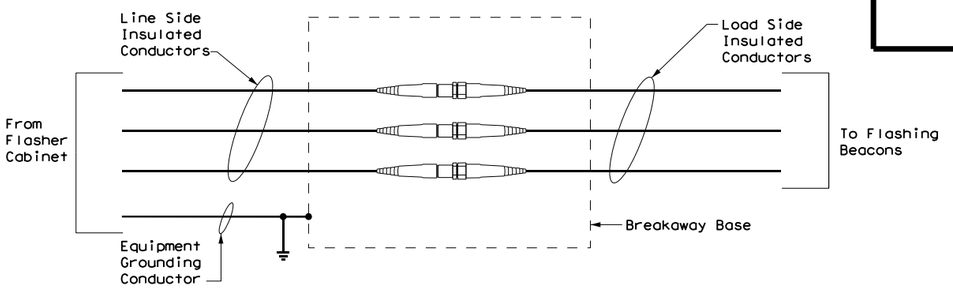
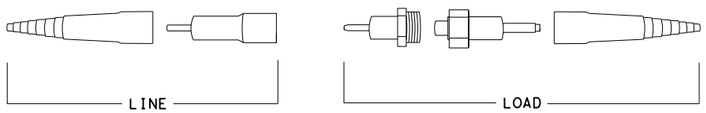


NON-FUSED BREAKAWAY ELECTRICAL CONNECTORS



NON-FUSED BREAKAWAY ELECTRICAL CONNECTORS
EXPLODED VIEW

Texas Department of Transportation

Traffic Operations Division Standard

ROADSIDE FLASHING BEACON ASSEMBLY

RFBA-13

FILE: rfba-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT January 1992	CONT	SECT	JOB	HIGHWAY
REVISIONS 5-93 12-04 10-93 3-13 4-98	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		186

DATE: 11/14/2023 1:28:30 PM
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STORMWATER POLLUTION PREVENTION PLAN (SWP3):

This SWP3 has been developed in accordance with the TPDES Construction General Permit TXR150000 (CGP). The Texas Department of Transportation (TxDOT) ensures that project specifications include adequate best management practices (BMPs) for this project.

For all projects with soil disturbing activity and for projects that have Environmental, Permits, Issues, and Commitments (EPICs) dependent on stormwater controls and water quality measures TxDOT will maintain a SWP3 with all pertinent records, correspondence, environmental documents, etc. at the project field office, Area Office, or electronically.

This SWP3 is consistent with requirements specified in applicable stormwater plans and the projects environmental permits, issues, and commitments (EPICs). A copy of the CGP is included in Attachment 2.12 of the SWP3 binder.

1.0 SITE/PROJECT DESCRIPTION

1.1 PROJECT CONTROL SECTION JOB (CSJ):
0805-04-033

1.2 PROJECT LIMITS:
From: RM 12

To: East of Rogers Rd

1.3 PROJECT COORDINATES:
BEGIN: (Lat) 29.9987° (N) ,(Long) 98.0874° (W)

END: (Lat) 30.0140° (N) ,(Long) 98.0634° (W)

1.4 TOTAL PROJECT AREA (Acres): 11.4

1.5 TOTAL AREA TO BE DISTURBED (Acres): 9.4

1.6 NATURE OF CONSTRUCTION ACTIVITY:
Grading, Flex Base, Asphalt Pavement, Signing and Pavement Markings, and Drainage

1.7 MAJOR SOIL TYPES:

Soil Type	Description
Brackett-Rock Outcrop-Comfort Complex	1-8% Slopes, Soils have a low infiltration rate (0.15-0.15 inches/hour) when thoroughly wetted. 1.5-1.66 feet thick.
Brackett-Rock Outcrop-Real Complex	8-30% Slopes, Soils have a low infiltration rate (0.05-0.15 inches/hour) when thoroughly wetted. 1.5-3 feet thick.
Bolar Clay Loam	1-3% Slopes, Soils have a low infiltration rate (0.15-0.15 inches/hour) when thoroughly wetted. 2.5 feet thick.

1.8 PROJECT SPECIFIC LOCATIONS (PSLs):
PSLs must be depicted on the Environmental Layout Sheets in Attachment 1.2 of this SWP3. PSLs may be identified during preconstruction meetings or during the construction process. Please choose from the options below:

☐ PSLs determined during preconstruction meeting
☐ PSLs determined during construction
☒ No PSLs planned for construction

Type	Sheet #s

All off-ROW PSLs required by the Contractor are the Contractor's responsibility. The Contractor shall secure all permits required by local, state, federal laws for off-ROW PSLs. The contractor shall provide diagrams, areas of disturbance, acreage, and BMPs for all off-ROW PSLs within one mile of the project.

1.9 CONSTRUCTION ACTIVITIES:
(Use the following list as a starting point when developing the Construction Activity Schedule and Ceasing Record in Attachment 2.5.)

☒ Mobilization
☒ Install sediment and erosion controls
☒ Blade existing topsoil into windrows, prep ROW, clear and grub
☒ Remove existing pavement
☒ Grading operations, excavation, and embankment
☒ Excavate and prepare subgrade for proposed pavement widening
☒ Remove existing culverts, safety end treatments (SETs)
☒ Remove existing metal beam guard fence (MBGF), bridge rail
☒ Install proposed pavement per plans
☒ Install culverts, culvert extensions, SETs
☒ Install mow strip, MBGF, bridge rail
☒ Place flex base
☒ Rework slopes, grade ditches
☒ Blade windrowed material back across slopes
☒ Revegetation of unpaved areas
☒ Achieve site stabilization and remove sediment and erosion control measures
☐ Other: _____
☐ Other: _____
☐ Other: _____

1.10 POTENTIAL POLLUTANTS AND SOURCES:

☒ Sediment laden stormwater from stormwater conveyance over disturbed area
☒ Fuels, oils, and lubricants from construction vehicles, equipment, and storage
☒ Solvents, paints, adhesives, etc. from various construction activities
☒ Transported soils from offsite vehicle tracking
☒ Construction debris and waste from various construction activities
☒ Contaminated water from excavation or dewatering pump-out water
☒ Sanitary waste from onsite restroom facilities
☒ Trash from various construction activities/receptacles
☒ Long-term stockpiles of material and waste
☒
☐ Other: _____
☐ Other: _____
☐ Other: _____

1.11 RECEIVING WATERS:
Receiving waters must be depicted on the Environmental Layout Sheets in Attachment 1.2 of this SWP3. Include Segment # for receiving waters.

Tributaries	Classified Waterbody
Unnamed Branch of Smith Creek	Upper Blanco River (1813)

* Add (*) for impaired waterbodies with pollutant in ().

1.12 ROLES AND RESPONSIBILITIES: TxDOT

☒ Development of plans and specifications
☒ Submit Notice of Intent (NOI) to TCEQ (≥5 acres)
☒ Post Construction Site Notice
☐ Submit NOI/CSN to local MS4
☒ Perform SWP3 inspections
☒ Maintain SWP3 records and update to reflect daily operations
☒ Complete and submit Notice of Termination to TCEQ
☒ Maintain SWP3 records for 3 years
☐ Other: _____
☐ Other: _____
☐ Other: _____

1.13 ROLES AND RESPONSIBILITIES: CONTRACTOR

☒ Day To Day Operational Control
☒ Submit Notice of Intent (NOI) to TCEQ (≥5 acres)
☒ Post Construction Site Notice
☒ Submit NOI/CSN to local MS4
☒ Maintain schedule of major construction activities
☒ Install, maintain and modify BMPs
☒ Complete and submit Notice of Termination to TCEQ
☒ Maintain SWP3 records for 3 years
☐ Other: _____
☐ Other: _____
☐ Other: _____

1.14 LOCAL MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4) OPERATOR COORDINATION:

MS4 Entity

STORMWATER POLLUTION PREVENTION PLAN (SWP3)

July 2023 Sheet 1 of 2

Texas Department of Transportation

FED. RD. DIV. NO.	PROJECT NO.		SHEET NO.
			187
STATE	STATE DIST.	COUNTY	
TEXAS	AUS	HAYS	
CONT.	SECT.	JOB	HIGHWAY NO.
0805	04	033	RM 3237

STORMWATER POLLUTION PREVENTION PLAN (SWP3):

2.0 BEST MANAGEMENT PRACTICES (BMPs) AND CONTROLS, INSPECTION, AND MAINTENANCE

The Contractor shall be the responsible party for implementing the BMPs described herein and for complying with the SWP3 for control of erosion and sedimentation during day-to-day operations. The Contractor shall implement changes to this SWP3 approved by TxDOT within the times specified in this SWP3 or the CGP.

2.1 EROSION CONTROL AND SOIL STABILIZATION BMPs:

T / P

- X X Protection of Existing Vegetation
- ☐ ☐ Vegetated Buffer Zones
- ☐ X Soil Retention Blankets
- ☐ ☐ Geotextiles
- ☐ ☐ Mulching/ Hydromulching
- ☐ ☐ Soil Surface Treatments
- X ☐ Temporary Seeding
- ☐ X Permanent Planting, Sodding or Seeding
- ☐ ☐ Biodegradable Erosion Control Logs
- X ☐ Rock Filter Dams/ Rock Check Dams
- ☐ ☐ Vertical Tracking
- ☐ ☐ Interceptor Swale
- ☐ X Riprap
- ☐ ☐ Diversion Dike
- ☐ ☐ Temporary Pipe Slope Drain
- ☐ ☐ Embankment for Erosion Control
- ☐ ☐ Paved Flumes
- ☐ ☐ Other: _____
- ☐ ☐ Other: _____
- ☐ ☐ Other: _____
- ☐ ☐ Other: _____

2.2 SEDIMENT CONTROL BMPs:

T / P

- ☐ ☐ Biodegradable Erosion Control Logs
- ☐ ☐ Dewatering Controls
- ☐ ☐ Inlet Protection
- X ☐ Rock Filter Dams/ Rock Check Dams
- ☐ ☐ Sandbag Berms
- X ☐ Sediment Control Fence
- X ☐ Stabilized Construction Exit
- ☐ ☐ Floating Turbidity Barrier
- ☐ ☐ Vegetated Buffer Zones
- X ☐ Vegetated Filter Strips
- ☐ ☐ Other: _____
- ☐ ☐ Other: _____
- ☐ ☐ Other: _____
- ☐ ☐ Other: _____

Refer to the Environmental Layout Sheets/ SWP3 Layout Sheets located in Attachment 1.2 of this SWP3

Sediment control BMPs requiring design capacity calculations (See SWP3 Attachment 1.3.):

T / P

- ☐ ☐ Sediment Trap
  - ☐ Calculated volume runoff from 2-year, 24-hour storm for each acre of disturbed area
  - ☐ 3,600 cubic feet of storage per acre drained
- ☐ ☐ Sedimentation Basin
  - ☐ Not required (<10 acres disturbed)
  - ☐ Required (>10 acres) and implemented.
    - ☐ Calculated volume runoff from 2-year, 24-hour storm for each acre of disturbed area
    - ☐ 3,600 cubic feet of storage per acre drained
  - ☐ Required (>10 acres), but not feasible due to:
    - ☐ Available area/Site geometry
    - ☐ Site slope/Drainage patterns
    - ☐ Site soils/Geotechnical factors
    - ☐ Public safety
    - ☐ Other: _____

2.3 PERMANENT CONTROLS:

(Coordinate post-construction BMPs with appropriate TxDOT maintenance sections.)

BMPs To Be Left In Place Post Construction:

Type	Stationing	
	From	To
Vegetative Filter Strips (℄ FLITE)	10+57.29	11+17.70
Vegetative Filter Strips (℄ 3237)	112+00.00 118+61.63 120+44.10 129+20.00 137+43.65	116+70.00 119+00.00 121+00.00 135+58.47 141+00.00
Permeable Concrete (C 3237)	23+60.00 112+00.00	42+00.00 137+20.00

Refer to the Environmental Layout Sheets/ SWP3 Layout Sheets located in Attachment 1.2 of this SWP3

2.4 OFFSITE VEHICLE TRACKING CONTROLS:

- X Excess dirt/mud on road removed daily
- ☐ Haul roads dampened for dust control
- ☐ Loaded haul trucks to be covered with tarpaulin
- X Stabilized construction exit
- ☐ Daily street sweeping
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

2.5 POLLUTION PREVENTION MEASURES:

- ☐ Chemical Management
- ☐ Concrete and Materials Waste Management
- X Debris and Trash Management
- ☐ Dust Control
- ☐ Sanitary Facilities
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

2.6 VEGETATED BUFFER ZONES:

Natural vegetated buffers shall be maintained as feasible to protect adjacent surface waters. If vegetated natural buffer zones are not feasible due to site geometry, the appropriate additional sediment control measures have been incorporated into this SWP3.

Type	Stationing	
	From	To

Refer to the Environmental Layout Sheets/ SWP3 Layout Sheets located in Attachment 1.2 of this SWP3

2.7 ALLOWABLE NON-STORMWATER DISCHARGES:

- X Fire hydrant flushings
- X Irrigation drainage
- X Pavement washwater (where spills or leaks have not occurred, and detergents are not used)
- X Potable water sources
- X Springs
- X Uncontaminated groundwater
- X Water used to wash vehicles or control dust
- X Other allowable non-stormwater discharges as allowed by TPDES GP TXR150000.

2.8 DEWATERING:

Dewatering discharges of accumulated stormwater, groundwater, and surface water including discharges from dewatering of trenches, excavations, foundations, vaults, and other points of accumulation are prohibited unless managed by appropriate controls to prevent and minimize the offsite discharge of sediment and other pollutants.

2.9 INSPECTIONS:

All disturbed areas and erosion and sediment control devices shall be inspected at least once every seven (7) days. Inspections shall be performed by TxDOT as indicated on the Field Inspection and Maintenance Report Form 2118 and retained in Attachment 2.5 of this SWP3.

When dewatering activities are present, a daily inspection will be conducted once per day during those activities and documented in accordance with CGP and TxDOT requirements.

2.10 MAINTENANCE:

Control measures shall be properly installed according to specifications. If it is determined that a BMP or control measure is not operating effectively, maintenance must be accomplished as soon as possible and before the next anticipated rain event, but in no case later than 7 calendar days after being able to access the site. Maintenance shall be performed by the Contractor as indicated on the Field Inspection and Maintenance Report Form 2118 and retained in Attachment 2.5 of this SWP3.

STORMWATER POLLUTION PREVENTION PLAN (SWP3)

 July 2023 Sheet 2 of 2

Texas Department of Transportation

FED. RD. DIV. NO.	PROJECT NO.		SHEET NO.
			188
STATE	STATE DIST.	COUNTY	
TEXAS	AUS	HAYS	
CONT.	SECT.	JOB	HIGHWAY NO.
0805	04	033	RM 3237

DATE:
FILE:

I. STORMWATER POLLUTION PREVENTION-CLEAN WATER ACT SECTION 402

TPDES TXR 150000: Stormwater Discharge Permit or Construction General Permit required for projects with 1 or more acres disturbed soil. Projects with any disturbed soil must protect for erosion and sedimentation in accordance with Item 506.

List MS4 Operator(s) that may receive discharges from this project. They may need to be notified prior to construction activities.

1.Hays County

2.

☐ No Action Required ☒ Required Action

Action No.

1. Prevent stormwater pollution by controlling erosion and sedimentation in accordance with TPDES Permit TXR 150000
2. Comply with the SW3P and revise when necessary to control pollution or required by the Engineer.
3. Post Construction Site Notice (CSN) with SW3P information on or near the site, accessible to the public and TCEQ, EPA or other inspectors.
4. When Contractor project specific locations (PSL's) increase disturbed soil area to 5 acres or more, submit NOI to TCEQ and the Engineer.

II. WORK IN OR NEAR STREAMS, WATERBODIES AND WETLANDS CLEAN WATER ACT SECTIONS 401 AND 404

USACE Permit required for filling, dredging, excavating or other work in any water bodies, rivers, creeks, streams, wetlands or wet areas.

The Contractor must adhere to all of the terms and conditions associated with the following permit(s):

☐ No Permit Required
☒ Nationwide Permit 14 - PCN not Required (less than 1/10th acre waters or wetlands affected)
☐ Nationwide Permit 14 - PCN Required (1/10 to <1/2 acre, 1/3 in tidal waters)
☐ Individual 404 Permit Required
☐ Other Nationwide Permit Required: NWP# _____

Required Actions: List waters of the US permit applies to, location in project and check Best Management Practices planned to control erosion, sedimentation and post-project TSS.

1.

2.

3.

4.

The elevation of the ordinary high water marks of any areas requiring work to be performed in the waters of the US requiring the use of a nationwide permit can be found on the Bridge Layouts.

Best Management Practices:

Erosion	Sedimentation	Post-Construction TSS
☒ Temporary Vegetation	☒ Silt Fence	☒ Vegetative Filter Strips
☒ Blankets/Matting	☒ Rock Berm	☐ Retention/Irrigation Systems
☐ Mulch	☐ Triangular Filter Dike	☐ Extended Detention Basin
☐ Sodding	☐ Sand Bag Berm	☐ Constructed Wetlands
☐ Interceptor Swale	☐ Straw Bale Dike	☐ Wet Basin
☐ Diversion Dike	☐ Brush Berms	☐ Erosion Control Compost
☐ Erosion Control Compost	☐ Erosion Control Compost	☐ Mulch Filter Berm and Socks
☐ Mulch Filter Berm and Socks	☐ Mulch Filter Berm and Socks	☐ Compost Filter Berm and Socks
☐ Compost Filter Berm and Socks	☐ Compost Filter Berm and Socks	☐ Vegetation Lined Ditches
	☐ Stone Outlet Sediment Traps	☐ Sand Filter Systems
	☐ Sediment Basins	☒ Grassy Swales

III. CULTURAL RESOURCES

Refer to TxDOT Standard Specifications in the event historical issues or archeological artifacts are found during construction. Upon discovery of archeological artifacts (bones, burnt rock, flint, pottery, etc.) cease work in the immediate area and contact the Engineer immediately.

☒ No Action Required ☐ Required Action

Action No.

1.

2.

3.

4.

IV. VEGETATION RESOURCES

Preserve native vegetation to the extent practical.
Contractor must adhere to Construction Specification Requirements Specs 162, 164, 192, 193, 506, 730, 751, 752 in order to comply with requirements for invasive species, beneficial landscaping, and tree/brush removal commitments.

☐ No Action Required ☒ Required Action

Action No.

1. Comply with Executive border 13112 on Invasive Species and the intent of the Executive Order Memorandum on Beneficial Landscapes for re-vegetating the project area. The proposed seed mixture (both grasses and forbs) would be in accordance with Part II. Construction Details contained within TxDOT's Standard Specifications for the Construction of Highways, Streets, and Bridges.
2.
3.

V. FEDERAL LISTED, PROPOSED THREATENED, ENDANGERED SPECIES, CRITICAL HABITAT, STATE LISTED SPECIES, CANDIDATE SPECIES AND MIGRATORY BIRDS.

☐ No Action Required ☒ Required Action

Action No.

