STATE OF TEXAS
DEPARTMENT OF TRANSPORTATION

PLANS OF PROPOSED
STATE HIGHWAY IMPROVEMENT

STATE AID PROJECT NO. C110-5-126
CONTROL NO. 0110-05-126

NET LENGTH OF ROADWAY	= 1828.45 FT	= 0.346 MI
NET LENGTH OF BRIDGE	= 389 FT	= 0.0736 MI
NET LENGTH OF PROJECT	= 2217.45 FT	= 0.419 MI

HARRIS COUNTY
IH 45

LIMITS: FROM CYPRESS STATION DR. TO CYPRESS OAKS DR.

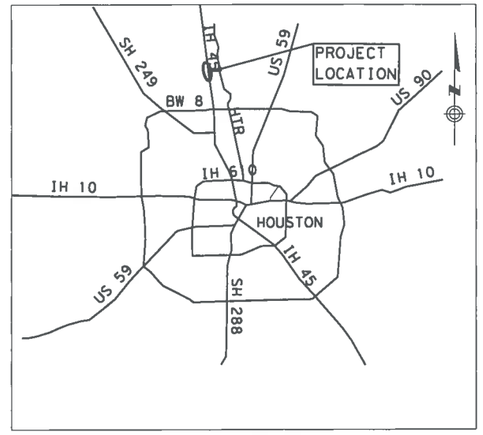
FOR THE CONSTRUCTION OF REPLACEMENT OF IH 45 SB FRONTAGE RD BRIDGE, FRONTAGE RD, SIDEWALK, EXIT RAMP, RETAINING WALL, STORM SEWER, GUARD RAIL, SIGNING AND PAVEMENT MARKING

STATE PROJECT NO.			
C110-05-126			
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45
DIST.	COUNTY		SHEET NO.
HOU	HARRIS		1

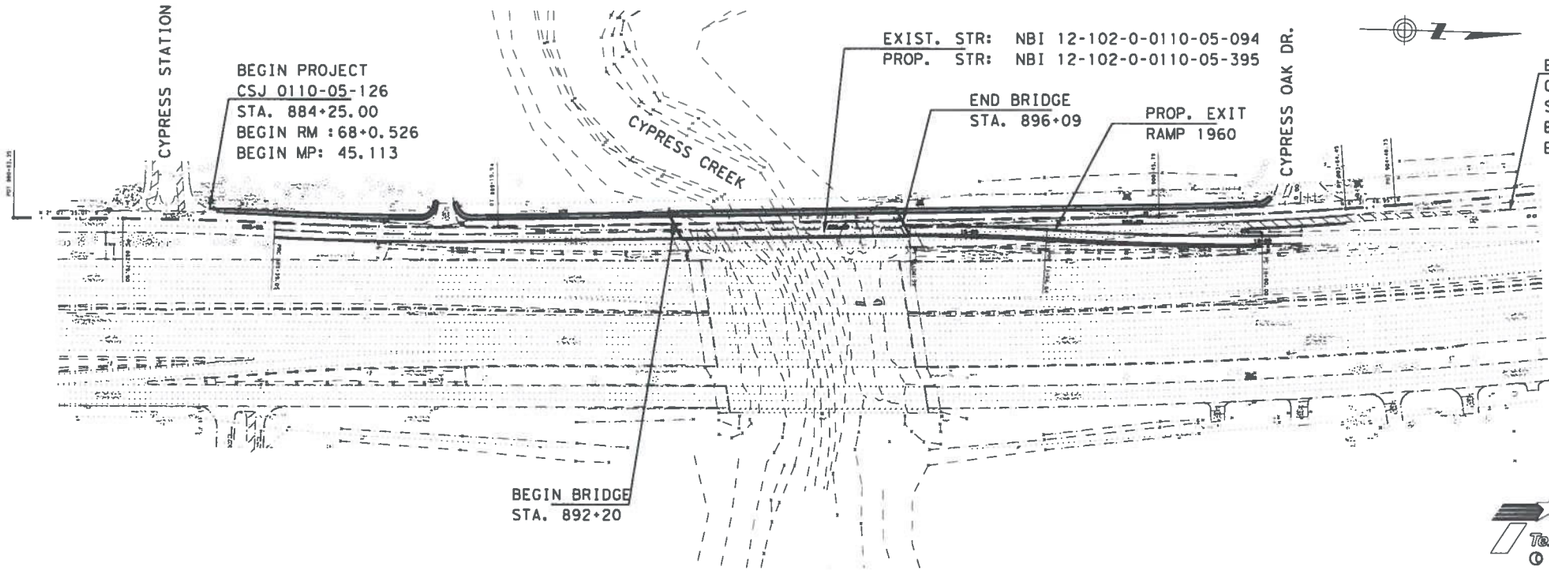
FUNCTIONALCLASSIFICATION: MAJOR COLLECTOR
DESIGN SPEED = 45 MPH

SB FRONTAGE RD:
A.D.T. (2021) = 25,000
A.D.T. (2041) = 34,300

SB MAIN LANE:
A.D.T. (2021) = 91,700
A.D.T. (2041) = 25,000



VICINITY MAP
SCALE: N.T.S



Texas Department of Transportation
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SEE SHEET 2 FOR INDEX SHEET.

REGISTERED ACCESSIBILITY SPECIALIST (RAS) INSPECTION REQUIRED.
TDLR PROJECT NO. TAB S2021021954.

ALL BEARINGS AND COORDINATES ARE BASED ON THE TEXAS STATE PLANE COORDINATE SYSTEM, SOUTH CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983 2011 ADJUSTMENT, EPOCH 2010.00). ALL COORDINATES AND DISTANCE ARE SURFACE AND MAY BE CONVERTED TO GRID BY DIVIDING BY A COMBINED ADJUSTMENT FACTOR 1.00013, THE TEXAS SURFACE ADJUSTMENT FACTOR FOR NORTH HARRIS COUNTY.

SPECIFICATIONS ADOPTED BY THE TEXAS DEPARTMENT OF TRANSPORTATION, NOVEMBER 1, 2014 AND THE SPECIFICATION ITEMS LISTED AND DATED AS FOLLOWS SHALL GOVERN ON THIS PROJECT: REQUIRED SPECIAL LABOR PROVISIONS FOR ALL STATE CONSTRUCTION PROJECTS (SP000-008).

SCALE: N.T.S
EXCEPTIONS: NONE
EQUATIONS: NONE
RAILROAD CROSSINGS: NONE

SUBMITTED FOR LETTING: 9/27/2021
R. A. [illegible], P.E.
AREA ENGINEER

RECOMMENDED FOR LETTING: 10/1/2021
DocuSigned by:
James W. Koch, P.E.
For DISTRICT ENGINEER
8A2ACFA465E24CC...

01/07/2021 10:25 AM
001 TITLE SHEET

INDEX OF SHEETS

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

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED
PROFESSIONAL ENGINEER

Sharmeen Rahman , P.E.

10/26/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

INDEX OF SHEETS

SHEET 1 OF 2

FED.RD. DIV.NO.	PROJECT NO.		SHEET NO.
6			2
STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED PROFESSIONAL ENGINEER

Sharmeen Rahman , P.E.

10/19/2021

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

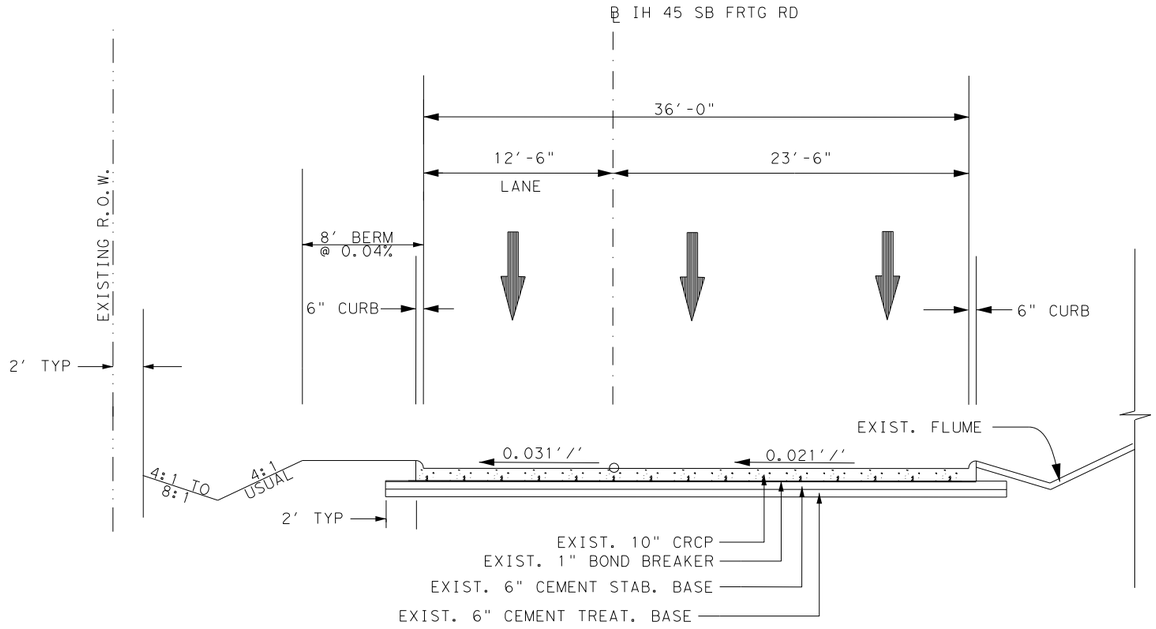
Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

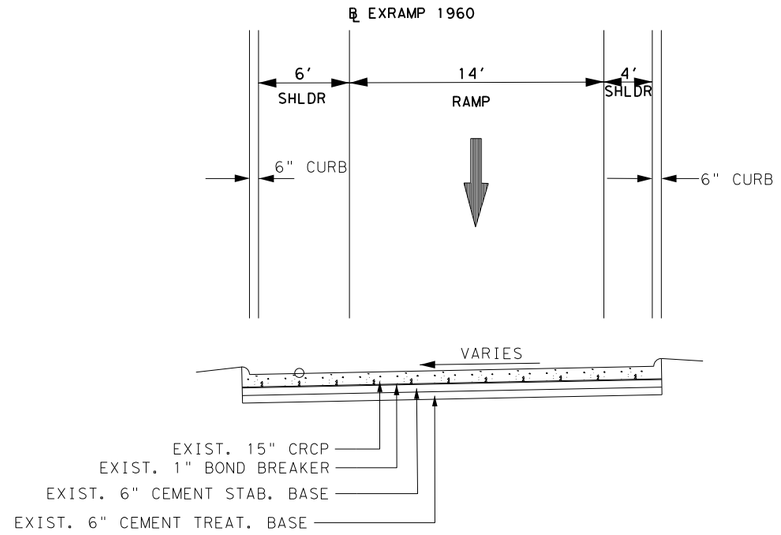
INDEX OF SHEETS

SHEET 2 OF 2

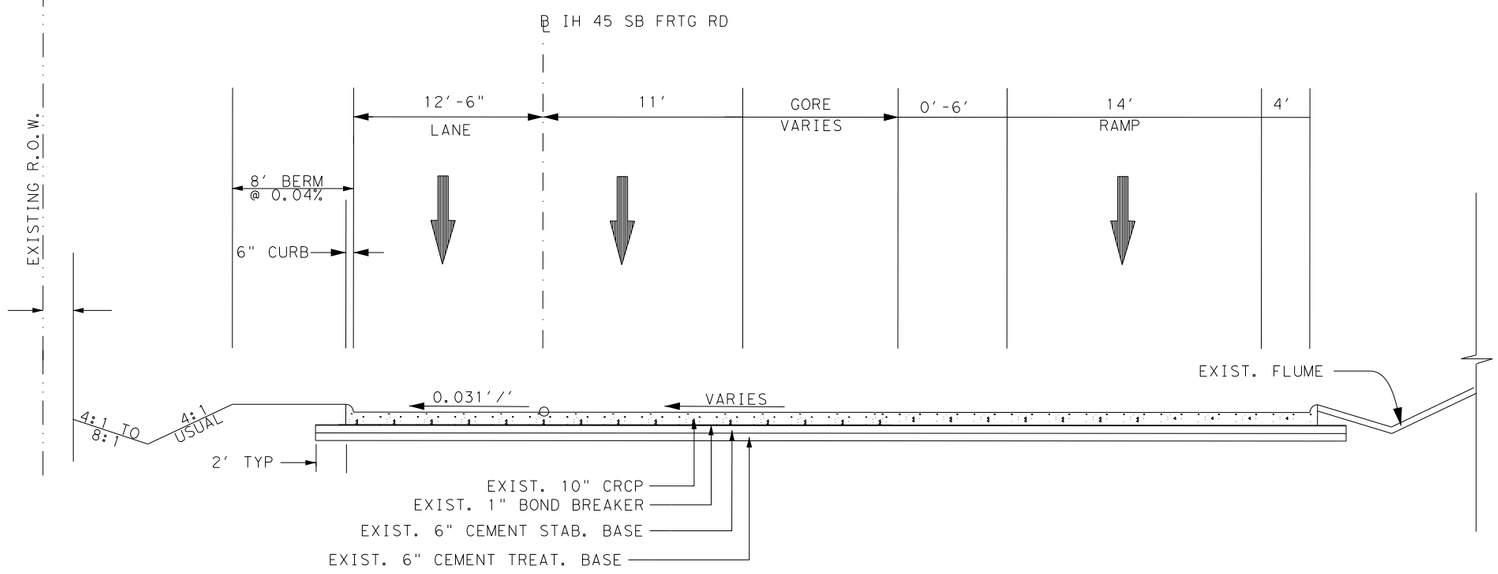
FED.RD. DIV.NO.	PROJECT NO.		SHEET NO.
6			3
STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45



EXISTING SB FRTG RD TYPICAL SECTION
STA. 884+25.00 TO STA. 892+38.25
STA. 896+14 TO STA. 897+83



EXIST. RAMP
STA. 5+64.33 TO STA. 7+28.38



EXISTING SB FRTG RD TYPICAL SECTION
STA. 897+83 TO STA. 902+89

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED
PROFESSIONAL ENGINEER

Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45

SB FRONTAGE RD EXISTING TYPICAL SECTIONS

NOT TO SCALE SHEET 1 OF 1

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		4

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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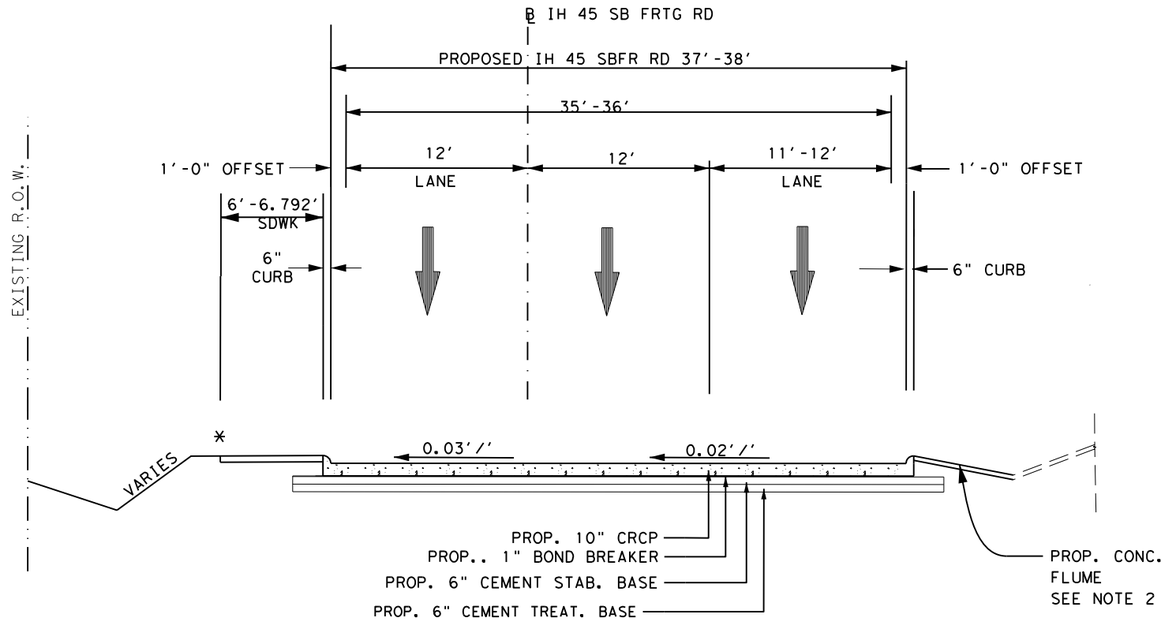
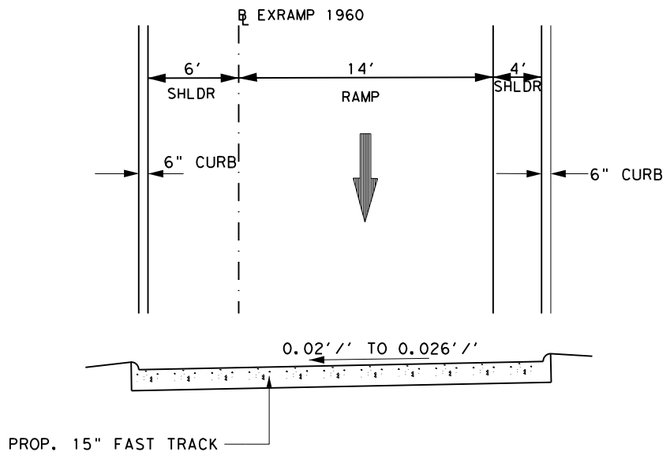


PROPOSED SB FRTG RD TYPICAL SECTION
STA. 884+25.00 TO STA. 892+20.00
STA. 896+09.00 TO STA. 897+29.23



PROPOSED RAMP
STA. 5+28.14 TO STA. 7+28.38

* RETAINING WALL LIMIT:

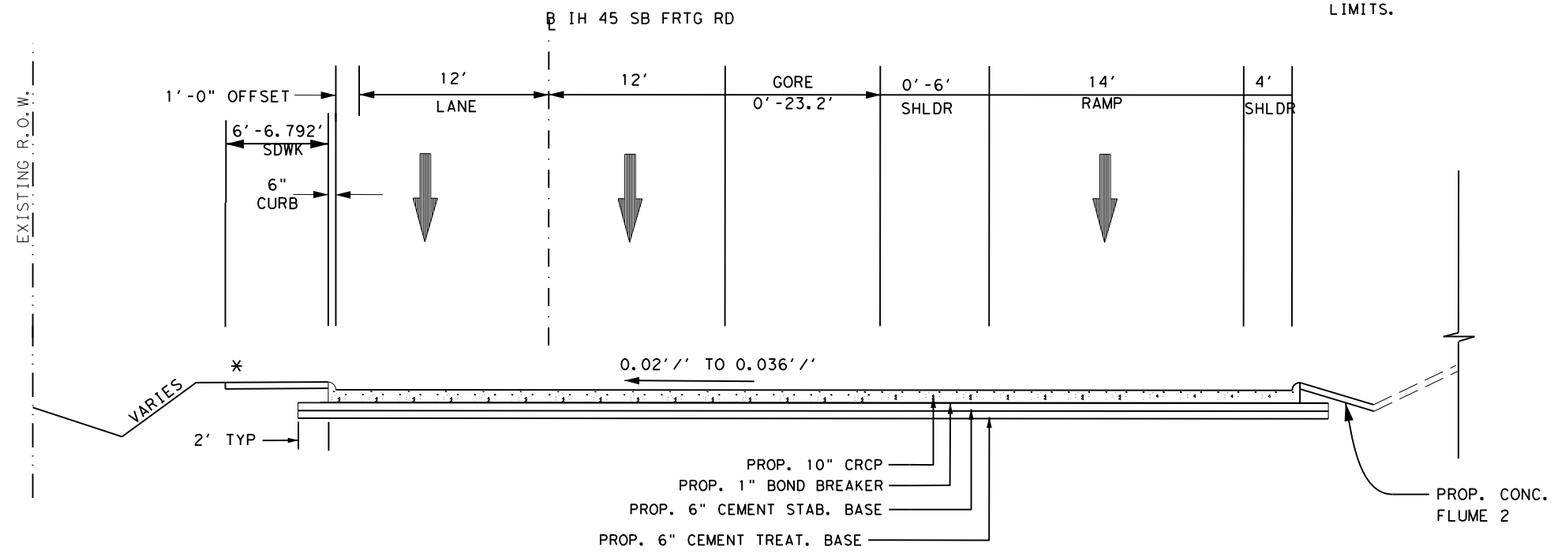
FROM IH 45 SBFR STA. 889+00.00 TO 892+45.57
FROM IH 45 SBFR STA. 895+75.11 TO 900+19.21

SEE SHEET 147-149 FOR RETAINING WALL DETAILS.

NOTE:

1. 13" FAST TRACK LIMIT:
   ℄ IH45 SBFR STA. 896+09 TO STA. 898+21.30
   15" FAST TRACK LIMIT:
   ℄ EXRAMP 1960 STA. 5+28.14 TO 7+28.32

2. SEE SHEET 130-133 FOR PROP. CONC. FLUME DETAILS AND LIMITS.



PROPOSED SB FRTG RD TYPICAL SECTION
STA. 897+29.23 TO STA. 902+36.52

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED
PROFESSIONAL ENGINEER

Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45

SB FRONTAGE RD PROPOSED TYPICAL SECTIONS

NOT TO SCALE SHEET 1 OF 1

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		4A

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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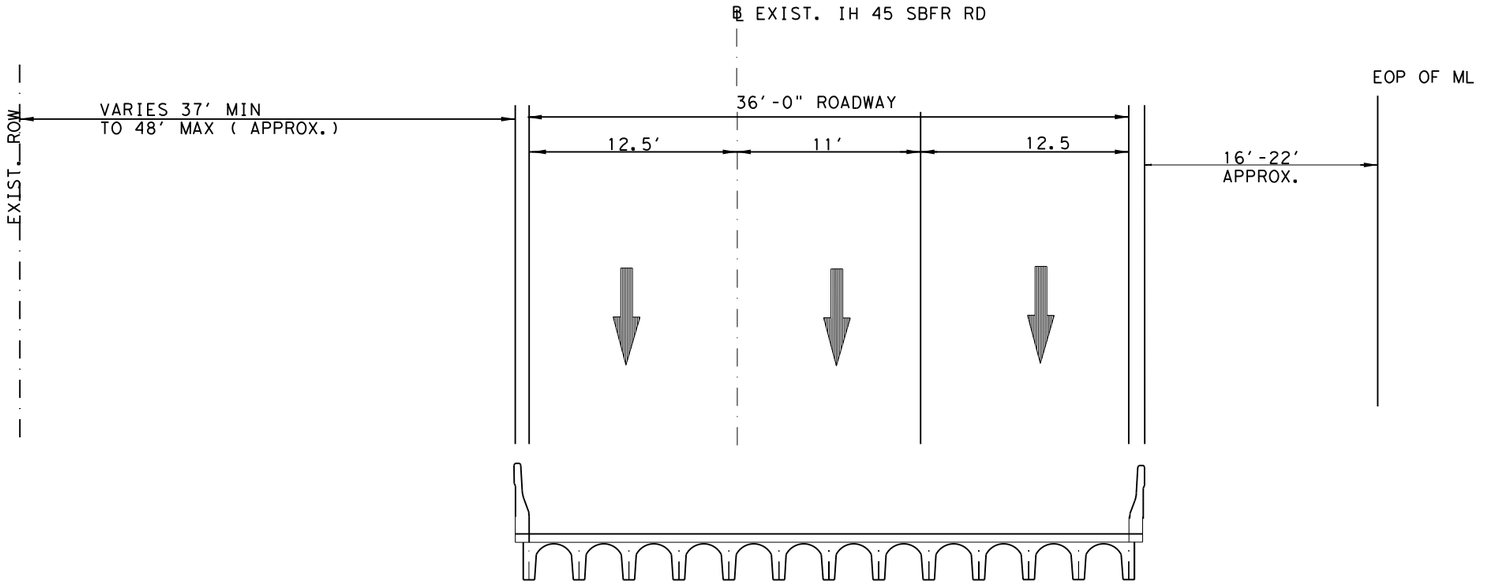

EXISTING BRIDGE TYPICAL SECTION
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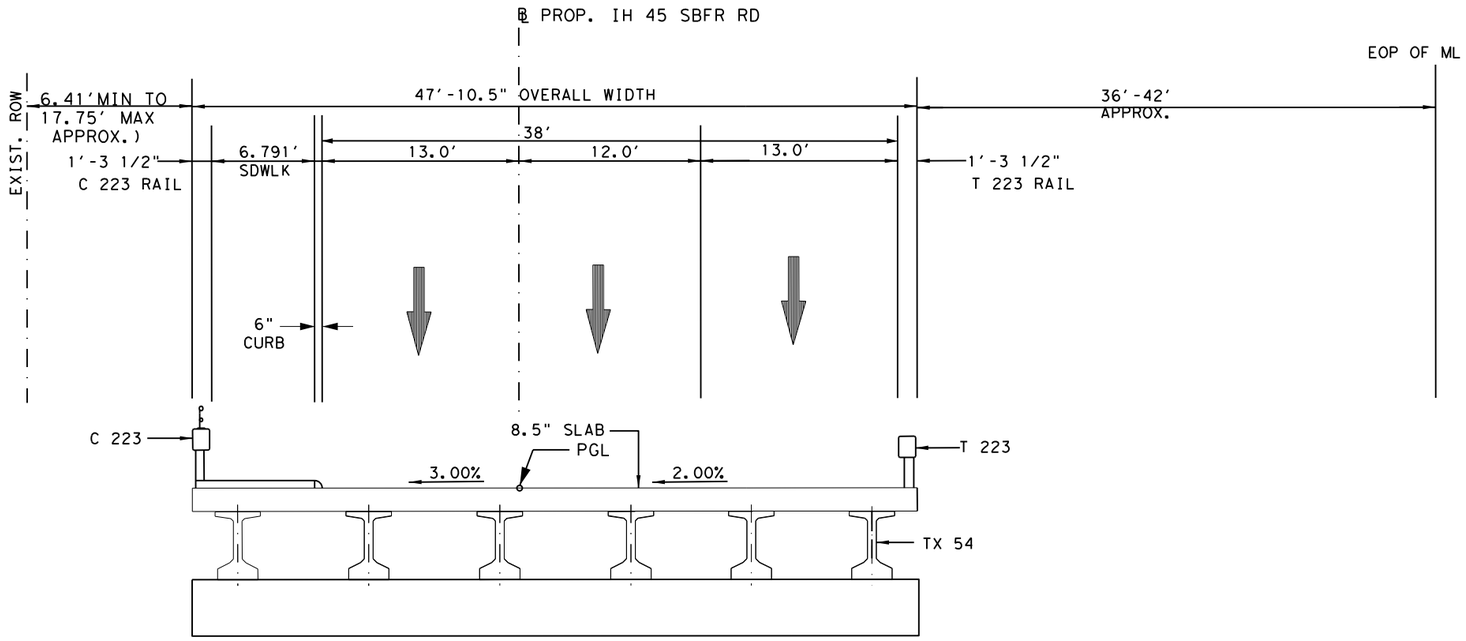

PROPOSED BRIDGE TYPICAL SECTION
STA. 892+20.00 TO STA. 896+09.00

Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45

SB FRONTAGE RD CYPRESS CREEK BRIDGE TYPICAL SECTIONS

NOT TO SCALE SHEET 1 OF 1

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		5

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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General Notes:

General:

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

Phillip A. Garlin *Phillip. Garlin@txdot.gov*
Roger Lopez *Roger Lopez@txdot.gov*

Contractor questions will be accepted through email, phone, and in person by the above individuals. Contractor questions will be reviewed by the Area Engineer or Assistant Area Engineer. Once a response is developed, it will be posted to TxDOT's Public FTP at the following address:

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

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

Unless otherwise shown on the plans, RAP generated by this project will become the property of the Contractor for use in the current construction project or in future projects.

If fixed features require, the governing slopes shown may vary between the limits shown and to the extent determined by the Engineer.

Superelevate the curves to match the existing surface.

Notify the Engineer immediately if discrepancies are discovered in the horizontal control or the benchmark data.

The following standard detail sheets are modified:

Modified Standards

MH- M *MH-M(MOD)*

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, except for roadway illumination, electrical, and traffic signal items.

The cost for materials, labor, and incidentals to provide for traffic across the roadway and for ingress and egress to private property in accordance with Section 7.2.4 of the standard

specifications is subsidiary to the various bid items. Restore access roadways to their original condition upon completing construction.

If a foundation is to be placed where a riprap surface or an asphalt concrete surface presently exists, use caution in breaking out the existing surface for placement. Break out no greater area than is required to place the foundation. After placing the foundation, wrap the periphery with 0.5 in. pre-molded mastic expansion joint. Then replace the remaining portion of the broken out surface with Class A or Class C concrete or cold mix asphalt concrete to the exact slope, pattern, and thickness of the existing riprap or asphalt. Payment for breaking out the existing surface, wrapping the foundation, and replacing the surface is subsidiary to the various bid items.

The lengths of the posts for ground mounted signs and the tower legs for the overhead sign supports are approximate. Verify the lengths before ordering these materials to meet the existing field conditions and to conform to the minimum sign mounting heights shown in the plans.

Furnish aluminum Type A signs instead of plywood signs for signs shown on the Summary of Small Signs sheet.

Stencil the National Bridge Inventory (NBI) number on each existing bridge shown on these plans. The NBI number is shown above the title block for each bridge layout.

Clearly mark or highlight on the shop drawings, the items being furnished for this project. Submit required shop drawings in accordance with the shop drawing distribution list shown in the note for Item 5 for review and distribution.

Make requests for additional soil information for this project at the Area Engineer's office.

Unless otherwise shown on the plans or otherwise directed, commence work after sunrise and ensure construction equipment is off the road by sunset.

Procure permits and licenses, which are to be issued by the City, County, or Municipal Utility District.

The existing bridges have been tested for Asbestos Containing Materials (ACM) and found to contain greater than 1% ACM and will be abated during construction. The ACM were found in the outer I- Beams.

TxDOT will be responsible for contracting a specialty subcontractor to abate ACM's in accordance with TxDOT 2014 Standard Specification 6.10 and applicable regulatory requirements, including 40 CFR 61.145 (Renovation and Demolition of Structures- Asbestos NESHAP) and OSHA 29 CFR 1926.1101 (Asbestos Standard for Construction), prior to dismantling the bridge.

Any groundwater elevation information provided is representative of conditions existing on the day when and for the specific location where this information was collected. The actual groundwater elevation may fluctuate with time, climatic conditions, and construction activity.

General: Roadway Illumination and Electrical

For roadway illumination and electrical items, use materials from pre-qualified producers as shown on the Construction Division (CST) of the Department's material producers list. Check the latest link on the Department's website for this list. The category/item is "Roadway Illumination and Electrical Supplies." No substitutions will be allowed for materials found on this list.

Perform electrical work in conformance with the National Electrical Code (NEC) and the Department's standard sheets.

General: Traffic Signals

For traffic signal items, use materials from the Pre-Qualified Producers List (located at http://www.dot.state.tx.us/GSD/purchasing/supps.htm) and the materials pre-qualified for illumination and electrical items (located at http://ftp.dot.state.tx.us/pub/txdot-info/cmd/mpl/riaes.pdf) as shown on the Department's Material Producers List and the Roadway Illumination and Electrical Supplies List. Check the latest links on the Department's website for these lists. No substitutions will be allowed for materials found on these lists.

General: Site Management

Mow the grass and weeds within the project limits a maximum of 3 times a year as directed. This work is subsidiary to the various bid items.

Mark stations every 100 ft. and maintain the markings for the project duration. Remove the station markings at the completion of the project. This work is subsidiary to the various bid items.

Do not mix or store materials, or store or repair equipment, on top of concrete pavement or bridge decks unless authorized by the Engineer. Permission will be granted to store materials on surfaces if no damage or discoloration will result.

Personal vehicles of employees are not permitted to park within the right of way, including sections closed to public traffic. Employees may park on the right of way at the Contractor's office, equipment, and materials storage yard sites.

Assume ownership of debris and dispose of at an approved location. Do not dispose of debris on private property unless approved in writing by the District Engineer.

Control the dust caused by construction operations. For sweeping the base material in preparation for laying asphalt and for sweeping the finished concrete pavement, use one of the following types of sweepers or approved equal:

Tricycle Type	**Truck Type - 4 Wheel**
Wayne Series 900	M-B Cruiser II
Elgin White Wing	Wayne Model 945
Elgin Pelican	Mobile TE-3
	Mobile TE-4
	Murphy 4042

General: Traffic Control and Construction

Schedule construction operations such that preparing individual items of work follows in close sequence to constructing storm drains in order to provide as little inconvenience as practical to the businesses and residents along the project.

Schedule work so that the base placement operations follow the subgrade work as closely as practical to reduce the hazard to the traveling public and to prevent undue delay caused by wet weather.

This project requires extensive grading operations in an environmentally sensitive area.

If relocating mailboxes, place them with the post firmly in the ground at nearby locations. Upon completing the project, the Engineer will locate the final mailbox placement. Perform this work in accordance with the requirements of the Item, "Mailbox Assemblies," except for measurement and payment. This work is subsidiary to the various bid items.

If fences cross construction easements shown on the plans and work is required beyond the fences, remove and replace the fences as directed. This work and the materials are subsidiary to the various bid items.

When design details are not shown on the plans, provide signs and arrows conforming to the latest "Standard Highway Sign Designs for Texas" manual.

General: Utilities

Consider the locations of underground utilities depicted in the plans as approximate and employ responsible care to avoid damaging utility facilities. Depending upon scope and magnitude of planned construction activities, advanced field confirmation by the utility owner or operator may be prudent. Where possible, protect and preserve permanent signs, markers, and designations of underground facilities.

If the Contractor damages or causes damage (breaks, leaks, nicks, dents, gouges, etc.) to the utility, contact the utility facility owner or operator immediately.

Be aware that an operational Computerized Transportation Management System (CTMS) exists within the limits of this project and that the system must remain operational throughout construction. If the Contractor damages or causes damage to this system, repair such damage within 8 hours of occurrence at no cost to the Department. In the event of system damage, notify the Director of Traffic Management Systems at 713-881-3283 within one hour of occurrence. Failure of the Contractor to repair damage to the main fiber optic cable and CCTV cable trunk lines, which convey all corridor information to TranStar, will result in the Contractor being billed for the full cost of emergency repairs.

At least 72 hours before starting work, make arrangements for locating existing Department-owned above ground and underground fiber optic, communications, power, illumination, and traffic signal cabling and conduit. Do this by calling the Department's Houston District Traffic Signal Operations Office at 713-802-5662, or by e-mailing the Department's Houston District Traffic Signal Operations Office at "HOU-LocateRequest@txdot.gov", to schedule marking of underground lines on the ground. Use caution if working in these areas to avoid damaging or interfering with existing facilities.

Notify the Engineer at least 48 hours before constructing junction boxes at storm drain and utility intersections.

Install or remove poles and luminaires located near overhead or underground electrical lines using established industry and utility safety practices. Consult the appropriate utility company before beginning such work.

If overhead or underground power lines need to be de-energized, contact the electrical service provider to perform this work. Costs associated with de-energizing the power lines or other protective measures required are at no expense to the Department.

If working near power lines, comply with the appropriate sections of Texas State Law and Federal Regulations relating to the type of work involved.

Perform electrical work in conformance with the National Electrical Code (NEC) and Department's standard sheets.

Before beginning any underground work, notify the City of Houston's Chief Inspector, Public Works and Engineering, to establish the locations of any existing electrical systems for lighting facilities within the limits of this project.

Item 5: Control of Work

Before contract letting, cross-section data for this project will be available to the prospective bidders in PDF format on the Department's Houston District website located at:

https://ftp.dot.state.tx.us/pub/txdot-info/Pre-Letting%20Responses/Houston%20District/Construction%20Projects/

The cross-section data provided above is for non-construction purposes only and it is the responsibility of the prospective bidder to validate the data with the appropriate plans, specifications, and estimates for the projects.

Submit shop drawings electronically for the fabrication of items as documented in Table 1 or Table 2 below. Information and requirements for electronic submittals can be viewed in the "Guide to Electronic Shop Drawing Submittal" which can be accessed through the following web link, ftp://ftp.dot.state.tx.us/pub/txdot-info/library/pubs/bus/bridge/e_submit_guide.pdf. References to 11 in. x 17 in. sheets in individual specifications for structural items imply electronic CAD sheets.

Table 1

2014 Construction Specification Required Shop/Working Drawing Submittals - TxDOT Generated Plans

Spec Item No.'s	Product	Submittal Required	Approval Required (Y/N)	Contractor/ Fabricator P.E. Seal Required	Reviewing Party	Shop or Working Drawing (Note 1)
7.16.1&.2	Construction Load Analyses	Y	Y	Y	B	WD
400	Excavation and Backfill for Structures (cofferdams)	Y	N	Y	A	WD
403	Temporary Special Shoring	Y	N	Y	C	WD
420	Formwork/Falsework	Y	N	Y	A	WD
423	Retaining Walls, (calcs req'd.)	Y	Y	Y	C	SD
425	Optional Design Calculations (Prstrs Bms)	Y	Y	Y	B	SD
425	Prestr Concr Sheet Piling	Y	Y	N	B	SD
425	Prestr Concr Beams	Y	Y	N	B	SD
425	Prestr Concr Bent	Y	Y	N	B	SD
426	Post Tension Details	Y	Y	N	B	SD
434	Elastomeric Bearing Pads (All)	Y	Y	N	B	SD
441	Bridge Protective Assembly	Y	Y	N	B	SD
441	Misc Steel (various steel assemblies)	Y	Y	N	B	SD
441	Steel Pedestals (bridge raising)	Y	Y	N	B	SD
441	Steel Bearings	Y	Y	N	B	SD
441	Steel Bent	Y	Y	N	B	SD
441	Steel Diaphragms	Y	Y	N	B	SD
441	Steel Finger Joint	Y	Y	N	B	SD
441	Steel Plate Girder	Y	Y	N	B	SD
441	Steel Tub-Girders	Y	Y	N	B	SD
441	Erection Plans, including Falsework	Y	N	Y	A	WD

449	Sign Structure Anchor Bolts	Y	Y	N	T	SD
450	Railing	Y	Y	N	A	SD
462	Concrete Box Culvert	Y	Y	N	C	SD
462	Concrete Box Culvert (Alternate Designs Only,calcs reqd.)	Y	Y	Y	B	SD
464	Reinforced Concrete Pipe (Jack and Bore only; ONLY when requested)	Y	Y	Y	A	SD
465	Pre-cast Junction Boxes, Grates, and Inlets	Y	Y	N	A	SD
465	Pre-cast Junction Boxes, Grates, and Inlets (Alternate Designs Only, calcs req'd.)	Y	Y	Y	B	SD
466	Pre-cast Headwalls and Wingwalls	Y	Y	N	A	SD
467	Pre-cast Safety End Treatments	Y	Y	N	A	SD
495	Raising Existing Structure (calcs reqd.)	Y	Y	Y	B	SD
610	Roadway Illumination Supports (Non-Standard only, calcs reqd.)	Y	Y	Y	BRG	SD
613	High Mast Illumination Poles (Non-standard only, calcs reqd.)	Y	Y	Y	BRG	SD
627	Treated Timber Poles	Y	Y	N	T	SD
644	Special Non-Standard Supports (Bridge Mounts, Barrier Mounts, Etc.)	Y	Y	Y	T	SD
647	Large Roadside Sign Supports	Y	Y	Y	T	SD
650	Cantilever Sign Structure Supports - Alternate Design Calcs.	Y	Y	Y	T	SD
650	Sign Structures	Y	Y	N	T	SD
680	Installation of Highway Traffic Signals	Y	Y	N	T	SD
682	Vehicle and Pedestrian Signal Heads	Y	Y	N	T	SD
684	Traffic Signal Cables	Y	Y	N	T	SD
685	Roadside Flashing Beacon Assemblies	Y	Y	N	T	SD
686	Traffic Signal Pole Assemblies (Steel) (Non-Standard only)	Y	Y	Y	T	SD
687	Pedestal Pole Assemblies	Y	Y	N	T	SD
688	Detectors	Y	Y	N	A	SD
784	Repairing Steel Bridge Members	Y	Y	Y	B	WD
SS	Prestr Concr Crown Span	Y	Y	N	B	SD
SS	Sound Barrier Walls	Y	Y	Y	A	SD
SS	Camera Poles	Y	Y	Y	TMS	SD
SS	Pedestrian Bridge (Calcs req'd.)	Y	Y	Y	B	SD
SS	Screw-In Type Anchor Foundations	Y	Y	N	T	SD
SS	Fiber Optic/Communication Cable	Y	Y	N	TMS	SD
SS	Spread Spectrum Radios for Signals	Y	Y	N	T	SD
SS	VIVDS System for Signals	Y	Y	N	T	SD
SS	CTMS Equipment	Y	Y	N	TMS	SD

Notes:

1. Document flow for Working Drawings differs from Shop Drawings in that Working Drawings must be submitted to the Engineer rather than the Engineer of Record and they are for the information of the Engineer only; an approval stamp and distribution to all project offices is not required.

Key to Reviewing Party

A - Area Office

Area Office	Email Address
Brazoria Area Office	HOU-BRZAShpDrwgs@txdot.gov
Fort Bend Area Office	HOU-FBAShpDrwgs@txdot.gov
Galveston Area Office	HOU-GALVAShpDrwgs@txdot.gov
Montgomery Area Office	HOU-MONTAShpDrwgs@txdot.gov
North Harris Area Office	HOU-NHAShpDrwgs@txdot.gov
Southeast Area Office	HOU-SEHAShpDrwgs@txdot.gov
Traffic Systems Construction Office	HOU-TSCShpDrwgs@txdot.gov
West/Central Harris Area Office	HOU-WWCHAOShpDrwgs@txdot.gov

B - Houston Bridge Engineer

Bridge Design (Houston TxDOT)	HOU-BrgShpDrwgs@txdot.gov

BRG - Austin Bridge Division

Bridge Design (Austin TxDOT)	BRG_ShopPlanReview@txdot.gov

C - Construction Office

Construction	HOU-ConstrShpDrwgs@txdot.gov
Laboratory	HOU-LabShpDrwgs@txdot.gov

T - Traffic Engineer

Traffic Operations	HOU-TrfShpDrwgs@txdot.gov

TMS – Traffic Management System

Computerized Traffic Management Systems (CTMS)	HOU-CTMSShpDrwgs@txdot.gov

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

Item 7: Legal Relations and Responsibilities

Do not initiate activities in a Project Specific Location (PSL), associated with a U.S. Army Corps of Engineers (USACE) permit area, that have not been previously evaluated by the USACE as part of the permit review of this project. Such activities include those pertaining to, but are not limited to, haul roads, equipment staging areas, borrow and disposal sites. Associated defined here means materials are delivered to or from the PSL. The permit area includes the waters of the U.S. or associated wetlands affected by activities associated with this project. Special restrictions may be required for such work. Assume responsibility for consultations with the

USACE regarding activities, including PSLs that have not been previously evaluated by the USACE. Provide the Department with a copy of consultations or approvals from the USACE before initiating activities.

The Contractor may proceed with activities in PSLs that do not affect a USACE permit area if a self-determination has been made that the PSL is non-jurisdictional or if proper USACE clearances have been obtained in jurisdictional areas or have been previously evaluated by the USACE as part of the permit review of this project. The Contractor is solely responsible for documenting any determinations that their activities do not affect a USACE permit area. Maintain copies of their determinations for review by the Department or any regulatory agency.

Document and coordinate with the USACE, if required, before hauling any excavation from or hauling any embankment to a USACE permit area by either 1 or 2 below:

1. **Restricted Use of Materials for the Previously Evaluated Permit Areas.** Document both the Project Specific Locations (PSL) and their authorization. Maintain copies for review by the Department or any regulatory agency. When an area within the project limits has been evaluated by the USACE as part of the permit process for this project:
   a. Suitable excavation of required material in the areas shown on the plans and cross sections as specified in the Item, "Excavation" is used for permanent or temporary fill (under the Item, "Embankment") within a USACE permit area.
   b. Suitable embankment (under the Item, "Embankment") from within the USACE permit area is used as fill within a USACE evaluated area.
   c. Unsuitable excavation or excess excavation, "Waste" (under the Item, "Excavation"), that is disposed of at a location approved within a USACE evaluated area.

2. **Contractor Materials from Areas Other than Previously Evaluated Areas.** Provide the Department with a copy of USACE coordination or approvals before initiating any activities for an area within the project limits that has not been evaluated by the USACE or for any off right of way locations used for the following, but not limited to, haul roads, equipment staging areas, borrow and disposal sites:
   a. The Item, "Embankment" used for temporary or permanent fill within a USACE permit area.
   b. Unsuitable excavation or excess excavation, "Waste" (under the Item, "Excavation"), that is disposed of outside a USACE evaluated area.

The total area disturbed for this project is 4.59 acres. The disturbed area in this project, the project locations in the Contract, and Contractor project specific locations (PSLs) within 1 mile of the project limits for the Contract, will further establish the authorization requirements for storm water discharges. The Department will obtain an authorization to discharge storm water from the Texas Commission on Environmental Quality (TCEQ) for the construction activities

shown on the plans. The Contractor is to obtain required authorization from the TCEQ for Contractor PSLs for construction support activities on or off the ROW. When the total area disturbed in the Contract and PSLs within 1 mile of the project limits exceeds 5 acres, provide a copy of the Contractor NOI for PSLs on the ROW to the Engineer (to the appropriate MS4 operator when on an off-state system route) and to the local government that operates a separate storm drain system.

This project will have a non-reporting NWP 14. There is no permit number to reference. The General Conditions for complying with a Nationwide Permit are included in the Plan.

This project does not require a U.S. Army Corps of Engineers (USACE) Section 404 Permit before letting, but if a permit is needed during construction, assume responsibility for preparing the permit application. Submit the permit application to the Department's District Environmental Section for approval. Once the permit application is approved, the Department will submit it to the USACE. Assume responsibility for the requested revisions, in coordination with the Department's District Environmental Section.

Avoid encroaching into the Waters of the US areas delineated in the plans. Place erosion control measures around the wetlands as shown on the plans. No construction work or construction equipment is permitted within this delineated area. If applicable for bridge construction, construct drilled shafts outside of this delineated area. Secure approval for the locations of field offices, material storage sites, material disposal sites, plants, borrow pits, etc. in writing before use to ensure that the proposed location is not within Jurisdictional Waters of the United States (wetlands).

Do not store any material in Waters of the United States inside the right of way without written approval.

Before construction operations begin, provide a drawing of the location of proposed temporary access roads, haul roads, or temporary fill used during construction operations to ensure that they are not within Jurisdictional Waters of the United States.

If the Contractor elects to use an area not permitted and determined to be within Jurisdictional Waters of the United States during the prosecution of the work, the Contractor will hold the Department harmless for delays caused by procuring the necessary permits from the United States Army Corps of Engineers.

Maintain the roadway slope stability. Maintaining slope stability is subsidiary to the various bid items.

The nesting / breeding season for migratory birds is February 15 through September 30.

Conduct any tree removal outside of the migratory bird nesting season. If this is not possible due to scheduling, then exercise caution to remove only those trees with no active nests. Do not

destroy nests on structures or in trees within the project limits during the nesting / breeding season.

Take measures to prevent the building of nests on any structures or trees within the project limits throughout the duration of the construction if work / removal will be performed during the nesting / breeding season. This can be accomplished by application of bird repellent gel, netting by hand every 3 to 4 days, or any other non-threatening method approved by the Houston District Environmental Section. Obtain this approval well in advance of the planned use. Contact the Houston District Environmental Section at 713-802-5244. The cost of this work is subsidiary to the various bid items.

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

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

In addition to lane closures, cease work 3 days before the predicted hurricane landfall on or near the roadway that adversely impacts the flow of traffic and reduces the capacity of the highway during an evacuation. Vehicles of the Contractor, subcontractors, or material suppliers will not be allowed to enter or exit the traffic stream, including those for the purpose of material hauling and delivery, and mobilization or demobilization of equipment. When directed, this prohibition will include a reasonable time period for the evacuees to return to their point of origin.

Roadway closures during the following key dates and special events are prohibited:

January 1, 2022, January 1, 2023
February 28, 2022 - March 20, 2022– Houston Livestock Show and Rodeo

Item 8: Prosecution and Progress

The Department will not adjust the number of days for the project and milestones, if any, due to differences in opinion regarding any assumptions made in the preparation of the schedule or for errors, omissions, or discrepancies found in the time determination schedule.

Working days will be computed and charged based on a 6 day workweek in accordance with Section 8.3.1.*2*

The Lane Closure Assessment Fee is $ *500.00*. This fee applies to the Contractor for closures or obstructions that overlap into restricted hour traffic for each hour or portion thereof, per lane,

regardless of the length of lane closure or obstruction. For Restricted Hours subject to Lane Assessment Fee refer to the Item, "Barricades, Signs, and Traffic Handling."

Item 100: Preparing Right of Way

Clean existing ditches under fill sections of undesirable materials including grass, muck, and trash. Perform this work in accordance with the Construction section of the Item, "Preparing Right of Way." This work is subsidiary to this bid Item.

The Item, "Preparing Right of Way" will be measured for payment only in those designated areas shown on the plans. Preparing right of way necessary to perform construction that is outside designated areas is subsidiary to this bid Item.

Remove abandoned utilities that are in conflict with the new utilities, at no expense to the Department.

Reestablish and maintain right of way stakes after completing the right of way preparation activities and until the new utilities are in place.

Remove and assume ownership of the existing ground mounted signs within the limits of roadway construction unless otherwise noted or directed. This work is subsidiary to the Item, "Preparing Right of Way."

Item 104: Removing Concrete

Removing concrete curb is paid as a separate bid item if the existing pavement on which it rests is not removed at the same time. Remove broken concrete riprap under the bridge as shown in the plan.

Item 105: Removing Treated and Untreated Base and Asphalt Pavement

Removing curb on cement-treated and untreated base or on cement treatment being removed at the same time is subsidiary to this bid Item.

Item 104: Removing Concrete
Item 105: Removing Treated and Untreated Base and Asphalt Pavement

Case 2 - ACP over cement or lime treatment

Removing the Asphalt Concrete Pavement (ACP) material is paid under the Item, "Salvaging, Hauling, and Stockpiling Reclaimable Asphalt Pavement."

Removing the cement or lime treatment is paid under the Item, "Removing Treated and Untreated Base and Asphalt Pavement."

Remove the ACP separately from the cement or lime treatment. Make the removed depth as uniform as possible during each removal pass if the pavement depth being removed is composed

of different asphalt layers. Unless otherwise approved, stockpile the RAP of differing types of quality separately by its intended use such as for the asphalt treatment, cement treatment, lime treatment, or asphalt concrete pavement. Break, crush, or mill the stockpiled materials so that 100 percent pass the 2-in. sieve.

Removing the base material and any asphalt bondbreaker material is paid under the Item, "Removing Treated and Untreated Base and Asphalt Pavement."

Item 110: Excavation

If manipulating the excavated material requires moving the same material more than once to accomplish the desired results, the excavation is measured and paid for only once regardless of the manipulation required.

Removed deposited silt by excavation from right of way to right of way as shown in the plan. Maintain existing side slopes. Do not disturb ordinary high water mark.

Transition the ditch grades and channel bottom widths at structure locations. Use only approved channel excavation in the embankment.

The total excavation quantity shown on the plans includes the quantity for excavating to 2 ft. behind the back of the proposed curb.

Item 132: Embankment

If salvaged base is used for the embankment material, break it into small pieces to achieve the required density and to facilitate placing in the embankment. Obtain approval of the material before placing in the embankment.

Furnish Type C material with a maximum Liquid Limit (LL) of 65, a minimum Plasticity Index (PI) of 5, and composed of suitable earth material such as loam, clay, or other materials that form a suitable embankment.

The embankment material used on the project which has a Liquid Limit exceeding 45 will be tested for Liquid Limits at the rate of one test per 20,000 cu. yd. or per total quantity less than 20,000 cu. yd., unless otherwise directed. Only use material that passes the above tests.

For unpaved areas, provide a finished grade with the top 4 in. capable of sustaining vegetation. Use fertile soil that is easily cultivated, free from objectionable material and highly resistant to erosion. Topsoil work is paid under the Item, "Topsoil."

Item 162: Sodding for Erosion Control
Item 164: Seeding for Erosion Control
Item 166: Fertilizer
Item 168: Vegetative Watering

Refer to the "Fertilizer, Seed, Sod, Straw, Compost, and Water" plan sheet for material specifications, application rates, and for watering requirements.

Item 204: Sprinkling

Perform subsidiary sprinkling as required under various other items in accordance with the Item, "Sprinkling."

Sprinkling for dust control is subsidiary to the various bid items.

Item 210: Rolling

Use a medium pneumatic roller meeting the requirements of Item 210 as directed. This work is subsidiary to the various bid items. On every asphalt shot, use a minimum of 3 pneumatic rollers or as directed. Use approved rolling patterns. Successive asphalt shots will not be allowed until acceptable rolling has been accomplished on the preceding asphalt shot.

Item 260: Lime Treatment (Road-Mixed)

For slurry placing, before discharging through the distributors, sufficiently agitate or mix the lime and water to place the lime in suspension and to obtain a uniform mixture.

The Engineer will observe the lime treatment that the Contractor elects to open to construction traffic immediately after compaction. If the construction traffic damages the subgrade, route the traffic off the damaged section in accordance with the standard specification. If the construction traffic does not damage the subgrade, cure the subgrade until other courses of material cover it. Apply these courses within 14 days with a maximum curing period of 7 days.

Place the hydrated and the commercial lime as a water suspension or slurry according to the slurry placing method shown in Section 260.4.3.2, "Slurry Placement."

Use the type of lime at particular locations as directed.

Place the quicklime dry or as a slurry.

For the dry quicklime, a spreader box is not required if the lime material is evenly distributed.

In limited areas, the Contractor may construct the lime slurry subgrade under a sequence of work in which the application, mixing, and compaction are completed in the same working day, if approved by the Engineer.

Provide documentation from certified public scales showing gross, tare, and net weights. Provide producer's delivery tickets also showing gross, tare, and net weights. Completely empty the lime trailers at the project site. The Engineer may direct the Contractor to reweigh any shipment of lime on certified scales. The cost of this operation is subsidiary to the Item, "Lime Treatment (Road-Mixed)."

The percentage of lime shown on the plans is estimated on the basis of engineering tests. If soil tests made during construction indicate properties different than those originally anticipated, the Engineer may vary the percentage of the lime to provide soil characteristics similar to those of the preliminary tests.

Mix the lime with the new base material in an approved pug mill type stationary mixer.

Item 276: Cement Treatment (Plant-Mixed)

Before placing the new base, wet and coat the vertical construction joints between the new base and the previously placed base with dry cement.

If the total thickness of the cement treatment is greater than 8 in., compact it in multiple lifts in accordance with Section 276.4.3, "Compaction." Place the courses in the same working day unless otherwise approved.

Use Class N Cement Treatment containing 4.5 percent cement based on the dry weight of the aggregate. There is no minimum compressive strength requirement for this Item.

The requirement for core drilling to determine the thickness of cement treatment is waived if using less than 500 sq. yd. at one location.

For widening the existing pavement, the Engineer may waive the requirements for preparing the subgrade by scarifying and compacting if the as-cut subgrade can be maintained to the density of the natural ground and to a uniform consistency when placing the base course. Keep the subgrade wet.

Compact in accordance with the standard specifications and complete the finishing operations within a period of 5 hours after adding the cement to the base material.

Cure the final course of cement treatment using an asphalt distributor that distributes the approved curing material and water mixture material at a rate of 0.25 gallons per square-yard evenly and smoothly or as recommended by the manufacturer at the recommended dilution rate, under a pressure necessary for proper distribution. Provide a curing material meeting the requirements of the Item, "Asphalts, Oils, and Emulsions" for curing the cement treatment. Use the following materials for curing the courses of cement treatment:

Curing Material	Application
Water	All courses, except final course

Curing Material	Application
PCE	Final course

Continue curing until placing another course or opening the finished section to traffic.

Spread the material so that the layers of base are uniform in depth and in loose density before compacting.

Type E material consists of Type A material, crushed concrete (except under flexible pavement), or Reclaimed Asphalt Pavement (RAP) meeting the requirements of the Item, "Flexible Base." If approved, the 50 percent maximum RAP limitation may be waived.

Unless otherwise directed, place the next pavement layer within 7 working days of placing the base.

If using crushed stone for the Type E material under this Item, ensure it meets the requirements for the Item, "Flexible Base," Type A, Grade 1-2. Texas Test Method TEX-117-E is not required for this Item.

If using Recycled Type E cement treatment under proposed flexible pavement, produce it using the existing base salvaged from within this project or from other approved Department projects and salvaged asphalt concrete pavement. Do not use crushed concrete under flexible pavement.

If using Recycled Type E cement treatment under proposed concrete pavement, produce it using the existing base salvaged from within this project or from other approved Department projects, salvaged asphalt concrete pavement, or crushed concrete. If using crushed concrete as an aggregate, meet the requirements of Grade 3.

If using salvaged existing base and asphalt concrete pavement as described above, size it so that all the material, except the existing individual aggregate, passes the 2-in. sieve and is of a gradation that allows satisfactory compaction. Provide salvaged material that does not contain deleterious material such as clay or organic material. Provide material passing the No. 40 sieve, defined as soil binder, with a maximum Plasticity Index of 10 and a maximum Liquid Limit of 35 when tested in accordance with test method TEX-106-E.

Meet the following additional requirements if the base and ACP are salvaged from other Department projects:

1. Obtain written approval before using the material.
2. Salvage and stockpile by approved methods.
3. Stockpile the material for exclusive use by the Department.

Item 292: Asphalt Treatment (Plant-Mixed)

Unless otherwise shown on the plans, RAP generated by this project will become the property of the Contractor for use in the current construction project or in future projects.

If using the iron ore topsoil as the primary aggregate, meaning 80 percent or more by weight of the total mixture, the requirements for the water susceptibility test are waived.

Mixtures containing the iron ore topsoil are exempted from test methods TEX-217-F (Part I, separation of deleterious material and Part II, decantation test for coarse aggregate) and TEX-203-F (Sand Equivalent Test).

Assume responsibility for proportioning the materials entering the asphalt mixture, regardless of the type of plant used.

Furnish the mix designs for approval.

Compact the courses to a minimum density of 95 percent of the maximum density as determined using test method TEX-126-E.

Meet the following grading requirements:

Sieve Size	Percent Passing Grade 4 (Bondbreaker)
1-3/4 in.	-
1 in.	-
1/2 in.	100
No. 4	30 - 70
No. 40	15 - 45

Physical requirements are as follows:

Maximum Plasticity Index (PI) = 8
Maximum Liquid Limit (LL) = 35
Maximum Wet Ball Mill = 50 (crushed stone)
Maximum LA Abrasion = 50 (iron ore)

If blending the materials, perform the Wet Ball Mill test for the composite aggregate.

Form bituminous mix incorporating 3.5 to 7 percent asphaltic binder by dry weight.

For nominal aggregate size less than 0.5 in., design the mix in accordance with test method TEX-204-F. The minimum stability in accordance with TEX-208-F is 30 percent with a laboratory molded density of 96 percent plus or minus 1.5 percent.

If the layer thickness after placing is 1.25 in. or less, the bondbreaker is exempt from the in-place density control described in Section 292.4.5, “Compaction.”

Item 360: Concrete Pavement

Where the pavement curb is left off for a later tie, provide the dowels or the tie bars as indicated on the paving detail sheets. The dowel bars and tie bars are subsidiary to the various bid items.

Repair portions of the concrete pavement surfaces that are damaged while in a plastic state before that area receives permanent pavement markings and opens to traffic. Perform repairs that are structurally equivalent to and cosmetically uniform with the adjacent undamaged areas. Do not repair by grouting onto the surface.

On pavement widening, hand finishing in place of the longitudinal float will be permitted.

Where existing pavement is widened with new pavement, place the new pavement a minimum of 2 ft. wide.

Equip the batching plants to proportion by weight, aggregates and bulk cement, using approved proportioning devices and approved automatic scales.

For mono curb, the curb height transitions will be paid at the contract unit price of the larger curb height in the transition. The 2.5-in. laydown curbs for driveways will be paid at the unit price bid for the Item, “Conc Curb (Mono) (Ty II).”

High-early strength cement may be used for frontage road and city street intersection construction.

Do not use limestone dust of fracture as fine aggregate.

If the concrete design requires greater than 5.5 sacks of cementitious material per cubic yard, obtain written approval. If placing concrete pavement mixes from April 1 to October 31, inclusive, use Mix Design Option 1 as specified in Section 421.4.2.6.1.

Perform saw cutting as shown on the plans in accordance with Section 360.4.10, “Sawing Joints.” This saw cutting is subsidiary to this bid Item.

The pay limits for concrete pavements with traffic rails extends to the outside edge or back of the traffic rail.

Complete the entire Fast Track Concrete construction process, from the time the Fast Track Work Area is closed to traffic, to the time the Fast Track Work Area is opened to traffic. The Fast Track operation includes, but is not limited to, traffic control, existing pavement and subgrade removal, preparation of subgrade, placement of steel, placement of Fast Track concrete pavement, cure time, striping, etc. Perform work in the Fast Track Work Area in an expeditious manner, within the allowable time period for any area shown below:

Fast Track Work Area

	Allowable Duration
1. IH 45 SBFR Sta. 898+21.30 to Sta. 902+36.52	2 weekdays and 2 weekend days
2. FM 1960 Exit Ramp	2 weekend days

Failure to perform any Fast Track Work Area construction within the above time frames will be cause for the Engineer to require the Contractor to shut down all other construction operations to ensure all resources are directed toward the completion of the Fast Track operation. This shutdown will remain in force until the Fast Track operation is complete. Such a shutdown will not warrant additional time, time suspension, or any additional costs to the Department.

Unless otherwise directed in writing, provide Class HES concrete with a minimum average flexural strength of 425 psi or a minimum average compressive strength of 3,000 psi in 16 hours.

When directed in writing, open the pavement to traffic before the minimum requirements have been attained.

When needed, place and remove forms in accordance with Section 360.4.5, except do not remove forms until at least 6 hours after concrete has been placed. The time for the form removal may be extended with the direction of the Engineer if weather or other conditions make it advisable.

Sprinkling and rolling, required for the compaction of the rough subgrade in advance of fine-grading are subsidiary to this Item. Maintenance of a moist condition of the subgrade in advance of fine-grading and concrete is subsidiary work, as provided above.

Items 360, 420, and 421: All Concrete Items

For the Department's concrete cylinder split samples, transport the test cylinders to the Houston District Laboratory located at 7600 Washington Avenue in Houston, or to the appropriate Area Laboratory, when applicable. Transporting the test cylinders is subsidiary to the various bid items.

The approach pavement is paid for under the Item, "Concrete Pavement."

Item 400: Excavation and Backfill for Structures

Plugging existing pipe culverts is subsidiary to the various bid items.

If Recycled Cement Treatment (Type D) is included in the plans, the following additional requirements apply:

1. Use only approved sand, crushed concrete, or salvaged base free from deleterious matter, as aggregate for cement-stabilized backfill.

2. Provide crushed concrete or salvaged base backfill material in accordance with the Item, "Cement Treatment (Plant-Mixed)(Type D)" (base or crushed concrete), except the recycled Type D material must not contain Reclaimed Asphalt Pavement (RAP).
3. For backfill material below the spring line of pipes, use cement-stabilized sand rather than Recycled Type D backfill material.
4. For the cement-stabilized sand backfill, use a minimum of 7 percent of hydraulic cement based on the dry weight of backfill material. The cement content for the crushed concrete and salvaged base is specified in the Item, "Cement Treatment (Plant-Mixed) (Type D)."
5. Place and compact the stabilized backfill material using a gradation that provides a dense mass without segregating and is impervious to passing of water.

Item 407: Steel Piling

Assume ownership of removed temporary steel sheet piling.

Item 416: Drilled Shaft Foundations

Include the cost for furnishing and installing anchor bolts mounted in the drilled shafts in the unit bid price for the various diameter drilled shafts.

The Department may test using ultrasonic methods the anchor bolts for overhead sign supports, light standards, and traffic signal poles after they are installed. Replace faulty anchor bolts as directed. Do not weld the anchor bolts.

Item 420: Concrete Substructures

Unless otherwise noted, use Class C concrete with an ordinary surface finish for signal, lighting, or sign structure foundations.

Item 421: Hydraulic Cement Concrete

Entrained air is required in all slip formed concrete (bridge rail, concrete traffic barrier, pavement, etc.), but is not required for other structural concrete. Adjust the dosage of air entraining agent for low air content as directed or allowed by the Engineer. If entrained air is provided where not required, do not exceed the manufacturer's recommended dosage.

Item 423: Retaining Walls

Place concrete riprap mow strips for retaining walls as shown on the plans and in accordance with the Item, "Riprap." Use Class B concrete reinforced with No. 4 bars spaced at 18 in. centers each direction and placed 2 in. below the surface. This work is paid for under the Item, "Riprap."

Provide and maintain positive drainage away from the earth wall system, including the leveling pad, for the contract duration.

Approved Mechanically Stabilized Earth (MSE) Wall Systems are listed at the website below or from the Department's home page>Business>Bridge>Retaining Walls>Approved MSE Panel Systems:

http://www.txdot.gov/business/resources/approved-systems/mse-wall.html

http://www.txdot.gov/business/resources/approved-systems/retaining-system.html

Item 427: Surface Finishes for Concrete

Provide a Surface Area I finish for structures. Use concrete paint for the surface finish.

Item 432: Riprap

If stone riprap is shown on the plans, use common stone riprap in accordance with Section 432.2.3.3, placed dry in accordance with Section 432.3.2.3. Do not grout. Crushed concrete may also be used.

Item 442: Metal for Structures

Use temperature zone 1 for Charpy V-Notch (CVN) testing.

Prestressed concrete panels will not be allowed on steel structures.

Item 462: Concrete Box Culverts and Drains
Item 464: Reinforced Concrete Pipe

Concrete collars are subsidiary to the various bid items except for those specified on the plans for stage construction, which are paid for under the Item, "Concrete Substructures" as "Cl C Conc (Collar)."

Rubber gaskets are required for concrete pipe joints except for connections of safety end treatments, driveway culverts, and joints between the existing pipes and extensions.

Open, install, and backfill each section, or a portion of a section, in the same day at locations requiring pipe culverts under existing roadways.

Place the pipe drains across existing roadways half at a time to allow passage of traffic. No trenches may remain open overnight.

Known locations of existing stub-outs are shown on the plans, but these stub-outs may be in a different position or condition. Delays, inconveniences, or additional work required will not be a basis for additional compensation.

Provide leave-outs or holes in the proposed storm drain structures and pipes for drainage during interim construction. This work is subsidiary to the various bid items.

The flowline elevations of side road structures are based on the proposed ditches. Field-verify these elevations and adjust them as necessary to meet the field conditions. Before placing these structures, prepare and submit for approval, the data (revised elevation, alignment, length, etc.) for the adjusted structures.

If groundwater is encountered while installing the storm drain system, install a suitable dewatering system to facilitate construction of the storm drains. The costs for materials and labor required to install and maintain this system are subsidiary to the Item, "Reinforced Concrete Pipe."

Item 465: Junction Boxes, Manholes, and Inlets

If required on the plans, build manholes and inlets to stage 1 construction, cover with temporary pavement, and complete in a later phase of construction. This temporary covering and pavement are subsidiary to the various bid items.

Construct manholes and inlets in graded areas, first to an elevation at least 4 in. above the top of the highest entering pipe and cover with a wooden cover. Complete the construction of such manholes and inlets to the finished elevation when completing the grading work for such manholes and inlets. Adjust the final elevation, if required, since this elevation is approximate.

Construct manholes and inlets in paved areas to an elevation so their temporary wooden covers are flush with the surface of the base material.

Do not leave excavations or trenches open overnight.

Items 496: Removing Structures
Items 497: Sale of Salvageable Material

Assume ownership and remove from the project site, items salvaged from the existing bridge decks.

Do not permit debris resulting from the structure removal or construction activities to enter a natural or manmade waterway such as drainage channels, rivers, streams, bays, etc. Remove debris which falls into such waterways. This work is subsidiary to the Item, "Removing Structures."

Item 502: Barricades, Signs, and Traffic Handling

Use a traffic control plan for handling traffic through the various phases of construction. Follow the phasing sequence unless otherwise agreed upon by the Area Engineer and the Project Manager. Ensure this plan conforms to the latest "Texas Manual on Uniform Traffic Control Devices" and the latest Barricade and Construction (BC) Standard Sheets. The latest versions of

Work Zone Standard Sheets WZ (BTS-1) and WZ (BTS-2) are the traffic control plan for the signal installations.

Submit changes to the traffic control plan to the Area Engineer. Provide a layout showing the construction phasing, signs, striping, and signalizations for changes to the original traffic control plan.

Furnish and maintain the barricades and warning signs, including the necessary temporary and portable traffic control devices, during the various phases of construction. Place and construct these barricades and warning signs in accordance with the latest "Texas Manual on Uniform Traffic Control Devices" for typical construction layouts.

Cover work zone signs when work related to the signs is not in progress, or when any hazard related to the signs no longer exists.

Keep the delineation devices, signs, and pavement markings clean. This work is subsidiary to the Item, "Barricades, Signs, and Traffic Handling."

Erect temporary signs when exit ramps are closed or moved to new locations during construction.

Before detouring traffic onto the mainlane shoulders, remove dirt, debris, vegetation, and other deleterious material from the surface of the shoulders. Appropriately sign the detour in an approved manner. This work is subsidiary to the various bid items.

Coordinate and schedule the work with the appropriate Metro representative if requiring access to the High Occupancy Vehicle lanes.

Cover or remove the permanent signs and construction signs that are incorrect or that do not apply to the current situation for a particular phase.

Replace the overhead signs, informational signs, and exit signs to be removed, with temporary signs providing the correct information to the traveling public. Size the replacement signs and include them in the traffic control plan.

Do not mount signs on drums or barricades, except those listed in the latest Barricades and Construction standard sheets.

Use traffic cones for daytime work only. Replace the cones with plastic drums during nighttime hours.

Place positive barriers to protect drop-off conditions greater than 2 ft. within the clear zone that remain overnight.

Do not reduce the existing number of lanes open to traffic except as shown on the following time schedule:

One Lane/Two lanes Closure

Day	Daytime Closure Hours	Nighttime Closure Hours	Restricted Hours Subject to Lane Assessment Fee
Monday	8:30 AM – 3:30 PM	Not Allowed	5:00 AM – 8:30 AM 3:30 PM - 8:30 PM
Tuesday	8:30 AM – 3:30 PM	Not Allowed	5:00 AM – 8:30 AM 3:30 PM - 8:30 PM
Wednesday	8:30 AM – 3:30 PM	Not Allowed	5:00 AM – 8:30 AM 3:30 PM - 8:30 PM
Thursday	8:30 AM – 3:30 PM	Not Allowed	5:00 AM – 8:30 AM 3:30 PM - 8:30 PM
Friday	8:30 AM – 3:30 PM	Not Allowed	5:00 AM – 8:30 AM 3:30 PM - 8:30 PM
Saturday	8:30 AM – 3:30 PM	Not Allowed	5:00 AM – 8:30 AM 3:30 PM - 8:30 PM
Sunday	As approved by the Engineer	NotAllowed	As approved by the Engineer

The above times are approved for the traffic control conditions listed. The Area Engineer may approve other closure times if traffic counts warrant. The Area Engineer may reduce the above times for special events.

Law enforcement assistance will be required for this project and is expected to be required for major traffic control changes and lane closures. Coordinate with local law enforcement and arrange for law enforcement as directed or agreed by the Engineer. Before payment will be made, complete the "Daily Report on Law Enforcement Force Account Work" (Form 318), provided by the Department and submit daily invoices that agree with this form for any day during the month in which approved services were provided.

Provide full-time, off-duty, uniformed, certified peace officers, as part of traffic control operations. The peace officers must be able to show proof of certification by the Texas Commission on Law Enforcement Officers Standards. The cost of the officers is paid for on a force account basis.

A minimum of 7 days in advance of any total closure, notify the Houston District Public Information Office of which roadways, ramps, intersections, or lanes will be closed, the dates they will remain closed, and when they will be opened again to traffic.

A minimum of 7 days in advance of any total closure, place a portable changeable message (PCM) sign at the location of each total closure which informs the traveling public of the details of the closure. Alternately, if the Traffic Control Plan provides a positive barrier at the location, a non-trailer mounted static message board sign behind the positive barrier may be used in place of a PCM.

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 Environmental Controls

The Storm Water Pollution Prevention Plan (SWP3) consists of temporary erosion control measures needed and provided for under this Item. Since the disturbed area is less than 5 acres, a "Notice of Intent" (NOI) is not required.

Use appropriate measures to prevent, minimize, and control the spill of hazardous materials in the construction staging area. Remove and dispose of materials in compliance with State and Federal laws.

Before starting construction, review with the Engineer the SWP3 used for temporary erosion control as outlined on the plans. Before construction, place the temporary erosion and sedimentation control features as shown on the SWP3.

Schedule the seeding or sodding work as soon as possible. The project schedule provides for a vegetation management plan.

After completing earthwork operations, restore and reseed the disturbed areas in accordance with the Department's specifications for permanent or temporary erosion control.

Implement temporary and permanent erosion control measures to comply with the National Pollution Discharge Elimination System (NPDES) general permit under the Clean Water Act.

Before starting grading operations and during the project duration, place the temporary or permanent erosion control measures to prevent sediment from leaving the right of way.

Transport Low Profile Concrete Barriers (LPCB) used for traffic handling from the Department's stockpile located on the north side of IH 610 at Long Drive.

Where required by the Engineer, provide anchor pins for Type 2 Low Profile Concrete Barriers (LPCB) as shown on the current LPCB standard. Anchor pins are subsidiary to the Low Profile Concrete Barrier.

Transport Standard Height Portable Traffic Barriers (including J-J Hook and Safety Shape) used for traffic handling from the Department's stockpile located on the south side of IH 610 at Cedar Crest Blvd. (located across IH 610 from Long Drive).

Use only the J-J Hook type connection between barriers.
After completing the project, return Low Profile Concrete Barriers (LPCB) used for traffic handling, to the Department's stockpile located on the north side of IH 610 at Long Drive. After completing the project, return the associated LPCB connecting hardware to the area office or as directed.

After completing the project, return Standard Height Portable Traffic Barriers (including J-J Hook and Single Slope) used for traffic handling, to the Department's stockpile located on the south side of at IH 610 at Cedar Crest Blvd. (located across IH 610 from Long Drive). After completing the project, return the associated Single Slope barrier connecting hardware to the area office or as directed.

After completing the project, Standard Height Safety Shape Portable Traffic Barriers used for traffic handling and the associated connecting hardware will become the property of the Contractor.

If placing the portable traffic barrier on pre-stressed concrete box beams with exposed reinforcing steel, protect the reinforcing steel by supporting the portable traffic barrier on 4 in. by 4 in. timbers. Place the timbers transversely and space them on 4 ft. centers. The cost of the labor and materials to perform this work are subsidiary to the Item, "Portable Traffic Barrier."

Item 529: Concrete Curb, Gutter, and Combined Curb and Gutter
Item 530: Intersections, Driveways, and Turnouts
Item 531: Sidewalks

An air-entraining admixture is not required.

For concrete curbs, use Grade 7 aggregate conforming to Section 421.2.6 of the Item, "Hydraulic Cement Concrete."

For driveways and turnouts, coarse aggregate Grade No. 3 through No. 8 conforming to the gradation requirements specified in the Item, "Hydraulic Cement Concrete" will be permitted.

For reinforcing steel in sidewalks and pedestrian ramps, use No. 4 bars at a maximum 18 in. spacing center-to-center in both directions.

Item 540: Metal Beam Guard Fence

Painting the timber posts is not required.

Use timber posts for galvanized steel metal beam guard fence, except for anchorage at turned down ends.

Furnish and install wood blocks between the rail elements and the timber posts as detailed on the plans. These block-outs are subsidiary to this bid Item.

The quantity of the metal beam guard fence is subject to change.

Provide a mow strip as shown on the plans, at metal beam guard fence locations, including any guardrail end treatments.

Galvanize the rail elements supplied for this project by using a Type II Zinc Coating.

At locations requiring attachment of Metal Beam Guard Fence (MBGF) to concrete railing or concrete traffic barrier, repair and fill any existing holes in the railing or barrier that are not in the correct location for attaching the new MBGF. Perform this work in accordance with the Item, "Concrete Structure Repair." Existing anchor bolt holes that cannot be utilized must be filled with an epoxy grout before drilling new holes. Then core-drill new holes in the correct locations and repair any resulting spalls at no expense to the Department. This work is considered subsidiary to the MBGF transition section (Item 540).

Item 542: Removing Metal Beam Guard Fence

Remove and assume ownership of unsalvageable metal beam guard fence rail elements and posts. Transport and store any functional, salvageable rail elements, including steel posts, which are not reused in this project, to the Department's stockpile located at 16803 Eastex Freeway, Humble, TX 77396.

Replace removed wood posts which are unusable because of damage by the Contractor, at no expense to the Department.

Item 545: Crash Cushion Attenuators

After completing the project, return remaining unused crash cushion attenuators units to the Area Office Maintenance yard or as directed, at no cost to the Department.

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

Item 585: Ride Quality for Pavement Surfaces

To eliminate the need for corrective action due to excessive deviations in the final surface layers, exercise caution to ensure satisfactory profile results in the intermediate paving layers (mixture).

Milling will not be allowed as a corrective action for excessive deviations in the final surface layer of hot-mix asphalt.

For concrete curb and gutter sections or frontage roads, use Surface Test Type B and Pay Adjustment Schedule 2 except for the outside lane. Use Surface Test Type B and Pay Adjustment Schedule 3 for the outside lane.

Item 636: Signs

Include aluminum route markers, exit only panels, routing signs, and other special panels attached to guide signs in the unit bid price for the parent guide sign material.

Furnish and install signs shown on the traffic signal "Summary of Traffic Signal Materials" sheet. Ensure that the legend on these sign panels is in accordance with the latest "Standard Highway Sign Designs for Texas" manual.

For design details not shown on the plans, provide signs and arrows conforming to the latest "Standard Highway Sign Designs for Texas" manual.

Item 644: Small Roadside Sign Assemblies

Sign locations shown on the plans are approximate. Before placing them, obtain approval of and then stake the exact locations for these signs.

Use the Texas Universal Triangular Slip Base with the concrete foundation for small ground mounted signs, unless otherwise shown in the plans.

Remove existing street name signs from existing stop signs and re-install them above the new stop signs. Removing and re-installing existing street name signs is subsidiary to the Item, "Small Roadside Sign Assemblies."

When design details are not shown on the plans, provide signs and arrows conforming to the latest "Standard Highway Sign Designs for Texas" manual.

Provide and install the materials for speed limit signs. For speed limit signs that are indicated with "XX," the Area Engineer will request a speed study through the Director of Transportation Operations to determine the legal speeds to be posted. This request will be made as soon as possible after the roadway opens to traffic. After the speed limit to be posted is determined, this information will be provided to the Contractor by the Area Engineer.

Use Type E Super High Specific Intensity (Fluorescent Prismatic) yellow green reflective sheeting background to fabricate school signs (S1-1, S3-1, S4-3, S5-1, W16-2, SW16-9p, and SW16-7pL(R)).

Assume ownership of the removed existing signs.

Locations of the relocated signs are approximate. Before placing them, obtain approval of and then stake the exact locations for these signs.

Replace existing signs that become damaged during relocation at no expense to the Department.

Item 647: Large Roadside Sign Supports and Assemblies

Locations of the relocated signs are approximate. Before placing them, obtain approval of and then stake the exact locations for these signs.

Replace existing signs that become damaged during relocation at no expense to the Department.

Assume ownership of the removed existing signs.

Item 662: Work Zone Pavement Markings

At the end of each workday, mark roadways that remain open to traffic during construction operations with standard pavement markings, in accordance with the latest "Texas Manual on Uniform Traffic Control Devices."

Using raised markers for removable work zone pavement markings on final concrete surfaces is optional.

For transition lane lines and detour lane lines, use raised pavement markers as shown for solid lines on the latest Barricade and Construction standard sheet for "Work Zone Pavement Marking Details."

Item 6038: Multipolymer Pavement Markings (MPM)

Use Type III glass beads for thermoplastic and multipolymer pavement markings.

Use a 0.100 in. (100 mil) thickness for thermoplastic pavement markings, measured to the top of the thermoplastic, not including the exposed glass beads.

Use a 0.022 in. (22 mil) thickness for multipolymer pavement markings, measured to the top of the multipolymer, not including the exposed glass beads.

If the Type II markings become dirty and require cleaning by washing, brushing, compressed air, or other approved methods before applying the Type I thermoplastic markings, this additional cleaning is subsidiary to the Item, "Reflectorized Pavement Markings."

Establish the alignment and layout for work zone striping and permanent striping.

Stripe all roadways before opening them to traffic.

Place pavement markings under these items in accordance with details shown on the plans, the latest "Texas Manual on Uniform Traffic Control Devices," or as directed.

When design details are not shown on the plans, provide pavement markings for arrows, words, and symbols conforming to the latest "Standard Highway Sign Designs for Texas" manual.

Item 672: Raised Pavement Markers

If other operations are complete on the project and if the curing time period is not yet elapsed, the contract time will be suspended until the curing is done.

Before placing the raised pavement markers on concrete pavement, blast clean the surface using an abrasive-blasting medium. This work is subsidiary to the Item, "Raised Pavement Markers."

Provide epoxy adhesive that is machine-mixed or nozzle-mixed and dispensed. Equip the machine or nozzle with a mechanism to ensure positive mix measurement control.

Item 677: Eliminating Existing Pavement Markings and Markers

Remove existing pavement markings on concrete or asphalt surfaces by flail milling or as directed.

Item 678: Pavement Surface Preparation for Markings

Do not blast clean asphalt concrete pavement. Clean asphalt concrete pavement as required under the applicable specifications or as directed.

On new concrete pavement or on existing concrete pavement when placing a new stripe on a new location, remove the curing compounds and contamination from the pavement surface by flail milling or as directed. In addition, air-blast the surface with compressed air just before placing the new stripe.

On existing concrete pavement when placing a new stripe on an existing location, after removing the existing stripe under the Item, "Eliminating Existing Pavement Markings and Markers," air-blast the surface with compressed air just before placing the new stripe.

Do not clean concrete pavement by grinding.

Item 752: Tree and Brush Removal

Perform tree and brush removal from right of way to right of way line as shown in the plan.

County: Harris

Control: 0110-05-126

Highway: IH 45

Item 6185: Truck Mounted Attenuator (TMA) and Trailer Attenuator (TA)

A shadow vehicle with Truck Mounted Attenuators (TMAs) or Trailer Attenuators (TAs) is required as shown on the appropriate Traffic Control Plan (TCP) sheets. TMAs/TAs must meet the requirements of the Compliant Work Zone Traffic Control Device List.

Level 3 Compliant TMAs/TAs are required for this project.

In addition to the shadow vehicles with TMAs/TAs that are specified as being required on the TCP layout sheets for this project, provide additional shadow vehicles with TMAs/TAs as shown on the TCP Standard sheets. The Contractor is responsible for determining if one or more of these operations will be ongoing at the same time to determine the total number of TMAs/TAs needed on the project.

Basis of Estimate

Item	Description	Limit and Rate	Unit
260	Lime Treatment (Road-Mixed) For materials used as subgrade * • Lime(HYD, COM, or QK)(SLRY) or QK(DRY)	 6 % by weight based on 100 Lb. / Cu. Ft. subgrade	SY TON
292	Asphalt Treatment (Plant-Mixed) • Asphalt • Aggregate	110 Lb. / Sq. Yd.-In. 5 % by weight 95 % by weight	TON

* If used in existing roadway base, rate will be determined on a case by case basis.

Estimate & Quantity Sheet

CONTROLLING PROJECT ID 0110-05-126 **DISTRICT** Houston **COUNTY** Harris
HIGHWAY IH 45

			CONTROL SECTION JOB		**0110-05-126**	TOTAL EST.	TOTAL FINAL
			PROJECT ID		**A00123340**		
			COUNTY		**Harris**		
			HIGHWAY		**IH 45**		
ALT	**BID CODE**	**DESCRIPTION**	**UNIT**	EST.	FINAL		
	100-6002	PREPARING ROW	STA	19.000		19.000	
	104-6001	REMOVING CONC (PAV)	SY	7,437.000		7,437.000	
	104-6009	REMOVING CONC (RIPRAP)	SY	1,388.000		1,388.000	
	104-6017	REMOVING CONC (DRIVEWAYS)	SY	158.000		158.000	
	104-6027	REMOVING CONC (APPR SLAB)	SY	169.000		169.000	
	105-6018	REMOVING STAB BASE AND ASPH PAV (7")	SY	7,316.000		7,316.000	
	110-6001	EXCAVATION (ROADWAY)	CY	1,382.000		1,382.000	
	110-6002	EXCAVATION (CHANNEL)	CY	25,000.000		25,000.000	
	132-6006	EMBANKMENT (FINAL)(DENS CONT)(TY C)	CY	4,472.000		4,472.000	
	132-6035	EMBANK(FINAL)(DC)(TY E)(CSBE)	CY	1,989.000		1,989.000	
	162-6002	BLOCK SODDING	SY	7,965.000		7,965.000	
	162-6003	STRAW OR HAY MULCH	SY	7,965.000		7,965.000	
	164-6051	DRILL SEED (TEMP)(WARM OR COOL)	SY	7,965.000		7,965.000	
	166-6001	FERTILIZER	AC	3.300		3.300	
	168-6001	VEGETATIVE WATERING	MG	394.000		394.000	
	260-6006	LIME TRT (EXST MATL) (6")	SY	5,545.000		5,545.000	
	260-6012	LIME(HYD,COM OR QK)(SLRY)OR QK(DRY)	TON	75.000		75.000	
	276-6224	CEM TRT(PLNT MX) (CL N)(TY E)(GR 4)(6")	SY	5,545.000		5,545.000	
	292-6017	ASPHALT STAB BASE (GR 4)(PG 64)	TON	272.000		272.000	
	360-6004	CONC PVMT (CONT REINF - CRCP) (10")	SY	4,815.000		4,815.000	
	360-6043	CONC PVMT (CONT REINF)(FAST TRK)(13")	SY	2,803.000		2,803.000	
	360-6045	CONC PVMT (CONT REINF)(FAST TRK)(15")	SY	531.000		531.000	
	400-6005	CEM STABIL BKFL	CY	1,306.000		1,306.000	
	400-6009	CEMENT STAB BACKFILL (INLET OR MH)	CY	187.000		187.000	
	402-6001	TRENCH EXCAVATION PROTECTION	LF	1,557.000		1,557.000	
	416-6001	DRILL SHAFT (18 IN)	LF	122.000		122.000	
	416-6003	DRILL SHAFT (30 IN)	LF	804.000		804.000	
	416-6005	DRILL SHAFT (42 IN)	LF	1,050.000		1,050.000	
	416-6015	DRILL SHAFT (NON - REINFORCED) (12 IN)	LF	7.000		7.000	
	420-6013	CL C CONC (ABUT)	CY	67.600		67.600	
	420-6029	CL C CONC (CAP)	CY	77.100		77.100	
	420-6037	CL C CONC (COLUMN)	CY	61.700		61.700	
	422-6001	REINF CONC SLAB	SF	18,625.000		18,625.000	
	422-6013	BRIDGE SIDEWALK	SF	3,339.000		3,339.000	
	423-6001	RETAINING WALL (MSE)	SF	9,312.000		9,312.000	
	425-6039	PRESTR CONC GIRDER (TX54)	LF	2,446.350		2,446.350	
	432-6001	RIPRAP (CONC)(4 IN)	CY	88.000		88.000	

Estimate & Quantity Sheet

CONTROLLING PROJECT ID 0110-05-126 **DISTRICT** Houston **COUNTY** Harris
HIGHWAY IH 45

			CONTROL SECTION JOB		**0110-05-126**	TOTAL EST.	TOTAL FINAL
			PROJECT ID		**A00123340**		
			COUNTY		**Harris**		
			HIGHWAY		**IH 45**		
ALT	**BID CODE**	**DESCRIPTION**	**UNIT**	EST.	FINAL		
	432-6002	RIPRAP (CONC)(5 IN)	CY	418.000		418.000	
	432-6008	RIPRAP (CONC)(CL B)(RR8&RR9)	CY	47.400		47.400	
	432-6045	RIPRAP (MOW STRIP)(4 IN)	CY	36.000		36.000	
	442-6007	STR STEEL (MISC NON - BRIDGE)	LB	318.000		318.000	
	450-6006	RAIL (TY T223)	LF	427.000		427.000	
	450-6032	RAIL (TY C223)	LF	1,119.000		1,119.000	
	454-6020	SEALED EXPANSION JOINT (4 IN) (SEJ - B)	LF	132.000		132.000	
	462-6008	CONC BOX CULV (5 FT X 4 FT)	LF	740.000		740.000	
	462-6011	CONC BOX CULV (6 FT X 4 FT)	LF	777.000		777.000	
	464-6003	RC PIPE (CL III)(18 IN)	LF	51.000		51.000	
	464-6005	RC PIPE (CL III)(24 IN)	LF	6.000		6.000	
	465-6172	INLET (COMPL)(TY AZR2G)	EA	6.000		6.000	
	465-6176	INLET (COMPL)(CURB)(TY C1)	EA	5.000		5.000	
	465-6270	MANH (COMPL)(TY M)	EA	5.000		5.000	
	465-6341	INLET (COMPL) (EXT) (TY CI)	EA	7.000		7.000	
	467-6227	SET (TY I)(S= 6 FT)(HW= 7 FT)(3:1) (C)	EA	2.000		2.000	
	467-6395	SET (TY II) (24 IN) (RCP) (6: 1) (P)	EA	2.000		2.000	
	496-6002	REMOV STR (INLET)	EA	1.000		1.000	
	496-6003	REMOV STR (MANHOLE)	EA	4.000		4.000	
	496-6004	REMOV STR (SET)	EA	2.000		2.000	
	496-6007	REMOV STR (PIPE)	LF	26.000		26.000	
	496-6008	REMOV STR (BOX CULVERT)	LF	1,529.000		1,529.000	
	496-6010	REMOV STR (BRIDGE 100 - 499 FT LENGTH)	EA	1.000		1.000	
	500-6001	MOBILIZATION	LS	1.000		1.000	
	502-6001	BARRICADES, SIGNS AND TRAFFIC HANDLING	MO	24.000		24.000	
	506-6002	ROCK FILTER DAMS (INSTALL) (TY 2)	LF	35.000		35.000	
	506-6011	ROCK FILTER DAMS (REMOVE)	LF	35.000		35.000	
	506-6020	CONSTRUCTION EXITS (INSTALL) (TY 1)	SY	150.000		150.000	
	506-6024	CONSTRUCTION EXITS (REMOVE)	SY	150.000		150.000	
	506-6034	CONSTRUCTION PERIMETER FENCE	LF	225.000		225.000	
	506-6038	TEMP SEDMT CONT FENCE (INSTALL)	LF	1,353.000		1,353.000	
	506-6039	TEMP SEDMT CONT FENCE (REMOVE)	LF	1,353.000		1,353.000	
	506-6041	BIODEG EROSN CONT LOGS (INSTL) (12")	LF	518.000		518.000	
	506-6043	BIODEG EROSN CONT LOGS (REMOVE)	LF	518.000		518.000	
	512-6013	PORT CTB (DES SOURCE)(SGL SLP)(TY 1)	LF	900.000		900.000	
	512-6021	PORT CTB (DES SOURCE)(LOW PROF)(TY 1)	LF	2,440.000		2,440.000	
	512-6022	PORT CTB (DES SOURCE)(LOW PROF)(TY 2)	LF	40.000		40.000	

Estimate & Quantity Sheet

CONTROLLING PROJECT ID 0110-05-126 **DISTRICT** Houston **COUNTY** Harris
HIGHWAY IH 45

						TOTAL EST.	TOTAL FINAL
		CONTROL SECTION JOB		**0110-05-126**			
		PROJECT ID		**A00123340**			
		COUNTY		**Harris**			
		HIGHWAY		**IH 45**			
ALT	**BID CODE**	**DESCRIPTION**	**UNIT**	EST.	FINAL		
	512-6025	PORT CTB (MOVE)(SGL SLP)(TY 1)	LF	1,710.000		1,710.000	
	512-6033	PORT CTB (MOVE)(LOW PROF)(TY 1)	LF	4,380.000		4,380.000	
	512-6034	PORT CTB (MOVE)(LOW PROF)(TY 2)	LF	80.000		80.000	
	512-6037	PORT CTB (STKPL)(SGL SLP)(TY 1)	LF	900.000		900.000	
	512-6045	PORT CTB (STKPL)(LOW PROF)(TY 1)	LF	2,440.000		2,440.000	
	512-6046	PORT CTB (STKPL)(LOW PROF)(TY 2)	LF	40.000		40.000	
	512-6080	PORT CTB CONNECT HARDWARE	EA	28.000		28.000	
	529-6011	CONC CURB (DOWEL)	LF	3,476.000		3,476.000	
	530-6025	DRIVEWAYS (CONC) (FAST TRACK)	SY	122.000		122.000	
	531-6002	CONC SIDEWALKS (5")	SY	907.000		907.000	
	531-6013	CURB RAMPS (TY 10)	EA	4.000		4.000	
	540-6001	MTL W-BEAM GD FEN (TIM POST)	LF	287.500		287.500	
	540-6006	MTL BEAM GD FEN TRANS (THRIE-BEAM)	EA	2.000		2.000	
	542-6001	REMOVE METAL BEAM GUARD FENCE	LF	455.000		455.000	
	542-6002	REMOVE TERMINAL ANCHOR SECTION	EA	2.000		2.000	
	544-6001	GUARDRAIL END TREATMENT (INSTALL)	EA	2.000		2.000	
	544-6003	GUARDRAIL END TREATMENT (REMOVE)	EA	2.000		2.000	
	545-6002	CRASH CUSH ATTEN (DES SOURCE)	EA	1.000		1.000	
	545-6004	CRASH CUSH ATTEN (STKPL)	EA	1.000		1.000	
	636-6002	ALUMINUM SIGNS (TY G)	SF	37.500		37.500	
	644-6001	IN SM RD SN SUP&AM TY10BWG(1)SA(P)	EA	2.000		2.000	
	644-6004	IN SM RD SN SUP&AM TY10BWG(1)SA(T)	EA	6.000		6.000	
	644-6006	IN SM RD SN SUP&AM TY10BWG(1)SA(T-EXAL)	EA	1.000		1.000	
	647-6001	INSTALL LRSS (STRUCT STEEL)	LB	293.700		293.700	
	647-6003	REMOVE LRSA	EA	1.000		1.000	
	658-6061	INSTL DEL ASSM (D-SW)SZ 1(BRF)GF2	EA	6.000		6.000	
	662-6060	WK ZN PAV MRK REMOV (W)4"(BRK)	LF	1,276.000		1,276.000	
	662-6063	WK ZN PAV MRK REMOV (W)4"(SLD)	LF	9,481.000		9,481.000	
	662-6071	WK ZN PAV MRK REMOV (W)8"(SLD)	LF	840.000		840.000	
	662-6095	WK ZN PAV MRK REMOV (Y)4"(SLD)	LF	7,702.000		7,702.000	
	662-6099	WK ZN PAV MRK REMOV (Y)8"(SLD)	LF	717.000		717.000	
	662-6100	WK ZN PAV MRK REMOV (Y)12"(SLD)	LF	272.000		272.000	
	672-6006	REFL PAV MRKR TY I-A	EA	21.000		21.000	
	672-6010	REFL PAV MRKR TY II-C-R	EA	84.000		84.000	
	677-6002	ELIM EXT PAV MRK & MRKS (6")	LF	1,406.000		1,406.000	
	677-6003	ELIM EXT PAV MRK & MRKS (8")	LF	1,377.000		1,377.000	
	677-6005	ELIM EXT PAV MRK & MRKS (12")	LF	241.000		241.000	

Estimate & Quantity Sheet

CONTROLLING PROJECT ID 0110-05-126 **DISTRICT** Houston **COUNTY** Harris
HIGHWAY IH 45

			CONTROL SECTION JOB		**0110-05-126**	TOTAL EST.	TOTAL FINAL
			PROJECT ID		**A00123340**		
			COUNTY		**Harris**		
			HIGHWAY		**IH 45**		
ALT	**BID CODE**	**DESCRIPTION**	**UNIT**	EST.	FINAL		
	678-6002	PAV SURF PREP FOR MRK (6")	LF	5,731.000		5,731.000	
	678-6004	PAV SURF PREP FOR MRK (8")	LF	1,340.000		1,340.000	
	678-6006	PAV SURF PREP FOR MRK (12")	LF	283.000		283.000	
	752-6015	TREE AND BRUSH REMOVAL	AC	2.260		2.260	
	3021-6001	WIDE FLANGE PAVEMENT TERMINALS	LF	95.750		95.750	
	6001-6001	PORTABLE CHANGEABLE MESSAGE SIGN	DAY	23.000		23.000	
	6038-6004	MULTIPOLYMER PAV MRK (W)(6")(SLD)	LF	2,084.000		2,084.000	
	6038-6005	MULTIPOLYMER PAV MRK (W)(6")(BRK)	LF	860.000		860.000	
	6038-6007	MULTIPOLYMER PAV MRK (W)(8")(SLD)	LF	845.000		845.000	
	6038-6017	MULTIPOLYMER PAV MRK (Y)(6")(SLD)	LF	1,927.000		1,927.000	
	6038-6020	MULTIPOLYMER PAV MRK (Y)(8")(SLD)	LF	495.000		495.000	
	6038-6021	MULTIPOLYMER PAV MRK (Y)(12")(SLD)	LF	283.000		283.000	
	6038-6024	MULTIPOLYMER PAV MRK (BLK)(6")(BRK)	LF	860.000		860.000	
	6185-6002	TMA (STATIONARY)	DAY	708.000		708.000	
	6185-6003	TMA (MOBILE OPERATION)	HR	8.000		8.000	
	18	LAW ENFORCEMENT: CONTRACTOR FORCE ACCOUNT WORK (PARTICIPATING)	LS	1.000		1.000	
		SAFETY CONTINGENCY: CONTRACTOR FORCE ACCOUNT WORK (PARTICIPATING)	LS	1.000		1.000	
		EROSION CONTROL MAINTENANCE: CONTRACTOR FORCE ACCOUNT WORK (PART)	LS	1.000		1.000	

SUMMARY OF WORKZONE QUANTITIES

LOCATION	500 6001	502 6001	512 6013	512 6021	512 6022	512 6025	512 6033	512 6034	512 6037	512 6045	512 6046	512 6080
	MOBILIZATION	BARRICADES, SIGNS AND TRAFFIC HANDLING	PORT CTB (DES SOURCE)(SGL SLP)(TY 1)	PORT CTB (DES SOURCE)(LOW PROF)(TY 1)	PORT CTB (DES SOURCE)(LOW PROF)(TY 2)	PORT CTB (MOVE)(SGL SLP)(TY 1)	PORT CTB (MOVE)(LOW PROF)(TY 1)	PORT CTB (MOVE)(LOW PROF)(TY 2)	PORT CTB (STKPL)(SGL SLP)(TY 1)	PORT CTB (STKPL)(LOW PROF)(TY 1)	PORT CTB (STKPL)(LOW PROF)(TY 2)	PORT CTB CONNECT HARDWARE
	LS	MO	LF	LF	LF	LF	LF	LF	LF	LF	LF	EA
PHASE 1A												
SHEET 1 OF 10				80								
SHEET 2 OF 10				540	20							
SHEET 3 OF 10			840	600								
SHEET 4 OF 10				560	20							
SHEET 5 OF 10												
SHEET 6 OF 10												
SHEET 7 OF 10												
SHEET 8 OF 10												
SHEET 9 OF 10												
SHEET 10 OF 10												
PHASE 1B												
SHEET 1 OF 6							80					
SHEET 2 OF 6							800					
SHEET 3 OF 6			60			900	320					
SHEET 4 OF 6	1	24		540			1120	20				28
SHEET 5 OF 6				120			120	20				
SHEET 6 OF 6												
PHASE 2												
SHEET 1 OF 6												
SHEET 2 OF 6												
SHEET 3 OF 6												
SHEET 4 OF 6							600					
SHEET 5 OF 6						420						
SHEET 6 OF 6												
PHASE 3												
SHEET 1 OF 6							80					
SHEET 2 OF 6							520	20				
SHEET 3 OF 6						390	220					
SHEET 4 OF 6							520	20				
SHEET 5 OF 6												
SHEET 6 OF 6									900	2440	40	
PROJECT TOTALS	**1**	**24**	**900**	**2440**	**40**	**1710**	**4380**	**80**	**900**	**2440**	**40**	**28**

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

SUMMARY OF WORKZONE QUANTITIES

SHEET 1 OF 3

FED. RD. DIV. NO.	PROJECT NO.		SHEET NO.
6			8
STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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SUMMARY OF WORKZONE QUANTITIES

LOCATION	545 6002	545 6004	662 6060	662 6063	662 6071	662 6095	662 6099	662 6100	677 6002	677 6003	677 6005
	CRASH CUSH ATTEN (DES SOURCE)	CRASH CUSH ATTEN (STKPL)	WK ZN PAV MRK REMOV (W)4"(BRK)	WK ZN PAV MRK REMOV (W)4"(SLD)	WK ZN PAV MRK REMOV (W)8"(SLD)	WK ZN PAV MRK REMOV (Y)4"(SLD)	WK ZN PAV MRK REMOV (Y)8"(SLD)	WK ZN PAV MRK REMOV (Y)12"(SLD)	ELIM EXT PAV MRK & MRKS (6")	ELIM EXT PAV MRK & MRKS (8")	ELIM EXT PAV MRK & MRKS (12")
	EA	EA	LF	LF	LF	LF	LF	LF	LF	LF	LF
PHASE 1A											
SHEET 1 OF 10			30	153					30		
SHEET 2 OF 10			140	540					180		
SHEET 3 OF 10			150	600					300		
SHEET 4 OF 10			226	685		356			176	1035	78
SHEET 5 OF 10				635		375			150	342	163
SHEET 6 OF 10				630					70		
SHEET 7 OF 10				615					70		
SHEET 8 OF 10				623							
SHEET 9 OF 10				27							
SHEET 10 OF 10				320		530			270		
PHASE 1B											
SHEET 1 OF 6				75		75					
SHEET 2 OF 6			60	534		600					
SHEET 3 OF 6			150	600		600					
SHEET 4 OF 6			150	530		600			20		
SHEET 5 OF 6	1		60			600			80		
SHEET 6 OF 6						340			60		
PHASE 2											
SHEET 1 OF 6											
SHEET 2 OF 6											
SHEET 3 OF 6											
SHEET 4 OF 6				60		660	225				
SHEET 5 OF 6		1				600					
SHEET 6 OF 6						340					
PHASE 3											
SHEET 1 OF 6			20	120		75					
SHEET 2 OF 6			150	610		600					
SHEET 3 OF 6			140	700		600					
SHEET 4 OF 6				738	840	751	151	128			
SHEET 5 OF 6				588			341	144			
SHEET 6 OF 6				98							
PROJECT TOTALS	**1**	**1**	**1276**	**9481**	**840**	**7702**	**717**	**272**	**1406**	**1377**	**241**

Texas Department of Transportation

IH 45
SB FRONTAGE RD

SUMMARY OF WORKZONE QUANTITIES

SHEET 2 OF 3

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		8A

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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SUMMARY OF WORKZONE QUANTITIES

LOCATION	6001 6001 PORTABLE CHANGEABLE MESSAGE SIGN DAY	6185 6002 TMA (STATIONARY) DAY	6185 6003 TMA (MOBILE OPERATION) HR
PHASE 1			
SHEET 1 OF 9			
SHEET 2 OF 9			
SHEET 3 OF 9			
SHEET 4 OF 9			
SHEET 5 OF 9			
SHEET 6 OF 9			
SHEET 7 OF 9			
SHEET 8 OF 9			
SHEET 9 OF 9			
PHASE 2A			
SHEET 1 OF 6			
SHEET 2 OF 6			
SHEET 3 OF 6			
SHEET 4 OF 6			
SHEET 5 OF 6	23	708	8
SHEET 6 OF 6			
PHASE 2B			
SHEET 1 OF 6			
SHEET 2 OF 6			
SHEET 3 OF 6			
SHEET 4 OF 6			
SHEET 5 OF 6			
SHEET 6 OF 6			
PHASE 3			
SHEET 1 OF 6			
SHEET 2 OF 6			
SHEET 3 OF 6			
SHEET 4 OF 6			
SHEET 5 OF 6			
SHEET 6 OF 6			
PROJECT TOTALS	**23**	**708**	**8**

Texas Department of Transportation

IH 45
SB FRONTAGE RD

SUMMARY OF WORKZONE QUANTITIES

SHEET 3 OF 3

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		8B

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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SUMMARY OF ROADWAY QUANTITIES

LOCATION	100 6002	110 6001	132 6006	132 6035	260 6006	260 6012	276 6224	292 6017	360 6004	360 6043	360 6045	432 6001	432 6045
	PREPARING ROW	EXCAVATION (ROADWAY)	EMBANKMENT (FINAL)(DENS CONT)(TY C)	EMBANK(FINAL)(DC)(TY E)(CSBE)	LIME TRT (EXST MATL) (6")	LIME(HYD,COM OR QK)(SLRY)OR QK(DRY)	CEM TRT(PLNT MX) (CL N)(TY E)(GR 4)(6")	ASPHALT STAB BASE (GR 4)(PG 64)	CONC PVMT (CONT REINF - CRCP) (10")	CONC PVMT (CONT REINF)(FAST TRK)(13")	CONC PVMT (CONT REINF)(FAST TRK)(15")	RIPRAP (CONC)(4 IN)	RIPRAP (MOW STRIP)(4 IN)
	STA	CY	CY	CY	SY	TON	SY	TON	SY	SY	SY	CY	CY
SHEET 1 OF 5	0.75	1382	4472		373	5.04	373	17.6	320				
SHEET 2 OF 5	6.00				3058	41.28	3058	152	2765				
SHEET 3 OF 5	6.00			1989	1199	16.19	1199	58	1062				3.33
SHEET 4 OF 5	6.00				746	10.07	746	37	668	2803	396	88	15.00
SHEET 5 OF 5					169	2.28	169	7			135		
PROJECT TOTALS	19	1,382	4,472	1,989	5,545	75	5,545	272	4,815	2,803	531	88	18

SUMMARY OF ROADWAY QUANTITIES

LOCATION	450 6032	529 6011	530 6025	531 6002	531 6013	540 6001	540 6006	544 6001	658 6061	3021 6001
	RAIL (TY C223)	CONC CURB (DOWEL)	DRIVEWAYS (CONC) (FAST TRACK)	CONC SIDEWALKS (5")	CURB RAMPS (TY 10)	MTL W-BEAM GD FEN (TIM POST)	MTL BEAM GD FEN TRANS (THRIE-BEAM)	GUARDRAIL END TREATMENT (INSTALL)	INSTL DEL ASSM (D-SW)SZ 1(BRF)GF2	WIDE FLANGE PAVEMENT TERMINALS
	LF	LF	SY	SY	EA	LF	EA	EA	EA	EA
SHEET 1 OF 5		152		44	1					
SHEET 2 OF 5	200	1154	122	362	2					
SHEET 3 OF 5	211	772		143		58	1		1	95.75
SHEET 4 OF 5	319	1340		358	1	229.5	1	2	5	
SHEET 5 OF 5		58								
PROJECT TOTALS	730	3,476	122	907	4	287.50	2	2	6	95.75

SUMMARY OF RETAINING WALL QUANTITIES

LOCATION	423 6001	432 6045	* 556 6005
	RETAINING WALL (MSE)	RIPRAP (MOW STRIP)(4 IN)	PIPE UNDERDRAINS (TY 5) (6")
	SF	CY	LF
SHEET 1 OF 2	3725	7.60	270.00
SHEET 2 OF 2	5587	10.40	357.00
PROJECT TOTALS	9312	18.00	627.00

* FOR CONTRACTORS INFORMATION ONLY

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

SUMMARY OF ROADWAY AND RETAINING WALL QUANTITIES

SHEET 1 OF 1

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		9

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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SUMMARY OF DEMOLITION QUANTITIES												
LOCATION	104 6001	104 6009	104 6017	104 6027	105 6018	110 6002	496 6010	542 6001	542 6002	544 6003	647 6003	752 6015
	REMOVING CONC (PAV)	REMOVING CONC (RIPRAP)	REMOVING CONC (DRIVEWAYS)	REMOVING CONC (APPR SLAB)	REMOVING STAB BASE AND ASPH PAV (7")	EXCAVATION (CHANNEL)	REMOV STR (BRIDGE 100 - 499 FT LENGTH)	REMOVE METAL BEAM GUARD FENCE	REMOVE TERMINAL ANCHOR SECTION	GUARDRAIL END TREATMENT (REMOVE)	REMOVE LRSA	TREE AND BRUSH REMOVAL
	SY	SY	SY	SY	SY	CY	EA	LF	EA	EA	EA	AC
SHEET 1 OF 5	325				325							
SHEET 2 OF 5	2469	221	158		2469							
SHEET 3 OF 5	753	648		169	753	25,000.00	1	153	2			2.26
SHEET 4 OF 5	3626	519			3505			302		2	1	
SHEET 5 OF 5	264				264							
PROJECT TOTALS	7,437	1,388	158	169	7,316	25,000	1	455	2	2	1	2.26

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

SUMMARY OF DEMOLITION QUANTITIES

SHEET 1 OF 1

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		10

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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SUMMARY OF BRIDGE QUANTITIES

LOCATION	416 6001	416 6003	416 6005	420 6013	420 6029	420 6037	422 6001	422 6013	425 6039	432 6008	442 6007	450 6006	450 6032	454 6020
	DRILL SHAFT (18 IN)	DRILL SHAFT (30 IN)	DRILL SHAFT (42 IN)	CL C CONC (ABUT)	CL C CONC (CAP)	CL C CONC (COLUMN)	REINF CONC SLAB	BRIDGE SIDEWALK	PRESTR CONC GIRDER (TX54)	RIPRAP (CONC)(CL B)(RR8&RR9)	STR STEEL (MISC NON - BRIDGE)	RAIL (TY T223)	RAIL (TY C223)	SEALED EXPANSION JOINT (4 IN) (SEJ - B)
	LF	LF	LF	CY	CY	CY	SF	SF	LF	CY	LB	LF	LF	LF
	122	804	1,050	67.60	77.10	61.70	18,625	3,339	2,446.35	47.40	318	427	389	132
PROJECT TOTALS	122	804	1,050	67.60	77.10	61.70	18,625	3,339	2,446.35	47.40	318	427	389	132

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Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

SUMMARY OF BRIDGE QUANTITIES

SHEET 1 OF 1

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		11

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

SUMMARY OF DRAINAGE QUANTITIES

LOCATION	400 6001	400 6005	400 6009	402 6001	432 6002	462 6008	462 6011	464 6003	464 6005	465 6172	465 6176
	STRUCT EXCAV	CEM STABIL BKFL	CEMENT STAB BACKFILL (INLET OR MH)	TRENCH EXCAVATION PROTECTION	RIPRAP (CONC)(5 IN)	CONC BOX CULV (5 FT X 4 FT)	CONC BOX CULV (6 FT X 4 FT)	RC PIPE (CL III)(18 IN)	RC PIPE (CL III)(24 IN)	INLET (COMPL) (TY AZR2G)	INLET (COMPL)(CURB)(TY C1)
	CY	CY	CY	LF	CY	LF	LF	LF	LF	EA	EA
SHEET 1 OF 4	1176	308	17	292	17		345				2
SHEET 2 OF 4	1195	386	68	485	191		432		6	2	1
SHEET 3 OF 4	1873	453	64	583	173	545				3	
SHEET 4 OF 4	656	159	38	197	37	195		51		1	2
PROJECT TOTALS	4900	1306	187	1557	418	740	777	51	6	6	5

* FOR CONTRACTOR'S INFORMATION ONLY

465 6270	465 6341	467 6227	467 6395	496 6002	496 6003	496 6004	496 6007	496 6008
MANH (COMPL)(TY M)	INLET (COMPL) (EXT) (TY CI)	SET (TY I)(S= 6 FT)(HW= 7 FT)(3:1) (C)	SET (TY II) (24 IN) (RCP) (6: 1) (P)	REMOV STR (INLET)	REMOV STR (MANHOLE)	REMOV STR (SET)	REMOV STR (PIPE)	REMOV STR (BOX CULVERT)
EA	EA	EA	EA	EA	EA	EA	LF	LF
	3				1			295
3	1	1	2		1	2		469
2		1			2		26	553
	3			1				212
5	7	2	2	1	4	2	26	1529

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

SUMMARY OF
DRAINAGE QUANTITIES

SHEET 1 OF 1

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		12

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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SUMMARY OF SWP3 QUANTITIES													
LOCATION	162 6003	164 6051	166 6001	168 6001	506 6002	506 6011	506 6020	506 6024	506 6034	506 6038	506 6039	506 6041	506 6043
	STRAW OR HAY MULCH	DRILL SEED (TEMP)(WARM OR COOL)	FERTILIZER	VEGETATIVE WATERING	ROCK FILTER DAMS (INSTALL) (TY 2)	ROCK FILTER DAMS (REMOVE)	CONSTRUCTION EXITS (INSTALL) (TY 1)	CONSTRUCTION EXITS (REMOVE)	CONSTRUCTION PERIMETER FENCE	TEMP SEDMT CONT FENCE (INSTALL)	TEMP SEDMT CONT FENCE (REMOVE)	BIODEG EROSN CONT LOGS (INSTL) (12")	BIODEG EROSN CONT LOGS (REMOVE)
	SY	SY	AC	MG	LF	LF	SY	SY	LF	LF	LF	LF	LF
SHEET 1 OF 5	462	462	0.10	11						75	75		
SHEET 2 OF 5	1990	1990	0.41	49						564	564	111	111
SHEET 3 OF 5	3272	3272	0.68	81	35	35	150	150	225	172	172	287	287
SHEET 4 OF 5	1502	1502	0.31	37						542	542	120	120
SHEET 5 OF 5	739	739	0.15	18									
PROJECT TOTALS	7965	7965	1.65	197	35	35	150	150	225	1353	1353	518	518

SUMMARY OF SOD QUANTITIES		
162 6002	166 6001	168 6001
BLOCK SODDING	FERTILIZER	VEGETATIVE WATERING
SY	AC	MG
462	0.10	11
1990	0.41	49
3272	0.68	81
1502	0.31	37
739	0.15	18
7965	1.65	197

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

SUMMARY OF SWP3 AND SOD QUANTITIES

SHEET 1 OF 1

FED.RD. DIV.NO.	PROJECT NO.		SHEET NO.
6			13
STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

SUMMARY OF SIGNING AND PAVEMENT MARKING QUANTITIES												
LOCATION	672 6006	672 6010	678 6002	678 6004	678 6006	6038 6004	6038 6005	6038 6007	6038 6017	6038 6020	6038 6021	6038 6024
	REFL PAV MRKR TY I-A	REFL PAV MRKR TY II-C-R	PAV SURF PREP FOR MRK (6")	PAV SURF PREP FOR MRK (8")	PAV SURF PREP FOR MRK (12")	MULTIPOLYMER PAV MRK (W)(6")(SLD)	MULTIPOLYMER PAV MRK (W)(6")(BRK)	MULTIPOLYMER PAV MRK (W)(8")(SLD)	MULTIPOLYMER PAV MRK (Y)(6")(SLD)	MULTIPOLYMER PAV MRK (Y)(8")(SLD)	MULTIPOLYMER PAV MRK (Y)(12")(SLD)	MULTIPOLYMER PAV MRK (BLK)(6")(BRK)
	EA	EA	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF
SHEET 1 OF 5		2	231			75	40		76			40
SHEET 2 OF 5		14	1713			513	300		600			300
SHEET 3 OF 5		14	1860			700	280		600			280
SHEET 4 OF 5	7	45	1646	996	125	746	150	845	600	151	125	150
SHEET 5 OF 5	14	9	280	344	158	50	90		50	344	158	90
ROJECT TOTAL	21	84	5731	1340	283	2084	860	845	1927	495	283	860

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Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

SUMMARY OF PAVEMENT MARKING QUANTITIES

SHEET 1 OF 1

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		14

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

SUMMARY OF SMALL SIGNS

LAYOUT SHEET NO.	SIGN NO.	SIGN TYPE	SIGN TEXT	SIGN DIMENSIONS (IN)	PLYWOOD SNGS	ALUMINUM SIGNS TYPE A	644 - INS SM RD SN SUP & AM TYPE OF MOUNT																		
							6001 10BWG (1) SA (P) EA	6002 10BWG (1) SA (P-BM) EA	6004 10BWG (1) SA (T) EA	6005 10BWG (1) SA (T-2EXT) EA	6006 10BWG (1) SA (U) EA	6017 10BWG (2) SA (P) EA	6019 10BWG (2) SA (T-2EXT) EA	6027 S80 (1) SA (P) EA	6040 S80 (1) SA (P-BM) EA	6030 S80 (1) SA (T) EA	6031 S80 (1) SA (T-2EXT) EA	6033 S80 (1) SA (U) EA	6034 S80 (1) SA (U-1EXT) EA	6035 S80 (1) SA (U-2EXT) EA	6036 S80 (1) SA (U-BM) EA	6037 S80 (1) SA (U-WC) EA	6050 S80 (2) SA (P) EA	6052 S80 (2) SA (T-2EXT) EA
3	1	M3-3B		24 X 12		X	X																		
		M1-1		24 X 24		X																			
3	2			48 X 30		X					X														
4	1	R2-1		24 X 30		X	X																		
4	2	W8-13aT		48 X 48		X			X																
4	3	R5-1		48 X 48		X			X																
4	4	R5-1	 BACK TO BACK	48 X 48		X			X																
		R4-3bT		48 X 48		X																			
4	5	R5-1A	 BACK TO BACK WITH LARGE EXIST. EXIT SIGN	48 X 36		X			X																
4	6	R5-1A		48 X 36		X			X																
5	1	W4-3L		48 X 48		X			X																
TOTAL		9					2		6		1														

GENERAL NOTES:

ALL SIGNS SHALL BE ERECTED ACCORDING TO THE LOCATION SHOWN ON THE LAYOUT SHEETS EXCEPT THAT THE ENGINEER MAY SHIFT A SIGN IN ORDER TO SECURE A MORE DESIRABLE LOCATION. THE CONTRACTOR WILL STAKE ALL SIGN LOCATIONS, AND NO CHANGES IN THOSE LOCATIONS SHALL BE MADE WITHOUT PRIOR APPROVAL OF THE ENGINEER.

ALUMINUM SIGN BLANKSTY A)

Square Ft.	Min. Thickness
Less than 7.5	0.080"
7.5 to 15	0.100"
Greater than 15	0.125"

SUMMARY OF SMALL SIGNS

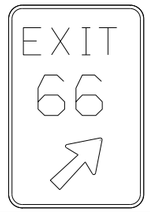
 SHEET 1 OF 1

DISTRICT	COUNTY	CONTROL	SECTION	JOB	SHEET NO.
HOU	HARRIS	0110	05	126	15

DISTRICT: HOU
COUNTY: HARRIS
CONTROL: 0110
SECTION: 05
JOB: 126
SHEET NO.: 15
HIGHWAY: IH 45

STD-N29

SUMMARY OF LARGE SIGNS

LAYOUT SHEET NO.	SIGN NO.	STATION NO.	TYPE	BACKGROUND COLOR	TEXT	SIGN DIMENSIONS (FT)	636 (6002) ALUM SIGNS (TY G) SF	636 (6003) ALUM SIGNS (TY O) SF	647 (6001) * INSTALL LRSS (STRUCT STL) TYPE MOUNT	SIZE	LENGTH (FT) LEFT POST	LENGTH (FT) CENTER POST	LENGTH (FT) RIGHT POST	TOTAL WEIGHT LBS	416 DRILL SHAFT FND (6015) (NON-REINF) (12") LF	416 DRILL SHAFT FND (6018) (SIGN MTS) (24") LF
4	1	902+85	E5-1C	GREEN		5'-0"X7'-6"	37.5		121	S4x7.7	14.5	0	14.5	293.7	7.0	
													GROUND MOUNTED			

LAYOUT SHEET NO.	SIGN NO.	STATION NO.	TYPE	BACKGROUND COLOR	TEXT	SIGN DIMENSIONS (FT)	636 (6002) ALUM SIGNS (TY G) SF	636 (6003) ALUM SIGNS (TY O) SF	647 (6001) * INSTALL LRSS (STRUCT STL) TYPE MOUNT	SIZE	LENGTH (FT) LEFT POST	LENGTH (FT) CENTER POST	LENGTH (FT) RIGHT POST	TOTAL WEIGHT LBS	416 DRILL SHAFT FND (6015) (NON-REINF) (12") LF	416 DRILL SHAFT FND (6018) (SIGN MTS) (24") LF

** OBJECT MARKER (OM1-3) NEED TO BE INSTALLED ON EACH POST. FURNISHING AND INSTALLING OBJECT MARKER OM1-3 IS SUBSIDIARY TO THE ITEM, "ALUMINUM SIGNS (TYPE G)".

*** THE SLOPE OF THE ROADSIDE WAS APPROXIMATED BY FIELD MEASUREMENT. THE CONTRACTOR SHALL VERIFY THE LENGTH OF THE POST PRIOR TO ANY CONSTRUCTION.

* POST LENGTHS SHOWN DO NOT INCLUDE STUB LENGTHS BUT THE TOTAL WEIGHT INCLUDES STUB POSTS, BASE CONNECTION PLATES & STIFFENERS, FRICTION FUSE R's AND ALL HIGH STRENGTH BOLTS, NUTS AND WASHERS.

SUMMARY OF LARGE SIGNS

SHEET 1 OF 1

STATE DISTRICT	FEDERAL REGION	PROJECT NO.	SHEET
12	6		16

COUNTY	CONTROL	SECTION	JOB	HIGHWAY NO.
HARRIS	0110	05	126	IH 45

STD-N34

TRAFFIC CONTROL NOTES

PHASE 1A

- SHIFT TRAFFIC ON THE INSIDE TWO SB FRONTAGE RD LANES AND DEMOLISH 8.83' OF THE EXISTING BRIDGE.
- MAINTAIN 2-11 FOOT LANES ON THE NORTH AND SOUTH SIDE OF THE BRIDGE.
- MAINTAIN TRAFFIC ON EXIT RAMP AND MAINTAIN 2 LANES OPEN ACROSS BRIDGE.
- INSTALL PROPOSED DRAINAGE STRUCTURES.
- CONSTRUCT 29.29' WIDE PROPOSED BRIDGE SECTION.
- CONSTRUCT CRCP PAVEMENT FROM BL IH 45 SBFR STA. 884+25 TO 892+20 AND FROM 896+09 TO STA. 898+21.30 AS SHOWN ON PLAN.
- CONSTRUCT FAST TRACK PAVEMENT FROM IH 45 SBFR STA. 898+21.30 TO 902+36.52.
- CONSTRUCT RETAINING WALL.

PHASE 1B

- PLACE TEMPORARY REMOVABLE WORK ZONE PAVEMENT MARKINGS AND SHIFT TRAFFIC TO THE TWO OUTSIDE LANES ON PAVEMENT CONSTRUCTED IN PHASE 1A.
- CLOSE FM 1960 EXIT RAMP AS PER STANDARD (6-3b)-12. CONSTRUCT RAMP WITH FAST TRACK FROM BL EXRAMP 1960 STA. 1+99.30 TO STA. 7+28.38. THIS WORK WILL BE COMPLETE IN 2 WEEKEND DAYS AND 2 WORK DAYS.

PHASE 2:

- KEEP TRAFFIC OPEN TO THE TWO OUTSIDE LANES AS IN PHASE 1B.
- PLACE TEMPORARY REMOVABLE WORK ZONE PAVEMENT MARKINGS ON NEWLY CONSTRUCTED RAMP ON PAHSE 1B AND OPEN TO TRAFFIC.
- CONSTRUCT REMAINING CRCP PAVEMENT FROM BL IH 45 SBFR STA. 884+25 TO 892+20 AND FROM 896+09 TO STA. 898+21.30 AND THE PROPOSED FLUME AS SHOWN ON PLAN.

PHASE 3:

- PLACE TEMPORARY REMOVABLE WORK ZONE PAVEMENT MARKINGS AND MAINTAIN 2 LANES OPEN TO TRAFFIC BEGINING TO END OF PROJECT.
- CONSTRUCT THE 6' SIDEWALK AS SHOWN ON PLANS.
- PLACE FINAL PAVEMENT MARKINGS.
- REMOVE BARRICADES, WORK ZONE SIGNS AND SWP3 BMPS. OPEN ROADWAY TO TRAFFIC.

THE PROJECT WILL BE COMPLETED AT THE END OF PHASE 3.

NOTES:

THIS IS A SUGGESTED TRAFFIC CONTROL PLAN SUBMITTED FOR THE CONTRACTOR'S CONSIDERATION. THE CONTRACTOR MAY SUBMIT AN ALTERNATE TRAFFIC CONTROL PLAN TO THE ENGINEER FOR APPROVAL. NO PHASE OF CONSTRUCTION SHALL START UNTIL COMPLETION OF THE PREVIOUS PHASE, UNLESS OTHER WISE APPROVED BY THE ENGINEER.

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED PROFESSIONAL ENGINEER

Sharmeen Rahman, P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

TRAFFIC CONTROL
NOTES

SHEET 1 OF 1

FED.RD. DIV.NO.	PROJECT NO.		SHEET NO.
6			17
STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

9/27/2021 11:21:13 AM
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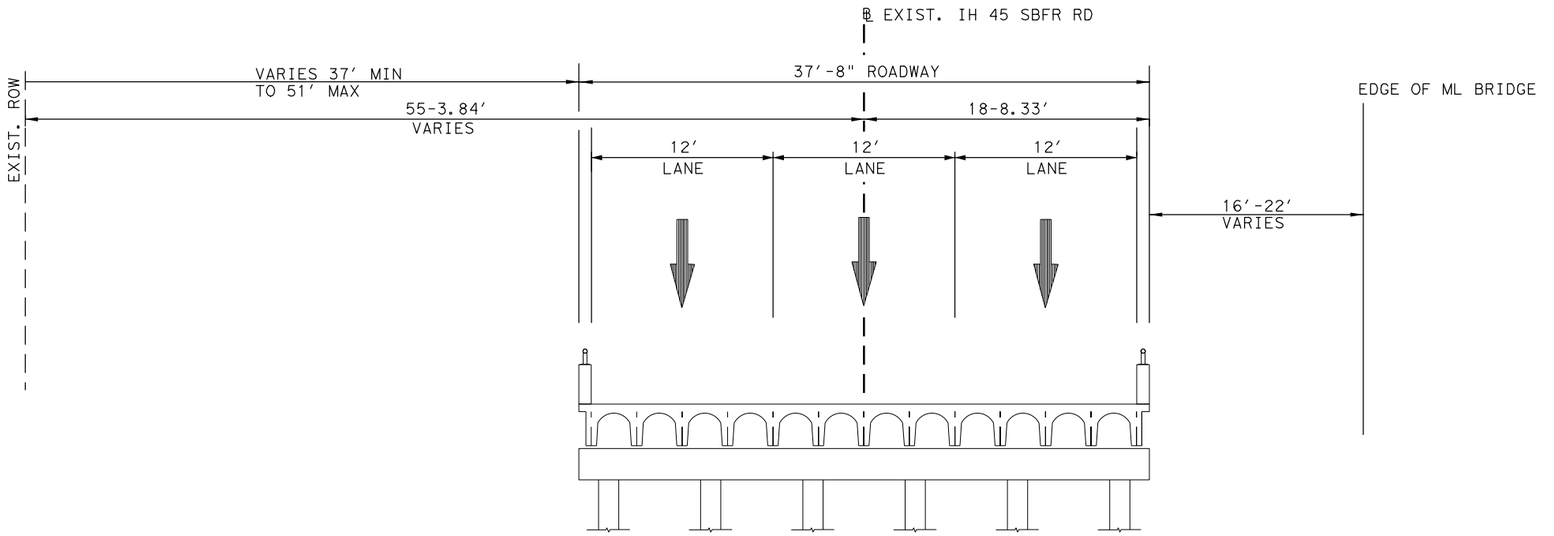

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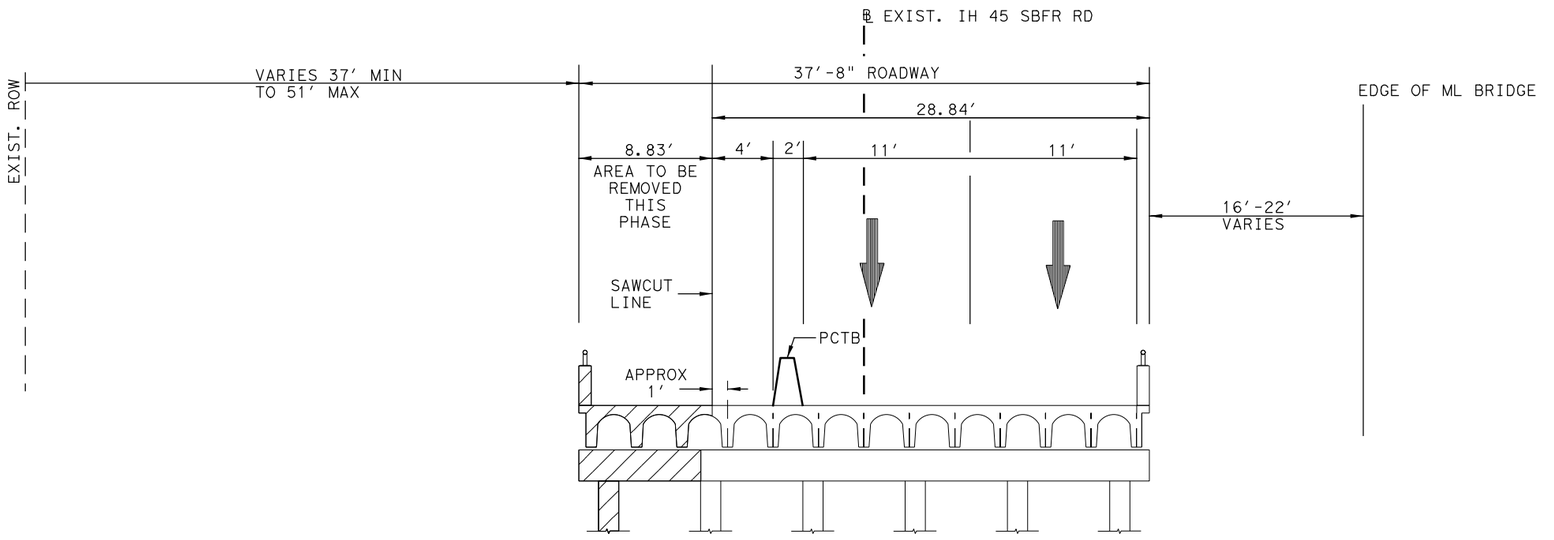

PHASE I STEP I

0′ 5′ 10′
SCALE: 1"=10′

HAYDEN CONSULTANTS, INC.
F-00640

STATE OF TEXAS
MOLLY MAUS
125260
LICENSED
PROFESSIONAL ENGINEER
9/24/2021

REV	DATE	BY	DESCRIPTION

HAYDEN CONSULTANTS, INC.
A GEI Company
5646 MILTON STREET, SUITE 500
DALLAS, TX 75206
PHONE 214.753.8100
FIRM REGISTRATION NO. 00640
WWW.HAYDENCONSULTANTS.COM

Texas Department of Transportation®

IH 45 SB FRONTAGE RD AT CYPRESS CREEK

BRIDGE CONSTRUCTION SEQUENCE

SCALE: 1"=10′ SHEET 1 OF 4

DESIGNED	FED. RD. DIV. NO.		FEDERAL AID PROJECT NO.	HIGHWAY NO.
HCI	6			IH 45
DRAWN	STATE	DISTRICT	COUNTY	SHEET NO.
HCI	TEXAS	12	HARRIS	18
CHECKED	CONTROL	SECTION	JOB	
HCI	0110	05	126	
APPROVED				
HCI				

USER: cmcdermott
DATE: 9/24/2021
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PLOT DRIVER: TXDOT_PDF_BW.pltcfg

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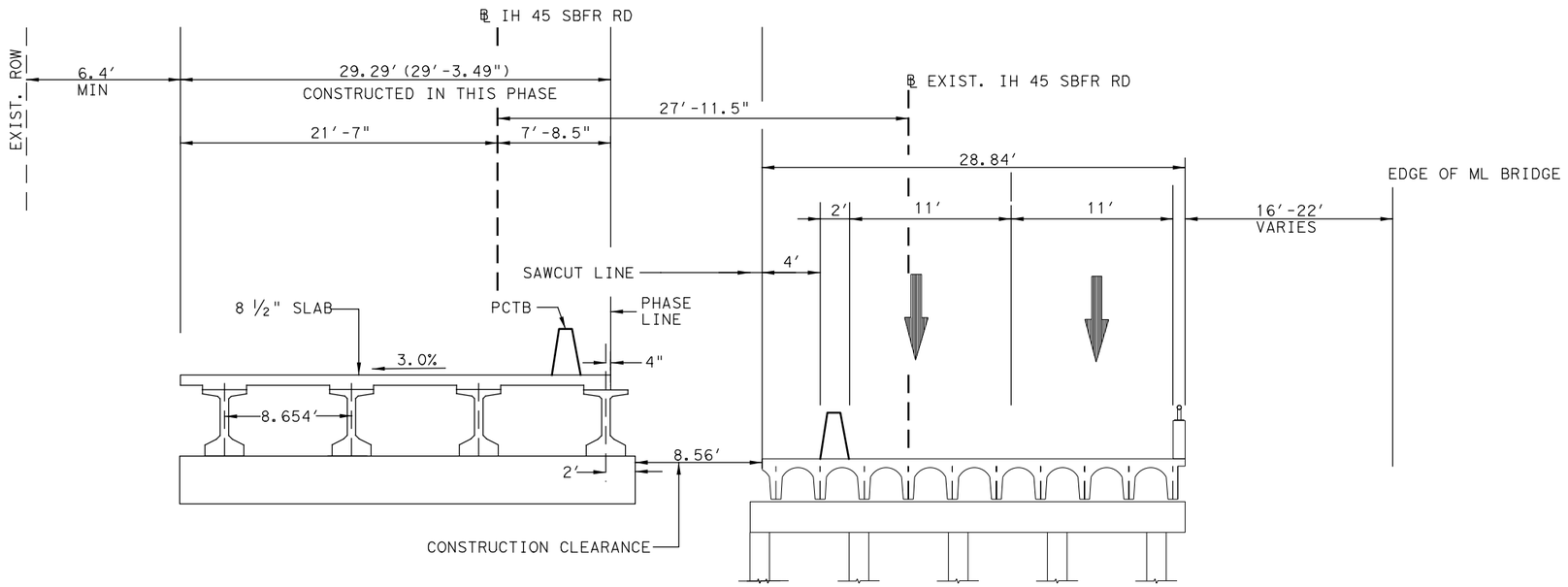
SCALE: 1"=10′



PHASE I STEP II

HAYDEN CONSULTANTS, INC.
F-00640

STATE OF TEXAS
MOLLY MAUS
125260
LICENSED PROFESSIONAL ENGINEER
9/24/2021

REV	DATE	BY	DESCRIPTION

HAYDEN CONSULTANTS, INC.
A GEI Company
5646 MILTON STREET, SUITE 500
DALLAS, TX 75206
PHONE 214.753.8100
FIRM REGISTRATION NO. 00640
WWW.HAYDENCONSULTANTS.COM

Texas Department of Transportation®

IH 45 SB FRONTAGE RD AT CYPRESS CREEK

BRIDGE CONSTRUCTION SEQUENCE

SCALE: 1"=10′ SHEET **2** OF **4**

DESIGNED	FED. RD. DIV. NO.		FEDERAL AID PROJECT NO.	HIGHWAY NO.
HCI	6			IH 45
DRAWN HCI	STATE	DISTRICT	COUNTY	SHEET NO.
CHECKED HCI	TEXAS	12	HARRIS	19
APPROVED HCI	CONTROL	SECTION	JOB	
	0110	05	126	

USER: cmcdermott
DATE: 9/24/2021
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LUM_TxDOT Civil Engineering
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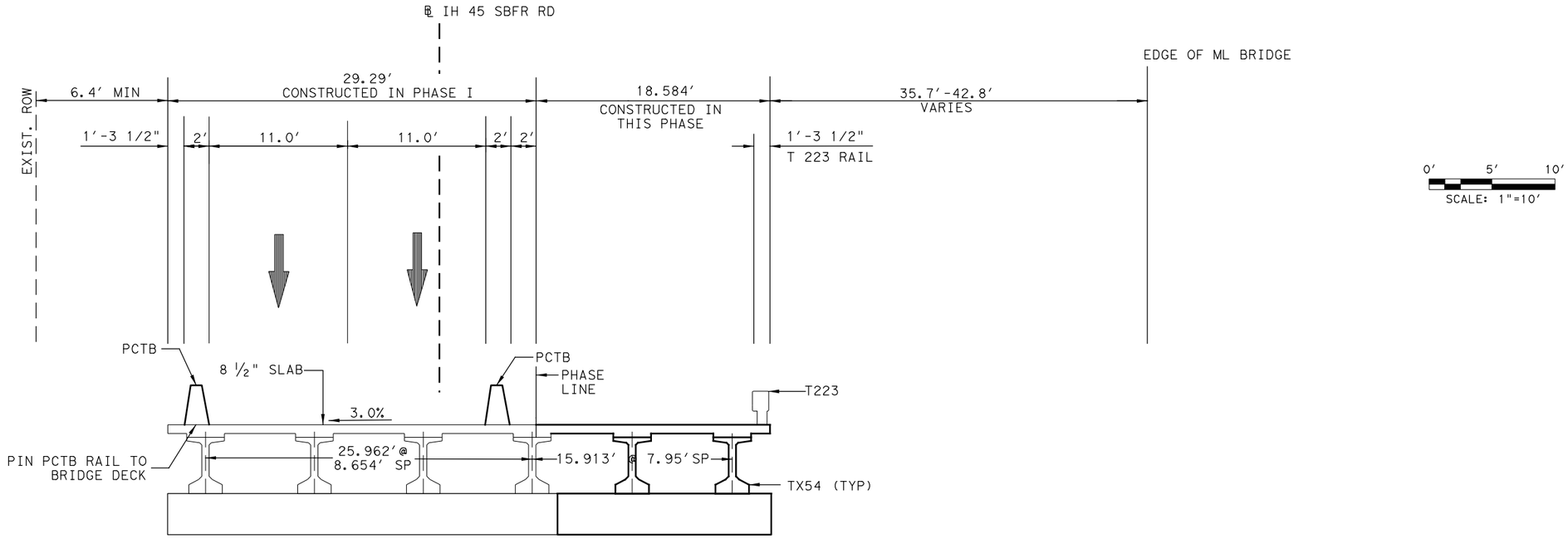
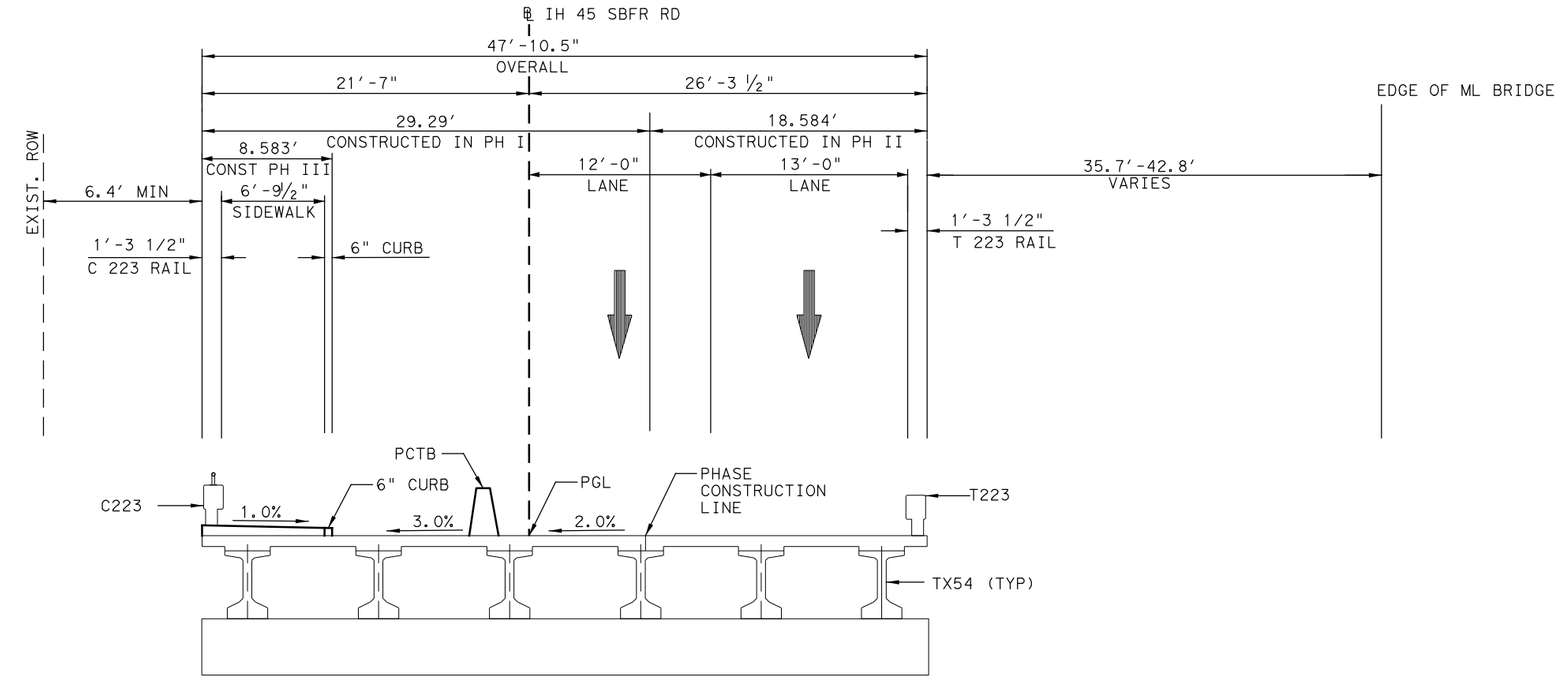


PHASE II



PHASE III

HAYDEN CONSULTANTS, INC.
F-00640

STATE OF TEXAS
MOLLY MAUS
125260
LICENSED
PROFESSIONAL ENGINEER
9/24/2021

REV	DATE	BY	DESCRIPTION

HAYDEN CONSULTANTS, INC.
A GEI Company
5646 MILTON STREET, SUITE 500
DALLAS, TX 75206
PHONE 214.753.8100
FIRM REGISTRATION NO. 00640
WWW.HAYDENCONSULTANTS.COM

Texas Department of Transportation®

IH 45 SB FRONTAGE RD AT CYPRESS CREEK

BRIDGE CONSTRUCTION SEQUENCE

SCALE: 1"=10' SHEET **3** OF **4**

DESIGNED	FED. RD. DIV. NO.		FEDERAL AID PROJECT NO.	HIGHWAY NO.
HCI	6			IH 45
DRAWN	STATE	DISTRICT	COUNTY	SHEET NO.
HCI	TEXAS	12	HARRIS	20
CHECKED	CONTROL	SECTION	JOB	
HCI	0110	05	126	
APPROVED				
HCI				

USER: cmcdermott
DATE: 9/24/2021
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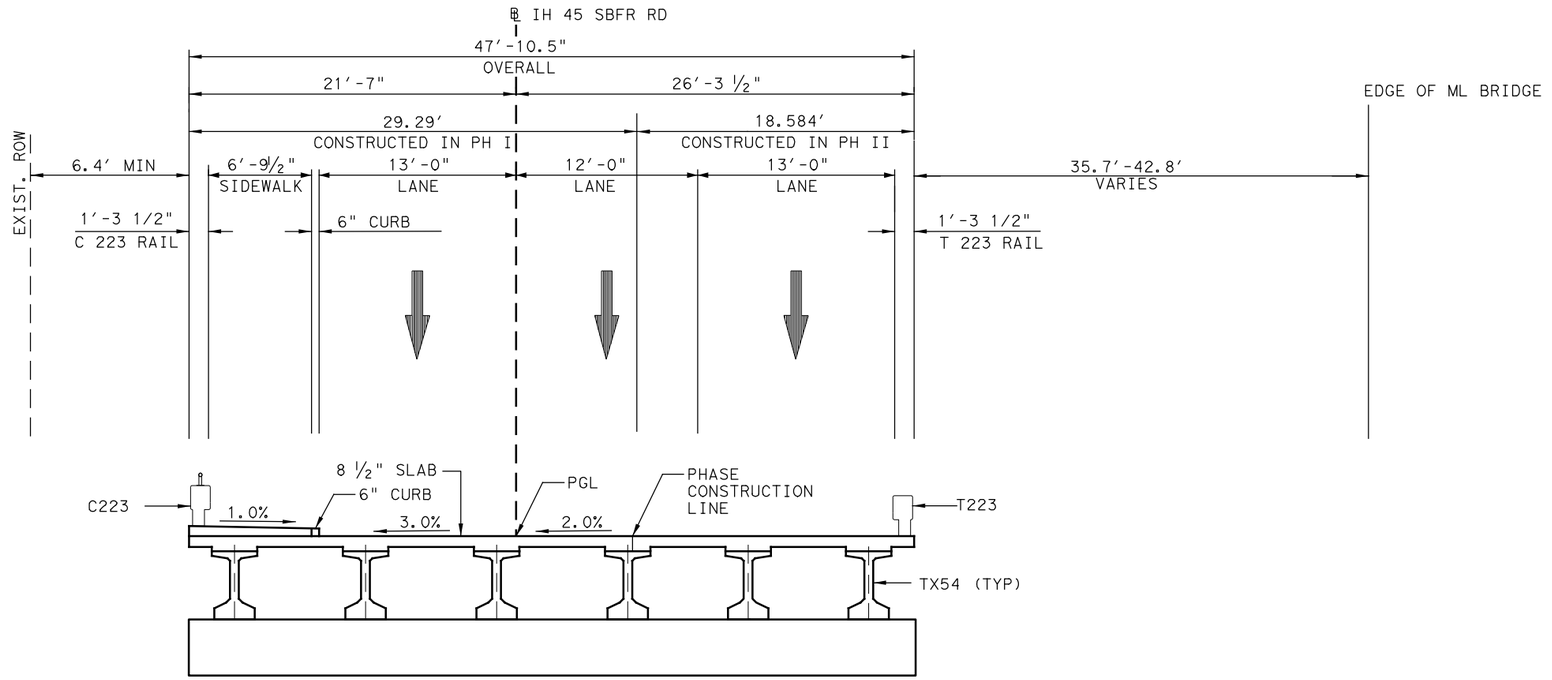

FINAL PROPOSED TYPICAL

HAYDEN CONSULTANTS, INC.
F-00640

STATE OF TEXAS
MOLLY MAUS
125260
LICENSED
PROFESSIONAL ENGINEER
9/24/2021

REV	DATE	BY	DESCRIPTION

HAYDEN CONSULTANTS, INC.
A GEI Company
5646 MILTON STREET, SUITE 500
DALLAS, TX 75206
PHONE 214.753.8100
FIRM REGISTRATION NO. 00640
WWW.HAYDENCONSULTANTS.COM

Texas Department of Transportation®

IH 45 SB FRONTAGE RD AT CYPRESS CREEK

BRIDGE CONSTRUCTION SEQUENCE

SCALE: 1"=10′ SHEET 4 OF 4

DESIGNED	FED. RD. DIV. NO.		FEDERAL AID PROJECT NO.	HIGHWAY NO.
HCI	6			IH 45
DRAWN	STATE	DISTRICT	COUNTY	SHEET NO.
HCI	TEXAS	12	HARRIS	21
CHECKED	CONTROL	SECTION	JOB	
HCI	0110	05	126	
APPROVED				
HCI				

USER: cmcdermott
DATE: 9/24/2021
SCALE: 1:10
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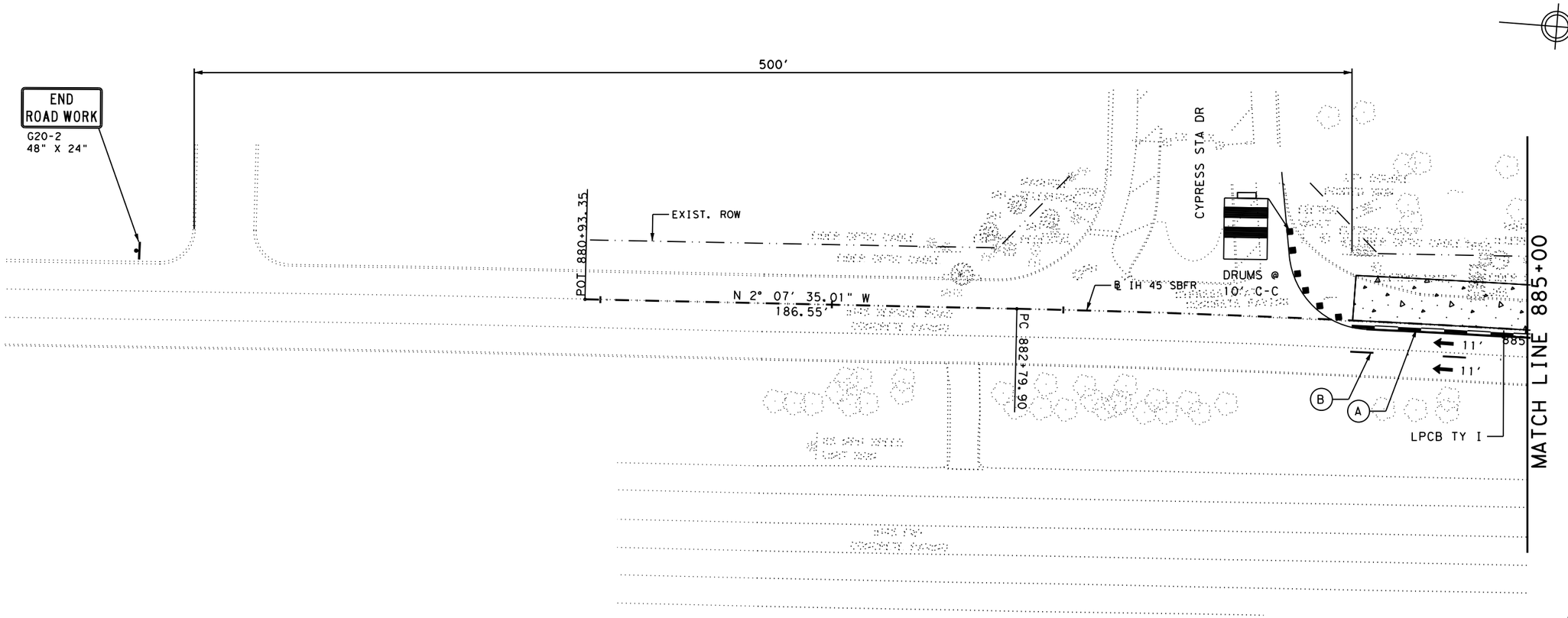

TRAFFIC CONTROL GENERAL NOTES:

1. ADVANCE WARNING SIGNS SHALL BE IN PLACE PRIOR TO ANY CONSTRUCTION AND SHALL REMAIN IN PLACE DURING ALL PHASE OF CONSTRUCTION. SEE "BARRICADES AND CONSTRUCTION" STANDARDS.
2. PROVIDE PORTABLE CHANGEABLE MESSAGE SIGNS AS NEEDED FOR ROAD CLOSURE NOTIFICATION.
3. PROVIDE AND MAINTAIN DRIVEWAY ACCESS THROUGHOUT CONSTRUCTION.
4. THE CONTRACTOR WILL BE RESPONSIBLE FOR MAINTAINING DRAINAGE THROUGHOUT ALL PHASES OF CONSTRUCTION.
5. CONSTRUCTION SPEED ZONE 40 MPH WILL BE IN PLACE.

LEGEND

- (A) WRK ZN PAV MRK REMOV(W)(4")(SLD)
- (B) WRK ZN PAV MRK REMOV(W)(4")(BRK)
- (C) WRK ZN PAV MRK REMOV(Y)(4")(SLD)
- (D) WRK ZN PAV MRK REMOV(W)(8")(SLD)
- (E) WRK ZN PAV MRK REMOV(Y)(8")(SLD)
- (F) WRK ZN PAV MRK REMOV(Y)(12")(SLD)

- FAST TRACK
- 10" CRCP
- BRIDGE SLAB
- SIDEWALK
- RIPRAP
- PAVEMENT COMPLETED IN PREVIOUS STEP

LEGEND			
	TY III BARRICADE		CHANNELIZING DEVICES
	HEAVY WORK VEHICLE		TRUCK MOUNTED ATTENUATOR (TMA)
	TRAILER MOUNTED FLASHING ARROW BOARD	M	PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)
	SIGN		OPEN TO TRAFFIC
	CONCRETE TRAFFIC BARRIER (CTB)		

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED
PROFESSIONAL ENGINEER

Sharmeen Rahman, P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

TRAFFIC CONTROL PLAN
PHASE 1A

SCALE: HORIZ. 1"= 50

SHEET 1 OF 10

FED.RD. DIV.NO.	PROJECT NO.		SHEET NO.
6			22
STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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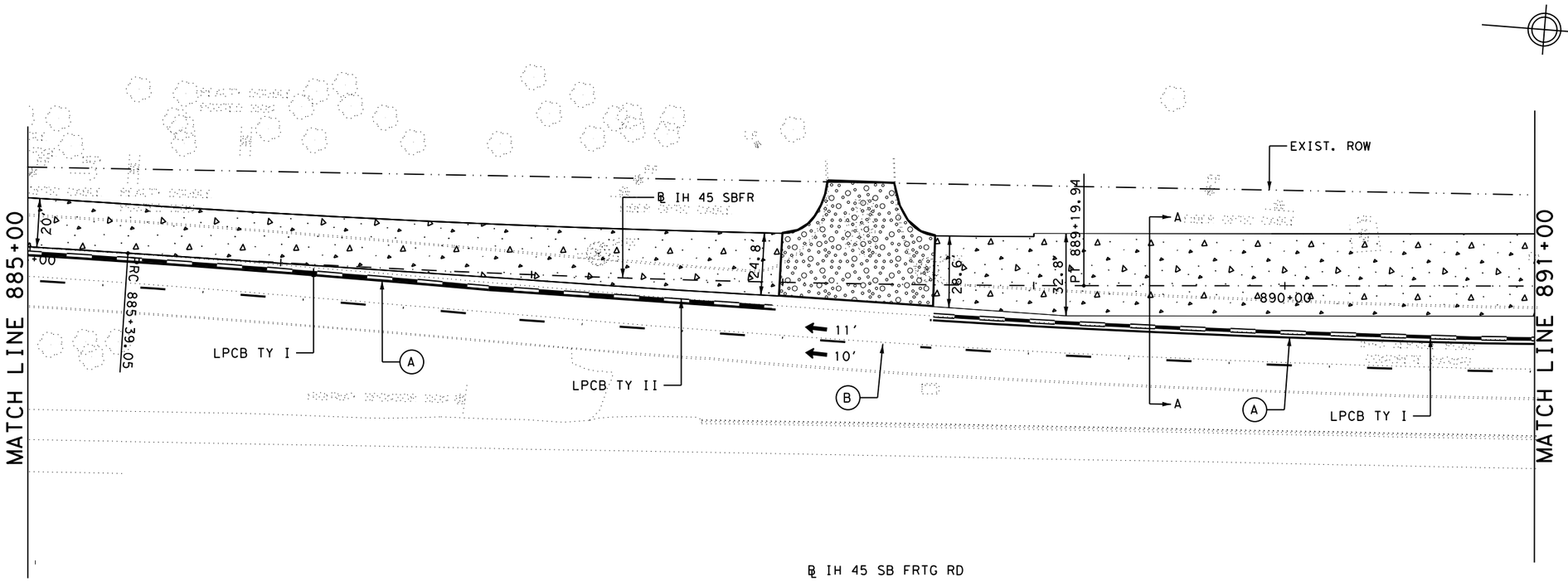

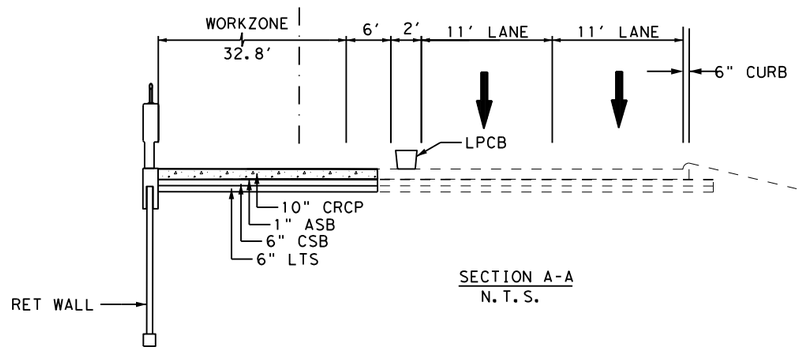

LEGEND

(A)	WRK ZN PAV MRK REMOV(W)(4")(SLD)		FAST TRACK
(B)	WRK ZN PAV MRK REMOV(W)(4")(BRK)		10" CRCP
(C)	WRK ZN PAV MRK REMOV(Y)(4")(SLD)		BRIDGE SLAB
(D)	WRK ZN PAV MRK REMOV(W)(8")(SLD)		SIDEWALK
(E)	WRK ZN PAV MRK REMOV(Y)(8")(SLD)		RIPRAP
(F)	WRK ZN PAV MRK REMOV(Y)(12")(SLD)		PAVEMENT COMPLETED IN PREVIOUS STEP

LEGEND			
	TY III BARRICADE		CHANNELIZING DEVICES
	HEAVY WORK VEHICLE		TRUCK MOUNTED ATTENUATOR (TMA)
	TRAILER MOUNTED FLASHING ARROW BOARD	M	PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)
	SIGN		OPEN TO TRAFFIC
	CONCRETE TRAFFIC BARRIER (CTB)		

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED PROFESSIONAL ENGINEER

Sharmeen Rahman, P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD AT CYPRESS CREEK

TRAFFIC CONTROL PLAN PHASE 1A

SCALE: HORIZ. 1"= 50

SHEET 2 OF 10

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		23

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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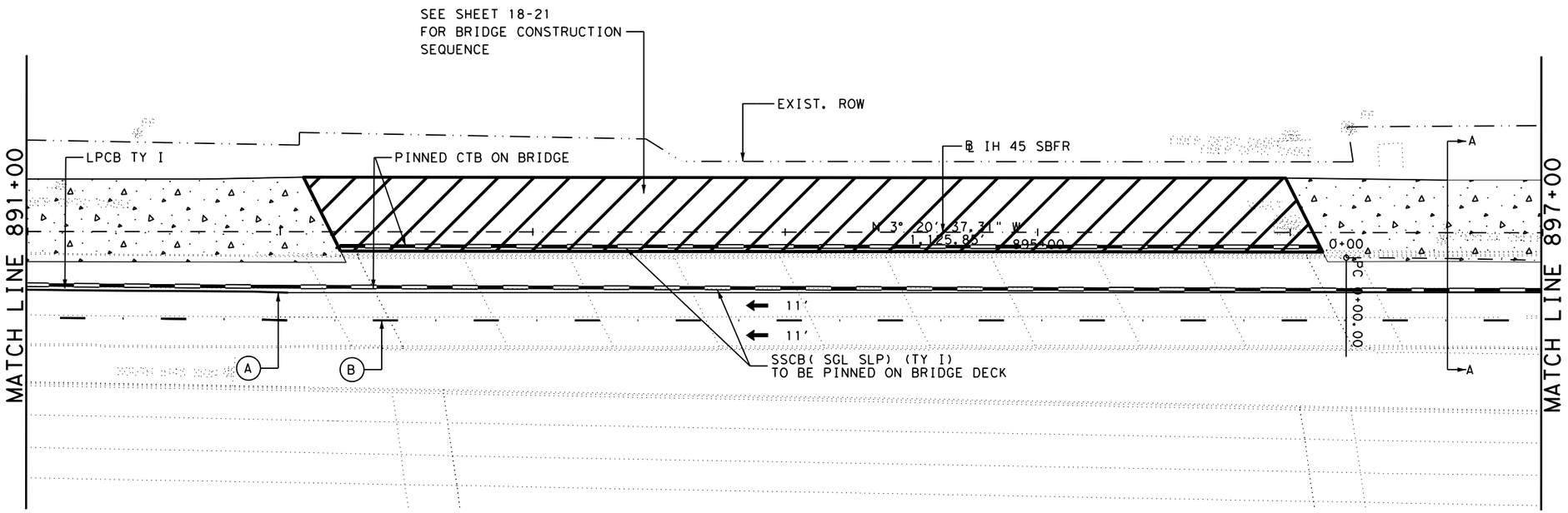

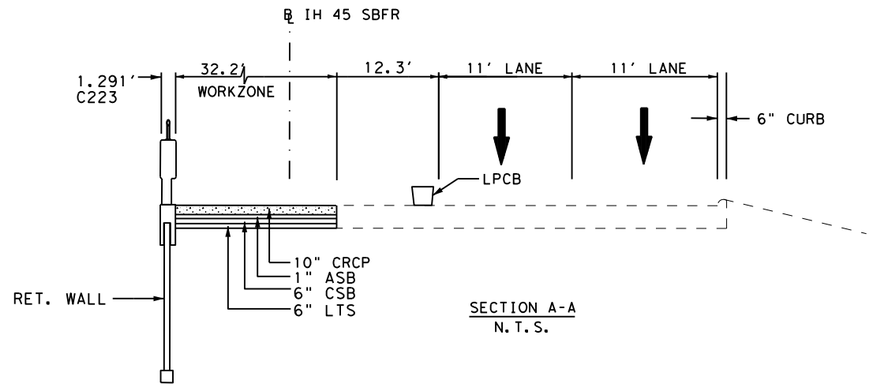

SECTION A-A
N.T.S.

LEGEND

(A)	WRK ZN PAV MRK REMOV(W)(4")(SLD)
(B)	WRK ZN PAV MRK REMOV(W)(4")(BRK)
(C)	WRK ZN PAV MRK REMOV(Y)(4")(SLD)
(D)	WRK ZN PAV MRK REMOV(W)(8")(SLD)
(E)	WRK ZN PAV MRK REMOV(Y)(8")(SLD)
(F)	WRK ZN PAV MRK REMOV(Y)(12")(SLD)

	FAST TRACK
	10" CRCP
	BRIDGE SLAB
	SIDEWALK
	RIPRAP
	PAVEMENT COMPLETED IN PREVIOUS STEP

LEGEND			
	TY III BARRICADE		CHANNELIZING DEVICES
	HEAVY WORK VEHICLE		TRUCK MOUNTED ATTENUATOR (TMA)
	TRAILER MOUNTED FLASHING ARROW BOARD	M	PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)
	SIGN		OPEN TO TRAFFIC
	CONCRETE TRAFFIC BARRIER (CTB)		

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED
PROFESSIONAL ENGINEER

Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

TRAFFIC CONTROL PLAN
PHASE 1A

SCALE: HORIZ. 1"= 50

SHEET 3 OF 10

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		24

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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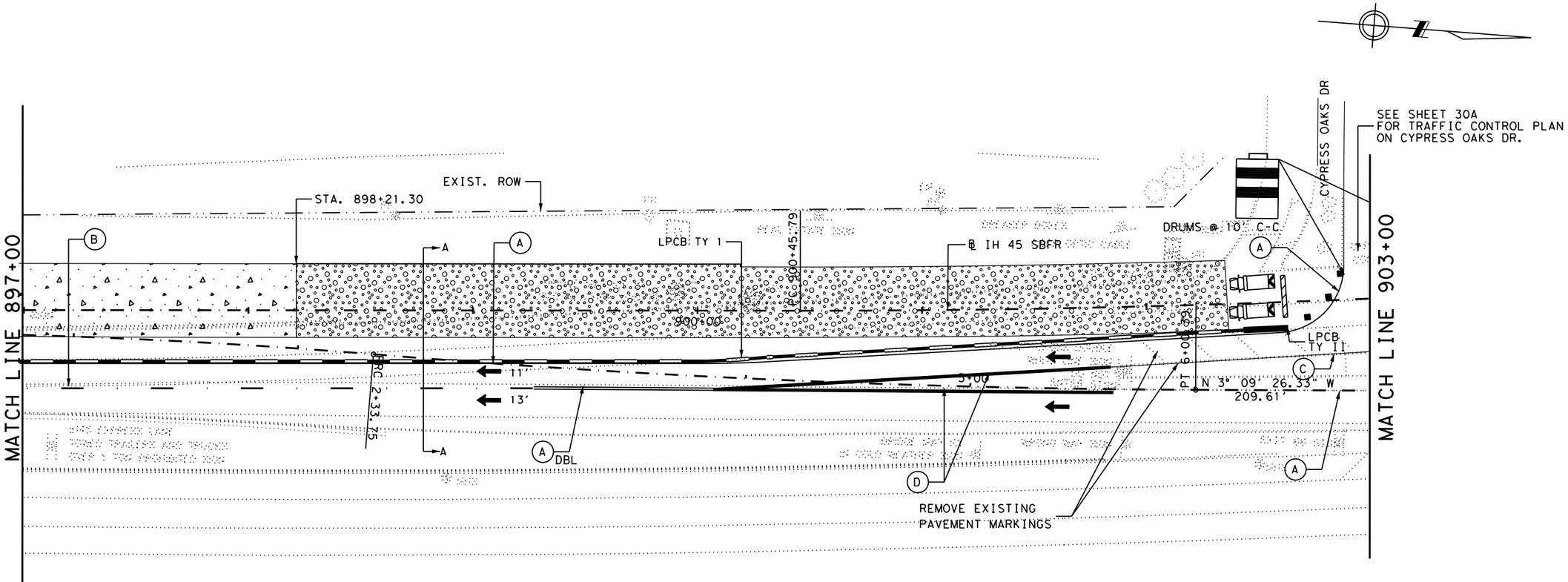

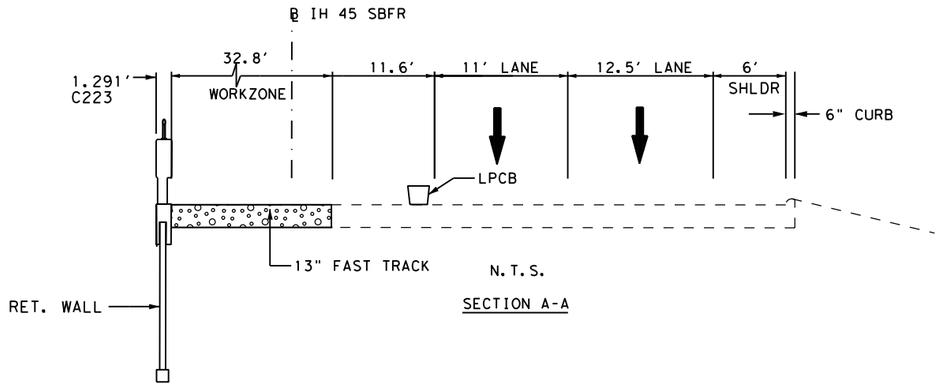

LEGEND

- (A) WRK ZN PAV MRK REMOV(W)(4")(SLD)
- (B) WRK ZN PAV MRK REMOV(W)(4")(BRK)
- (C) WRK ZN PAV MRK REMOV(Y)(4")(SLD)
- (D) WRK ZN PAV MRK REMOV(W)(8")(SLD)
- (E) WRK ZN PAV MRK REMOV(Y)(8")(SLD)
- (F) WRK ZN PAV MRK REMOV(Y)(12")(SLD)

- FAST TRACK
- 10" CRCP
- BRIDGE SLAB
- SIDEWALK
- RIPRAP
- PAVEMENT COMPLETED IN PREVIOUS STEP

LEGEND			
	TY III BARRICADE		CHANNELIZING DEVICES
	HEAVY WORK VEHICLE		TRUCK MOUNTED ATTENUATOR (TMA)
	TRAILER MOUNTED FLASHING ARROW BOARD	M	PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)
	SIGN		OPEN TO TRAFFIC
	CONCRETE TRAFFIC BARRIER (CTB)		

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED
PROFESSIONAL ENGINEER

Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

TRAFFIC CONTROL PLAN
PHASE 1A

SCALE: HORIZ. 1"= 50

SHEET 4 OF 10

FED. RD. DIV. NO.	PROJECT NO.	SHEET NO.
6		25

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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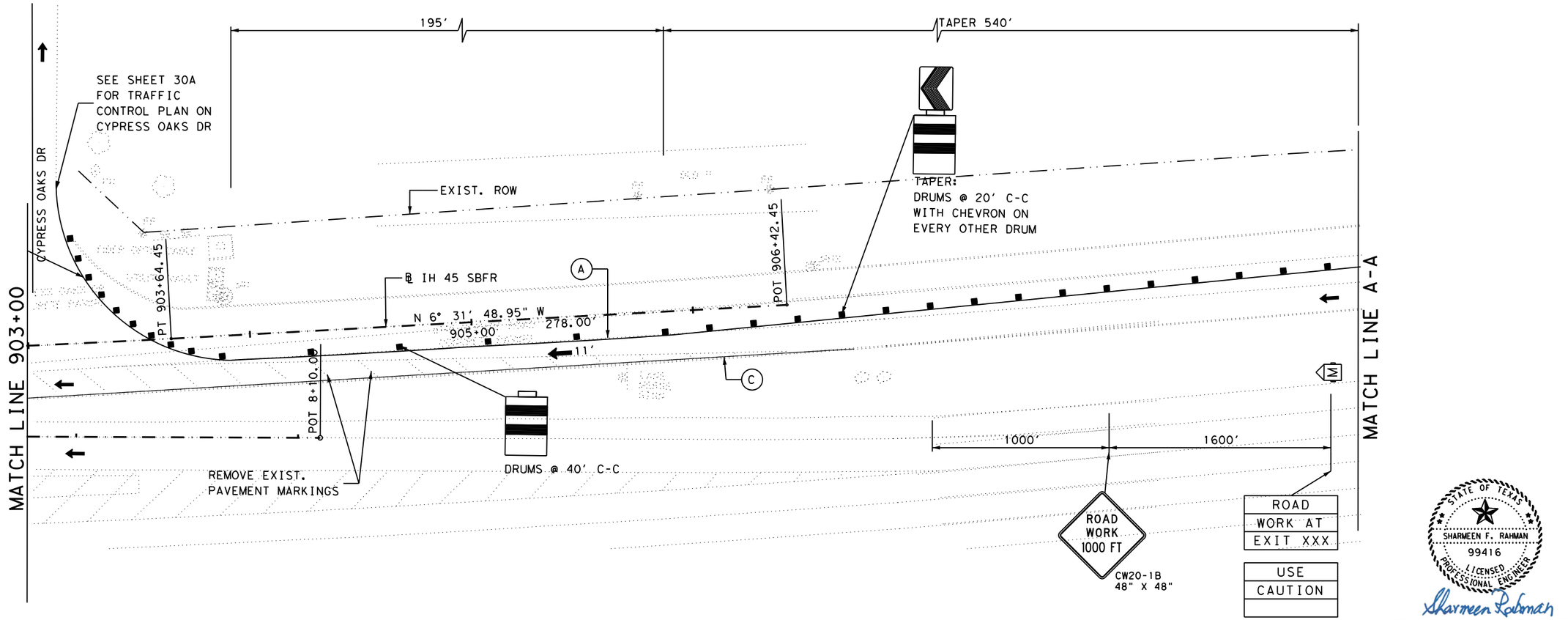

LEGEND

- (A) WRK ZN PAV MRK REMOV(W)(4")(SLD)
- (B) WRK ZN PAV MRK REMOV(W)(4")(BRK)
- (C) WRK ZN PAV MRK REMOV(Y)(4")(SLD)
- (D) WRK ZN PAV MRK REMOV(W)(8")(SLD)
- (E) WRK ZN PAV MRK REMOV(Y)(8")(SLD)
- (F) WRK ZN PAV MRK REMOV(Y)(12")(SLD)

- FAST TRACK
- 10" CRCP
- BRIDGE SLAB
- SIDEWALK
- RIPRAP
- PAVEMENT COMPLETED IN PREVIOUS STEP

LEGEND			
	TY III BARRICADE		CHANNELIZING DEVICES
	HEAVY WORK VEHICLE		TRUCK MOUNTED ATTENUATOR (TMA)
	TRAILER MOUNTED FLASHING ARROW BOARD	M	PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)
	SIGN		OPEN TO TRAFFIC
	CONCRETE TRAFFIC BARRIER (CTB)		

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED
PROFESSIONAL ENGINEER

Sharmeen Rahman, P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

TRAFFIC CONTROL PLAN
PHASE 1A

SCALE: HORIZ. 1"= 50

SHEET 5 OF 10

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		26

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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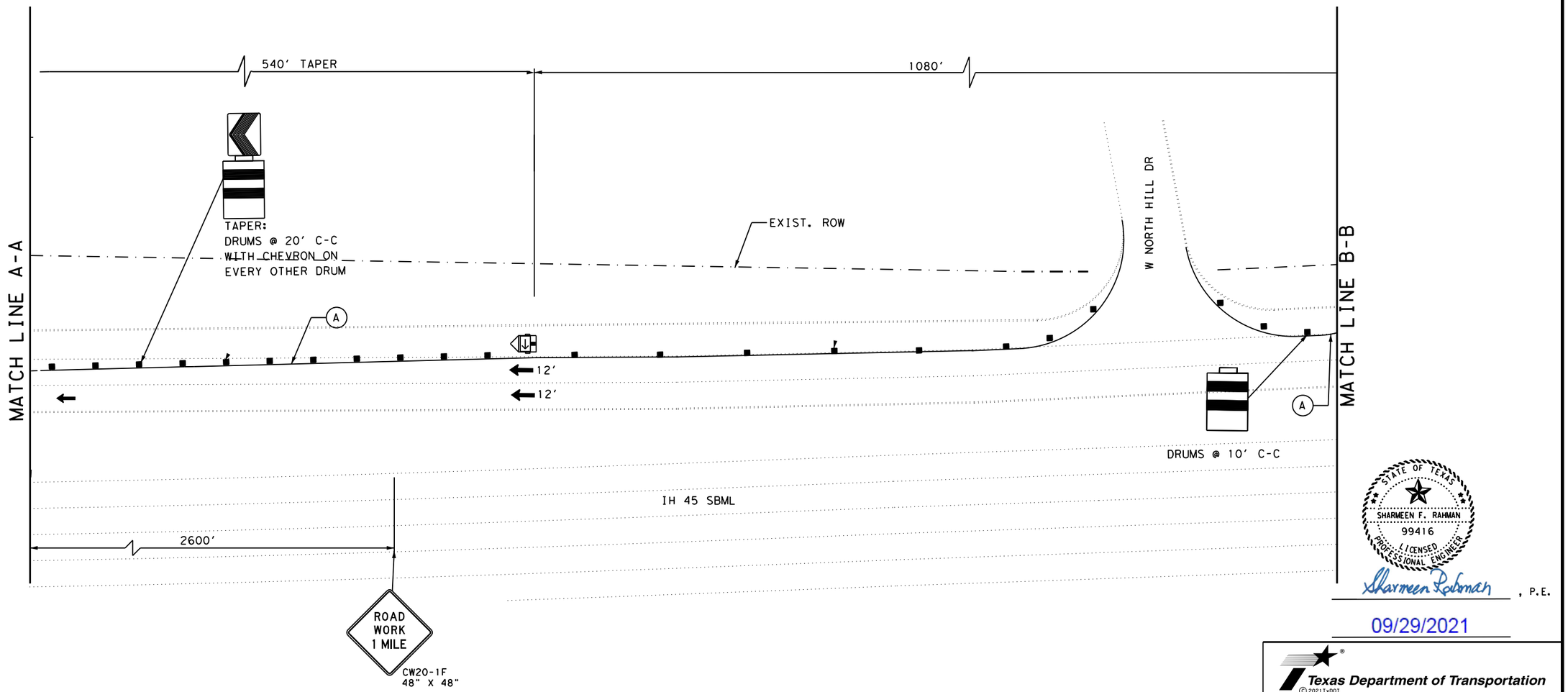

LEGEND

(A)	WRK ZN PAV MRK REMOV (W) (4") (SLD)		FAST TRACK
(B)	WRK ZN PAV MRK REMOV (W) (4") (BRK)		10" CRCP
(C)	WRK ZN PAV MRK REMOV (Y) (4") (SLD)		BRIDGE SLAB
(D)	WRK ZN PAV MRK REMOV (W) (8") (SLD)		SIDEWALK
(E)	WRK ZN PAV MRK REMOV (Y) (8") (SLD)		RIPRAP
(F)	WRK ZN PAV MRK REMOV (Y) (12") (SLD)		PAVEMENT COMPLETED IN PREVIOUS STEP

LEGEND			
	TY III BARRICADE		CHANNELIZING DEVICES
	HEAVY WORK VEHICLE		TRUCK MOUNTED ATTENUATOR (TMA)
	TRAILER MOUNTED FLASHING ARROW BOARD	M	PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)
	SIGN		OPEN TO TRAFFIC
	CONCRETE TRAFFIC BARRIER (CTB)		

STATE OF TEXAS
SHARMEEN F. RAHMAN
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09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

TRAFFIC CONTROL PLAN
PHASE 1A

SCALE: HORIZ. 1"= 50

SHEET 6 OF 10

FED.RD. DIV.NO.	PROJECT NO.		SHEET NO.
6			27
STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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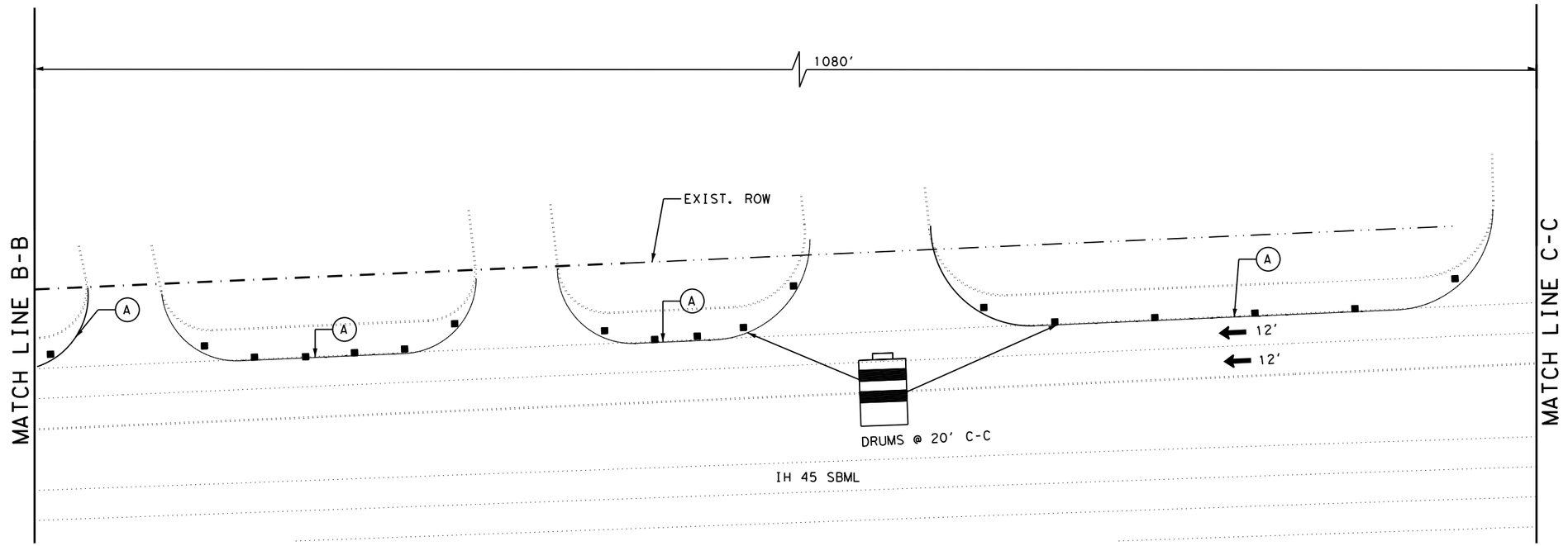

LEGEND

(A)	WRK ZN PAV MRK REMOV(W)(4")(SLD)
(B)	WRK ZN PAV MRK REMOV(W)(4")(BRK)
(C)	WRK ZN PAV MRK REMOV(Y)(4")(SLD)
(D)	WRK ZN PAV MRK REMOV(W)(8")(SLD)
(E)	WRK ZN PAV MRK REMOV(Y)(8")(SLD)
(F)	WRK ZN PAV MRK REMOV(Y)(12")(SLD)

	FAST TRACK
	10" CRCP
	BRIDGE SLAB
	SIDEWALK
	RIPRAP
	PAVEMENT COMPLETED IN PREVIOUS STEP

LEGEND			
	TY III BARRICADE		CHANNELIZING DEVICES
	HEAVY WORK VEHICLE		TRUCK MOUNTED ATTENUATOR (TMA)
	TRAILER MOUNTED FLASHING ARROW BOARD	M	PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)
	SIGN		OPEN TO TRAFFIC
	CONCRETE TRAFFIC BARRIER (CTB)		

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
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Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

TRAFFIC CONTROL PLAN
PHASE 1A

SCALE: HORIZ. 1"= 50

SHEET 7 OF 10

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		28

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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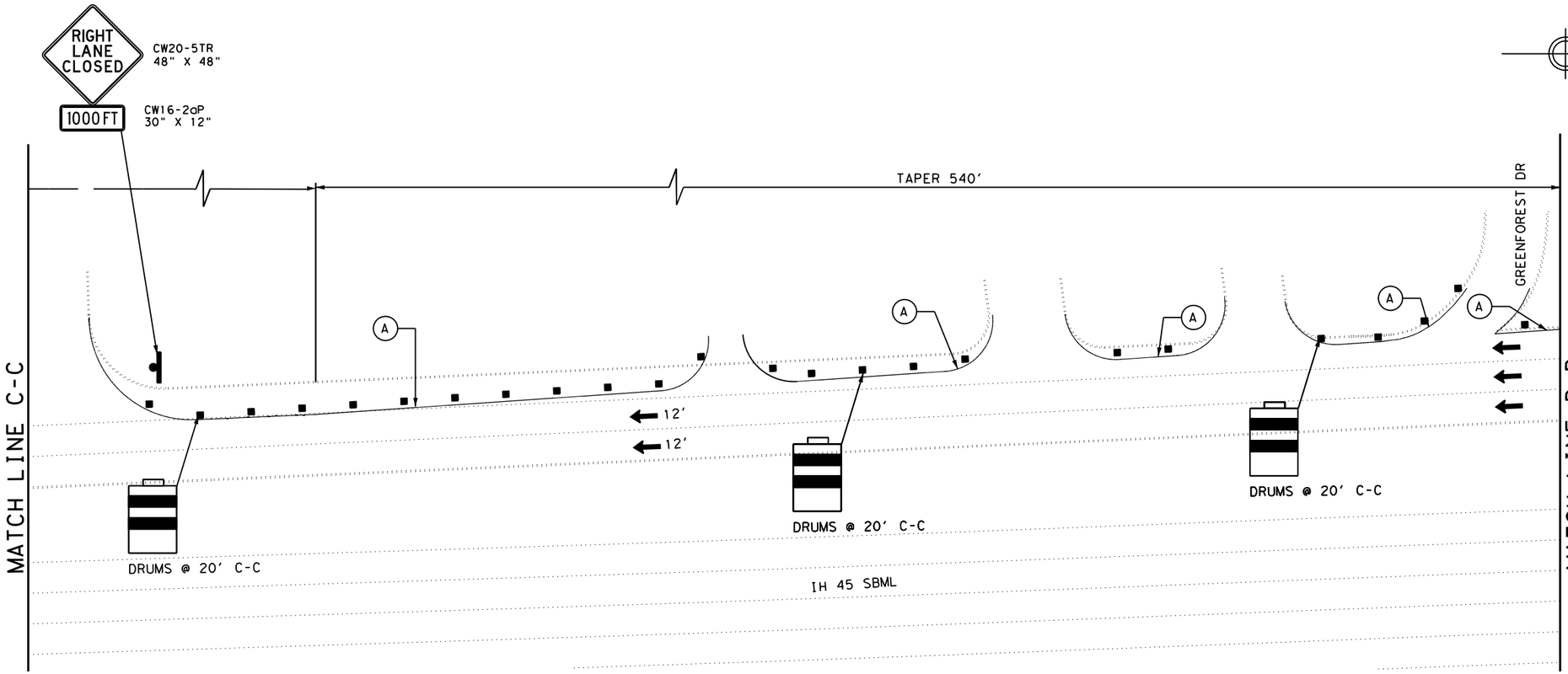

LEGEND

(A)	WRK ZN PAV MRK REMOV(W)(4")(SLD)		FAST TRACK
(B)	WRK ZN PAV MRK REMOV(W)(4")(BRK)		10" CRCP
(C)	WRK ZN PAV MRK REMOV(Y)(4")(SLD)		BRIDGE SLAB
(D)	WRK ZN PAV MRK REMOV(W)(8")(SLD)		SIDEWALK
(E)	WRK ZN PAV MRK REMOV(Y)(8")(SLD)		RIPRAP
(F)	WRK ZN PAV MRK REMOV(Y)(12")(SLD)		PAVEMENT COMPLETED IN PREVIOUS STEP

LEGEND			
	TY III BARRICADE		CHANNELIZING DEVICES
	HEAVY WORK VEHICLE		TRUCK MOUNTED ATTENUATOR (TMA)
	TRAILER MOUNTED FLASHING ARROW BOARD	M	PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)
	SIGN		OPEN TO TRAFFIC
	CONCRETE TRAFFIC BARRIER (CTB)		

STATE OF TEXAS
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Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD AT CYPRESS CREEK

TRAFFIC CONTROL PLAN PHASE 1A

SCALE: HORIZ. 1"= 50

SHEET 8 OF 10

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		29

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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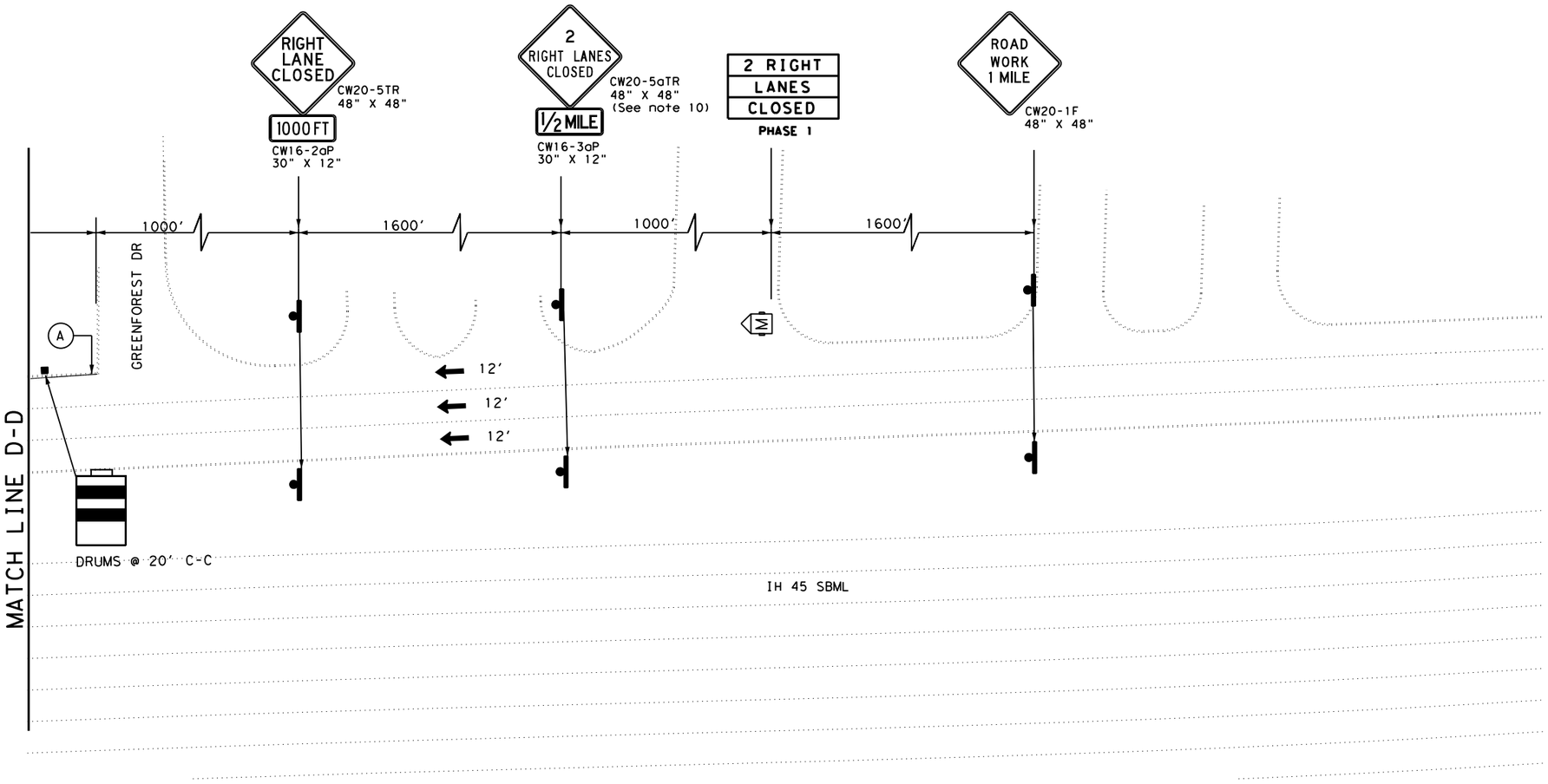

LEGEND

(A)	WRK ZN PAV MRK REMOV(W)(4")(SLD)
(B)	WRK ZN PAV MRK REMOV(W)(4")(BRK)
(C)	WRK ZN PAV MRK REMOV(Y)(4")(SLD)
(D)	WRK ZN PAV MRK REMOV(W)(8")(SLD)
(E)	WRK ZN PAV MRK REMOV(Y)(8")(SLD)
(F)	WRK ZN PAV MRK REMOV(Y)(12")(SLD)

	FAST TRACK
	10" CRCP
	BRIDGE SLAB
	SIDEWALK
	RIPRAP
	PAVEMENT COMPLETED IN PREVIOUS STEP

LEGEND			
	TY III BARRICADE		CHANNELIZING DEVICES
	HEAVY WORK VEHICLE		TRUCK MOUNTED ATTENUATOR (TMA)
	TRAILER MOUNTED FLASHING ARROW BOARD	M	PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)
	SIGN		OPEN TO TRAFFIC
	CONCRETE TRAFFIC BARRIER (CTB)		

STATE OF TEXAS
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Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

TRAFFIC CONTROL PLAN
PHASE 1A

SCALE: HORIZ. 1"= 50

SHEET 9 OF 10

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		30

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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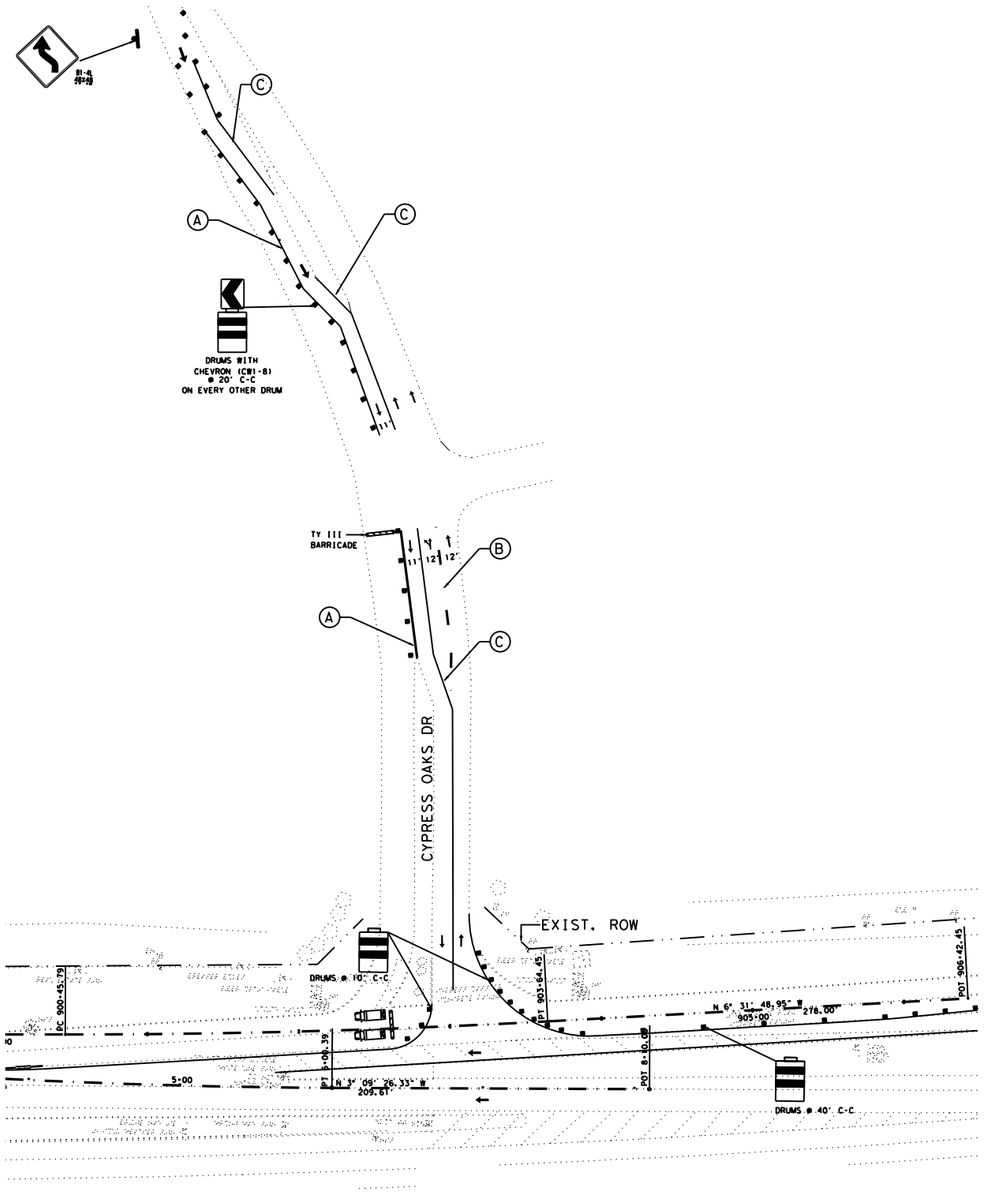

LEGEND

A	WRK ZN PAV MRK REMOV(W)(4")(SLD)
B	WRK ZN PAV MRK REMOV(W)(4")(BRK)
C	WRK ZN PAV MRK REMOV(Y)(4")(SLD)
D	WRK ZN PAV MRK REMOV(W)(8")(SLD)
E	WRK ZN PAV MRK REMOV(Y)(8")(SLD)
F	WRK ZN PAV MRK REMOV(Y)(12")(SLD)

FAST TRACK
10" CRCP
BRIDGE SLAB
SIDEWALK
RIPRAP
PAVEMENT COMPLETED IN PREVIOUS STEP

LEGEND			
	TY III BARRICADE		CHANNELIZING DEVICES
	HEAVY WORK VEHICLE		TRUCK MOUNTED ATTENUATOR (TMA)
	TRAILER MOUNTED FLASHING ARROW BOARD	M	PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)
	SIGN		OPEN TO TRAFFIC
	CONCRETE TRAFFIC BARRIER (CTB)		

STATE OF TEXAS
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LICENSED
PROFESSIONAL ENGINEER

Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

TRAFFIC CONTROL PLAN
PHASE IA

SCALE: HORIZ. 1" = 50

SHEET 10 OF 10

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		30A

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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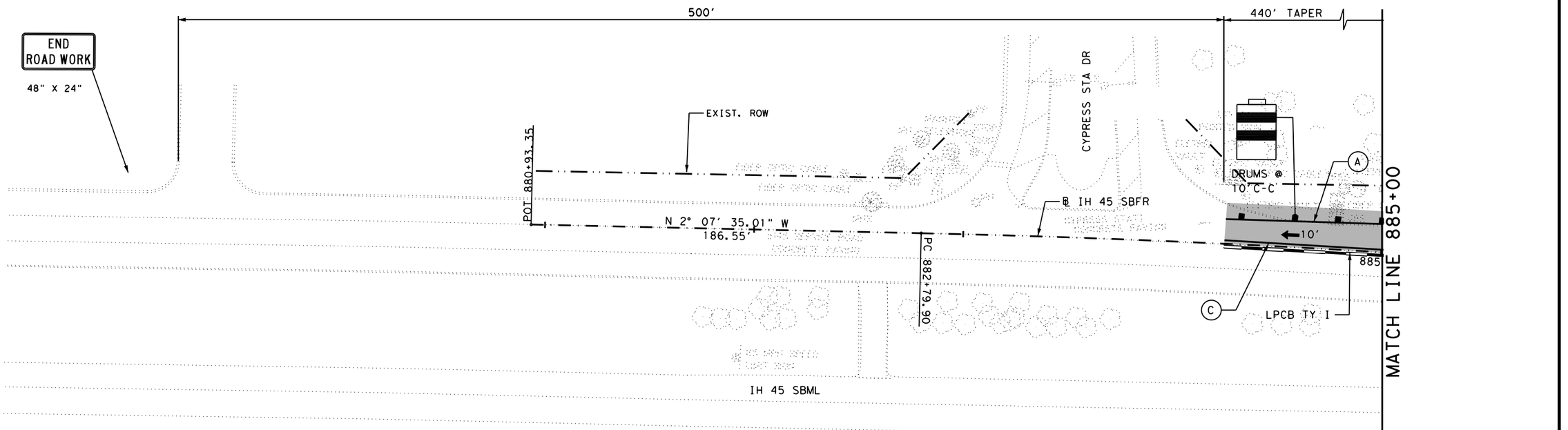

LEGEND

A	WRK ZN PAV MRK REMOV(W)(4")(SLD)		FAST TRACK
B	WRK ZN PAV MRK REMOV(W)(4")(BRK)		10" CRCP
C	WRK ZN PAV MRK REMOV(Y)(4")(SLD)		BRIDGE SLAB
D	WRK ZN PAV MRK REMOV(W)(8")(SLD)		SIDEWALK
E	WRK ZN PAV MRK REMOV(Y)(8")(SLD)		RIPRAP
F	WRK ZN PAV MRK REMOV(Y)(12")(SLD)		PAVEMENT COMPLETED IN PREVIOUS STEP

LEGEND			
	TY III BARRICADE		CHANNELIZING DEVICES
	HEAVY WORK VEHICLE		TRUCK MOUNTED ATTENUATOR (TMA)
	TRAILER MOUNTED FLASHING ARROW BOARD	M	PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)
	SIGN		OPEN TO TRAFFIC
	CONCRETE TRAFFIC BARRIER (CTB)		

STATE OF TEXAS
SHARMEEN F. RAHMAN
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PROFESSIONAL ENGINEER

Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

TRAFFIC CONTROL PLAN
PHASE 1B

SCALE: HORIZ. 1"= 50

SHEET 1 OF 6

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		31

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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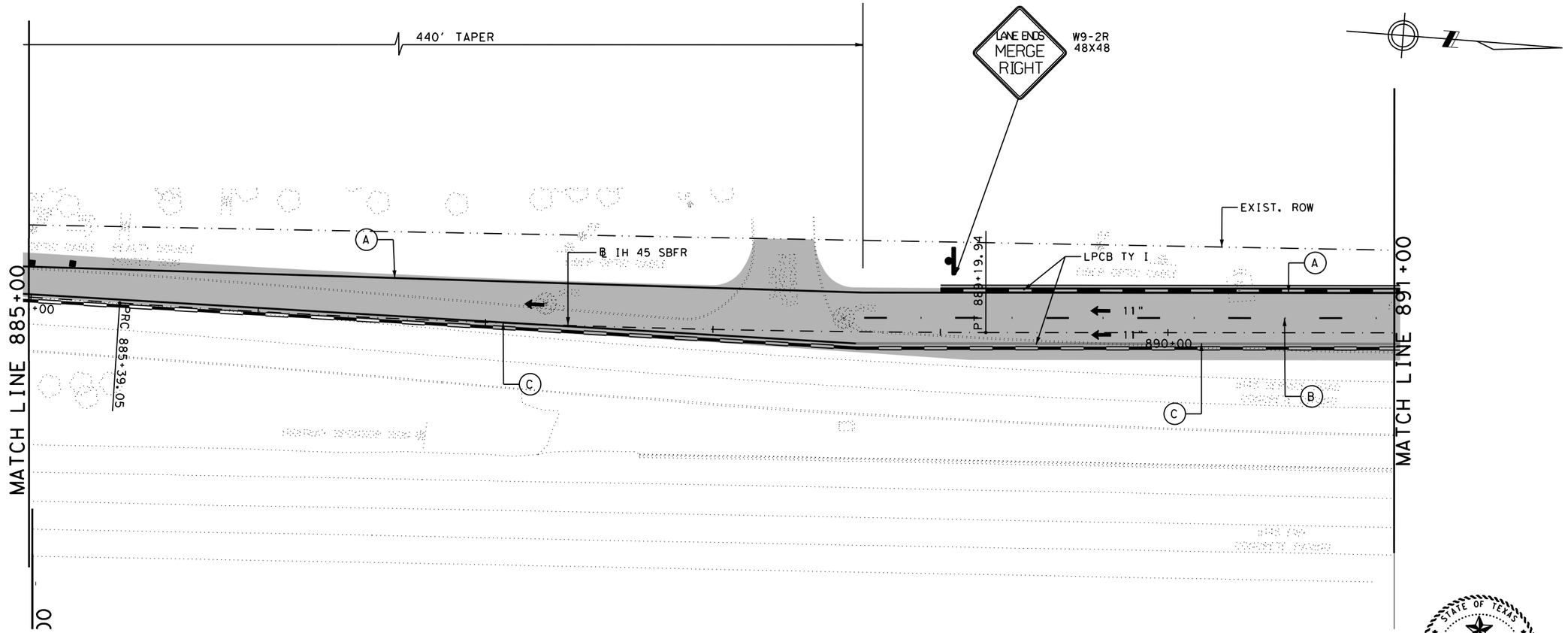

LEGEND

(A)	WRK ZN PAV MRK REMOV(W)(4")(SLD)
(B)	WRK ZN PAV MRK REMOV(W)(4")(BRK)
(C)	WRK ZN PAV MRK REMOV(Y)(4")(SLD)
(D)	WRK ZN PAV MRK REMOV(W)(8")(SLD)
(E)	WRK ZN PAV MRK REMOV(Y)(8")(SLD)
(F)	WRK ZN PAV MRK REMOV(Y)(12")(SLD)

	FAST TRACK
	10" CRCP
	BRIDGE SLAB
	SIDEWALK
	RIPRAP
	PAVEMENT COMPLETED IN PREVIOUS STEP

LEGEND			
	TY III BARRICADE		CHANNELIZING DEVICES
	HEAVY WORK VEHICLE		TRUCK MOUNTED ATTENUATOR (TMA)
	TRAILER MOUNTED FLASHING ARROW BOARD	M	PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)
	SIGN		OPEN TO TRAFFIC
	CONCRETE TRAFFIC BARRIER (CTB)		

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED
PROFESSIONAL ENGINEER

Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

TRAFFIC CONTROL PLAN
PHASE 1B

SCALE: HORIZ. 1"= 50

SHEET 2 OF 6

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		32

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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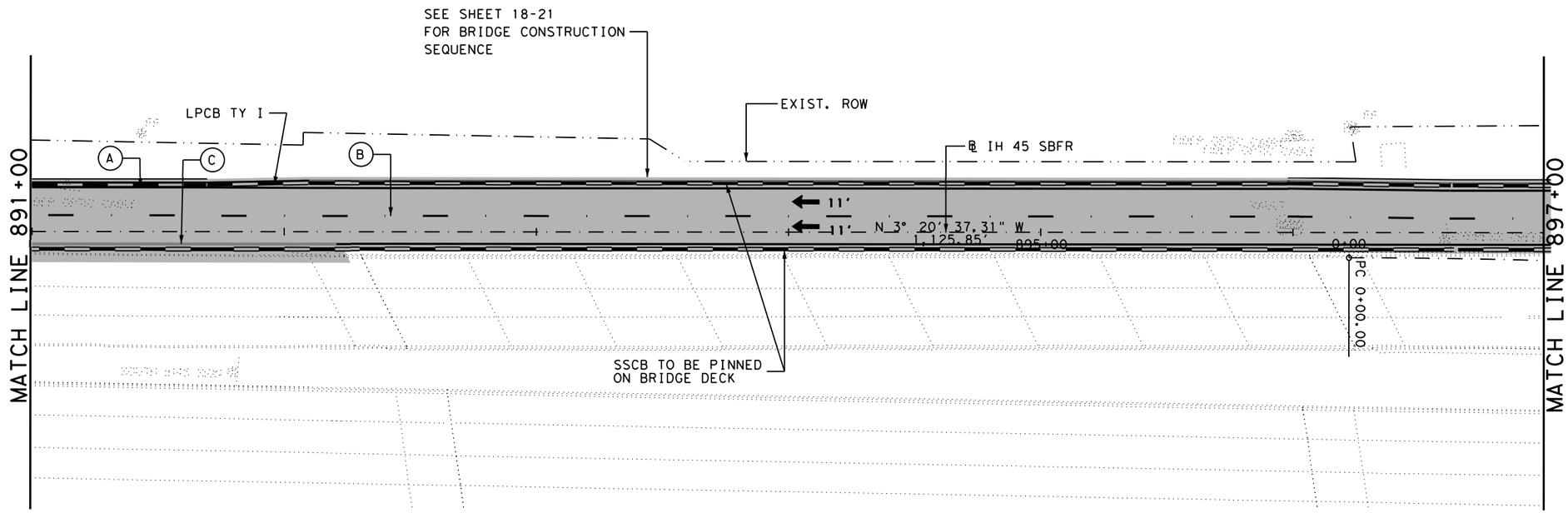

LEGEND

(A)	WRK ZN PAV MRK REMOV(W)(4")(SLD)
(B)	WRK ZN PAV MRK REMOV(W)(4")(BRK)
(C)	WRK ZN PAV MRK REMOV(Y)(4")(SLD)
(D)	WRK ZN PAV MRK REMOV(W)(8")(SLD)
(E)	WRK ZN PAV MRK REMOV(Y)(8")(SLD)
(F)	WRK ZN PAV MRK REMOV(Y)(12")(SLD)

	FAST TRACK
	10" CRCP
	BRIDGE SLAB
	SIDEWALK
	RIPRAP
	PAVEMENT COMPLETED IN PREVIOUS STEP

LEGEND			
	TY III BARRICADE		CHANNELIZING DEVICES
	HEAVY WORK VEHICLE		TRUCK MOUNTED ATTENUATOR (TMA)
	TRAILER MOUNTED FLASHING ARROW BOARD	M	PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)
	SIGN		OPEN TO TRAFFIC
	CONCRETE TRAFFIC BARRIER (CTB)		

STATE OF TEXAS
SHARMEEN F. RAHMAN
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Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

TRAFFIC CONTROL PLAN
PHASE 1B

SCALE: HORIZ. 1"= 50

SHEET 3 OF 6

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		33

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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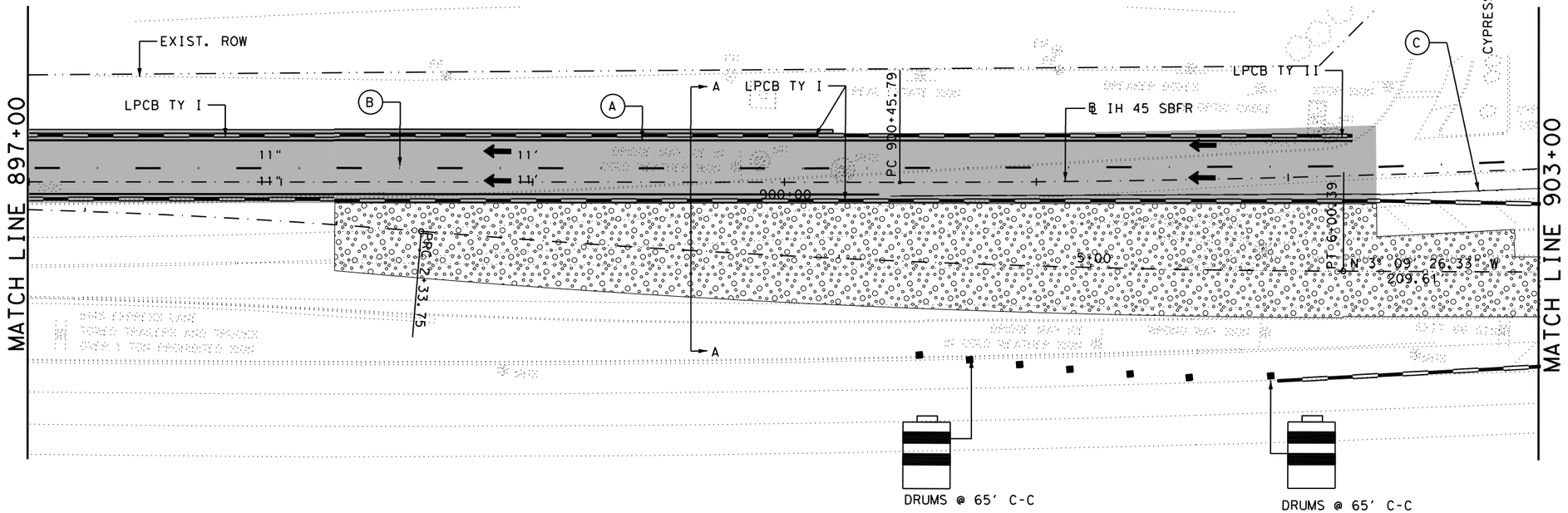

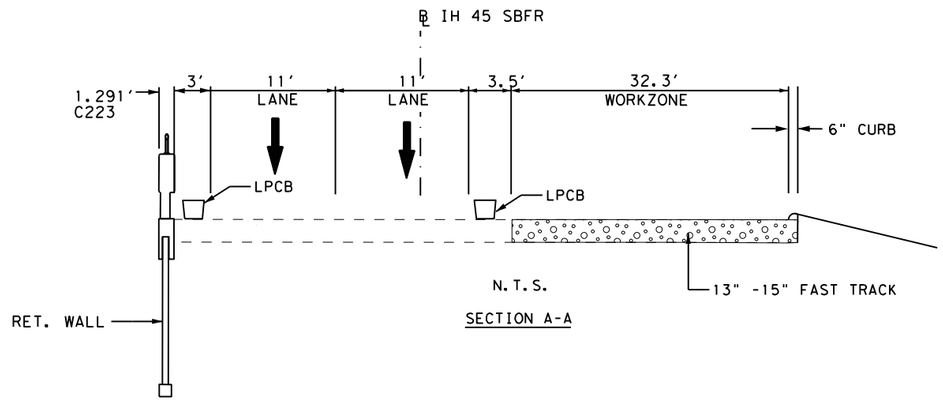

LEGEND

- (A) WRK ZN PAV MRK REMOV(W)(4")(SLD)
- (B) WRK ZN PAV MRK REMOV(W)(4")(BRK)
- (C) WRK ZN PAV MRK REMOV(Y)(4")(SLD)
- (D) WRK ZN PAV MRK REMOV(W)(8")(SLD)
- (E) WRK ZN PAV MRK REMOV(Y)(8")(SLD)
- (F) WRK ZN PAV MRK REMOV(Y)(12")(SLD)

- FAST TRACK
- 10" CRCP
- BRIDGE SLAB
- SIDEWALK
- RIPRAP
- PAVEMENT COMPLETED IN PREVIOUS STEP

LEGEND			
	TY III BARRICADE		CHANNELIZING DEVICES
	HEAVY WORK VEHICLE		TRUCK MOUNTED ATTENUATOR (TMA)
	TRAILER MOUNTED FLASHING ARROW BOARD	M	PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)
	SIGN		OPEN TO TRAFFIC
	CONCRETE TRAFFIC BARRIER (CTB)		

STATE OF TEXAS
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Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

TRAFFIC CONTROL PLAN
PHASE 1B

SCALE: HORIZ. 1"= 50

SHEET 4 OF 6

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		34

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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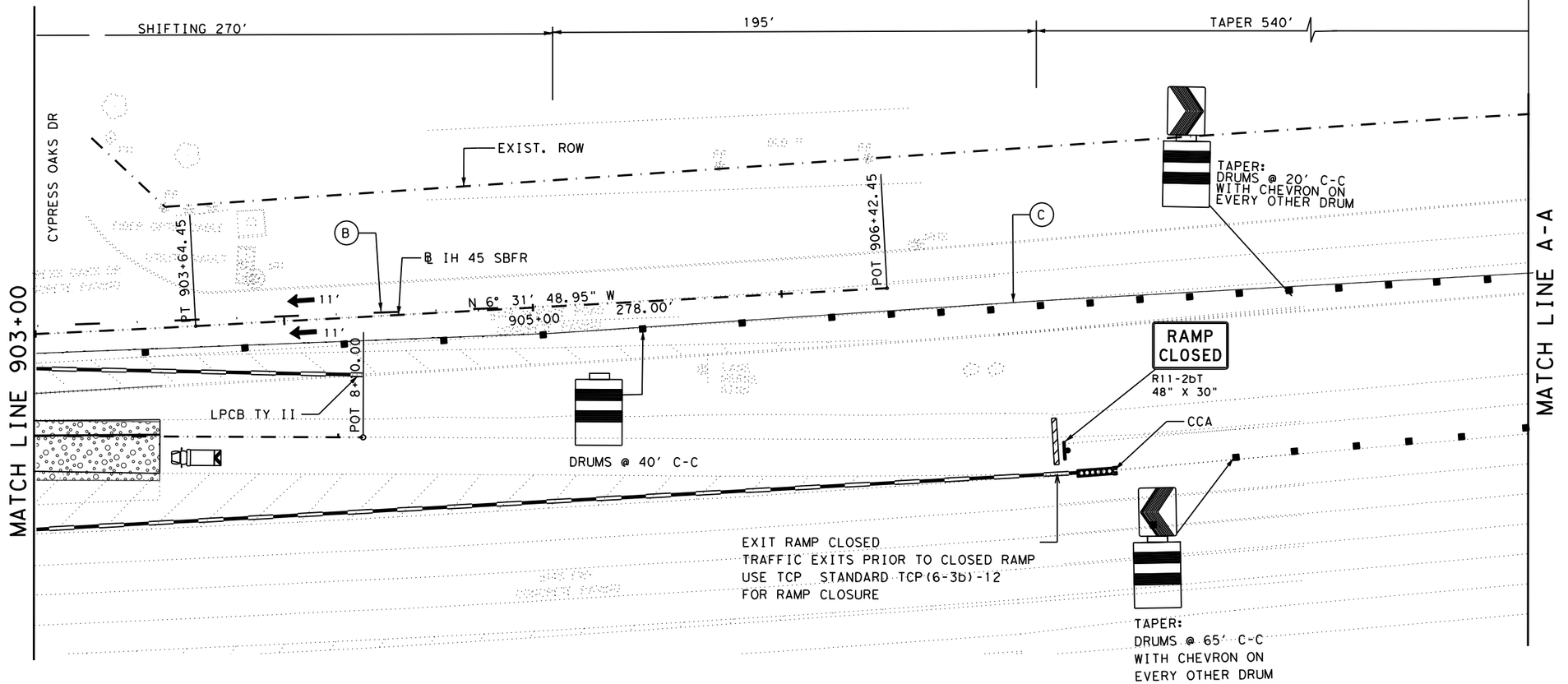

LEGEND

(A)	WRK ZN PAV MRK REMOV(W)(4")(SLD)		FAST TRACK
(B)	WRK ZN PAV MRK REMOV(W)(4")(BRK)		10" CRCP
(C)	WRK ZN PAV MRK REMOV(Y)(4")(SLD)		BRIDGE SLAB
(D)	WRK ZN PAV MRK REMOV(W)(8")(SLD)		SIDEWALK
(E)	WRK ZN PAV MRK REMOV(Y)(8")(SLD)		RIPRAP
(F)	WRK ZN PAV MRK REMOV(Y)(12")(SLD)		PAVEMENT COMPLETED IN PREVIOUS STEP

LEGEND			
	TY III BARRICADE		CHANNELIZING DEVICES
	HEAVY WORK VEHICLE		TRUCK MOUNTED ATTENUATOR (TMA)
	TRAILER MOUNTED FLASHING ARROW BOARD	M	PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)
	SIGN		OPEN TO TRAFFIC
	CONCRETE TRAFFIC BARRIER (CTB)		

STATE OF TEXAS
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LICENSED PROFESSIONAL ENGINEER

Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

TRAFFIC CONTROL PLAN
PHASE 1B

SHEET 5 OF 6

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		35

STATE	DIST	COUNTY
TEXAS	HOU	HARRIS

CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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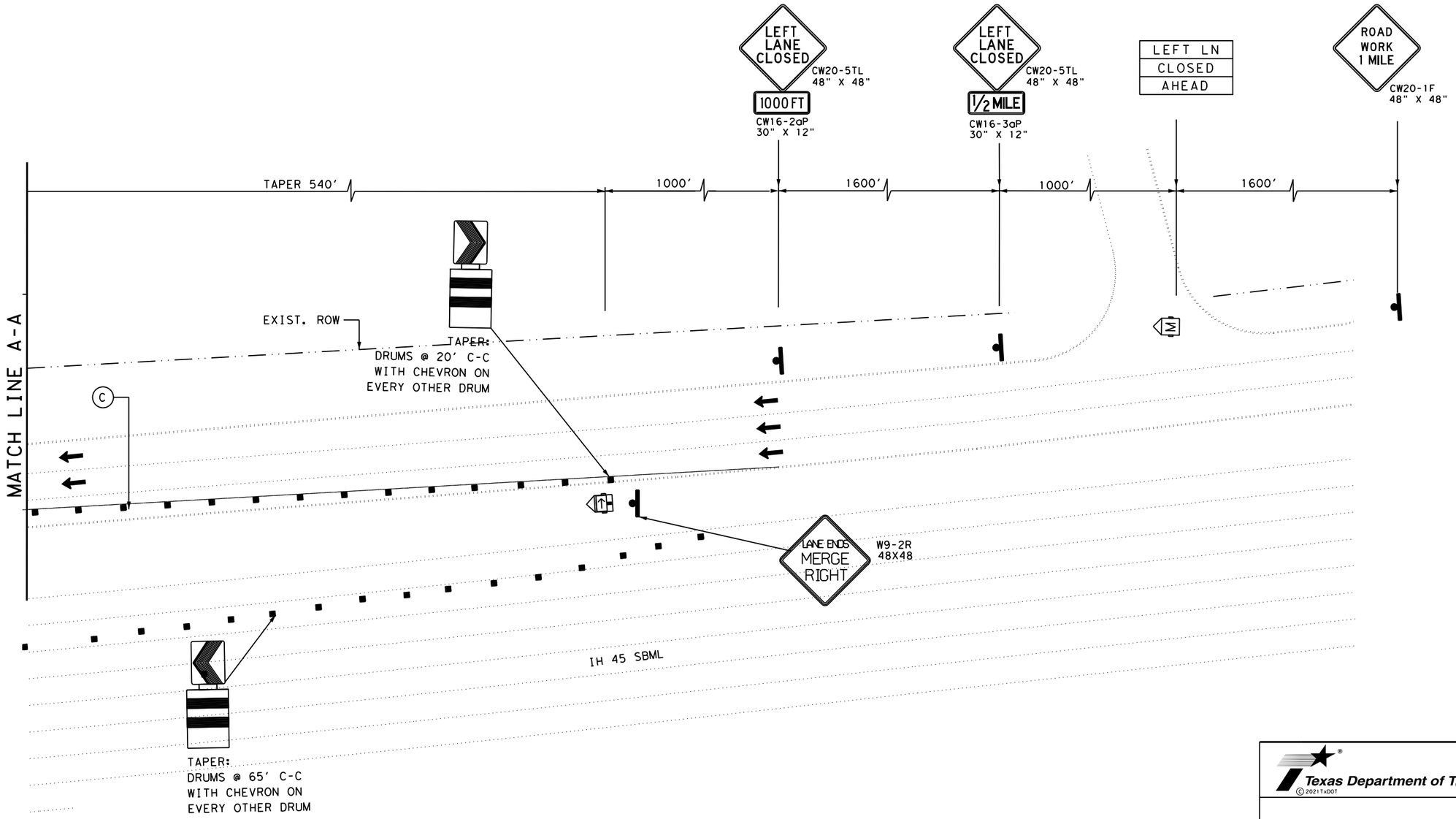

LEGEND

(A)	WRK ZN PAV MRK REMOV (W) (4") (SLD)		FAST TRACK
(B)	WRK ZN PAV MRK REMOV (W) (4") (BRK)		10" CRCP
(C)	WRK ZN PAV MRK REMOV (Y) (4") (SLD)		BRIDGE SLAB
(D)	WRK ZN PAV MRK REMOV (W) (8") (SLD)		SIDEWALK
(E)	WRK ZN PAV MRK REMOV (Y) (8") (SLD)		RIPRAP
(F)	WRK ZN PAV MRK REMOV (Y) (12") (SLD)		PAVEMENT COMPLETED IN PREVIOUS STEP

LEGEND			
	TY III BARRICADE		CHANNELIZING DEVICES
	HEAVY WORK VEHICLE		TRUCK MOUNTED ATTENUATOR (TMA)
	TRAILER MOUNTED FLASHING ARROW BOARD	M	PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)
	SIGN		OPEN TO TRAFFIC
	CONCRETE TRAFFIC BARRIER (CTB)		

STATE OF TEXAS
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LICENSED PROFESSIONAL ENGINEER

Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

TRAFFIC CONTROL PLAN
PHASE 1B

SCALE: HORIZ. 1"= 50

SHEET 6 OF 6

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		36

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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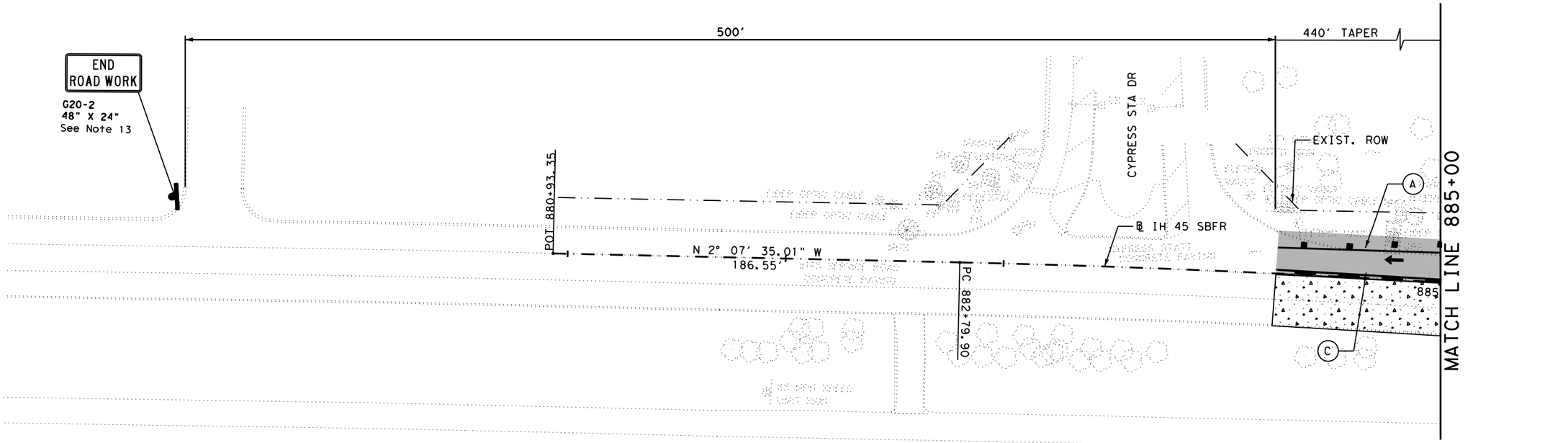

LEGEND

(A)	WRK ZN PAV MRK REMOV(W)(4")(SLD)
(B)	WRK ZN PAV MRK REMOV(W)(4")(BRK)
(C)	WRK ZN PAV MRK REMOV(Y)(4")(SLD)
(D)	WRK ZN PAV MRK REMOV(W)(8")(SLD)
(E)	WRK ZN PAV MRK REMOV(Y)(8")(SLD)
(F)	WRK ZN PAV MRK REMOV(Y)(12")(SLD)

	FAST TRACK
	10" CRCP
	BRIDGE SLAB
	SIDEWALK
	RIPRAP
	PAVEMENT COMPLETED IN PREVIOUS STEP

LEGEND			
	TY III BARRICADE		CHANNELIZING DEVICES
	HEAVY WORK VEHICLE		TRUCK MOUNTED ATTENUATOR (TMA)
	TRAILER MOUNTED FLASHING ARROW BOARD	M	PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)
	SIGN		OPEN TO TRAFFIC
	CONCRETE TRAFFIC BARRIER (CTB)		

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED PROFESSIONAL ENGINEER

Sharmeen Rahman, P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

TRAFFIC CONTROL PLAN
PHASE 2

SCALE: HORIZ. 1"= 50

SHEET 1 OF 6

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		37

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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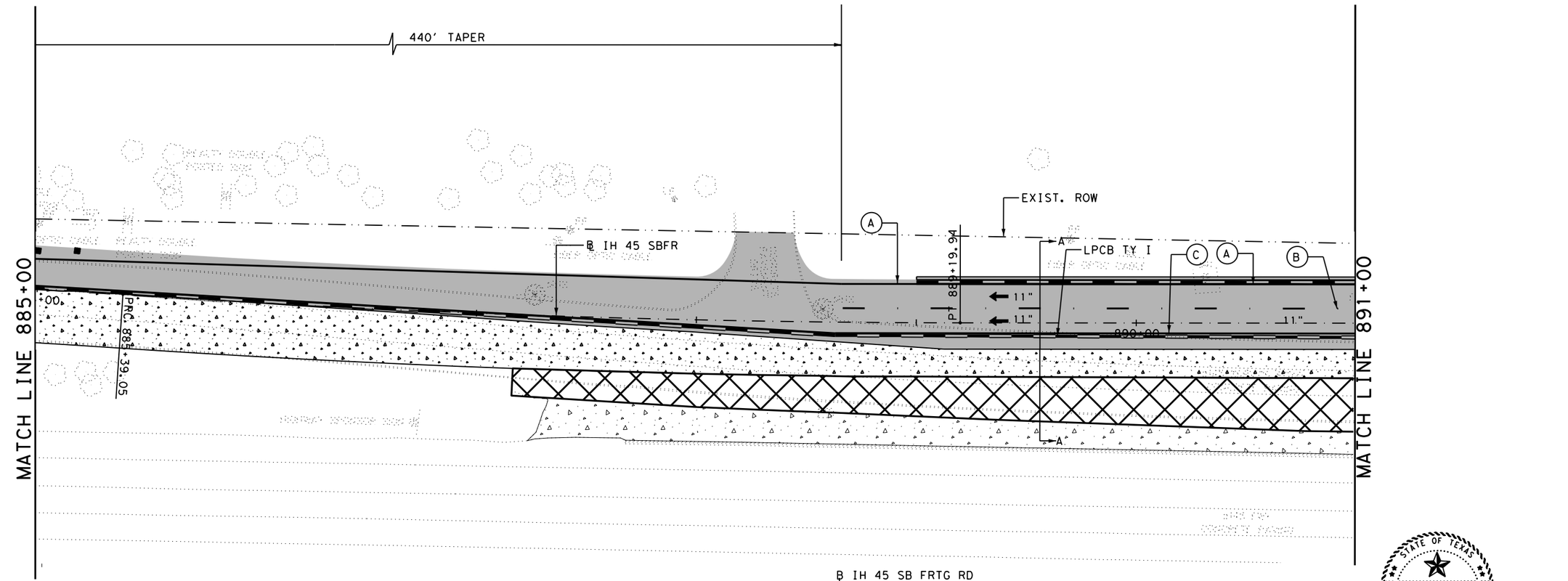

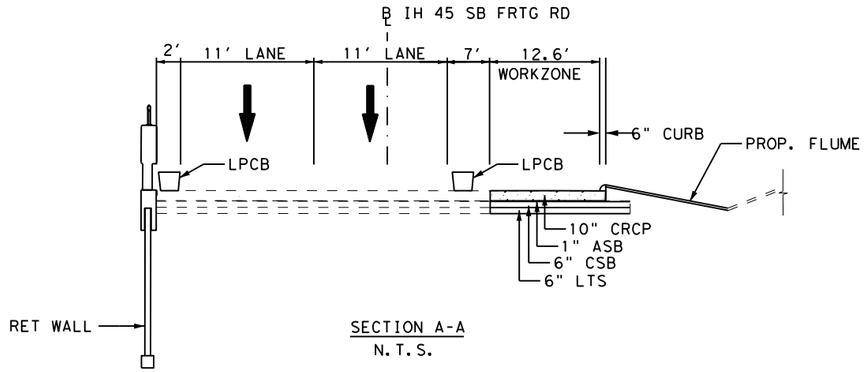

SECTION A-A
N.T.S.

LEGEND

(A)	WRK ZN PAV MRK REMOV(W)(4")(SLD)
(B)	WRK ZN PAV MRK REMOV(W)(4")(BRK)
(C)	WRK ZN PAV MRK REMOV(Y)(4")(SLD)
(D)	WRK ZN PAV MRK REMOV(W)(8")(SLD)
(E)	WRK ZN PAV MRK REMOV(Y)(8")(SLD)
(F)	WRK ZN PAV MRK REMOV(Y)(12")(SLD)

	FAST TRACK
	10" CRCP
	BRIDGE SLAB
	SIDEWALK
	RIPRAP
	PAVEMENT COMPLETED IN PREVIOUS STEP

LEGEND			
	TY III BARRICADE		CHANNELIZING DEVICES
	HEAVY WORK VEHICLE		TRUCK MOUNTED ATTENUATOR (TMA)
	TRAILER MOUNTED FLASHING ARROW BOARD	M	PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)
	SIGN		OPEN TO TRAFFIC
	CONCRETE TRAFFIC BARRIER (CTB)		

STATE OF TEXAS
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99416
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09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

TRAFFIC CONTROL PLAN
PHASE 2

SCALE: HORIZ. 1"= 50

SHEET 2 OF 6

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		38

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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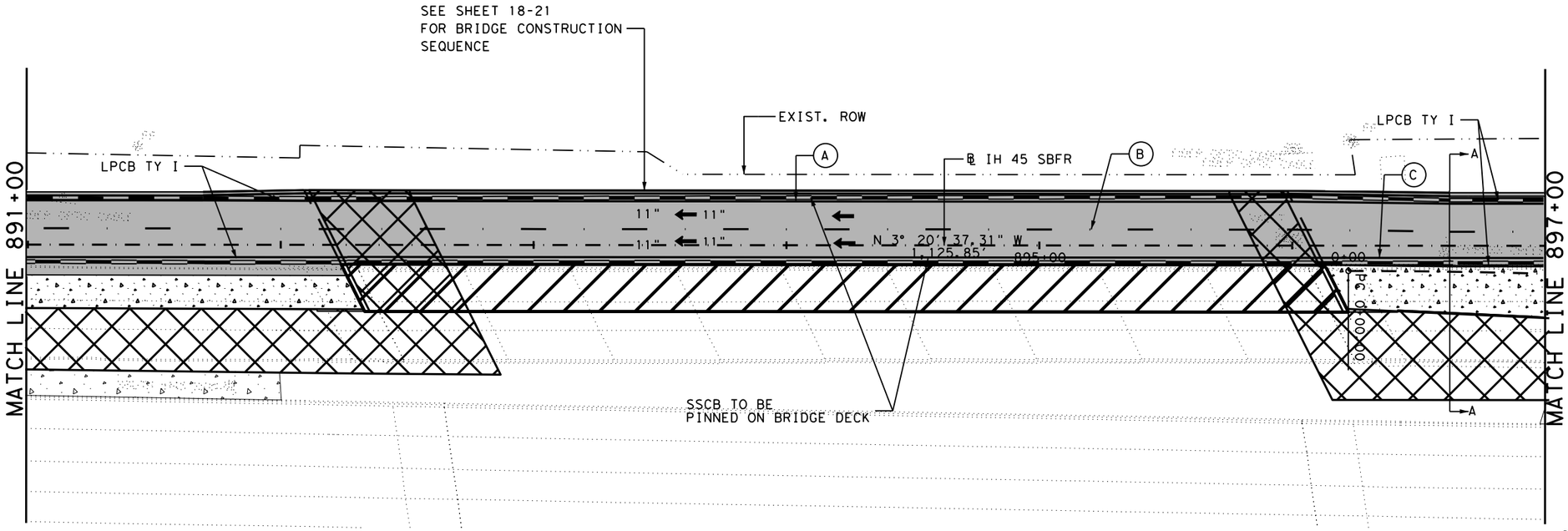

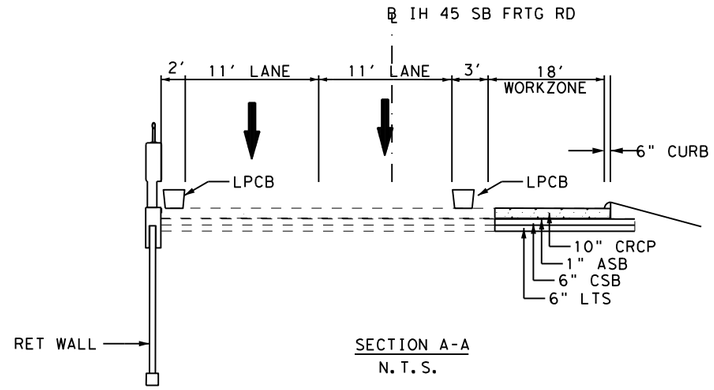

SECTION A-A
N.T.S.

LEGEND

	TY III BARRICADE	■ ■	CHANNELIZING DEVICES
	HEAVY WORK VEHICLE		TRUCK MOUNTED ATTENUATOR (TMA)
	TRAILER MOUNTED FLASHING ARROW BOARD	M	PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)
	SIGN		OPEN TO TRAFFIC
	CONCRETE TRAFFIC BARRIER (CTB)		

LEGEND

- (A) WRK ZN PAV MRK REMOV(W)(4")(SLD)
- (B) WRK ZN PAV MRK REMOV(W)(4")(BRK)
- (C) WRK ZN PAV MRK REMOV(Y)(4")(SLD)
- (D) WRK ZN PAV MRK REMOV(W)(8")(SLD)
- (E) WRK ZN PAV MRK REMOV(Y)(8")(SLD)
- (F) WRK ZN PAV MRK REMOV(Y)(12")(SLD)

- FAST TRACK
- 10" CRCP
- BRIDGE SLAB
- SIDEWALK
- RIPRAP
- PAVEMENT COMPLETED IN PREVIOUS STEP

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED
PROFESSIONAL ENGINEER

Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

TRAFFIC CONTROL PLAN
PHASE 2

SCALE: HORIZ. 1"= 50

SHEET 3 OF 6

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		39

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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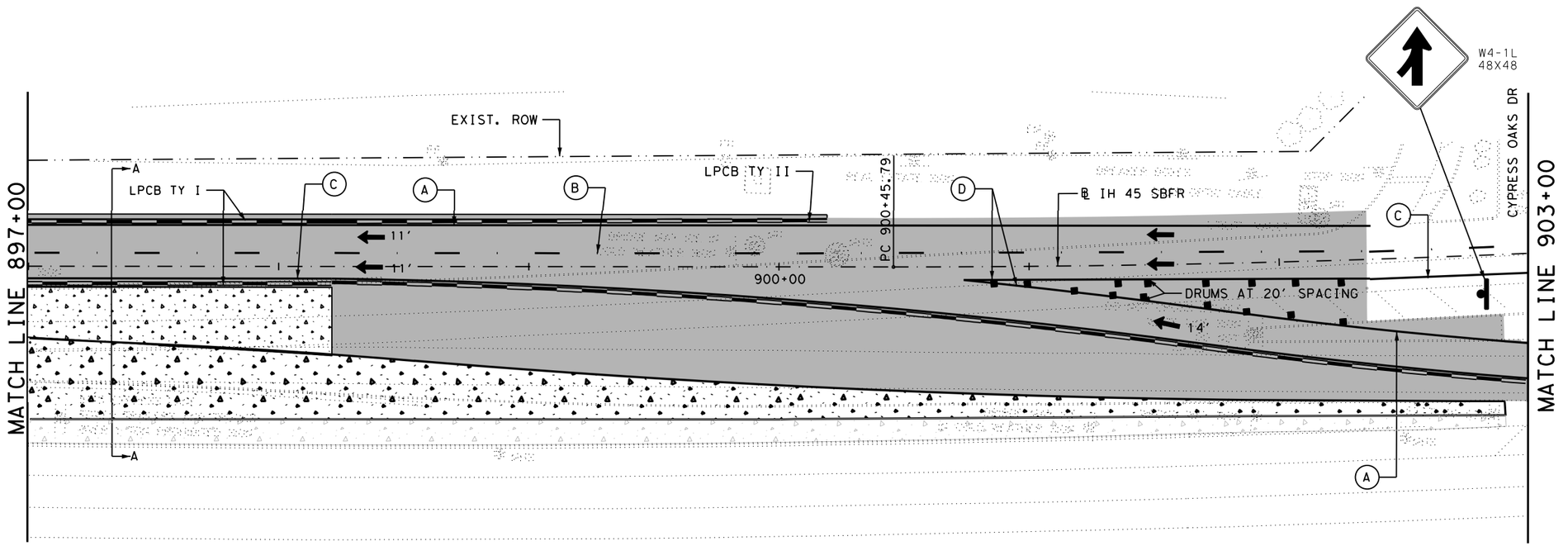

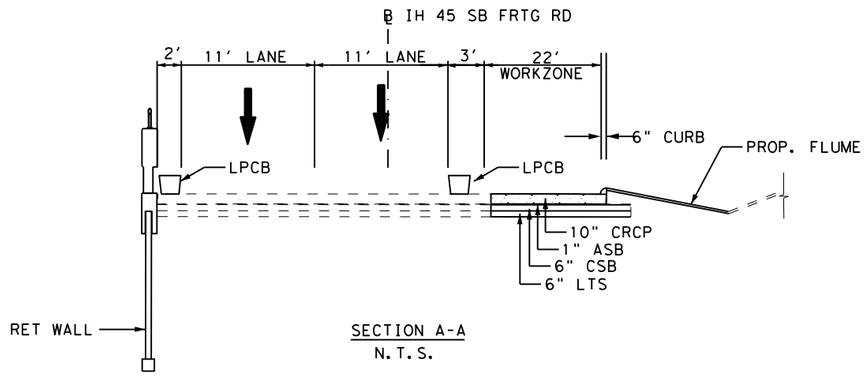

SECTION A-A
N. T. S.

LEGEND

(A)	WRK ZN PAV MRK REMOV(W)(4")(SLD)
(B)	WRK ZN PAV MRK REMOV(W)(4")(BRK)
(C)	WRK ZN PAV MRK REMOV(Y)(4")(SLD)
(D)	WRK ZN PAV MRK REMOV(W)(8")(SLD)
(E)	WRK ZN PAV MRK REMOV(Y)(8")(SLD)
(F)	WRK ZN PAV MRK REMOV(Y)(12")(SLD)

	FAST TRACK
	10" CRCP
	BRIDGE SLAB
	SIDEWALK
	RIPRAP
	PAVEMENT COMPLETED IN PREVIOUS STEP

LEGEND			
	TY III BARRICADE		CHANNELIZING DEVICES
	HEAVY WORK VEHICLE		TRUCK MOUNTED ATTENUATOR (TMA)
	TRAILER MOUNTED FLASHING ARROW BOARD	M	PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)
	SIGN		OPEN TO TRAFFIC
	CONCRETE TRAFFIC BARRIER (CTB)		

STATE OF TEXAS
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99416
LICENSED PROFESSIONAL ENGINEER

Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

TRAFFIC CONTROL PLAN
PHASE 2

SCALE: HORIZ. 1"= 50

SHEET 4 OF 6

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		40

STATE	DIST	COUNTY
TEXAS	HOU	HARRIS

CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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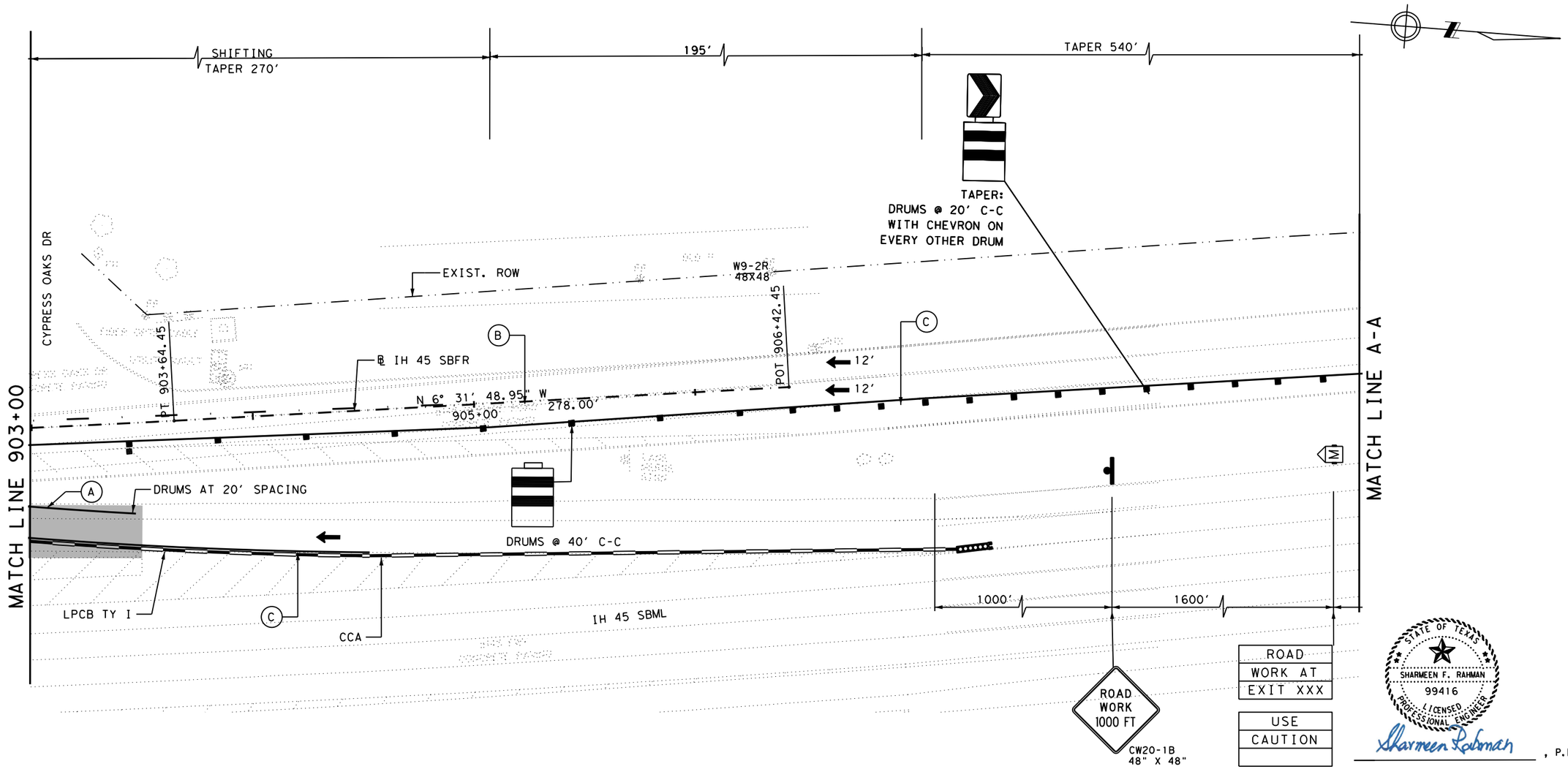

LEGEND

(A)	WRK ZN PAV MRK REMOV(W)(4")(SLD)		FAST TRACK
(B)	WRK ZN PAV MRK REMOV(W)(4")(BRK)		10" CRCP
(C)	WRK ZN PAV MRK REMOV(Y)(4")(SLD)		BRIDGE SLAB
(D)	WRK ZN PAV MRK REMOV(W)(8")(SLD)		SIDEWALK
(E)	WRK ZN PAV MRK REMOV(Y)(8")(SLD)		RIPRAP
(F)	WRK ZN PAV MRK REMOV(Y)(12")(SLD)		PAVEMENT COMPLETED IN PREVIOUS STEP

LEGEND			
	TY III BARRICADE		CHANNELIZING DEVICES
	HEAVY WORK VEHICLE		TRUCK MOUNTED ATTENUATOR (TMA)
	TRAILER MOUNTED FLASHING ARROW BOARD	M	PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)
	SIGN		OPEN TO TRAFFIC
	CONCRETE TRAFFIC BARRIER (CTB)		

STATE OF TEXAS
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99416
LICENSED
PROFESSIONAL ENGINEER

Sharmeen Rahman, P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

TRAFFIC CONTROL PLAN
PHASE 2

SCALE: HORIZ. 1"= 50

SHEET 5 OF 6

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		41

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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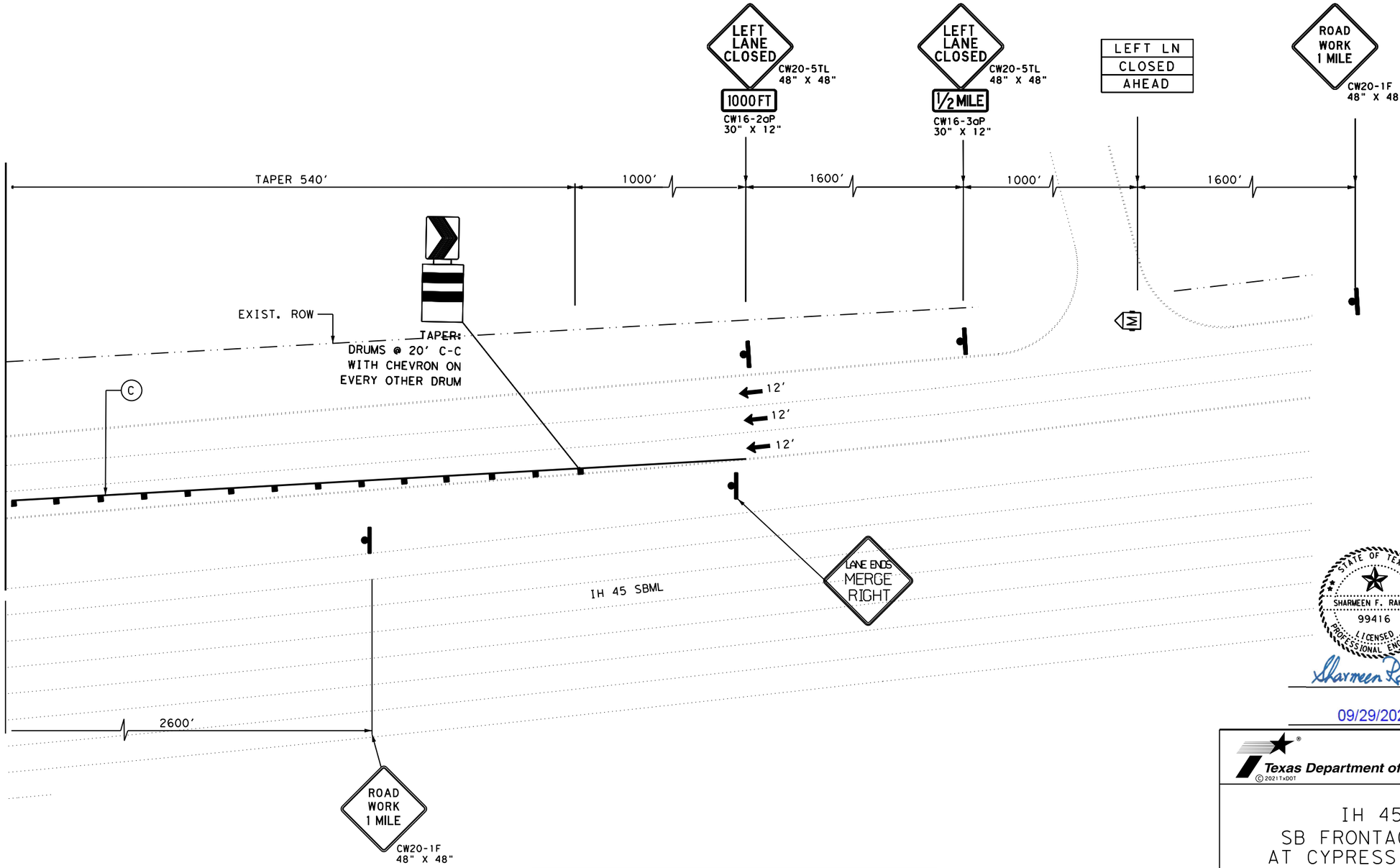

LEGEND

(A)	WRK ZN PAV MRK REMOV(W)(4")(SLD)
(B)	WRK ZN PAV MRK REMOV(W)(4")(BRK)
(C)	WRK ZN PAV MRK REMOV(Y)(4")(SLD)
(D)	WRK ZN PAV MRK REMOV(W)(8")(SLD)
(E)	WRK ZN PAV MRK REMOV(Y)(8")(SLD)
(F)	WRK ZN PAV MRK REMOV(Y)(12")(SLD)

	FAST TRACK
	10" CRCP
	BRIDGE SLAB
	SIDEWALK
	RIPRAP
	PAVEMENT COMPLETED IN PREVIOUS STEP

LEGEND			
	TY III BARRICADE		CHANNELIZING DEVICES
	HEAVY WORK VEHICLE		TRUCK MOUNTED ATTENUATOR (TMA)
	TRAILER MOUNTED FLASHING ARROW BOARD	M	PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)
	SIGN		OPEN TO TRAFFIC
	CONCRETE TRAFFIC BARRIER (CTB)		

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
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Sharmeen Rahman, P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

TRAFFIC CONTROL PLAN
PHASE 2

SCALE: HORIZ. 1"= 50

SHEET 6 OF 6

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		42

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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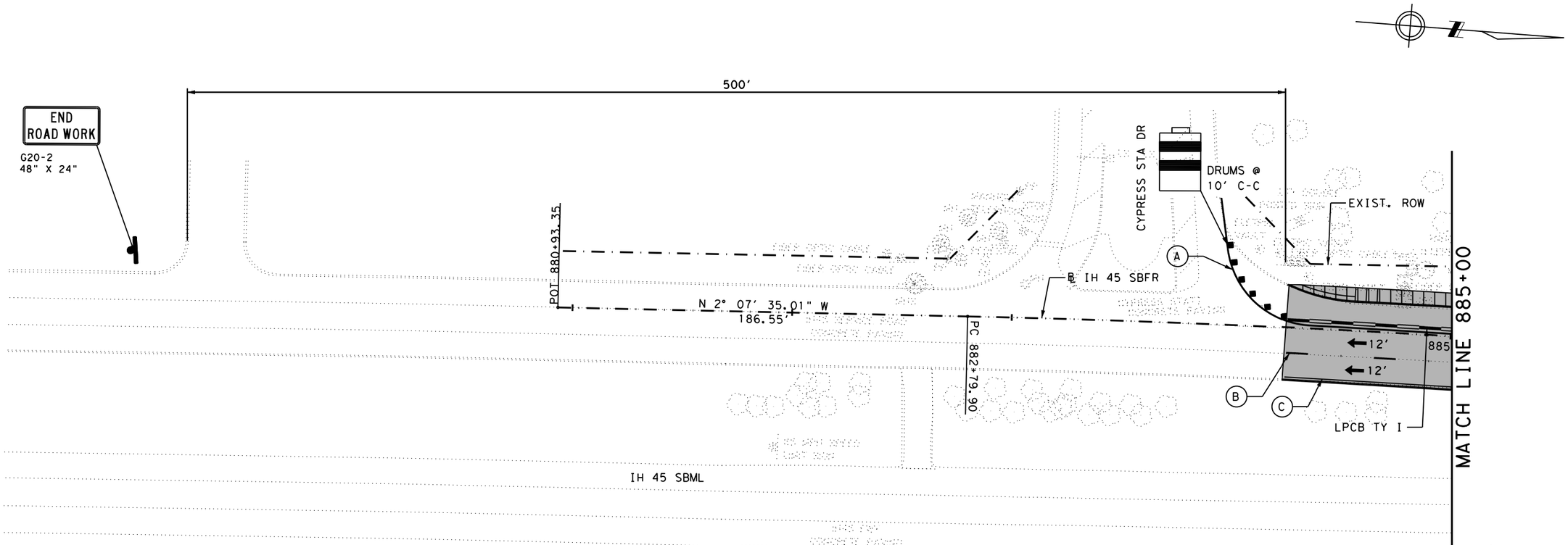

LEGEND

(A)	WRK ZN PAV MRK REMOV(W)(4")(SLD)		FAST TRACK
(B)	WRK ZN PAV MRK REMOV(W)(4")(BRK)		10" CRCP
(C)	WRK ZN PAV MRK REMOV(Y)(4")(SLD)		BRIDGE SLAB
(D)	WRK ZN PAV MRK REMOV(W)(8")(SLD)		SIDEWALK
(E)	WRK ZN PAV MRK REMOV(Y)(8")(SLD)		RIPRAP
(F)	WRK ZN PAV MRK REMOV(Y)(12")(SLD)		PAVEMENT COMPLETED IN PREVIOUS STEP
			RIPRAP COMPLETED IN PREVIOUS STEP

LEGEND			
	TY III BARRICADE	■ ■	CHANNELIZING DEVICES
	HEAVY WORK VEHICLE		TRUCK MOUNTED ATTENUATOR (TMA)
	TRAILER MOUNTED FLASHING ARROW BOARD	M	PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)
	SIGN		OPEN TO TRAFFIC
	CONCRETE TRAFFIC BARRIER (CTB)		

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED
PROFESSIONAL ENGINEER

Sharmeen Rahman , P.E.

09/29/21

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

TRAFFIC CONTROL PLAN
PHASE 3

SCALE: HORIZ. 1"= 50

SHEET 1 OF 6

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		43

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

9/29/2021 9:57:14 AM
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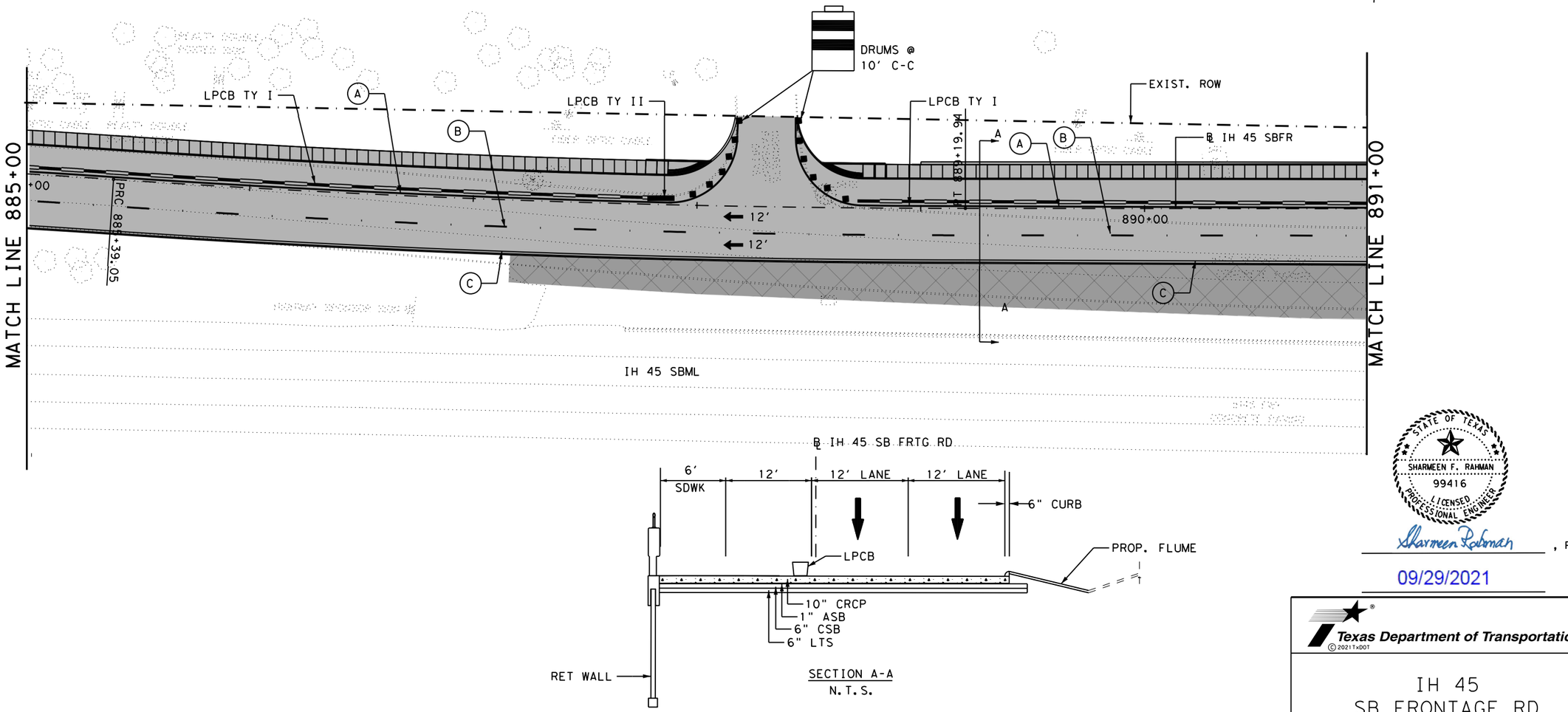

LEGEND

(A)	WRK ZN PAV MRK REMOV(W)(4")(SLD)
(B)	WRK ZN PAV MRK REMOV(W)(4")(BRK)
(C)	WRK ZN PAV MRK REMOV(Y)(4")(SLD)
(D)	WRK ZN PAV MRK REMOV(W)(8")(SLD)
(E)	WRK ZN PAV MRK REMOV(Y)(8")(SLD)
(F)	WRK ZN PAV MRK REMOV(Y)(12")(SLD)

	FAST TRACK
	10" CRCP
	BRIDGE SLAB
	SIDEWALK
	RIPRAP
	PAVEMENT COMPLETED IN PREVIOUS STEP
	RIPRAP COMPLETED IN PREVIOUS STEP

LEGEND			
	TY III BARRICADE		CHANNELIZING DEVICES
	HEAVY WORK VEHICLE		TRUCK MOUNTED ATTENUATOR (TMA)
	TRAILER MOUNTED FLASHING ARROW BOARD	M	PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)
	SIGN		OPEN TO TRAFFIC
	CONCRETE TRAFFIC BARRIER (CTB)		

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED
PROFESSIONAL ENGINEER

Sharmeen Rahman, P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

TRAFFIC CONTROL PLAN
PHASE 3

SHEET 2 OF 6

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		44

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

9/29/2021 10:17:01 AM
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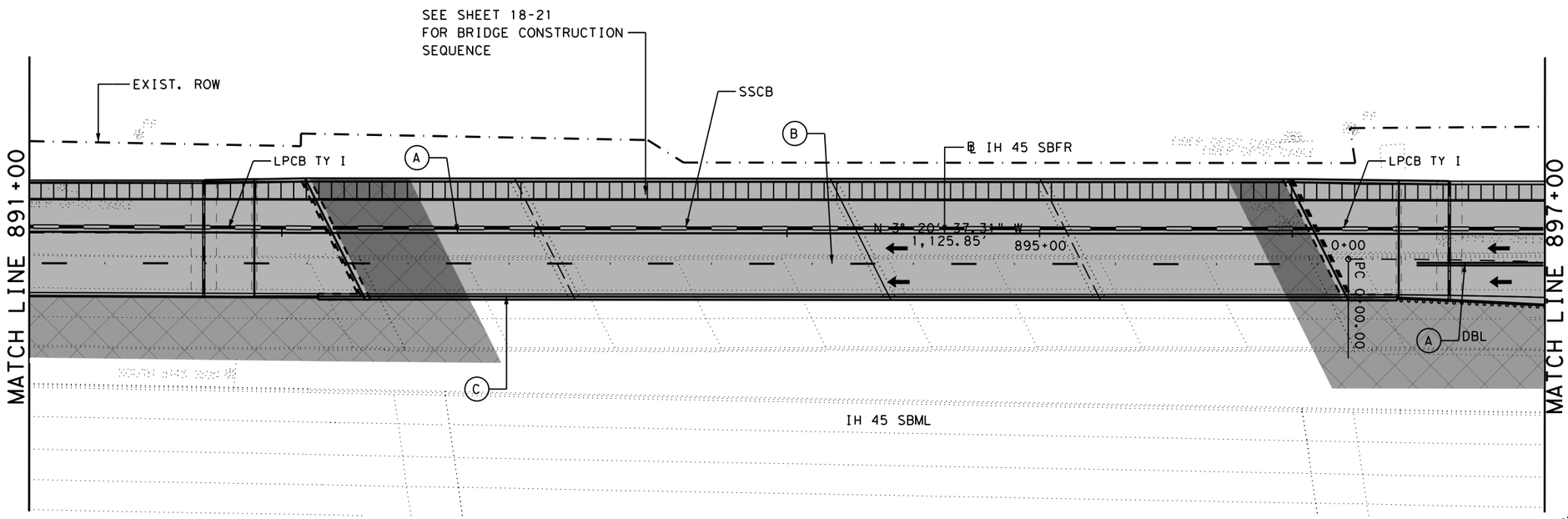

LEGEND

- (A) WRK ZN PAV MRK REMOV(W)(4")(SLD)
- (B) WRK ZN PAV MRK REMOV(W)(4")(BRK)
- (C) WRK ZN PAV MRK REMOV(Y)(4")(SLD)
- (D) WRK ZN PAV MRK REMOV(W)(8")(SLD)
- (E) WRK ZN PAV MRK REMOV(Y)(8")(SLD)
- (F) WRK ZN PAV MRK REMOV(Y)(12")(SLD)

- FAST TRACK
- 10" CRCP
- BRIDGE SLAB
- SIDEWALK
- RIPRAP
- PAVEMENT COMPLETED IN PREVIOUS STEP
- RIPRAP COMPLETED IN PREVIOUS STEP

LEGEND			
	TY III BARRICADE		CHANNELIZING DEVICES
	HEAVY WORK VEHICLE		TRUCK MOUNTED ATTENUATOR (TMA)
	TRAILER MOUNTED FLASHING ARROW BOARD	M	PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)
	SIGN		OPEN TO TRAFFIC
	CONCRETE TRAFFIC BARRIER (CTB)		

STATE OF TEXAS
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Sharmeen Rahman , P.E.

09/29/21

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

TRAFFIC CONTROL PLAN
PHASE 3

SCALE: HORIZ. 1"= 50

SHEET 3 OF 6

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		45

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

9/29/2021 10:05:05 AM
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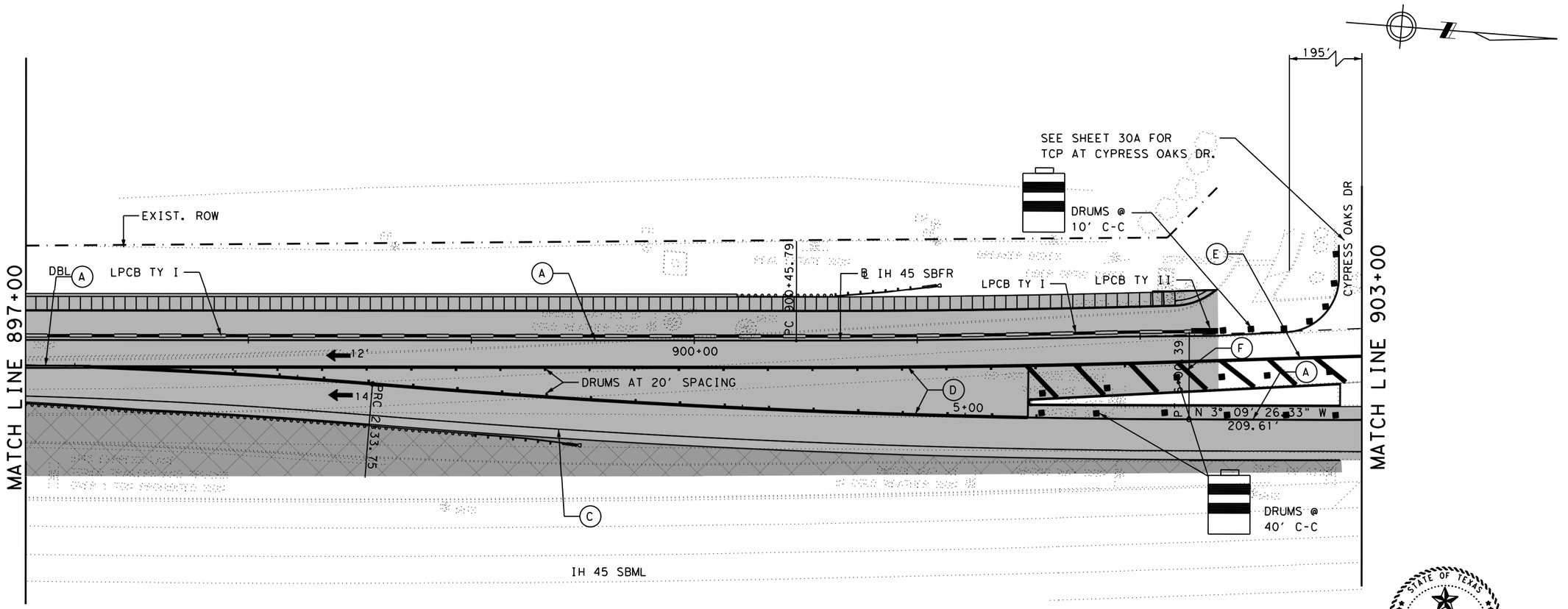

LEGEND

(A)	WRK ZN PAV MRK REMOV(W)(4")(SLD)		FAST TRACK
(B)	WRK ZN PAV MRK REMOV(W)(4")(BRK)		10" CRCP
(C)	WRK ZN PAV MRK REMOV(Y)(4")(SLD)		BRIDGE SLAB
(D)	WRK ZN PAV MRK REMOV(W)(8")(SLD)		SIDEWALK
(E)	WRK ZN PAV MRK REMOV(Y)(8")(SLD)		RIPRAP
(F)	WRK ZN PAV MRK REMOV(Y)(12")(SLD)		PAVEMENT COMPLETED IN PREVIOUS STEP
			RIPRAP COMPLETED IN PREVIOUS STEP

LEGEND			
	TY III BARRICADE		CHANNELIZING DEVICES
	HEAVY WORK VEHICLE		TRUCK MOUNTED ATTENUATOR (TMA)
	TRAILER MOUNTED FLASHING ARROW BOARD	M	PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)
	SIGN		OPEN TO TRAFFIC
	CONCRETE TRAFFIC BARRIER (CTB)		

STATE OF TEXAS
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PROFESSIONAL ENGINEER

Sharmeen Rahman, P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

TRAFFIC CONTROL PLAN
PHASE 3

SCALE: HORIZ. 1"= 50

SHEET 4 OF 6

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		46

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

9/29/2021 10:03:09 AM
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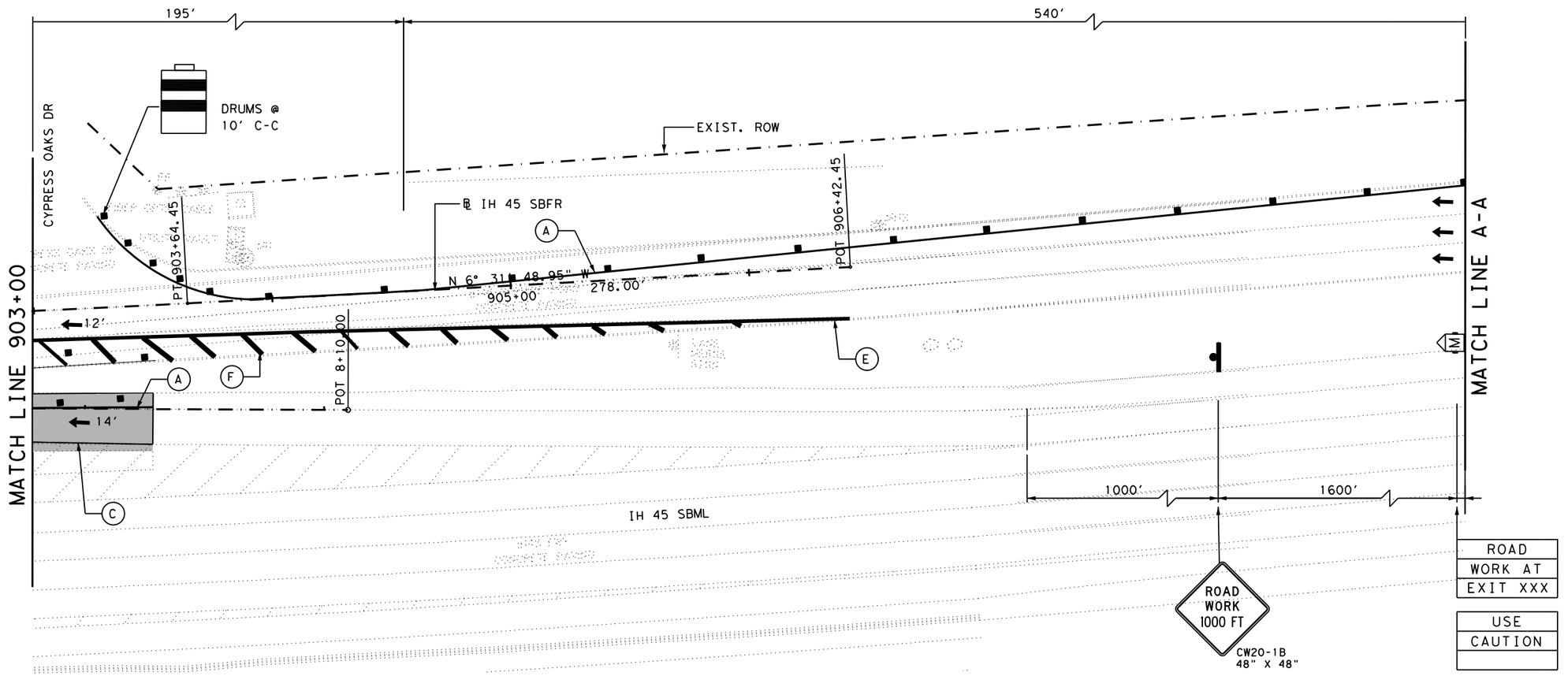

LEGEND

- (A) WRK ZN PAV MRK REMOV(W)(4")(SLD)
- (B) WRK ZN PAV MRK REMOV(W)(4")(BRK)
- (C) WRK ZN PAV MRK REMOV(Y)(4")(SLD)
- (D) WRK ZN PAV MRK REMOV(W)(8")(SLD)
- (E) WRK ZN PAV MRK REMOV(Y)(8")(SLD)
- (F) WRK ZN PAV MRK REMOV(Y)(12")(SLD)

- FAST TRACK
- 10" CRCP
- BRIDGE SLAB
- SIDEWALK
- RIPRAP
- PAVEMENT COMPLETED IN PREVIOUS STEP
- RIPRAP COMPLETED IN PREVIOUS STEP

LEGEND			
	TY III BARRICADE		CHANNELIZING DEVICES
	HEAVY WORK VEHICLE		TRUCK MOUNTED ATTENUATOR (TMA)
	TRAILER MOUNTED FLASHING ARROW BOARD	M	PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)
	SIGN		OPEN TO TRAFFIC
	CONCRETE TRAFFIC BARRIER (CTB)		

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PROFESSIONAL ENGINEER

Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

TRAFFIC CONTROL PLAN
PHASE 3

SCALE: HORIZ. 1"= 50

SHEET 5 OF 6

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		47

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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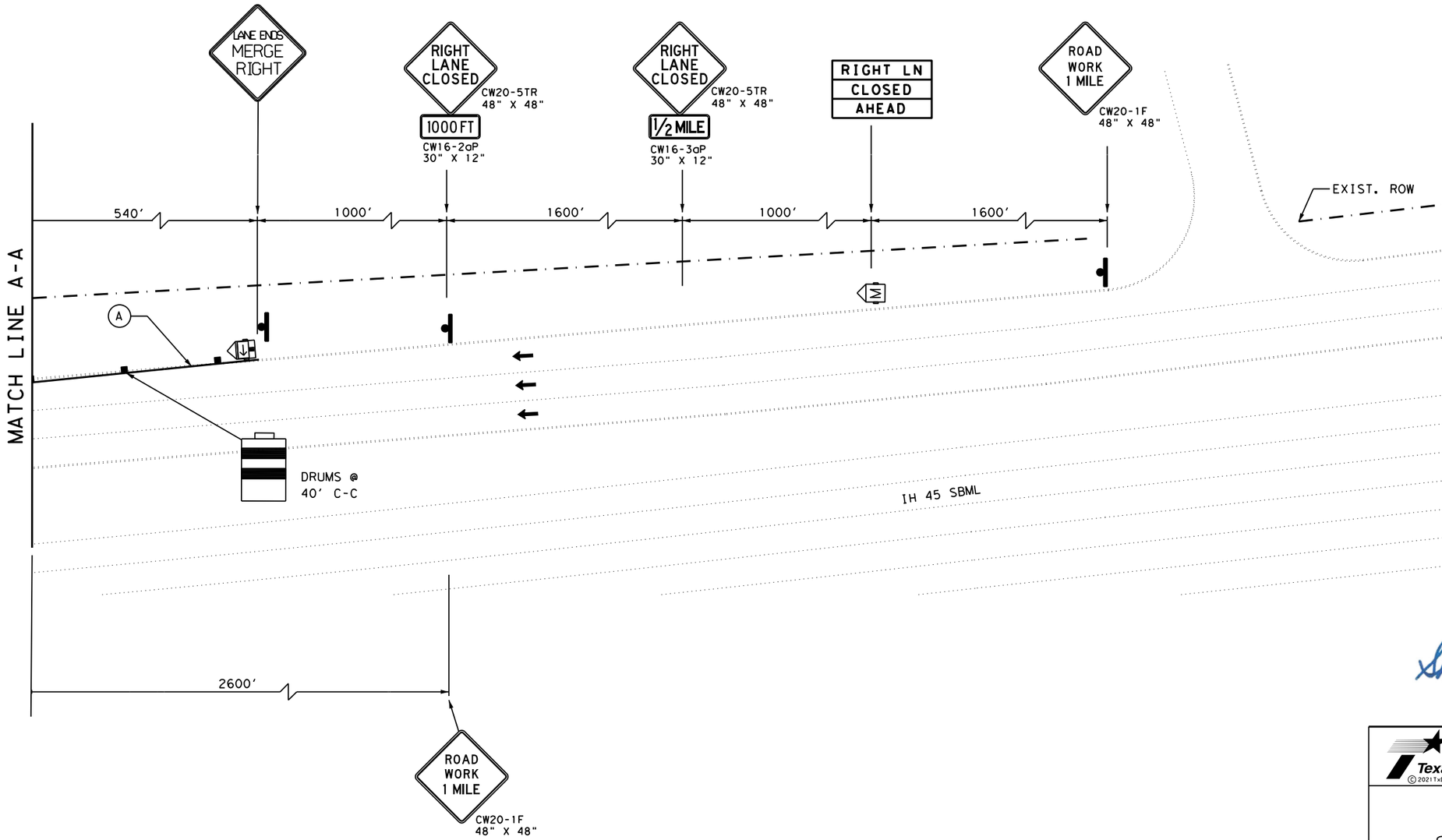

LEGEND

(A)	WRK ZN PAV MRK REMOV(W)(4")(SLD)
(B)	WRK ZN PAV MRK REMOV(W)(4")(BRK)
(C)	WRK ZN PAV MRK REMOV(Y)(4")(SLD)
(D)	WRK ZN PAV MRK REMOV(W)(8")(SLD)
(E)	WRK ZN PAV MRK REMOV(Y)(8")(SLD)
(F)	WRK ZN PAV MRK REMOV(Y)(12")(SLD)

	FAST TRACK
	10" CRCP
	BRIDGE SLAB
	SIDEWALK
	RIPRAP
	PAVEMENT COMPLETED IN PREVIOUS STEP
	RIPRAP COMPLETED IN PREVIOUS STEP

LEGEND			
	TY III BARRICADE		CHANNELIZING DEVICES
	HEAVY WORK VEHICLE		TRUCK MOUNTED ATTENUATOR (TMA)
	TRAILER MOUNTED FLASHING ARROW BOARD	M	PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)
	SIGN		OPEN TO TRAFFIC
	CONCRETE TRAFFIC BARRIER (CTB)		

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED
PROFESSIONAL ENGINEER

Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

TRAFFIC CONTROL PLAN
PHASE 3

SCALE: HORIZ. 1"= 50

SHEET 6 OF 6

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		48

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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DATE:
FILE:

BARRICADE AND CONSTRUCTION (BC) STANDARD SHEETS GENERAL NOTES:

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

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

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

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

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

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

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

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

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

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

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

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

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

WORKER SAFETY NOTES:

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

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

COMPLIANT WORKZONE TRAFFIC CONTROL DEVICES

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

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

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

Texas Department of Transportation

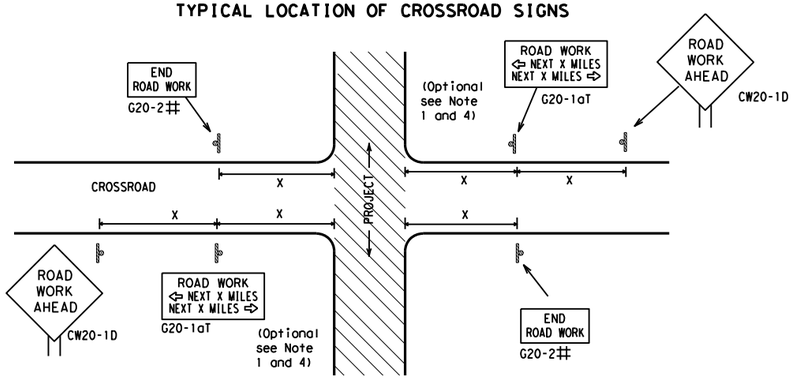
Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION GENERAL NOTES AND REQUIREMENTS

BC(1)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS 4-03 7-13 9-07 8-14 5-10 5-21	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		49

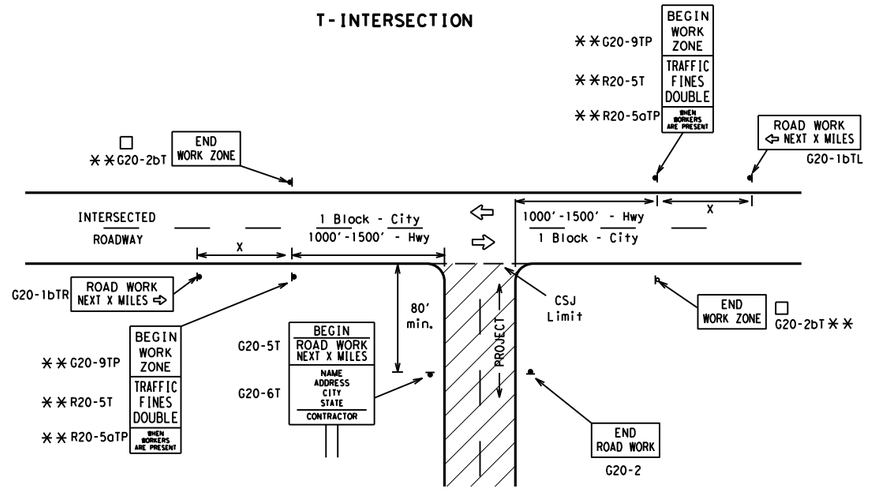
TYPICAL LOCATION OF CROSSROAD SIGNS



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]

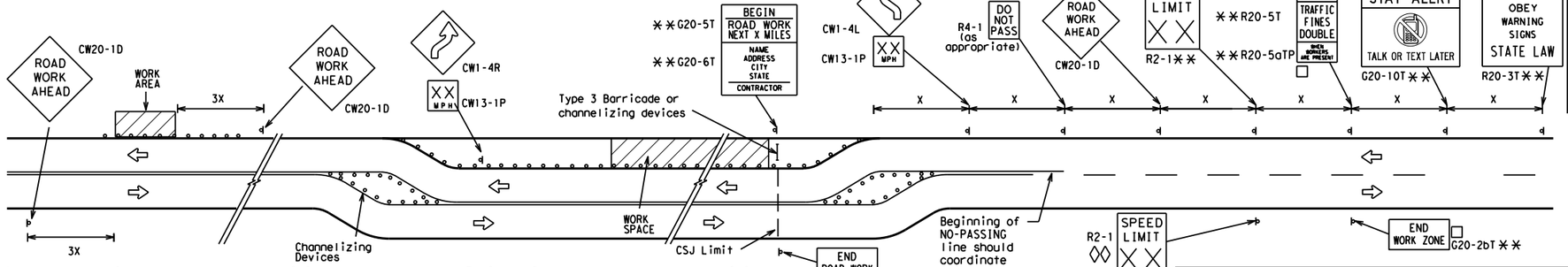
* For typical sign spacings on divided highways, expressways and freeways, see Part 6 of the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD) typical application diagrams or TCP Standard Sheets.

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

GENERAL NOTES

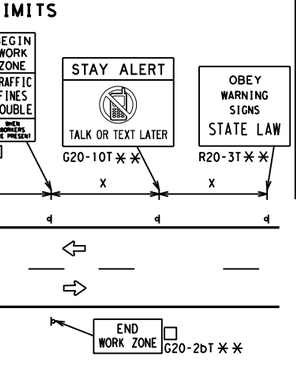
1. Special or larger size signs may be used as necessary.
2. Distance between signs should be increased as required to have 1500 feet advance warning.
3. Distance between signs should be increased as required to have 1/2 mile or more advance warning.
4. 36" x 36" "ROAD WORK AHEAD" (CW20-1D)signs may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

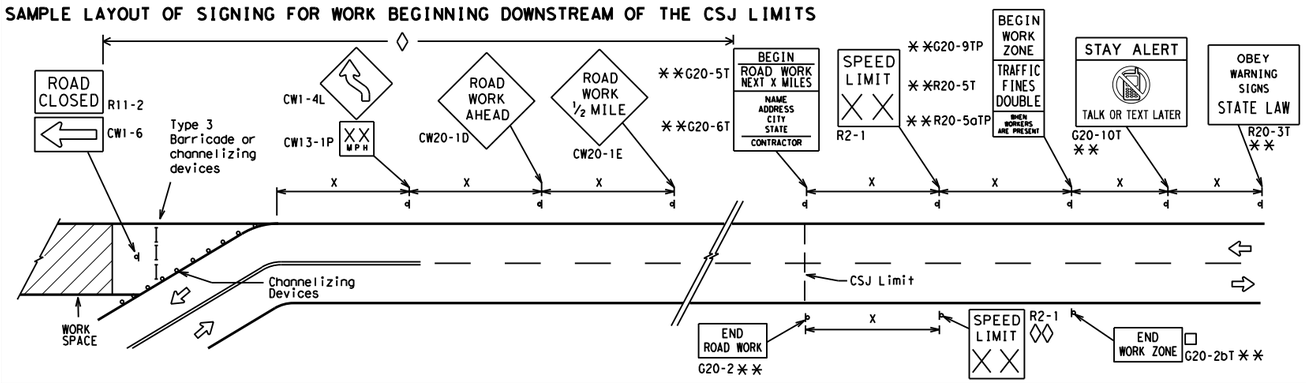


When extended distances occur between minimal work spaces, the Engineer/Inspector should ensure additional "ROAD WORK AHEAD"(CW20-1D)signs are placed in advance of these work areas to remind drivers they are still within the project limits. See the applicable TCP sheets for exact location and spacing 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
REVISIONS	0110	05	126	IH 45
9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	HOU	HARRIS		50

DATE:
FILE:

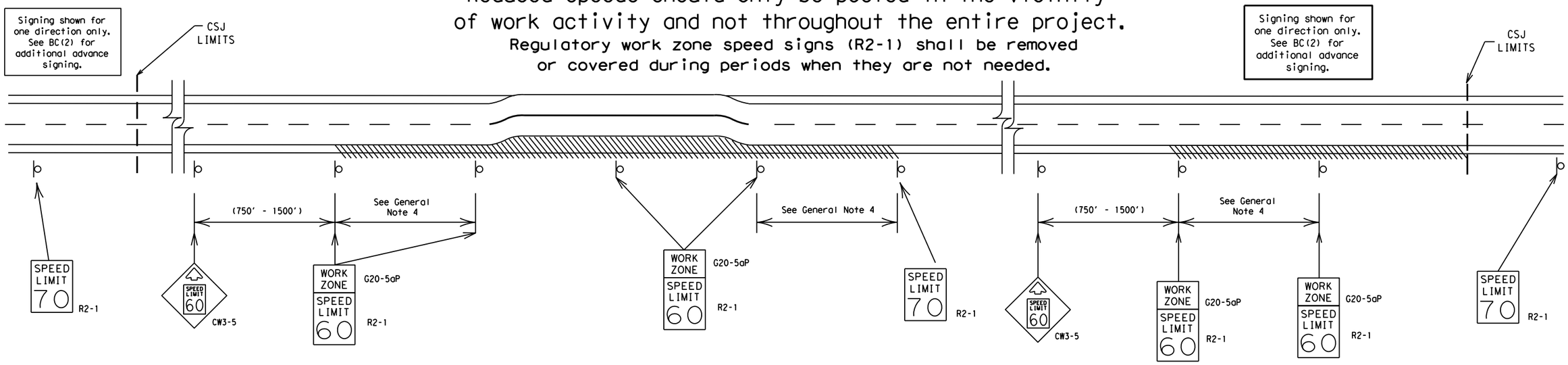
DATE:
FILE:

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

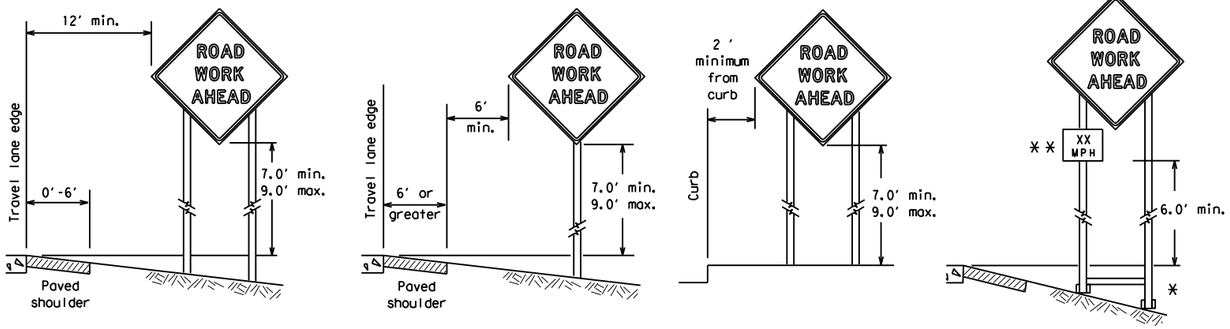
BARRICADE AND CONSTRUCTION WORK ZONE SPEED LIMIT

BC(3)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS 9-07 8-14 7-13 5-21	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		51

DATE:
FILE:

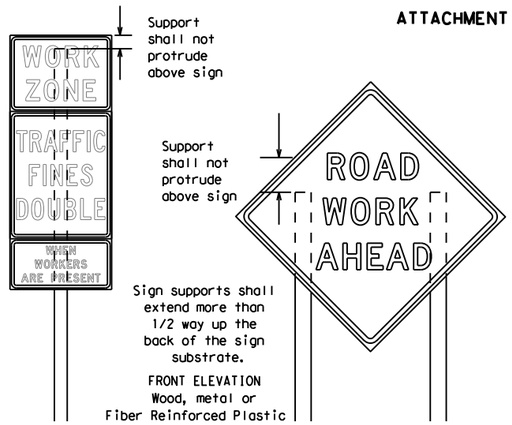
TYPICAL MINIMUM CLEARANCES FOR LONG TERM AND INTERMEDIATE TERM SIGNS

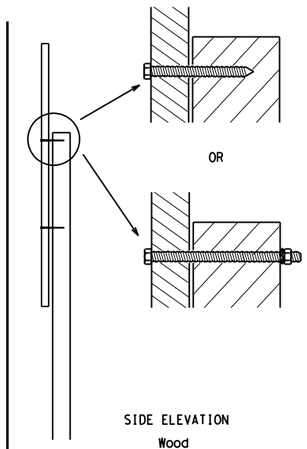


* When placing skid supports on unlevel ground, the leg post lengths must be adjusted so the sign appears straight and plumb. Objects shall NOT be placed under skids as a means of leveling.

** 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





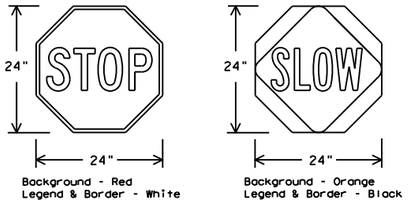
Attachment to wooden supports will be by bolts and nuts or screws. Use TxDOT's or manufacturer's recommended procedures for attaching sign substrates to other types of sign supports

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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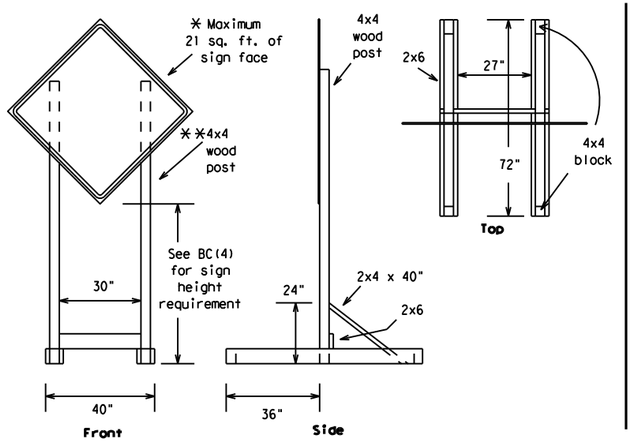
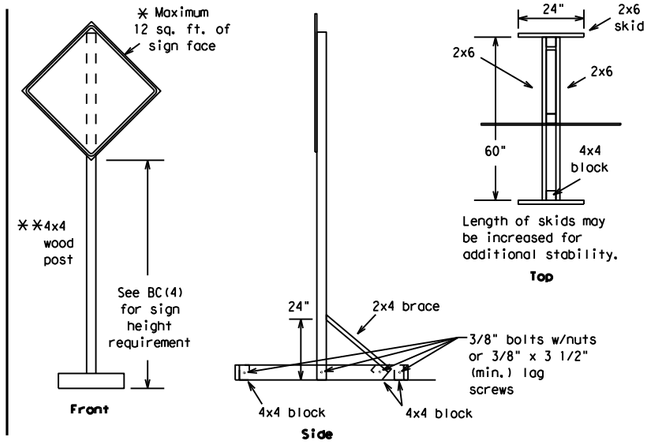
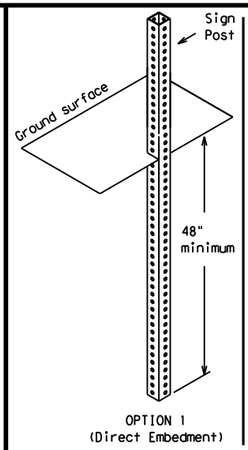
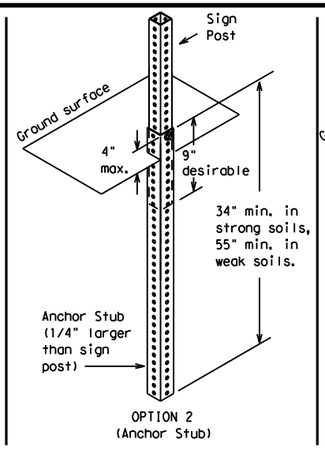


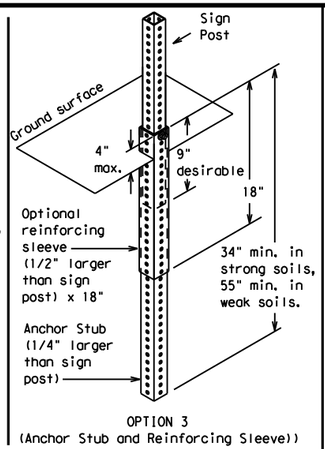


SKID MOUNTED WOOD SIGN SUPPORTS

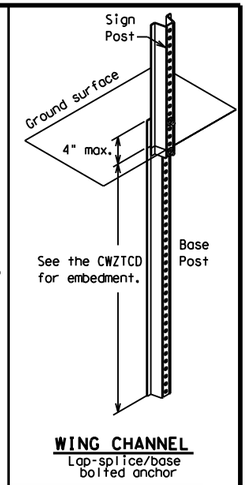
* LONG/INTERMEDIATE TERM STATIONARY - PORTABLE SKID MOUNTED SIGN SUPPORTS







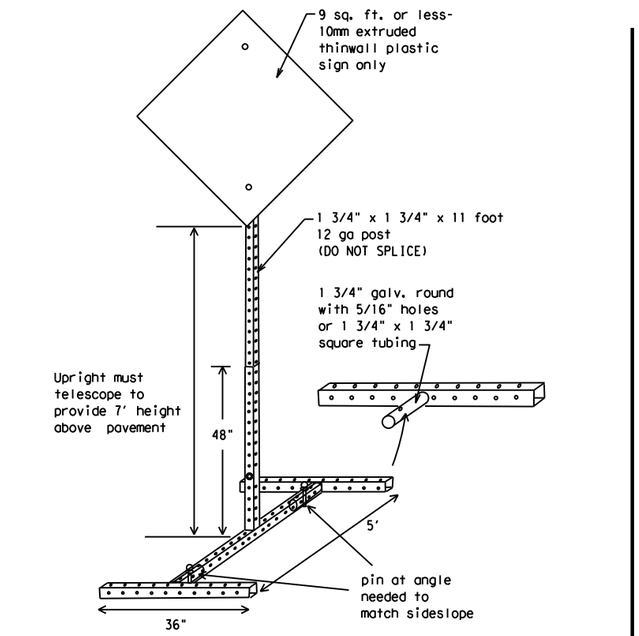
PERFORATED SQUARE METAL TUBING

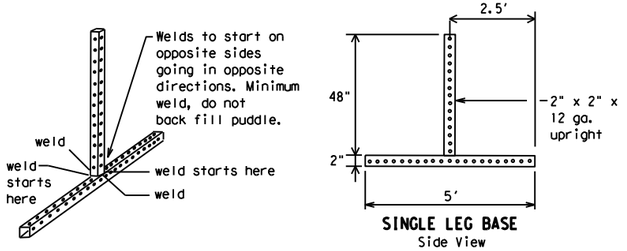


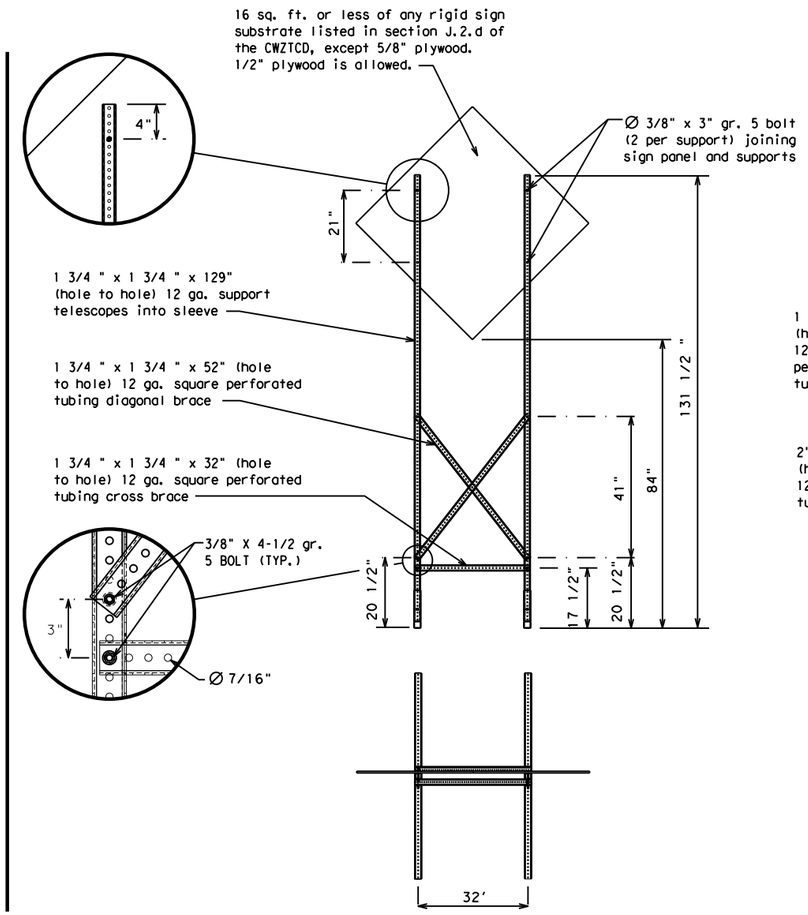
WING CHANNEL
Lap-splice/base bolted anchor

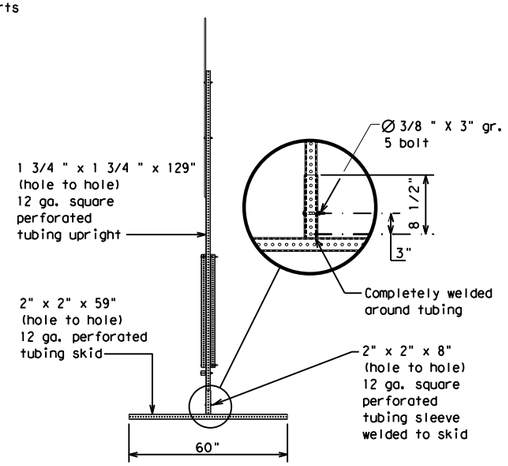
GROUND MOUNTED SIGN SUPPORTS

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









SKID MOUNTED PERFORATED SQUARE STEEL TUBING SIGN SUPPORTS

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

WEDGE ANCHORS

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

OTHER DESIGNS

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

GENERAL NOTES

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

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

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

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

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

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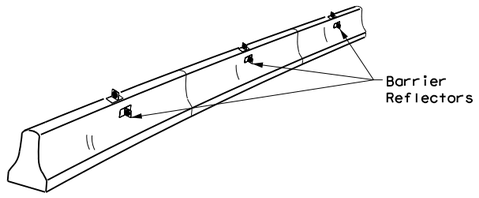
7-13 5-21	HOU	HARRIS		54

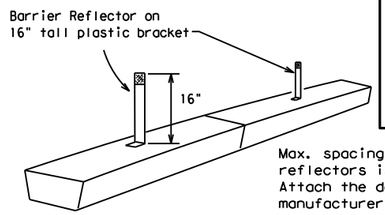
100

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



CONCRETE TRAFFIC BARRIER (CTB)

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

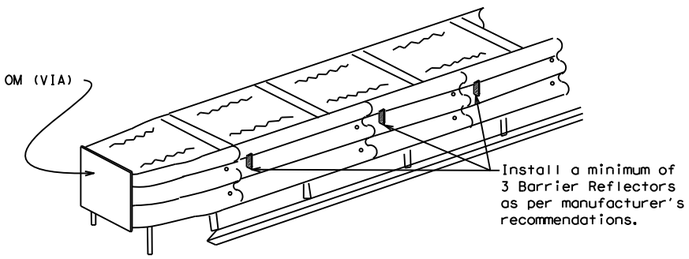


Max. spacing of barrier reflectors is 20 feet. Attach the delineators as per manufacturer's recommendations.

LOW PROFILE CONCRETE BARRIER (LPCB) USED IN WORK ZONES

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

LOW PROFILE CONCRETE BARRIER (LPCB)

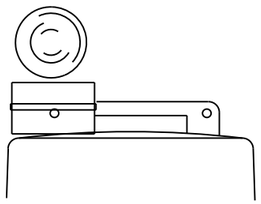


DELINEATION OF END TREATMENTS

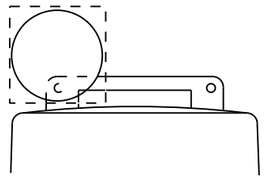
END TREATMENTS FOR CTB'S USED IN WORK ZONES

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

BARRIER REFLECTORS FOR CONCRETE TRAFFIC BARRIER AND ATTENUATORS



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



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

WARNING LIGHTS

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

WARNING LIGHTS MOUNTED ON PLASTIC DRUMS

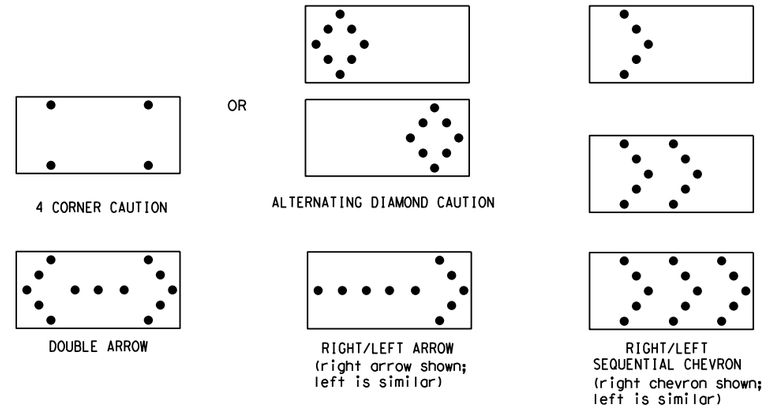
1. Type A flashing warning lights are intended to warn drivers that they are approaching or are in a potentially hazardous area.
2. Type A random flashing warning lights are not intended for delineation and shall not be used in a series.
3. A series of sequential flashing warning lights placed on channelizing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

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

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

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

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



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

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

ATTENTION

Flashing Arrow Boards shall be equipped with automatic dimming devices.

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

FLASHING ARROW BOARDS

TRUCK-MOUNTED ATTENUATORS

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

Texas Department of Transportation

Traffic Safety Division Standard

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

BC(7)-21

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DATE:
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101

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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:

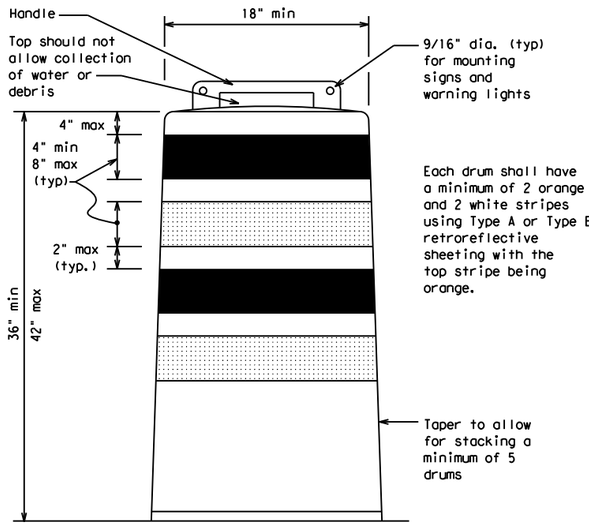
1. Plastic drums shall be a two-piece design; the "body" of the drum shall be the top portion and the "base" shall be the bottom.
2. The body and base shall lock together in such a manner that the body separates from the base when impacted by a vehicle traveling at a speed of 20 MPH or greater but prevents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

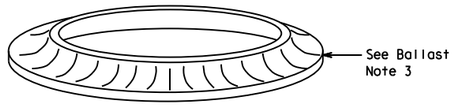
RETROREFLECTIVE SHEETING

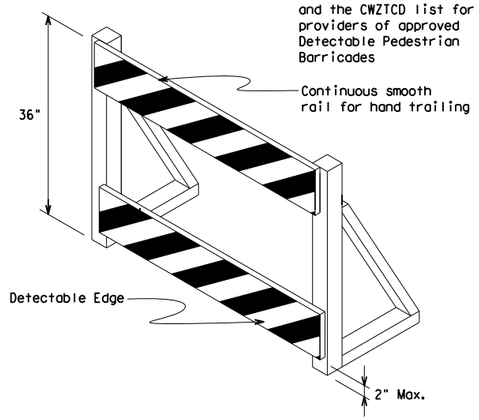
1. The stripes used on drums shall be constructed of sheeting meeting the color and retroreflectivity requirements of Departmental Materials Specification DMS-8300, "Sign Face Materials." Type A or Type B reflective sheeting shall be supplied unless otherwise specified in the plans.
2. The sheeting shall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

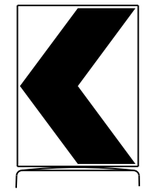




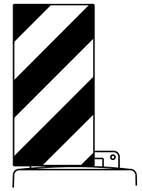


DETECTABLE PEDESTRIAN BARRICADES

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
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7-13				

102

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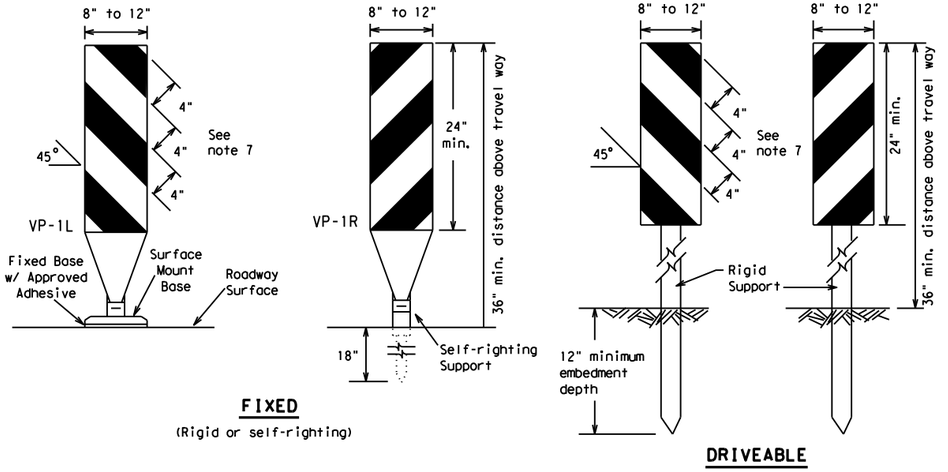


FIXED
(Rigid or self-righting)

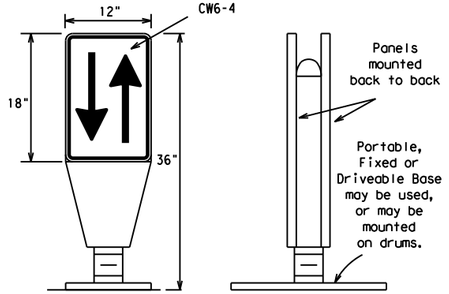
DRIVEABLE

(Rigid or self-righting)

PORTABLE

VERTICAL PANELS (VPs)

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.



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)

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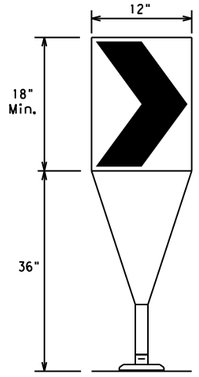


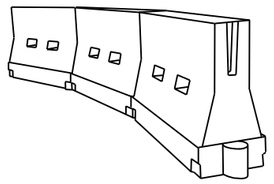
Fixed Base w/ Approved Adhesive (Driveable Base, or Flexible Support can be used)

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

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

SUGGESTED MAXIMUM SPACING OF CHANNELIZING DEVICES AND MINIMUM DESIRABLE TAPER LENGTHS

SHEET 9 OF 12

Texas Department of Transportation | Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC(9)-21

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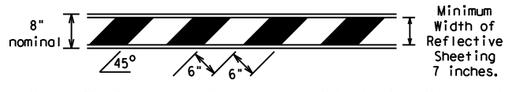
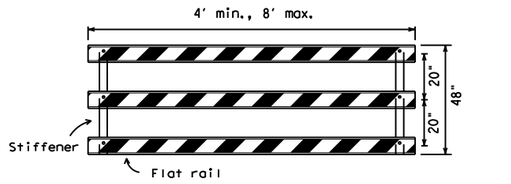
TYPE 3 BARRICADES

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.



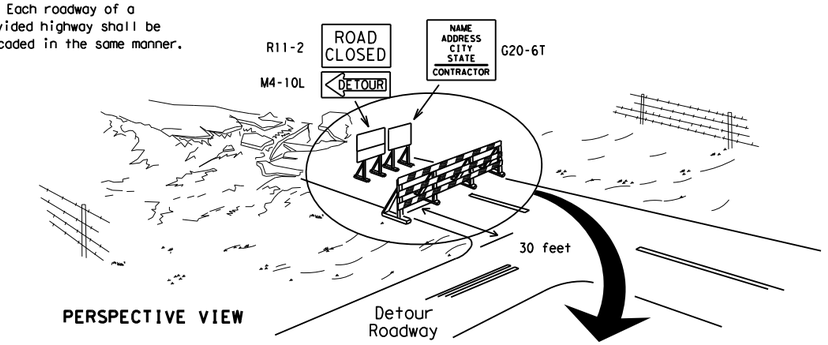
TYPICAL STRIPING DETAIL FOR BARRICADE RAIL



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

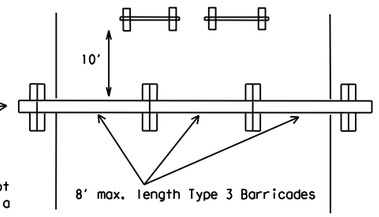
TYPICAL PANEL DETAIL FOR SKID OR POST TYPE BARRICADES

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



PERSPECTIVE VIEW

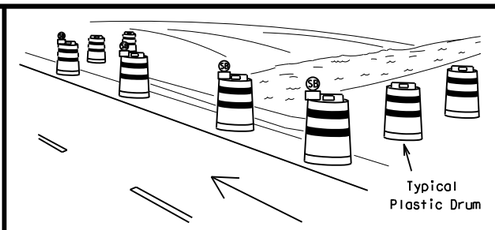
The three rails on Type 3 barricades shall be reflectorized orange and reflective white stripes on one side facing one-way traffic and both sides for two-way traffic.
Barricade striping should slant downward in the direction of detour.



PLAN VIEW

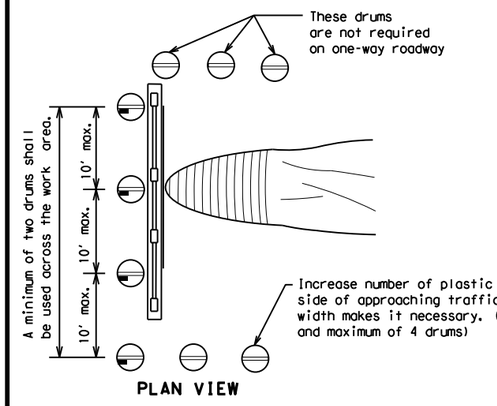
1. Signs should be mounted on independent supports at a 7 foot mounting height in center of roadway. The signs should be a minimum of 10 feet behind Type 3 Barricades.
2. Advance signing shall be as specified elsewhere in the plans.

TYPE 3 BARRICADE (POST AND SKID) TYPICAL APPLICATION



PERSPECTIVE VIEW

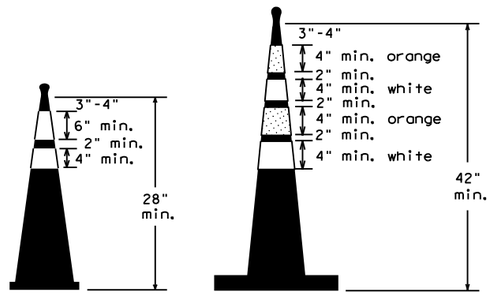
1. Where positive redirectional capability is provided, drums may be omitted.
2. Plastic construction fencing may be used with drums for safety as required in the plans.
3. Vertical Panels on flexible support may be substituted for drums when the shoulder width is less than 4 feet.
4. When the shoulder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



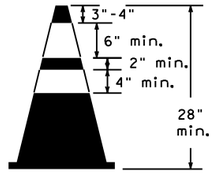
PLAN VIEW

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

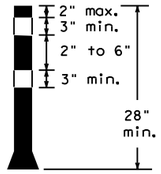
CULVERT WIDENING OR OTHER ISOLATED WORK WITHIN THE PROJECT LIMITS



Two-Piece cones



One-Piece cones

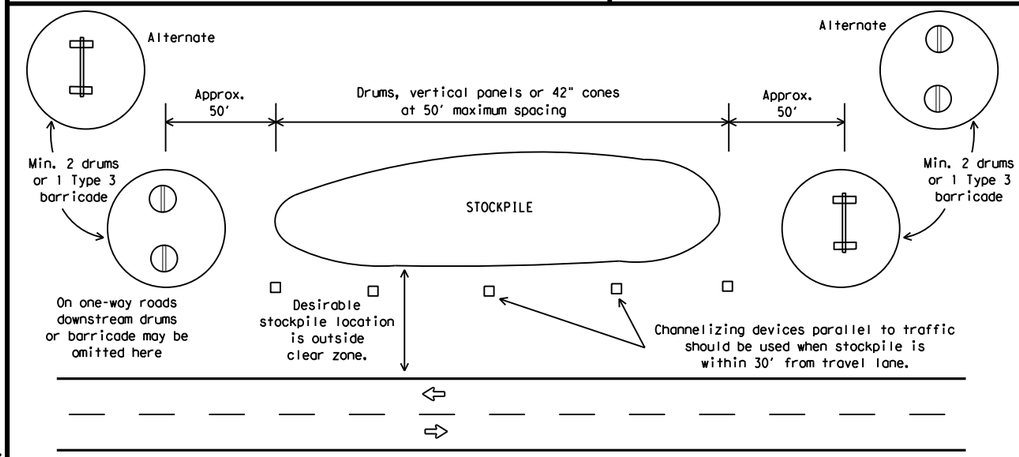


Tubular Marker

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

DATE:
FILE:

SHEET 10 OF 12

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC(10)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	HOU	HARRIS		58

104

DATE:
FILE:

WORK ZONE PAVEMENT MARKINGS

GENERAL

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

RAISED PAVEMENT MARKERS

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

PREFABRICATED PAVEMENT MARKINGS

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

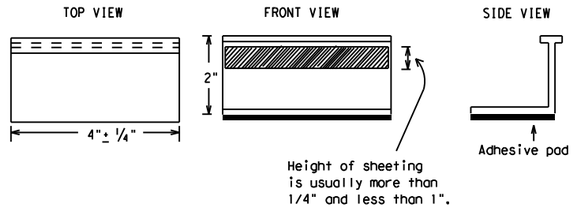
MAINTAINING WORK ZONE PAVEMENT MARKINGS

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

REMOVAL OF PAVEMENT MARKINGS

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

Temporary Flexible-Reflective Roadway Marker Tabs



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

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

RAISED PAVEMENT MARKERS USED AS GUIDEMARKS

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

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

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

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

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PAVEMENT MARKINGS

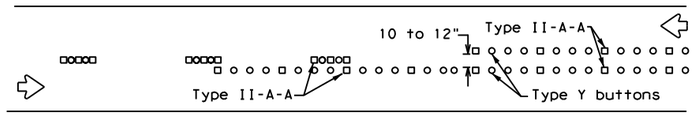
BC(11)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
2-98 9-07 5-21	DIST	COUNTY		SHEET NO.
1-02 7-13	HOU	HARRIS		59
11-02 8-14				

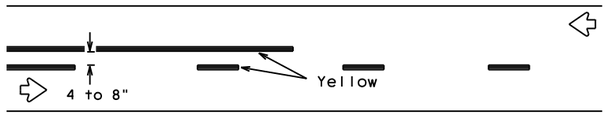
DATE:
FILE:

PAVEMENT MARKING PATTERNS

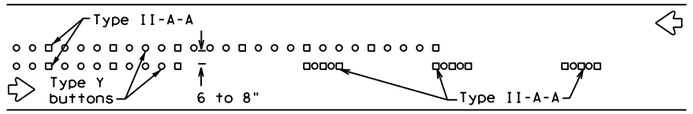
REFLECTORIZED PAVEMENT MARKINGS - PATTERN A



RAISED PAVEMENT MARKERS - PATTERN A



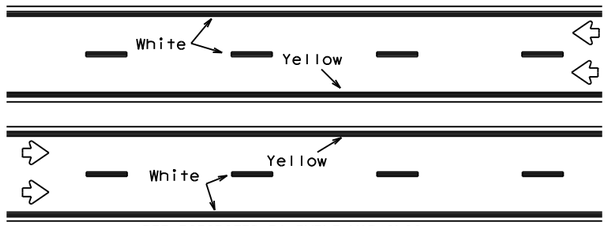
REFLECTORIZED PAVEMENT MARKINGS - PATTERN B



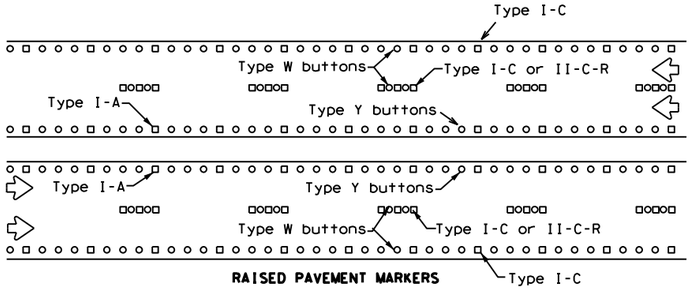
RAISED PAVEMENT MARKERS - PATTERN B

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

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



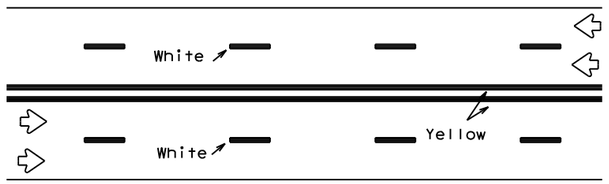
REFLECTORIZED PAVEMENT MARKINGS



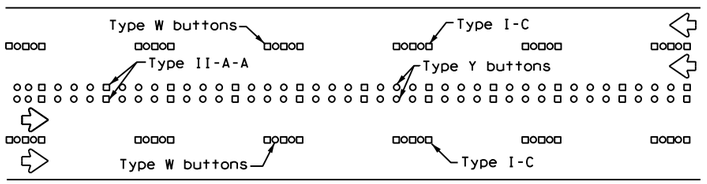
RAISED PAVEMENT MARKERS

Prefabricated markings may be substituted for reflectorized pavement markings.

EDGE & LANE LINES FOR DIVIDED HIGHWAY



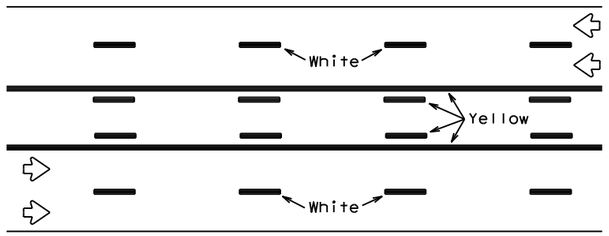
REFLECTORIZED PAVEMENT MARKINGS



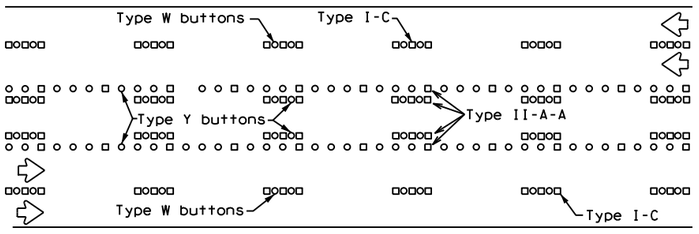
RAISED PAVEMENT MARKERS

Prefabricated markings may be substituted for reflectorized pavement markings.

LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



REFLECTORIZED PAVEMENT MARKINGS



RAISED PAVEMENT MARKERS

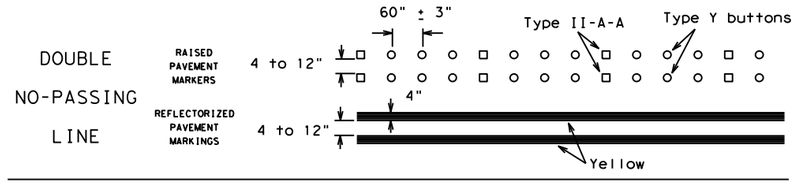
Prefabricated markings may be substituted for reflectorized pavement markings.

TWO-WAY LEFT TURN LANE

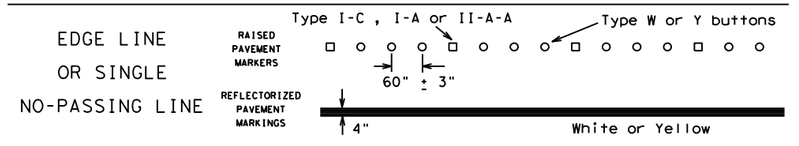
STANDARD WORK ZONE PAVEMENT MARKINGS DETAILS

SOLID LINES

DOUBLE NO-PASSING LINE

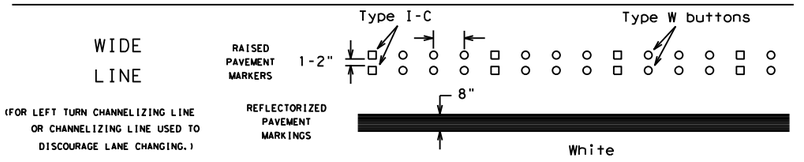


EDGE LINE OR SINGLE NO-PASSING LINE



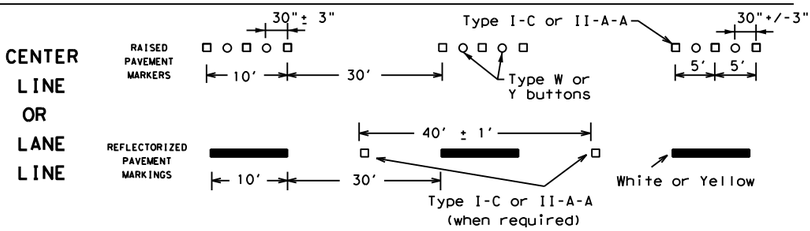
WIDE LINE

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

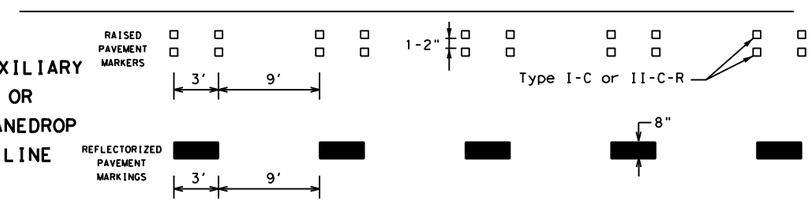


BROKEN LINES

CENTER LINE OR LANE LINE

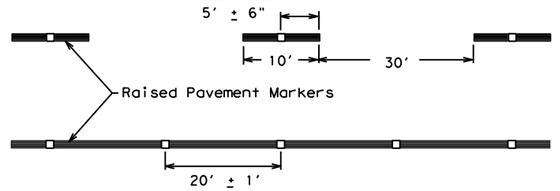


AUXILIARY OR LANEDROP LINE



REMOVABLE MARKINGS WITH RAISED PAVEMENT MARKERS

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



Centerline only - not to be used on edge lines

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

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PAVEMENT MARKING PATTERNS

BC(12)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS 1-97 9-07 5-21 2-98 7-13 11-02 8-14	0110	05	126	IH 45
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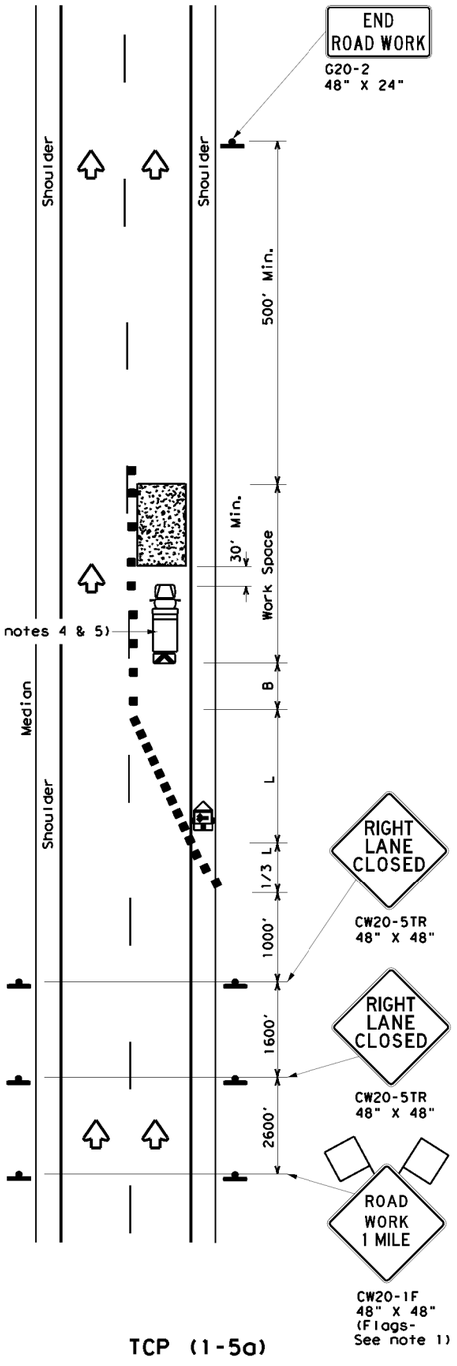
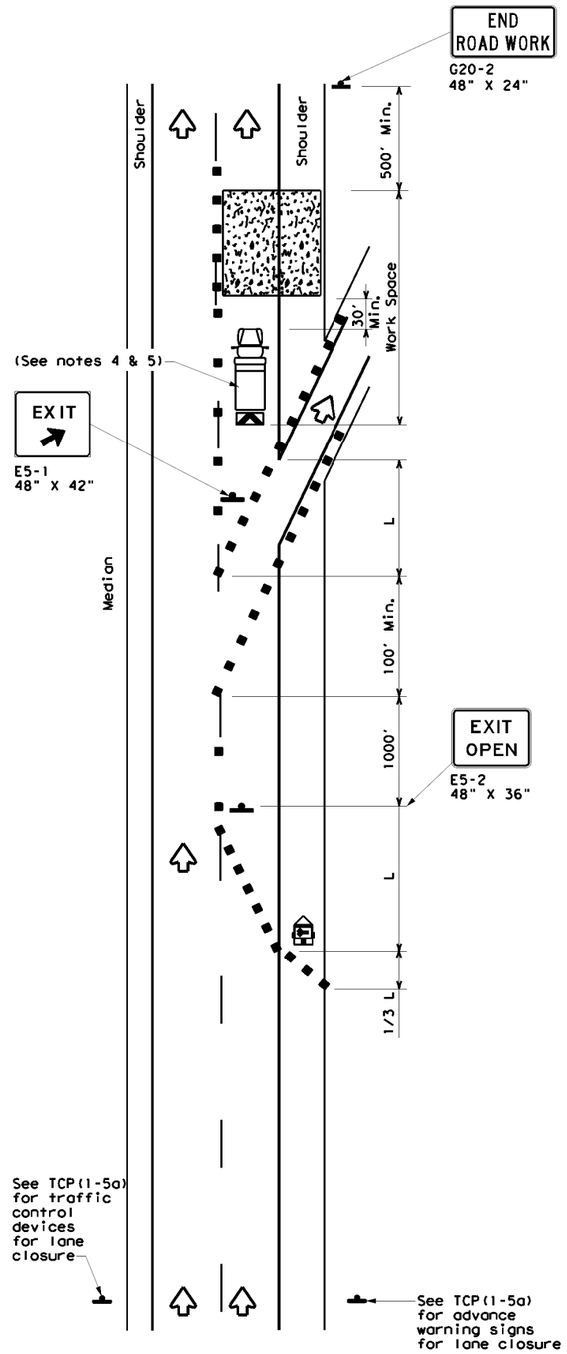
	HOU	HARRIS		60

DATE:
FILE:



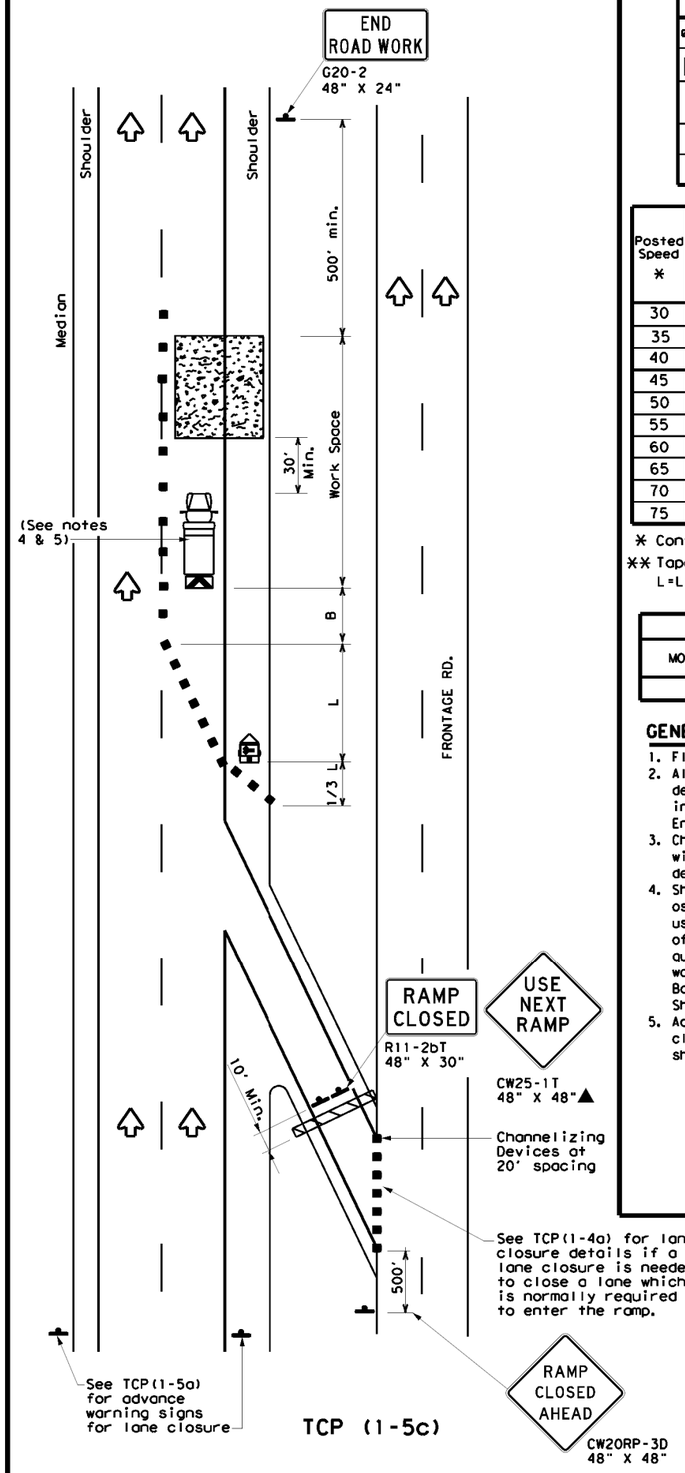
TCP (1-5a)

ONE LANE CLOSURE



TCP (1-5b)

LANE CLOSURE NEAR EXIT RAMPS



TCP (1-5c)

LANE CLOSURE NEAR ENTRANCE RAMPS

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

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

* Conventional Roads Only

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

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

GENERAL NOTES

1. Flags attached to signs where shown, are REQUIRED.
2. All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated elsewhere in the plans, or for routine maintenance work, when approved by the Engineer.
3. Channelizing devices used to close lanes may be supplemented with the Chevron Alignment Sign placed on every other channelizing device. Chevrons may be attached to plastic drums as per BC Standards.
4. 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 in each closed lane, on the shoulder or off the paved surface, next to those shown in order to protect a wider work space.

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL PLAN LANE CLOSURES FOR DIVIDED HIGHWAYS

TCP(1-5)-18

FILE: tcp1-5-18.dgn	DN:	CK:	DW:	CK:
©TxDOT February 2012	CONT	SECT	JOB	HIGHWAY
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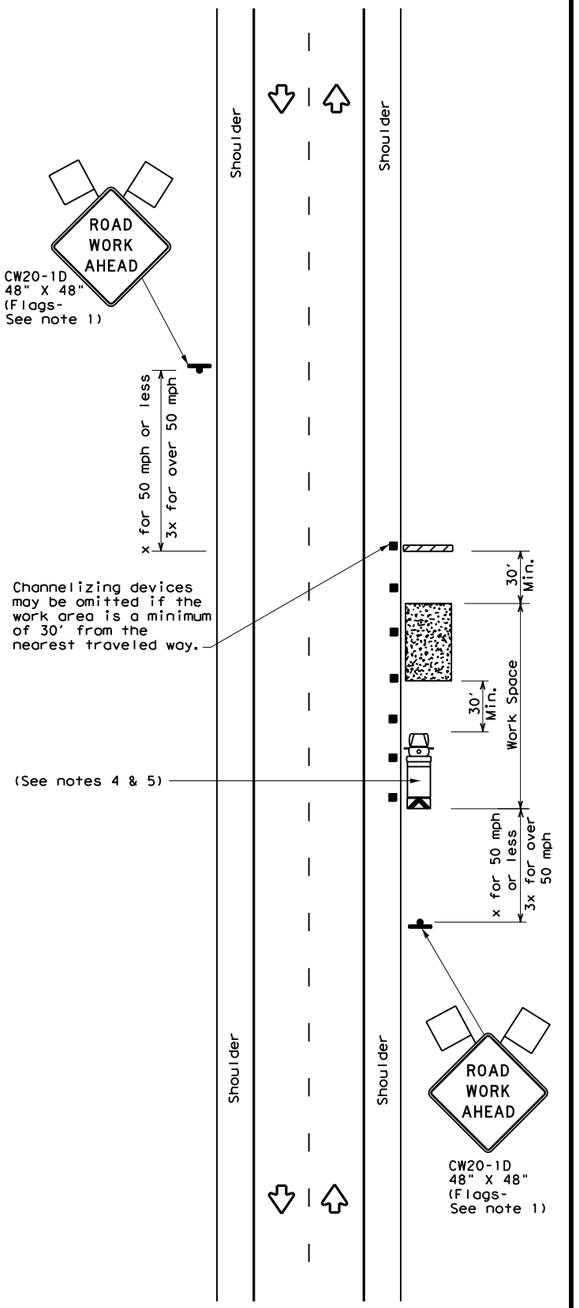
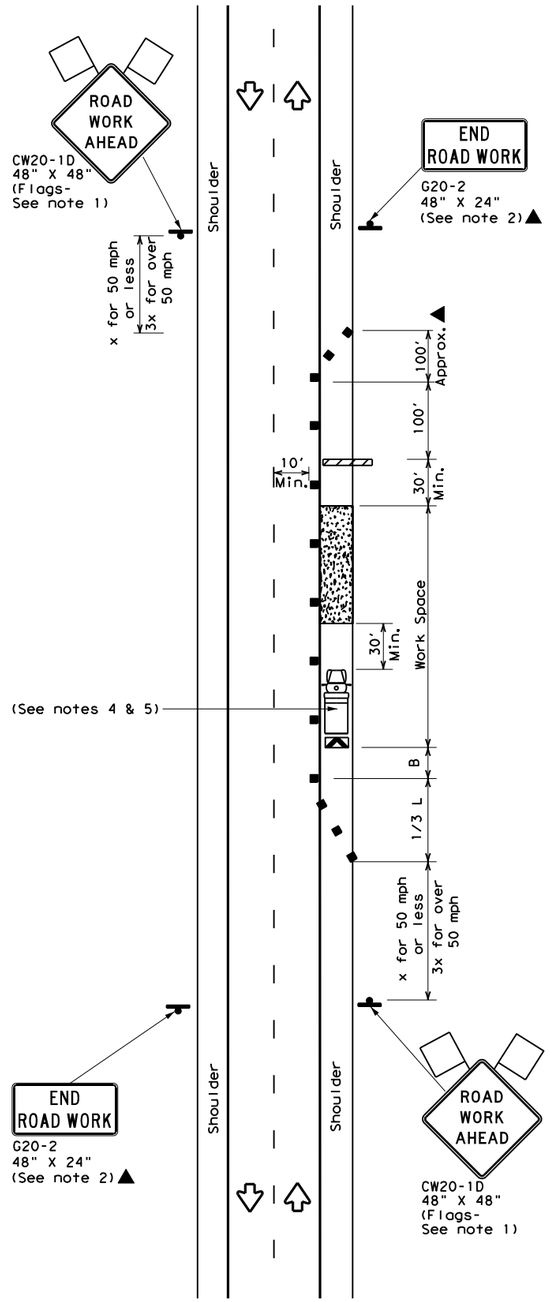
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		61

DATE:
FILE:



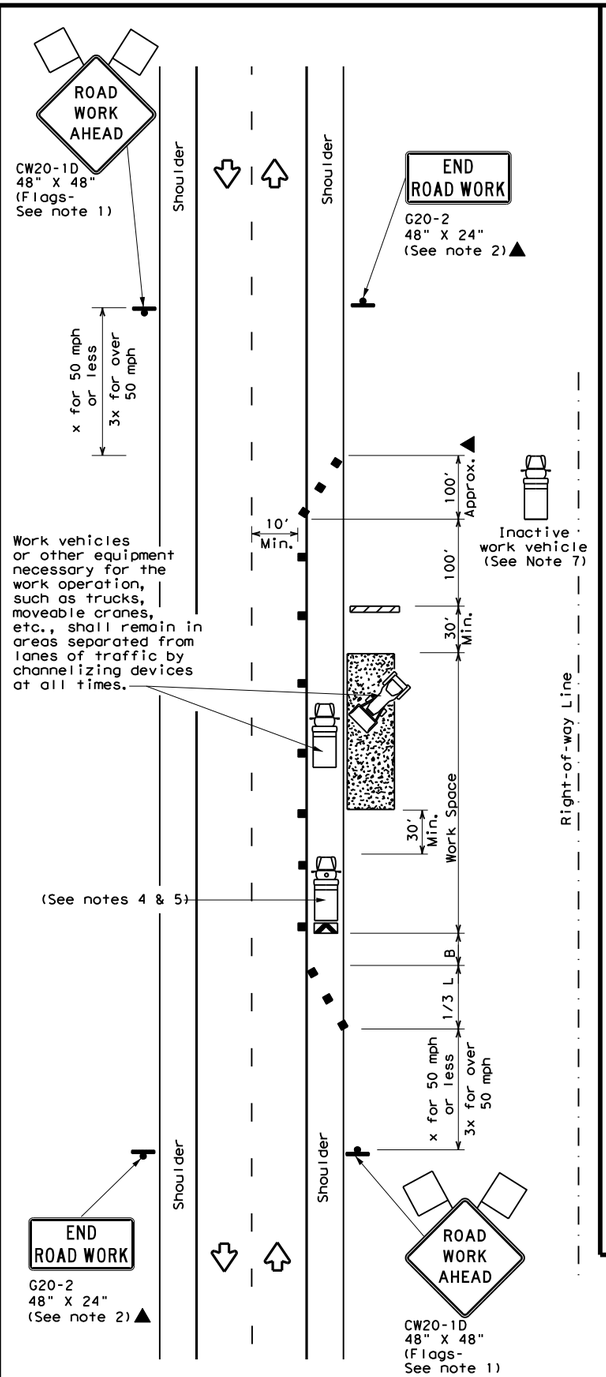
TCP (2-1a)

WORK SPACE NEAR SHOULDER
Conventional Roads



TCP (2-1b)

WORK SPACE ON SHOULDER
Conventional Roads



TCP (2-1c)

WORK VEHICLES ON SHOULDER
Conventional Roads

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

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

* Conventional Roads Only

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

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

GENERAL NOTES

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

Texas Department of Transportation

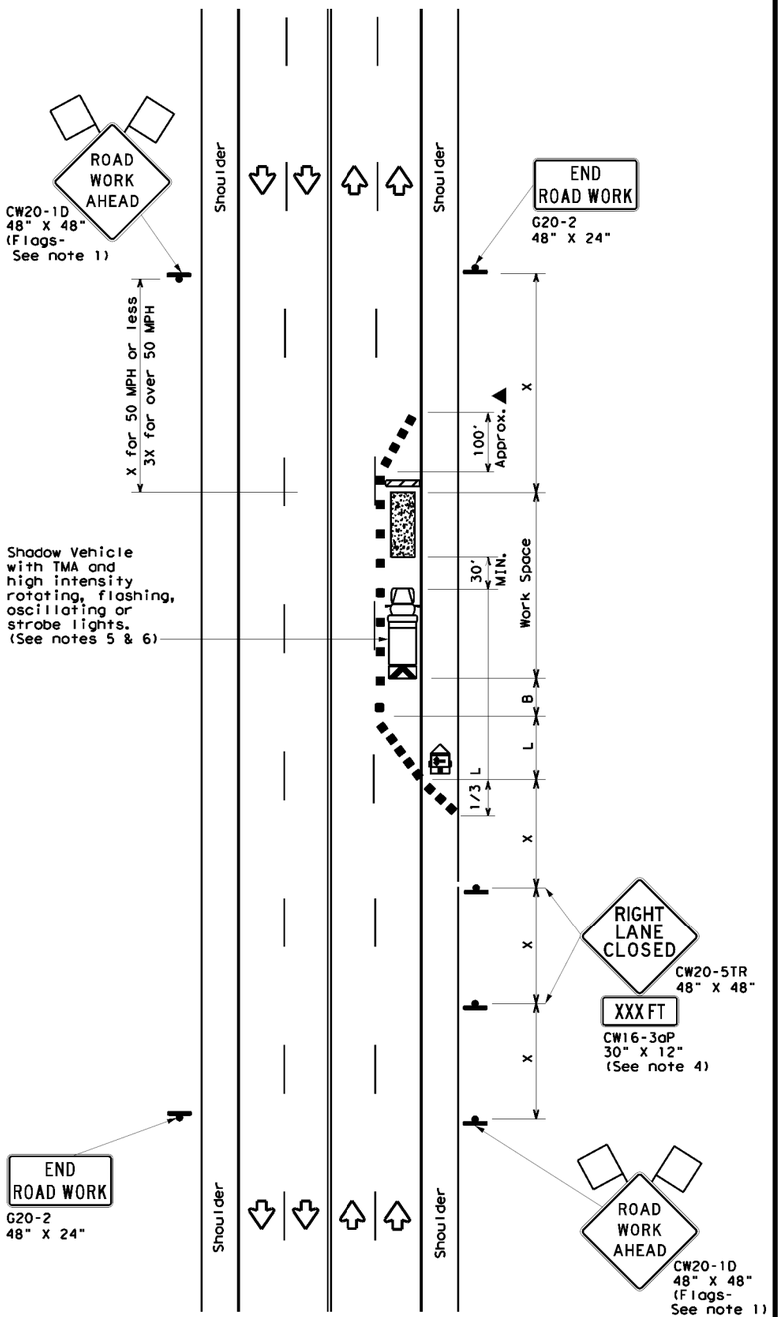
Traffic Operations Division Standard

TRAFFIC CONTROL PLAN CONVENTIONAL ROAD SHOULDER WORK

TCP(2-1)-18

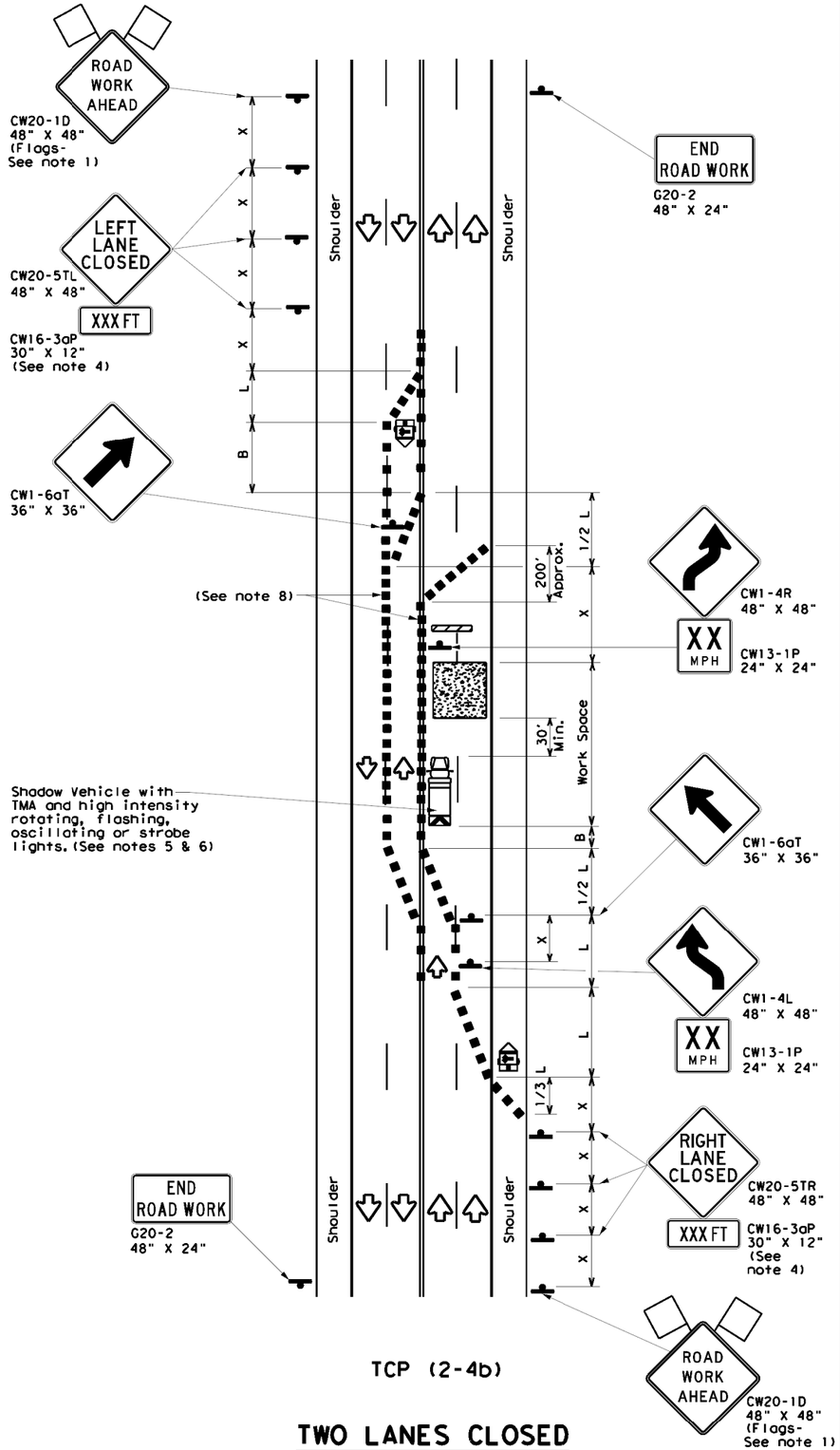
FILE: tcp2-1-18.dgn	DN:	CK:	DW:	CK:
© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
2-94 4-98	DIST	COUNTY		SHEET NO.
8-95 2-12	HOU	HARRIS		62
1-97 2-18				

DATE:
FILE:



TCP (2-4a)

ONE LANE CLOSED



TCP (2-4b)

TWO LANES CLOSED

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

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

* Conventional Roads Only

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

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

GENERAL NOTES

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

TCP (2-4a)

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

TCP (2-4b)

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

Texas Department of Transportation

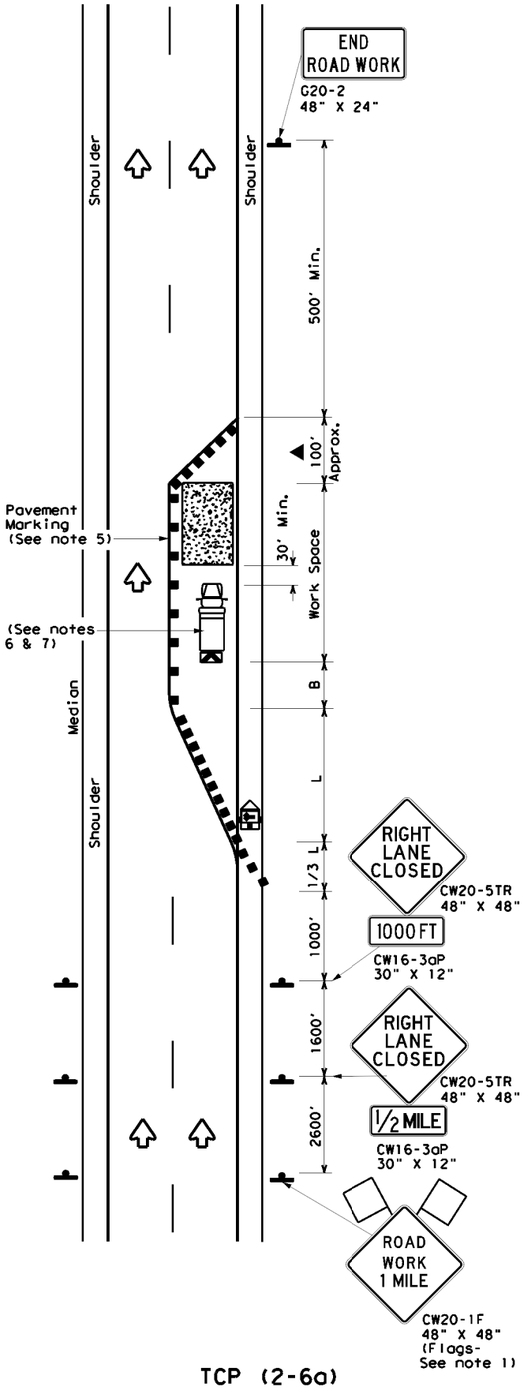
Traffic Operations Division Standard

TRAFFIC CONTROL PLAN
LANE CLOSURES ON MULTILANE CONVENTIONAL ROADS

TCP(2-4)-18

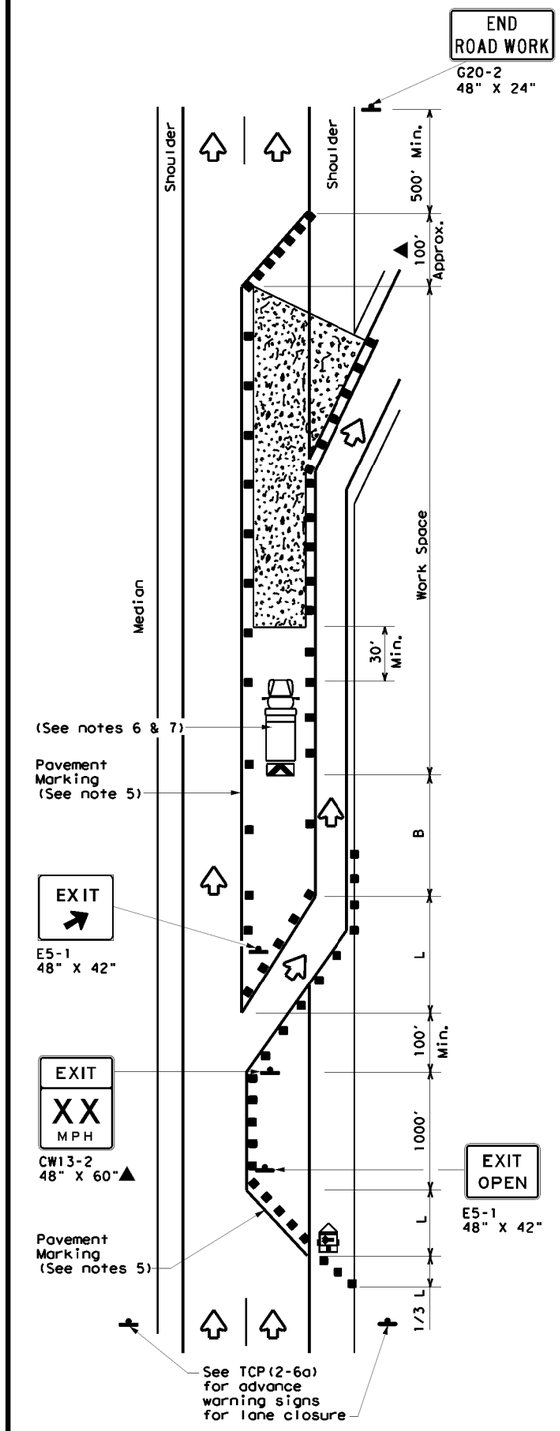
FILE: tcp2-4-18.dgn	DN:	CK:	DW:	CK:
© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS 8-95 3-03	0110	05	126	IH 45
1-97 2-12	DIST	COUNTY		SHEET NO.
4-98 2-18	HOU	HARRIS		63

DATE:
FILE:



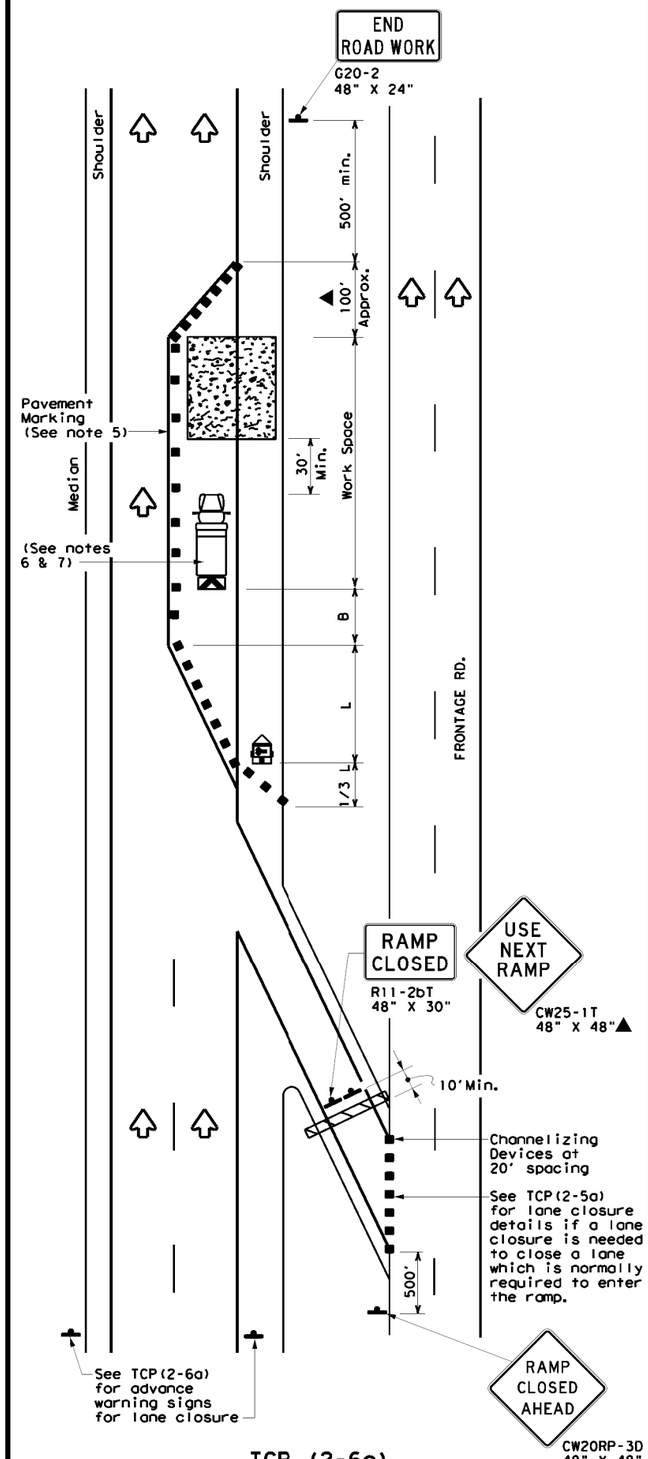
TCP (2-6a)

ONE LANE CLOSURE



TCP (2-6b)

LANE CLOSURE NEAR EXIT RAMPS



TCP (2-6c)

LANE CLOSURE NEAR ENTRANCE RAMPS

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

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

* Conventional Roads Only

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

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

GENERAL NOTES

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

Texas Department of Transportation

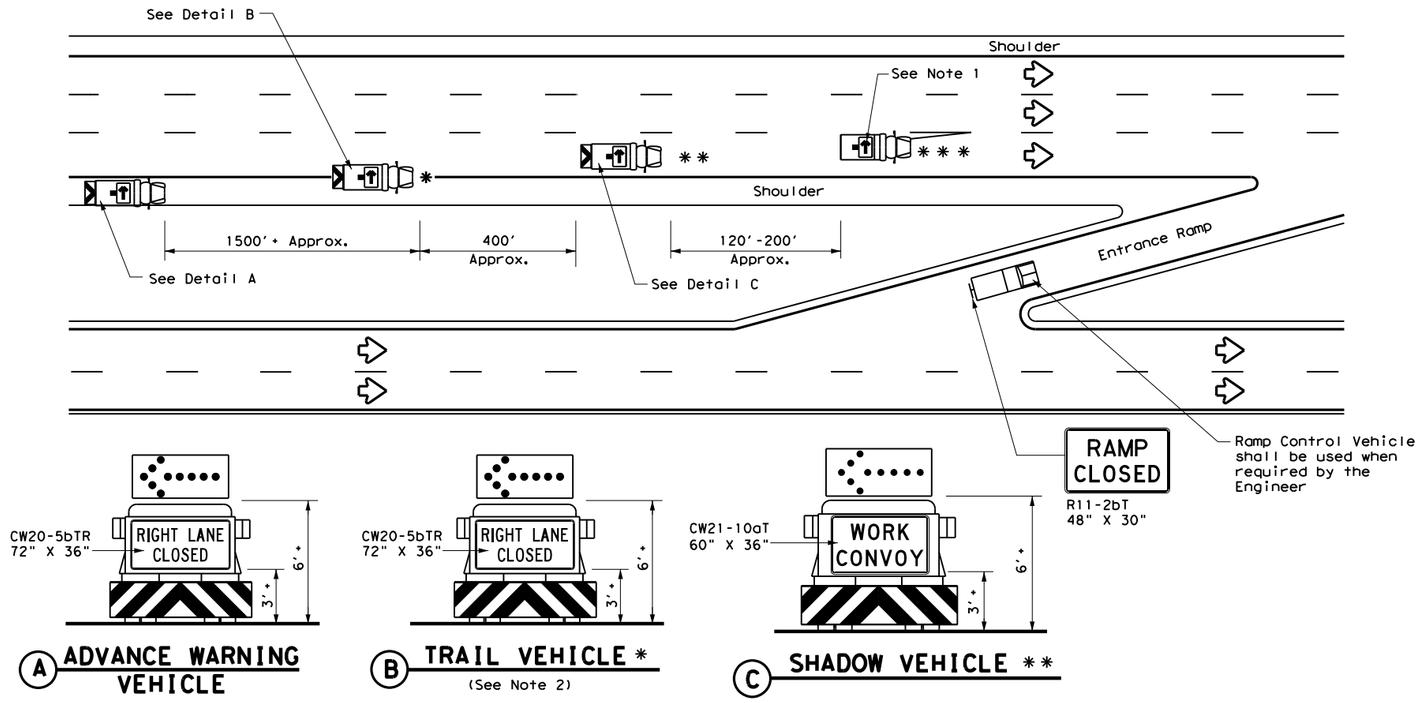
Traffic Operations Division Standard

TRAFFIC CONTROL PLAN LANE CLOSURES ON DIVIDED HIGHWAYS

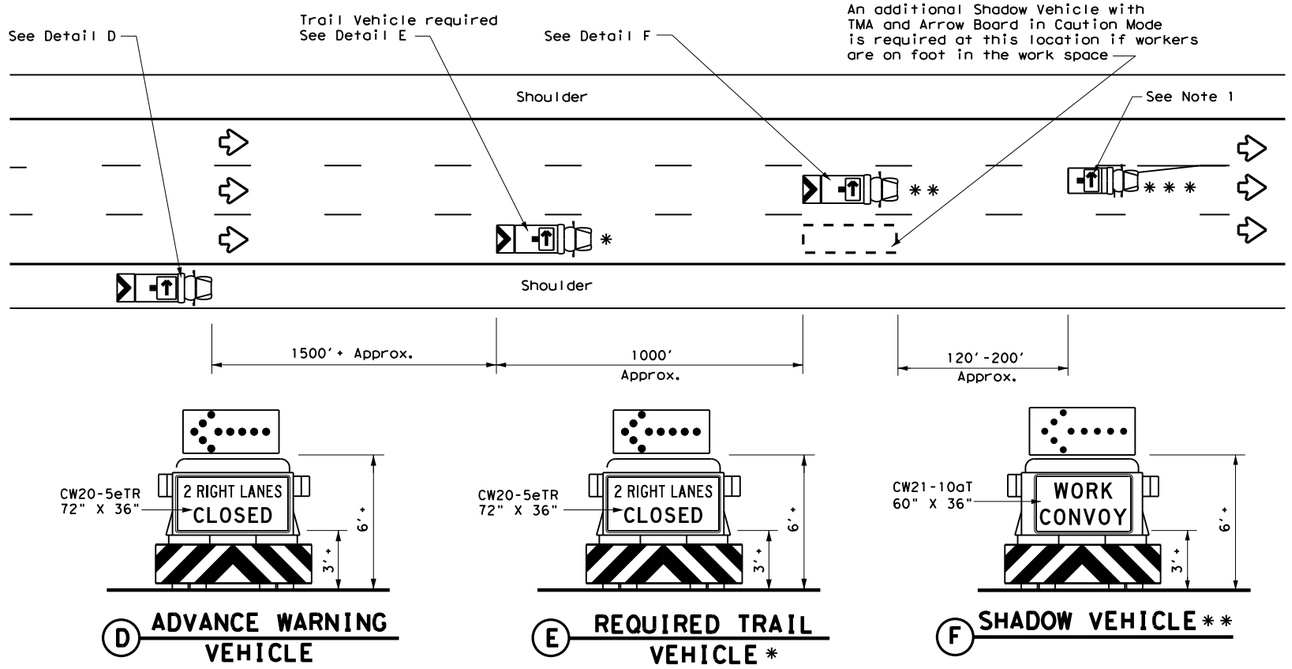
TCP(2-6)-18

FILE: tcp2-6-18.dgn	DN:	CK:	DW:	CK:
© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
2-94 4-98	DIST	COUNTY		SHEET NO.
8-95 2-12	HOU	HARRIS		64
1-97 2-18				

DATE:
FILE:



RIGHT LANE CLOSURE ON DIVIDED HIGHWAY - TCP(3-2a)



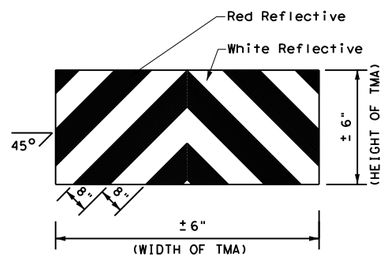
INTERIOR LANE CLOSURE ON MULTI-LANE DIVIDED HIGHWAY - TCP(3-2b)

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

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

GENERAL NOTES

1. ADVANCE WARNING, TRAIL and SHADOW vehicles shall be equipped with Type B or Type C flashing arrow boards as per the Barricade and Construction (BC) standards. Arrow boards on WORK vehicles will be optional based on the type of work being performed. The arrow boards shall be operated from inside the vehicle.
2. For TCP(3-2a) the Engineer will determine if the TRAIL VEHICLE is required based on prevailing roadway conditions, traffic volume, and sight distance restrictions. All other vehicles shown for both TCP(3-2a) and TCP(3-2b) are required.
3. The use of amber high intensity rotating, flashing, oscillating, or strobe lights on vehicles are required. Blue high intensity rotating, flashing, oscillating or strobe lights when mounted on the driver's side of the vehicle may be operated simultaneously with the amber beacons or strobe lights.
4. The use of truck mounted attenuators (TMA) on the ADVANCE WARNING, SHADOW, and TRAIL vehicles are required.
5. Reflective sheeting on the rear of the TMA shall meet or exceed the reflectivity and color requirements of DMS 8300, Type A.
6. Each vehicle shall have two-way radio communication capability.
7. When work convoys must change lanes, the TRAIL VEHICLE should change lanes first to shadow the other convoy vehicles.
8. Vehicle spacing between the TRAIL VEHICLE and the SHADOW VEHICLE will vary depending on sight distance restrictions. Motorists approaching the work convoy should be able to see the TRAIL VEHICLE in time to slow down and/or change lanes as they approach the TRAIL VEHICLE. Vehicle spacing between the WORK VEHICLE and SHADOW VEHICLE may vary according to terrain, work activity and other factors.
9. Standard 48" X 48" diamond shaped warning signs with the same message as those shown may be used where adequate mounting space exists.
10. The signs shown should be used on the Advance Warning Vehicle. As an option, a portable changeable message sign (PCMS) or a truck mounted changeable message sign (TMCMS) with a minimum character height of 12", and displaying the same legend may be substituted for these signs. An appropriate directional arrow display, simulating the size and legibility of the flashing arrow board, must be used in the second phase of the PCMS/TMCMS message. When this is done, the arrow board will not be required on the Advance Warning Vehicle.
11. Standard diamond shape versions of the CW20-5 series signs may be used as an option if the rectangular signs shown are not available.
12. The principles on this sheet may be used to close lanes from the left side of the roadway considering the number of lanes, shoulder width, sight distance, and ramp frequency.
13. Signs and flashing arrow board modes shall be appropriately altered when implementing left lane closures or interior closures which close the left lanes.
14. The Advance Warning Vehicle may straddle the edgeline when shoulder width makes it necessary.