1. No construction, removal and clearing of vegetation will occur during the breeding season for the Golden-cheeked warbler (September 15 through March 1).
2. Implementation of Bird BMPs and Terrestrial BMPs
3. Eastern spotted skunk - Contractors will be advised of potential occurrence in the project area, to avoid harming the species if encountered, and to avoid unnecessary impacts to dens.

Western burrowing owl Bird BMPs (listed below)

Eastern spotted skunk Contractors will be advised of potential occurrence in the project area, to avoid harming the species if encountered, and to avoid unnecessary impacts to dens.

Plateau spot-tailed earless lizard Terrestrial Reptile BMPs (listed below)

BIRD BMPs

In addition to complying with the Migratory Bird Treaty Act (MBTA) perform the following BMPs:

1. Prior to construction, perform daytime surveys for nests including under bridges and in culverts to determine if they are active before removal. Nests that are active should not be disturbed.

BIRD BMPs (cont.)

2. Do not disturb, destroy, or remove active nests, including ground nesting birds, during the nesting season;

3. Avoid the removal of unoccupied, inactive nests, as practicable;

4. Prevent the establishment of active nests during the nesting season on TxDOT owned and operated facilities and structures proposed for replacement or repair;

5. Do not collect, capture, relocate, or transport birds, eggs, young, or active nests without a permit.

TERRESTRIAL REPTILES BMPS

1. Apply hydromulching and/or hydroseeding in areas for soil stabilization and/or revegetation of disturbed areas where feasible. If hydromulching and/or hydroseeding are not feasible due to site conditions, utilize erosion control blankets or mats that contain no netting or contain loosely woven, natural fiber netting is preferred. Plastic netting should be avoided to the extent practicable.

2. For open trenches and excavated pits, install escape ramps at an angle of less than 45 degrees (1:1) in areas left uncovered. Visually inspect excavation areas for trapped wildlife prior to backfilling.

3. Inform contractors that if reptiles are found on project site allow species to safely leave the project area.

4. Avoid or minimize disturbing or removing downed trees, rotting stumps, and leaf litter where feasible.

LIST OF ABBREVIATIONS

BMP:	Best Management Practice	SPCC:	Spill Prevention Control and Countermeasure
CGP:	Construction General Permit	SW3P:	Storm Water Pollution Prevention Plan
DSHS:	Texas Department of State Health Services	PCN:	Pre-Construction Notification
FHWA:	Federal Highway Administration	PSL:	Project Specific Location
MOA:	Memorandum of Agreement	TCEQ:	Texas Commission on Environmental Quality
MOU:	Memorandum of Understanding	TPDES:	Texas Pollutant Discharge Elimination System
MS4:	Municipal Separate Stormwater Sewer System	TPWD:	Texas Parks and Wildlife Department
MBTA:	Migratory Bird Treaty Act	TxDOT:	Texas Department of Transportation
NOT:	Notice of Termination	T&E:	Threatened and Endangered Species
NWP:	Nationwide Permit	USACE:	U.S. Army Corps of Engineers
NOI:	Notice of Intent	USFWS:	U.S. Fish and Wildlife Service

Texas Department of Transportation

Design Division Standard

ENVIRONMENTAL PERMITS, ISSUES AND COMMITMENTS

EPIC

SHEET 1 OF 2

FILE: epic.dgn	DN: TxDOT	CK: RG	DW: VP	CK: AR	
	CONT	SECT	JOB	HIGHWAY	
REVISIONS 12-12-2011 (DS) 05-07-14 ADDED NOTE SECTION IV. 01-23-2015 SECTION I (CHANGED ITEM 1122 TO ITEM 506, ADDED GRASSY SWALES.	0805	04	033	RM 3237	
	DIST	COUNTY		SHEET NO.	
	AUS	HAYS		189	

DATE:
FILE:

VI. HAZARDOUS MATERIALS OR CONTAMINATION ISSUES

General (applies to all projects):

Comply with the Hazard Communication Act (the Act) for personnel who will be working with hazardous materials by conducting safety meetings prior to beginning construction and making workers aware of potential hazards in the workplace. Ensure that all workers are provided with personal protective equipment appropriate for any hazardous materials used.

Obtain and keep on-site Material Safety Data Sheets (MSDS) for all hazardous products used on the project, which may include, but are not limited to the following categories: Paints, acids, solvents, asphalt products, chemical additives, fuels and concrete curing compounds or additives. Provide protected storage, off bare ground and covered, for products which may be hazardous. Maintain product labelling as required by the Act.

Maintain an adequate supply of on-site spill response materials, as indicated in the MSDS. In the event of a spill, take actions to mitigate the spill as indicated in the MSDS, in accordance with safe work practices, and contact the District Spill Coordinator immediately. The Contractor shall be responsible for the proper containment and cleanup of all product spills.

Contact the Engineer if any of the following are detected:

* Dead or distressed vegetation (not identified as normal)
* Trash piles, drums, canister, barrels, etc.
* Undesirable smells or odors
* Evidence of leaching or seepage of substances

Does the project involve any bridge class structure rehabilitation or replacements (bridge class structures not including box culverts)?

☐ Yes ☒ No

If "No", then no further action is required.
If "Yes", then TxDOT is responsible for completing asbestos assessment/inspection.

Are the results of the asbestos inspection positive (is asbestos present)?

☐ Yes ☐ No

If "Yes", then TxDOT must retain a DSHS licensed asbestos consultant to assist with the notification, develop abatement/mitigation procedures, and perform management activities as necessary. The notification form to DSHS must be postmarked at least 15 working days prior to scheduled demolition.

If "No", then TxDOT is still required to notify DSHS 15 working days prior to any scheduled demolition.

In either case, the Contractor is responsible for providing the date(s) for abatement activities and/or demolition with careful coordination between the Engineer and asbestos consultant in order to minimize construction delays and subsequent claims.

Any other evidence indicating possible hazardous materials or contamination discovered on site. Hazardous Materials or Contamination Issues Specific to this Project:

☒ No Action Required ☐ Required Action

Action No.

1.

2.

3.

VII. OTHER ENVIRONMENTAL ISSUES

(includes regional issues such as Edwards Aquifer District, etc.)

☐ No Action Required ☒ Required Action

Action No.

1. FILL CAVITY S-1 COMPLETELY WITH HAND MIXED CONCRETE (<1 CY)

2.

3.

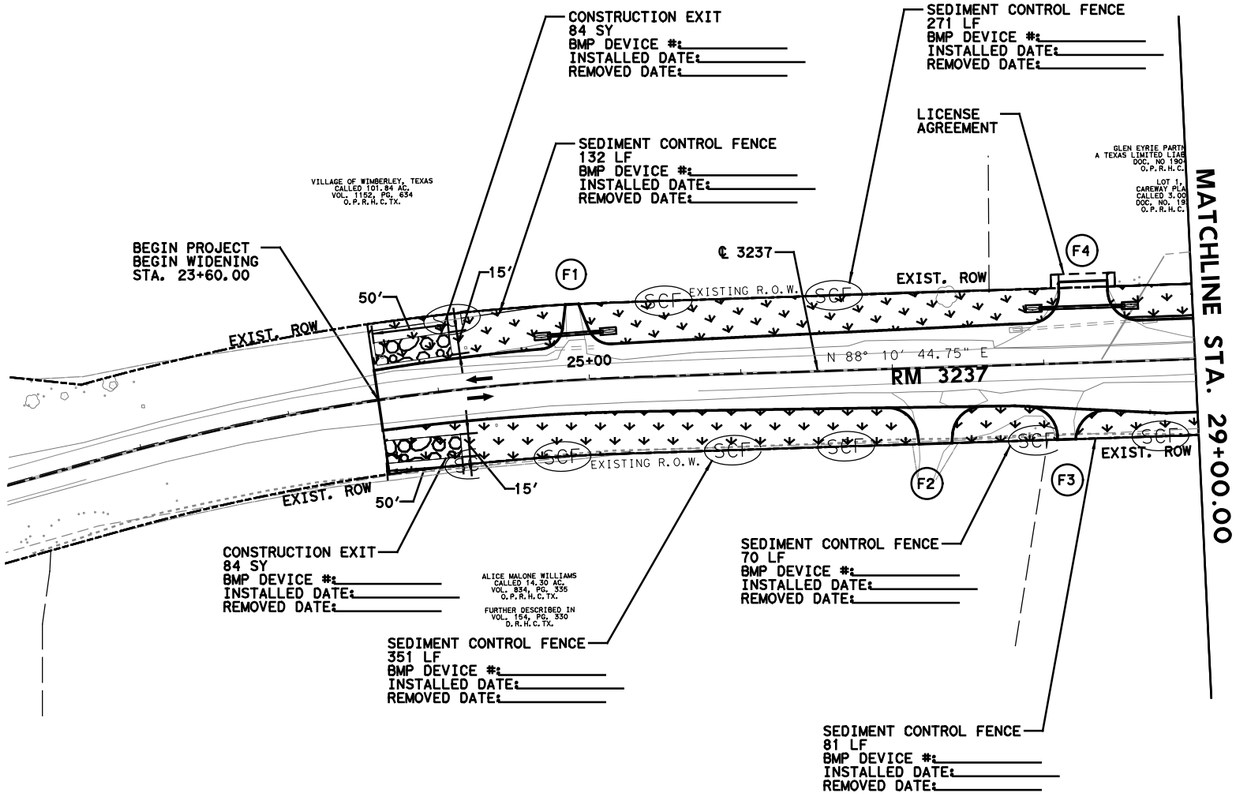
Texas Department of Transportation

Design Division Standard

ENVIRONMENTAL PERMITS, ISSUES AND COMMITMENTS

EPIC

FILE: epic.dgn	DN: TxDOT	CK: RG	DW: VP	CK: AR
©TxDOT: February 2015	CONT	SECT	JOB	HIGHWAY
REVISIONS	0805	04	033	RM 3237
12-12-2011 (DS)	DIST	COUNTY		SHEET NO.
05-07-14 ADDED NOTE SECTION IV.	AUS	HAYS		190
01-23-2015 SECTION I (CHANGED ITEM 1122 TO ITEM 506, ADDED GRASSY SWALES.				



QUANTITY SUMMARY				
ITEM	CODE	DESCRIPTION	UNIT	QTY
164	6003	CELL FBR MLCH SEED(TEMP)(WARM)	SY	2706
168	6001	VEGETATIVE WATERING	MG	54
506	6020	CONSTRUCTION EXITS (INSTALL) (TY 1)	SY	168
506	6024	CONSTRUCTION EXITS (REMOVE)	SY	168
506	6038	TEMP SEDMT CONT FENCE (INSTALL)	LF	905
506	6039	TEMP SEDMT CONT FENCE (REMOVE)	LF	905

N

0 50 100
SCALE IN FEET

LEGEND:

- SCF — SEDIMENT CONTROL FENCE
- RFD2 — ROCK FILTER DAM (TY 2)
- RFD3 — ROCK FILTER DAM (TY 3)
- CONSTRUCTION EXIT
- LIMITS OF CONSTRUCTION
- RIPRAP
- DISTURBED AND SEEDING AREA

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED PROFESSIONAL ENGINEER
11/17/2023

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

HAYS COUNTY TEXAS

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

RM 3237
TEMPORARY EROSION CONTROL

SHEET 1 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS				
HNS	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK	TX	AUS	HAYS	
AMP	CONTROL	SECTION	JOB	191
CHECK	0805	04	033	
AMP				

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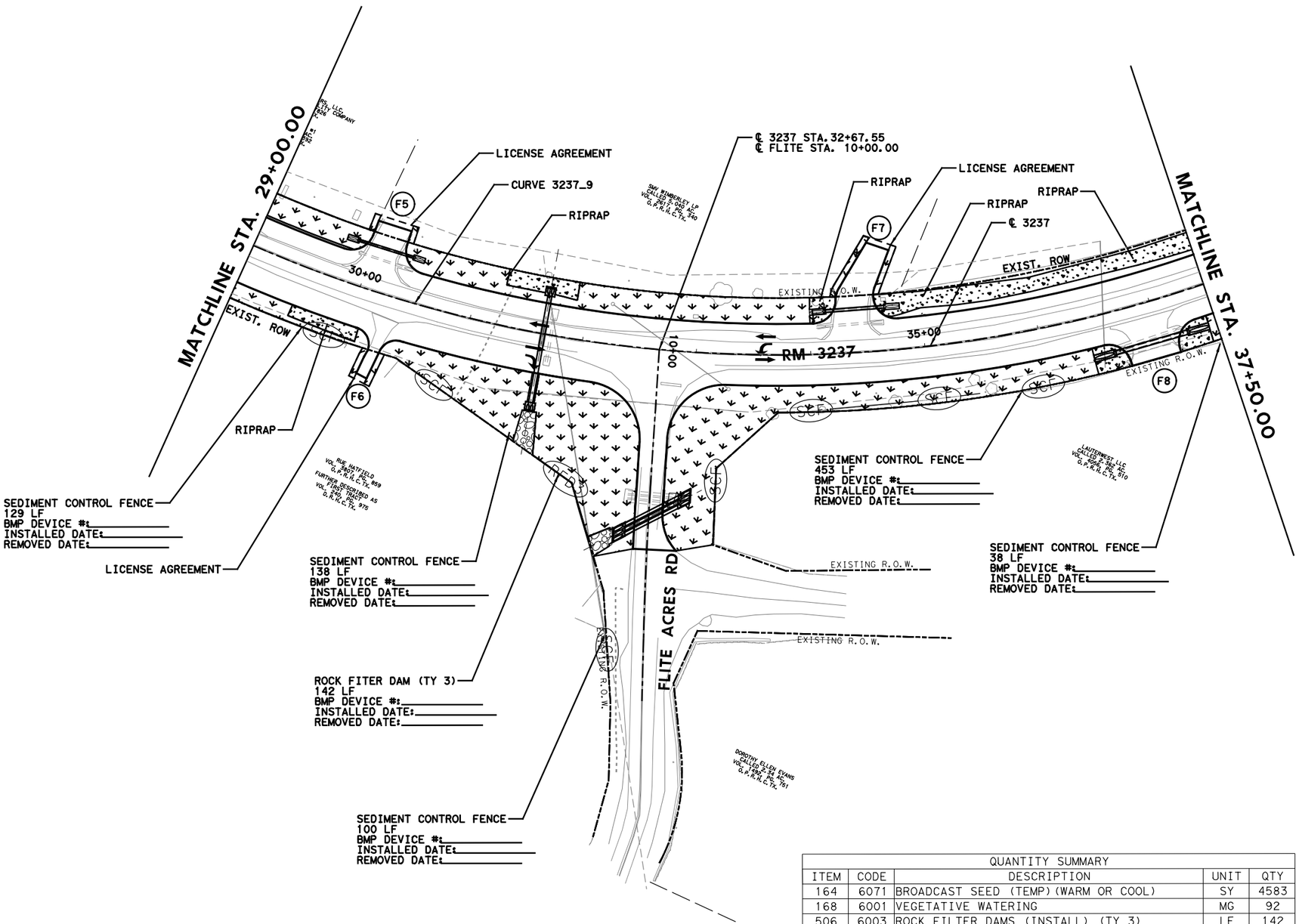

QUANTITY SUMMARY				
ITEM	CODE	DESCRIPTION	UNIT	QTY
164	6071	BROADCAST SEED (TEMP)(WARM OR COOL)	SY	4583
168	6001	VEGETATIVE WATERING	MG	92
506	6003	ROCK FILTER DAMS (INSTALL) (TY 3)	LF	142
506	6011	ROCK FILTER DAMS (REMOVE)	LF	142
506	6038	TEMP SEDMT CONT FENCE (INSTALL)	LF	858
506	6039	TEMP SEDMT CONT FENCE (REMOVE)	LF	858

N

0 50 100
SCALE IN FEET

LEGEND:

- SCF — SEDIMENT CONTROL FENCE
- RFD2 — ROCK FILTER DAM (TY 2)
- RFD3 — ROCK FILTER DAM (TY 3)
- CONSTRUCTION EXIT
- LIMITS OF CONSTRUCTION
- RIPRAP
- DISTURBED AND SEEDING AREA

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED
PROFESSIONAL ENGINEER
11/17/2023

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
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HAYS COUNTY TEXAS

Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

RM 3237
TEMPORARY EROSION CONTROL

SHEET 2 OF 6

DESIGN	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	192
AMP	0805	04	033	
CHECK				
AMP				

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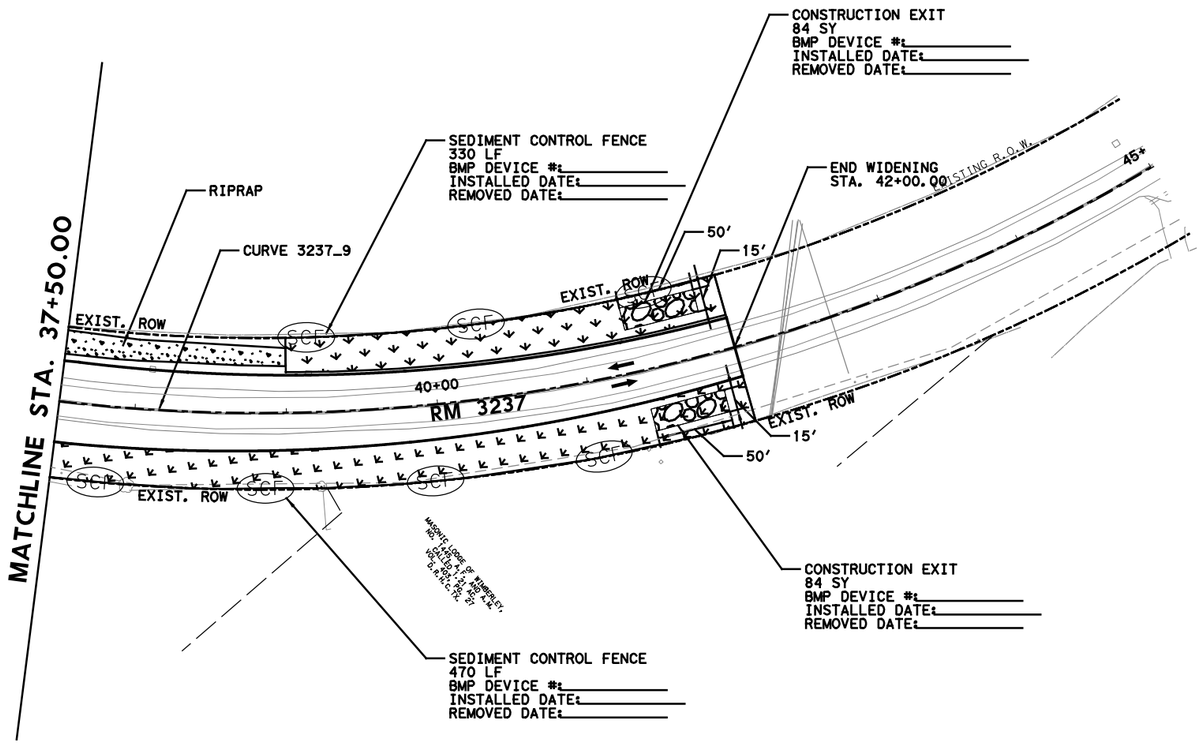