STRIPING FOR TMA

Texas Department of Transportation

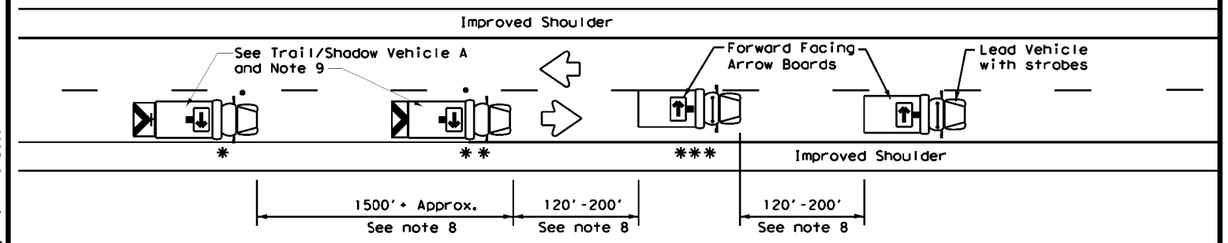
Traffic Operations Division Standard

TRAFFIC CONTROL PLAN MOBILE OPERATIONS DIVIDED HIGHWAYS

TCP(3-2)-13

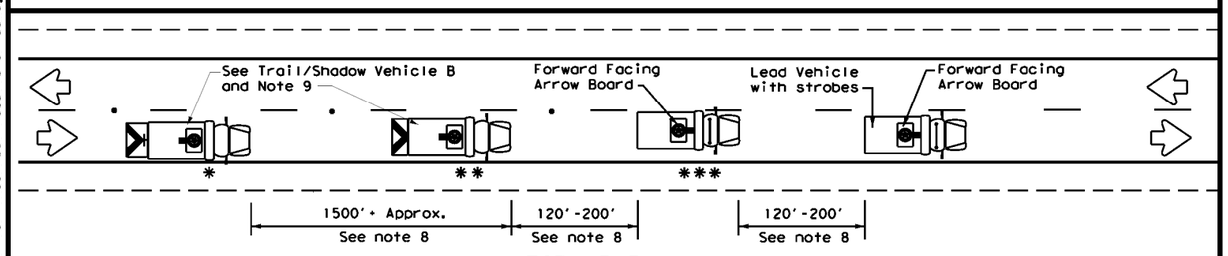
FILE: tcp3-2.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS 2-94 4-98 8-95 7-13 1-97	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		65

176



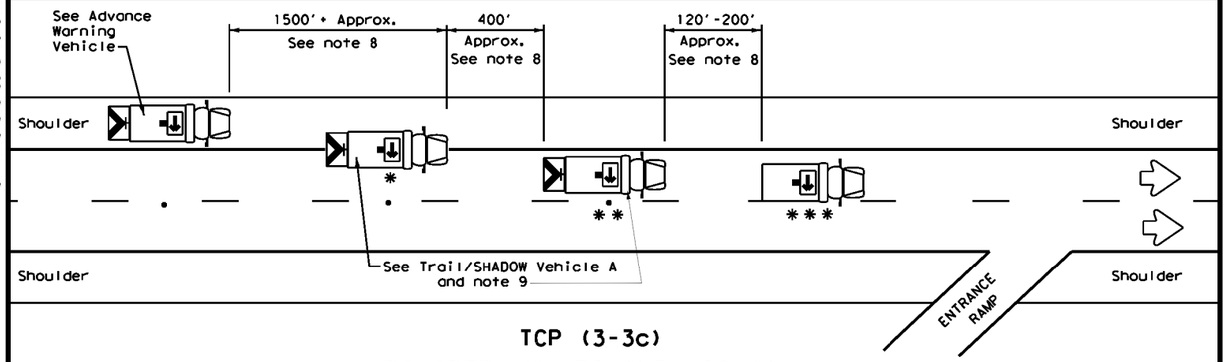
TCP (3-3a)

TWO LANE HIGHWAY WITH PAVED SHOULDERS
(WORK ON TRAVEL LANE)



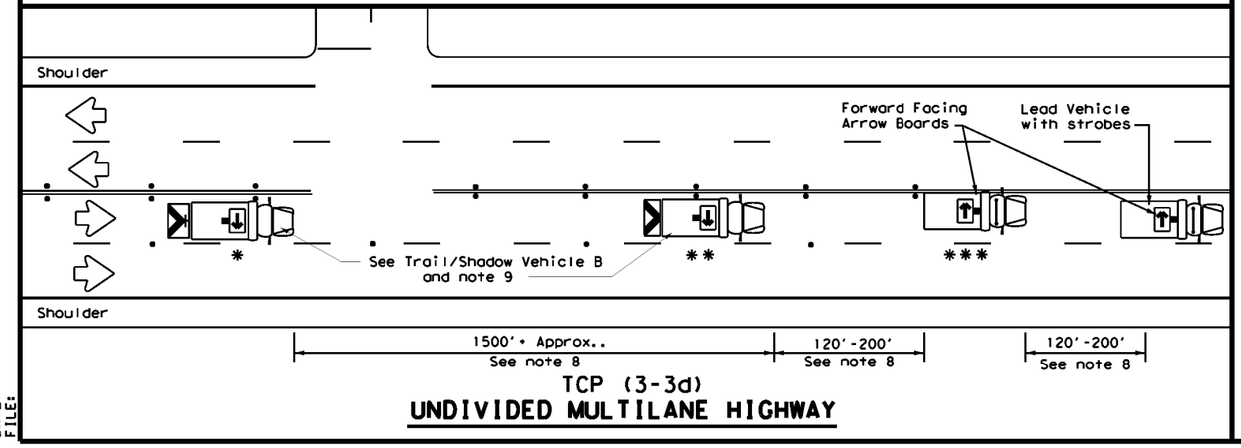
TCP (3-3b)

TWO LANE HIGHWAY WITHOUT PAVED SHOULDERS
(WORK ON TRAVEL LANE)



TCP (3-3c)

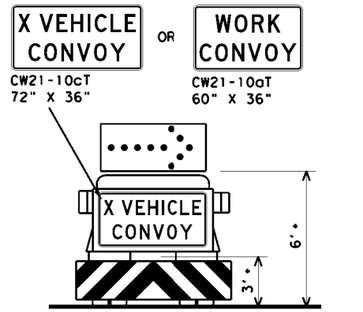
DIVIDED MULTILANE HIGHWAY



TCP (3-3d)

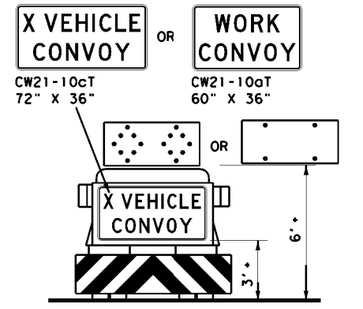
UNDIVIDED MULTILANE HIGHWAY

DATE:
FILE:



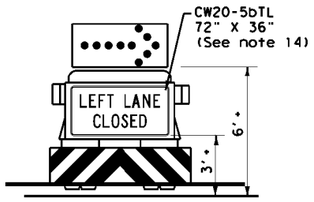
TRAIL/SHADOW VEHICLE A

with RIGHT Directional display
Flashing Arrow Board

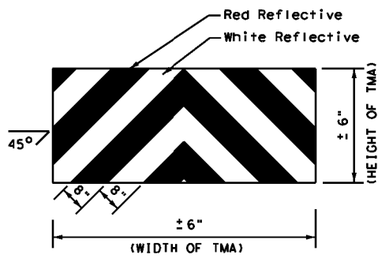


TRAIL/SHADOW VEHICLE B

with Flashing Arrow Board
in Caution Mode



ADVANCE WARNING VEHICLE



STRIPING FOR TMA

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

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

GENERAL NOTES

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

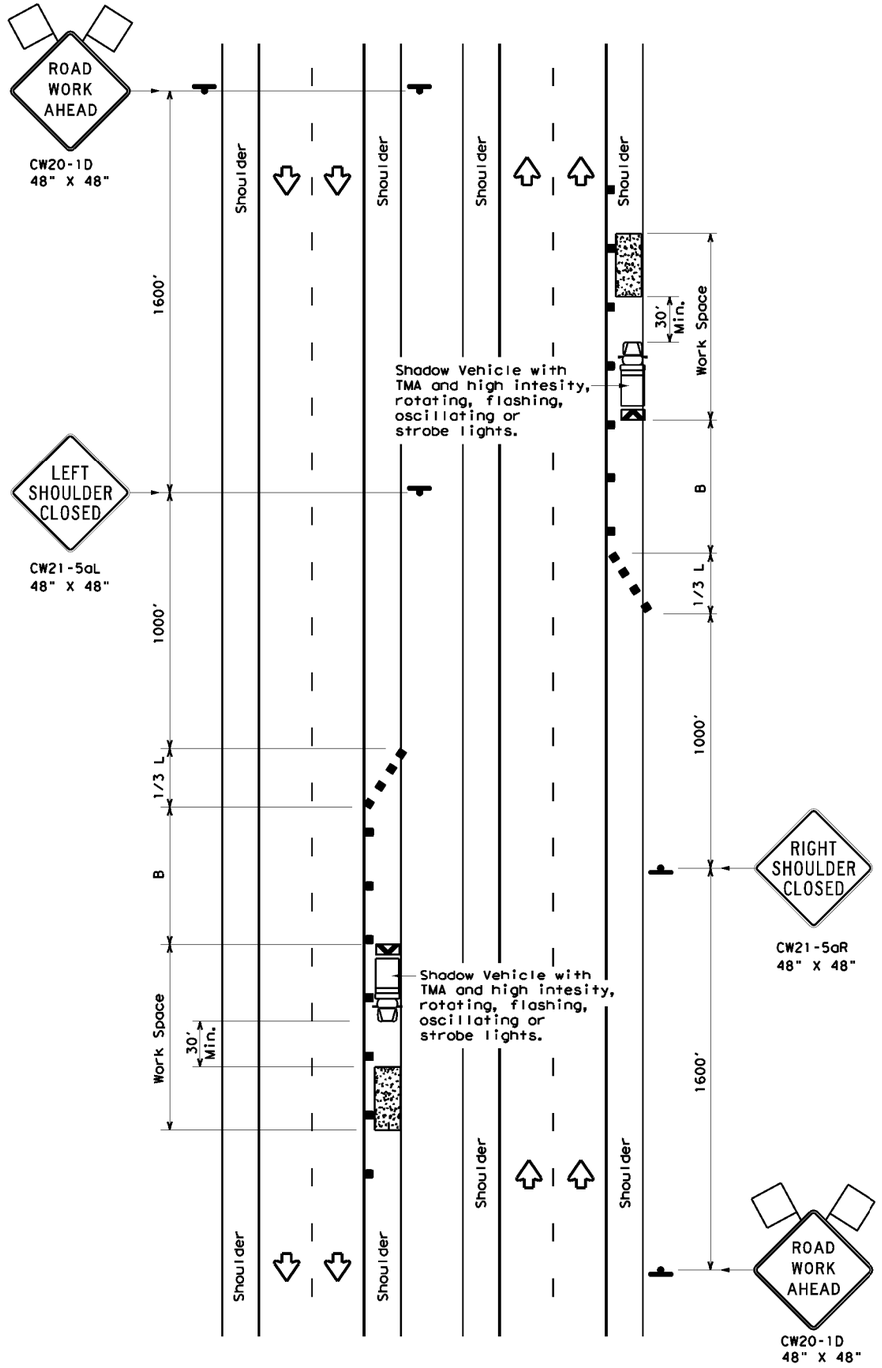
Texas Department of Transportation

Traffic Operations Division Standard

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

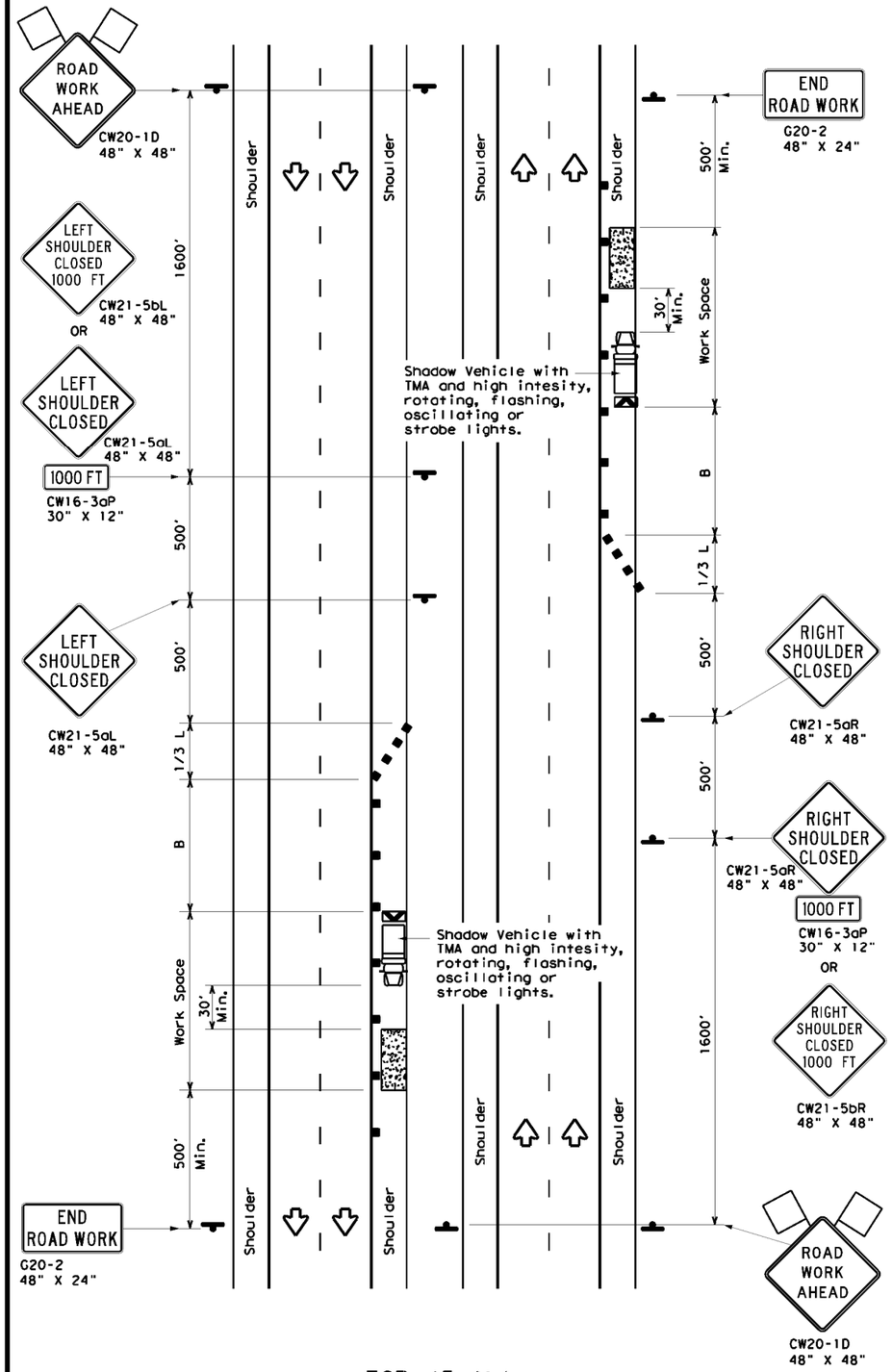
FILE: tcp3-3.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT September 1987	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
2-94 4-98	DIST	COUNTY		SHEET NO.
8-95 7-13				
1-97 7-14	HOU	HARRIS		66

DATE:
FILE:



TCP (5-1a)

WORK AREA ON SHOULDER



TCP (5-1b)

WORK AREA ON SHOULDER

LEGEND

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

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

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

TYPICAL USAGE

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

GENERAL NOTES

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

Texas Department of Transportation

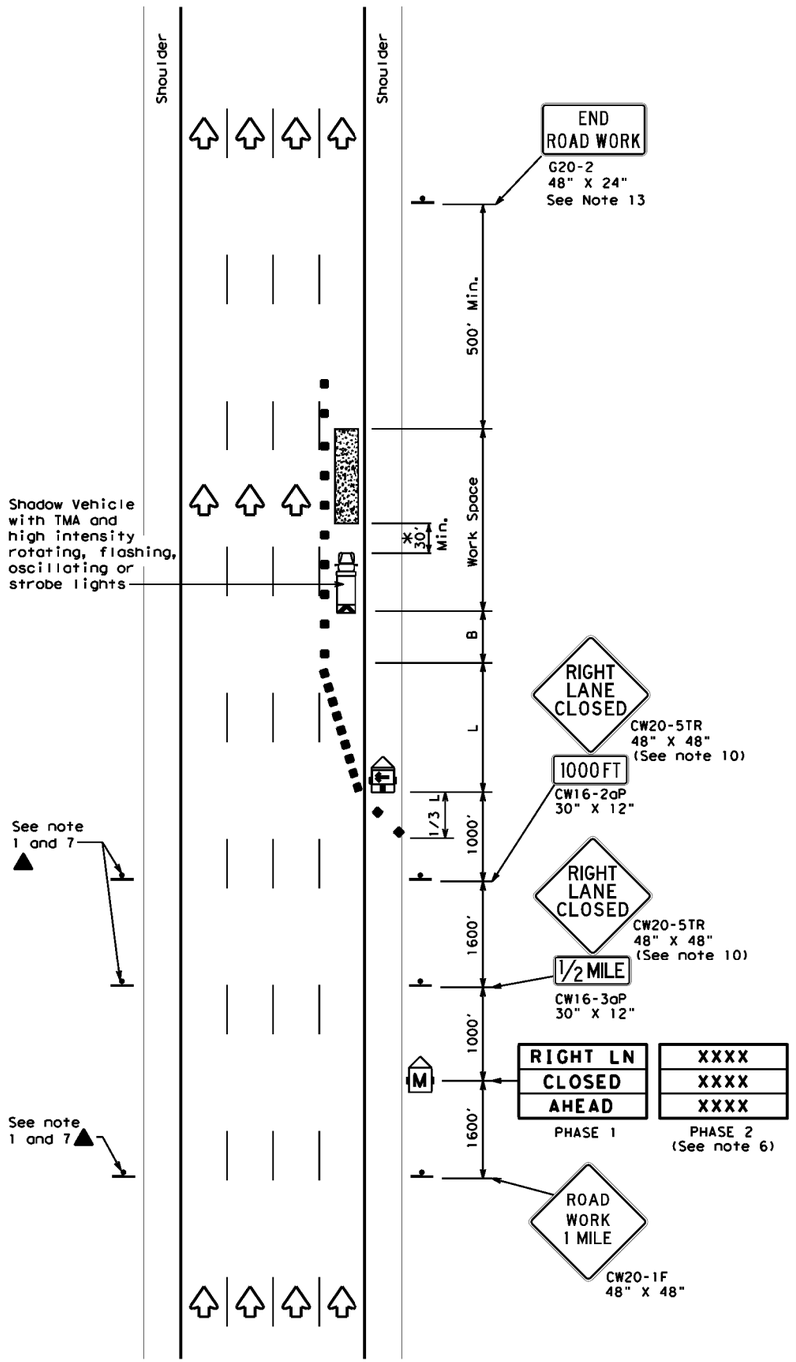
Traffic Operations Division Standard

TRAFFIC CONTROL PLAN SHOULDER WORK FOR FREEWAYS / EXPRESSWAYS

TCP(5-1)-18

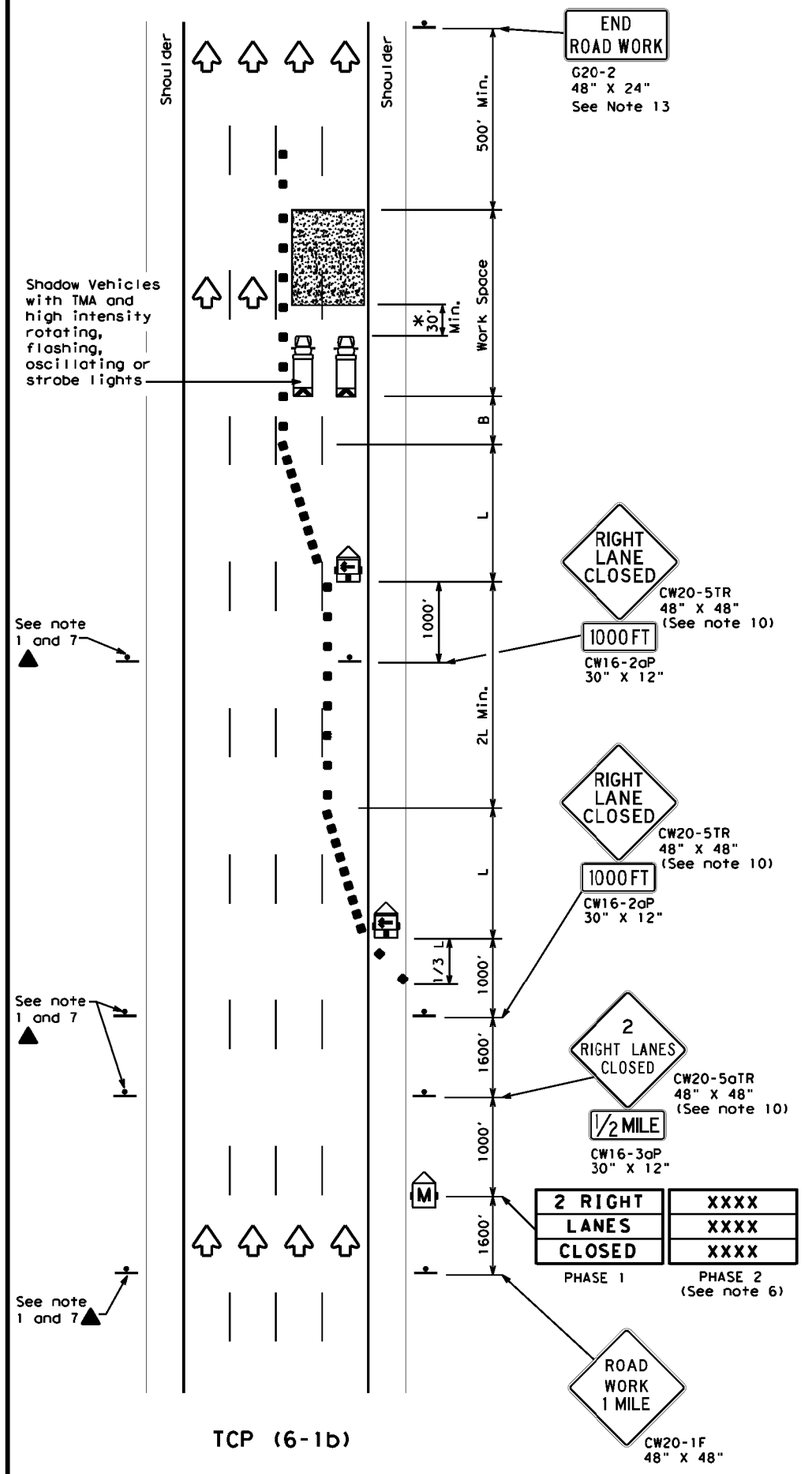
FILE: tcp5-1-18.dgn	DN:	CK:	DW:	CK:
©TxDOT February 2012	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
2-18	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		67

DATE:
FILE:



TCP (6-1a)

TYPICAL FREEWAY ONE LANE CLOSURE



TCP (6-1b)

TYPICAL FREEWAY TWO LANE CLOSURE

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

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

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

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

GENERAL NOTES

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

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

Texas Department of Transportation
Traffic Operations Division Standard

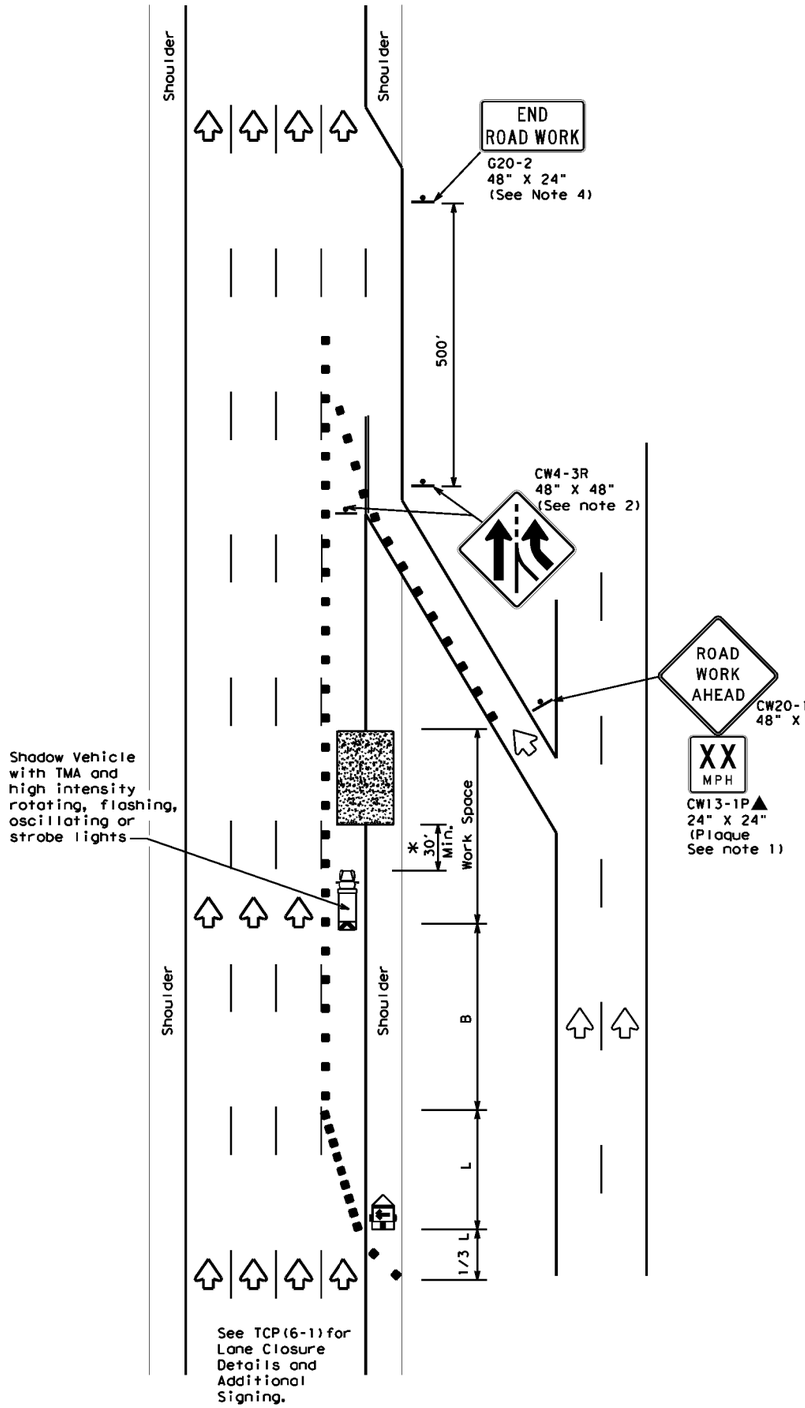
TRAFFIC CONTROL PLAN FREEWAY LANE CLOSURES

TCP(6-1)-12

FILE: tcp6-1.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
8-12	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		68

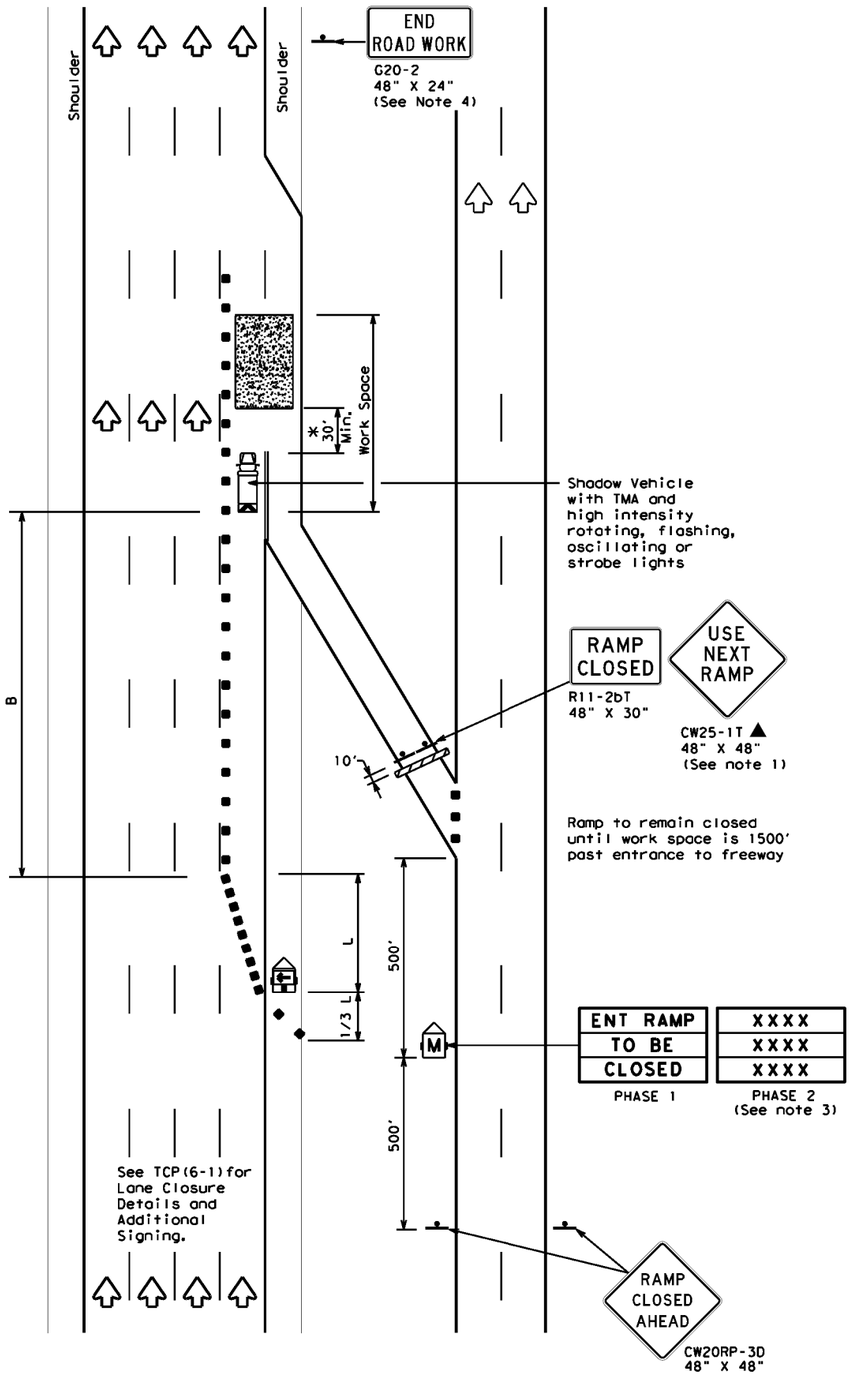
201

DATE:
FILE:



TCP (6-2a)

ENTRANCE RAMP OPEN
WORK WITHIN 500' OF RAMP



TCP (6-2b)

ENTRANCE RAMP CLOSED

LEGEND

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

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

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

TYPICAL USAGE

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

GENERAL NOTES

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

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

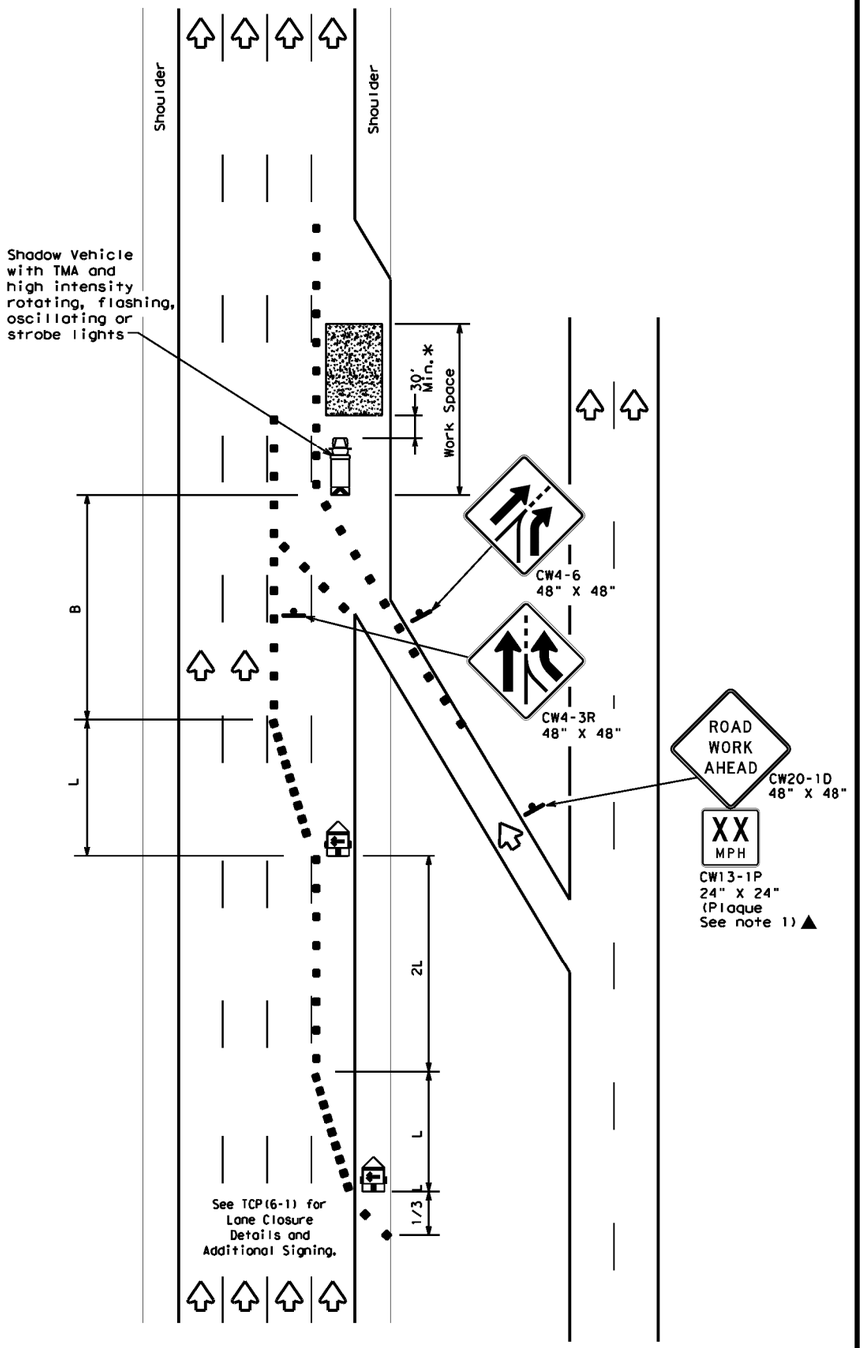
Additional requirements for lane closures and advance signing shall be as shown on TCP (6-1) or as directed by the Engineer.

Texas Department of Transportation
Traffic Operations Division Standard

TRAFFIC CONTROL PLAN
WORK AREA NEAR RAMP

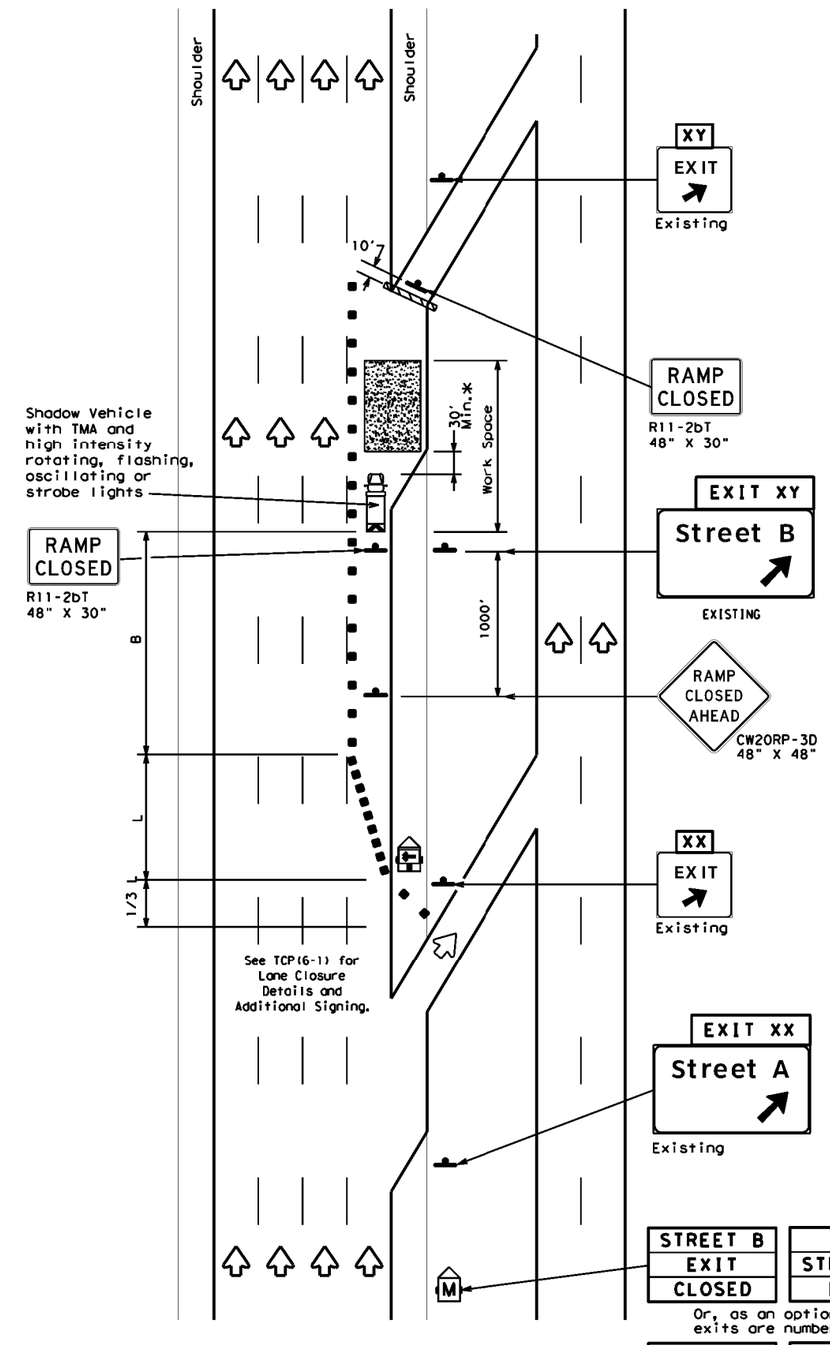
TCP(6-2)-12

FILE: tcp6-2.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 1994	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
1-97 8-98	DIST	COUNTY		SHEET NO.
4-98 8-12	HOU	HARRIS		69



TCP (6-3a)

ENTRANCE RAMP OPEN



TCP (6-3b)

EXIT RAMP CLOSED

TRAFFIC EXITS PRIOR TO CLOSED RAMP

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

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

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

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

GENERAL NOTES:

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

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

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

Texas Department of Transportation
Traffic Operations Division Standard

TRAFFIC CONTROL PLAN
WORK AREA BEYOND RAMP

TCP(6-3)-12

FILE: tcp6-3.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 1994	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
1-97 8-98	DIST	COUNTY		SHEET NO.
4-98 8-12	HOU	HARRIS		70

DATE:
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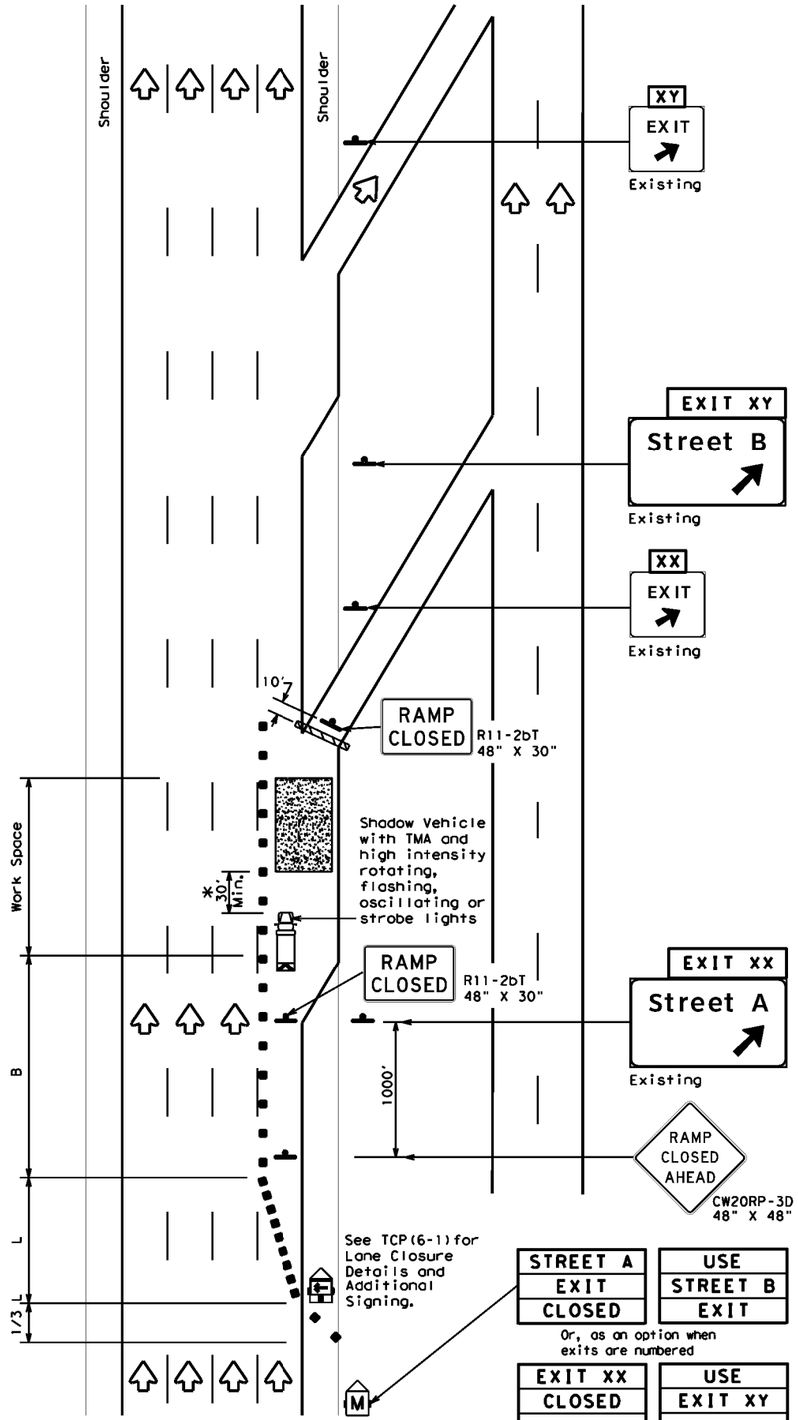
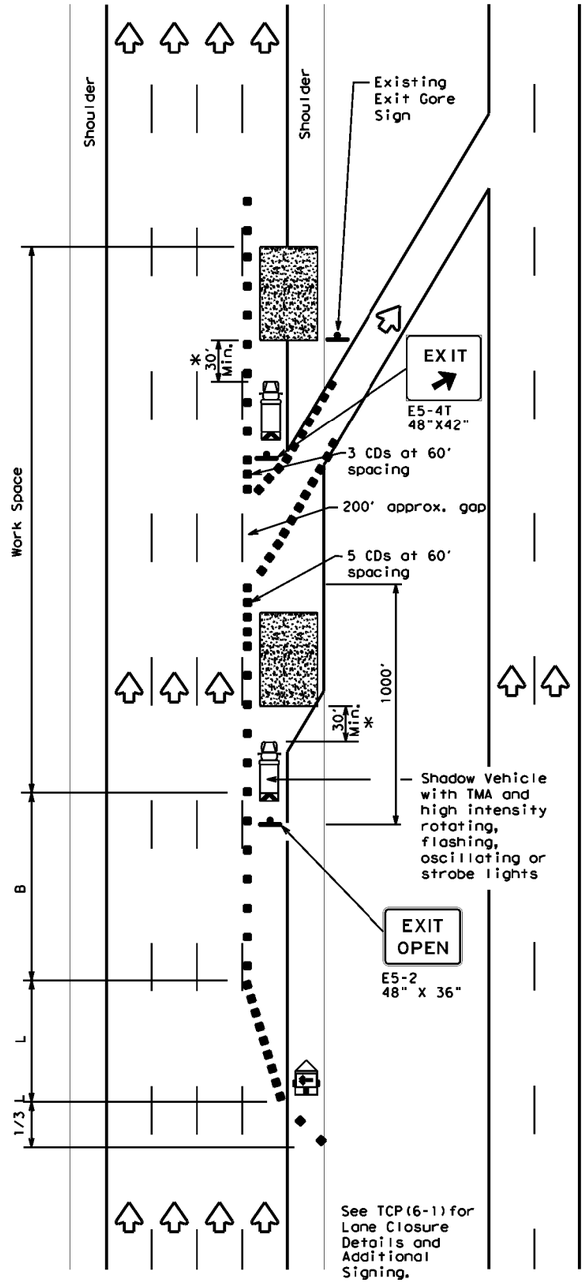


TCP (6-4a)

EXIT RAMP CLOSED

TRAFFIC EXITS PAST CLOSED RAMP



TCP (6-4b)

EXIT RAMP OPEN

LEGEND

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

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

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

TYPICAL USAGE

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

GENERAL NOTES

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

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

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

Texas Department of Transportation
Traffic Operations Division Standard

TRAFFIC CONTROL PLAN
WORK AREA AT EXIT RAMP

TCP(6-4)-12

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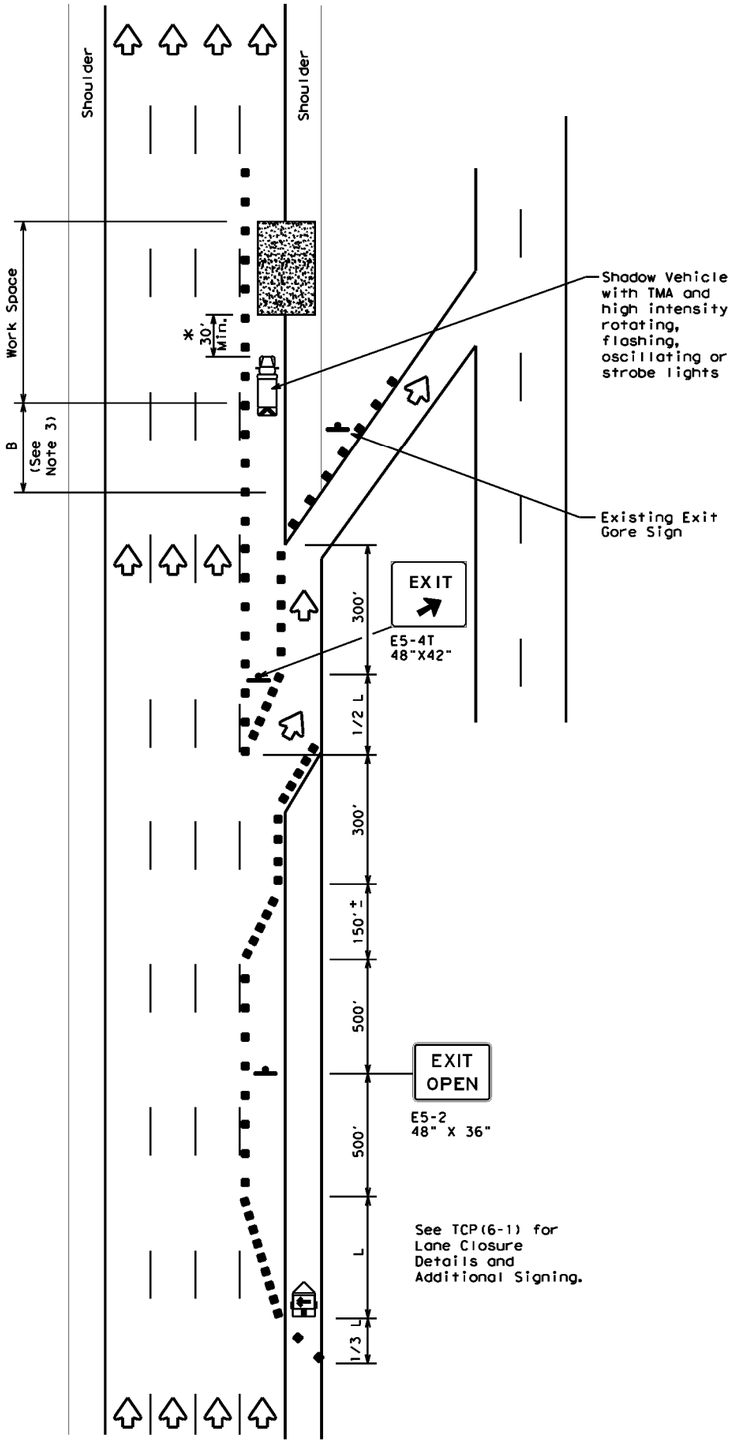
©TxDOT Feburary 1994	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
1-97 8-98	DIST	COUNTY		SHEET NO.
4-98 8-12	HOU	HARRIS		71

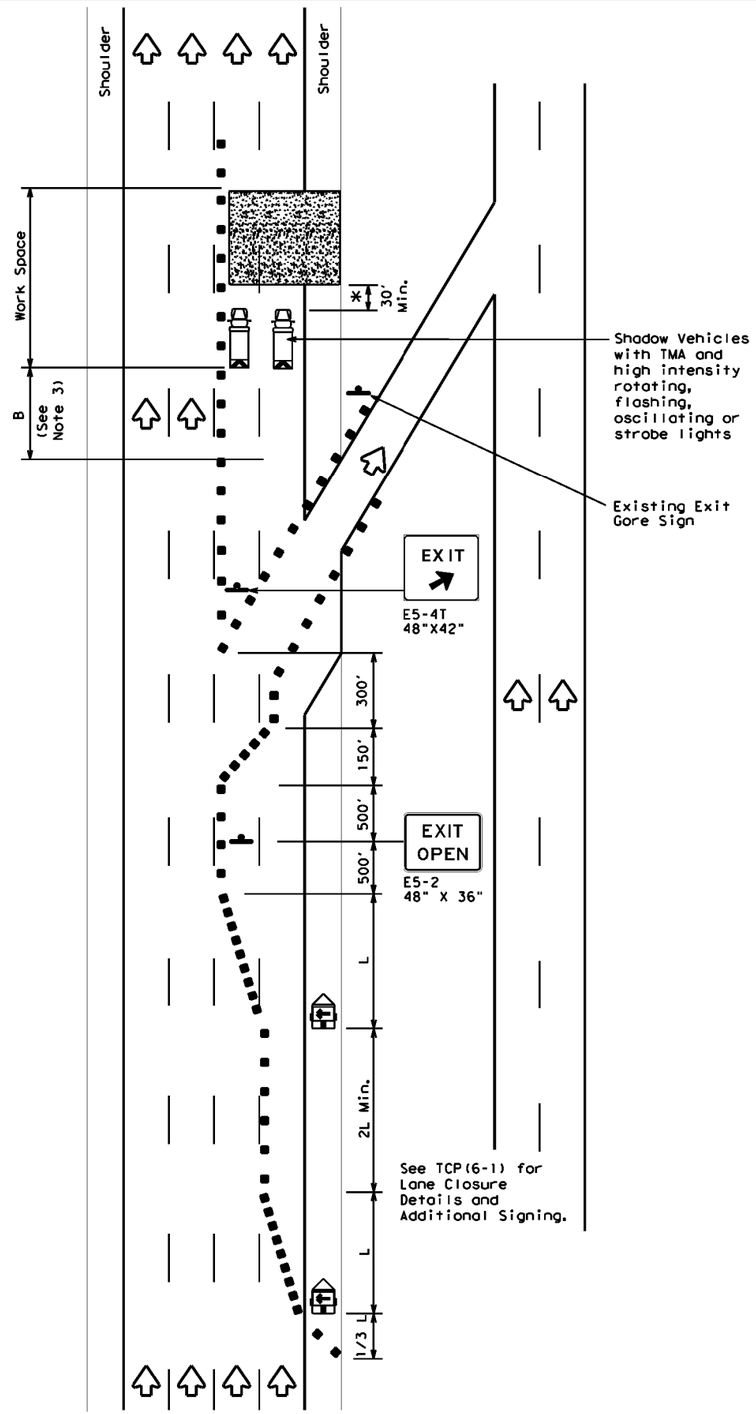
DATE:
FILE:

DATE:
FILE:



TCP (6-5a)

EXIT RAMP OPEN



TCP (6-5b)

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

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

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

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

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

GENERAL NOTES

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

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

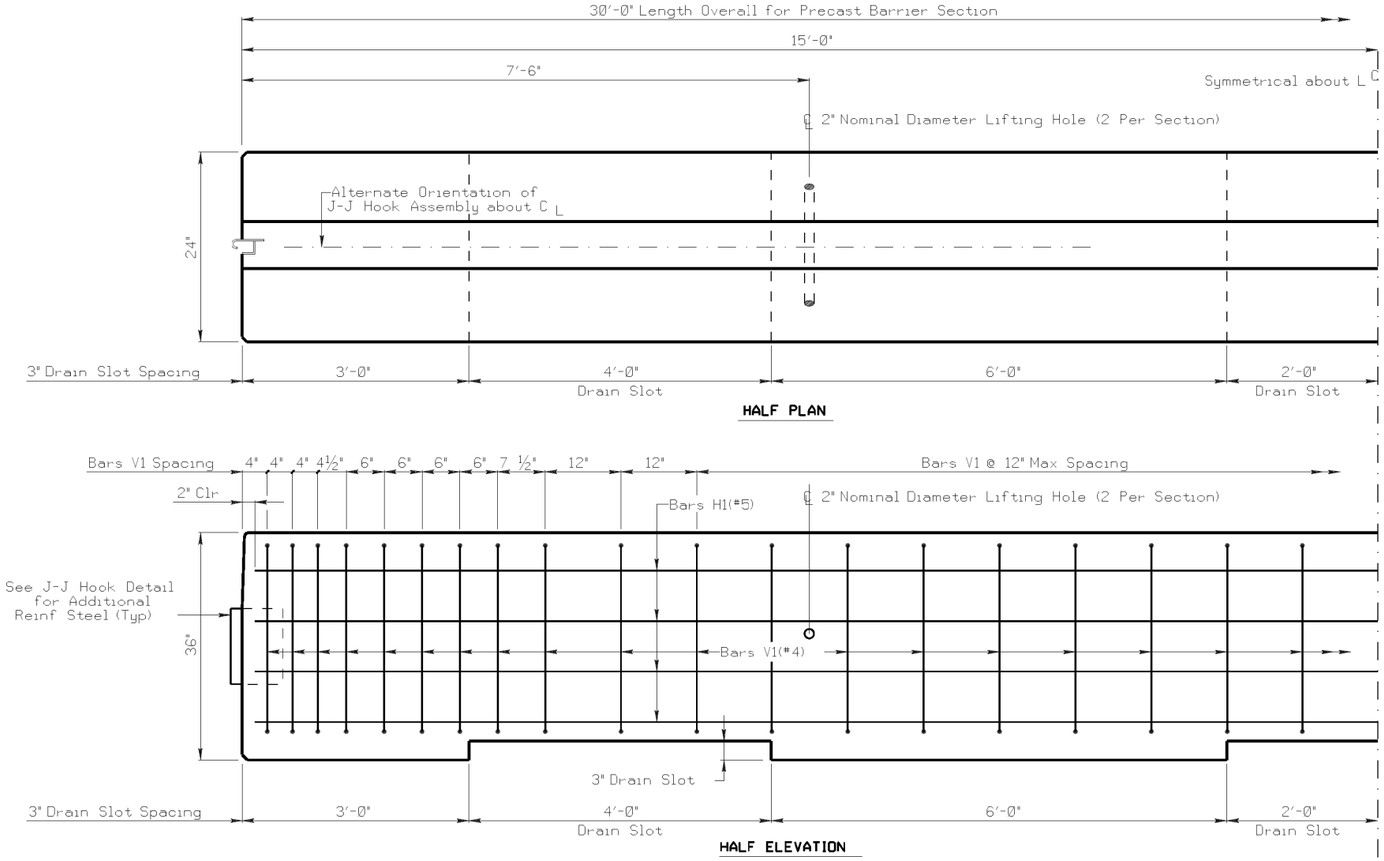
Additional requirements for lane closures and advance signing shall be as shown on TCP (6-1) or as directed by the Engineer.

Texas Department of Transportation
Traffic Operations Division Standard

TRAFFIC CONTROL PLAN
WORK AREA BEYOND EXIT RAMP

TCP(6-5)-12

FILE: tcp6-5.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT Feburary 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
1-97 8-98	DIST	COUNTY		SHEET NO.
4-98 8-12	HOU	HARRIS		72



PRECAST SINGLE SLOPE CONCRETE BARRIER

GENERAL NOTES:

1) Precast barrier length will be 30 feet(1 inch +/-) unless otherwise specified in the plans.

2) All concrete will be Class C.

3) All reinforcing steel will be Grade 60, unless otherwise specified. All welded rebar is ASTM A706.

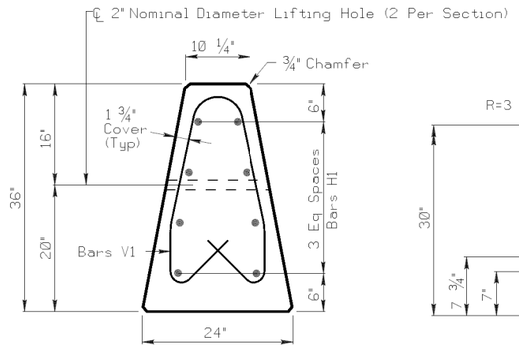
4) Chamfer all edges ¾inch.

5) The minimum bar splice length is 24 times the bar diameter.

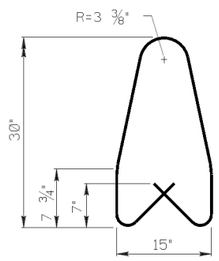
6) Welded wire fabric may be used as an option to conventional reinforcement. All wire is 60 ksi yield strength.

7) Transitions to barrier height,as needed,will be determined by the Engineer. Changes in barrier height should not normally exceed 2 inches per 30 feet. Vertical steel will be uniformly transitioned throughout the variation in barrier height as directed by the Engineer.

8) Installation of barrier anchorage is not paid for directly. Installation is incidental to barrier bid items.

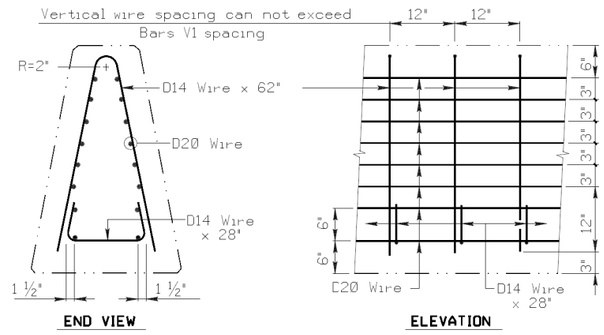


TYPICAL SECTION



BARS V1(#4)

WELDED WIRE FABRIC
36" BARRIER
3x12-D20xD14



WELDED WIRE FABRIC (OPTIONAL REINFORCING)

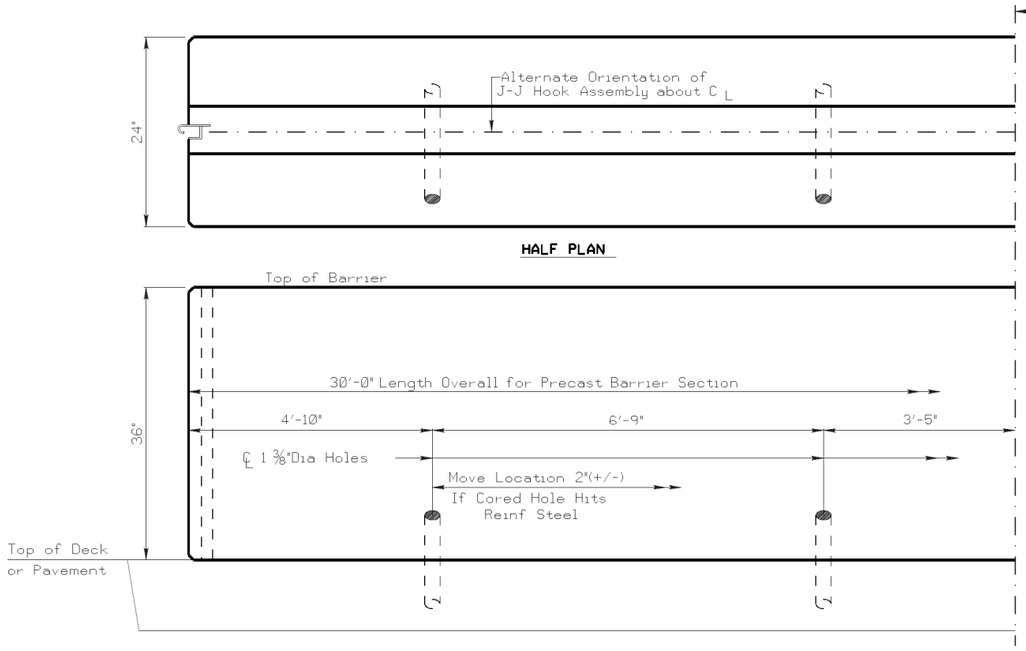
R = Radius
Dia = Diameter

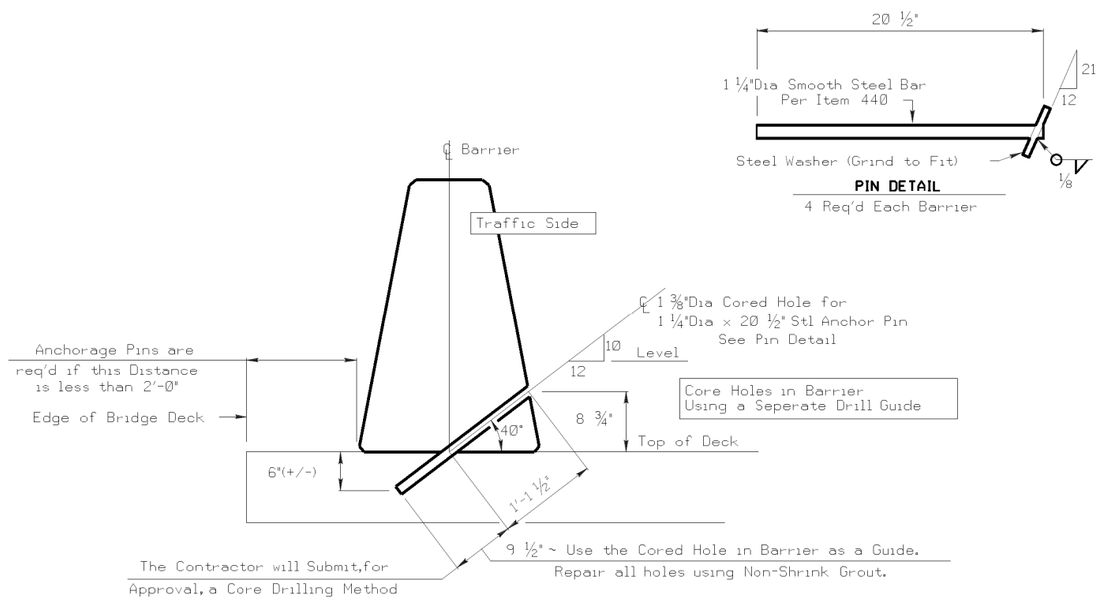
Texas Department of Transportation
Houston District (Roadway)

PRECAST SINGLE SLOPE CONCRETE BARRIER (J-J HOOK CONNECTION)

PSSCB-JJ

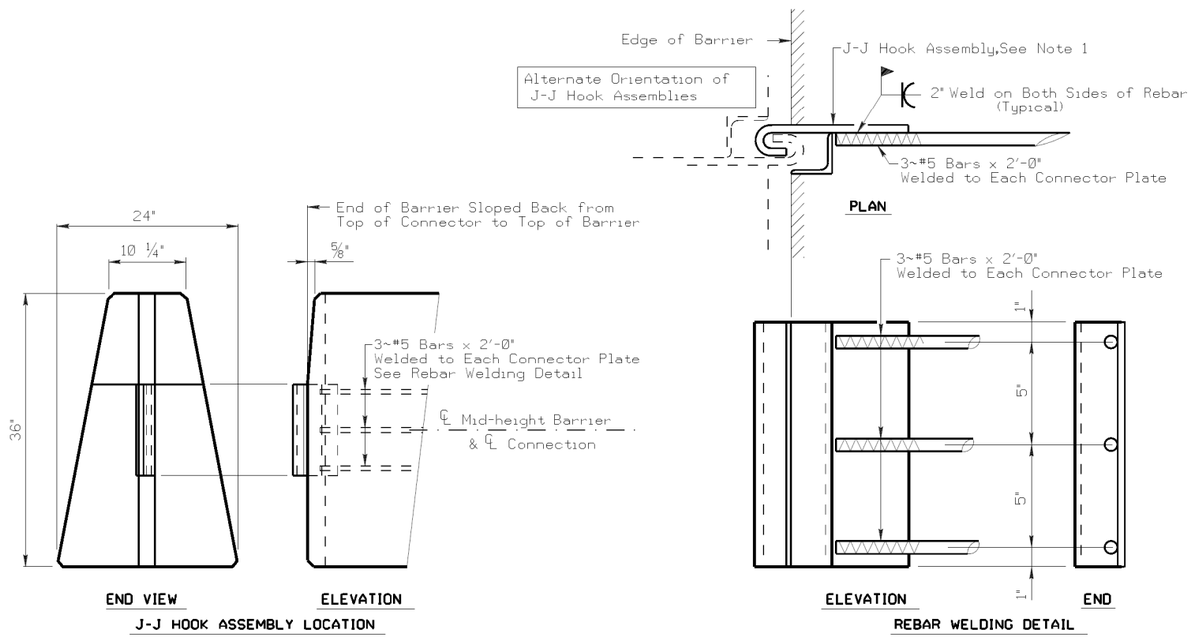
FILE: STDC3.DGN	DN: TxDot	CK: TxDot	DW: TxDot	CK: TxDot
©TxDOT JANUARY 2005	DIST	FED REG	PROJECT NO.	SHEET
REVISIONS	HOUSTON	6		73
12/2004	COUNTY		CONTROL SECT JOB	HIGHWAY
	HARRIS		0110 05 126	IH 45





BARRIER ANCHORAGE DETAIL

For Barrier located on Bridge Deck with less than 2' clearance or transition to dissimilar Barrier



J-J HOOK DETAILS

CONNECTOR NOTES AND SPECIFICATIONS

1) J-J Hooks are a patented design as manufactured by EASI-SET Industries, phone 1-800-547-4045. All steel assemblies for joint shall be galvanized after fabrication in accordancewith item 445, "Galvanizing."
2) Reinforcing Steel:
ASTM A-36 (plain).
3) Welding:
All Welding to be in accordance with American Welding Society (AWS) Structural Welding Codes.
Use weldable rebar per Item 440.
4) Tolerances:
J-J Hook assembly tolerances as per manufacturer.
Installation and fabrication tolerances as follows:
Barrier length +¼"
Connector location +/- 1/16"

R = Radius
Dia = Diameter

SHEET 2 OF 2

Texas Department of Transportation
Houston District (Roadway)

PRECAST SINGLE SLOPE CONCRETE BARRIER (J-J HOOK CONNECTION)

PSSCB-JJ

FILE: STDC3.DGN	DN: TxDot	CK: TxDot	DW: TxDot	CK: TxDot
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REVISIONS 12/2004	HOUSTON	6		74
	COUNTY	CONTROL	SECT	JOB	HIGHWAY
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DATE:
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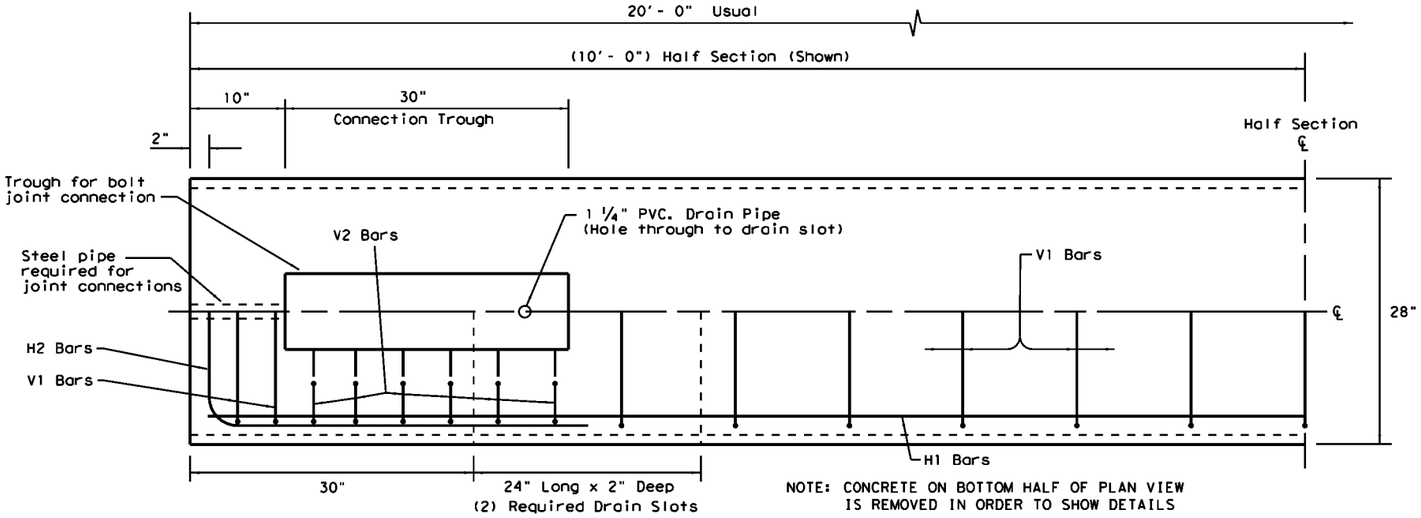
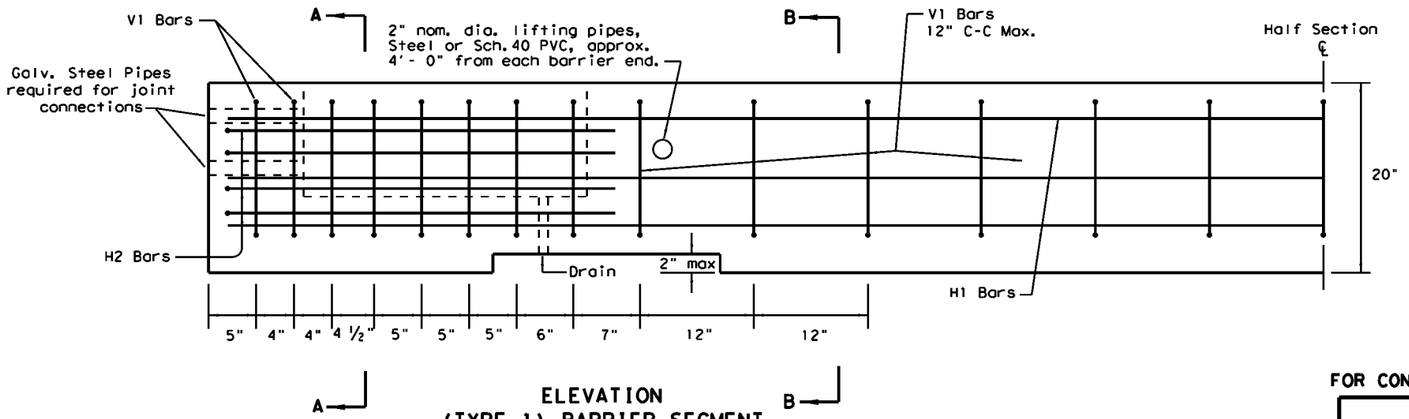
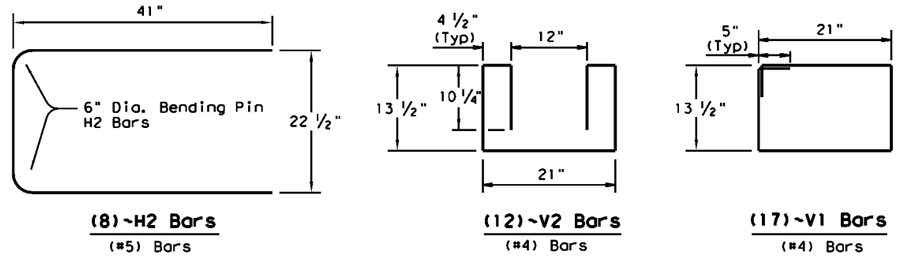


NOTE: CONCRETE ON BOTTOM HALF OF PLAN VIEW IS REMOVED IN ORDER TO SHOW DETAILS

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



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



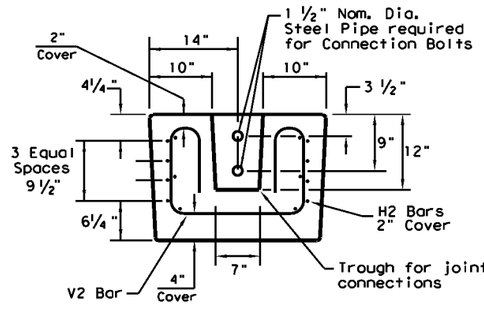
(8)~H2 Bars (#5) Bars

(12)~V2 Bars (#4) Bars

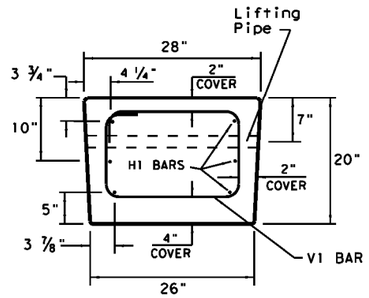
(17)~V1 Bars (#4) Bars

REINFORCING STEEL DETAILS
TYPE 1 - BARRIER SEGMENT

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



SECTION A-A



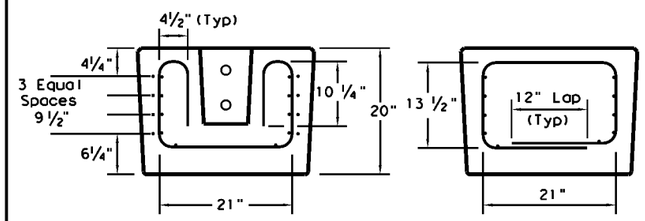
SECTION B-B

GENERAL NOTES

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

FOR CONTRACTORS INFORMATION ONLY

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



SECTION A-A
SECTION B-B

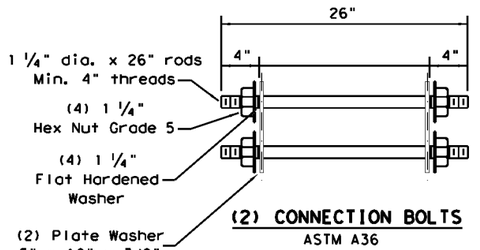
(WWR) GENERAL NOTES

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

REQUIRED (WWR) WIRE DESIGN

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

WELDED WIRE REINFORCEMENT (WWR)- OPTIONAL REINFORCING



(2) CONNECTION BOLTS
ASTM A36

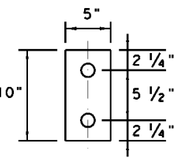


PLATE WASHER
5" x 10" x ⅜"

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

SHEET 1 OF 2

Texas Department of Transportation

Design Division Standard

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

FILE: lpcb13.dgn	DN: TxDOT	CK: AM	DW: VP	CK:
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REVISIONS	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
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DATE:
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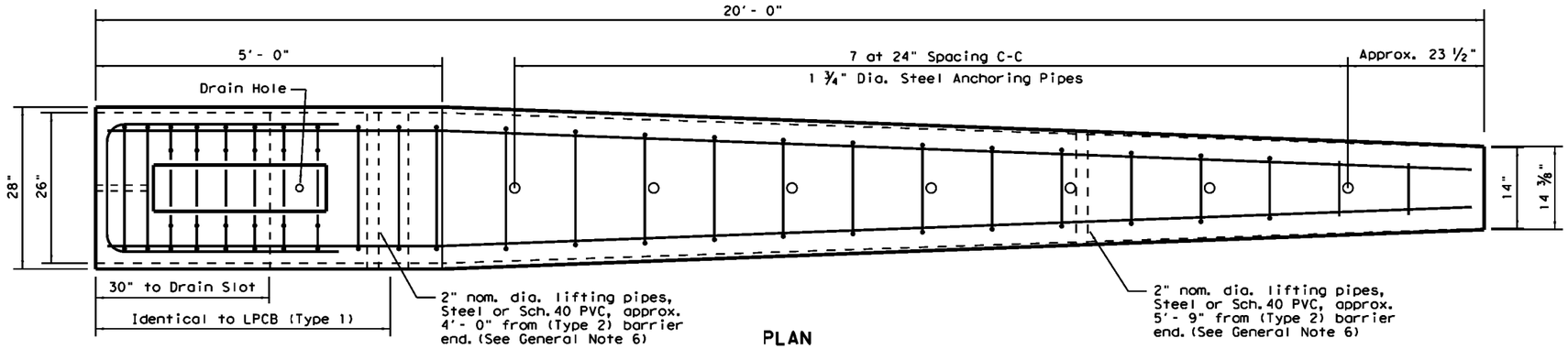
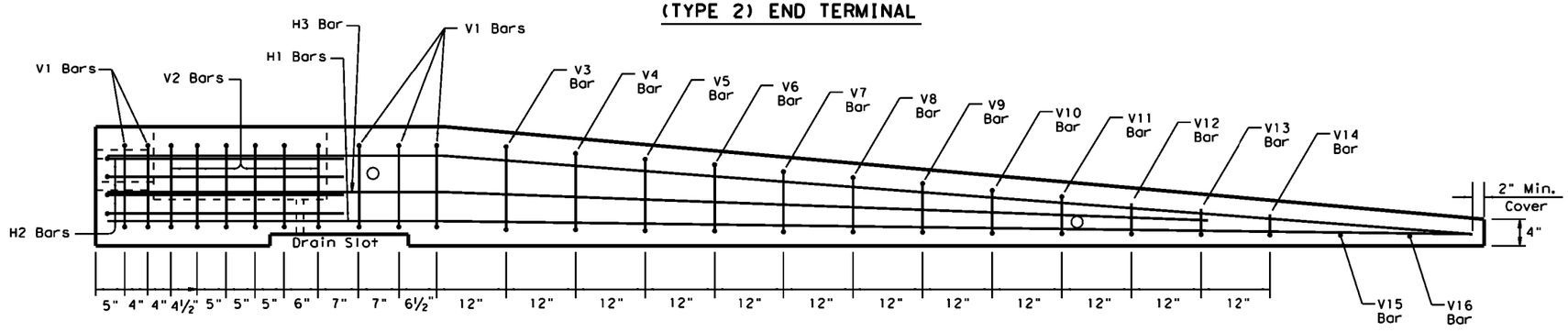
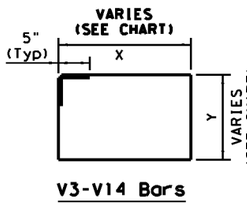


PLAN
(TYPE 2) END TERMINAL



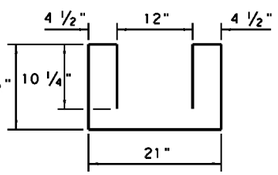
ELEVATION
(TYPE 2) END TERMINAL

Note:
Anchoring pipes not shown in Elevation View

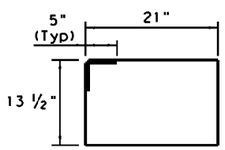


V3-V14 Bars

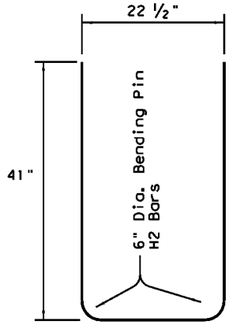
BAR (#4)	X (IN.)	Y (IN.)
V3 BAR	20 ¼	14 ½
V4 BAR	19 ½	13 ½
V5 BAR	18 ½	12 ¼
V6 BAR	17 ½	11 ¼
V7 BAR	17	10 ¼
V8 BAR	16 ¼	9
V9 BAR	15 ½	8
V10 BAR	14 ½	7
V11 BAR	13 ¾	6



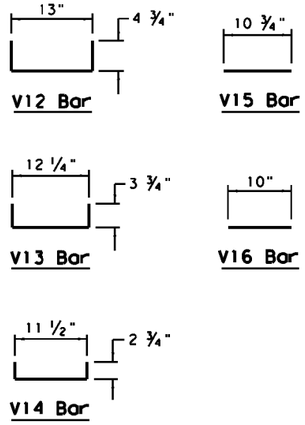
(6)-V2 Bars



(5)-V1 Bars

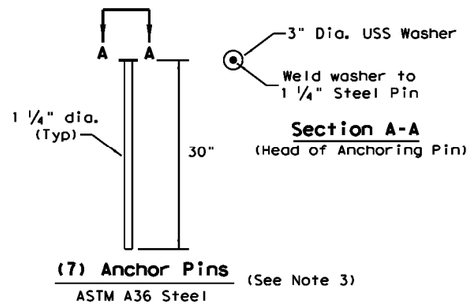


(4)-H2 Bars
(#5) Bars



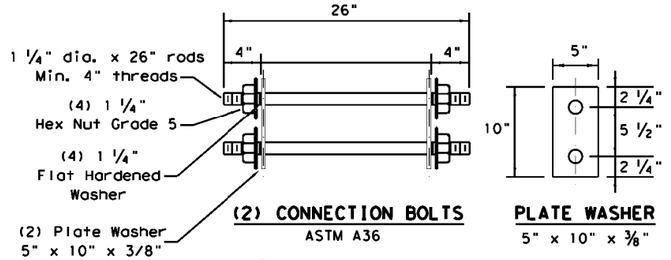
Note: All V Bars are (#4)

REINFORCING STEEL DETAILS
TYPE 2 - END TERMINAL



Section A-A
(Head of Anchoring Pin)

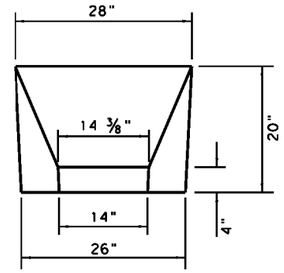
(7) Anchor Pins
ASTM A36 Steel
(See Note 3)



(2) CONNECTION BOLTS
ASTM A36

PLATE WASHER
5" x 10" x ⅜"

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

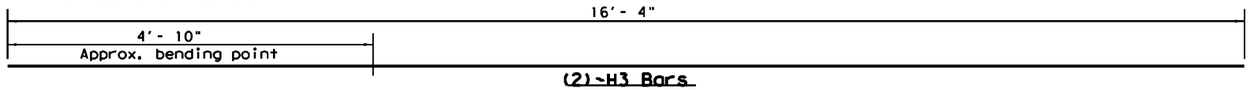


APPROACH VIEW

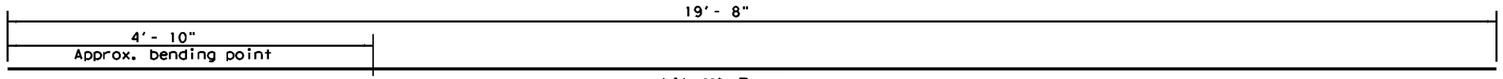
TYPE 2 - NOTES

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

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



(2)-H3 Bars
(#5) Bar



(4)-H1 Bars
(#5) Bar

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

FOR CONTRACTORS INFORMATION ONLY

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

Texas Department of Transportation
Design Division Standard

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

FILE: lpcb13.dgn	DN: TxDOT	CK: AM	DW: VP	CK:
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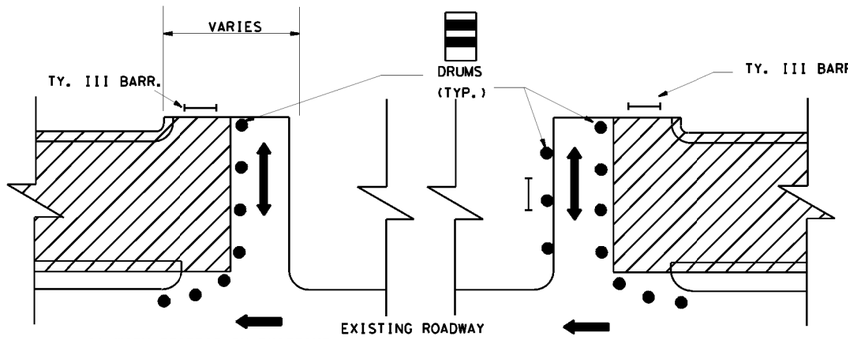
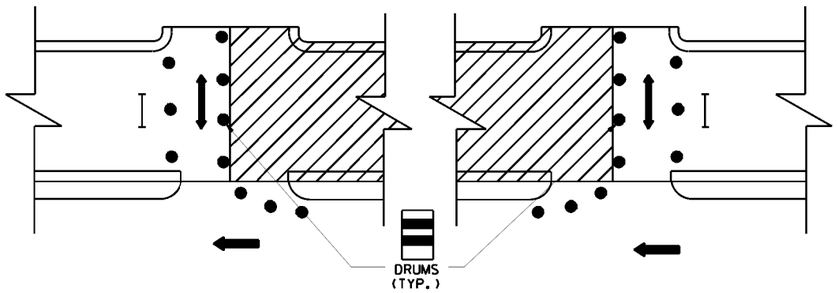
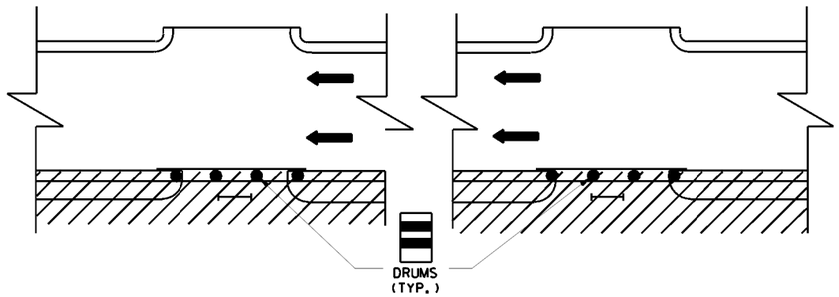


1) WITH TRAFFIC ON EXISTING
BUILD ONE-HALF OF DRIVE.

2) BUILD OTHER HALF OF DRIVE



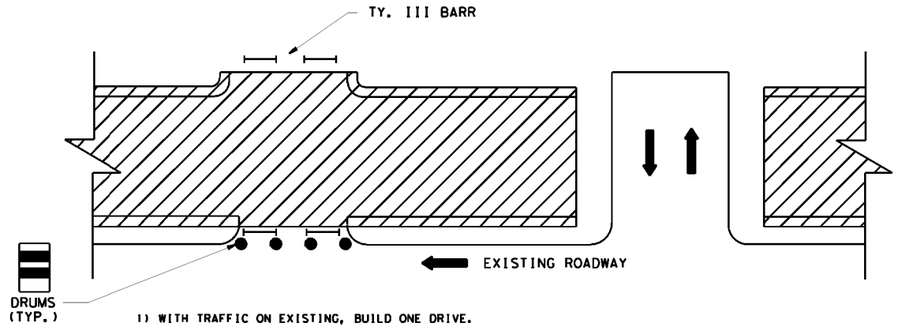
2) BUILD OTHER HALF OF DRIVE



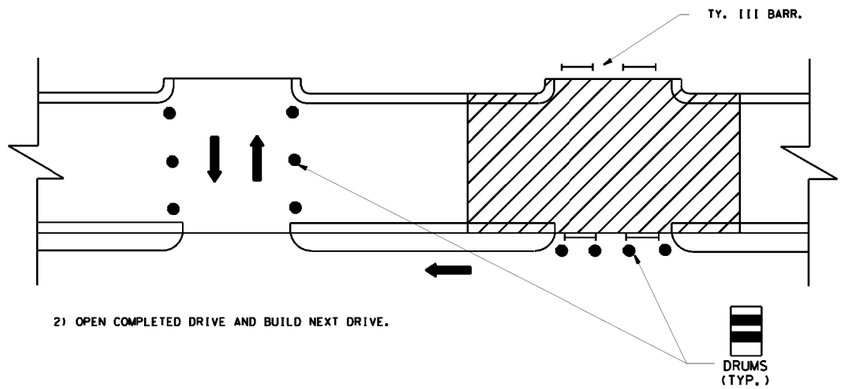
3) OPEN DRIVE

4) AFTER TRAFFIC MOVES TO NEW ROADWAY,
BUILD REMAINING CURB.

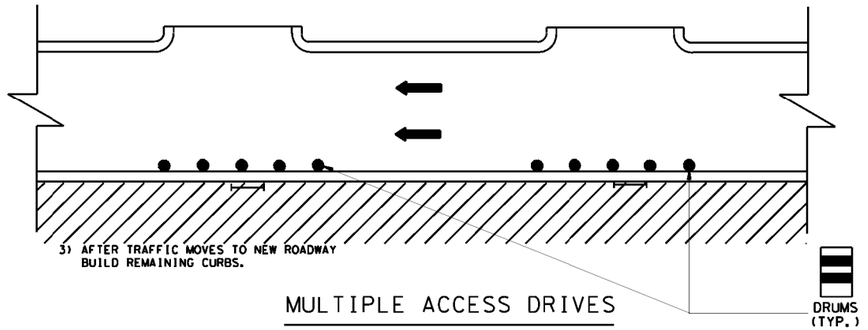
SINGLE ACCESS DRIVES



1) WITH TRAFFIC ON EXISTING, BUILD ONE DRIVE.



2) OPEN COMPLETED DRIVE AND BUILD NEXT DRIVE.



3) AFTER TRAFFIC MOVES TO NEW ROADWAY
BUILD REMAINING CURBS.

MULTIPLE ACCESS DRIVES

Texas Department of Transportation
Houston District

CONSTRUCTION SEQUENCE FOR MISCELLANEOUS DRIVES

CSMD TC8010-2020

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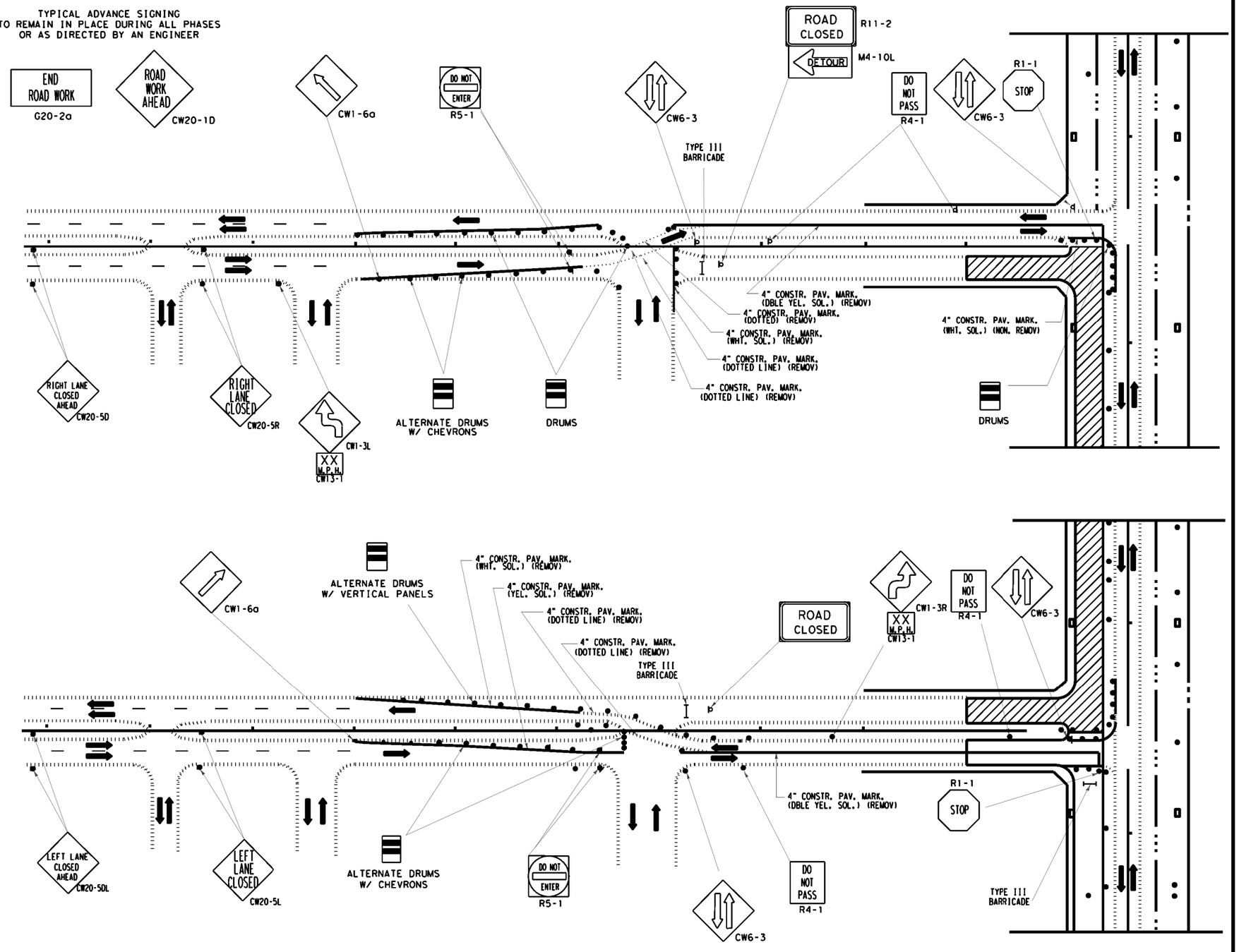
STD H-29

TYPICAL ADVANCE SIGNING
TO REMAIN IN PLACE DURING ALL PHASES
OR AS DIRECTED BY AN ENGINEER



TYPICAL TRANSITION LENGTHS
AND
SUGGESTED MAXIMUM SPACING OF DEVICES

POSTED SPEED	FORMULA	MINIMUM DESIRABLE TAPER LENGTHS ⓐ ⓑ 10' OFFSET	11' OFFSET	12' OFFSET	SUGGESTED MAX. SPAC. OF DEVICE ON A TAPER	ON A TANGENT	MINIMUM SIGN SPACING x DISTANCE
30	$L=\frac{WS^2}{60}$	150'	165'	180'	30'	60'-75'	120'
35		205'	225'	245'	35'	70'-90'	160'
40		265'	295'	320'	40'	80'-100'	240'
45	L=WS	450'	495'	540'	45'	90'-110'	320'
50		500'	550'	600'	50'	100'-125'	400'
55		550'	605'	660'	55'	110'-140'	500'
60		600'	660'	720'	60'	120'-150'	ⓑ 600'
65		650'	715'	780'	65'	130'-165'	ⓑ 700'
70		700'	770'	840'	70'	140'-175'	ⓑ 800'

ⓐ CONVENTIONAL ROADS ONLY
ⓑ ⓑ TAPER LENGTHS HAVE BEEN ROUNDED OFF.

CONSTRUCTION WARNING
SIGN SPACING

POSTED SPEED (MPH)	"X" SIGN SPACINGS (FEET)
30 OR LESS	120
35	120
40	240
45	320
50	400
55	500
60	600
65	700
70	800

LEGEND

CONSTRUCTION AREA

OPEN TO TRAFFIC

Texas Department of Transportation
Houston District

BOULEVARD CLOSURES

TCPTC 3050-96

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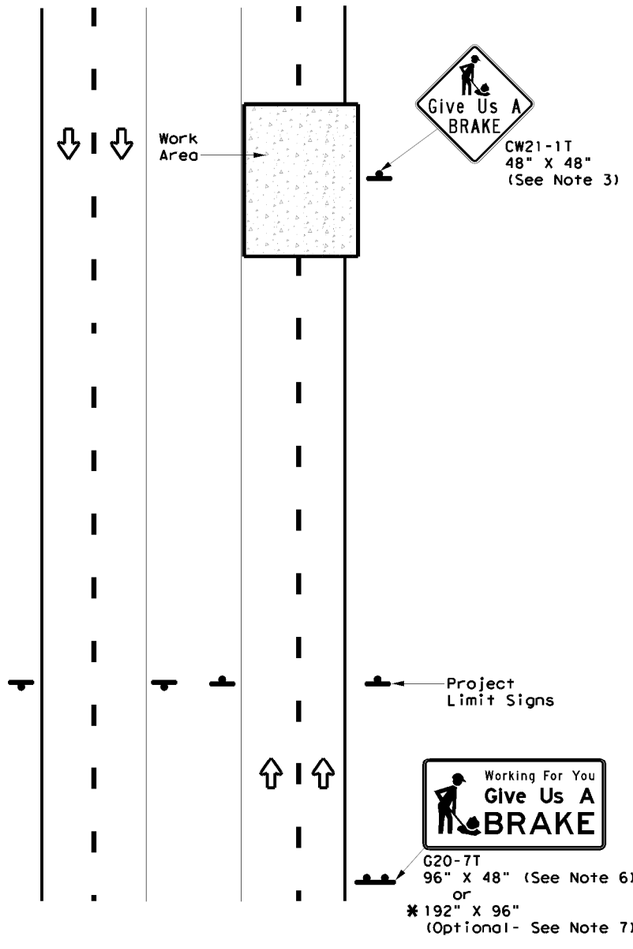
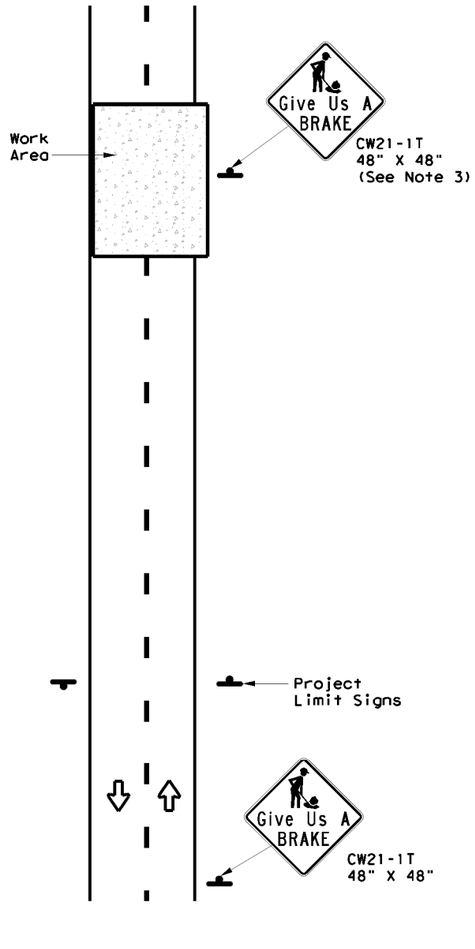
COUNTY	CONTROL	SECT	JOB	HIGHWAY
HOU	0110	05	127	IH 45

STD IH-45



DIVIDED HIGHWAY



UNDIVIDED HIGHWAY

SIGNS ARE SHOWN FOR ONE DIRECTION OF TRAVEL

* When the optional larger WORKING FOR YOU GIVE US A BRAKE (G20-7T) 192" x 96" sign is required, the locations shall be noted elsewhere in the plans.

SUMMARY OF LARGE SIGNS

BACKGROUND COLOR	SIGN DESIGNATION	SIGN	SIGN DIMENSIONS	REFLECTIVE SHEETING	SQ FT	GALVANIZED STRUCTURAL STEEL			DRILLED SHAFT 24" DIA. (LF)
						Size	(LF) ①	(LF) ②	
Orange	G20-7T	Working For You Give Us A BRAKE	96" X 48"	Type B_{FL} or C_{FL}	32	▲	▲	▲	▲
Orange	G20-7T	Working For You Give Us A BRAKE	192" X 96"	Type B_{FL} or C_{FL}	128	W8x18	16	17	12

▲ See Note 6 Below

LEGEND	
	Sign
	Large Sign
	Traffic Flow

DEPARTMENTAL MATERIAL SPECIFICATIONS	
PLYWOOD SIGN BLANKS	DMS-7100
ALUMINUM SIGN BLANKS	DMS-7110
SIGN FACE MATERIALS	DMS-8300

COLOR	USAGE	SHEETING MATERIAL
ORANGE	BACKGROUND	TYPE B_{FL} OR TYPE C_{FL}
BLACK	LEGEND & BORDERS	NON-REFLECTIVE ACRYLIC FILM

GENERAL NOTES

1. See BC and SMD sheets for additional sign support details.
2. Sign locations shall be approved by the Engineer.
3. For projects more than two miles in length, Give Us a BRAKE signs should be repeated halfway through the project. The Give Us a Brake (CW21-1T) may be used for this purpose.
4. Work zone speed limits are sometimes used in conjunction with GIVE US A BRAKE signing. See BC(3) for location and spacing of construction speed zone signing when required.
5. Give Us a Brake (CW21-1T) signs and supports shall be considered subsidiary to Item 502, "Barricades, Signs and Traffic Handling."
6. The 96" X 48" Working For You Give Us A BRAKE (G20-7T) may use a 1/2" or 5/8" plywood substrate or 0.125" aluminum sheeting substrate and may be supported by two 4" x 6" wood posts with drilled holes for breakaway as per BC(5) and will be subsidiary to Item 502.
7. The Working For You Give Us A BRAKE (G20-7T) 192" X 96" sign shall be paid for under the following specification items:
   Item 636 - Aluminum Signs
   Item 647 - Large Roadside Sign Supports and Assemblies.
   Item 416 - Drilled Shaft Foundations
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.

Texas Department of Transportation

Traffic Operations Division Standard

WORK ZONE "GIVE US A BRAKE" SIGNS

WZ(BRK)-13

FILE: wzbrk-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT August 1995	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
6-96 5-98 7-13	DIST	COUNTY		SHEET NO.
8-96 3-03	HOU	HARRIS		79

DATE:
FILE:

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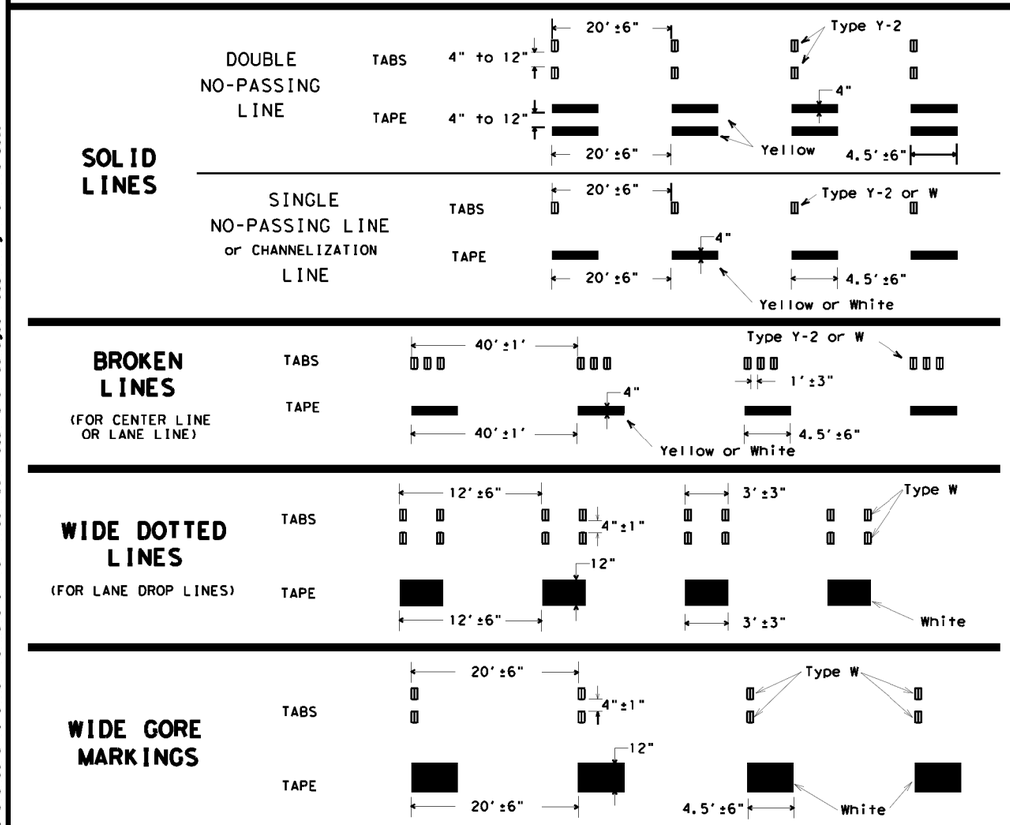
DATE:
FILE:

WORK ZONE SHORT TERM PAVEMENT MARKINGS DETAILS



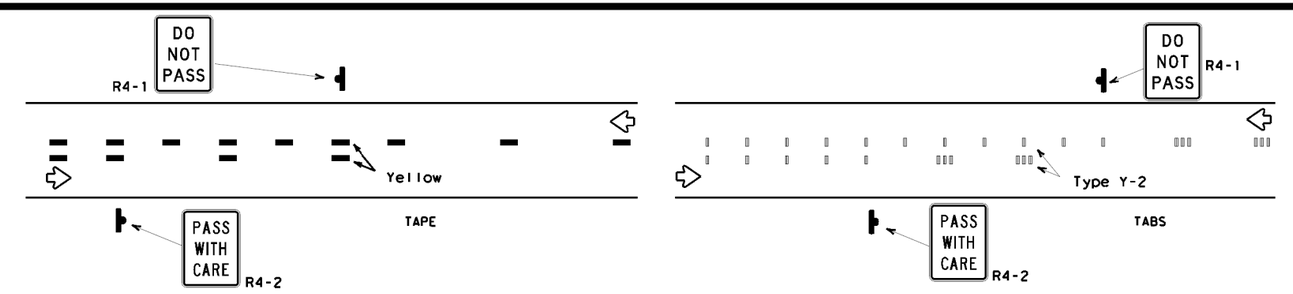
NOTES:

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.

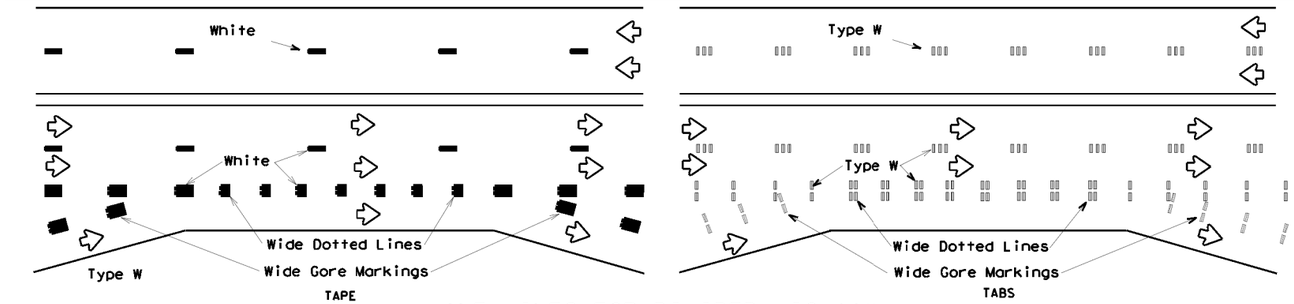
TEMPORARY FLEXIBLE, REFLECTIVE ROADWAY MARKER TABS (TABS)

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.

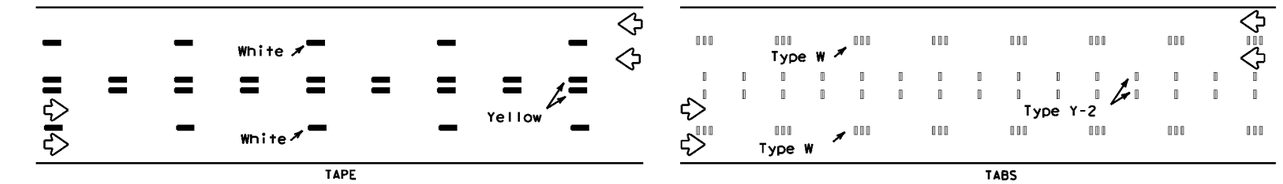
WORK ZONE SHORT TERM PAVEMENT MARKINGS PATTERNS



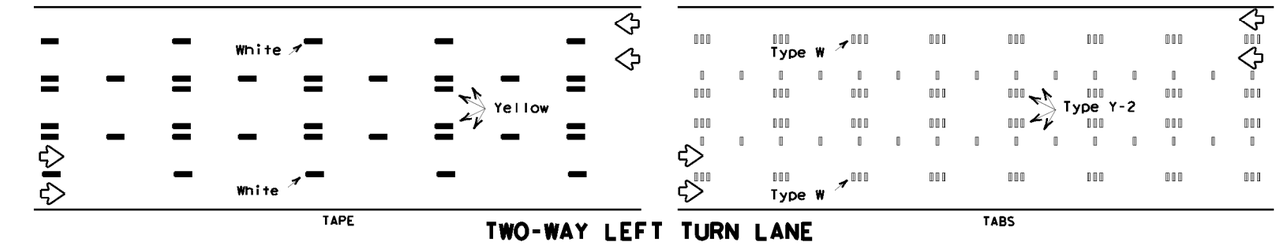
CENTER LINE & NO-PASSING ZONE BARRIER LINES FOR TWO LANE TWO-WAY HIGHWAYS



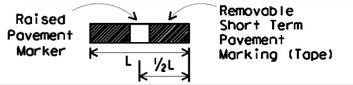
LANE LINES FOR DIVIDED HIGHWAY



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

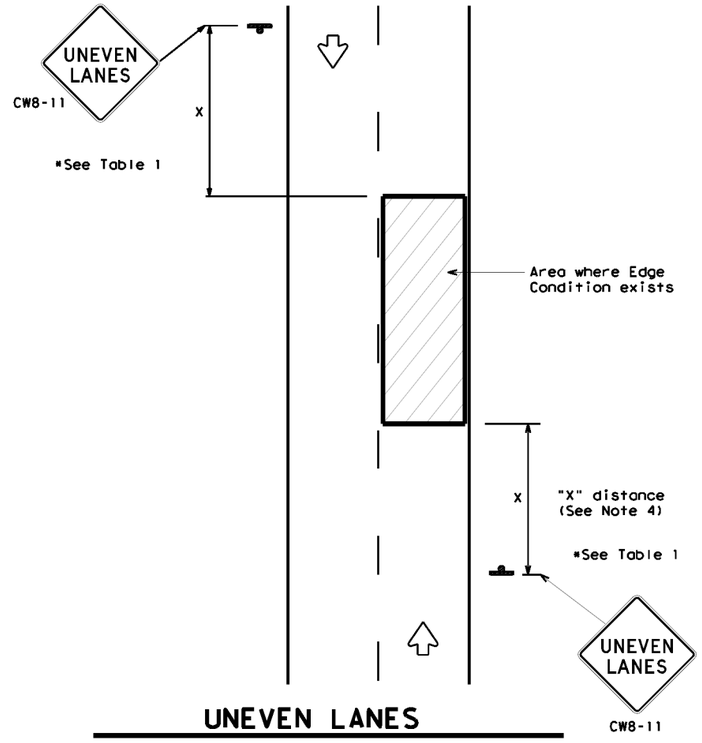
Traffic Operations Division Standard

WORK ZONE SHORT TERM PAVEMENT MARKINGS

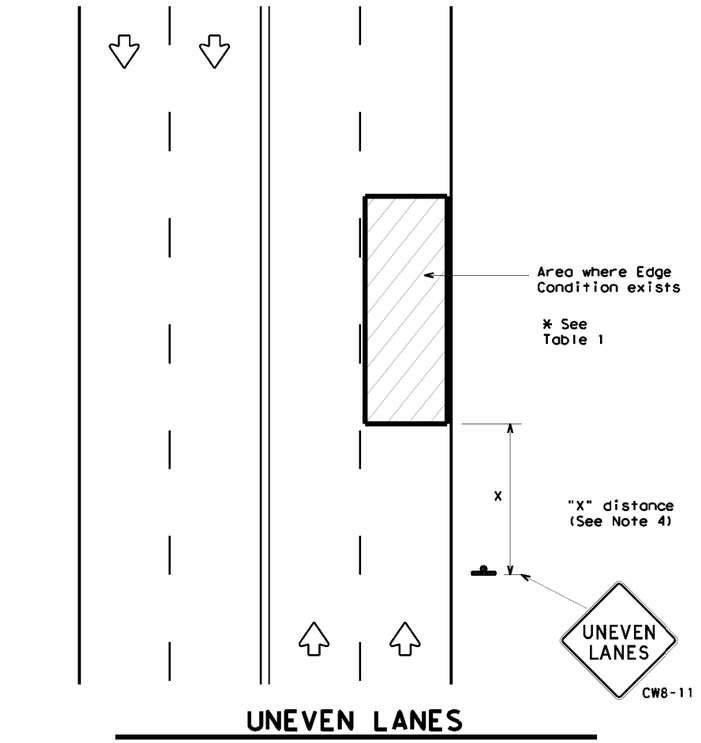
WZ(STPM)-13

FILE:	wzstpm-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT	April 1992	CONT	SECT	JOB	HIGHWAY
REVISIONS		0110	05	126	IH 45
1-97		DIST	COUNTY		SHEET NO.
3-03		HOU	HARRIS		80
7-13					

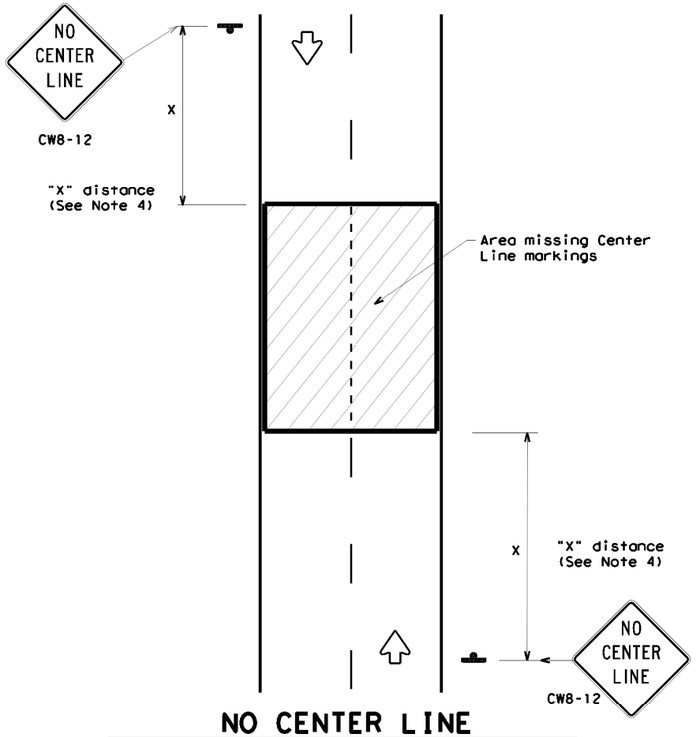
DATE:
FILE:



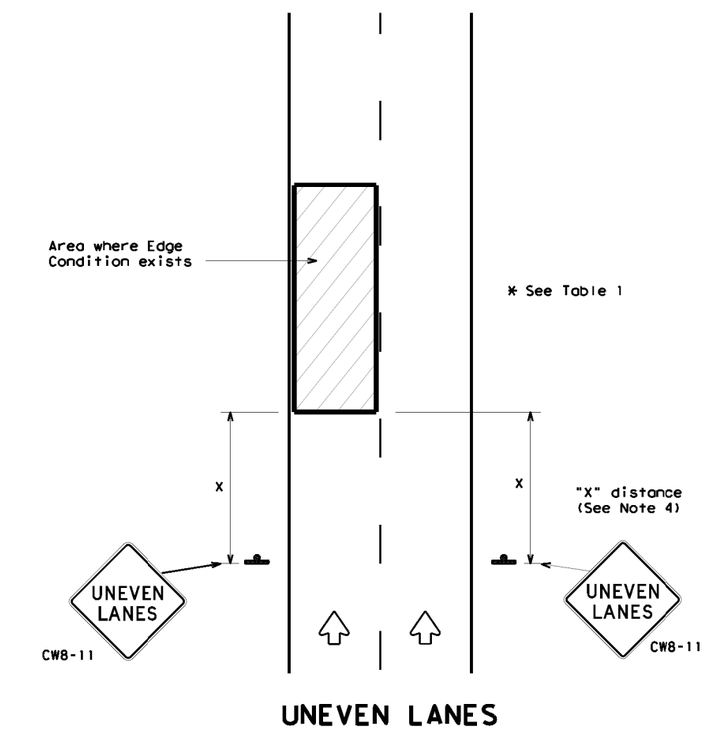
UNEVEN LANES
TWO LANE CONVENTIONAL ROAD



UNEVEN LANES
FOUR LANE CONVENTIONAL ROAD



NO CENTER LINE
TWO LANE CONVENTIONAL ROAD



UNEVEN LANES
DIVIDED ROADWAY

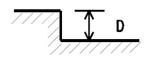
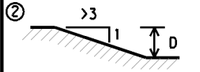
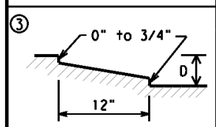
DEPARTMENTAL MATERIAL SPECIFICATIONS	
PERMANENT PREFABRICATED PAVEMENT MARKINGS	DMS-8240
TEMPORARY (REMOVABLE) PREFABRICATED PAVEMENT MARKINGS	DMS-8241
SIGN FACE MATERIALS	DMS-8300

COLOR	USAGE	SHEETING MATERIAL
ORANGE	BACKGROUND	TYPE B_{FL} OR TYPE C_{FL} SHEETING
BLACK	LEGEND & BORDERS	ACRYLIC NON-REFLECTIVE SHEETING

GENERAL NOTES

1. If spalling or holes occur, ROUGH ROAD (CW8-8) signs should be placed in advance of the condition and be repeated every two miles where the condition persists.
2. UNEVEN LANES (CW8-11) signs shall be installed in advance of the condition and repeated every mile. Signs installed along the uneven lane condition may be supplemented with the NEXT XX MILES (CW7-3aP) plaque or Advisory Speed (CW13-1P) plaque.
3. NO CENTER LINE (CW8-12) signs and temporary pavement markings as per the WZ(STPM) standard shall be installed if yellow centerlines separating two way traffic are obscured or obliterated. Repeat NO CENTER LINE signs every two miles where the center line markings are not in place. The signs and markings shall remain in place until permanent pavement markings are installed.
4. Signs shall be spaced at the distances recommended as per BC standards.
5. Additional signs may be required as directed by the Engineer. Signs shall remain in place until final surface is applied. Signs shall be considered subsidiary to Item 502 "BARRICADES, SIGNS AND TRAFFIC HANDLING."
6. Signs shall be fabricated and mounted on supports as shown on the BC standards and/or listed on the "Compliant Work Zone Traffic Control Devices" list.
7. Short term markings shall not be used to simulate edge lines.
8. All signs shall be constructed in accordance with the details found in the "Standard Highway Sign Designs for Texas," latest edition.

TABLE 1

Edge Condition	Edge Height (D)	* Warning Devices
① 	Less than or equal to: 1¼" (maximum-planing) 1½" (typical-overlay)	Sign: CW8-11
	Distance "D" may be a maximum of 1 1/4 " for planing operations and 2" for overlay operations if uneven lanes with edge condition 1 are open to traffic after work operations cease.	
② 	Less than or equal to 3"	Sign: CW8-11
③  Notched Wedge Joint	Distance "D" may be a maximum of 3" if uneven lanes with edge condition 2 or 3 are open to traffic after work operations cease. Uneven lanes should not be open to traffic when "D" is greater than 3".	

TRAFFIC CONTROL DURING PLANING, OVERLAY AND LEVELING OPERATIONS ARE SHOWN ELSEWHERE IN THE PLANS.

MINIMUM WARNING SIGN SIZE	
Conventional roads	36" x 36"
Freeways/expressways, divided roadways	48" x 48"

Texas Department of Transportation

Traffic Operations Division Standard

SIGNING FOR UNEVEN LANES

WZ(UL)-13

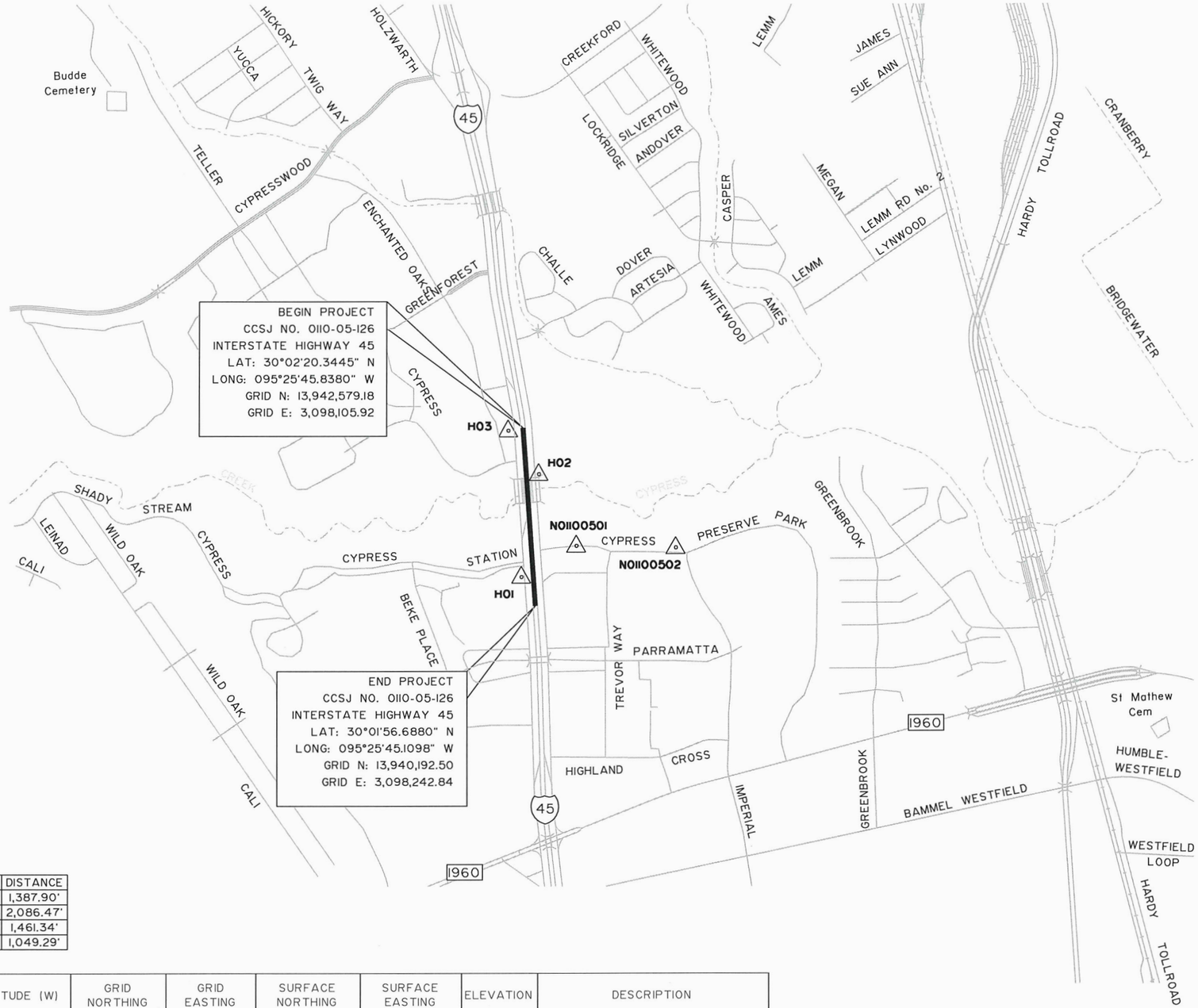
FILE: wzul-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT April 1992	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
8-95 2-98 7-13	DIST	COUNTY		SHEET NO.
1-97 3-03	HOU	HARRIS		81

NOTES:

1. ALL BEARINGS ARE REFERENCED TO THE TEXAS COORDINATE SYSTEM OF 1983, SOUTH CENTRAL ZONE (NAD83, 2011 ADJUSTMENT, EPOCH 2010.00).

2. ALL DISTANCES AND COORDINATES ARE IN US SURVEY FEET DISPLAYED IN SURFACE VALUES WITH THE TxDOT SURFACE ADJUSTMENT FACTOR OF 1.00013.

3. ALL ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) USING GEOID12B.



N

11x17 - SCALE: 1" = NOT TO SCALE
22x34 - SCALE: 1" = NOT TO SCALE

THE SURVEY CONTROL INFORMATION HAS BEEN ACCEPTED AND INCORPORATED INTO THIS PSBE

STATE OF TEXAS
REGISTERED
JIBRAEL K. AHMAD
6183
PROFESSIONAL
LAND SURVEYOR
07/23/20

I HEREBY CERTIFY THAT THIS CONTROL MAP WAS PREPARED UNDER MY SUPERVISION IN MARCH 2020.

TRAVERSE TABLE

FROM	TO	BEARING	DISTANCE
N0110050I	N0110050Z	S 87°10'48" E	1,387.90'
N0110050Z	H01	S 85°10'31" W	2,086.47'
H01	H02	N 11°10'39" E	1,461.34'
H02	H03	N 23°56'15" W	1,049.29'

PT NO.	LATITUDE (N)	LONGITUDE (W)	GRID NORTHING	GRID EASTING	SURFACE NORTHING	SURFACE EASTING	ELEVATION	DESCRIPTION
N0110050I	30°01'58.8676"	095°25'39.0664"	13,940,428.80	3,098,767.08	13,942,241.05	3,099,169.92	92.71'	CP:3.25" DM IN CONC BULL NOSE
N0110050Z	30°01'57.7727"	095°25'23.3286"	13,940,360.52	3,100,153.12	13,942,172.77	3,100,556.14	92.15'	CP:3.25" DM IN CONC
H01	30°01'56.6653"	095°25'47.0288"	13,940,185.06	3,098,074.31	13,941,997.28	3,098,477.06	102.15'	CP:3.25" DM IN CONC INLET
H02	30°02'10.7629"	095°25'43.3101"	13,941,618.49	3,098,357.55	13,943,430.90	3,098,760.34	98.64'	CP:3.25" DM IN CONC SIDEWALK
H03	30°02'20.3795"	095°25'47.8179"	13,942,577.40	3,097,931.87	13,944,389.94	3,098,334.60	91.41'	CP:3.25" DM IN CONC INLET

REVISIONS:

JONES|CARTER
2322 West Grand Parkway North, Suite 150
• Katy, Texas 77449 • 832.913.4000
Texas Board of Professional Land Surveying
Registration No. 10194039

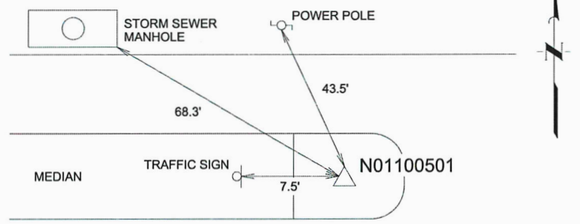
CONTROL INDEX SHEET
INTERSTATE HIGHWAY 45

FED. RD. DIV. NO.	FEDERAL AID PROJECT		SHEET NO.
06			82
STATE	DIST.	COUNTIES	
TEXAS	HOU.	HARRIS	
CONT.	SECT.	JOB	HIGHWAY
0110	05	126	IH 45

N01100501

N: 13,942,241.05
E: 3,099,169.92
ELEV: 92.71'

DESC: TXDOT ALUMINUM DISK SET IN CONCRETE BULL NOSE



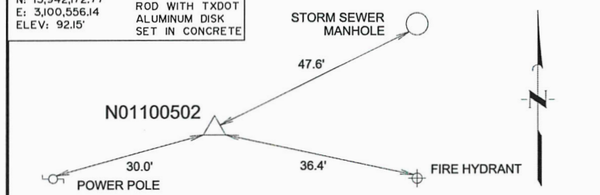
NOT TO SCALE
US SURVEY FEET

CONTROL POINT N01100501 IS A TXDOT ALUMINUM DISK SET IN CONCRETE BULL NOSE, IN THE MEDIAN OF CYPRESS PRESERVE PARK DRIVE, LOCATED APPROXIMATELY 380' EAST OF INTERSTATE HIGHWAY 45.

N01100502

N: 13,942,172.77
E: 3,100,556.14
ELEV: 92.15'

DESC: 5/8" IRON ROD WITH TXDOT ALUMINUM DISK SET IN CONCRETE



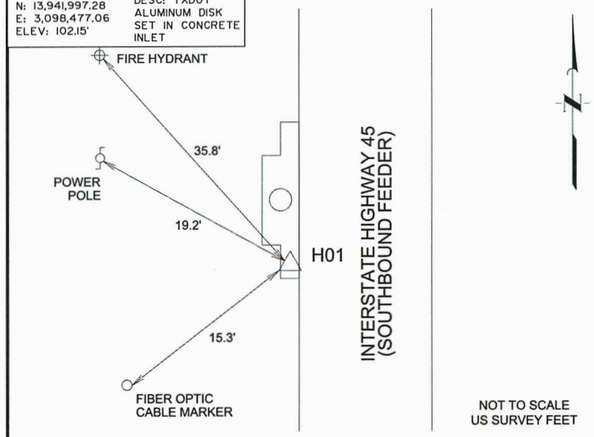
NOT TO SCALE
US SURVEY FEET

CONTROL POINT N01100502 IS A 5/8" IRON ROD WITH TXDOT ALUMINUM DISK SET IN CONCRETE, ON THE NORTH SIDE OF CYPRESS PRESERVE PARK DRIVE, LOCATED APPROXIMATELY 100' WEST OF IMPERIAL VALLEY DRIVE.

H01

N: 13,941,997.28
E: 3,098,477.06
ELEV: 102.15'

DESC: TXDOT ALUMINUM DISK SET IN CONCRETE INLET



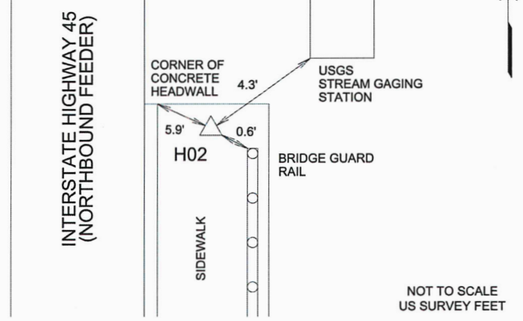
NOT TO SCALE
US SURVEY FEET

CONTROL POINT H01 IS A TXDOT ALUMINUM DISK SET IN CONCRETE INLET, ON THE WEST OF INTERSTATE HIGHWAY 45 SOUTHBOUND FEEDER, LOCATED APPROXIMATELY 100' SOUTH OF CYPRESS STATION DRIVE.

H02

N: 13,943,430.90
E: 3,098,760.34
ELEV: 98.64'

DESC: TXDOT ALUMINUM DISK SET IN CONCRETE SIDEWALK



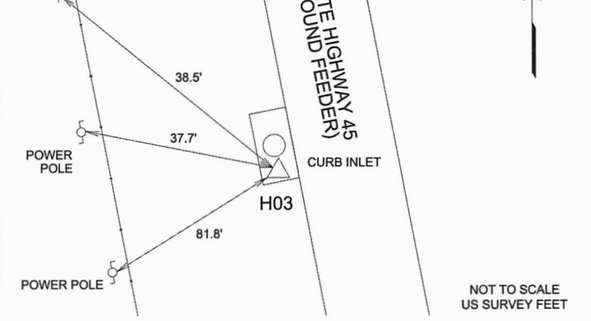
NOT TO SCALE
US SURVEY FEET

CONTROL POINT H02 IS A TXDOT ALUMINUM DISK SET IN CONCRETE SIDEWALK, ON THE EAST OF INTERSTATE HIGHWAY 45 NORTHBOUND FEEDER, LOCATED APPROXIMATELY 1,200' NORTH OF CYPRESS PRESERVE PARK DRIVE.

H03

N: 13,944,389.94
E: 3,098,334.60
ELEV: 91.41'

DESC: TXDOT ALUMINUM DISK SET IN CONCRETE INLET



NOT TO SCALE
US SURVEY FEET

CONTROL POINT H03 IS A TXDOT ALUMINUM DISK SET IN CONCRETE INLET, ON THE WEST OF INTERSTATE HIGHWAY 45 SOUTHBOUND FEEDER, LOCATED APPROXIMATELY 350' NORTH OF CYPRESS OAKS DRIVE.

NOTES:

1. ALL BEARINGS ARE REFERENCED TO THE TEXAS COORDINATE SYSTEM OF 1983, SOUTH CENTRAL ZONE (NAD83, 2011 ADJUSTMENT, EPOCH 2010.00).

2. ALL DISTANCES AND COORDINATES ARE IN US SURVEY FEET DISPLAYED IN SURFACE VALUES WITH THE TxDOT SURFACE ADJUSTMENT FACTOR OF 1.00013.

3. ALL ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) USING GEOID12B.

THE SURVEY CONTROL INFORMATION HAS BEEN ACCEPTED AND INCORPORATED INTO THIS PAGE

STATE OF TEXAS
REGISTERED
JIBRAEL K. AHMAD
6183
PROFESSIONAL
LAND SURVEYOR
03/27/20

I HEREBY CERTIFY THAT THIS CONTROL MAP WAS PREPARED UNDER MY SUPERVISION IN MARCH 2020.

REVISIONS:

JONES|CARTER
2322 West Grand Parkway North, Suite 150
• Katy, Texas 77449 • 832.913.4000
Texas Board of Professional Land Surveying
Registration No. 10194039

HORIZONTAL & VERTICAL CONTROL SHEET INTERSTATE HIGHWAY 45

FED. RD. DIV. NO.	FEDERAL AID PROJECT		SHEET NO.
06			83
STATE	DIST.	COUNTY	
TEXAS	HOU.	HARRIS	
CONT.	SECT.	JOB	HIGHWAY
0110	05	126	IH 45

<* 1 DESCRIBE CHAIN IH45 SBFR

Chain IH45 SBFR contains:
110 CUR IH45 SBFR1 CUR IH45_SBFR2 CUR IH45_SBFR3 111

Beginning chain IH45 SBFR description
==========

Point 110 N 13,941,838.0596 E 3,098,498.5198 Sta 880+93.35

Course from 110 to PC IH45_SBFR1 N 2° 07′ 35.01" W Dist 186.5489

Curve Data

Curve IH45_SBFR1

P.I. Station	884+09.50	N	13,942,153.9906	E	3,098,486.7894	
Delta =	2° 35′ 29.59"	(RT)				
Degree =	1° 00′ 00.00"					
Tangent =	129.5998					
Length =	259.1554					
Radius =	5,729.5780					
External =	1.4655					
Long Chord =	259.1333					
Mid. Ord. =	1.4652					
P.C. Station	882+79.90	N	13,942,024.4800	E	3,098,491.5981	
P.T. Station	885+39.05	N	13,942,283.5861	E	3,098,487.8416	
C.C.		N	13,942,237.0703	E	3,104,217.2308	
Back = N	2° 07′ 35.01" W					
Ahead = N	0° 27′ 54.59" E					
Chord Bear = N	0° 49′ 50.21" W					

Curve Data

Curve IH45_SBFR2

P.I. Station	887+29.57	N	13,942,474.0930	E	3,098,489.3883	
Delta =	3° 48′ 31.89"	(LT)				
Degree =	1° 00′ 00.00"					
Tangent =	190.5131					
Length =	380.8859					
Radius =	5,729.5780					
External =	3.1665					
Long Chord =	380.8158					
Mid. Ord. =	3.1647					
P.C. Station	885+39.05	N	13,942,283.5861	E	3,098,487.8416	
P.T. Station	889+19.94	N	13,942,664.2818	E	3,098,478.2765	
C.C.		N	13,942,330.1019	E	3,092,758.4524	
Back = N	0° 27′ 54.59" E					
Ahead = N	3° 20′ 37.31" W					
Chord Bear = N	1° 26′ 21.36" W					

Course from PT IH45_SBFR2 to PC IH45_SBFR3 N 3° 20′ 37.31" W Dist 1,125.8495

Curve Data

Curve IH45_SBFR3

P.I. Station	902+05.16	N	13,943,947.3129	E	3,098,403.3156	
Delta =	3° 11′ 11.65"	(LT)				
Degree =	1° 00′ 00.00"					
Tangent =	159.3695					
Length =	318.6569					
Radius =	5,729.5780					
External =	2.2160					
Long Chord =	318.6158					
Mid. Ord. =	2.2152					
P.C. Station	900+45.79	N	13,943,788.2146	E	3,098,412.6109	
P.T. Station	903+64.45	N	13,944,105.6484	E	3,098,385.1909	
C.C.		N	13,943,454.0348	E	3,092,692.7868	
Back = N	3° 20′ 37.31" W					
Ahead = N	6° 31′ 48.95" W					
Chord Bear = N	4° 56′ 13.13" W					

Course from PT IH45_SBFR3 to 111 N 6° 31′ 48.95" W Dist 278.0034

Point 111 N 13,944,381.8480 E 3,098,353.5741 Sta 906+42.45

==========
Ending chain IH45 SBFR description

<* 1 DESCRIBE CHAIN EXRAMP 1960

Chain EXRAMP 1960 contains:
CUR SB1960_X_031 CUR SB1960_X_032 500

Beginning chain EXRAMP 1960 description
==========

Curve Data

Curve SB1960_X_031

P.I. Station	1+16.94	N	13,943,482.6720	E	3,098,440.4793	
Delta =	4° 40′ 30.15"	(RT)				
Degree =	2° 00′ 00.00"					
Tangent =	116.9409					
Length =	233.7520					
Radius =	2,864.7890					
External =	2.3858					
Long Chord =	233.6872					
Mid. Ord. =	2.3838					
P.C. Station	0+00.00	N	13,943,365.9302	E	3,098,447.2999	
P.T. Station	2+33.75	N	13,943,599.5814	E	3,098,443.1963	
C.C.		N	13,943,533.0201	E	3,101,307.2119	
Back = N	3° 20′ 37.31" W					
Ahead = N	1° 19′ 52.84" E					
Chord Bear = N	1° 00′ 22.23" W					

Curve Data

Curve SB1960_X_032

P.I. Station	4+17.17	N	13,943,782.9456	E	3,098,447.4578	
Delta =	4° 29′ 19.17"	(LT)				
Degree =	1° 13′ 27.37"					
Tangent =	183.4137					
Length =	366.6398					
Radius =	4,680.0000					
External =	3.5927					
Long Chord =	366.5461					
Mid. Ord. =	3.5899					
P.C. Station	2+33.75	N	13,943,599.5814	E	3,098,443.1963	
P.T. Station	6+00.39	N	13,943,966.0809	E	3,098,437.3558	
C.C.		N	13,943,708.3177	E	3,093,764.4597	
Back = N	1° 19′ 52.84" E					
Ahead = N	3° 09′ 26.33" W					
Chord Bear = N	0° 54′ 46.74" W					

Course from PT SB1960_X_032 to 500 N 3° 09′ 26.33" W Dist 209.6055

Point 500 N 13,944,175.3683 E 3,098,425.8112 Sta 8+10.00

==========
Ending chain EXRAMP 1960 description

<* 1 DESCRIBE CHAIN DRWY

Chain DRWY contains:
1000 1010

Beginning chain DRWY description
==========

Point 1000 N 13,942,576.4553 E 3,098,482.7318 Sta 0+00.00

Course from 1000 to 1010 S 87° 41′ 21.05" W Dist 100.0006

Point 1010 N 13,942,572.4232 E 3,098,382.8125 Sta 1+00.00

==========
Ending chain DRWY description

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED PROFESSIONAL ENGINEER

Sharmeen Rahman , P.E.

09/29/2021

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IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

HORIZONTAL ALIGNMENT DATA

SHEET 1 OF 1

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		84

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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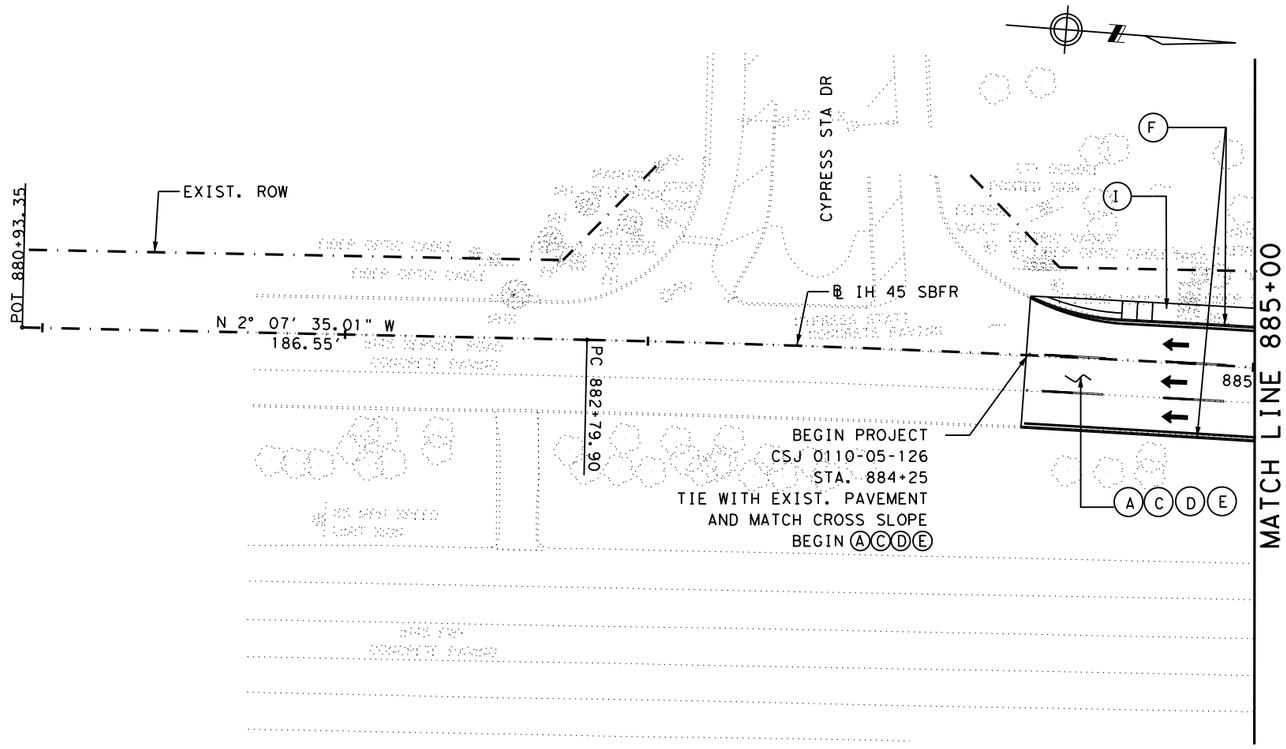

Ⓐ 10" CRCP
Ⓑ 13" FAST TRACK
Ⓒ 1" ASB
Ⓓ 6" CEMENT STAB. BASE
Ⓔ 6" CEMENT TREAT. BASE
Ⓕ 6" CURB
Ⓖ C223 RAIL
Ⓗ T223 RAIL
Ⓘ 5" SIDEWALK
Ⓙ 4" CONC. RIPRAP
Ⓚ METAL BEAM GUARD FENCE
Ⓛ GUARD RAIL END TREATMENT
Ⓜ THRIE BEAM
Ⓝ 15" FAST TRACK

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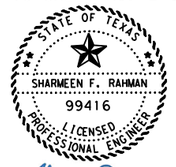

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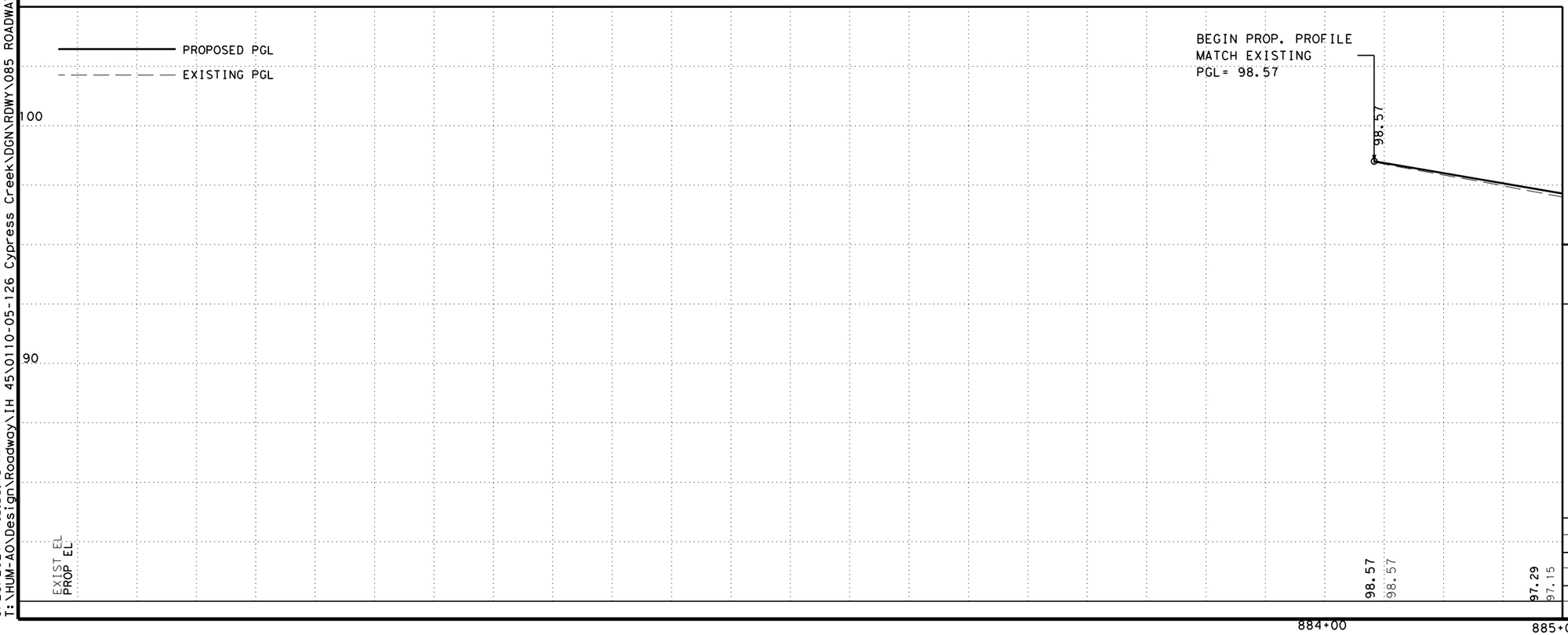
09/29/2021



Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

PLAN AND PROFILE

SCALE: HORIZ. 1"= 50
VERT. 1"= 5'

SHEET 1 OF 5

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		85

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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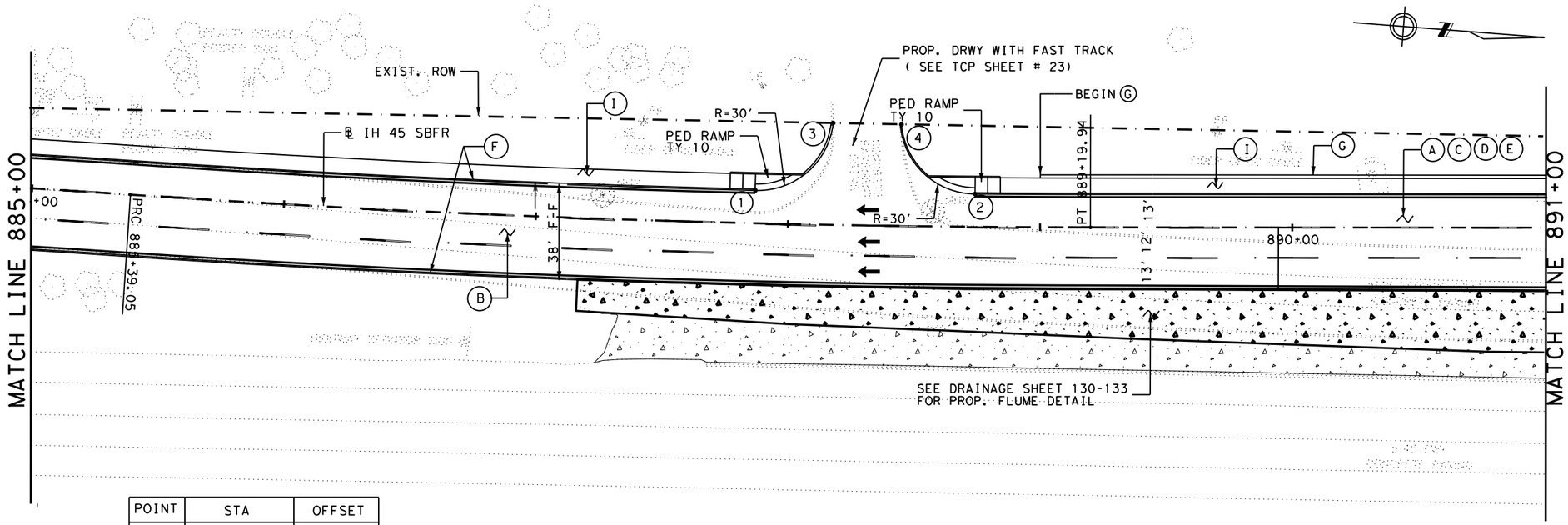

POINT	STA	OFFSET
1	887+86.80	13' LT
2	888+74.00	13' LT
3	888+16.65	40.33' LT
4	888+43.92	40.28' LT

- (A) 10" CRCP
- (B) 13" FAST TRACK
- (C) 1" ASB
- (D) 6" CEMENT STAB. BASE
- (E) 6" CEMENT TREAT. BASE
- (F) 6" CURB
- (G) C223 RAIL
- (H) T223 RAIL
- (I) 5" SIDEWALK
- (J) 4" CONC. RIPRAP
- (K) METAL BEAM GUARD FENCE
- (L) GUARD RAIL END TREATMENT
- (M) THRIE BEAM
- (N) 15" FAST TRACK

NOTE:

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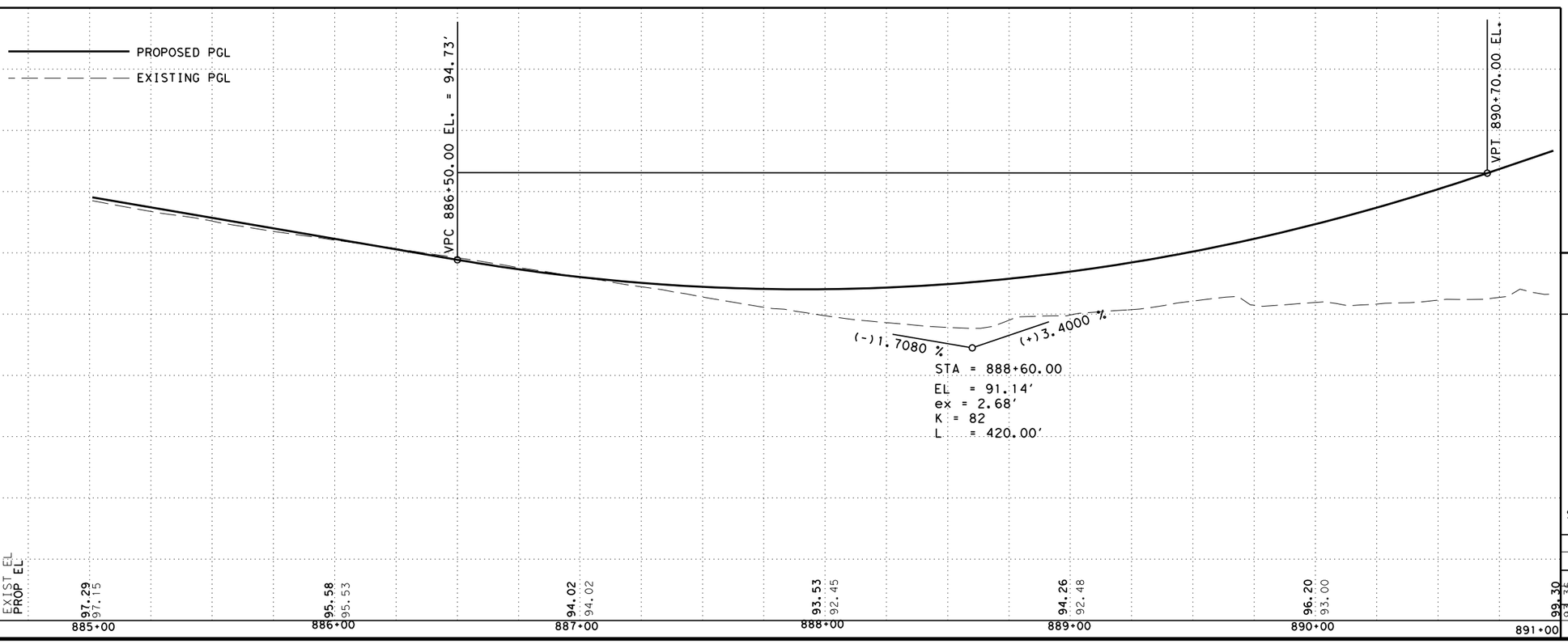

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IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

PLAN AND PROFILE

SCALE: HORIZ. 1"= 50
VERT. 1"= 5'

SHEET 2 OF 5

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		86

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

9/28/2021 10:05:51 AM
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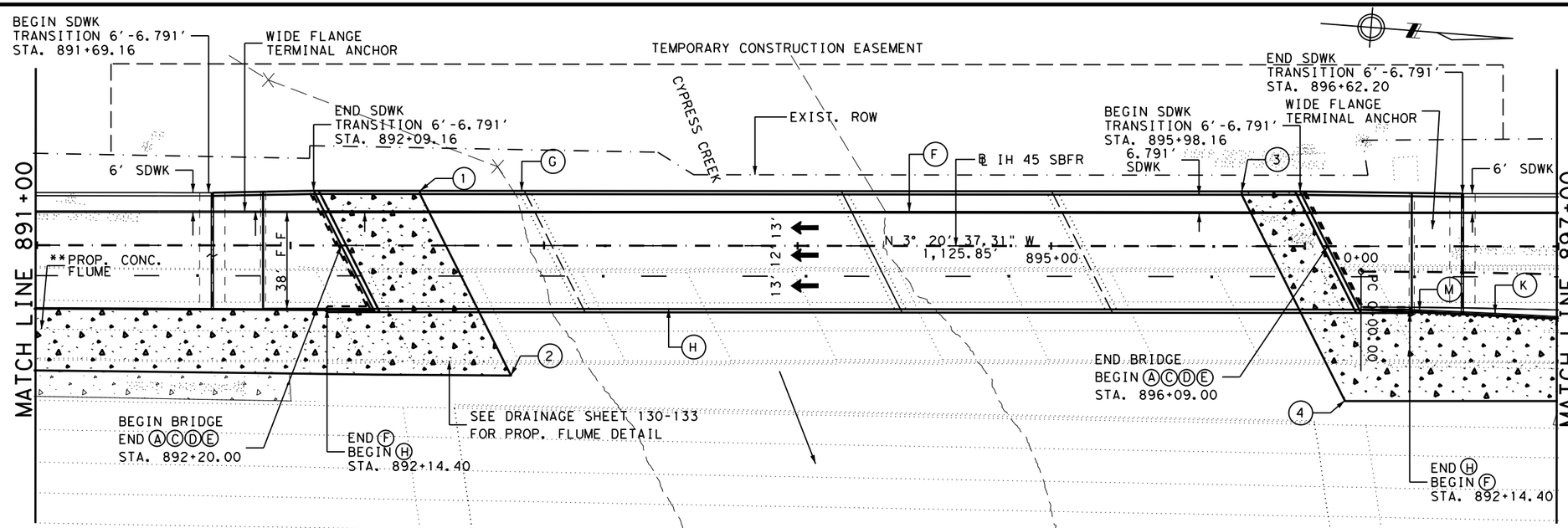
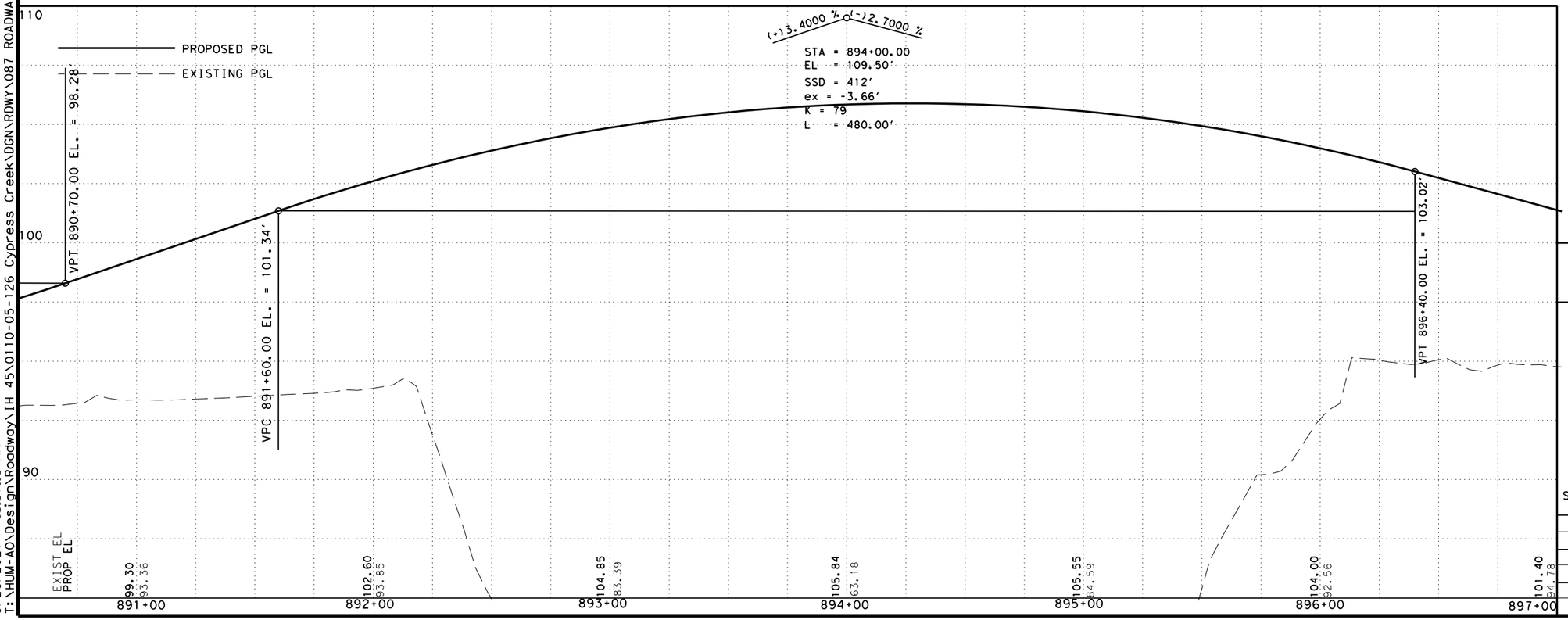


POINT	STA.	OFFSET
1	892+51.05	21.58' LT
2	892+87.00	51.30' RT
3	895+75.12	21.58' LT
4	896+15.87	60.88' RT



(A) 10" CRCP
(B) 13" FAST TRACK
(C) 1" ASB
(D) 6" CEMENT STAB. BASE
(E) 6" CEMENT TREAT. BASE
(F) 6" CURB
(G) C223 RAIL
(H) T223 RAIL
(I) 5" SIDEWALK
(J) 4" CONC. RIPRAP
(K) METAL BEAM GUARD FENCE
(L) GUARD RAIL END TREATMENT
(M) THRIE BEAM
(N) 15" FAST TRACK

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Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

PLAN AND PROFILE

SCALE: HORIZ. 1"= 50
VERT. 1"= 5'

SHEET 3 OF 5

FED.RD. DIV. NO.	PROJECT NO.		SHEET NO.
6			87
STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

9/28/2021 10:07:16 AM
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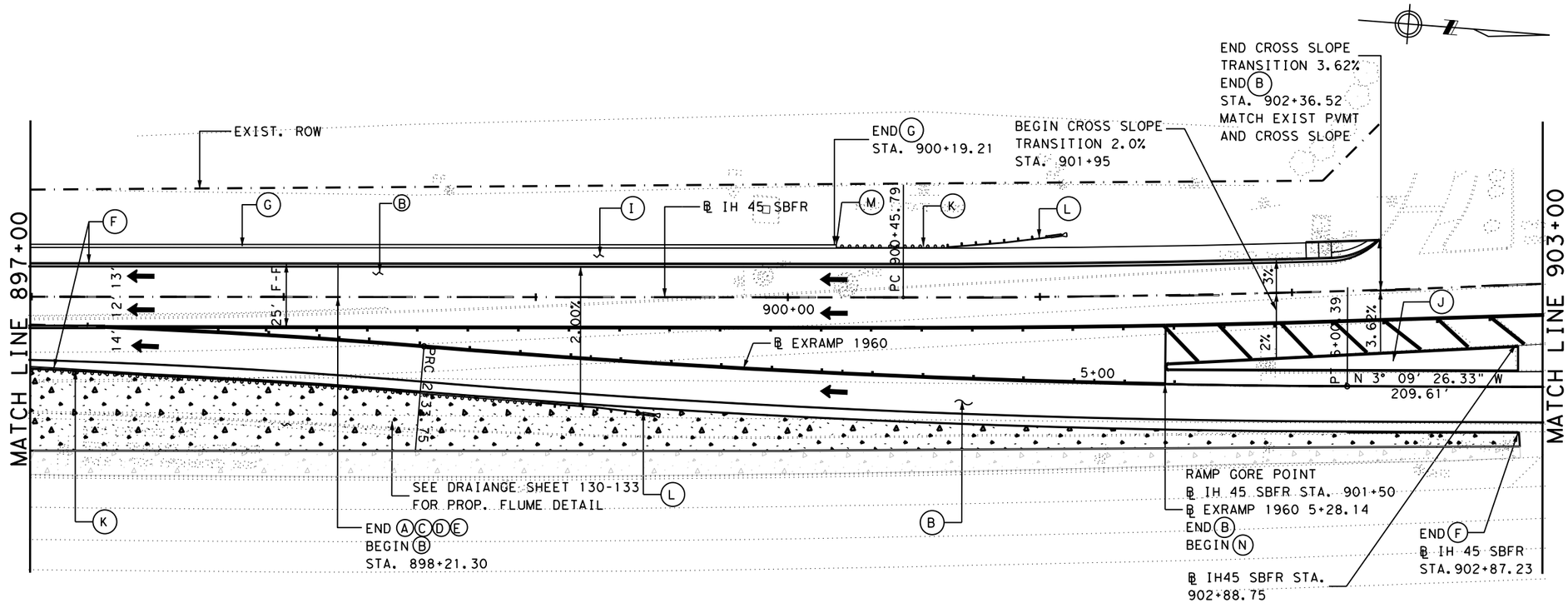

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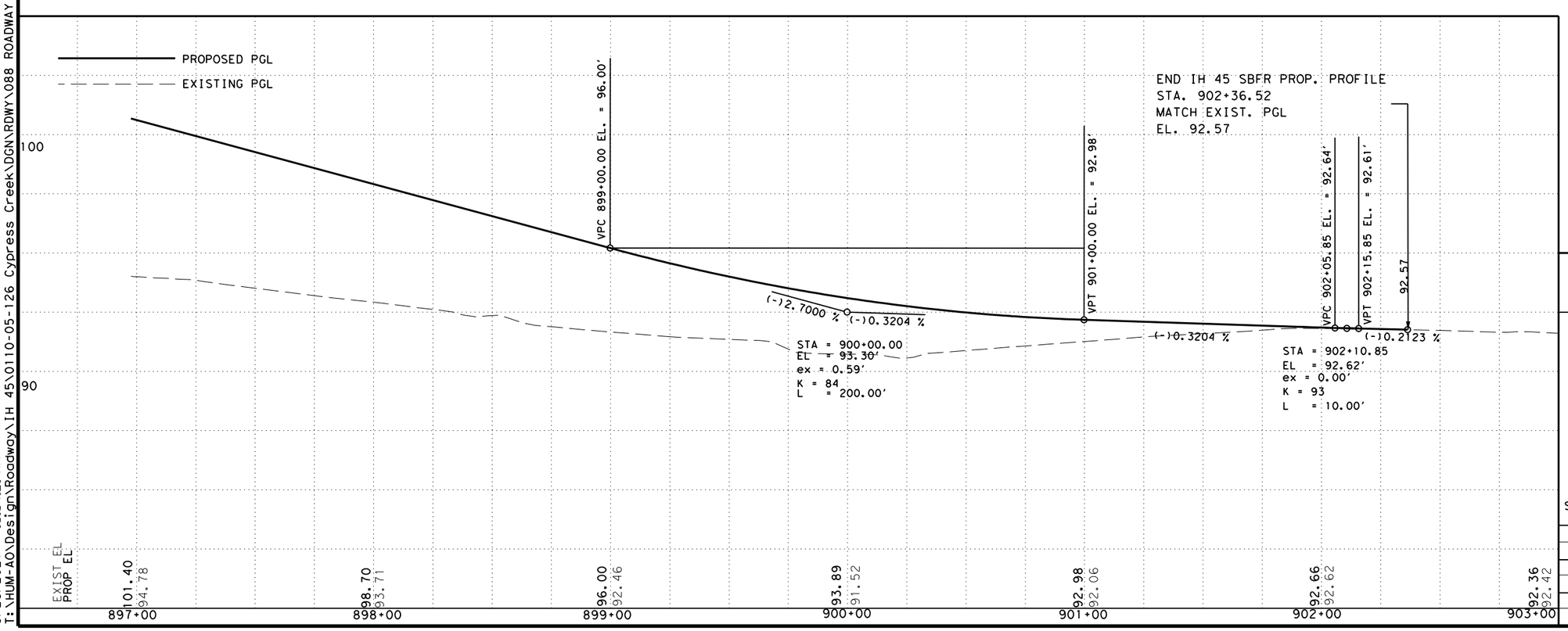

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SHARMEEN F. RAHMAN
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09/29/2021

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IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

PLAN AND PROFILE

SCALE: HORIZ. 1"= 50
VERT. 1"= 5'
SHEET 4 OF 5

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		88

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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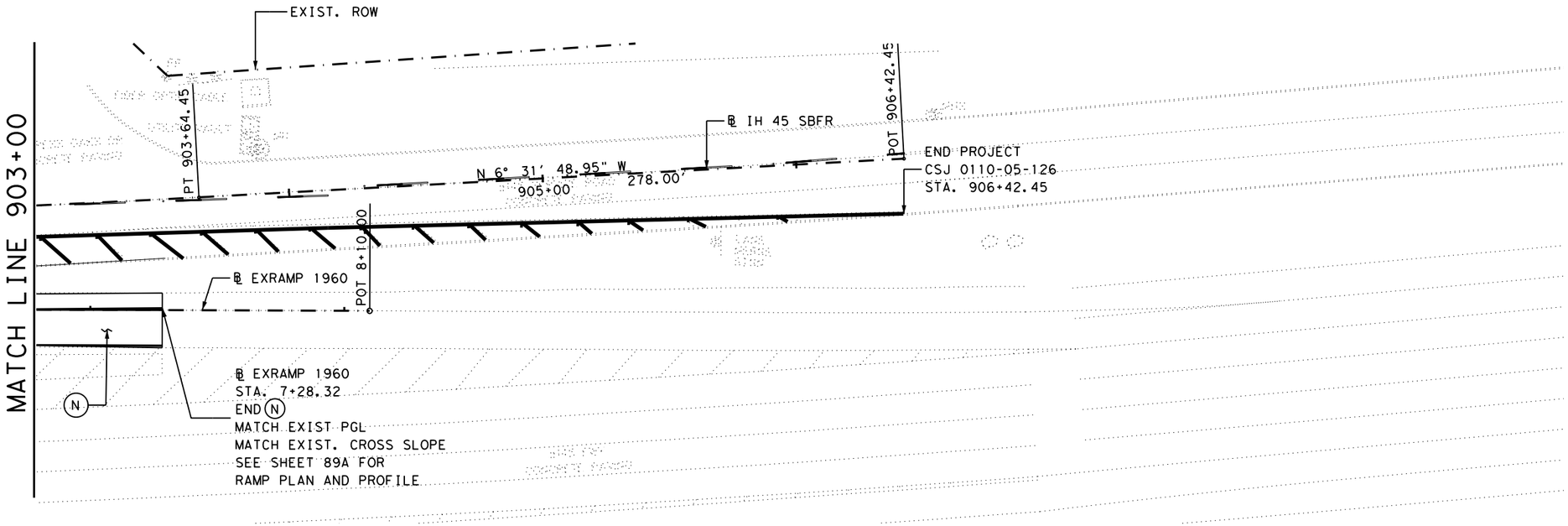

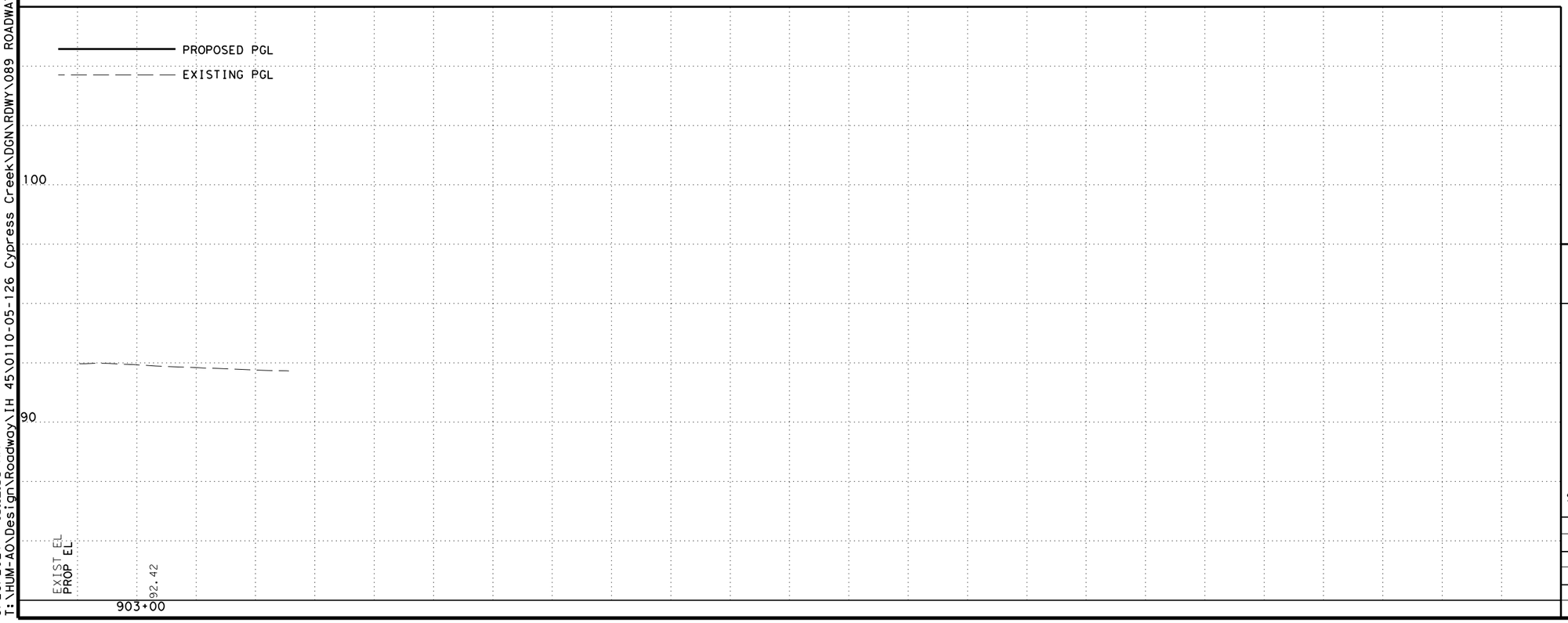

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IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

PLAN AND PROFILE

SCALE: HORIZ. 1"= 50
VERT. 1"= 5'

SHEET 5 OF 5

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		89

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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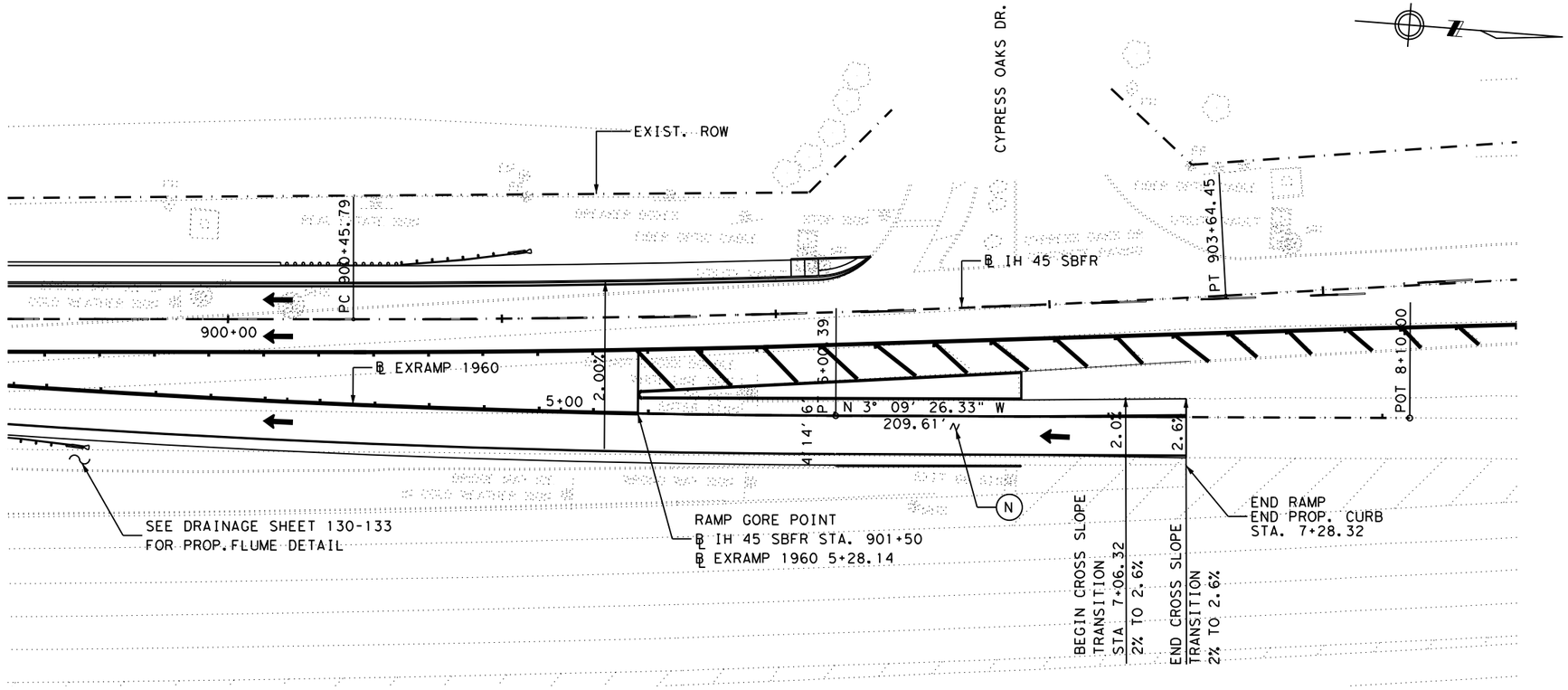

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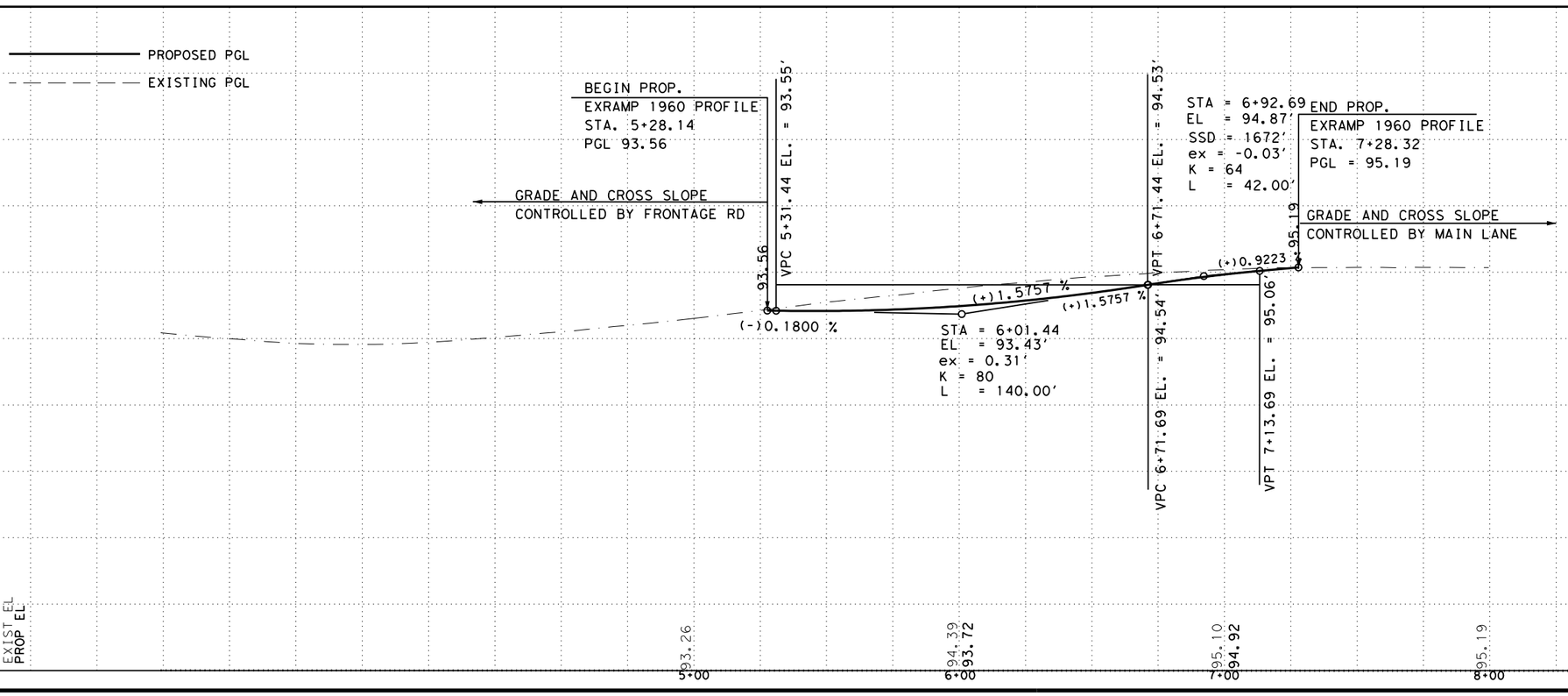

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99416
LICENSED PROFESSIONAL ENGINEER
STATE OF TEXAS

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09/29/2021

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IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

EXIT RAMP 1960
PLAN AND PROFILE

SCALE: HORIZ. 1"= 50
VERT. 1"= 5'

SHEET 1 OF 1

FED. RD. DIV. NO.	PROJECT NO.	SHEET NO.
6		89A

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

9/28/2021 10:01:49 AM
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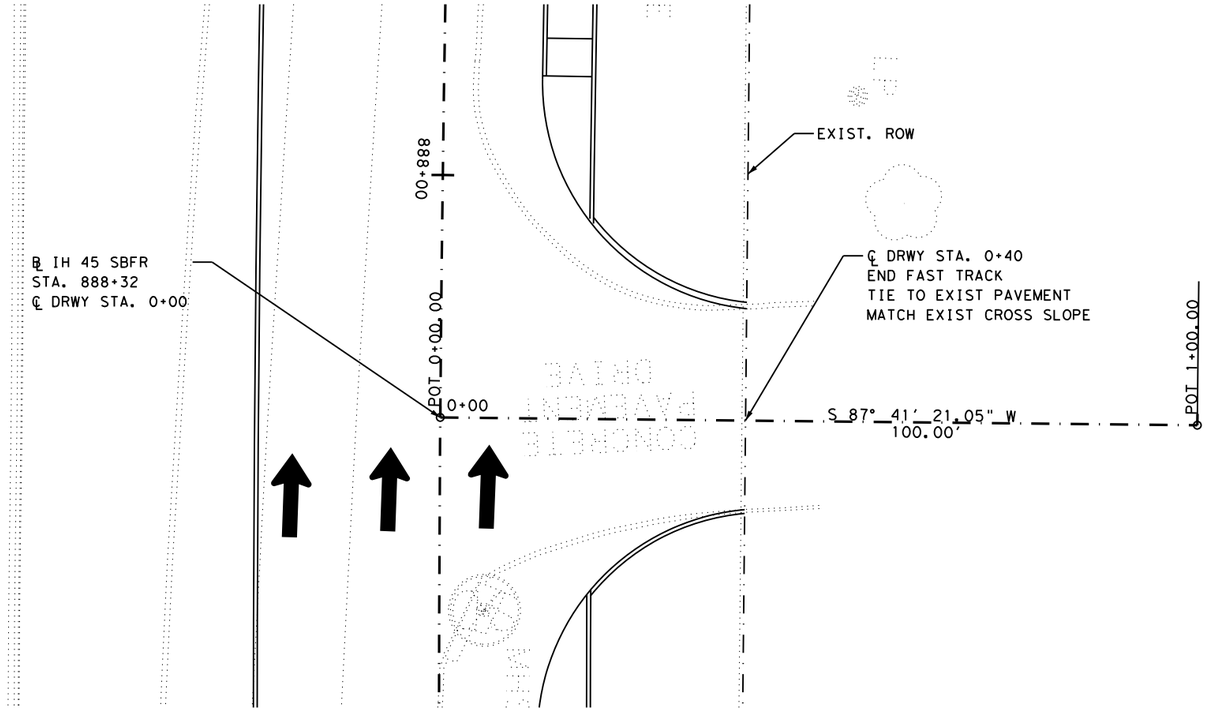

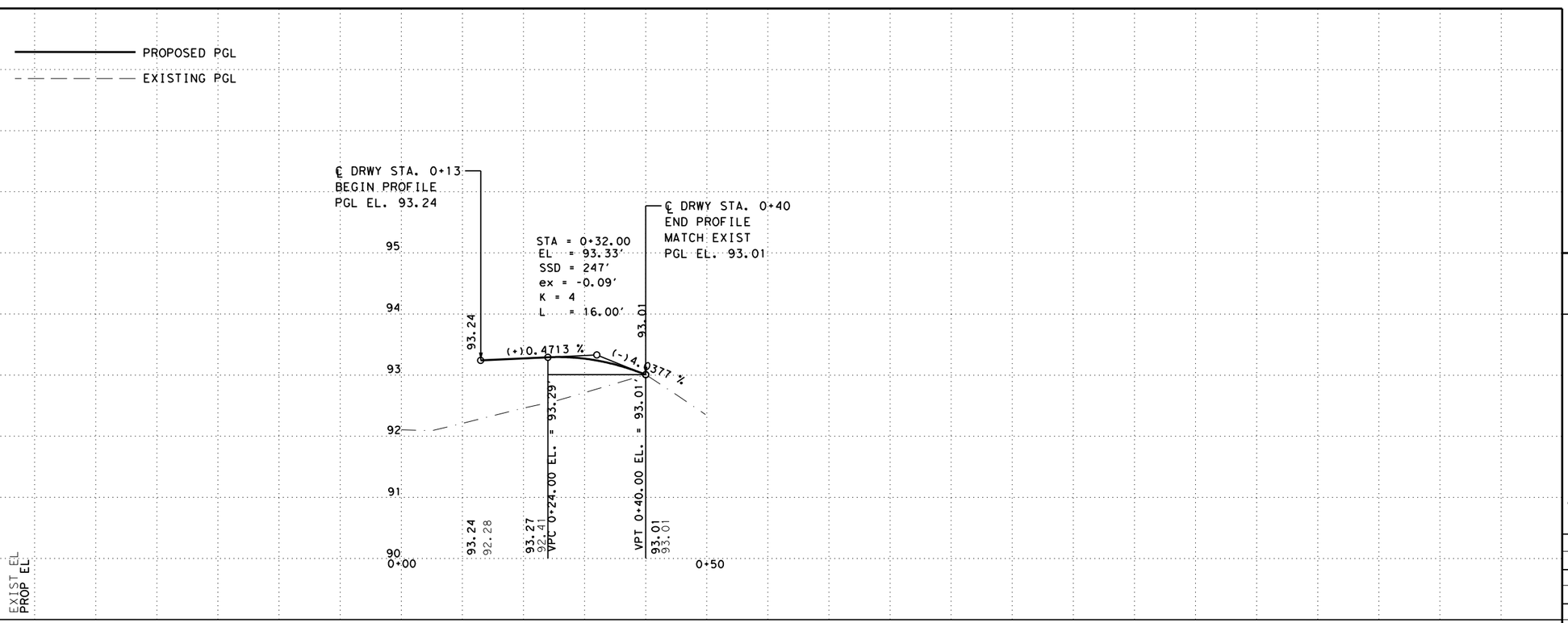

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LICENSED
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09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

DRIVEWAY PLAN AND PROFILE

SCALE: HORIZ. 1"= 20
VERT. 1"= 2'

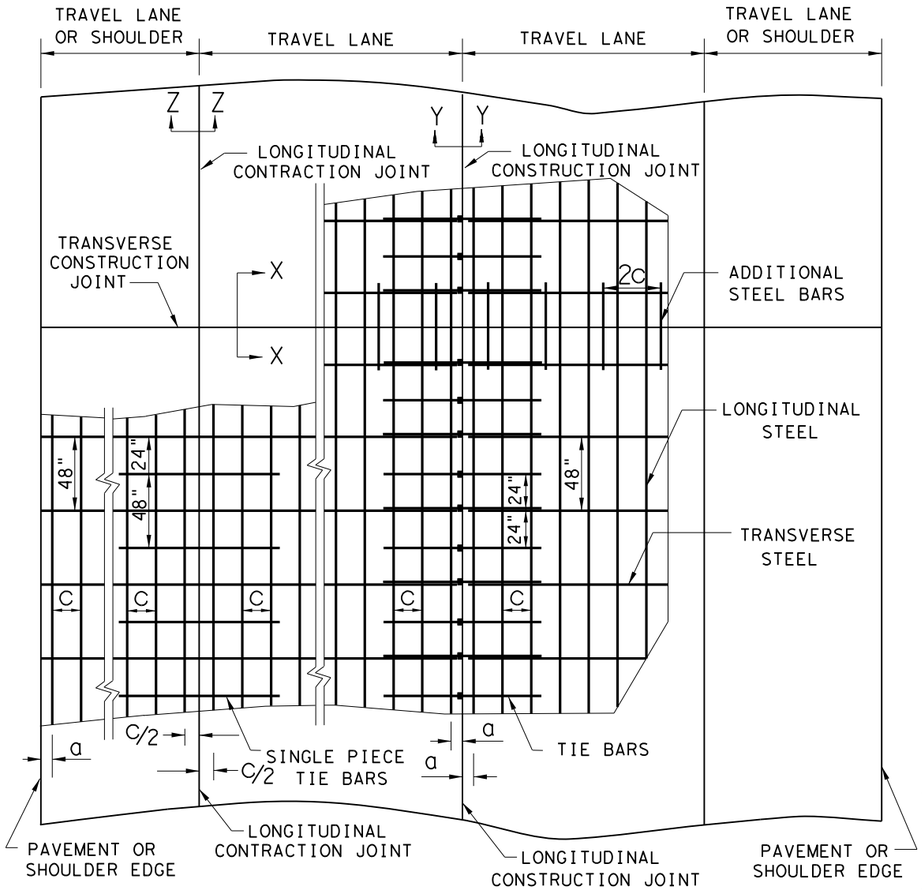
SHEET 1 OF 1

FED.RD. DIV.NO.	PROJECT NO.		SHEET NO.
6			89B
STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

DATE:
FILE:

TABLE NO. 1 LONGITUDINAL STEEL					
SLAB THICKNESS AND BAR SIZE		REGULAR STEEL BARS	FIRST SPACING AT EDGE OR JOINT	ADDITIONAL STEEL BARS AT TRANSVERSE CONSTRUCTION JOINT (SECTION X-X)	
T (IN.)	BAR SIZE	SPACING C (IN.)	SPACING a (IN.)	SPACING 2 X C (IN.)	LENGTH L (IN.)
7.0	#5	6.5	3 TO 4	13	50
7.5	#5	6.0	3 TO 4	12	50
8.0	#6	9.0	3 TO 4	18	50
8.5	#6	8.5	3 TO 4	17	50
9.0	#6	8.0	3 TO 4	16	50
9.5	#6	7.5	3 TO 4	15	50
10.0	#6	7.0	3 TO 4	14	50
10.5	#6	6.75	3 TO 4	13.5	50
11.0	#6	6.5	3 TO 4	13	50
11.5	#6	6.25	3 TO 4	12.5	50
12.0	#6	6.0	3 TO 4	12	50
12.5	#6	5.75	3 TO 4	11.5	50
13.0	#6	5.5	3 TO 4	11	50

TABLE NO. 2 TRANSVERSE STEEL AND TIE BARS						
SLAB THICKNESS (IN.)	TRANSVERSE STEEL		TIE BARS AT LONGITUDINAL CONTRACTION JOINT (SECTION Z-Z)		TIE BARS AT LONGITUDINAL CONSTRUCTION JOINT (SECTION Y-Y)	
	BAR SIZE	SPACING (IN.)	BAR SIZE	SPACING (IN.)	BAR SIZE	SPACING (IN.)
7.0 - 7.5	#5	48	#5	48	#5	24
8.0 - 13.0	#5	48	#6	48	#6	24

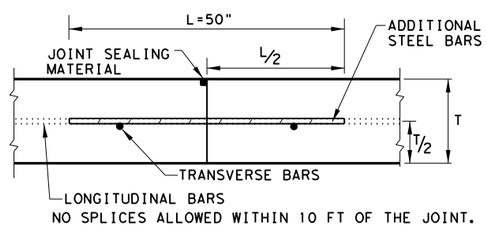


TYPICAL PAVEMENT LAYOUT

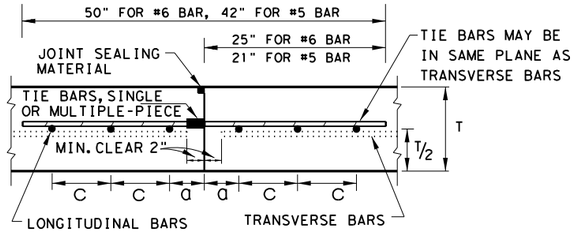
PLAN VIEW (NOT TO SCALE)

GENERAL NOTES

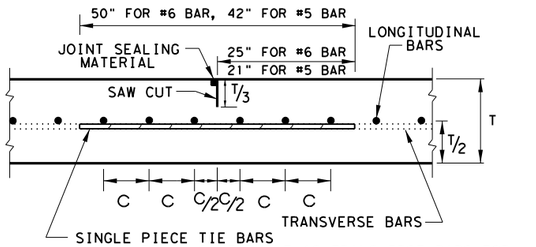
1. DETAILS FOR PAVEMENT WIDTH, PAVEMENT THICKNESS AND THE CROWN CROSS-SLOPE SHALL BE SHOWN ELSEWHERE IN THE PLANS. PAVEMENTS WIDER THAN 100 FT. WITHOUT A FREE LONGITUDINAL JOINT ARE NOT COVERED BY THIS STANDARD.
2. USE COARSE AGGREGATES WITH A RATED COEFFICIENT OF THERMAL EXPANSION (CoTE) OF NOT MORE THAN 5.5 X 10^{-6} IN/IN/ °F AS LISTED IN THE CONCRETE RATED SOURCE QUALITY CATALOG (CRSQC).
3. ALL THE REINFORCING STEEL AND TIE BARS SHALL BE DEFORMED STEEL BARS CONFORMING TO ASTM A 615 (GRADE 60) OR ASTM A 996 (GRADE 60) OR ABOVE. STEEL BAR SIZES AND SPACINGS SHALL CONFORM TO TABLE NO. 1 AND TABLE NO. 2.
4. STEEL BAR PLACEMENT TOLERANCE SHALL BE +/- 1 IN. HORIZONTALLY AND +/- 0.5 IN. VERTICALLY. CALCULATED AVERAGE BAR SPACING (CONCRETE PLACEMENT WIDTH / NUMBER OF LONGITUDINAL BARS) SHALL CONFORM TO TABLE NO. 1
5. PAVEMENT WIDTHS OF MORE THAN 15 FT. SHALL HAVE A LONGITUDINAL JOINT (SECTION Z-Z OR SECTION Y-Y). THESE JOINTS SHALL BE LOCATED WITHIN 6 IN. OF THE LANE LINE UNLESS THE JOINT LOCATION IS SHOWN ELSEWHERE ON THE PLANS.
6. THE SAW CUT DEPTH FOR THE LONGITUDINAL CONTRACTION JOINT (SECTION Z-Z) SHALL BE ONE THIRD OF THE SLAB THICKNESS (T/3).
7. WHEN TYING CONCRETE GUTTER AT A LONGITUDINAL JOINT, THE TIE BAR LENGTH OR POSITION MAY BE ADJUSTED. PROVIDE 3 IN. OF CONCRETE COVER FROM THE BACK OF GUTTER TO THE END OF TIE BAR.
8. REPLACE MISSING OR DAMAGED TIE BARS WITHOUT ADDITIONAL COMPENSATION BY DRILLING MIN. 10 IN. DEEP AND GROUTING TIE BARS WITH TYPE III, CLASS C EPOXY. MEET THE PULL-OUT TEST REQUIREMENTS IN ITEM 361.
9. OMIT TIE BARS LOCATED WITHIN 18-IN. OF THE TRANSVERSE CONSTRUCTION JOINTS (SECTION X-X). USE HAND-OPERATED IMMERSION VIBRATORS TO CONSOLIDATE THE CONCRETE ADJACENT TO ALL FORMED JOINTS.
10. LONGITUDINAL REINFORCING STEEL SPLICES SHALL BE A MINIMUM OF 25 IN. STAGGER THE LAP LOCATIONS SO THAT NO MORE THAN 1/3 OF THE LONGITUDINAL STEEL IS SPLICED IN ANY GIVEN 12-FT. WIDTH AND 2-FT. LENGTH OF THE PAVEMENT.
11. THE DETAIL FOR THE JOINT SEALANT AND RESERVOIR IS SHOWN ON STANDARD SHEET "CONCRETE PAVING DETAILS, JOINT SEALS."



TRANSVERSE CONSTRUCTION JOINT
SECTION X - X



LONGITUDINAL CONSTRUCTION JOINT
SECTION Y - Y



LONGITUDINAL CONTRACTION JOINT
SECTION Z - Z

Texas Department of Transportation

Design Division Standard

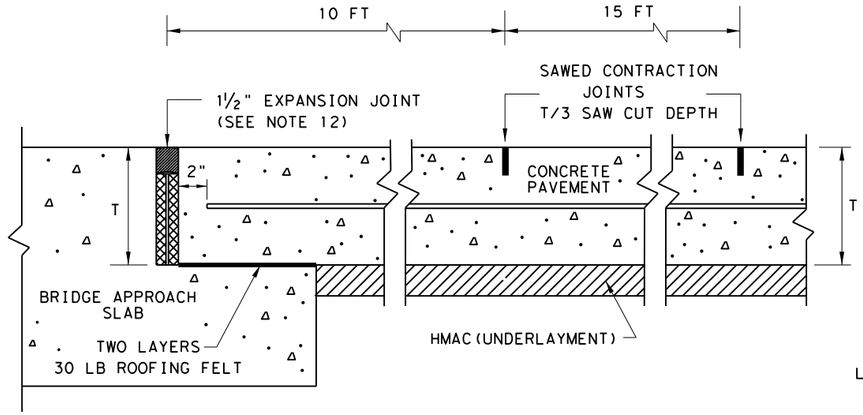
CONTINUOUSLY REINFORCED CONCRETE PAVEMENT

ONE LAYER STEEL BAR PLACEMENT T - 7 to 13 INCHES

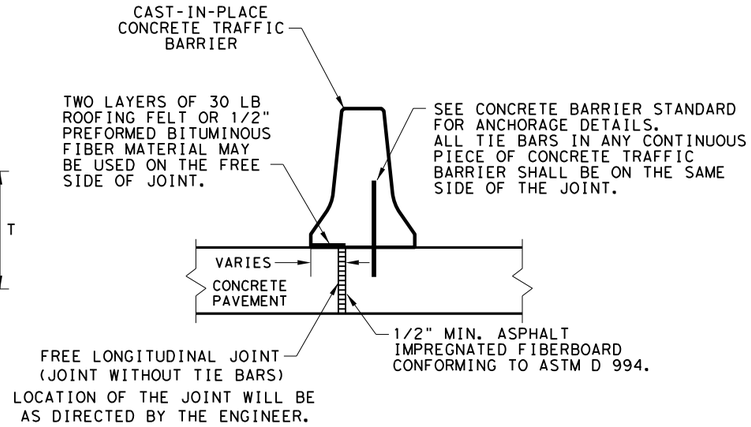
CRCP(1)-20

FILE: crcp120.dgn	DN: TxDOT	CK: KM	DW: AN	CK: VP
© TxDOT: APRIL 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS 10/10/2011 ADD GN #12 04/09/2013 REMOVE 6" AND 6.5" ADD CTE REQUIREMENTS 05/05/2017 CoTE AS RATED 4.3	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		90

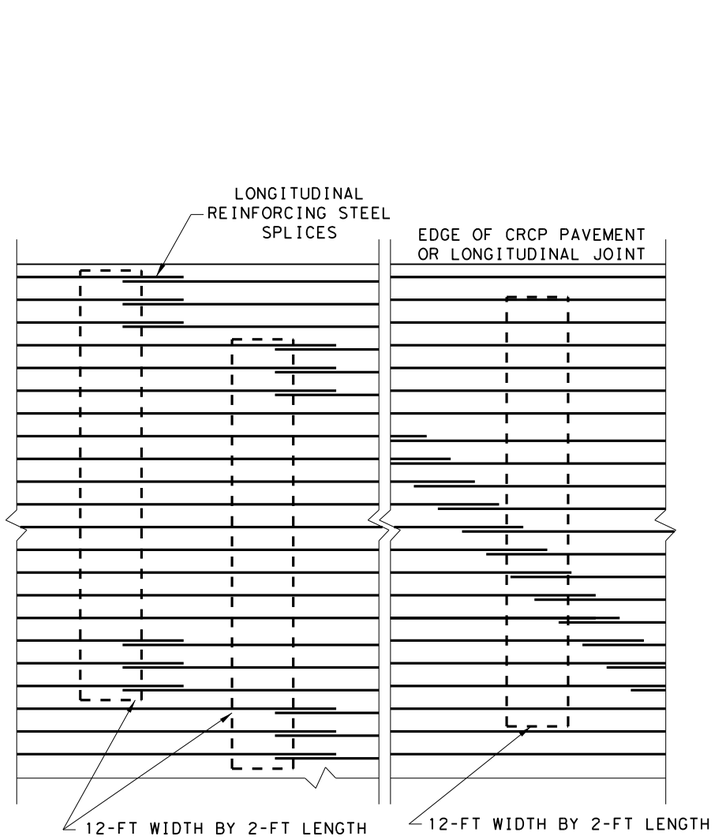
DATE:
FILE:



TRANSVERSE EXPANSION JOINT DETAIL
AT BRIDGE APPROACH

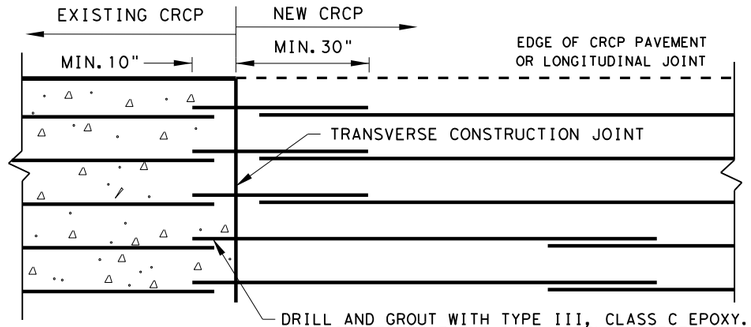


FREE LONGITUDINAL JOINT DETAIL

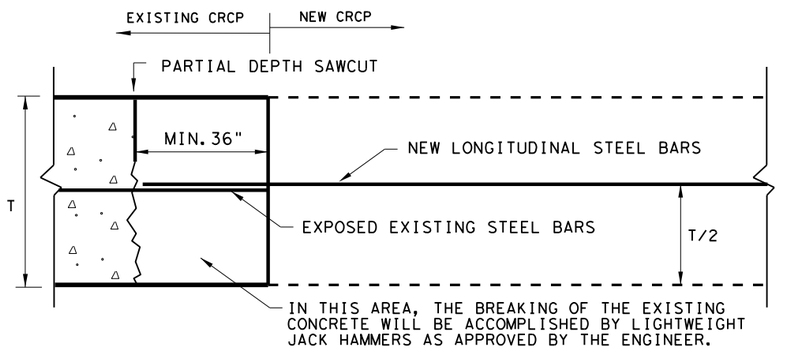


STAGGER THE LAP LOCATIONS SO THAT NO MORE THAN 1/3 OF THE LONGITUDINAL STEEL IS SPLICED IN ANY GIVEN 12-FT. WIDTH AND 2-FT. LENGTH OF THE PAVEMENT. ANY OTHER LAP CONFIGURATION MEETING THIS REQUIREMENT WILL BE ALLOWED.

EXAMPLES OF LAP CONFIGURATION
PLAN VIEW (NOT TO SCALE)

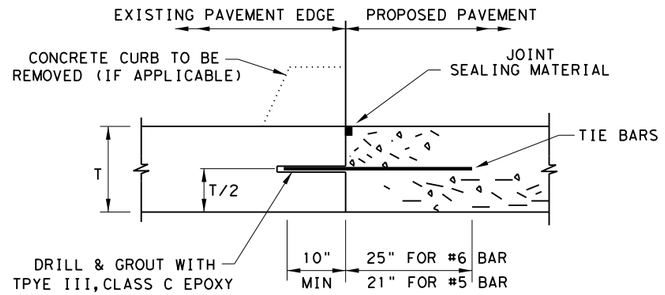


OPTION A: DRILL AND EPOXY
PLAN VIEW (NOT TO SCALE)



OPTION B: BREAKBACK AND LAP

TRANSVERSE TIE JOINT DETAIL
EXISTING CRCP TO NEW CRCP



1. BEFORE WIDENING WORK, DEMONSTRATE THAT THE BOND STRENGTH OF THE EPOXY-GROUTED TIE BARS MEETS THE REQUIRMENTS OF PULL-OUT TEST SPECIFIED IN ITEM 361.
2. SPACE TIE BARS AT 24" SPACING. USE #6 TIE BARS FOR 8" AND THICKER SLABS, USE #5 TIE BARS FOR LESS THAN 8" THICK SLABS.

LONGITUDINAL WIDENING JOINT DETAIL

Texas Department of Transportation

Design Division Standard

CONTINUOUSLY REINFORCED CONCRETE PAVEMENT

ONE LAYER STEEL BAR PLACEMENT
T - 7 to 13 INCHES

CRCP(1)-20

FILE: crcp120.dgn	DN: TxDOT	CK: KM	DW: AN	CK: VP
© TxDOT: APRIL 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS 03/16/2020 REMOVED TABLE 1A	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		91

DATE:
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TABLE NO. 1 LONGITUDINAL STEEL

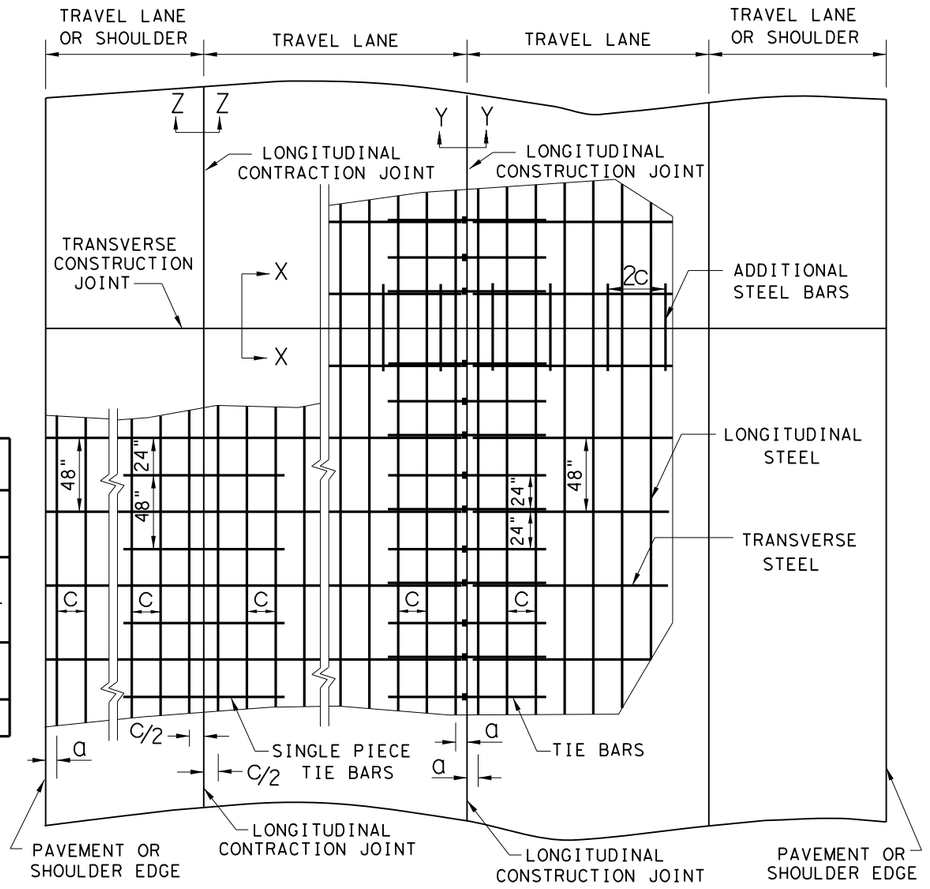
SLAB THICKNESS AND BAR SIZE		FOR BOTH STEEL MATS		FOR TOP STEEL MAT ONLY	
		REGULAR STEEL BARS	FIRST SPACING AT EDGE OR JOINT	ADDITIONAL STEEL BARS AT TRANSVERSE CONSTRUCTION JOINT (SECTION X-X)	
T (IN.)	BAR SIZE	SPACING c (IN.)	SPACING a (IN.)	SPACING 2 x c (IN.)	LENGTH L (IN.)
14	#6	9.5	3 TO 4	19	50
15	#6	8.5	3 TO 4	17	50

TABLE NO. 2 TRANSVERSE STEEL AND TIE BARS

SLAB THICKNESS T (IN.)	FOR BOTH STEEL MATS		FOR LOWER STEEL MAT ONLY		FOR BOTH STEEL MATS	
	TRANSVERSE STEEL		TIE BARS AT LONGITUDINAL CONTRACTION JOINT (SECTION Z-Z)		TIE BARS AT LONGITUDINAL CONSTRUCTION JOINT (SECTION Y-Y)	
	BAR SIZE	SPACING (IN.)	BAR SIZE	SPACING (IN.)	BAR SIZE	SPACING (IN.)
14 - 15	#5	48	#6	48	#6	24

TABLE NO. 3
TWO LAYER STEEL PLACEMENT
HEIGHT OF STEEL MATS

SLAB THICKNESS T (IN.)	LOWER STEEL MAT HEIGHT T1 (IN.)	TOP STEEL MAT HEIGHT T2 (IN.)
14	4.5	8.0
15	5.0	8.5

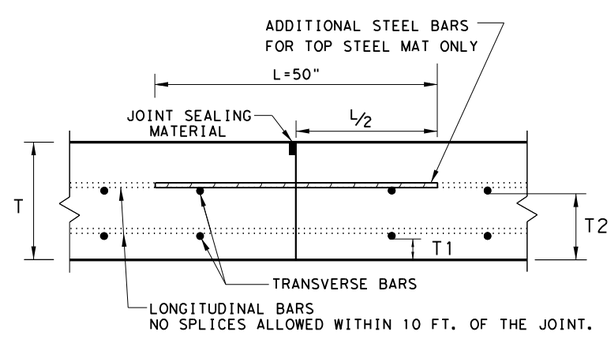


TYPICAL PAVEMENT LAYOUT

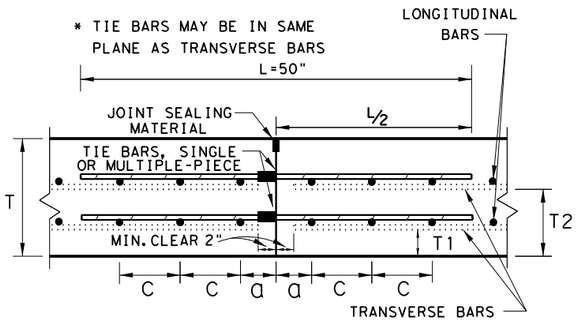
PLAN VIEW (NOT TO SCALE)

GENERAL NOTES

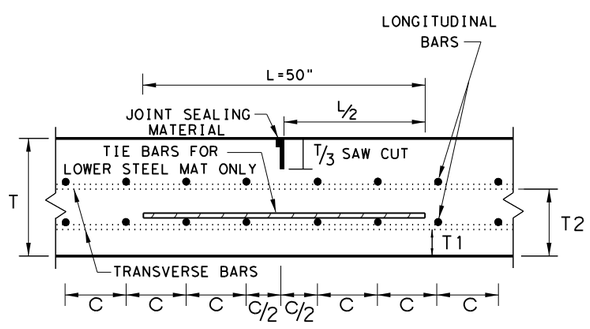
1. DETAILS FOR PAVEMENT WIDTH, PAVEMENT THICKNESS AND THE CROWN CROSS-SLOPE SHALL BE SHOWN ELSEWHERE IN THE PLANS. PAVEMENTS WIDER THAN 100 FT. WITHOUT A FREE LONGITUDINAL JOINT ARE NOT COVERED BY THIS STANDARD.
2. USE COARSE AGGREGATES WITH A RATED COEFFICIENT OF THERMAL EXPANSION (CoTE) OF NOT MORE THAN 5.5 X 10^{-6} IN/IN/°F AS LISTED IN THE CONCRETE RATED SOURCE QUALITY CATALOG (CRSQC).
3. ALL THE REINFORCING STEEL AND TIE BARS SHALL BE DEFORMED STEEL BARS CONFORMING TO ASTM A 615 (GRADE 60) OR ASTM A 996 (GRADE 60) OR ABOVE. STEEL BAR SIZES ANS SPACINGS SHALL CONFORM TO TABLE NO. 1, TABLE NO. 2 AND TABLE NO. 3.
4. STEEL BAR PLACEMENT TOLERANCE SHALL BE +/- 1 IN. HORIZONTALLY AND +/- 0.5 IN. VERTICALLY. CALCULATED AVERAGE BAR SPACING (CONCRETE PLACEMENT WIDTH / NUMBER OF LONGITUDINAL BARS) SHALL CONFORM TO TABLE NO. 1.
5. PAVEMENT WIDTHS OF MORE THAN 15 FT. SHALL HAVE A LONGITUDINAL JOINT (SECTION Z-Z OR SECTION Y-Y). THESE JOINTS SHALL BE LOCATED WITHIN 6 IN. OF THE LANE LINE UNLESS THE JOINT LOCATION IS SHOWN ELSEWHERE ON THE PLANS.
6. THE SAW CUT DEPTH FOR THE LONGITUDINAL CONTRACTION JOINT (SECTION Z-Z) SHALL BE ONE THIRD OF THE SLAB THICKNESS (T/3).
7. WHEN TYING CONCRETE GUTTER AT A LONGITUDINAL JOINT, THE TIE BAR LENGTH OR POSITION MAY BE ADJUSTED. PROVIDE 3 IN. OF CONCRETE COVER FROM THE BACK OF GUTTER TO THE END OF TIE BAR.
8. REPLACE MISSING OR DAMAGED TIE BARS WITHOUT ADDITIONAL COMPENSATION BY DRILLING MIN. 10 IN. DEEP AND GROUTING TIE BARS WITH TYPE III, CLASS C EPOXY. MEET THE PULL-OUT TEST REQUIREMENTS IN ITEM 361.
9. OMIT TIE BARS LOCATED WITHIN 18 IN. OF THE TRANSVERSE CONSTRUCTION JOINTS (SECTION X-X). USE HAND-OPERATED IMMERSION VIBRATORS TO CONSOLIDATE THE CONCRETE ADJACENT TO ALL FORMED JOINTS.
10. LONGITUDINAL REINFORCING STEEL SPLICES SHALL BE A MINIMUM OF 25 IN. STAGGER THE LAP LOCATIONS SO THAT NO MORE THAN 1/3 OF THE LONGITUDINAL STEEL IS SPLICED IN ANY GIVEN 12-FT. WIDTH AND 2-FT. LENGTH OF THE PAVEMENT.
11. THE DETAIL FOR THE JOINT SEALANT AND RESERVOIR IS SHOWN ON STANDARD SHEET "CONCRETE PAVING DETAILS, JOINT SEALS."



TRANSVERSE CONSTRUCTION JOINT
SECTION X - X



LONGITUDINAL CONSTRUCTION JOINT
SECTION Y - Y



LONGITUDINAL CONTRACTION JOINT
SECTION Z - Z

SHEET 1 OF 2

Texas Department of Transportation — Design Division Standard

CONTINUOUSLY REINFORCED CONCRETE PAVEMENT

TWO LAYER STEEL BAR PLACEMENT T - 14 & 15 INCHES

CRCP(2)-20

FILE: crcp220.dgn	DN: TxDOT	CK: KM	DW: AN	CK: VP
© TxDOT: APRIL 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS 10/10/2011 ADD ON #12 04/09/2013 REMOVE 6" AND 6.5" ADD CTE REQUIREMENTS 04/19/2017 CoTE AS RATED 4.3	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		92

DATE:
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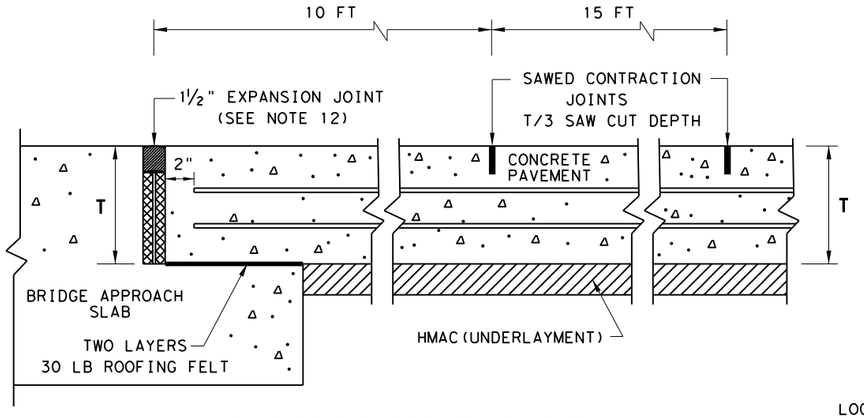
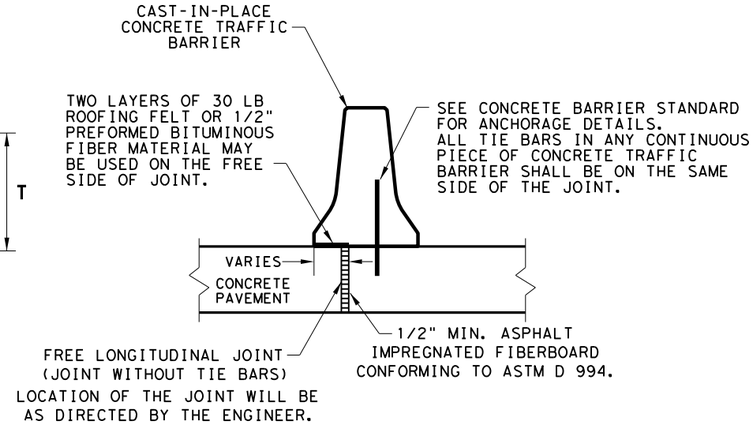
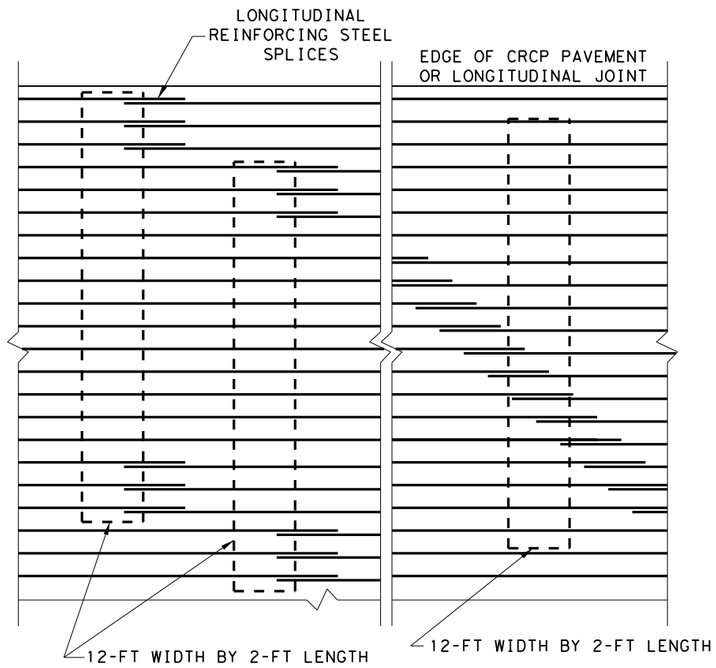


TRANSVERSE EXPANSION JOINT DETAIL
AT BRIDGE APPROACH



FREE LONGITUDINAL JOINT DETAIL



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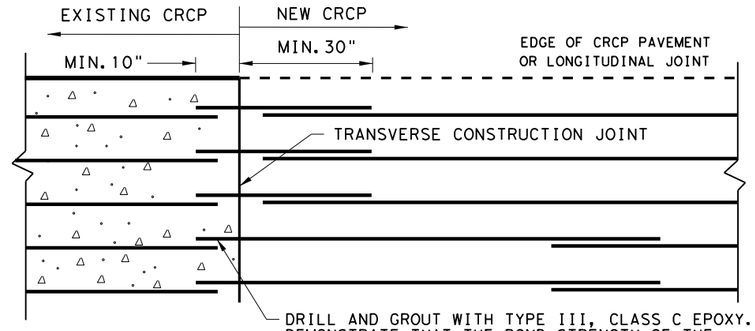
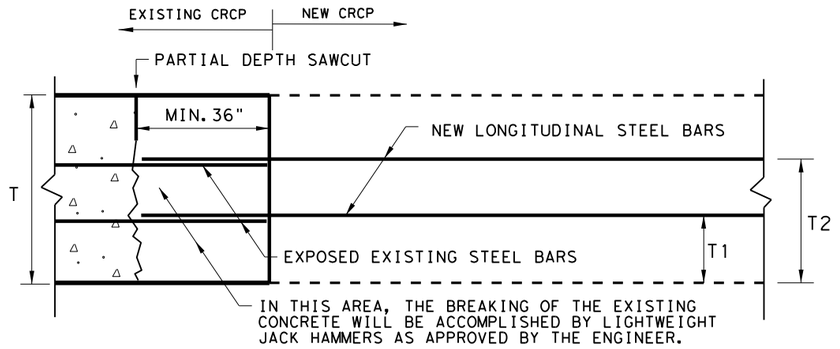
EXAMPLES OF LAP CONFIGURATION
PLAN VIEW (NOT TO SCALE)

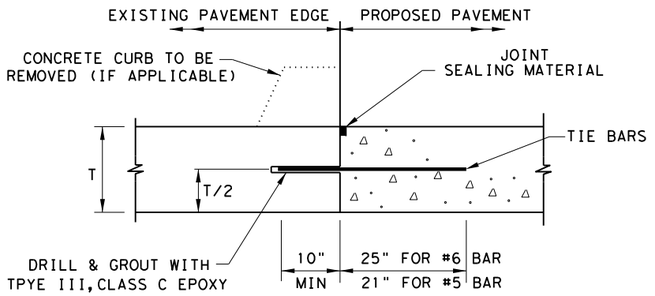


OPTION A: DRILL AND EPOXY
PLAN VIEW (NOT TO SCALE)



OPTION B: BREAKBACK AND LAP

TRANSVERSE TIE JOINT DETAIL
EXISTING CRCP TO NEW CRCP



1. BEFORE WIDENING WORK, DEMONSTRATE THAT THE BOND STRENGTH OF THE EPOXY-GROUTED TIE BARS MEETS THE REQURIMENTS OF PULL-OUT TEST SPECIFIED IN ITEM 361.
2. SPACE TIE BARS AT 24" SPACING. USE #6 TIE BARS FOR 8" AND THICKER SLABS, USE #5 TIE BARS FOR LESS THAN 8" THICK SLABS.

LONGITUDINAL WIDENING JOINT DETAIL

Texas Department of Transportation

Design Division Standard

CONTINUOUSLY REINFORCED CONCRETE PAVEMENT

TWO LAYER STEEL BAR PLACEMENT T - 14 & 15 INCHES

CRCP(2)-20

FILE: crcp220.dgn	DN: TxDOT	CK: KM	DW: AN	CK: VP
© TxDOT: APRIL 2020	CONT	SECT	JOB	HIGHWAY
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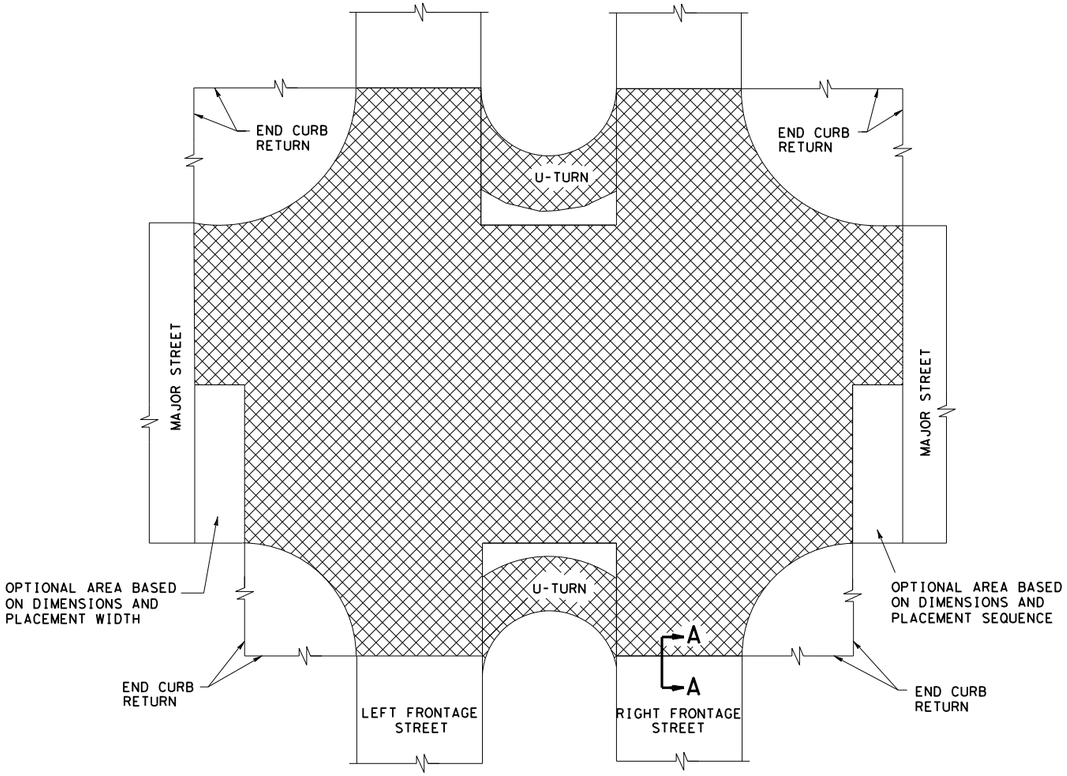


FIGURE 2

INTERSECTION OF MAJOR STREET
WITH FRONTAGE STREET

FAST TRACK PAVING AREA

TYPICAL PAVING PLANS

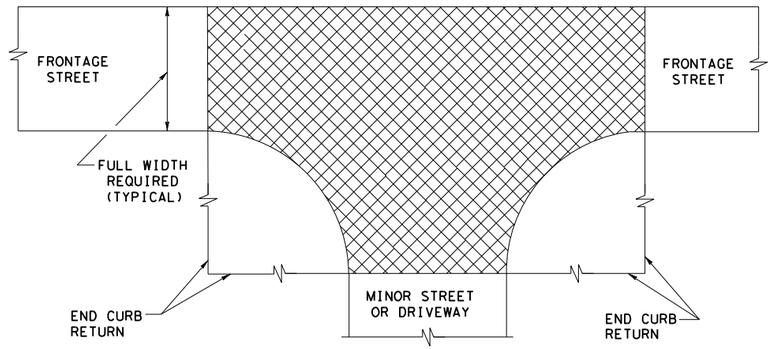


FIGURE 3

INTERSECTION OF MINOR STREET OR
DRIVEWAY WITH FRONTAGE STREET

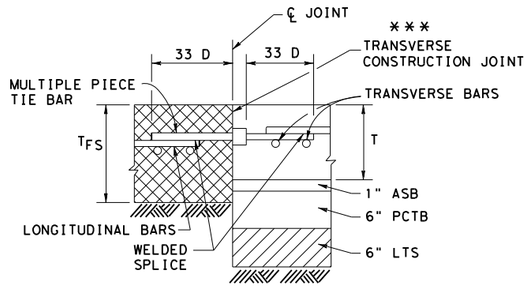
TABLE 1

EQUIVALENT PAVEMENT THICKNESS	
T * (IN.)	T_{FS} ** (IN.)
<=12"	T+3"
>12"	15"

*WITH BASE STRUCTURE OF:
1" ASPHALT STABILIZED BASE
6" PORTLAND CEMENT TREATED BASE
6" LIME TREATED SUBGRADE

**ON AS CUT SUBGRADE

***SEE JOINT SEALING DETAILS ON CRCP STANDARDS



SINGLE MAT

TRANSVERSE CONSTRUCTION JOINTS

SECTION A - A
FIGURE 1

GENERAL NOTES

1. DEFINITION OF TERMS

   T_{FS} - FAST TRACK CONCRETE PAVING DEPTH AT INTERSECTIONS AND LEAVE OUTS.
   T - NOMINAL CONCRETE PAVING DEPTH AS SHOWN IN THE PLANS.
   DETERMINE FAST TRACK CONCRETE PAVING DEPTH USING TABLE 1 AND THE NOMINAL CONCRETE PAVING DEPTH "T" SHOWN IN THE PLANS.

2. AT INTERSECTIONS AND LEAVE-OUT LOCATIONS USE THE SAME LONGITUDINAL AND TRANSVERSE BAR SPACING FOR THE FAST TRACK PAVING AREA AS THAT USED FOR THE ADJACENT CONCRETE PAVING DEPTH "T"(EXCEPT BAR SIZE SHALL BE #7 ON SINGLE MAT). FOR SINGLE MAT FAST TRACK PAVING, PLACE THE LONGITUDINAL AND TRANSVERSE BARS FOR THE FAST TRACK PAVING AREA AT THE HORIZONTAL PLANE ELEVATION THAT IS TWO TIE-BAR DIAMETERS LOWER THAN THAT USED FOR THE ADJACENT CONCRETE PAVEMENT DEPTH "T", AS SHOWN IN FIGURE 1. USE SINGLE MAT STEEL IN FAST TRACK PAVING AREAS ADJACENT TO PAVEMENT SLABS WITH SINGLE MAT REINFORCING. USE DOUBLE MAT STEEL IN FAST TRACK PAVING AREAS ADJACENT TO PAVEMENT SLABS WITH DOUBLE MAT REINFORCING.

3. THE REQUIRED FAST TRACK PAVING AREAS WILL BE SHOWN ON THE PLANS. THE CONTRACTOR HAS THE OPTION TO UTILIZE FAST TRACK CONCRETE PAVING AT U-TURNS, AT INTERSECTIONS, AT MINOR STREETS, AND AT DRIVEWAYS WITH FRONTAGE ROAD LEAVE-OUT AREAS THAT ARE NOT SHOWN ON THE PLANS, WITH PRIOR WRITTEN APPROVAL FROM THE ENGINEER. TYPICAL PAVING PLANS FOR THE INTERSECTION OF A MAJOR STREET WITH THE FRONTAGE ROAD ARE SHOWN AS FIGURE 2, AND FOR THE INTERSECTION OF A MINOR STREET OR DRIVEWAY WITH THE FRONTAGE ROAD AS FIGURE 3. FAST TRACK PAVE THE FRONTAGE ROAD FOR THE FULL FRONTAGE ROAD WIDTH AND PLACE IN STAGES AS REQUIRED.

4. USE ADDITIONAL #6 REINFORCING STEEL BARS (MINIMUM 42 INCHES LONG) AND SPACE THEM MIDWAY BETWEEN ALTERNATE LONGITUDINAL BARS ALONG THE THE TRANSVERSE CONSTRUCTION JOINT FORMED AT THE FAST TRACK PAVING INTERFACE (T_{FS}) WITH THE ADJACENT PAVEMENT SLAB (T).

5. SPLICE LENGTH IS A MINIMUM OF 33 TIMES THE NOMINAL STEEL DIAMETER.

6. PLACE THE CONCRETE PLACEMENT AT A UNIFORM DEPTH THROUGHOUT THE FAST TRACK CONCRETE PAVING AREA.

7. FOR CONTINUOUS SECTIONS OF ROADWAY WHERE FAST TRACK PAVING IS THE PRIMARY PAVEMENT TYPE, USE THE BAR SIZE AND SPACING FROM THE CRCP STANDARDS THAT CORRESPONDS TO THE FAST TRACK SLAB THICKNESS.

8. USE LONGITUDINAL TIE-BARS OF THE SAME SIZE DIAMETER AND SPACING AS THE LONGITUDINAL BAR. A SINGLE PIECE TIE-BAR MAY BE USED IF THE 33 TIMES DIAMETER TIE-BAR PROJECTION DOES NOT INTERFERE WITH THE SAFE HANDLING OF TRAFFIC.

9. BASE THE DEPTH OF SAW CUTS FOR SAWED JOINTS ON THE FAST TRACK CONCRETE PAVEMENT THICKNESS.

10. THIS STANDARD IS NOT INTENDED TO REPLACE OTHER STANDARDS EXCEPT WHERE SPECIFICALLY STATED HEREIN. FOR PAVING DETAILS NOT SHOWN ON THIS DRAWING, REFER TO THE STANDARD SHEETS FOR CONTINUOUSLY REINFORCED CONCRETE PAVEMENT SHOWN ELSEWHERE IN THE PLANS.

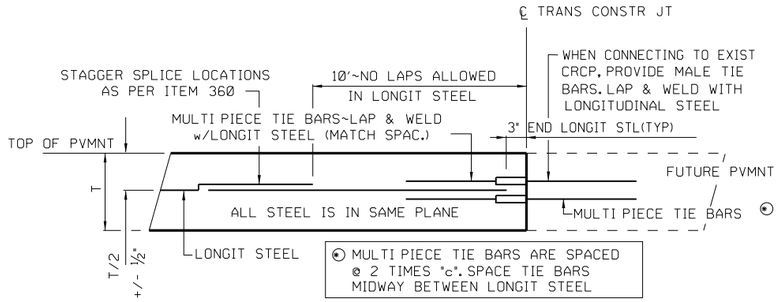
LEGEND

ASB - ASPHALT STABILIZED BASE
CRCP - CONTINUOUSLY REINFORCED CONCRETE PAVEMENT
D - DIAMETER
LTS - LIME TREATED SUBGRADE
PCTB - PORTLAND CEMENT TREATED BASE

Texas Department of Transportation
Houston District

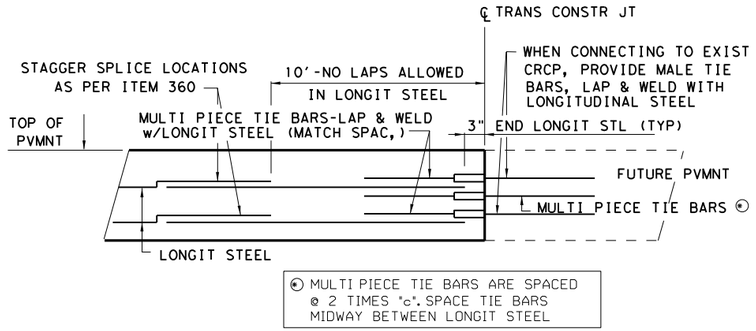
FAST TRACK CONTINUOUSLY REINFORCED CONCRETE PAVEMENT
DETAILS
CRCP-FT

FILE: STDB-4.dgn	DN:	CK:	DW:	CK:	
© TxDOT DEC. 2009	DIST	FED REG	PROJECT NO.		SHEET
REVISIONS 5/05 2004 SPECS 2/15 2014 SPECS	HOU	6			94
	COUNTY		CONTROL	SECT	JOB	HIGHWAY
	HARRIS		0110	05	126	IH 45



SECTION - SINGLE STEEL MAT

AT END OF PROJECT OR TEMPORARY END OF PAVEMENT



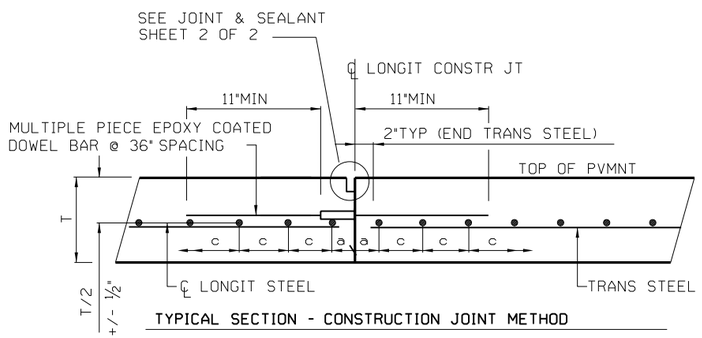
SECTION - DOUBLE STEEL MAT

AT END OF PROJECT OR TEMPORARY END OF PAVEMENT

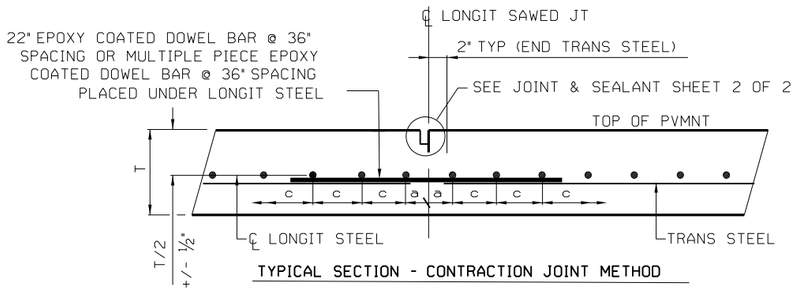
LONGITUDINAL DOWEL JOINT DETAILS

LOCATE WHERE SHOWN IN THE PLANS OR AS APPROVED. CONTRACTOR MAY USE EITHER METHOD

SINGLE STEEL MAT

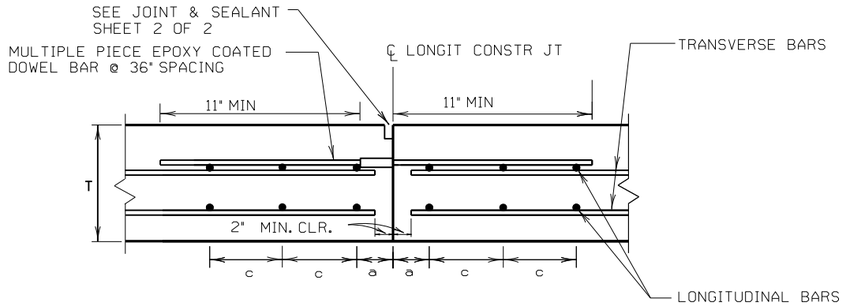


TYPICAL SECTION - CONSTRUCTION JOINT METHOD

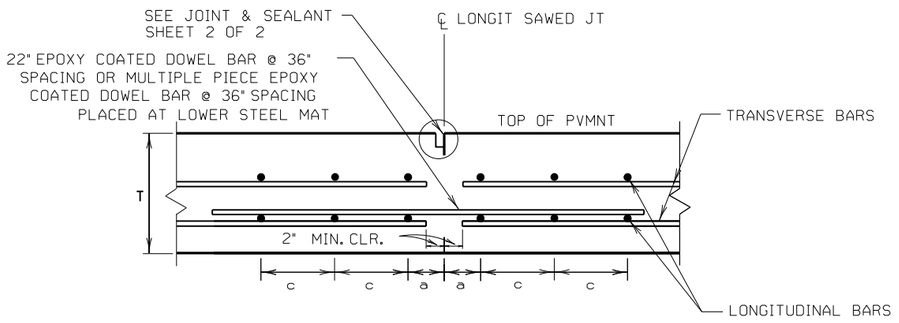


TYPICAL SECTION - CONTRACTION JOINT METHOD

DOUBLE STEEL MAT



TYPICAL SECTION - CONSTRUCTION JOINT METHOD



TYPICAL SECTION - CONTRACTION JOINT METHOD

GENERAL NOTES

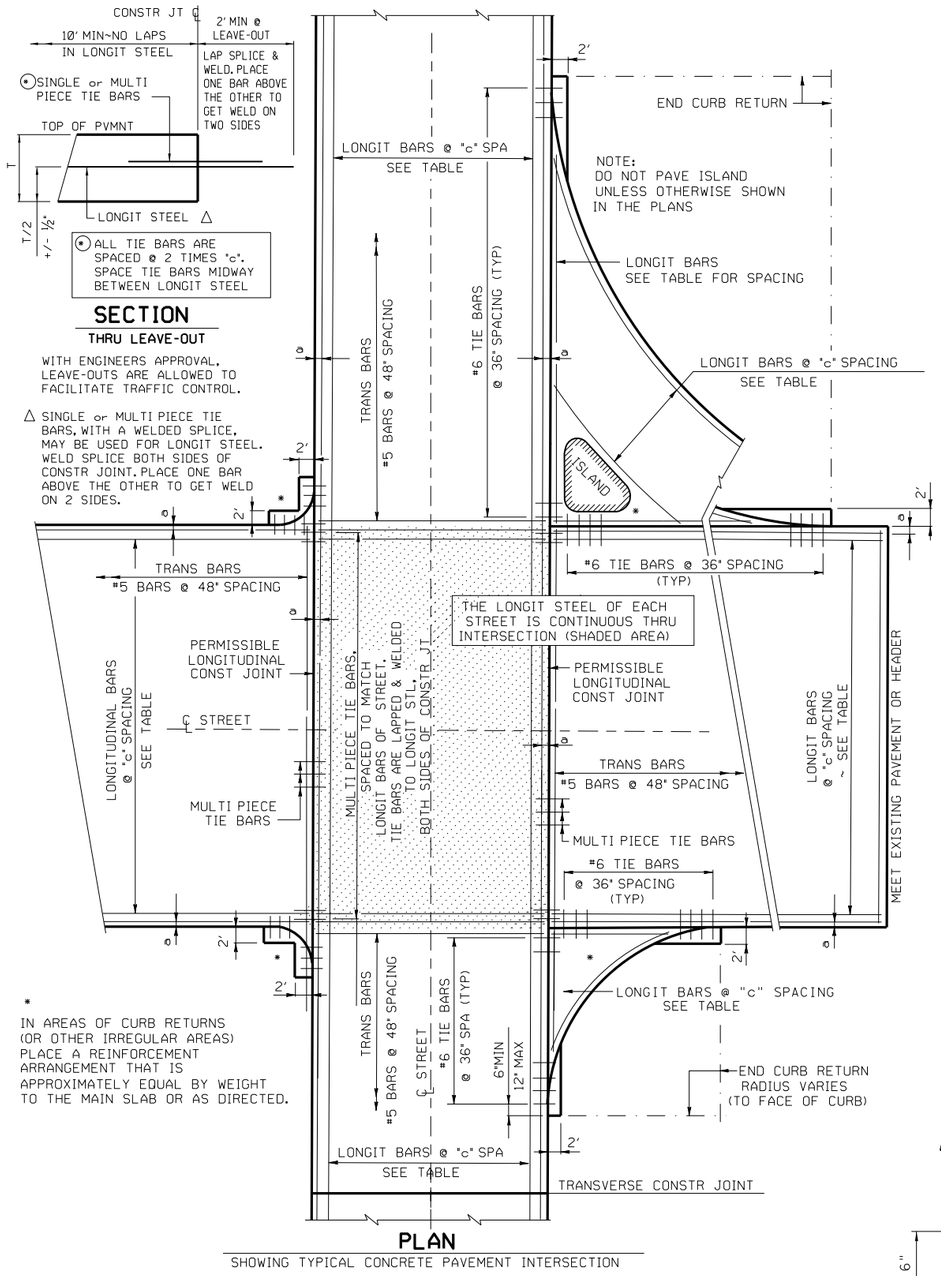
1. DETAILS FOR 7.0 IN. TO 13.0 IN. THICK CONCRETE PAVEMENT ARE SHOWN ON STANDARD CRCP(1)-17. DETAILS FOR 14 IN. TO 15 IN. THICK CONCRETE PAVEMENT ARE SHOWN ON STANDARD CRCP(2)-17.
2. DOWELS AND TIE BARS - DOWELS ARE ONE INCH MINIMUM DIAMETER. ENSURE DOWELS ARE FREE OF GREASE AND ARE EPOXY COATED. DO NOT SHEAR CUT DOWELS DURING FABRICATION. PROVIDE TIE BARS PER ITEM 360. FURNISH MULTI PIECE TIE BARS AND DOWELS WITH STOP COUPLINGS AND WITH THREADS ON THE BARS.
3. USE CHAIRS OF SUFFICIENT STRUCTURAL QUALITY AND NUMBER TO SUPPORT THE MAT TO THE VERTICAL TOLERANCES. CHAIRS WILL BE APPROVED BY THE ENGINEER AND DO NOT REQUIRE GALVANIZING.
4. MECHANICALLY PLACING REINFORCING STEEL IS NOT ALLOWED. NO BARS, DOWELS OR TIE BARS MAY BE VIBRATED INTO POSITION.
5. WHERE DIFFERENT THICKNESS PAVEMENTS MEET, TRANSITION THE THINNER SECTION TO THE THICKER SECTION OVER A DISTANCE OF 20 FT. PLACE REINFORCING STEEL WITHIN THE TRANSITION THE SAME AS IN THE THICKER PAVEMENT.
6. PERFORM WELDING PER ITEM 448. FURNISH WELDABLE REBAR PER ITEM 440.

Texas Department of Transportation
Houston District

CONTINUOUSLY REINFORCED CONCRETE PAVEMENT HOUSTON SUPPLEMENT CRCP-HS

REVISIONS
4/12 CHANGED CTE FROM 6.0 TO 5.0
8/14 UPDATE TO REFERENCE CRCP-13 STND.
2/15 REVISED GENERAL NOTES, MINOR CORRECTIONS.
4/17 REVISED NOTE #3 OF GENERAL NOTES, MINOR CORRECTIONS.

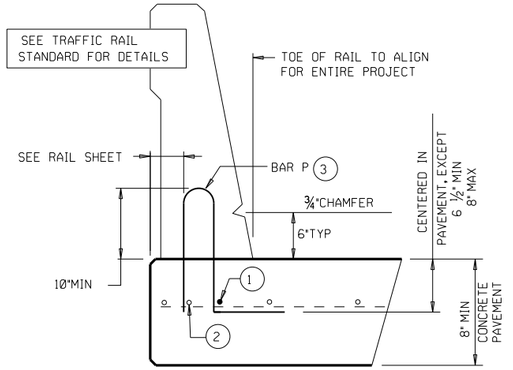
DN: -	CK: -	DW: -	CK: -	
DISTRICT	PROJECT NO.			SHEET
HOU				95
COUNTY	CONTROL	SECTION	JOB	HIGHWAY
HARRIS	0110	05	126	IH 45



PLAN

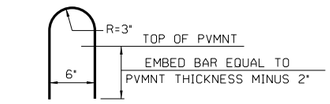
SHOWING TYPICAL CONCRETE PAVEMENT INTERSECTION

1. AS AN AID IN SUPPORTING REINFORCEMENT, ADDITIONAL LONGITUDINAL BARS MAY BE USED IN THE SLAB WITH THE APPROVAL OF THE ENGINEER. FURNISH SUCH BARS AT NO EXPENSE TO THE DEPARTMENT.
2. LONGITUDINAL SLAB BAR MAY BE ADJUSTED LATERALLY 3" +/- TO TIE REINFORCING.
3. ANCHORAGE BAR SHOWN IS FOR AN SSTR OR T551 RAIL. SEE RAILING DETAIL SHEET FOR SPACING OF BAR P. FOR OTHER RAIL TYPES SEE RAILING DETAIL SHEET.

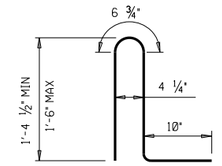


RAIL DETAIL

FOR ADDITIONAL DETAILS, SEE RAIL STANDARD SHEET.
THE MINIMUM LENGTH OF A CONCRETE RAILING PANEL IS FIVE FEET.

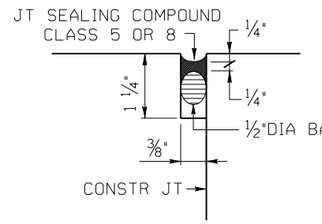


BAR A (#3)

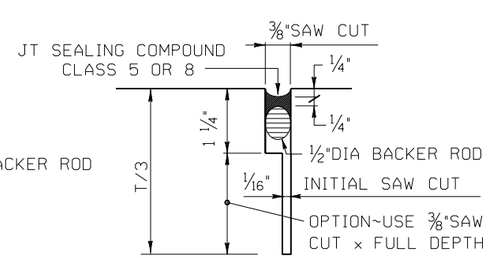


BAR P (#5)

RAIL ANCHOR INSTALLED IN PAVEMENT (3)

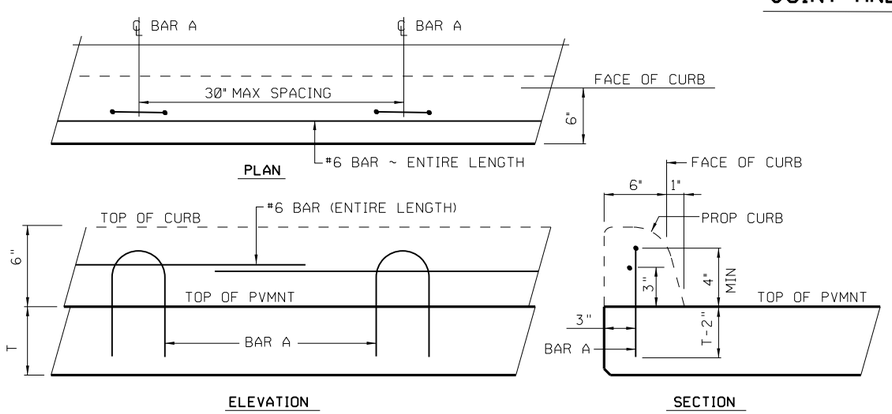


DETAIL 1 ~ CONSTR JOINT



DETAIL 2 ~ SAWED JOINT

JOINT AND SEALANT DETAILS



CURB DETAIL

SEE CC & DID STANDARD

SHEET 2 OF 2

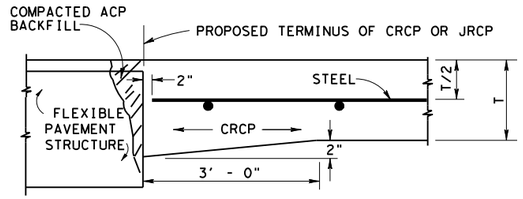
Texas Department of Transportation
Houston District

CONTINUOUSLY REINFORCED CONCRETE PAVEMENT HOUSTON SUPPLEMENT CRCP-HS

DN: -	CK: -	DW: -	CK: -	
DISTRICT	PROJECT NO.			SHEET
HOU				96
COUNTY	CONTROL	SECTION	JOB	HIGHWAY
HARRIS	0110	05	126	IH 45

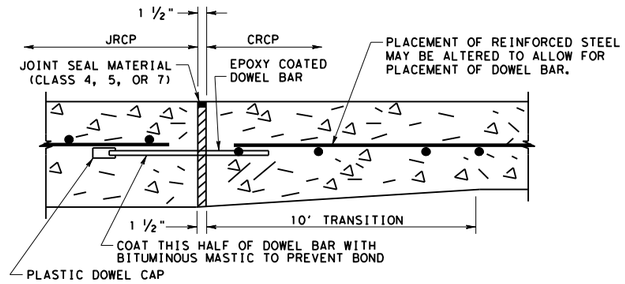
REVISIONS
4/12 CHANGED CTE FROM 6.0 TO 5.0 (ON SHEET 1)
2/15 MINOR CORRECTIONS.

STD-B1B



NOTE:
ADDITIONAL CONCRETE FOR THICKENED EDGE IS SUBSIDIARY TO VARIOUS BID ITEMS. BACKFILL DISTURBED MATERIAL IN THE FLEXIBLE PAVEMENT WITH ACP. THIS ACP IS SUBSIDIARY TO VARIOUS BID ITEMS.

JUNCTURE A & B - CRCP OR JRCP WITH FLEXIBLE TYPE PAVEMENT STRUCTURE

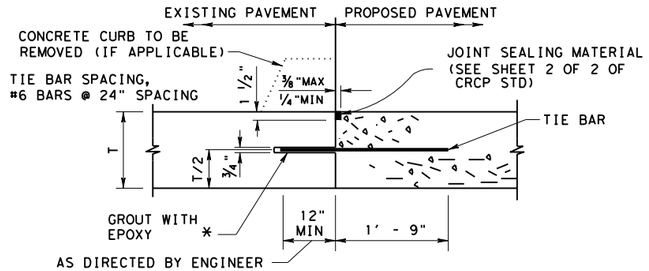


FOR DETAILS NOT SHOWN, SEE TRANSVERSE EXPANSION JOINT DETAILS ELSEWHERE IN PLANS.

DETAIL "B" - DOWEL ASSEMBLY AT EXPANSION JOINT

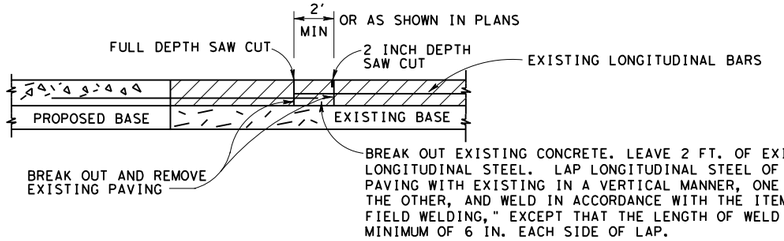
DOWEL BAR DATA			
SLAB THICKNESS(T)	6"-7.5"	8"-10"	10.5"-15"
DOWEL SIZE	1"	1 ¼"	1 ½"
DOWEL LENGTH	18"	20"	22"
DOWEL BAR SPACING	12"	12"	12"

TABLE A - DOWEL BAR DATA



JUNCTURE D - TYPICAL CONNECTION TO EXISTING CONCRETE

*FOR EPOXY TYPE SEE ITEM 361.



JUNCTURE F - "BREAK BACK" CONCRETE CRCP WITH CRCP OR JRCP WITH JRCP

GENERAL NOTES

1. FOR FURTHER INFORMATION REGARDING PLACING CONCRETE AND REINFORCEMENT, REFER TO THE GOVERNING SPECIFICATION FOR CONCRETE PAVEMENT.
2. THE DESIGN REQUIREMENTS FOR THE PAVEMENT STRUCTURE, I.E. BAR SPACING, BAR SIZE LAP REQUIREMENTS, ETC., ARE SHOWN ON THE APPROPRIATE PAVEMENT DESIGN DETAIL.
3. SLEEPER SLAB AND ADDITIONAL REINFORCING REQUIRED ON THIS DRAWING ARE INCIDENTAL TO THE VARIOUS BID ITEMS.
4. USE THE SIZE, SPACING, AND LENGTH OF DOWEL BARS SHOWN IN TABLE "A".
5. WHERE THERE WILL BE A JUNCTURE AND ADDITIONAL JRCP PAVING WILL BE PLACED AT A FUTURE DATE, MULTIPLE PIECE DOWEL BARS WILL BE PERMITTED AT THE JUNCTURE. PROVIDE MULTIPLE PIECE DOWEL BAR ASSEMBLIES WITH A MINIMUM ULTIMATE TENSILE STRENGTH OF 60.0 KIPS AND THAT HAVE SMOOTH EPOXY COATED BARS. ENSURE THE MULTIPLE PIECE DOWEL BAR ASSEMBLIES HAVE STOP TYPE COUPLINGS AND HAVE HAVE ROLLED THREADS ON THE BARS. DISMANTLE THE BAR AND FIT THE COUPLING PORTION USED IN CONSTRUCTION, WITH A PLASTIC CAP. FURNISH THE REMAINING PORTION OF THE BAR TO THE ENGINEER.
6. WHERE THE PAVING IS CRCP AND A RAMP COMPOSED OF A FLEXIBLE PAVEMENT WILL BE USED AT THE JUNCTURE UNTIL FUTURE PAVING IS CONSTRUCTED, MULTIPLE PIECE TIE BARS MAY BE USED IF PERMITTED BY THE ENGINEER. IF USED, ENSURE THE MULTIPLE PIECE TIE BAR ASSEMBLIES HAVE STOP TYPE COUPLINGS AND ROLLED THREADS ON THE BARS. FURNISH MULTIPLE PIECE TIE BAR ASSEMBLIES THAT DEVELOP A MINIMUM ULTIMATE TENSILE STRENGTH EQUAL TO 1.25 TIMES THE YIELD STRENGTH OF THE TRANSVERSE BARS BEING JOINED. FOR TIE BARS, USE DEFORMED REINFORCING BARS. TIE BAR ASSEMBLIES MADE FROM STEELS OTHER THAN ASTM GRADE 60 AND WITH DEFORMATIONS OTHER THAN ASTM STD. MAY BE USED PROVIDED THEY PROVE SATISFACTORY TO THE ENGINEER AND ARE IN EVERY RESPECT THE EQUAL TO THE ASSEMBLIES SPECIFIED. LABORATORY TESTING OF THE PROPOSED ASSEMBLIES, AT THE CONTRACTOR'S EXPENSE, MAY BE REQUIRED. LAP AND WELD ONE PORTION OF THE TIE BAR ASSEMBLY TO EACH LONGITUDINAL BAR IN ACCORDANCE WITH THE ITEM "STRUCTURAL FIELD WELDING "AND THE OTHER PORTION INTO THE COUPLING PRIOR TO PAVING. ENSURE MULTIPLE PIECE TIE BAR LENGTHS CONFORM TO THE TIE BAR LENGTHS SHOWN ELSEWHERE IN THE PLANS. ADDITIONAL "SHEAR STEEL" WILL ALSO BE REQUIRED AND MAY BE USED WITH MULTIPLE PIECE ASSEMBLIES AS PREVIOUSLY DESCRIBED. USE ADDITIONAL STEEL BARS OF EQUAL DIAMETER AT A SPACING DOUBLE THAT OF THE LONGITUDINAL STEEL AND ENSURE THE LENGTH IS 66 TIMES THE TIE BAR DIAMETER.
7. DO NOT SHEAR CUT DOWEL BARS.
8. ENSURE DOWEL BAR EPOXY COATING CONFORMS TO ARTICLE 440.2.7., "EPOXY COATING".
9. REPLACE ANY BENT LONGITUDINAL REINFORCING. IF THERE IS NOT SUFFICIENT EXPOSED REINFORCING TO PROVIDE A MINIMUM OF A 33 TIMES BAR DIAMETER LAP, REMOVE THE EXISTING PAVEMENT AND SUFFICIENTLY EXPOSE THE EXISTING REINFORCING TO PROVIDE A 33 TIMES BAR DIAMETER LAP. REPLACE ANY SHEAR BARS THAT ARE DISTURBED, BY DRILLING AND GROUTING AS REQUIRED BY NOTE 12 BELOW. PERFORM THIS CORRECTIVE ACTION AT NO EXPENSE TO THE DEPARTMENT.
10. TIE BARS AND DOWEL BARS OMITTED, LOST, OR DAMAGED SHALL BE REPAIRED BY DRILLING AND EPOXY GROUTING AT NO EXPENSE TO THE DEPARTMENT.
11. JUNCTURES A & B ARE ONLY SUITABLE FOR MINOR STREETS WITH LOW TRAFFIC VOLUMES.
12. FURNISH ADDITIONAL SHEAR BARS (DIAMETER "D") OF THE SAME SIZE AS LONGITUDINAL BARS AND SPACE THEM MIDWAY BETWEEN ALTERNATE LONGITUDINAL BARS ALONG THE TRANSVERSE CONSTRUCTION JOINT FORMED AT THE LEAVE-OUT.

LEGEND

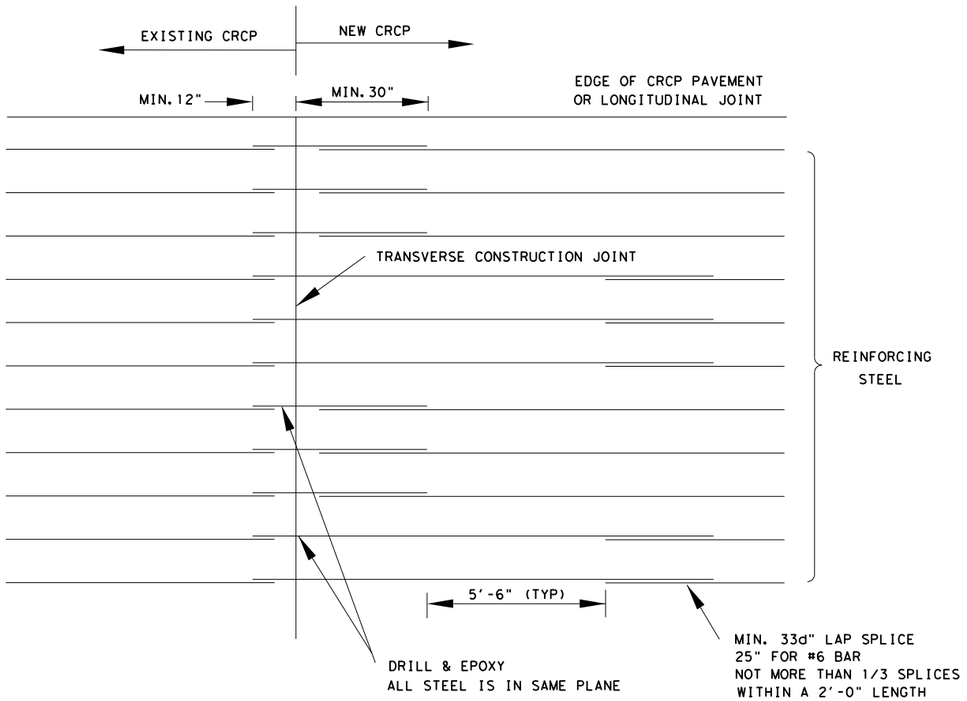
ACP - ASPHALT CONCRETE PAVEMENT
CRCP - CONTINUOUSLY REINFORCED CONCRETE PAVEMENT
JRCP - JOINTED REINFORCED CONCRETE PAVEMENT
T - THICKNESS

Texas Department of Transportation
Houston District

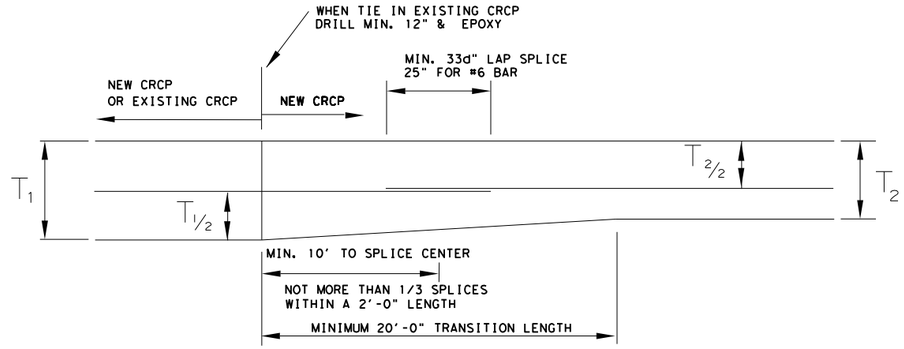
CONCRETE PAVEMENT JUNCTURES

CPJ

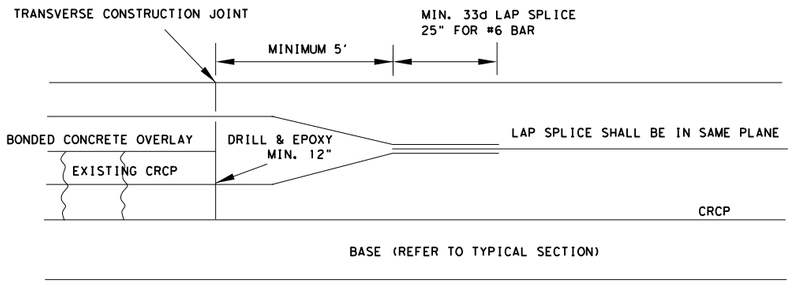
FILE: STDB-5.dgn	DN:	CK:	DW:	CK:	
©TxDOT DEC. 2009	DIST	FED REG	PROJECT NO.		SHEET
REVISIONS 5/05 2004 SPECS REVISED 4/2008 2/15 2014 SPECS	HOU	6			97
	COUNTY		CONTROL	SECT JOB	HIGHWAY
	HARRIS		0110	05 126	IH 45



EXISTING CRCP TO NEW CRCP

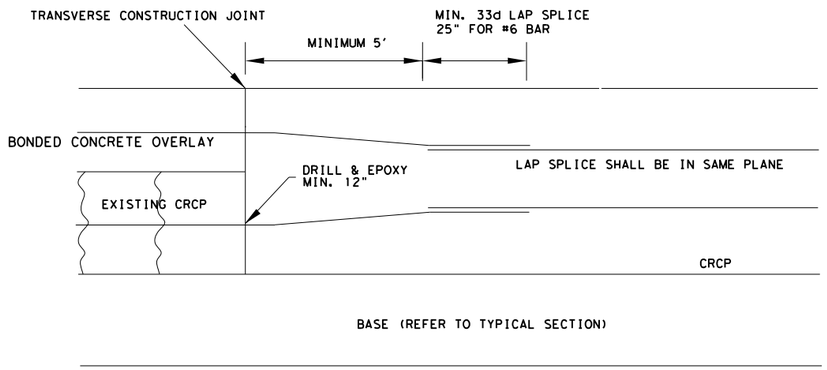


CRCP THICKNESS TRANSITION



CRCP BONDED OVERLAY TO CRCP TRANSITION

(ONE LAYER STEEL)



CRCP BONDED OVERLAY TO CRCP TRANSITION

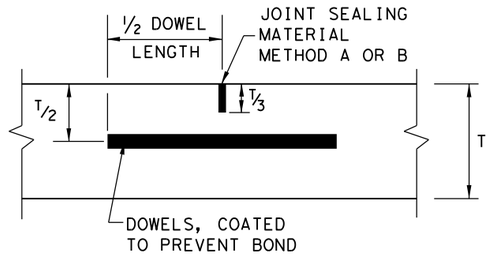
(TWO LAYER STEEL)

Texas Department of Transportation
Houston District

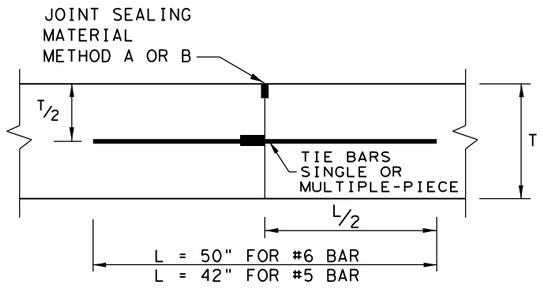
CONCRETE PAVEMENT JUNCTURES

CPJ

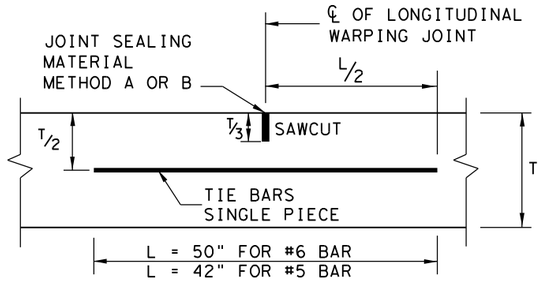
FILE: STDB-5.dgn	DN:	CK:	DW:	CK:		
© TxDOT DEC. 2009	DIST	FED REG	PROJECT NO.			SHEET
REVISIONS 5/05 2004 SPECS REVISED 4/2008 2/15 2014 SPECS	HOU	6				98
	COUNTY		CONTROL	SECT	JOB	HIGHWAY
	HARRIS		0110	05	126	IH 45



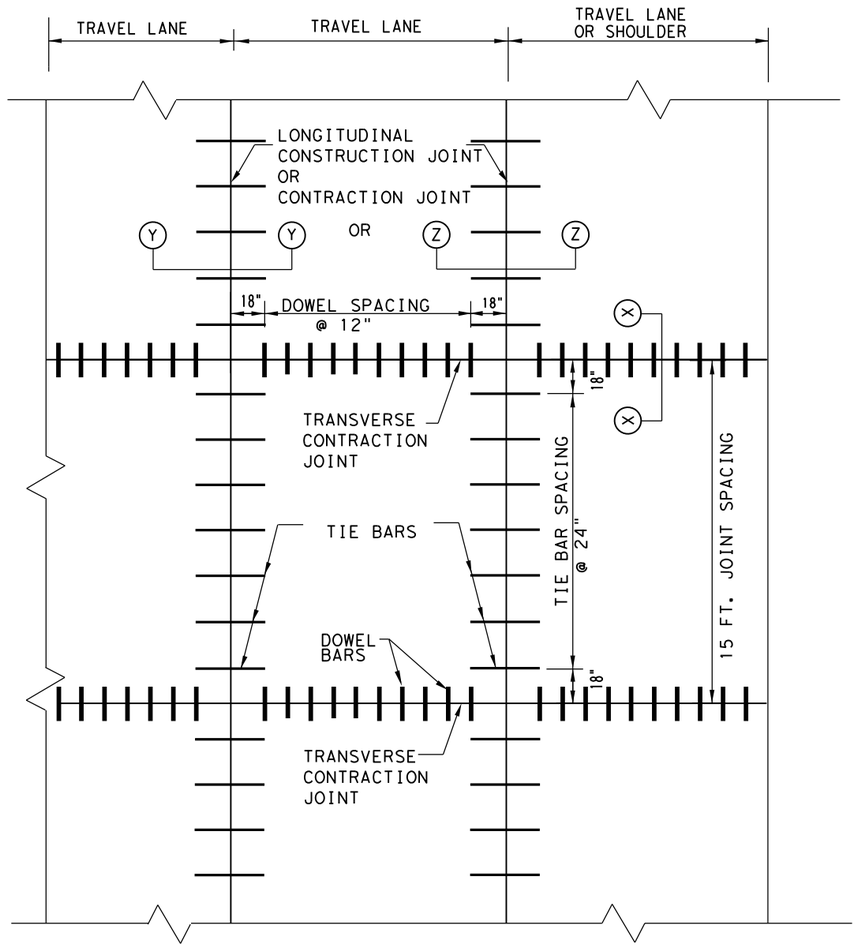
TRANSVERSE CONTRACTION JOINT
SECTION X-X



LONGITUDINAL CONSTRUCTION JOINT
SECTION Y-Y



LONGITUDINAL CONTRACTION JOINT
SECTION Z-Z



TYPICAL PAVEMENT LAYOUT
PLAN VIEW (NOT TO SCALE)

GENERAL NOTES

1. DETAILS FOR PAVEMENT WIDTH, PAVEMENT THICKNESS AND THE CROWN CROSS-SLOPE SHALL BE SHOWN ELSEWHERE IN THE PLANS. PAVEMENTS WIDER THAN 100 FT. WITHOUT A FREE LONGITUDINAL JOINT ARE NOT COVERED BY THIS STANDARD.
2. FOR FURTHER INFORMATION REGARDING THE PLACEMENT OF CONCRETE AND LOAD TRANSFER DEVICES REFER TO THE GOVERNING SPECIFICATION FOR "CONCRETE PAVEMENT".
3. THE SPACING BETWEEN TRANSVERSE CONTRACTION JOINTS SHALL BE 15 FT. UNLESS OTHERWISE SHOWN IN THE PLANS.
4. TRANSVERSE CONSTRUCTION JOINTS MAY BE FORMED BY USE OF METAL OR WOOD FORMS EQUAL IN DEPTH TO THE DEPTH OF PAVEMENT, OR BY METHODS APPROVED BY THE ENGINEER.
5. USE HAND-OPERATED IMMERSION VIBRATORS TO CONSOLIDATE THE CONCRETE ADJACENT TO ALL THE FORMED JOINTS.
6. PAVEMENT WIDTHS OF MORE THAN 15 FT. SHALL HAVE A LONGITUDINAL JOINT (SECTION Z-Z OR SECTION Y-Y). THESE JOINTS SHALL BE LOCATED WITHIN 6 IN. OF THE LANE LINE UNLESS THE JOINT LOCATION IS SHOWN ELSEWHERE ON THE PLANS.
7. THE JOINT BETWEEN OUTSIDE LANE AND SHOULDER SHALL BE A LONGITUDINAL CONTRACTION JOINT (SECTION Z-Z) UNLESS OTHERWISE SHOWN IN THE PLANS. THE SAW CUT DEPTH FOR THE LONGITUDIANL CONTRACTION JOINT (SECTION Z-Z) SHALL BE ONE THIRD OF THE SLABTHICKNESS (T/3).
8. WHEN TYING CONCRETE GUTTER AT A LONGITUDINAL JOINT, THE TIE BAR LENGTH OR POSITION MAY BE ADJUSTED. PROVIDE 3 IN. OF CONCRETE COVER FROM THE BACK OF GUTTER TO THE END OF TIE BAR.
9. REPLACE MISSING OR DAMAGED TIE BARS WITHOUT ADDITIONAL COMPENSATION BY DRILLING MIN. 10 IN. DEEP AND GROUTING TIE BARS WITH TYPE III, CLASS C EPOXY. MEET THE PULL-OUT TEST REQUIREMENTS IN ITEM 361.
10. WHEN AN MONOLITHIIC CURB IS SPECIFIED, THE JOINT IN THE CURB SHALL COINCIDE WITH PAVEMENT JOINTS AND MAY BE FORMED BY ANY MEANS APPROVED BY THE ENGINEER.
11. DOWEL BAR PLACEMENT TOLERANCE SHALL BE +/- 1/4 IN. HORIZONTALLY AND VERTICALLY UNLESS OTHERWISE SPECIFIED. WHERE DOWEL BAR BASKETS ARE USED, REMOVE THE SHIPPING WIRES.
12. THE DETAIL FOR JOINT SEALANT AND RESERVOIR IS SHOWN ON STANDARD SHEET "CONCRETE PAVING DETAILS, JOINT SEALS."

TABLE NO. 1 DOWELS (SMOOTH BARS)

SLAB THICKNESS T (IN.)	BAR DIA. AND LENGTH	AVERAGE SPACING (IN.)
6 to 7.5	1" X 18"	12
8 to 10	1 1/4" X 18"	12
>= 10.5	1 1/2" X 18"	12

TABLE NO. 2 TIE BARS (DEFORMED BARS)

SLAB THICKNESS T (IN.)	BAR SIZE	AVERAGE SPACING (IN.)
6 to 7.5	#5	24
>= 8	#6	24

Texas Department of Transportation — Design Division Standard

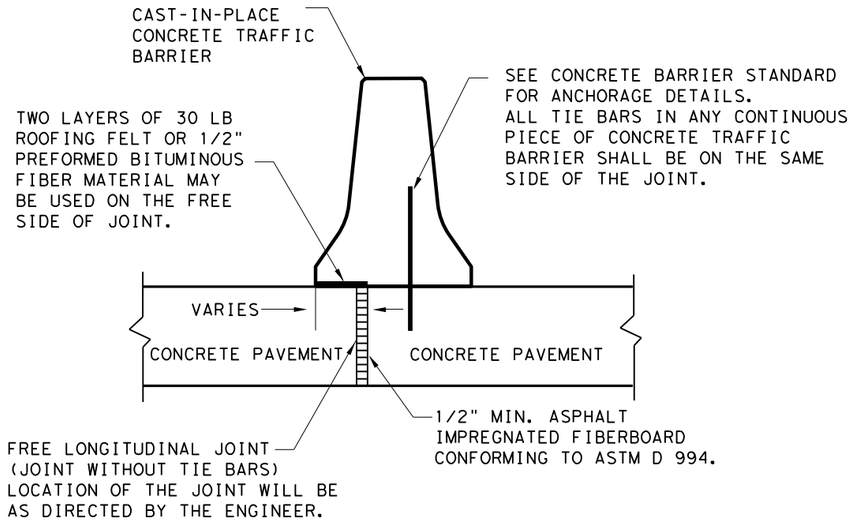
CONCRETE PAVEMENT DETAILS
CONTRACTION DESIGN
T-6 to 12 INCHES

CPCD-14

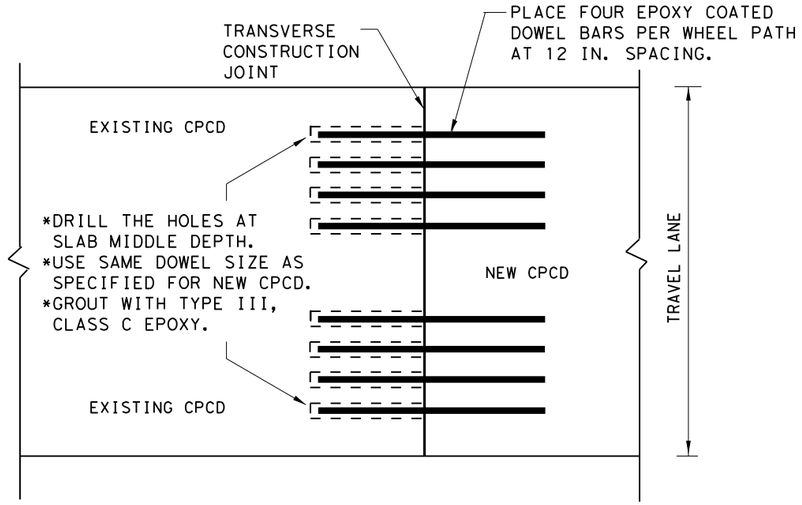
FILE: cpcd14.dgn	DN: TxDOT		DN: HC	DW: HC	CK: AN
	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0110	05	126	IH 45	
	DIST	COUNTY		SHEET NO.	
	HOU	HARRIS		99	

DATE:
FILE:

DATE:
FILE:



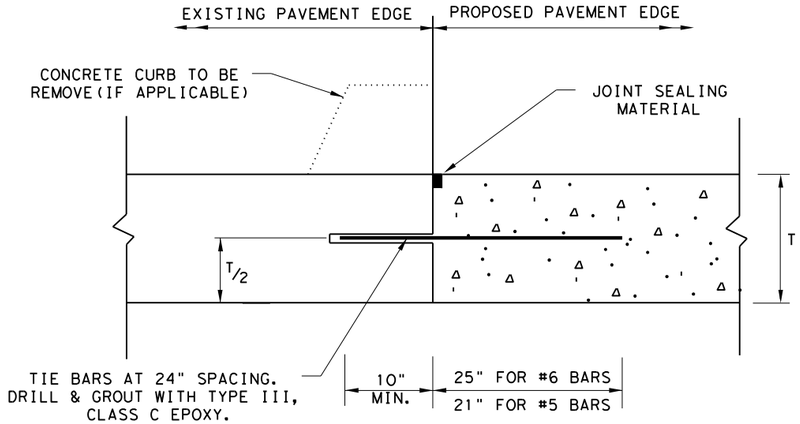
FREE LONGITUDINAL JOINT DETAIL



TRANSVERSE JOINT DETAIL

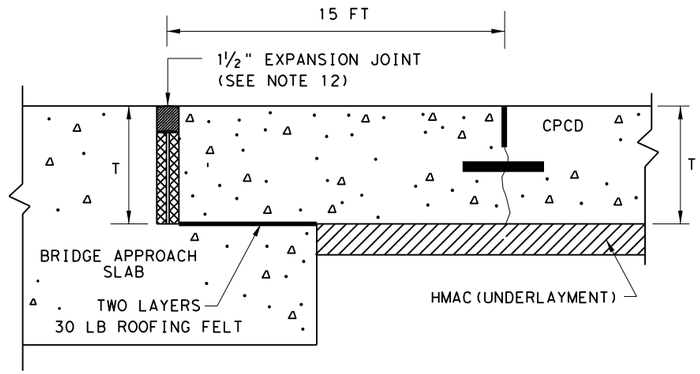
EXISTING CPCD TO NEW CPCD

PLAN VIEW (NOT TO SCALE)



1. BEFORE WIDENING WORK, DEMONSTRATE THAT THE BOND STRENGTH OF THE EPOXY-GROUTED TIE BARS MEETS THE REQUIREMENTS OF PULL-OUT TEST SPECIFIED IN ITEM 361.
2. SPACE TIE BARS AT 24" SPACING. USE #6 BARS FOR 8" AND THICKER SLABS, USE #5 BARS FOR LESS THAN 8" THICK SLABS.
3. THE TRANSVERSE JOINTS OF PROPOSED PAVEMENT SHALL COINCIDE WITH EXISTING PAVEMENT JOINTS UNLESS OTHERWISE SHOWN ON THE PLANS.

LONGITUDINAL WIDENING JOINT DETAIL



TRANSVERSE EXPANSION JOINT DETAIL

AT BRIDGE APPROACH

SHEET 2 OF 2

Texas Department of Transportation

Design Division Standard

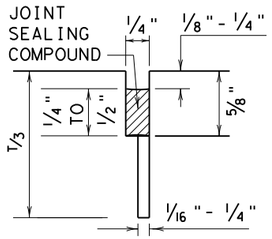
CONCRETE PAVEMENT DETAILS
CONTRACTION DESIGN
T-6 to 12 INCHES

CPCD-14

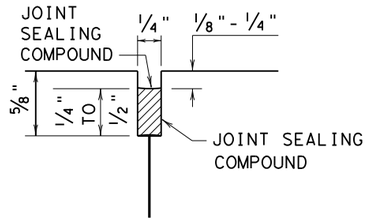
FILE: cpcd14.dgn	DN: TxDOT	DN: HC	DW: HC	CK: AN
© TxDOT: DECEMBER 2014	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		100

DATE:
FILE:

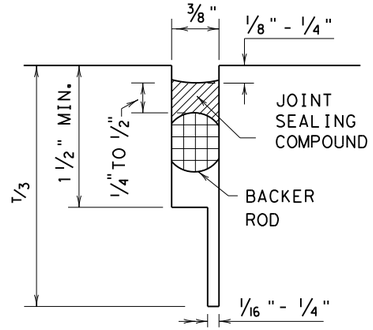
METHOD B: JOINT SEALING COMPOUND



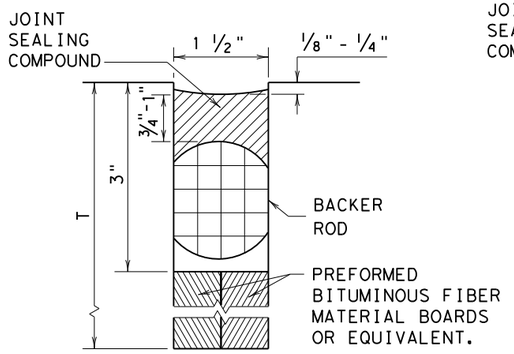
LONGITUDINAL SAWED
CONTRACTION JOINT



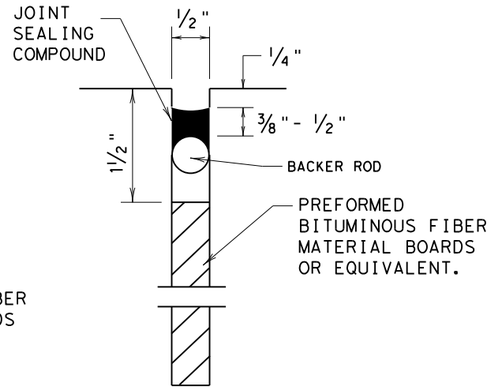
LONGITUDINAL OR TRANSVERSE
CONSTRUCTION JOINT



TRANSVERSE SAWED
CONTRACTION JOINT

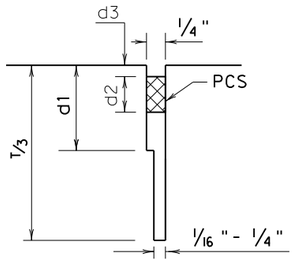


TRANSVERSE FORMED
EXPANSION JOINT

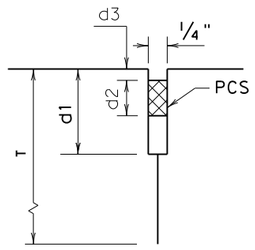


FORMED
ISOLATION JOINT

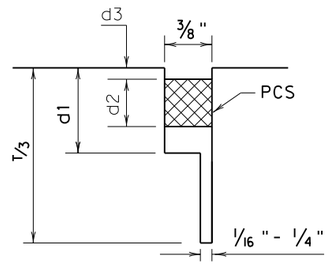
METHOD A: PREFORMED COMPRESSION SEALS (PCS) (DMS-6310 CLASS 6)



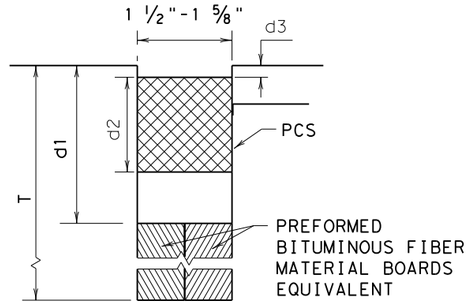
LONGITUDINAL SAWED
CONTRACTION JOINT



LONGITUDINAL
CONSTRUCTION JOINT



TRANSVERSE SAWED
CONTRACTION JOINT



TRANSVERSE FORMED
EXPANSION JOINT

GENERAL NOTES

1. UNLESS OTHERWISE SHOWN IN THE PLANS, EITHER METHOD "A" OR METHOD "B" MAY BE USED.
2. THE LOCATION OF JOINTS SHALL BE AS SHOWN ELSEWHERE IN THE PLANS.
3. THE JOINT RESERVOIR FOR SEALANT OR PCS SHALL BE SAWED UNLESS OTHERWISE SHOWN ON THE PLANS FOR THE LONGITUDINAL AND TRANSVERSE CONSTRUCTION JOINTS AND THE SAWED JOINTS.
4. DIMENSIONS d1, d2, AND d3 SHOWN IN METHOD A SHALL BE IN ACCORDANCE WITH THE PREFORMED COMPRESSION SEAL MANUFACTURER'S RECOMMENDATION.
5. REFER TO DMS-6310 "JOINT SEALANTS AND FILLERS" FOR THE CLASSIFICATIONS.
6. FOR SAWED LONGITUDINAL JOINT, LONGITUDINAL OR TRANSVERSE CONSTRUCTION JOINT, USE JOINT SEALANT CLASS 5 OR 8 UNLESS OTHERWISE SHOWN ON THE PLAN OR APPROVED.
7. FOR TRANSVERSE SAWED CONTRACTION, TRANSVERSE FORMED EXPANSION JOINT, AND ISOLATION JOINT USE JOINT SEALANT CLASS 5 OR 8 AT NEW JOINTS. USE JOINT SEALANT CLASS 4, 5, 7, OR 8 FOR MAINTAINING EXISTING JOINTS.
8. THE JOINTS SHALL BE CLEANED IN ACCORDANCE WITH THE ITEM 438 "CLEANING AND SEALING JOINTS" OR ITEM 713 "CLEANING AND SEALING JOINTS AND CRACKS (CONCRETE PAVEMENT)".
9. ISOLATION JOINTS ACCOMMODATE HORIZONTAL AND VERTICAL MOVEMENTS THAT OCCUR BETWEEN A PAVEMENT AND A STRUCTURE. ISOLATION JOINTS MAY BE USED FOR BRIDGE ABUTMENTS, INTERSECTIONS, CURB AND GUTTER, OLD AND NEW PAVEMENTS, OR AROUND DRAINAGE INLETS, MANHOLES, FOOTINGS AND LIGHTING STRUCTURES.

Texas Department of Transportation

Design Division Standard

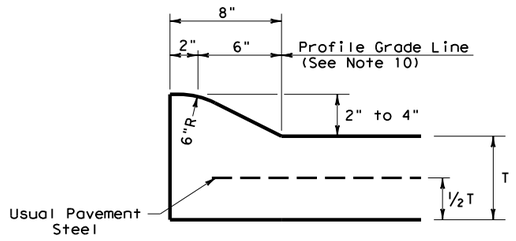
CONCRETE PAVING DETAILS

JOINT SEALS

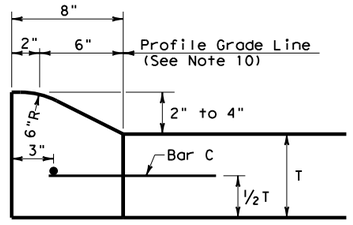
JS-14

FILE: js14.dgn	DN: TxDOT	DN: HC	DW: HC	CK: AN
© TxDOT: DECEMBER 2014	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		101

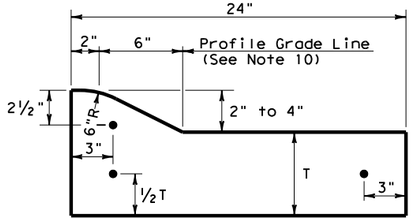
DATE:
FILE:



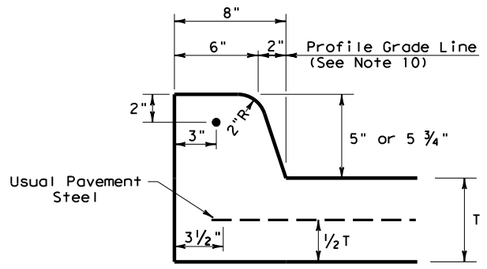
TYPE I CURB (MONOLITHIC)
2" - 4" HEIGHT



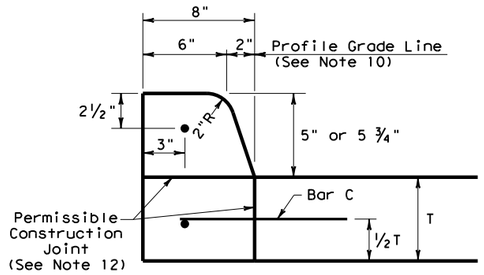
TYPE I CURB
2" - 4" HEIGHT



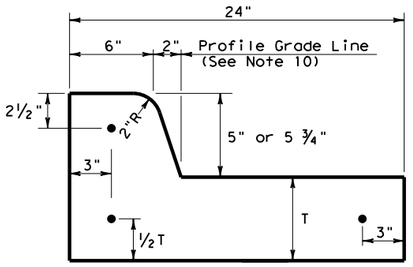
TYPE I CURB AND GUTTER
2" - 4" HEIGHT



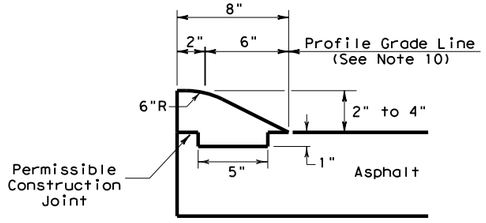
TYPE II CURB (MONOLITHIC)
5" - 5 ¾" HEIGHT



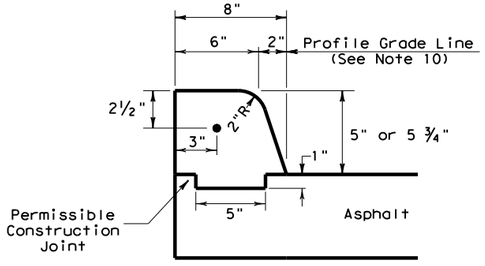
TYPE II CURB
5" - 5 ¾" HEIGHT



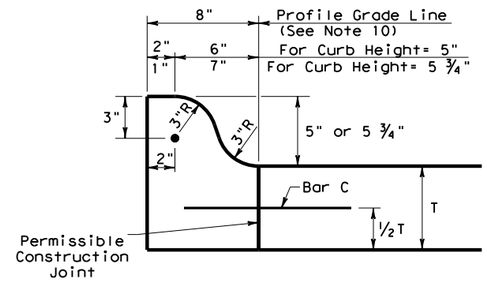
TYPE II CURB AND GUTTER
5" - 5 ¾" HEIGHT



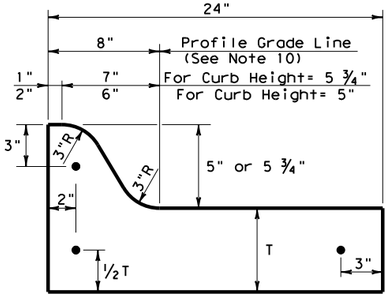
TYPE III CURB (KEYED)
2" - 4" HEIGHT



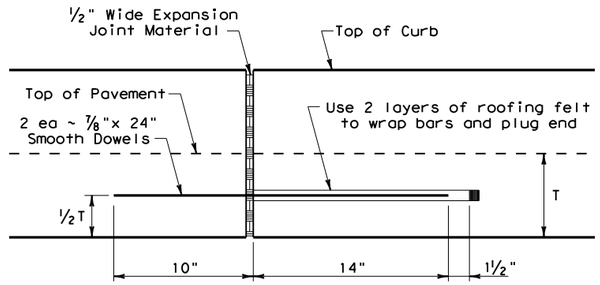
TYPE IV CURB (KEYED)
5" - 5 ¾" HEIGHT



TYPE IIa CURB
5" - 5 ¾" HEIGHT

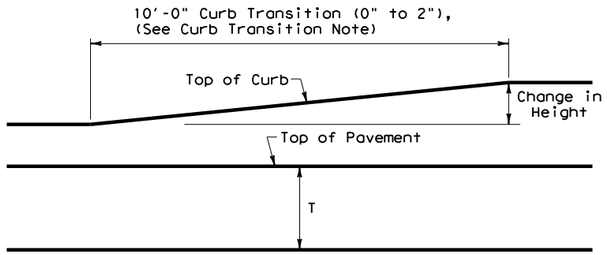


TYPE IIa CURB AND GUTTER
5" - 5 ¾" HEIGHT



EXPANSION JOINT DETAIL

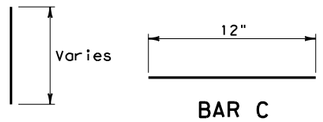
CURB TRANSITION NOTE:
Field conditions may require a longer or shorter transition, and shall be shown elsewhere in the plans, or as directed by the Engineer.



CURB TRANSITION
Note: To be paid for as Highest Curb

GENERAL NOTES

1. All materials and construction shall be in accordance with Item 529, "Concrete Curb, Gutter, and Combined Curb and Gutter."
2. Concrete shall be Class A.
3. When reinforcing bars are used, they shall be No.4 unless otherwise shown. The use of fiber reinforced concrete in lieu of reinforcing steel is acceptable. Use fibers meeting the requirements of DMS 4550, "Fibers for Concrete," and dose fibers in accordance with Material Producers List (MPL) "Fibers for Class A and B Concrete Applications."
4. Round exposed sharp edges with a rounding tool, to a minimum radius of ¼ inch.
5. All existing curbs and driveways to be removed shall be sawed or removed at existing joints.
6. Where concrete curb is to be placed on existing concrete pavement, Bar B may be drilled and the grouted in place, or may be inserted into fresh concrete.
7. Expansion and contraction joints shall be constructed to match pavement joints in all curbs and curb and gutter adjacent to jointed concrete pavement. Where placement of curb or curb and gutter is not adjacent to concrete pavement, expansion joints shall be provided at structures, curb returns at streets, and at locations directed by The Engineer.
8. Vertical and horizontal dowel bars and transverse reinforcing bars shall be placed at four feet C~C.
9. Dimension 'T' shown is the thickness of concrete pavement. When curb is installed adjacent to flexible pavement dimension 'T' is 8" maximum.
10. Usual profile grade line. Refer to typical sections and plan-profile sheets for exact locations.
11. One-half inch expansion joint material shall be provided where curb or curb and gutter is adjacent to sidewalk or riprap.
12. When horizontal permissible construction joints are used, the longitudinal pavement steel shall be placed in accordance with pavement details shown elsewhere in the plans. Reinforcing steel for curb section shall then conform to that required for concrete curb.
13. Bar B used as needed to support curb reinforcing steel during concrete placement.



BAR B

BAR C

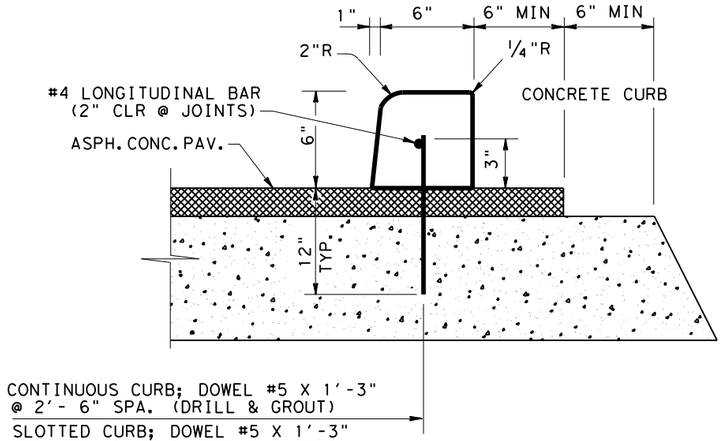
Texas Department of Transportation

Design Division Standard

CONCRETE CURB AND CURB AND GUTTER

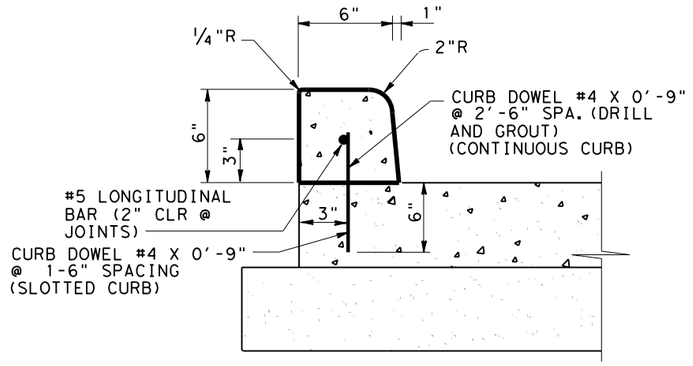
CCCG-21

FILE: cccg21.dgn	DN: TXDOT	CK: AN	DW: SS	CK: KM
© TxDOT: FEBRUARY 2021 REVISIONS	CONT	SECT	JOB	HIGHWAY
	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		102



SHOWN ON EXISTING OR PROPOSED ACP PAVEMENT

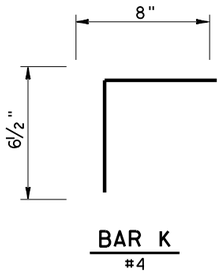
(PAY ITEM 529-6011) - FOR CONTINUOUS



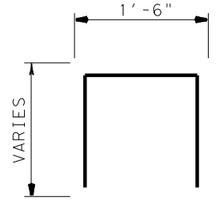
SHOWN ON EXISTING OR PROPOSED CONCRETE PAVEMENT

(PAY ITEM 529-6011) - FOR CONTINUOUS

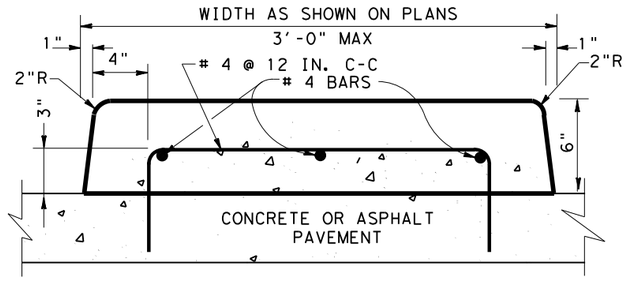
CONCRETE CURB (DOWEL) (6 IN.)



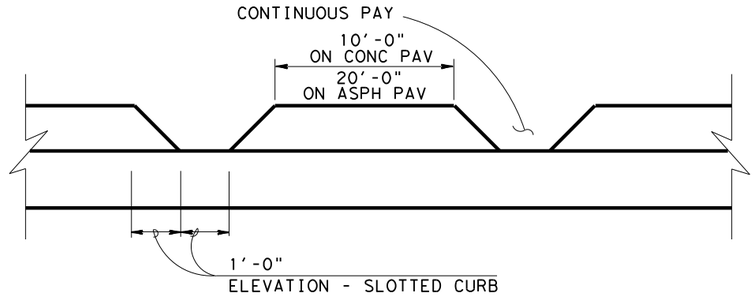
BAR K
#4



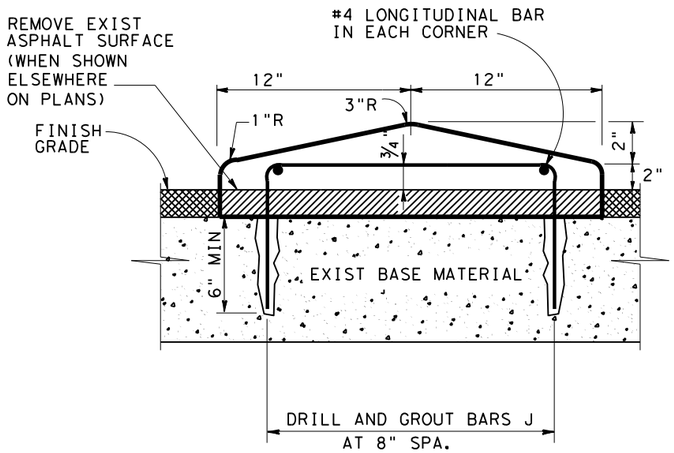
BAR J
#4



ITEM 536-6001 CONCRETE MEDIAN
SEE NOTE 2

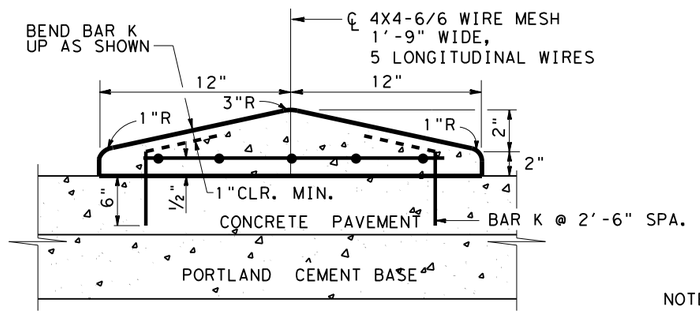


ITEM 529-6012 CONCRETE CURB (SLOTTED) - ON CONC.
ITEM 529-6009 CONC CURB (DOWEL)(SLOTTED) - ON ASPH.



SHOWN ON EXISTING ACP PAVEMENT

SEE NOTE 2 - ITEM 536-6003 CONC DIRECTIONAL ISLAND



SHOWN ON EXISTING OR PROPOSED CONCRETE PAVEMENT

SEE NOTE 2 - ITEM 536-6003 CONC DIRECTIONAL ISLAND

NOTES:

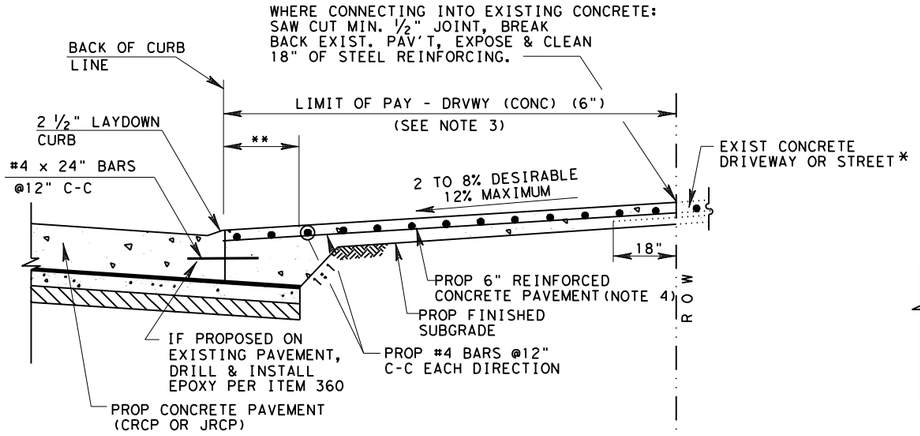
1. DRILL AND GROUT BARS SHOWN AS PER ITEM 420.4.7.10, 6" EMBEDMENT, MINIMUM ON CONC.
2. INSTALL A 2 INCH DRAINAGE OPENING AT 10 FT C-C WHEN CURB/ISLAND IS NOT ON TOP OF CROSS SECTION. (LOCATED ON A 2 OR 3 PERCENT TRANSVERSE GRADE, OR SUPERELEVATION.)

CONCRETE DIRECTIONAL ISLAND

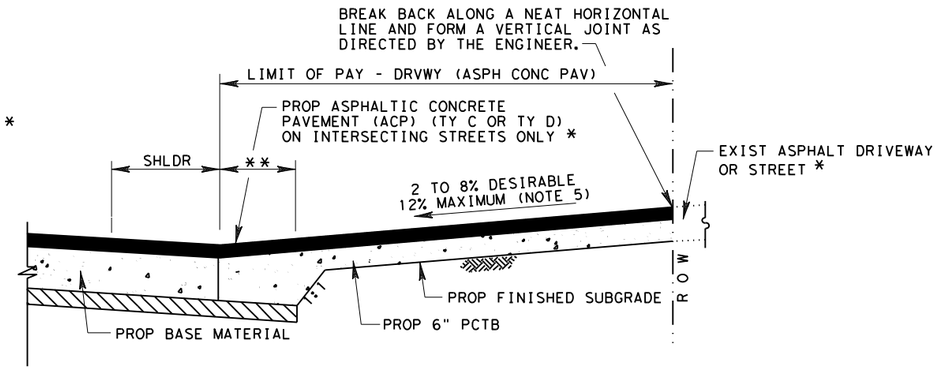
Texas Department of Transportation
Houston District

CONCRETE CURB AND DIRECTIONAL ISLAND DETAILS CC & DID

FILE: STDB-9.dgn	DN:	CK:	DW:	CK:
©TxDOT 2014	DIST	FED REG	PROJECT NO.	SHEET
REVISIONS	HOU	6		103
	COUNTY	CONTROL	SECT JOB	HIGHWAY
	HARRIS	0110	05 126	IH 45



PROPOSED DRIVEWAY DETAIL
REINFORCED CONCRETE AT CONCRETE
CURB AND GUTTER ROADWAY



PROPOSED DRIVEWAY DETAIL
ASPHALT W/ PCTB AT ASPHALT ROADWAY

NOTES:

1. ALSO SEE SHEET 2 OF 2 FOR DRIVEWAY SLOPES WITH PROPOSED SIDEWALKS.
2. FOR INTERSECTIONS BUILT WITH CRCP PAVEMENT SEE CRCP DETAIL.
3. FAST TRACK CONCRETE IS PAID AS DRVWY (CONC) (FAST TRACK).
4. THICKNESS OF DRIVEWAY IS 6 INCHES FOR REGULAR AND FAST TRACK CONCRETE.
5. MAXIMUM SLOPE IS: 12% RESIDENTIAL
   8% OTHERS

LEGEND:

PCTB- PORTLAND CEMENT TREATED BASE

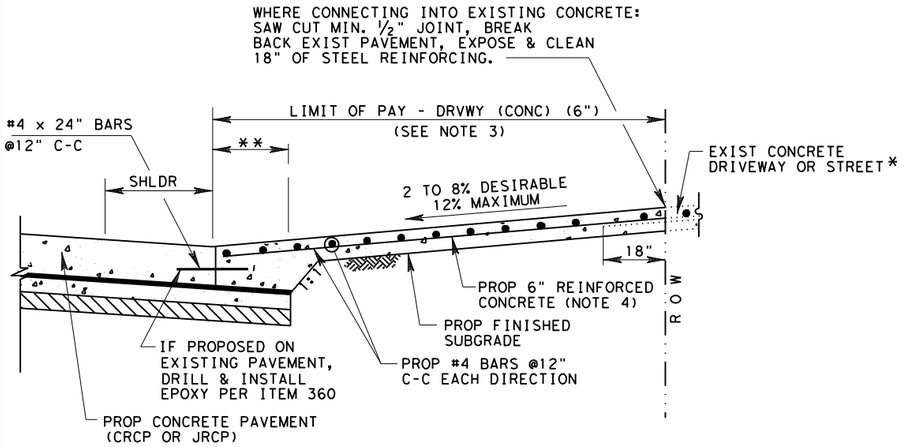
JRCP- JOINTED REINFORCED CONCRETE PAVEMENT

CRCP- CONTINUOUSLY REINFORCED CONCRETE PAVEMENT

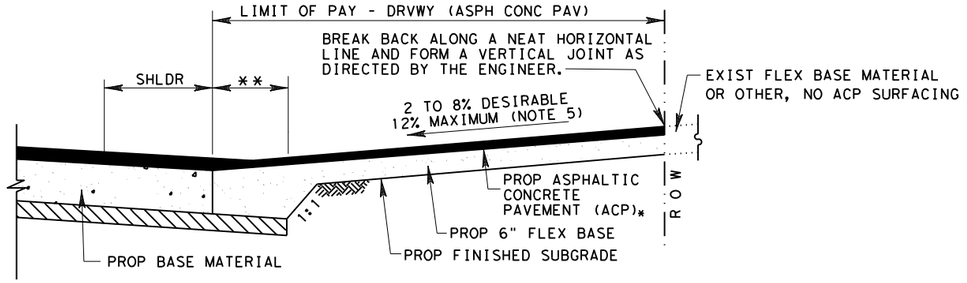
ACP- ASPHALTIC CONCRETE PAVEMENT

* FOR STREET INTERSECTIONS REFER TO PAVING DETAILS AND INTERSECTION DETAILS FOR REINFORCING STEEL AND SECTION REQUIREMENTS.

** PROPOSED LIMIT OF ROADWAY BASE AND/OR SUBGRADE



PROPOSED DRIVEWAY DETAIL
REINFORCED CONCRETE AT CONCRETE ROADWAY



PROPOSED DRIVEWAY DETAIL
ASPHALT W/ FLEX BASE AT ASPHALT ROADWAY

SHEET 1 OF 3

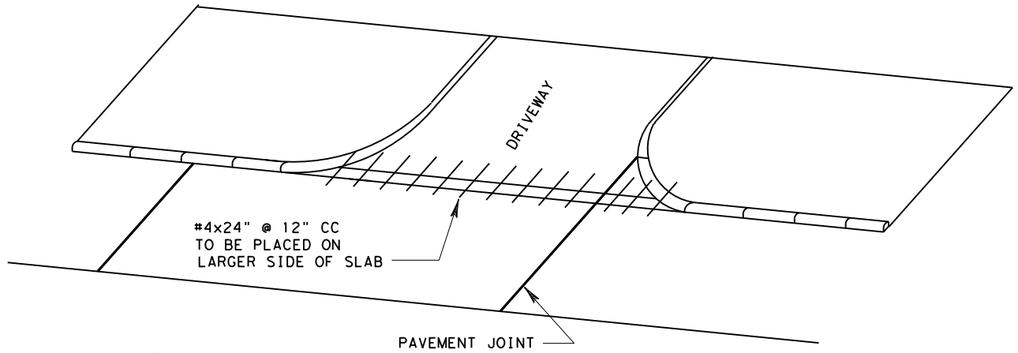
Texas Department of Transportation
Houston District

DRIVEWAY DETAILS

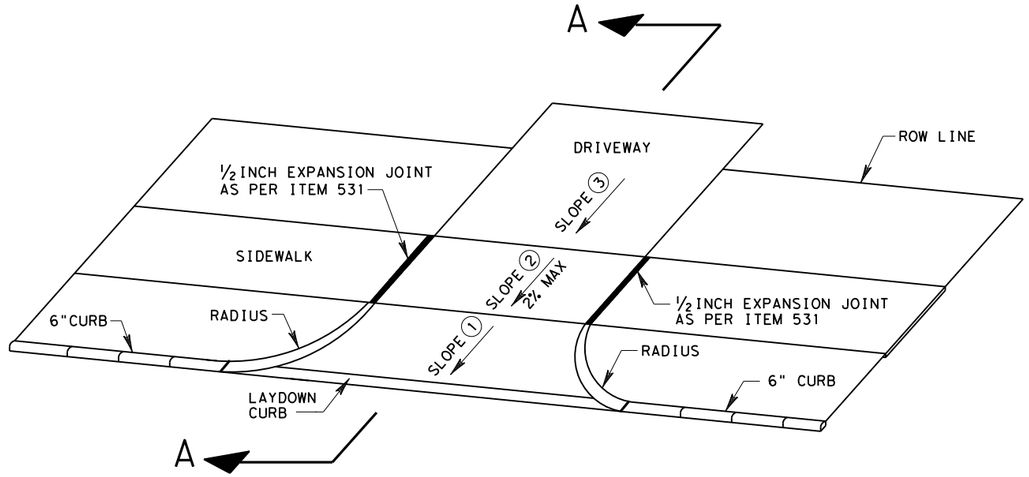
DD

FILE: STDB-8a.dgn	DN:	CK:	DW:	CK:		
© TxDOT SEPT. 2004	DIST	FED REG	PROJECT NO.			SHEET
REVISIONS 11/15 ADDED NOTE FOR PCTB 3/17 MODIFIED PAVEMENT SLOPES	HOU	6				104
	COUNTY		CONTROL	SECT	JOB	HIGHWAY
	HARRIS		0110	05	126	IH 45

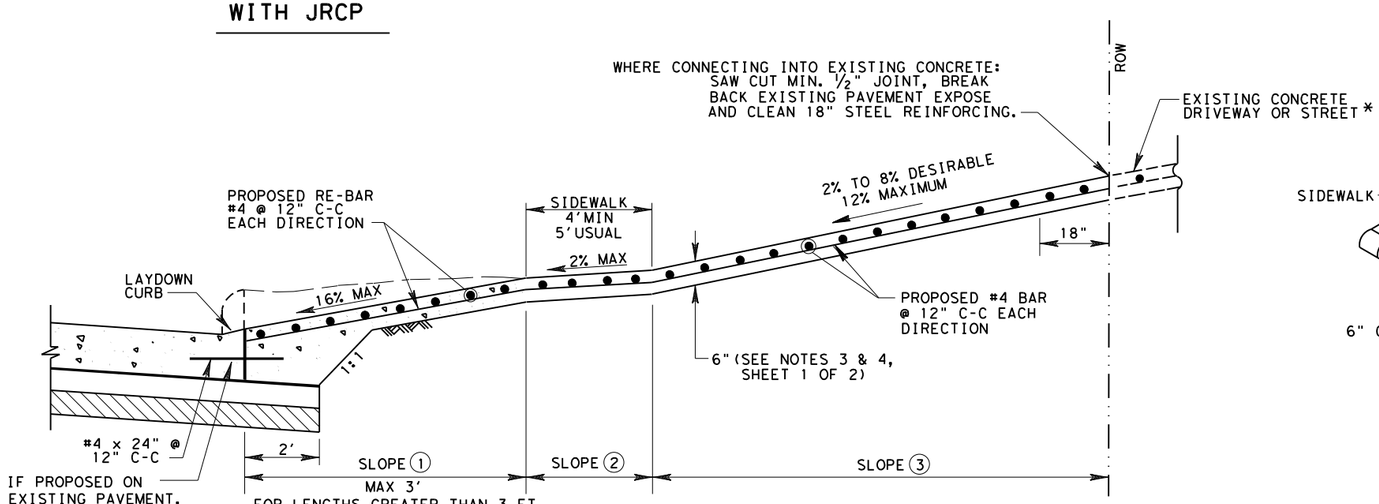
STDB8A



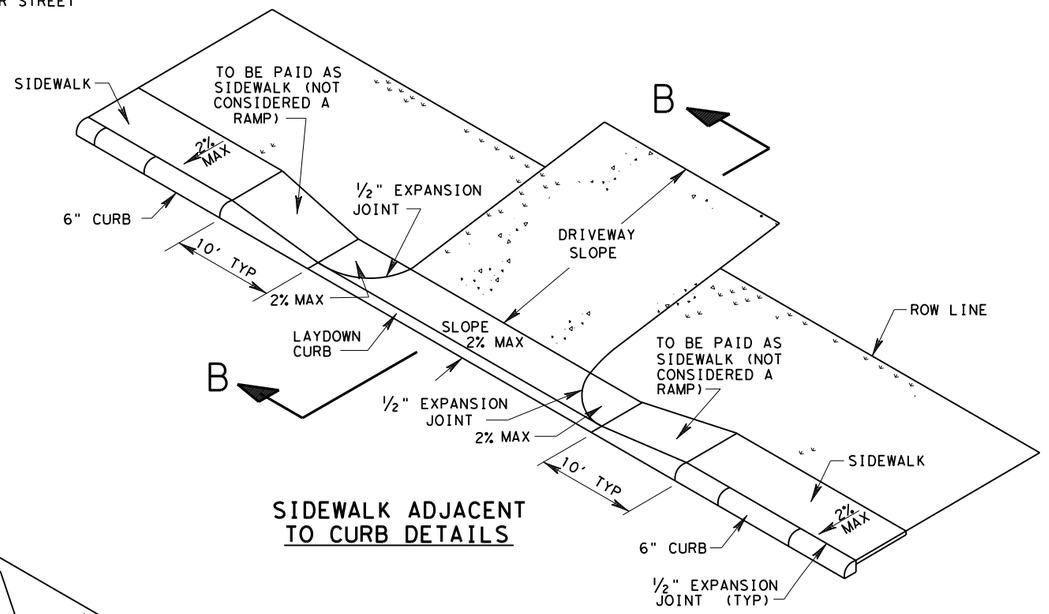
TIE BAR PLACEMENT WITH JRCP



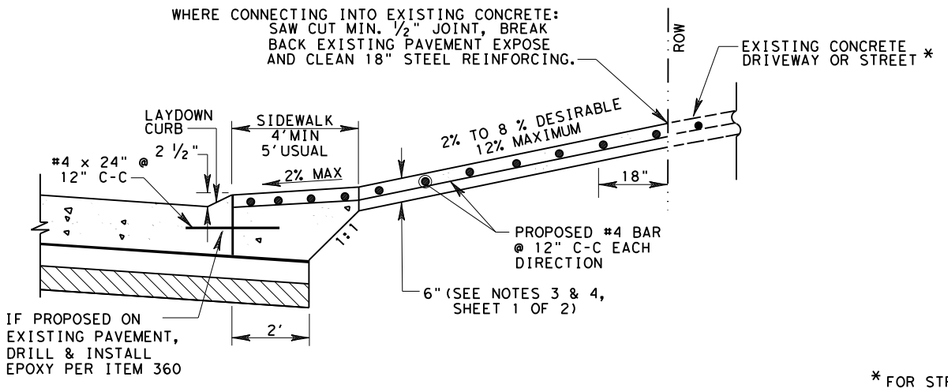
SIDEWALK OFFSET FROM CURB DETAILS



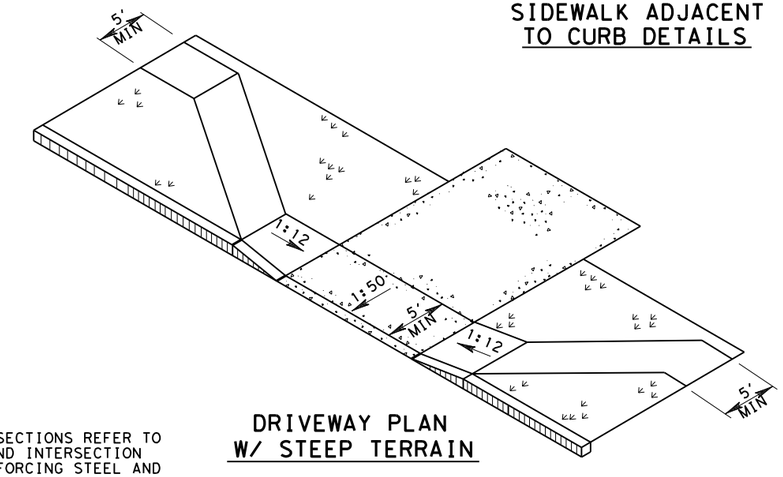
SLOPES W/ SIDEWALKS OFFSET FROM CURB (SECTION A-A)



SIDEWALK ADJACENT TO CURB DETAILS



DRIVEWAY SLOPES W/ SIDEWALKS ADJACENT TO CURB (SECTION B-B)



DRIVEWAY PLAN W/ STEEP TERRAIN

* FOR STREET INTERSECTIONS REFER TO PAVING DETAILS AND INTERSECTION DETAILS FOR REINFORCING STEEL AND SECTION REQUIREMENTS.

SHEET 2 OF 3

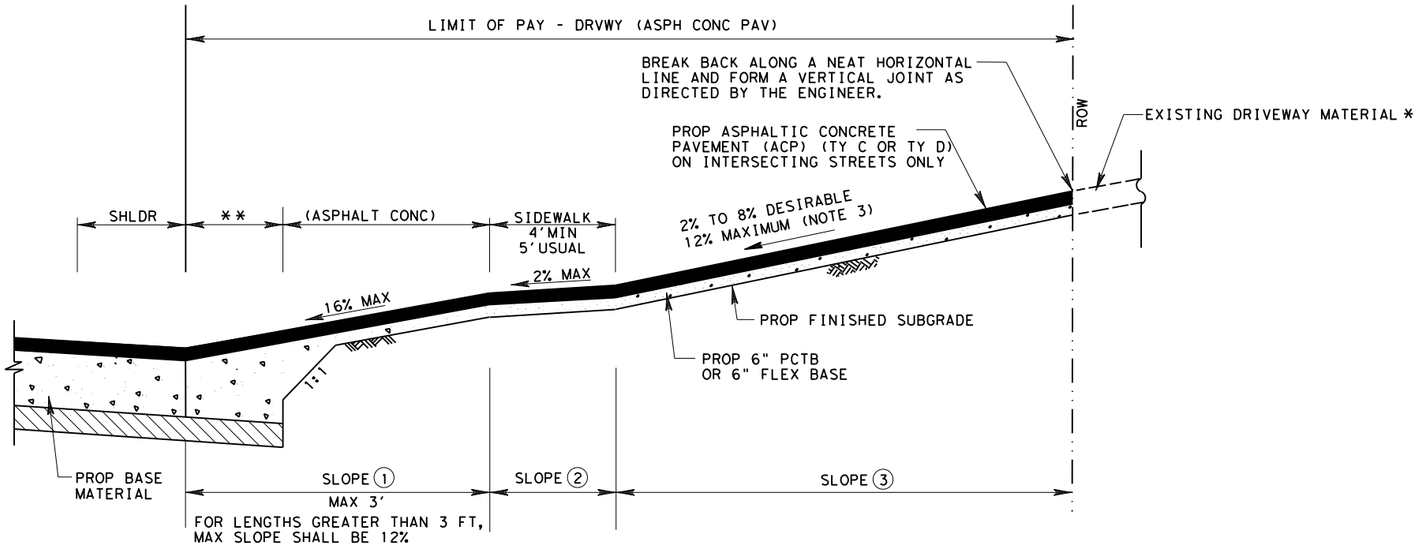
Texas Department of Transportation
Houston District

DRIVEWAY DETAILS

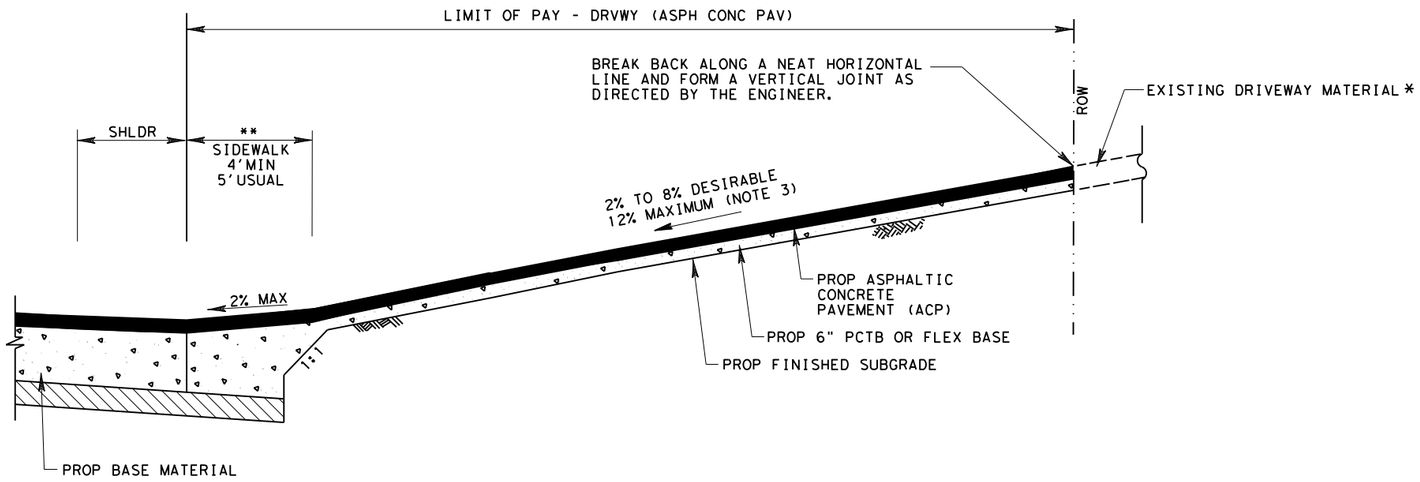
DD

FILE: STDB-8b.dgn	DN:	CK:	DW:	CK:
©TxDOT SEPT. 2004	DIST	FED REG	PROJECT NO.	SHEET
REVISIONS 9/09 ADDED NOTE FOR ITEM 360. 11/15 ADDED NOTE FOR PCTB	HOU	6		105
	COUNTY	CONTROL	SECT JOB	HIGHWAY
	HARRIS	0110	05 126	IH 45

STDB8B



PROPOSED DRIVEWAY SLOPES
WITH SIDEWALKS OFFSET



PROPOSED DRIVEWAY SLOPES
WITH SIDEWALKS ADJACENT

NOTES:

1. ALSO SEE SHEET 2 OF 3 FOR DRIVEWAY SLOPES WITH PROPOSED SIDEWALKS.
2. FOR INTERSECTIONS BUILT WITH CRCP PAVEMENT SEE CRCP DETAIL.
3. MAXIMUM SLOPE IS: 12% RESIDENTIAL 8% OTHERS

LEGEND:

PCTB- PORTLAND CEMENT TREATED BASE

ACP- ASPHALTIC CONCRETE PAVEMENT

* FOR STREET INTERSECTIONS REFER TO PAVING DETAILS AND INTERSECTION DETAILS.

** PROPOSED LIMIT OF ROADWAY BASE AND/OR SUBGRADE

Texas Department of Transportation
Houston District

DRIVEWAY DETAILS

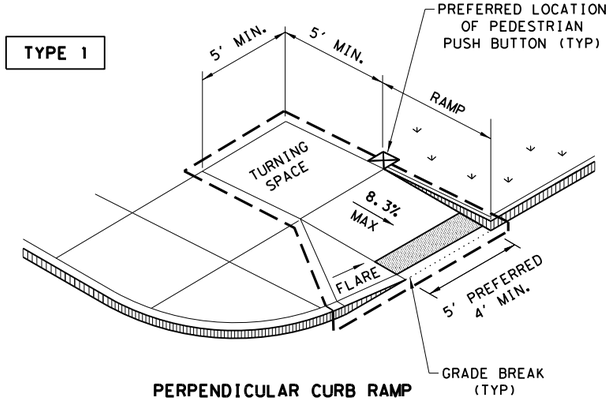
DD

FILE: STDB-8c.dgn	DN:	CK:	DW:	CK:		
© TxDOT SEPT. 2004	DIST	FED REG	PROJECT NO.			SHEET
REVISIONS 11/15 ADDED NOTE FOR PCTB 3/17 MODIFIED PAVEMENT SLOPES	HOU	6				106
	COUNTY		CONTROL	SECT	JOB	HIGHWAY
	HARRIS		0110	05	126	IH 45

STDB8C

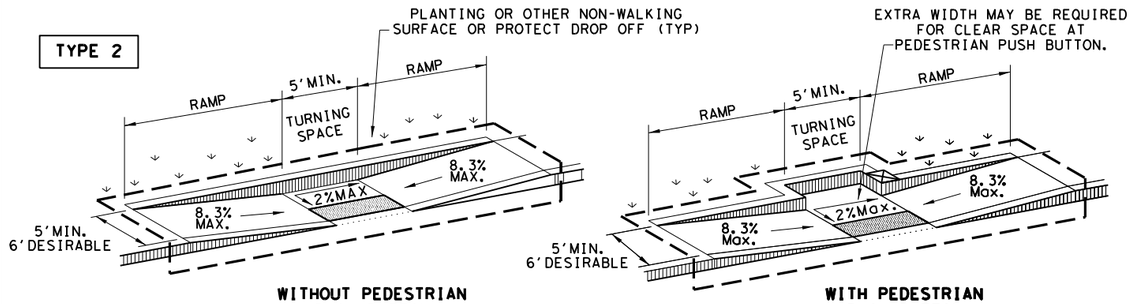
DATE:
FILE:

TYPE 1



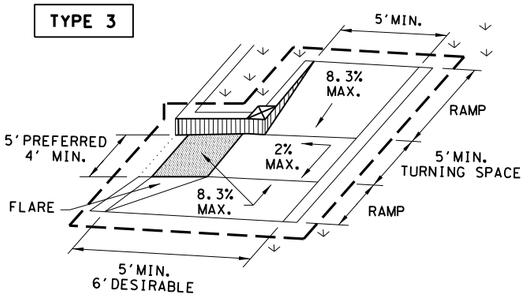
PERPENDICULAR CURB RAMP

TYPE 2

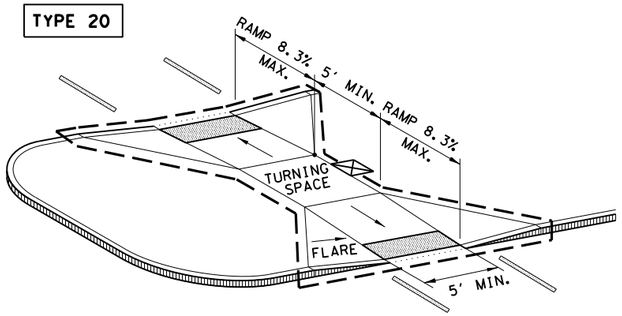


PARALLEL CURB RAMP

TYPE 3

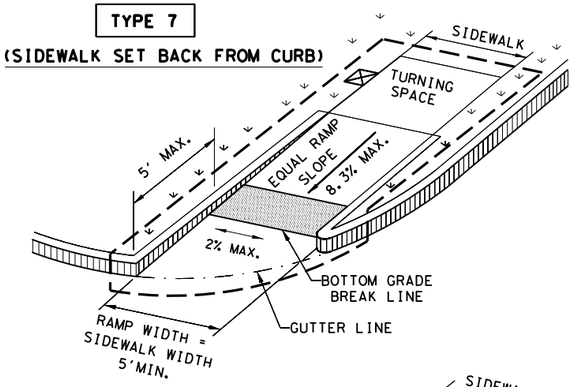


TYPE 20

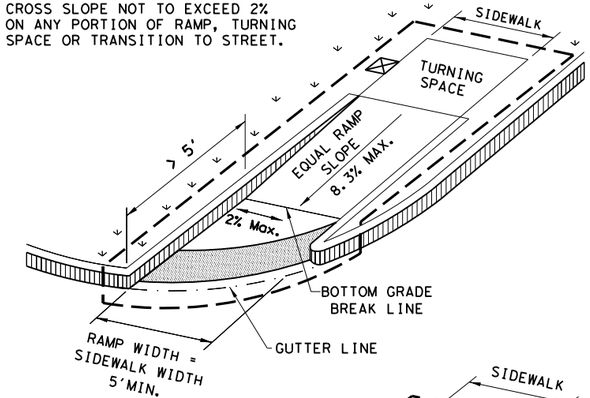


CURB RAMPS AT MEDIAN ISLANDS

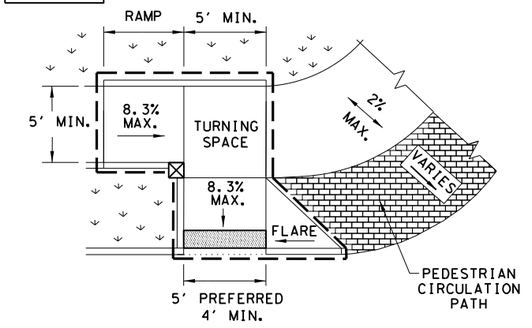
TYPE 7
(SIDEWALK SET BACK FROM CURB)



CROSS SLOPE NOT TO EXCEED 2% ON ANY PORTION OF RAMP, TURNING SPACE OR TRANSITION TO STREET.

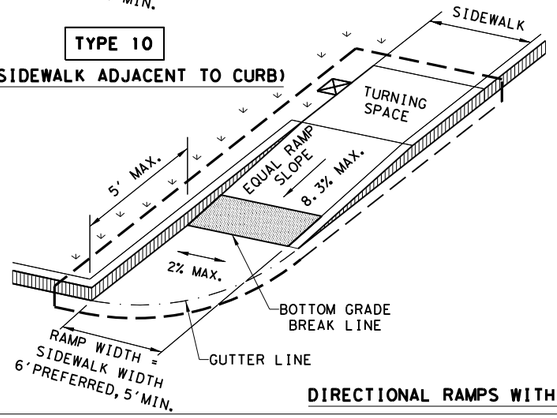


TYPE 6

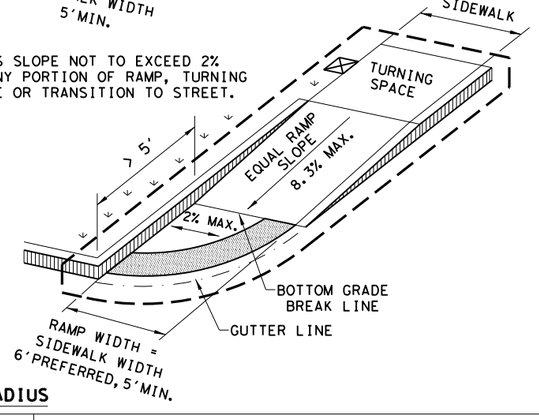


COMBINATION CURB RAMPS

TYPE 10
(SIDEWALK ADJACENT TO CURB)

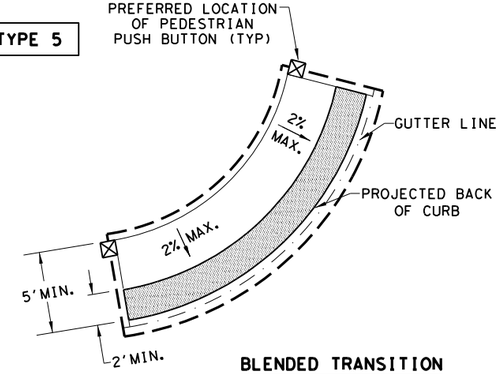


CROSS SLOPE NOT TO EXCEED 2% ON ANY PORTION OF RAMP, TURNING SPACE OR TRANSITION TO STREET.



DIRECTIONAL RAMPS WITHIN RADIUS

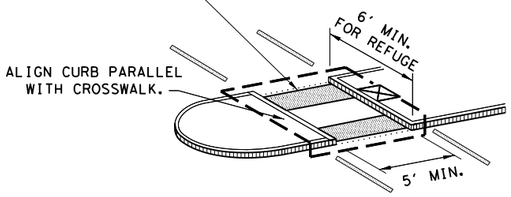
TYPE 5



BLENDED TRANSITION
(FLUSH LANDING)

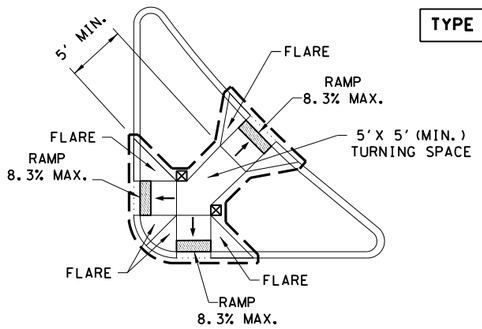
TYPE 21

INSTALL DETECTABLE WARNING SURFACE AT EACH END OF THE CUT-THROUGH RAMP WITH A MINIMUM 2' USUAL SIDEWALK SURFACE BETWEEN. IF MEDIAN IS LESS THAN 6' WIDE, ELIMINATE DETECTABLE WARNING SURFACES.



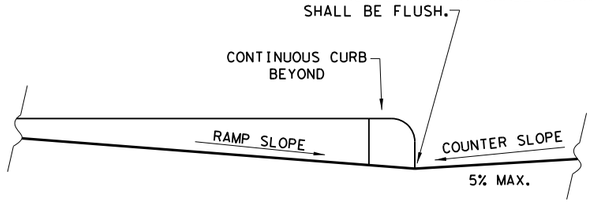
NOTE: CURB DETAILS ARE SHOWN ELSEWHERE IN THE PLANS.

TYPE 22



COMBINATION ISLAND RAMPS

BOTTOM GRADE BREAK OF CURB RAMP WILL NORMALLY BE AT GUTTER LINE. SURFACE SLOPES AT GRADE BREAKS SHALL BE FLUSH.



TYPICAL SECTION OF PERPENDICULAR CURB RAMP AT CONNECTION TO ROADWAY

NOTES / LEGEND:

SEE GENERAL NOTES ON SHEET 2 OF 4 FOR MORE INFORMATION.

DENOTES PLANTING OR NON-WALKING SURFACE NOT PART OF PEDESTRIAN CIRCULATION PATH.

DETECTABLE WARNING SURFACE

DENOTES PREFERRED LOCATION OF PEDESTRIAN PUSH BUTTON IF APPLICABLE.

GUTTER LINE

GRADE BREAK .....

RAMP LIMITS OF PAYMENT

Texas Department of Transportation

Design Division Standard

PEDESTRIAN FACILITIES CURB RAMPS

PED-18

FILE: ped18	DN: TxDOT		DW: VP	CK: KM	CK: PK & JG
© TxDOT: MARCH, 2002	CONT	SECT	JOB		HIGHWAY
REVISIONS	0110	05	126		IH 45
REVISED 08,2005	DIST	COUNTY			SHEET NO.
REVISED 06,2012	HOU	HARRIS			107
REVISED 01,2018					

DATE:
FILE:

GENERAL NOTES

CURB RAMPS

1. Install a curb ramp or blended transition at each pedestrian street crossing.
2. All slopes shown are maximum allowable. Cross slopes of 1.5% and lesser running should be used. Adjust curb ramp length or grade of approach sidewalks as directed.
3. Maximum allowable cross slope on sidewalk and curb ramp surfaces is 2%.
4. The minimum sidewalk width is 5'. Where the sidewalk is adjacent to the back of curb, a 6' sidewalk width is desirable. Where a 5' sidewalk cannot be provided due to site constraints, sidewalk width may be reduced to 4' for short distances. 5'x 5' passing areas at intervals not to exceed 200' are required.
5. Turning Spaces shall be 5'x 5' minimum. Cross slope shall be maximum 2%.
6. Clear space at the bottom of curb ramps shall be a minimum of 4'x 4' wholly contained within the crosswalk and wholly outside the parallel vehicular travel path.
7. Provide flared sides where the pedestrian circulation path crosses the curb ramp. Flared sides shall be sloped at 10% maximum, measured parallel to the curb. Returned curbs may be used only where pedestrians would not normally walk across the ramp, either because the adjacent surface is planted, substantially obstructed, or otherwise protected.
8. Additional information on curb ramp location, design, light reflective value and texture may be found in the latest draft of the Proposed Guidelines for Pedestrian Facilities in the Public Right of Way (PROWAG) as published by the U.S. Architectural and Transportation Barriers Compliance Board (Access Board).
9. To serve as a pedestrian refuge area, the median should be a minimum of 6' wide, measured from back of curbs. Medians should be designed to provide accessible passage over or through them.
10. Small channelization islands, which do not provide a minimum 5'x 5' landing at the top of curb ramps, shall be cut through level with the surface of the street.
11. Crosswalk dimensions, crosswalk markings and stop bar locations shall be as shown elsewhere in the plans. At intersections where crosswalk markings are not required, curb ramps shall align with theoretical crosswalks unless otherwise directed.
12. Provide curb ramps to connect the pedestrian access route at each pedestrian street crossing. Handrails are not required on curb ramps.
13. Curb ramps and landings shall be constructed and paid for in accordance with Item 531 "Sidewalks".
14. Place concrete at a minimum depth of 5" for ramps, flares and landings, unless otherwise directed.
15. Furnish and install No. 3 reinforcing steel bars at 18" o.c. both ways, unless otherwise directed.
16. Provide a smooth transition where the curb ramps connect to the street.
17. Curbs shown on sheet 1 within the limits of payment are considered part of the curb ramp for payment, whether it is concrete curb, gutter, or combined curb and gutter.
18. Existing features that comply with applicalble standards may remain in place unless otherwise shown on the plans.

DETECTABLE WARNING MATERIAL

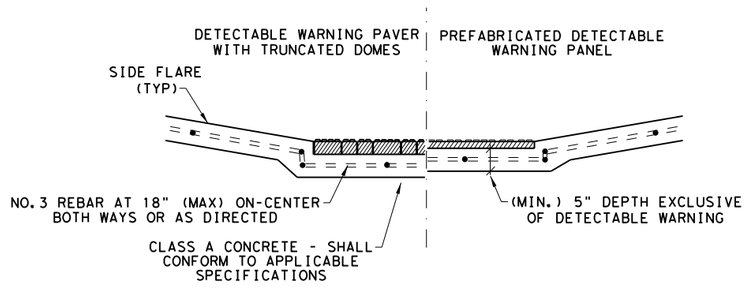
19. Curb ramps must contain a detectable warning surface that consists of raised truncated domes complying with PROWAG. The surface must contrast visually with adjoining surfaces, including side flares. Furnish and install an approved cast-in-place dark brown or dark red detectable warning surface material adjacent to uncolored concrete, unless specified elsewhere in the plans.
20. Detectable Warning Materials must meet TxDOT Departmental Materials Specification DMS 4350 and be listed on the Material Producer List. Install products in accordance with manufacturer's specifications.
21. Detectable warning surfaces must be firm, stable and slip resistant.
22. Detectable warning surfaces shall be a minimum of 24 inches in depth in the direction of pedestrian travel, and extend the full width of the curb ramp or landing where the pedestrian access route enters the street.
23. Detectable warning surfaces shall be located so that the edge nearest the curb line is at the back of curb and neither end of that edge is greater than 5 feet from the back of curb. Detectable warning surfaces may be curved along the corner radius.
24. Shaded areas on Sheet 1 of 4 indicate the approximate location for the detectable warning surface for each curb ramp type.

DETECTABLE WARNING PAVERS (IF USED)

25. Furnish detectable warning paver units meeting all requirements of ASTM C-936, C-33. Lay in a two by two unit basket weave pattern or as directed.
26. Lay full-size units first followed by closure units consisting of at least 25 percent (25%) of a full unit. Cut detectable warning paver units using a power saw.

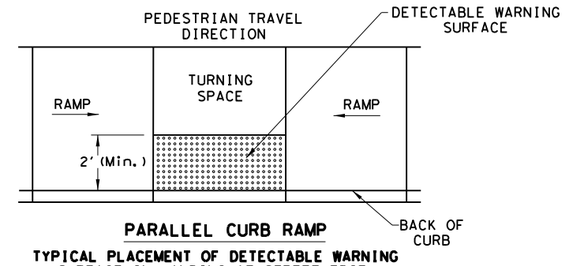
SIDEWALKS

27. Provide clear ground space at operable parts, including pedestrian push buttons. Operable parts shall be placed within unobstructed reach range specified in PROWAG section R406.
28. Place traffic signal or illumination poles, ground boxes, controller boxes, signs, drainage facilities and other items so as not to obstruct the pedestrian access route or clear ground space.
29. Street grades and cross slopes shall be as shown elsewhere in the plans.
30. Changes in level greater than 1/4 inch are not permitted.
31. The least possible grade should be used to maximize accessibility. The running slope of sidewalks and crosswalks within the public right of way may follow the grade of the parallel roadway. Where a continuous grade greater than five percent (5%) must be provided, handrails may be desirable to improve accessibility. Handrails may also be needed to protect pedestrians from potentially hazardous conditions. If provided, handrails shall comply with PROWAG R409.
32. Handrail extensions shall not protrude into the usable landing area or into intersecting pedestrian routes.
33. Driveways and turnouts shall be constructed and paid for in accordance with Item "Intersections, Driveways and Turnouts". Sidewalks shall be constructed and paid for in accordance with Item, "Sidewalks".
34. Sidewalk details are shown elsewhere in the plans.

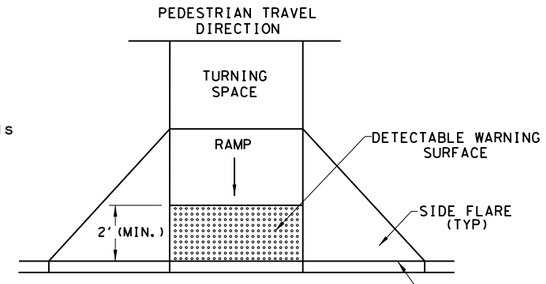


SECTION VIEW DETAIL
CURB RAMP AT DETECTIBLE WARNINGS

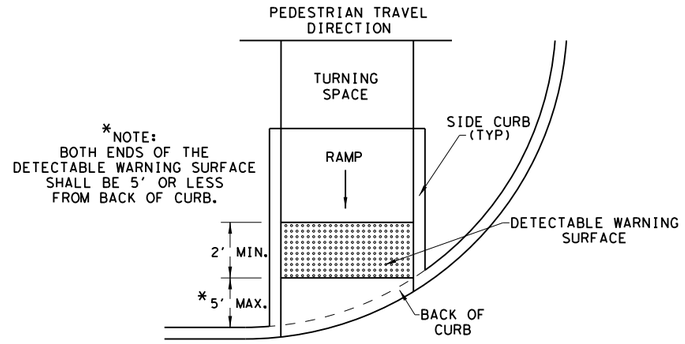
DETECTABLE WARNING SURFACE DETAILS



PARALLEL CURB RAMP
TYPICAL PLACEMENT OF DETECTABLE WARNING SURFACE ON LANDING AT STREET EDGE.



PERPENDICULAR CURB RAMP
TYPICAL PLACEMENT OF DETECTABLE WARNING SURFACE ON SLOPING RAMP RUN.



DIRECTIONAL CURB RAMP
TYPICAL PLACEMENT OF DETECTABLE WARNING SURFACE ON SLOPING RAMP RUN.

SHEET 2 OF 4

Texas Department of Transportation | Design Division Standard

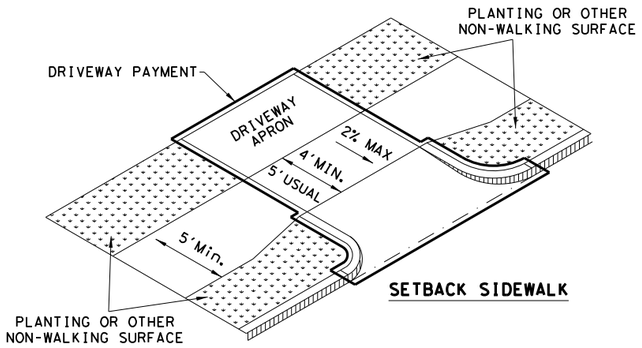
PEDESTRIAN FACILITIES CURB RAMPS

PED-18

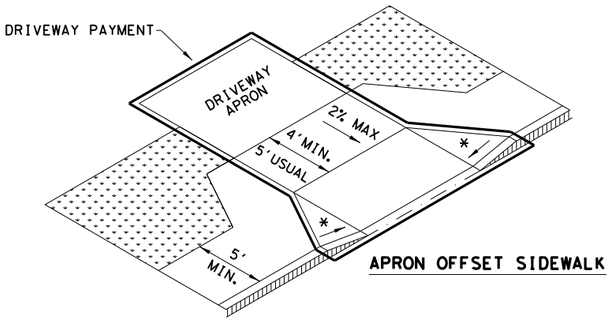
FILE: ped18	DN: TxDOT		DW: VP	CK: KM	CK: PK & JG
© TxDOT: MARCH, 2002	CONT	SECT	JOB		HIGHWAY
REVISIONS	0110	05	126		IH 45
REVISED 08,2005 REVISED 06,2012 REVISED 01,2018	DIST	COUNTY			SHEET NO.
	HOU	HARRIS			108

DATE:
FILE:

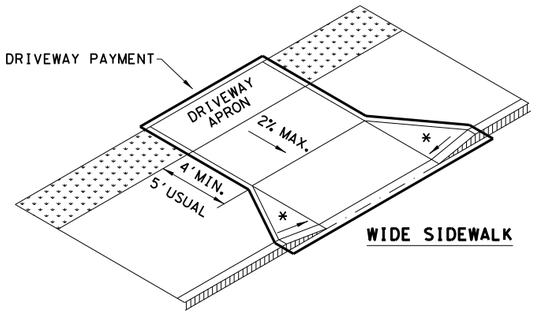
SIDEWALK TREATMENT AT DRIVEWAYS



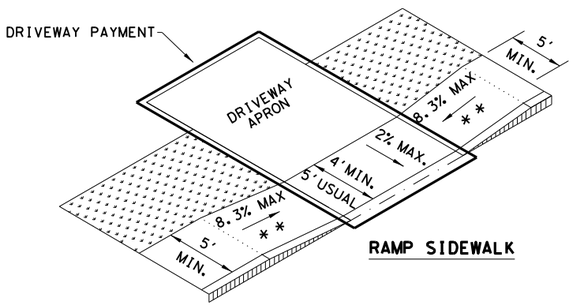
SETBACK SIDEWALK



APRON OFFSET SIDEWALK



WIDE SIDEWALK

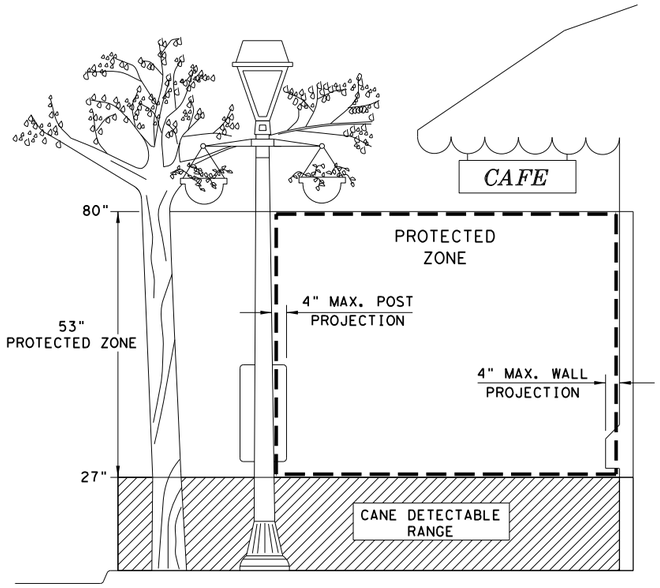


RAMP SIDEWALK

NOTES:

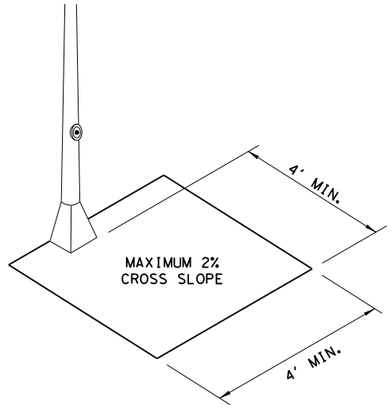
* WHERE DRIVEWAYS CROSS THE PEDESTRIAN ROUTE, SIDES SHALL BE FLARED AT 10% MAX SLOPE.

* * IF CURB HEIGHT IS GREATER THAN 6 INCHES, USE GRADE LESS THAN OR EQUAL TO 5%. HANDRAIL AND DETECTABLE WARNING ARE NOT REQUIRED.

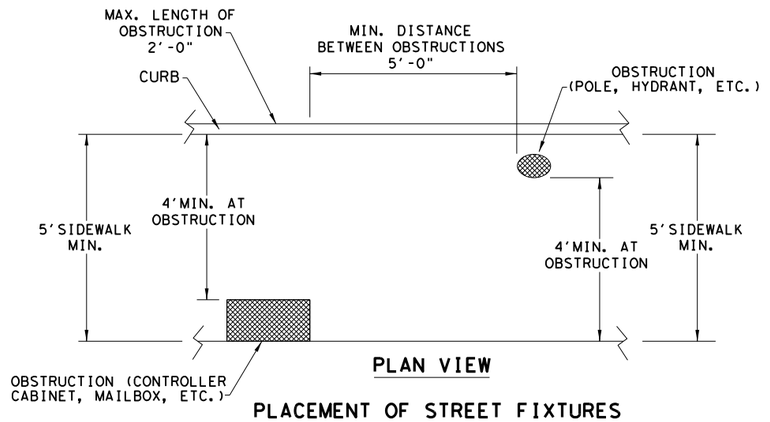


PROTECTED ZONE

NOTE: IN PEDESTRIAN CIRCULATION AREA, MAXIMUM 4" PROJECTION FOR POST OR WALL MOUNTED OBJECTS BETWEEN 27" AND 80" ABOVE THE SURFACE.



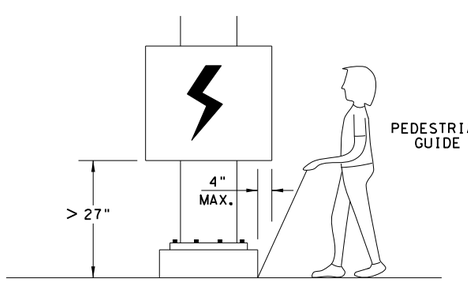
CLEAR SPACE ADJACENT TO PEDESTRIAN PUSH BUTTON



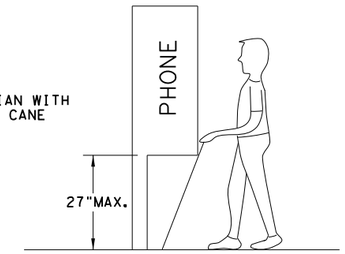
PLAN VIEW

PLACEMENT OF STREET FIXTURES

NOTE: ITEMS NOT INTENDED FOR PUBLIC USE. MINIMUM 4' X 4' CLEAR GROUND SPACE REQUIRED AT PUBLIC USE FIXTURES.



WHEN AN OBSTRUCTION OF A HEIGHT GREATER THAN 27" FROM THE SURFACE WOULD CREATE A PROTRUSION OF MORE THAN 4" INTO THE PEDESTRIAN CIRCULATION AREA, CONSTRUCT ADDITIONAL CURB OR FOUNDATION AT THE BOTTOM TO PROVIDE A MAXIMUM 4" OVERHANG.



PROTRUDING OBJECTS OF A HEIGHT ≤ 27" ARE DETECTABLE BY CANE AND DO NOT REQUIRE ADDITIONAL TREATMENT.

DETECTION BARRIER FOR VERTICAL CLEARANCE < 80"

Texas Department of Transportation

Design Division Standard

PEDESTRIAN FACILITIES CURB RAMPS

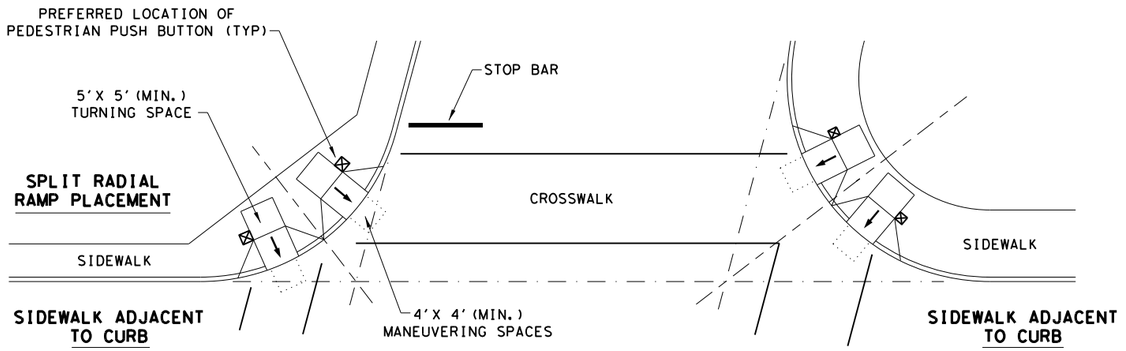
PED-18

FILE: ped18	DN: TxDOT	DW: VP	CK: KM	CK: PK & JG	
© TxDOT: MARCH, 2002	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0110	05	126	IH 45	
REVISED 08, 2005 REVISED 06, 2012 REVISED 01, 2018	DIST	COUNTY		SHEET NO.	
	HOU	HARRIS		109	

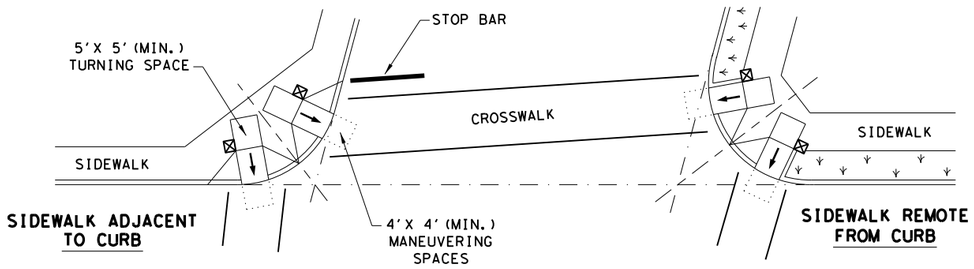
DATE:
FILE:

TYPICAL CROSSING LAYOUTS

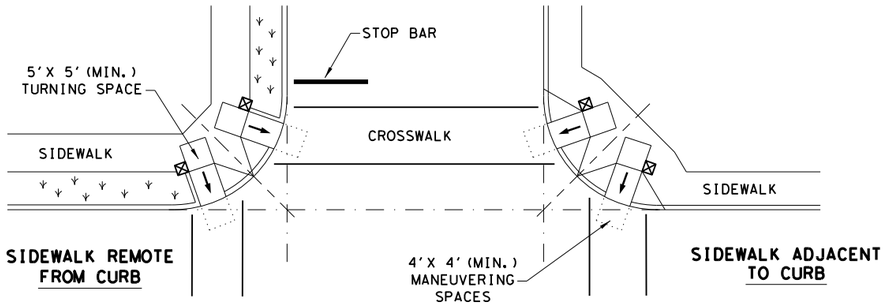
SEE SHEET 1 OF 4 FOR DETAILS AND DIMENSIONS



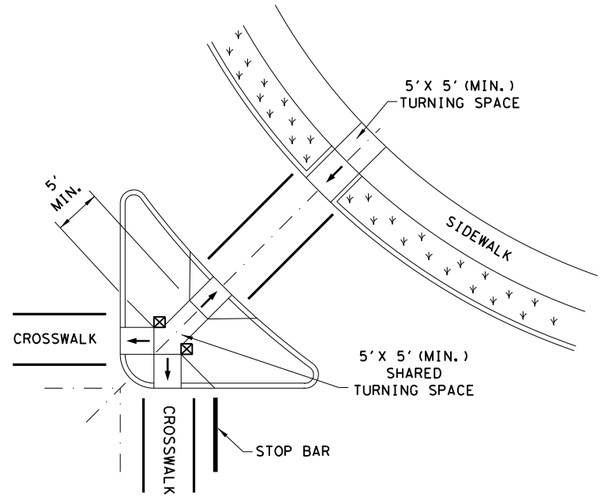
SKEWED INTERSECTION WITH "LARGE" RADIUS



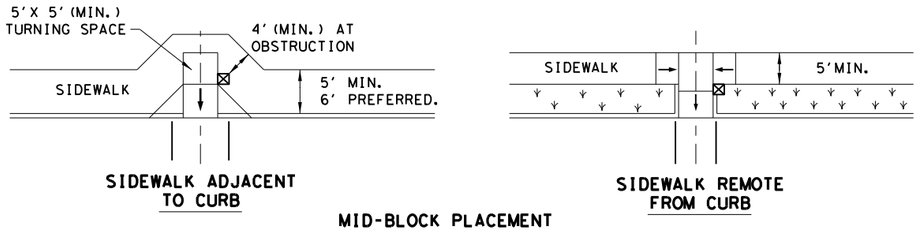
SKEWED INTERSECTION WITH "SMALL" RADIUS



NORMAL INTERSECTION WITH "SMALL" RADIUS



AT INTERSECTION
W/FREE RIGHT TURN & ISLAND



MID-BLOCK PLACEMENT
PERPENDICULAR RAMPS

LEGEND:

SHOWS DOWNWARD SLOPE. →

DENOTES PREFERRED LOCATION OF PEDESTRIAN PUSH BUTTON (IF APPLICABLE). ⊠

DENOTES PLANTING OR NON-WALKING SURFACE NOT PART OF PEDESTRIAN CIRCULATION PATH.