0 50 100
SCALE IN FEET

LEGEND:

- SCF — SEDIMENT CONTROL FENCE
- RFD2 — ROCK FILTER DAM (TY 2)
- RFD3 — ROCK FILTER DAM (TY 3)
- CONSTRUCTION EXIT
- LIMITS OF CONSTRUCTION
- RIPRAP
- DISTURBED AND SEEDING AREA

QUANTITY SUMMARY				
ITEM	CODE	DESCRIPTION	UNIT	QTY
164	6071	BROADCAST SEED (TEMP)(WARM OR COOL)	SY	2188
168	6001	VEGETATIVE WATERING	MG	44
506	6020	CONSTRUCTION EXITS (INSTALL) (TY 1)	SY	168
506	6024	CONSTRUCTION EXITS (REMOVE)	SY	168
506	6038	TEMP SEDMT CONT FENCE (INSTALL)	LF	800
506	6039	TEMP SEDMT CONT FENCE (REMOVE)	LF	800

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED PROFESSIONAL ENGINEER
11/17/2023

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
TBPE FIRM NO. F-10069
3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
www.structurepoint.com

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RM 3237 SAFETY IMPROVEMENTS

RM 3237
TEMPORARY EROSION CONTROL

SHEET 3 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS				
HNS	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK	TX	AUS	HAYS	
AMP	CONTROL	SECTION	JOB	193
CHECK	0805	04	033	
AMP				

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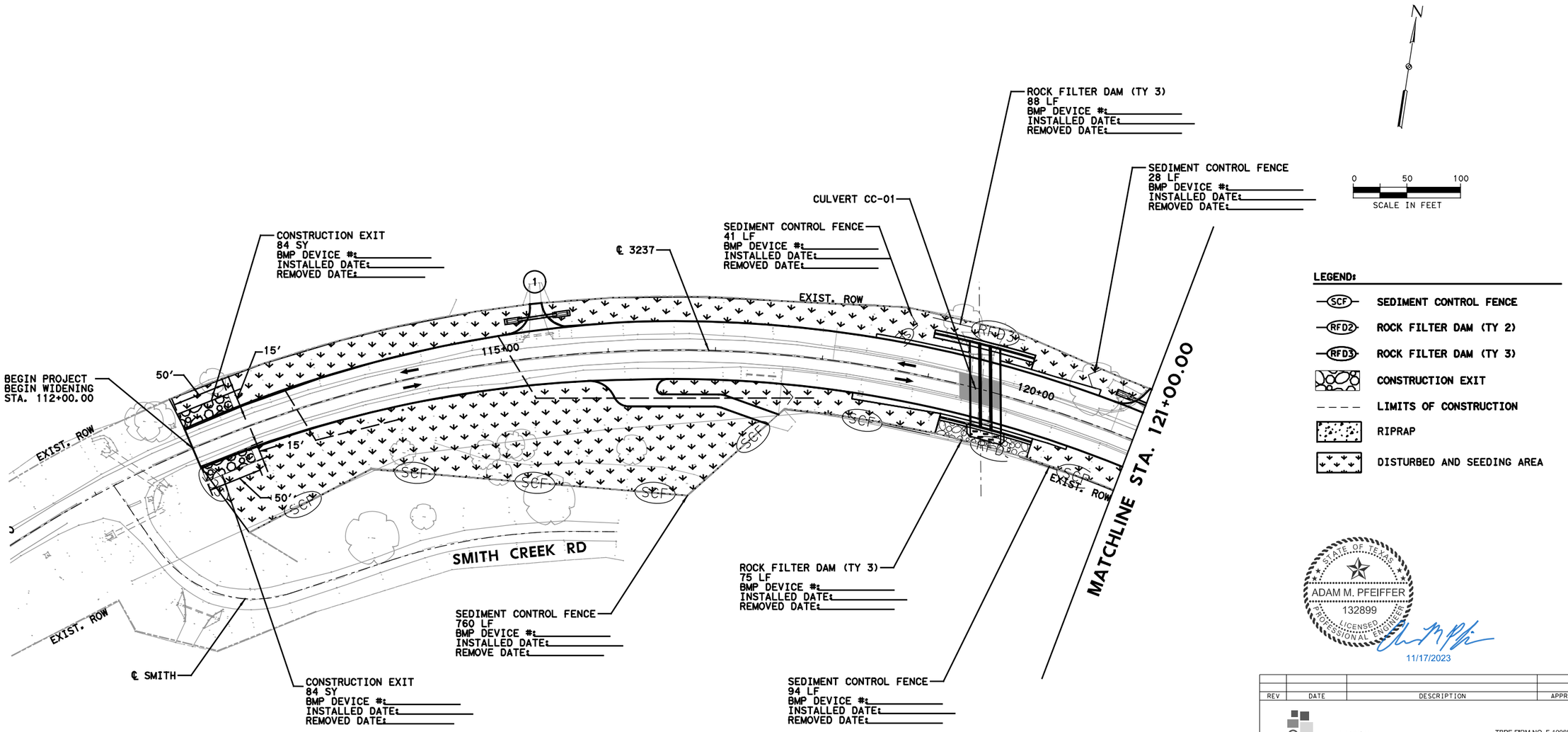

QUANTITY SUMMARY				
ITEM	CODE	DESCRIPTION	UNIT	QTY
164	6003	BROADCAST SEED (TEMP)(WARM OR COOL)	SY	7287
168	6001	VEGETATIVE WATERING	MG	146
506	6003	ROCK FILTER DAMS (INSTALL) (TY 3)	LF	163
506	6011	ROCK FILTER DAMS (REMOVE)	LF	163
506	6020	CONSTRUCTION EXITS (INSTALL) (TY 1)	SY	168
506	6024	CONSTRUCTION EXITS (REMOVE)	SY	168
506	6038	TEMP SEDMT CONT FENCE (INSTALL)	LF	923
506	6039	TEMP SEDMT CONT FENCE (REMOVE)	LF	923

STATE OF TEXAS
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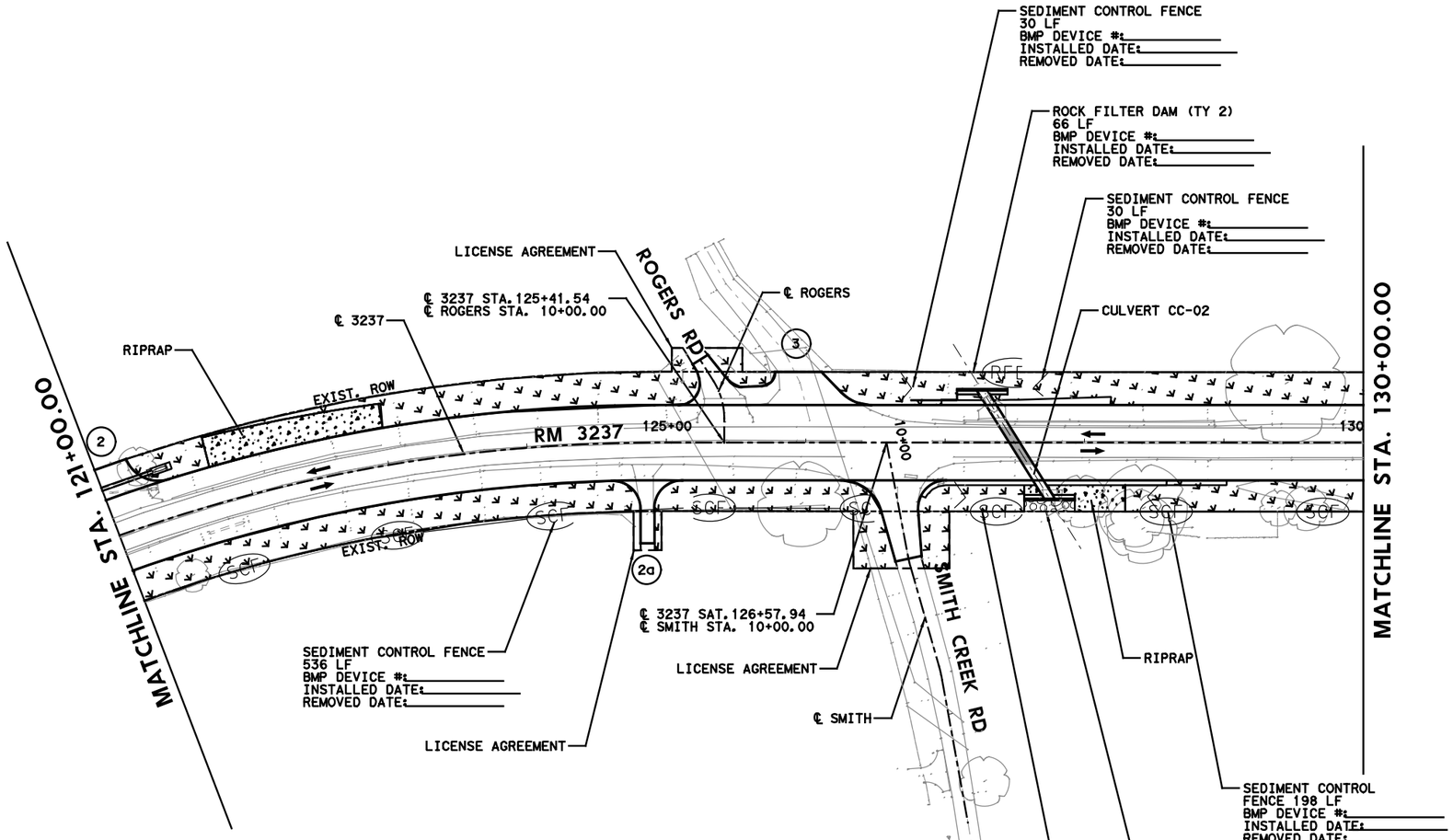
RM 3237 SAFETY IMPROVEMENTS

RM 3237
TEMPORARY EROSION CONTROL

SHEET 4 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	194
AMP	0805	04	033	
CHECK				
AMP				



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0 50 100
SCALE IN FEET

LEGEND:

- SCF — SEDIMENT CONTROL FENCE
- RFD2 — ROCK FILTER DAM (TY 2)
- RFD3 — ROCK FILTER DAM (TY 3)
- CONSTRUCTION EXIT
- LIMITS OF CONSTRUCTION
- RIPRAP
- DISTURBED AND SEEDING AREA

QUANTITY SUMMARY				
ITEM	CODE	DESCRIPTION	UNIT	QTY
164	6003	BROADCAST SEED (TEMP)(WARM OR COOL)	SY	3863
168	6001	VEGETATIVE WATERING	MG	77
506	6002	ROCK FILTER DAMS (INSTALL) (TY 2)	LF	109
506	6011	ROCK FILTER DAMS (REMOVE)	LF	109
506	6038	TEMP SEDMT CONT FENCE (INSTALL)	LF	895
506	6039	TEMP SEDMT CONT FENCE (REMOVE)	LF	895

STATE OF TEXAS
ADAM M. PFEIFFER
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11/17/2023

REV	DATE	DESCRIPTION	APPROVED

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AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
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RM 3237 SAFETY IMPROVEMENTS

RM 3237
TEMPORARY EROSION CONTROL

SHEET 5 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	195
AMP	0805	04	033	
CHECK				
AMP				

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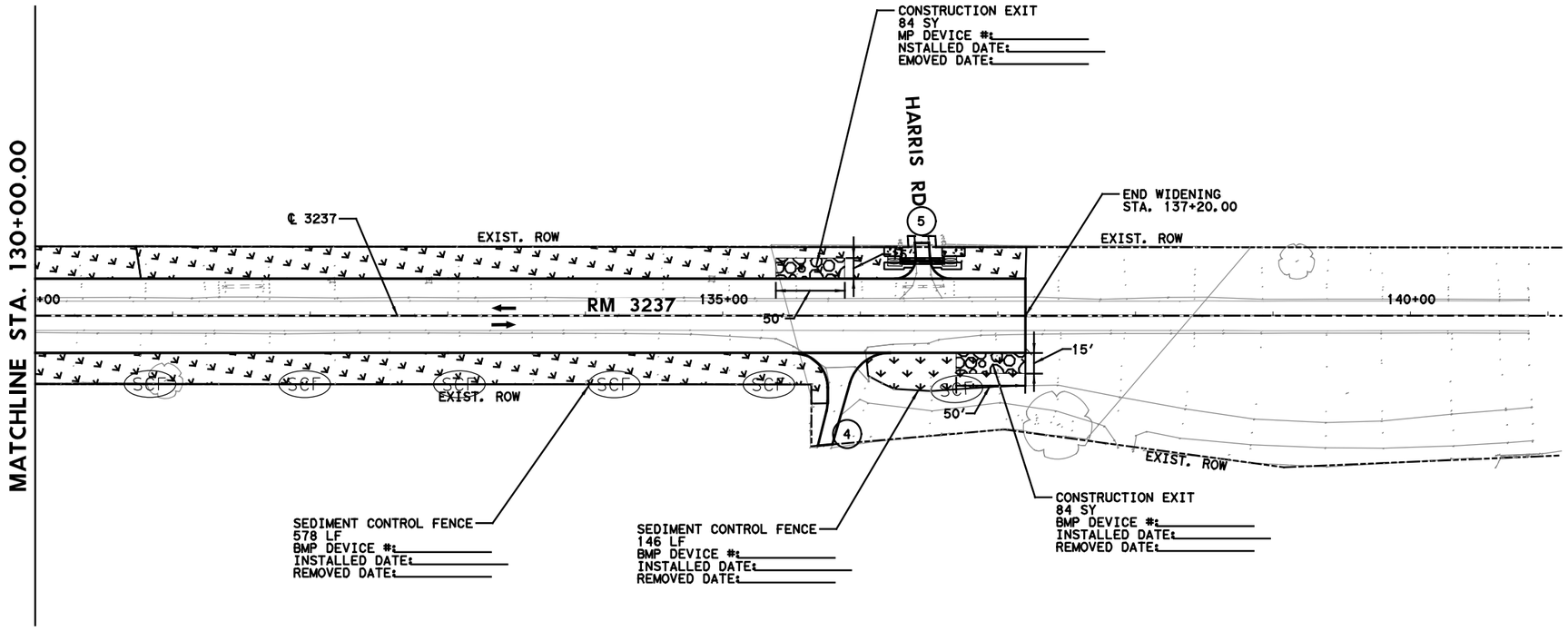

0 50 100
SCALE IN FEET

LEGEND:

- SCF — SEDIMENT CONTROL FENCE
- RFD2 — ROCK FILTER DAM (TY 2)
- RFD3 — ROCK FILTER DAM (TY 3)
- CONSTRUCTION EXIT
- LIMITS OF CONSTRUCTION
- RIPRAP
- DISTURBED AND SEEDING AREA

QUANTITY SUMMARY				
ITEM	CODE	DESCRIPTION	UNIT	QTY
164	6003	BROADCAST SEED (TEMP)(WARM OR COOL)	SY	3580
168	6001	VEGETATIVE WATERING	MG	72
506	6020	CONSTRUCTION EXITS (INSTALL) (TY 1)	SY	168
506	6024	CONSTRUCTION EXITS (REMOVE)	SY	168
506	6038	TEMP SEDMT CONT FENCE (INSTALL)	LF	724
506	6039	TEMP SEDMT CONT FENCE (REMOVE)	LF	724

STATE OF TEXAS
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11/17/2023

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AUSTIN, TX 78746
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Texas Department of Transportation

RM 3237 SAFETY IMPROVEMENTS

RM 3237
TEMPORARY EROSION CONTROL

SHEET 6 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS				
HNS	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK	TX	AUS	HAYS	
AMP	CONTROL	SECTION	JOB	196
CHECK	0805	04	033	
AMP				

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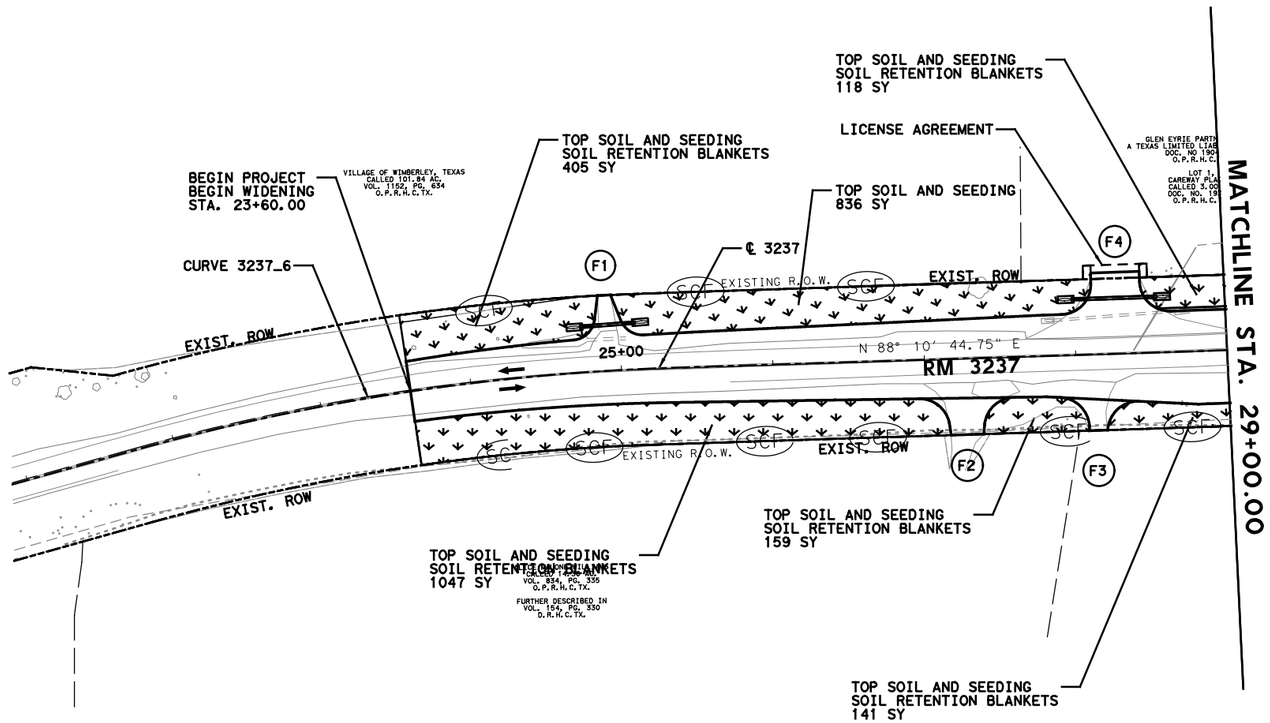

QUANTITY SUMMARY				
ITEM	CODE	DESCRIPTION	UNIT	QTY
160	6003	FURNISHING AND PLACING TOPSOIL (4")	SY	2706
164	6003	BROADCAST SEED (PERM) (RURAL) (CLAY)	SY	2706
168	6001	VEGETATIVE WATERING	MG	54
169	6001	SOIL RETENTION BLANKETS (CL 1) (TY A)	SY	2706
180	6001	WILDFLOWER SEEDING	AC	0.56