SHEET 4 OF 4

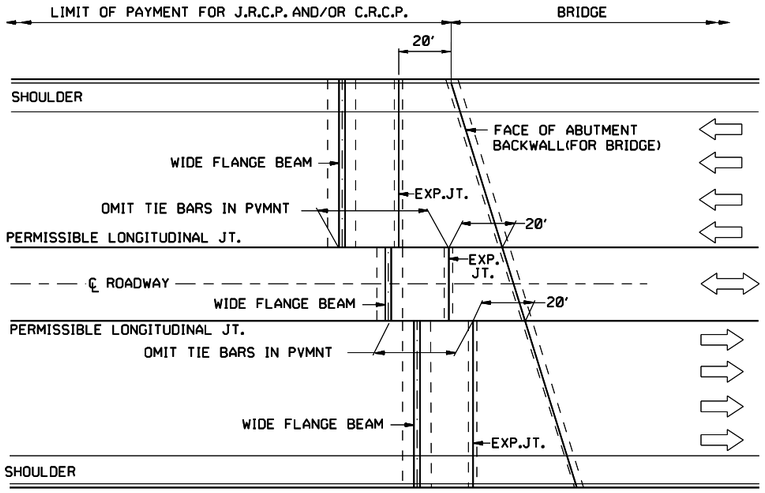
Texas Department of Transportation

Design Division Standard

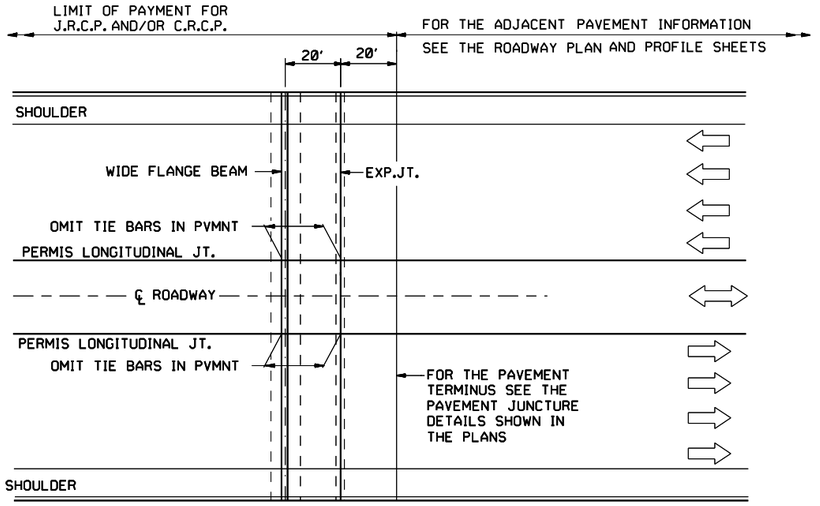
PEDESTRIAN FACILITIES CURB RAMPS

PED-18

FILE: ped18	DN: TxDOT		DW: VP	CK: KM	CK: PK & JG
	CONT	SECT	JOB		HIGHWAY
REVISIONS	0110	05	126		IH 45
REVISED 08, 2005 REVISED 06, 2012 REVISED 01, 2018	DIST	COUNTY			SHEET NO.
	HOU	HARRIS			110



TYPICAL ROADWAY LAYOUT CONCRETE MEDIAN AND SHOULDERS (AT BRIDGES)

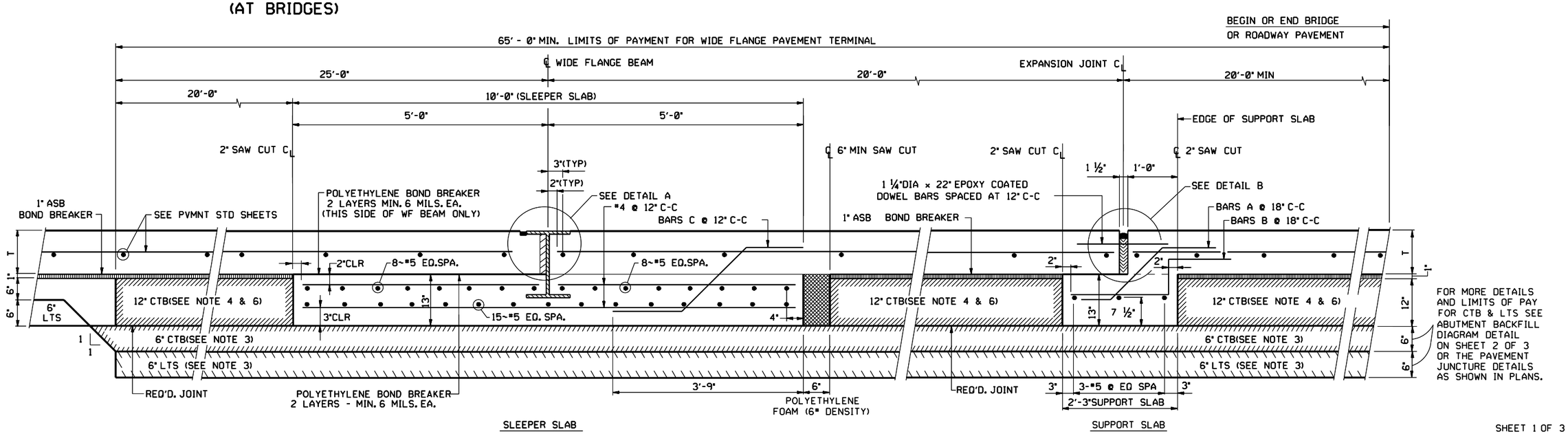


TYPICAL ROADWAY LAYOUT CONCRETE MEDIAN AND SHOULDERS

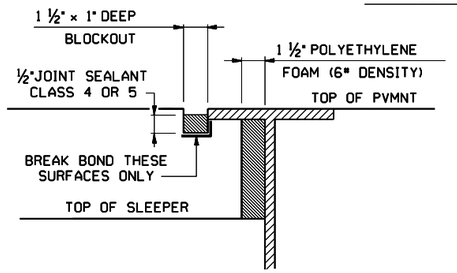
NOTES

1. BLOCK-OUT REQUIRED AT EACH END OF WIDE FLANGE BEAM ADJACENT TO ⅜ INCH END PLATE WHERE BLOCK-OUT IS PLACED ABUTTING CONCRETE PAVEMENT, RIPRAP OR STABILIZED BASE. THE BLOCKED OUT AREA WILL BE FILLED WITH POLYETHYLENE FOAM (6 POUND DENSITY). SEE SHEET 3 OF 3 FOR BLOCK-OUT DETAIL.
2. FOR ADDITIONAL DETAILS ON REINFORCEMENT MEMBER QUANTITIES AND THE WIDE FLANGE BEAM SEE SHEET 2 OF 3.
3. REPLACE 6 INCH LIME TREATMENT AND 6 INCH CEMENT TREATMENT WITH CEMENT STABILIZED BACK-FILL AT STRUCTURES WITH CEMENT STABILIZED BACKFILL EMBANKMENT. SEE "CEMENT STABILIZED BACKFILL EMBANKMENT" STANDARD SHEET FOR DETAILS.
4. 12 INCH CEMENT STABILIZED BACKFILL MAY BE SUBSTITUTED FOR 12 INCH CTB, AT CONTRACTOR'S OPTION, ON APPLICABLE STRUCTURES WITH CEMENT STABILIZED BACKFILL EMBANKMENT.

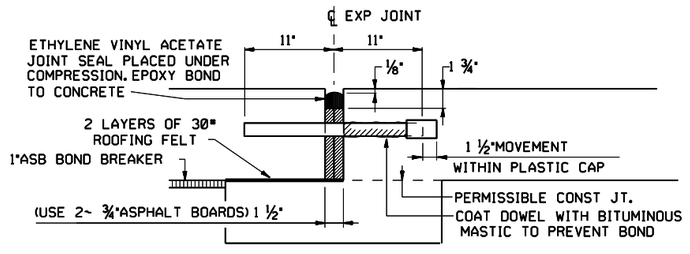
CTB - CEMENT TREATED BASE
LTS - LIME TREATED SUBGRADE
CRCP - CONTINUOUSLY REINFORCED CONCRETE PAVEMENT
JRCP - JOINTED REINFORCED CONCRETE PAVEMENT
ASB - ASPHALT STABILIZED BASE
T - PAVEMENT THICKNESS



TYPICAL SECTION THRU TERMINAL ANCHORAGE @ SLEEPER SLAB & SUPPORT SLAB



DETAIL A



DETAIL B

SHEET 1 OF 3

Texas Department of Transportation
Houston District

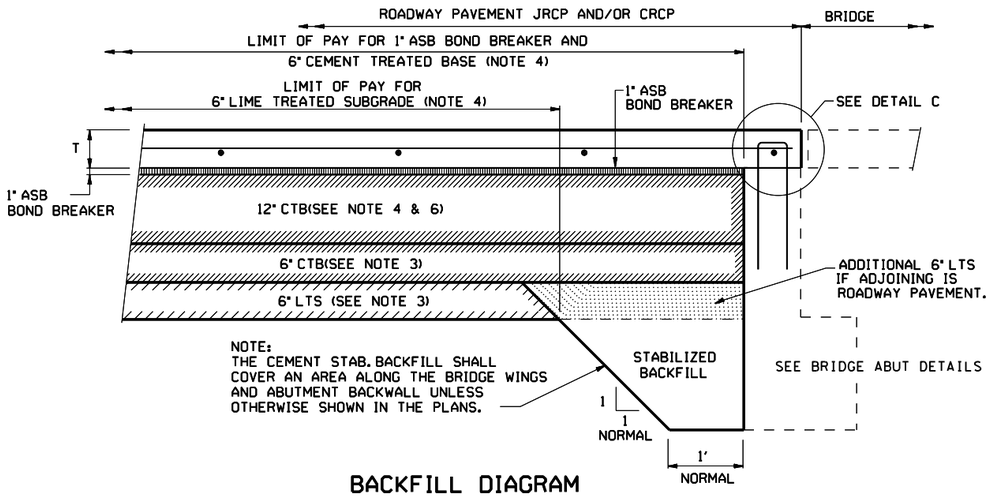
WIDE FLANGE PAVEMENT TERMINALS

FOR CONTINUOUSLY & JOINTED REINFORCED CONCRETE PAVEMENT DETAILS
(FOR USE AT BRIDGE END OR PAVEMENT TERMINUS)

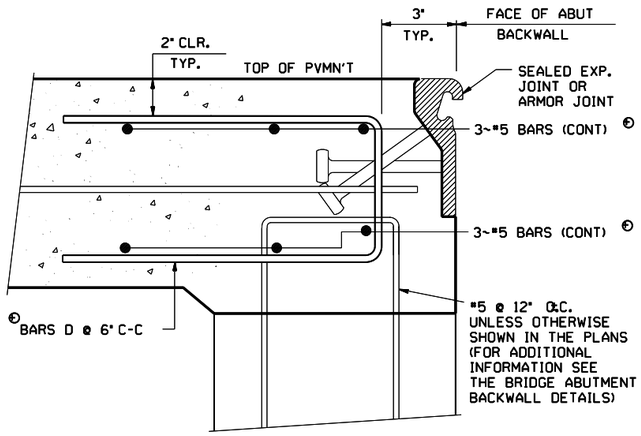
WFPT

FILE: STDB-3.DGN	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT 2014	DISTRICT	FED REG	PROJECT NO.	SHEET
REVISIONS 02/15 2014 SPECS	HOU	6		111
	COUNTY		CONTROL SECT JOB	HIGHWAY
	HARRIS		0110 05 126	IH 45

STDB-3



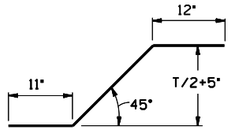
BACKFILL DIAGRAM



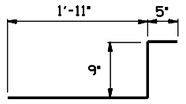
DETAIL C

(SHOWING ADDITIONAL REINFORCEMENT FOR ROADWAY PAVEMENT WITH SEALED EXPANSION JOINTS OR ARMOR JOINTS AT ABUTMENTS.)

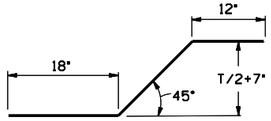
⊕ THE ADDITIONAL STEEL REQUIRED BY THE ABOVE DETAIL "C" SHALL NOT BE PAID FOR DIRECTLY, BUT SHALL BE CONSIDERED INCIDENTAL TO THE ITEM, "CONCRETE PAVEMENT".



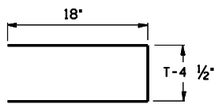
BARS A (#4)



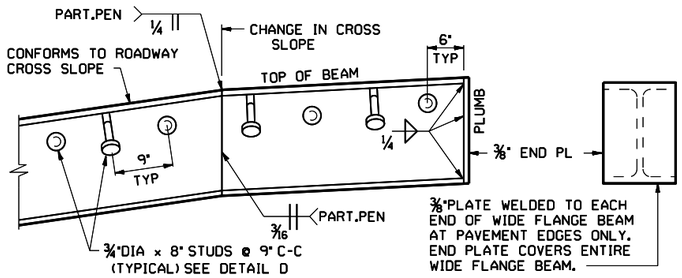
BARS B (#4)



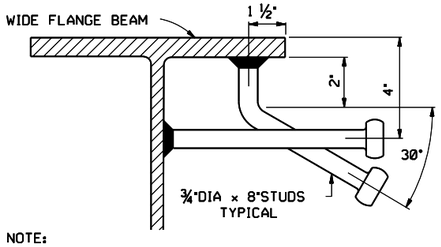
BARS C (#4)



BARS D (#5)



WIDE FLANGE DETAIL



NOTE:
STUDS SHALL BE ELECTRIC ARC END WELDED WITH COMPLETE FUSION. ANY STUD WHICH IS DISLODGED IN SHIPPING OR CAN BE DISLODGED BY HAMMER SHALL BE REPLACED.

DETAIL D

NOTES: (CONT)

5. THIS STANDARD WILL BE USED WITH SPECIAL SPECIFICATION "CONCRETE PAVEMENT TERMINALS" THIS ITEM WILL BE MEASURED BY THE LINEAR FOOT OF WIDE FLANGE BEAM COMPLETE IN PLACE.

   WIDE FLANGE BEAM, SUPPORT SLAB, SLEEPER SLAB, 12 INCHES OF CEMENT TREATED BASE, POLYETHYLENE BONDBREAKER AND ANY EXCAVATION NECESSARY WILL NOT BE PAID FOR DIRECTLY, BUT WILL BE CONSIDERED SUBSIDIARY TO SPECIAL SPECIFICATION ITEM, "CONCRETE PAVEMENT WIDE FLANGE TERMINALS".

7. POLYETHYLENE FOAM (6 POUND DENSITY), SAW CUTS, EXPANSION JOINTS, EPOXY COATED DOWEL AND EXPANSION JOINT MATERIALS WILL NOT BE PAID FOR DIRECTLY BUT SHALL BE CONSIDERED INCIDENTAL TO THE ITEM 360.

8. THE CONCRETE PAVEMENT, 1 INCH ASB BONDBREAKER, 6 INCH PORTLAND CEMENT TREATED BASE AND 6 INCH LIME TREATED SUBGRADE WILL BE PAID FOR UNDER THE APPROPRIATE BID ITEMS.

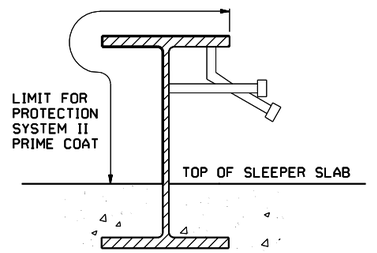
9. SHEAR CUTTING OF DOWEL BARS IS PROHIBITED.

10. EPOXY COATING OF DOWEL BARS PER SPECIFICATION ITEM 440.

11. CEMENT STABILIZED BACKFILL IS REQUIRED AT ALL ABUTMENTS.

CTB - CEMENT TREATED BASE
LTS - LIME TREATED SUBGRADE
CRCP - CONTINUOUSLY REINFORCED CONCRETE PAVEMENT
JRCP - JOINTED REINFORCED CONCRETE PAVEMENT
ASB - ASPHALT STABILIZED BASE
T - PAVEMENT THICKNESS

TABLE OF BEAM SIZES	
PAVEMENT THICKNESS	WIDE FLANGE BEAM DESIGNATION
8"-9 ½"	W14 X 68
10"-11 ½"	W16 X 89
12"-13"	W18 X 97
14" & 15"	W21 X111



WIDE FLANGE PAINTING DETAIL

SEE "TABLE OF BEAM SIZES"

ESTIMATED QUANTITIES (FOR CONTRACTOR'S INFORMATION ONLY)

	ITEM	PAVEMENT THICKNESS				
		8" THRU 10"	10 ½" THRU 12"	12 ½" THRU 13"	14"	15"
SLEEPER SLAB	CONCRETE	0.40 CY/LF	0.40 CY/LF	0.40 CY/LF	0.40 CY/LF	0.40 CY/LF
	REINFORCING STEEL	49.1 LBS/LF	49.3 LBS/LF	49.6 LBS/LF	49.7 LBS/LF	49.8 LBS/LF
SUPPORT SLAB	CONCRETE	0.09 CY/LF	0.09 CY/LF	0.09 CY/LF	0.09 CY/LF	0.09 CY/LF
	REINFORCING STEEL	6.3 LBS/LF	6.4 LBS/LF	6.5 LBS/LF	6.6 LBS/LF	6.6 LBS/LF
	12" CEMENT TREATED BASE	1.95 CY/LF (BASED ON JOINTS BEING NORMAL TO THE PAVEMENT CENTERLINE)				

Texas Department of Transportation
Houston District

WIDE FLANGE PAVEMENT TERMINALS

FOR CONTINUOUSLY & JOINTED REINFORCED CONCRETE PAVEMENT DETAILS
(FOR USE AT BRIDGE END OR PAVEMENT TERMINUS)

WFPT

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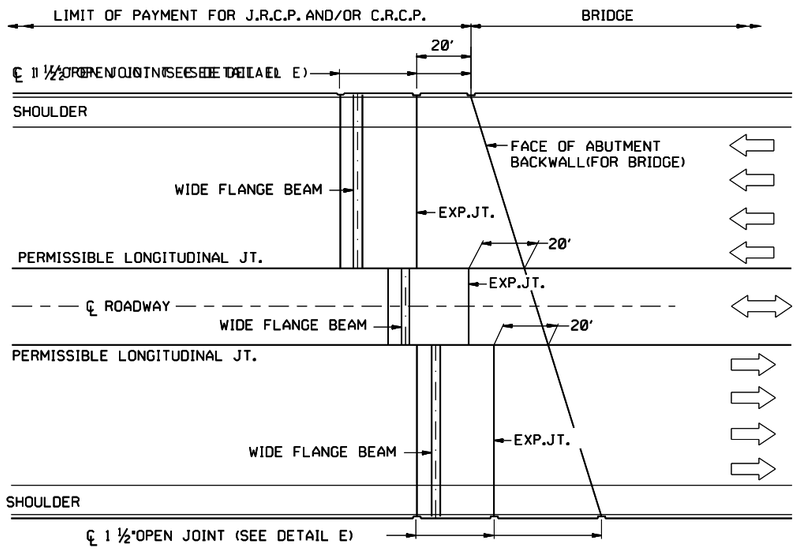
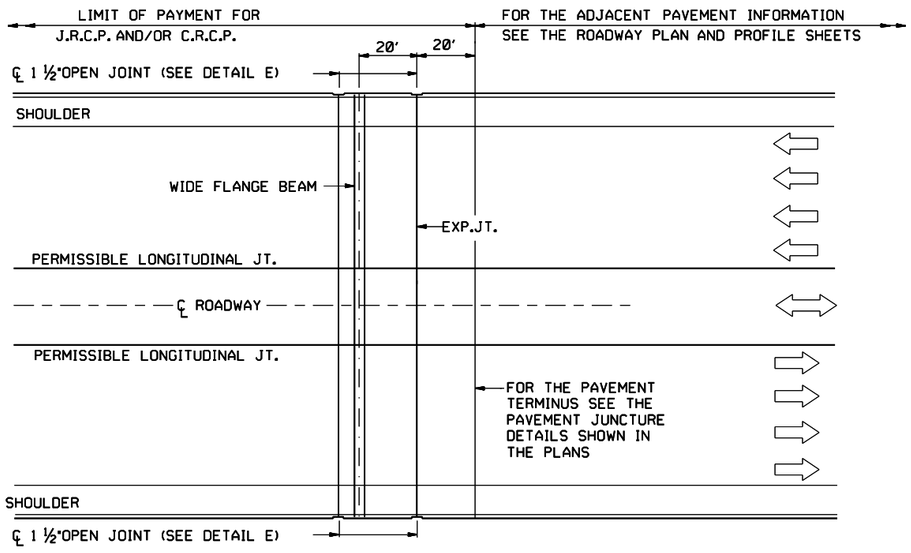
REVISIONS 02/15 2014 SPECS	HOU	6		112
	COUNTY	CONTROL	SECT	JOB	HIGHWAY
	HARRIS	0110	05	126	IH45

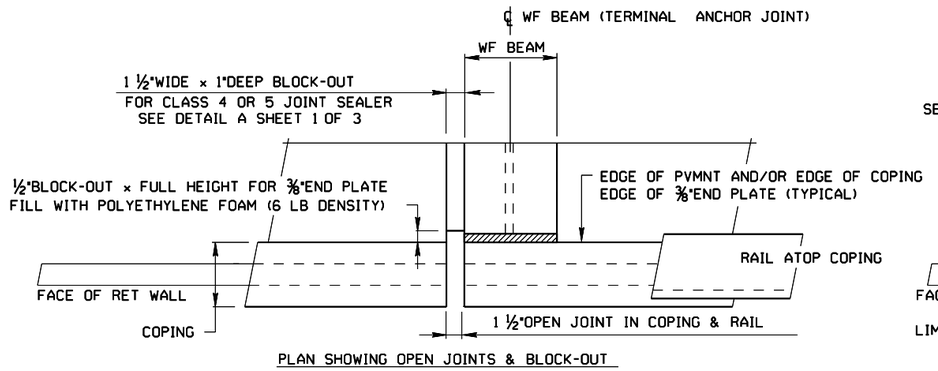
STDB-3



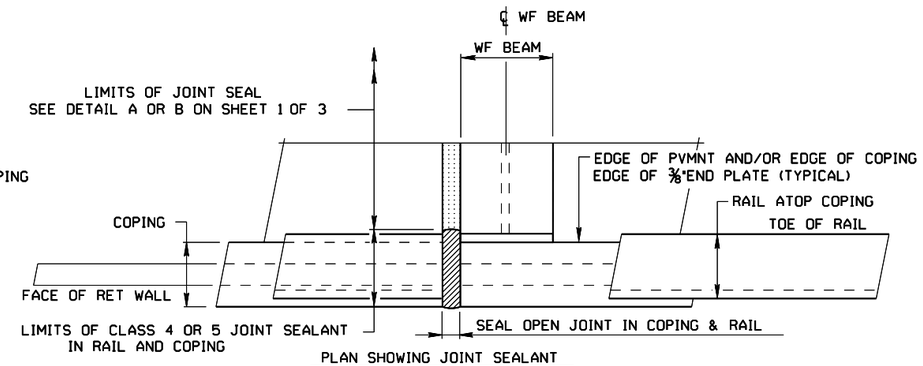
PLAN
SHOWING OPEN JOINT LAYOUT



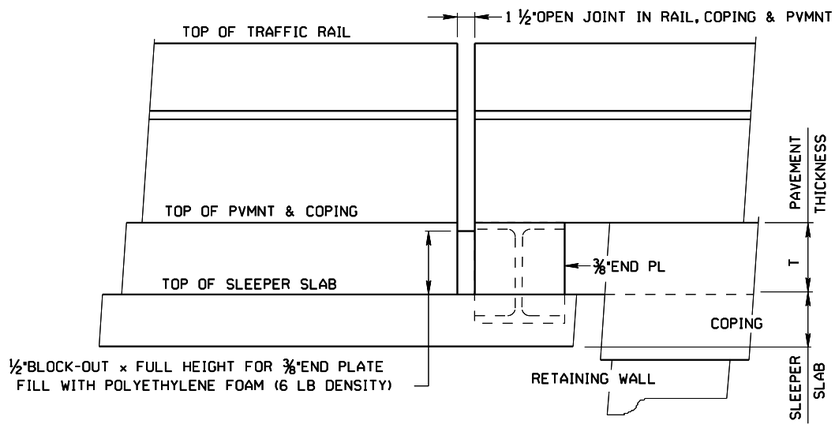
PLAN
SHOWING OPEN JOINT LAYOUT



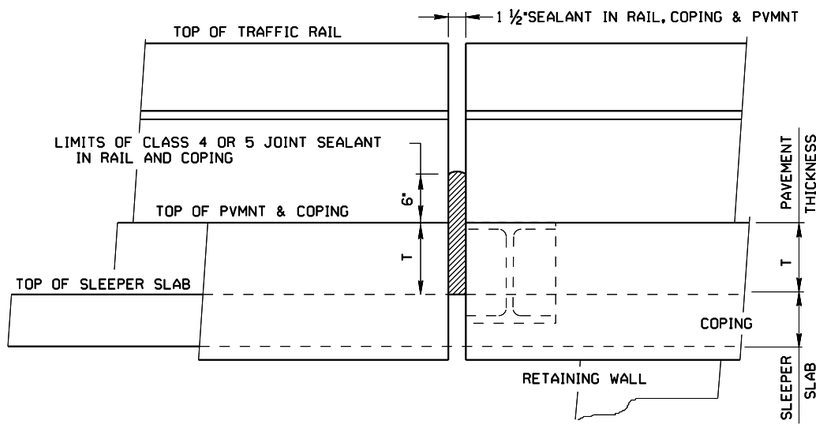
PLAN SHOWING OPEN JOINTS & BLOCK-OUT



PLAN SHOWING JOINT SEALANT



ELEVATION SHOWING OPEN JOINTS & BLOCK-OUT



ELEVATION SHOWING JOINT SEALANT

DETAIL E

SHOWN @ WIDE FLANGE ~ ALL OTHER JOINTS SIMILAR

Texas Department of Transportation
Houston District

WIDE FLANGE PAVEMENT TERMINALS

FOR CONTINUOUSLY & JOINTED REINFORCED CONCRETE PAVEMENT DETAILS
(FOR USE AT RETAINING WALLS)

WFPT

FILE: STDB-3.DGN	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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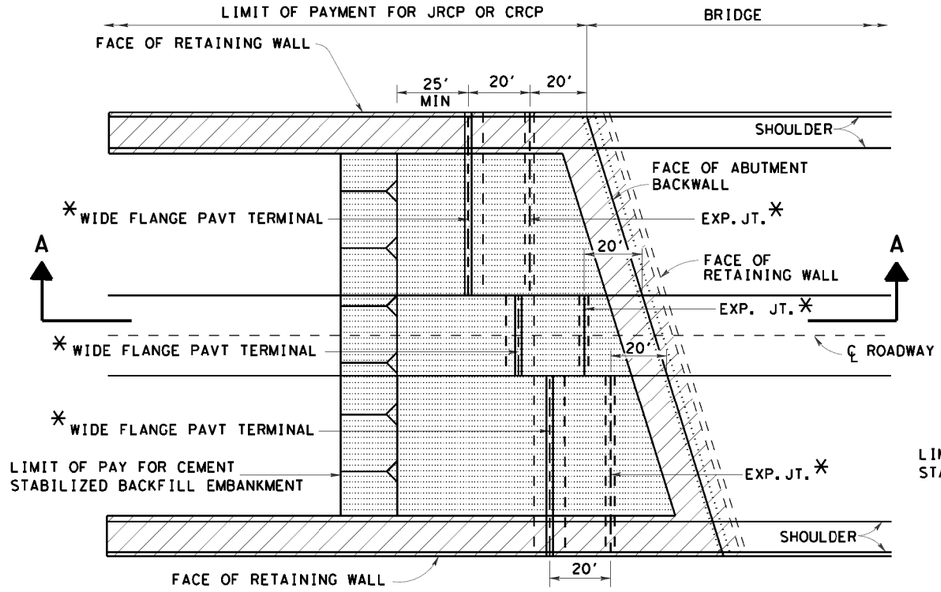
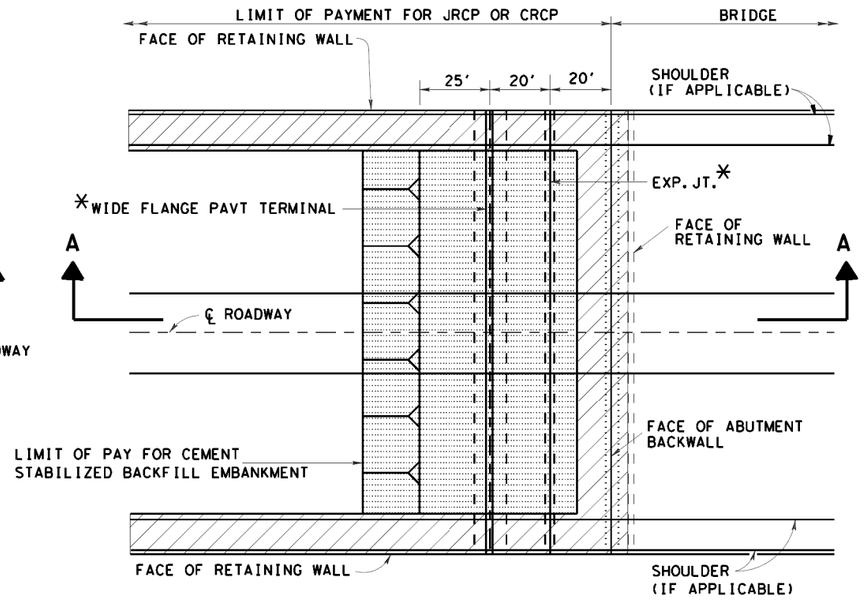
REVISIONS 02/15 2014 SPECS	HOU	6		113
	COUNTY		CONTROL SECT JOB	HIGHWAY
	HARRIS		0110 05 126	IH 45



TYPICAL ROADWAY LAYOUT CONCRETE MEDIAN AND SHOULDERS (AT SKEWED BRIDGES)



TYPICAL ROADWAY LAYOUT CONCRETE MEDIAN AND SHOULDERS (AT NON-SKEWED BRIDGES)

NOTES

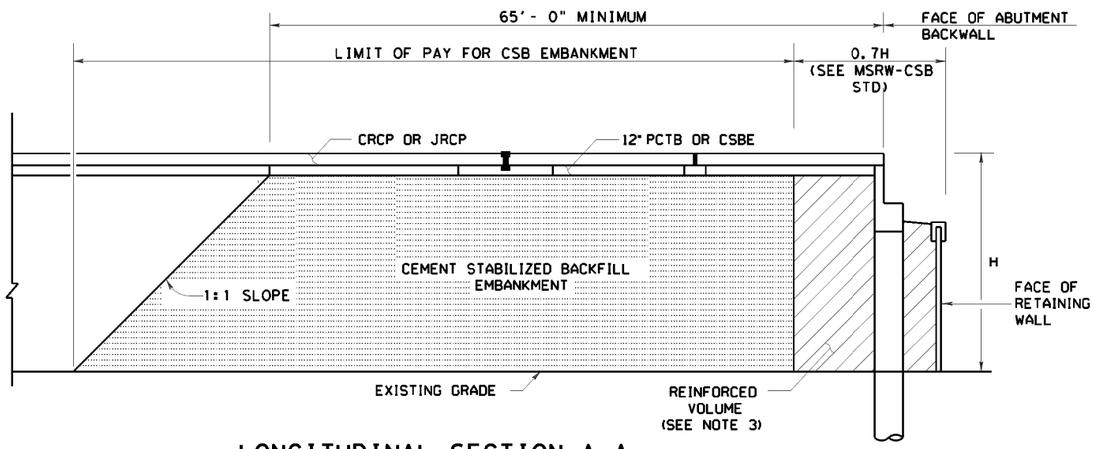
1. USE CEMENT STABILIZED BACKFILL EMBANKMENT IN ACCORDANCE WITH ITEM 132 AND HOUSTON DISTRICT-WIDE SPECIAL PROVISION (132-001).
2. FOR ADDITIONAL DETAILS ON WIDE FLANGE PAVEMENT TERMINALS SEE "WIDE FLANGE PAVEMENT TERMINALS" STANDARD SHEET.
3. FOR ADDITIONAL DETAILS ON RETAINING WALLS SEE "MECHANICALLY STABILIZED RETAINING WALL - CEMENT STABILIZED BACKFILL" MSRW-CSB STANDARD SHEET.

CRCP - CONTINUOUSLY REINFORCED CONCRETE PAVEMENT
CSBE - CEMENT STABILIZED BACKFILL EMBANKMENT
EXP JT - EXPANSION JOINT
H - HEIGHT OF RETAINING WALL
JRCP - JOINTED REINFORCED CONCRETE PAVEMENT
MSRW - MECHANICALLY STABILIZED RETAINING WALL
PCTB - PORTLAND CEMENT TREATED BASE

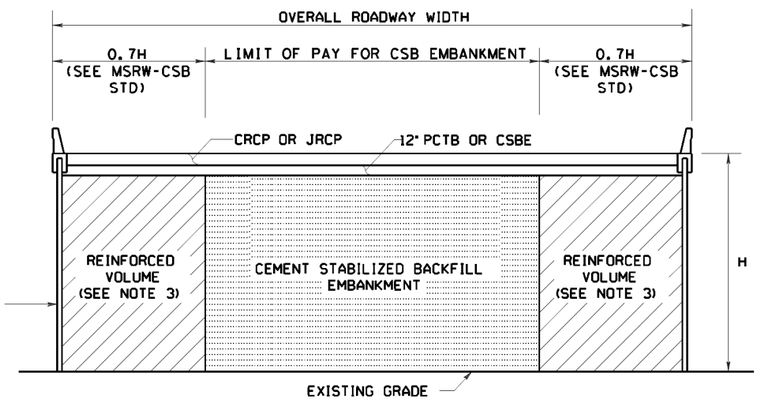
LEGEND

LIMITS OF REINFORCED VOLUME (CEMENT STABILIZED BACKFILL). THIS VOLUME IS PAID UNDER ITEM 132-6006, EMBANKMENT (FINAL) (DC) (TY C).

LIMITS OF CEMENT STABILIZED BACKFILL EMBANKMENT. THIS QUANTITY IS PAID UNDER ITEM 132-6035, EMBANKMENT (FINAL) (DENS CONT) (TY E) (CSBE).



LONGITUDINAL SECTION A-A



TRANSVERSE SECTION

* THIS APPLIES ONLY WHEN WIDE FLANGE TERMINALS ARE USED ON APPROACHES TO BRIDGES. IF NOT USING THIS SYSTEM, SEE APPROACH SLAB DETAILS ELSEWHERE IN THE PLANS.

Texas Department of Transportation
Houston District

CEMENT STABILIZED BACKFILL EMBANKMENT

(FOR USE WITH RETAINING WALLS AT BRIDGE ABUTMENTS)

CSBE-RW

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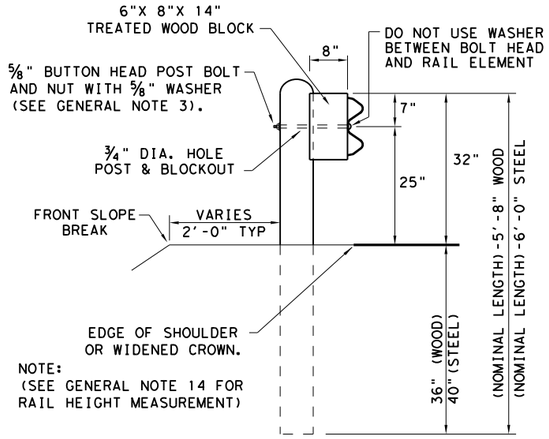
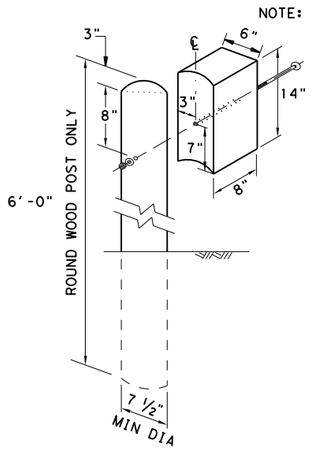
	HOU	6		113A
	COUNTY	CONTROL	SECT	JOB	HIGHWAY
	HARRIS	0110	05	126	IH 45

DATE:
FILE:

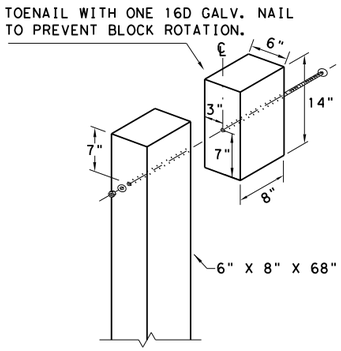


TYPICAL POST PLACEMENT

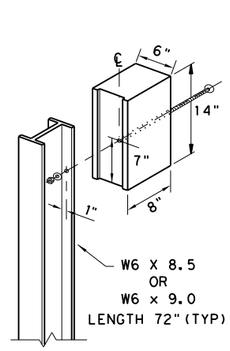


WOOD BLOCK TO ROUND WOOD POST

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

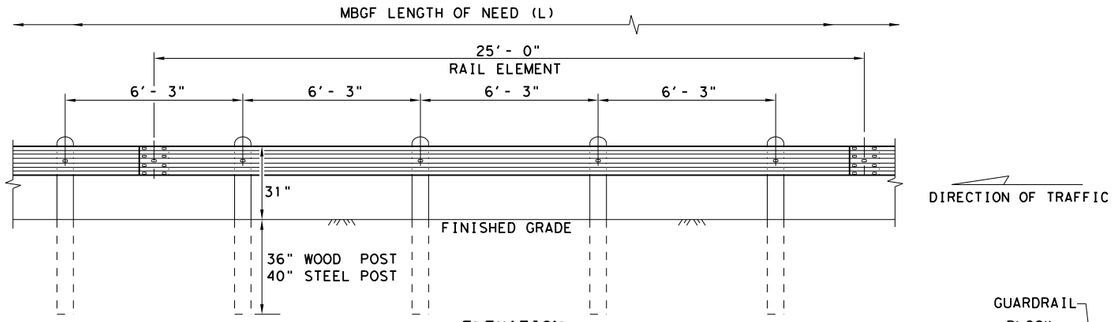


WOOD BLOCK TO RECTANGULAR WOOD POST



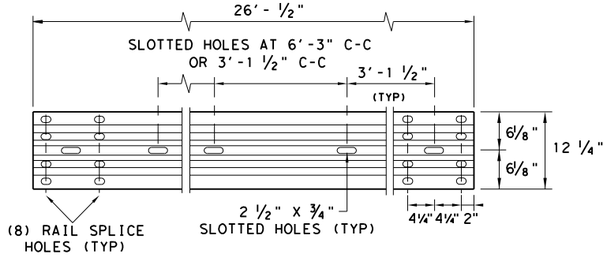
ROUTED WOOD BLOCK TO I-BEAM STEEL POST

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



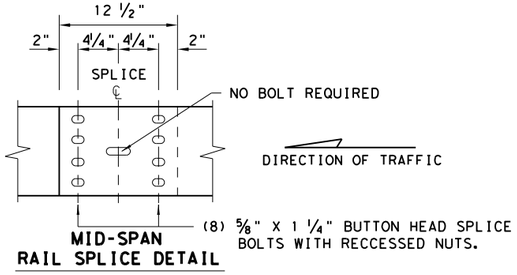
ELEVATION MID-SPAN RAIL SPLICE

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



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

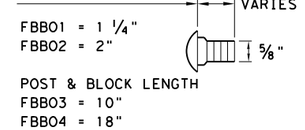
NOTES: SEE GENERAL NOTE 2 FOR ALLOWABLE RAIL TYPES.
SEE RAIL SPLICE DETAIL FOR REQUIRED HARDWARE.



MID-SPAN RAIL SPLICE DETAIL

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

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

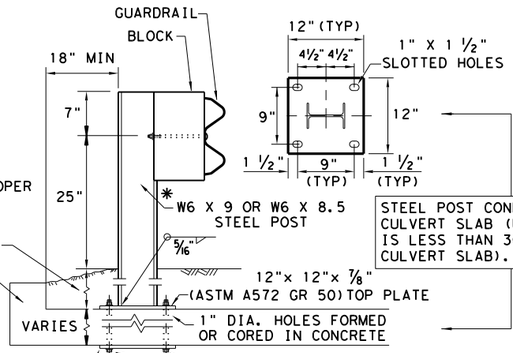


FBB01 = 1 ¼"
FBB02 = 2"

POST & BLOCK LENGTH
FBB03 = 10"
FBB04 = 18"

BUTTON HEAD BOLT

NOTE: SEE GENERAL NOTE 3 FOR SPLICE & POST BOLT DETAILS.



*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. FOR THE LOW FILL CULVERT OPTION, POSTS LOCATED PARTIALLY OR WHOLLY BETWEEN PRECAST BOX CULVERT UNITS, THE USE OF A CAST-IN-PLACE CONCRETE CLOSURE BETWEEN BOXES IS REQUIRED. THE LENGTH OF THE CAST-IN-PLACE CONCRETE CLOSURE SHALL ACCOMMODATE THE PLACEMENT OF THE LOW FILL CULVERT OPTION. SEE CONCRETE CLOSURE DETAILS ON BRIDGE STANDARD SCP-MD.
14. GUARDRAIL HEIGHT MEASUREMENT: WHEN THE GUARDRAIL IS LOCATED ABOVE PAVEMENT, MEASURE THE HEIGHT FROM THE PAVEMENT TO THE TOP OF THE W-BEAM RAIL. WHEN THE GUARDRAIL IS LOCATED UP TO 2 FT. OFF OF THE EDGE OF PAVEMENT OR FOR A PAVEMENT OVERLAY, USE A 10-FOOT STRAIGHTEDGE TO EXTEND THE PAVEMENT/SHOULDER SLOPE TO THE BACK OF RAIL, MEASURE FROM THE BOTTOM OF STRAIGHTEDGE TO THE TOP OF RAIL. FOR GUARDRAIL LOCATED DOWN A 10:1 SLOPE, MEASURE FROM THE NOMINAL TERRAIN.

Texas Department of Transportation

Design Division Standard

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

FILE: gf3119.dgn	DN: TxDOT	CK: KM	DW: VP	CK: CGL/AG
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REVISIONS	0110	05	126	IH 45
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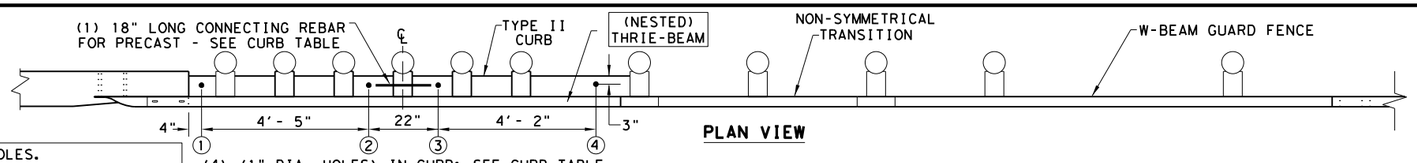
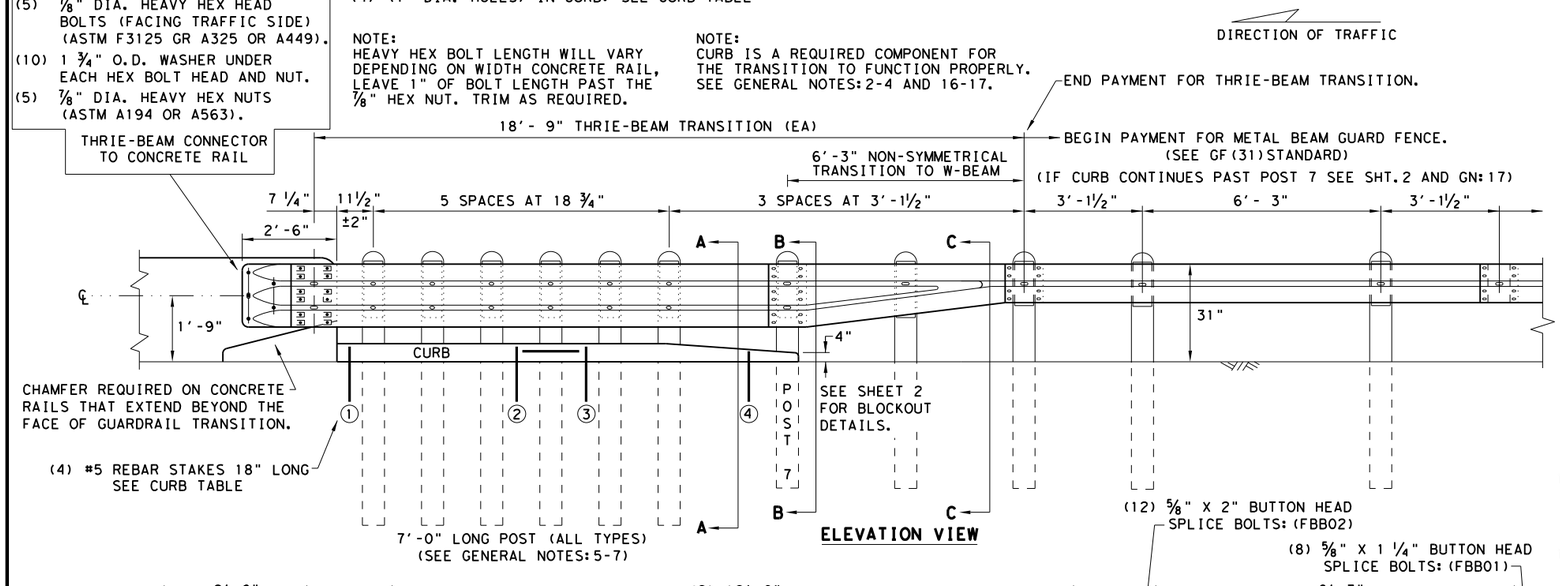


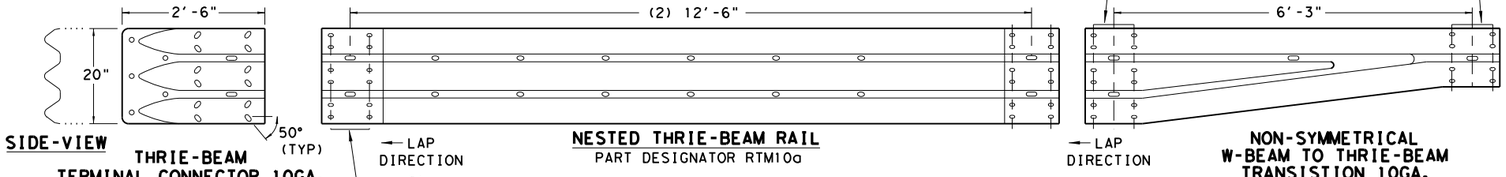
(5) 1" DIA. HOLES.
(5) ⅞" DIA. HEAVY HEX HEAD BOLTS (FACING TRAFFIC SIDE) (ASTM F3125 GR A325 OR A449).
(10) 1 ¾" O.D. WASHER UNDER EACH HEX BOLT HEAD AND NUT.
(5) ⅞" DIA. HEAVY HEX NUTS (ASTM A194 OR A563).

NOTE:
HEAVY HEX BOLT LENGTH WILL VARY DEPENDING ON WIDTH CONCRETE RAIL, LEAVE 1" OF BOLT LENGTH PAST THE ⅞" HEX NUT. TRIM AS REQUIRED.

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

DIRECTION OF TRAFFIC

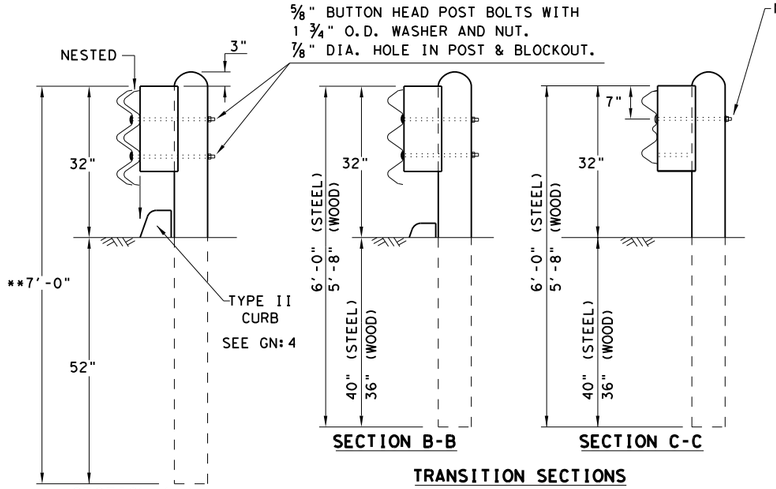




(12) ⅝" X 2" BUTTON HEAD SPLICE BOLTS WITH RECESSED NUTS: (FBB02)
(12) RECTANGULAR GUARDRAIL PLATE WASHERS: (FWR03)

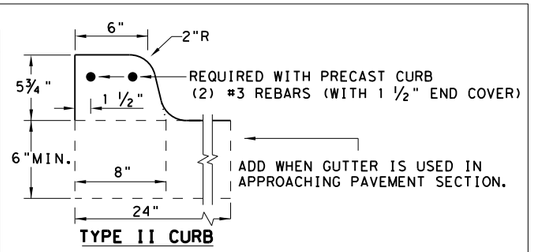
PLATE WASHER INSTRUCTIONS

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



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

THRIE-BEAM TERMINAL - CURB TABLE
PRECAST CURB FULL LENGTH EQUALS 12'- 2" THE PRECAST CURB MAY BE FORMED INTO TWO SECTIONS.
CURB (1) LENGTH 5'- 8"
CURB (2) LENGTH 6'- 6"
TAPER CURB (2) TO A HEIGHT OF 4" AT POST 7
CONNECTING PRECAST CURB SECTIONS (1) & (2):
FORM OR CORE 1" DIA. HOLE 9" LONG INTO EACH CURB END. USE (1) #5 GR.60 REBAR 18" LONG TO CONNECT BOTH CURBS.
SECURING PRECAST OR CAST-IN-PLACE TO FINISHED GRADE *:
FORM OR CORE (4) 1" DIA. HOLES, SEE PLAN AND ELEVATION VIEWS FOR HOLE LOCATIONS. DRIVE (4) #5 GR.60 REBAR STAKES 18" LONG INTO THE GROUND AND ½" BELOW TOP OF CURB. FILL HOLES WITH APPROVED GROUT MIXTURE.



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

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

TYPE II CURB DETAILS

GENERAL NOTES

1. CONTACT THE DESIGN DIVISION FOR DRAINAGE CUT OUT OPTIONS NEEDED WITHIN THE CURB SECTION OF THE THRIE-BEAM TRANSITION. (512) 416-2678
2. CONCRETE CURB MAY BE CAST-IN-PLACE OR PRECAST AS SHOWN ON THIS SHEET. WHEN USED IN CONJUNCTION WITH THE THRIE-BEAM TRANSITIONS, CURB SHALL BE TYPE II (5- ¾" HEIGHT); SEE CURRENT CCCG STANDARD SHEET FOR FURTHER DETAILS. IF OTHER CURB HEIGHTS ARE SHOWN IN THE PLANS IN CONJUNCTION WITH THE TRANSITION, THE CURB HEIGHT MAY BE FROM 4" TO 8" WITH A RELATIVELY VERTICAL FACE. CONCRETE CURB SHALL BE CONTINUOUS TO THE SEVENTH POST UNLESS OTHERWISE SHOWN IN THE PLANS. SEE GENERAL NOTE: 17 FOR CIRCUMSTANCES WHERE CURB CONTINUES PAST POST 7.
3. CONCRETE CURB TYPE II SUBSIDIARY TO "METAL BEAM GUARD FENCE TRANSITION". IF NO ADDITIONAL CURB IS INDICATED BEYOND THE TRANSITION, THEN ANY CURB HEIGHT GREATER THAN 4" WILL BE TAPERED DOWN BEGINNING AT THE LAST 7 FT. POST TO A MAXIMUM HEIGHT OF 4" AT POST 7. IF SHOWN ELSEWHERE IN THE PLANS, ADDITIONAL CURB UNDERNEATH GUARDRAIL WILL BE PAID FOR BY THE LINEAR FOOT.
4. UNLESS OTHERWISE SHOWN IN THE PLANS, TRANSITIONS SHALL BE PLACED WITH THE BLOCKOUT FACE IN FRONT OF OR DIRECTLY ABOVE THE CURB FACE. SEE SECTION A-A.
5. FOR ROUND WOOD POST SYSTEMS, ALL ROUND WOOD POSTS SHALL BE 7 ½" DIA. MINIMUM THROUGHOUT THE THRIE-BEAM TRANSITION.
6. THE TYPE OF POST (ROUND WOOD POST, RECTANGULAR WOOD POST OR STEEL POST) WILL BE AS SHOWN IN THE PLANS. REFER TO GF(31) STANDARD SHEET.
7. THE POST LENGTH SHALL BE MARKED ON ALL 7'- 0" LONG POSTS BY THE MANUFACTURER. THE MARK SHALL BE LOCATED WITHIN THE TOP 1 FT. REGION OF THE POST, AT LEAST ⅝" IN HEIGHT, AND VISIBLE AFTER INSTALLATION. WOODEN POSTS SHALL BE MARKED WITH A BRAND, AND STEEL POSTS WITH A STENCIL BEFORE GALVANIZING.
8. POSTS SHALL NOT BE SET IN CONCRETE, OF ANY DEPTH.
9. RAIL ELEMENTS SHALL MEET THE REQUIREMENTS OF ITEM 540, "METAL BEAM GUARD FENCE" EXCEPT AS MODIFIED ON THE PLANS. THE THRIE-BEAM TERMINAL CONNECTOR AND THE THRIE-BEAM TRANSITION TO W-BEAM SHALL BE OF THE SAME MATERIAL, BUT SHALL NOT BE LESS THAN 10 GAUGE. CONTRACTOR SHALL VERIFY THAT THE LOCATIONS OF BOLT HOLES MATCH THOSE IN THE THRIE-BEAM TERMINAL CONNECTOR PRIOR TO ORDERING MATERIALS.
10. BUTTON HEAD "POST BOLTS & NUTS" SHALL MEET THE REQUIREMENTS OF (ASTM A307), AND SHALL BE OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT AND ⅝" WASHER (FWC16a) AND NOT MORE THAN 1" BEYOND IT. TRIM REMAINING BOLT LENGTH TO MEET REQUIRED LENGTH.
11. FITTINGS (BOLTS, NUTS, AND WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING". FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
12. CROWN SHALL BE WIDENED TO ACCOMMODATE TRANSITIONS.
13. WHERE SOLID ROCK IS ENCOUNTERED, CONTACT THE DESIGN DIVISION FOR ADDITIONAL GUIDANCE. (512) 416-2678
14. UNLESS OTHERWISE SHOWN IN THE PLANS, A COMPOSITE MATERIAL BLOCK THAT MEETS THE REQUIREMENTS OF DMS-7210, "COMPOSITE MATERIAL POSTS AND BLOCKS FOR METAL BEAM GUARD FENCE" MAY BE SUBSTITUTED FOR BLOCKS OF SIMILAR DIMENSIONS. TXDOT'S MATERIALS AND TESTS DIVISION MAINTAINS A MATERIAL PRODUCER LIST (MPL) FOR PRODUCERS OF MATERIALS CONFORMING TO DMS-7210. ONLY PRODUCERS ON THE MPL CAN FURNISH COMPOSITE MATERIAL BLOCKS.
15. REFER TO GF(31) STANDARD SHEET & BRIDGE RAILING DETAILS FOR ADDITIONAL DETAILS.
16. THE INSTALLATION OF THE TYPE II CURB IS CRITICAL FOR THE PERFORMANCE OF THE THRIE-BEAM TRANSITION SYSTEM. THE CURB PREVENTS (VEHICLE WHEEL SNAGGING) AT THE CONCRETE RAIL AND IS REQUIRED TO MEET MASH CRASH TEST CRITERIA.
17. IF CURB EXTENDS BEYOND POST 7, 25' OF NESTED W-BEAM GUARDRAIL SHALL BE INSTALLED BEYOND THE PAY LIMITS OF THRIE-BEAM TRANSITION SECTION, (SEE SHT.2). PAYMENT FOR THIS 25' SECTION WILL BE BY LINEAR FOOT, PAY ITEM "0540 6XXX MTL W-BEAM GD FEN (NESTED)(TIM POST)" OR "540 6XXX MTL W-BEAM GD FEN (NESTED)(STEEL POST)" AS APPLICABLE FOR POST TYPE. SEE SHT.2 FOR ADDITIONAL INFORMATION.

HIGH-SPEED TRANSITION

Texas Department of Transportation — Design Division Standard

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

GF(31)TR TL3-20

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©TxDOT: NOVEMBER 2020	CONT	SECT	JOB	HIGHWAY		
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	HOU	HARRIS		115		

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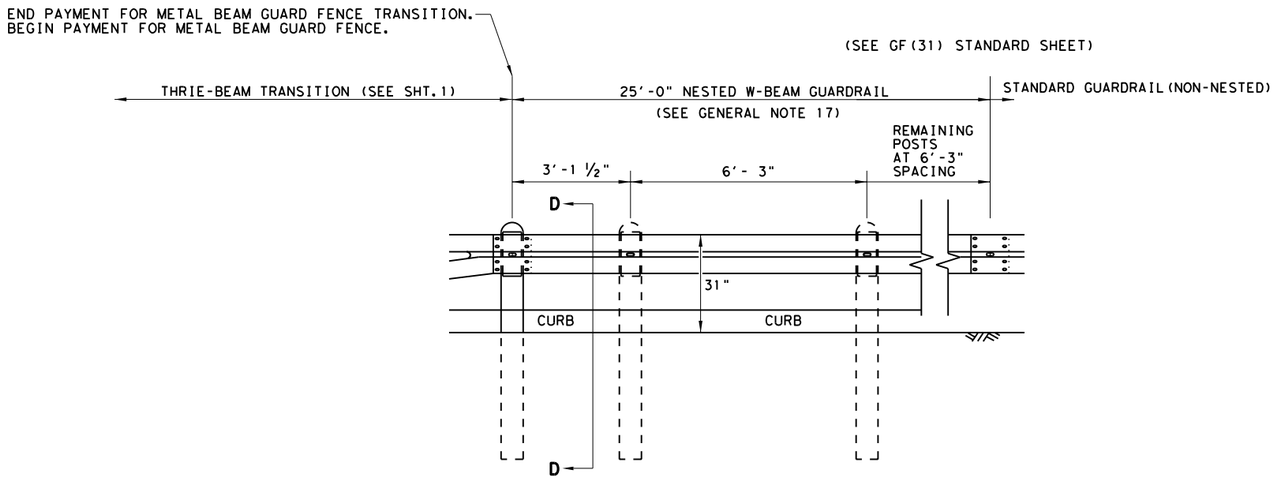
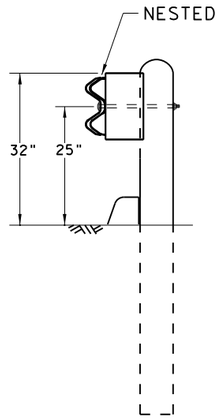
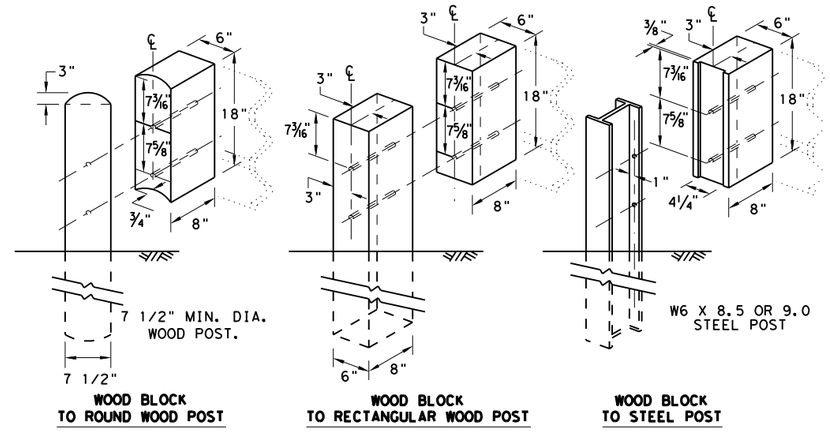
REQUIRED ALTERNATIVE FOR CONTINUOUS CURB EXTENDING PAST POST 7 (SEE SHT. 1 GENERAL NOTE 17)



ELEVATION VIEW



SECTION D-D



THRIE BEAM TRANSITION BLOCKOUT DETAILS

HIGH-SPEED TRANSITION

SHEET 2 OF 2

Texas Department of Transportation | Design Division Standard

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

GF(31)TR TL3-20

FILE: gf31tr1320.dgn	DN: TxDOT	CK: KM	DW: KM	CK: CGL/AG	
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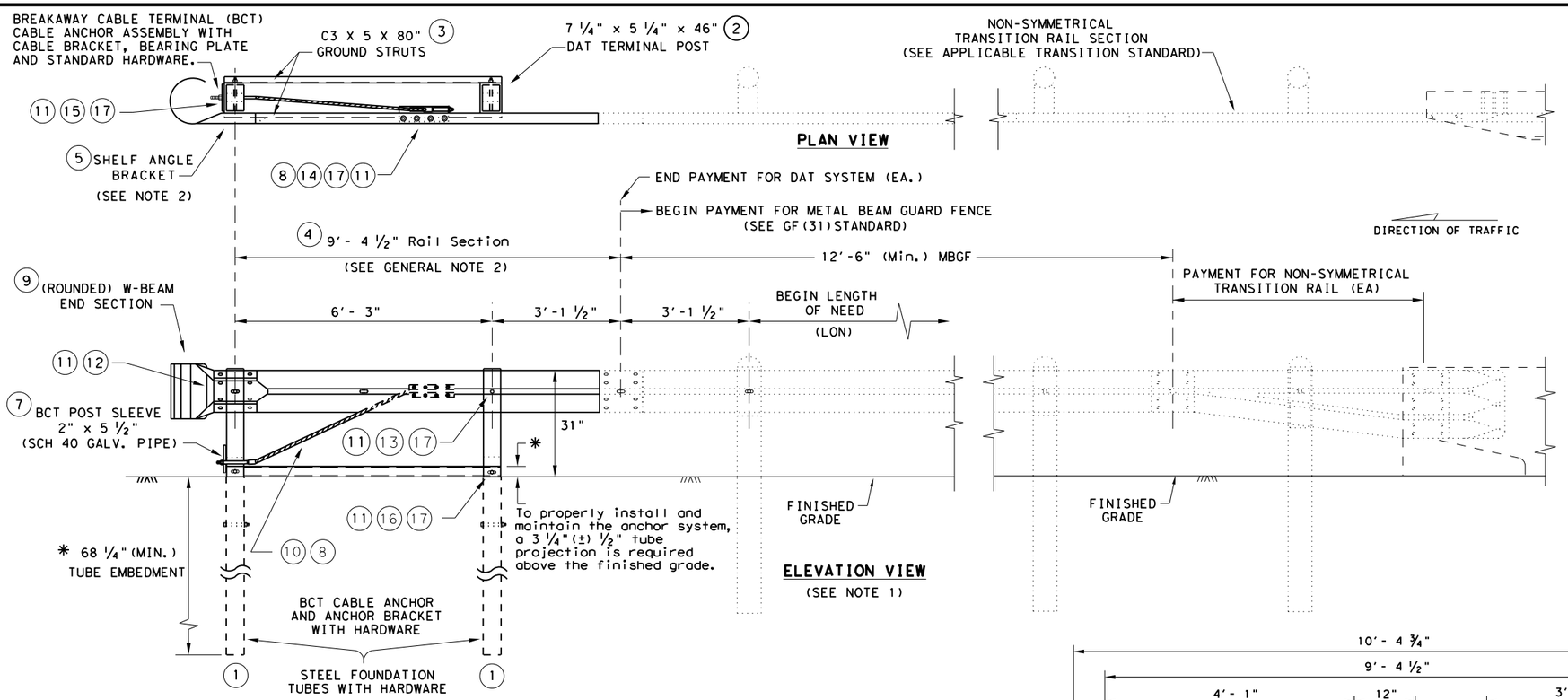


DOWNSTREAM ANCHOR TERMINAL (DAT)

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

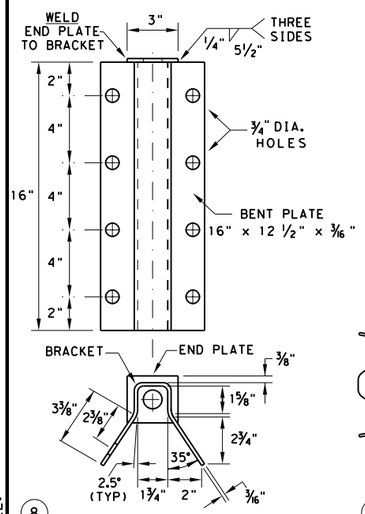
GENERAL NOTES

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.

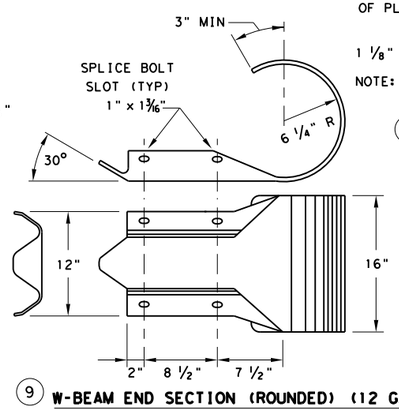
MOW STRIP INSTALLATION

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.

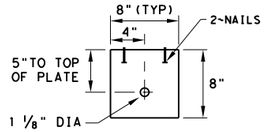
#	(DAT) PARTS LIST	QTY
(1)	STEEL FOUNDATION TUBE	2
(2)	DAT TERMINAL POST	2
(3)	CHANNEL STRUT	2
(4)	TERMINAL RAIL ELEMENT	1
(5)	SHELF ANGLE BRACKET	1
(6)	BCT BEARING PLATE	1
(7)	BCT POST SLEEVE	1
(8)	GUARDRAIL ANCHOR BRACKET	1
(9)	(ROUNDED) W-BEAM END SECTION	1
(10)	BCT CABLE ANCHOR	1
(11)	RECESSED NUT, 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



(8) GUARDRAIL ANCHOR BRACKET

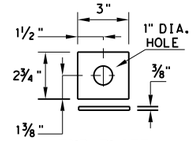


(9) W-BEAM END SECTION (ROUNDED) (12 GA.)

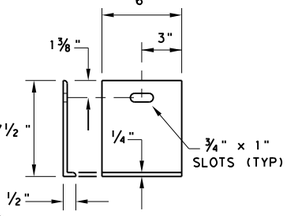


NOTE: DRIVE NAILS AND BEND OVER TO PREVENT PLATE ROTATION

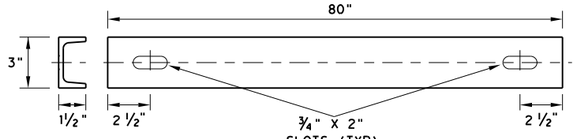
(6) BEARING PLATE
8"x 8"x 5/8" R



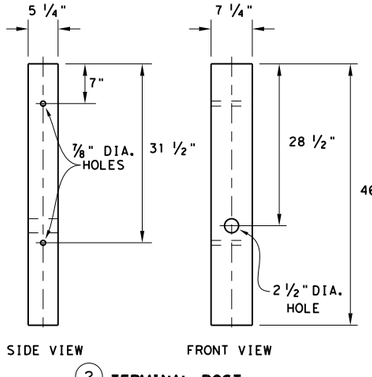
END PLATE



(5) SHELF ANGLE BRACKET

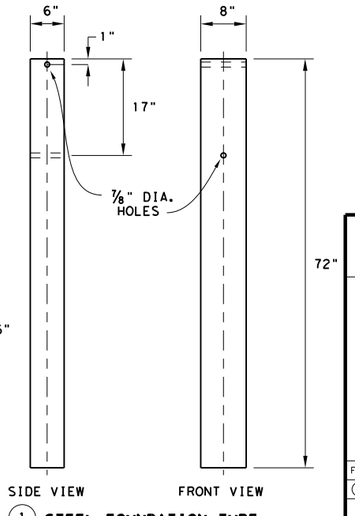


(3) CHANNEL STRUT
C3 X 5 X 80", GRADE A36



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

(4) TERMINAL RAIL ELEMENT FOR DAT



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

Texas Department of Transportation — Design Division Standard

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

GF(31)DAT-19

FILE: gf31dat19.dgn	DN: TxDOT	CK: KM	DW: VP	CK: CGL/AG
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	HOU	HARRIS		117

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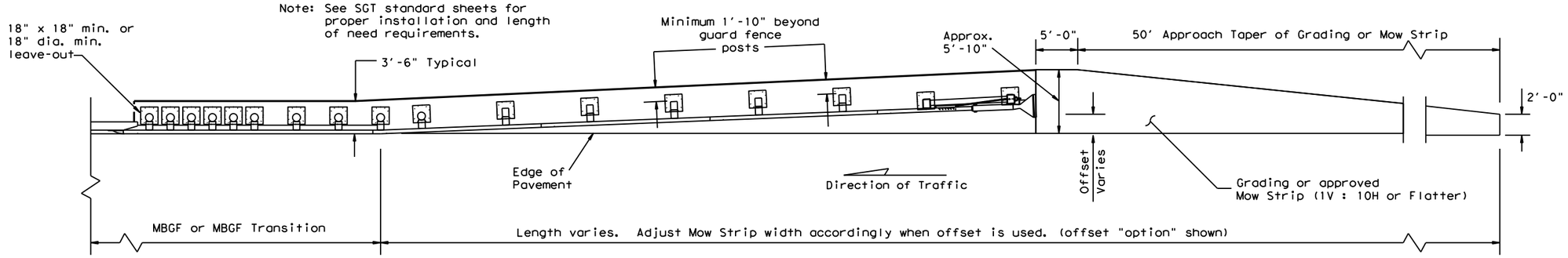
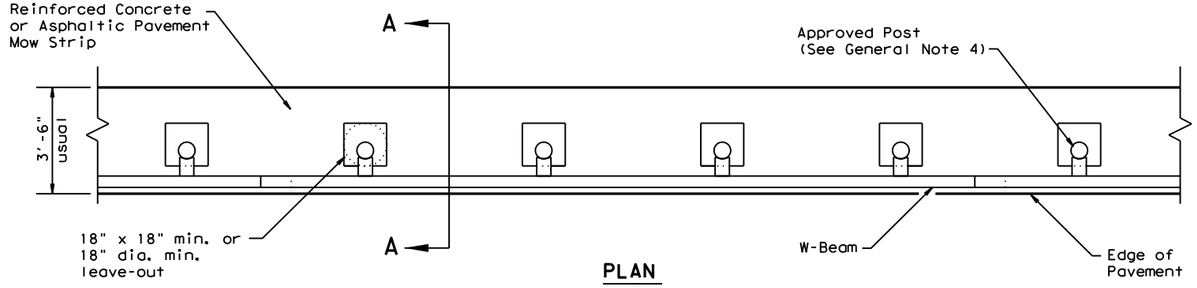
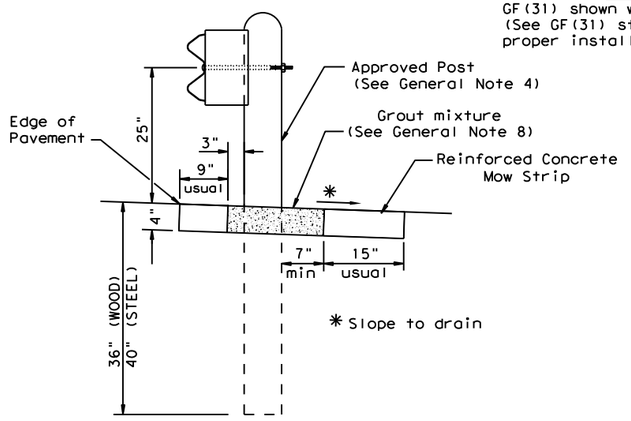


GRADING AND MOW STRIP AT GUARDRAIL END TREATMENTS



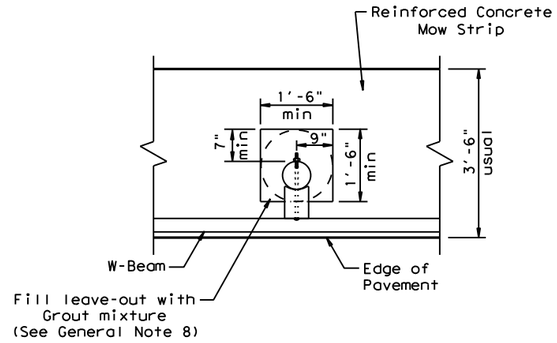
PLAN

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



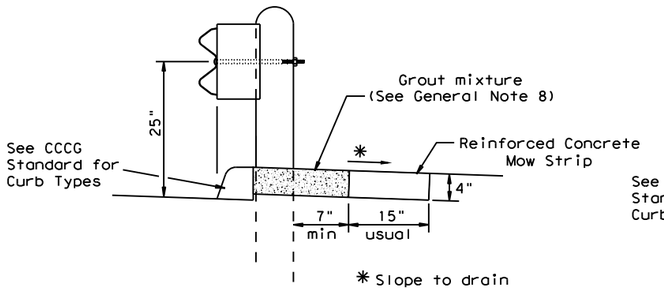
SECTION A-A

Typical



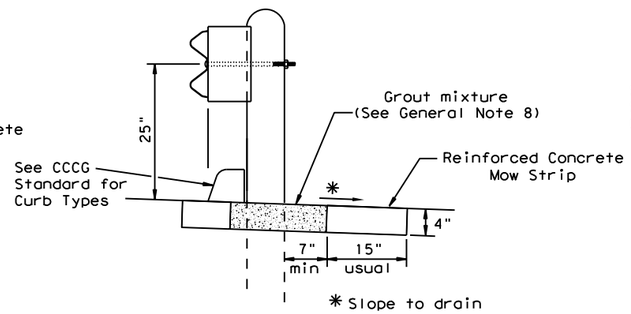
MOW STRIP DETAIL

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



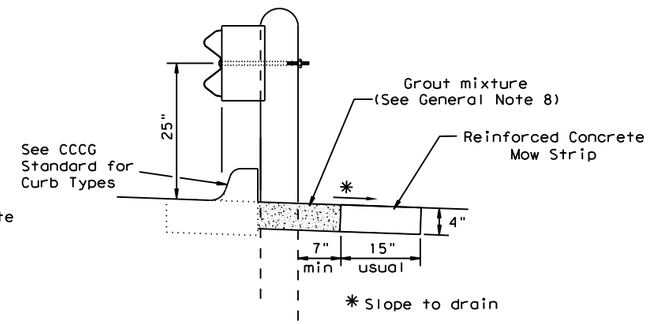
CURB OPTION (1)

This option will increase the post embedment throughout the system.



CURB OPTION (2)

Curb shown on top of mow strip



CURB OPTION (3)

Note: Site Condition(s)

Site conditions may exist where grading is required for the proper installation of metal guard fence and end treatments.

Approach grading or mow strip may be decreased or eliminated, as directed by the Engineer.

GENERAL NOTES

1. This mow strip design is for use with metal beam guard fence, guard fence transitions, and guard fence end treatments. See applicable GF(31) MBGF or GF(31) Transition Standard sheet for additional information.
2. Mow strips shall be reinforced concrete with (wire mesh or synthetic fiber), as shown on the plans and will be paid for under the pertinent bid item. Reinforced concrete shall be placed in accordance with Item 432, "Riprap." The use of the synthetic fiber in lieu of steel reinforcing is acceptable, provided the fiber producer is on the Department Material Producer List (MPL), maintained by TxDOT, Construction Division.
3. The leave-out behind the post shall be a minimum of 7".
4. Only steel (W6 x 8.5 or W6 x 9.0), or 7 ½" Dia. round wood posts are acceptable for use in the mow strip. See GF(31) Standard for additional details.
5. Other curb placement options may be used. Curbs are not considered part of the mow strip and will be paid for under other pertinent bid item.
6. Thickness of the mow strip will be 4".
7. The limits of payment for reinforced concrete will include leave-outs for the posts.
8. The leave-outs shall be filled with a Grout mixture consisting of: 2719 pounds sand, 188 pounds Type 1 or II cement, and 550 pounds of water per cubic yard, with a 28-day compressive strength of approximately 230 psi or less. Provide grout with a consistency that will flow into and completely fill all voids. Due to auger size, larger leave-out dimensions are acceptable from both an impact performance and maintenance repair standpoint (Suggested Maximum leave-out of 20"). Payment for furnishing and placing the grout mixture will be subsidiary to the pay item of riprap mow strip.

Texas Department of Transportation

Design Division Standard

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

GF(31)MS-19

FILE: gf31ms19.dgn	DN: TxDOT	CK: KM	DW: VP	CK: CGL/AG
©TxDOT: NOVEMBER 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		118

DATE:
FILE:

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

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

LINE AT THE BACK OF POST #2 THRU #8

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

ANCHOR PADDLE PN: 15204A

ANGLE STRUT PN: 15202G

16"

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

DO NOT BOLT ANCHOR RAIL TO - POST (2)

SEE DETAIL 1

BEGIN LENGTH OF NEED

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

PLAN VIEW

TRAFFIC FLOW

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

BEGIN STANDARD MBGF

END PAYMENT FOR SGT

6¼"

3'-1 ½" 6'-3" 6'-3"

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

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

OUTSIDE SLOTS CUTOUT
(2)½" X 6'-9 ⅝"

MBGF LAPPED IN DIRECTION OF TRAFFIC FLOW

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

SoftStop ANCHOR RAIL (12GA) PN: 15215G

SoftStop FACE SEE GN(3) & NOTE: B

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

ANCHOR PADDLE PN: 15204A

END OF ANCHOR RAIL PN: 15215G

SEE NOTE: C

SEE NOTE: A

POST 32" HEIGHT

31"

RAIL HEIGHT

RAIL 25'-0" PN: 61G

RAIL 25'-0" PN: 15215G

DO NOT BOLT ANCHOR RAIL TO POST(2)

SEE DETAIL 2

SEE DETAIL 3

ⅬⅥ" DIA. YIELDING HOLES

ⅬⅥ" DIA. YIELDING HOLES

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

POST 40" DEPTH (TYP 1-8)

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

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

6'-1⅜"

B B A A

ELEVATION VIEW

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

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

ALTERNATE BLOCKOUT SEE GENERAL NOTE: 6

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

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

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

8" 6" 14"

⅝" HGR NUT PN: 3340G

⅝" X 10" HGR POST BOLT PN: 3500G

ⅬⅥ"DIAMETER YIELDING HOLES LOCATED IN FLANGES

FINISHED GRADE

(HOLES APROXIMATELY CENTERED AT FINISHED GRADE)

ISOMETRIC VIEW POST(1 & 2)

W6 X 8.5 I-BEAM POST SHOWING STANDARD WOOD BLOCKOUT

NOTE: NO BLOCKOUT INSTALLED AT POST(1)

(1) ⅝" x 1 ¾" HEX HD BOLT PN 3391G

ANGLE STRUT PN: 15202G

(2) ⅝" WASHERS PN 4372G

(1) ⅝" HGR HEX NUT PN 3340G

DETAIL 1

SHOWN AT POST(1) NEAR GROUND

(1) ⅝" HEX NUT

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

(2) ⅝" ROUND WASHERS PN: 3240G

DETAIL 2

SHOWN AT POST(1)

ANCHOR KEEPER PLATE (24 GA) PN: 15207G

ANCHOR PLATE WASHER ½" THICK PN: 15206G

1" ROUND WASHER F463 PN: 4902G

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

ALTERNATE BLOCKOUT SEE GENERAL NOTE: 6

(2) ⅝" ROUND WASHER (WIDE) PN: 3240G

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

ANCHOR PADDLE PN: 15204A

(2) ⅝" HEX NUT A563 GR. DH PN: 3245G

W-BEAM FLATTENED (4 PLIES)

ANGLE STRUT PN: 15202G

SEE NOTE: A

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

(4) ¾" FLAT WASHER (TYP) PN: 3701G

(2) ¾" HEX NUT (TYP) PN: 3704G

6'- 1 ⅜" POST DEPTH

(2) ANCHOR POST ANGLE PN: 15201G

DETAIL 3 AT POST(0)

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

TRAFFIC FLOW

W-BEAM RAIL 25'-0"

6" X 8" X 14" BLOCKOUT WOOD

⅝" X 10" HGR POST BOLT PN: 3500G

⅝" HGR NUT PN: 3340G

POST HEIGHT 32"

31" RAIL HEIGHT

40"

FINISHED GRADE

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

SECTION VIEW B-B

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

6" X 8" X 14" BLOCKOUT WOOD

W-BEAM RAIL 25'-0"

⅝" X 10" HGR POST BOLT PN: 3500G

⅝" HGR NUT PN: 3340G

POST HEIGHT 32"

31" RAIL HEIGHT

40"

FINISHED GRADE

POST(2)

SECTION VIEW A-A

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

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

POST 17"- ½" HEIGHT

4'- 9 ½"

ⅬⅥ" DIA. YIELDING HOLES

40"

POST(1)

FRONT VIEW POST(1)

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

NOTE: NO BLOCKOUT INSTALLED AT POST(1)

APPROX 5'-10"

5'-0"

50' APPROACH GRADING

STANDARD MBGF

2'-0"

EDGE OF PAVEMENT

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

2'-0" MAX. RAIL OFFSET

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

APPROACH GRADING AT GUARDRAIL END TREATMENTS

GENERAL NOTES

1. FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: TRINITY HIGHWAY AT 1(888)323-6374. 2525 N. STEMMONS FREEWAY, DALLAS, TX 75207
2. FOR INSTALLATION, REPAIR AND MAINTENANCE REFER TO THE; SoftStop END TERMINAL, PRODUCT DESCRIPTION ASSEMBLY MANUAL. PN: 620237B
3. APPLY HIGH INTENSITY REFLECTIVE SHEETING, "OBJECT MARKER" ON THE FRONT FACE OF THE DEVICE PER MANUFACTURER'S RECOMMENDATIONS. OBJECT MARKER SHALL CONFORM TO THE STANDARDS REQUIRED IN TEXAS MUTCD.
4. FOR POST (LEAVE-OUT) INSTALLATION AND GUIDANCE SEE TXDOT'S LATEST ROADWAY MOW STRIP STANDARD.
5. HARDWARE (BOLTS, NUTS, & WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING". FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
6. A COMPOSITE MATERIAL BLOCKOUT THAT MEETS THE REQUIREMENTS OF DMS-7210, MAY BE SUBSTITUTED FOR BLOCKOUTS OF SIMILAR DIMENSIONS. SEE CONSTRUCTION DIVISION MATERIAL PRODUCER LIST (MPL) FOR CERTIFIED PRODUCERS.
7. IF SOLID ROCK IS ENCOUNTERED SEE THE MANUFACTURER'S INSTALLATION MANUAL AND REFER TO THE LATEST ROADWAY MBGF STANDARD FOR INSTALLATION GUIDANCE.
8. POSTS SHALL NOT BE SET IN CONCRETE.
9. IT IS ACCEPTABLE TO INSTALL THE SoftStop IMPACT HEAD PARALLEL TO THE GRADE LINE OR WITH AN UPWARD TILT.
10. DO NOT ATTACH THE SoftStop SYSTEM DIRECTLY TO A RIGID BARRIER.
11. UNDER NO CIRCUMSTANCES SHALL THE GUARDRAIL WITHIN THE SoftStop SYSTEM BE CURVED.
12. A FLARE RATE OF UP TO 25:1 MAY BE USED TO PREVENT THE TERMINAL HEAD FROM ENCROACHING ON THE SHOULDER. THE FLARE MAY BE DECREASED OR ELIMINATED FOR SPECIFIC INSTALLATIONS, IF DIRECTED BY THE ENGINEER.

NOTE: A	THE INSTALLATION HEIGHT OF FULLY ASSEMBLED ANCHOR POST WILL VARY FROM 3-¾" MIN. TO 4" MAX. ABOVE FINISHED GRADE.
NOTE: B	PART PN: 5852B RIGHT-SIDE (HIGH INTENSITY REFLECTIVE SHEETING) 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 ⅜")
15203G	1	POST #1 - (SYTP) (4'- 9 ½")
15000G	1	POST #2 - (SYTP) (6'- 0")
533G	6	POST #3 THRU #8 - I-BEAM (W6 x 8.5) (6'- 0")
4076B	7	BLOCKOUT - WOOD (ROUTED) (6" x 8" x 14")
6777B	7	BLOCKOUT - COMPOSITE (4" x 7 ½" x 14")
15204A	1	ANCHOR PADDLE
15207G	1	ANCHOR KEEPER PLATE (24 GA)
15206G	1	ANCHOR PLATE WASHER (½" THICK)
15201G	2	ANCHOR POST ANGLE (10" LONG)
15202G	1	ANGLE STRUT
		HARDWARE
4902G	1	1" ROUND WASHER F436
3908G	1	1" HEAVY HEX NUT A563 GR. DH
3717G	2	¾" x 2 ½" HEX BOLT A325
3701G	4	¾" ROUND WASHER F436
3704G	2	¾" HEAVY HEX NUT A563 GR. DH
3360G	16	⅝" x 1 ¼" W-BEAM RAIL SPLICE BOLTS HGR
3340G	25	⅝" W-BEAM RAIL SPLICE NUTS HGR
3500G	7	⅝" x 10" HGR POST BOLT A307
3391G	1	⅝" x 1 ¾" HEX HD BOLT A325
4489G	1	⅝" x 9" HEX HD BOLT A325
4372G	4	⅝" WASHER F436
105285G	2	⅝" x 2 ½" HEX HD BOLT GR-5
105286G	1	⅝" x 1 ½" HEX HD BOLT GR-5
3240G	6	⅝" ROUND WASHER (WIDE)
3245G	3	⅝" HEX NUT A563 GR. DH
5852B	1	HIGH INTENSITY REFLECTIVE SHEETING - SEE NOTE: B

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

Texas Department of Transportation

Design Division Standard

TRINITY HIGHWAY
SOFTSTOP END TERMINAL
MASH - TL-3

SGT(10S)31-16

FILE: sgt10s3116	DN: TxDOT	CK: KM	DW: VP	CK: MB/VP	
©TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0110	05	126	IH 45	
	DIST	COUNTY		SHEET NO.	
	HOU	HARRIS		119	

DATE:
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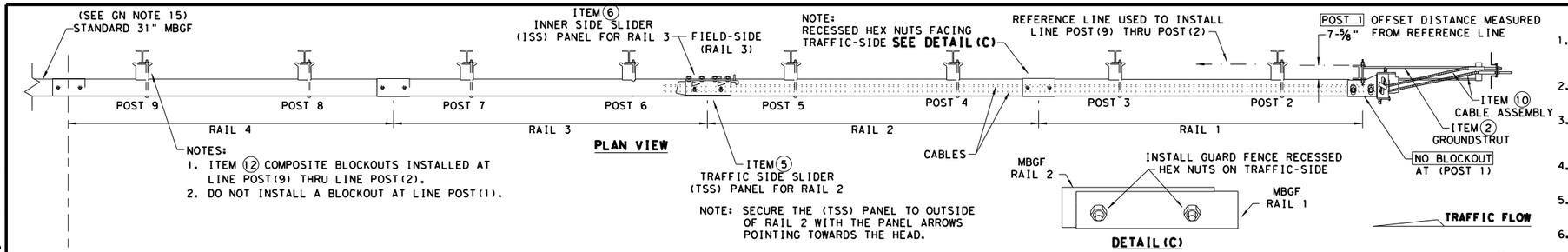

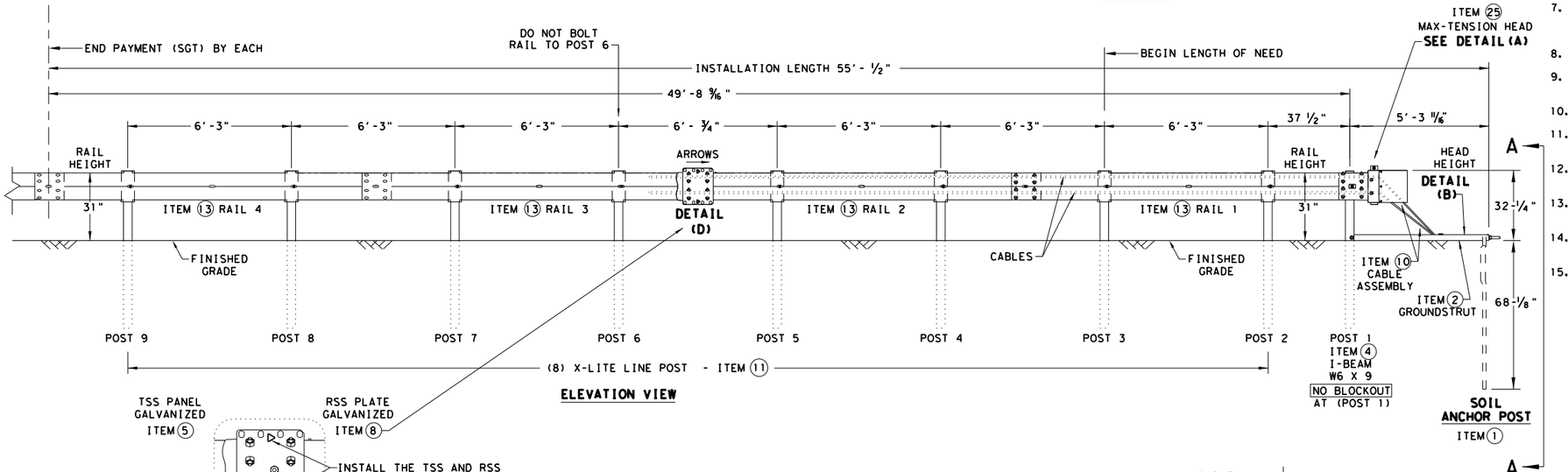

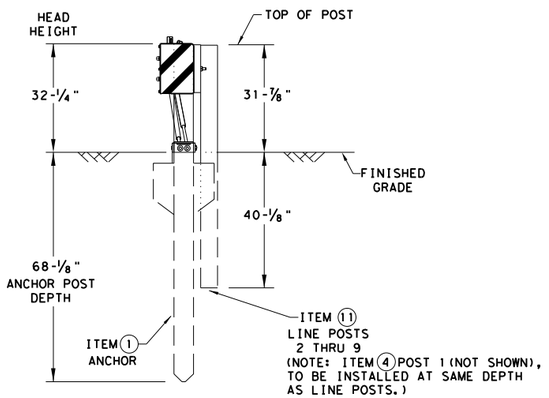

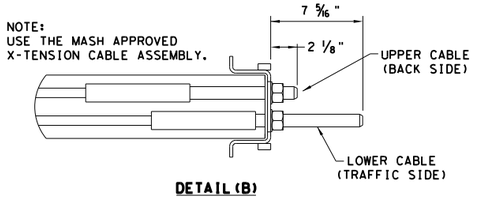

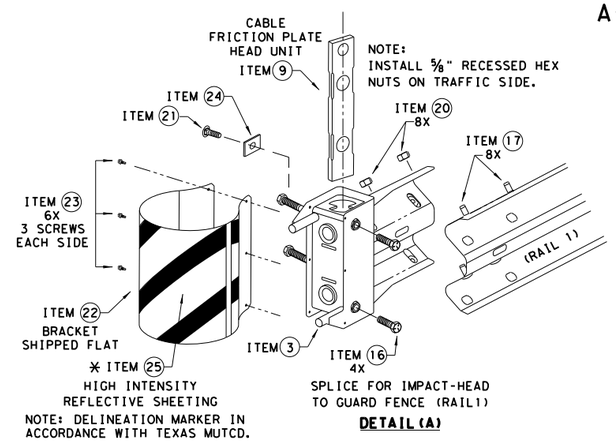

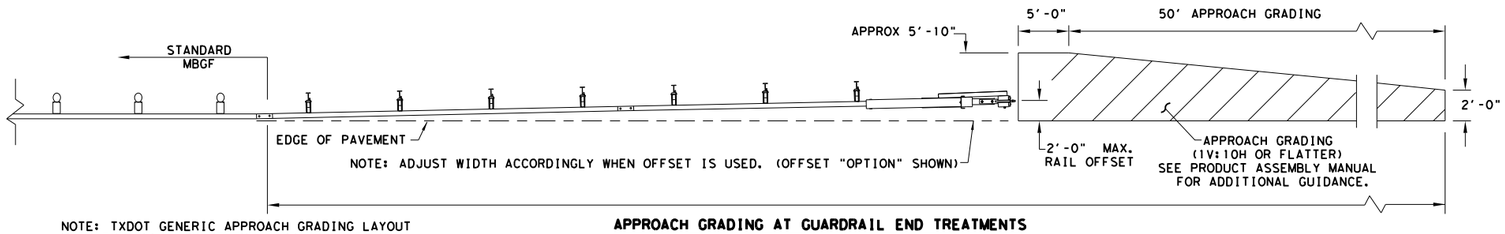

TRAFFIC FLOW

GENERAL NOTES

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

ITEM #	PART NUMBER	DESCRIPTION	QTY
1	BSI-1610060-00	SOIL ANCHOR - GALVANIZED	1
2	BSI-1610061-00	GROUND STRUT - GALVANIZED	1
3	BSI-1610062-00	MAX-TENSION IMPACT HEAD	1
4	BSI-1610063-00	W6x9 I-BEAM POST 6FT.-GALVANIZED	1
5	BSI-1610064-00	TSS PANEL - TRAFFIC SIDE SLIDER	1
6	BSI-1610065-00	ISS PANEL - INNER SIDE SLIDER	1
7	BSI-1610066-00	TOOTH - GEOMET	1
8	BSI-1610067-00	RSS PLATE - REAR SIDE SLIDER	1
9	B061058	CABLE FRICTION PLATE - HEAD UNIT	1
10	BSI-1610069-00	CABLE ASSEMBLY - MASH X-TENSION	2
11	BSI-1012078-00	X-LITE LINE POST-GALVANIZED	8
12	B090534	8" W-BEAM COMPOSITE-BLOCKOUT XT110	8
13	BSI-4004386	12'-6" W-BEAM GUARD FENCE PANELS 12GA.	4
14	BSI-1102027-00	X-LITE SQUARE WASHER	1
15	BSI-2001886	⅝" X 7" THREAD BOLT HH (GR.5)GEOMET	1
16	BSI-2001885	¾" X 3" ALL-THREAD BOLT HH (GR.5)GEOMET	4
17	4001115	⅝" X 1 ¼" GUARD FENCE BOLTS (GR.2)MGAL	48
18	2001840	⅝" X 10" GUARD FENCE BOLTS MGAL	8
19	2001636	⅝" WASHER F436 STRUCTURAL MGAL	2
20	4001116	⅝" RECESSED GUARD FENCE NUT (GR.2)MGAL	59
21	BSI-2001888	⅝" X 2" ALL THREAD BOLT (GR.5)GEOMET	1
22	BSI-1701063-00	DELINEATION MOUNTING (BRACKET)	1
23	BSI-2001887	¼" X ¾" SCREW SD HH 410SS	7
24	4002051	GUARDRAIL WASHER RECT AASHTO FWR03	1
* 25	SEE NOTE BELOW	HIGH INTENSITY REFLECTIVE SHEETING	1
** 26	4002337	8" W-BEAM TIMBER-BLOCKOUT, PDB01B	8
** 27	BSI-4004431	25' W-BEAM GUARDRAIL PANEL,8-SPACE,12GA.	2
28	MANMAX Rev-(D)	MAX-TENSION INSTALLATION INSTRUCTIONS	1

* TO BE PROVIDED BY DISTRIBUTOR OR CONTRACTOR.

** ALTERNATIVE ITEMS NOT SHOWN.
ITEM(26) 8" WOOD-BLOCKOUTS
ITEM(27) 25'GUARD FENCE PANELS

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

Texas Department of Transportation

Design Division Standard

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

FILE: sgt11s3118.dgn	DN: TxDOT	CK: KM	DW: TxDOT	CK: CL
© TxDOT: FEBRUARY 2018	CONT	SECT	JOB	HIGHWAY
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	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		120

DATE:
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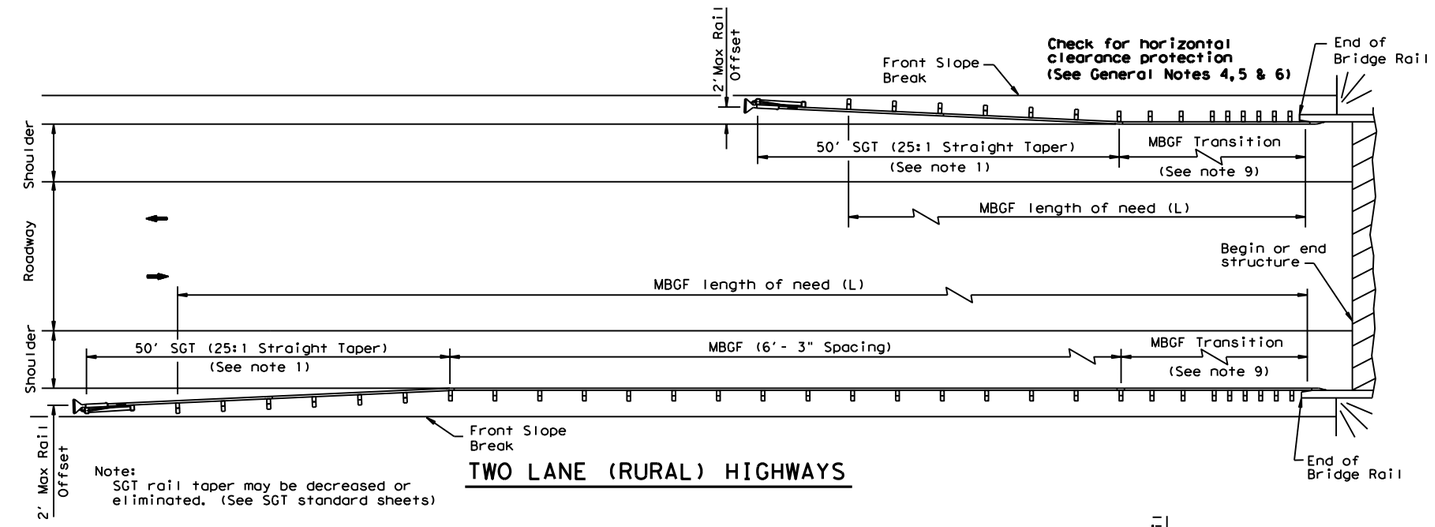
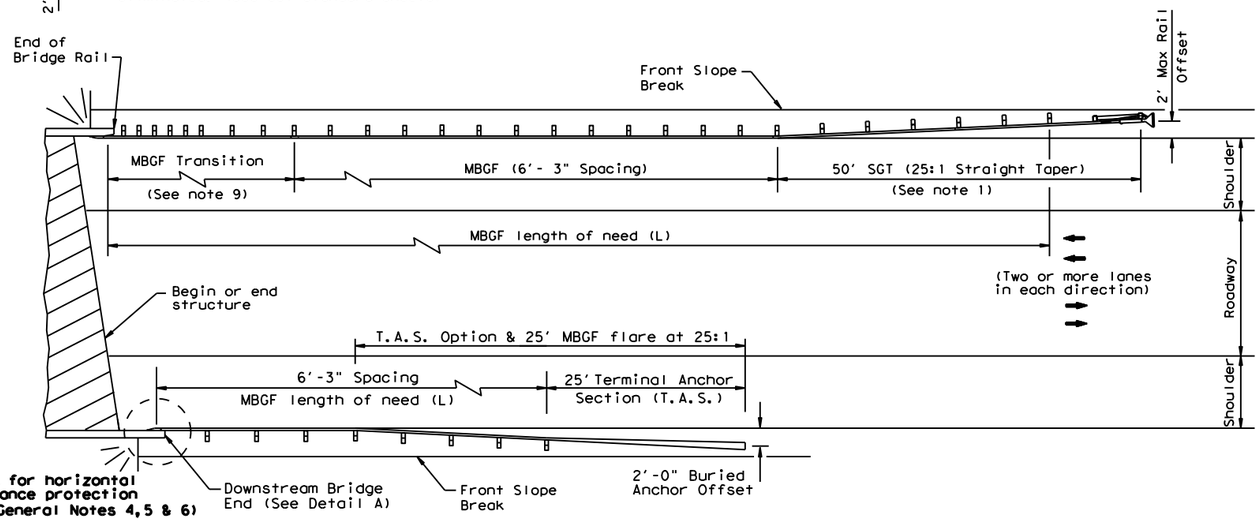
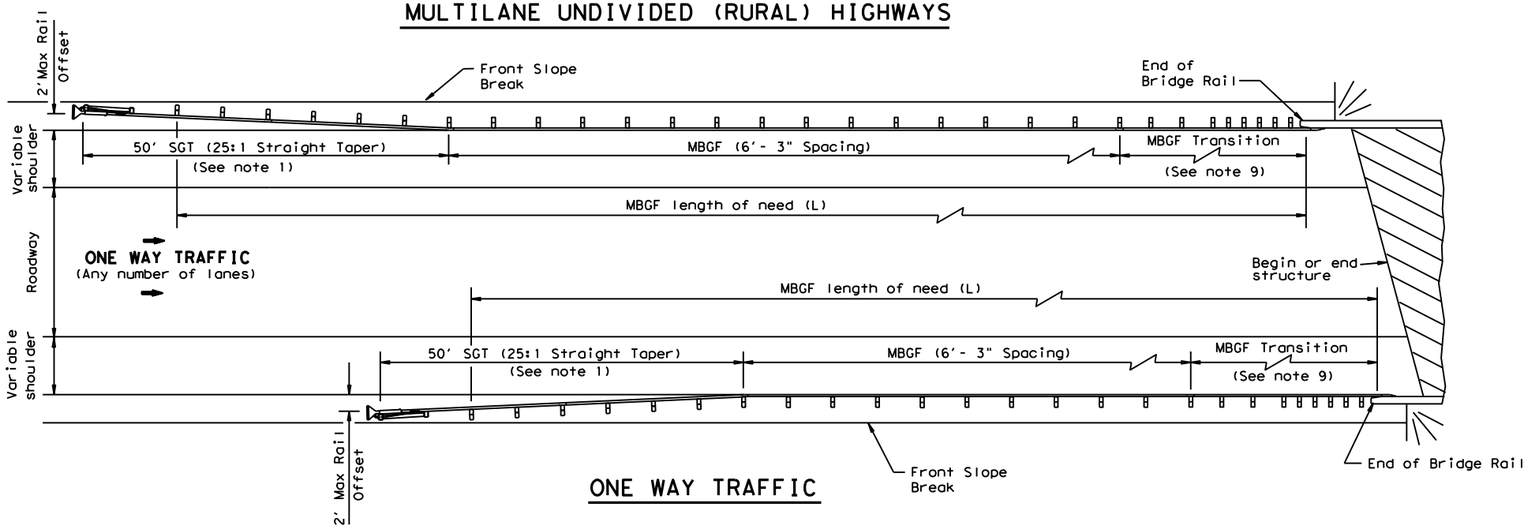


Note:
SGT rail taper may be decreased or eliminated. (See SGT standard sheets)

TWO LANE (RURAL) HIGHWAYS



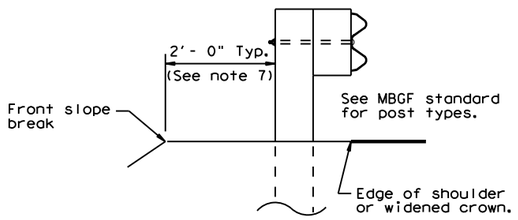
MULTILANE UNDIVIDED (RURAL) HIGHWAYS



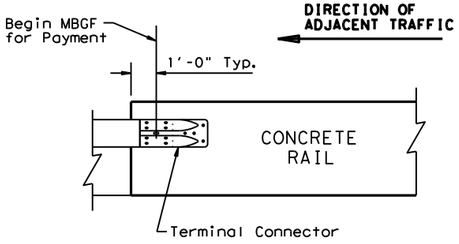
ONE WAY TRAFFIC

GENERAL NOTES

1. For more detail: See MBGF, SGT, and MBGF Transition standard sheets.
2. Quantities of metal beam guard fence (MBGF) at individual bridge ends are shown elsewhere in plans.
3. Use average daily traffic (ADT) for the current year to determine MBGF length of need in accordance with the Roadway Design Manual unless otherwise specified. Where significant traffic volume growth is anticipated on low volume (0-750 ADT) highways, use length determinations for the higher volume category.
4. MBGF may not be required to shield departure end of bridge unless other obstacles within the horizontal clearance limits or opposing traffic indicate a MBGF consideration.
5. Terminal anchor sections (TAS) are only for downstream end anchorage use, outside the horizontal clearance area of opposing traffic.
6. Direct connection of MBGF (at 6'-3" post spacing without transition) to concrete rail are only for downstream rail connections outside the horizontal clearance area of opposing traffic. (See Detail A)
7. The crown shall be widened to accommodate MBGF. Typically the "front slope" break should be 2'- 0" from the back of the MBGF post. This applies to new construction on new alignment or where existing roadway cross section is to be widened to increase roadway width. This does not apply to rehabilitation work where existing roadway crown width is to be retained (See Typical Cross Section at MBGF).
8. For restrictive bridge widths: The MBGF should be properly transitioned from the existing bridge rail to the adjoining MBGF (See MBGF Transition Standards). Metal beam guard fence at these bridge location(s) shall be flared at the rate of 25:1 or flatter, and be of the length necessary to locate the terminal end at the 2 ft."maximum" offset from the shoulder edge.
9. Transition length and post spacing will vary depending on the transition type. Transition type will be shown elsewhere in the plans.



TYPICAL CROSS SECTION AT MBGF



DETAIL A

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

ONLY FOR USE IN MAINTENANCE REPAIRS.

Texas Department of Transportation

Design Division Standard

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

BED(28)-19

FILE: bed2819.dgn	DN: TxDOT	CK: KM	DW: BD	CK: VP
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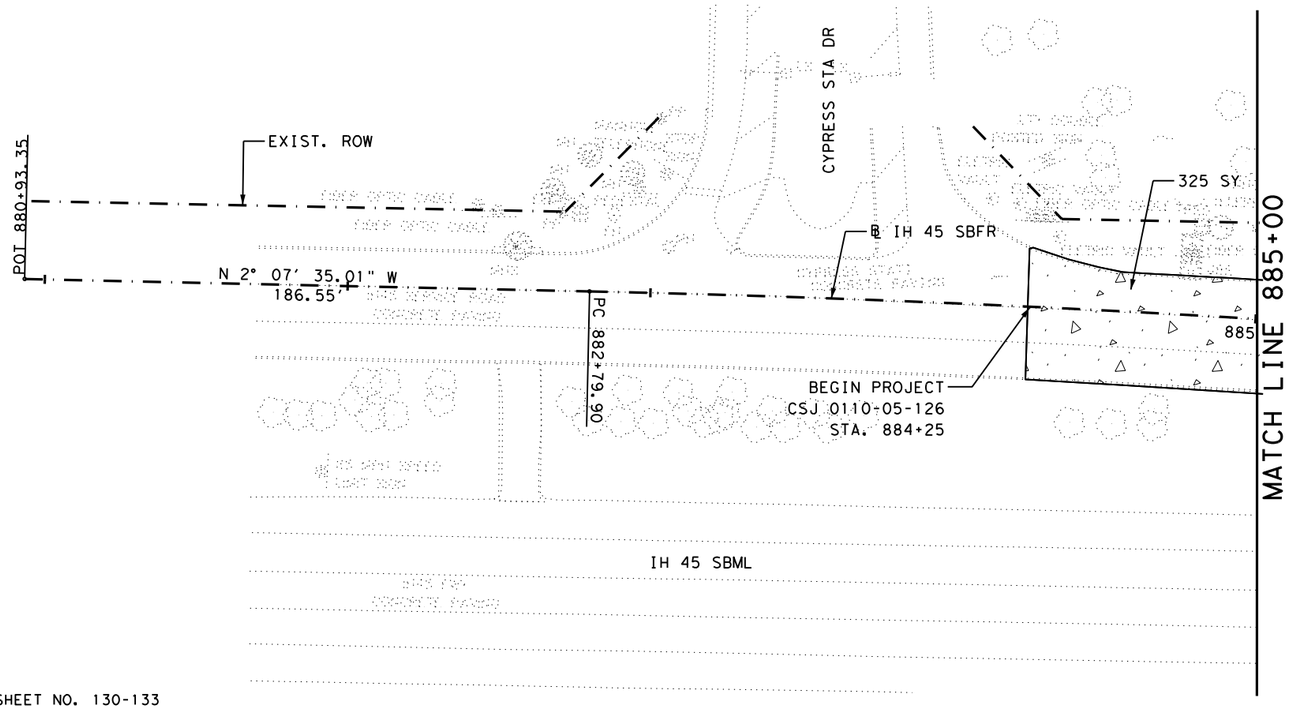
REVISIONS	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		121



NOTE:

1. REMOVAL OF SMALL SIGN IS SUBSIDIARY TO BID ITEM 100 6001.
2. BROKEN RIPRAP UNDER BRIDGE WILL BE PAID BY ITEM NO. 104 6009.
2. FOR REMOVAL OF EXISTING DRAINAGE ITEMS PLEASE REFER TO DRAINAGE SHEET NO. 130-133

LEGEND:

REMOVAL OF CONC (PAV)& REMOVING STAB BASE AND ASPH PAV (7")
ITEM 104-6001 & ITEM 105-6018

REMOVAL OF STR (BRIDGE 100 - 499 FT LENGTH)
ITEM 0496 6010

REMOVAL CONC (RIPRAP)
ITEM 0104 6009

REMOVING CONC (DRIVEWAYS)
ITEM 0104 6017

REMOVING CONC (DRIVEWAYS)
ITEM 0104 6017

REMOVAL OF EXIST. SIGN

REMOVE METAL BEAM GUARD FENCE
ITEM 542 6001

REMOVE TERMINAL ANCHOR SECTION
ITEM 0542 6002

GUARDRAIL END TREATMENT (REMOVE)
ITEM 544 6003

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED
PROFESSIONAL ENGINEER

Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

DEMOLITION LAYOUT

SCALE: HORIZ. 1"= 50

SHEET 1 OF 5

FED.RD. DIV.NO.	PROJECT NO.		SHEET NO.
6			122
STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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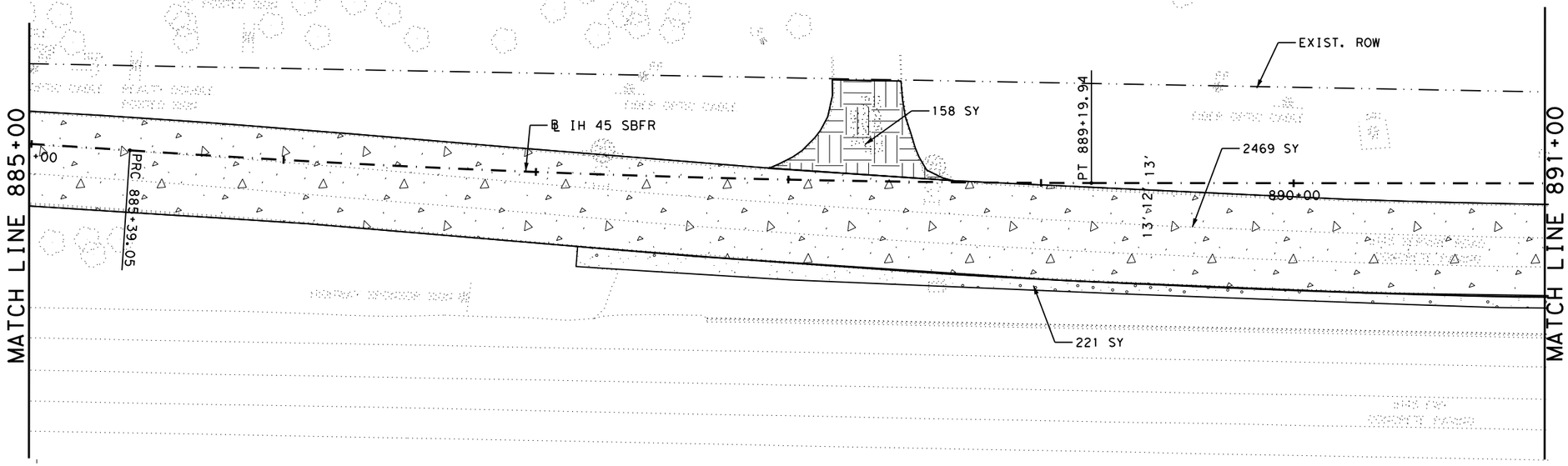

NOTE:

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2. BROKEN RIPRAP UNDER BRIDGE WILL BE PAID BY ITEM NO. 104 6009.
2. FOR REMOVAL OF EXISTING DRAINAGE ITEMS PLEASE REFER TO DRAINAGE SHEET NO. 130-133

LEGEND:

REMOVAL OF CONC (PAV)& REMOVING STAB BASE AND ASPH PAV (7")
ITEM 104-6001 & ITEM 105-6018

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ITEM 544 6003

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED
PROFESSIONAL ENGINEER

Sharmeen Rahman, P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

DEMOLITION LAYOUT

SCALE: HORIZ. 1"= 50

SHEET 2 OF 5

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		123

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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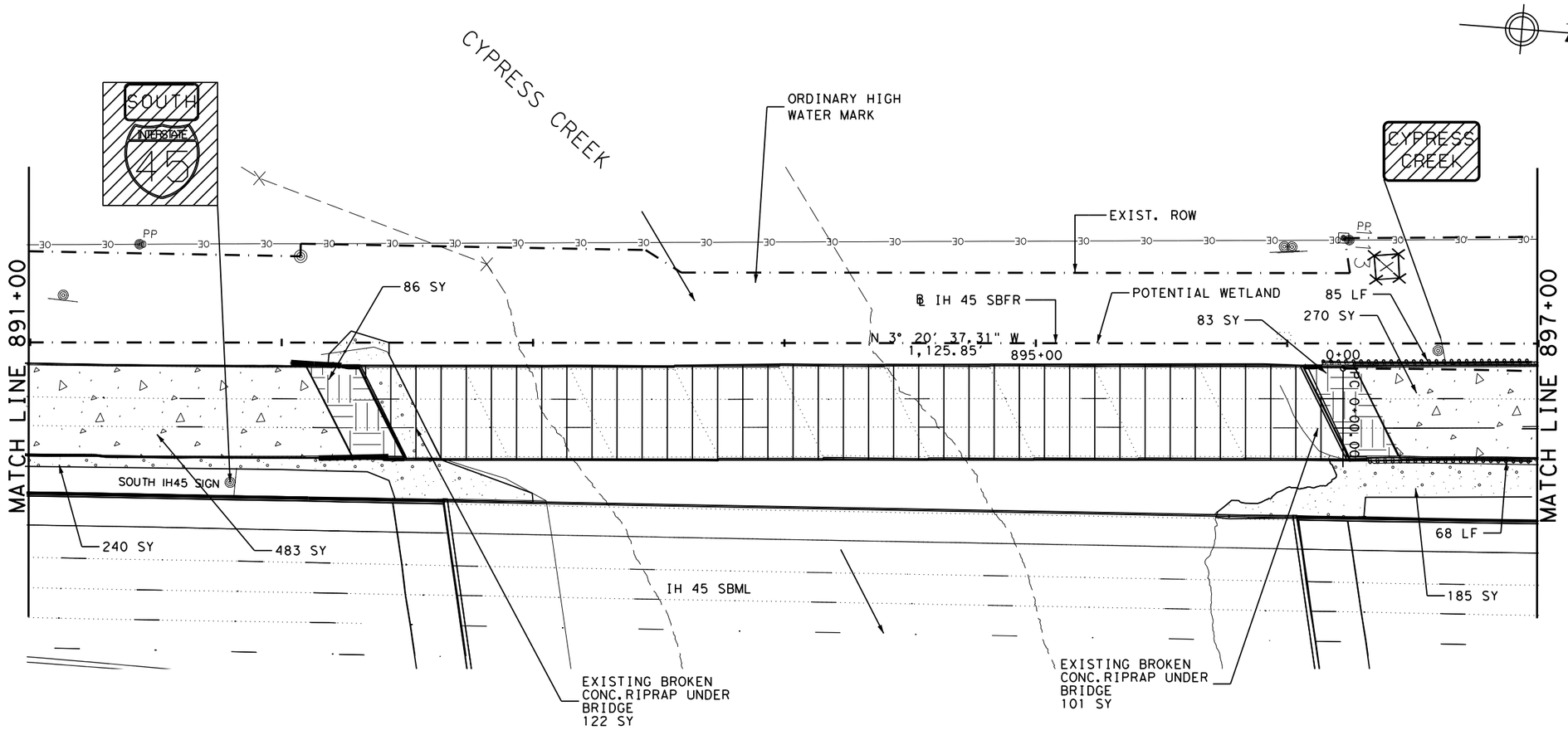

NOTE:

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2. BROKEN RIPRAP UNDER BRIDGE WILL BE PAID BY ITEM NO. 104 6009.
2. FOR REMOVAL OF EXISTING DRAINAGE ITEMS PLEASE REFER TO DRAINAGE SHEET NO. 130-133

LEGEND:

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GUARDRAIL END TREATMENT (REMOVE)
ITEM 544 6003

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED PROFESSIONAL ENGINEER

Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

DEMOLITION LAYOUT

SCALE: HORIZ. 1"= 50

SHEET 3 OF 5

FED.RD. DIV.NO.	PROJECT NO.		SHEET NO.
6			124
STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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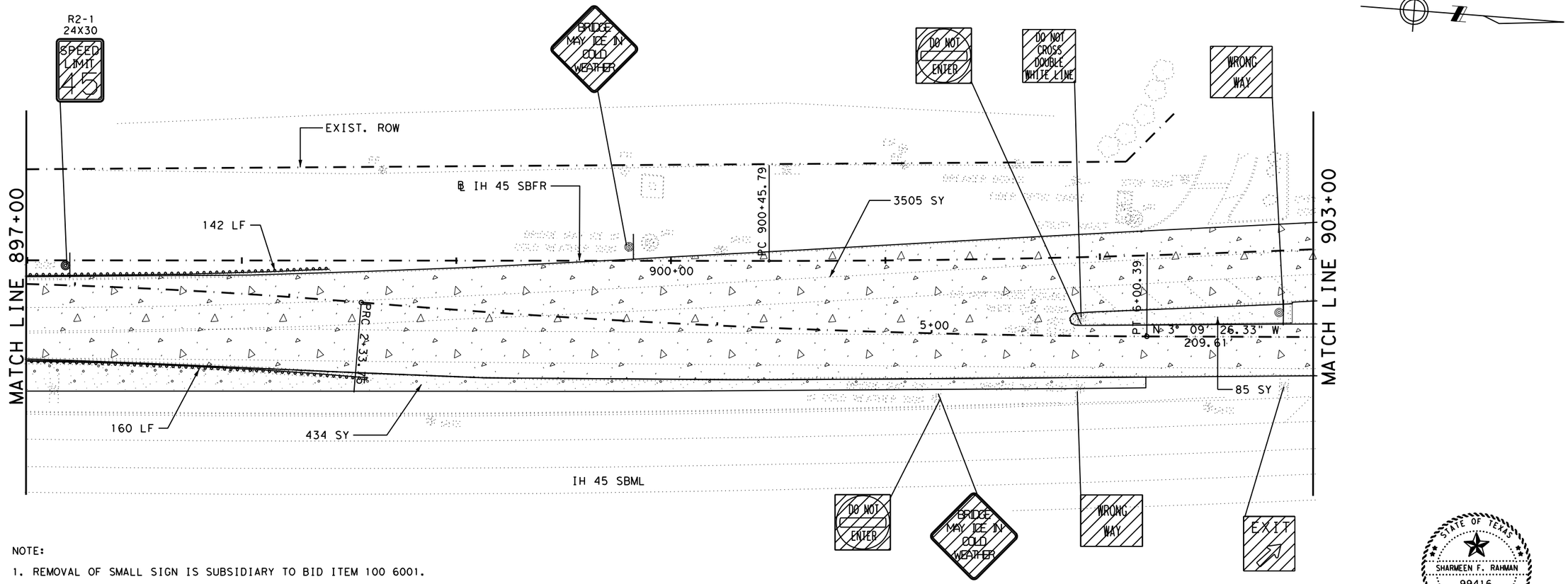

NOTE:

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2. BROKEN RIPRAP UNDER BRIDGE WILL BE PAID BY ITEM NO. 104 6009.
2. FOR REMOVAL OF EXISTING DRAINAGE ITEMS PLEASE REFER TO DRAINAGE SHEET NO. 130-133

LEGEND:

REMOVAL OF CONC (PAV)& REMOVING STAB BASE AND ASPH PAV (7")
ITEM 104-6001 & ITEM 105-6018

REMOVAL OF STR (BRIDGE 100 - 499 FT LENGTH)
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ITEM 0542 6002

GUARDRAIL END TREATMENT (REMOVE)
ITEM 544 6003

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED PROFESSIONAL ENGINEER

Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

DEMOLITION LAYOUT

SCALE: HORIZ. 1"= 50

SHEET 4 OF 5

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		125

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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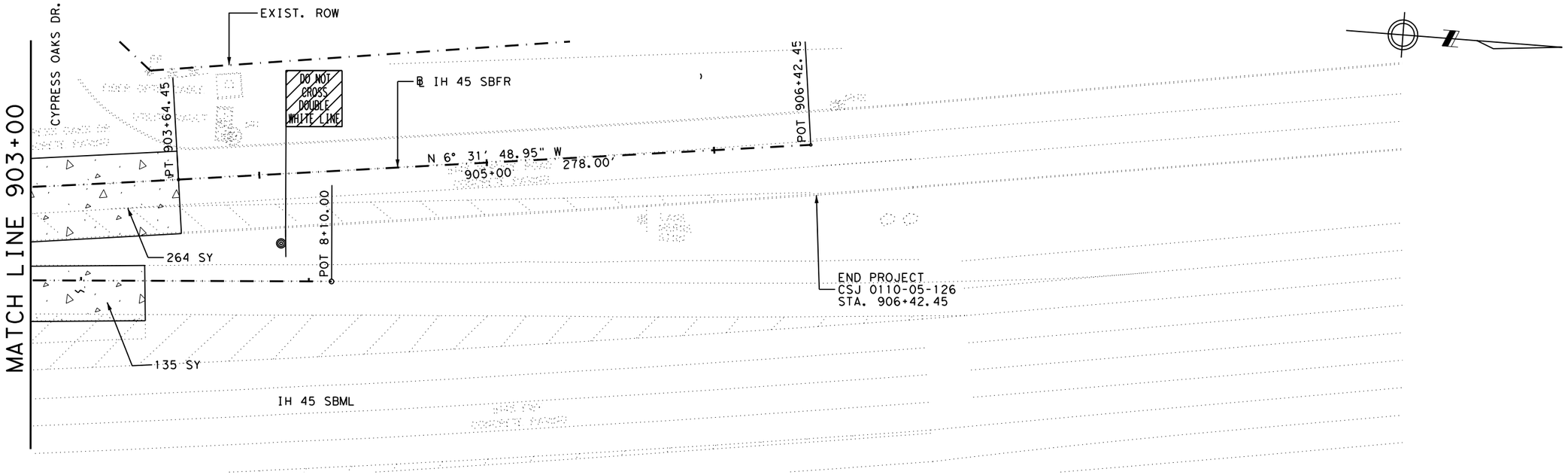

NOTE:

1. REMOVAL OF SMALL SIGN IS SUBSIDIARY TO BID ITEM 100 6001.
2. BROKEN RIPRAP UNDER BRIDGE WILL BE PAID BY ITEM NO. 104 6009.
2. FOR REMOVAL OF EXISTING RCP PLEASE REFER TO DRAINAGE SHEET NO. 130-133

LEGEND:

REMOVAL OF CONC (PAV)& REMOVING STAB BASE AND ASPH PAV (7")
ITEM 104-6001 & ITEM 105-6018

REMOVAL OF STR (BRIDGE 100 - 499 FT LENGTH)
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REMOVING CONC (DRIVEWAYS)
ITEM 0104 6017

REMOVING CONC (DRIVEWAYS)
ITEM 0104 6017

REMOVAL OF EXIST. SIGN

REMOVE METAL BEAM GUARD FENCE
ITEM 542 6001

REMOVE TERMINAL ANCHOR SECTION
ITEM 0542 6002

GUARDRAIL END TREATMENT (REMOVE)
ITEM 544 6003

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED
PROFESSIONAL ENGINEER

Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

DEMOLITION LAYOUT

SCALE: HORIZ. 1"= 50

SHEET 5 OF 5

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		126

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

9/28/2021 10:27:02 AM
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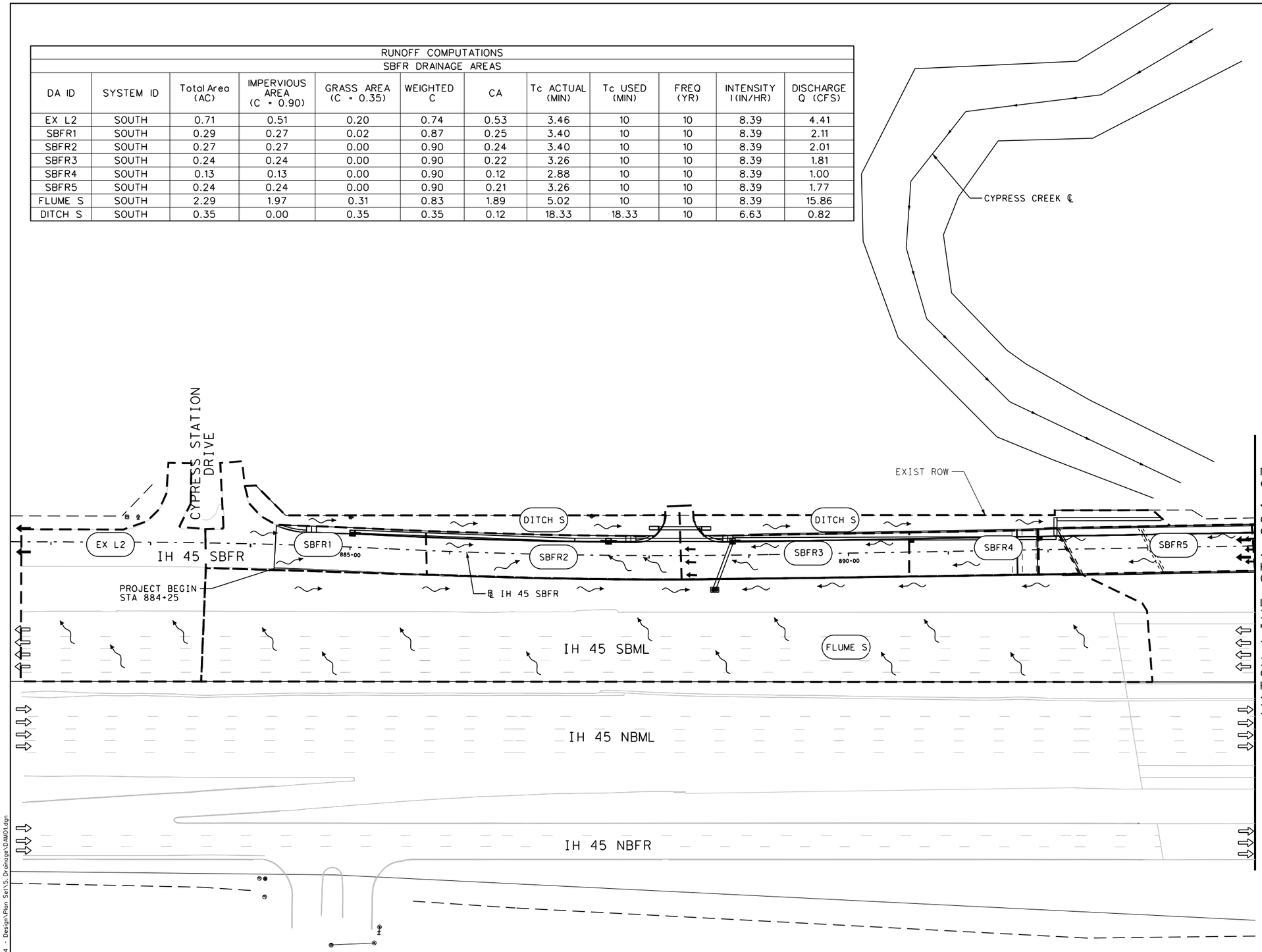
RUNOFF COMPUTATIONS SBFR DRAINAGE AREAS											
DA ID	SYSTEM ID	Total Area (AC)	IMPERVIOUS AREA (C = 0.90)	GRASS AREA (C = 0.35)	WEIGHTED C	CA	Tc ACTUAL (MIN)	Tc USED (MIN)	FREQ (YR)	INTENSITY I (IN/HR)	DISCHARGE Q (CFS)
EX L2	SOUTH	0.71	0.51	0.20	0.74	0.53	3.46	10	10	8.39	4.41
SBFR1	SOUTH	0.29	0.27	0.02	0.87	0.25	3.40	10	10	8.39	2.11
SBFR2	SOUTH	0.27	0.27	0.00	0.90	0.24	3.40	10	10	8.39	2.01
SBFR3	SOUTH	0.24	0.24	0.00	0.90	0.22	3.26	10	10	8.39	1.81
SBFR4	SOUTH	0.13	0.13	0.00	0.90	0.12	2.88	10	10	8.39	1.00
SBFR5	SOUTH	0.24	0.24	0.00	0.90	0.21	3.26	10	10	8.39	1.77
FLUME S	SOUTH	2.29	1.97	0.31	0.83	1.89	5.02	10	10	8.39	15.86
DITCH S	SOUTH	0.35	0.00	0.35	0.35	0.12	18.33	18.33	10	6.63	0.82



LEGEND

- MANHOLE / JUNCTION
- GRATE INLET
- CURB INLET
- CURB INLET W/ EXTENSION
- ℄ CHANNEL
- DRAINAGE BOUNDARY
- DIRECTION OF FLOW
- X-XX-XX DRAINAGE AREA ID
- EXIST DIRECTION OF TRAFFIC
- PROPOSED DIRECTION OF TRAFFIC
- PROPOSED STORM SEWER

NOTES:

1. CONTRIBUTING DRAINAGE AREAS UPSTREAM OF PROJECT AREA ARE BASED ON INFORMATION PROVIDED IN AS BUILT DRAWING FOR CSJ 0110-05-089.

N

0' 50' 100'
SCALE: 1"=50'

STATE OF TEXAS
DAVID H. ZUHLKE
83450
LICENSED PROFESSIONAL ENGINEER
09/24/21

LJA Engineering, Inc.
FRN - F-1386

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IH 45
SB FRONTAGE RD

DRAINAGE AREA MAP
BEGIN TO STA 894+07

SHEET 1 OF 2

FED. RD. DIV. NO.	STATE	PROJECT NO.			HIGHWAY NO.
6	TEXAS				IH 45
STATE DISTRICT	COUNTY	CONTROL NO.	SECTION NO.	JOB NO.	SHEET NO.
HOU	HARRIS	0110	05	126	127

11:39:17 AM 9/28/2021
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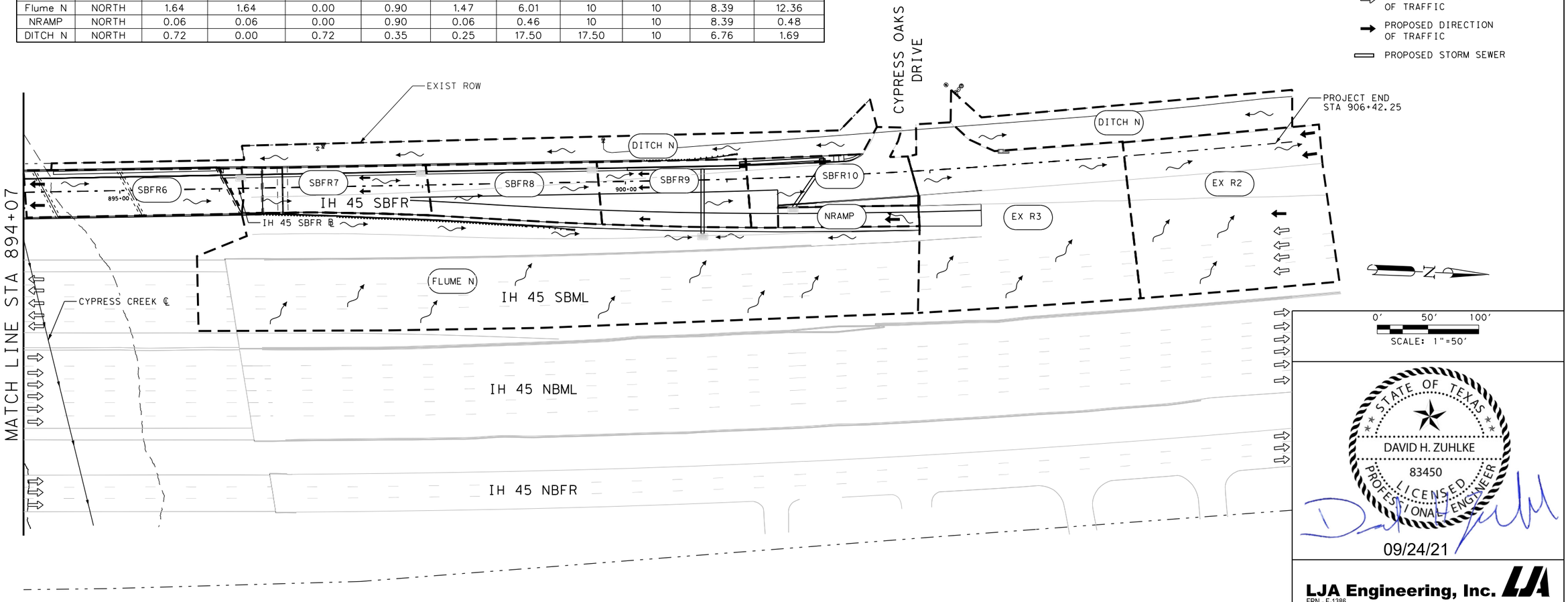
RUNOFF COMPUTATIONS SBFR DRAINAGE AREAS											
DA ID	SYSTEM ID	Total Area (AC)	IMPERVIOUS AREA (C = 0.90)	GRASS AREA (C = 0.35)	Weighted C	CA	Tc ACTUAL (MIN)	Tc USED (MIN)	FREQ (YR)	INTENSITY I(IN/HR)	DISCHARGE Q (CFS)
SBFR6	NORTH	0.23	0.23	0.00	0.90	0.21	3.50	10	10	8.39	1.74
SBFR7	NORTH	0.19	0.19	0.00	0.90	0.17	3.38	10	10	8.39	1.46
SBFR8	NORTH	0.21	0.21	0.00	0.90	0.19	3.10	10	10	8.39	1.62
SBFR9	NORTH	0.22	0.22	0.00	0.90	0.20	2.91	10	10	8.39	1.65
SBFR10	NORTH	0.22	0.22	0.00	0.90	0.20	2.31	10	10	8.39	1.66
EX R3	NORTH	0.93	0.72	0.21	0.77	0.72	4.11	10	10	8.39	6.04
EX R2	NORTH	0.69	0.57	0.12	0.81	0.55	5.82	10	10	8.39	4.63
Flume N	NORTH	1.64	1.64	0.00	0.90	1.47	6.01	10	10	8.39	12.36
NRAMP	NORTH	0.06	0.06	0.00	0.90	0.06	0.46	10	10	8.39	0.48
DITCH N	NORTH	0.72	0.00	0.72	0.35	0.25	17.50	17.50	10	6.76	1.69

NOTES:

1. CONTRIBUTING DRAINAGE AREAS UPSTREAM OF PROJECT AREA ARE BASED ON INFORMATION PROVIDED IN AS BUILT DRAWING FOR CSJ 0110-05-089.

LEGEND

- MANHOLE / JUNCTION
- GRATE INLET
- CURB INLET
- CURB INLET W/ EXTENSION
- ℄ CHANNEL
- DRAINAGE BOUNDARY
- DIRECTION OF FLOW
- X-XX-XX DRAINAGE AREA ID
- EXIST DIRECTION OF TRAFFIC
- PROPOSED DIRECTION OF TRAFFIC
- PROPOSED STORM SEWER



0′ 50′ 100′
SCALE: 1"=50′

STATE OF TEXAS
DAVID H. ZUHLKE
83450
LICENSED PROFESSIONAL ENGINEER
09/24/21

LJA Engineering, Inc.
FRN - F-1386

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IH 45
SB FRONTAGE RD

DRAINAGE AREA MAP
STA 894+07 TO STA 906+42.25

SHEET 2 OF 2

FED.RD. DIV.NO.	STATE	PROJECT NO.			HIGHWAY NO.
6	TEXAS				IH 45
STATE DISTRICT	COUNTY	CONTROL NO.	SECTION NO.	JOB NO.	SHEET NO.
HOU	HARRIS	0110	05	126	128

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Hydrologic Component	10-yr	50-yr	100-yr	500-yr
	Peak flow (cfs)			
K1000000_0590_J	11062.2	17772.4	20730.8	31634.6
K1000000_0574_J	11901.2	19231.3	22818.8	32902.2
K1000000_0477_J	12059.5	19233.7	22539.8	32805.8
K1000000_0461_J	13521.5	21325	24887.1	34835.1

DRAINAGE AREA
IH 45 AT CYPRESS CREEK
274 SQUARE MILES

IH 45 CYPRESS CREEK BRIDGE

K1000000_0574_J

K1000000_0590_J

K1000000_0461_J

K1000000_0477_J

Cypress Creek

LEGEND

DRAINAGE AREA

N

0' 2000' 4000'
SCALE: 1"=2000'

STATE OF TEXAS
DAVID H. ZUHLKE
83450
LICENSED
PROFESSIONAL ENGINEER

09/24/2021

LJA Engineering, Inc.
FRN - F-1386

Texas Department of Transportation

IH 45
SB FRONTAGE RD

CYPRESS CREEK BRIDGE
DRAINAGE AREA MAP

FED. RD. DIV. NO.	STATE	PROJECT NO.			HIGHWAY NO.
6	TEXAS				IH 45
STATE DISTRICT	COUNTY	CONTROL NO.	SECTION NO.	JOB NO.	SHEET NO.
HOU	HARRIS	0110	05	126	129

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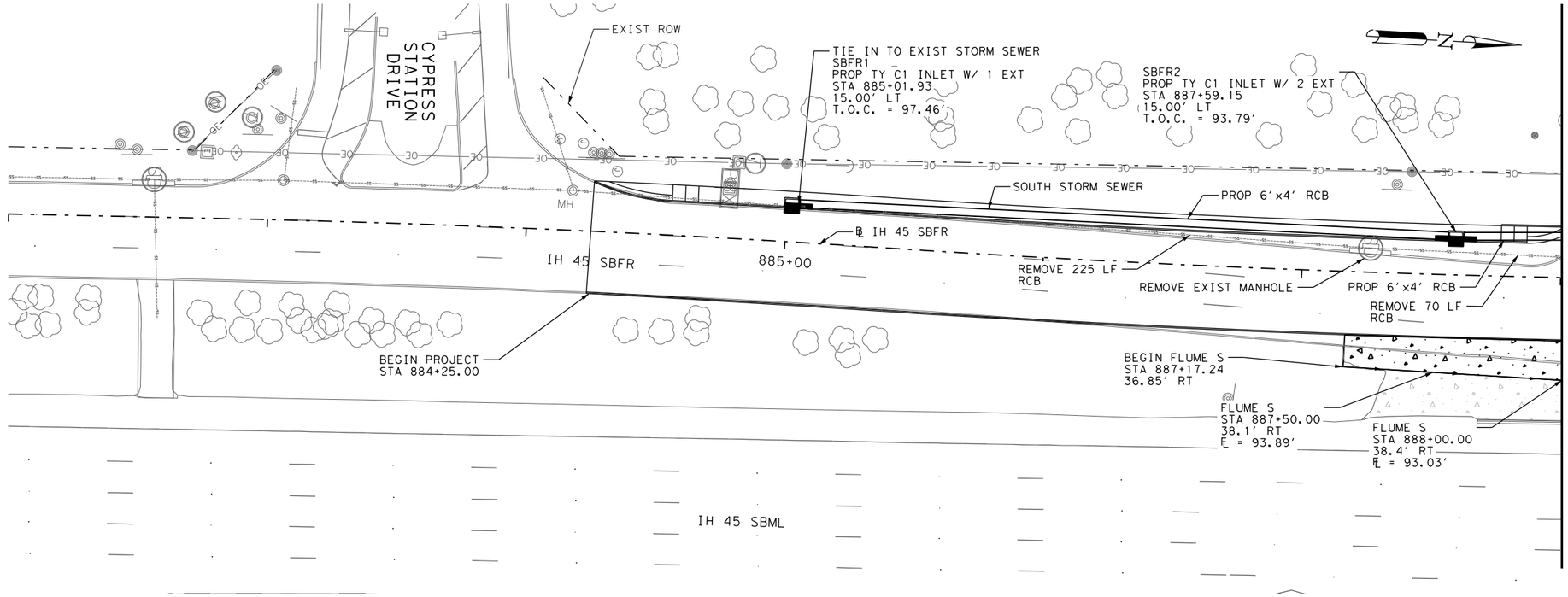
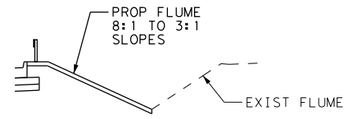


LEGEND

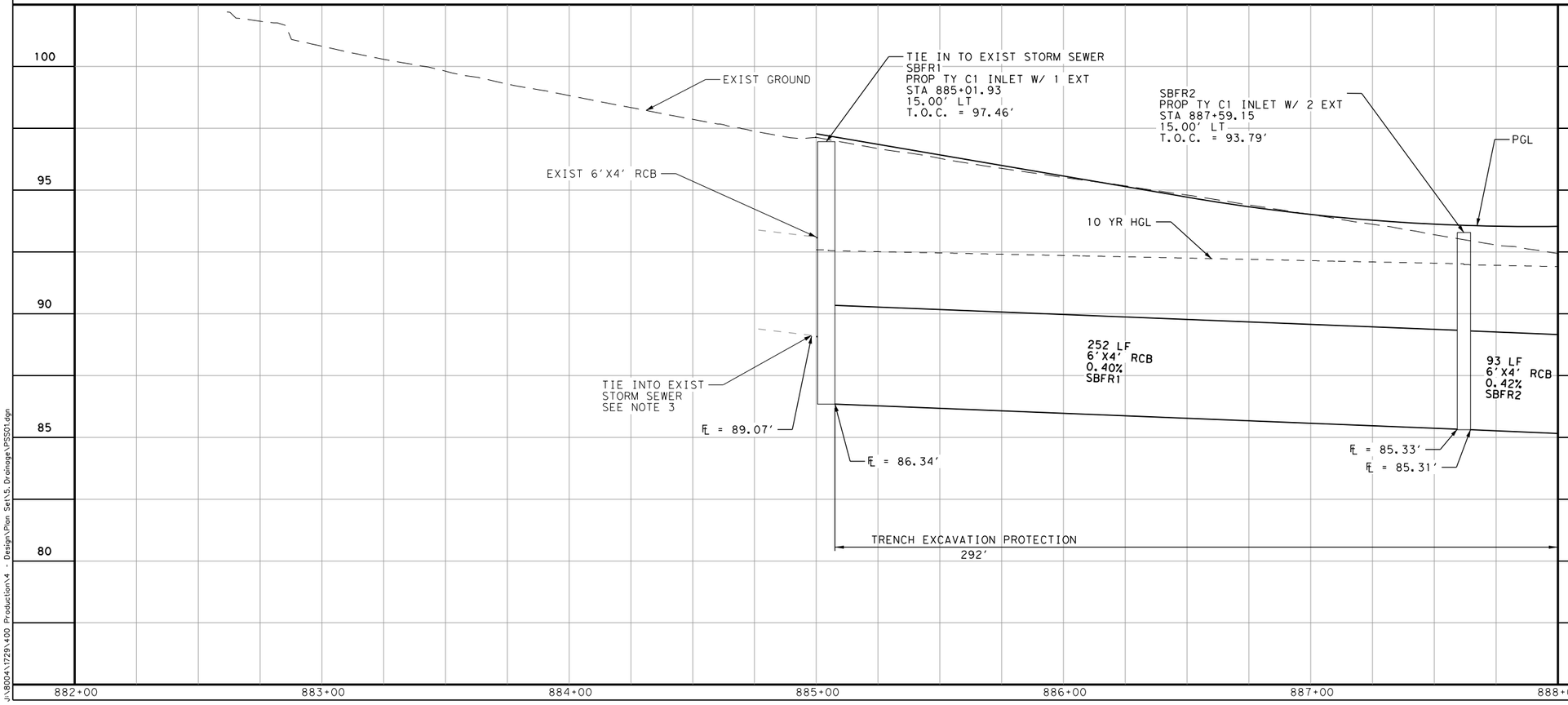
- MANHOLE / JUNCTION
- GRATE INLET
- CURB INLET
- CURB INLET W/ EXTENSION
- ℄ FLUME
- PROPOSED RETAINING WALL
- EXIST DIRECTION OF TRAFFIC
- PROPOSED DIRECTION OF TRAFFIC
- PROPOSED STORM SEWER



PROPOSED FLUME CROSS SECTION
NTS

NOTES:

1. PROPOSED CLASS 3 STORM SEWER LENGTHS SHOWN ARE PAY LENGTHS.
2. ALL STATIONS SHOWN ARE MEASURED TO THE CENTER OF THE INLET. TYPE M JUNCTION BOX, OR TRUNK LINE.
3. CONTRACTOR SHOULD FIELD VERIFY EXISTING STORM SEWER ELEVATIONS PRIOR TO STARTING CONSTRUCTION OF PROPOSED SYSTEM.
4. RETAINING WALL BACKFILL SHALL BE CEMENT STABILIZED FOR STORM SEWER LOCATED WITHIN 5 FEET OF RETAINING WALL FOOTING.
5. CONTRACTOR TO VERIFY PROPOSED AND EXISTING ELEVATIONS AFTER SILT REMOVAL IS COMPLETED.



0' 25' 50'
SCALE: 1"=50' - HORZ
1"=5' - VERT

STATE OF TEXAS
DAVID H. ZUHLKE
83450
LICENSED PROFESSIONAL ENGINEER
09/24/21

LJA Engineering, Inc.
FRN - F-1386

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IH 45
SB FRONTAGE RD
STORM SEWER
PLAN AND PROFILE
BEGIN TO STA 888+00

SHEET 1 OF 4

FED.RD. DIV.NO.	STATE	PROJECT NO.			HIGHWAY NO.
6	TEXAS				IH 45
STATE DISTRICT	COUNTY	CONTROL NO.	SECTION NO.	JOB NO.	SHEET NO.
HOU	HARRIS	0110	05	126	130

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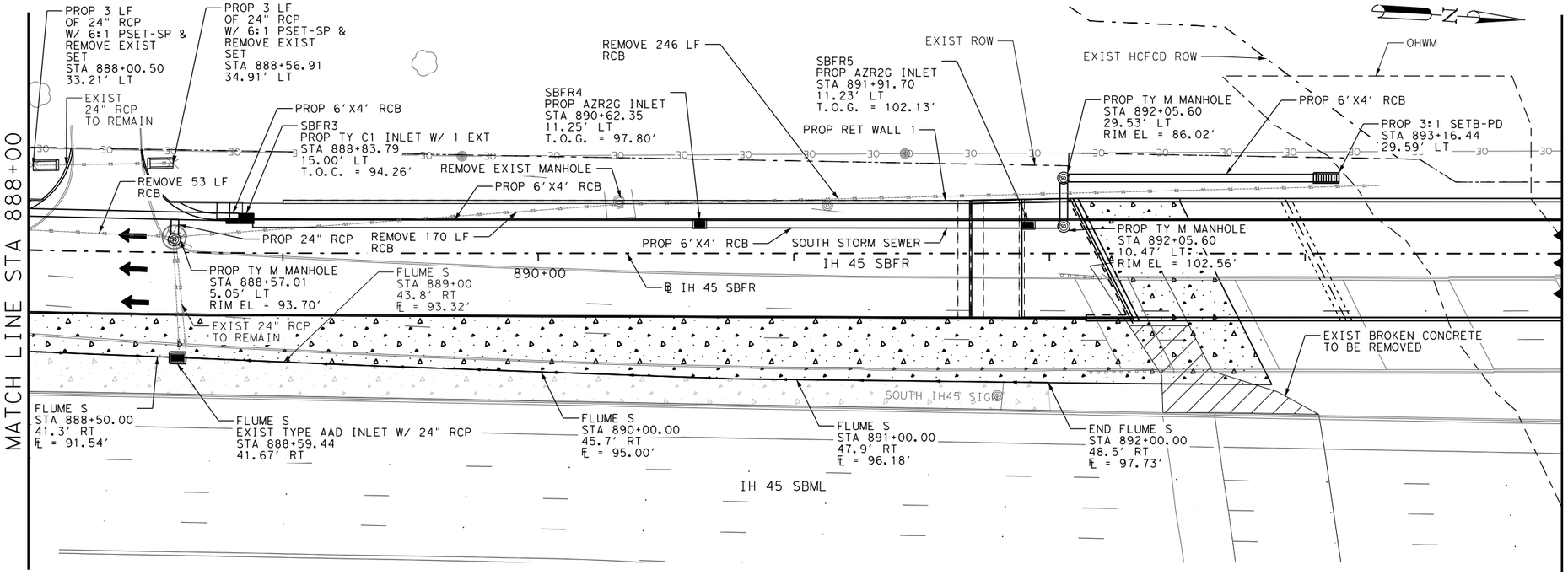
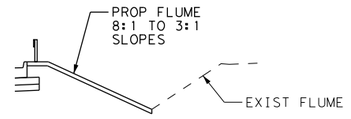


LEGEND

- MANHOLE / JUNCTION
- GRATE INLET
- CURB INLET
- CURB INLET W/ EXTENSION
- ℄ FLUME
- PROPOSED RETAINING WALL
- EXIST DIRECTION OF TRAFFIC
- PROPOSED DIRECTION OF TRAFFIC
- PROPOSED STORM SEWER



PROPOSED FLUME CROSS SECTION
NTS

NOTES:

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2. ALL STATIONS SHOWN ARE MEASURED TO THE CENTER OF THE INLET. TYPE M JUNCTION BOX, OR TRUNK LINE.
3. CONTRACTOR SHOULD FIELD VERIFY EXISTING STORM SEWER ELEVATIONS PRIOR TO STARTING CONSTRUCTION OF PROPOSED SYSTEM.
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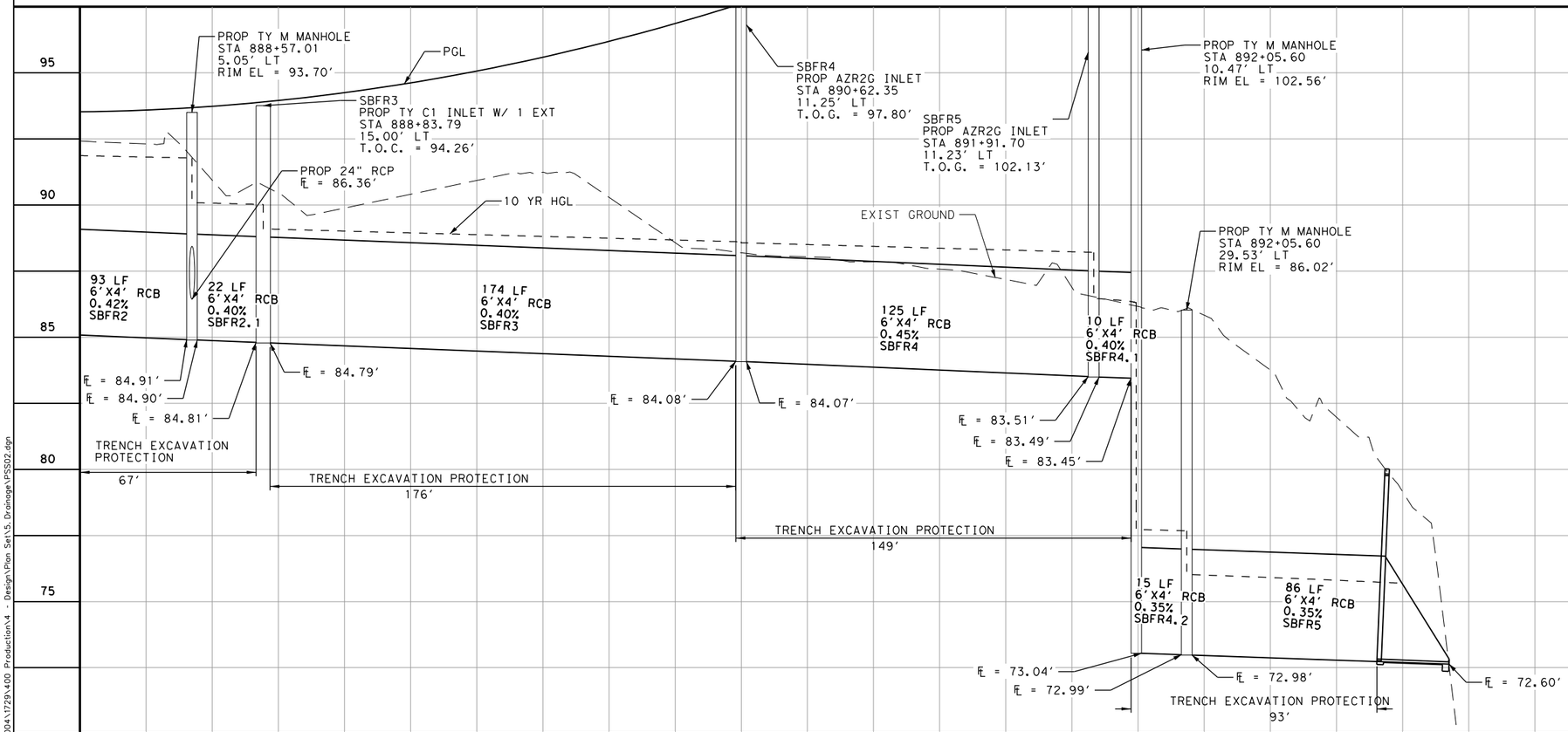
5. CONTRACTOR TO VERIFY PROPOSED AND EXISTING ELEVATIONS AFTER SILT REMOVAL IS COMPLETED.



0' 25' 50'
SCALE: 1"=50' - HORZ
1"=5' - VERT

STATE OF TEXAS
DAVID H. ZUHLKE
83450
LICENSED PROFESSIONAL ENGINEER
09/24/21

LJA Engineering, Inc.
FRN - F-1386

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IH 45
SB FRONTAGE RD
STORM SEWER
PLAN AND PROFILE
STA 888+00 TO STA 894+00

SHEET 2 OF 4

FED.RD. DIV.NO.	STATE	PROJECT NO.			HIGHWAY NO.
6	TEXAS				IH 45
STATE DISTRICT	COUNTY	CONTROL NO.	SECTION NO.	JOB NO.	SHEET NO.
HOU	HARRIS	0110	05	126	131

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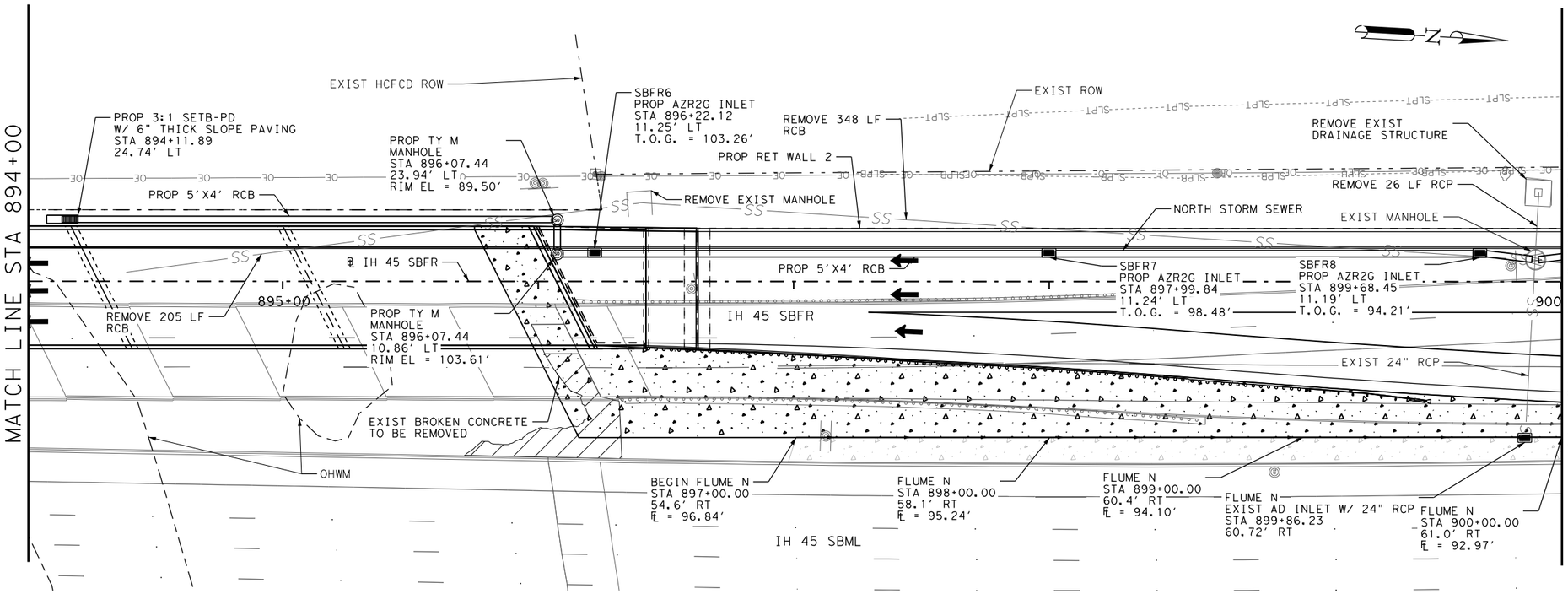
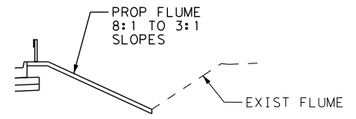


LEGEND

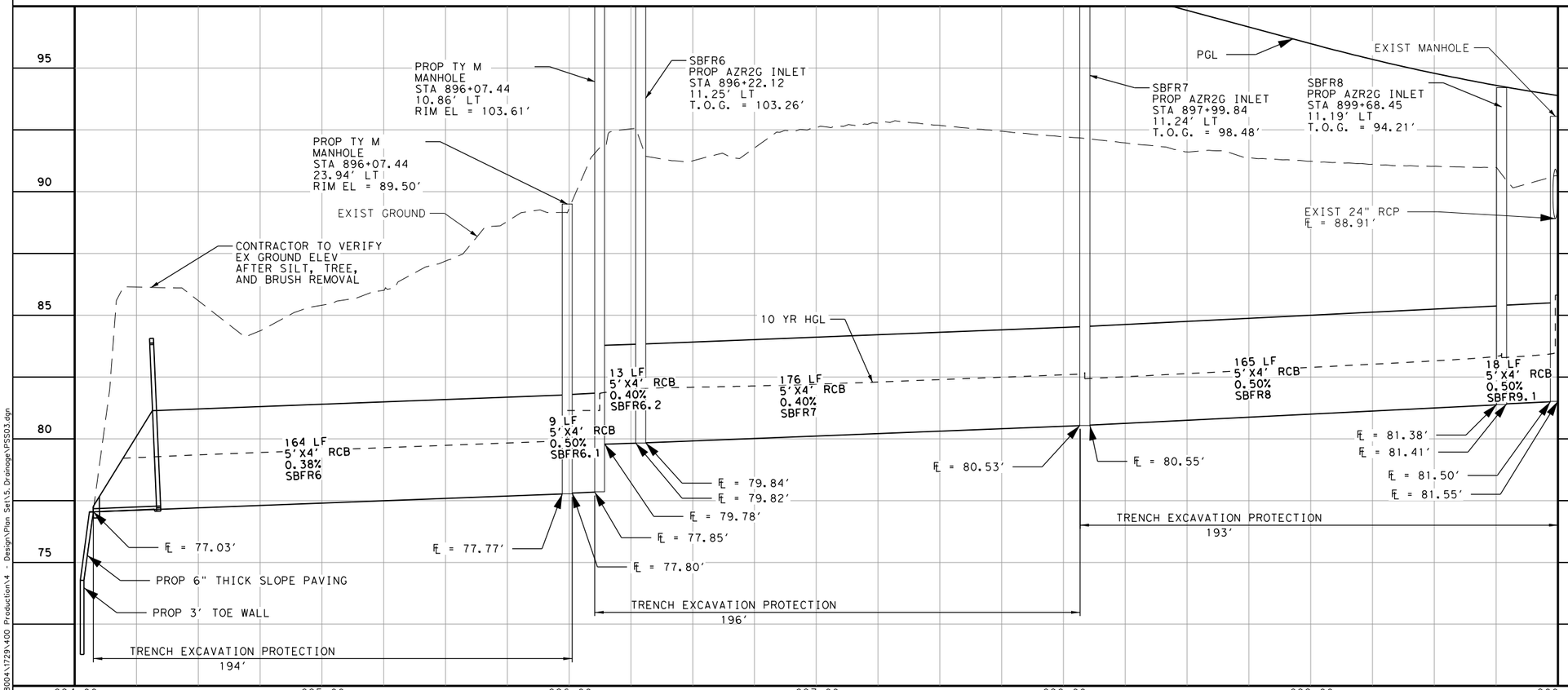
- MANHOLE / JUNCTION
- GRATE INLET
- CURB INLET
- CURB INLET W/ EXTENSION
- ℄ FLUME
- PROPOSED RETAINING WALL
- EXIST DIRECTION OF TRAFFIC
- PROPOSED DIRECTION OF TRAFFIC
- PROPOSED STORM SEWER



PROPOSED FLUME CROSS SECTION
NTS

NOTES:

1. PROPOSED CLASS 3 STORM SEWER LENGTHS SHOWN ARE PAY LENGTHS.
2. ALL STATIONS SHOWN ARE MEASURED TO THE CENTER OF THE INLET. TYPE M JUNCTION BOX, OR TRUNK LINE.
3. CONTRACTOR SHOULD FIELD VERIFY EXISTING STORM SEWER ELEVATIONS PRIOR TO STARTING CONSTRUCTION OF PROPOSED SYSTEM.
4. RETAINING WALL BACKFILL SHALL BE CEMENT STABILIZED FOR STORM SEWER LOCATED WITHIN 5 FEET OF RETAINING WALL FOOTING.
5. CONTRACTOR TO VERIFY PROPOSED AND EXISTING ELEVATIONS AFTER SILT REMOVAL IS COMPLETED.



0' 25' 50'
SCALE: 1"=50' - HORZ
1"=5' - VERT

STATE OF TEXAS
DAVID H. ZUHLKE
83450
LICENSED
PROFESSIONAL ENGINEER
10/25/21

LJA Engineering, Inc.
FRN - F-1386

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IH 45
SB FRONTAGE RD
STORM SEWER
PLAN AND PROFILE
STA 894+00 TO STA 900+00

SHEET 3 OF 4

FED.RD. DIV.NO.	STATE	PROJECT NO.			HIGHWAY NO.
6	TEXAS				IH 45
STATE DISTRICT	COUNTY	CONTROL NO.	SECTION NO.	JOB NO.	SHEET NO.
HOU	HARRIS	0110	05	126	132

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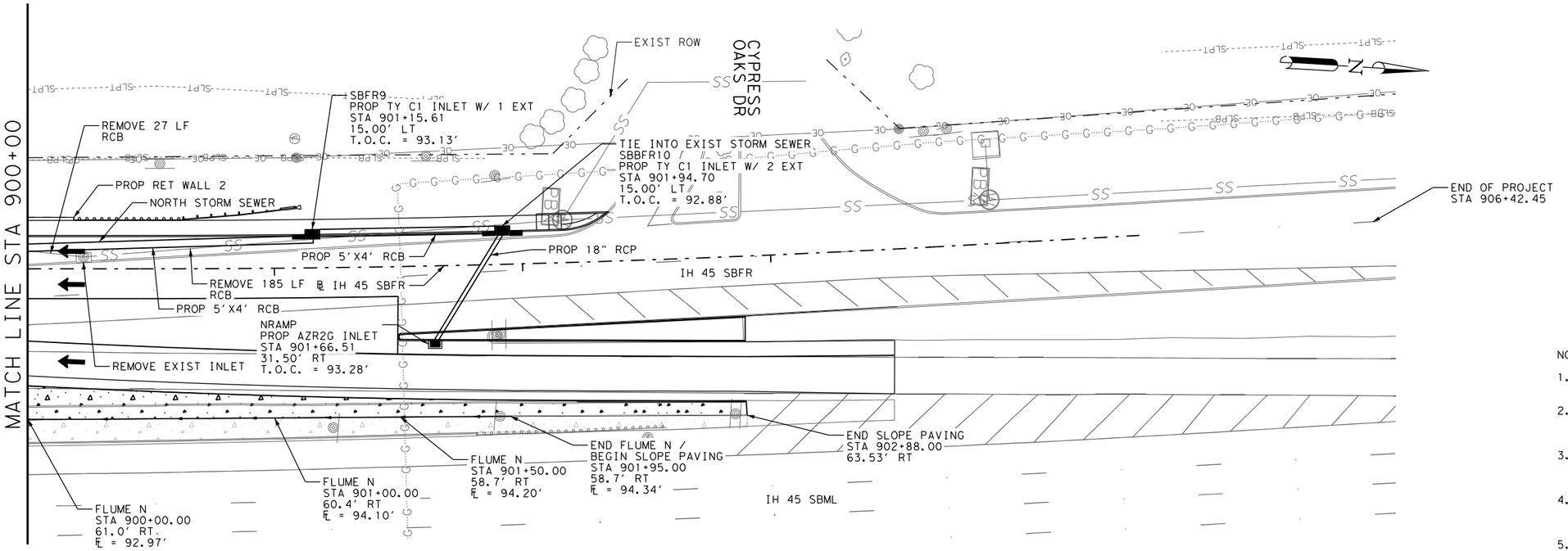
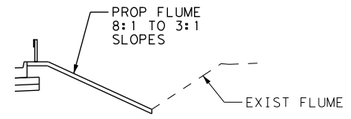


LEGEND

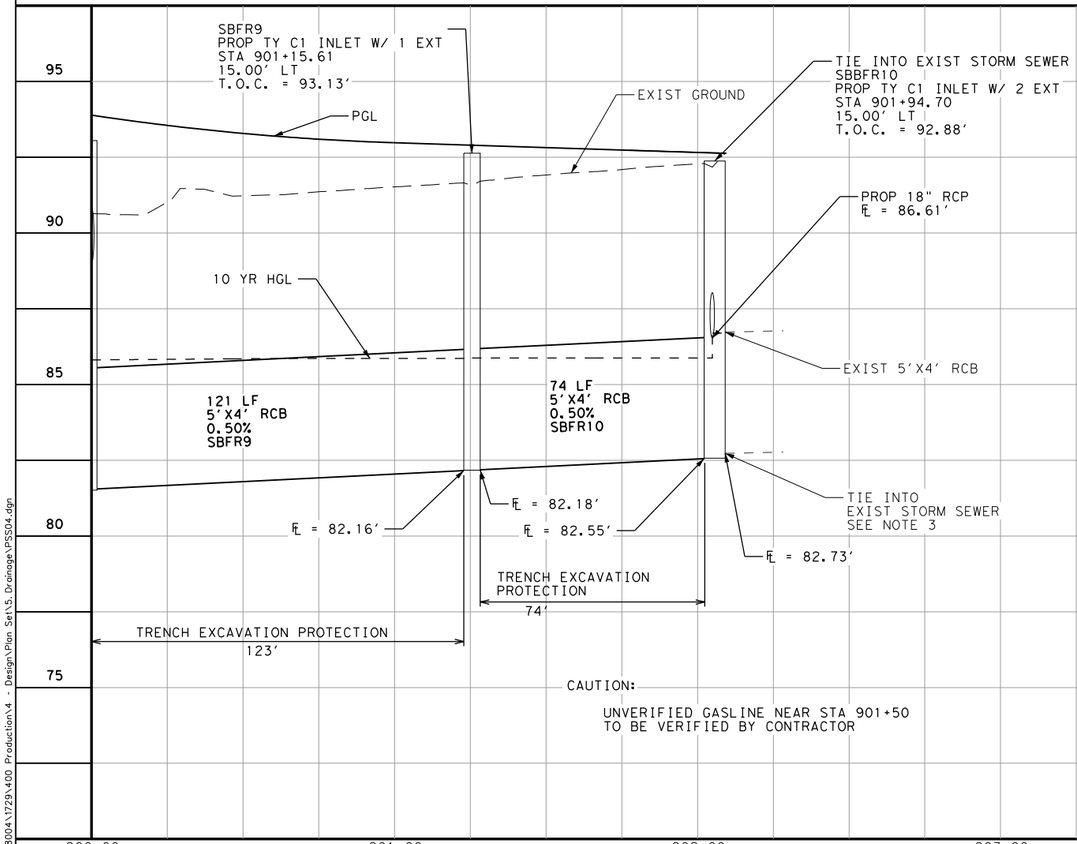
- MANHOLE / JUNCTION
- GRATE INLET
- CURB INLET
- CURB INLET W/ EXTENSION
- ℄ FLUME
- PROPOSED RETAINING WALL
- EXIST DIRECTION OF TRAFFIC
- PROPOSED DIRECTION OF TRAFFIC
- PROPOSED STORM SEWER



PROPOSED FLUME CROSS SECTION
NTS

NOTES:

1. PROPOSED CLASS 3 STORM SEWER LENGTHS SHOWN ARE PAY LENGTHS.
2. ALL STATIONS SHOWN ARE MEASURED TO THE CENTER OF THE INLET. TYPE M JUNCTION BOX, OR TRUNK LINE.
3. CONTRACTOR SHOULD FIELD VERIFY EXISTING STORM SEWER ELEVATIONS PRIOR TO STARTING CONSTRUCTION OF PROPOSED SYSTEM.
4. RETAINING WALL BACKFILL SHALL BE CEMENT STABILIZED FOR STORM SEWER LOCATED WITHIN 5 FEET OF RETAINING WALL FOOTING.
5. CONTRACTOR TO VERIFY PROPOSED AND EXISTING ELEVATIONS AFTER SILT REMOVAL IS COMPLETED.



0' 25' 50'
SCALE: 1"=50' - HORZ
1"=5' - VERT

STATE OF TEXAS
DAVID H. ZUHLKE
83450
LICENSED PROFESSIONAL ENGINEER
09/24/21

LJA Engineering, Inc.
FRN - F-1386

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IH 45
SB FRONTAGE RD
STORM SEWER
PLAN AND PROFILE
STA 900+00 TO STA 906+42.45

SHEET 4 OF 4

FED.RD. DIV.NO.	STATE	PROJECT NO.			HIGHWAY NO.
6	TEXAS				IH 45
STATE DISTRICT	COUNTY	CONTROL NO.	SECTION NO.	JOB NO.	SHEET NO.
HOU	HARRIS	0110	05	126	133

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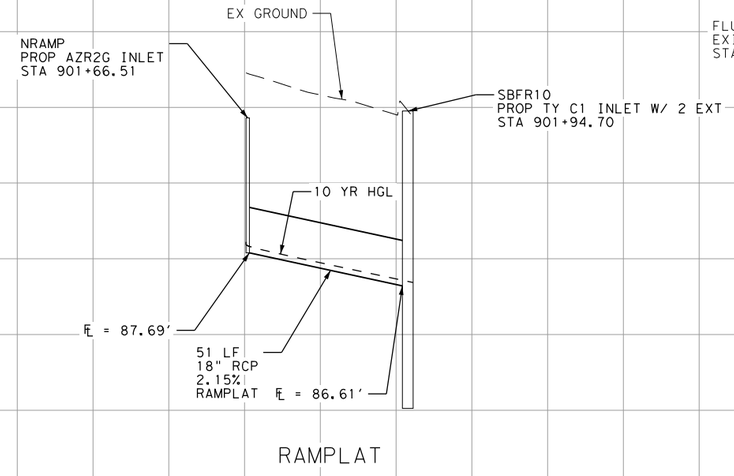
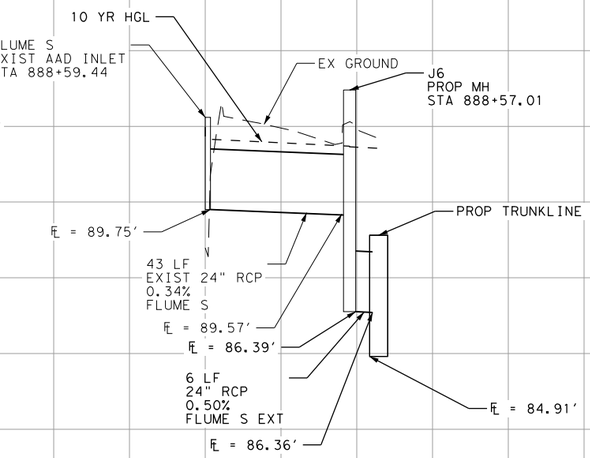


RAMPLAT



FLUME S

STATE OF TEXAS
DAVID H. ZUHLKE
83450
LICENSED
PROFESSIONAL ENGINEER
09/24/21

LJA Engineering, Inc.
FRN - F-1386

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IH 45
SB FRONTAGE RD

STORM SEWER LATERAL SHEET

SHEET 1 OF 1

FED. RD. DIV. NO.	STATE	PROJECT NO.			HIGHWAY NO.
6	TEXAS				IH 45
STATE DISTRICT	COUNTY	CONTROL NO.	SECTION NO.	JOB NO.	SHEET NO.
HOU	HARRIS	0110	05	126	134

STORM SEWER COMPUTATIONS																			
SOUTH STORM SYSTEM																			
LINK ID	UPSTREAM NODE ID	DOWNSTREAM NODE ID	UPSTREAM HGL	DOWNSTREAM HGL	DISCHARGE (CFS)	CAPACITY (CFS)	SLOPE (%)	LOSS	UNIFORM VELOCITY (FPS)	UNIFORM DEPTH (FT)	ACTUAL VELOCITY (FPS)	ACTUAL DEPTH (FT)	LENGTH (FT)	SHAPE	NO. OF BARRELS	RISE (FT)	SPAN (FT)	MANNING'S COEFFICIENT	INVERT UPSTREAM	INVERT DOWNSTREAM
SBFR5	J3	OUTL	77.68	75.45	163.72	229.33	0.34	1.65	8.82	3.09	9.58	2.85	85.91	Box	1	4	6	0.013	72.98	72.60
SBFR4.2	J1	J3	78.68	77.68	163.72	230.20	0.36	0.96	9.00	3.03	6.82	4.00	15.06	Box	1	4	6	0.013	73.05	72.98
SBFR4.1	SBFR5	J1	88.22	86.29	163.72	245.33	0.40	1.83	9.38	2.91	9.58	2.85	9.88	Box	1	4	6	0.013	83.50	83.44
SBFR4	SBFR4	SBFR5	88.61	88.22	161.94	259.24	0.44	0.04	9.69	2.78	6.75	4.00	125.28	Box	1	4	6	0.013	84.08	83.50
SBFR3	SBFR3	SBFR4	90.02	88.61	160.95	245.20	0.40	0.92	9.32	2.88	6.71	4.00	173.96	Box	1	4	6	0.013	84.80	84.08
SBFR2.1	J2	SBFR3	91.78	90.02	159.14	244.91	0.40	1.69	9.32	2.85	6.63	4.00	22.25	Box	1	4	6	0.013	84.90	84.80
SBFR2	SBFR2	J2	92.02	91.78	143.27	252.77	0.42	0.03	9.19	2.60	5.97	4.00	93.12	Box	1	4	6	0.013	85.32	84.90
Flume S	Flume S	J6	92.46	91.78	15.86	14.18	0.43	0.40	5.18	2.00	5.05	2.00	53.49	Circular	1	2	n/a	0.013	89.76	89.57
SBFR1	SBFR1	SBFR2	92.58	92.02	141.26	245.44	0.40	0.03	9.06	2.60	5.89	4.00	251.75	Box	1	4	6	0.013	86.35	85.32
EX L2	EX L2	SBFR1	93.00	92.58	139.15	200.95	0.27	0.06	7.81	2.97	6.59	3.52	239.55	Box	1	4	6	0.013	89.73	89.06
EX L1	EX L1	EX L2	94.11	93.00	134.74	205.32	0.29	0.76	7.89	2.85	6.87	3.27	30.19	Box	1	4	6	0.013	89.84	89.73
FLUME S EXT	J6	J2	91.85	91.78	15.86	17.215	0.50	0.02	5.84	1.61	5.05	2.00	5.58	Circular	1	2	n/a	0.013	86.39	86.36
STORM SEWER COMPUTATIONS																			
NORTH STORM SYSTEM																			
LINK ID	UPSTREAM NODE ID	DOWNSTREAM NODE ID	UPSTREAM HGL	DOWNSTREAM HGL	DISCHARGE (CFS)	CAPACITY (CFS)	SLOPE (%)	LOSS	UNIFORM VELOCITY (FPS)	UNIFORM DEPTH (FT)	ACTUAL VELOCITY (FPS)	ACTUAL DEPTH (FT)	LENGTH (FT)	SHAPE	NO. OF BARRELS	RISE (FT)	SPAN (FT)	MANNING'S COEFFICIENT	INVERT UPSTREAM	INVERT DOWNSTREAM
SBFR6	J5	OUTR	81.14	79.08	83.31	185.44	0.37	1.22	7.69	2.17	8.12	2.05	163.56	Box	1	4	5	0.013	77.77	77.03
SBFR6.1	J4	J5	81.60	81.14	83.31	212.66	0.50	0.46	8.55	1.95	4.97	3.35	9.08	Box	1	4	5	0.013	77.86	77.79
SBFR6.2	SBFR6	J4	82.05	81.82	83.31	178.43	0.34	0.07	7.48	2.23	8.12	2.05	12.59	Box	1	4	5	0.013	79.83	79.77
SBFR7	SBFR7	SBFR6	82.69	82.05	81.58	189.25	0.40	0.06	7.87	2.07	7.34	2.22	175.58	Box	1	4	5	0.013	80.54	79.83
SBFR8	SBFR8	SBFR7	83.47	82.43	80.12	212.83	0.50	0.08	8.49	1.89	8.49	1.89	164.54	Box	1	4	5	0.013	81.39	80.54
SBFR9.1	EXMH	SBFR8	85.81	83.28	78.51	212.68	0.50	2.33	8.46	1.86	8.34	1.88	17.72	Box	1	4	5	0.013	81.51	81.40
SBFR9	SBFR9	EXMH	85.87	85.81	66.15	212.64	0.51	0.01	8.07	1.64	3.31	4.00	121.08	Box	1	4	5	0.013	82.17	81.54
Flume N	Flume N	EXMH	90.99	90.17	12.36	10.12	0.26	0.32	4.04	2.00	5.91	1.26	65.71	Circular	1	2	n/a	0.013	89.03	88.91
SBFR10	SBFR10	SBFR9	86.69	85.87	64.50	212.10	0.51	0.81	8.02	1.61	3.48	3.70	73.90	Box	1	4	5	0.013	82.56	82.17
EX R3	EX R3	SBFR10	86.77	86.69	61.91	133.92	0.19	0.02	5.56	2.23	3.12	3.97	170.86	Box	1	4	5	0.013	83.08	82.72
RAMPLAT	NRAMP	SBFR10	88.06	86.72	0.48	16.56	2.15	0.09	3.93	0.18	3.93	0.18	50.52	Circular	1	1.5	n/a	0.013	87.69	86.61
EX R2	EX R2	EX R3	86.88	86.77	55.87	135.18	0.20	0.02	5.47	2.04	3.04	3.68	271.33	Box	1	4	5	0.013	83.66	83.09
EX R1	EX R1	EX R2	87.06	86.88	51.24	150.13	0.25	0.17	5.81	1.76	3.22	3.19	19.59	Box	1	4	5	0.013	83.77	83.70

INLET COMPUTATIONS														
ON GRADE INLETS														
SOUTH STORM SYSTEM														
ID	STATION	OFFSET (FT)	ELEVATION (FT)	TYPE	DISCHARGE (CFS)	ALLOWABLE PONDED WIDTH (FT)	PONDED WIDTH (FT)	ALLOWABLE PONDED DEPTH (FT)	PONDED DEPTH (FT)	SLOPE	LENGTH (FT)	WIDTH (FT)	DEPRESSION (FT)	CAPACITY (CFS)	BY PASS (CFS)	TO NODE
SBFR1	885+01.93	15.00	97.46	TYPE C1	2.19	13.00	10.99	0.50	0.22	0.45	10	n/a	0.25	2.19	0.00	SBFR2
SBFR3	888+83.79	15.00	94.26	TYPE C1	2.19	13.00	10.98	0.50	0.22	0.45	10	n/a	0.25	2.18	0.00	SBFR2
SBFR4	890+62.35	11.25	97.80	AZR2G	1.49	13.00	9.51	0.50	0.19	0.45	3.083	2.542	n/a	1.11	0.38	SBFR3
SBFR5	891+91.70	11.23	102.13	AZR2G	1.77	13.00	10.15	0.50	0.20	0.45	3.083	2.542	n/a	1.28	0.49	SBFR4
NORTH STORM SYSTEM														
SBFR6	896+22.12	11.25	103.26	AZR2G	1.74	13.00	10.07	0.50	0.20	0.45	3.083	2.542	n/a	1.26	0.48	SBFR7
SBFR7	897+99.84	11.24	98.48	AZR2G	1.93	13.00	10.48	0.50	0.21	0.45	3.083	2.542	n/a	1.37	0.56	SBFR8
SBFR8	899+68.45	11.19	94.21	AZR2G	2.18	13.00	10.96	0.50	0.22	0.45	3.083	2.542	n/a	1.51	0.67	SBFR9
SBFR9	901+15.61	15.00	93.13	TYPE C1	2.32	13.00	11.22	0.50	0.22	0.45	10	n/a	0.25	2.30	0.01	SBFR10
SBFR10	901+94.70	15.00	92.88	TYPE C1	2.13	13.00	10.86	0.50	0.22	0.45	15	n/a	0.25	2.13	0.00	EX INLET

SAG INLET																			
ID	STATION	OFFSET (FT)	ELEVATION (FT)	TYPE	DISCHARGE (CFS)	DISCHARGE LEFT (CFS)	DISCHARGE RIGHT (CFS)	ALLOWABLE PONDED WIDTH TOTAL (FT)	PONDED WIDTH LEFT (FT)	PONDED WIDTH RIGHT (FT)	SLOPE LEFT	SLOPE RIGHT	LENGTH (FT)	WIDTH (FT)	DEPRESSION (FT)	AREA (SQ. FT)	PERIMETER (FT)	CAPACITY (CFS)	ALLOWABLE PONDED DEPTH TOTAL (FT)	PONDED DEPTH (FT)
SBFR2	887+59.15	15	93.79	TYPE C1	2.02	1.01	1.01	13	6.43	5.63	1.67	3.40	15	n/a	0.25	n/a	n/a	16.59	0.50	0.12
Flume N	900+10.00	60.71	92.75	AD	12.36	9.27	3.09	13	14.26	9.45	2.00	2.00	n/a	n/a	n/a	4.14	9.92	5.41	0.50	1.23
Flume S	888+59.44	41.67	92.79	AAD	15.86	11.90	3.97	13	15.66	10.38	2.00	2.00	n/a	n/a	n/a	8.29	14.88	8.12	0.50	0.78
NRAMP	901+66.51	31.5	93.28	AZR2G	0.48	0.04	0.37	13	0.74	6.47	0.18	1.58	n/a	n/a	n/a	4.60	8.39	4.58	0.50	0.11

NOTES:

1. SUPPLIED FLOW WAS USED AT THE TIE-IN POINTS TO THE EXISTING STORM SEWERS TO ACCOUNT FOR CONVEYANCE OF EXISTING FLOW.
2. INLET ID FLUME N AND FLUME S ARE EXISTNG STORM DRAIN INLETS WHICH ARE NOT SUPPOSED TO BE REPLACED. EXISTING FLUME INLET CAPACITY LESS THAN DISCHARGE.
3. 50% CLOGGING ANALYSIS ACHIEVED THROUGH USING AZR1G INLETS DURING MODELING.