N

0 50 100

SCALE IN FEET

NOTES:

PLACE SRB(CL1)(TYP A) A MINIMUM OF 10' ALONG THE EDGE OF THE PAVEMENT AND ON ALL SLOPES GREATER THAN 3:1 EXCEPT WHERE RIPRAP IS IDENTICAL

LEGEND:

- EXIST ROW
- VEGETATIVE FILTER STRIPS
- DISTURBED AND SEEDING AREA
- RIPRAP

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED PROFESSIONAL ENGINEER
11/17/2023

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
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3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
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RM 3237 SAFETY IMPROVEMENTS

RM 3237
PERMANENT EROSION CONTROL

SHEET 1 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	197
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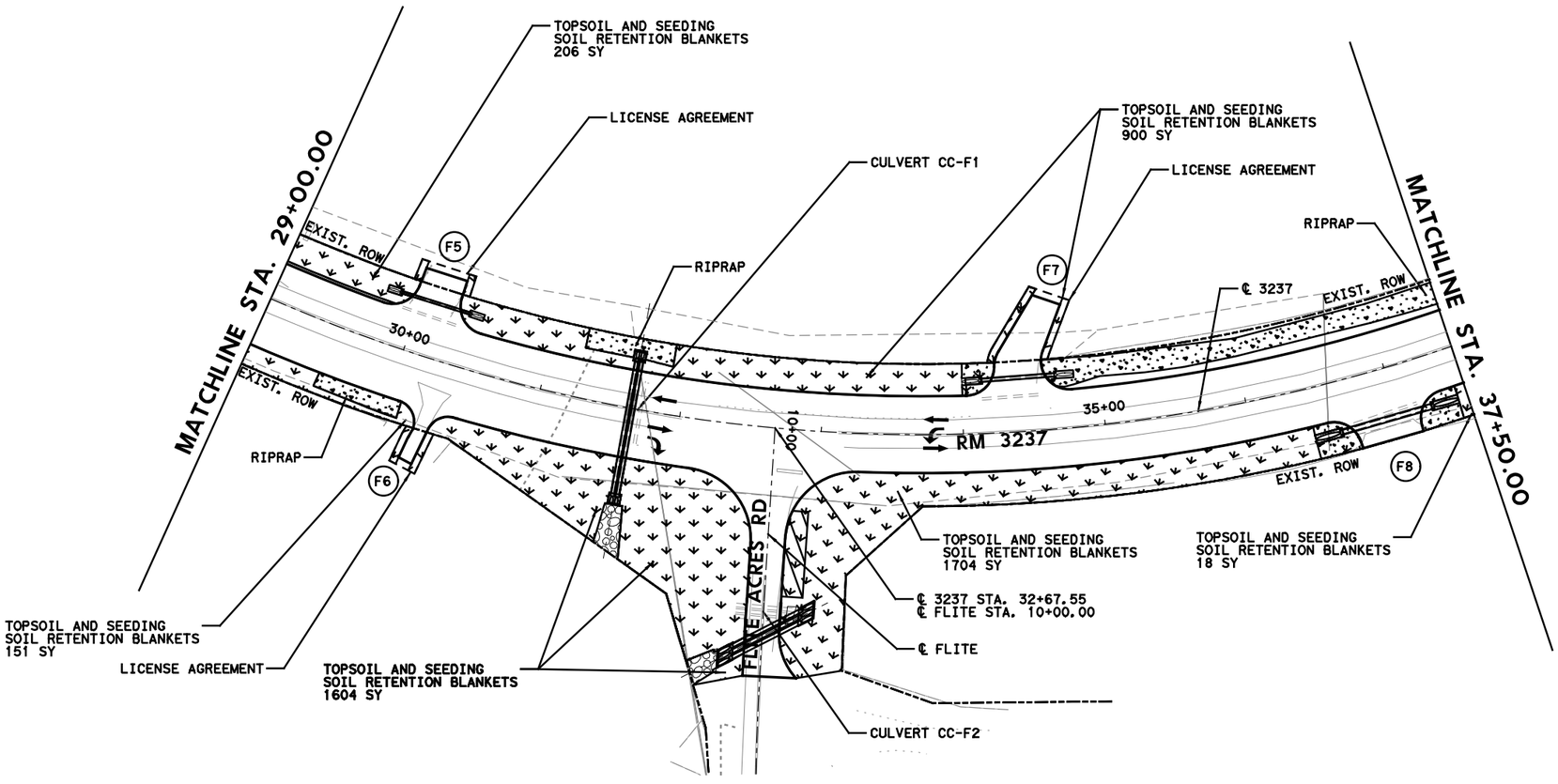
CHECK				
AMP				



QUANTITY SUMMARY				
ITEM	CODE	DESCRIPTION	UNIT	QTY
160	6003	FURNISHING AND PLACING TOPSOIL (4")	SY	4583
164	6003	BROADCAST SEED (PERM) (RURAL) (CLAY)	SY	4583
168	6001	VEGETATIVE WATERING	MG	92
169	6001	SOIL RETENTION BLANKETS (CL 1) (TY A)	SY	4583
180	6001	WILDFLOWER SEEDING	AC	0.95

N

0 50 100
SCALE IN FEET

NOTES:

PLACE SRB(CL1)(TYP A) A MINIMUM OF 10' ALONG THE EDGE OF THE PAVEMENT AND ON ALL SLOPES GREATER THAN 3:1 EXCEPT WHERE RIPRAP IS IDENTICAL

LEGEND:

- EXIST ROW
- VEGETATIVE FILTER STRIPS
- DISTURBED AND SEEDING AREA
- RIPRAP

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED PROFESSIONAL ENGINEER
11/17/2023

REV	DATE	DESCRIPTION	APPROVED

AMERICAN STRUCTUREPOINT INC.
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3711 SOUTH MOPAC EXPY
BUILDING ONE, SUITE 350
AUSTIN, TX 78746
TEL 512.494.6037 FAX 317.543.0270
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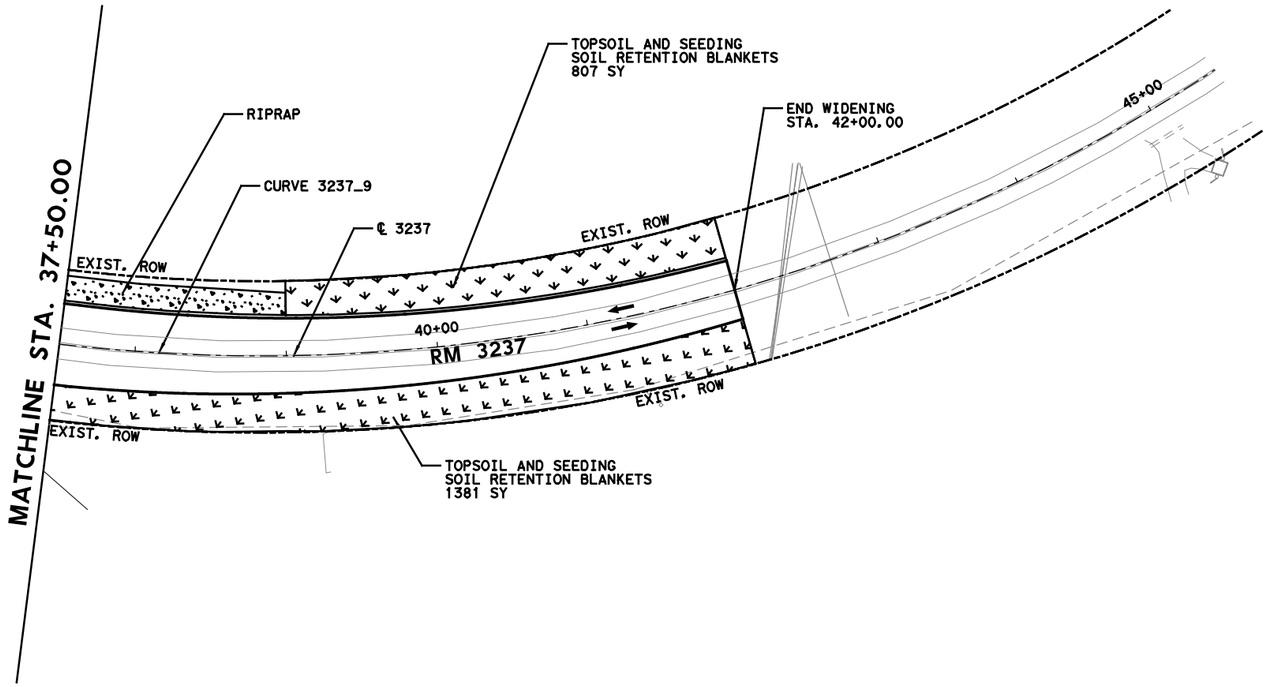
RM 3237 SAFETY IMPROVEMENTS

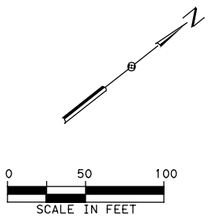
RM 3237
PERMANENT EROSION CONTROL

SHEET 2 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS				
HNS	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK	TX	AUS	HAYS	
AMP	CONTROL	SECTION	JOB	198
CHECK	0805	04	033	
AMP				



QUANTITY SUMMARY				
ITEM	CODE	DESCRIPTION	UNIT	QTY
160	6003	FURNISHING AND PLACING TOPSOIL (4")	SY	2188
164	6003	BROADCAST SEED (PERM) (RURAL) (CLAY)	SY	2188
168	6001	VEGETATIVE WATERING	MG	44
169	6001	SOIL RETENTION BLANKETS (CL 1) (TY A)	SY	2188
180	6001	WILDFLOWER SEEDING	AC	0.45



NOTES:

PLACE SRB(CL1)(TYP A) A MINIMUM OF 10' ALONG THE EDGE OF THE PAVEMENT AND ON ALL SLOPES GREATER THAN 3:1 EXCEPT WHERE RIPRAP IS IDENTICAL

LEGEND:

- EXIST ROW
- VEGETATIVE FILTER STRIPS
- DISTURBED AND SEEDING AREA
- RIPRAP

REV	DATE	DESCRIPTION	APPROVED

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AUSTIN, TX 78746
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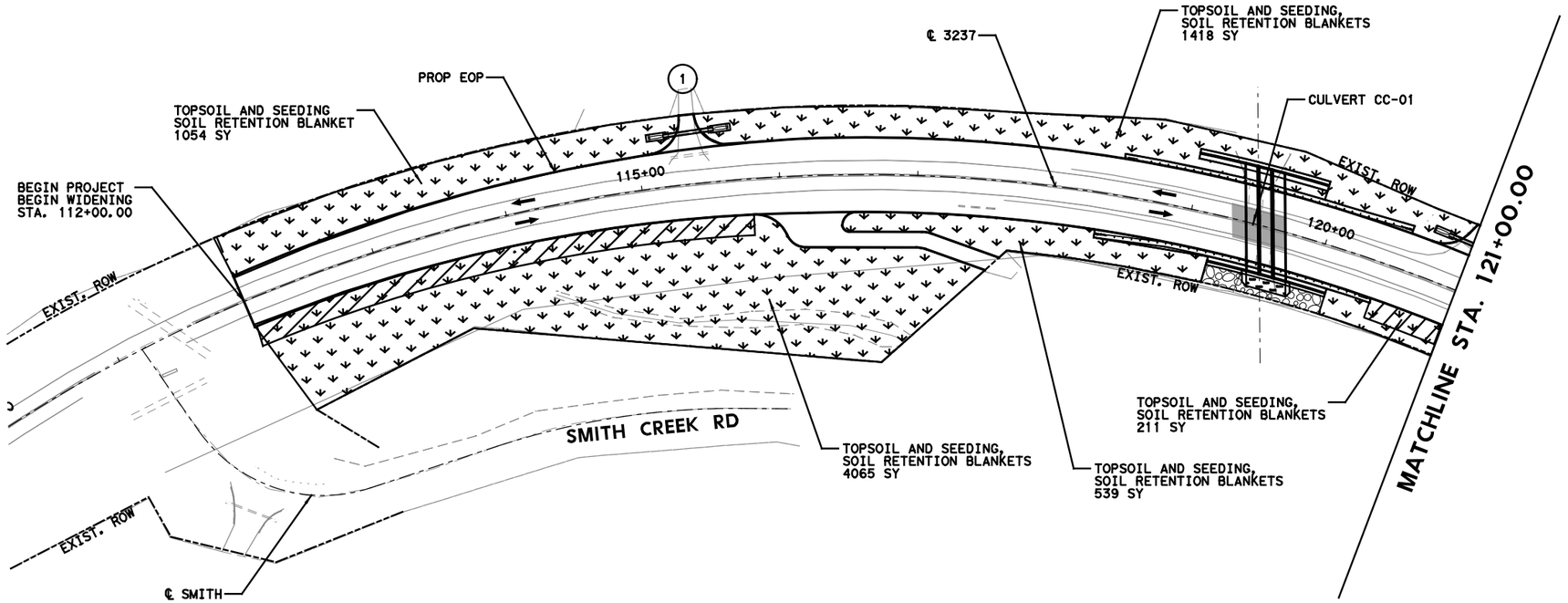
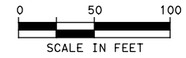
RM 3237 SAFETY IMPROVEMENTS

RM 3237
PERMANENT EROSION CONTROL

SHEET 3 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	199
AMP	0805	04	033	
CHECK				
AMP				





NOTES:

PLACE SRB(CL1)(TYP A) A MINIMUM OF 10' ALONG THE EDGE OF THE PAVEMENT AND ON ALL SLOPES GREATER THAN 3:1 EXCEPT WHERE RIPRAP IS IDENTICAL

LEGEND:

- EXIST ROW
- VEGETATIVE FILTER STRIPS
- DISTURBED AND SEEDING AREA
- RIPRAP

QUANTITY SUMMARY				
ITEM	CODE	DESCRIPTION	UNIT	QTY
160	6003	FURNISHING AND PLACING TOPSOIL (4")	SY	7287
164	6003	BROADCAST SEED (PERM) (RURAL) (CLAY)	SY	7287
168	6001	VEGETATIVE WATERING	MG	146
169	6001	SOIL RETENTION BLANKETS (CL 1) (TY A)	SY	7287
180	6001	WILDFLOWER SEEDING	AC	1.51

11/17/2023

REV	DATE	DESCRIPTION	APPROVED

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TEL 512.494.6037 FAX 317.543.0270
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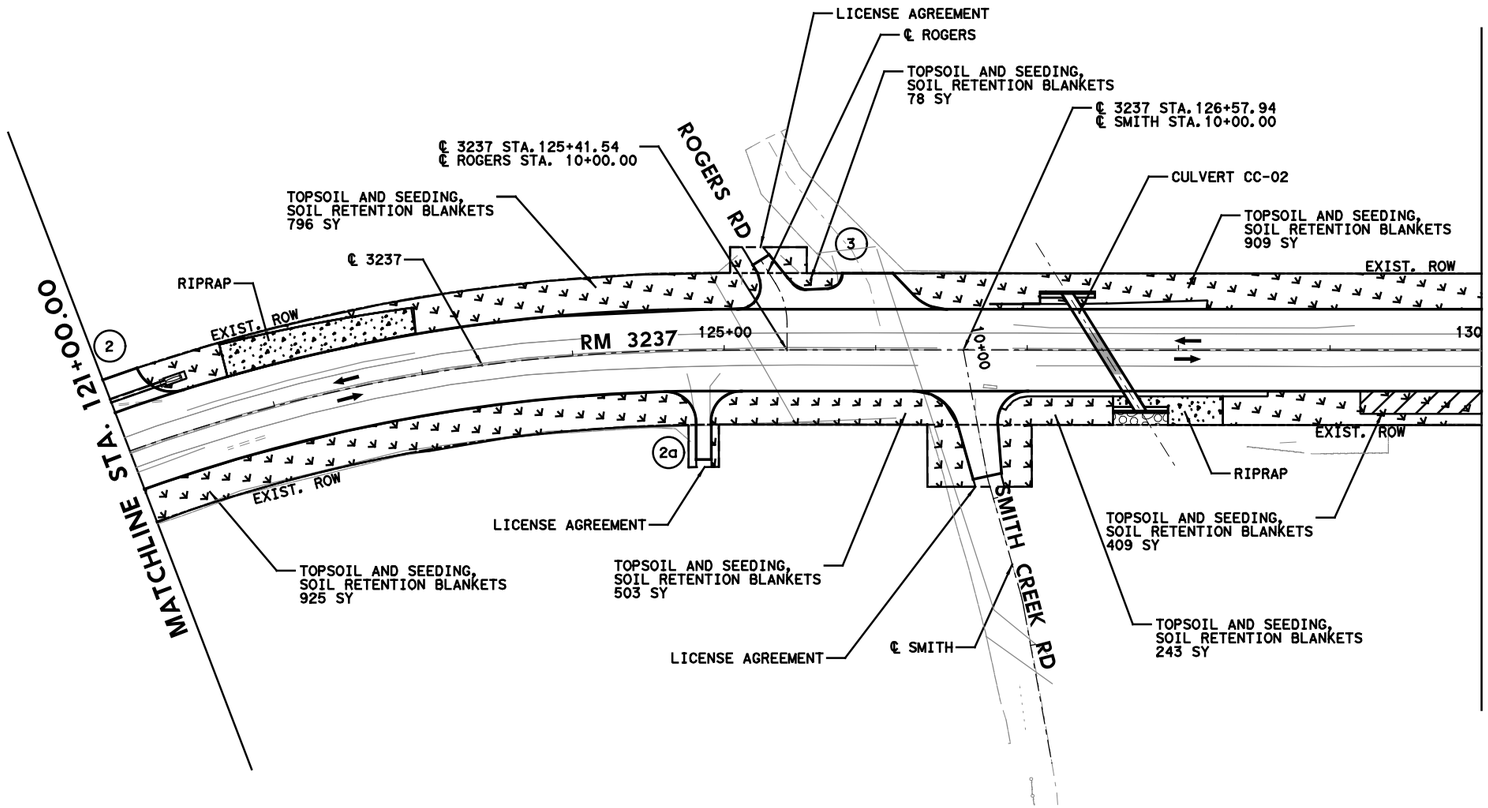
RM 3237 SAFETY IMPROVEMENTS

RM 3237
PERMANENT EROSION CONTROL

SHEET 4 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	200
AMP	0805	04	033	
CHECK				
AMP				



QUANTITY SUMMARY				
ITEM	CODE	DESCRIPTION	UNIT	QTY
160	6003	FURNISHING AND PLACING TOPSOIL (4")	SY	3863
164	6003	BROADCAST SEED (PERM) (RURAL) (CLAY)	SY	3863
168	6001	VEGETATIVE WATERING	MG	77
169	6001	SOIL RETENTION BLANKETS (CL 1) (TY A)	SY	3863
180	6001	WILDFLOWER SEEDING	AC	0.80

0 50 100
SCALE IN FEET

NOTES:

PLACE SRB(CL1)(TYP A) A MINIMUM OF 10' ALONG THE EDGE OF THE PAVEMENT AND ON ALL SLOPES GREATER THAN 3:1 EXCEPT WHERE RIPRAP IS IDENTICAL

LEGEND:

- EXIST ROW
- VEGETATIVE FILTER STRIPS
- DISTURBED AND SEEDING AREA
- RIPRAP

STATE OF TEXAS
ADAM M. PFEIFFER
132899
LICENSED PROFESSIONAL ENGINEER
11/17/2023

REV	DATE	DESCRIPTION	APPROVED

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RM 3237 SAFETY IMPROVEMENTS

RM 3237
PERMANENT EROSION CONTROL

SHEET 5 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	201
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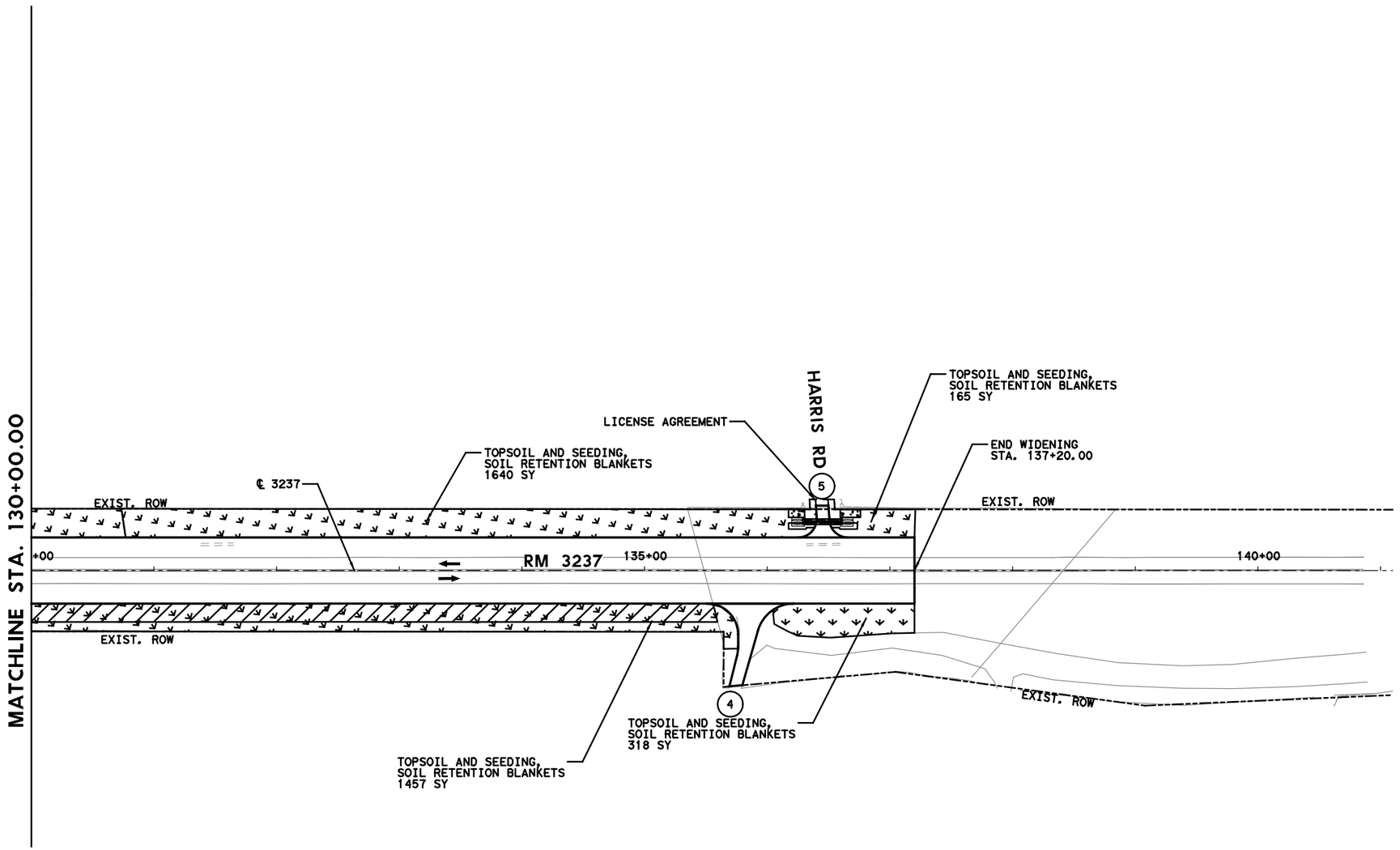
CHECK				
AMP				



QUANTITY SUMMARY				
ITEM	CODE	DESCRIPTION	UNIT	QTY
160	6003	FURNISHING AND PLACING TOPSOIL (4")	SY	3580
164	6003	BROADCAST SEED (PERM) (RURAL) (CLAY)	SY	3580
168	6001	VEGETATIVE WATERING	MG	72
169	6001	SOIL RETENTION BLANKETS (CL 1) (TY A)	SY	3580
180	6001	WILDFLOWER SEEDING	AC	0.74

0 50 100
SCALE IN FEET

NOTES:

PLACE SRB(CL1)(TYP A) A MINIMUM OF 10' ALONG THE EDGE OF THE PAVEMENT AND ON ALL SLOPES GREATER THAN 3:1 EXCEPT WHERE RIPRAP IS IDENTICAL

LEGEND:

- EXIST ROW
- VEGETATIVE FILTER STRIPS
- DISTURBED AND SEEDING AREA
- RIPRAP

STATE OF TEXAS
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RM 3237
PERMANENT EROSION CONTROL

SHEET 6 OF 6

DESIGN	FED.RD. DIV. NO.	FEDERAL AID PROJECT NO.		HIGHWAY NO.
ERM				RM 3237
GRAPHICS	STATE	DISTRICT	COUNTY	SHEET NO.
HNS	TX	AUS	HAYS	
CHECK	CONTROL	SECTION	JOB	202
AMP	0805	04	033	
CHECK				
AMP				

The following TCEQ requirements (Form TCEQ-0592A, Rev. 7/15/15) are applicable to all work that disturbs 5 or more acres in the contributing zone of the Edwards Aquifer in Hays, Travis and/or Williamson Counties and must be adhered to by the Contractor and all Subcontractors:

1. A written notice of construction must be submitted to the TCEQ regional office at least 48 hours prior to the start of any ground disturbance or construction activities. This notice must include:
   - the name of the approved project;
   - the activity start date; and
   - the contact information of the prime contractor.

2. All contractors conducting regulated activities associated with this project should be provided with complete copies of the approved Contributing Zone Plan (CZP) and the TCEQ letter indicating the specific conditions of its approval. During the course of these regulated activities, the contractor(s) should keep copies of the approved plan and approval letter on-site.

3. No hazardous substance storage tank shall be installed within 150 feet of a water supply source, distribution system, well, or sensitive feature.

4. Prior to beginning any construction activity, all temporary erosion and sedimentation (E&S) control measures must be properly installed and maintained in accordance with the manufacturers specifications. If inspections indicate a control has been used inappropriately, or incorrectly, the applicant must replace or modify the control for site situations. These controls must remain in place until the disturbed areas have been permanently stabilized.

5. Any sediment that escapes the construction site must be collected and properly disposed of before the next rain event to ensure it is not washed into surface streams, sensitive features, etc.

6. Sediment must be removed from the sediment traps or sedimentation basins when it occupies 50% of the basin's design capacity.

7. Litter, construction debris, and construction chemicals exposed to stormwater shall be prevented from being discharged offsite.

8. All excavated material that will be stored on-site must have proper E&S controls.

9. If portions of the site will have a cease in construction activity lasting longer than 14 days, soilstabilization in those areas shall be initiated as soon as possible prior to the 14th day of inactivity. If activity will resume prior to the 21st day, stabilization measures are not required. If drought conditions or inclement weather prevent action by the 14th day, stabilization measures shall be initiated as soon as possible.

10. The following records should be maintained and made available to the TCEQ upon request:
    - the dates when major grading activities occur;
    - the dates when construction activities temporarily or permanently cease on a portion of the site; and
    - the dates when stabilization measures are initiated.

11. The holder of any approved CZP must notify the appropriate regional office in writing and obtain approval from the executive director prior to initiating any of the following:

    A. any physical or operational modification of any best management practices (BMPs) or structure(s), including but not limited to temporary or permanent ponds, dams, berms, silt fences, and diversionary structures;
    B. any change in the nature or character of the regulated activity from that which was originally approved;
    C. any change that would significantly impact the ability to prevent pollution of the Edwards Aquifer; or
    D. any development of land previously identified as undeveloped in the approved contributing zone plan.

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TCEQ REGIONAL OFFICE

Austin Regional Office
12100 Park 35 Circle
Bldg A, Room 179
Austin, Texas 78753
Phone: (512) 339-2929
Fax: (512) 339-3795

Texas Department of Transportation | Austin District Standard

TCEQ REQUIREMENTS FOR THE CONTRIBUTING ZONE OF THE EDWARDS AQUIFER

(DISTURBING 5 OR MORE ACRES)

TCEQ-CZ-19(AUS)

©TxDOT&YEAR&	CONT	SECT	JOB	HIGHWAY
REVISIONS	0805	04	033	RM 3237
01/10/14: REQUIREMENTS AND ADDRESS UPDATED	DIST	COUNTY		SHEET NO.
01/21/16: REQUIREMENTS UPDATED				
09/24/19: UPDATED RELEASE YEAR	AUS	HAYS		203

DATE 11/17/2023
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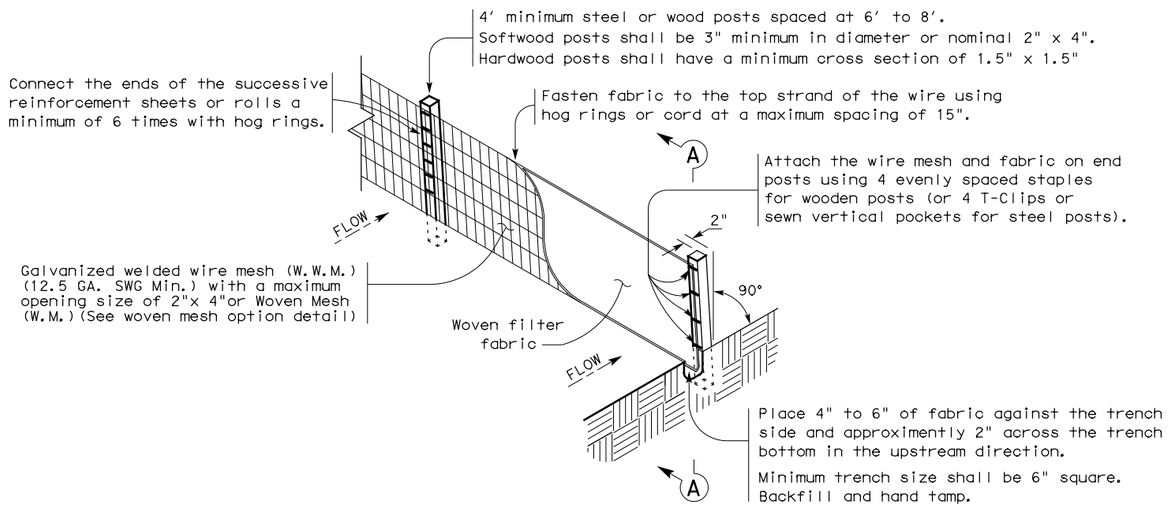
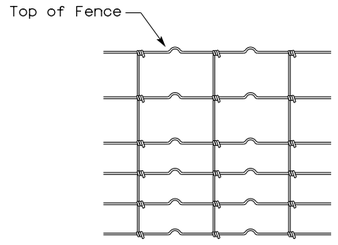
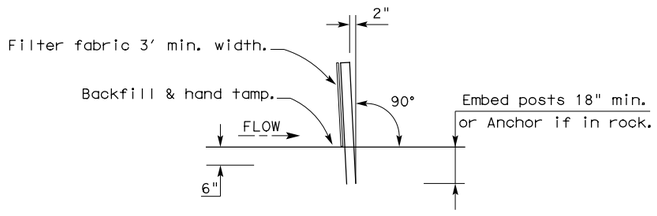


TEMPORARY SEDIMENT CONTROL FENCE

SCF





SECTION A-A

HINGE JOINT KNOT WOVEN MESH (OPTION) DETAIL

Galvanized hinge joint knot woven mesh (12.5 GA.SWG Min.) requires a minimum of five horizontal wires spaced at a maximum of 12 inches apart and all vertical wires spaced at a maximum of 12 inches apart.

SEDIMENT CONTROL FENCE USAGE GUIDELINES

A sediment control fence may be constructed near the downstream perimeter of a disturbed area along a contour to intercept sediment from overland runoff. A 2 year storm frequency may be used to calculate the flow rate to be filtered.

Sediment control fence should be sized to filter a maximum flow through rate of 100 GPM/FT^2. Sediment control fence is not recommended to control erosion from a drainage area larger than 2 acres.

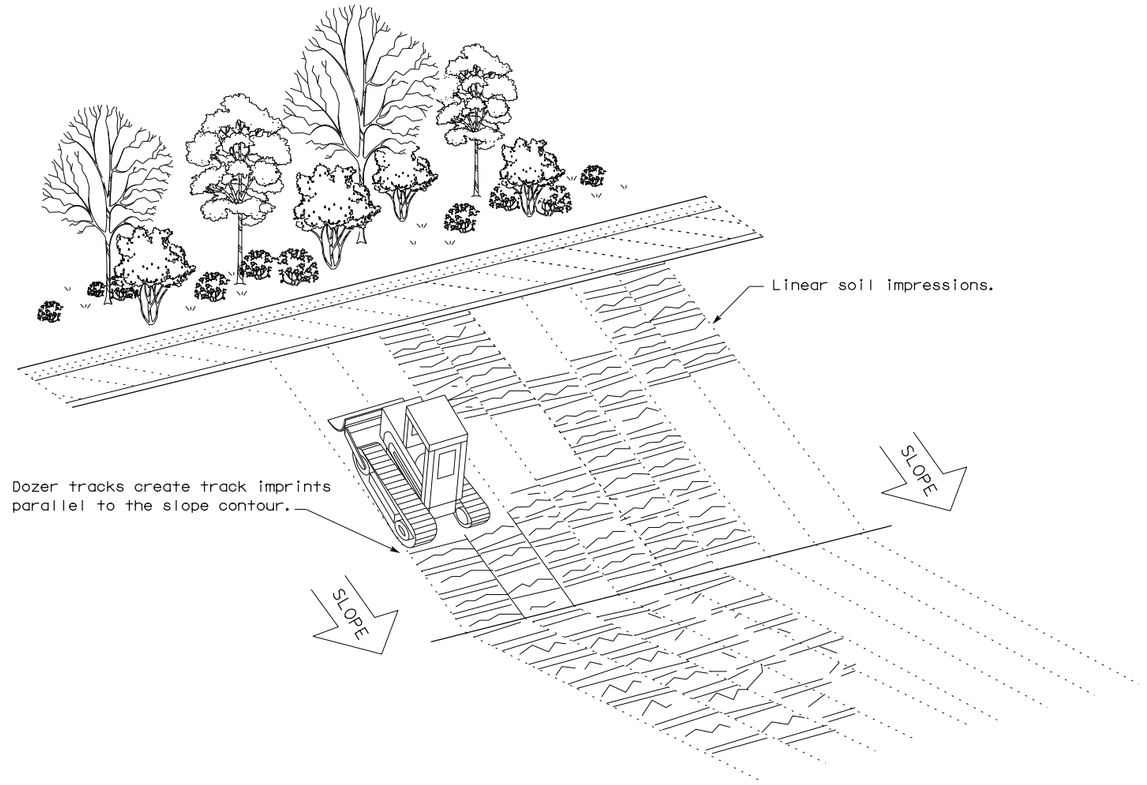
LEGEND

Sediment Control Fence

SCF

GENERAL NOTES

1. Vertical tracking is required on projects where soil distributing activities have occurred unless otherwise approved.
2. Perform vertical tracking on slopes to temporarily stabilize soil.
3. Provide equipment with a track undercarriage capable of producing linear soil impressions measuring a minimum of 12" in length by 2" to 4" in width by 1/2" to 2" in depth.
4. Do not exceed 12" between track impressions.
5. Install continous linear track impressions where the minimum 12" length impressions are perpendicular to the slope or direction of water flow.



VERTICAL TRACKING

Texas Department of Transportation

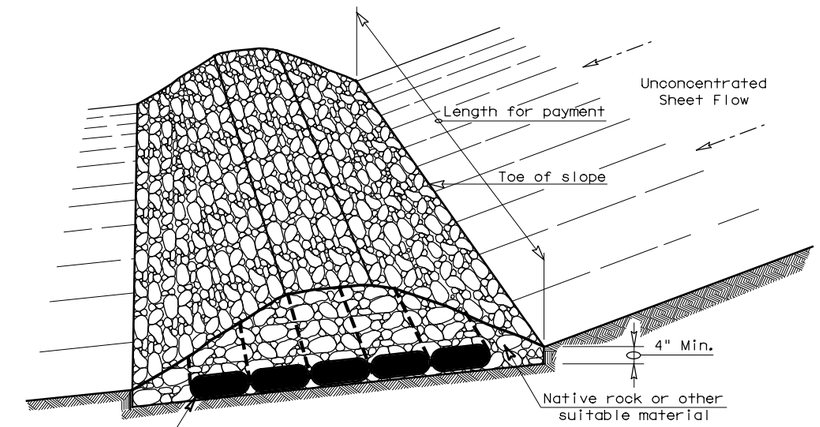
Design Division Standard

TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

FENCE & VERTICAL TRACKING

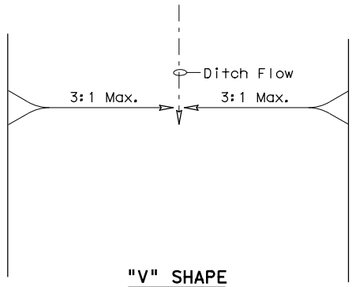
EC(1)-16

FILE: ec116	DN: TxDOT	CK: KM	DW: VP	DN/CK: LS
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY
REVISIONS	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		204

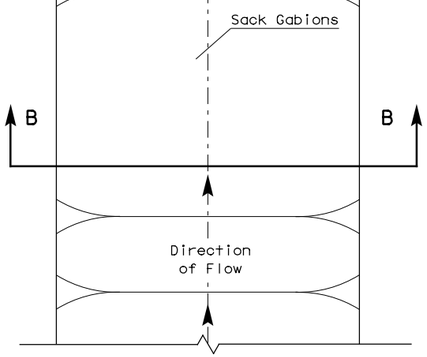


FILTER DAM AT TOE OF SLOPE

RFD1



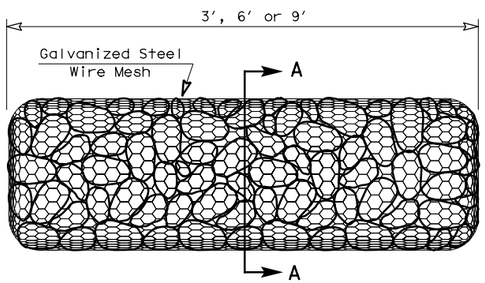
"V" SHAPE
PLAN VIEW



PLAN VIEW

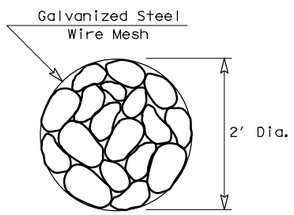
¾" Dia.
Rebar Stakes

SECTION B-B

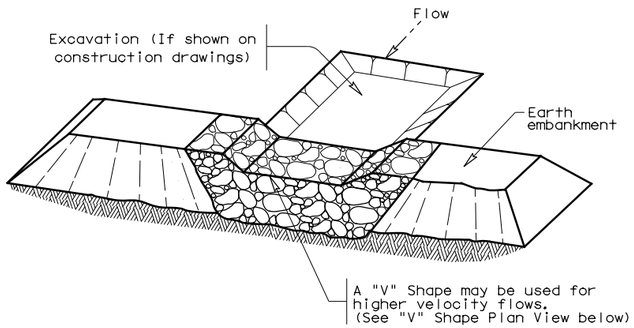


TYPE 4 (SACK GABIONS)

RFD4

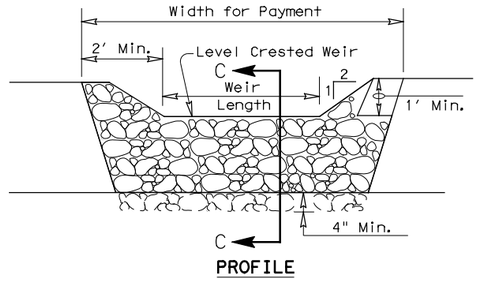


SECTION A-A

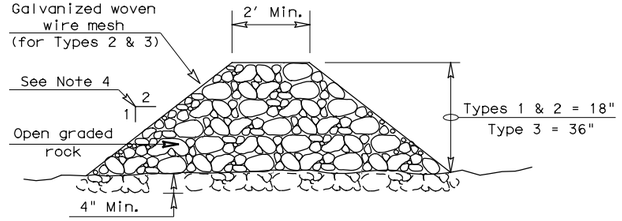


FILTER DAM AT SEDIMENT TRAP

RFD1 — OR — RFD2



PROFILE



SECTION C-C

ROCK FILTER DAM USAGE GUIDELINES

Rock Filter Dams should be constructed downstream from disturbed areas to intercept sediment from overland runoff and/or concentrated flow. The dams should be sized to filter a maximum flow through rate of 60 GPM/FT^2 of cross sectional area. A 2 year storm frequency may be used to calculate the flow rate.