STATE OF TEXAS
DAVID H. ZUHLKE
83450
LICENSED
PROFESSIONAL ENGINEER

10/25/21

LJA Engineering, Inc.
FRN - F-1386

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IH 45
SB FRONTAGE RD

STORM SEWER HYDRAULIC DATA SHEET

SHEET 1 OF 1

FED.RD. DIV.NO.	STATE	PROJECT NO.			HIGHWAY NO.
6	TEXAS				IH 45
STATE DISTRICT	COUNTY	CONTROL NO.	SECTION NO.	JOB NO.	SHEET NO.
HOU	HARRIS	0110	05	126	135

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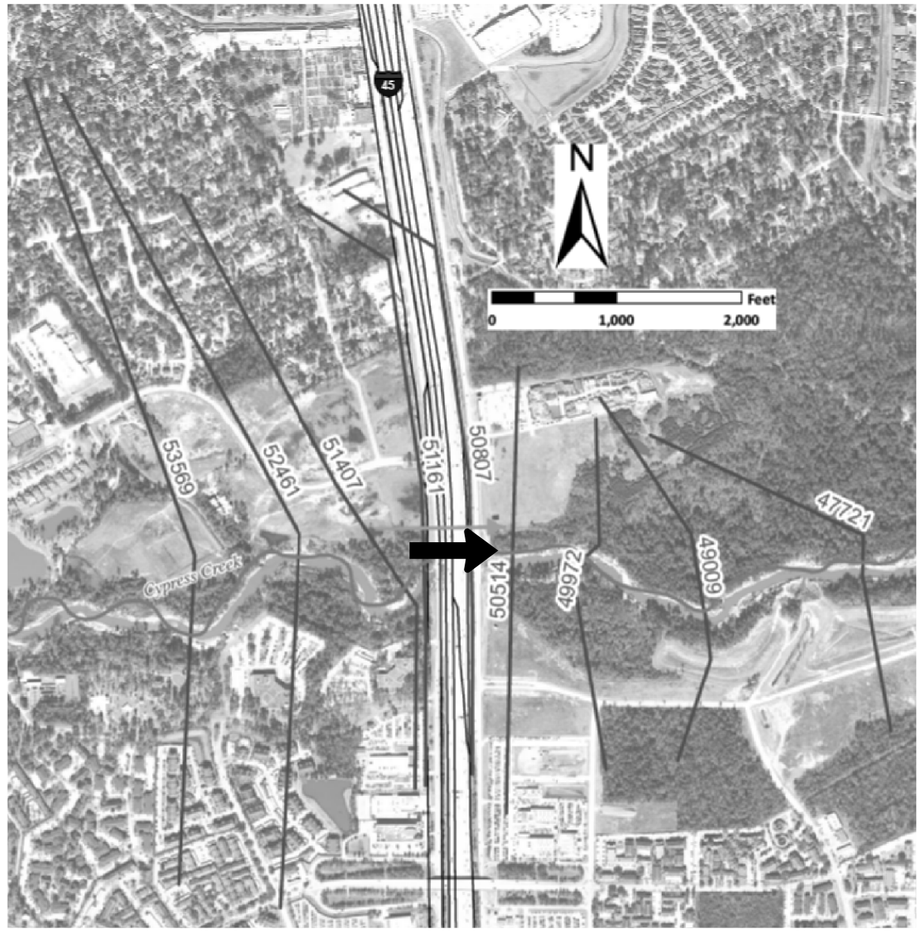
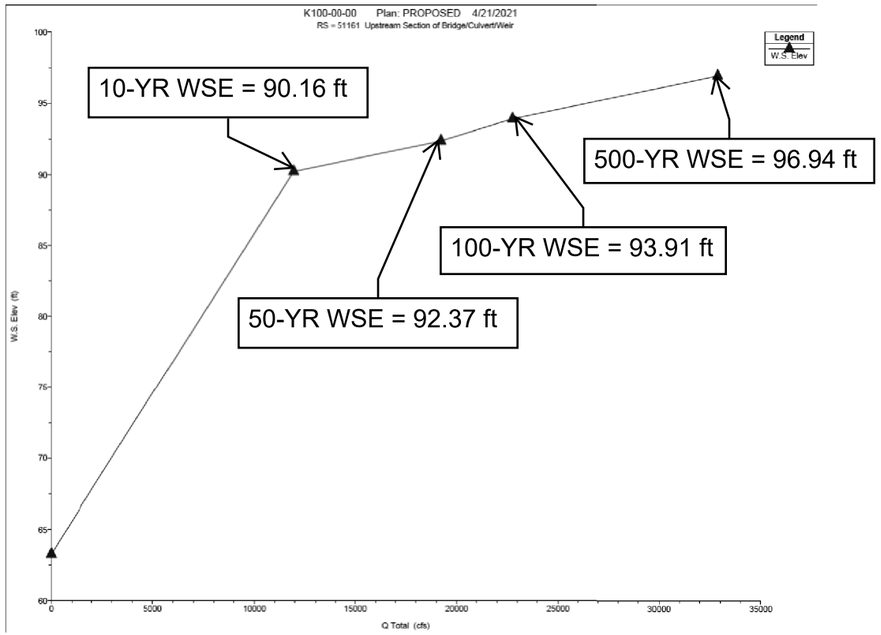


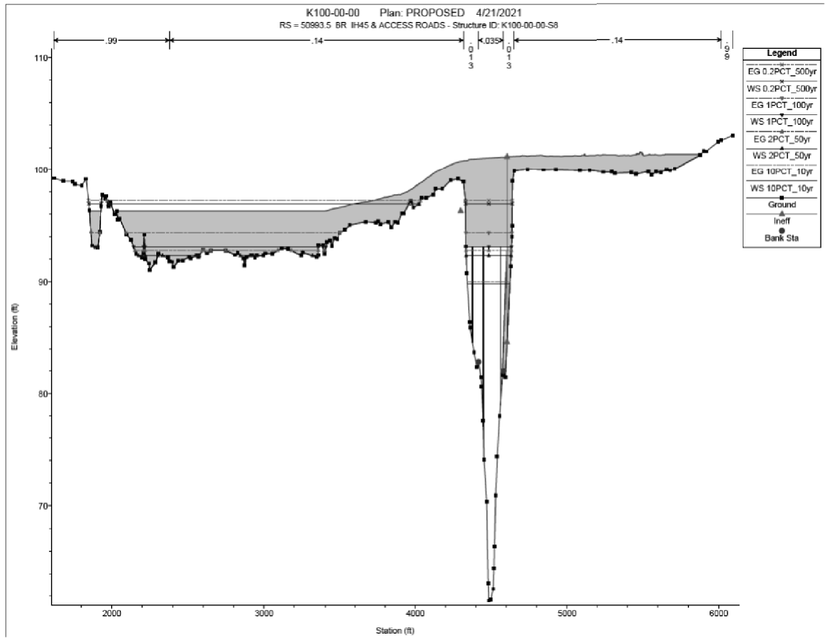
HEC-RAS CROSS SECTION LAYOUT

RIVER STATION	REVISED EXISTING WSE				PROPOSED WSE				DELTA WSE			
	10-YR (FT)	50-YR (FT)	100-YR (FT)	500-YR (FT)	10-YR (FT)	50-YR (FT)	100-YR (FT)	500-YR (FT)	10-YR (FT)	50-YR (FT)	100-YR (FT)	500-YR (FT)
52461	91.11	93.29	94.61	97.45	90.49	92.97	94.57	97.40	-0.62	-0.32	-0.04	-0.05
51407	90.93	92.98	94.28	97.10	90.29	92.63	94.23	97.04	-0.64	-0.35	-0.05	-0.06
51161	90.81	92.72	93.95	97.00	90.16	92.37	93.91	96.94	-0.65	-0.35	-0.04	-0.06
50993.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50807	88.73	92.23	93.57	95.92	88.73	92.23	93.57	95.92	0.00	0.00	0.00	0.00
50514	88.76	92.27	93.62	96.04	88.76	92.27	93.62	96.04	0.00	0.00	0.00	0.00
49972	88.52	91.99	93.36	95.75	88.52	91.99	93.36	95.75	0.00	0.00	0.00	0.00

HEC-RAS INFORMATION



ELEVATION VS. DISCHARGE AT XS 50993.5



IH 45 BRIDGE CROSSING
XS 50993.5
NOT TO SCALE

NOTES:

1. PROJECT DATUM = NAVD88 (TXDOT).

2. ALL ELEVATIONS SHOWN REFLECT THE PROJECT DATUM.

3. THIS SITE IS DESIGNATED ZONE "AE" AS SHOWN ON FEMA FIRM PANEL NO. 48201C0270M. THE BASE FLOOD ELEVATION IS 89 FT. DRAINAGE IMPACT ANALYSIS REPORT IH 45 OVER CYPRESS CREEK DATED AUGUST 2021 AS PREPARED BY LJA ENGINEERING, INC. AND APPROVED BY TXDOT AUGUST 12, 2021. COORDINATION COMPLETED WITH THE LOCAL FLOODPLAIN ADMINISTRATOR FOR HARRIS COUNTY, TEXAS, SHAWN STURHAN ON 09/21/2021.

4. HYDROLOGY COMPUTATIONS WERE BASED ON THE HEC-HMS MODEL DEVELOPED BY THE HARRIS COUNTY FLOOD CONTROL DISTRICT. SEE DRAINAGE AREA MAP FOR HYDROLOGIC INFORMATION.

5. HYDRAULIC COMPUTATIONS WERE BASED ON THE HEC-RAS MODEL OBTAINED FROM HARRIS COUNTY FLOOD CONTROL DISTRICT. THE REVISED EXISTING AND PROPOSED CONDITIONS WERE DEVELOPED WITH CURRENT INFORMATION AND PLANS FROM TXDOT. THE HEC-RAS PROJECT NAME IS K-100-00-00.PRJ. MODEL ELEVATIONS ARE PROVIDED IN THE NAVD 88 (2001 ADJ.) DATUM.

6. THE BOUNDARY CONDITION USED FOR THE EXISTING AND PROPOSED HEC-RAS ANALYSIS WAS NORMAL DEPTH.

*DATE WILL BE FILLED OUT AND ANALYSIS WILL BE SUBMITTED TO FLOODPLAIN ADMINISTRATOR AFTER TXDOT APPROVES AN ACCEPTS THE REPORT.

STATE OF TEXAS
DAVID H. ZUHLKE
83450
LICENSED
PROFESSIONAL ENGINEER
09/24/2021

LJA Engineering, Inc.
FRN - F-1386

Texas Department of Transportation

IH 45
SB FRONTAGE RD

CYPRESS CREEK BRIDGE HYDRAULIC DATA SHEET

FED. RD. DIV. NO.	STATE	PROJECT NO.			HIGHWAY NO.
6	TEXAS				IH 45
STATE DISTRICT	COUNTY	CONTROL NO.	SECTION NO.	JOB NO.	SHEET NO.
HOU	HARRIS	0110	05	126	136

1. PROPERTY DESCRIPTION

I. LOCATION INFORMATION

A. HARRIS COUNTY COMMISSIONER'S PRECINCT:
☐ 1 ☐ 2 ☐ 3 ☒ 4

B. KEY MAP: 332F

C. ADDRESS: IH 45 SBFR OVER CYPRESS CREEK

II. LEGAL DESCRIPTION

A. ACREAGE: 1.9

B. ☐ SUBDIVISION: _____

☐ SURVEY & ABSTRACT: _____

C. ADJACENT ROADS: IH 45 SBFR OVER CYPRESS CREEK

III. PLATTING

A. SUBDIVISION PLAT
☐ PROPOSED PLAT / REPLAT
☐ RECORDED PLAT / REPLAT

PLAT NAME: _____

B. STREETS PROPOSED
☐ PUBLIC
☐ PRIVATE
☐ PUBLIC & PRIVATE
☐ NONE

IV. JURISDICTIONS

☐ CITY OF _____
☐ ETJ, CITY OF HOUSTON
☐ ETJ, CITY OF _____
☒ NO ETJ
☐ UTILITY DISTRICT (NAME)_____

V. HCAD ACCOUNT NOS. (ALL)

_____

2. SITE DETENTION DRAINAGE

I. PROPOSED DRAINAGE AREA

☐ NEW DEVELOPMENT AREA: _____
☐ RE-DEVELOPMENT AREA (AMOUNT INCREASED IMPERVIOUS AREA): _____
☐ LOW IMPACT DEVELOPMENT (LID)
METHOD/DESCRIPTION _____

II. METHODOLOGY

HCFCD PCPM DETENTION METHOD USED:
☐ METHOD 1 (LESS THAN 20 ACRES)
☐ METHOD 2 (20 ACRES TO 640 ACRES)
☐ METHOD 3 (GREATER THAN 640 ACRES)
☐ OTHER _____

III. DETENTION VOLUME & OUTFALL

OUTFALL TO:
☐ .65, H.C.F.C.D. CHANNEL, (H.C.F.C.D. UNIT NO.) _____
☐ .75, EXISTING STORM SEWER (OWNER & OPERATOR) _____
☐ 1.00, ROADSIDE DITCH, (OWNER & ROAD NAME) _____
☐ OTHER (OWNER & OPERATOR) _____

IV. STORMWATER DETENTION BASIN INFORMATION

A. HCFCD PCPM SUMMARY TABLE SEE SHEET _____ OF THESE PLANS.

DETENTION BASIN SERVICE AREA		acres	
STORM EVENT	50% EXCEEDANCE (2-YEAR)	10% EXCEEDANCE (10-YEAR)	1% EXCEEDANCE (100-YEAR)
MAXIMUM ALLOWABLE OUTFLOW (PRE-DEVELOPMENT PEAK FLOW)			
MAXIMUM OUTFLOW PROVIDED (PEAK FLOW FROM BASIN)			
LOWEST NATURAL/FINISHED GROUND OR FINISHED FLOOR ELEVATION ESTIMATE			
DESIGN WATER SURFACE ELEVATION			
MINIMUM STORAGE REQUIRED (ac-ft)			
DETENTION STORAGE PROVIDED (ac-ft)			
STORAGE RATE PROVIDED (ac-ft/ac)			
OUTFLOW VELOCITY INTO CHANNEL (ft/sec)			
DRAIN TIME – 1% ONLY (hours)			
EMERGENCY OVERFLOW (TYPE, SIZE, ELEVATION, ETC)			

B. DETENTION BASIN TO BE MAINTAINED BY _____

C. DETENTION SERVICE AREA MAP ON SHEET _____

D. ADDITIONAL CRITERIA FOR PUMPED DETENTION BASINS
VOLUME OF PUMPED 1% EXCEEDANCE STORAGE VOLUME = _____ ACFT _____ % OF TOTAL VOLUME
MAXIMUM DESIGN OUTFLOW VELOCITY INTO HCFCD CHANNEL = _____ FT/SEC
DRAIN TIME FOR BASIN = _____ HOURS BASED ON _____HEAD CONDITIONS

V. DETENTION PROVIDED IN OTHER PLANS:

HCFCD PROJECT No. _____ DATE SIGNED BY HCFCD: _____
PLAN TITLE _____
DETENTION POND SERVICE AREA MAP IS PROVIDED ON SHEET _____
ENGINEERING FIRM _____
DETENTION BASIN MAINTAINED BY: _____

VI. FLOW RESTRICTOR SIZE

OUTFALL PIPE SIZE: _____
RESTRICTOR PIPE SIZE: _____
RESTRICTOR PLATE DIMENSION: _____

VII. DETENTION PROVIDED BY

☐ REGIONAL DETENTION BASIN SYSTEM (APPROVED H.C. PRJ NO.): _____

FOR PROJECTS LOCATED IN ANY FLOODPLAIN

Development constructed or placed in accordance with these plans will comply with all provisions of the designated Floodplain Administrator.

No net fill is allowed in the flood plain and no fill is allowed in the floodway.

OFFSITE SHEET FLOW: (100 YEAR)

OFFSITE SHEET FLOW MAPPING, TOTAL DISCHARGE CALCULATIONS, AND DESIGNACCOMODATIONS ARE SHOWN ON SHEET ____ OR, AS PRESENTED IN THE APPROVED DRAINAGE STUDY ENTITLED _____

TOTALACREAGE = ____
TOTAL DISCHARGE = ____

NOTE: ALL OFFSITE SHEET FLOW FROM ADJACENT PROPERTIES MUST BE IDENTIFIED AND PROPERLY ACCOUNTED FOR IN THE PROJECT. THE SIGNING ENGINEER HEREBY CERTIFIES THAT THESE AREAS HAVE BEEN ADDRESSED.

3. SWQ DISCHARGE INTO FCD FACILITY

I. SWPPP: CONSTRUCTION MEASURES. (Must complete)

☐ DISTURBS >1AC. SITE PLAN & DETAILS ON SHEET(S) _____
☐ DISTURBS <1AC. N/A

*II. APPLICABILITY FOR PERMANENT FEATURES. (Must complete)

EXEMPT NEW DEVELOPMENT:
☐ PROJECT IS ON A PARCEL (A COMMON PLAN OF DEVELOPMENT) LESS THAN 5 ACRES. (Must be verified with plat)

EXEMPT REDEVELOPMENT:
☐ PROJECT DOES NOT MEET THE DEFINITION OF SIGNIFICANT REDEVELOPMENT (Part A,Sec. 2.39 of Regulations of Harris County, Texas for Stormwater Quality Management)

EXEMPT GRANDFATHERED:
☐ PROJECT'S DRAINAGE TIES DIRECTLY INTO AN EXISTING DRAINAGE SYSTEM PRIOR TO OCTOBER 1, 2001.
(FOR VERIFICATION: PROVIDE ORIGINAL DRAINAGE AREA MAP INCLUDING CALCULATIONS)

GENERAL:
☐ PROJECT'S SWQ REQUIREMENTS FALL WITHIN THE JURISDICTION OF: _____
☐ STORMWATER QUALITY PERMIT REQUIREMENT IS COVERED BY AN EXISTING SWQMP WITHIN PROJECT TITLE: _____
HARRIS COUNTY PROJECT No _____ & SWQ PERMIT No.

STORMWATER QUALITY MANAGEMENT PLAN:
☐ SITE PLAN ON SHEET(S)

III. PERMANENT SWQ FEATURES. (COMPLETE IF NOT EXEMPT)

☐ VEGETATIVE CONTROLS USED: (FILTER STRIP, GRASSY SWALE, URBAN FORESTRY DETAILS AND CALCULATIONS APPEAR ON SHEET(S) _____
☐ POND STRUCTURE USED (WET, DRY, WETLANDS) DETAILS AND CALCULATIONSAPPEAR ON SHEET(S)_____
☐ HYDRODYNAMIC TYPE SEPARATOR MODEL: _____
☐ OTHER(S): _____

4. FLOOD PLAIN STATUS

I. GENERAL INFORMATION

FIRM PANEL(S) FOR PROPERTY: 48201C0270M
FIRM PANEL(S) DATE: 10-16-2013
STATUS OF PROPERTY ON MAP
☐ ENTIRELY LOCATED IN UNSHADED ZONE "X"
☒ LOCATED PARTIALLY OR ENTIRELY IN ANY "A" ZONE OR SHADED ZONE "X", DELINEATE FLOODPLAIN BOUNDARY ON CONSTRUCTION DRAWINGS
(DRAINAGE LAYOUT PG. NO.___138_) (1% BASE FLOOD LEVEL 93.91)
(0.2% BASE FLOOD LEVEL 96.94)
☐ SITE REMOVED FROM FLOODPLAIN BY LOMR, LOMR-F, LOMA
CASE NO._____ REVISED FLOODPLAIN IS SHOWN ON SHEET_____

ELEVATION INFORMATION
BENCHMARK USED
☐ HARRIS COUNTY FLOODPLAIN REFERENCE MARK
☐ HARRIS-GALVESTON COASTAL SUBSIDENCE DISTRICT BENCHMARK (FOR COASTAL AREAS)
DESCRIPTION OF BENCHMARK INCLUDING ELEVATION, DATUM AND YEAR OF ADJUSTMENT *(2001 ADJ.)* TxDOT NAVD 88

II. FLOOD PLAIN DETERMINATION BASED ON GROUND ELEVATION

☐ PROPERTY LIES ENTIRELY ABOVE THE BASE FLOOD LEVEL AND IN SHADED ZONE "X"
☒ PROPERTY LIES PARTIALLY OR ENTIRELY BELOW THE BASE FLOOD LEVEL

III. FLOODPLAIN STORAGE SUMMARY

(APPLIES ONLY TO PORTION OF LAND LOCATED WITHIN FEMA REGULATORY FLOODPLAIN).

A. TOTAL VOLUME OF MATERIAL PROPOSED TO BE MOVED OR PLACED WITHIN THE FIRM DELINEATED FLOODPLAIN (FILL, BASE, CONCRETE, ASPHALT, ETC.):
BELOW 0.2% BASE FLOOD ELEVATION (2001 ADJ.) ___ CUBIC YARDS _____

B. TOTAL VOLUME OF MATERIAL PROPOSED TO BE REMOVED FROM THE FIRM DELINEATED FLOODPLAIN:
BELOW 0.2% BASE FLOOD ELEVATION (2001 ADJ.) ____ CUBIC YARDS _____
INCLUDING CALCULATIONS)

C. FILL AREA & VOLUME CALCULATIONS ARE SHOWN ON SHEET _____

5. WORK IN HCFCD RIGHT-OF-WAY

I. TYPE OF WORK TO BE PERFORMED IN HCFCD HCFCD ROW

A. BOND/NOTIFICATION INFORMATION
☐ HCFCD WATERSHED CYPRESS CREEK
☐ HCFCD UNIT No. K100-00-00
☐ NUMBER OF OUTFALLS 2
☐ UTILITY CROSSING
☒ ROADWAY BRIDGE/CULVERT CROSSING
☐ FILL ACTIVITY
☐ REHABILITATION OF CHANNEL
☐ MAINTENANCE
☐ TEMPORARY CROSSING
☐ TRAIL (LENGTH) _____
☐ OTHER _____
COST OF WORK IN HCFCD ROW _____

II. USACE ENVIRONMENTAL PERMIT

☐ US ARMY CORPS OF ENGINEERS NATIONWIDE PERMIT NUMBER(S) _____
☐ US ARMY CORPS OF ENGINEERS INDIVIDUAL PERMITS
☐ OTHER
☒ NO PERMITS REQUIRED
EXPLAIN:
NO WORK WITHIN WATERS OF THE US

III. REFERENCE / BASIS OF DETERMINATION

☒ ENVIRONMENTAL CONSULTANT REPORT
BY WSP USA, INC
REPORT TITLE WATERS OF THE US DELINEATION
REPORT DATE JUNE 2021
☐ OTHER _____

NOTES:
I. – III. REQUIRED ON PROJECTS WITH WORK IN A HCFCD CHANNEL. PLEASE REFERENCE SECTION 17 OF THE FLOOD CONTROL DISTRICT POLICY, CRITERIA, AND PROCEDURE MANUAL FOR MORE INFORMATION.

IV. HCFCD STANDARD NOTES: SEE SHEET 146 OF THESE PLANS.

V. HCFCD STANDARD DETAILS: SEE SHEET N/A OF THESE PLANS.

VI. HCFCD ACCESS PLAN: SEE SHEET N/A OF THESE PLANS.

VII. REFER TO THE FOLLOWING PLAN SHEETS: 131 AND 132
FOR EXISTING AND PROPOSED RIGHT(S) OF WAY INCLUDING DELINEATION AND RECORDING INFORMATION PER HCFCD POLICY, CRITERIA, & PROCEDURE MANUAL (i.e., DRAINAGE EASEMENT, FEE STRIP, ETC.) AND GRANTEE (e.g. COH, HCFCD, PUBLIC, TXDOT, ETC.)

6. REPORTS/AGREEMENTS

I. HCFCD ACCEPTED REPORTS (ALL)

STORMWATER DRAINAGE DESIGN REPORT
REPORT TITLE DRAINAGE IMPACT ANALYSIS REPORT IH 45 SBFR BRIDGE REPLACMENT OVER CYPRESS CREEK
HCFCD PROJECT # 2108300140
ENGINEERING FIRM LJA ENGINEERING INC.
REPORT ACCEPTANCE DATE 09-21-21

GEOTECHNICAL INVESTIGATION REPORT
REPORT TITLE GEOTECHNICAL ENGINEERING REPORT I-45 SBFR BRIDGE OVER CYPRESS CREEK
HCFCD PROJECT #
ENGINEERING FIRM TERRACON CONSULTANTS, INC.
REPORT ACCEPTANCE DATE _____

HCFCD APPROVED VARIANCE
DESCRIPTION OF VARIANCE _____
DOCUMENT ID # _____
VARIANCE ACCEPTANCE DATE _____

II. AGREEMENT TYPE & No.:

☐ INTERLOCAL (ILA): _____
☐ HCFCD MAINTENANCE _____
☐ TURF ESTABLISHMENT _____
☐ OTHER _____

HCFCD SIGNATURE BLOCK

PROJECT NAME: _____
ADDRESS: _____
WAS ACCEPTED BY HARRIS COUNTY FLOOD CONTROL DISTRICT FOR THE PURPOSES LISTED BELOW:

HARRIS COUNTY FLOOD CONTROL DISTRICT

INTERPOSE NO OBJECTION
BY _____
FOR ITEMS LOCATED OUTSIDE OF HCFCD RIGHT-OF-WAY
APPROVED:
BY _____
FOR ITEMS LOCATED WITHIN EXISTING HCFCD RIGHT-OF-WAY
APPROVED:
BY _____
FOR ITEMS LOCATED WITHIN PROPOSED HCFCD RIGHT-OF-WAY
NO REVIEW REQUIRED:
BY _____
FINAL PERMITTING BY OTHERS

ADDITIONAL COMMENTS:

THE PROJECT WAS REVIEWED, HOWEVER, THIS DOES NOT MEAN THE ENTIRE PROJECT, INCLUDING ALL SUPPORTING DATA AND CALCULATIONS HAVE BEEN COMPLETELY CHECKED AND VERIFIED. THESE DRAWINGS ARE SIGNED, DATED AND SEALED BY A PROFESSIONAL ENGINEER LICENSED TO PRACTICE IN THE STATE OF TEXAS, WHICH THEREFORE CONVEYS THE ENGINEER'S RESPONSIBILITY AND ACCOUNTABILITY. THIS DOES NOT RELIEVE ANY PARTY FROM COMPLYING WITH APPROPRIATE FEDERAL, STATE AND LOCAL ENVIRONMENTAL RULES, LAWS, AND REGULATIONS AND ANY OTHER LEGALLY ADOPTED REGULATION OR ORDINANCE RELATED TO LAND DEVELOPMENT. IF THE CITY SIGNATURES ARE REQUIRED BY ORDINANCE, COUNTY PERMITS WILL NOT BE ISSUED UNTIL SUCH SIGNATURES ARE OBTAINED. PLAN APPROVAL EXPIRATION TO BE IN ACCORDANCE WITH LOCAL GOVERNEMENT CODE CH. 245.

ENGINEER'S CERTIFICATION

I, David Zuhlke A LICENSED PROFESSIONAL ENGINEER IN THE STATE OF TEXAS, DO HEREBY CERTIFY THAT THE INFORMATION PRESENTED ON THIS SHEET IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND THAT I AM NOT VIOLATING ANY PROVISION OF THE CURRENT TEXAS ENGINEERING PRACTICE ACT AND RULES CONCERNING THE PRACTICE OF ENGINEERING AND PROFESSIONAL ENGINEERING LICENSURE.

ANY VIOLATIONS WILL BE FORWARDED TO THE HARRIS COUNTY DISTRICT ATTORNEY'S OFFICE FOR PROSECUTION.

THE COMPLETED PROJECT CONSISTS OF DRAWING SHEETS 127 THRU 138

_____ _____
SIGNATURE DATE

STATE OF TEXAS · DAVID H. ZUHLKE · 83450 · LICENSED PROFESSIONAL ENGINEER · 09/24/2021

REVISIONS

NOTE: REVISION BLOCK IS TO BE USED ONLY FOR CHANGES MADE AFTER PLANS HAVE BEEN APPROVED BY HARRIS COUNTY FLOOD CONTROL.

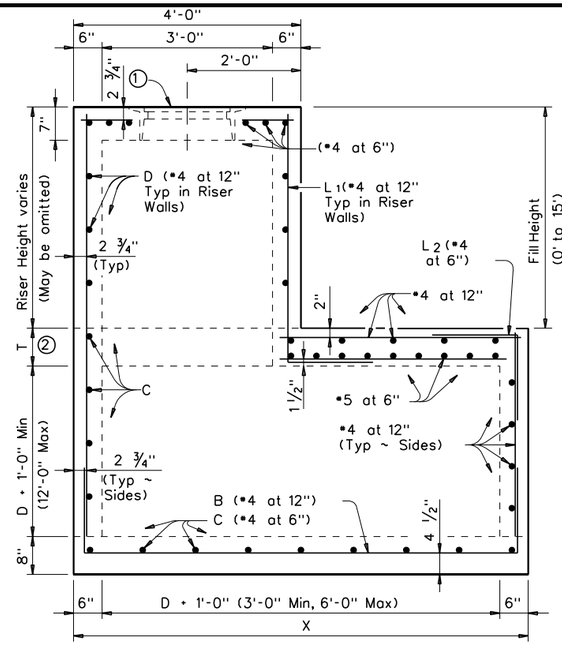
DATE	SHEET NO.	DESCRIPTION	P.E. INITIAL	H.C.F.C.D APPROVED DATE

HARRIS COUNTY FLOOD CONTROL PROJECT NO.

SHEET NUMBER 137

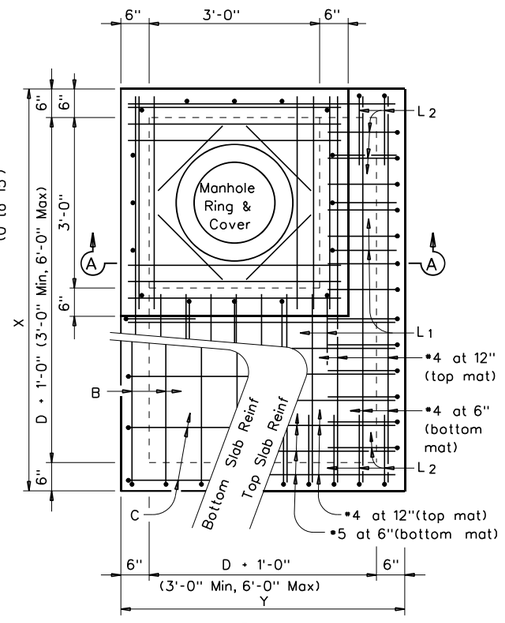
HARRIS COUNTY
FLOOD CONTROL DISTRICT
REVIEW SHEET

VERSION 1.0 OCTOBER 2019



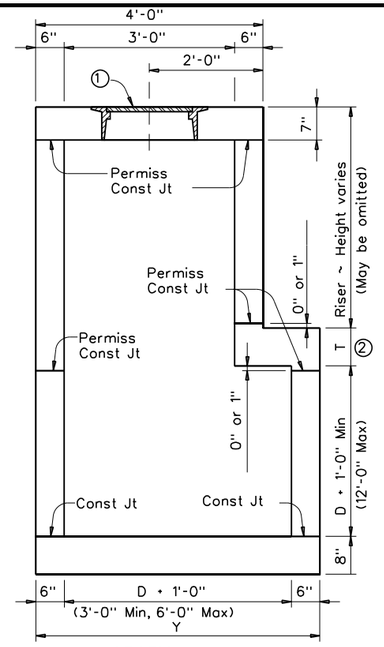
ELEVATION

D = Maximum inside diameter of any Pipe entering the side shown or the opposite side



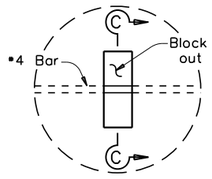
PLAN

MANHOLE WITH CAST-IN-PLACE RISER

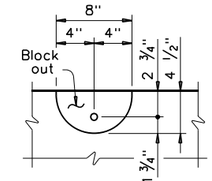


SECTION A-A

② For Fill Height less than or equal to 10', T=8".
For Fill Height between 10' and 15', T=10".

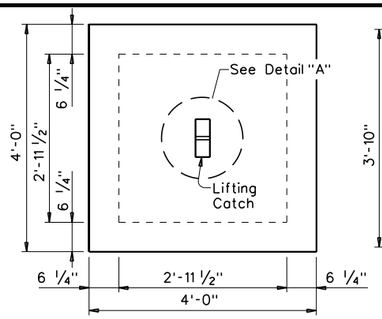


DETAIL "A"

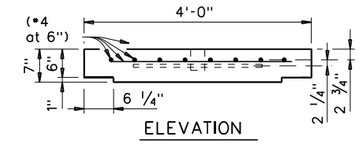


SECTION C-C

LIFTING CATCH

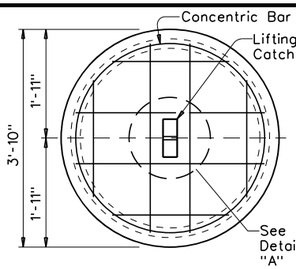


PLAN

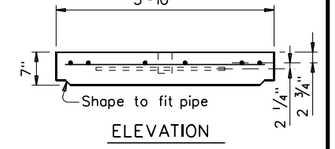


ELEVATION

CAST-IN-PLACE RISER COVER



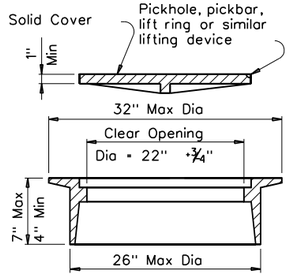
PLAN



ELEVATION

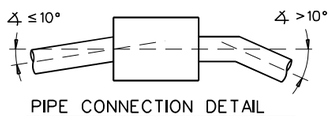
CONCRETE PIPE RISER COVER

OPTIONAL PRECAST CONCRETE LIFT-OFF COVERS



RING AND COVER DETAILS

Approximate Weight = 245 lb



PIPE CONNECTION DETAIL

Connecting pipes should enter within 10° of normal to inlet wall. If necessary, pipe elbow or curved approach alignment should be used to stay within this limit.

GENERAL NOTES:

Unless otherwise shown in the plans, payment will be made for each manhole of the Type M.

When approved, precast inlets with equivalent structural capacity may be furnished. Sealed engineering calculations and drawings shall be submitted for approval prior to construction.

Shop drawings will not be required.

In areas of conflict between reinforcing steel, blockouts, pipes, anchor bolts or other reinforcing steel, the reinforcement shall be bent or adjusted to clear as directed by the Engineer.

The riser may be constructed of reinforced concrete as shown or of Reinforced Concrete Pipe, Class III, in accordance with ASTM Designation C-76. If pipe is used, joints shall conform to the Item "Reinforced Concrete Pipe Culverts". Precast Concrete Lift-Off Cover may be substituted for Ring and Cover.

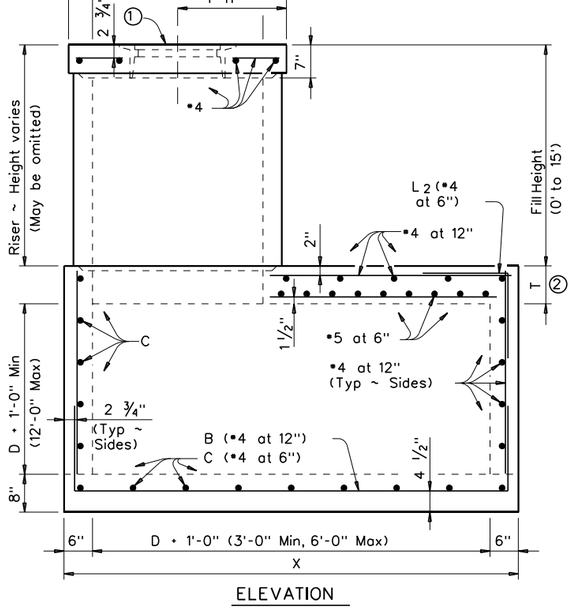
The riser, either cast-in-place or concrete pipe, may be located in any corner.

All reinforcing steel shall be •4 unless otherwise noted.

Pipes may enter any or all walls. The maximum size of pipe that can be accommodated is 60". More than one pipe may enter a side, subject to the maximum box dimension shown. The clear distance between adjacent pipes should be 9" minimum.

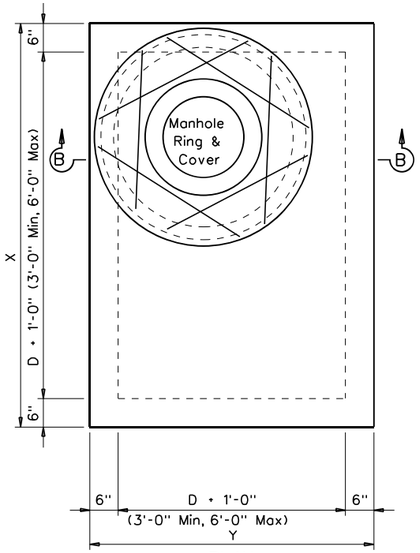
Ring and cover shall conform to the requirements of AASHTO M306, "Standard Specification for Drainage Structure Castings". Materials shall conform to ASTM A48, Class 35B for gray iron castings or ASTM A536, Grade 65-45-12 for ductile iron castings. Aluminum alloy castings shall not be permitted.

All concrete shall be Class "A" (f'c = 3000 psi).

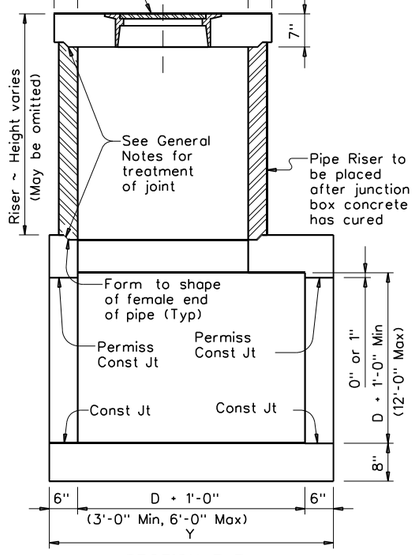


ELEVATION

① See Ring and Cover Details

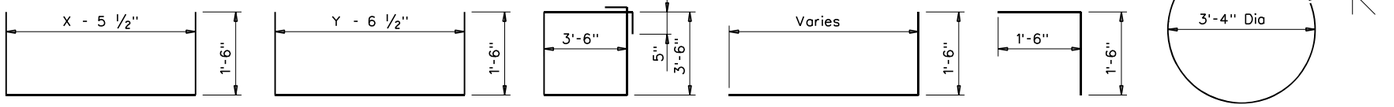


PLAN



SECTION B-B

OPTIONAL MANHOLE WITH CONCRETE PIPE RISER



BARS B | BARS C | BARS D | BARS L_1 | BARS L_2 | CONCENTRIC BAR

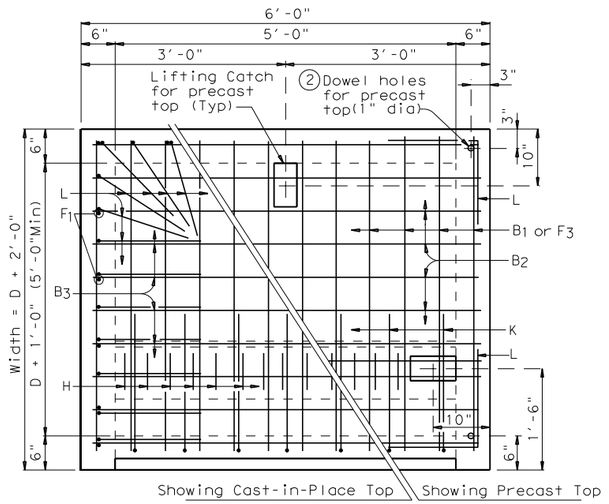
Texas Department of Transportation
Bridge Division

MANHOLE TYPE M
(JUNCTION BOX WITH ACCESS)
15' MAX FILL

MH-M (MOD)

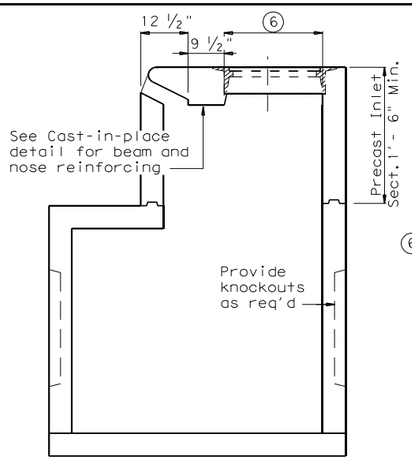
FILE: mh-mstde.dgn	DN: TxDOT	CK: TER	DW: MCB	CK: TER/GAF
©TxDOT May 2005	DISTRICT	FEDERAL AID PROJECT		SHEET
REVISIONS	HOU			138
	COUNTY	CONTROL	SECT	JOB	HIGHWAY
	HARRIS	0110	05	126	IH 45

ACC:
LEVELS DISPLAYED
1



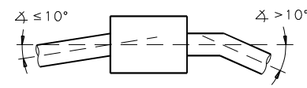
PLAN

② If precast top is used, provide 4 ~ 5/8" dia x 1'-6" smooth bars in inlet walls for 1" dia holes



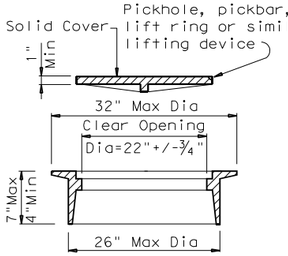
PREFABRICATED INLET

⑥ For reinforcing steel and dimensions not shown, see fabricators shop drawings. Structure shall be of the size required to accommodate size of pipe shown elsewhere in the plans. Length of inlet = 5'-0"



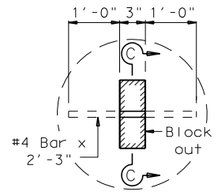
PIPE CONNECTION DETAIL

Connecting pipes should enter within 10° of normal to inlet wall. If necessary, pipe elbow or curved approach alignment should be used to stay within this limit.

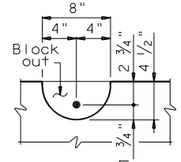


RING AND COVER DETAILS

EJIW No V-1814 or Neenah No R5900 FTX



PLAN

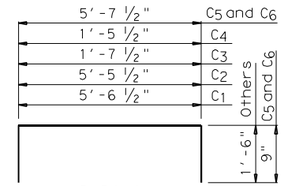


SECTION C-C

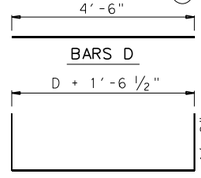
LIFTING CATCH

REINF STEEL		
Bar	Size	Spacing
B_1	#4	6"
B_2	#5	6"
B_3	#4	6"
C_{1-2}	#4	12"
C_{3-4}	#4	⑨
C_5	#6	⑨
C_6	#4	⑨
D	#4	⑨
E	#4	12"
F_{1-5}	#4	12"
G	#4	6"
H	#3	4"
K	#4	9"
L	#4	6"

⑨ As shown

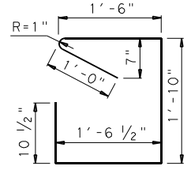


BARS C

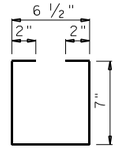


BARS D

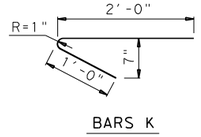
BARS E



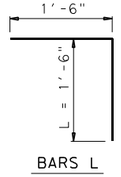
BARS G



BARS H



BARS K



BARS L

GENERAL NOTES:

No alternate designs nor alternate details shall be permitted for precast or cast in place inlets.

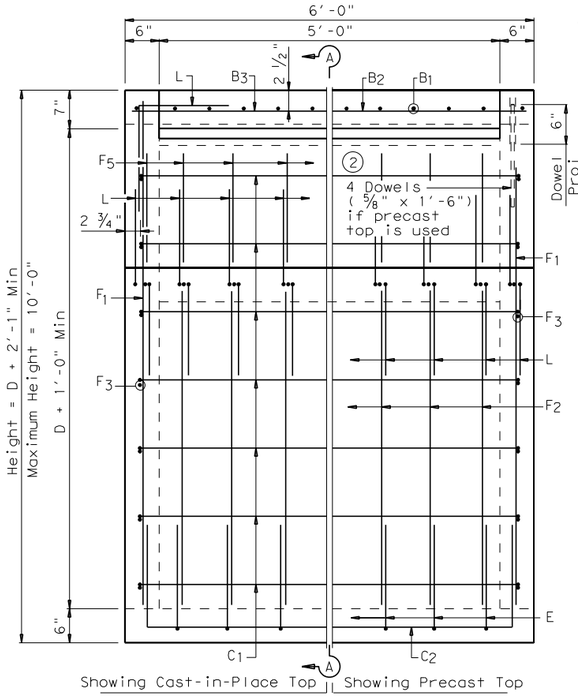
Quantities shown herein are for Contractor's information only. Unless otherwise shown in the plans, payment will be made for each inlet of the type specified and for each extension. Each five foot curb opening of extension is considered "one extension" regardless of whether placed monolithically or precast. Extension length shall be in multiples of 5 feet.

Engineer has the option of specifying cast-in-place top with ring and cover or removable precast top as specified elsewhere in plans.

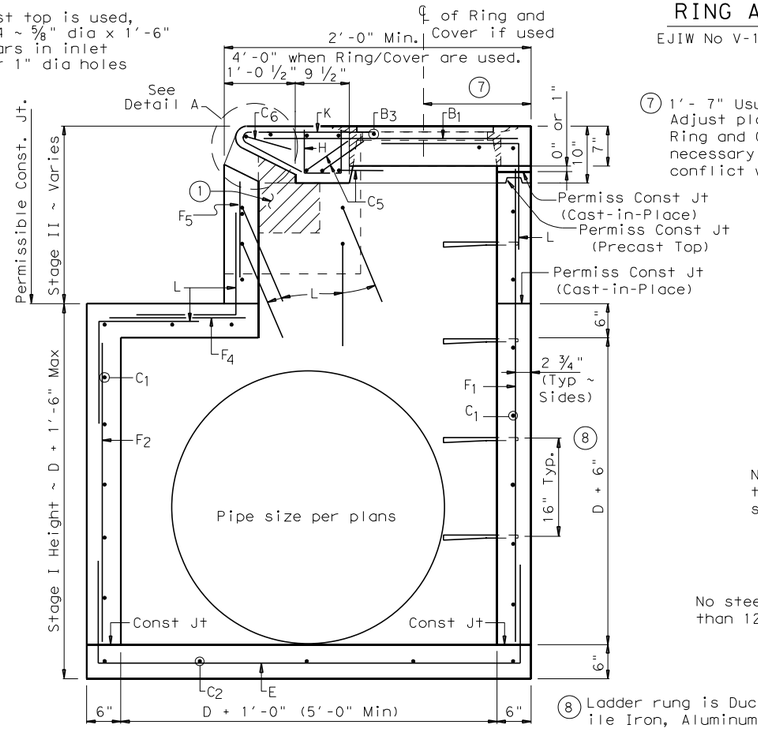
Shop drawings will be required for precast construction of inlets.

In areas of conflict between reinforcing steel, blockouts, pipes, anchor bolts or other reinforcing steel, the reinforcement shall be bent or adjusted to clear as directed by the Engineer.

Ring and cover shall conform to the requirements of AASHTO M306, "Standard Specification for Drainage Structure Castings". Materials shall conform to ASTM A48, Class 35B for gray iron castings or ASTM A536, Grade 65-45-12 for ductile iron castings. Aluminum alloy castings shall not be permitted.

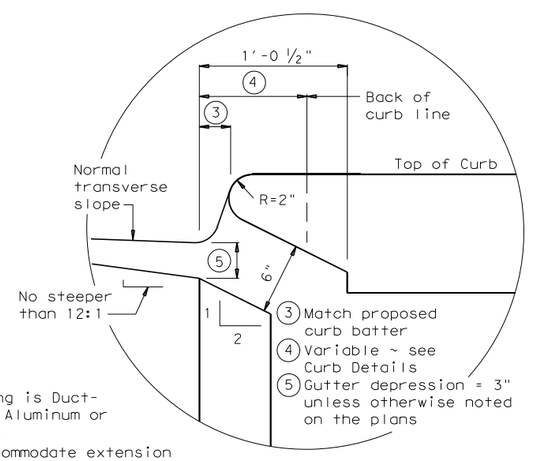


ELEVATION



SECTION A-A

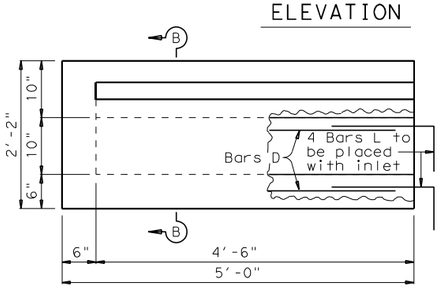
⑦ 1'- 7" Usual, Adjust placement of Ring and Cover as necessary to avoid conflict with Bars H.



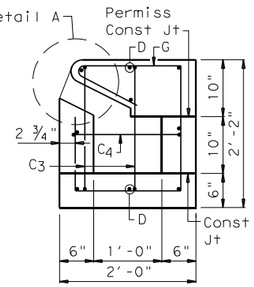
DETAIL A

⑧ Ladder rung is Ductile Iron, Aluminum or Cast Iron.

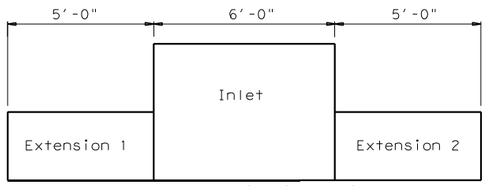
① Block out to accommodate extension if used and to place 4 Bars L



EXTENSION ELEVATION



SECTION B-B



Note: If more than one extension is required, they should be located as indicated above. No slope is required in flowline of extension.

EXTENSION PLACEMENT

INSTALL A 3 FT. (HORIZ.) x 6 IN. (VERT.) OPENING ON THE BACK OF THE INLET WHEN SPECIFIED ELSEWHERE ON THE PLANS. MOVE STEPS AS NEEDED. NO REINFORCING ON OPENING/ON 2 IN. ADJACENT TO OPENING.

DESIGNERS:
CLARIFY FLOWLINE OF OPENING AND INCLUDE OPENING IN HYDRAULIC CALCULATIONS.

D = Diameter
R = Radius

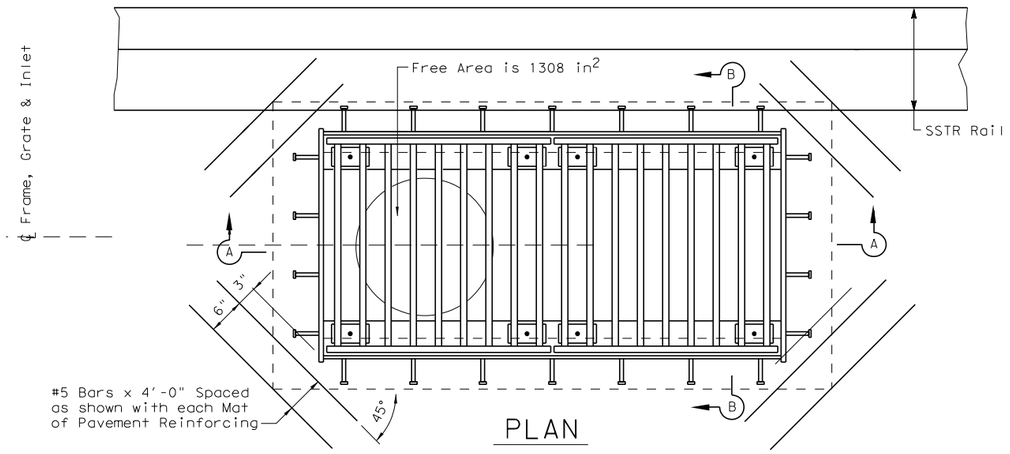
Texas Department of Transportation
Houston District

CURB INLET TYPE C1
(WITH OR WITHOUT EXTENSION)

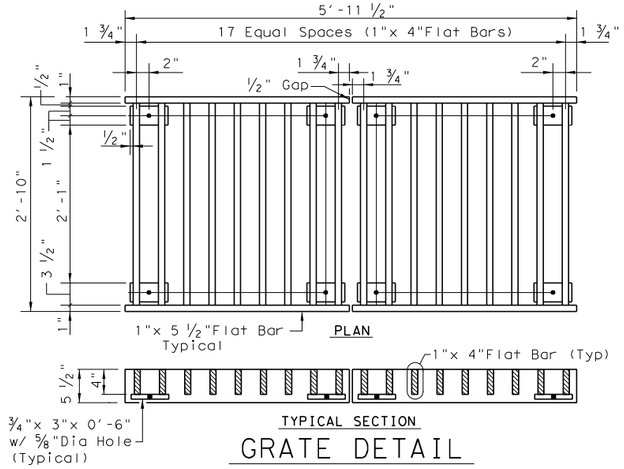
HIL-C1

FILE: STDD2.DGN	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT	STD:	
© TxDOT Feb 2010	DIST	FED REG	PROJECT NO.			SHEET
REVISIONS	HOUS	6				139
2/2010 Note for alternate design added.	COUNTY			CONTROL	SECT	JOB	HIGHWAY
2/2010 Added note concerning opening on the back of inlet.	HARRIS			0110	05	126	IH 45

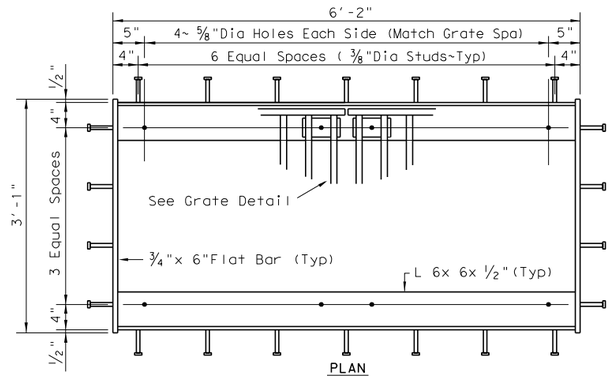
STDD2.DGN



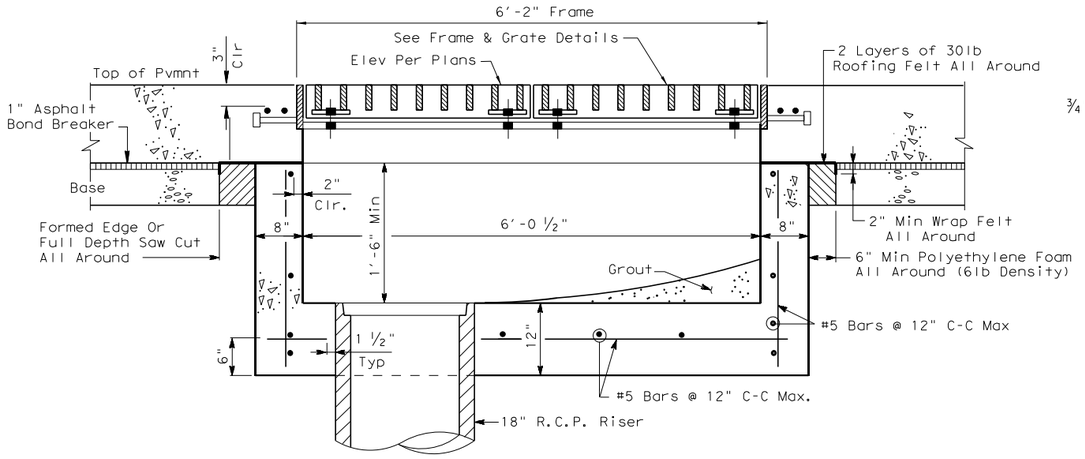
PLAN



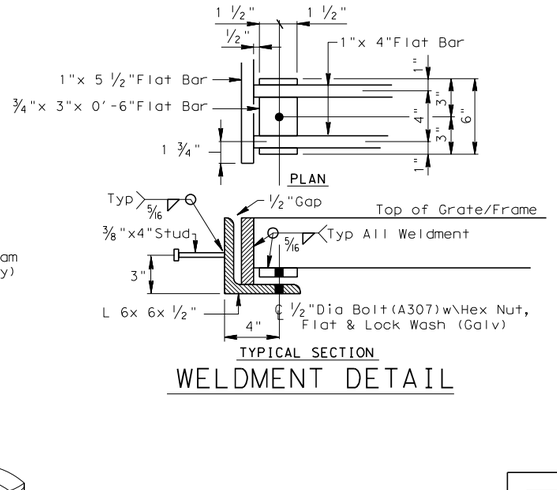
GRATE DETAIL



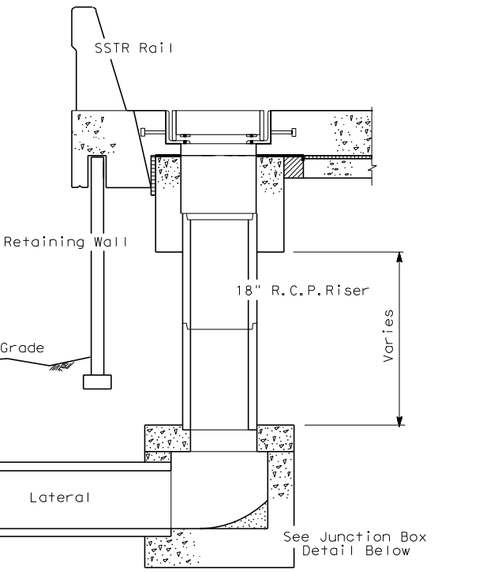
FRAME DETAIL



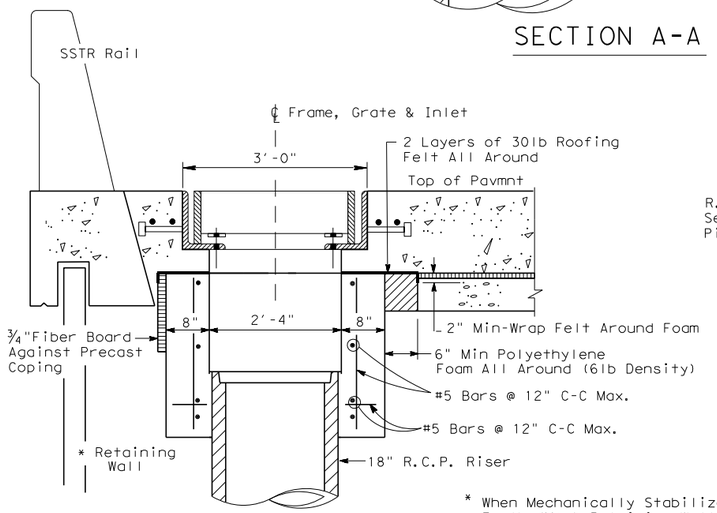
SECTION A-A



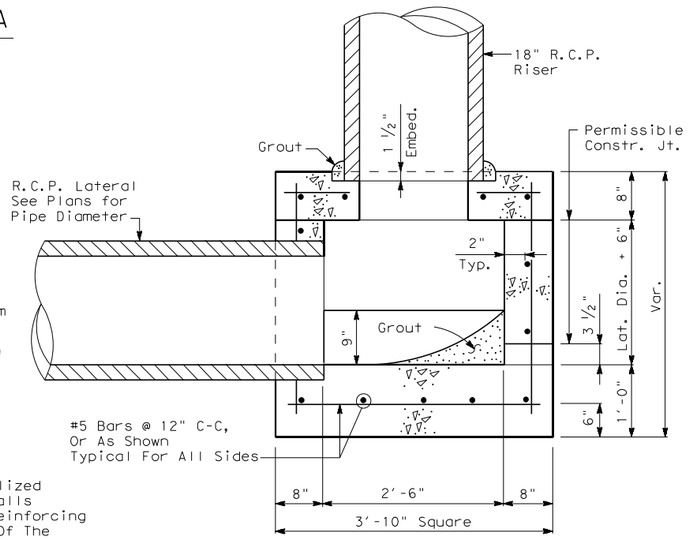
WELDMENT DETAIL



TYPICAL SECTION



SECTION B-B



JUNCTION BOX DETAIL

* When Mechanically Stabilized Earth (Mse) Retaining Walls Are Used, Do Not Omit Reinforcing Strips In The Vicinity Of The Inlet. These Strips Shall Be Adjusted Or Repositioned To Clear Inlets In Accordance With Wall Manufacture's Recommendations.

GENERAL NOTES:

Alternate designs shall conform to special provisions for Item 465.

All steel is ASTM-A36 and shall be galvanized after fabrication. Cost Of Furnishing And Installing Frames, Grates, Additional Pavement Reinforcing, Roofing Felt, Polyethylene Foam, Vertical Riser and Junctin Box Shall Be Included In The Unit Price Bid For The Type Of Inlet Selected.

All Concrete Shall Be Class C.

Shop Drawings Will Be Required For Precast Construction Of Inlets.

d = Diameter

FOR TRAFFIC LOADS

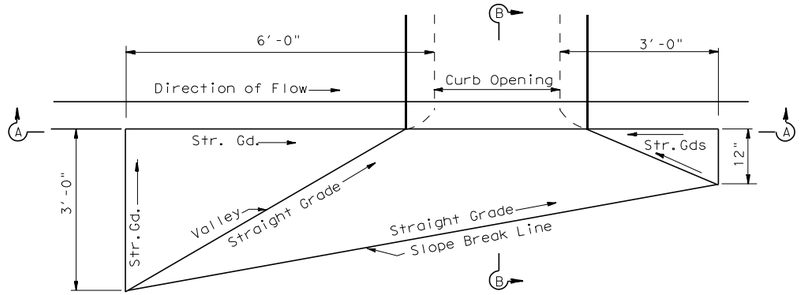
Texas Department of Transportation
Houston District

INLET TYPE AZR2G

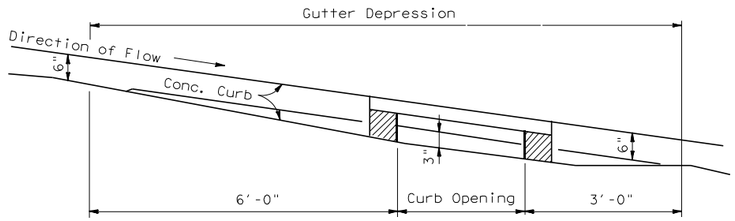
HIL-AZR2G

FILE: STDD9.DGN	DN: TxDOT	CK:TxDOT	DW:TxDOT	CK: TxDOT	STD:	
©TxDOT Feb 2010	DIST	FED REC	PROJECT NO.			SHEET
REVISIONS 12/2008 Updated abbreviation of Std. title. 2/2010 Note for alternate design added.	HOUS	6				140
	COUNTY		CONTROL	SECT	JOB	HIGHWAY
	HARRIS		0110	05	126	IH 45

STDD9.DGN

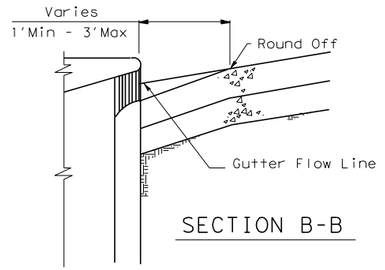


PLAN

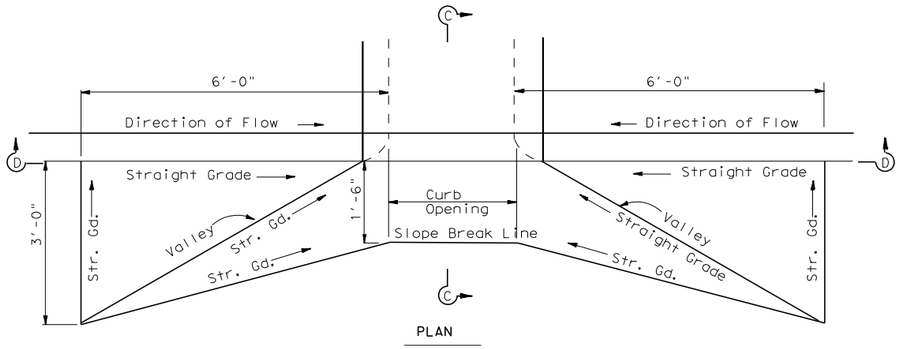


SECTION A-A

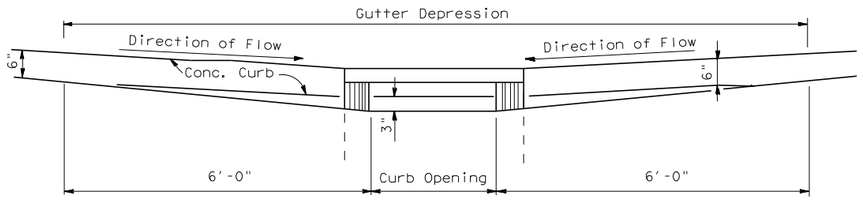
CURB INLET ON GRADE



SECTION B-B

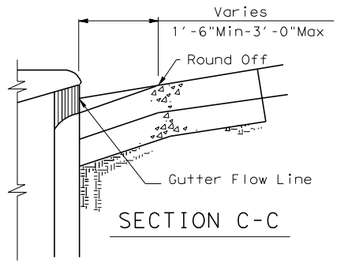


PLAN



SECTION D-D

CURB INLET AT SAG



SECTION C-C

GENERAL NOTES:

Base Course under Concrete Pavement shall be full depth and shall conform to surface depression details.

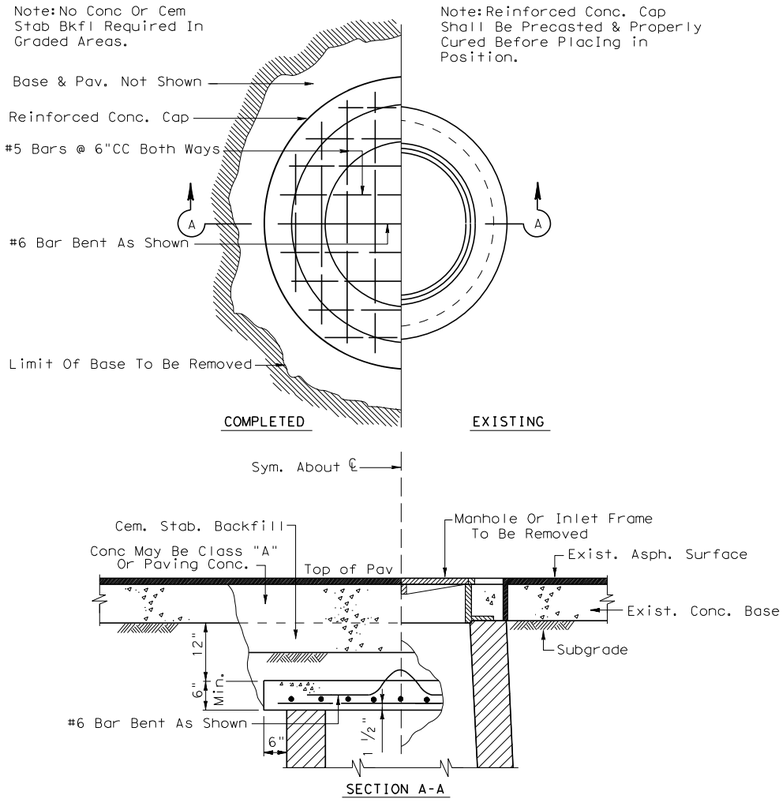
Texas Department of Transportation
Houston District

GUTTER DEPRESSION DETAILS FOR CURB INLETS

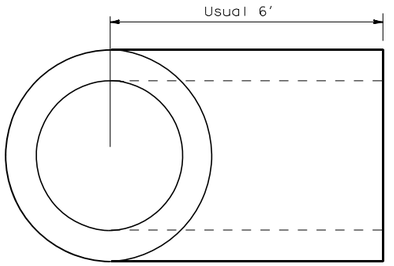
GD

FILE: STDD12.DGN	DN: TxDOT	CK:TxDOT	DW:TxDOT	CK: TxDOT	STD:	
© TxDOT Mar 2004	DIST	FED REG	PROJECT NO.			SHEET
REVISIONS	HOUS	6				141
	COUNTY		CONTROL	SECT	JOB	HIGHWAY
	HARRIS		0110	05	126	IH 45

STDD12.DGN

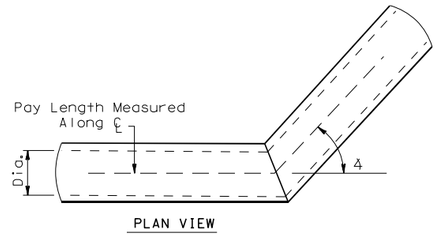


DETAIL SHOWING METHOD OF CAPPING ABANDONED MANHOLES OR INLETS (GRADED OR PAVED AREAS)



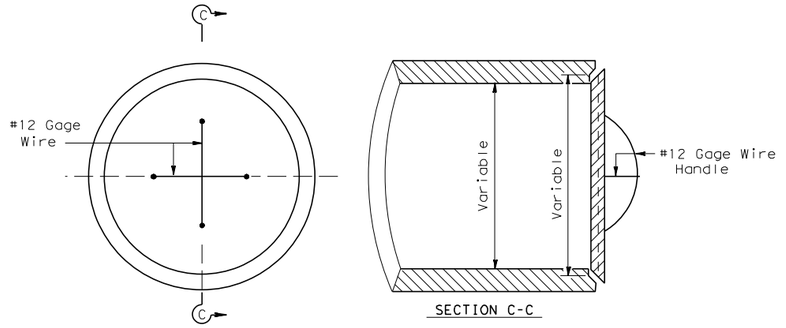
Note: Jointing Material Shall Conform To Requirements Of Item "Reinforced Concrete Pipe." Material For Tees Shall Conform To Requirements Of Item "Reinforced Concrete Pipe." Payment For Tee To Be In Accordance With Item "Reinforced Concrete Pipe."

PRECAST STORM SEWER TEE



BENDING DETAIL

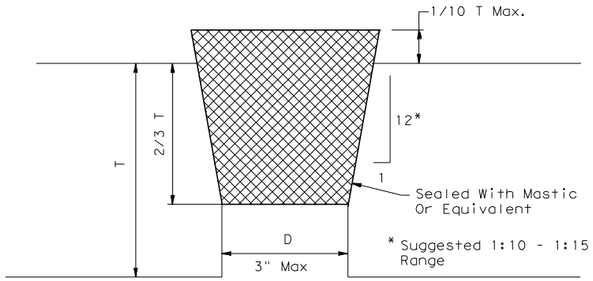
Note: Bending Of Proposed Pipe Sewer Or RCP In A Vertical & /Or Horizontal Plane Shall Be Accomplished By The Use Of A "Pipe Collar" Or A "Precast Elbow", As Approved By The Engineer.
Price Of "Pipe Collar" Or, "Precast Elbow" Shall Be Subsidiary To The Unit Prices Bid For Item Reinforced Concrete Pipe.
Pay Length Measurement To Be Along Horizontal ℄ & Horizontal Plane Of Pipes.



Note: The Price Of Plug Shall Be Subsidiary To The Unit Bid Price For Pipe Sewer Or RCP. Mortar Joints To Be Used As Directed By The Engineer. Removal Of The Existing Plugs For Storm Sewer Or RCP Conns. Shall Be Considered Incidental To Item "Excavation And Backfill For Structures."

Concrete Plug For End Of Pipe Culvert Or Sewer

CONCRETE PLUG FOR PIPE

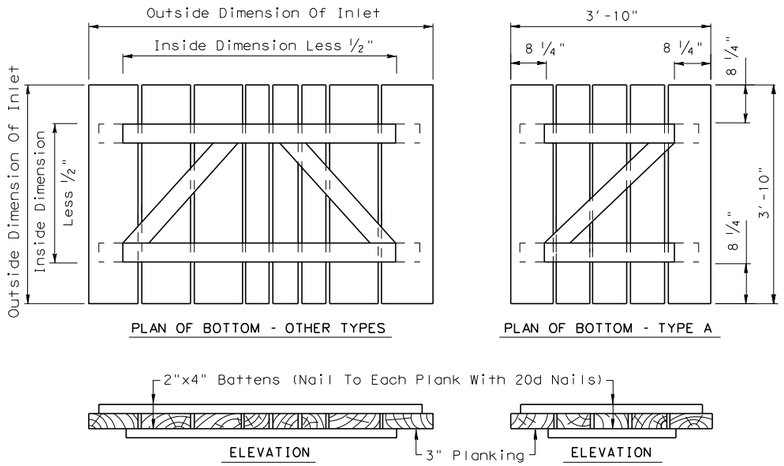


T = Wall Thickness On Top Of Box Or Pipe
D = Diameter Of Lifting Hole

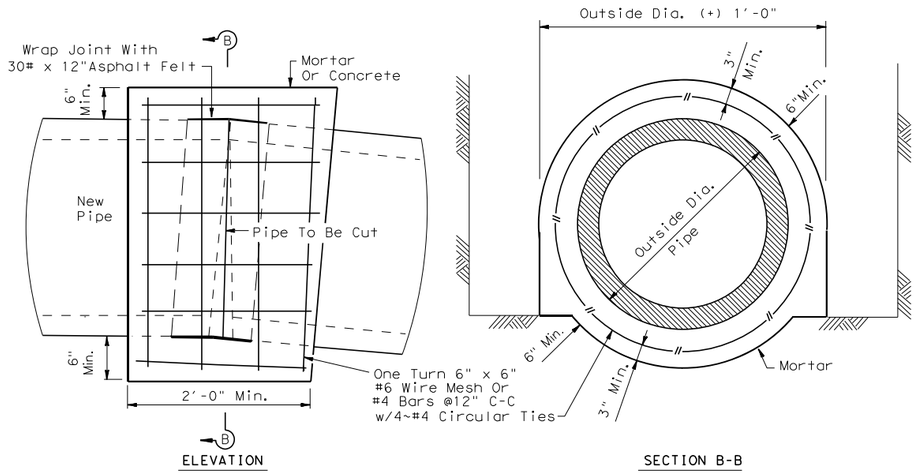
Minimum Length Of Plug Is 2/3 T +/-
Minimum Diameter At Bottom Of Plug = D - ⅛"
Maximum 1/10 T Of Plug Not Seated In Lifting Hole

Note: The Plug Shall Be Cast With The Same Taper As The Lifting Hole.

DETAIL OF PLUG FOR LIFTING HOLES IN RCB AND RCP



TEMPORARY COVERS FOR ALL TYPES OF INLETS



PIPE COLLAR DETAIL

For Horizontal Or Vertical Placement

d = Diameter
R = Radius

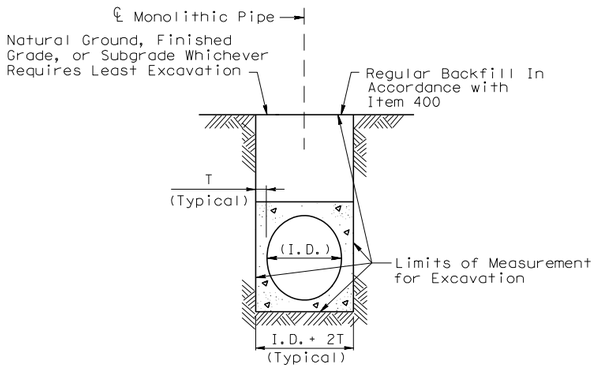
Texas Department of Transportation
Houston District (Bridge)

MISCELLANEOUS SEWER DETAILS

MSD

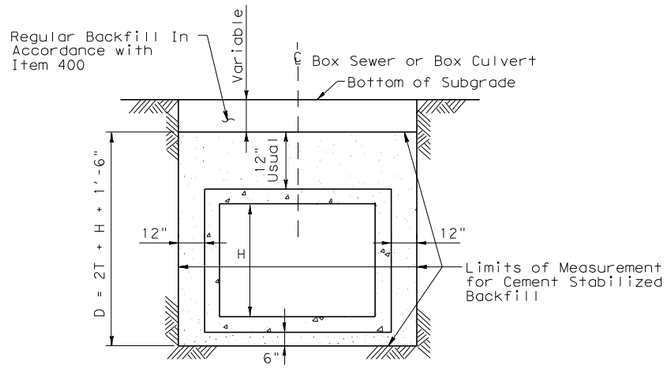
FILE: STDD11.DGN	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK:
© TxDOT Mar 2004	DISTRICT	FED REG	PROJECT NO.	SHEET
REVISIONS	HOUS	6		142
	COUNTY	CONTROL	SECT	JOB	HIGHWAY
	HARRIS	0110	05	126	IH 45

STDD11.DGN



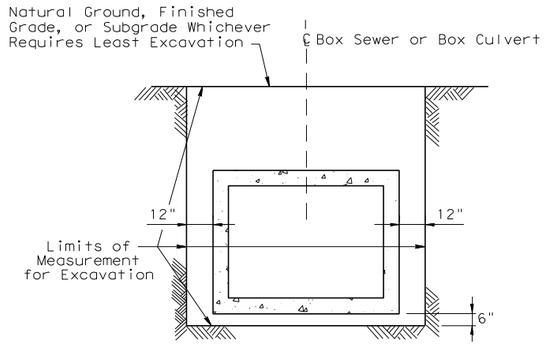
EXCAVATION DETAIL

MONOLITHIC PIPE
IN A PAVED OR GRADED AREA



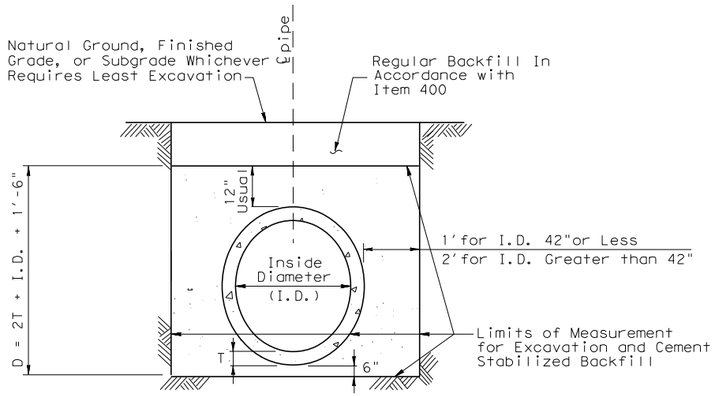
BACKFILL DETAIL

BOX CULVERTS
IN A GRADED OR PAVED AREA
INCLUDING DETOURS *



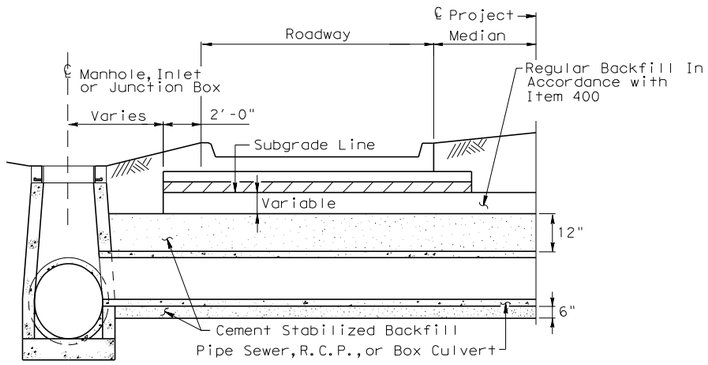
EXCAVATION DETAIL

BOX CULVERTS
IN A GRADED AREA



EXCAVATION & BACKFILL DETAIL

REINFORCED CONCRETE PIPE
IN A GRADED OR PAVED AREA
INCLUDING DETOURS



BACKFILL DETAIL

AT MANHOLE, INLET OR JUNCTION BOX

REINFORCED CONCRETE PIPE

EXCAVATION AND BACKFILL QUANTITIES

PIPE DIA. IN.	T FT.	CULVERT OR SEWER EXCAVATION IN A PAVED OR GRADED AREA C.Y. PER L.F. PER FT. OF DEPTH	CEMENT STABILIZED BACKFILL IN A PAVED OR GRADED AREA C.Y. PER L.F. OF PIPE
18	0.19	0.144	0.383
24	0.23	0.165	0.478
30	0.29	0.188	0.586
36	0.33	0.210	0.692
42	0.38	0.231	0.808
48	0.42	0.327	1.394
54	0.46	0.349	1.560
60	0.50	0.370	1.731
66	0.54	0.392	1.907
72	0.58	0.414	2.088
78	0.62	0.435	2.275
84	0.67	0.457	2.474

MONOLITHIC PIPE

EXCAVATION QUANTITIES

PIPE DIA. IN.	T FT.	EXCAVATION C.Y. PER L.F. PER FT. OF DEPTH
36	0.417	0.142
42	0.458	0.164
48	0.458	0.182
54	0.500	0.204
60	0.583	0.228
66	0.583	0.247
72	0.625	0.269
78	0.625	0.287
84	0.625	0.306

NOTE:

Cement stabilized backfill may be omitted in private driveways as indicated elsewhere in the plans.

Rubber gaskets shall be required for all joints on proposed cross drainage, pipe culverts and proposed storm sewer systems, unless otherwise shown in the plans.

* Backfill with cement stabilized material will be required for all structures under detours unless noted otherwise in the General Notes.

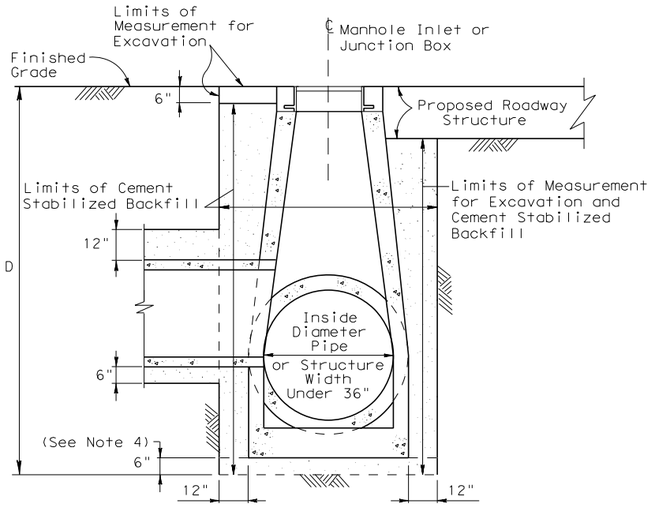
D = Depth
H = Height
T = Thickness
R = Radius
Dia = Diameter

Texas Department of Transportation
Houston District

EXCAVATION AND BACKFILL DIAGRAMS

E&BD

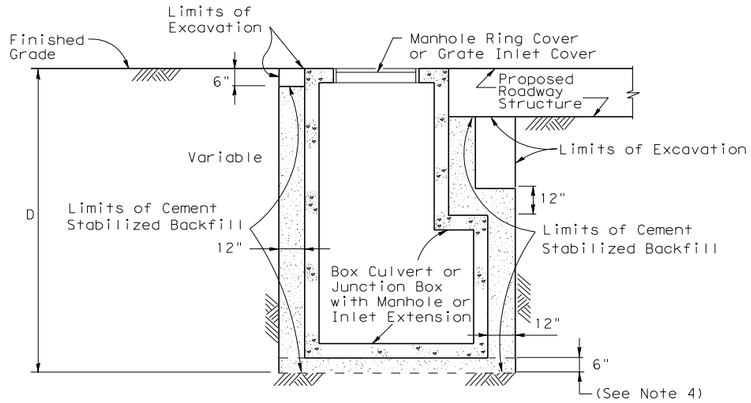
FILE: STDE1.DGN	DN: TxDot	CK: TxDot	DW: TxDot	CK: TxDot
© TxDOT FEB 2010	DIST	FED REG	PROJECT NO.	SHEET
REVISIONS REVISED 11/05 REVISED 2/2010 Added note to Table 1, Sht 2 of 2. REVISED 6/12	HOUSTON	6		143
	COUNTY		CONTROL SECT JOB	HIGHWAY
	HARRIS		0110 05 126	IH 45



EXCAVATION AND BACKFILL DETAIL

MANHOLES SMALLER THAN 36 IN.
IN A PAVED OR GRADED AREAS

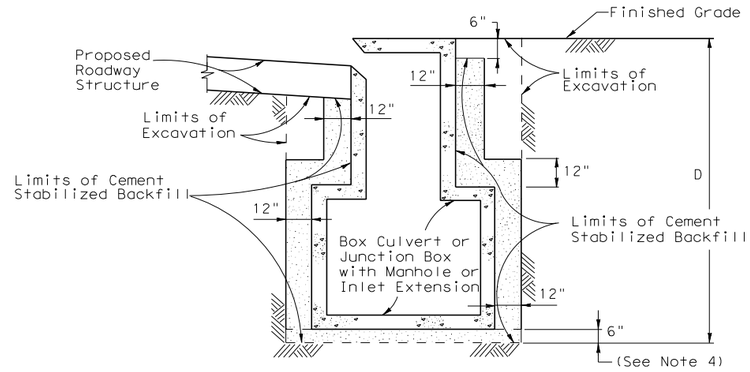
N.T.S.



EXCAVATION AND BACKFILL DETAIL

JUNCTION BOXES IN A
PAVED OR GRADED AREA

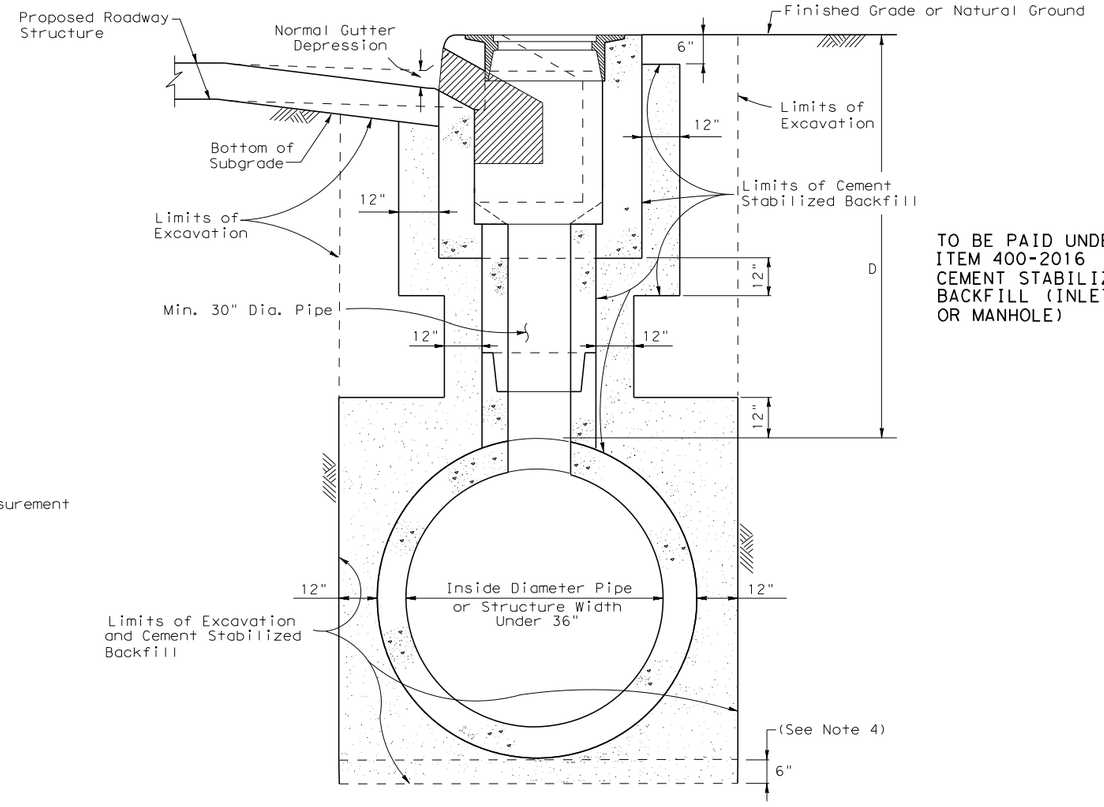
N.T.S.



EXCAVATION AND BACKFILL DETAIL

INLET EXTENSIONS ON A BOX CULVERT
IN A PAVED OR GRADED AREA

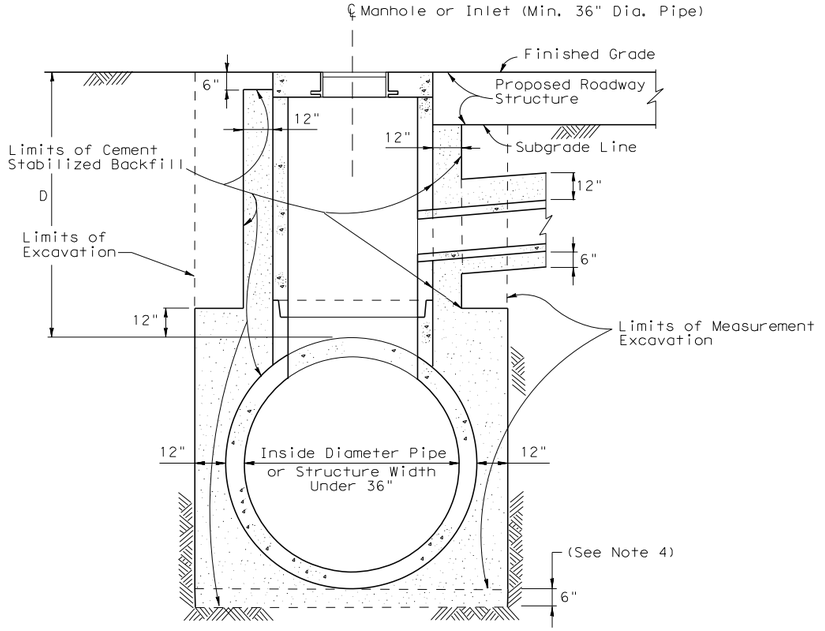
N.T.S.



EXCAVATION AND BACKFILL DETAIL

CURB INLETS IN A PAVED OR GRADED AREA

N.T.S.



EXCAVATION AND BACKFILL DETAIL

MANHOLES 36 IN. AND GREATER
IN A PAVED OR GRADED AREA

N.T.S.

TABLE I

SCHEDULE FOR PAY QUANTITIES OF CEMENT STABILIZED BACKFILL (SEE NOTE 1)

MANHOLE OR INLET DEPTH (D) IN FEET	CEMENT STABILIZED BACKFILL IN CUBIC YARDS
0 through 5	5.75
> 5 through 10	8.25
greater than 10	12.75

TO BE PAID UNDER ITEM 400-2016 CEMENT STABILIZED BACKFILL (INLET OR MANHOLE)

NOTES:

1. The Contractor is paid a fixed estimated amount for cement stabilized backfill based on depth (D) and Table. 1.
2. Proposed roadway structure includes pavement, base and any subgrade.
3. For backfill of intersecting pipes and box culverts, see "Excavation and Backfill Diagram for Pipes and Box Culverts."
4. 6" cement stabilized backfill will be required only for precast units.

D = Depth
H = Height
T = Thickness
R = Radius
Dia = Diameter

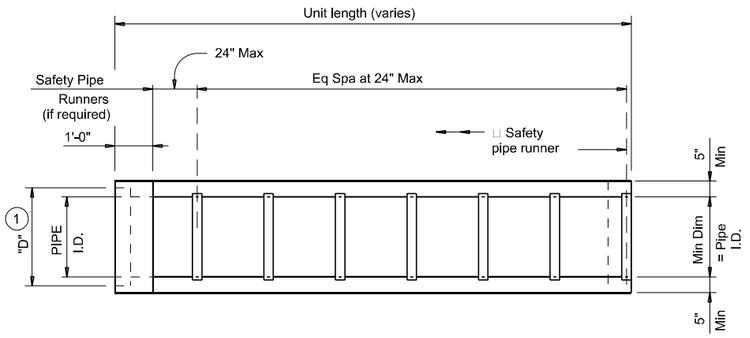
Texas Department of Transportation
Houston District

EXCAVATION AND BACKFILL DIAGRAMS

E&BD

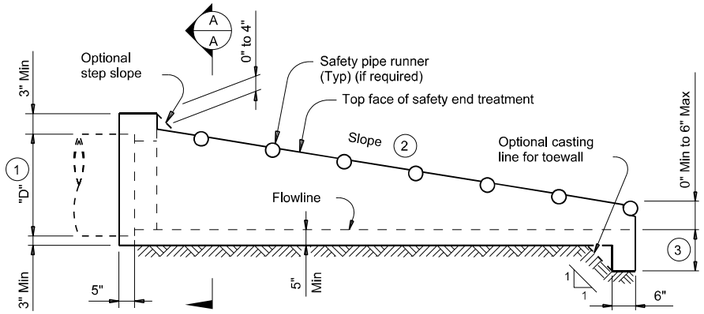
FILE: STDE1.DGN	DN: TxDot	CK: TxDot	DW: TxDot	CK: TxDot
© TxDOT FEB 2010	DIST	FED REG	PROJECT NO.	SHEET
REVISIONS REVISED 11/05 REVISED 2/2010 Added note to Table 1. REVISED 6/12	HOUSTON	6		143A
	COUNTY		CONTROL SECT JOB	HIGHWAY
	HARRIS		0110 05 126	IH 45

DATE:
FILE:



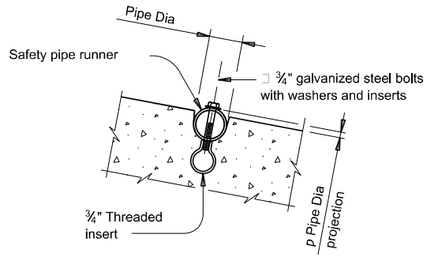
PLAN

(Showing bell end connection.)



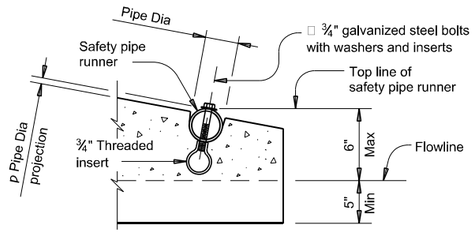
LONGITUDINAL ELEVATION

(Showing bell end connection.)

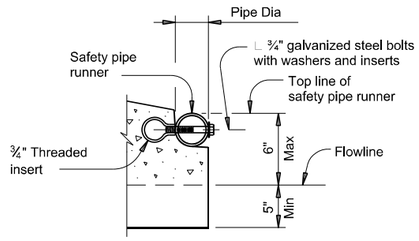


INSTALLATION DETAIL FOR SAFETY PIPE RUNNERS

(If required)



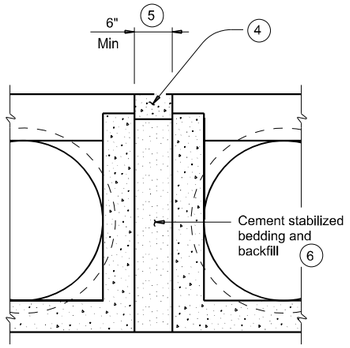
OPTION A



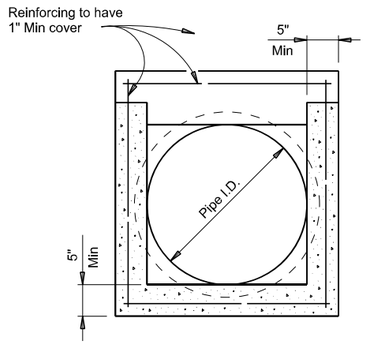
OPTION B

END DETAILS FOR INSTALLATION OF SAFETY PIPE RUNNERS

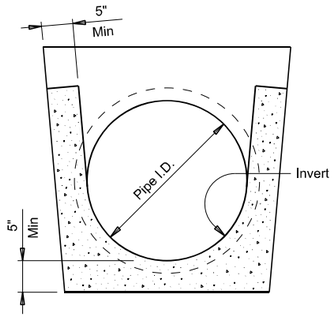
(If required)



MULTIPLE PIPE INSTALLATION

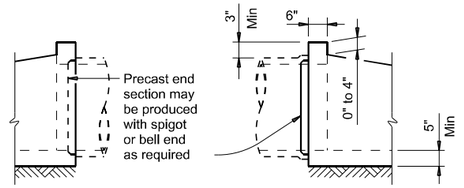


OPTION WITH SQUARE BOTTOM



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"	N/A	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 PBGC standard for grouted connections with TP and precast safety end treatment.

Texas Department of Transportation

Bridge Division Standard

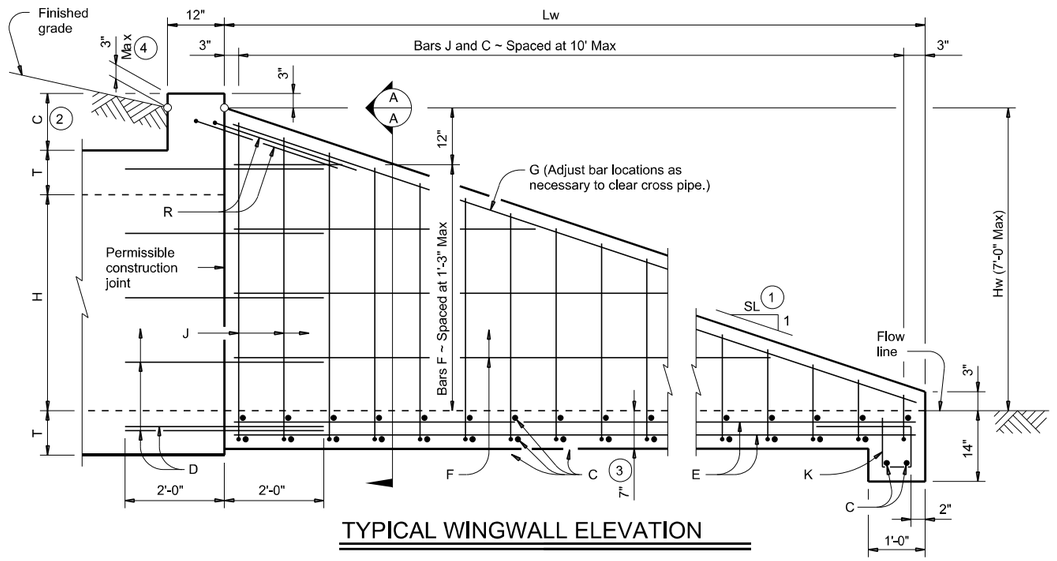
PRECAST SAFETY END TREATMENT

TYPE II ~ PARALLEL DRAINAGE

PSET-SP

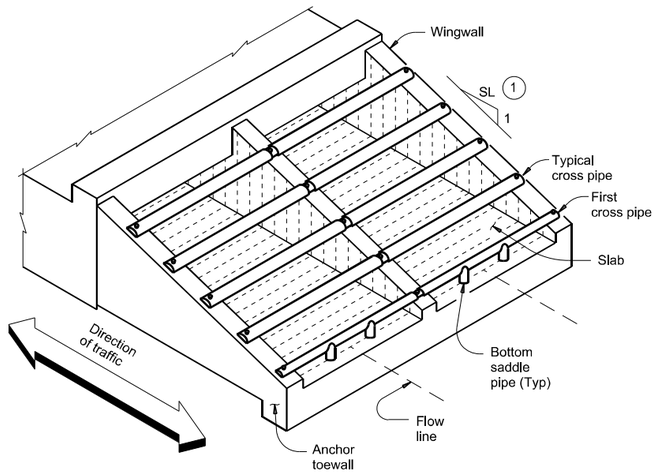
FILE: psetspss-20.dgn	DN: RLW	CK: KLR	DW: JTR	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOUS	HARRIS		144

DATE:
FILE:



TYPICAL WINGWALL ELEVATION

(Cross pipes not shown for clarity.)



ISOMETRIC VIEW OF TYPICAL INSTALLATION

(Showing bolted anchor option.)

WING DIMENSION CALCULATIONS:

Hw = H + T + C - 0.250'
Lw = (Hw - 0.333') (SL)

For cast-in-place culverts:
Atw = (N) (S) + (N + 1) (U)
For precast culverts:
Atw = (N) (2U + S) + (N - 1) (0.500')

Total Wingwall Area (SF)
= (0.5) (Hw + 0.333') (Lw) (N - 1)
Total Concrete Volume (CY)
= [(Wingwall Area) (0.583') +
(Lw) (Atw) (0.583') +
(Atw) (1.167') (1.167' - 0.583')] ÷ (27)

PIPE RUNNER DIMENSION CALCULATIONS:

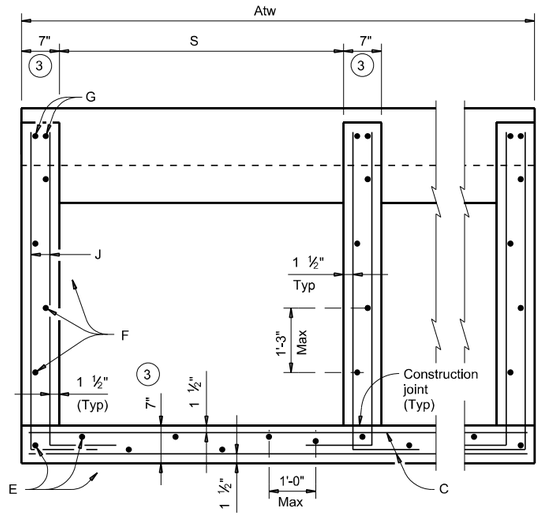
Pipe Runner Length (feet)
= (Lw) (K1) - (1.917')
Total Reinforcing (Lb)
= (1.55) (Lw) (Atw) +
(4.43) (Atw) +
(K2) (Hw) (N + 1) (Lw) √

C = Height of curb above top of top slab (feet)
Hw = Height of wingwall (feet)
K = Constant value for use in formulas

Slope SL:1	K1	K2
3:1	~ 1.054 ~	7.45
4:1	~ 1.031 ~	8.49
6:1	~ 1.014 ~	10.30

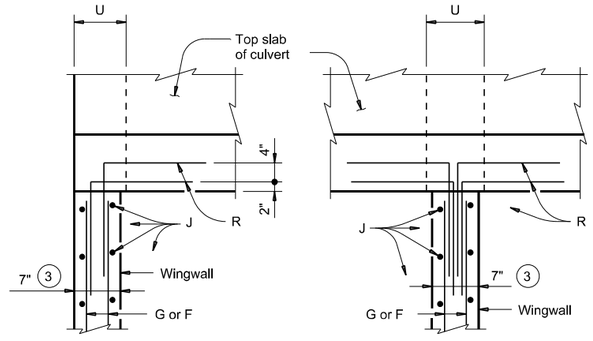
Atw = Anchor toewall length (feet)
Lw = Length of wingwall (feet)
N = Number of culvert barrels
SL:1 = Side slope ratio (horizontal : 1 vertical)

See applicable box culvert standard for H, S, T, and U values.



SECTION A-A

(Showing typical wingwall and wing slab reinforcing. Pipe runners not shown for clarity.)

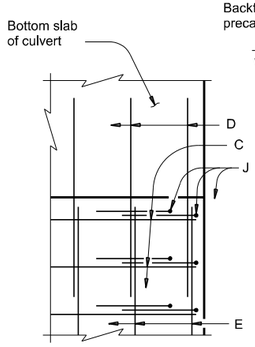


AT TOP OF EXTERIOR WINGWALL

(Cast-in-place culvert)

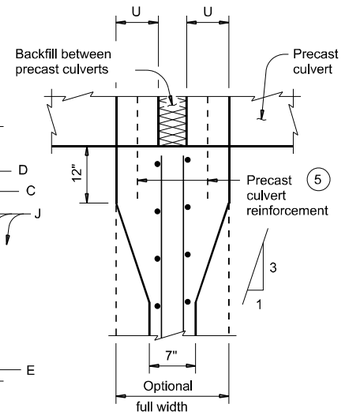
AT TOP OF INTERIOR WINGWALL

(Cast-in-place culvert)



AT OUTSIDE OF BOTTOM SLAB

(Cast-in-place culvert)



AT INTERIOR WINGWALL

(Precast culvert)

PLAN VIEWS OF CORNER DETAILS

MATERIAL NOTES:

Provide Grade 60 reinforcing steel.
Provide galvanized reinforcing steel if required elsewhere in the plans.
Adjust reinforcing as necessary to provide a minimum clear cover of 1 ½".
Provide Class "C" concrete (f'c = 3,600 psi).
Provide pipe runners, cross pipes, and anchor pipes meeting the requirements of ASTM A53 (Type E or S, Gr B), ASTM A500 Gr B, or API 5LX52.
Provide ASTM A307 bolts.
Galvanize all steel components, except the concrete reinforcing, unless required elsewhere in the plans, after fabrication.
Repair galvanizing damaged during transport or construction in accordance with Item 445, "Galvanizing."

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.
The safety end treatments shown herein are intended for use in those installations where out of control vehicles are likely to traverse the openings approximately perpendicular to the cross pipes.
Cross pipes are designed for a traversing load of 10,000 pounds at yield as recommended by Research Report 280-2F, "Safety Treatment of Roadside Parallel-Drainage Structures", Texas Transportation Institute, March 1981.
The quantities for concrete, reinforcing steel, and cross pipes resulting from the formulas given herein are for Contractor's information only.
See the Box Culvert Supplement (BCS) standard sheet for additional dimensions and information.
Alternate design drawings bearing the seal of a professional engineer will be acceptable for precast construction of the safety end treatments.

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

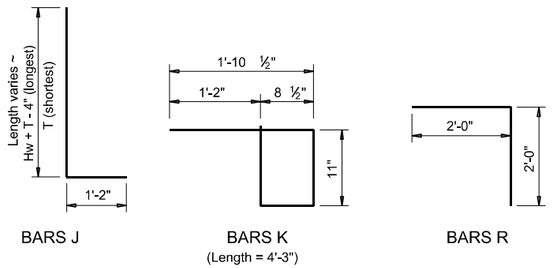


TABLE OF REINFORCING BAR SIZES AND SPACING		
Bar	Size	Spacing
C	#4	10" Max
D	#4	Match F and E
E	#4	1'- 0" Max
F	#4	1'- 3" Max
G	#6	As shown
J	#4	10" Max
K	#4	1'- 0" Max
R	#4	As shown

1. Provide 6:1 or flatter slope.
2. 0" Min to 5'-0" Max. Estimated curb heights are shown elsewhere in the plans. For structures without railing and curbs taller than 1'-0", refer to Extended Curb Details the Extended Curb Details (ECD) standard sheet.
3. Wingwall and slab thicknesses may be the same as the adjacent culvert wall and slab thicknesses (7" Minimum). If thicknesses greater than the minimum (7") are used, no changes will be made in quantities and no additional compensation will be allowed.
4. For vehicle safety, reduce height, if necessary, to provide a maximum 3" projection above finished grade. No changes will be made in quantities and no additional compensation will be allowed for this work.
5. For culverts with C = 0", the precast culvert reinforcing may extend 1'-0" minimum into wingwall. Wingwall bars D and R may be omitted. Otherwise, refer to the Wingwall Connection detail on the Box Culvert Precast Miscellaneous Details (SCP-MD) standard sheet.

Texas Department of Transportation

Bridge Division Standard

SAFETY END TREATMENT

FOR BOX CULVERTS
(MAXIMUM Hw = 7'-0")
TYPE I ~ PARALLEL DRAINAGE

SETB-PD

FILE: setbpdse-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOUS	HARRIS		145

DATE:
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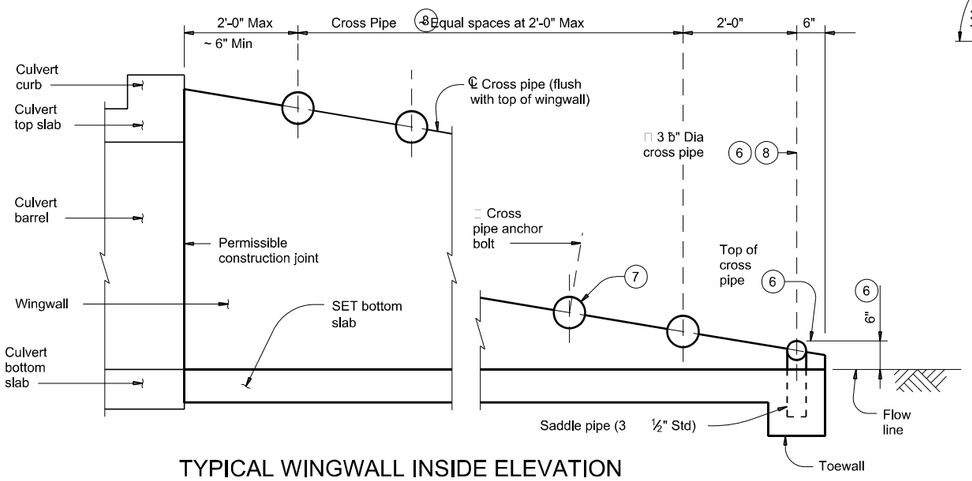
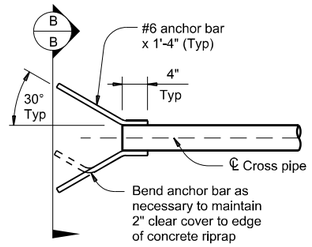
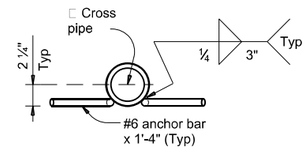


TYPICAL WINGWALL INSIDE ELEVATION

(Showing installation of cross pipes.)

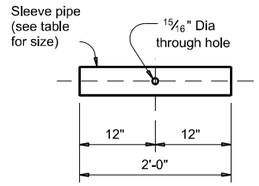


PART PLAN



SECTION B-B

OPTIONAL ANCHOR BAR DETAILS



SLEEVE PIPE DETAILS 9

REQUIRED PIPE SIZES 8		
Culvert Span Sizes	Cross Pipe Size	Sleeve Pipe Size 9
First Pipe	3 ½" STD	2 ½" STD
30" to 42"	4" STD	3" STD
48" to 72"	5" STD	4" STD
78" to 120"	6" STD	5" STD

STANDARD PIPE SIZES		
Pipe Size	Pipe O.D.	Pipe I.D.
2 ½" STD	2.875"	2.469"
3" STD	3.500"	3.068"
3 ½" STD	4.000"	3.548"
4" STD	4.500"	4.026"
5" STD	5.563"	5.047"
6" STD	6.625"	6.065"

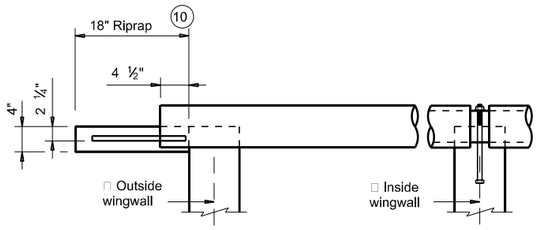
6 The proper installation of the first cross pipe is critical for vechicle saftey. Place the top of the first cross pipe at no more than 6" above the flow line.

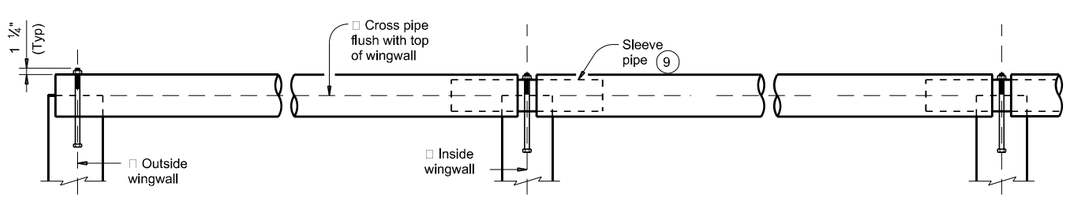
7 Always install the third cross pipe from the bottom of the culvert using a bolted connection. Take care to ensure that concrete does not flow into this cross pipe so as to permit disassembly of the bolted connection to allow cleanout access.

8 Provide cross pipes and sleeve pipes (if required) as shown in the Required Pipe Sizes table. Provide 3 1#2" saddle pipes for the 3 1#2" first cross pipe.

9 At Contractor's option, make the cross pipe continuous across the inside wingwalls. If this option is selected, omit the sleeve pipe and make a 15#16" diameter throughhole in the cross pipe to accept the anchor bolt at the centerline of each interior wingwall.

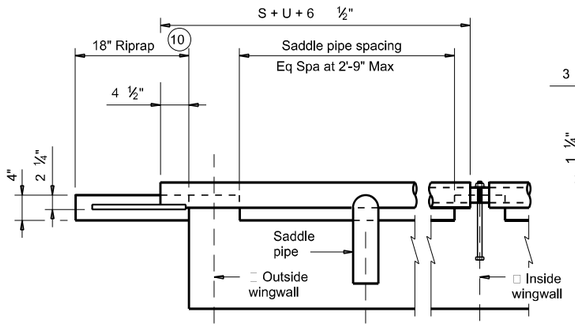
10 Provide riprap when using the Optional Anchor Bar details. Riprap is included in the bid price for Safety End Treatment. Provide riprap in accordance with Item 432, "Riprap".

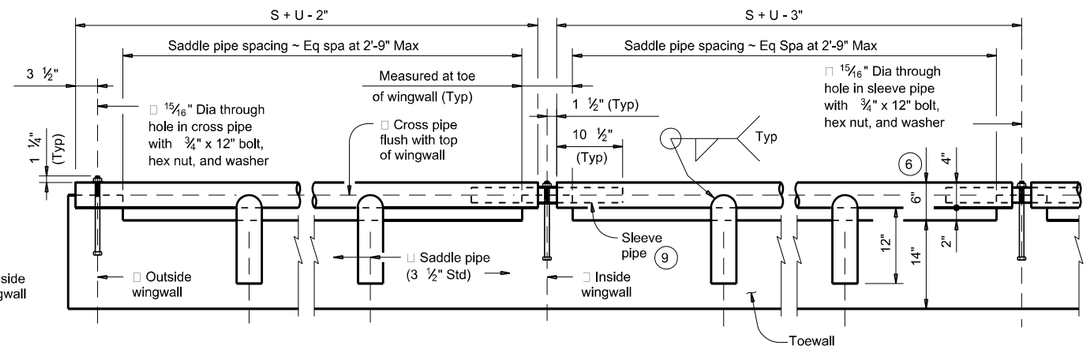




SECTION THROUGH INSTALLATION OF TYPICAL FULL CROSS PIPE

(Anchor details and dimensions are similar to those shown below in Section Through Installation of 3 b" First Cross Pipe detail.)





SECTION THROUGH INSTALLATION OF 3 ½" FIRST CROSS PIPE

OUTSIDE CULVERT BARREL WITH OPTIONAL ANCHOR BARS & RIPRAP

OUTSIDE CULVERT BARREL WITH BOLTED ANCHOR

INSIDE CULVERT BARREL

CROSS PIPE INSTALLATION DETAILS

SHEET 2 OF 2

Texas Department of Transportation

Bridge Division Standard

SAFETY END TREATMENT

FOR BOX CULVERTS
(MAXIMUM Hw = 7'-0")
TYPE I ~ PARALLEL DRAINAGE

SETB-PD

FILE: setbpdse-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOUS	HARRIS		145A

STANDARD HCFCD NOTES FOR CONSTRUCTION DRAWINGS

1. TxDOT will invite the Harris County Flood Control District (HCFCD) to the preconstruction meeting. An invitation will be sent to the following address at least two weeks prior to the meeting:

   Harris County Flood Control District, Property Management Department
   Attn: Development Coordination and Inspection Section (DCIS)
   9900 Northwest Freeway, Houston, Texas 77092
   Fax: 713-684-4212
   Email: DCIS@hcfcd.org

2. Obtain and comply with applicable City, County, State, and Federal permits and approvals. Obtain a permit (notification) from Harris County to enter Harris County Flood Control District (HCFCD) Right-of-Way. Deliver to HCFCD's Development Coordination and Inspection Section the completed Pre-Construction Notification Form (See Appendix B of HCFCD site http://www.hcfcd.org/downloads/manuals/HCFCD *PCPM*Dec2010.pdf). Include with this delivery a copy of the approved construction drawings and a copy of any Section 404 Corps of Engineers individual permit(s). The address for delivery is listed above. Submit notifications by regular mail, email, or fax. For minor projects, only the title sheet and any plan sheets showing HCFCD Right-of-Way need to be submitted. Ensure this pre-construction notification is received by the HCFCD at least four calendar days prior to construction.

3. Protect, maintain, and restore existing backslope drainage systems.

4. Before installing outfall(s), verify that the channel and pipe flow line(s) are in accordance with the applicable HCFCD standards in the plans. Resolve any discrepancies before construction in cooperation with the responsible Design Engineer. No water should remain in the facility during normal water surface conditions in the channel/waterway.

5. For wet bottom detention basins, ensure no water is above the design level in the wet bottom during normal water surface conditions in the channel/waterway.

6. Within HCFCD Right-of-Way, perform earthwork in accordance with TxDOT ITEM 110 - EXCAVATION (CHANNEL), ITEM 110 - EXCAVATION (SPECIAL), ITEM 132 - EMBANKMENT (FINAL) (ORD COMP)(TY C). Perform any excavation and backfill for structures in accordance with Item 400.

7. Backslope swale and interceptor structure elevations and locations shown on the plans are approximate. Final elevations and locations will be field verified by the Engineer and HCFCD's Development Coordination and Inspection Section before installation.

8. Maintain flow in channel during construction and restore the channel to original condition.

9. Remove excavated material from HCFCD Right-of-Way. Do not place fill within a designated flood plain area without first obtaining a fill permit from the appropriate jurisdictional authority. With HCFCD's written approval, the Contractor may place embankment material temporarily within HCFCD Right-of-Way for up to two days. The maximum height of this temporary material is 5 ft. and the minimum distance to the edge of the waterway slope is 3 ft.

10. Do not cast or mix any materials within HCFCD Right-of-Way.

11. Establish turf grass on disturbed areas within the channel or detention Right-of-Way, except the channel bottom and where structural erosion measures are used. Minimum acceptance criteria for vegetative cover is 70% with no erosion or rills deeper than 4 in. See Houston District Standard "Fertilizer, Seed, Sod, Straw, Compost, and Water", for seeding requirements. If block sod is called for on channel side slopes, pin each block with four 6-in. by 1-in. by 6-in. 11 gauge steel "U" staples.

12. After the Contractor informs the Engineer that the work performed within HCFCD's Right-of-Way is ready for HCFCD's final inspection, the Engineer will schedule HCFCD's final inspection at least one month before TxDOT's acceptance of project from the Contractor.

13. For the final HCFCD inspection request, TxDOT will submit the standard certification letter (See Appendix B of HCFCD site http://www.hcfcd.org/downloads/manuals/HCFCD *PCPM*Dec2010.pdf), along with record drawings of work performed within HCFCD's Right-of-Way, to the HCFCD's Development Coordination and Inspection Section requesting final inspection of items constructed in the HCFCD's Right-of-Way. Before requesting inspection, stake and flag Harris County Flood Control's Right-of-Way and/or easements. This flagging will be incidental to the work performed within the HCFCD Right-of-Way.

14. If deficiencies are found by HCFCD inspectors, TxDOT will immediately schedule a follow-up inspection and the Contractor will address any HCFCD comments in a timely manner.

15. Before project acceptance by TxDOT from the Contractor, TxDOT must receive a Letter of Final Acceptance from the HCFCD approving the work performed within their Right-of-Way.

Texas Department of Transportation
Houston District

HARRIS COUNTY FLOOD CONTROL DISTRICT NOTES
HCFCD-N

FILE: STDG-5.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT	
© TxDOT DEC,2012	DIST	FED REG	PROJECT NO.		SHEET
REVISIONS 10/2012 - Rev. Notes in coord. w/ HCFCD 6/2012 - rev. notes (minor)	HOU	6			146
	COUNTY	CONTROL	SECT	JOB	HIGHWAY
	HARRIS	0110	05	126	IH 45

STDG5A

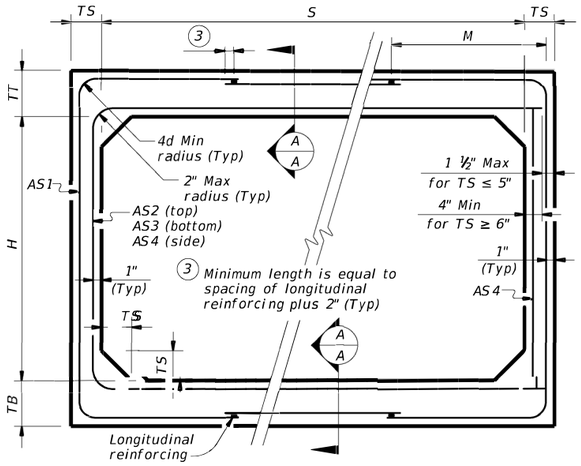
DATE:
FILE:

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)
5	2	8	7	6	< 2	–	0.19	0.27	0.18	0.14	0.19	0.19	0.17	6.0
5	2	6	6	6	2 < 3	44	0.22	0.20	0.16	0.14	–	–	–	5.1
5	2	6	6	6	3 – 5	44	0.16	0.14	0.14	0.14	–	–	–	5.1
5	2	6	6	6	10	36	0.15	0.14	0.14	0.14	–	–	–	5.1
5	2	6	6	6	15	36	0.20	0.18	0.18	0.14	–	–	–	5.1
5	2	6	6	6	20	36	0.26	0.23	0.24	0.14	–	–	–	5.1
5	2	6	6	6	25	36	0.33	0.29	0.29	0.14	–	–	–	5.1
5	2	6	6	6	30	36	0.39	0.34	0.35	0.14	–	–	–	5.1
5	3	8	7	6	< 2	–	0.19	0.31	0.21	0.14	0.19	0.19	0.17	6.6
5	3	6	6	6	2 < 3	45	0.18	0.24	0.19	0.14	–	–	–	5.7
5	3	6	6	6	3 – 5	36	0.14	0.17	0.16	0.14	–	–	–	5.7
5	3	6	6	6	10	36	0.14	0.16	0.17	0.14	–	–	–	5.7
5	3	6	6	6	15	35	0.16	0.21	0.22	0.14	–	–	–	5.7
5	3	6	6	6	20	35	0.21	0.27	0.28	0.14	–	–	–	5.7
5	3	6	6	6	25	35	0.26	0.34	0.34	0.14	–	–	–	5.7
5	3	6	6	6	30	35	0.31	0.41	0.41	0.14	–	–	–	5.7
5	4	8	7	6	< 2	–	0.19	0.33	0.24	0.14	0.19	0.19	0.17	7.2
5	4	6	6	6	2 < 3	45	0.16	0.27	0.22	0.14	–	–	–	6.3
5	4	6	6	6	3 – 5	45	0.14	0.19	0.18	0.14	–	–	–	6.3
5	4	6	6	6	10	36	0.14	0.18	0.18	0.14	–	–	–	6.3
5	4	6	6	6	15	35	0.14	0.23	0.24	0.14	–	–	–	6.3
5	4	6	6	6	20	35	0.17	0.30	0.31	0.14	–	–	–	6.3
5	4	6	6	6	25	35	0.21	0.37	0.38	0.14	–	–	–	6.3
5	4	6	6	6	30	35	0.25	0.44	0.45	0.14	–	–	–	6.3
5	5	8	7	6	< 2	–	0.19	0.35	0.26	0.14	0.19	0.19	0.17	7.8
5	5	6	6	6	2 < 3	45	0.14	0.29	0.24	0.14	–	–	–	6.9
5	5	6	6	6	3 – 5	45	0.14	0.21	0.20	0.14	–	–	–	6.9
5	5	6	6	6	10	45	0.14	0.19	0.20	0.14	–	–	–	6.9
5	5	6	6	6	15	36	0.14	0.24	0.25	0.14	–	–	–	6.9
5	5	6	6	6	20	35	0.15	0.31	0.32	0.14	–	–	–	6.9
5	5	6	6	6	25	35	0.18	0.38	0.39	0.14	–	–	–	6.9
5	5	6	6	6	30	35	0.21	0.46	0.47	0.14	–	–	–	6.9

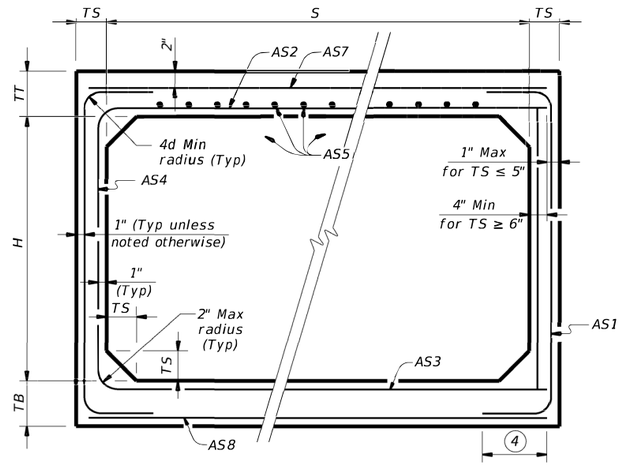
(1) For box length = 8'-0"

(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"

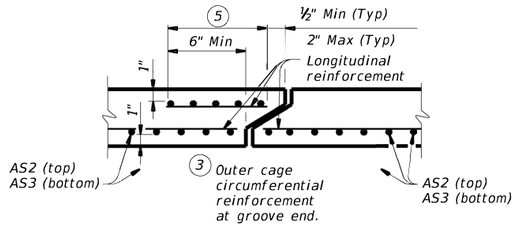
FILL HEIGHT 2 FT AND GREATER



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)".

HL93 LOADING

Texas Department of Transportation

Bridge Division Standard

SINGLE BOX CULVERTS PRECAST

5'-0" SPAN

SCP-5

FILE:	scp05sts-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT	February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS		0110	05	126	IH 45
		DIST	COUNTY		SHEET NO.
		HOU	HARRIS		146A

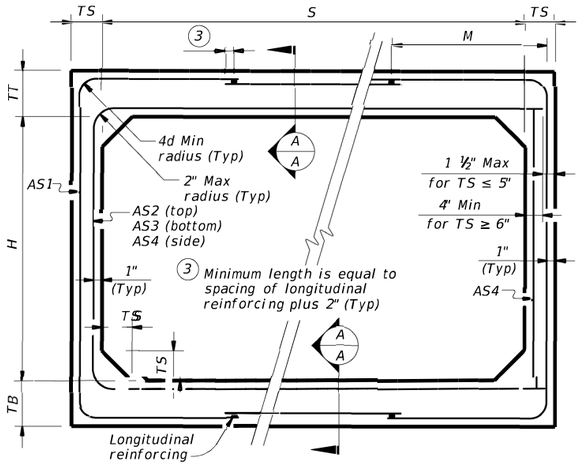
DATE:
FILE:

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)
6	2	8	7	7	< 2	–	0.23	0.27	0.19	0.17	0.19	0.19	0.17	7.2
6	2	7	7	7	2 < 3	43	0.25	0.21	0.17	0.17	–	–	–	6.8
6	2	7	7	7	3 – 5	43	0.20	0.17	0.17	0.17	–	–	–	6.8
6	2	7	7	7	10	39	0.20	0.17	0.17	0.17	–	–	–	6.8
6	2	7	7	7	15	39	0.26	0.20	0.20	0.17	–	–	–	6.8
6	2	7	7	7	20	39	0.34	0.26	0.26	0.17	–	–	–	6.8
6	2	7	7	7	25	39	0.43	0.32	0.32	0.17	–	–	–	6.8
6	2	7	7	7	30	39	0.52	0.38	0.39	0.17	–	–	–	6.8
6	3	8	7	7	< 2	–	0.20	0.31	0.22	0.17	0.19	0.19	0.17	7.9
6	3	7	7	7	2 < 3	43	0.21	0.24	0.19	0.17	–	–	–	7.5
6	3	7	7	7	3 – 5	39	0.17	0.18	0.17	0.17	–	–	–	7.5
6	3	7	7	7	10	39	0.17	0.18	0.19	0.17	–	–	–	7.5
6	3	7	7	7	15	38	0.22	0.24	0.24	0.17	–	–	–	7.5
6	3	7	7	7	20	38	0.28	0.31	0.31	0.17	–	–	–	7.5
6	3	7	7	7	25	38	0.35	0.38	0.39	0.17	–	–	–	7.5
6	3	7	7	7	30	38	0.42	0.46	0.46	0.17	–	–	–	7.5
6	4	8	7	7	< 2	–	0.19	0.34	0.25	0.17	0.19	0.19	0.17	8.6
6	4	7	7	7	2 < 3	43	0.19	0.27	0.21	0.17	–	–	–	8.2
6	4	7	7	7	3 – 5	39	0.17	0.21	0.19	0.17	–	–	–	8.2
6	4	7	7	7	10	39	0.17	0.20	0.21	0.17	–	–	–	8.2
6	4	7	7	7	15	38	0.18	0.27	0.27	0.17	–	–	–	8.2
6	4	7	7	7	20	38	0.24	0.34	0.35	0.17	–	–	–	8.2
6	4	7	7	7	25	38	0.29	0.43	0.42	0.17	–	–	–	8.2
6	4	7	7	7	30	38	0.35	0.51	0.52	0.17	–	–	–	8.2
6	5	8	7	7	< 2	–	0.19	0.37	0.28	0.17	0.19	0.19	0.17	9.3
6	5	7	7	7	2 < 3	43	0.17	0.30	0.24	0.17	–	–	–	8.9
6	5	7	7	7	3 – 5	43	0.17	0.23	0.21	0.17	–	–	–	8.9
6	5	7	7	7	10	39	0.17	0.22	0.23	0.17	–	–	–	8.9
6	5	7	7	7	15	38	0.17	0.28	0.29	0.17	–	–	–	8.9
6	5	7	7	7	20	38	0.20	0.37	0.38	0.17	–	–	–	8.9
6	5	7	7	7	25	38	0.25	0.45	0.46	0.17	–	–	–	8.9
6	5	7	7	7	30	38	0.30	0.54	0.55	0.17	–	–	–	8.9
6	6	8	7	7	< 2	–	0.19	0.38	0.30	0.17	0.19	0.19	0.17	10
6	6	7	7	7	2 < 3	52	0.17	0.32	0.26	0.17	–	–	–	9.6
6	6	7	7	7	3 – 5	52	0.17	0.24	0.22	0.17	–	–	–	9.6
6	6	7	7	7	10	43	0.17	0.23	0.24	0.17	–	–	–	9.6
6	6	7	7	7	15	39	0.17	0.29	0.31	0.17	–	–	–	9.6
6	6	7	7	7	20	39	0.18	0.38	0.39	0.17	–	–	–	9.6
6	6	7	7	7	25	38	0.23	0.46	0.48	0.17	–	–	–	9.6
6	6	7	7	7	30	38	0.27	0.55	0.57	0.17	–	–	–	9.6

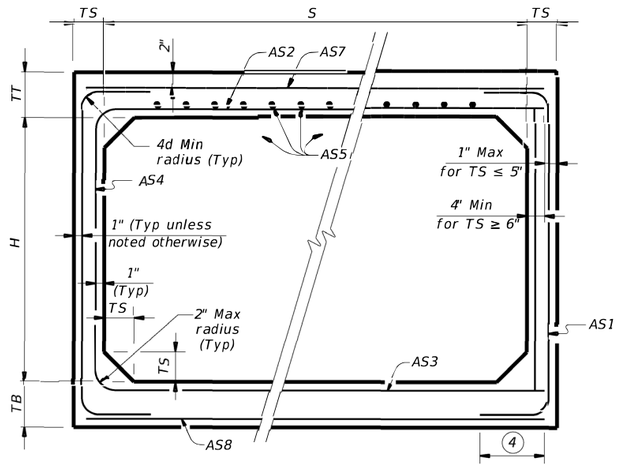
(1) For box length = 8'-0"

(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"

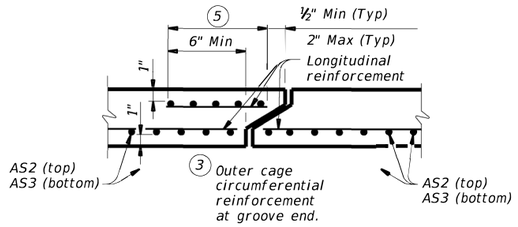
FILL HEIGHT 2 FT AND GREATER



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:

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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.

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HL93 LOADING

Texas Department of Transportation

Bridge Division Standard

SINGLE BOX CULVERTS PRECAST

6'-0" SPAN

SCP-6

FILE: scp06sts-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		146B

RETW_1

Beginning chain RETW_1 description
Feature: Geom_Centerline

Point 2 N 13,942,643.2349 E 3,098,458.6787 Sta 10+00.00

Course from 2 to PC RETW_1_3 N 3° 20′ 37.31" W Dist 282.4050

Curve Data

Curve RETW_1_3					
P.I. Station	12+83.13	N	13,942,925.8832	E	3,098,442.1651
Delta =	1° 42′ 21.96" (LT)				
Degree =	117° 37′ 52.13"				
Tangent =	0.7252				
Length =	1.4504				
Radius =	48.7080				
External =	0.0054				
Long Chord =	1.4503				
Mid. Ord. =	0.0054				
P.C. Station	12+82.41	N	13,942,925.1592	E	3,098,442.2074
P.T. Station	12+83.86	N	13,942,926.6056	E	3,098,442.1012
C.C.		N	13,942,922.3183	E	3,098,393.5823
Back = N	3° 20′ 37.31" W				
Ahead = N	5° 02′ 59.26" W				
Chord Bear = N	4° 11′ 48.28" W				

Course from PT RETW_1_3 to 3 N 5° 05′ 32.37" W Dist 25.2472

Point 3 N 13,942,951.7531 E 3,098,439.8603 Sta 13+09.10

Course from 3 to 4 N 3° 20′ 37.31" W Dist 50.0000

Point 4 N 13,943,001.6680 E 3,098,436.9440 Sta 13+59.10

Ending chain RETW_1 description

RETW_2

Beginning chain RETW_2 description

Point RW2001 N 13,943,290.1660 E 3,098,420.0707 Sta 10+00.00

Course from RW2001 to RW2002 N 3° 20′ 37.31" W Dist 50.0000

Point RW2002 N 13,943,340.0809 E 3,098,417.1544 Sta 10+50.00

Course from RW2002 to PC RETW_21 N 1° 49′ 40.24" W Dist 29.9529

Curve Data

Curve RETW_21					
P.I. Station	10+80.61	N	13,943,370.6797	E	3,098,416.1779
Delta =	1° 30′ 57.06" (LT)				
Degree =	114° 35′ 29.61"				
Tangent =	0.6615				
Length =	1.3228				
Radius =	50.0000				
External =	0.0044				
Long Chord =	1.3228				
Mid. Ord. =	0.0044				
P.C. Station	10+79.95	N	13,943,370.0185	E	3,098,416.1990
P.T. Station	10+81.28	N	13,943,371.3400	E	3,098,416.1393
C.C.		N	13,943,368.4237	E	3,098,366.2244
Back = N	1° 49′ 40.24" W				
Ahead = N	3° 20′ 37.31" W				
Chord Bear = N	2° 35′ 08.77" W				

Course from PT RETW_21 to RW2003 N 3° 20′ 37.31" W Dist 391.4388

Point RW2003 N 13,943,762.1124 E 3,098,393.3085 Sta 14+72.71

Ending chain RETW_2 description

STATE OF TEXAS
MICHAEL C. McDANIEL
135553
LICENSED
PROFESSIONAL ENGINEER
9/28/2021

LJA Engineering, Inc.
FRN - F-1386

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IH 45
SB FRONTAGE RD

RETAINING WALL ALIGNMENT DATA

FED.RD. DIV.NO.	STATE	PROJECT NO.			HIGHWAY NO.
6	TEXAS				IH 45
STATE DISTRICT	COUNTY	CONTROL NO.	SECTION NO.	JOB NO.	SHEET NO.
HOU	HARRIS	0110	05	126	147

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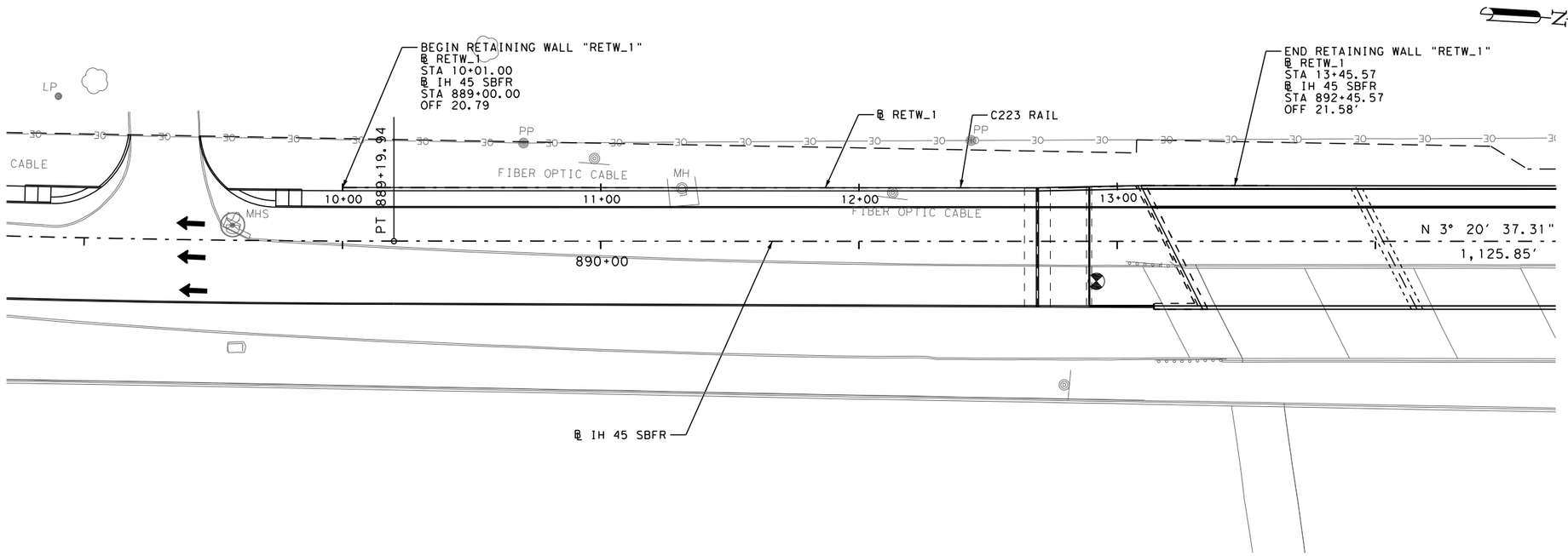
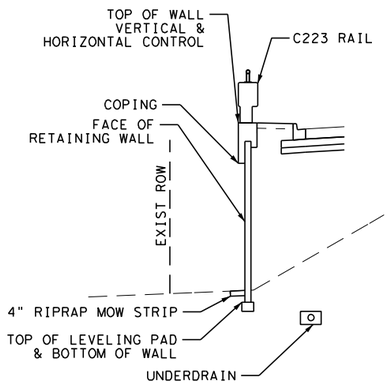
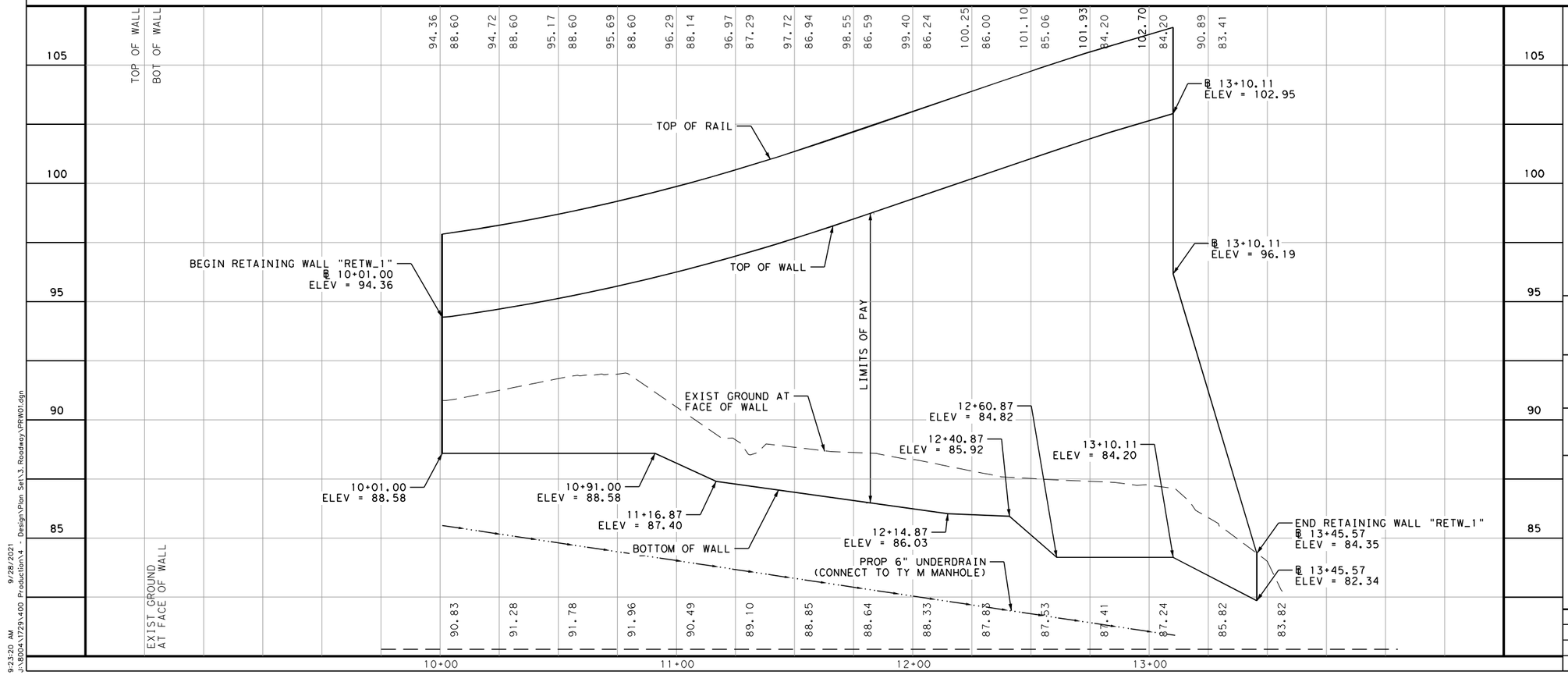




TYPICAL SECTION

NTS



0' 25' 50'
SCALE: 1"=50' - HORZ
1"=5' - VERT

STATE OF TEXAS
MICHAEL C. McDANIEL
135553
LICENSED
PROFESSIONAL ENGINEER
9/28/2021

LJA Engineering, Inc.
FRN - F-1386

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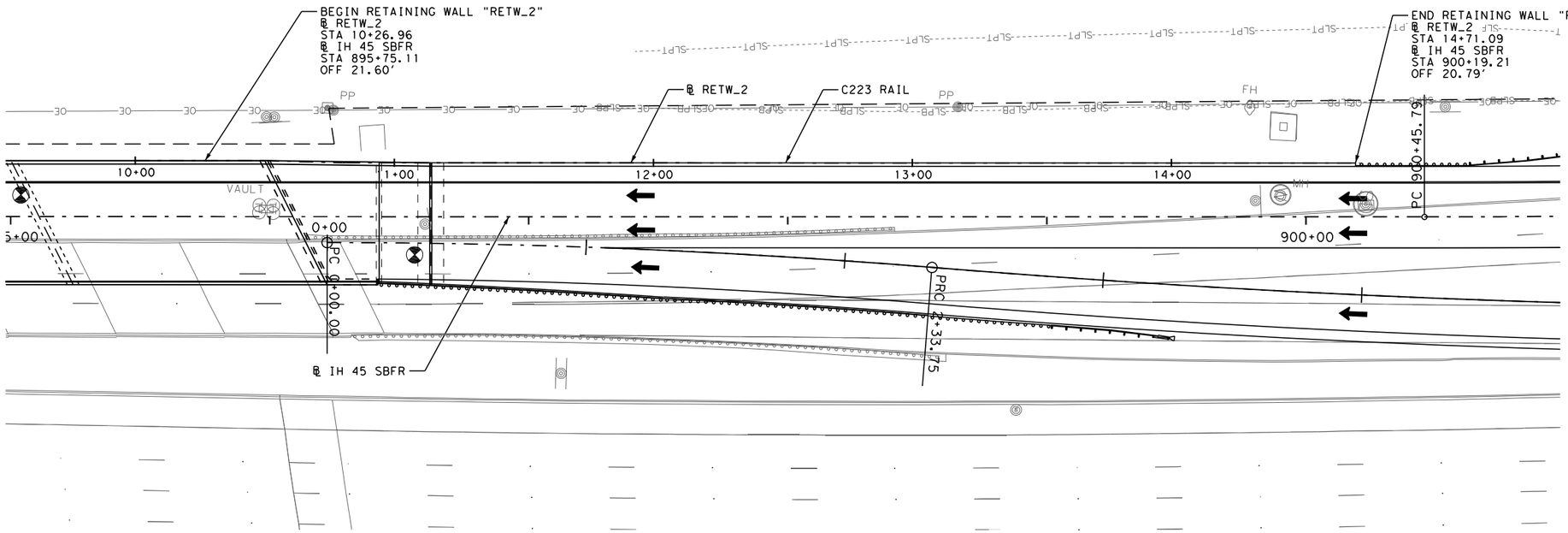
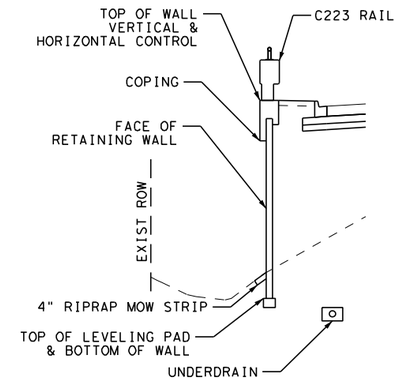
IH 45
SB FRONTAGE RD
RETAINING WALL RETW_1
PLAN AND PROFILE
STA 10+00

SHEET 1 OF 2

FED.RD. DIV.NO.	STATE	PROJECT NO.			HIGHWAY NO.
6	TEXAS				IH 45
STATE DISTRICT	COUNTY	CONTROL NO.	SECTION NO.	JOB NO.	SHEET NO.
HOU	HARRIS	0110	05	126	148

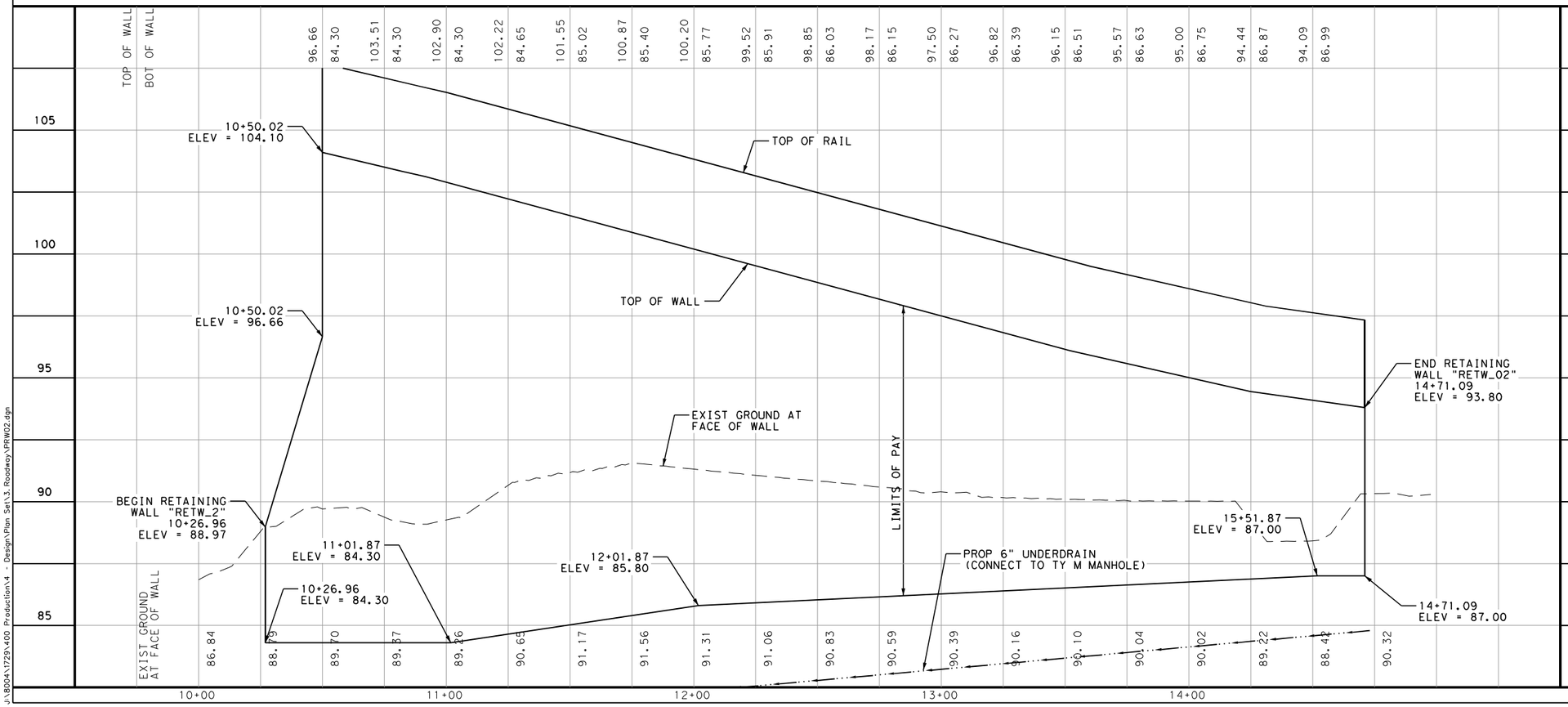
9/28/2021
9:23:20 AM
J:\18004\1729\400 Production\4 - Design\Plan Set\3. Roadway\PRW01.dgn





TYPICAL SECTION

NTS



0′ 25′ 50′

SCALE: 1"=50′ - HORZ
1"=5′ - VERT

STATE OF TEXAS
MICHAEL C. McDANIEL
135553
LICENSED PROFESSIONAL ENGINEER

9/28/2021

LJA Engineering, Inc.
FRN - F-1386

Texas Department of Transportation
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IH 45
SB FRONTAGE RD
RETAINING WALL RETW_2
PLAN AND PROFILE
STA 10+00

SHEET 2 OF 2

FED.RD. DIV.NO.	STATE	PROJECT NO.			HIGHWAY NO.
6	TEXAS				IH 45
STATE DISTRICT	COUNTY	CONTROL NO.	SECTION NO.	JOB NO.	SHEET NO.
HOU	HARRIS	0110	05	126	149

9/28/2021
9:23:21 AM
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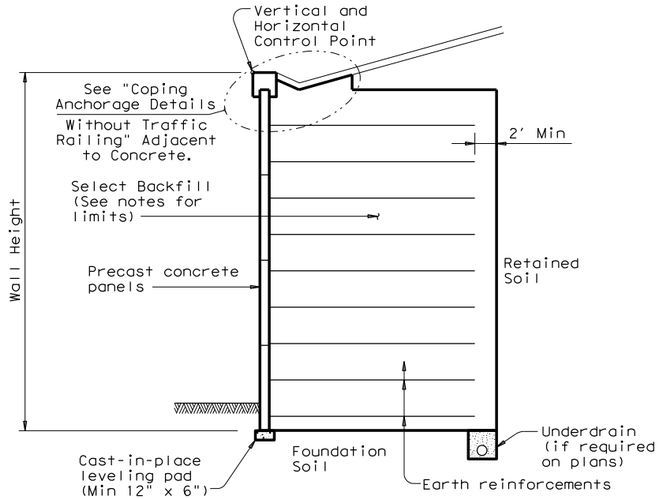
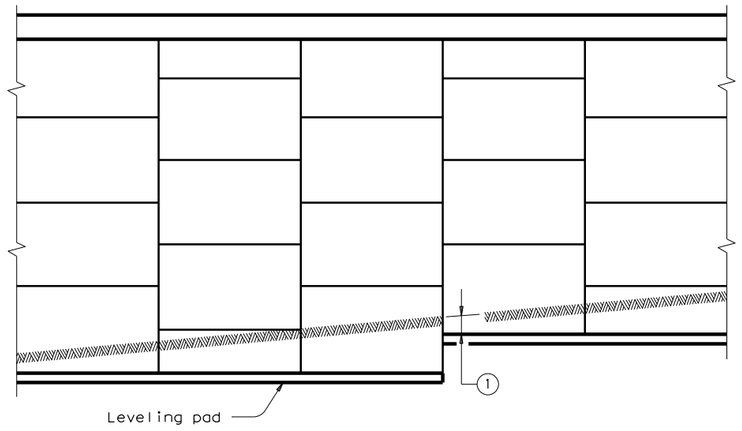
DATE:
FILE:

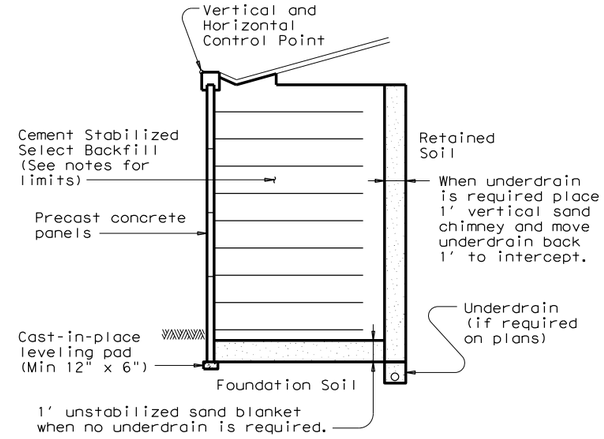


TYPICAL SECTION

(Wall at bottom of slope)

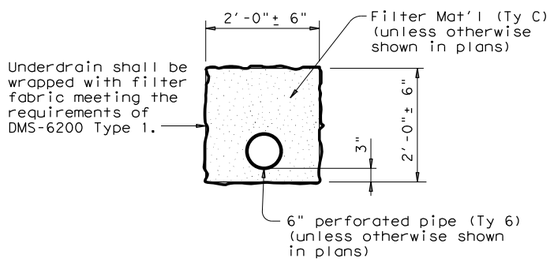


ELEVATION

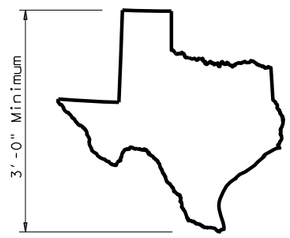


SPECIAL DRAINAGE PROVISIONS

(When cement stabilized backfill is used)



UNDERDRAIN DETAIL



MAP OF TEXAS EMBLEM (2)

(1) Minimum embedment conforming to values given on the RW(MSE)DD standard.

(2) Map of Texas emblem shall be formed into a wall panel next to each bridge abutment. The exact location of each emblem shall be approved by the Engineer. The cost of forming the emblems will not be paid for directly, but shall be incidental to the Item "Retaining Wall". The map of Texas shall be inset a minimum of ¾" into the face of the panel, and shall receive a smooth finish. The inset area shall be finished in a contrasting color as approved by the Engineer.

SHEET 1 OF 2

Texas Department of Transportation

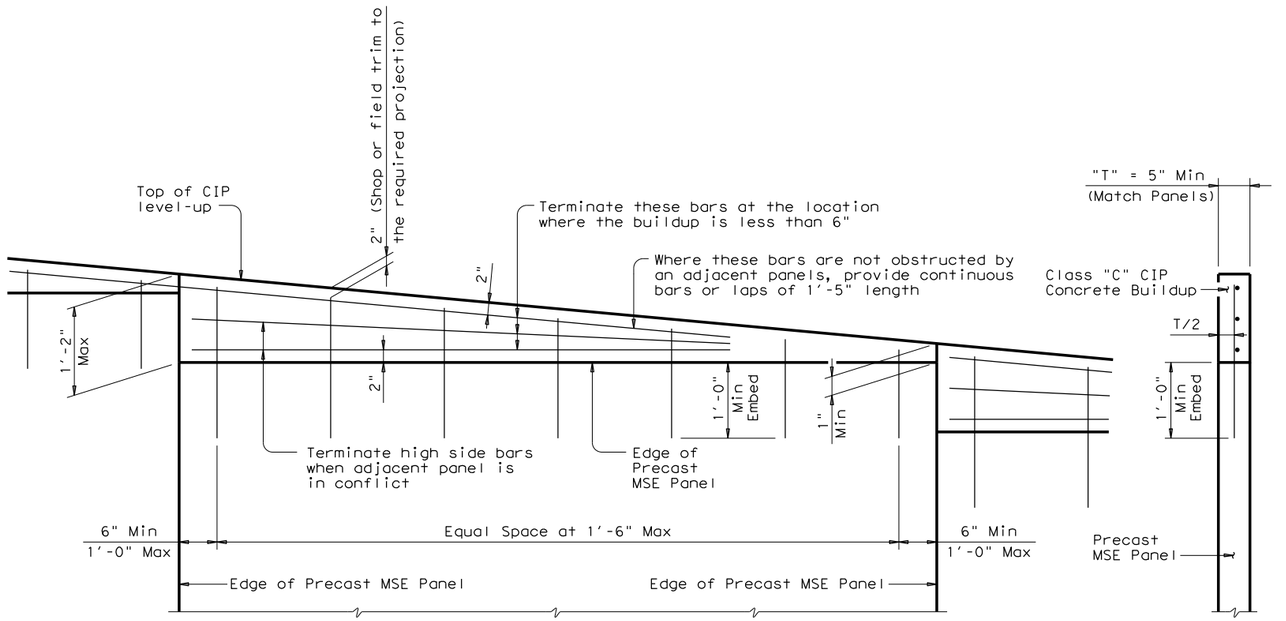
Bridge Division Standard

MECHANICALLY STABILIZED EARTH RETAINING WALL

RW(MSE)

FILE: rwstde01.dgn	DN: TxDOT	CK: TxDOT	DW: JGD	CK: MJG
©TxDOT March 2010	CONT	SECT	JOB	HIGHWAY
REVISIONS 04-11: Added Table & Corrosion Criteria. 01-13: Wall embed. (WS) table, retained fill, soil strength.	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		150

DATE:
FILE:



LEVEL UP DETAIL (5)

Provide Grade 60 (#4) Reinforcement

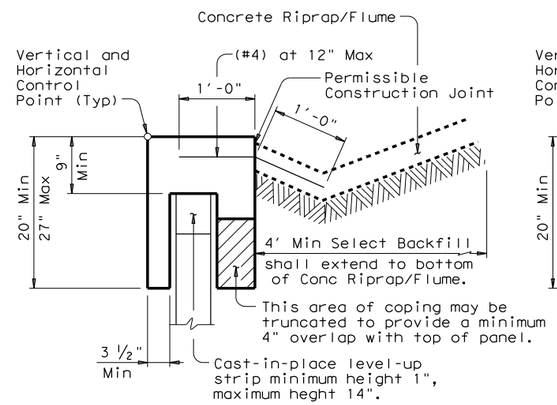
(3) Precast coping shall be anchored to prevent rotation or displacement. Use these details to develop custom anchorage for precast copings. Details shall include coping reinforcement. Concrete flume (if required) shall be paid for separately from Item 423.

(4) Soil design parameter must be based on long term soil strength. Design parameters must be listed on the RW(MSE)DD standard.

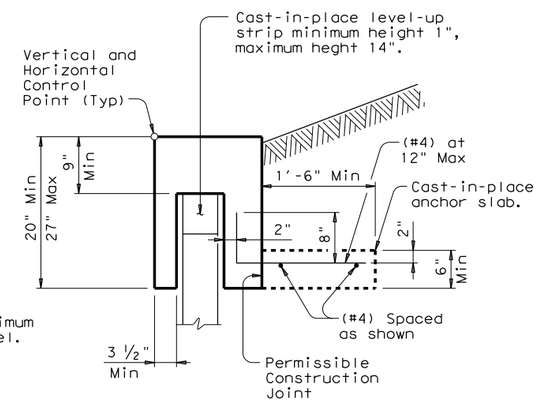
(5) Cast vertical bars into the top of panels. At contractor's option vertical bars may be embedded 4" with a Type III Clac C epoxy anchorage system. Follow manufacturer's directions for installing the epoxied vertical bars.

(6)

SELECT BACKFILL UNIT WEIGHT			
Type AS, BS & DS	Unit Weight	Inernal Stability	External Stability
	105 PCF	Pullout	Sliding, Overturning, Eccentricity
	125 PCF	Rupture	Bearing



ADJACENT TO CONCRETE
(Excluding Concrete Pavement)



ADJACENT TO SOIL

COPING ANCHORAGE DETAILS WITHOUT TRAFFIC RAILING (3)

DESIGN PARAMETERS:

Design of retaining walls shall be based on the following design parameters unless stated elsewhere in the plans:

Retained Soil	Unit Weight = 125 pcf Ø = (4) C = 0 psf
Foundation Soil	Ø = (4) C = 0 psf
Select Backfill	Unit Weight = See Table (6) Ø = 34 C = 0 psf
Cement Stabilized Select Backfill	Unit Weight = 125 pcf Ø = 45 C = 0 psf

Stress in steel and concrete shall be in accordance with current AASHTO Standard and Interim Specifications. The minimum length of earth reinforcements are as shown on the RW(MSE)DD standard.

STABILITY CRITERIA:

Stability criteria applies to both dry and drawdown analysis.
Factor of safety in sliding along the base of the structure shall be greater than or equal to 1.5.
Factor of safety in overturning shall be greater than or equal to 2.0.
The base pressure resultant shall fall within the middle third of the retaining wall.
The factor of safety against pullout of the earth reinforcements shall be greater than or equal to 1.5 at each level. Pullout resistance shall be determined from test data evaluated at ¾ inch strain.

CORROSION CRITERIA:

The earth reinforcement elements shall be designed to have a minimum design life of 75 years, using current AASHTO corrosion rates.
Stress calculations (rupture) shall be done on the calculated earth reinforcement section remaining after 75 years. Pullout calculations may be based on non-corroded section.

PRECAST COPINGS:

Wall supplier is to maximize lengths of precast coping. Precast coping is to be provided in 10' minimum lengths (typical). To optimize coping lengths at radiuses, end of runs or other wall geometric conditions favorable to shorter coping sections, shorter lengths may be used pending approval by the Engineer. This applies only to coping without railing.

JOINT SEALER:

The joints between coping segments must be sealed in accordance with the DMS-6310 "Joint Sealant's and Fillers", joint sealing material, Class 4. The joint must be sealed 3" below and 6" above the adjoining pavement surface, or as directed by the Engineer. The purpose of the joint sealing is to contain surface drainage and prevent infiltration into the retaining wall backfill.

GENERAL NOTES:

Section and elevation shown is for informational purposes only. Specific geometry is to be determined based on wall layouts and other plan information.
The select backfill specified for use within the mechanically stabilized earth volume shall extend horizontally from the back of the panels to a minimum 2' beyond the end of the earth reinforcements. The select backfill shall extend vertically from the top of the leveling pad or 4" below the lowest earth reinforcement, whichever is lower, to the top of panels.
The uppermost earth reinforcements shall be no more than 3.0' below the top of wall.
The lowest level of earth reinforcements shall be no more than 2.0' above the top of the leveling pad.
Minimum wire size for earth reinforcements shall be W7.0. If different longitudinal and cross wires are used in an earth reinforcement mesh, the smaller wire shall have at least 50% of the cross sectional area of the larger wire.
A maximum of four wire mesh configurations (wire sizes) will be allowed on a project. Each mesh configuration shall have a unique transverse bar spacing, differing from other configurations by a minimum of 3". Earth reinforcement lengths shall be stepped in increments no finer than 12".
Standard precast concrete panels shall have a maximum height of 6', and a maximum surface area of 50 sq ft. Top and bottom panels may exceed these limitations as necessary to achieve required wall grades. Maximum height of any panel shall be 7'-6". Minimum panel thickness shall be 5". Panels shall be arranged to provide offset horizontal joints.
An open joint shall be provided around the perimeter of the concrete panels. The joint configuration shall be such that 1) the filter fabric and/or pad materials are not exposed at the wall face and 2) the design opening is between ⅜" and ¾".
A one-piece corner panel shall be provided for wall angle changes of greater than 30 degrees. Butting of chamfered panels will be allowed for angle changes of 30 degrees or less.
Concrete coping shall be provided along the top of wall, at the vertical steps at bridge backwalls, and at other vertical steps along the top of wall. The joints between all coping segments shall be sealed to prevent infiltration of water into the retaining wall backfill. Sealing shall be in accordance with the DMS-6310 "Joint Sealants and Fillers", using Class 4 joint sealant.
When obstructions (inlets, drilled shafts, piling, etc.) prevent placement of soil reinforcements in their normal locations, provide details and calculations that establish support for the affected panels. Furnish the same earth reinforcement coverage as that required in the absence of the obstruction. For skewed (rotated) earth reinforcements no adjustment in length is needed for skew angles between 1 and 10 degrees. For skew angles greater than 10 degrees adjust the length of earth reinforcement to provide a cosine length of the reinforcement equivalent to the stated design length for the section of wall. Provide calculations that justify any alterations made to the soil reinforcements or modifications to their normal placement. Do not use panels without any soil reinforcements connected to them unless they are connected with galvanized hardware to adjacent panels which do have supporting Soil reinforcements attached to them and as approved by the Engineer.
Reinforced concrete must be Class "C", Precast concrete Class "H", Unreinforced concrete Class "A".
All reinforcing steel must be Grade 60.
Coping and anchor slabs are considered subsidiary to the Item "Retaining Wall".
These details are to be used in conjunction with the retaining wall layout, standard RW(MSE)DD and other applicable standards.

Texas Department of Transportation

Bridge Division Standard

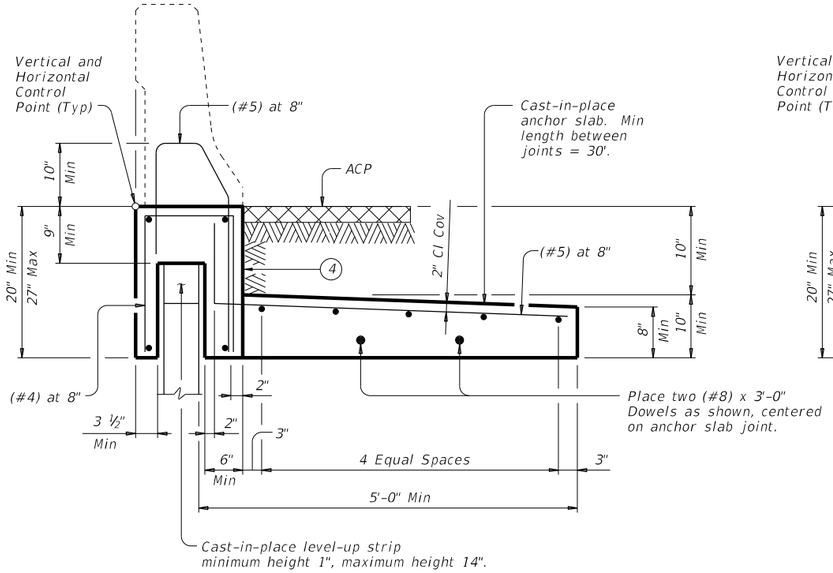
126

MECHANICALLY STABILIZED EARTH RETAINING WALL

RW(MSE)

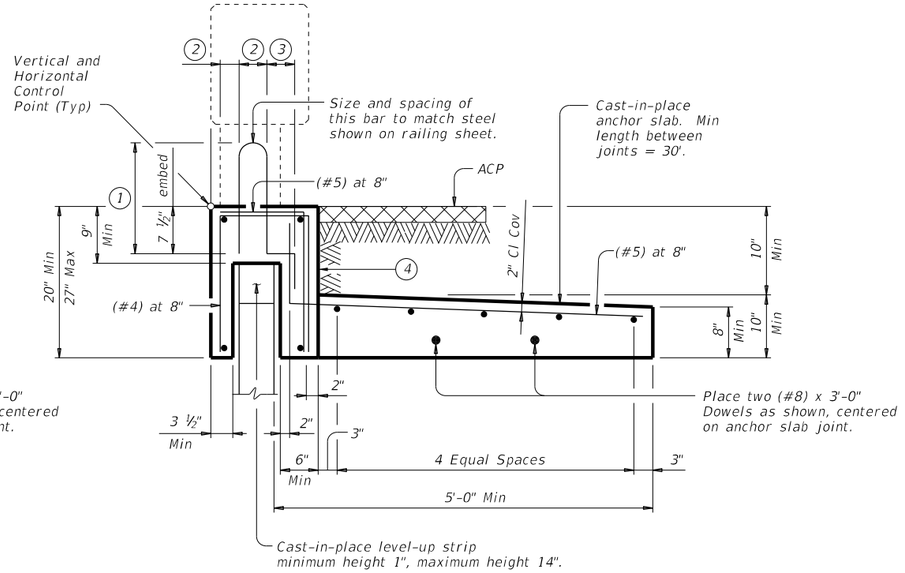
FILE: rwstde01.dgn	DN: TxDOT	CK: TxDOT	DW: JGD	CK: MJG
©TxDOT March 2010	CONT	SECT	JOB	HIGHWAY
REVISIONS 04-11: Added Table & Corrosion Criteria. 01-13: Wall embed. (WS) table, retained fill, soil strength.	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		151

DATE:
FILE:



"WIDE BASED" ADJACENT TO ACP

(Showing T551 Rail, other rails listed similar)



"NARROW BASED" ADJACENT TO ACP

(Showing T223 Rail, other rails listed similar)

Rail Type (5)	Detail	Precasting Rail with Coping Allowed
T1F/T1W/C1W/T2P/C2P	NARROW	NO
T221/C221/T222	NARROW	YES
T223/C223	NARROW	NO
T401/T402/C402	NARROW	NO
T411/C411	NARROW	NO
T551/T552	WIDE	YES
T66	NARROW	NO
SSTR	WIDE	YES

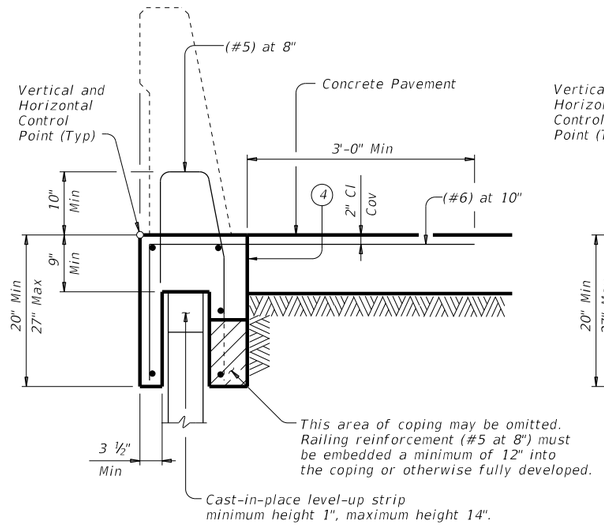
(1) Reinforcement length equal to length shown on the appropriate Rail standard plus 1".

(2) Match dimension on the appropriate Rail standard.

(3) Match dimension on the appropriate Rail standard. Bend end of rail anchorage reinforcing as shown as required to maintain clear cover.

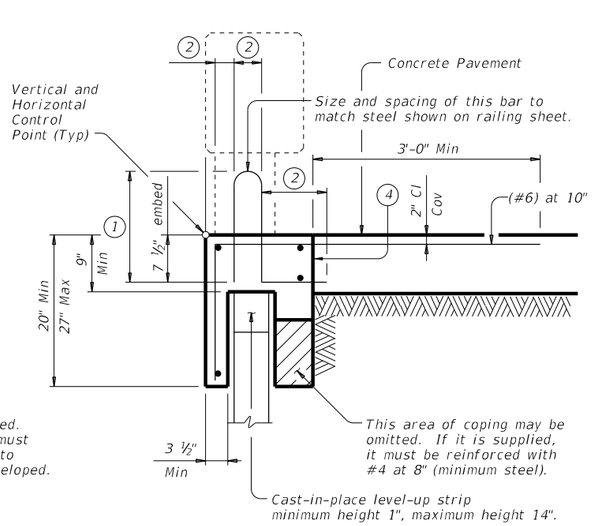
(4) See "Coping Joint Sealer Details".

(5) Use of these rails will result in a railing acceptable for MASH Test Level 3 (TL-3) regardless of the higher ratings that may be indicated on the rail standard.



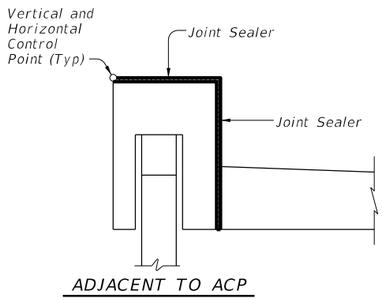
"WIDE BASED" ADJACENT TO CONCRETE PAVEMENT

(Showing SSTR Rail, other rails listed similar)

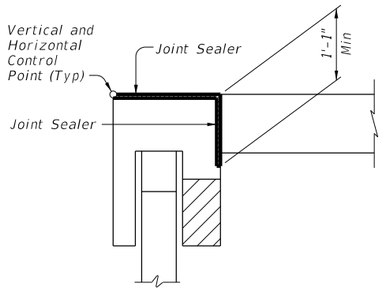


"NARROW BASED" ADJACENT TO CONCRETE PAVEMENT

(Showing T223 Rail, other rails listed similar)



ADJACENT TO ACP



ADJACENT TO CONCRETE PAVEMENT

COPING JOINT SEALER DETAILS

(Reinforcing steel not shown for clarity)

CAST-IN-PLACE COPINGS:

Provide compressible material to isolate precast panel from cast-in-place coping to prevent cracking. Attach compressible material to both sides of precast panel prior to casting concrete for coping.

When cast-in-place coping is anchored to reinforced concrete pavement, a smooth level-up strip must be provided on the top of the precast panels. The purpose of the level-up is to allow the pavement and coping to move longitudinally relative to the wall without causing damage.

Align coping and railing joints with precast panel joints. Optional rail joints are allowed as approved by Engineer. Provide railing construction joints or expansion joints at no greater than 100' spacing.

PRECAST COPINGS:

Provide a smooth level-up strip on top of the precast panels prior to installation of the coping. Shims may be used on top of the level-up strip to facilitate alignment. Total shim thickness not to exceed 1".

Provide precast coping in 10' minimum lengths.

JOINTED CONCRETE PAVEMENT:

When coping is adjacent to and anchored into jointed concrete pavement, the coping joints must coincide with the pavement joints.

JOINT SEALER:

Seal joints between coping segments in accordance with Item 438, "Cleaning and Sealing Joints". Provide Class 4 joint seal. Place sealant flush with coping surface. The purpose of the joint sealing is to reduce surface drainage infiltration into the retaining wall backfill. Sealing coping joint is considered subsidiary to other items.

GENERAL NOTES:

Details on this sheet are to be used in development of specific details for mounting traffic railing on mechanically stabilized earth (MSE) walls.

The specific details proposed must have strengths equivalent to those shown on this sheet. Areas of particular importance are the connection of the coping to the railing, the strength of the vertical coping leg connecting the railing to the anchor slab, and the connection of the coping to the anchor slab or concrete pavement.

Submit shop drawings for the traffic railing foundations to the Engineer in accordance with Item 423 "Retaining Wall". The shop drawings must include bar bending details.

Precasting of railing with the coping will be allowed as noted in the table on this sheet.

The Contractor's attention is directed to the fact that various configurations of precast coping/railing combinations are covered by patent. The contractor must provide for use of these systems in accordance with Article 7.3.

Provide Class C concrete (f'c=3,600 psi).

Provide Grade 60 reinforcing steel.

Provide (#4) longitudinal bars, unless otherwise shown.

Coping and anchor slabs are considered subsidiary to Item 423 "Retaining Wall". Payment for traffic railing is per the linear foot for the appropriate railing type.

Texas Department of Transportation

Bridge Division Standard

RETAINING WALL TRAFFIC RAILING FOUNDATIONS

RW(TRF)

FILE: rwstde03-20.dgn	DN: TxDOT	CK: TxDOT	DW: JTR	CK: MPM
©TxDOT March 2010	CONT	SECT	JOB	HIGHWAY
REVISIONS 01-13: Precast option with Rails. 03-18: Cast-In-Place Copings, railing construction and expansion joints. 02-20: Note 5 added for precast rail option.	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		152

DATE:
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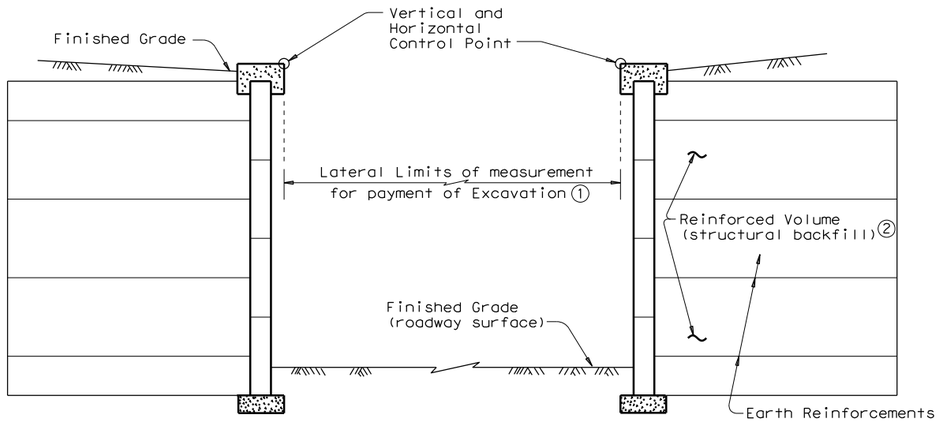
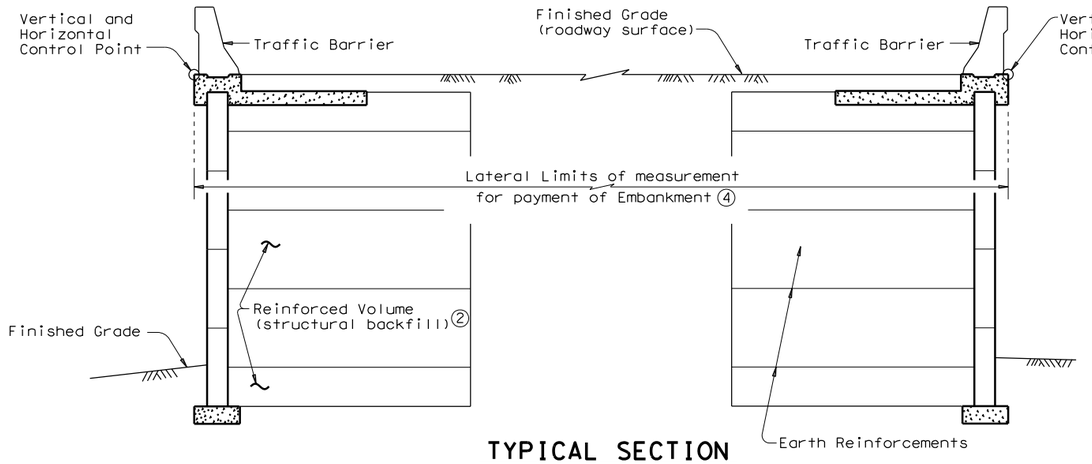


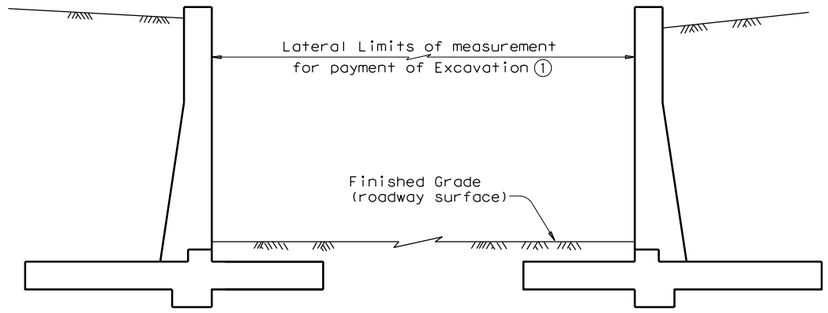
TYPICAL SECTION

Excavation Between MSE Retaining Walls ③



TYPICAL SECTION

Embankment Between MSE Retaining Walls ③



TYPICAL SECTION

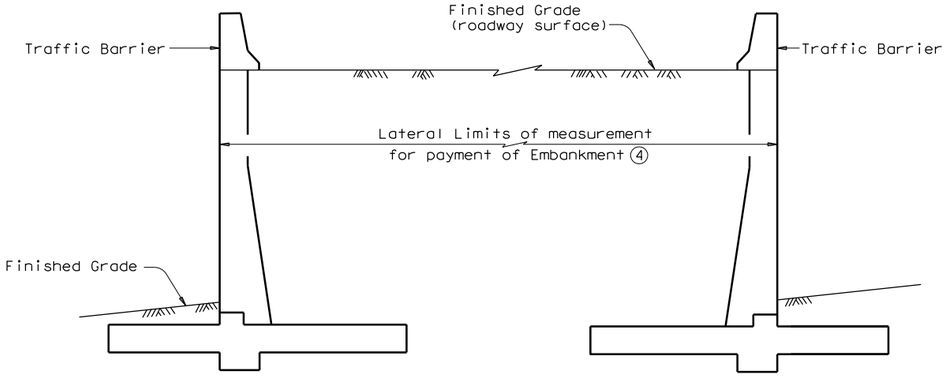
Excavation Between Conventional Retaining Walls

① Only the Excavation above the proposed subgrade elevation will be measured for payment.

② Meeting requirements of Retaining-Wall Item.

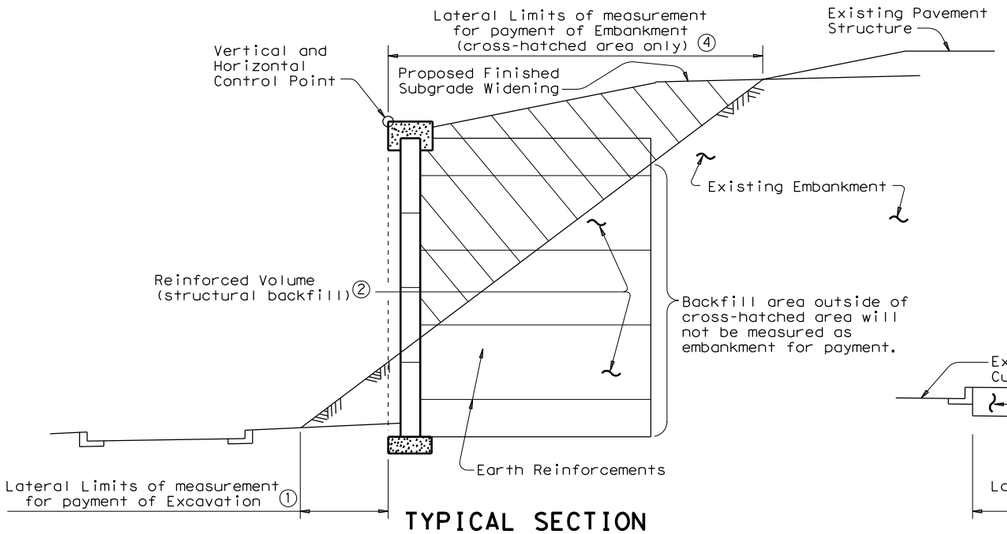
③ Earthwork measurement with other designs of retaining walls will be made to the outside finished face in the same manner.