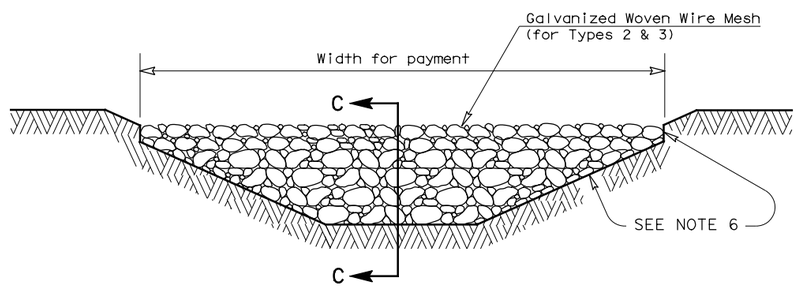
Type 1 (18" high with no wire mesh) (3" to 6" aggregate): Type 1 may be used at the toe of slopes, around inlets, in small ditches, and at dike or swale outlets. This type of dam is recommended to control erosion from a drainage area of 5 acres or less. Type 1 may not be used in concentrated high velocity flows (approximently 8 Ft/Sec or more) in which aggregate wash out may occur. Sandbags may be used at the embedded foundation (4" deep min.) for better filtering efficiency of low flows if called for on the plans or directed by the Engineer.

Type 2 (18" high with wire mesh) (3" to 6" aggregate): Type 2 may be used in ditches and at dike or swale outlets.

Type 3 (36" high with wire mesh) (4" to 8" aggregate): Type 3 may be used in stream flow and should be secured to the stream bed.

Type 4 (Sack gabions) (3" to 6" aggregate): Type 4 May be used in ditches and smaller channels to form an erosion control dam.

Type 5: Provide rock filter dams as shown on plans.



FILTER DAM AT CHANNEL SECTIONS

RFD1 — OR — RFD2 — OR — RFD3

GENERAL NOTES

1. If shown on the plans or directed by the Engineer, filter dams should be placed near the toe of slopes where erosion is anticipated, upstream and/or downstream at drainage structures, and in roadway ditches and channels to collect sediment.
2. Materials (aggregate, wire mesh, sandbags, etc.) shall be as indicated by the specification for "Rock Filter Dams for Erosion and Sedimentation Control".
3. The rock filter dam dimensions shall be as indicated on the SW3P plans.
4. Side slopes should be 2:1 or flatter. Dams within the safety zone shall have sideslopes of 6:1 or flatter.
5. Maintain a minimum of 1' between top of rock filter dam weir and top of embankment for filter dams at sediment traps.
6. Filter dams should be embedded a minimum of 4" into existing ground.
7. The sediment trap for ponding of sediment laden runoff shall be of the dimensions shown on the plans.
8. Rock filter dam types 2 & 3 shall be secured with 20 gauge galvanized woven wire mesh with 1" diameter hexagonal openings. The aggregate shall be placed on the mesh to the height & slopes specified. The mesh shall be folded at the upstream side over the aggregate and tightly secured to itself on the downstream side using wire ties or hog rings. For in stream use, the mesh should be secured or staked to the stream bed prior to aggregate placement.
9. Sack Gabions should be staked down with ¾" dia. rebar stakes, and have a double-twisted hexagonal weave with a nominal mesh opening of 2 ½" x 3 ¼"
10. Flow outlet should be onto a stabilized area (vegetation, rock, etc.).
11. The guidelines shown hereon are suggestions only and may be modified by the Engineer.

PLAN SHEET LEGEND

Type 1 Rock Filter Dam	RFD1
Type 2 Rock Filter Dam	RFD2
Type 3 Rock Filter Dam	RFD3
Type 4 Rock Filter Dam	RFD4

Texas Department of Transportation — Design Division Standard

TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

ROCK FILTER DAMS

EC(2)-16

FILE: ec216	DN: TxDOT	CK: KM	DW: VP	DN/CK: LS
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY
REVISIONS	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		205

DATE: 11/17/2023
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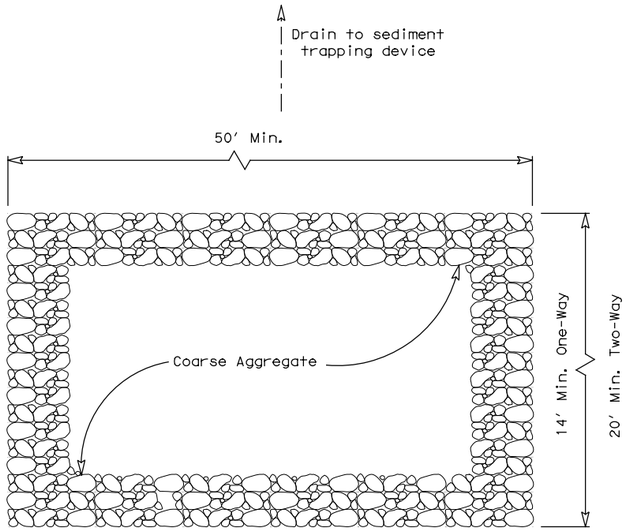
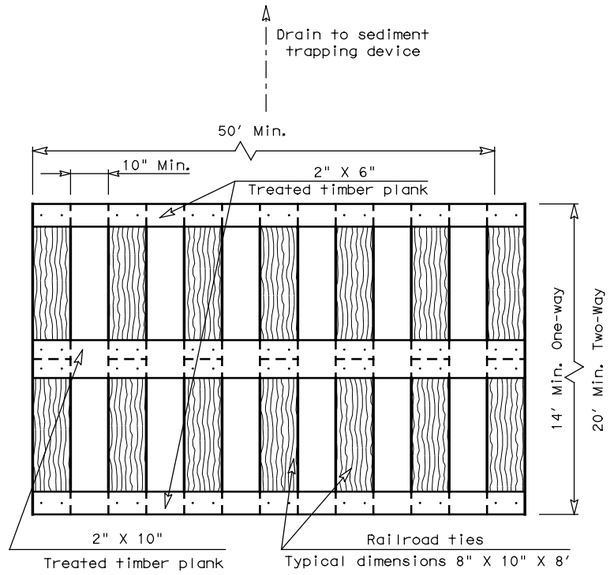


PLAN VIEW



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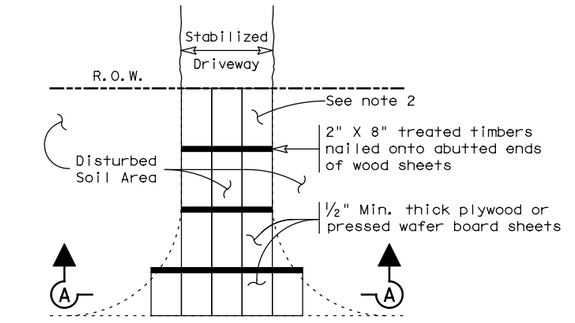
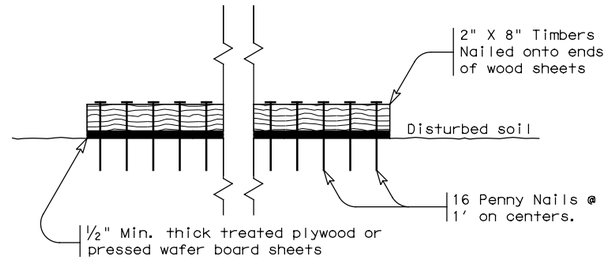


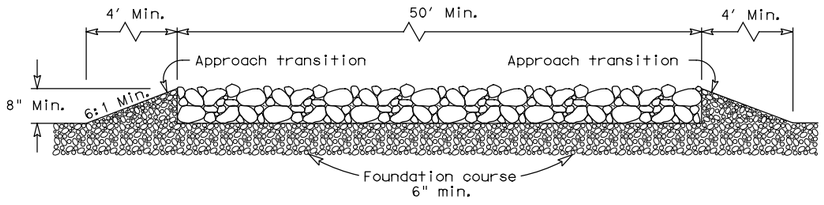
PLAN VIEW



SECTION A-A

CONSTRUCTION EXIT (TYPE 3)

SHORT TERM



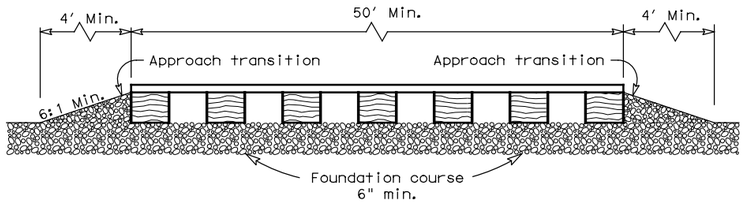
ELEVATION VIEW

CONSTRUCTION EXIT (TYPE 1)

ROCK CONSTRUCTION (LONG TERM)

GENERAL NOTES (TYPE 1)

1. The length of the type 1 construction exit shall be as indicated on the plans, but not less than 50′.
2. The coarse aggregate should be open graded with a size of 4" to 8".
3. The approach transitions should be no steeper than 6:1 and constructed as directed by the Engineer.
4. The construction exit foundation course shall be flexible base, bituminous concrete, portland cement concrete or other materialas approved by the Engineer.
5. The construction exit shall be graded to allow drainage to a sediment trapping device.
6. The guidelines shown hereon are suggestions only and may be modified by the Engineer.
7. Construct exits with a width of at least 14 ft. for one-way and 20 ft. for two-way traffic for the full width of the exit, or as directed by the engineer.



ELEVATION VIEW

CONSTRUCTION EXIT (TYPE 2)

TIMBER CONSTRUCTION (LONG TERM)

GENERAL NOTES (TYPE 2)

1. The length of the type 2 construction exit shall be as indicated on the plans, but not less than 50′.
2. The treated timber planks shall be attached to the railroad ties with ½"x 6" min. lag bolts. Other fasteners may be used as approved by the Engineer.
3. The treated timber planks shall be #2 grade min., and should be free from large and loose knots.
4. The approach transitions shall be no steeper than 6:1 and constructed as directed by the Engineer.
5. The construction exit foundation course shall be flexible base, bituminous concrete, portland cement concrete or other material as approved by the Engineer.
6. The construction exit should be graded to allow drainage to a sediment trapping device.
7. The guidelines shown hereon are suggestions only and may be modified by the Engineer.
8. Construct exits with a width of at least 14 ft. for one-way and 20 ft. for two-way traffic for the full width of the exit, or as directed by the engineer.

GENERAL NOTES (TYPE 3)

1. The length of the type 3 construction exit shall be as shown on the plans, or as directed by the Engineer.
2. The type 3 construction exit may be constructed from open graded crushed stone with a size of two to four inches spread a min. of 4" thick to the limits shown on the plans.
3. The treated timber planks shall be #2 grade min., and should be free from large and loose knots.
4. The guidelines shown hereon are suggestions only and may be modified by the Engineer.

Texas Department of Transportation

Design Division Standard

TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

CONSTRUCTION EXITS

EC(3)-16

FILE: ec316	DN: TxDOT	CK: KM	DW: VP	DN/CK: LS
	CONT	SECT	JOB	HIGHWAY
REVISIONS	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		206

VOIDS DEFINITION

- VOID GREATER THAN SIX INCHES ACROSS IN ANY DIRECTION AND/OR
- VOID IS GREATER THAN ONE SQUARE FOOT ALONG ANY PLANE AND/OR
- VOID BLOWS AIR AND/OR
- VOID CONTINUALLY RECEIVES WATER DURING A RAIN EVENT AND/OR
- VOID HAS WATER FLOWING THROUGH OR OUT OF IT AND/OR

GENERAL NOTES

1. USING EXPLOSIVES IS NOT ALLOWED.
2. THE PROJECT AREA IS A KNOWN KARST AREA. FRACTURED MATERIAL, BOULDERS,UNDERGROUND VOIDS, GROUNDWATER, UNSTABLE MATERIAL, AND DRASTICALLY VARYING STRATA CAN BE EXPECTED. THE CONTRACTOR SHALL WORK WITH TXDOT AND TXDOT'S PARTNERS TO ALLOW ACCESS AND ON-SITE MONITORING OF EXCAVATION.
3. THE VOID MITIGATION DETAILS ARE EXAMPLES. IMPLEMENTATION OF THE APPROVED MITIGATION PLAN SHOULD USE THE REFERENCED BID ITEMS.
4. CONCRETE USED FOR VOID MITIGATION SHALL BE 3,000 PSI IN ACCORDANCE WITH ITEM 420 CLASS A CONC (MISC). QUANTITIES UNDER 4 CY MAY BE HAND MIXED ON SITE USING 5,000 PSI RATED BAG MIX CONCRETE.
5. 3 IN. x 5 IN. ROCK SHALL BE IN ACCORDANCE WITH ITEM 506. LARGE ROCK > 1 FT. SHALL BE IN ACCORDANCE WITH 12 IN. ROCK PER ITEM 432.
6. FILTER FABRIC AND EROSION LOGS WILL BE IN ACCORDANCE WITH ITEM 506.
7. IMPERMEABLE LINER WILL BE IN ACCORDANCE WITH ITEM 5056. THE EDGE OF THE LINER SHALL BE ANCHORED IN A 6 IN. WIDE BY 18 IN. DEEP TRENCH.
8. STEEL CASING, USED FOR DRILL SHAFT CONSTRUCTION, SHALL BE IN ACCORDANCE WITH ITEM 416.
9. AGGREGATE OR OTHER BACKFILL WILL BE PAID FOR BY OVERRUN OF EXISTING EMBANKMENT ITEM. FILTER FABRIC OVER THE AGGREGATE IS SUBSIDIARY. SANDBAGS SHALL BE PAID USING SANDBAGS FOR EROSION CONTROL. THE SANDBAGS SHALL BE POLYPROPYLENE AND FILLED WITH PEA GRAVEL. CONNECTOR PIPE SHALL BE PAID USING PIPE(PVC)(SCH 80)(6 IN).
10. IF A SINGLE VOID IMPACT CAUSES DELAYS BY MORE THAN 20 WORKING DAYS, DELAY WILL BE CONSIDERED FOR THE IMPACT BEYOND THE INITIAL 20 DAYS. IF THE ACCUMULATION OF VOID IMPACTS CAUSE DELAYS BY MORE 40 WORKING DAYS, DELAY WILL BE CONSIDERED FOR THE IMPACT BEYOND THE 40 DAYS . OVERHEAD, BARRICADES AND DELAYS WILL BE EVALUATED AND PAID IN ACCORDANCE WITH THE CONTRACT. IMPACTS WILL NOT BE CONSIDERED IMPACT AFTER A RESPONSE PROCEDURE IS PROVIDED. ALL DELAYS CAUSED BY A VOID AND THE DURATION FOR IMPLEMENTATION OF A RESPONSE ARE NON-COMPENSABLE FOR LABOR, EQUIPMENT, STANDBY, MOBILIZATIONS, AND COST ESCALATIONS.

VOID MITIGATION AND PROTECTION MEASURES

REFER TO VOID MITIGATION DETAILS FOR ADDITIONAL INFORMATION. VOID MITIGATION DETAILS ARE TO BE APPROVED BY GEOSCIENTIST AND THE TCEQ (IF APPLICABLE) PRIOR TO IMPLEMENTATION.

1. IN THE EVENT THAT UNKNOWN KARST VOIDS ARE ENCOUNTERED, WORK AT THAT LOCATION WILL BE HALTED IMMEDIATELY AND THE FEATURE WILL BE INSPECTED PROMPTLY BY TXDOT.
2. WHEN REQUIRED, TXDOT WILL INSPECT ALL VOIDS TO DETERMINE THE POTENTIAL OF THE FEATURES TO PROVIDE SUITABLE HABITAT FOR ENDANGERED KARST INVERTEBRATES. WORK AT THAT LOCATION WILL NOT RESUME UNTIL AUTHORIZATION TO DISTURB THE FEATURE HAS BEEN OBTAINED. REFER TO THE EPIC SHEET FOR ADDITIONAL INFORMATION FOR THREATENED OR ENDANGERED SPECIES.

TXDOT WILL INSPECT ALL VOIDS TO DETERMINE THE APPROPRIATE VOID MITIGATION PLAN.

3. ADDITIONAL EXCAVATION OF THE VOID MAY BE REQUIRED BY TXDOT OR THE GEOSCIENTIST TO FULLY EVALUATE THE VOID AND/OR MITIGATION PLAN PREPERATION. TXDOT APPROVAL IS REQUIRED PRIOR THE EXCAVATION. THIS WORK IS SUBSIDIARY.