④ Only the Embankment above the existing ground line will be measured for payment.



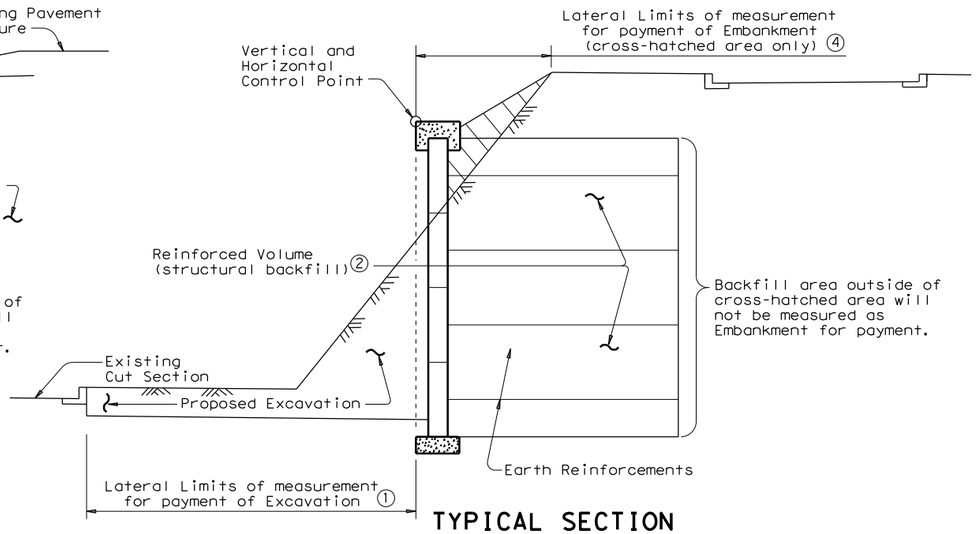
TYPICAL SECTION

Embankment Between Conventional Retaining Walls



TYPICAL SECTION

Widening Embankment with MSE Retaining Walls ③



TYPICAL SECTION

Widening Cut Section with MSE Retaining Walls ③

Texas Department of Transportation

Bridge Division Standard

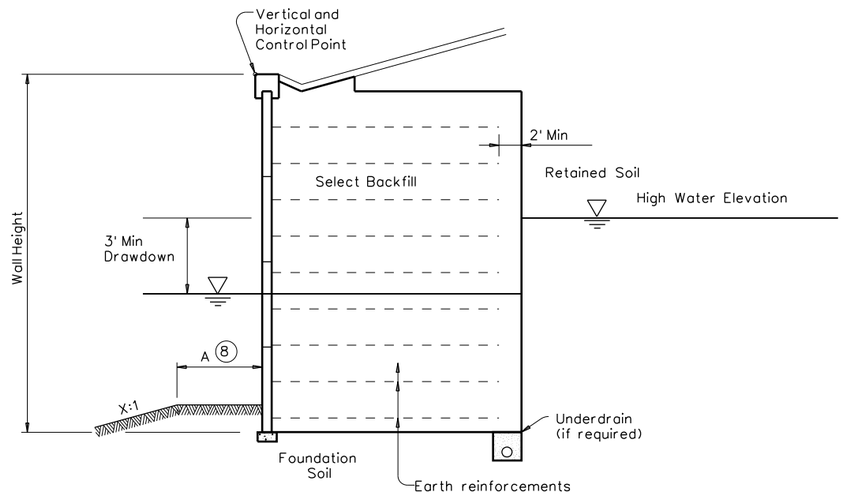
EARTHWORK MEASUREMENT AT RETAINING WALLS

RW(EM)

FILE: rwstde12.dgn	DN: TxDOT	CK: TxDOT	DW: BWH	CK: JMH
©TxDOT March 2010	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		153

WALL SUMMARY

MSE Retaining Wall	Begin Station (1)	End Station (1)	Retained Soil Friction Angle (2)	Foundation Soil Friction Angle (2)	Ground Improvement (3)	Min Earth Reinforcement Length (4)	Min Wall Embedment (7)	Underdrain Required (5)	Drawdown Analysis (6)	Bench Width (8)
RETW_1	10+01.00	13+45.57	34 DEGREES	26 DEGREES	NONE		2 ft	YES	YES	4 ft
15 TO 19 ft						1.00 H				
10 TO 15 ft						0.94 H				
2 TO 10 ft						1.20 H OR 8 ft				
RETW_2	10+26.96	14+71.09	34 DEGREES	26 DEGREES	NONE		2 ft	YES	YES	4 ft
15 TO 20 ft						0.95 H				
10 TO 15 ft						0.94 H				
5 TO 10 ft						1.20 H OR 8 ft				



TYPICAL SECTION
(RAPID DRAWDOWN CONDITION)

(1) Indicate limits for which the stated soil design requirements/assumptions are applicable.

(2) Retained and Foundation friction angle listed should be based on local experience or measured/correlated long term strength values.

(3) Indicate if ground improvement is required or not required. If shown as required, refer to Ground Improvement Detail(s) for additional information.

(4) Indicate on table minimum length and length ratio required. The minimum default length of earth reinforcements shall be either 8'-0" or 70% of the wall height, whichever is greater. Wall height and design wall height may differ depending on project geometry and loading conditions. Note: Wall height at bridge abutments is equal to the distance between the top of leveling pad and finished grade at the bridge abutment backwall.

(5) Indicate if underdrain is required or not required.

(6) Indicate if rapid drawdown analysis is required.

(7) Guidance to wall designer of record for determination of minimum wall embedment: Unless noted elsewhere in the plans, the minimum embedment provided from the top of leveling pad to finish grade shall be 1' for level ground where there is no potential for erosion or future excavation or 2' for sloping ground (4.0H:1.0V or steeper) or where there is potential for removal of soil in front of the wall.

(8) Horizontal Bench width at base of wall varies. Use the following criteria to establish base width.
A = 2.0' Min for X $\geq$ 4
A = 4.0' Min for X $\leq$ 4
Applicable to both drawdown and dry condition.

SPECIAL NOTES:
This sheet is to be filled out by the wall designer of record at time of plan preparation to provide soil strength parameters for the design of the specified walls.
The completed sheet shall be signed, sealed, and dated by a licensed Professional Engineer.

STATE OF TEXAS
PATRICK M. BEECHER
90858
LICENSED PROFESSIONAL ENGINEER

10/20/2021

Texas Department of Transportation

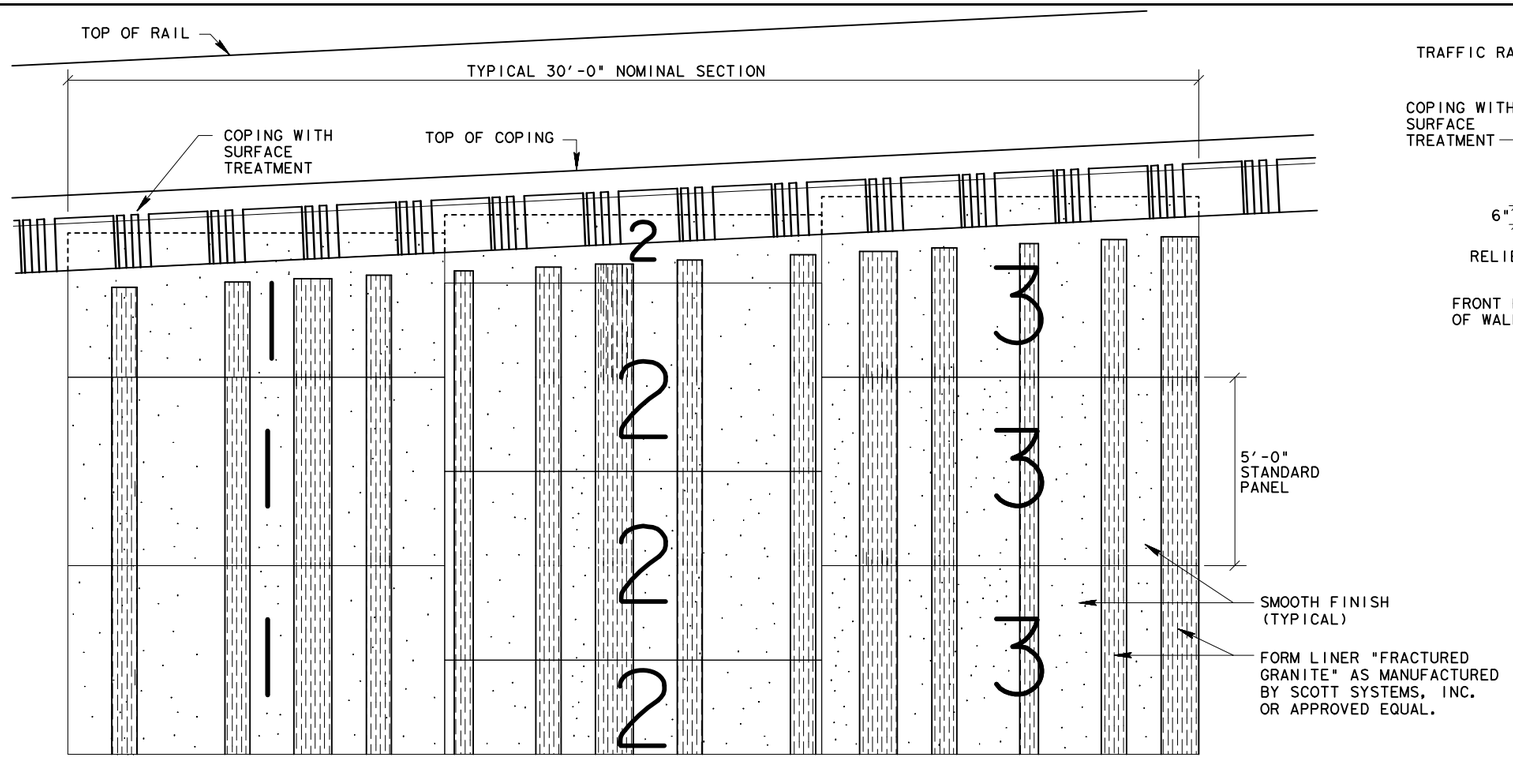
Bridge Division Standard

MECHANICALLY STABILIZED EARTH RETAINING WALL DESIGN DATA

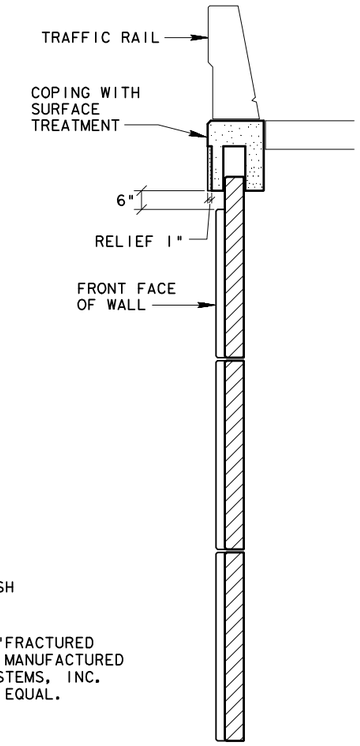
RW(MSE)DD

FILE:	rwstde16.dgn	DN: TxDOT	CK: MJG	DW: JTR	CK: MJG
©TxDOT	January 2013	CONT	SECT	JOB	HIGHWAY
REVISIONS		0110	05	126	IH 45
		DIST	COUNTY		SHEET NO.
		HOU	HARRIS		154

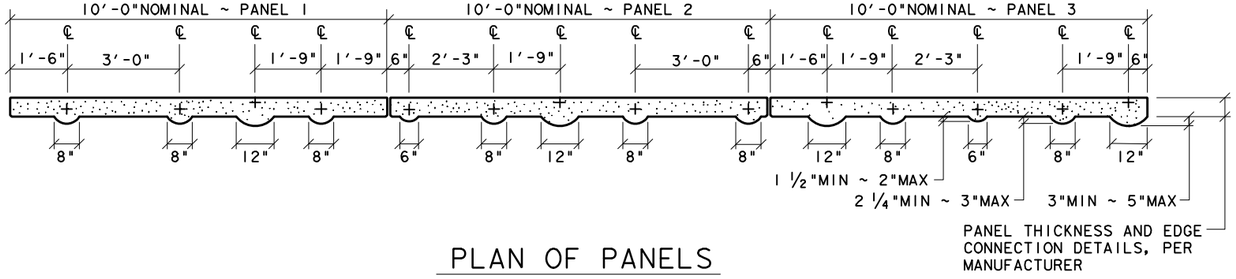
DATE:
FILE:



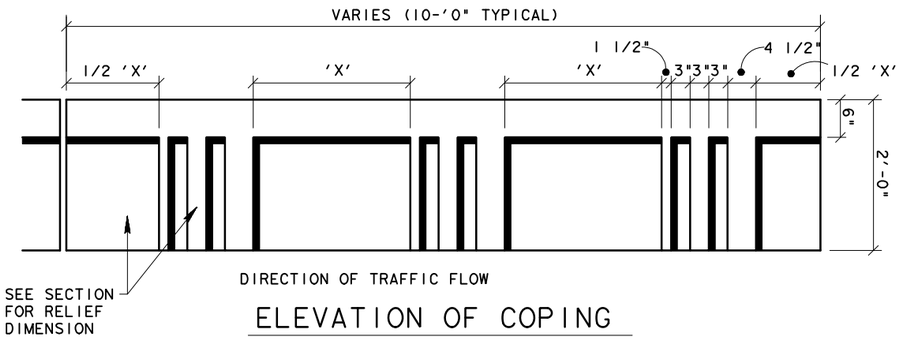
ELEVATION



SECTION



PLAN OF PANELS



ELEVATION OF COPING

NOT TO SCALE

NOTES:

1. DETAILS FOR CONSTRUCTION OF RETAINING WALLS ARE SHOWN IN THE STANDARD DRAWING " MECHANICALLY STABILIZED EARTH RETAINING WALL."
2. ITEM 427 "SURFACE FINISHES FOR CONCRETE" ARE CONSIDERED INCIDENTAL TO ITEM 423 "RETAINING WALL". SEE SHEET TITLED "SURFACE FINISHES FOR CONCRETE".
3. FORM LINER USED TO PROVIDE TEXTURE SHALL BE OF ONE PIECE CONSTRUCTION. JOINTS SHALL NOT BE PERMITTED IN FORM LINERS.
4. THE CONTRACTOR SHALL PROVIDE THE ENGINEER AND DISTRICT LANDSCAPE ARCHITECT WITH AN 18" SQUARE OR LARGER SAMPLE OF THE FRACTURED GRANITE FORM LINER FOR APPROVAL PRIOR TO MANUFACTURING RETAINING WALL PANELS.

Texas Department of Transportation
Houston District Bridge
Green Ribbon Project

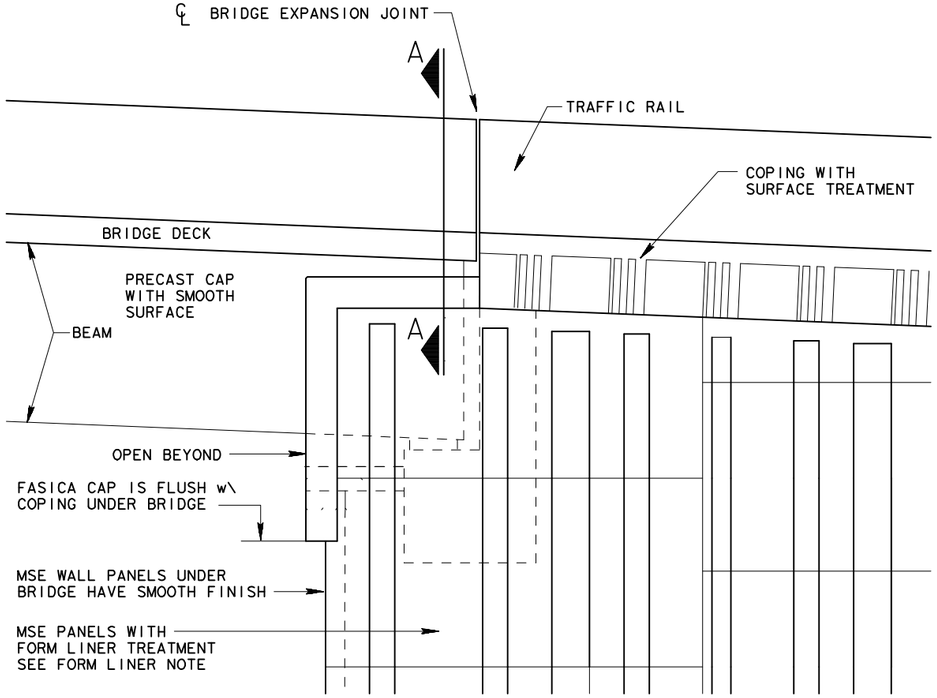
RETAINING WALL DETAILS

VERTICAL SCHEME

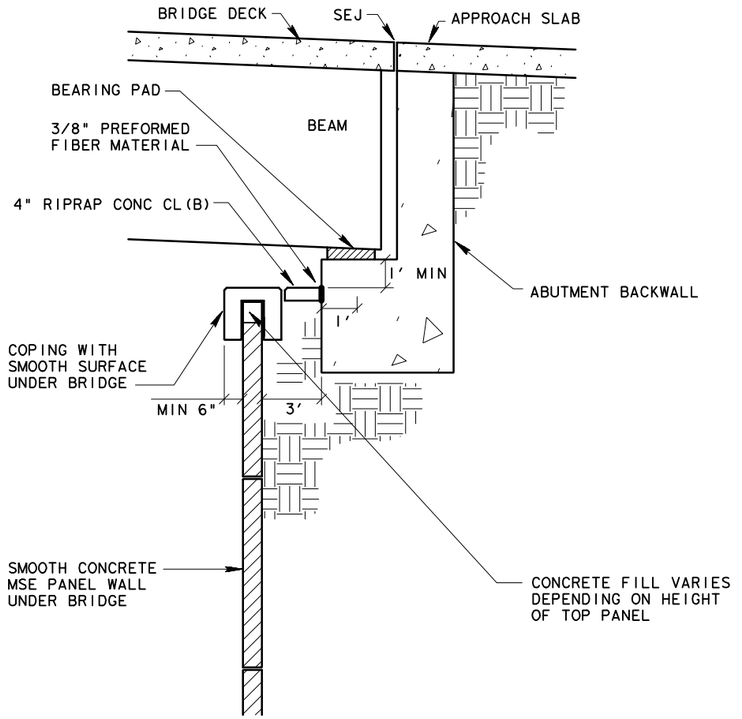
RWD-VS

FILE: STDJI.DGN	DN:	CK:	DW:	CK:	
© TxDOT DEC 2005	DISTRICT	FED REG	PROJECT NO.		SHEET
REVISIONS	HOUSTON	6			155
	COUNTY		CONTROL	SECT	JOB	HIGHWAY
	HARRIS		0110	05	126	IH 45

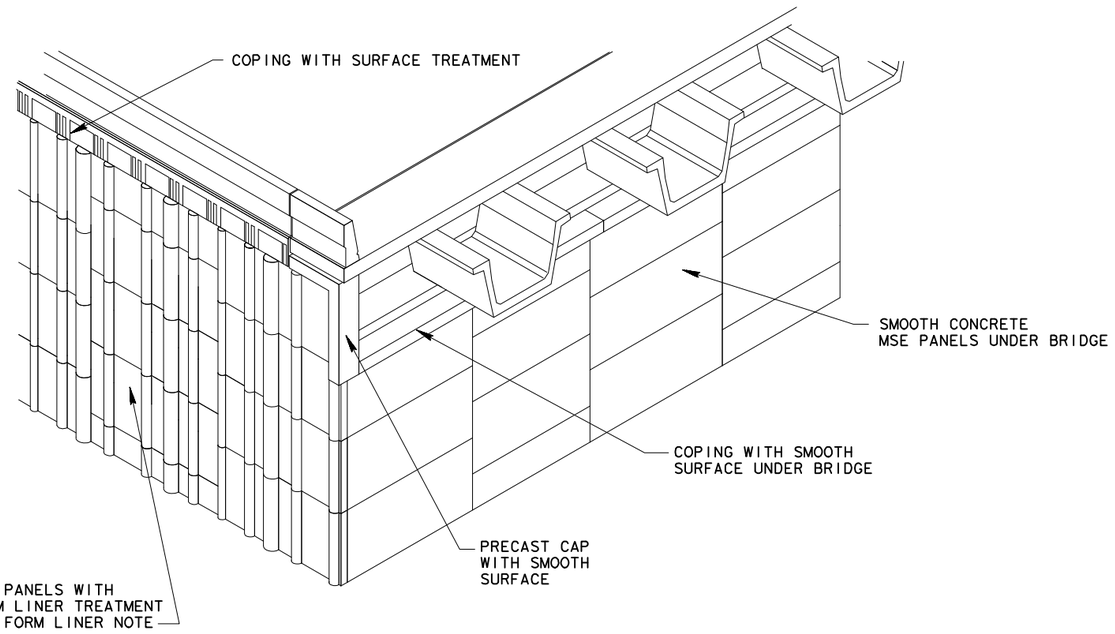
STD-JI

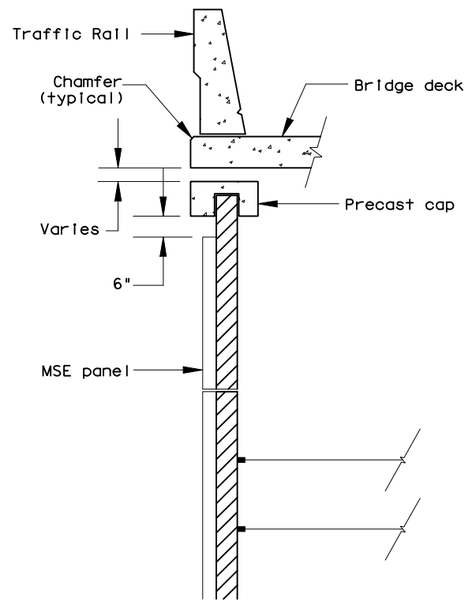


ELEVATION



TYPICAL WALL SECTION @ ABUTMENT





SECTION A-A

NOT TO SCALE

VERTICAL SCHEME: MSE Retaining Wall w/ Vertical Front Face

Texas Department of Transportation
Houston District Bridge
Green Ribbon Project

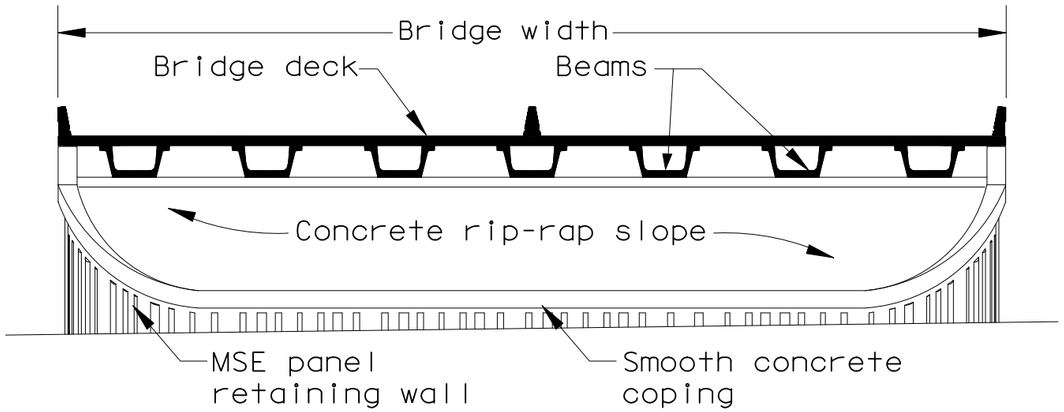
RETAINING WALL DETAILS

VERTICAL SCHEME

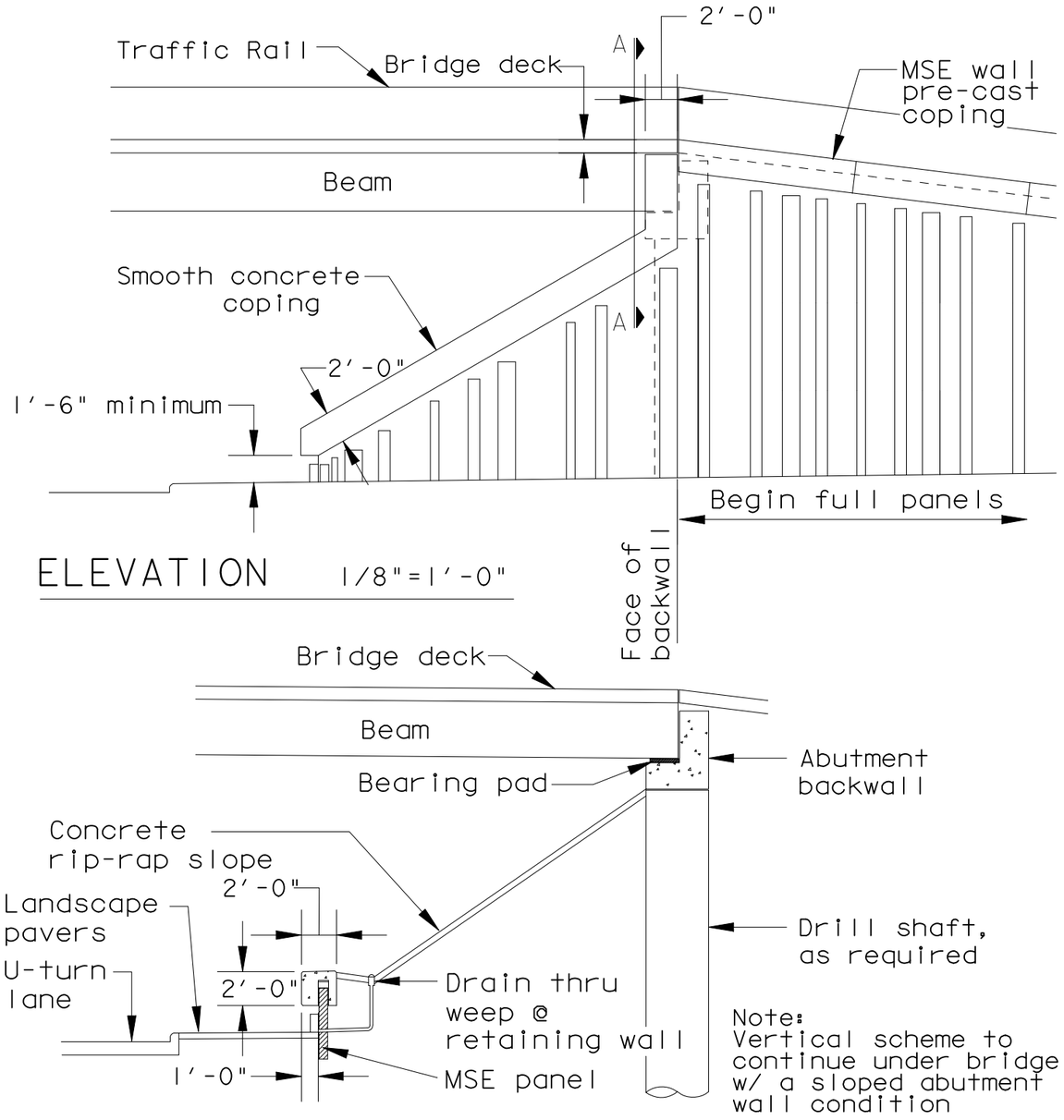
RWD-VS

FILE: STDJI.DGN	DN:	CK:	DW:	CK:	
© TxDOT DEC 2005	DISTRICT	FED REG	PROJECT NO.		SHEET
REVISIONS	HOUSTON	6			156
	COUNTY		CONTROL	SECT	JOB	HIGHWAY
	HARRIS		0110	05	126	IH 45

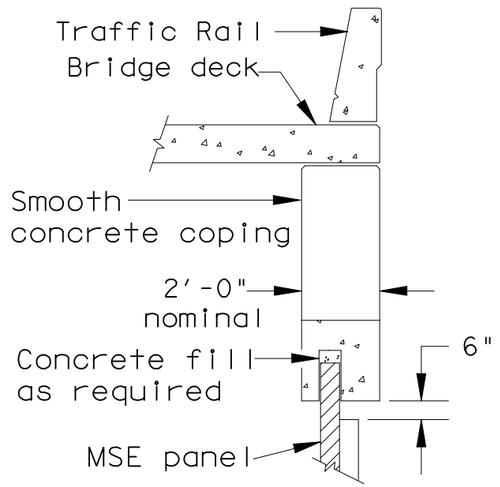
STD J-1



ELEVATION 1/16"=1'-0"



ELEVATION 1/8"=1'-0"



SECTION A-A 1/4"=1'-0"

SECTION 1/8"=1'-0"

VERTICAL SCHEME: MSE Retaining Wall w/ Sloped Rip Rap

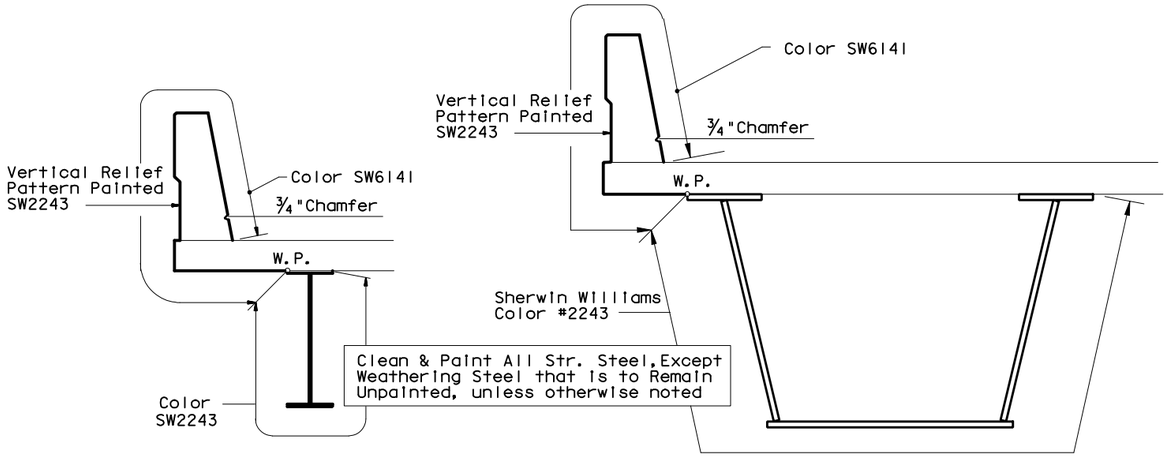
Texas Department of Transportation
Houston District Bridge
Green Ribbon Project

RETAINING WALL DETAILS
VERTICAL SCHEME

RWD-VS

FILE: STDJ1.DGN	DN:	CK:	DW:	CK:	
© TxDOT DEC 2005	DISTRICT	FED REG	PROJECT NO.		SHEET
REVISIONS	HOUSTON	6			157
	COUNTY		CONTROL	SECT	JOB	HIGHWAY
	HARRIS		0110	05	126	IH 45

VERTICAL SCHEME		SHERWIN WILLIAMS COLOR # 6141 OR EQUAL	SHERWIN WILLIAMS COLOR # 2243 OR EQUAL
MSE WALL	PANEL	X	
	COPING ACCENT		X
STRUCTURES	COLUMN	X	
	BENT CAP	X	
	BEAM		X
RAIL	MEDIAN LOCATION	X	
	EDGE LOCATION	X	X
SOUND WALL	PANEL	X	
	COPING /END COL.		X
OTHER STRUCTURES	SIGN COLUMNS	X	
	NEW RIP RAP	X	

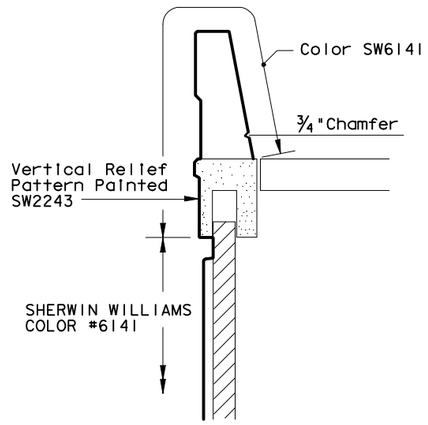


SECTION THRU BRIDGE STEEL I-BEAM

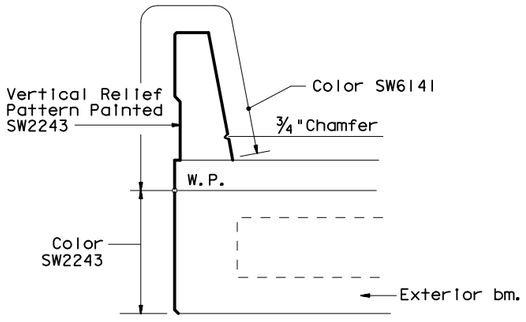
TYPICAL ALL GIRDERS, U.N.O.

SECTION THRU BRIDGE STEEL TUB-GIRDER

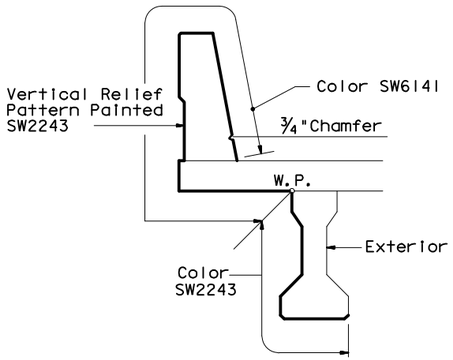
TYPICAL ALL GIRDERS, U.N.O.



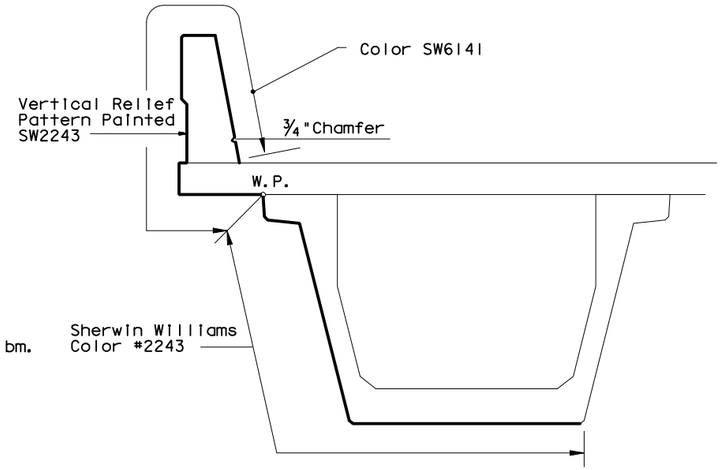
SECTION THRU RETAINING WALL



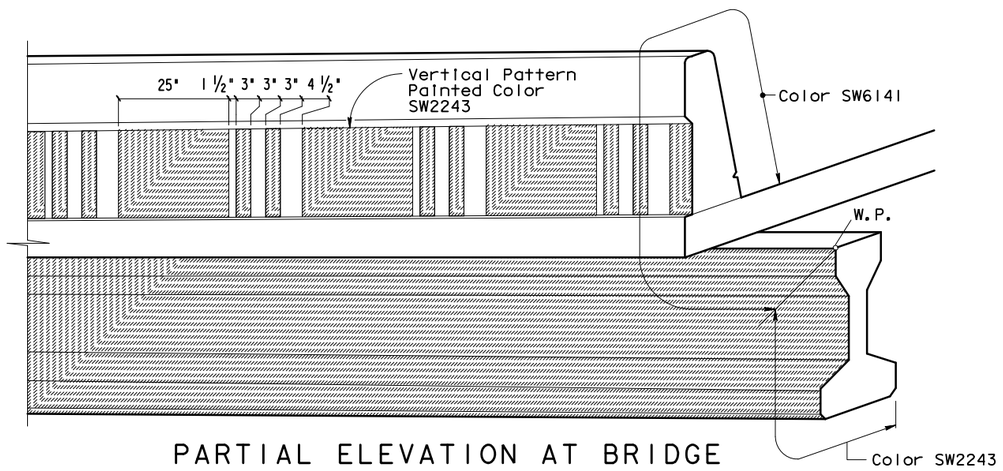
SECTION THRU BRIDGE CONC BOX BEAM



SECTION THRU BRIDGE CONC I-BEAM



SECTION THRU BRIDGE CONC U-BEAM



PARTIAL ELEVATION AT BRIDGE

TYPICAL SECTIONS

Showing dual color. All other bridge components are color SW6141 Or equal.

NOTES: Provide a Surface Area 1, Concrete Paint Finish, as per the Standard Specifications and these Details

NEW CONCRETE SURFACES

Item 427 "Surface Finishes For Concrete" will NOT be Measured or Paid for on New Concrete Surfaces: Item 427 will be Incidental to various bid items on New Concrete Surfaces.

EXISTING CONCRETE SURFACES

Item 427 "Surface Finishes For Concrete" will be Measured and Paid for on Existing Concrete Surfaces.

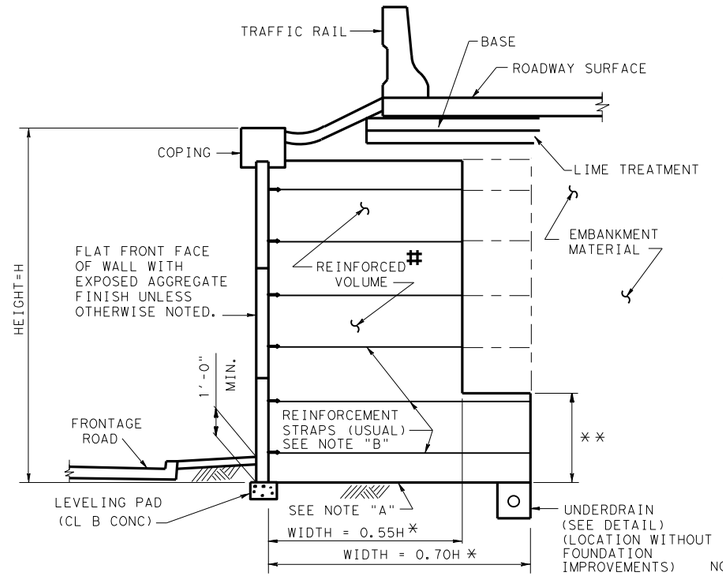
Texas Department of Transportation
Houston District Bridge
Green Ribbon Project

SURFACE FINISHES FOR CONCRETE

VERTICAL SCHEME

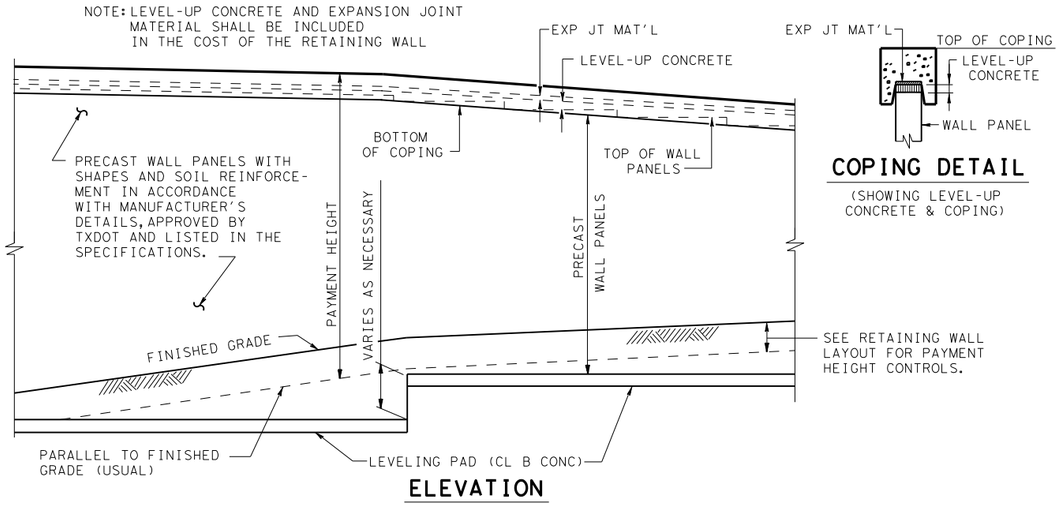
SFC-VS

FILE: STDJ9.DGN	DN:	CK:	DW:	CK:	
© TxDOT APRIL 2010	DISTRICT	FED REG	PROJECT NO.		SHEET
REVISIONS	HOUSTON	6			158
	COUNTY		CONTROL	SECT	JOB	HIGHWAY
	HARRIS		0110	05	126	IH 45



TYPICAL SECTION

(WALL AT BOTTOM OF SLOPE)



ELEVATION

COPING DETAIL

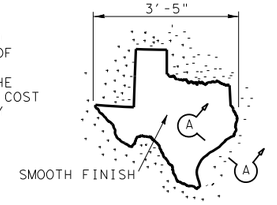
(SHOWING LEVEL-UP CONCRETE & COPING)

NOTE "A":
COMPACT THE SOIL UNDER THE LEVELING PAD AND THE REINFORCED VOLUME INCLUDING A MINIMUM OF TWO (2) FEET IN FRONT OF THE LEVELING PAD TO A MINIMUM OF 98% OF THE MAXIMUM DRY DENSITY, AS PRESENTED IN TEST METHOD TEX-114-E. THE DENSITY TESTING OF THE SOIL WILL BE OUTLINED IN TEST METHOD TEX-115-E. COST OF THIS COMPACTION WILL NOT BE PAID FOR DIRECTLY BUT IS INCIDENTAL TO THE UNIT PRICE BID FOR BID FOR "RETAINING WALL."

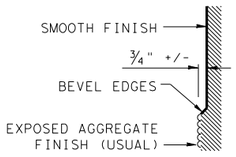
NOTE "B":
WHEN BACKFILL DOES NOT COMPLY WITH pH AND RESISTIVITY REQUIREMENTS, USE EPOXY COATED METALLIC REINFORCEMENTS. ALSO EPOXY COAT CONNECTION HARDWARE USED WITH EPOXY COATED REINFORCEMENTS. USE EPOXY CONFORMING TO THE REQUIREMENTS OF THE ITEM, "EPOXY." THIS WORK WILL NOT BE PAID FOR DIRECTLY, BUT IS CONSIDERED INCIDENTAL TO THE UNIT PRICE BID FOR "RETAINING WALL".

* THE CONTRACTOR HAS THE OPTION OF PROVIDING A REINFORCED VOLUME WITH TWO DIFFERENT WIDTHS (0.55H BUT NOT LESS THAN SIX FEET AND 0.70H BUT NOT LESS THAN EIGHT FEET), OR WITH A CONSTANT WIDTH EQUAL TO 0.70H BUT NOT LESS THAN EIGHT FEET AS SHOWN.

** 3 IN. MINIMUM ABOVE THE SECOND COURSE OF SOIL REINFORCEMENTS, BUT NO LESS THAN 4 FEET.



ELEVATION

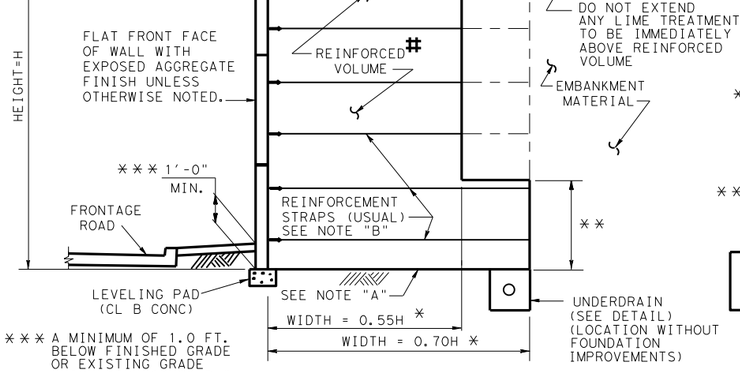


SECTION A-A

MAP OF TEXAS EMBLEM

(FOR NON - GREEN RIBBON PROJECTS ONLY)

FORM MAP OF TEXAS EMBLEM INTO A WALL PANEL NEXT TO EACH BRIDGE ABUTMENT. PLACE THE EXACT LOCATION OF EACH EMBLEM AS APPROVED BY THE ENGINEER. THE COST OF FORMING THE EMBLEMS WILL NOT BE PAID FOR DIRECTLY, BUT IS CONSIDERED INCIDENTAL TO THE UNIT PRICE BID FOR "RETAINING WALL".

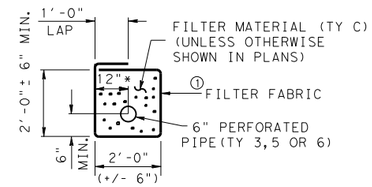


*** A MINIMUM OF 1.0 FT. BELOW FINISHED GRADE OR EXISTING GRADE WHICHEVER IS LOWER."

TYPICAL SECTION

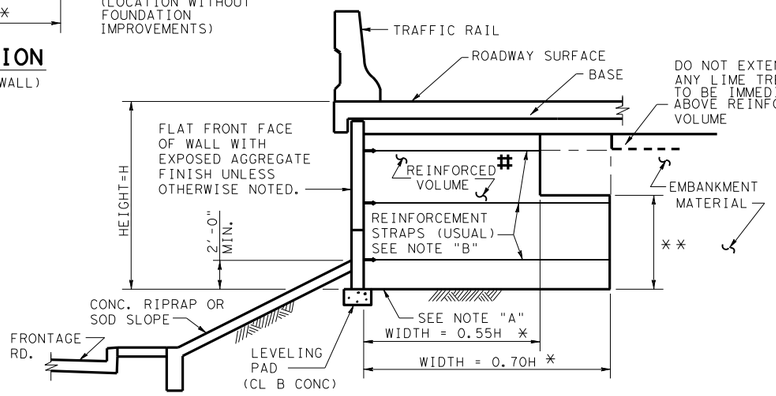
(SHOWING ROADWAY ON WALL)

① FILTER FABRIC MEETING THE REQUIREMENTS OF DMS-6200 TYPE 1.



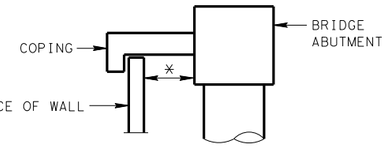
UNDERDRAIN DETAIL

 # CEMENT STABILIZED BACKFILL REINFORCED VOLUME TO BE PAID AS ITEM 132-6006 EMBANKMENT (FINAL) (DENS CONT) (TY C)



TYPICAL SECTION

(WALL AT TOP OF SLOPE)



* 2' MINIMUM AND 3' DESIRABLE EDGE DISTANCE FROM BACK OF PANEL TO FRONT OF ABUTMENT.

TYPICAL SECTION

(WALL AT ABUTMENT)

CORROSION CRITERIA

DESIGN THE EARTH REINFORCEMENT ELEMENTS TO HAVE A CORROSION RESISTANCE DURABILITY TO ENSURE A MINIMUM DESIGN LIFE OF 75 YEARS. COMPUTE THE MAXIMUM LOSS PER SIDE DUE TO CORROSION BY ASSUMING A UNIFORM LOSS MODEL BASED ON THE FOLLOWING:

ZINC CORROSION RATE (FIRST 2 YEARS) - 15 UM/YR.
ZINC CORROSION RATE (SUBSEQUENT YEARS) - 4 UM/YR.
CARBON STEEL CORROSION RATE - 12 UM/YR.

PERFORM STRESS AND PULLOUT CALCULATIONS ON THE CALCULATED EARTH REINFORCEMENT SECTION REMAINING AFTER 75 YEARS.

NOTES

RAILING AND ROADWAY SLAB ARE PAID FOR UNDER THE APPROPRIATE ROADWAY ITEMS. MODIFICATIONS TO THE RAIL OR ROADWAY SLAB TO FORM COPING ARE CONSIDERED INCIDENTAL TO THE SQUARE FOOT COST OF THE BID ITEM, "RETAINING WALL".

PLACE THE UPPERMOST REINFORCEMENT STRAPS NO MORE THAN 3.5' BELOW THE TOP OF THE WALL. PLACE THE LOWEST LEVEL OF REINFORCEMENT STRAPS NO MORE THAN 2.0' ABOVE THE TOP OF THE LEVELING PAD.

PROVIDE UNDERDRAINS ONLY AT LOCATIONS SHOWN ON THE PLANS. INCLUDE THE COST OF FURNISHING AND INSTALLING UNDERDRAINS IN THE UNIT PRICE BID FOR "RETAINING WALL."

THE REINFORCED VOLUME CONSISTS OF CEMENT STABILIZED BACKFILL IN ACCORDANCE WITH ITEM 132 AND HOUSTON DISTRICT SPECIAL PROVISION (132-001).

PAYMENT HEIGHT SHOWN IN RETAINING WALL LAYOUTS IS CONSIDERED THE MINIMUM HEIGHT TO BE FURNISHED. ADDITIONAL WALL FURNISHED BELOW PAYMENT LINE DUE TO DETAILING OR FABRICATOR DESIGN REQUIREMENTS WILL NOT BE PAID FOR DIRECTLY BUT SHALL BE CONSIDERED INCIDENTAL.

THE CONTRACTOR MAY USE A DIFFERENT TYPE OF TRAFFIC RAIL AND COPING ON RETAINING WALLS IF THE DESIGN AND DETAILS ARE APPROVED BY THE ENGINEER.

WHEN OBSTRUCTIONS (INLETS, DRILLED SHAFTS, PILING, ETC.) PREVENT PLACEMENT OF SOIL REINFORCEMENTS IN THEIR NORMAL LOCATIONS, PROVIDE DETAILS AND CALCULATIONS THAT ESTABLISH SUPPORT FOR THE AFFECTED PANELS. FURNISH THE SAME STEEL AREA OF SOIL REINFORCEMENTS AS THAT REQUIRED IN THE ABSENCE OF THE OBSTRUCTION. PROVIDE CALCULATIONS THAT JUSTIFY ANY ALTERATIONS MADE TO THE SOIL REINFORCEMENTS OR MODIFICATIONS TO THEIR NORMAL PLACEMENT. DO NOT USE PANELS WITHOUT ANY SOIL REINFORCEMENTS CONNECTED TO THEM UNLESS THEY ARE CONNECTED WITH GALVANIZED HARDWARE TO ADJACENT PANELS WHICH DO HAVE SUPPORTING SOIL REINFORCEMENTS ATTACHED TO THEM AND AS APPROVED BY THE ENGINEER.

DESIGN PARAMETERS

BASE RETAINING WALL DESIGN ON THE FOLLOWING DESIGN PATTERNS:

EMBANKMENT MATERIAL (BEHIND CEMENT STABILIZED BACKFILL)	UNIT WEIGHT - 125 PCF ø = 30°C = 0 PSF KA = 0.333
CEMENT STABILIZED BACKFILL	UNIT WEIGHT = 125 PCF ø = 45°C = 0 PSF

ALLOWABLE STRESSES IN STEEL AND CONCRETE ARE IN ACCORDANCE WITH CURRENT A.A.S.H.T.O. AND INTERIM SPECIFICATIONS.

THE MINIMUM LENGTH OF REINFORCEMENT STRAPS FOR A 0.55H STEP WALL IS SIX FEET AND FOR A 0.70H WALL IS EIGHT FEET.

EXTERNAL STABILITY CRITERIA

PROVIDE A FACTOR OF SAFETY IN SLIDING ALONG THE BASE OF THE STRUCTURE OF GREATER THAN OR EQUAL TO 1.5.

PROVIDE A FACTOR OF SAFETY IN OVERTURNING OF GREATER THAN OR EQUAL TO 2.0.

THE MAXIMUM ALLOWABLE BEARING PRESSURE IS ½ THE ULTIMATE BEARING CAPACITY OF THE FOUNDATION.

THE WIDTHS SHOWN HEREIN ARE CONSIDERED MINIMUM UNLESS A LARGER WIDTH IS SPECIFIED ON THE WALL PLANS OR REQUIRED BY THE FABRICATOR'S DETAILS.

ENSURE THE BASE PRESSURE RESULTANT FALLS WITHIN THE MIDDLE THIRD OF THE RETAINING WALL.

PROVIDE A FACTOR OF SAFETY AGAINST PULLOUT OF THE EARTH REINFORCEMENTS OF GREATER THAN OR EQUAL TO 1.5 AT EACH LEVEL. DETERMINE PULLOUT RESISTANCE FROM TEST DATA EVALUATED AT ¾ INCH STRAIN.

Texas Department of Transportation
Houston District

MECHANICALLY STABILIZED RETAINING WALL

CEMENT STABILIZED BACKFILL

MSRW-CSB

FILE: STDJ4.DGN	DN:	CK:	DW:	CK:	
© TxDOT 2014	DIST	FED REG	PROJECT NO.		SHEET
MAR 2015 - 2014 SPECS	HOU	6			158A
		CONTROL	SECT	JOB	HIGHWAY
		0110	05	126	IH 45

DRILLING LOG

WinCore Version 3.3

County	Harris	Hole	B-1	District	Houston
Highway	IH-45	Structure	Bridge	Date	6/4/2020
CSJ	0110-05-126	Station	896+56	Grnd. Elev.	96.50 ft
		Offset	14.69 RT	GW Elev.	80.50 ft

Elev. (ft)	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	LL	PI	Wet Den. (pcf)	Additional Remarks
		CLAY, lean, with sand, stiff, tan and reddish brown, with sand pockets (CL)			15	36	21		#200(%)-75; HP-4.5
	14 (6) 16 (6)								
5					12			141	-w/ calcareous nodules 5' to7' HP-4.5
89.5									
	25 (6) 28 (6)	CLAY, lean, sandy, very stiff, tan and reddish brown, with sand pockets (SC)			11	30	16		#200(%)-65; HP-4.5
10									-w/silt seams 10' to 12' 4-4-5; N=9
84.5									
	22 (6) 36 (6)	CLAY, lean, with sand, very stiff, tan and reddish brown, with sand pockets (CL)							#200(%)-77; HP-4.5
81. 15		SILT, sandy, dense, tan (ML)							-15-min GW=16' 6-10-9; N=19
	42 (6) 50 (5)								9-12-12; N=24
20					15	0	0		#200(%)-56; 8-9-12; N=21
73.5	10 (6) 10 (6)	SILT, sandy, loose to slightly compact, tan, with clay pockets (ML)							-Initial GW=25' 4-6-9; N=15
25									
68.5	7 (6) 10 (6)	CLAY, fat, soft to stiff, tan, with sand pockets (CH)							
30			0	25	20			131	HP-2.0
	11 (6) 12 (6)								
35					36	55	33		-redd. brw. 35' to 40' #200(%)-98; HP-3.5
	13 (6) 15 (6)								
40									HP-3.5
	9 (6) 12 (6)								
45									-redd. brw. 45' to 48' HP-4.0
48.5	12 (6) 13 (6)	CLAY, lean, stiff, tan, with sand pockets (CL)							
50					17	40	27		#200(%)-92; HP-2.5
43.5	11 (6) 12 (6)	CLAY, fat, stiff, tan and reddish brown, with sand pockets and calcareous nodules (CH)							
55									HP-3.5
38.5	50 (5) 49 (6)	CLAY, fat, hard, reddish brown, with sand pockets and slickensides (CH)							-w/ cal. nodules 58' to 65'
60									

Remarks: Pavement consisted of about 10 1/2 inches of concrete underlain by about 1 inch of asphaltic concrete and 1 inch of concrete. Dry drilled to 25 feet, wet rotary thereafter. Approximate GPS coordinates: 30.03622, -95.42969. Groundwater was observed at a depth of about 25 ft while drilling and about 16 ft after 15 minutes. The GW Elev. above was based on the 15-min water reading.

Any ground water elevation information provided on this boring log is representative of conditions existing on the day and for the specific location where this information was collected. The actual groundwater elevation may fluctuate due to time, climatic conditions, and/or construction activity.

Driller: M. Johnson **Logger:** H. Zamudio **Organization:** Terracon Consultants, Inc.

N:\Projects\2020\92205026\Working Files\Laboratory-Field Data-Boring Logs\Wincore\B1-B3.CLG

DRILLING LOG

WinCore Version 3.3

County	Harris	Hole	B-1	District	Houston
Highway	IH-45	Structure	Bridge	Date	6/4/2020
CSJ	0110-05-126	Station	896+56	Grnd. Elev.	96.50 ft
		Offset	14.69 RT	GW Elev.	80.50 ft

Elev. (ft)	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	LL	PI	Wet Den. (pcf)	Additional Remarks
		CLAY, fat, hard, reddish brown, with sand pockets and slickensides (CH)							HP-4.5
	50 (3.5) 50 (6)								
65					37	46.9			
					22	66	44	127	#200(%)-99; HP-4.5
	40 (6) 50 (3)								
70									HP-4.5
23.5	24 (6) 26 (6)	CLAY, fat, very stiff, reddish brown, with sand pockets and slickensides (CH)							
75					41	31.1			
					27			124	HP-3.0
18.5	12 (6) 12 (6)	SAND, silty, slightly compact, reddish brown, with clay pockets (SM)							
80					17				#200(%)-14; 11-18-28; N=46
13.5	50 (3.5) 50 (2.5)	SAND, silty, dense, reddish brown, with clay pockets (SM)							
85									16-20-24; N=44
	50 (6) 42 (6)								
90					18				#200(%)-13; 18-28-40; N=68
3.5	50 (3) 50 (1.5)	SAND, silty, very dense, reddish brown, with clay pockets (SM)							
95									40-50/5"; N-50/5"
	50 (1.5) 50 (0.5)								
-3.5 100									
105									
110									
115									
120									

Remarks: Pavement consisted of about 10 1/2 inches of concrete underlain by about 1 inch of asphaltic concrete and 1 inch of concrete. Dry drilled to 25 feet, wet rotary thereafter. Approximate GPS coordinates: 30.03622, -95.42969. Groundwater was observed at a depth of about 25 ft while drilling and about 16 ft after 15 minutes. The GW Elev. above was based on the 15-min water reading.

Any ground water elevation information provided on this boring log is representative of conditions existing on the day and for the specific location where this information was collected. The actual groundwater elevation may fluctuate due to time, climatic conditions, and/or construction activity.

Driller: M. Johnson **Logger:** H. Zamudio **Organization:** Terracon Consultants, Inc.

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Beecher, Patrick
Oct 20 2021 4:38 PM

STATE OF TEXAS
PATRICK M. BEECHER
90858
LICENSED
PROFESSIONAL ENGINEER
10/20/2021

Terracon

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IH 45
SB FRONTAGE RD

BORING LOGS DATA

SHEET 1 OF 3

FED. RD. DIV. NO.	STATE	PROJECT NO.			HIGHWAY NO.
6	TEXAS				IH 45
STATE DISTRICT	COUNTY	CONTROL NO.	SECTION NO.	JOB NO.	SHEET NO.
HOU	HARRIS	0110	05	126	159

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DRILLING LOG

WinCore Version 3.3

County	Harris	Hole	B-2	District	Houston
Highway	IH-45	Structure	Bridge	Date	10/26/2020
CSJ	0110-05-126	Station	895+04	Grnd. Elev.	85.20 ft
		Offset	8.33 LT	GW Elev.	78.20 ft

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test Lateral Press. (psi)	Triaxial Test Deviator Stress (psi)	Properties MC	LL	PI	Wet Den. (pcf)	Additional Remarks
			SAND, clayey, slightly compact, tan, with clay pockets (SC)							- w/ shell fragments 0' to 2'
		12 (6) 16 (6)				11.6				3-10-11; N=21 #200(%)-44; 6-5-4; N=9
79.7										
5			SAND, silty, compact to dense, tan (SM)							- w/ clay pockets 5' to 7' 5-7-9; N=16 - 5-min GW = 7' cave in
		20 (6) 28 (6)								5-10-12; N=22 -initial GW=10'
10						18				#200(%)-49; 12-10-13; N=23
		50 (6) 50 (6)								9-11-16; N=27
15										13-11-8; N=19
68.2			SILT, sandy, dense to very dense, tan, with clay pockets (ML)							13-16-18; N=34
20		50 (6) 50 (2)				19				#200(%)-58; 47-14-13; N=27
		50 (0.75) 50 (0.25)								6-8-10; N=18
25										
57.2		10 (6) 11 (6)	CLAY, fat, w/ sand, soft to stiff, tan and light gray, with slickensides (CH)			24				#200(%)-81; 4-7-8; N=15
30		9 (6) 9 (6)		17.5	28	27	62	42	130	HP-4.5
35										
48.2		10 (6) 10 (6)	CLAY, lean, soft to stiff, reddish brown and light gray, with slickensides (CL)							HP-4.5
40										
		12 (6) 12 (6)								HP-4.5
45										
		16 (6) 17 (6)		23.5	43	18	49	34	134	HP-4.5 - w/ cal. nodules 47' to 62'
50										
32.2		28 (6) 36 (6)	CLAY, fat, very stiff to hard, reddish brown and light gray, with slickensides (CH)							HP-4.5 - w/ cemented seams 53' to 62'
55										
		50 (3) 50 (5.5)								HP-3.0
60										

Remarks: Dry drilled to 12 feet, wet rotary thereafter. Approximate GPS coordinates: 30.03587, -95.42974. Groundwater was observed at a depth of about 10 ft while drilling and the soils caved in at a depth of about 7 after 5 minutes. The GW Elev. above was based on the cave-in depth observed.

Any ground water elevation information provided on this boring log is representative of conditions existing on the day and for the specific location where this information was collected. The actual groundwater elevation may fluctuate due to time, climatic conditions, and/or construction activity.

Driller: M. Johnson **Logger: C. Ramirez** **Organization: Terracon Consultants, Inc.**

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DRILLING LOG

WinCore Version 3.3

County	Harris	Hole	B-2	District	Houston
Highway	IH-45	Structure	Bridge	Date	10/26/2020
CSJ	0110-05-126	Station	895+04	Grnd. Elev.	85.20 ft
		Offset	8.33 LT	GW Elev.	78.20 ft

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test Lateral Press. (psi)	Triaxial Test Deviator Stress (psi)	Properties MC	LL	PI	Wet Den. (pcf)	Additional Remarks
		24 (6) 18 (6)	CLAY, fat, very stiff to hard, reddish brown and light gray, with slickensides (CH)			29	67	43	126	HP-4.5
65										
18.2		11 (6) 9 (6)	CLAY, fat, soft, reddish brown and light gray, with slickensides (CH)							HP-2.5
70										
13.2		50 (4) 50 (3.5)	SAND, poorly graded, with silt, dense to very dense, reddish brown and tan (SP-SM)			18				#200(%)-12; 16-24-32; N=56
75										13-22-31; N=53
		43 (6) 50 (4)								8-22-30; N=52
80										
		50 (1) 50 (0.25)				20				#200(%)-9
85										41-46-50/5"; N=96/11"
		50 (4) 50 (2.5)								24-41-49; N=90
90										
		50 (3) 50 (3)				17				#200(%)-12; 16-23-29; N=52
95										
		50 (3) 50 (1.5)								
-14.8	100									
105										
110										
115										
120										

Remarks: Dry drilled to 12 feet, wet rotary thereafter. Approximate GPS coordinates: 30.03587, -95.42974. Groundwater was observed at a depth of about 10 ft while drilling and the soils caved in at a depth of about 7 after 5 minutes. The GW Elev. above was based on the cave-in depth observed.

Any ground water elevation information provided on this boring log is representative of conditions existing on the day and for the specific location where this information was collected. The actual groundwater elevation may fluctuate due to time, climatic conditions, and/or construction activity.

Driller: M. Johnson **Logger: C. Ramirez** **Organization: Terracon Consultants, Inc.**

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Beecher, Patrick
Oct 20 2021 4:38 PM

STATE OF TEXAS
PATRICK M. BEECHER
90858
LICENSED
PROFESSIONAL ENGINEER

10/20/2021

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IH 45
SB FRONTAGE RD

BORING LOGS DATA

SHEET 2 OF 3

FED. RD. DIV. NO.	STATE	PROJECT NO.			HIGHWAY NO.
6	TEXAS				IH 45
STATE DISTRICT	COUNTY	CONTROL NO.	SECTION NO.	JOB NO.	SHEET NO.
HOU	HARRIS	0110	05	126	160

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DRILLING LOG

WinCore Version 3.3

County	Harris	Hole	B-3	District	Houston
Highway	IH-45	Structure	Bridge	Date	6/8/2020
CSJ	0110-05-126	Station	891+92	Grnd. Elev.	96.40 ft
		Offset	15.46 RT	GW Elev.	68.90 ft

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	LL	PI	Wet Den. (pcf)	Additional Remarks
			CLAY, lean, with sand, very soft, dark gray, with sand pockets (CL)			14	39	25		#200(%)-77; HP-3.5
		2 (6) 2 (6)								-w/ calcareous nodules 5' to7'
90.9	5		CLAY, lean, with sand, stiff, dark gray, with sand pockets (CL)			19	34	20		#200(%)-63; HP-4.5
		14 (6) 18 (6)				14			137	#200(%)-72; HP-4.5
	10									HP-2.5
84.4			SILT, sandy, compact, tan, with clay pockets (ML)							10-19-18; N=37
	15	29 (6) 31 (6)								13-14-14; N=28
78.4		46 (6) 50 (5)	SILT, sandy, dense, tan (ML)			8	0	0		#200(%)-51; 12-16-15; N=31
	20									15-16-15; N=31
73.4		21 (6) 18 (6)	SAND, silty, slightly compact, tan (SM)							
	25					18				#200(%)-35; 7-8-10; N=18
		12 (6) 14 (6)								-Initial GW=28'; 15-min=27.5'
	30									4-6-10; N=16
63.4		10 (6) 15 (6)	CLAY, lean, with sand, stiff, tan and reddish brown, with snad seams (CL)							
	35					24	29	12		#200(%)-76; 2-3-5; N=8
58.4		13 (6) 10 (6)	CLAY, fat, stiff, reddish brown, with sand pockets (CH)							
	40									5-7-8; N=15
		10 (6) 11 (6)								
	45			0	38.5	24			128	HP-3.75
		12 (6) 13 (6)								
	50									HP-4.25
43.4		13 (6) 17 (6)	CLAY, lean, stiff, reddish brown, with sand pockets (CL)							
	55					15	45	31		#200(%)-91; HP-4.0
38.4		18 (6) 23 (6)	CLAY, fat, stiff to very stiff, reddish brown, with slickensides (CH)							
	60									-w/ cal. nodules 60' to 65'

Remarks: Pavement consisted of about 10 1/2 inches of concrete underlain by about 1 inch of asphaltic concrete and 6 1/2 inches of concrete. Dry drilled to 32 feet, wet rotary thereafter. Approximate GPS coordinates: 30.03503, -95.42965. Groundwater was observed at a depth of about 28 ft while drilling and about 27 1/2 ft after 15 minutes. The GW Elev. above was based on the 15-min water reading.

Any ground water elevation information provided on this boring log is representative of conditions existing on the day and for the specific location where this information was collected. The actual groundwater elevation may fluctuate due to time, climatic conditions, and/or construction activity.

Driller: M. Johnson Logger: H. Zamudio Organization: Terracon Consultants, Inc.

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DRILLING LOG

WinCore Version 3.3

County	Harris	Hole	B-3	District	Houston
Highway	IH-45	Structure	Bridge	Date	6/8/2020
CSJ	0110-05-126	Station	891+92	Grnd. Elev.	96.40 ft
		Offset	15.46 RT	GW Elev.	68.90 ft

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	LL	PI	Wet Den. (pcf)	Additional Remarks
			CLAY, fat, stiff to very stiff, reddish brown, with slickensides (CH)							HP-4.5
		19 (6) 21 (6)								
	65					23	66	44	130	#200(%)-98; HP-4.5
		25 (6) 25 (6)								
	70									HP-4.0
		19 (6) 22 (6)								
	75									HP-4.5
18.4		14 (6) 13 (6)	CLAY, fat, stiff, reddish brown, with sand pockets and slickensides (CH)							
	80			44	42.8	26	73	50	124	#200(%)-90; HP-4.25
13.4		12 (6) 14 (6)	SAND, silty, slightly compact, reddish brown, with clay pockets (SM)							
	85									10-13-21; N=34
8.4		50 (4) 50 (2)	SAND, poorly graded, with silt, dense, reddish brown (SP-SM)							
	90					17				#200(%)-12; 18-37-50/5" N=87/11"
		50 (3) 50 (2)								
	95									20-27-36; N=63
		48 (6) 50 (4)								
-3.6	100									
	105									
	110									
	115									
	120									

Remarks: Pavement consisted of about 10 1/2 inches of concrete underlain by about 1 inch of asphaltic concrete and 6 1/2 inches of concrete. Dry drilled to 32 feet, wet rotary thereafter. Approximate GPS coordinates: 30.03503, -95.42965. Groundwater was observed at a depth of about 28 ft while drilling and about 27 1/2 ft after 15 minutes. The GW Elev. above was based on the 15-min water reading.

Any ground water elevation information provided on this boring log is representative of conditions existing on the day and for the specific location where this information was collected. The actual groundwater elevation may fluctuate due to time, climatic conditions, and/or construction activity.

Driller: M. Johnson Logger: H. Zamudio Organization: Terracon Consultants, Inc.

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STATE OF TEXAS
PATRICK M. BEECHER
90858
LICENSED PROFESSIONAL ENGINEER

10/20/2021

Terracon

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IH 45
SB FRONTAGE RD

BORING LOGS DATA

SHEET 3 OF 3

FED. RD. DIV. NO.	STATE	PROJECT NO.			HIGHWAY NO.
6	TEXAS				IH 45
STATE DISTRICT	COUNTY	CONTROL NO.	SECTION NO.	JOB NO.	SHEET NO.
HOU	HARRIS	0110	05	126	161

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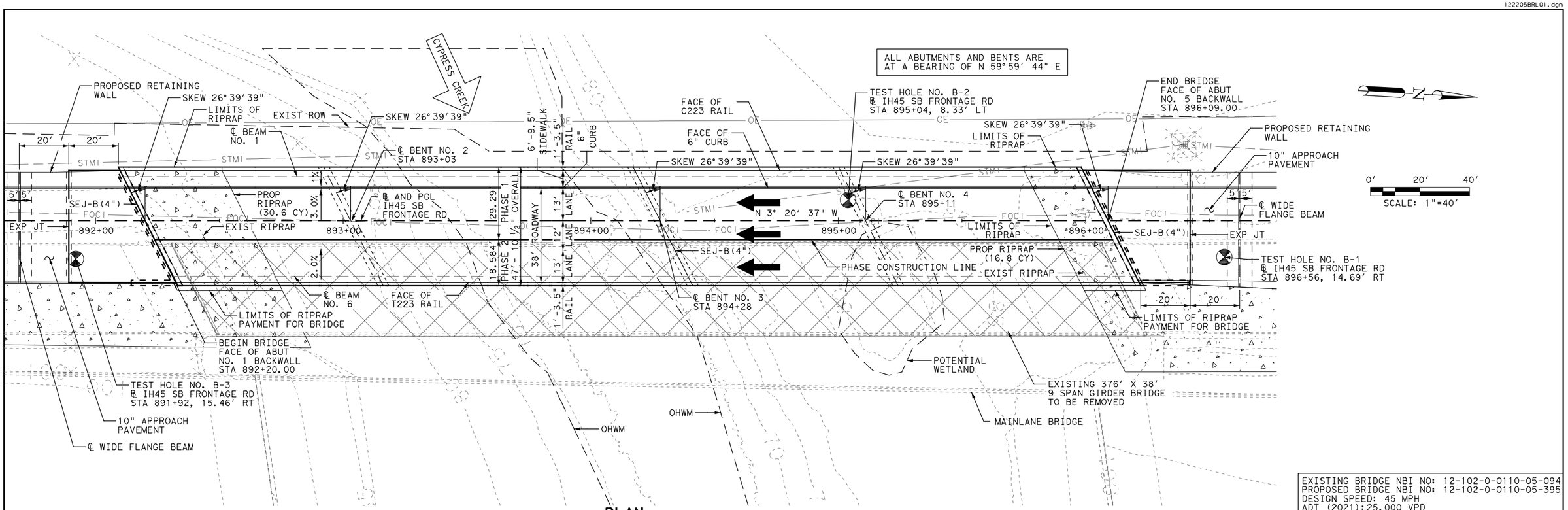
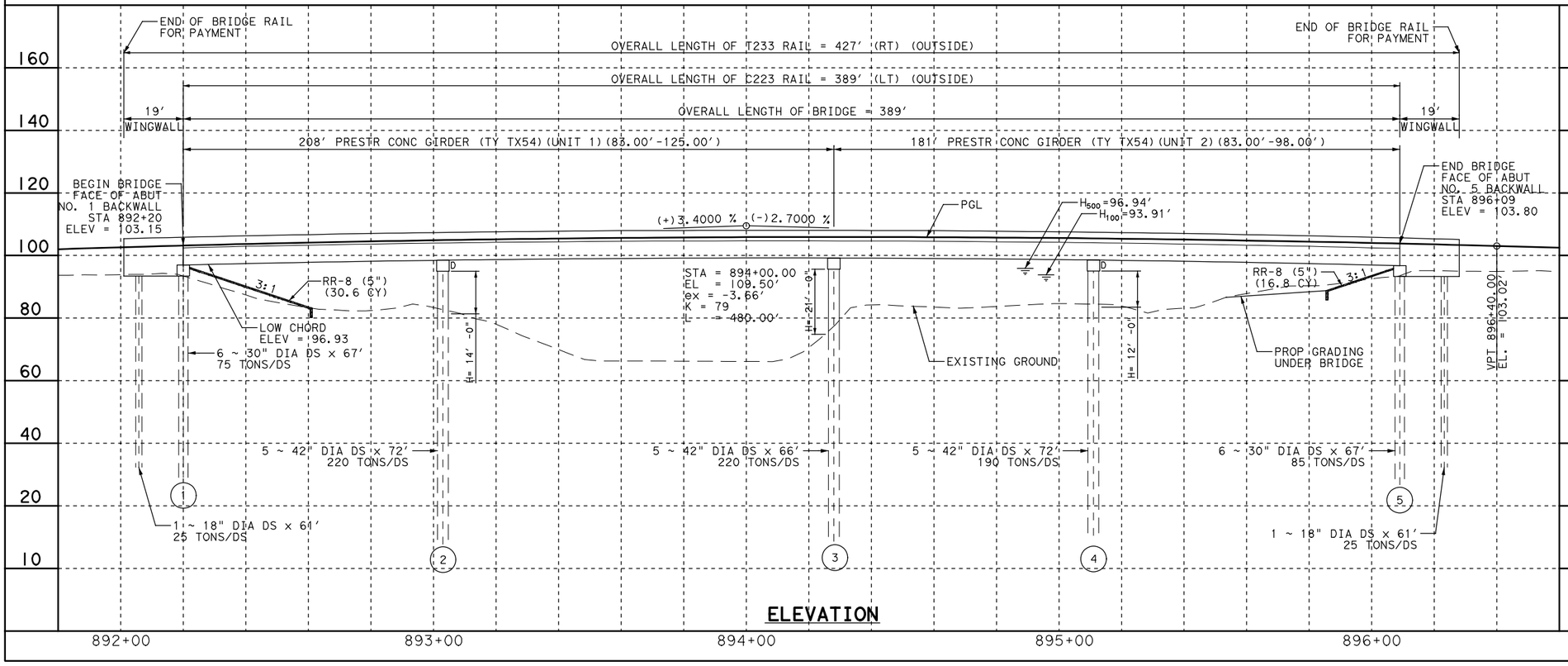


PLAN

EXISTING BRIDGE NBI NO: 12-102-0-0110-05-094
PROPOSED BRIDGE NBI NO: 12-102-0-0110-05-395
DESIGN SPEED: 45 MPH
ADT (2021):25,000 VPD
ADT (2041):34,300 VPD
FUNCTIONAL CLASS: MAJOR COLLECTOR



ELEVATION

HAYDEN CONSULTANTS, INC.
F-00640
STATE OF TEXAS
MOLLY MAUS
125260
LICENSED PROFESSIONAL ENGINEER
9/24/2021

REV	DATE	BY	DESCRIPTION

HAYDEN CONSULTANTS, INC. A GEI Company
5646 MILTON STREET, SUITE 500
DALLAS, TX 75206
PHONE 214.753.8100
FIRM REGISTRATION NO. 00640
WWW.HAYDENCONSULTANTS.COM

Texas Department of Transportation®

IH 45 SB FRONTAGE RD AT CYPRESS CREEK

BRIDGE LAYOUT

SCALE: 1"=40' SHEET 1 OF 1

DESIGNED	FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
HCI	6		IH 45
DRAWN	STATE	COUNTY	SHEET NO.
HCI	TEXAS	HARRIS	162
CHECKED	DISTRICT	JOB	
HCI	12	126	
APPROVED	CONTROL	SECTION	
HCI	0110	05	

USER: cmcdermott
DATE: 9/24/2021
SCALE: 1:40
FILE: Z:\Projects\122205 LJA_TxDOT Civil Engineering_Contract No. 36-21DP5058\122205 IH 45 SB Frontage Road\DGN\Shf\122205BRL01.dgn
PLOT DRIVER: TXDOT_PDF_BW.pltcfg
TIME: 9:21:50 AM
PENTABLE: 122205PENTABLE.tbl

ESTIMATED QUANTITIES

ITEM NO.	416-6001	416-6003	416-6005	420-6013	420-6029	420-6037	422-6001	422-6013	425-6039	432-6008	442-6007	450-6006	450-6032	454-6020
ITEM	DRILL SHAFT (18 IN)	DRILL SHAFT (30 IN)	DRILL SHAFT (42 IN)	CL C CONC (ABUT)	CL C CONC (CAP)	CL C CONC (COLUMN)	REINF CONC SLAB	BRIDGE SIDEWALK	PRESTR CONC GIRDER (TX54)	RIPRAP (CONC) (CLB)(RR8&RR9)	STR STEEL (MISC NON-BRIDGE)	RAIL (TY T223)	RAIL (TY C223)	SEALED EXPANSION JOINT (4 IN) (SEJ - B)
UNIT	LF	LF	LF	CY	CY	CY	SF	SF	LF	CY	LB	LF	LF	LF
QUANTITY	122	804	1,050	67.6	77.1	61.7	18,625	3,339	2,446.35	47.4	318	427	389	132

BEARING SEAT ELEVATIONS

		Beam 1	Beam 2	Beam 3	Beam 4	Beam 5	Beam 6	Beam 7
Abut 1	(FWD)	96.768	97.145	97.520	97.819	98.080	98.340	
Bent 2	(BK)	98.570	98.902	99.233	99.487	99.707	99.925	
	(FWD)	98.605	98.854	99.101	99.339	99.519	99.738	99.955
Bent 3	(BK)	99.720	99.918	100.115	100.302	100.431	100.587	100.742
	(FWD)	99.723	99.985	100.246	100.430	100.585	100.739	
Bent 4	(BK)	99.387	99.605	99.820	99.960	100.074	100.186	
	(FWD)	99.367	99.584	99.799	99.937	100.050	100.162	
Abut 5	(BK)	97.868	98.032	98.193	98.279	98.343	98.406	

STATE OF TEXAS
AN YAN
114660
LICENSED
PROFESSIONAL ENGINEER

An Yan, P.E.
08/30/2021

Texas Department of Transportation

Houston District (Bridge)

ESTIMATED QUANTITIES & BEARING SEAT ELEVATIONS
IH45 SB FRTG RD
AT CYPRESS CREEK BRIDGE REPLACEMENT

FILE: IH45-SB_Cyp_EQ.dgn	DN: AY	CK: MEC	DW: GB	CK: MEC
©TxDOT 8/30/2021	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		163

DATE: 11/06/2020 09:49 PM
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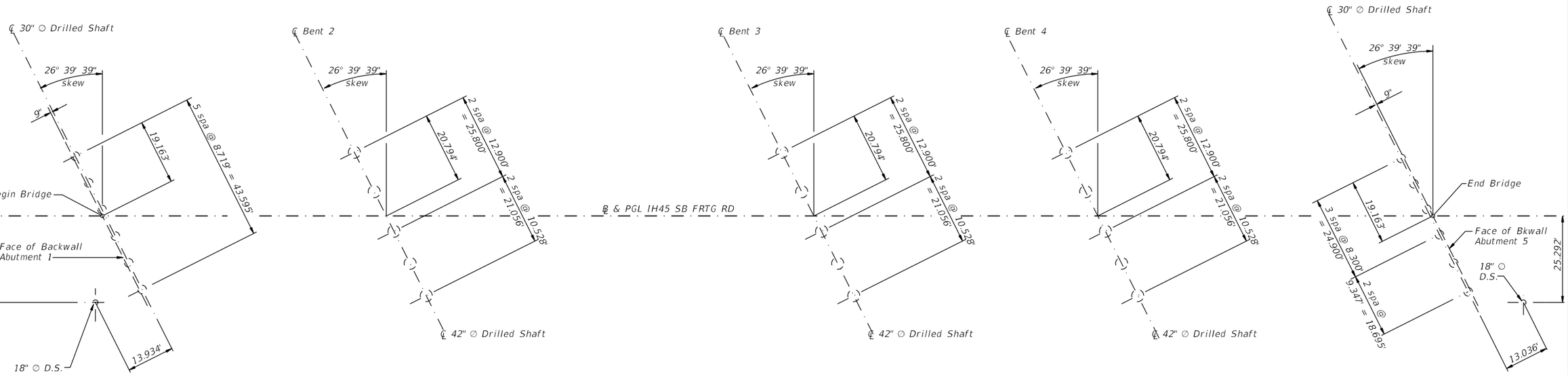

GENERAL NOTES:

THE CONTRACTOR SHALL VERIFY LOCATION OF ALL UTILITIES BEFORE CONSTRUCTION OR ORDERING MATERIAL.

REFER TO THE BRIDGE LAYOUT FOR BENT STATIONING AND BEARINGS.

DRILLED SHAFT LENGTHS SHOWN ON BRIDGE LAYOUT ARE FOR INFORMATION ONLY. TABLE OF FOUNDATION QUANTITIES SUPERSEDES ANY FOUNDATION DISCREPANCY ON BRIDGE LAYOUT.

ABUTMENT DRILLED SHAFT LOCATIONS ARE OFFSET FROM FACE OF BACKWALL. REFER TO ABUTMENT DETAILS FOR MORE INFORMATION. DIMENSIONS ARE MEASURED ALONG FACE OF BACKWALL.

STATE OF TEXAS
AN YAN
114660
LICENSED PROFESSIONAL ENGINEER

An Yan, P.E.
08/26/2021

HL93 LOADING

SHEET 1 OF 1

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Houston District (Bridge)

FOUNDATION LAYOUT

IH45 SB FRTG RD

AT CYPRESS CREEK BRIDGE REPLACEMENT

FILE: IH45-SB_Cyp_Fdn.dgn	DN: AY	CK: MEC	DW: GB	CK: MEC
©TxDOT 8/26/2021 REVISIONS	CONT.	SECT	JOB	HIGHWAY
	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		164

DATE: 11/06/2020 09:49 PM
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FOUNDATION QUANTITY TABLE

					DRILLED SHAFTS						
						0416-6001	0416-6003	0416-6005			
BRIDGE NAME	ABUT / BENT	COLUMN NO.	PHASE	FOOTING TYPE		18" DIA DRILLED SHAFT	30" DIA DRILLED SHAFT	42" DIA DRILLED SHAFT	LOAD	TOP OF DS ELEV	DS TIP ELEV
					QUANTITY	LENGTH (FT) *	LENGTH (FT) *	LENGTH (FT) *	(TONS) *	(FT)	(FT)
IH45 SB FRTG RD AT CYPRESS CREEK BRIDGE REPLACEMENT	ABUT 1 WWL	-	-	-	-	-			-	-	-
	ABUT 1 WWR	1	2	DS18	1	61			25	95.374	
	ABUT 1	1	1	DS30	1		67		75	94.170	
		2	1	DS30	1		67		75	94.480	
		3	1	DS30	1		67		75	94.800	
		4	1	DS30	1		67		75	95.110	
		5	2	DS30	1		67		75	95.400	
		6	2	DS30	1		67		75	95.650	
	BENT 2	1	1	DS42	1			72	220	80.963	
		2	1	DS42	1			72	220	81.405	
		3	1	DS42	1			72	220	81.798	
		4	2	DS42	1			72	220	82.059	
		5	2	DS42	1			72	220	82.316	
	BENT 3	1	1	DS42	1			66	220	75.097	
		2	1	DS42	1			66	220	75.447	
		3	1	DS42	1			66	220	75.748	
		4	2	DS42	1			66	220	75.933	
		5	2	DS42	1			66	220	76.116	
	BENT 4	1	1	DS42	1			72	190	83.753	
		2	1	DS42	1			72	190	84.042	
		3	1	DS42	1			72	190	84.282	
		4	2	DS42	1			72	190	84.417	
		5	2	DS42	1			72	190	84.550	
	ABUT 5 WWL	-	-	-	-	-			-	-	
	ABUT 5 WWR	1	2	DS18	1	61			25	95.418	
	ABUT 5	1	1	DS30	1		67		85	95.260	
		2	1	DS30	1		67		85	95.380	
		3	1	DS30	1		67		85	95.490	
		4	1	DS30	1		67		85	95.610	
		5	2	DS30	1		67		85	95.690	
		6	2	DS30	1		67		85	95.750	

HL93 LOADING

SHEET 1 OF 1

STATE OF TEXAS
AN YAN
114660
LICENSED PROFESSIONAL ENGINEER

An Yan, P.E.
08/26/2021

Texas Department of Transportation

Houston District (Bridge)

FOUNDATION QUANTITY TABLE
IH45 SB FRTG RD
AT CYPRESS CREEK BRIDGE REPLACEMENT

FILE: IH45-SB_Cyp_FQT.dgn	DN: AY	CK: MEC	DW: GB	CK: MEC
©TxDOT 8/26/2021	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		165

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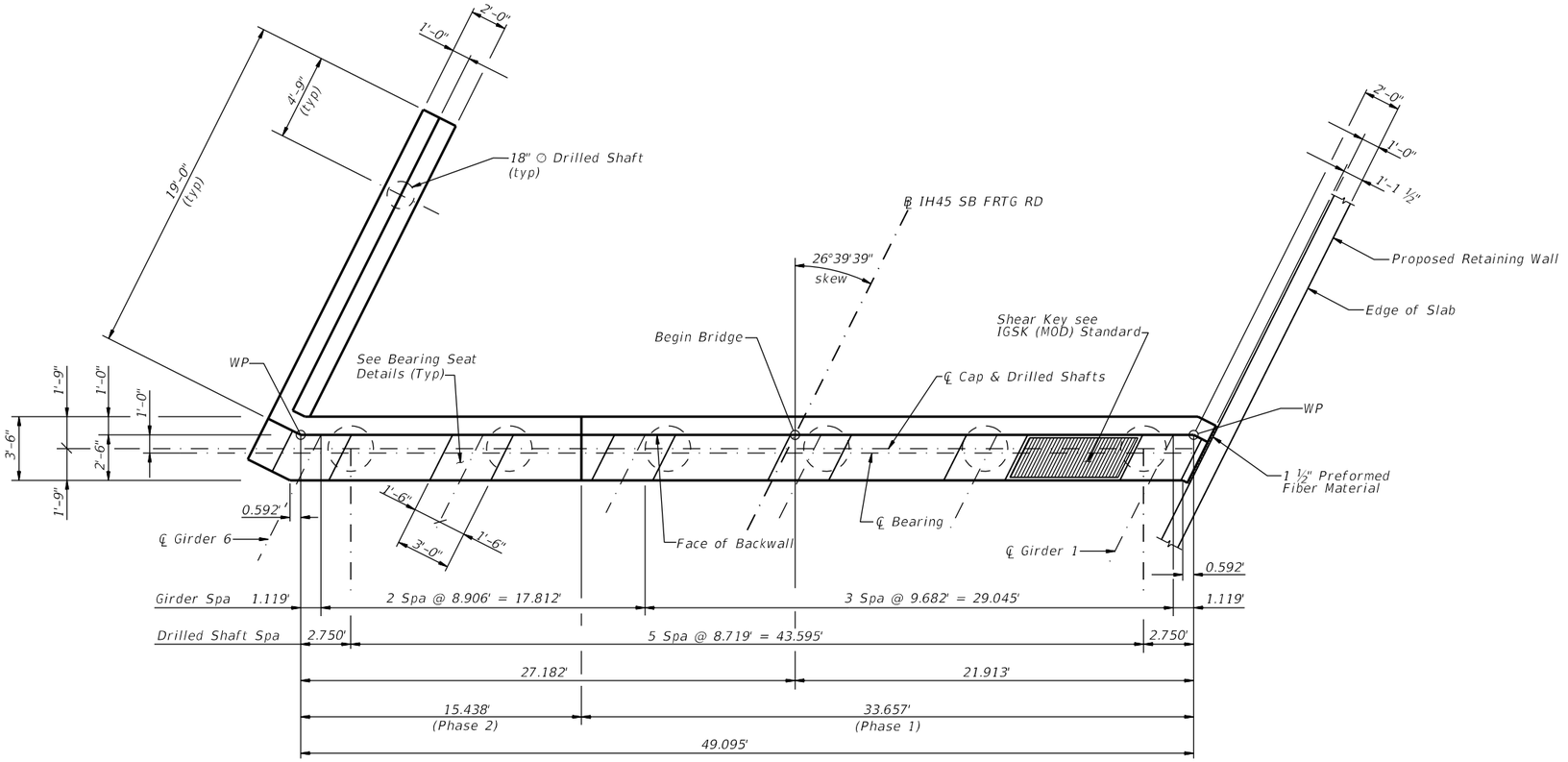
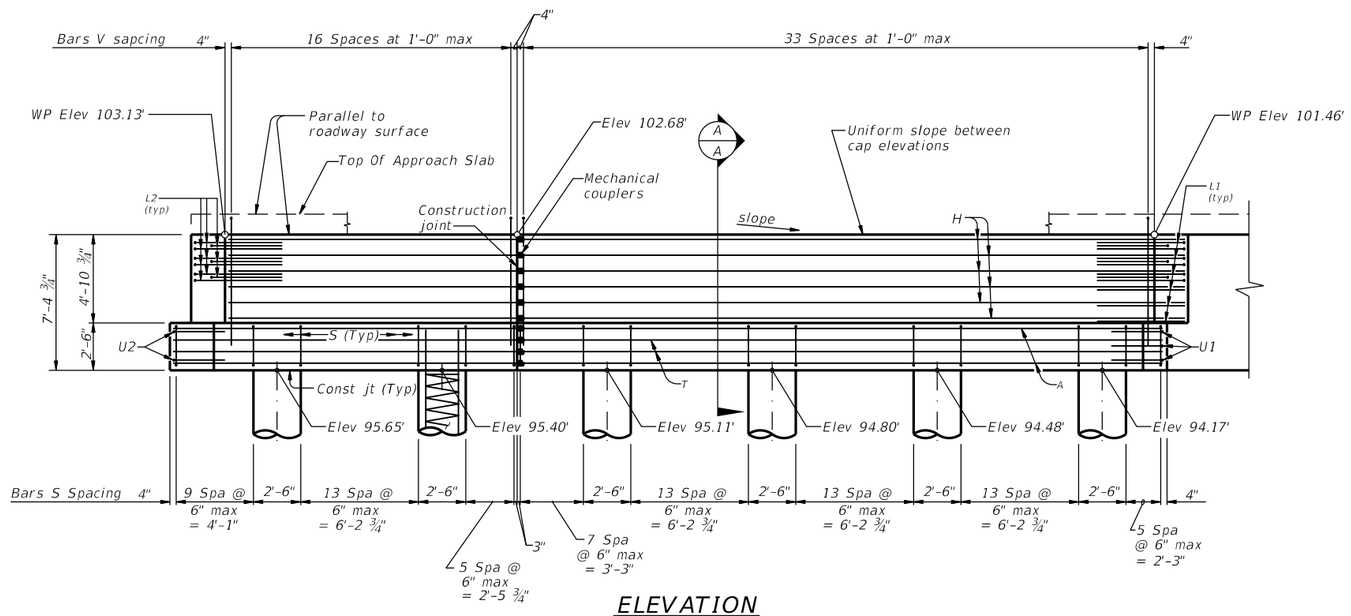


PLAN



ELEVATION

(Looking back station)

HL93 LOADING

SHEET 1 OF 3

STATE OF TEXAS
AN YAN
114660
LICENSED PROFESSIONAL ENGINEER

An Yan, P.E.
08/26/2021

Texas Department of Transportation

Houston District (Bridge)

ABUTMENT 1

IH45 SB FRTG RD

AT CYPRESS CREEK BRIDGE REPLACEMENT

FILE: IH45_SB_Cyp_Abut1.dgn	DN: AY	CK: MEC	DW: GB	CK: MEC
©TxDOT 8/26/2021	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		166

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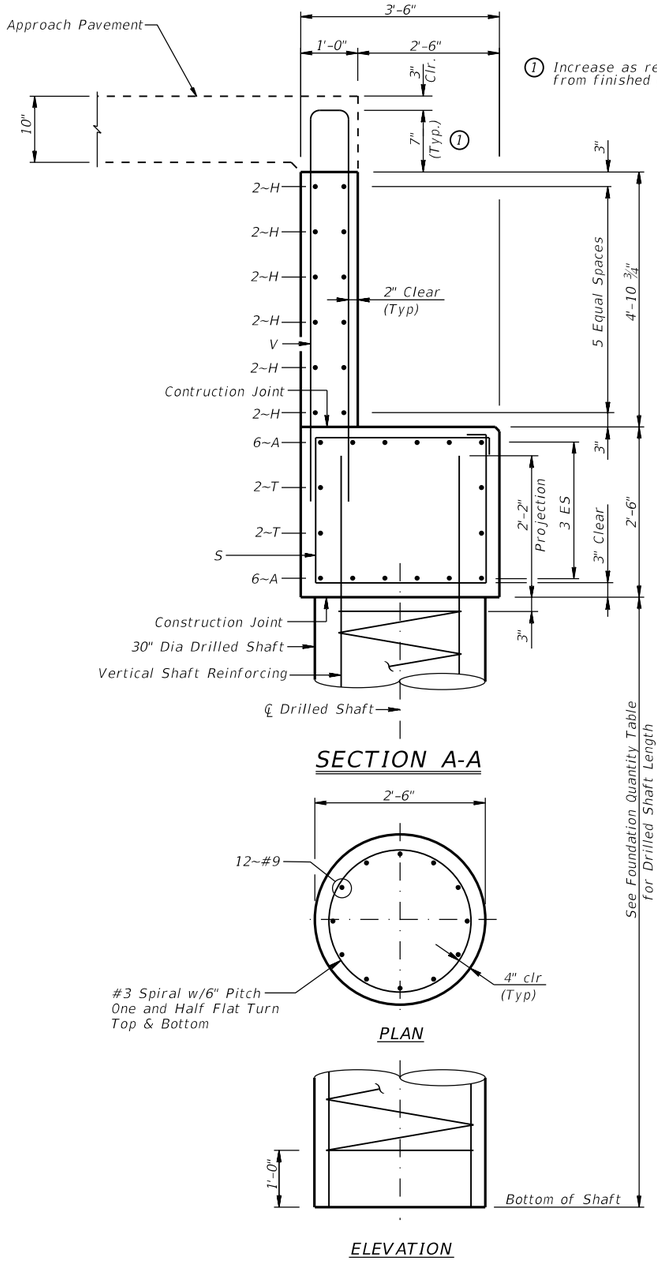
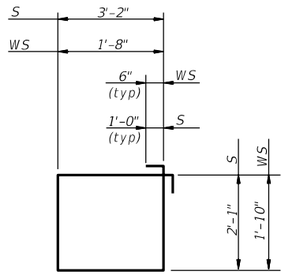


SECTION A-A

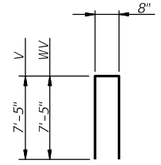
PLAN

ELEVATION

30" DIAMETER DRILLED SHAFT



BARS S & WS



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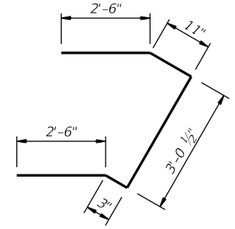

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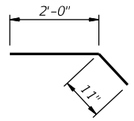
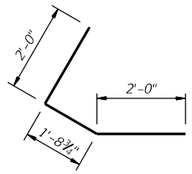


BARS L1



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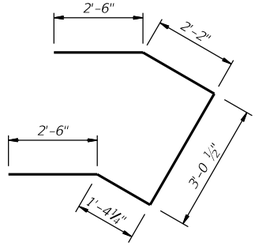

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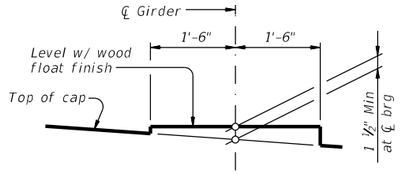

BEARING SEAT DETAIL

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

TABLE OF ESTIMATED QUANTITIES				
PHASE 2				
BAR	NO.	SIZE	LENGTH	WEIGHT
A	12	# 11	15'-5"	984
H	12	# 6	15'-5"	278
L2	9	# 6	5'-9"	78
S	30	# 6	12'-6"	564
T	4	# 6	15'-5"	93
U2	2	# 6	11'-7"	35
V	17	# 5	15'-6"	275
WH1	12	# 6	18'-8"	337
WH2	9	# 6	21'-2"	286
WS	20	# 4	8'-0"	107
WV	20	# 5	15'-6"	324
ITEM			UNIT	QUANTITY
* Reinforcing Steel			LBS	3,361
Class "C" Conc (Abut)			CY	15.5

TABLE OF ESTIMATED QUANTITIES				
PHASE 1				
BAR	NO.	SIZE	LENGTH	WEIGHT
⊕ A	12	# 11	33'-8"	2,147
⊕ H	12	# 6	33'-8"	607
L1	12	# 6	2'-11"	35
S	57	# 6	12'-6"	1,070
T	4	# 6	33'-8"	203
U1	3	# 6	9'-3"	41
V	34	# 5	15'-6"	550
WH1	0	–	–	–
WH2	0	–	–	–
WS	0	–	–	–
WV	0	–	–	–
ITEM			UNIT	QUANTITY
* Reinforcing Steel			LBS	4,653
Class "C" Conc (Abut)			CY	18.1

* Reinforcing Steel Quantities Are For Contractor's Information Only.

⊕ Includes One Mechanical Coupler

GENERAL NOTES:

- Designed According to AASHTO LRFD Bridge Design Specifications.
- Reinforcing Steel Quantity is for Contractor's information Only.
- See Table of Estimated Foundation Quantities for Foundation loads and Drilled Shaft lengths.
- Chamfer All Exposed Edges 3/4".
- See Shear Key (IGSK) (MOD) Standard sheet for all shear key details and notes, if applicable.

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

MATERIAL NOTES:

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

HL93 LOADING

STATE OF TEXAS
AN YAN
114660
LICENSED PROFESSIONAL ENGINEER

An Yan, P.E.
08/26/2021

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Houston District (Bridge)

ABUTMENT 1

IH45 SB FRTG RD

AT CYPRESS CREEK BRIDGE REPLACEMENT

FILE: IH45_SB_Cyp_Abut1.dgn	DN: AY	CK: MEC	DW: GB	CK: MEC
©TxDOT 8/26/2021	CONT	SECT	JOB	HIGHWAY
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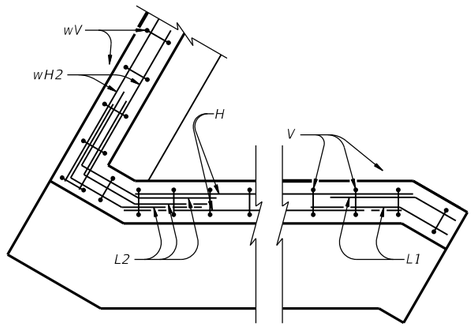
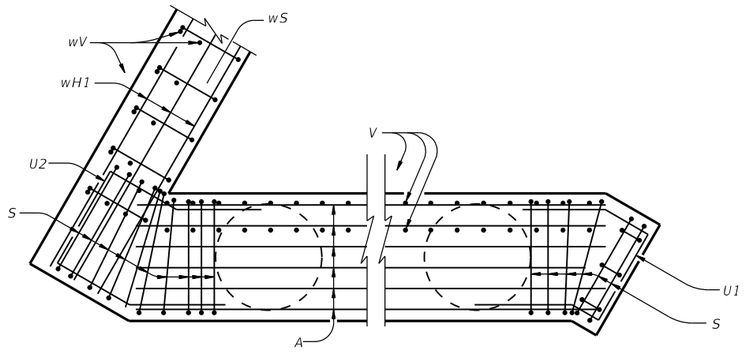
	HOU	HARRIS		167

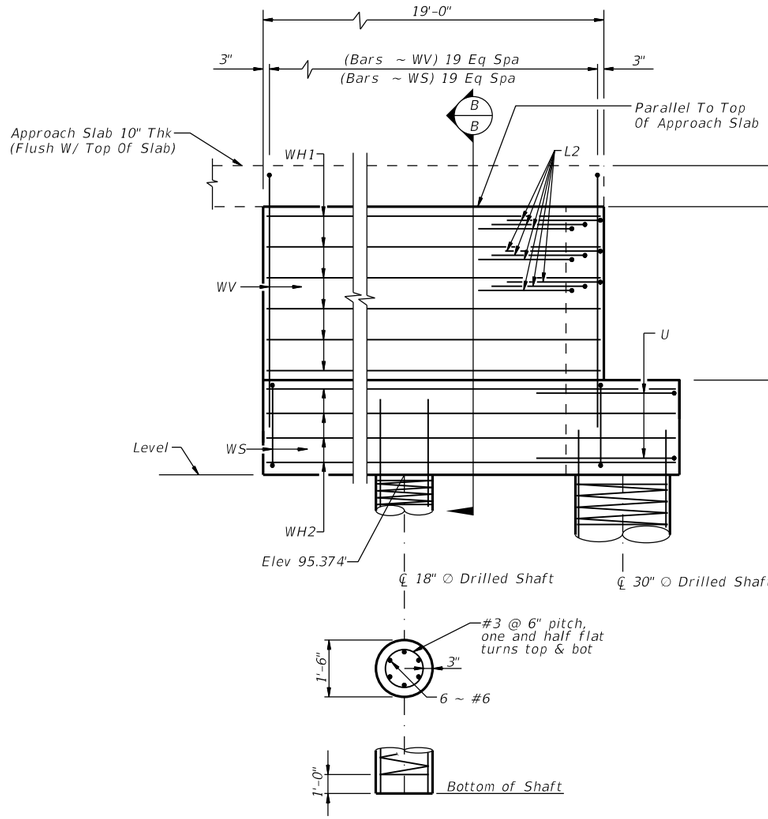


PLAN AT ABUTMENT BACKWALL

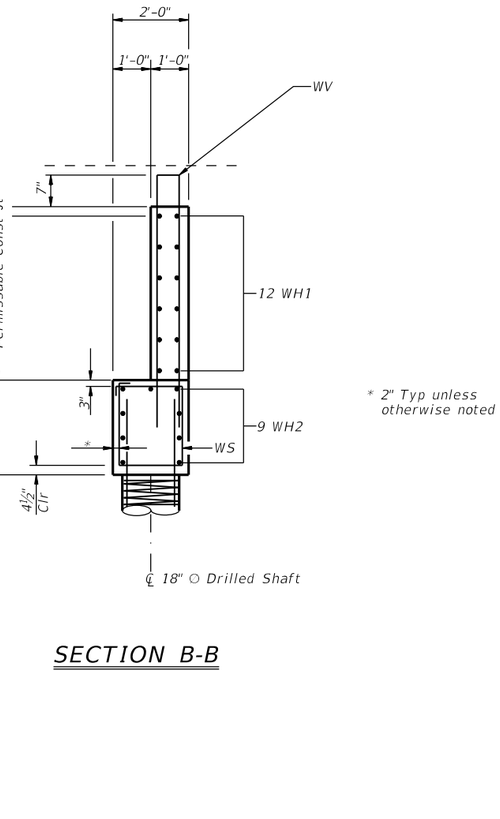


PLAN AT ABUTMENT CAP

CORNER DETAILS



WINGWALL ELEVATION



SECTION B-B

HL93 LOADING

SHEET 3 OF 3

STATE OF TEXAS
AN YAN
114660
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PROFESSIONAL ENGINEER

An Yan, P.E.
08/26/2021

Texas Department of Transportation

Houston District (Bridge)

ABUTMENT 1
IH45 SB FRTG RD
AT CYPRESS CREEK BRIDGE REPLACEMENT

FILE: IH45_SB_Cyp_Abut1.dgn	DN: AY	CK: MEC	DW: GB	CK: MEC			
©TxDOT 8/26/2021	CONT	SECT	JOB	HIGHWAY			
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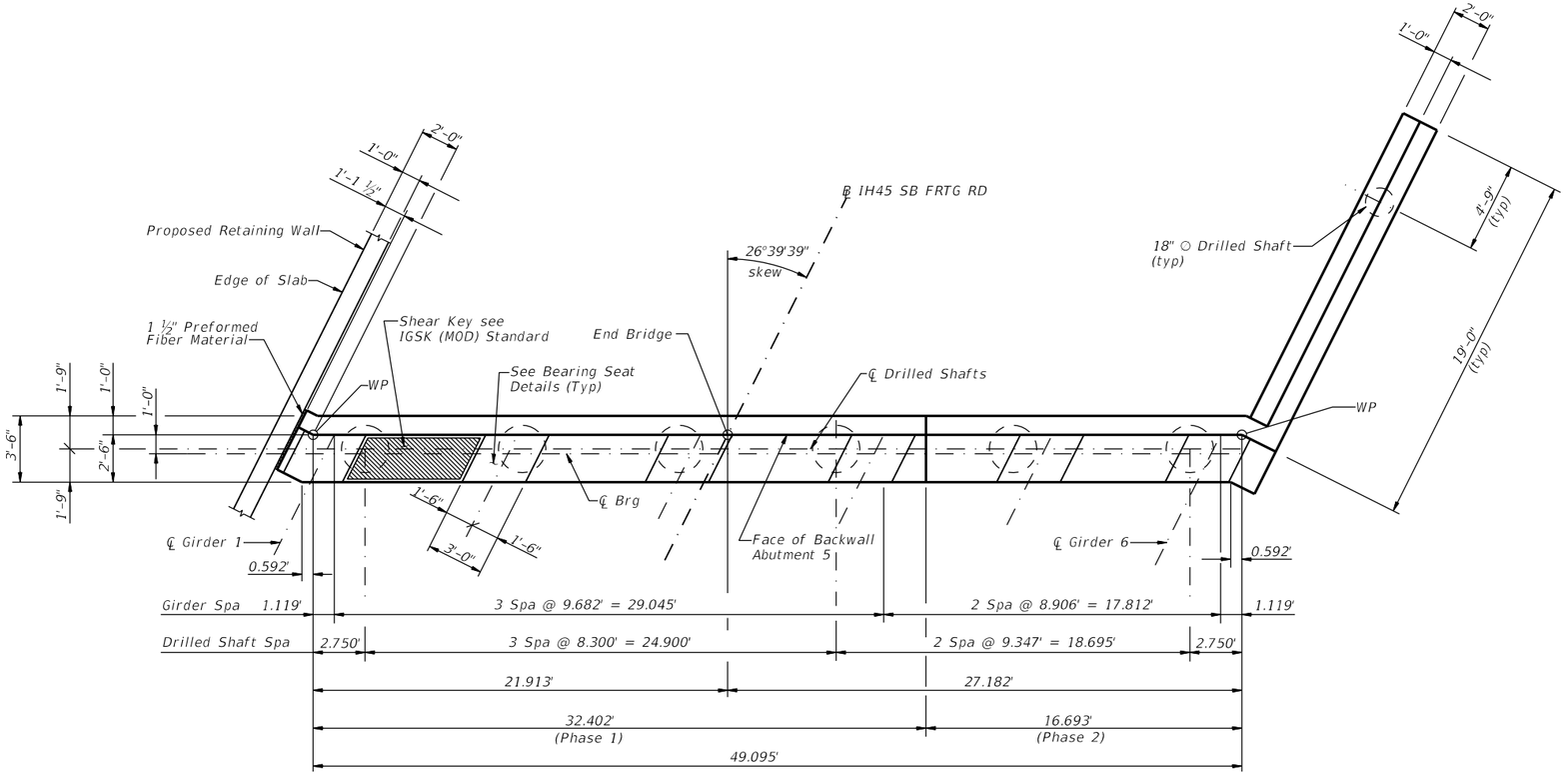
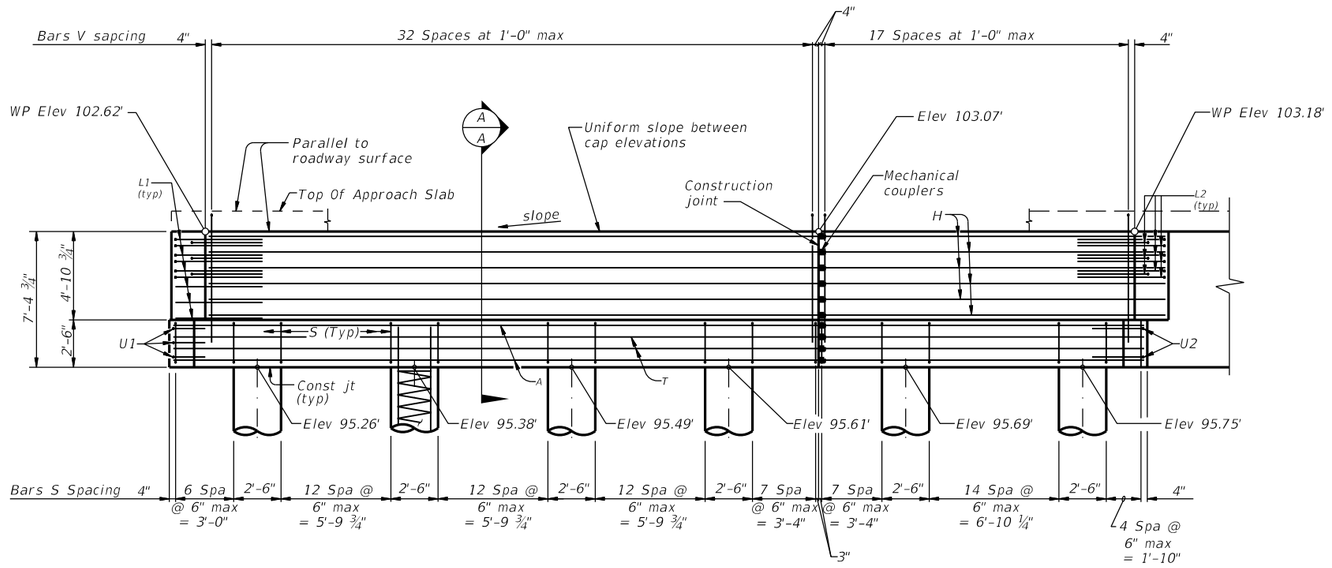


PLAN



ELEVATION

(Looking Forward Station)

HL93 LOADING

SHEET 1 OF 3

An Yan, P.E.

08/26/2021

Texas Department of Transportation

Houston District (Bridge)

ABUTMENT 5

IH45 SB FRTG RD

AT CYPRESS CREEK BRIDGE REPLACEMENT

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	HOU	HARRIS		169

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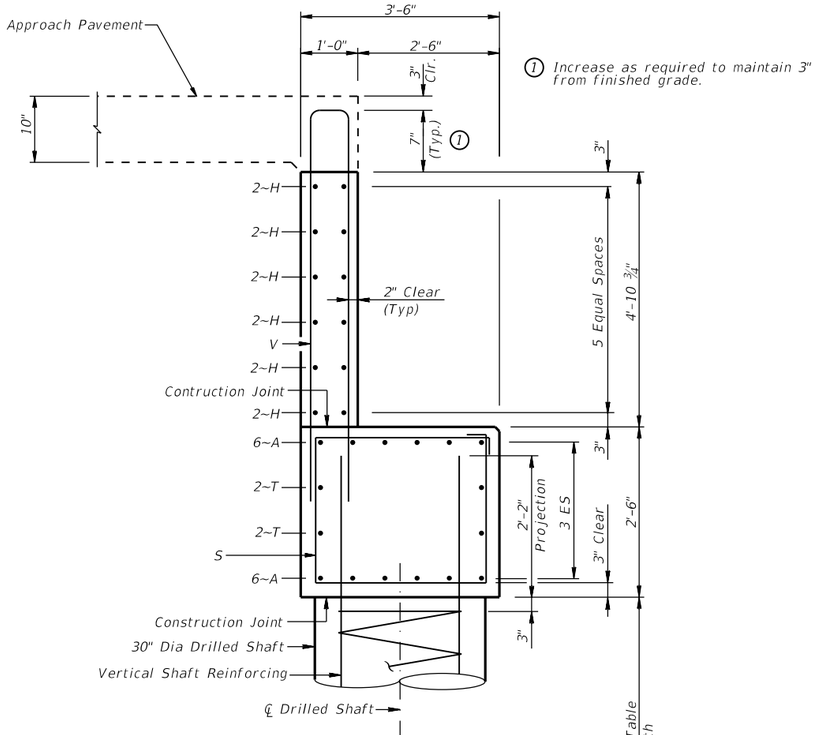
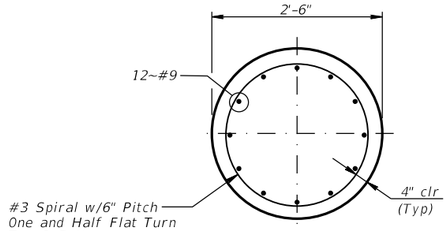
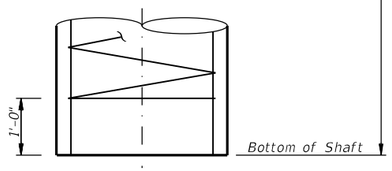


SECTION A-A

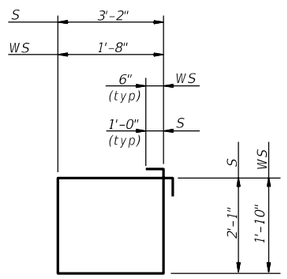


PLAN

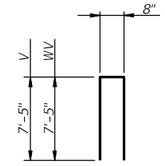


ELEVATION

30" DIAMETER DRILLED SHAFT



BARS S & WS



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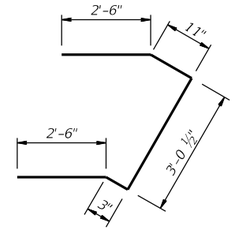

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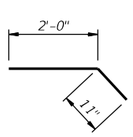

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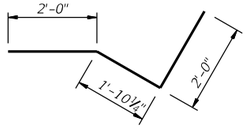

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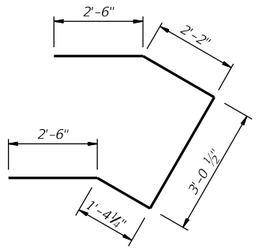

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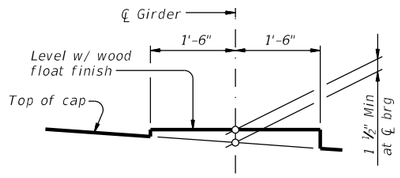

BEARING SEAT DETAIL

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

TABLE OF ESTIMATED QUANTITIES

PHASE 2

	BAR	NO.	SIZE	LENGTH	WEIGHT
	A	12	# 11	16'-9"	1,068
	H	12	# 6	16'-9"	302
	L2	9	# 6	5'-11"	81
	S	32	# 6	12'-6"	601
	T	4	# 6	16'-9"	101
	U2	2	# 6	11'-7"	35
	V	18	# 5	15'-6"	291
	WH1	12	# 6	18'-8"	336
	WH2	9	# 6	21'-2"	287
	WS	20	# 4	8'-0"	107
	WV	20	# 5	15'-6"	324
	ITEM			UNIT	QUANTITY
*	Reinforcing Steel			LBS	3,533
	Class "C" Conc (Abut)			CY	16.2

TABLE OF ESTIMATED QUANTITIES

PHASE 1

	BAR	NO.	SIZE	LENGTH	WEIGHT
⊕	A	12	# 11	32'-5"	2,067
⊕	H	12	# 6	32'-5"	585
	L1	12	# 6	2'-11"	53
	S	55	# 6	12'-6"	1,032
	T	4	# 6	32'-5"	195
	U1	3	# 6	9'-3"	35
	V	33	# 5	15'-6"	534
	WH1	14	# 6	–	–
	WH2	20	# 6	–	–
	WS	38	# 4	–	–
	WV	38	# 5	–	–
	ITEM			UNIT	QUANTITY
*	Reinforcing Steel			LBS	4,501
	Class "C" Conc (Abut)			CY	17.5

* Reinforcing Steel Quantities Are For Contractor's Information Only.

⊕ Includes One Mechanical Coupler

GENERAL NOTES:

- Designed According to AASHTO LRFD Bridge Design Specifications.
- Reinforcing Steel Quantity is for Contractor's information Only.
- See Table of Estimated Foundation Quantities for Foundation loads and Drilled Shaft lengths.
- Chamfer All Exposed Edges 3/4".
- See Shear Key (IGSK) (MOD) Standard sheet for all shear key details and notes, if applicable.

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

MATERIAL NOTES:

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

HL93 LOADING

STATE OF TEXAS
AN YAN
114660
LICENSED PROFESSIONAL ENGINEER

An Yan, P.E.
08/26/2021

Texas Department of Transportation

Houston District (Bridge)

ABUTMENT 5

IH45 SB FRTG RD

AT CYPRESS CREEK BRIDGE REPLACEMENT

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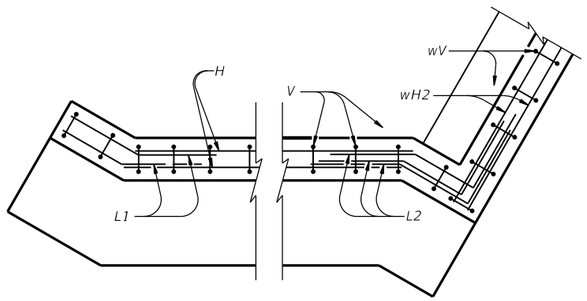
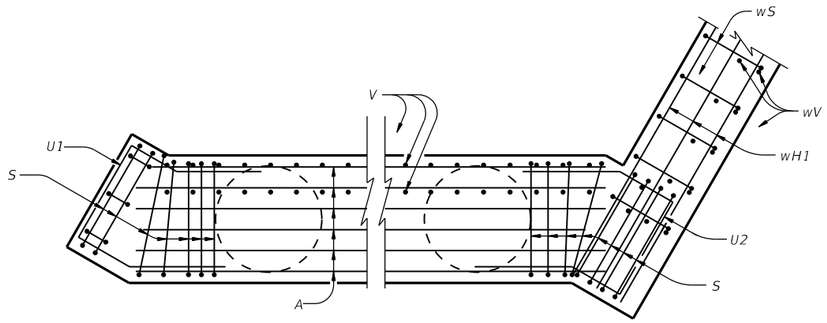
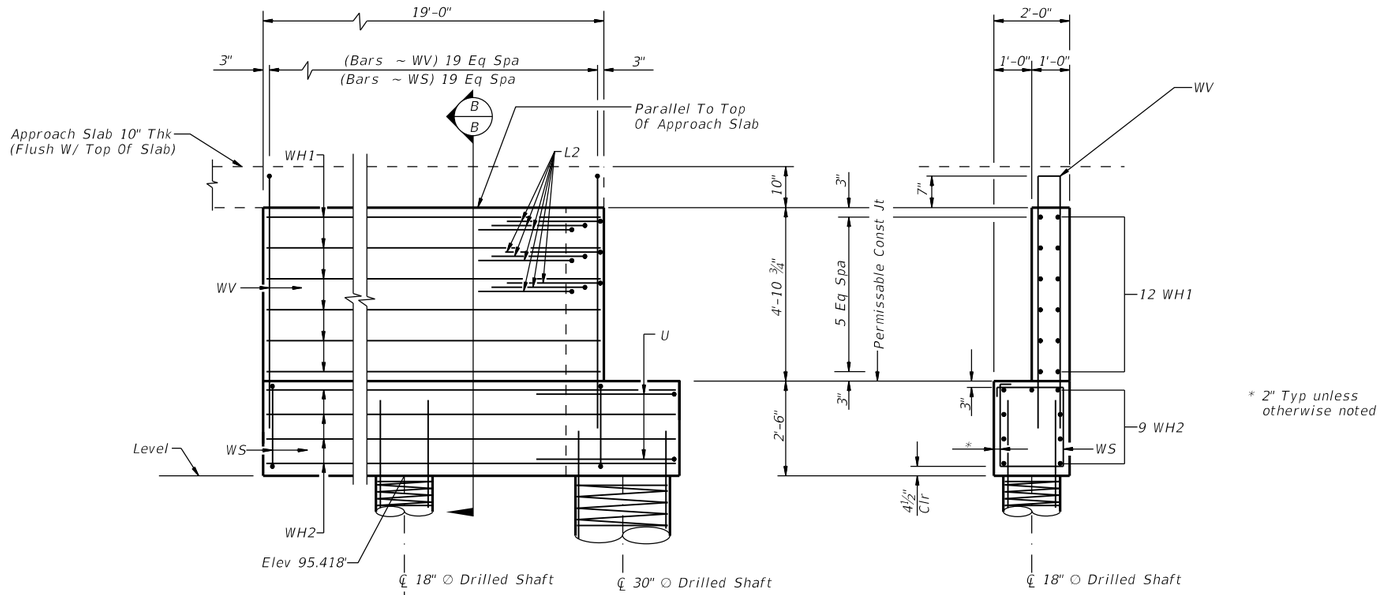


PLAN AT ABUTMENT BACKWALL

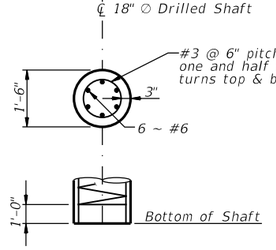


PLAN AT ABUTMENT CAP

CORNER DETAILS



SECTION B-B



WINGWALL ELEVATION

* 2" Typ unless otherwise noted

HL93 LOADING

SHEET 3 OF 3

STATE OF TEXAS
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An Yan, P.E.
08/26/2021

Texas Department of Transportation

Houston District (Bridge)

ABUTMENT 5
IH45 SB FRTG RD
AT CYPRESS CREEK BRIDGE REPLACEMENT

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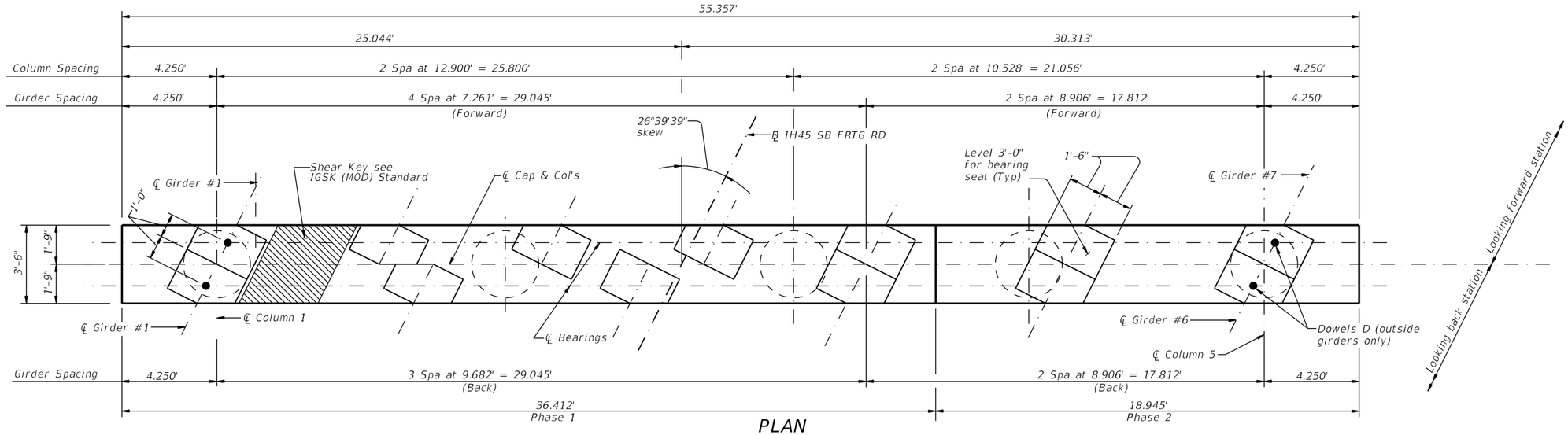

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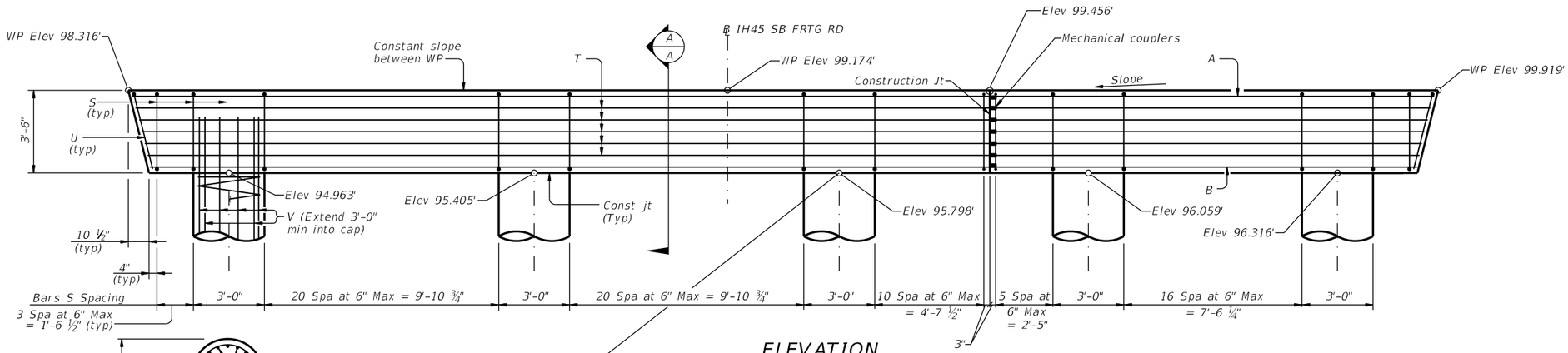
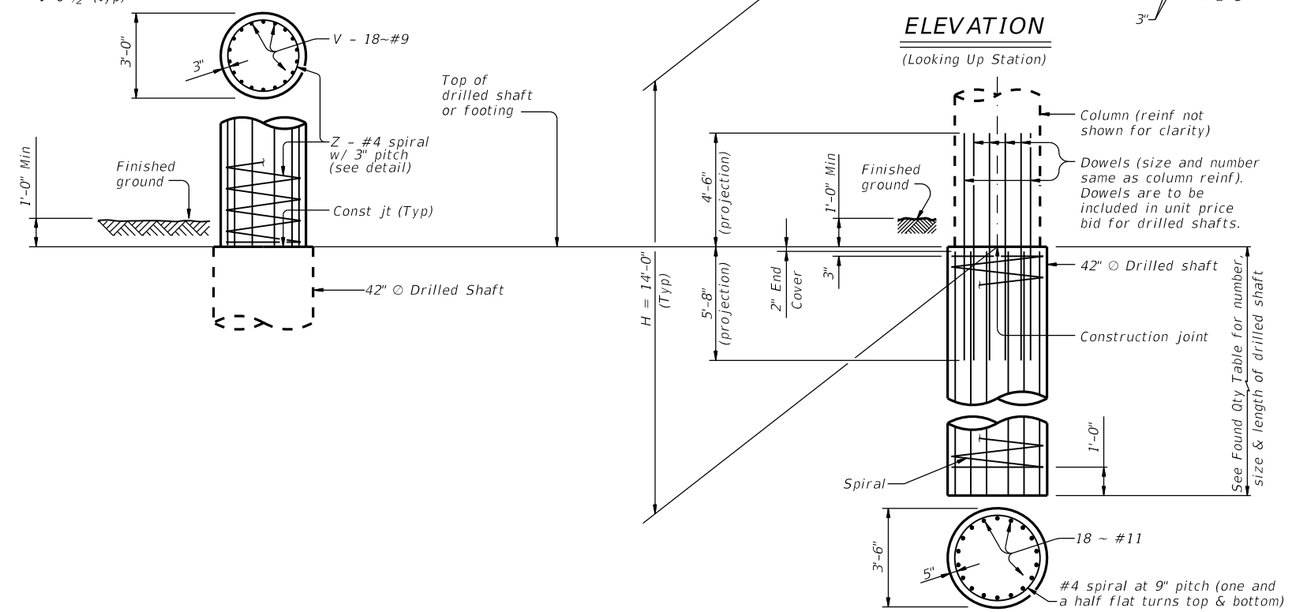


ELEVATION

(Looking Up Station)



HL93 LOADING

SHEET 1 OF 2

STATE OF TEXAS
AN YAN
114660
LICENSED PROFESSIONAL ENGINEER

An Yan, P.E.
08/26/2021

Texas Department of Transportation

Houston District (Bridge)

BENT 2

IH45 SB FRTG RD

AT CYPRESS CREEK BRIDGE REPLACEMENT

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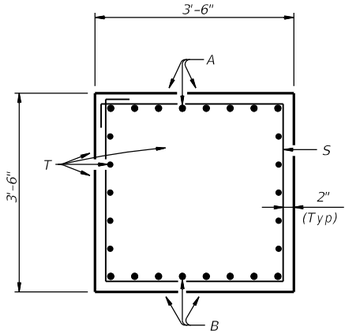


SECTION A-A

TABLE OF ESTIMATED QUANTITIES

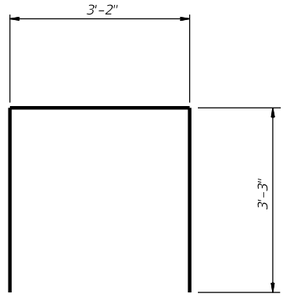
PHASE 2

Bar	No.	Size	Length	Weight
A	8	#11	18'-7"	790
B	8	#11	17'-9"	755
D	2	#9	1'-8"	14
S	28	#6	14'-8"	617
T	10	#5	18'-2"	190
U	1	#5	9'-8"	10
V	36	#9	17'-0"	2,081
Z	2	#4	447'-8"	599
Reinforcing Steel			Lbs	5,056
Class "C" Concrete (Cap)			CY	8.5
Class "C" Concrete (Col)			CY	7.4

TABLE OF ESTIMATED QUANTITIES

PHASE 1

Bar	No.	Size	Length	Weight
A	8	#11	36'-5"	1,548
B	8	#11	35'-7"	1,512
D	2	#9	1'-8"	14
S	57	#6	14'-8"	1,256
T	10	#5	36'-0"	376
U	1	#5	9'-8"	10
V	54	#9	17'-0"	3,121
Z	3	#4	447'-8"	898
Reinforcing Steel			Lbs	8,735
Class "C" Concrete (Cap)			CY	17.2
Class "C" Concrete (Col)			CY	11.0



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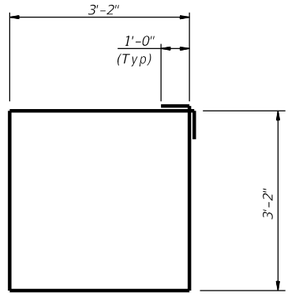

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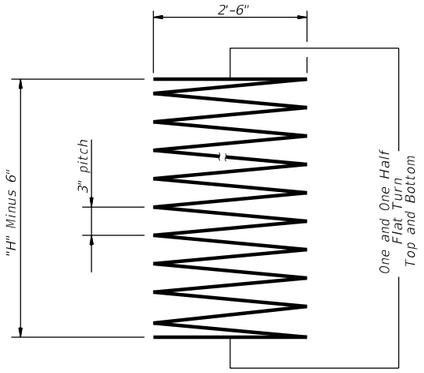

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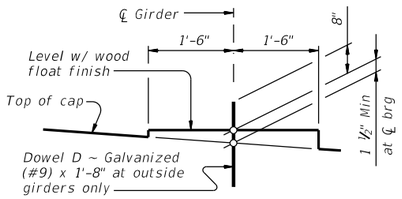

BEARING SEAT DETAIL

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

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.

See Common Foundation Details (FD) standard sheet for all foundation details and notes.

See Shear Key (IGSK) (MOD) standard sheet for all shear key details and notes, if applicable. Shear key is included in cap quantities.

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

MATERIAL NOTES:

Provide Class C concrete (f'c = 3,600 psi).

Provide Class C (HPC) concrete if shown elsewhere in the plans.

Provide Grade 60 reinforcing steel.

Galvanize dowel bars D.

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SHEET 2 OF 2

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Houston District (Bridge)

BENT 2

IH45 SB FRTG RD

AT CYPRESS CREEK BRIDGE REPLACEMENT

FILE: IH45-SB_Cyp_Bt2.dgn	DN: AY	CK: MEC	DW: GB	CK: MEC
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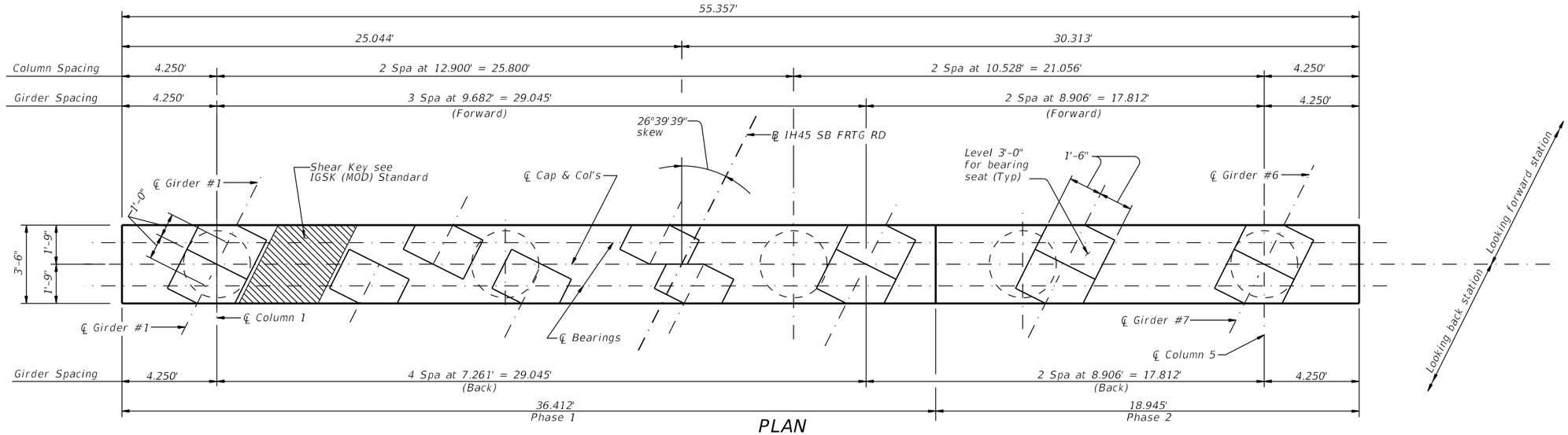

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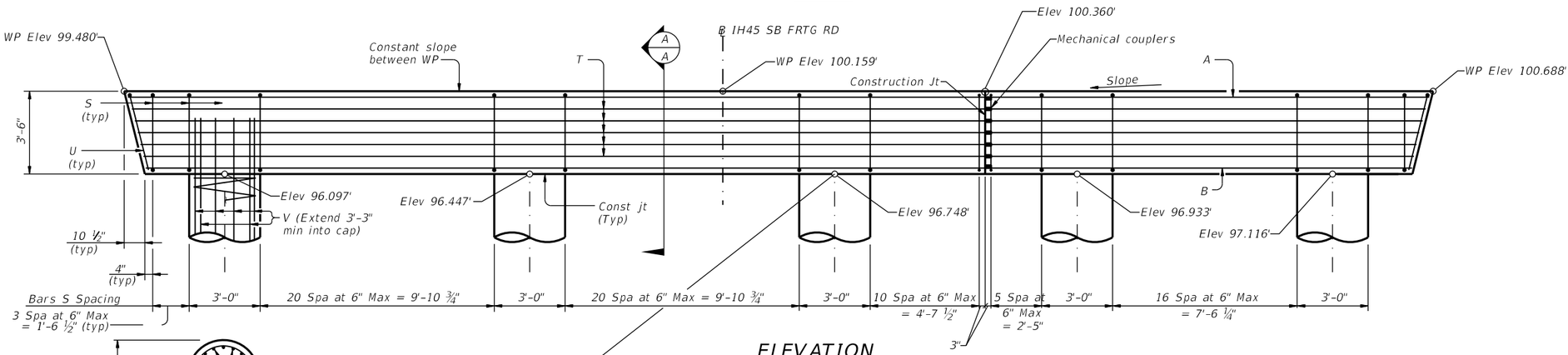
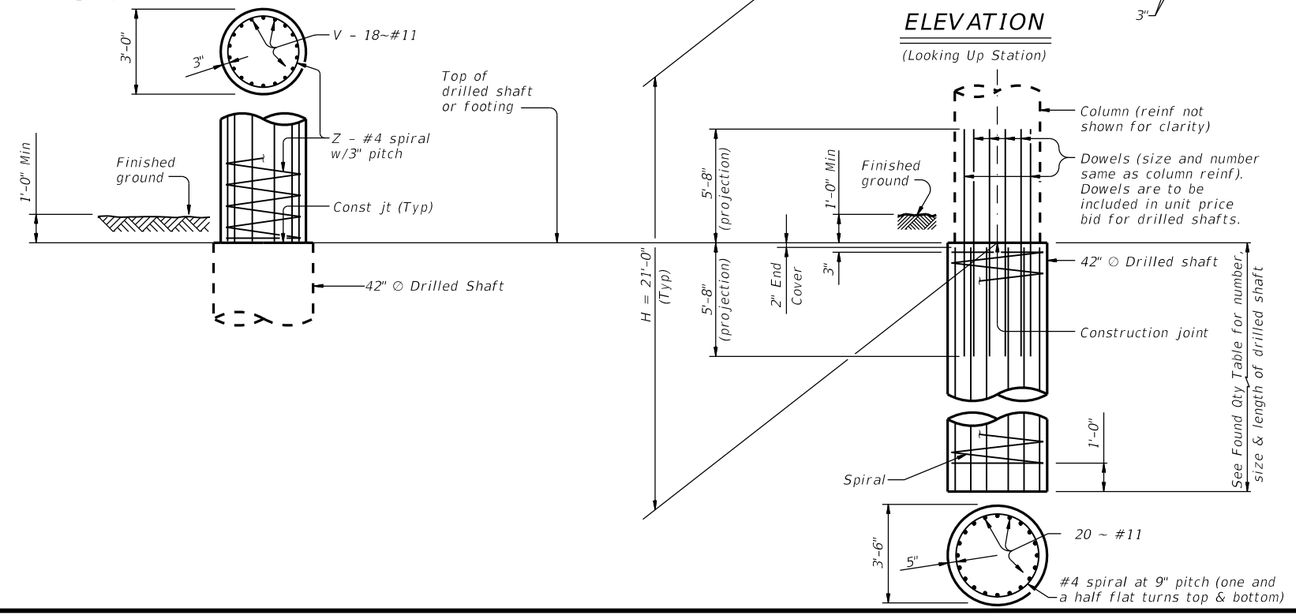


ELEVATION

(Looking Up Station)



HL93 LOADING

SHEET 1 OF 2

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08/26/2021

Texas Department of Transportation

Houston District (Bridge)

BENT 3

IH45 SB FRTG RD

AT CYPRESS CREEK BRIDGE REPLACEMENT

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	HOU	HARRIS		174

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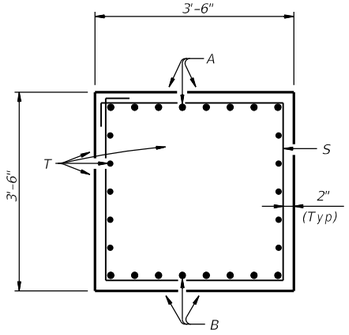


SECTION A-A

TABLE OF ESTIMATED QUANTITIES

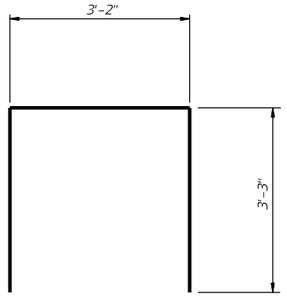
PHASE 2

Bar	No.	Size	Length	Weight
A	8	#11	18'-7"	790
B	8	#11	17'-9"	755
D	0	#9	1'-8"	0
S	28	#6	14'-8"	617
T	10	#5	18'-2"	190
U	1	#5	9'-8"	10
V	36	#11	24'-3"	4,654
Z	2	#4	667'-8"	893
Reinforcing Steel			Lbs	7,909
Class "C" Concrete (Cap)			CY	8.5
Class "C" Concrete (Col)			CY	11.0

TABLE OF ESTIMATED QUANTITIES

PHASE 1

Bar	No.	Size	Length	Weight
A	8	#11	36'-5"	1,548
B	8	#11	35'-7"	1,512
D	0	#9	1'-8"	0
S	57	#6	14'-8"	1,256
T	10	#5	36'-0"	376
U	1	#5	9'-8"	10
V	54	#11	24'-3"	6,981
Z	3	#4	667'-8"	1,339
Reinforcing Steel			Lbs	13,022
Class "C" Concrete (Cap)			CY	17.2
Class "C" Concrete (Col)			CY	16.5



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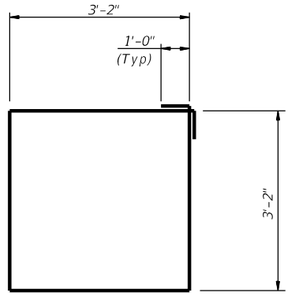

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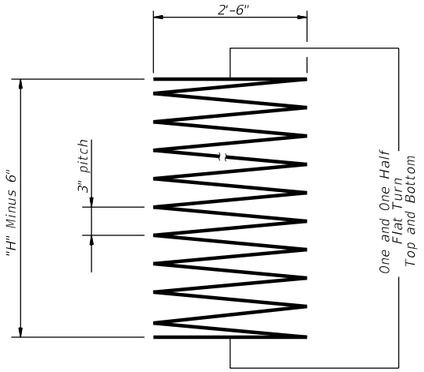

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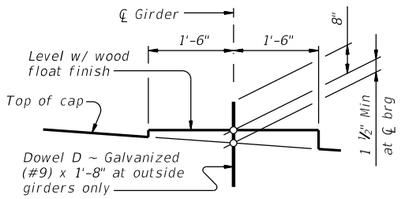

BEARING SEAT DETAIL

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

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.

See Common Foundation Details (FD) standard sheet for all foundation details and notes.

See Shear Key (IGSK) (MOD) standard sheet for all shear key details and notes, if applicable. Shear key is included in cap quantities.

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

MATERIAL NOTES:

Provide Class C concrete (f'c = 3,600 psi).

Provide Class C (HPC) concrete if shown elsewhere in the plans.

Provide Grade 60 reinforcing steel.

Galvanize dowel bars D.

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SHEET 2 OF 2

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Houston District (Bridge)

BENT 3

IH45 SB FRTG RD

AT CYPRESS CREEK BRIDGE REPLACEMENT

FILE: IH45-SB_Cyp_Bt3.dgn	DN: AY	CK: MEC	DW: GB	CK: MEC
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	HOU	HARRIS		175

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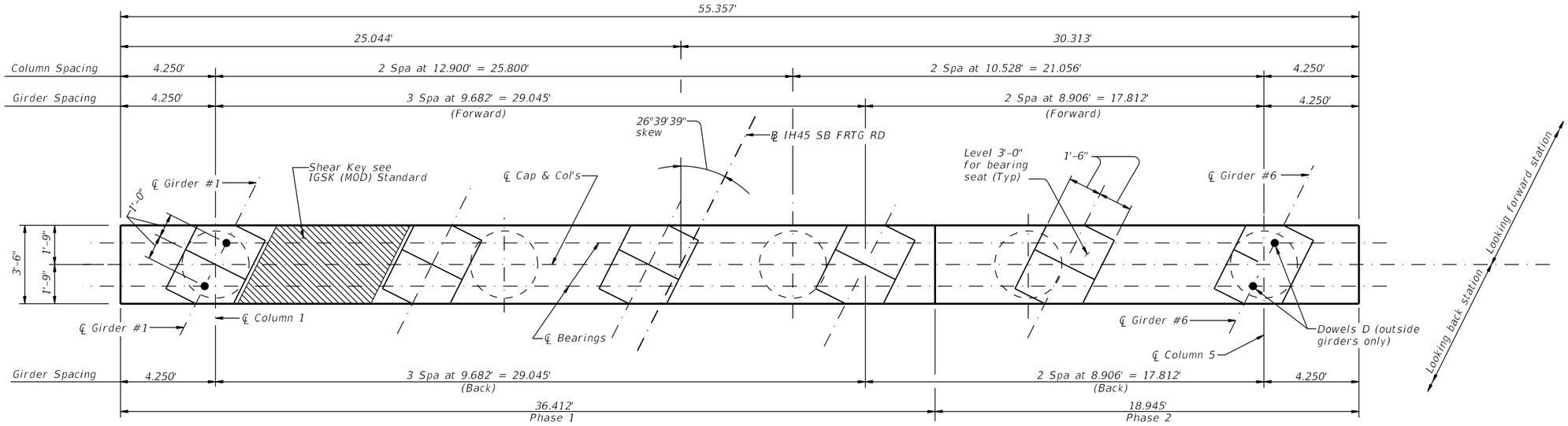

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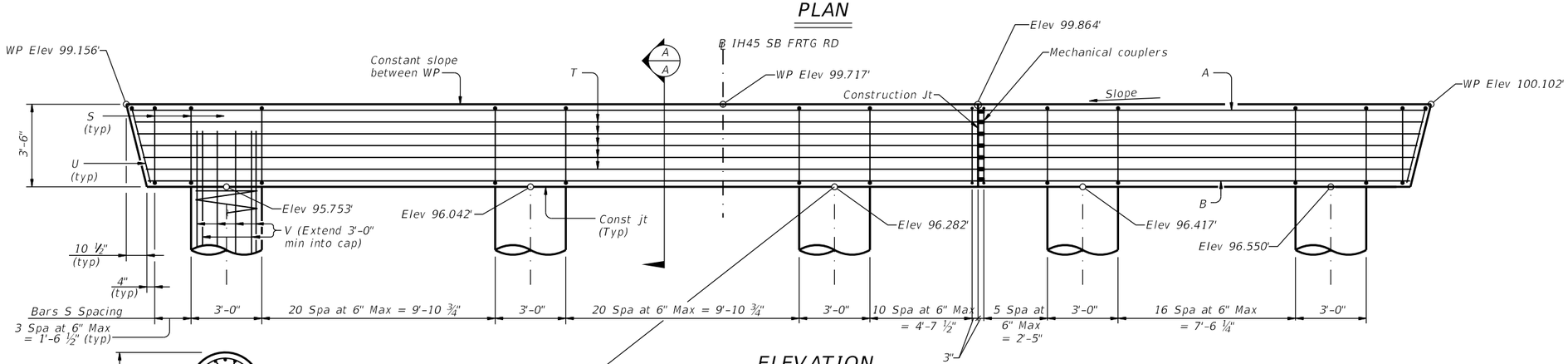
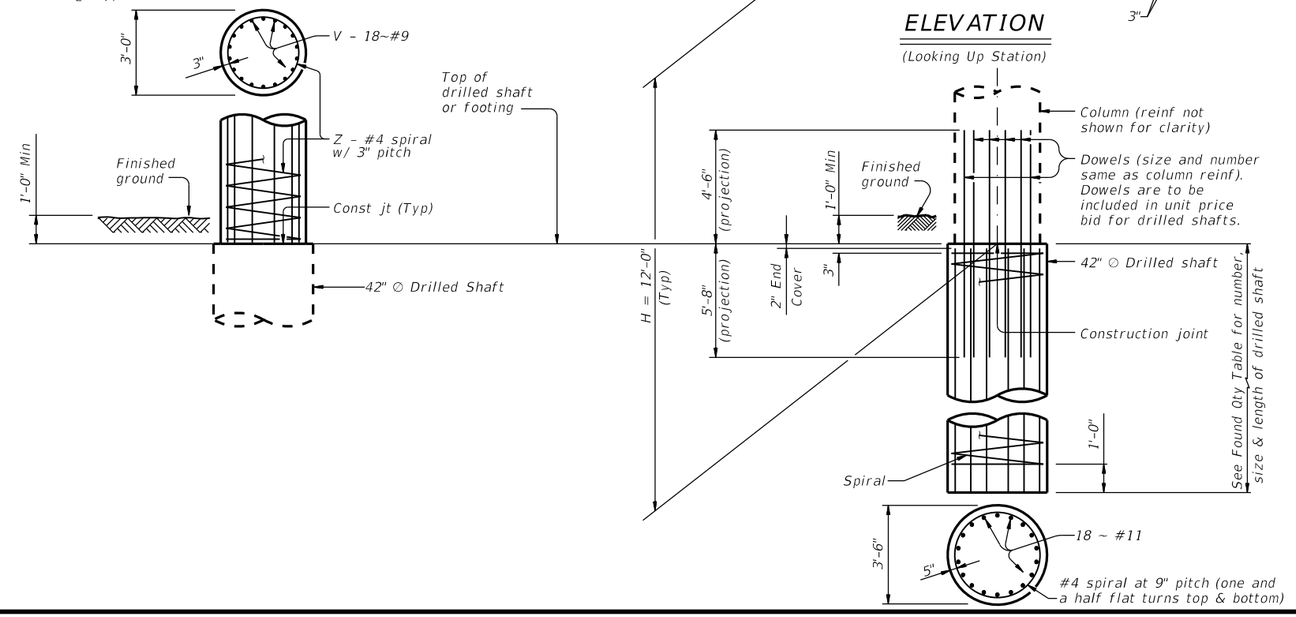


ELEVATION

(Looking Up Station)



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SHEET 1 OF 2

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08/26/2021

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BENT 4

IH45 SB FRTG RD

AT CYPRESS CREEK BRIDGE REPLACEMENT

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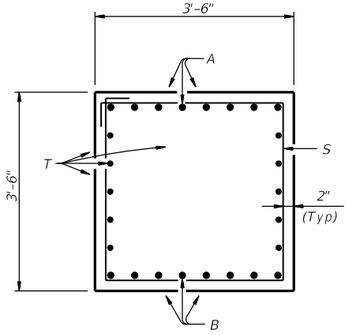


SECTION A-A

TABLE OF ESTIMATED QUANTITIES

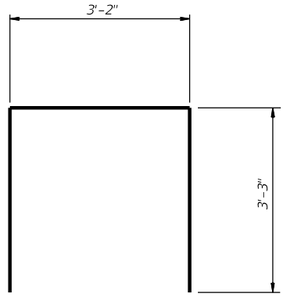
PHASE 2

Bar	No.	Size	Length	Weight
A	8	#11	18'-7"	790
B	8	#11	17'-9"	755
D	2	#9	1'-8"	14
S	28	#6	14'-8"	617
T	10	#5	18'-2"	190
U	1	#5	9'-8"	10
V	36	#9	15'-0"	1,836
Z	2	#4	384'-11"	515
Reinforcing Steel			Lbs	4,727
Class "C" Concrete (Cap)			CY	8.5
Class "C" Concrete (Col)			CY	6.3

TABLE OF ESTIMATED QUANTITIES

PHASE 1

Bar	No.	Size	Length	Weight
A	8	#11	36'-5"	1,548
B	8	#11	35'-7"	1,512
D	2	#9	1'-8"	14
S	57	#6	14'-8"	1,256
T	10	#5	36'-0"	376
U	1	#5	9'-8"	10
V	54	#9	15'-0"	2,724
Z	3	#4	384'-11"	772
Reinforcing Steel			Lbs	8,212
Class "C" Concrete (Cap)			CY	17.2
Class "C" Concrete (Col)			CY	9.5



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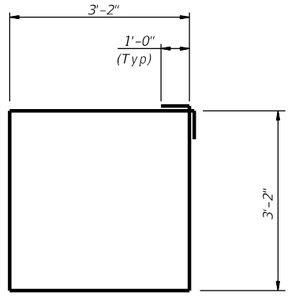

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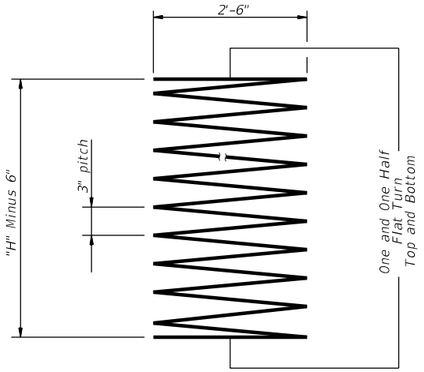

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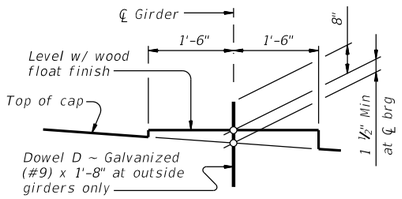

BEARING SEAT DETAIL

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

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.

See Common Foundation Details (FD) standard sheet for all foundation details and notes.

See Shear Key (IGSK) (MOD) standard sheet for all shear key details and notes, if applicable. Shear key is included in cap quantities.

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

MATERIAL NOTES:

Provide Class C concrete (f'c = 3,600 psi).

Provide Class C (HPC) concrete if shown elsewhere in the plans.

Provide Grade 60 reinforcing steel.

Galvanize dowel bars D.

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Houston District (Bridge)

BENT 4

IH45 SB FRTG RD

AT CYPRESS CREEK BRIDGE REPLACEMENT

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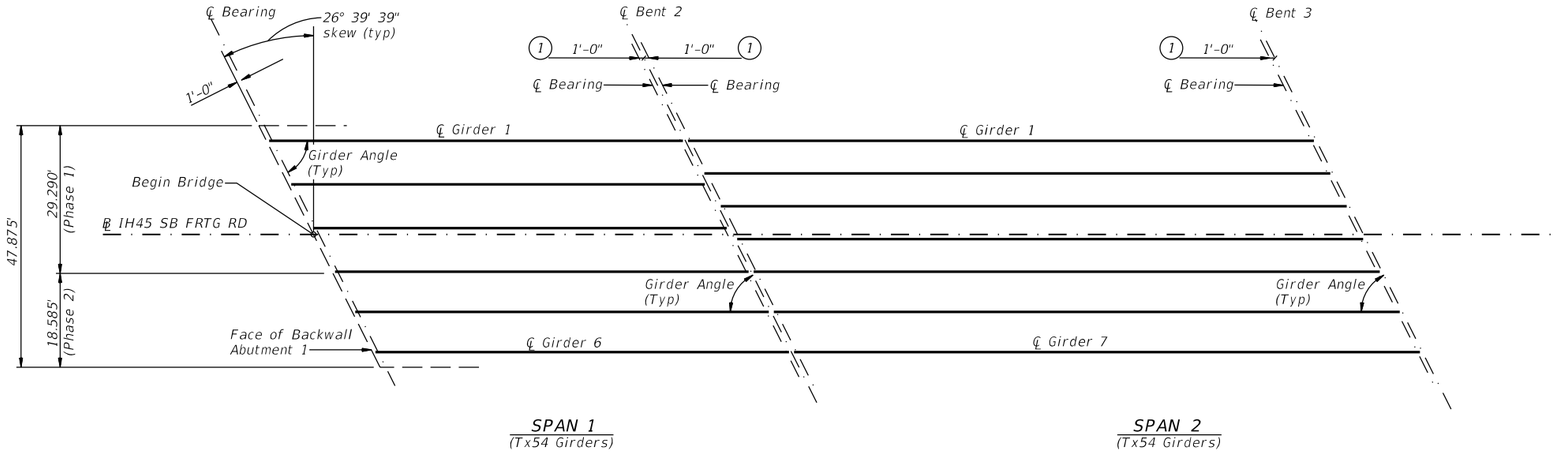

UNIT 1

BENT REPORT

BENT NO. 1 (N 59 59 44.00 E)
DISTANCE BETWEEN STATION LINE AND BEAM 1, 20.794 L

			BEAM SPAC. (C.L. BENT) (3)	BEAM ANGLE D M S
SPAN 1	BEAM	1	0.000	63 20 21
	BEAM	2	9.682	63 20 21
	BEAM	3	9.682	63 20 21
	BEAM	4	9.682	63 20 21
	BEAM	5	8.906	63 20 21
	BEAM	6	8.906	63 20 21
	TOTAL		46.857	

BENT NO. 2 (N 59 59 44.00 E)
DISTANCE BETWEEN STATION LINE AND BEAM 1, 20.794 L

			BEAM SPAC. (C.L. BENT)	BEAM ANGLE D M S
SPAN 1	BEAM	1	0.000	63 20 21
	BEAM	2	9.682	63 20 21
	BEAM	3	9.682	63 20 21
	BEAM	4	9.682	63 20 21
	BEAM	5	8.906	63 20 21
	BEAM	6	8.906	63 20 21
	TOTAL		46.857	

BENT REPORT

BENT NO. 2 (N 59 59 44.00 E)
DISTANCE BETWEEN STATION LINE AND BEAM 1, 20.794 L

			BEAM SPAC. (C.L. BENT)	BEAM ANGLE D M S
SPAN 2	BEAM	1	0.000	63 20 21
	BEAM	2	7.261	63 20 21
	BEAM	3	7.261	63 20 21
	BEAM	4	7.261	63 20 21
	BEAM	5	7.261	63 20 21
	BEAM	6	8.906	63 20 21
	BEAM	7	8.906	63 20 21
	TOTAL		46.857	

BENT NO. 3 (N 59 59 44.00 E)
DISTANCE BETWEEN STATION LINE AND BEAM 1, 20.794 L

			BEAM SPAC. (C.L. BENT)	BEAM ANGLE D M S
SPAN 2	BEAM	1	0.000	63 20 21
	BEAM	2	7.261	63 20 21
	BEAM	3	7.261	63 20 21
	BEAM	4	7.261	63 20 21
	BEAM	5	7.261	63 20 21
	BEAM	6	8.906	63 20 21
	BEAM	7	8.906	63 20 21
	TOTAL		46.857	

BEAM REPORT

BEAM REPORT, SPAN 1

	C-C BENT	HORIZONTAL DISTANCE C-C BRG.	TRUE DISTANCE BOT. BM. FLG (2)	BEAM SLOPE
BEAM 1	83.000	80.881	82.49	0.0223
BEAM 2	83.000	80.881	82.49	0.0217
BEAM 3	83.000	80.881	82.49	0.0212
BEAM 4	83.000	80.881	82.49	0.0206
BEAM 5	83.000	80.881	82.49	0.0201
BEAM 6	83.000	80.881	82.49	0.0196

BEAM REPORT

BEAM REPORT, SPAN 2

	C-C BENT	HORIZONTAL DISTANCE C-C BRG.	TRUE DISTANCE BOT. BM. FLG (2)	BEAM SLOPE
BEAM 1	125.000	123.000	124.51	0.0091
BEAM 2	125.000	123.000	124.50	0.0087
BEAM 3	125.000	123.000	124.50	0.0082
BEAM 4	125.000	123.000	124.50	0.0078
BEAM 5	125.000	123.000	124.50	0.0074
BEAM 6	125.000	123.000	124.50	0.0069
BEAM 7	125.000	123.000	124.50	0.0064

Notes:

(1) See Standard IGEB for orientation of dimension, girder end and bearing details.

(2) Girder lengths shown are bottom girder flange lengths with adjustment made for girder slope.

(3) Dimensions shown along "℄ Bent" on Bent Reports are referenced along face of backwall at abutments. Dimensions shown between "℄ Bents" on Beam Reports are referenced from face of backwall at abutments.

TABLE OF ESTIMATED QUANTITIES

ITEM	UNIT	QUANTITY			
		PHASE 1		PHASE 2	
		SPAN 1	SPAN 2	SPAN 1	SPAN 2
PRESTRESSED CONCRETE GIRDER Tx54	LF	329.96	622.51	164.98	249.00

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SHEET 1 OF 2

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Houston District (Bridge)

FRAMING PLAN

IH45 SB FRTG RD

AT CYPRESS CREEK BRIDGE REPLACEMENT

FILE: IH45_SB_Cyp_Frame1.dgn	DN: AY	CK: MEC	DW: GB	CK: MEC
©TxDOT 8/26/2021 REVISIONS	CONT.	SECT	JOB	HIGHWAY
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	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		178

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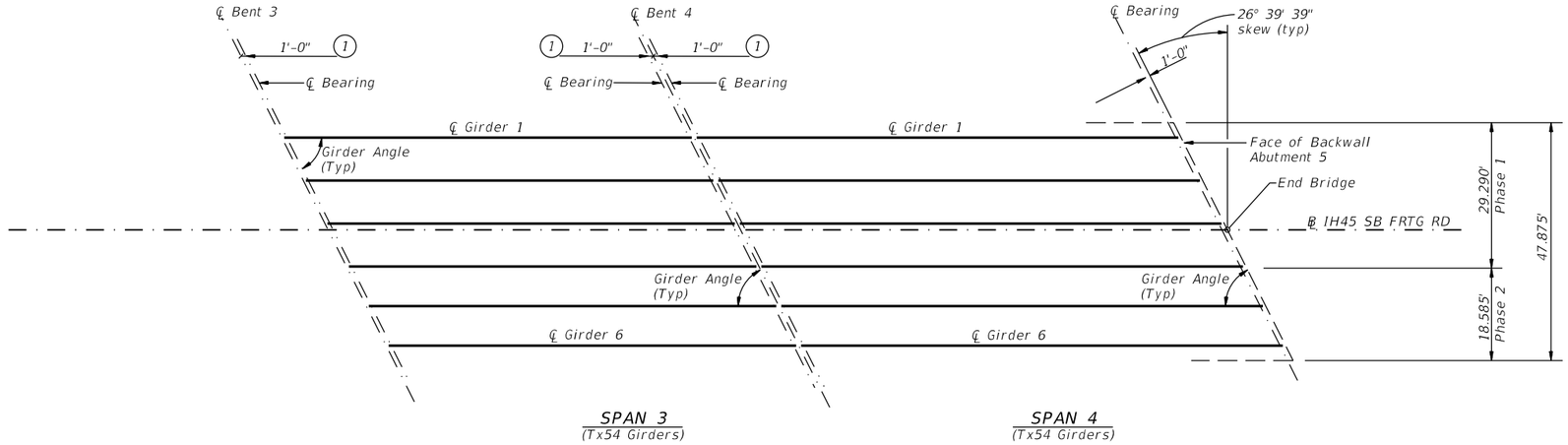

UNIT 2

BENT REPORT

BENT NO. 3 (N 59 59 44.00 E)
DISTANCE BETWEEN STATION LINE AND BEAM 1, 20.794 L

		BEAM SPAC. (C.L. BENT)	BEAM ANGLE D M S
SPAN 3	BEAM 1	0.000	63 20 21
	BEAM 2	9.682	63 20 21
	BEAM 3	9.682	63 20 21
	BEAM 4	9.682	63 20 21
	BEAM 5	8.906	63 20 21
	BEAM 6	8.906	63 20 21
	TOTAL	46.857	

BENT NO. 4 (N 59 59 44.00 E)
DISTANCE BETWEEN STATION LINE AND BEAM 1, 20.794 L

		BEAM SPAC. (C.L. BENT)	BEAM ANGLE D M S
SPAN 3	BEAM 1	0.000	63 20 21
	BEAM 2	9.682	63 20 21
	BEAM 3	9.682	63 20 21
	BEAM 4	9.682	63 20 21
	BEAM 5	8.906	63 20 21
	BEAM 6	8.906	63 20 21
	TOTAL	46.857	
SPAN 4	BEAM 1	0.000	63 20 21
	BEAM 2	9.682	63 20 21
	BEAM 3	9.682	63 20 21
	BEAM 4	9.682	63 20 21
	BEAM 5	8.906	63 20 21
	BEAM 6	8.906	63 20 21
	TOTAL	46.857	

ABUT NO. 5 (N 59 59 44.00 E)
DISTANCE BETWEEN STATION LINE AND BEAM 1, 20.794 L

		BEAM SPAC. (C.L. BENT) (3)	BEAM ANGLE D M S
SPAN 4	BEAM 1	0.000	63 20 21
	BEAM 2	9.682	63 20 21
	BEAM 3	9.682	63 20 21
	BEAM 4	9.682	63 20 21
	BEAM 5	8.906	63 20 21
	BEAM 6	8.906	63 20 21
	TOTAL	46.857	

BEAM REPORT

BEAM REPORT, SPAN 3

	HORIZONTAL DISTANCE C-C BENT	TRUE DISTANCE C-C BRG.	BEAM BOT. BM. FLG. (2)	SLOPE
BEAM 1	83.000	81.000	82.50	-0.0041
BEAM 2	83.000	81.000	82.50	-0.0047
BEAM 3	83.000	81.000	82.50	-0.0053
BEAM 4	83.000	81.000	82.50	-0.0058
BEAM 5	83.000	81.000	82.50	-0.0063
BEAM 6	83.000	81.000	82.50	-0.0068

BEAM REPORT, SPAN 4

	HORIZONTAL DISTANCE C-C BENT	TRUE DISTANCE C-C BRG.	BEAM BOT. BM. FLG. (2)	SLOPE
BEAM 1	98.000	95.881	97.48	-0.0156
BEAM 2	98.000	95.881	97.48	-0.0162
BEAM 3	98.000	95.881	97.48	-0.0167
BEAM 4	98.000	95.881	97.48	-0.0173
BEAM 5	98.000	95.881	97.49	-0.0178
BEAM 6	98.000	95.881	97.49	-0.0183

Notes:

(1) See Standard IGEB for orientation of dimension, girder end and bearing details.

(2) Girder lengths shown are bottom girder flange lengths with adjustment made for girder slope.

(3) Dimensions shown along "℄ Bent" on Bent Reports are referenced along face of backwall at abutments. Dimensions shown between "℄ Bents" on Beam Reports are referenced from face of backwall at abutments.

TABLE OF ESTIMATED QUANTITIES

ITEM	UNIT	QUANTITY			
		PHASE 1		PHASE 2	
		SPAN 1	SPAN 2	SPAN 1	SPAN 2
PRESTRESSED CONCRETE GIRDER Tx54	LF	330.00	389.92	165.00	194.98

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08/26/2021

HL93 LOADING

SHEET 2 OF 2

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Houston District (Bridge)

FRAMING PLAN

IH45 SB FRTG RD

AT CYPRESS CREEK BRIDGE REPLACEMENT

FILE: IH45_SB_Cyp_Frame2.dgn	DN: AY	CK: MEC	DW: GB	CK: MEC
©TxDOT 8/26/2021	CONT.	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
	DIST.	COUNTY		SHEET NO.
	HOU	HARRIS		179

DATE: 11/06/2020 09:49 PM
FILE: pw:\txdot.projectwiseonline.com:TXDOT3\Documents\12 - HOU\Design Projects\011005126\4 - Design\Bridge\IH45SB FRTG\IH45-SB Cyp Frame2.dgn

STRUCTURE	DESIGNED GIRDERS									DEPRESSED STRAND PATTERN			CONCRETE		OPTIONAL DESIGN				
	SPAN NO.	GIRDER NO.	GIRDER TYPE	PRESTRESSING STRANDS						NO.	TO END (in)	TO CL (in)	RELEASE STRGTH (1) f'ci (ksi)	MINIMUM 28 DAY COMP STRGTH f'c (ksi)	DESIGN LOAD COMP STRESS (TOP ℄) (SERVICE I) fct(ksi)	DESIGN LOAD TENSILE STRESS (BOTT ℄) (SERVICE III) fcb(ksi)	REQUIRED MINIMUM ULTIMATE MOMENT CAPACITY (STRENGTH I) (kip-ft)	LIVE LOAD DISTRIBUTION FACTOR (2)	
				NON-STD STRAND PATTERN	TOTAL NO.	SIZE (in)	STRGTH fpu (ksi)	"e" ℄ (in)	"e" END (in)									Moment	Shear
IH 45 SB FRTG	1	1–2	Tx54		22	0.6	270	20.281	11.917	4	50.5	4.5	5.800	7.600	2.333	–2.468	5086	0.728	0.928
		3–4	Tx54		20	0.6	270	20.408	11.208	4	50.5	4.5	5.800	7.600	2.333	–2.468	5086	0.728	0.928
		5–6	Tx54		20	0.6	270	20.408	11.208	4	50.5	4.5	5.800	7.600	2.080	–2.134	4703	0.686	0.876
	2	1	Tx54		46	0.6	270	18.660	11.356	8	50.5	8.5	5.800	7.600	4.487	–4.405	8333	0.538	0.770
		2,4–5	Tx54		46	0.6	270	18.660	11.356	8	50.5	8.5	5.800	7.600	4.741	–4.568	8537	0.573	0.770
		3, 6–7	Tx54		50	0.6	270	18.128	9.008	12	50.5	12.5	5.800	7.600	4.865	–4.701	8714	0.614	0.885
	3	1–2	Tx54		22	0.6	270	20.281	11.917	4	50.5	4.5	5.800	7.600	2.340	–2.475	5098	0.728	0.928
		3–4	Tx54		20	0.6	270	20.408	11.208	4	50.5	4.5	5.800	7.600	2.340	–2.475	5098	0.728	0.928
		5–6	Tx54		20	0.6	270	20.408	11.208	4	50.5	4.5	5.800	7.600	2.086	–2.140	4701	0.686	0.876
	4	1	Tx54		28	0.6	270	20.008	13.436	4	50.5	4.5	5.800	7.600	2.914	–3.051	6251	0.695	0.932
		2–3	Tx54		30	0.6	270	19.808	11.008	6	50.5	6.5	5.800	7.600	3.248	–3.346	6669	0.695	0.932
		4–6	Tx54		28	0.6	270	20.008	13.436	4	50.5	4.5	5.800	7.600	3.149	–3.108	6162	0.676	0.880

NON-STANDARD STRAND PATTERNS

PATTERN	STRAND ARRANGEMENT AT ℄ OF GIRDER

(1) Based on the following allowable stresses (ksi):

Compression = 0.65 f'ci

Tension = $0.24\sqrt{f'ci}$

Optional designs must likewise conform.

(2) Portion of full HL93.

DESIGN NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.

Optional designs for girders 120 feet or longer must have a calculated residual camber equal to or greater than that of the designed girder.

Prestress losses for the designed girders have been calculated for a relative humidity of 60 percent. Optional designs must likewise conform.

FABRICATION NOTES:

Provide Class H concrete.

Provide Grade 60 reinforcing steel bars.

Use low relaxation strands, each pretensioned to 75 percent of fpu.

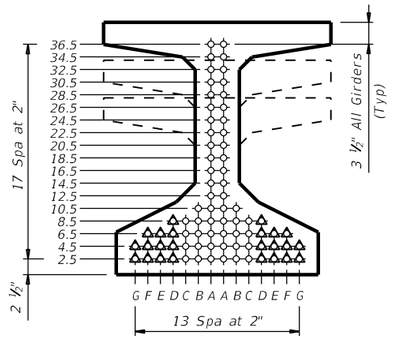
Strand debonding must comply with Item 424.4.2.2.2.4. Full-length debonded strands are only permitted in positions marked Δ. Double wrap full-length debonded strands in outer most position of each row.

When shown on this sheet, the Fabricator has the option of furnishing either the designed girder or an approved optional design. All optional design submittals must be signed, sealed and dated by a Professional Engineer registered in the State of Texas.

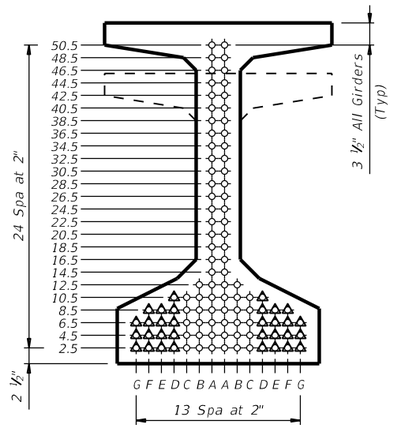
Seal cracks in girder ends exceeding 0.005" in width as directed by the Engineer. The fabricator is permitted to decrease the spacing of Bars R and S by providing additional bars to help limit crack width provided the decreased spacing results in no less than 1" clear between bars. The fabricator must take an approved corrective action if cracks greater than 0.005" form on a repetitive basis.

DEPRESSED STRAND DESIGNS:

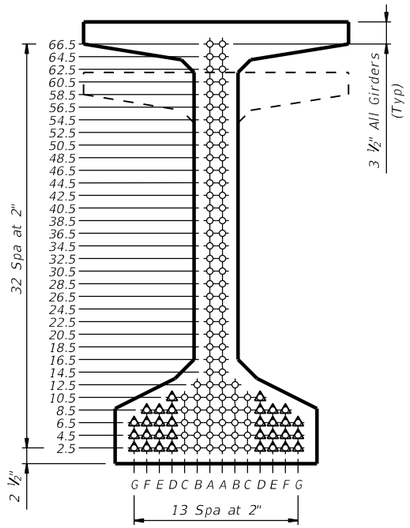
Locate strands for the designed girder as low as possible on the 2" grid system unless a non-standard strand pattern is indicated. Fill row "2.5", then row "4.5", then row "6.5", etc., beginning each row in the "A" position and working outward until the required number of strands is reached. All strands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



TYPE Tx28, Tx34 & Tx40



TYPE Tx46 & Tx54



TYPE Tx62 & Tx70

HL93 LOADING

STATE OF TEXAS
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114660
LICENSED PROFESSIONAL ENGINEER

An Yan, P.E.
08/26/2021

Texas Department of Transportation

Bridge Division Standard

PRESTRESSED CONCRETE I-GIRDER DESIGNS
(NON-STANDARD SPANS) AT CYPRESS CREEK BRIDGE REPLACEMENT

IGND

FILE: IH45_SB_Cyp_ignd.dgn	DN: AY	CK: TxDOT	DW: EFC	CK: TAR
©TxDOT August 2017	CONT	SECT	JOB	HIGHWAY
REVISIONS 10-19: Modified for depressed strands only.	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	Harris		180

DISCLAIMER:
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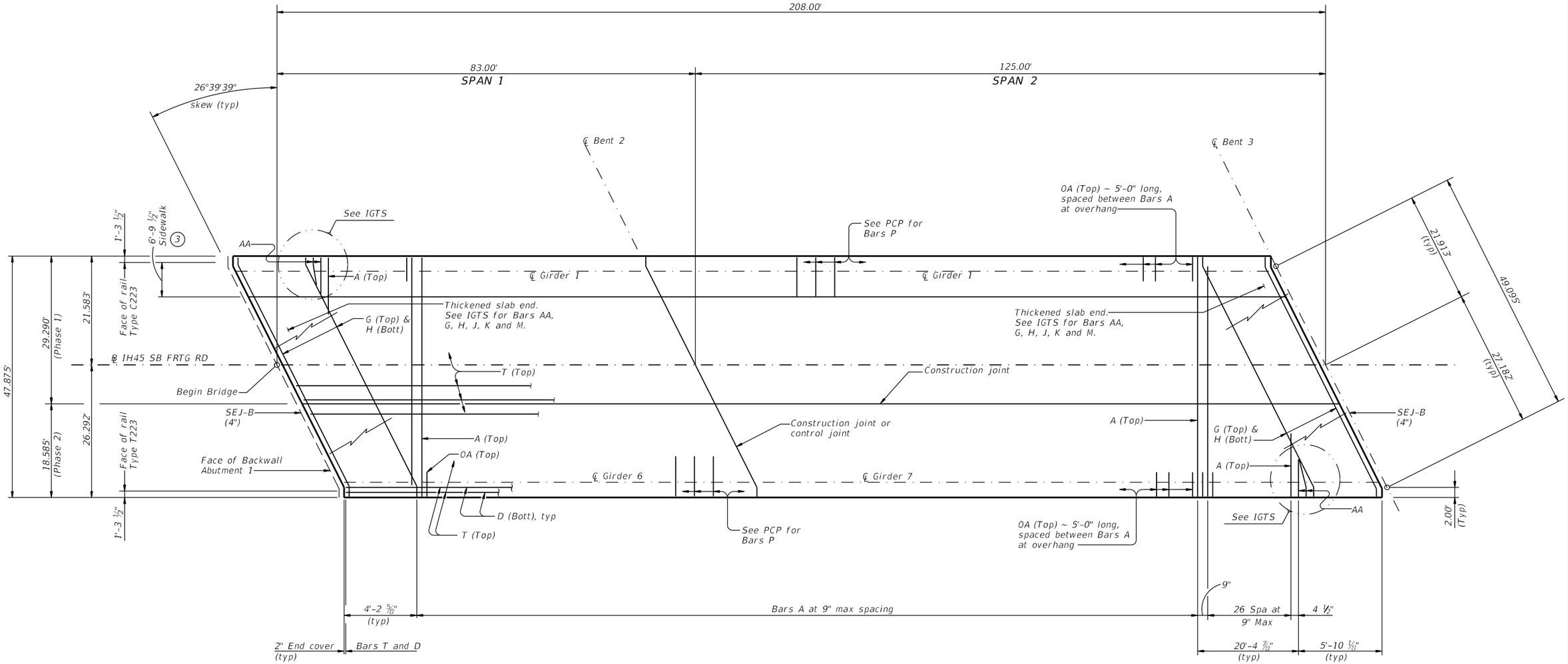

UNIT 1

HL93 LOADING

SHEET 1 OF 2

NOTES:

1. See IGTS Standard for Thickened Slab End Details.
   See PCP Standard for other details.
2. See IGCS (MOD) Standard for Continuous Slab Details.
   See PCP Standard for other details.
3. See BRSM Standard for Raised Sidewalk on Bridge Details.
   See BS-EJCP Standard for Expansion Joint Cover Plates.

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Houston District (Bridge)

SLAB PLAN

IH45 SB FRTG RD

AT CYPRESS CREEK BRIDGE REPLACEMENT

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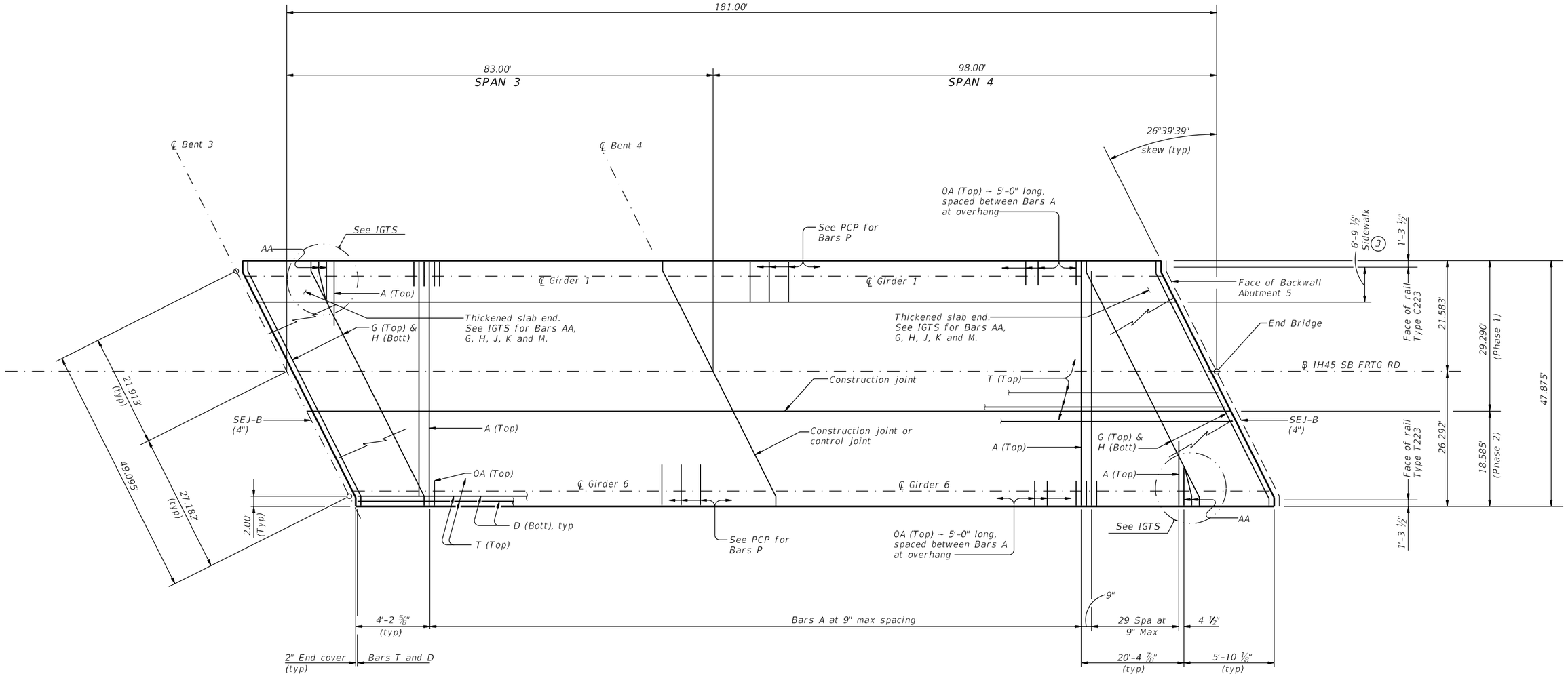

UNIT 2

HL93 LOADING

SHEET 2 OF 2

NOTES:

1. See IGTS Standard for Thickened Slab End Details. See PCP Standard for other details.
2. See IGCS (MOD) Standard for Continuous Slab Details. See PCP Standard for other details.
3. See BRSM Standard for Raised Sidewalk on Bridge Details. See BS-EJCP Standard for Expansion Joint Cover Plates.