VOID DISCOVERY PROTOCOL

IF A VOID IS DISCOVERED, THE FOLLOWING PROTOCOL WILL BE FOLLOWED:

1. ALL VOIDS REQUIRE AN EMAIL NOTIFICATION TO TXDOT DESIGNATED REPRESENTATIVE WITHIN 2 HOURS OF DISCOVERY. THE EMAIL WILL REQUIRE LOCATION INFORMATION (STATION, LATITUDE & LONGITUDE), DATES OF DISCOVERY, VIDEO/PICTURE DOCUMENTATION, SIZE, ETC. CONTRACTOR SHALL SUPPLY A CAMERA AND DIGITAL PICTURE/VIDEO DOCUMENTATION OF ALL VOIDS AND PROVIDE A MEASUREMENT OF THE SIZE OF THE VOID. FOR VOIDS THAT CANNOT BE SAFELY EXPLORED, ANOTHER DEVICE SHALL BE PROVIDED TO DOCUMENT THE VOID. CONTACT THE DISTRICT CONSTRUCTION OFFICE FOR AN EXAMPLE EMAIL THAT SHALL BE FOLLOWED. THIS WORK IS SUBSIDIARY.
2. ALL ACTIVITY WITHIN A 50-FOOT RADIUS OF THE VOID SHALL STOP. BLOCK TRAFFIC FROM DRIVING NEAR THE VOID AND PREVENT CONSTRUCTION EQUIPMENT FROM OPERATING IN THE VICINITY OF THE VOID USING BARRELS, ORANGE CONSTRUCTION FENCE OR OTHER APPROVED HIGHLY VISIBLE BARRIER.
3. A DRY VOID THAT IS LESS THAN 1 CF IN VOLUME OR LESS THAN 6 IN. IN ALL DIRECTIONS WILL NOT REQUIRE ACTION BEYOND NOTIFICATION. TXDOT SHALL BE NOTIFIED IMMEDIATELY VIA EMAIL AND PHONE WHEN A VOID IS FOUND THAT REQUIRES ACTION. TXDOT WILL RESPOND WITHIN 6 BUSINESS DAYS FROM TIME OF EMAIL NOTIFICATION TO PROVIDE GUIDANCE TO THE CONTRACTOR.
4. COVER THE VOID TO PREVENT CONTAMINATION AND CHANGES IN AMBIENT CONDITIONS (TARPS AND PLYWOOD, OR SIMILAR MATERIALS ARE APPROPRIATE AS AVAILABLE). WHERE COVERING THE VOID IS NOT FEASIBLE, CONTRACTOR SHALL OBTAIN APPROVAL FROM TXDOT OF ALTERNATE TEMPORARY PROTECTION MEASURES. BIODEGRADABLE EROSION CONTROL LOG (BECL) SHOULD WRAP THE SURFACE PERIMETER OF THE VOID. TEMPORARY PROTECTIONS SHOULD REMAIN IN PLACE UNTIL FINAL MITIGATION AND PROTECTION MEASURES ARE APPROVED AND IN PLACE. AN EARTHEN BERM WILL BE MAINTAINED ON THE UP-GRADIENT SIDE OF VOID TO PREVENT ANY CONSTRUCTION RUNOFF FROM ENTERING ANY PART OF THE FEATURE WHICH MAY REMAIN.THIS WORK IS SUBSIDIARY.
5. WHEN REQUIRED TXDOT SHALL IMMEDIATELY NOTIFY THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY (TCEQ) AUSTIN REGIONAL OFFICE.
6. TXDOT WILL PROVIDE FOR THE EVALUATION OF THE VOID A QUALIFIED GEOSCIENTIST LICENSED BY THE TEXAS BOARD OF PROFESSIONAL GEOSCIENTISTS OR BY A PROFESSIONAL ENGINEER WHO QUALIFIES TO PRACTICE GEOSCIENCE ACCORDING TO THE TEXAS BOARD OF PROFESSIONAL GEOSCIENTISTS.
7. WHEN REQUIRED TXDOT WILL SUBMIT AND OBTAIN APPROVAL OF AN ENCOUNTERED FEATURE MITIGATION PLAN TO THE TCEQ AUSTIN REGION OFFICE.
8. WORK SHOULD CEASE IN THE AREA UNTIL ASSESSMENT OF THE VOID CAN BE COMPLETED, TCEQ APPROVES THE ENCOUNTERED FEATURE MITIGATION PLAN AND MITIGATION IS COMPLETED. WHEN THE VOID IS OUTSIDE TCEQ JURISDICTION, TXDOT WILL APPROVE THE ENCOUNTERED FEATURE MITIGATION PLAN.

VOIDS RELATED TO DRILLED SHAFTS, SOIL NAILS, ROCK NAILS AND OTHER SIMILAR FUNCTIONS

1. SUBMIT INSTALLATION PLAN FOR REVIEW NO LATER THAN 2 MONTHS BEFORE CONSTRUCTION.
2. THE USE OF DRILLING FLUIDS, UNDERWATER PLACEMENT, OR SLURRY METHOD WILL NOT BE ALLOWED IF A VOID IS EXPOSED DURING DRILLING OF SHAFTS OR NAILS. THE CONTRACTOR SHALL USE APPROPRIATE INDUSTRY APPROVED METHODS TO PROVIDE A PRODUCT IN COMPLIANCE WITH THE SPECIFICATIONS. ADDITIONAL TIME OR COMPENSATION WILL NOT BE ALLOWED FOR USE OF ALTERNATE METHODS OR CASING INSTALLATION.
3. DURING NON-WORK HOURS OPEN HOLES SHALL BE PROTECTED FOR SAFETY AND COVERED. SHAFTS SHALL BE SURROUNDED BY EROSION CONTROL LOGS AT AN OFFSET OF 10' FROM THE EDGE OF THE OPENING. THIS WORK IS SUBSIDIARY
4. VIDEO DOCUMENTATION SHALL BE CONDUCTED OF A DRILL SHAFT ONCE EXCAVATION IS COMPLETE AND PRIOR TO PLACING REINFORCEMENT. SUFFICIENT LIGHTING SHALL ACCOMPANY THE VIDEO CAMERA TO ENSURE THE SHAFT AND VOIDS ARE VISIBLE. THIS WORK IS SUBSIDIARY.
5. CONCRETE USED TO FILL THE VOIDS WILL BE PAID USING CLASS A CONC (MISC) ITEM BUT WILL USE THE CLASS OF CONCRETE AS REQUIRED BY THE SPECIFICATION. QUANTITY OF CONCRETE WILL BE BASED ON VISUAL INSPECTION PROVIDED BY THE CONTRACTOR. IF VISUAL INSPECTION IS UNABLE TO DETERMINE THE SIZE OF THE VOID THE CONCRETE FOR PAYMENT WILL BE MEASURED AS THE ADDITIONAL CONCRETE BEYOND THE AMOUNT REQUIRED TO PLACE A CLEAN SHAFT PLUS 10 PERCENT WASTE.
6. THE USE OF PERMANENT CASING SHALL BE IN ACCORDANCE WITH ITEM 416. MATERIAL COST FOR CASING THAT REMAINS WILL BE PAID BY INVOICE FROM SUPPLIER WITH MARK UP IN ACCORDANCE WITH MATERIAL FOR ITEM 9.7. ADDITIONAL LABOR, EQUIPMENT, TIME, ETC. FOR INSTALLATION OF THE CASING WILL NOT BE COMPENSABLE.
7. ADDITIONAL NAIL LENGTH WILL BE PAID BY OVERRUN OF EXISTING BID ITEM. ALTERNATE NAIL TYPE COST WILL BE PAID BY INVOICE FROM SUPPLIER WITH MARK UP IN ACCORDANCE WITH MATERIAL FOR ITEM 9.7. LABOR, EQUIPMENT, ADDITIONAL TIME, ETC. WILL NOT BE COMPENSABLE.
8. CORE HOLES ARE REQUIRED FOR ALL DRILLED SHAFTS.

Texas Department of Transportation

Austin District Standard

VOID MITIGATION NOTES

VMD-18(AUS)

SHEET 1 OF 7

©TxDOT®YEAR®	CONT	SECT	JOB	HIGHWAY
	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		207

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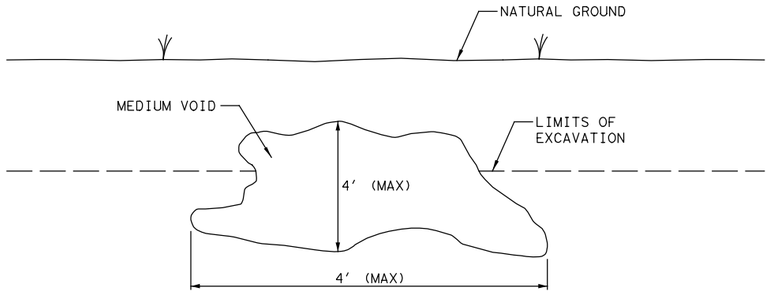
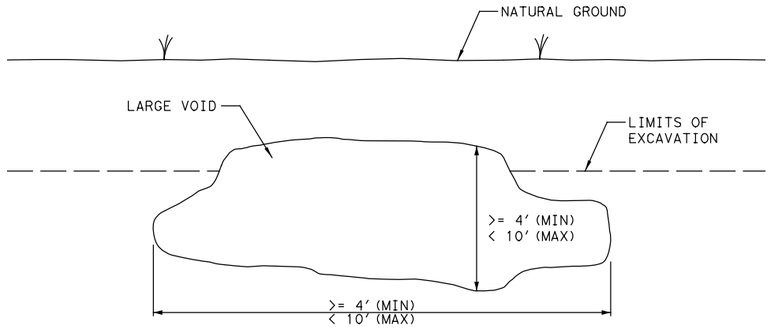
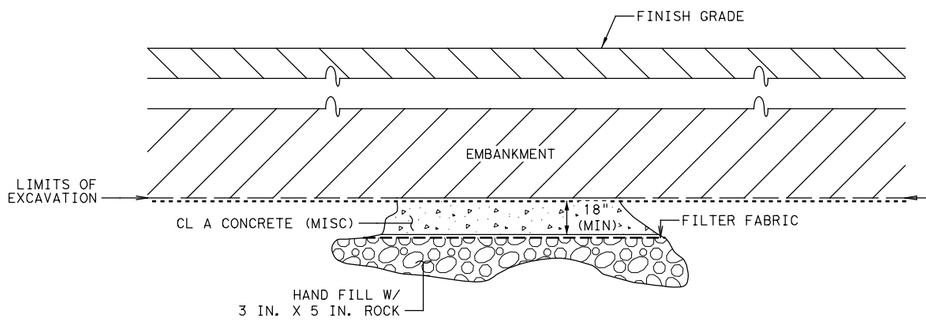
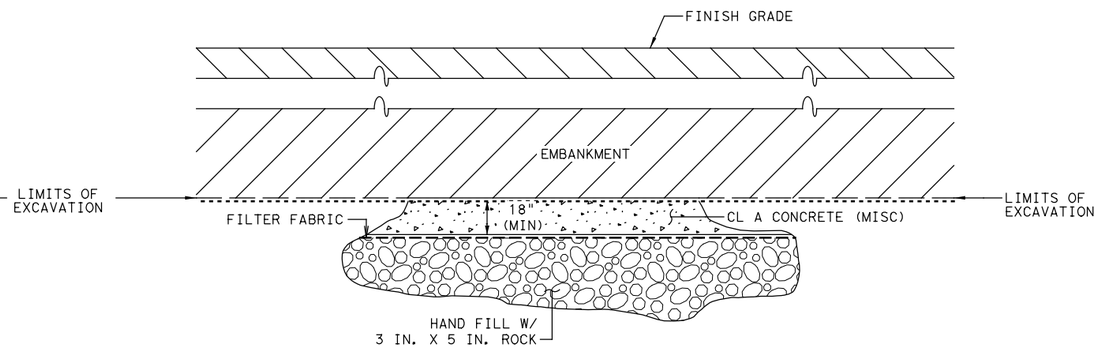






ROADWAY/S.U.P. GRADING OPERATIONS
MEDIUM (DRY VOID)
(<4' IN ANY DIRECTION)
(1 CF < 64 CF)



ROADWAY/S.U.P. GRADING OPERATIONS
LARGE (DRY VOID)
(>=4' <10' ANY DIRECTION)
(64 CF < 1000 CF)

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VOID MITIGATION DETAILS

VMD-18(AUS)

SHEET 2 OF 7

©TxDOT$YEAR$	CONT	SECT	JOB	HIGHWAY
	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		208

DATE: 11/17/2023 5:10:40 PM
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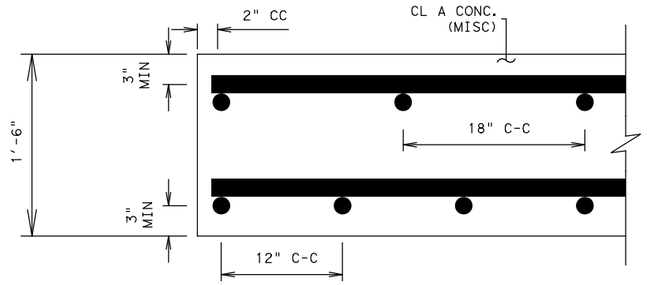
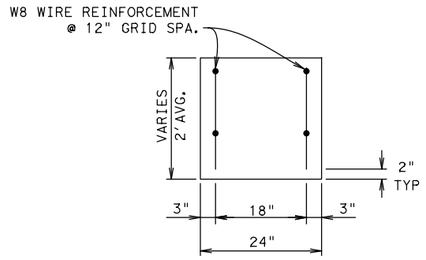


REINFORCING DETAIL



VARIABLE DEPTH CONCRETE WALL

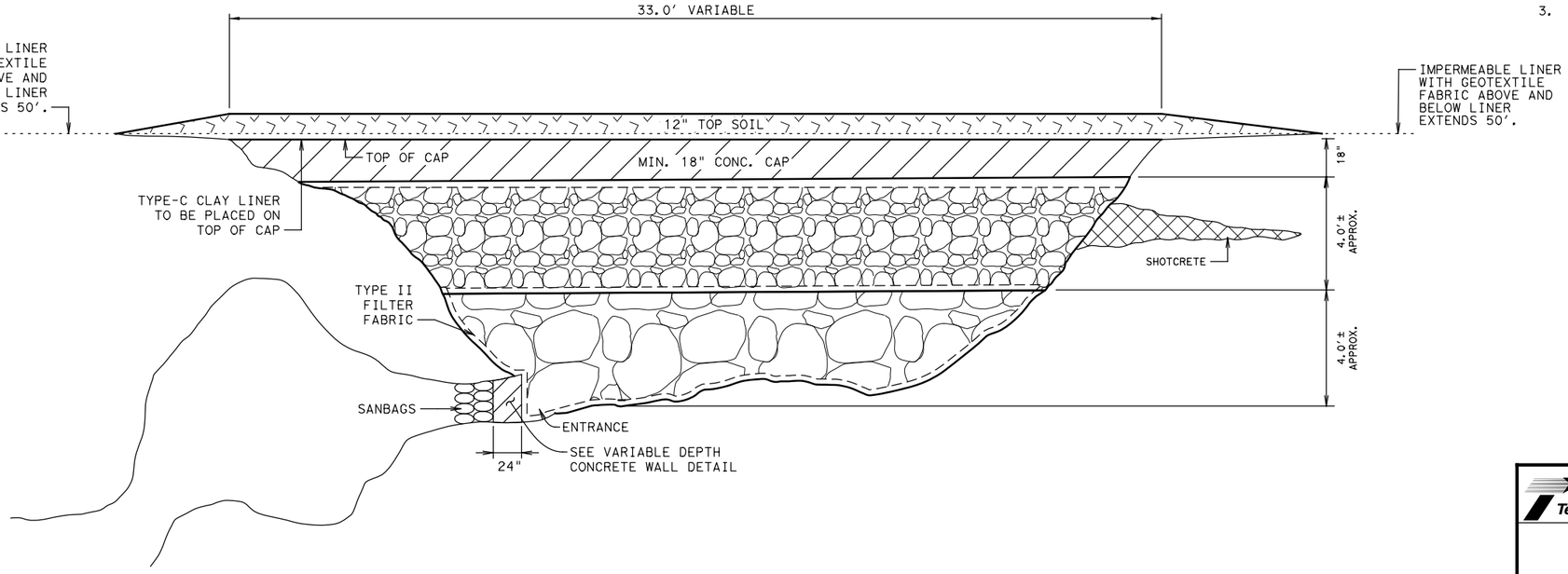
SCALE (IN FEET):
0 5

LEGEND

- CLASS A CONC. (MISC)
- 3 IN. x 5 IN. ROCK
- LARGE ROCK (≥ 1 FT)
- SHOTCRETE

NOTE:

1. CONCRETE WALL AND CONCRETE CAP SHALL BE PAID USING CLASS A CONC. (MISC).
2. SHOTCRETE WILL BE PAID USING CLASS A CONC. (MISC).
3. THE 12 IN. TOPSOIL AND LINER MAY NOT BE APPLICABLE IF THE VOID IS NOT IN A POND.



ELEVATION OF VOID IN A POND

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VOID MITIGATION DETAILS

VMD-18(AUS)

CONT	SECT	JOB	HIGHWAY
0805	04	033	RM 3237
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AUS	HAYS		209

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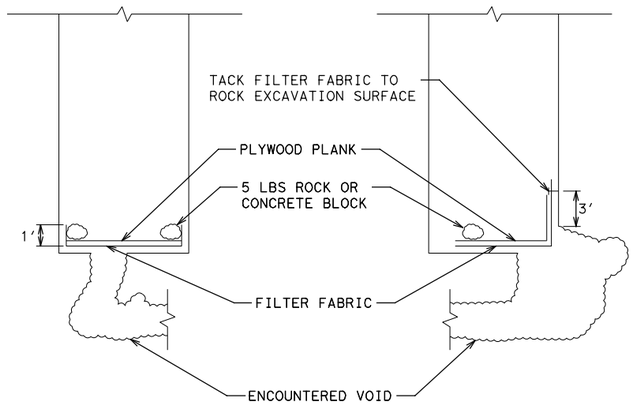

TEMPORARY PROTECTION
VOID AT BOTTOM OF TRENCH

NOTES:

1. PLACE TEMPORARY PROTECTION WITHIN TRENCH TO COVER VOID AS INDICATED. FABRIC SHALL EXTEND A MINIMUM OF 3 IN. BEYOND EDGE OF VOID. PLACE A PLYWOOD PLANK (MINIMUM 0.75 IN. THICK) OVER FABRIC. PLANK AND FABRIC SHALL BE WEIGHTED AS REQUIRED BY 5 LBS ROCK OR CONCRETE BLOCK TO SECURE FILTER FABRIC.

2. TEMPORARY PROTECTION SHALL BE IN PLACE AT ALL TIMES THAT CONSTRUCTION OPERATIONS ARE NOT IN ACTUAL PROGRESS.

3. CONSTRUCTION OPERATIONS WITHIN 50' SHALL NOT PROGRESS DURING OCCURRENCE OF RAIN TO ALLOW FOR PROTECTION OF VOID DURING A RAIN EVENT.

4. LOCALIZED EROSION MEASURES (SILT FENCE, EROSION CONTROL LOG OR TRIANGULAR FILTER DIKES) SHALL BE INSTALLED ALONG THE TRENCH TO ENSURE THAT LOOSE SPOILS OR RUNOFF DO NOT ENTER THE TRENCH OR AFFECT PERFORMANCE OF TEMPORARY PROTECTION. USE EARTHEN BERN TO DIVERT WATER AWAY FROM THE TRENCH.

5. SPECIAL CARE SHALL BE TAKEN TO ENSURE THAT EROSION CONTROL MEASURES REQUIRED ALONG THE TRENCH ARE MAINTAINED, CLEANED AND FULLY FUNCTIONAL.

6. FILTER FABRIC AND ROCK OR CONCRETE BLOCKS AND PLYWOOD PLANK SHALL BE REMOVED FROM THE TRENCH WHEN PERMANENT VOID MITIGATION MEASURES ARE INSTALLED.

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VOID MITIGATION DETAILS

VMD-18(AUS)

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AUS	HAYS		210

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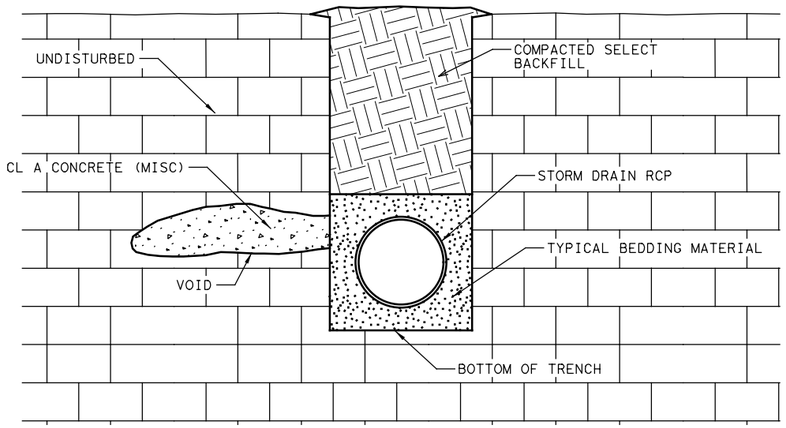
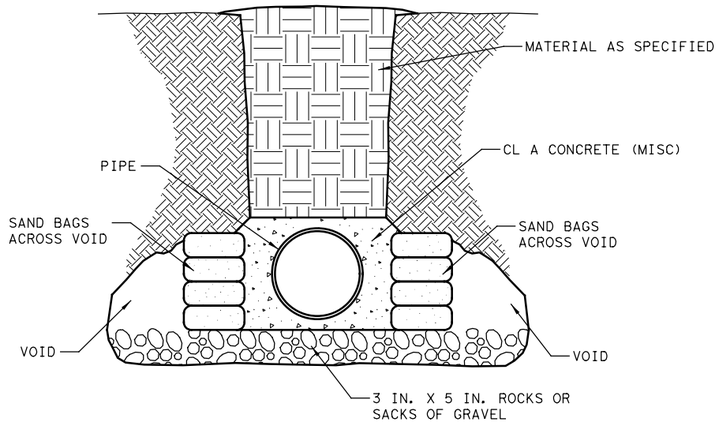


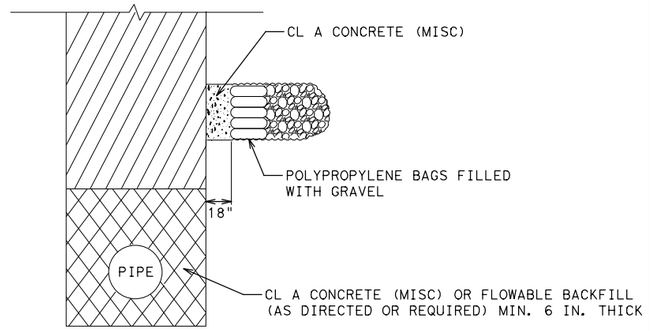
TRENCHING OPERATIONS
SMALL/MEDIUM (DRY VOID)
(<64 CF)

VOID IS EITHER LARGER THAN SIX (6) INCHES IN AT LEAST ONE DIRECTION OR IS LOCATED WITHIN THE LEVEL OF THE PIPE EMBEDMENT. ALL ROCK WITHIN AND SURROUNDING THE VOID IS SOUND.



TRENCHING OPERATIONS
LARGE (DRY VOID)
(64 CF < 1,000 CF)

VOID INTERSECTS THE PLANE OF THE TRENCH FLOOR AND ANY OPENING IN TRENCH FLOOR IS GREATER THAN FOUR (4) FEET IN ANY DIRECTION, OR THE TRENCH FLOOR IS UNSTABLE.

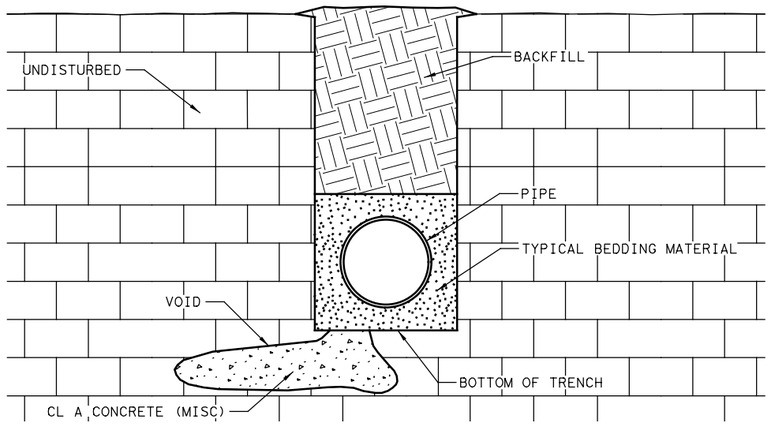


TRENCHING OPERATIONS
LARGE (DRY VOID)
(64 CF < 1,000 CF)

VOID IS ABOVE THE PLANE OF THE TRENCH FLOOR

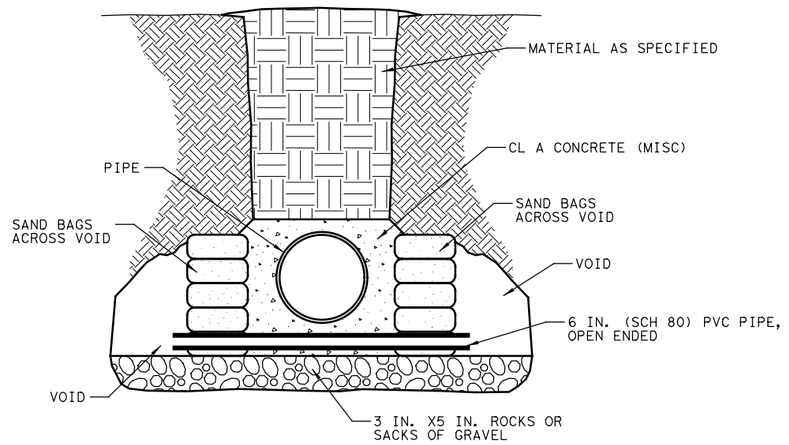
GENERAL NOTE:

1. ALL PIPES SHALL BE ENCASED WITH CLASS A CONCRETE THAT EXTENDS 5' BEYOND THE EDGE OF THE VOIDIN ALL DIRECTIONS. THE CONCRETE SHALL PROVIDE 6 IN. COVER AROUND THE PIPE.



TRENCHING OPERATIONS
SMALL/MEDIUM (DRY VOID)
(<64 CF)

VOID INTERSECTS THE PLANE OF THE TRENCH FLOOR AND IS LESS THAN FOUR (4) FEET IN ANY DIRECTION. ALL ROCK WITHIN AND SURROUNDING THE VOID IS SOUND.



TRENCHING OPERATIONS
LARGE (WET VOID)
(64 CF < 1,000 CF)

VOID INTERSECTS THE PLANE OF THE TRENCH FLOOR AND ANY OPENING IN TRENCH FLOOR IS GREATER THAN FOUR (4) FEET IN ANY DIRECTION, OR THE TRENCH FLOOR IS UNSTABLE.

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VOID MITIGATION DETAILS

VMD-18(AUS)

SHEET 5 OF 7

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	AUS	HAYS		211

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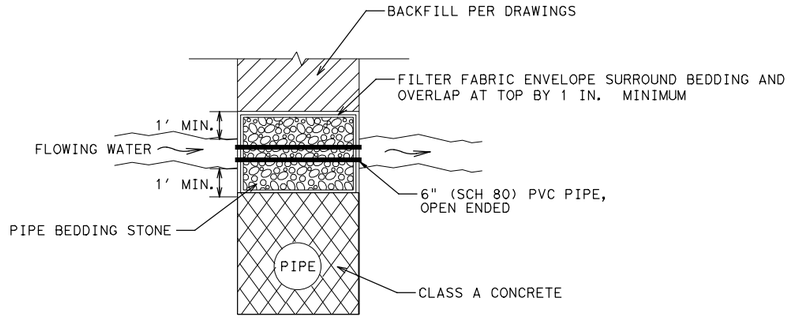
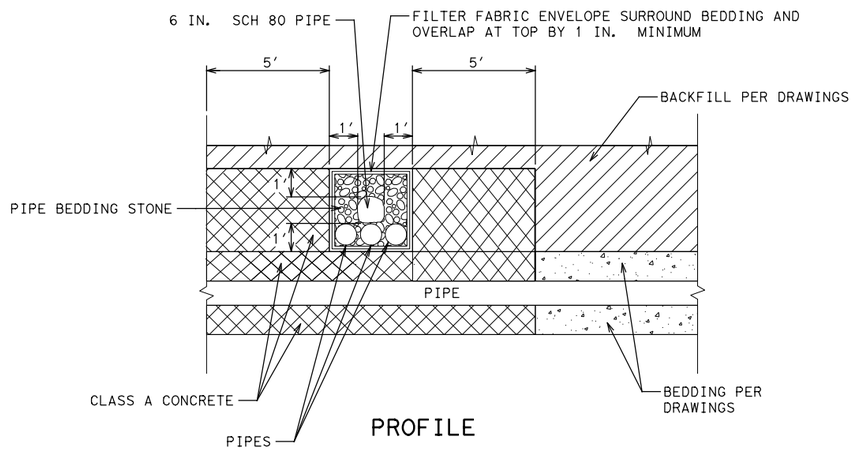


CROSS SECTION



PROFILE

TRENCHING OPERATIONS
GROUNDWATER ABOVE
BEDDING MATERIAL

GENERAL NOTE:

1. ALL PIPES SHALL BE ENCASED WITH CLASS A CONCRETE THAT EXTENDS 5′ BEYOND THE EDGE OF THE VOID IN ALL DIRECTIONS. THE CONCRETE SHALL PROVIDE 6 IN. COVER AROUND THE PIPE.

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VOID MITIGATION DETAILS

VMD-18(AUS)

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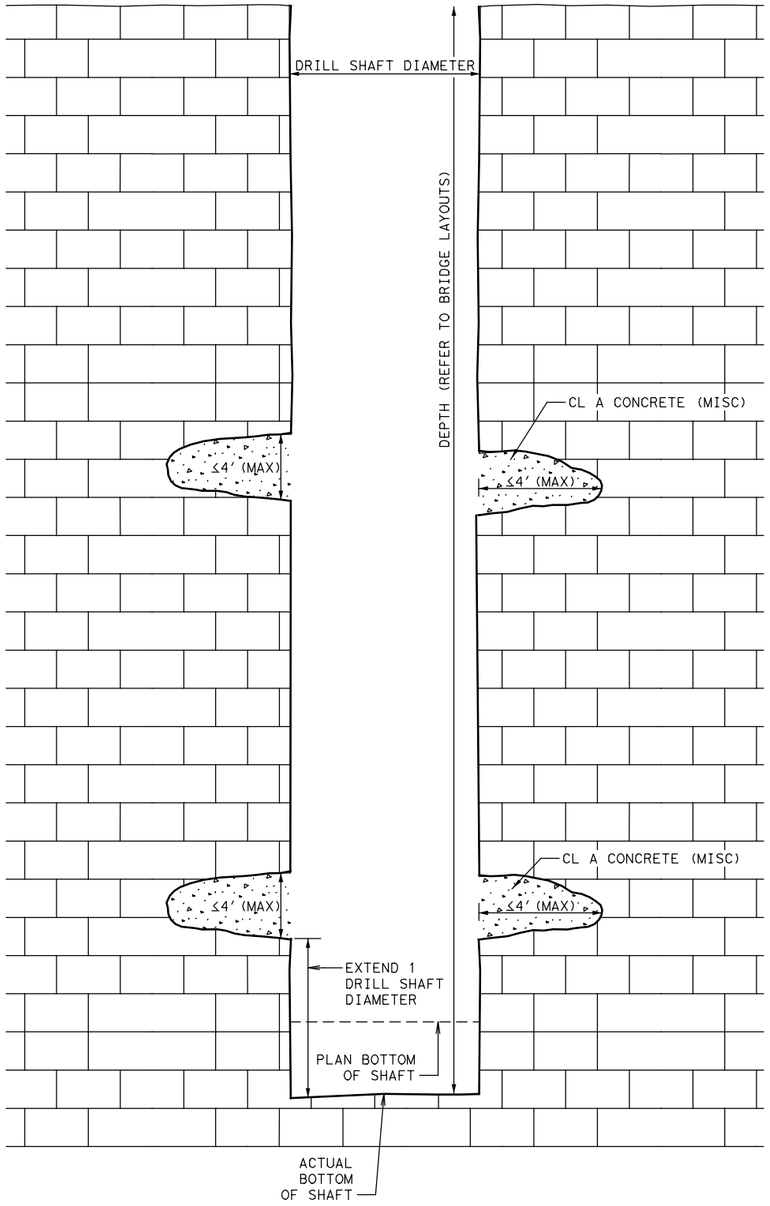
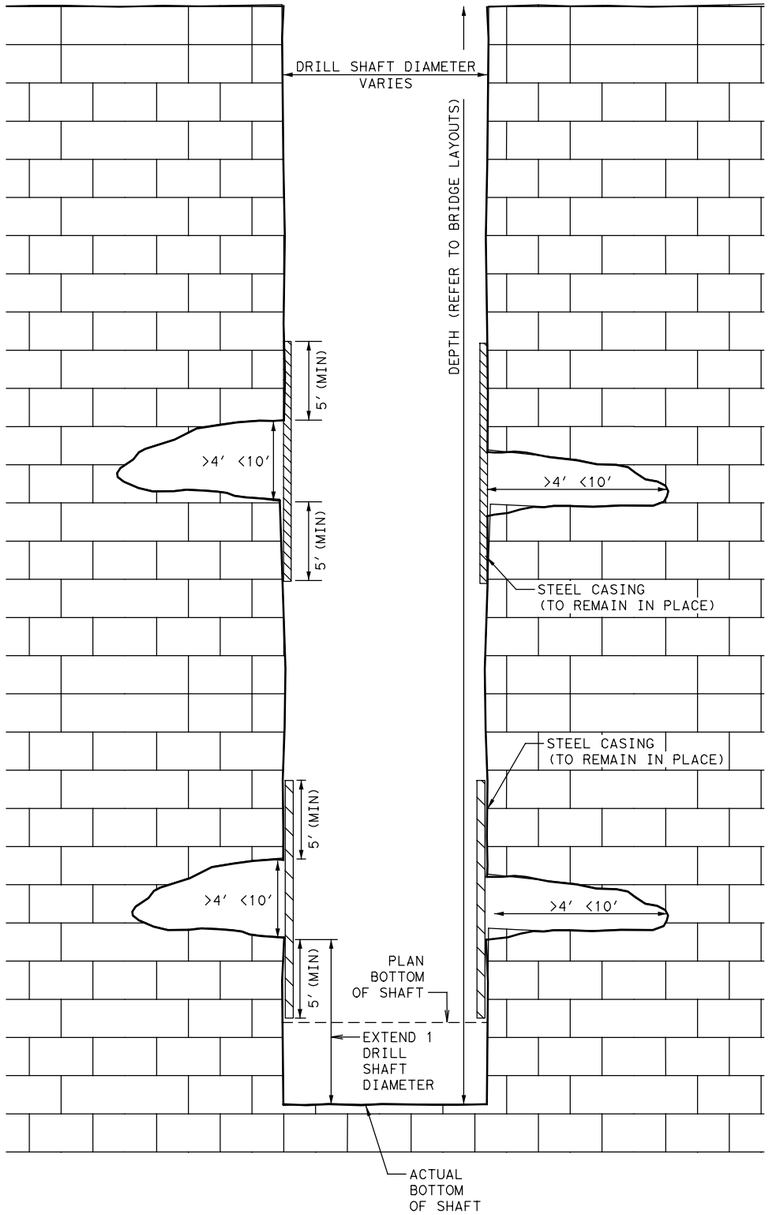


DRILL SHAFT OPERATIONS
SMALL/MEDIUM (DRY VOID)
(≤4′ IN ANY DIRECTION)

CONCRETE FOR THE VOID SHALL BE PLACED CONTINUOUSLY WITH THE SHAFT

WHERE VOIDS ARE ENCOUNTERED, DRILL SHAFT LENGTHS MAY NEED TO BE INCREASED. APPROVAL FROM THE ENGINEER OF RECORD IS REQUIRED TO COMPLETE CONSTRUCTION OF THE DRILLED SHAFT.



DRILL SHAFT OPERATIONS
LARGE (DRY VOID)
(>4′ <10′ IN ANY DIRECTION)

WHERE VOIDS ARE ENCOUNTERED, DRILL SHAFT LENGTHS MAY NEED TO BE INCREASED. APPROVAL FROM THE ENGINEER OF RECORD IS REQUIRED TO COMPLETE CONSTRUCTION OF THE DRILL SHAFT.

NOTES:

1. STEEL CASING WILL BE USED FOR DRILL SHAFT CONSTRUCTION THAT ENCOUNTERS LARGE VOIDS, SO AS TO ALLOW A MINIMUM AMOUNT OF CONCRETE TO ENTER THE VOID.
2. STEEL CASING SHOULD EXTEND A MINIMUM OF FIVE FEET FROM THE EDGE OF THE VOID.
3. AS PART OF THE DRILL SHAFT INSTALLATION PLAN, CONTRACTOR SHALL PROVIDE MEANS AND METHODS FOR ANCHORING THE CASING.
4. REFER TO GENERAL NOTES FOR ADDITIONAL INFORMATION.
5. STEEL CASING MAYBE EXTENDED TO THE TOP OF THE SHAFT. THE ENTIRE LENGTH OF CASING INSTALLED IN A SHAFT WILL BE COMPENSATED IN ACCORDANCE WITH THE VOID MITIGATION NOTES.

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VOID MITIGATION DETAILS

VMD-18(AUS)

SHEET 7 OF 7

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	0805	04	033	RM 3237
	DIST	COUNTY		SHEET NO.
	AUS	HAYS		213

DATE: 11/17/2023 5:10:41 PM
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