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08/26/2021

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SLAB PLAN

IH45 SB FRTG RD

AT CYPRESS CREEK BRIDGE REPLACEMENT

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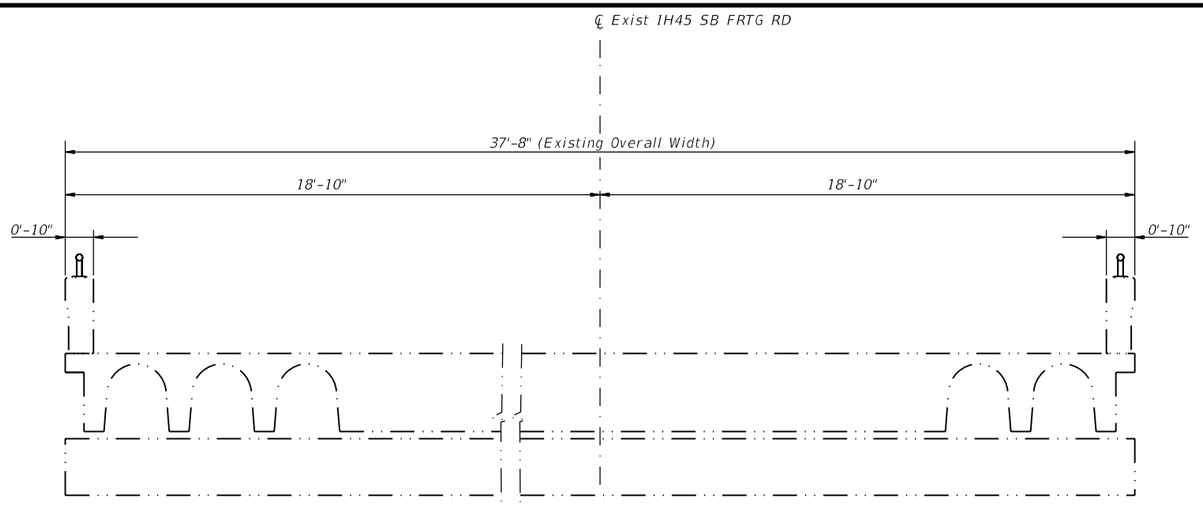

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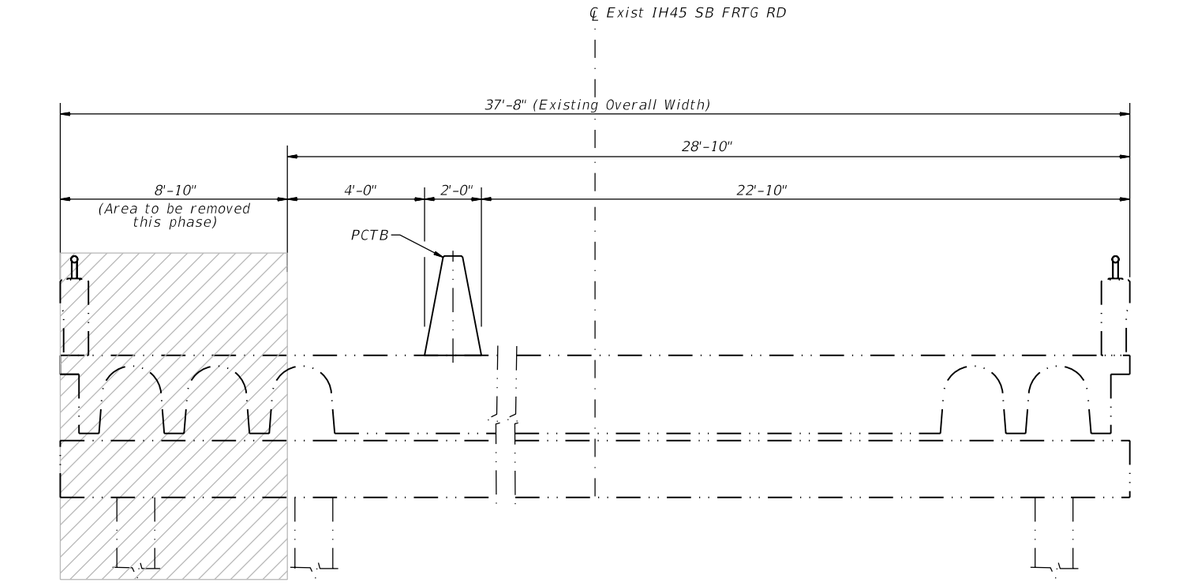

TYPICAL TRANSVERSE SECTION - PHASE 1 CONSTRUCTION

(STEP 1)

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SLAB DETAILS

IH45 SB FRTG RD

AT CYPRESS CREEK BRIDGE REPLACEMENT

FILE: IH45-SB_Cyp_SlabDet1.dgn	DN: AY	CK: MEC	DW: GB	CK: MEC
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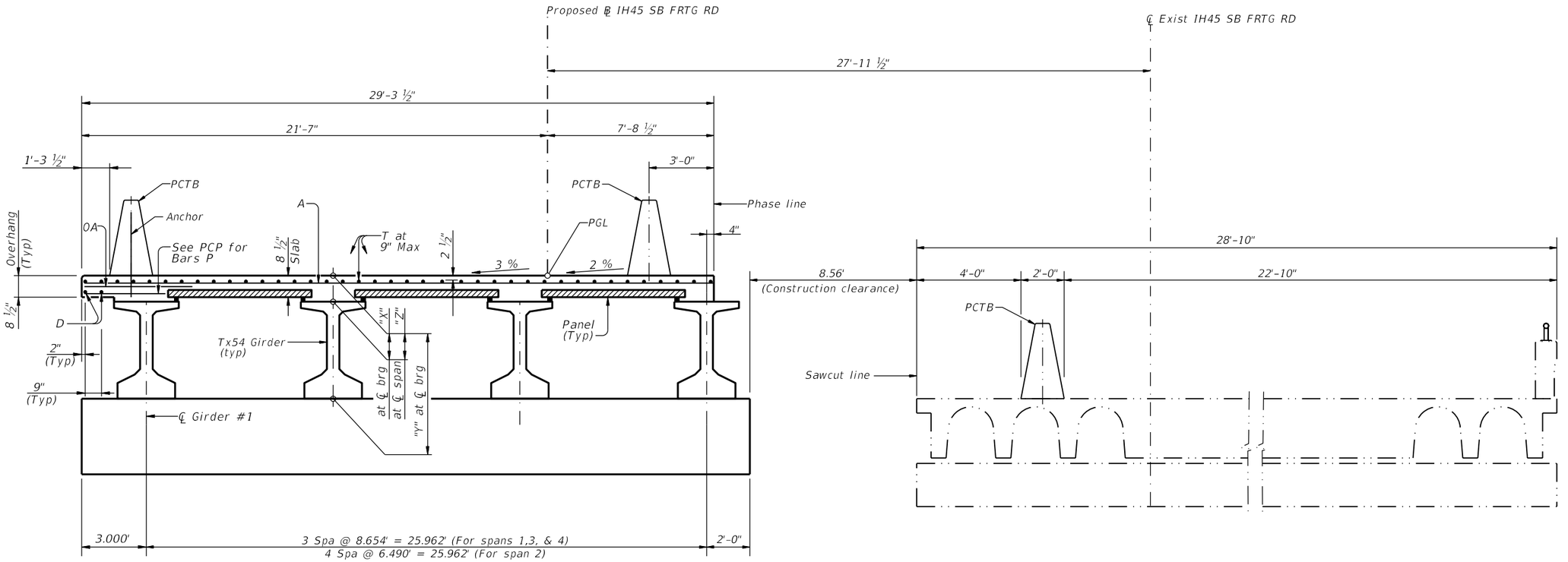
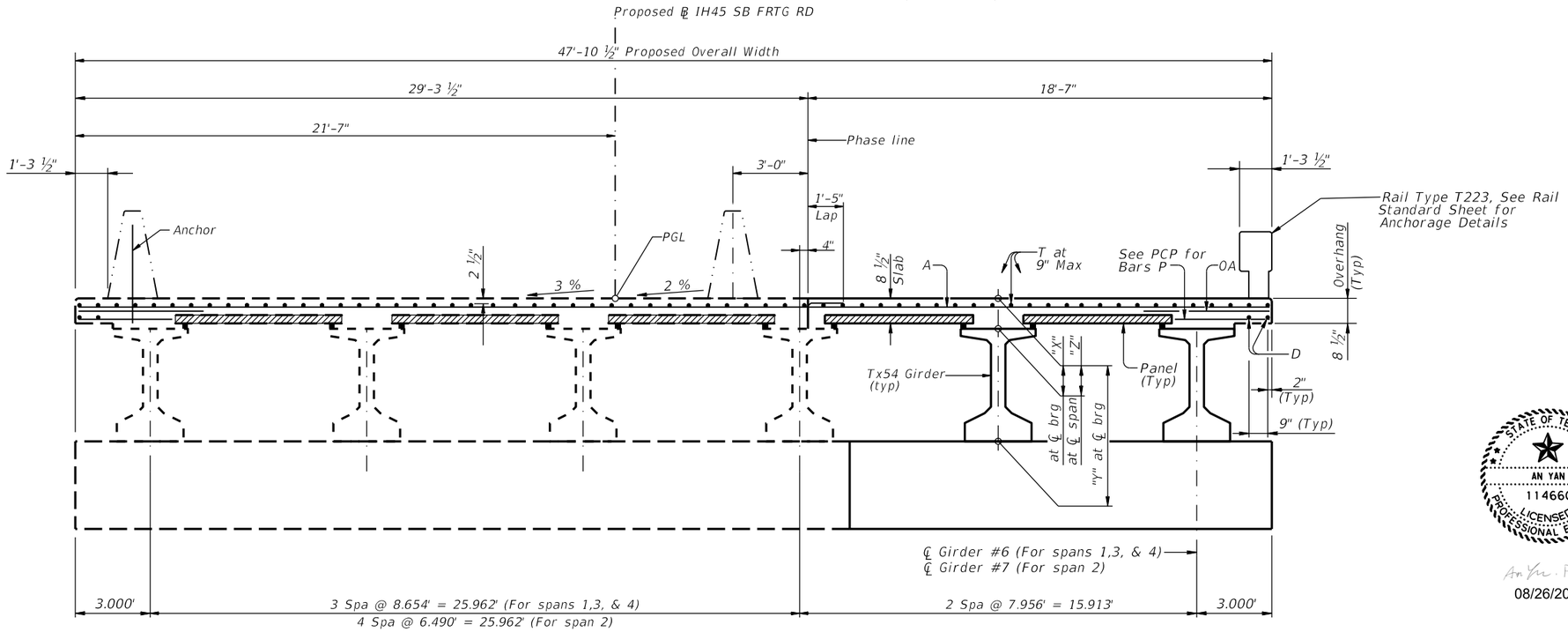


TYPICAL TRANSVERSE SECTION - PHASE 1 CONSTRUCTION

(STEP 2)



TYPICAL TRANSVERSE SECTION - PHASE 2 CONSTRUCTION

HL93 LOADING

SHEET 2 OF 4

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Houston District (Bridge)

SLAB DETAILS

IH45 SB FRTG RD

AT CYPRESS CREEK BRIDGE REPLACEMENT

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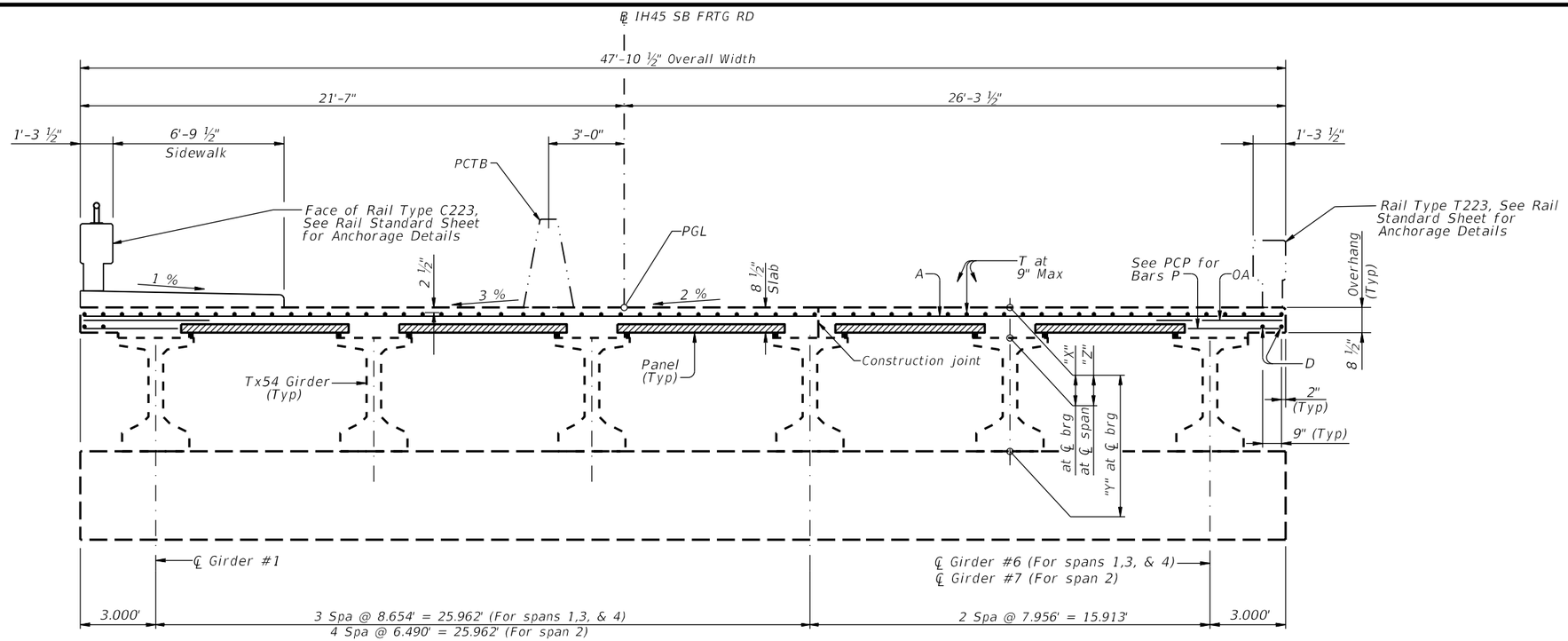

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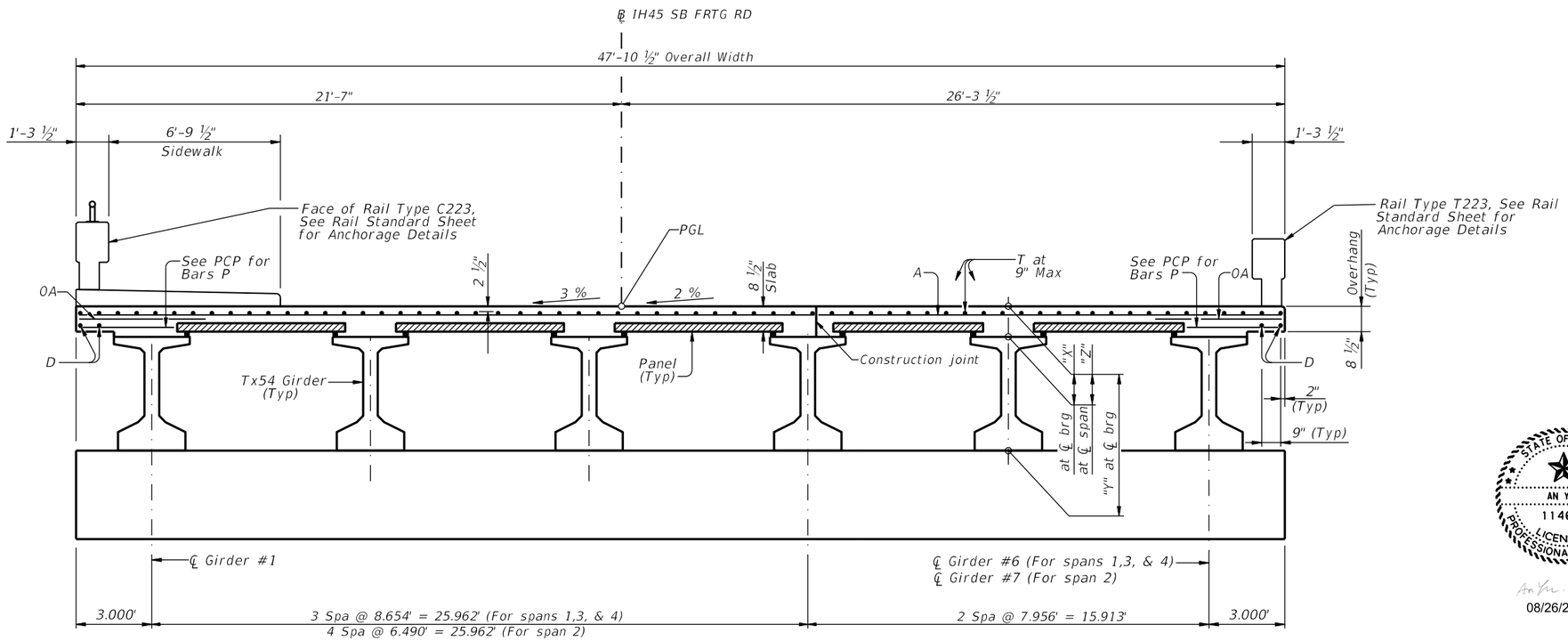

TYPICAL TRANSVERSE SECTION - FINAL

HL93 LOADING

SHEET 3 OF 4

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08/26/2021

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SLAB DETAILS

IH45 SB FRTG RD

AT CYPRESS CREEK BRIDGE REPLACEMENT

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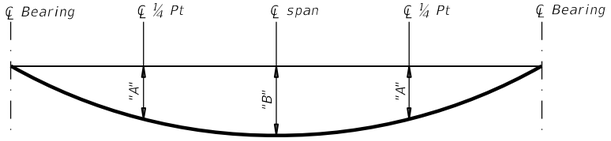

DEAD LOAD DEFLECTION DIAGRAM

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

TABLE OF DEAD LOAD DEFLECTIONS

SPAN NO.	GIRDER NO.	"A" * (Feet)	"B" * (Feet)
1	1	0.030	0.042
1	2-3	0.035	0.049
1	4	0.033	0.047
1	5	0.032	0.045
1	6	0.028	0.040
2	1	0.135	0.190
2	2-4	0.140	0.197
2	5	0.157	0.220
2	6	0.172	0.242
2	7	0.151	0.212
3	1	0.029	0.042
3	2-3	0.035	0.050
3	4	0.033	0.048
3	5	0.032	0.046
3	6	0.028	0.040
4	1	0.058	0.082
4	2-3	0.069	0.097
4	4	0.066	0.093
4	5	0.063	0.089
4	6	0.056	0.078

* Theoretical Dimension

TABLE OF SECTION DEPTHS

UNIT	SPAN	GIRDER	Section Depths "X"	"Y"	"Z" *
1	1	1	10½"	5'-4½"	10⅞"
	1	2	10½"	5'-4½"	11"
	1	3-6	10½"	5'-4½"	11⅛"
	2	1-4	10½"	5'-4½"	10⅞"
	2	5	10½"	5'-4½"	11⅛"
	2	6	10½"	5'-4½"	11¼"
	2	7	10½"	5'-4½"	11"
2	3	1	10½"	5'-4½"	10⅞"
	3	2	10½"	5'-4½"	11"
	3	3	10½"	5'-4½"	11¼"
	3	4-6	10½"	5'-4½"	11⅛"
	4	1-3, 5-6	10½"	5'-4½"	11"
	4	4	10½"	5'-4½"	11⅛"

* Theoretical Dimension

TABLE OF ESTIMATED QUANTITIES

PHASE 2

ITEM	UNIT	QUANTITY
Reinf Conc Slab	SF	7,230
Reinf Steel	LB	16,629

TABLE OF ESTIMATED QUANTITIES

PHASE 1

ITEM	UNIT	QUANTITY
Reinf Conc Slab	SF	11,394
Reinf Steel	LB	26,207

Reinforcing steel weight is calculated using an approximate factor of 2.3 Lbs/SF and is for Contractor's information only. No Direct Payment.

BAR TABLE

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

GENERAL NOTES:

Designed According To AASHTO LRFD Bridge Design Specifications.

See PCP And PCP-FAB For Panel Details Not Shown.

See IGTS Standard For Thickened Slab End Details And Quantity Adjustments

See IGMS Standard For Miscellaneous Details

See PMDF Standard For Details And Quantity Adjustments If This Options Is Used.

See BRSM Standard for Raised Sidewalk on Bridge Details.

See BS-EJCP Standard for Sidewalk Expansion Joint Cover Plates.

Cover Dimensions Are Clear Dimensions, Unless Noted Otherwise.

MATERIAL NOTES:

Provide Class S concrete (f'c = 4,000 psi).

Provide Grade 60 Reinforcing Steel.

Provide Bar Laps, Where Required, As Follows: Uncoated ~ #4 = 1'-5"

Deformed Welded Wire Reinforcement (WWR) (ASTM A1064) of Equal Size And Spacing May Be Substituted For Bars A, D, OA, P Or T Unless Noted Otherwise. Provide The Same Laps As Required For Reinforcing Bars.

HL93 LOADING

STATE OF TEXAS
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An Yan, P.E.
08/26/2021

Texas Department of Transportation

Houston District (Bridge)

SLAB DETAILS

IH45 SB FRTG RD

AT CYPRESS CREEK BRIDGE REPLACEMENT

FILE: IH45-SB_Cyp_SlabDet4.dgn	DN: AY	CK: MEC	DW: GB	CK: MEC
©TxDOT 8/26/2021	CONT	SECT	JOB	HIGHWAY
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	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		186

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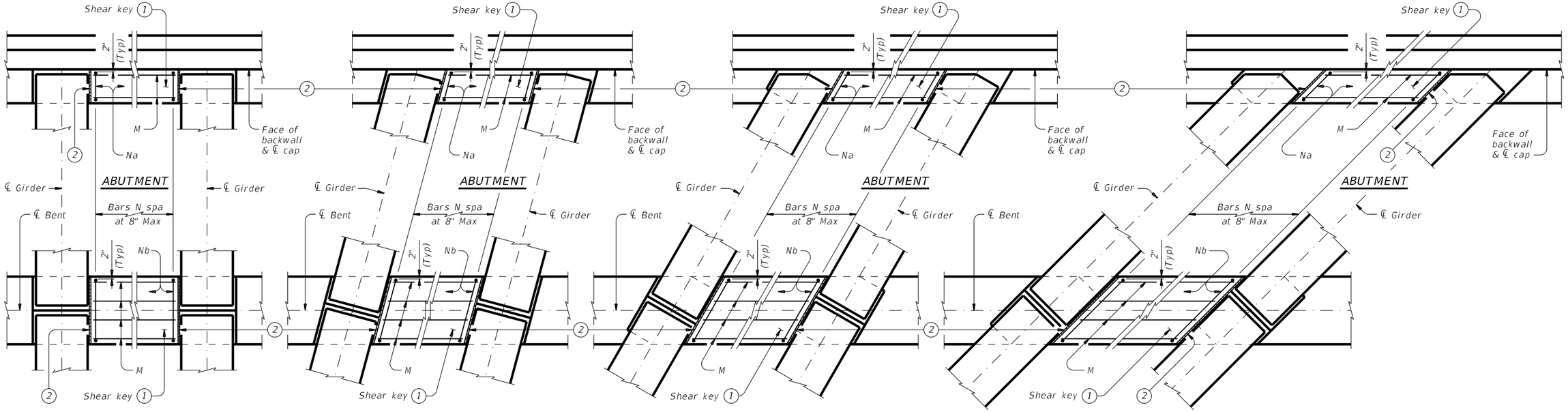


PARTIAL PLANS WITH NO SKEW

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

PARTIAL PLANS WITH 15° SKEW

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

PARTIAL PLANS WITH 30° SKEW

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

PARTIAL PLANS WITH 45° SKEW

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

(1) Place shear keys on the upstream side of structure between outside girder and next adjacent girder, unless shown otherwise on plans.

(2) UHMW polyethylene wear pad. (Typ)

(3) Leave a ¼" gap plus or minus between girder and face of wear pad. Cast wear pad with shear key, smooth side facing girder. Care must be taken to keep concrete from flowing under girder. Slope top of shear keys in accordance with Item 420.4.9, "Treatment and Finishing of Horizontal Surfaces."

(4) Measure at higher bearing seat elevation forward or back. Dimension based on typical bearing pad and bearing seat. Increase as necessary to maintain 5" overlap.

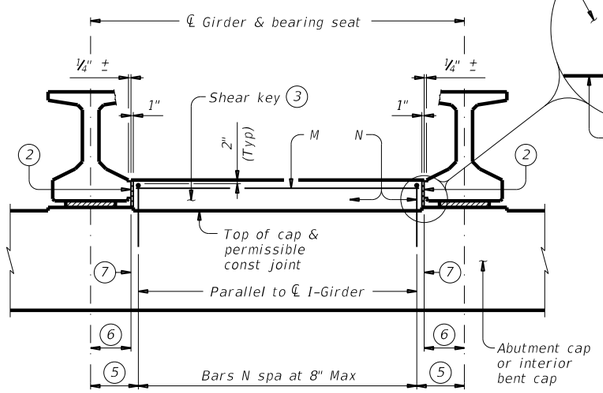
(5) With No Skew = 1'-8 ¼", measured along ℄ cap.
With Skew = 1'-8 ¼" ⧸ Cos Skew, measured along ℄ cap.

(6) With No Skew = 1'-4 ¼", measured along ℄ cap.
With Skew = 1'-4 ¼" ⧸ Cos Skew, measured along ℄ cap.

(7) Face of UHMW polyethylene wear pad. Smooth side of pad facing girder.

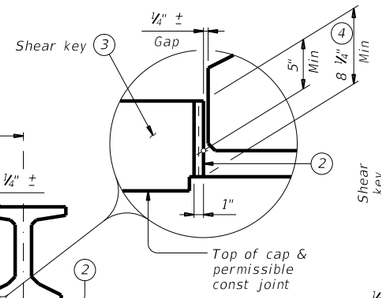
(8) Abutments = ½ Cap width.
Interior bents = Cap width.

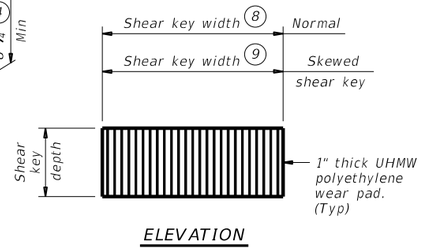
(9) Abutments = ½ Cap width ⧸ Cos Skew.
Interior bents = Cap width ⧸ Cos Skew.



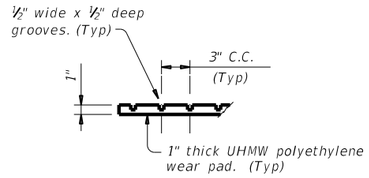
PARTIAL ELEVATION OF ABUTMENT OR INTERIOR BENT CAP (1)

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



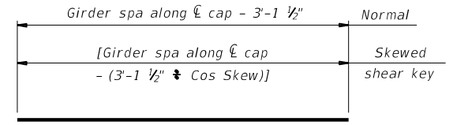


ELEVATION

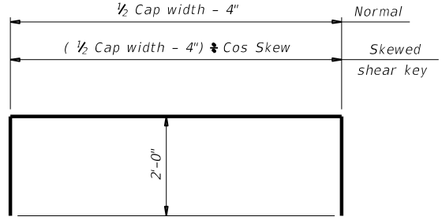


PART SECTION

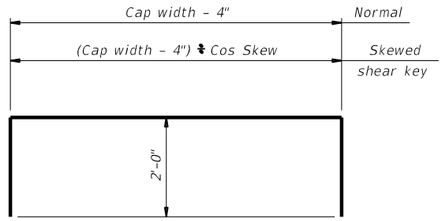
ULTRA HIGH MOLECULAR WEIGHT (UHMW) POLYETHYLENE WEAR PAD DETAILS



BARS M (#5)



BARS Na (#5)
(For abutments)



BARS Nb (#5)
(For interior bents)

CONSTRUCTION NOTES:

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

GENERAL NOTES:

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

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

Texas Department of Transportation

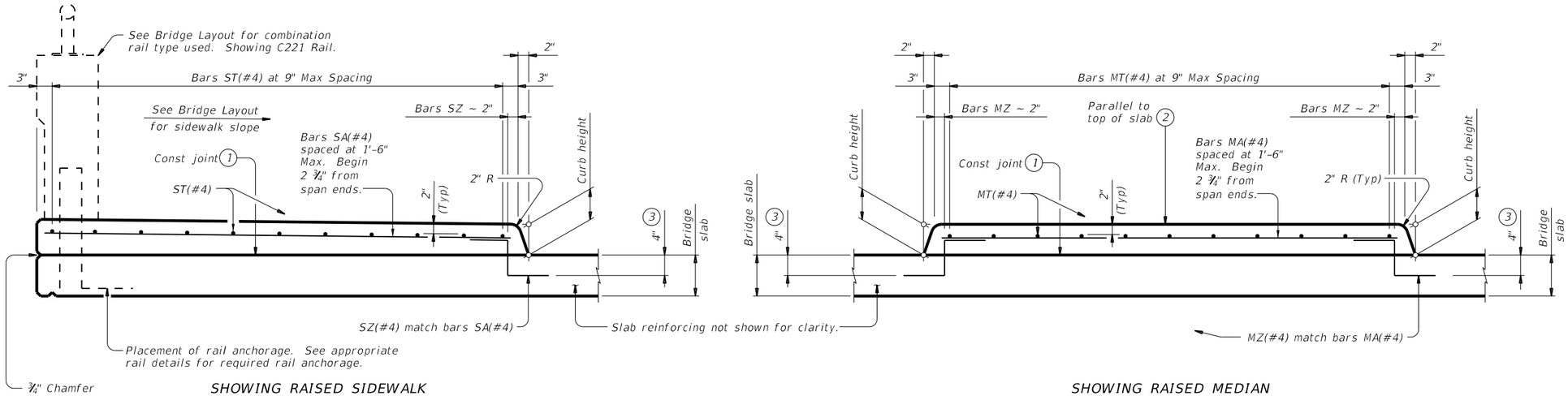
Bridge Division Standard

SHEAR KEY DETAILS
PRESTR CONCRETE I-GIRDERS

IGSK

FILE: igskstds-17.dgn	DN: TxDOT	CK: TxDOT	DW: JTR	CK: AES
©TxDOT August 2017	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		188

DATE:
FILE:



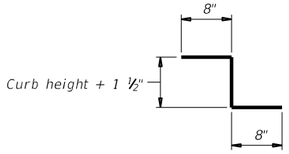
TYPICAL TRANSVERSE SECTIONS

See Span Details for dimensions not shown.

(1) Provide broom finish to top of bridge slab where raised sidewalk or raised median area is defined.

(2) Unless noted otherwise on the span details.

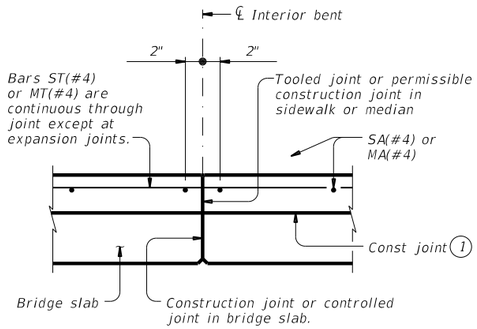
(3) Bars may rest on top of PCPs.



BARS SZ(#4) AND MZ(#4)

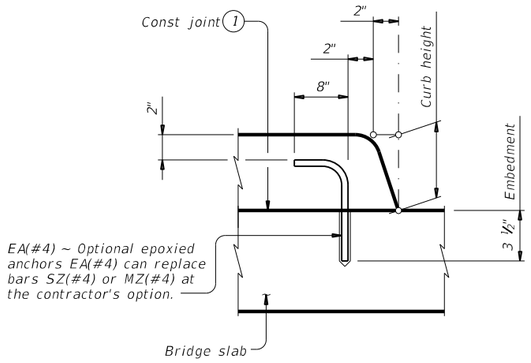
APPROVED SLIP RESISTANT PLATE	
Product	Manufacturer Website
Algrip™, Steel	www.algrip.com
Mebac® #3, Steel	www.harscoikg.com
SlipNOT® Grade 2, Steel	www.slipnot.com

Provide drain cover plates fabricated with a product from this list. No exceptions are permitted.



LONGITUDINAL SECTION AT INTERIOR BENT

At bents with expansion joints, provide an open joint in the sidewalk/median matching the deck's joint width.



OPTIONAL EPOXY ANCHORS

Embed EA(#4) bar into concrete with a Type III (Class C, D, E, or F) epoxy meeting the requirements of DMS-6100, "Epoxies and Adhesives". Follow manufacturer's directions for installing the epoxied anchor bars.

MATERIAL NOTES:

Provide the same concrete required for the bridge deck, Class S or Class S (HPC) concrete.

Provide Grade 60 reinforcing steel. Deformed welded wire reinforcement (WWR) meeting ASTM A1064 of equivalent size and spacing may be substituted for bars SA, ST, MA, and MT.

Provide epoxy coat or galvanize reinforcement if bridge deck reinforcement is required to be epoxy coated or galvanized.

Provide hot-dip galvanize slip resistant steel plate after fabrication in accordance with Item 445, "Galvanizing".

Chamfer or round edges approximately 1/16" prior to galvanizing.

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.

Provide the following bar or wire lap lengths when required:
- Uncoated, 1'-7" Min
- Coated, 2'-5" Min

Submittal and approval of drain cover plate shop drawings is not required if fabrication is accordance with these details.

Raised sidewalks will be paid under Item 422 by the SF of Bridge Sidewalk or Bridge Sidewalk (HPC). Raised medians will be paid under Item 422 by the SF of Bridge Median or Bridge Median (HPC).

Payment for drain cover plates will be by the pound of "Structural Steel (Misc Non-Bridge)" as per Item 442, "Metal for Structures". Weight of one drain cover plate is 48 plf.

DESIGNER NOTES:

These details do not apply for longitudinal grades exceeding 5 percent.

Cover dimensions are clear dimensions, unless noted otherwise.

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

Texas Department of Transportation

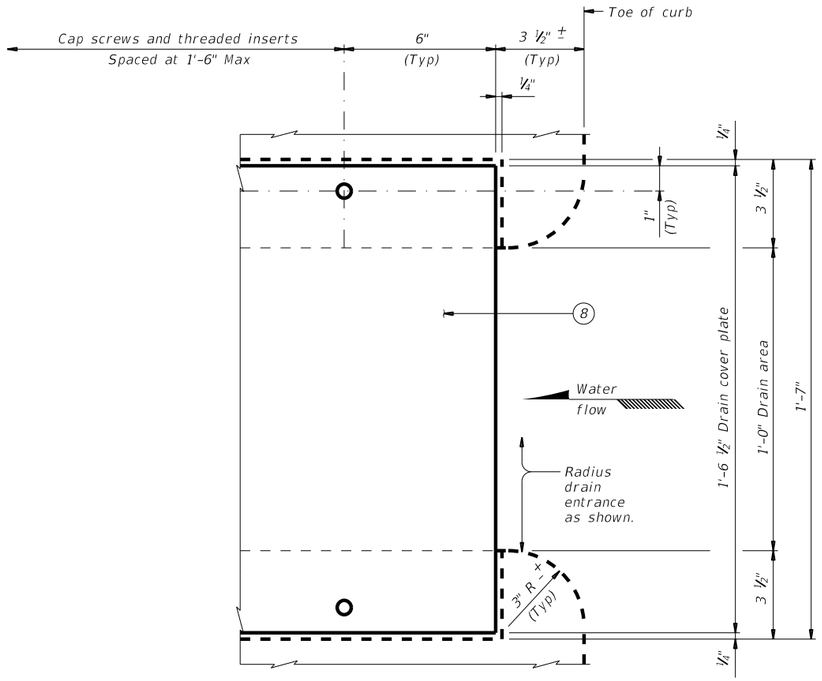
Bridge Division Standard

BRIDGE RAISED SIDEWALK AND MEDIAN DETAILS

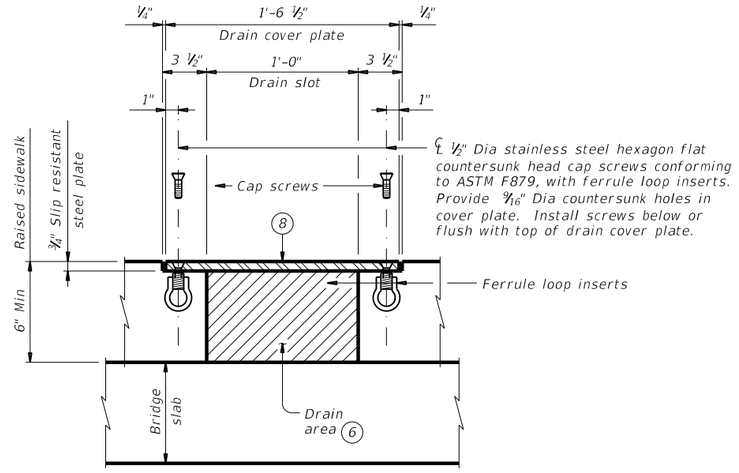
BRSM

FILE: brsmste1-19.dgn	DN: JMH	CK: TxDOT	DW: JTR	CK: TxDOT
©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		189

DATE:
FILE:

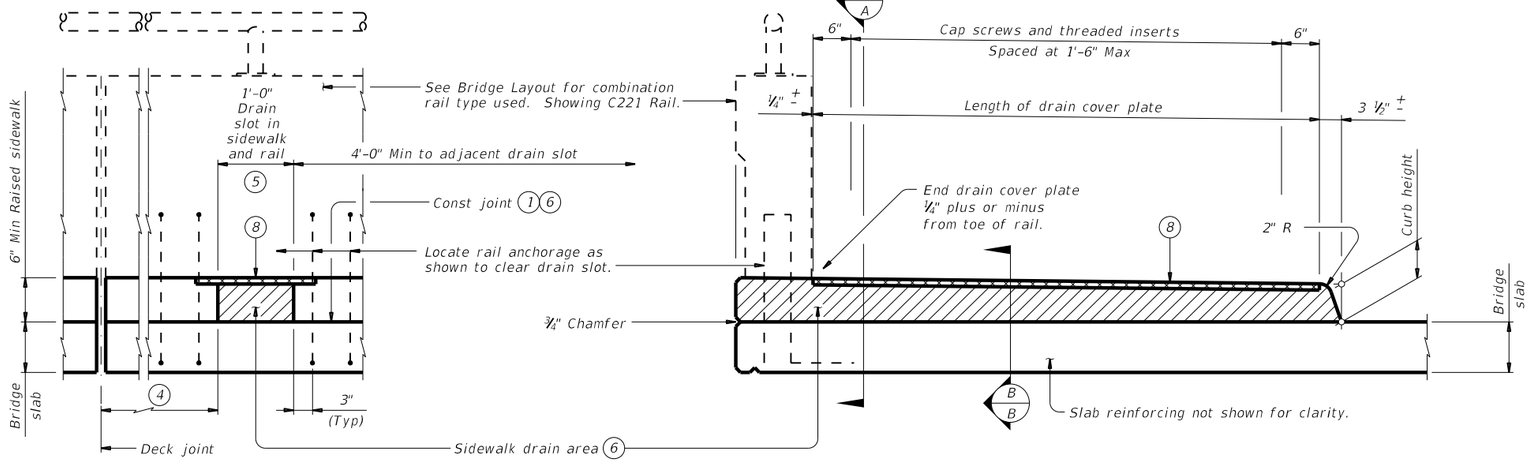


PARTIAL PLAN CURB DRAIN



SECTION B-B

Reinforcing not shown for clarity.



SECTION A-A

SHOWING RAISED SIDEWALK WITH DRAIN SLOT

OPTIONAL DRAIN DETAILS (7)

(1) Provide broom finish to top of bridge slab where raised sidewalk or raised median area is defined.

(4) 3'-0" Min at deck expansion joints, deck construction joints or controlled joints, rail intermediate wall joints or from face of substructure.

(5) For rail Type C1W, center drain slots between posts.

(6) Steel trowel top surface of bridge deck in drain locations.

(7) Provide sidewalk drains where shown elsewhere on the plans or as directed by the Engineer. Do not place drains over railroad tracks, lower roadways, or sidewalks. Place drain and cover plate perpendicular to toe of rail.

(8) Drain cover plate (PL ¾ x 18 ½ slip resistant steel plate). Install flush with top of sidewalk.

Texas Department of Transportation

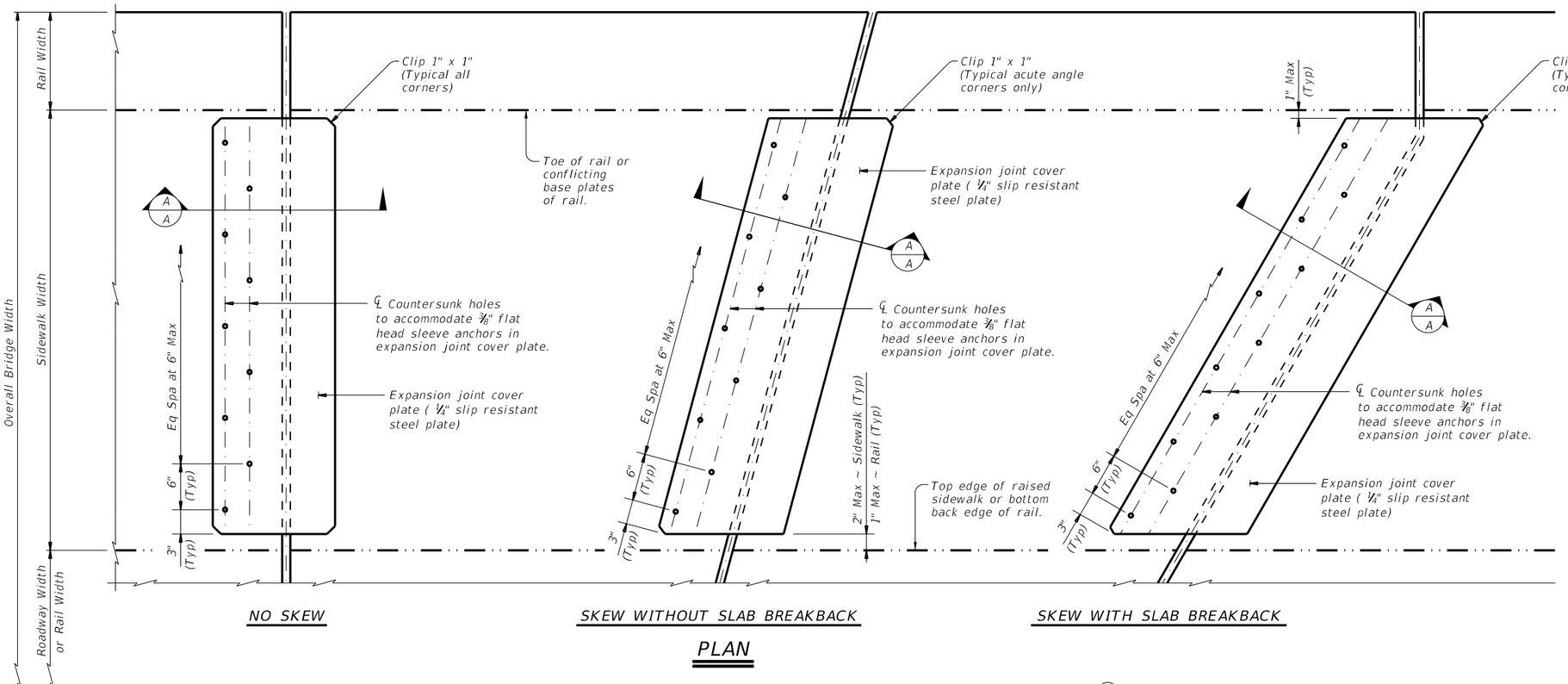
Bridge Division Standard

BRIDGE RAISED SIDEWALK AND MEDIAN DETAILS

BRSM

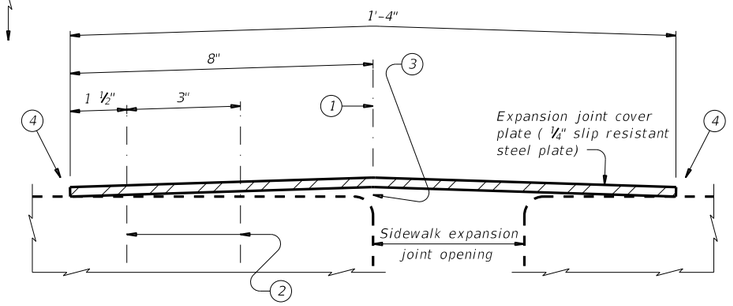
FILE: brsmste1-19.dgn	DN: JMH	CK: TxDOT	DW: JTR	CK: TxDOT
©TxDOT April 2019 REVISIONS	CONT	SECT	JOB	HIGHWAY
	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		190

DATE:
FILE:

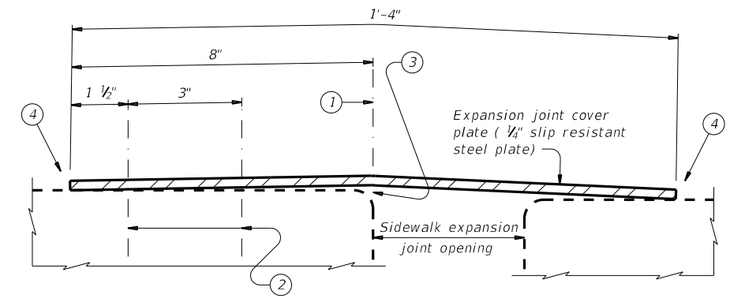


NO SKEW | SKEW WITHOUT SLAB BREAKBACK | SKEW WITH SLAB BREAKBACK

PLAN



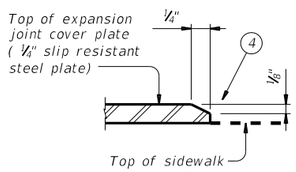
SHOWING LEVEL EXP JOINT



SHOWING UNLEVEL EXP JOINT
(Install sleeve anchors on high side of expansion joint)

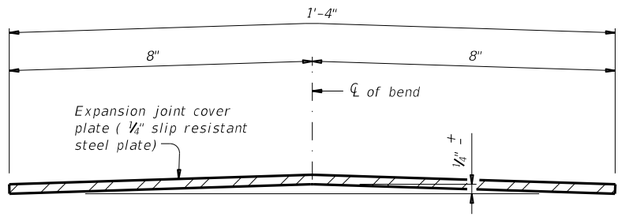
SECTION A-A

1. ℄ Expansion joint cover plate and edge of expansion joint.
2. ℄ ⅜" x 2 ½" Min, Flat Head Sleeve Anchors, Stainless Steel. Countersink Flat Head Sleeve Anchors in ¼" Slip Resistant Steel Plate.
3. It is not necessary to remove plate crown provided the plate is firmly secured to the sidewalk.
4. Transverse edges must be in contact with sidewalk surface after installation.



EXP JOINT COVER PLATE BEVEL DETAIL

Bevel all plate edges as shown.



BENDING DIAGRAM OF EXP JOINT COVER PLATE

APPROVED SLIP RESISTANT PLATE	
Product	Manufacturer Website
Algrip™, Steel	www.algrip.com
Mebac® #3, Steel	www.harscoikg.com
SlipNOT® Grade 2, Steel	www.slipnot.com

Provide cover plates fabricated with a product from this list. No exceptions are permitted.

FABRICATION NOTES:

Shop drawings for the fabrication of Bridge Sidewalk Expansion Joint Cover Plate will not require the Engineer's approval if fabrication is in accordance with the details shown on this standard.

A Bridge Sidewalk Expansion Joint Cover Plate Layout which identifies location side of sleeve anchors and orientation of all cover plate sections must be developed by the fabricator. Mark each steel section in accordance with the Bridge Sidewalk Expansion Joint Cover Plate Layout. A copy of the Bridge Sidewalk Expansion Joint Cover Plate Layout is to be provided to the Engineer.

Sidewalk expansion joint cover plates must be hot-dipped galvanized ¼" slip resistant steel plate. Checker plate or diamond plate is not allowed nor are slip resistant tapes, films and non-metallic coatings.

Minimum required yield strength of steel plate is 36 ksi.

Hot-dip galvanize slip resistant steel plate after fabrication in accordance with Item 445, "Galvanizing".

Provide stainless steel flat head sleeve anchors meeting the requirements of ASTM F 593, Group I, Alloy 304. Countersink holes in slip-resistant plate for sleeve anchors. Drill holes in sidewalk as per sleeve anchor manufacturer's recommendations. Install sleeve anchors flush with, or slightly recessed below, top surface of sidewalk expansion joint cover plate.

GENERAL NOTES:

Sidewalk expansion joint cover plates can only accommodate up to a 7" maximum expansion joint opening.

Details provided are applicable to concrete walkway surfaces only.

Payment for sidewalk expansion joint cover plates are by the pound of "Structural Steel (Misc Non-Bridge)" as per Item 442, "Metal for Structures".

Estimated weight of one sidewalk expansion joint cover plate is 14 plf.

Texas Department of Transportation

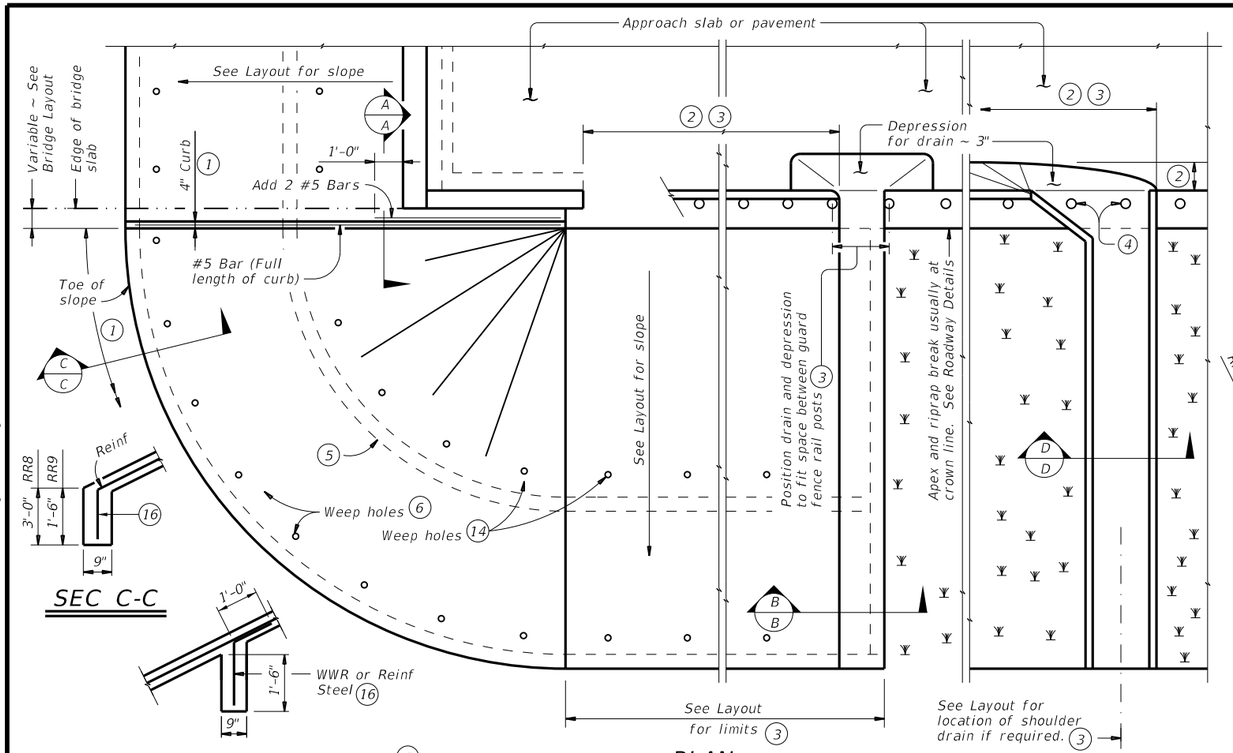
Bridge Division Standard

BRIDGE SIDEWALK EXPANSION JOINT COVER PLATE (ALL SKEWS)

BS-EJCP

FILE: bsejste1-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
8-20: Closer tolerances on cover plate.	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		191

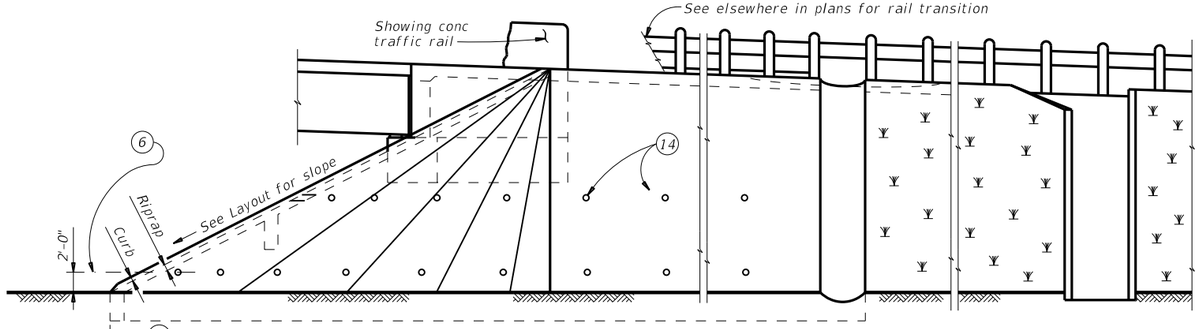
DATE:
FILE:



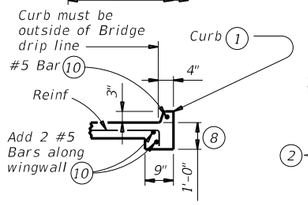
PLAN

SEC C-C

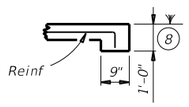
INTERMEDIATE TOEWALL



ELEVATION

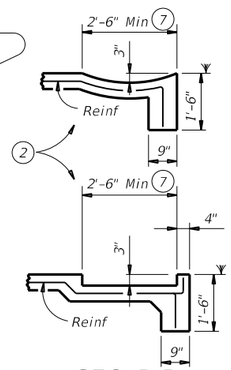


SEC A-A



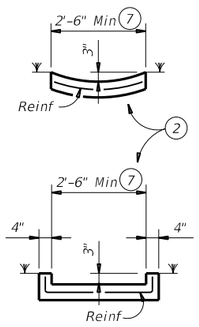
SEC B-B

(No drain)



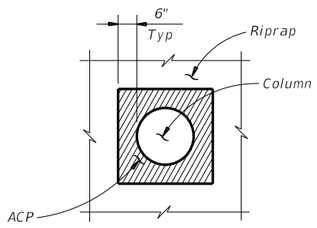
SEC B-B

(Shoulder drain integral with riprap)



SEC D-D

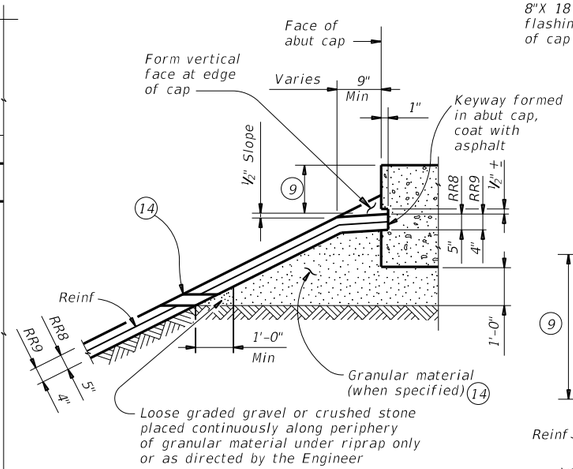
(Shoulder drain)



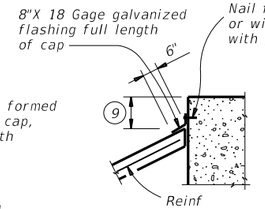
Riprap blockout to be filled with ACP. (Subsidiary to riprap)

RIPRAP DETAIL AT COLUMNS

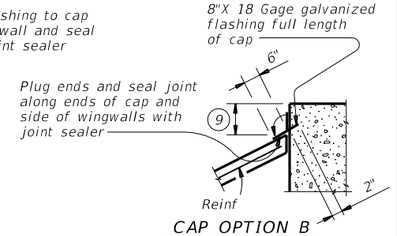
(As directed by the Engineer)



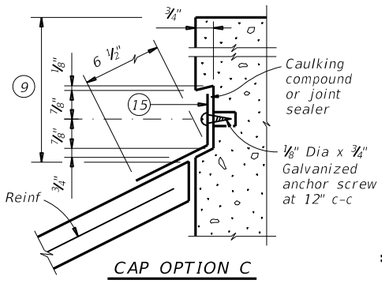
SHOWING KEYWAY OPTION



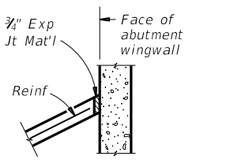
CAP OPTION A



CAP OPTION B

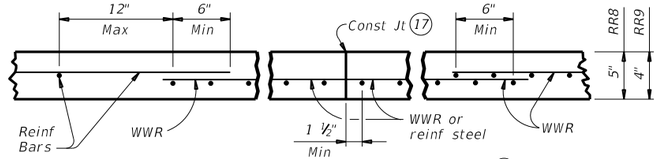


CAP OPTION C



SECT THRU RIPRAP AT WINGWALL (12)

SECTIONS THRU RIPRAP AT CAP (11)



REINFORCEMENT DETAILS (13)

See General Notes for optional synthetic fiber reinforcement.

1. When riprap is shown extended around header on layout, extend slab and toewall as shown and eliminate 4" curb.
2. Limits and configuration of drains and depressions are as shown elsewhere in plans or as directed by the Engineer.
3. Location of shoulder drain must consider limitations imposed by rail transition. Do not locate shoulder drains at expansion joints between approach slab and concrete pavement.
4. See details elsewhere in plans for installation of guard fence posts through concrete riprap.
5. Provide intermediate toewall only when designated elsewhere in the plans or included in the specifications.
6. Provide lower level of 2" Dia weep holes at 10' c-c backed by 1 CF packet of gravel and galvanized hardware cloth at all locations unless directed by the Engineer to eliminate.
7. Use wider or other drain configurations if shown elsewhere in plans or if directed by the Engineer.
8. Wall extension may be reduced or modified if approved by the Engineer. Increase wall extension to 1'-6" whenever the optional intermediate toewall is called for in the plans.
9. Top of cap to top of riprap dimension varies as directed by the Engineer. Should be 9" Min for beam/slab type bridges and 1'-6" for slab span, box beam, or slab beam bridges.
10. #5 bars shown are required even when synthetic fiber reinforcing option is selected.
11. Provide sealing option for joint between the face of cap and riprap as designated by the Engineer or as shown elsewhere on plans.
12. Flashing (shown in Cap Option A) may be used at wingwall in addition to Exp Jt Mat'l if shown on plans or directed by the Engineer.
13. Provide #3 reinforcing bars at 18" Spa c-c. Provide Welded Wire Reinforcement (WWR) as 6x6-D2.9xD2.9 or D3xD3. Combinations of WWR and reinforcing bars may be used if both are permitted. Use lap splices of a minimum 6 inches, measured from the transverse wire of WWR, and the ends of reinforcing bars.
14. If granular material is specified, provide upper level of 2" Dia weep holes at 10' c-c backed by galvanized hardware cloth.
15. 8" x 18 Gage Galv Sheet Metal
16. Provide WWR or #3 bars, with 1'-0" extension into slope.
17. WWR or reinforcing steel is continuous through riprap construction joints. Provide WWR or reinforcing steel that extends 1'-1" minimum into adjacent riprap on each side of construction joint even if synthetic reinforcing fiber is utilized.

FOR CONTRACTOR'S INFORMATION ONLY:
5" of RR8 = 0.015 CY/SF
4" of RR9 = 0.012 CY/SF
#3 Reinf at 18" c-c = 0.501 Lbs/SF
6x6-D3xD3 = 0.408 Lbs/SF

GENERAL NOTES:

Provide Class "B" concrete (f'c = 2,000 psi) unless noted elsewhere in plans.

Provide Grade 60 reinforcing steel.

Provide deformed welded wire reinforcement (WWR) meeting ASTM A1064, unless otherwise shown.

Provide reinforcing bars, deformed WWR, or any suitable combination of both types for riprap reinforcing, unless specified elsewhere in the plans.

Optionally synthetic fibers may be used if approved by the Engineer. Provide synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) in lieu of steel reinforcing in riprap concrete.

Install construction joints or grooved joints extending the full slant slope height at intervals of approximately 20 feet unless otherwise directed by the Engineer.

Hardware cloth, loose grade stone behind weep holes, flashing, or other sealing material are subsidiary to the bid item "Riprap".

See Layout for limits of riprap.

RR8 is to be used on stream crossings.

RR9 is to be used on other embankments.

Texas Department of Transportation

Bridge Division Standard

CONCRETE RIPRAP AND SHOULDER DRAINS
EMBANKMENTS AT BRIDGE ENDS (TYPES RR8 & RR9)

CRR

FILE: crrstde1-19.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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REVISIONS	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
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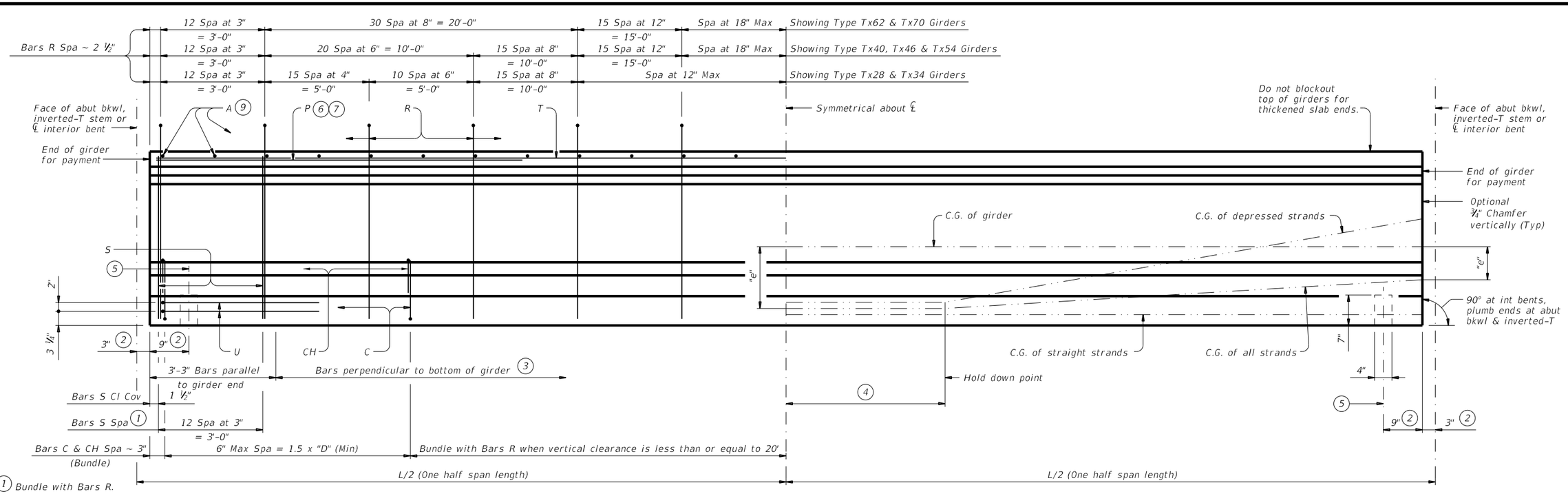
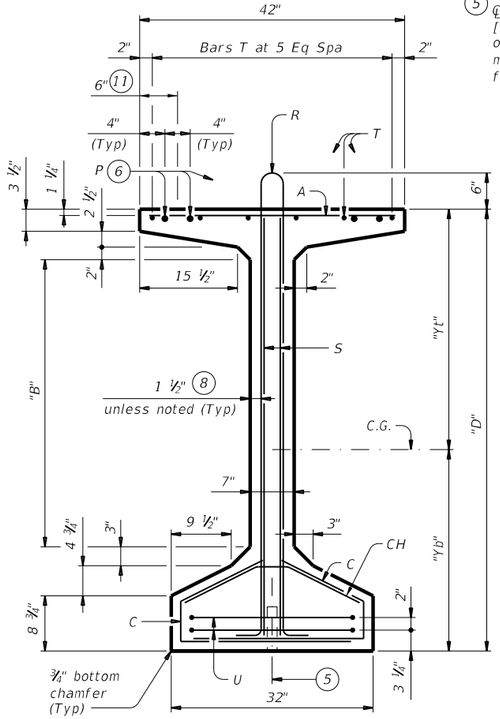
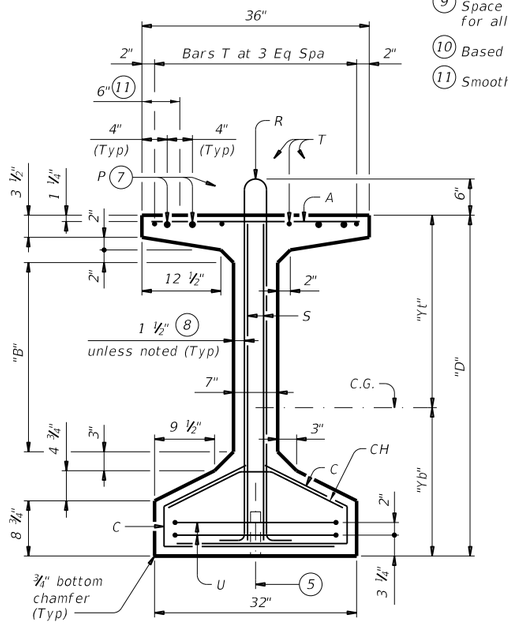


GIRDER ELEVATION

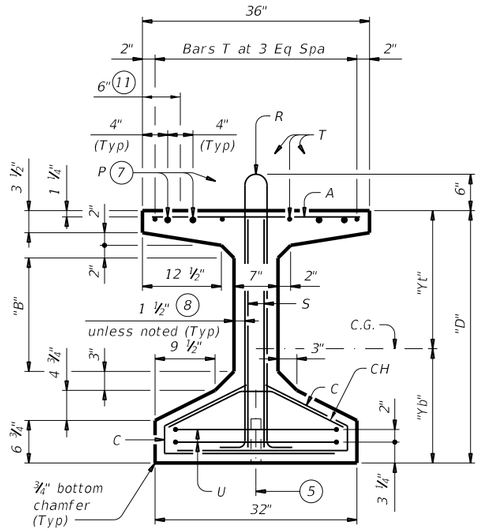
1. Bundle with Bars R.
2. Measured along ℄ Girder at interior bents; perpendicular to abutment bkwl or inverted-T stem.
3. The average of the top and bottom spacing of Bars R cannot exceed the required spacing.
4. L/20, but not less than 5'-0" (-0,+2').
5. ℄ 4" x 1 ½" Vertical Slotted Hole at doweled girder end [labeled (D) on Bridge Layout]. Required for outside girder only or as shown on substructure details. Anchorage holes may be tapered (4 ¾" x 1 ⅝") at base. If holes are formed with sheet metal, forms may be left in place.
6. Bars P (#6 x 15'-0") required in Tx62 and Tx70 girders. At the fabricator's option bars larger than #6 may be used. When L is less than 50 ft, Bars P are to be the same length as Bars T.
7. Bars P (#6 x 15'-0") are only required in Tx28, Tx34, Tx40, Tx46, and Tx54 girders when "e" at girder ends exceeds 0.25 x "D". At the fabricator's option bars larger than #6 may be used. When L is less than 50 ft, Bars P are to be the same length as Bars T.
8. 1 ⅜" Clear Cover to Bars S.
9. Space Bars A at 6" Max for girders requiring overhang bracket hangers. Space at 12" Max for all other girders. Tie to Bars R as necessary. See standard IGMS for "Deck Forming Notes".
10. Based on 155 pcf total weight of concrete and reinforcing steel.
11. Smooth trowel finish on the slab overhang side of exterior girder.



TYPE Tx62 & Tx70



TYPE Tx46 & Tx54



TYPE Tx28, Tx34 & Tx40

GIRDER DIMENSIONS AND SECTION PROPERTIES

Girder Type	"D" (in.)	"B" (in.)	"Yt" (in.)	"Yb" (in.)	Area (in.²)	"Ix" (in.⁴)	"Iy" (in.⁴)	Weight (10) (plf)
Tx28	28	6	15.02	12.98	585	52,772	40,559	630
Tx34	34	12	18.49	15.51	627	88,355	40,731	675
Tx40	40	18	21.90	18.10	669	134,990	40,902	720
Tx46	46	22	25.90	20.10	761	198,089	46,478	819
Tx54	54	30	30.49	23.51	817	299,740	46,707	880
Tx62	62	37 ½"	33.72	28.28	910	463,072	57,351	980
Tx70	70	45 ½"	38.09	31.91	966	628,747	57,579	1,040

GENERAL NOTES:

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

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

HL93 LOADING

SHEET 1 OF 2

Texas Department of Transportation

Bridge Division Standard

PRESTRESSED CONCRETE I-GIRDER DETAILS

IGD

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10-19: Added Bars C and CH full length for VC<= 20'	DIST	COUNTY		SHEET NO.
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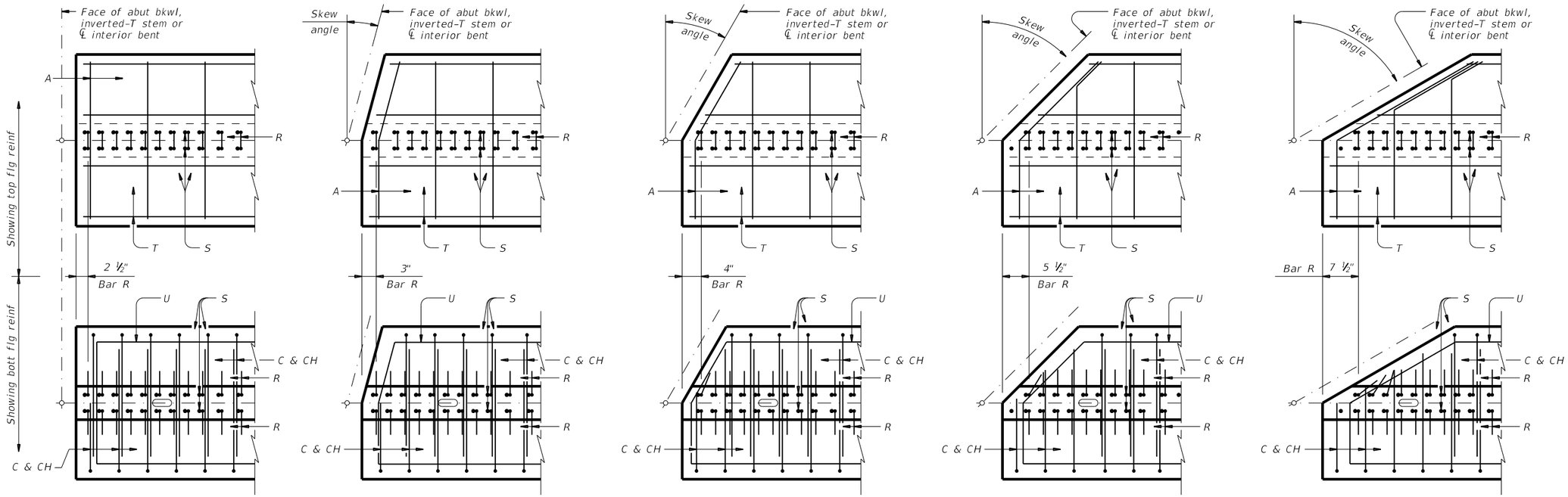
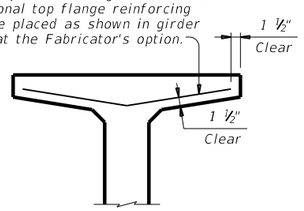
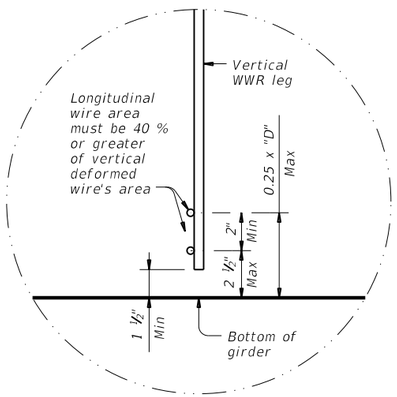


PLAN OF GIRDER ENDS (12)

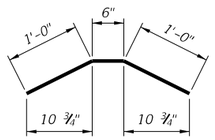
To control top flange cracking that may occur during form removal, additional top flange reinforcing may be placed as shown in girder ends at the Fabricator's option.



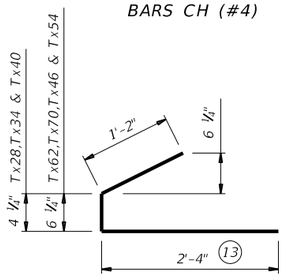
OPTIONAL TOP FLANGE REINFORCING DETAIL



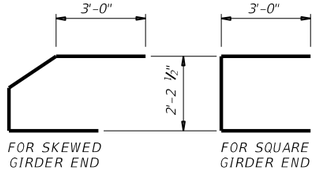
OPTIONAL WELDED WIRE REINFORCEMENT (WWR) DETAIL



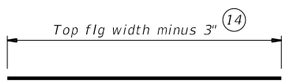
BARS CH (#4)



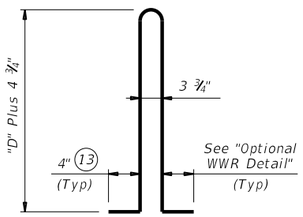
BARS C (#4)



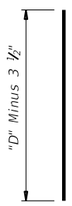
BARS U (#5)



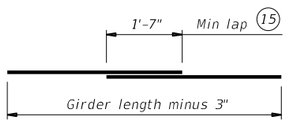
BARS A (#3)



BARS R (#4) (16)



BARS S (#6)



BARS T (#4)

(12) Reinforcing patterns shown are provided as guides to determine reinforcement placement in skewed ends. Place Bars S as close to girder end as cover requirements permit, which may prevent them to be bundled with Bars R.

(13) Bars may be cut or bent at skewed end as required.

(14) Increase as necessary for bars at skewed end.

(15) No portion of bar less than 10 ft.

(16) For Welded Wire Reinforcement (WWR) option, area of Bars R may be reduced in proportion to the increase in reinforcement yield strength over 60 ksi. Yield strength of WWR is limited to 75 ksi.

HL93 LOADING SHEET 2 OF 2

Texas Department of Transportation

Bridge Division Standard

PRESTRESSED CONCRETE I-GIRDER DETAILS

IGD

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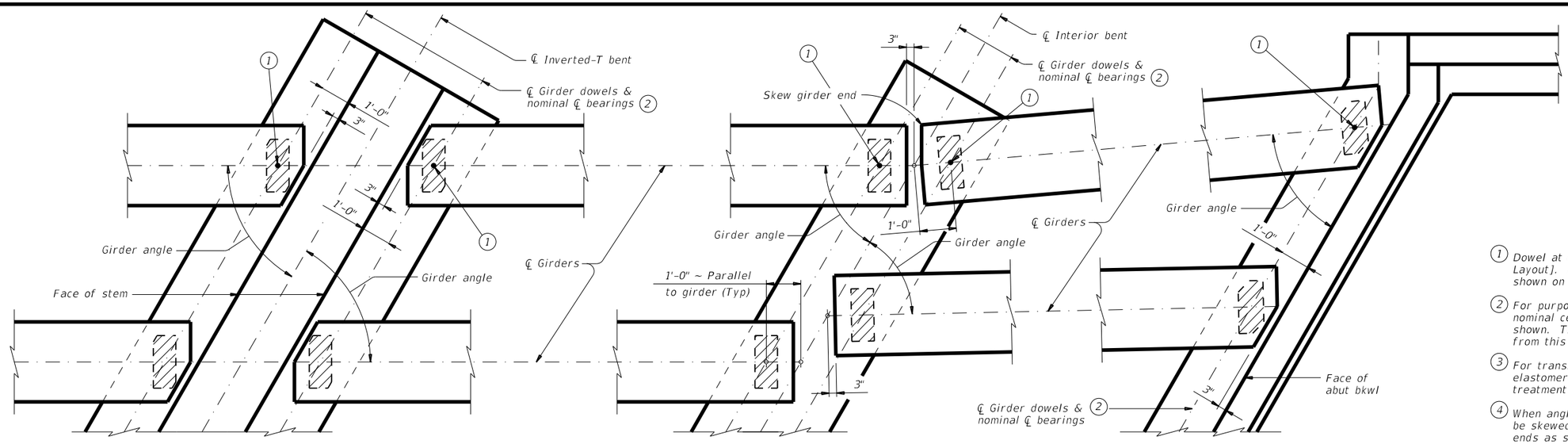


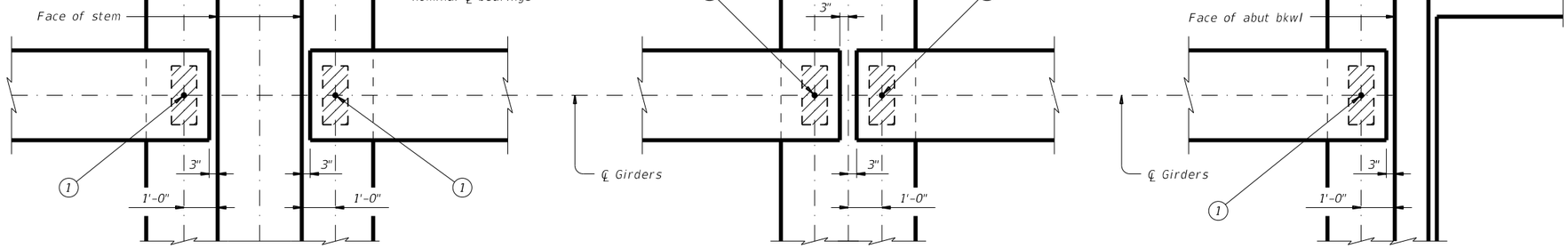
(1) Dowel at doweled girder end [labeled (D) on Bridge Layout]. Required for outside girder only or as shown on substructure details.

(2) For purposes of computing bearing seat elevations, nominal centerline of bearing must be defined as shown. The actual center of bearing pad may vary from this line.

(3) For transition bents with backwall, girder and elastomeric bearings must receive the same treatment as shown for abutments.

(4) When angle exceeds 0°, one or both girders ends must be skewed to maintain the clearance between girder ends as shown in view.

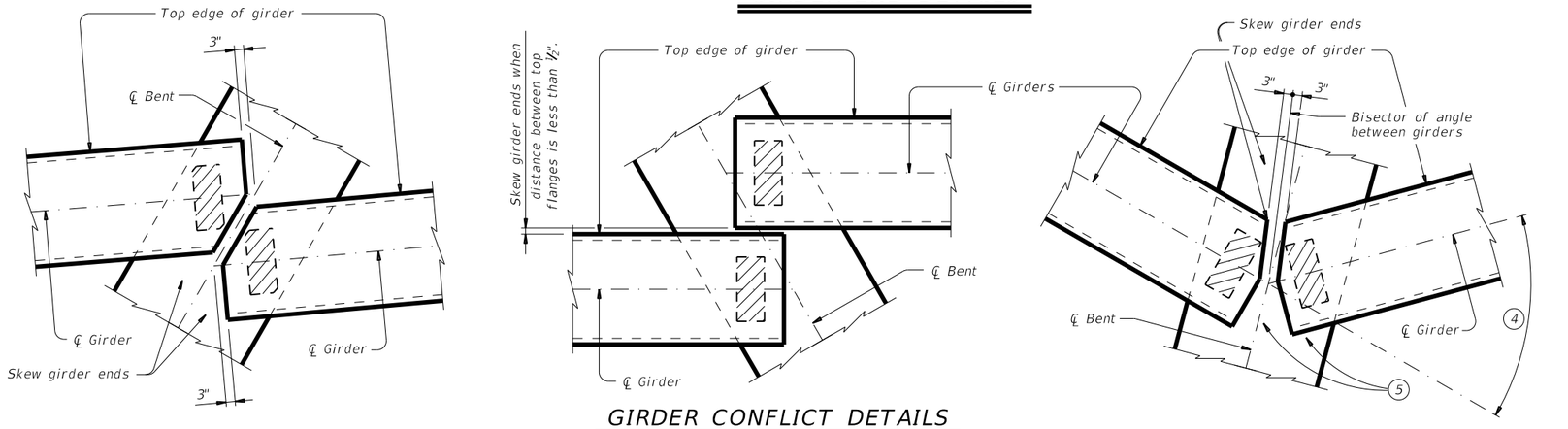
(5) See Table of Bearing Pad Dimensions for bearing size. Girder end skew angles in Table not applicable for this situation. Table reflects girder conflicts of this type on radial bents only.



GENERAL NOTES:

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

GIRDER END DETAILS



GIRDER CONFLICT DETAILS

HL93 LOADING SHEET 1 OF 3

Texas Department of Transportation

Bridge Division Standard

ELASTOMERIC BEARING AND GIRDER END DETAILS
PRESTR CONCRETE I-GIRDERS

IGEB

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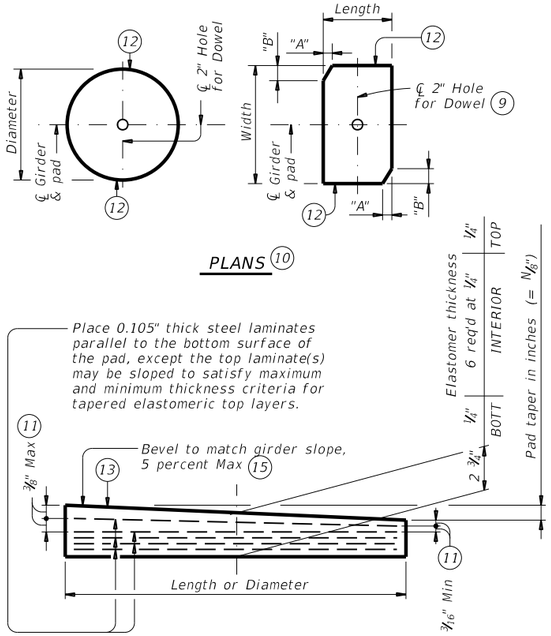
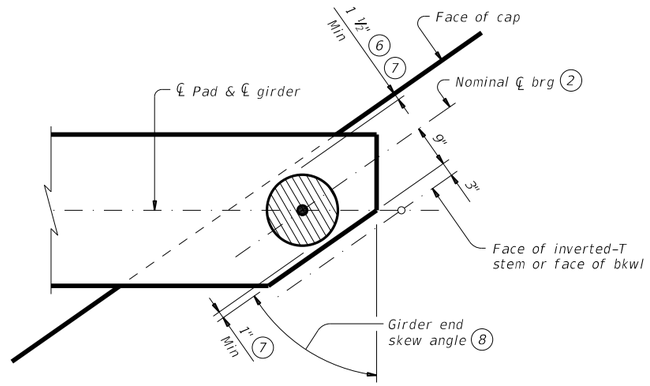


LAMINATED ELASTOMERIC BEARING PAD

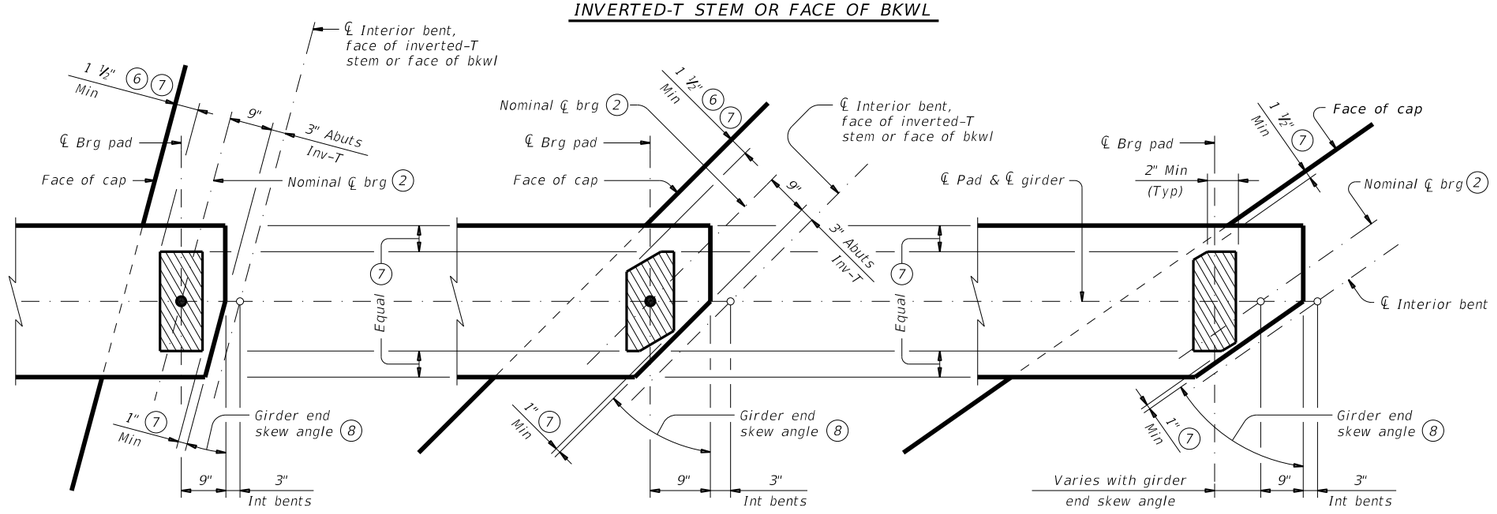
(50 DUROMETER)

TABLE OF MINIMUM SUBSTRUCTURE DIMENSIONS (14)			
Girder Type	Abutments	Int Bents	Inv-T Bents
	Face of Bkwl to Face of Cap	Overall Cap Width	Corbel Width
Tx28 thru Tx54	1'-9"	3'-6"	1'-10 ½"
Tx62 & Tx70	2'-0"	4'-0"	2'-1 ½"

TABLE OF BEARING PAD DIMENSIONS						
Bent Type	Girder Type	Bearing Type (13)	Girder End Skew Angle Range	Pad Size Lgth x Wdth	Pad Clip Dimensions "A"	Pad Clip Dimensions "B"
ABUTMENTS, INVERTED-T AND TRANSITION BENTS WITH BACKWALLS	Tx28,Tx34, Tx40,Tx46 & Tx54	G-1-"N"	0° thru 21°	8" x 21"	---	---
		G-2-"N"	21°+ thru 30°	8" x 21"	1 ½"	2 ½"
		G-3-"N"	30°+ thru 45°	9" x 21"	4 ½"	4 ½"
		G-4-"N"	45°+ thru 60°	15" Dia	---	---
	Tx62 & Tx70	G-5-"N"	0° thru 21°	9" x 21"	---	---
		G-6-"N"	21°+ thru 30°	9" x 21"	1 ½"	2 ½"
		G-7-"N"	30°+ thru 45°	10" x 21"	4 ½"	4 ½"
		G-8-"N"	45°+ thru 60°	10" x 21"	7 ¼"	4 ¼"
CONVENTIONAL INTERIOR BENTS	Tx28,Tx34, Tx40,Tx46 & Tx54	---	---	---	---	---
		---	---	---	---	---
		G-1-"N"	0° thru 60°	8" x 21"	---	---
	Tx62 & Tx70	G-5-"N"	0° thru 60°	9" x 21"	---	---
CONVENTIONAL INTERIOR BENTS WITH SKEWED GIRDER ENDS (GIRDER CONFLICTS) (16)	Tx28,Tx34, Tx40,Tx46 & Tx54	G-1-"N"	0° thru 18°	8" x 21"	---	---
		G-2-"N"	18°+ thru 30°	8" x 21"	1 ½"	2 ½"
		G-9-"N"	30°+ thru 45°	8" x 21"	3"	3"
		G-10-"N"	45°+ thru 60°	9" x 21"	6"	3 ½"
	Tx62 & Tx70	G-5-"N"	0° thru 18°	9" x 21"	---	---
		G-5-"N"	18°+ thru 30°	9" x 21"	---	---
		G-11-"N"	30°+ thru 45°	9" x 21"	1 ½"	1 ½"
		G-12-"N"	45°+ thru 60°	9" x 21"	3"	1 ¾"



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



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

SKEWED GIRDER ENDS AT CONVENTIONAL INTERIOR BENTS (16)

(NO GIRDER DOWELS)

BEARING PAD PLACEMENT DIAGRAMS

(2) For purposes of computing bearing seat elevations, nominal centerline of bearing must be defined as shown. The actual center of bearing pad may vary from this line.

(6) 3" for inverted-T.

(7) Place centerline pad as near nominal centerline bearing as possible between limits shown.

(8) Girder end skew angle is equal to 90° minus the girder angle except at some conflicting girders.

(9) Provide 2" dia hole only at locations required. See Substructure details for location.

(10) See Table of Bearing Pad Dimensions for dimensions.

(11) Maximum and minimum layer thicknesses shown are for elastomer only, on tapered layers.

(12) Locate Permanent Mark here.

(13) Indicate BEARING TYPE on all pads. For tapered pads, locate BEARING TYPE on the high side. The Fabricator must include the value of "N" (amount of taper in ⅛" increments) in this mark.
Examples: N=0, (for 0" taper)
N=1, (for ⅛" taper)
N=2, (for ¼" taper)
(etc.)
Fabricated pad top surface slope must not vary from plan girder slope by more than $\left(\frac{0.0625"}{\text{Length or Dia}}\right)$ IN/IN.

(14) Substructure dimensions must satisfy the minimums provided to accommodate the elastomeric bearings shown on this standard.

(15) See sheet 3 of 3 for beveled plate use when slopes exceed 5 percent.

(16) If girder end is skewed for a girder conflict at an interior bent and a beveled sole plate is required, use bearing type for abutments at this location. Location of bearing centerline is to be set as for abutments in this case.

HL93 LOADING

Texas Department of Transportation

Bridge Division Standard

ELASTOMERIC BEARING AND GIRDER END DETAILS

PRESTR CONCRETE I-GIRDERS

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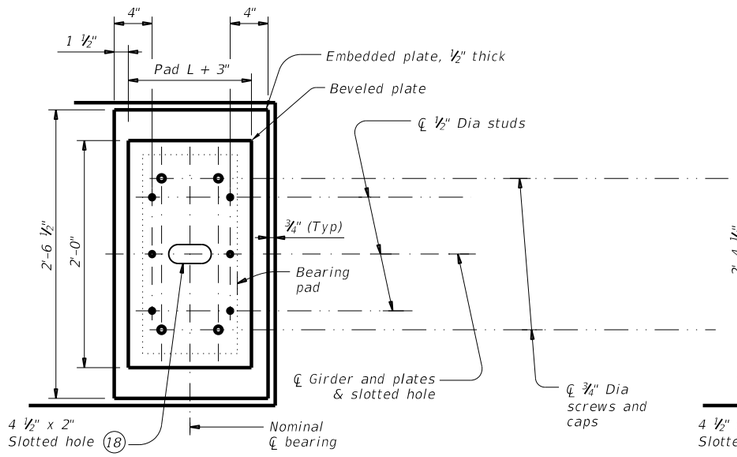
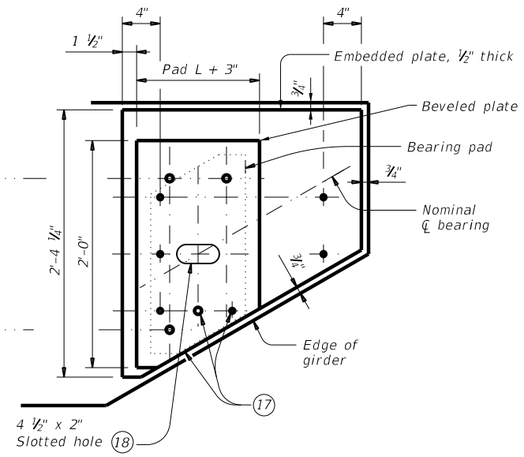
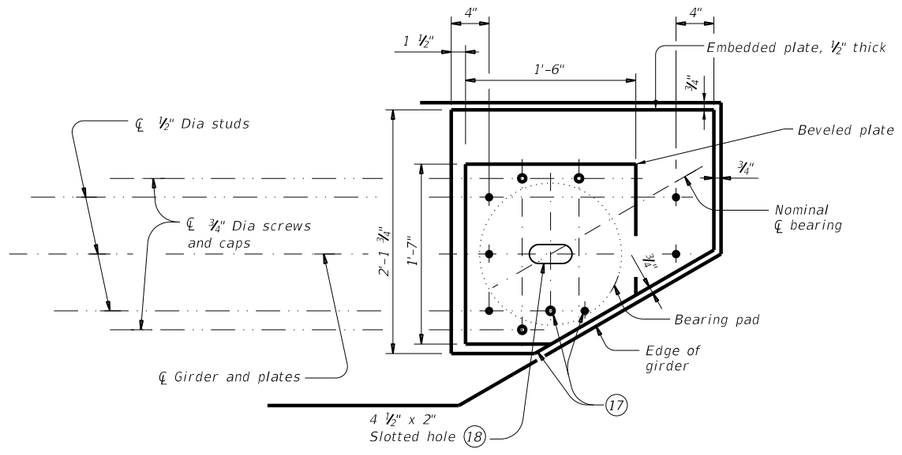


NORMAL GIRDER END
RECTANGULAR BEARING PAD

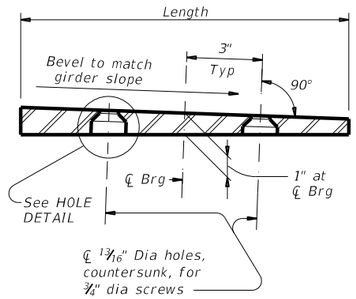


SKEWED GIRDER END
CLIPPED RECTANGULAR BEARING PAD

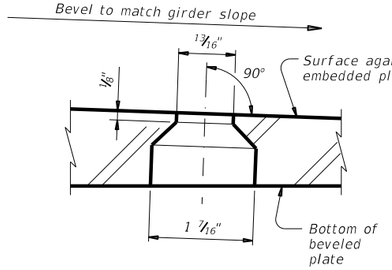


SKEWED GIRDER END
15" DIA BEARING PAD

PLAN VIEW OF SOLE PLATE DETAILS



SECTION

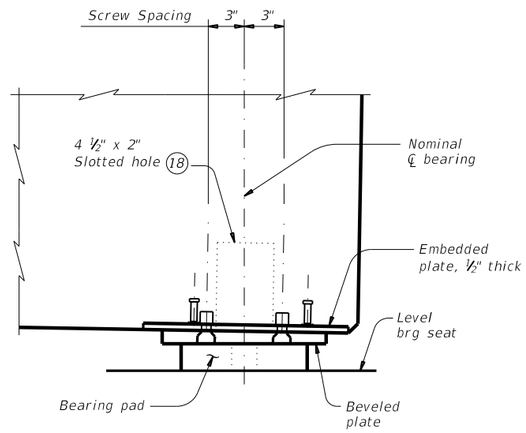


HOLE DETAIL

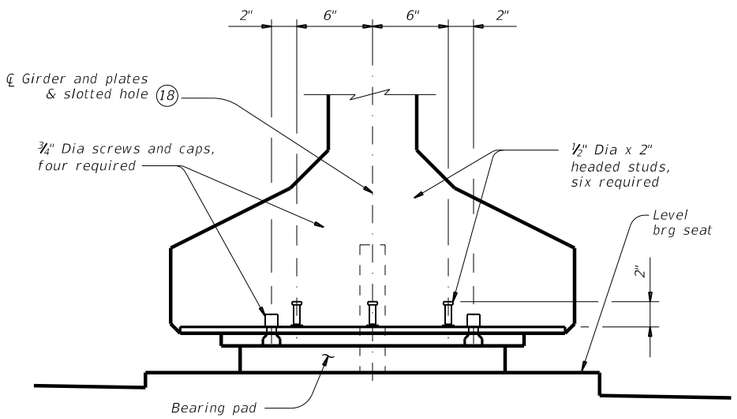
(17) Cut beveled and embedded plates to match girder end skew. Adjust location of screw and stud as shown when necessary.

(18) Slotted hole is required at doweled girder end locations.

BEVELED PLATE DETAILS



SIDE ELEVATION



END ELEVATION
Showing normal girder end.

GIRDER DETAILS

SOLE PLATE NOTES:

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

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

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

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

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

¾" Dia screws must be electroplated, socket flat head countersunk cap screws conforming to ASTM F835. Electroplating must conform to ASTM B633, SC 2, Type I. Provide screws long enough to maintain a ¾" minimum embedment into the embedded plate and galvanized cap. Provide galvanized steel caps (16 ga Min) with a nominal 1" inside diameter and deep enough to accommodate the screws, but not less than ½" deep or deeper than 1".

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

HL93 LOADING SHEET 3 OF 3

Texas Department of Transportation

Bridge Division Standard

ELASTOMERIC BEARING AND GIRDER END DETAILS
PRESTR CONCRETE I-GIRDERS

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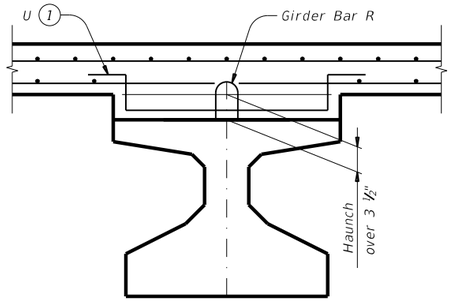
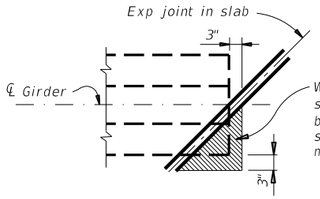
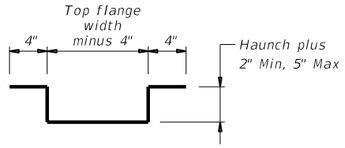


HAUNCH REINFORCING DETAIL

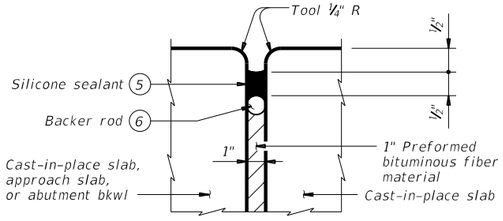


Where flanges project under slab of adjacent span, provide a minimum of ½" clearance between top of girder and bottom of adjacent slab. Polystyrene or other suitable compressible material may be used as a filler.

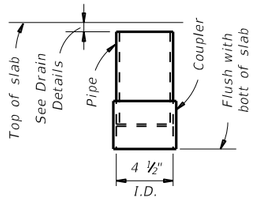
TREATMENT AT GIRDER END FOR SKEWED SPANS



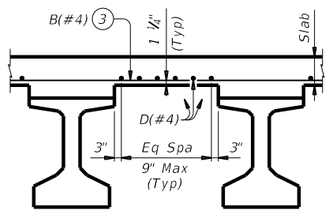
BARS U (#4)



TYPE A JOINT DETAIL (7)

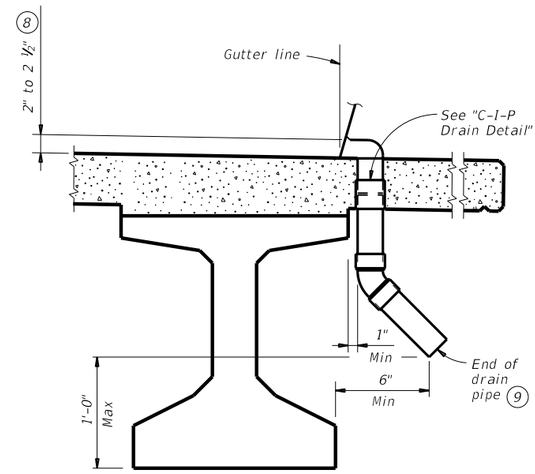


C-I-P DRAIN DETAIL (2)



TYPICAL PART TRANSVERSE SLAB SECTION WITHOUT PCP (4)

Top reinforcing steel not shown for clarity.



DRAIN DETAIL (10)

(1) Space Bars U with girder Bars R in all areas where measured haunch exceeds 3 ½".

(2) Roughen outside of PVC with coarse rasp or equal to ensure bond with cast-in-place concrete.

(3) Bars B(#4) spaced at 9" Max with 2" end cover. Overhang option, Contractor's may end alternating bars B(#4) at centerline outside girder.

(4) Provide Grade 60 reinforcing steel. Provide bar laps, where required, as follows:
Uncoated ~ #4 = 1'-7"
Epoxy coated ~ #4 = 2'-5"

(5) Class 7 silicone sealant that conforms to DMS-6310. Install when ambient temperature is between 55°F and 85°F and rising. Engineer to determine allowable hours for sealant application.

(6) 1 ¼" backer rod must be compatible with joint sealant. Use of multiple pieces to create a backer rod cross section is not permitted. Top of backer rod must be convex as shown.

(7) The maximum distance between Type A expansion joints is 100'. See Bridge Layout for location of joints.

(8) Drain entrance formed in rail or sidewalk.

(9) Water may not be discharged onto girders.

(10) All drain pipe and fittings to be 4" diameter (Sch 40) PVC. See Item 481 "Pipe for Drains" for pipe, connections and solvent welding. Bend reinforcing steel to clear PVC 1". Drain length and location is as directed by the Engineer. Drains are not permitted over roadways or railways, or within 10'-0" of bent caps. Degrease outside of exposed PVC, apply acrylic water base primer, then coat with same surface finishing material as used for outside girder face. Variations of the above designs, as required for the type of rail used and its location on the structure, may be installed with the approval and direction of the Engineer.

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.

Payment for Type A joint will be as per Item 454, "Bridge Expansion Joints."

All other items (reinforcing steel, drains, etc.) shown on this sheet are subsidiary to other bid items.

Cover dimensions are clear dimensions, unless noted otherwise.

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

DECK FORMWORK NOTES:

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

Texas Department of Transportation

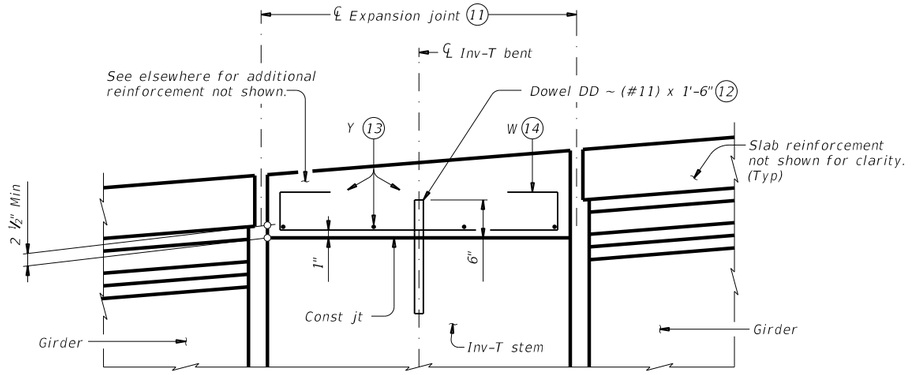
Bridge Division Standard

MISCELLANEOUS SLAB DETAILS

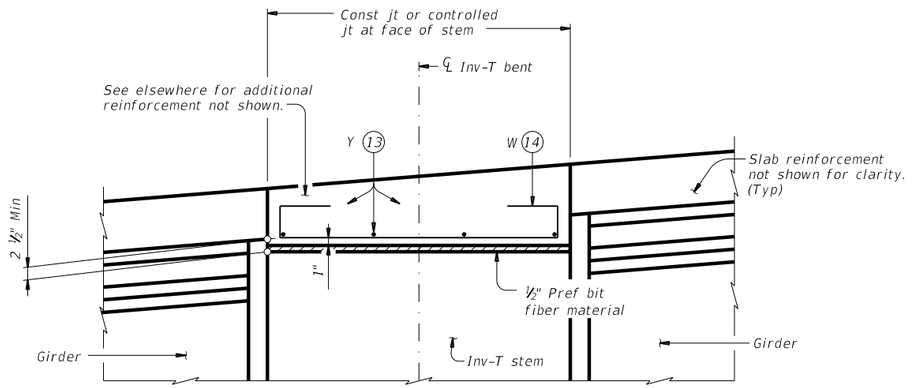
PRESTR CONCRETE I-GIRDERS

IGMS

FILE: igmssts1-19.dgn	DN: TxDOT	CK: TxDOT	DW: JTR	CK: TxDOT			
©TxDOT August 2017	CONT	SECT	JOB		HIGHWAY		
REVISIONS	0110	05	126		IH 45		
10-19: Modified Note 7. Type A now a pay item.	DIST	COUNTY			SHEET NO.		
	HOU	HARRIS			198		

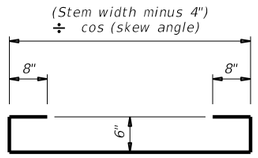


SHOWING EXPANSION JOINTS

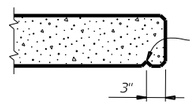


SHOWING CONST JTS OR CONTROLLED JTS

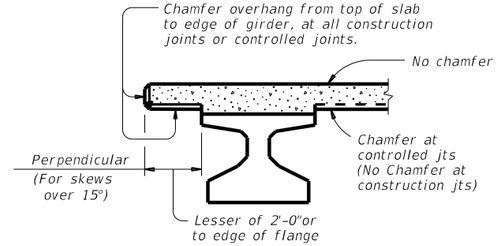
REINFORCEMENT OVER INV-T BENTS



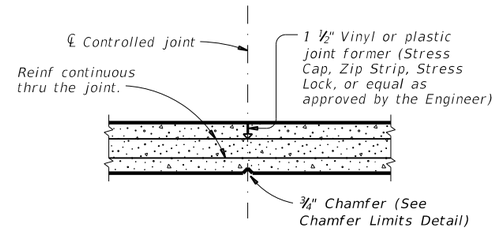
BARS W (#4)



DRIP BEAD DETAIL



CHAMFER LIMITS DETAIL (15)



CONTROLLED JOINT DETAIL

(Saw-cutting is not allowed)

(11) See Layout for joint type.

(12) Dowels DD (#11) spaced at 5 Ft Max. See Inv-T bents for quantity and location.

(13) Space Bars Y (#4) at 12" Max. Use 2" end cover. Number of Bars Y must satisfy spacing limit. Place parallel to bent.

(14) Space Bars W at 12" Max (3" from end of cap). Tilt if necessary to maintain cover requirements. Place parallel to longitudinal slab reinforcement.

(15) See Span details for type of joint and joint locations.

DATE:
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SHEET 2 OF 2

Texas Department of Transportation

Bridge Division Standard

MISCELLANEOUS SLAB DETAILS

PRESTR CONCRETE I-GIRDERS

IGMS

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REVISIONS	0110	05	126	IH 45
10-19: Modified Note 7, Type A now a pay item.	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		199

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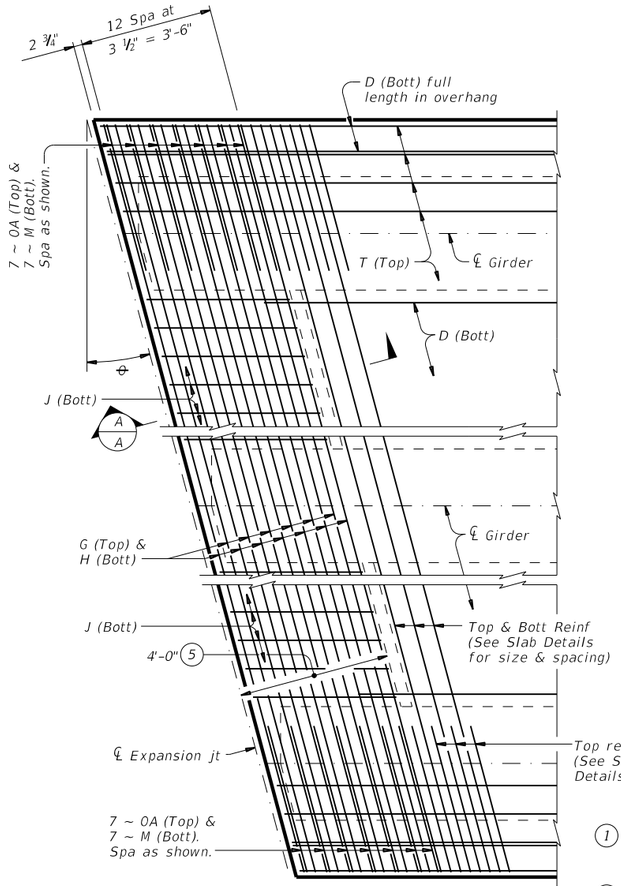
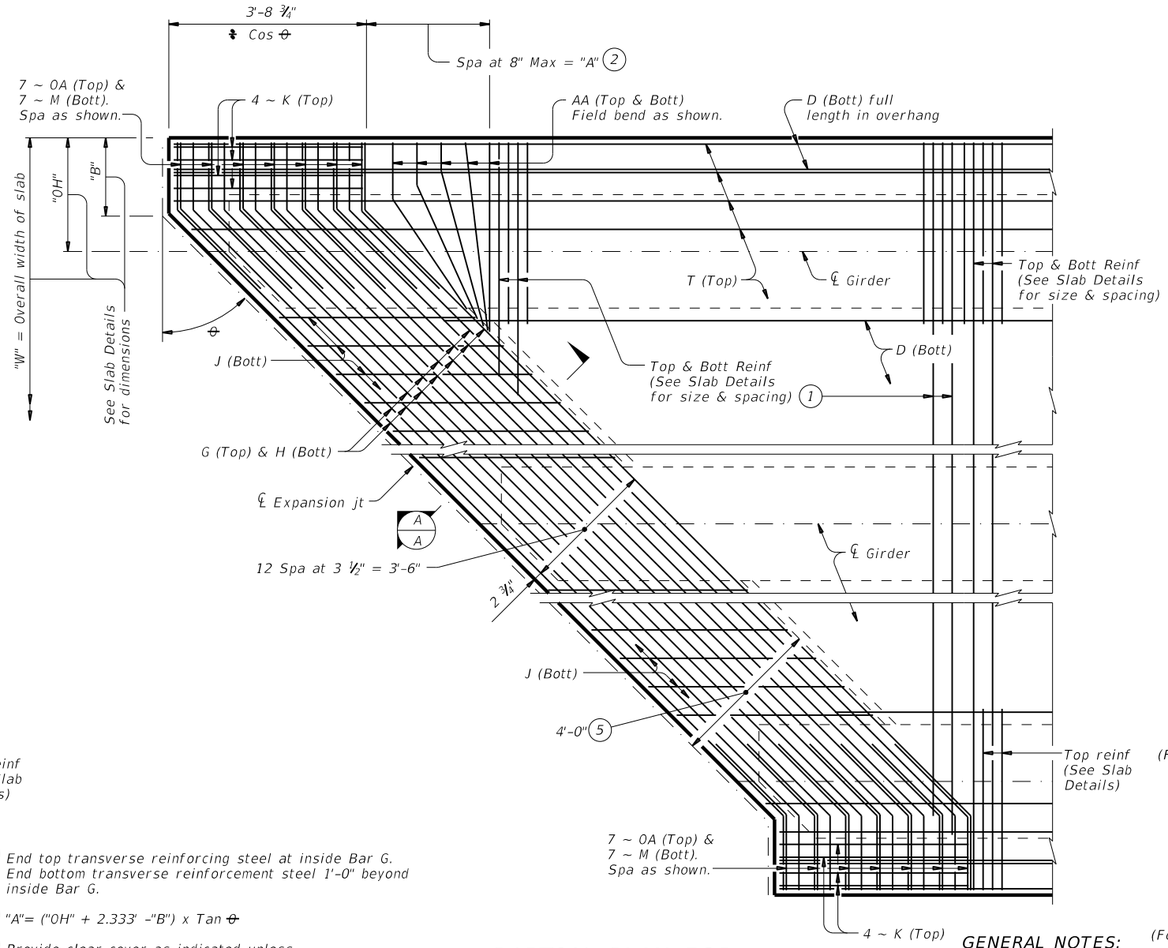


PARTIAL PLAN FOR SLABS WITHOUT BREAKBACK



PARTIAL PLAN FOR SLABS WITH BREAKBACK

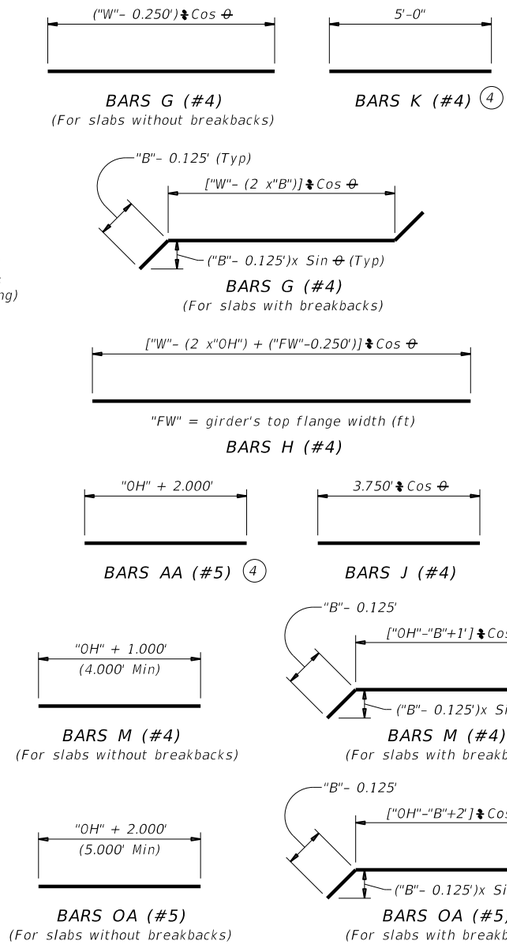
(1) End top transverse reinforcing steel at inside Bar G. End bottom transverse reinforcement steel 1'-0" beyond inside Bar G.

(2) "A"= ("0H" + 2.333' -"B") x Tan θ

(3) Provide clear cover as indicated unless otherwise shown on Span Details.

(4) Only required on slabs with breakbacks.

(5) Thickened slab end dimensioned perpendicular to face of bkwl, centerline interior bent or face of inverted-T stem.



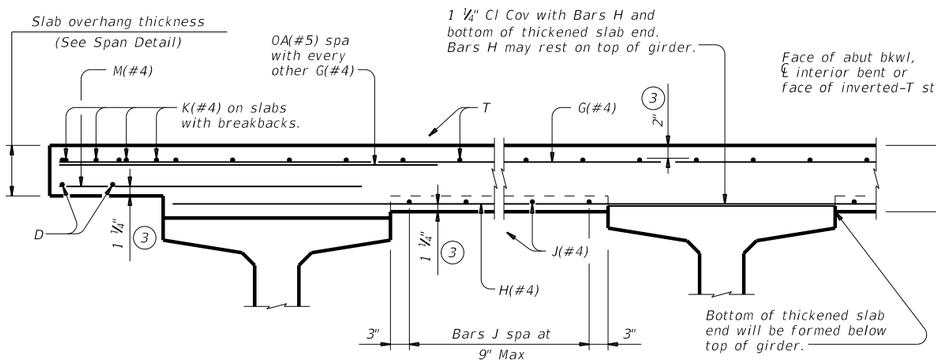
GENERAL NOTES:

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

MATERIAL NOTES:

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

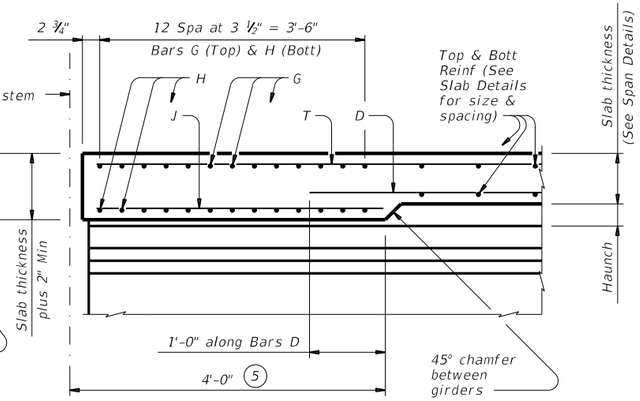
Cover dimensions are clear dimensions, unless noted otherwise.
Reinforcing bar dimensions shown are out-to-out of bar.



2" AND MORE OF HAUNCH — LESS THAN 2" OF HAUNCH

TYPICAL TRANSVERSE SECTION

(Showing Prestressed Conc I-Girders at ℄ Brg)



SECTION A-A

(Showing with 2" and more of haunch)

HL93 LOADING

Texas Department of Transportation — Bridge Division Standard

THICKENED SLAB END DETAILS
PRESTRESSED CONCRETE I-GIRDER SPANS

IGTS

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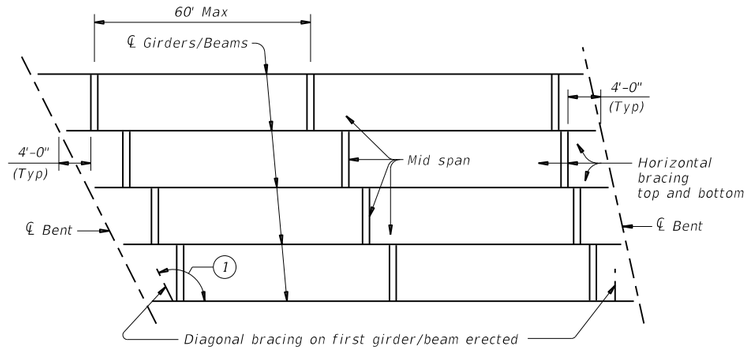
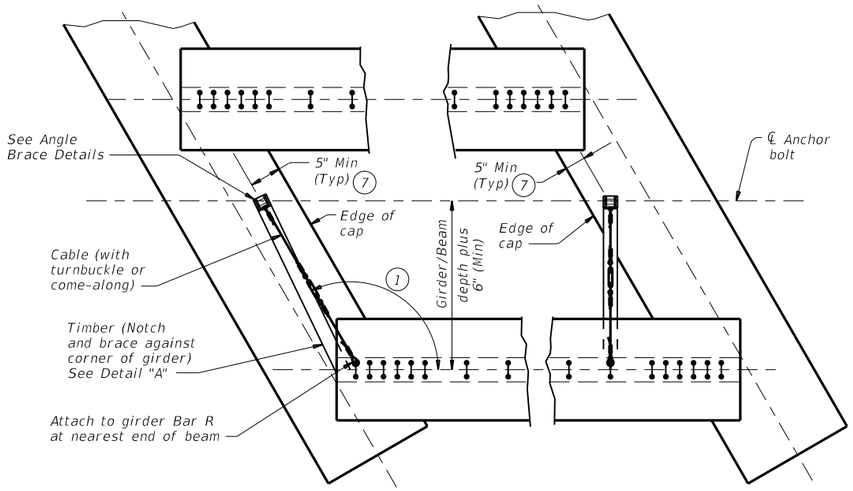
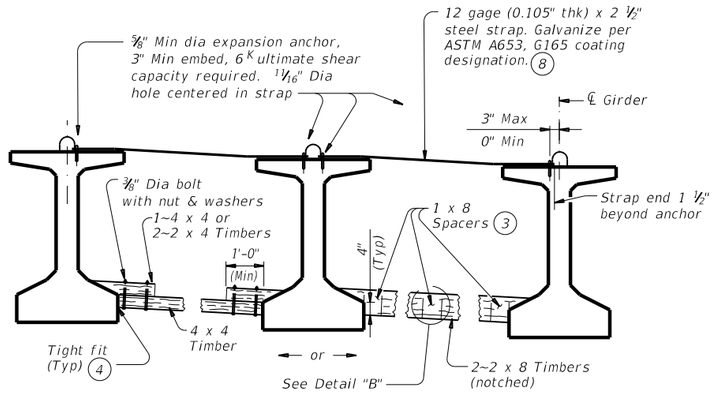


ERECTION BRACING

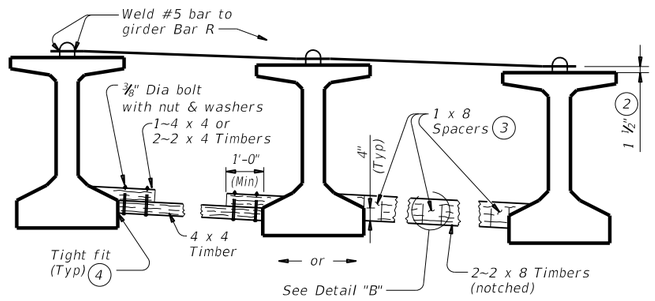


PLAN



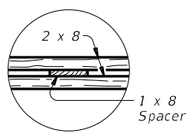
FOR ERECTION BRACING, OPTION 1

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



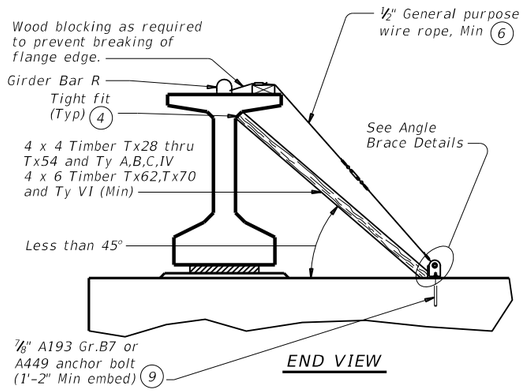
FOR ERECTION BRACING, OPTION 2

HORIZONTAL BRACING DETAILS 5



PLAN

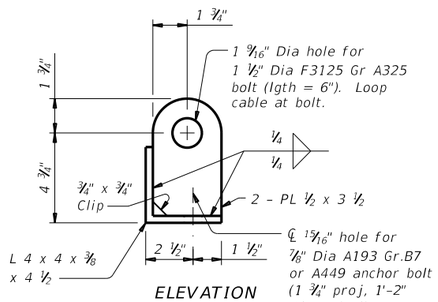
DETAIL "B"



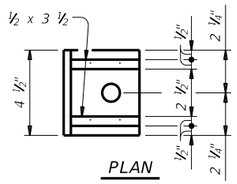
END VIEW

DIAGONAL BRACING DETAILS 5

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



ELEVATION



PLAN

ANGLE BRACE DETAILS

HAULING & ERECTION:

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

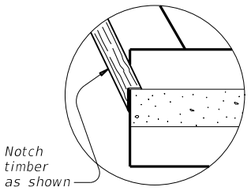
ERECTION BRACING:

Erection bracing details shown are considered the minimum for fulfilling the bracing requirements of Item 425.

Required erection bracing must be placed immediately after erection of each girder and remain in place until additional bracing as required for slab placement is in place. This standard is needed in all cases to meet requirements for Slab Placement Bracing.

PHASED CONSTRUCTION:

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



DETAIL "A"

(1) If angle shown exceeds 120 degrees, move diagonal brace to other side of girder/beam and place square to girder/beam. This may prevent exterior girder from being erected first.

(2) Place and weld #5 bars as shown during erection. If forming deck with prestressed panels, bars can be temporarily removed, one at a time, during panel erection. Re-install bar prior to additional panel erection. Bars can rest on panels and be bent down and welded to girder Bars R (See Sheet 2 of 2).

(3) Clear distance between spacers must not exceed 3'. Nail together with 16d nails.

(4) Use wedges as necessary to obtain tight fit. Nail wedges to timbers.

(5) Pressure treated landscape timbers can not be used.

(6) All hardware used with cable must be able to develop a minimum 25 kips breaking strength. Use thimbles at all loops in cable. Install cable clamps with saddles bearing against the live end and U-bolts bearing aginst the dead end.

(7) It is acceptable to tie anchor bolts to cap reinforcement.

(8) Prior to installing, field bend strap to lay flush on both girders' top flange and slope between flange tips.

(9) Anchor bolt may be drilled and epoxied in place. Provide 25k minimum pullout. Core drill hole.

Texas Department of Transportation

Bridge Division Standard

MINIMUM ERECTION AND BRACING REQUIREMENTS
PRESTRESSED CONCRETE I-GIRDERS AND I-BEAMS

MEBR(C)

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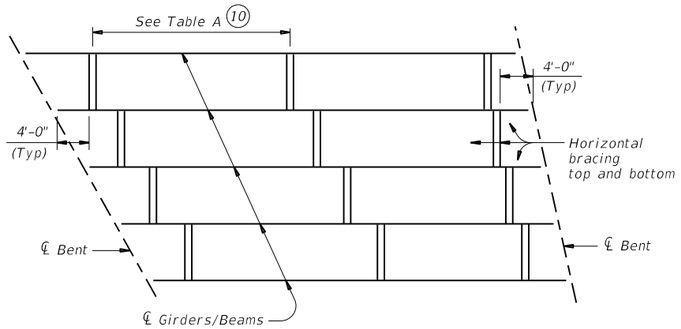


SLAB PLACEMENT BRACING

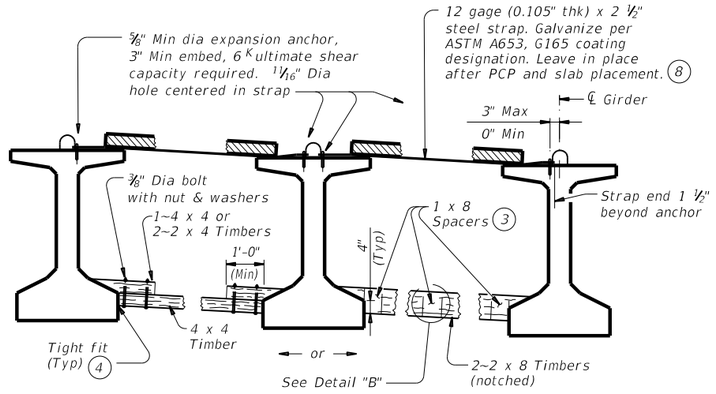
TABLE A

OPTION 1-RIGID BRACING (STEEL STRAP)

Girder or Beam Type	Maximum Bracing Spacing	
	Slab Overhang less than 4'-0" (11)	Slab Overhang 4'-0" and greater (11)
Tx28	¼ points	¼ points
Tx34	¼ points	¼ points
Tx40	¼ points	⅛ points
Tx46	¼ points	⅛ points
Tx54	¼ points	⅛ points
Tx62	¼ points	⅛ points
Tx70	¼ points	⅛ points
A	⅛ points	⅛ points
B	⅛ points	⅛ points
C	⅛ points	⅛ points
IV	¼ points	⅛ points
VI	¼ points	⅛ points

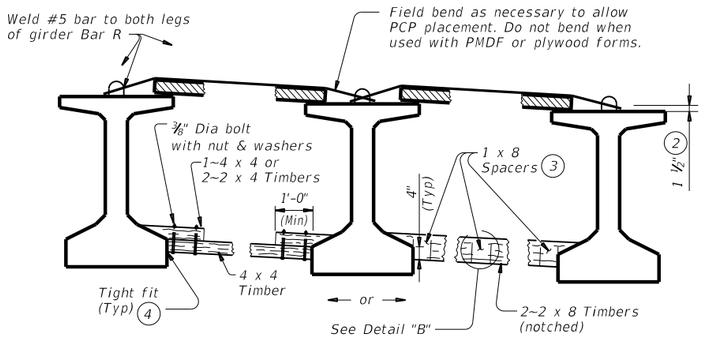
OPTION 2-FLEXIBLE BRACING (NO. 5 OVER PCP)

Girder or Beam Type	Maximum Bracing Spacing	
	Slab Overhang less than 4'-0" (11)	Slab Overhang 4'-0" and greater (11)
Tx28	¼ points	⅛ points
Tx34	¼ points	⅛ points
Tx40	¼ points	⅛ points
Tx46	¼ points	⅛ points
Tx54	¼ points	⅛ points
Tx62	¼ points	⅓ points
Tx70	¼ points	⅛ points
A	2.0 ft	1.5 ft
B	3.0 ft	2.0 ft
C	4.5 ft	2.0 ft
IV	¼ points	4.0 ft
VI	¼ points	4.0 ft



FOR SLAB PLACEMENT BRACING, OPTION 1 - RIGID

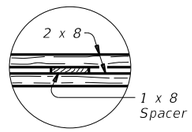
(Showing slab formed with PCP. This option is not allowed when slab is formed with PMDF or plywood.)



FOR SLAB PLACEMENT BRACING, OPTION 2 - FLEXIBLE

(Showing slab formed with PCP.)

HORIZONTAL BRACING DETAILS (5)



PLAN

DETAIL "B"

(2) Place and weld #5 bars as shown during erection. If forming deck with prestressed panels, bars can be temporarily removed, one at a time, during panel erection. Re-install bar prior to additional panel erection. Bars can rest on panels and be bent down and welded to girder Bars R.

(3) Clear distance between spacers must not exceed 3'. Nail together with 16d nails.

(4) Use wedges as necessary to obtain tight fit. Nail wedges to timbers.

(5) Pressure treated landscape timbers can not be used.

(8) Prior to installing, field bend strap to lay flush on both girders' top flange and slope between flange tips.

(10) Bracing spacing (¼ and ⅛ points) measured between first and last typical brace location.

(11) Measure slab overhang from centerline of girder or beam. When overhang varies in span, determine bracing spacing based on largest overhang.

SLAB PLACEMENT BRACING:

The details for slab placement bracing are considered minimum for fulfilling the requirements of Specification Items 422 and 425.

Required slab placement bracing must remain in place until slab concrete has attained a compressive strength of 3000 psi.

GENERAL NOTES:

Bracing details for spans longer than 150' are not provided. The Contractor must submit proposed bracing details for such conditions to the Engineer for approval prior to erection.

Systems equal to or better than those shown may be used provided details of such systems are submitted to and approved by the Engineer prior to erection.

Use of these systems or details does not relieve the Contractor of the responsibility for the adequacy of the bracing and the safety of the structure.

Removal of bracing for short periods of time to align girders and beams is permissible.

All turn-buckles, come-alongs, anchors and other connections must be capable of developing the full strength of the cable shown.

Furnish anchor bolts and nuts in accordance with Item 449, "Anchor Bolts".

Texas Department of Transportation

Bridge Division Standard

MINIMUM ERECTION AND BRACING REQUIREMENTS

PRESTRESSED CONCRETE I-GIRDERS AND I-BEAMS

MEBR(C)

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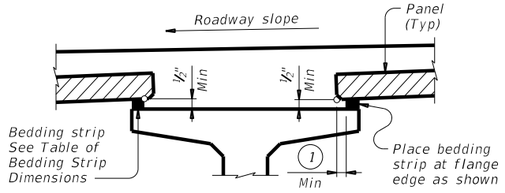
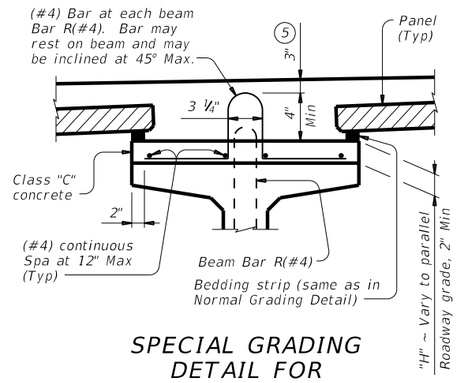


NORMAL GRADING DETAIL (3)

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



SPECIAL GRADING DETAIL FOR CONCRETE BEAMS

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

TABLE OF BEDDING STRIP DIMENSIONS		
WIDTH	HEIGHT (4)	
	Min	Max
1" (Min)	½"	2"
1 ¼"	½"	2 ½"
1 ½"	½"	3"
1 ¾"	½"	3 ½"
2"	½"	4"
2 ¼"	½"	4 ½" (2)
2 ½"	½"	5" (2)
2 ¾"	½"	5 ½" (2)
3" (Max)	½"	6" (2)

(1) 2" Min for I-giders, 1 ½" Min for all other beam types.

(2) Allowed for I-girders, not allowed on other beam types.

(3) To reduce the quantity of cast-in-place concrete, bedding strip thickness may be increased in ¼" increments. Bedding strips must be comprised of one layer. Bond bedding strips to the beams with an adhesive compatible with bedding strips. Bedding strips over 2.5" high may need to be bonded to panels. The same thickness strip must be used under any one panel edge and the maximum change in thickness between adjacent panels is ¼". Alternatively, bedding strips may be cut to grade. Panels may be supported by an alternate method, using a commercial product, if approved by the Engineer of Bridge Design, Bridge Division. If bedding strips exceed 6" high for I-Girders, 4" high for all other beam types, use Special Grading Detail for Concrete Beams or submit an alternate method to the Bridge Division for approval.

(4) Height must not exceed twice the width.

(5) Provide clear cover as indicated unless otherwise shown on Span Details.

(6) See Span Details and Thickened Slab End Details for top slab reinforcement and clear cover. Transverse top slab reinforcement may rest on top of prestressed concrete panels if necessary to maintain clear cover.

(7) Space Bars UP(#4) with Beam Bars R(#4) in all areas where measured haunch exceeds 3 ½" with I-girders, and 3" for all other beam types. Epoxy coating for Bars UP is not required.

(8) Do not locate construction joints on top of a panel.

(9) Butt adjacent bedding strips together with adhesive. Cut v-notches, approx ¼" deep, in the top of the bedding strips at 8' o.c..

CONSTRUCTION NOTES:

Erected panels must bear uniformly on bedding strips of extruded polystyrene placed along top flange edges.

Placing panels to minimize joint openings is recommended.

If additional blocking is needed, special grading details for supporting the panels and extra reinforcing between beam and slab will be considered subsidiary to deck construction.

Bars U, shown on PCP-FAB, may be bent over or cut off if necessary.

Care must be taken to ensure proper cleaning of construction debris and consolidation of concrete material under the edges of the panels. Bedding strips must be placed at beam flange edges so that adequate space is provided for the mortar to flow a minimum of 1 ½" under the panels as the slab concrete is placed.

To allow the proper amount of mortar to flow between beam and panel, the minimum vertical opening must be at least ½". Roadway cross-slope reduces the opening available for entry of the mortar. Bedding strips varying in thickness across the beam are therefore required.

For clear span between U-beams less than or equal to 18", see Permissible Slab Forming Detail on Miscellaneous Slab Detail sheets, UBMS.

MATERIAL NOTES:

Provide Grade 60 reinforcing steel in the cast-in-place slab. See Table of Reinforcing Steel for size and spacing of reinforcement.

If the top and bottom layer of reinforcing steel is shown on the Span Details to be epoxy coated, then the D, E, P, & Z bars must be epoxy coated.

Provide bar Laps, where required, as follows:
Uncoated ~ #4 = 1'-7"
Epoxy Coated ~ #4 = 2'-5"

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.

Panel placement may follow either Option 1 or Option 2 except Option 1 must be used if the skew exceeds 45 degrees.

Use of Prestressed Concrete Panels is not permitted for horizontally curved steel plate or tub girders. See Span Details for other possible restrictions on their use.

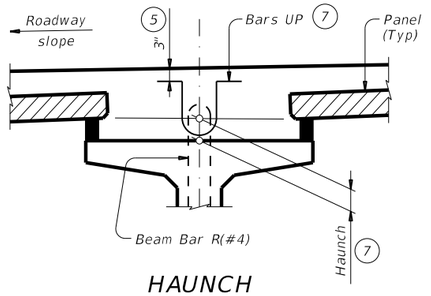
These details are to be used in conjunction with the Span Details, PCP-FAB and other applicable standard drawings.

When panel support (bedding strips) deviates from what is shown herein, provide details signed and sealed by a professional Engineer.

Any additional reinforcement or concrete required on this standard is considered subsidiary to the bid Item "Reinforced Concrete Slab".

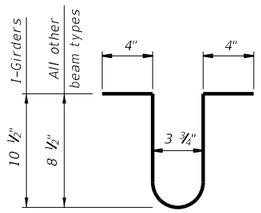
Cover dimensions are clear dimensions, unless noted otherwise.

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

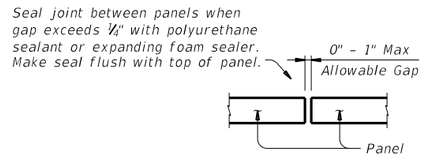


HAUNCH REINFORCING DETAIL

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

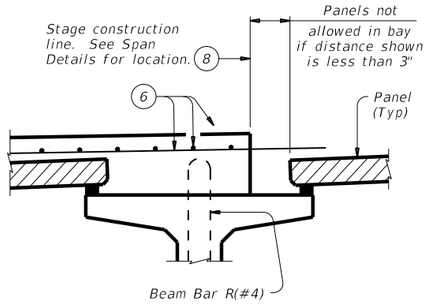


BARS UP (#4) (7)

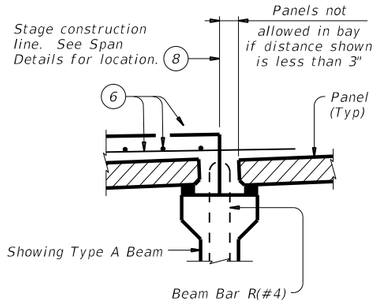


PANEL JOINTS

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



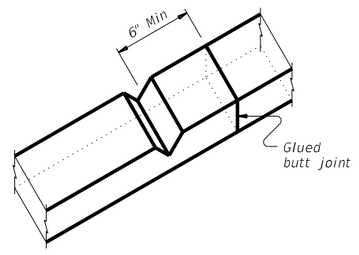
PRESTR CONC I-GIRDERS



PRESTR CONC I-BEAMS

STAGE CONSTRUCTION LIMITATIONS

(Other beam types similar)



BEDDING STRIP DETAIL (9)

HL93 LOADING SHEET 1 OF 4

Texas Department of Transportation — Bridge Division Standard

PRESTRESSED CONCRETE PANELS
DECK DETAILS

PCP

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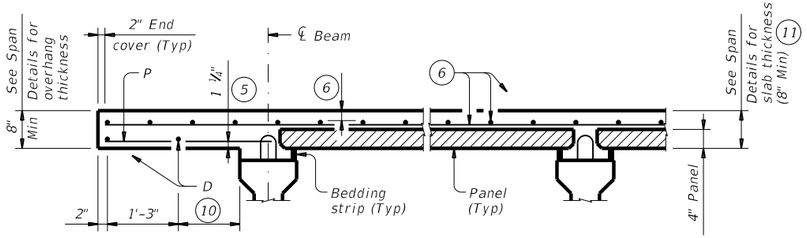
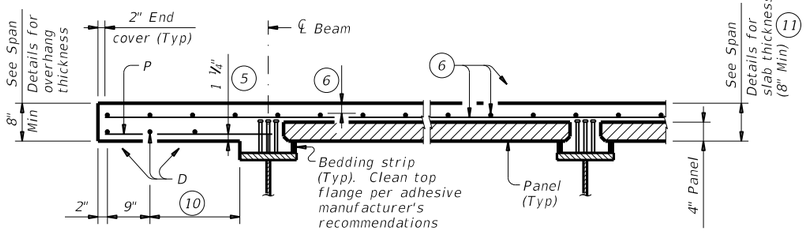
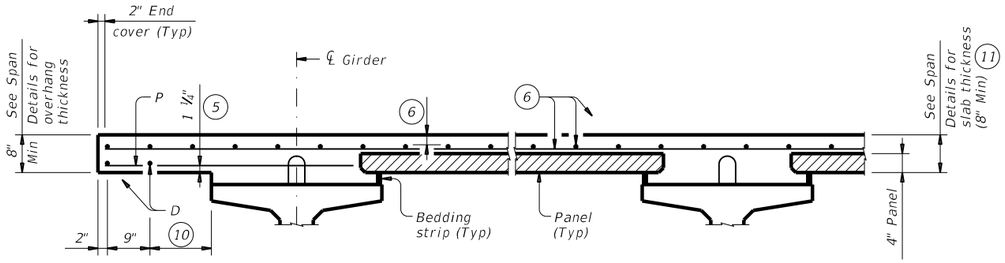


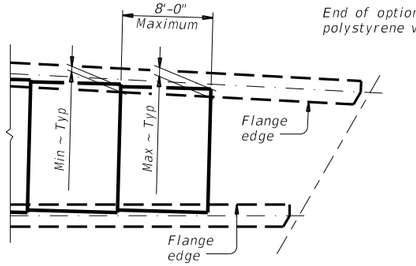
PRESTRESSED CONCRETE I-BEAMS



STEEL BEAMS

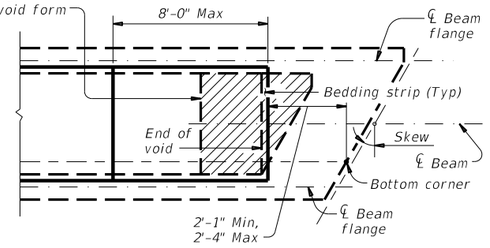


PRESTRESSED CONCRETE I-GIRDERS

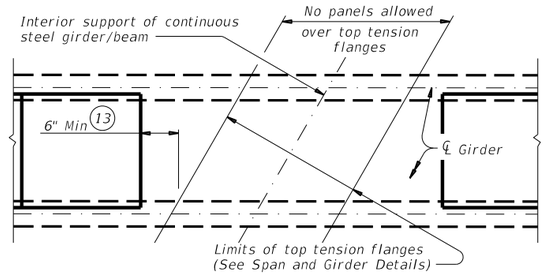


AT FLARED BEAMS OR GIRDERS

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



OVER CONC U-BEAMS



AT INT SUPPORTS OF CONTINUOUS STEEL GIRDERS

PART PLANS OF PANEL PLACEMENT

(5) Provide clear cover as indicated unless otherwise shown on Span Details.

(6) See Span Details and Thickened Slab End Details for top slab reinforcement and clear cover. Transverse top slab reinforcement may rest on top of prestressed concrete panels if necessary to maintain clear cover.

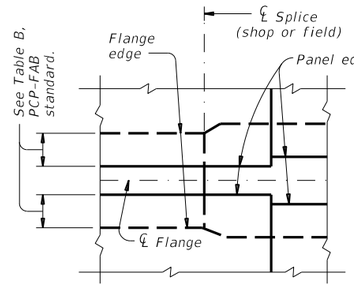
(9) Butt adjacent bedding strips together with adhesive. Cut v-notches, approx ¼" deep, in the top of the bedding strips at 8' o.c..

(10) Equally space additional bar if more than 1'-3" Max.

(11) The actual thickness constructed may exceed the slab thickness shown on the Span Details but the extra thickness may be no more than 2" (1" for prestressed concrete U-beams and steel beams). Bearing seat elevations or finished grade may be adjusted.

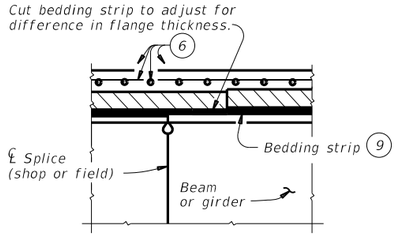
(12) Field adjust Bars Z1(#4) to match actual slope of slab overhangs. Width of slab overhang will vary along span with curved slab edges. Adjust Bar Z1(#4) dimensions to maintain proper cover. Bars Z2(#4) are located at Inverted-Tee stems only.

(13) Location of concrete placement sequence boundaries and bolted field splices should be considered by the contractor in determining panel limits.



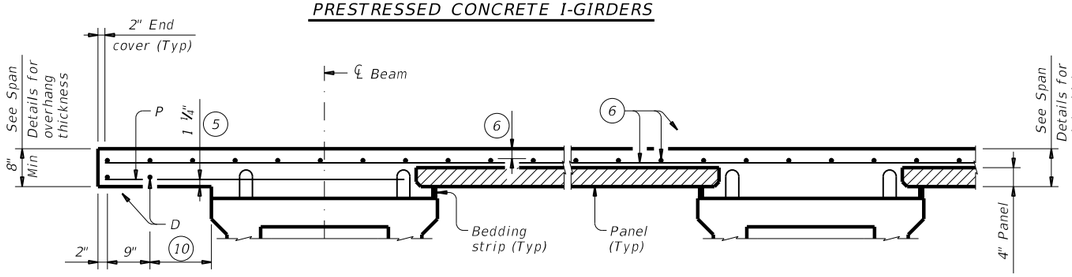
PLAN AT SPLICE

(Showing steel beams with flange width transition)

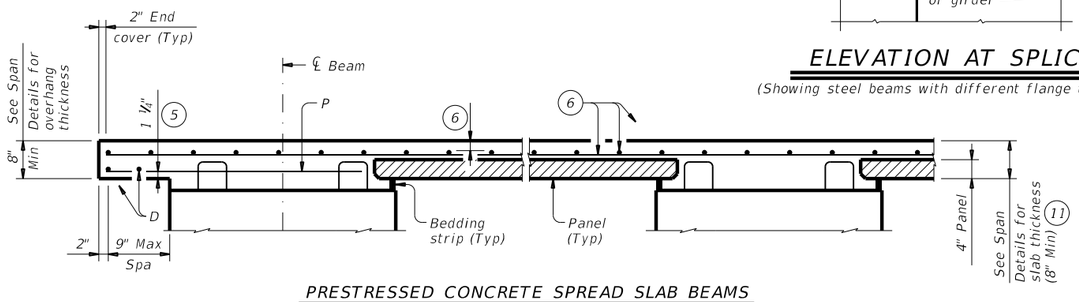


ELEVATION AT SPLICE

(Showing steel beams with different flange thickness)

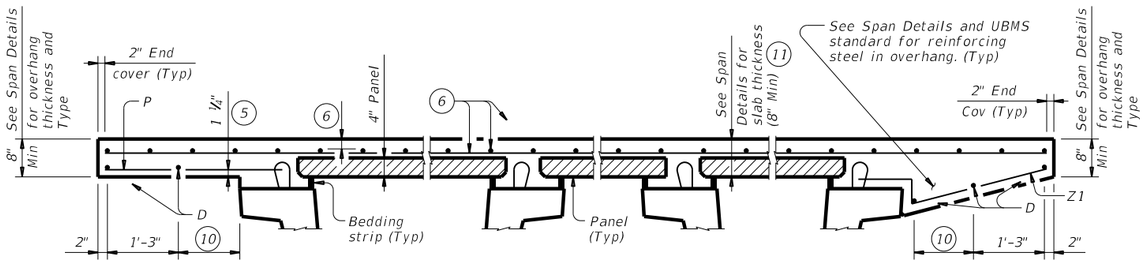


PRESTRESSED CONCRETE X-BEAMS



PRESTRESSED CONCRETE SPREAD SLAB BEAMS

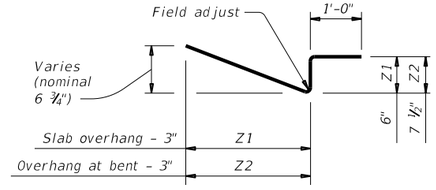
Bars P over exterior beams are still required when no overhang is used. In this case, only one Bar D, 2" from slab edge, is required.



NORMAL OVERHANG WITH PRESTR CONC U-BEAMS

SLOPED OVERHANG WITH PRESTR CONC U-BEAMS

TYPICAL PART TRANSVERSE SECTIONS



BARS Z (#4) (12)

HL93 LOADING SHEET 2 OF 4

Texas Department of Transportation

Bridge Division Standard

PRESTRESSED CONCRETE PANELS
DECK DETAILS

PCP

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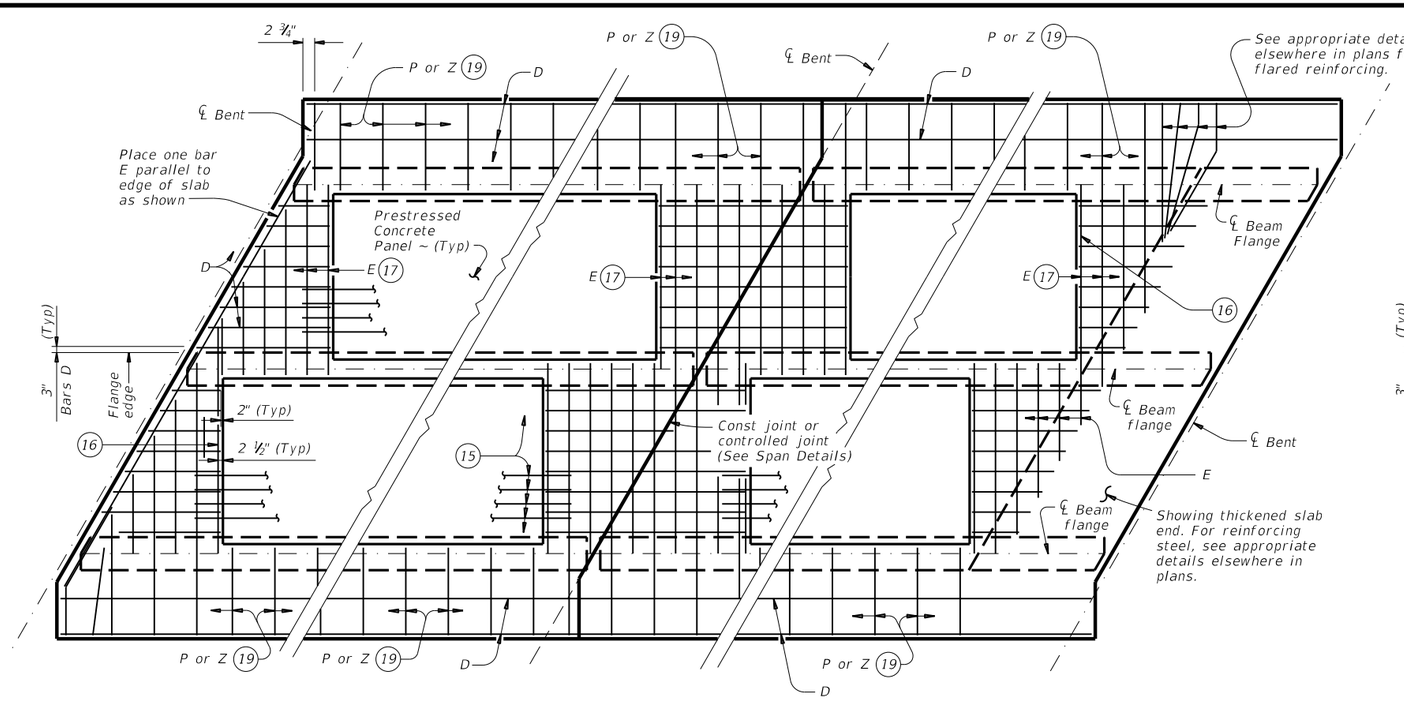
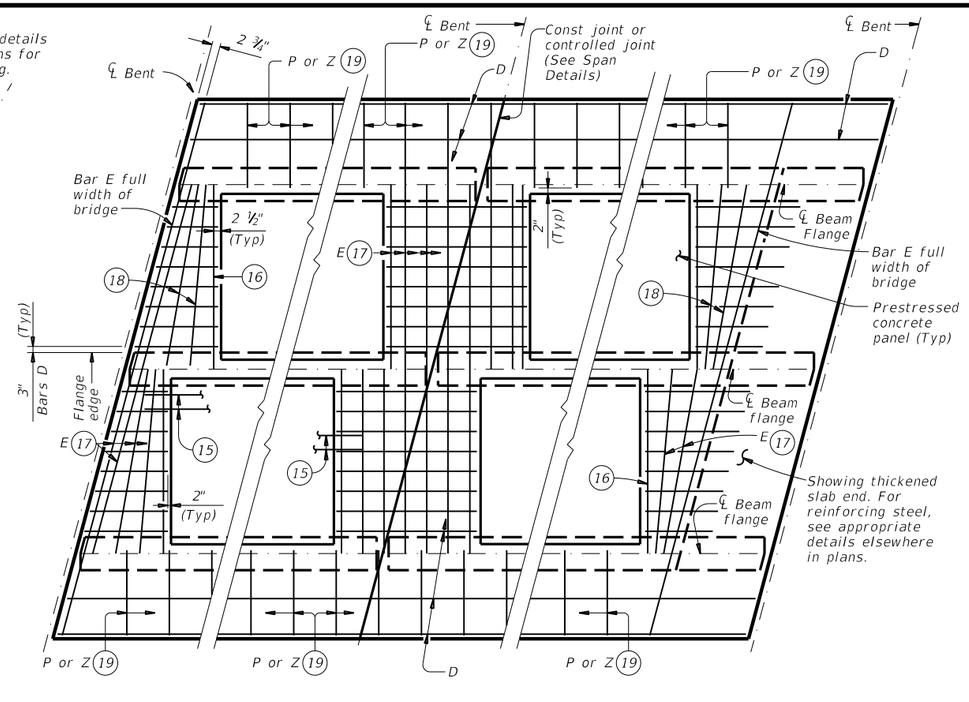


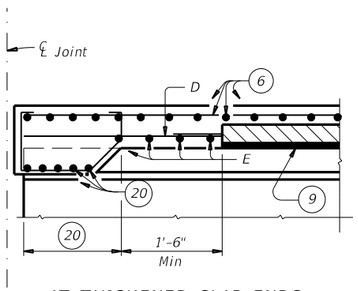
AT ALL SPAN ENDS UNLESS NOTED OTHERWISE | AT INTERIOR BENTS | AT THICKENED END SLABS

OPTION 1 ~ PLAN OF SLABS WITH NORMAL REINFORCEMENT

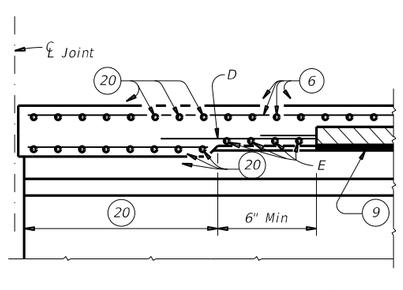


AT ALL SPAN ENDS UNLESS NOTED OTHERWISE | AT INTERIOR BENTS | AT THICKENED END SLABS

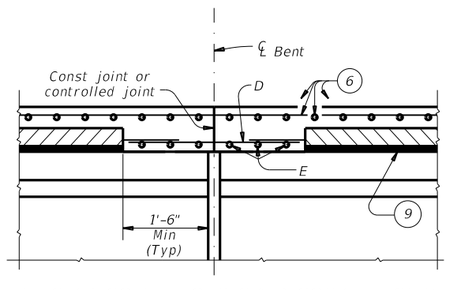
OPTION 1 ~ PLAN OF SLABS WITH SKEWED REINFORCEMENT



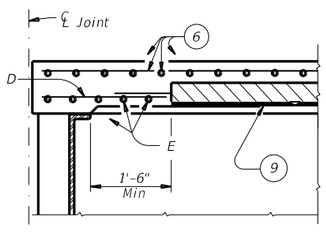
AT THICKENED SLAB ENDS FOR PRESTR CONC U-BMS



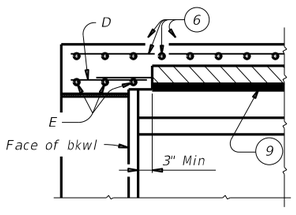
AT THICKENED SLAB ENDS FOR PRESTR CONC I-BMS AND STEEL BMS



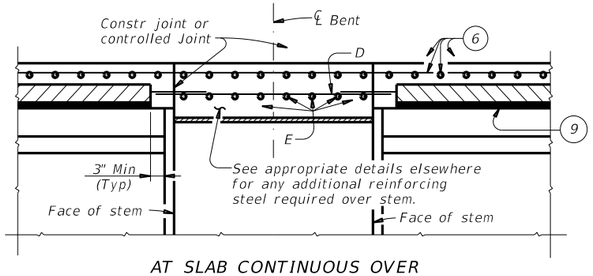
AT SLAB CONTINUOUS OVER CONVENTIONAL INTERIOR BENTS FOR ALL SIMPLE SPAN BMS



AT CONVENTIONAL END DIAPHRAGMS FOR STEEL BMS



AT SLAB OVER ABUTMENT BACKWALL FOR ALL BMS



AT SLAB CONTINUOUS OVER INVERTED-T BENTS FOR ALL BMS

OPTION 1 ~ ELEVATIONS AT BEAM ENDS

(6) See Span Details and Thickened Slab End Details for top slab reinforcement and clear cover. Transverse top slab reinforcement may rest on top of prestressed concrete panels if necessary to maintain clear cover.

(9) Butt adjacent bedding strips together with adhesive. Cut v-notches, approx ¼" deep, in the top of the bedding strips at 8' o.c.

(14) Max Spacing as listed unless otherwise shown.

(15) At connection with cast-in-place slab, extend longitudinal panel reinforcement. See PCP-FAB for details.

(16) Maintain one Bar E(#4) parallel to panel ends (Typ).

(17) Bars E(#4) not continuous over beam flanges must overlap beam flange 6" Min.

(18) Add flared Bars E(#4) (Min Spa = 6", Max Spa = 12") as required at panel ends.

(19) Where possible, Bars E(#4) may be extended into overhangs to replace Bars P(#4). Bars Z(#4) are required for sloped overhangs with U-Beams.

(20) See appropriate thickened slab end details for reinforcing and limits of thickened slab end.

TABLE OF REINFORCING STEEL (14)

BAR	SIZE	Max Spa (in.)
D	#4	9
E	#4	9
P	#4	18
UP	#4	~
Z	#4	18

HL93 LOADING

SHEET 3 OF 4

Texas Department of Transportation

Bridge Division Standard

PRESTRESSED CONCRETE PANELS DECK DETAILS

PCP

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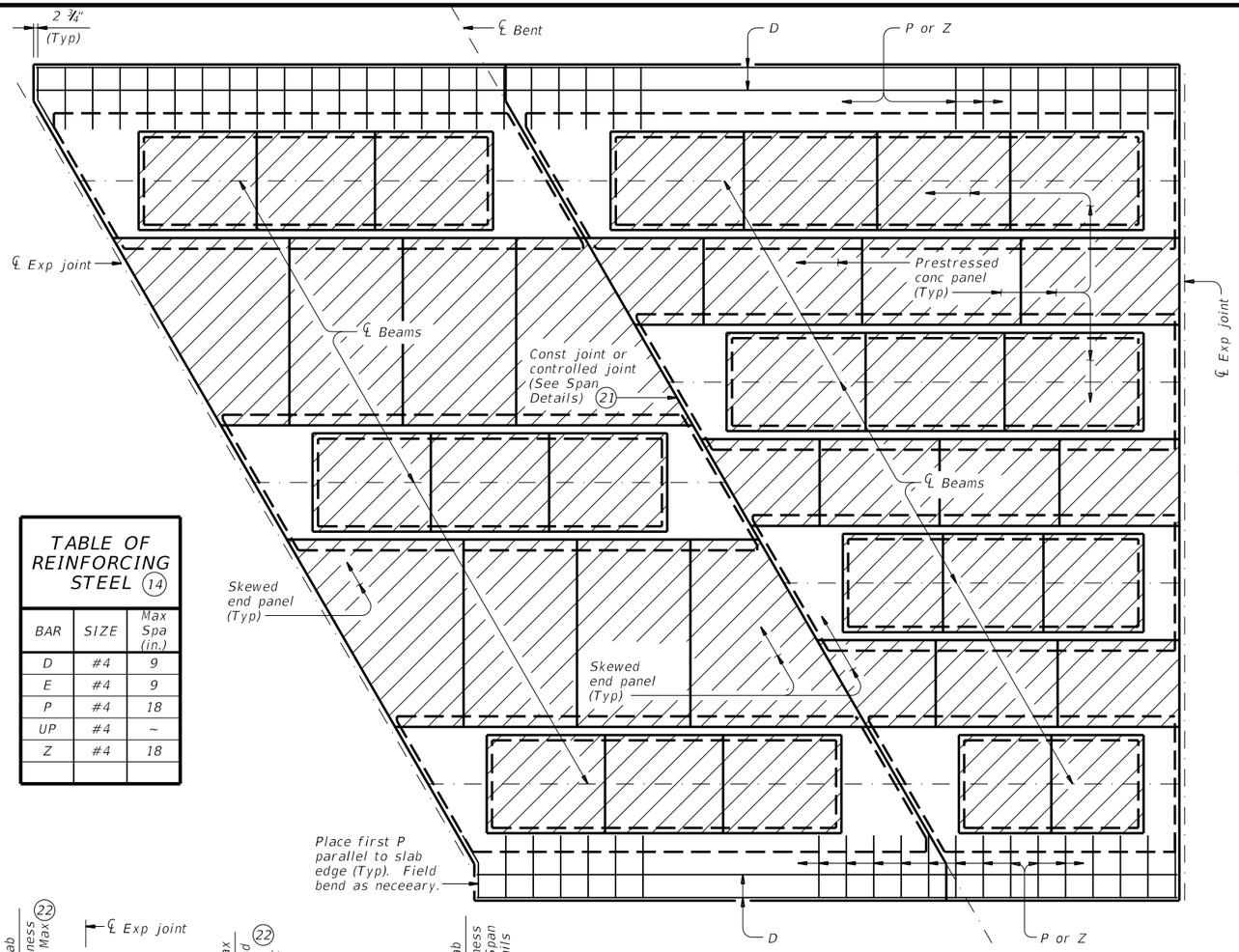
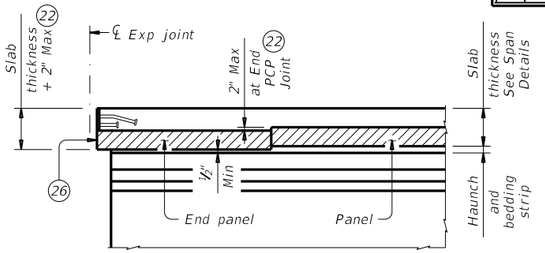


OPTION 2 ~ PLAN OF SLAB

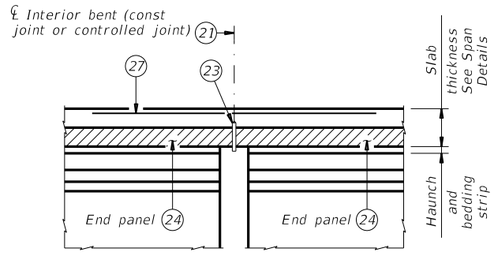
(Showing U-Beams; other beams similar)

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



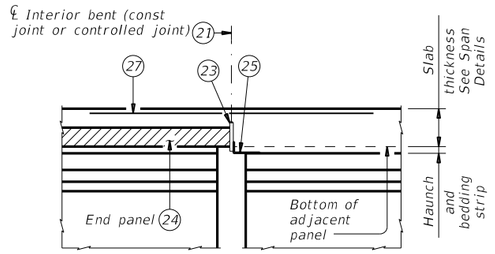
JOINTS (BETWEEN BEAMS/GIRDERS OR AT INV-T STEM)

For SEJ-A, SEJ-S(0), AJ, and Type A expansion joints only.



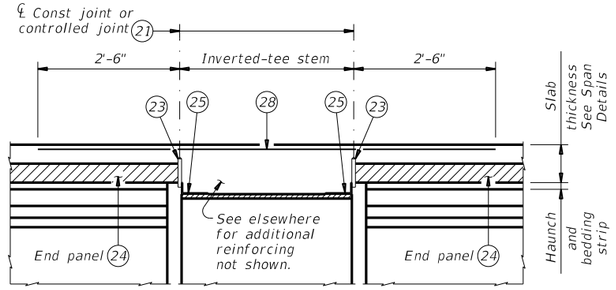
CONVENTIONAL INTERIOR BENT

Panel against panel between beams/girders.



CONVENTIONAL INTERIOR BENT

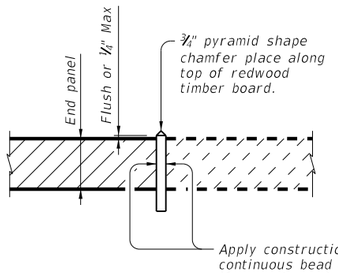
Panel against beam/girder end in adacent span.



INVERTED-T BENT

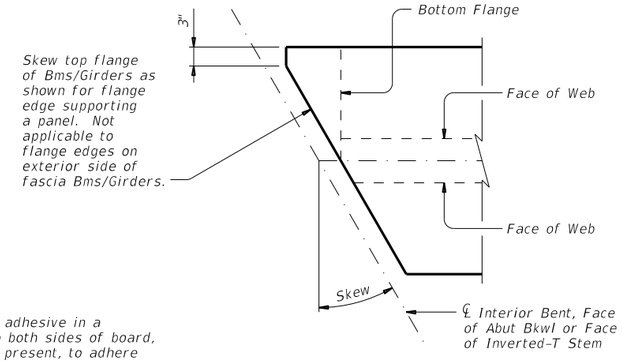
Panels against inverted-tee stem

OPTION 2 ~ ELEVATIONS AT BEAM ENDS (6)



ELEVATION EXAMPLE OF END PANEL AND TIMBER BOARD (23)

See "Option 2 ~ Elevation At Beam Ends".



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

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

(6) See Span Details and Thickened Slab End Details for top slab reinforcement and clear cover. Transverse top slab reinforcement may rest on top of prestressed concrete panels if necessary to maintain clear cover.

(14) Max Spacing as listed unless otherwise shown.

(21) 1 ½" Vinyl or plastic joint former at controlled joints (Stress Cap, Zip Strip, Stress Lock, or equal as approved by the Engineer.)

(22) End panel may be set up to 2" lower to accommodate expansion joint hardware, provided bedding strip is not less than ½" thick.

(23) ¾" thick redwood timber board, leave in place. Redwood timber board placed flush with top of panel or within ¼" Max above panel. Place ¾" pyramid shape chamfer along top of timber board. See "Elevation Example of End Panel and Timber Board". Place straight, within ¼" of centerline of bent or face of inverted-tee, across bridge width and end board at exterior flange edge of fascia beams/girders. Do not extend into overhang.

(24) Place panel within ½" of ¾" thick board.

(25) Permanent galvanized steel sheet form. Removable formwork is acceptable.

(26) Place end panel within ½" of expansion joint opening. End panel cannot encroach on required expansion joint opening.

(27) Place additional (#4) bar 5'-0" in length between every slab bars T. Center (#4) bar on Joint.

(28) Place additional (#4) bar continuous 2'-6" beyond each side of Inverted-T Stem between every slab bars T.

SPECIAL OPTION 2 CONSTRUCTION NOTES:

When Option 2 is chosen bottom mat of thickened end slab reinforcing is not required. Use the same top mat as shown on the Thickened Slab End Details sheet.

Placing panels adjacent to expansion joints and bent centerlines prior to completing interior panel placement is recommended. Saw cutting panels to fit is acceptable when approved by the Engineer. Minimum distance from a saw cut edge to a panel strand is 1 ½".

Do not extend the longitudinal panel reinforcement into the cast-in-place slab.

Top flanges of beams and girders on skewed bridges must be modified as shown on this drawing. The Contractor is responsible for coordinating this modification with the beam fabricator prior to submitting shop drawings for approval.

Fabricator may optionally skew the whole end. When electing to skew whole end, girder end details and bearing type at conventional interior bent must be changed to use condition at abutment. Fabricator must coordinate change in bearing type, bearing centerline location, and dowel location with Engineer and Contractor. Show appropriate changes on girder and bearing shop drawings.

Bending of anchor studs of expansion joints shown on standards AJ, SEJ-A and SEJ-S(0) is permissible if necessary to clear top of end panels. The Contractor is responsible for coordinating modifications with the joint fabricator. Submit shop drawings for approval when modifications to expansion joint hardware are made.

Bedding strips under skewed end panels must conform to the requirements of Item 422 except their minimum compressive strength must be 60 psi.

Provide Bars AA, G, K and 0A from standard IGTS in the slab.

HL93 LOADING SHEET 4 OF 4

Texas Department of Transportation — Bridge Division Standard

PRESTRESSED CONCRETE PANELS
DECK DETAILS

PCP

FILE: pcpstde1-19.dgn	DN: TxDOT	CK: TxDOT	DW: JTR	CK: JMH
©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
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	HOU	HARRIS		206

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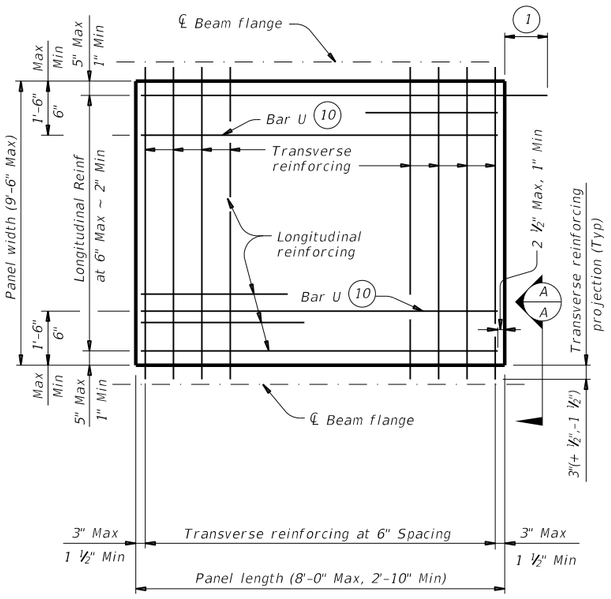
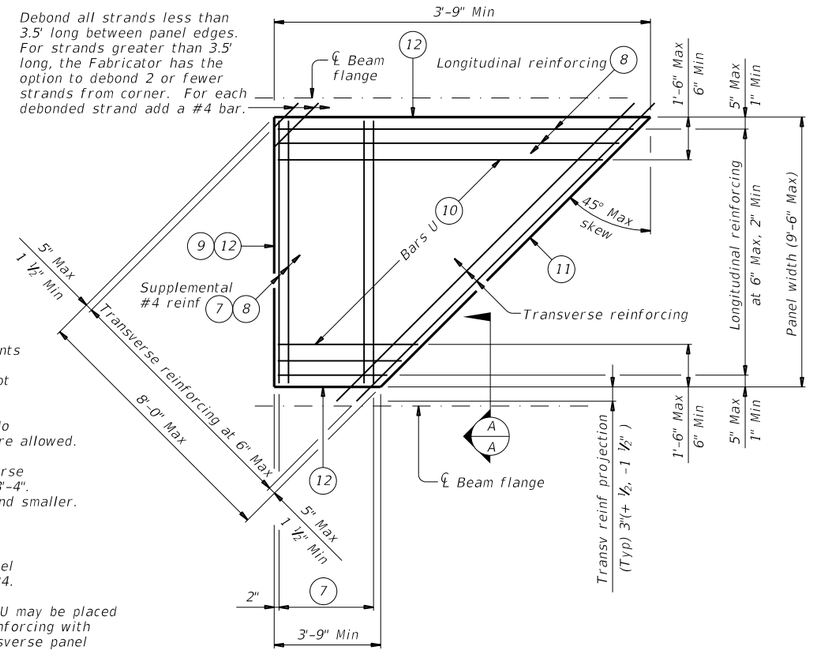
FILE:



TYPICAL NON-SKEWED PANEL PLAN



TYPICAL SKEWED END PANEL PLAN

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

1. At connection with cast-in-place slab, extend longitudinal panel reinforcement 1'-0" (+2",-0") past panel end. Alternatively, provide (#3) x 2'-0" dowels at 6" Max Spacing and extend dowels 1'-0" past panel end.
2. Four loops required per panel.
3. Four loops required per panel. ⅜" or ½" strands may be used.
4. Normal dimensions must be used on spans with parallel beams. Maximum and Minimum dimensions apply only to spans with flared beams.
5. See Normal Grading Detail on PCP standard for lap requirements and bedding strip dimensions. Some laps shown in tables cannot utilize all bedding strip widths.
6. One Splice allowed per panel. No more than two sheets of WWR are allowed.
7. Provide (#4) bars under transverse reinforcing, 10 Spaces at 4" = 3'-4". Omit for 5 degree (1:12) skew and smaller.
8. End Cover 2 ½" Max, 1" Min.
9. Recess strands on indicated panel edge in accordance with Item 424.
10. At the fabricator's option, Bars U may be placed parallel to transverse panel reinforcing with horizontal legs in plane of transverse panel reinforcing.
11. Use length of indicated panel edge as panel width for purpose of determining type of transverse reinforcing.
12. Timber form work permissible this edge.

Debond all strands less than 3.5' long between panel edges. For strands greater than 3.5' long, the Fabricator has the option to debond 2 or fewer strands from corner. For each debonded strand add a #4 bar.

TABLE A (4) (5)			
Beam Type	Normal (In.)	Min (In.)	Max (In.)
A	3	2 ½	3 ½
B	3	2 ½	3 ½
C	4	3	4 ½
IV	6	4	7 ½
VI	6 ½	4 ½"	8 ½
U40 – 54	5 ½	5 ½	7
Tx28-70	6	5	7 ½
XB20 – 40	4	3	4 ½
XSB12 – 15	4	3	4 ½

TABLE B (4) (5)			
Top Flange Width	Normal (In.)	Min (In.)	Max (In.)
11" to 12"	2 ¾	2 ½	2 ¾
Over 12" to 15"	3 ¼	3	3 ¼
Over 15" to 18"	4	3	4 ¾
Over 18"	5	3 ½	6 ¼

GENERAL NOTES:

Provide Class H concrete for panels. Release strength f'ci=3,500 psi. Minimum 28 day strength f'c=5,000 psi.

Provide ¾" chamfer along bottom edge of panel on beam side.

Do not use epoxy-coated reinforcing steel bar or strand in panels.

Remove laitance from top panel surface.

Finish top of panel to a roughness between a No. 6 and No. 9 concrete surface profile, inclusive, as specified by the International Concrete Repair Institute (ICRI).

Shop drawings for the fabrication of panels will not require the Engineer's approval if fabrication is in accordance with the details shown on this standard.

A panel layout which identifies location of each panel must be developed by the Fabricator. Permanently mark each panel in accordance with the panel layout. A copy of the layout is to be provided to the Engineer.

TRANSVERSE PANEL REINFORCEMENT:

For panel widths over 5', use ⅜" or ½" Dia (270k) prestressing strands with a tension of 14.4 kips per strand.

For panel widths over 3'-6" up to and including 5', use ⅜" or ½" Dia (270k) prestressing strands with a tension of 14.4 kip per strand. Optionally, (#4) Grade 60 reinforcing bars may be used in lieu of prestressed strands.

For panel widths up to 3'-6", use (#4) Grade 60 reinforcing bars (prestressed strands alone are not allowed).

Place transverse panel reinforcement at panel centroid and space at 6" Max.

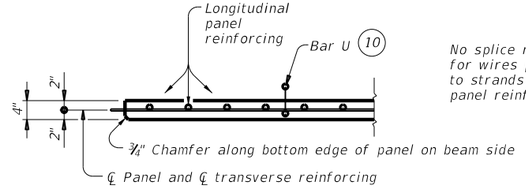
LONGITUDINAL PANEL REINFORCEMENT:

Any of the following options may be used for longitudinal panel reinforcement:

1. (#3) Grade 60 reinforcing steel at 6" Max Spacing. No splices allowed.
2. ⅜" Dia prestressing strands at 4 ½" Max Spacing (unstressed). No splices allowed.
3. ½" Dia prestressing strands at 6" Max Spacing (unstressed). No splices allowed.
4. Deformed Welded Wire Reinforcement (WWR) (ASTM A1064) providing 0.22 sq in per foot of panel width. Wires larger than D11 not permitted. Provide transverse wires to ensure proper handling of reinforcing. One splice per panel is allowed. See WWR Splice Detail.

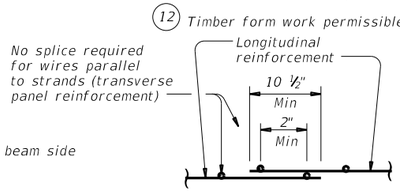
No combination of longitudinal reinforcement options in a panel is allowed.

Place longitudinal panel reinforcement above or below transverse panel reinforcement. Must be placed above transverse panel reinforcement for skewed end panels with supplemental (#4) reinforcement.

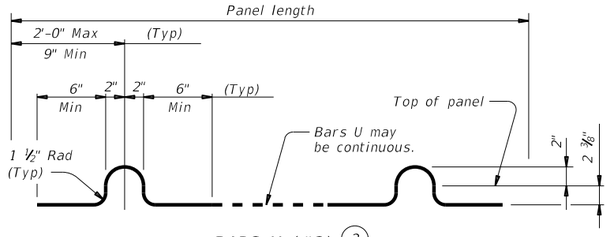


SECTION A-A

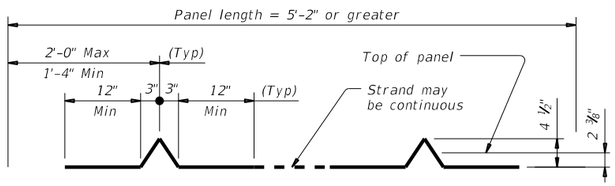
(Not showing supplemental #4 bars for skewed end panels.)



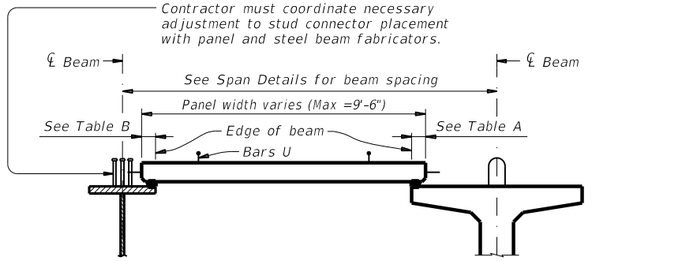
WELDED WIRE REINFORCEMENT (WWR) SPLICE DETAIL (6)



BARS U (#3) (2)



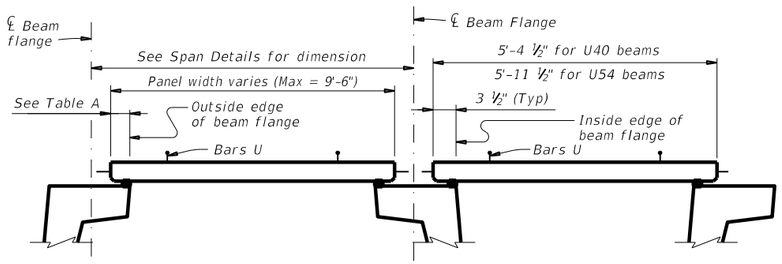
OPTIONAL STRAND FOR BARS U (3)



STEEL BEAMS

PRESTRESSED CONCRETE BEAMS OR GIRDERS

Typ unless noted otherwise



PRESTRESSED CONCRETE U-BEAMS

TYPICAL SECTIONS FOR DETERMINING PANEL WIDTH

HL93 LOADING

Texas Department of Transportation

Bridge Division Standard

PRESTRESSED CONCRETE PANEL FABRICATION DETAILS

PCP-FAB

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	HOU	HARRIS		207

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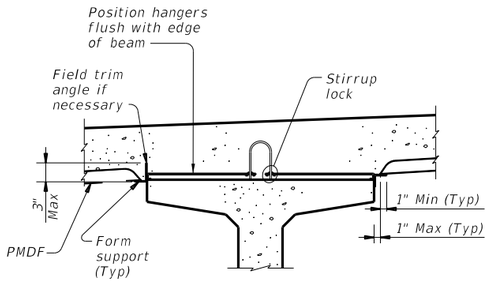
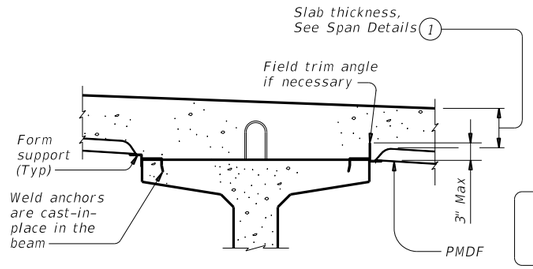
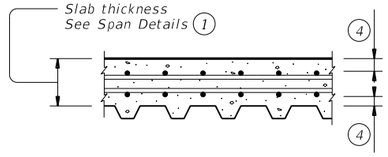


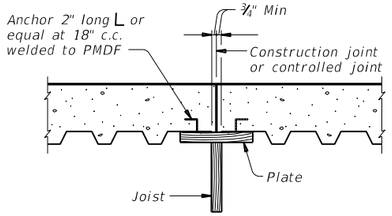
PRESTR CONC I-BEAMS AND I-GIRDERS WITH STIRRUP LOCKS



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

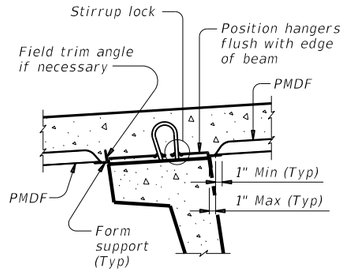


TYP LONGITUDINAL SLAB SECTION

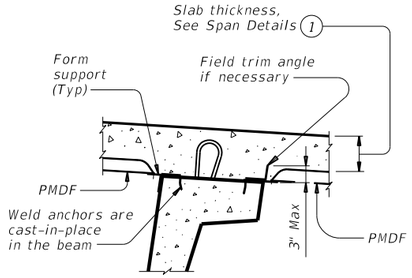


Note: In spans where PMD forms are used, timber forms must be used at construction joints. Adequate provision must be made to support edge of metal form and to provide anchorage of metal form to slab concrete where joined to wood forms.

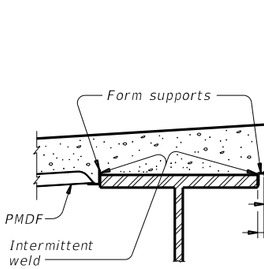
SECTION THRU CONSTRUCTION JOINT



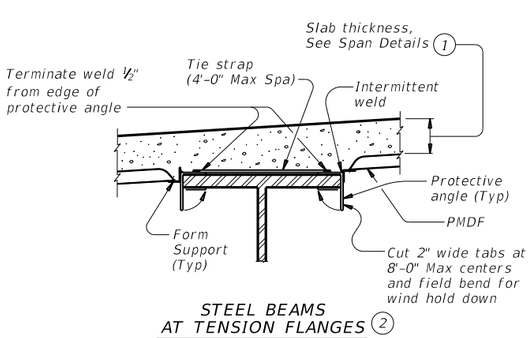
U-BEAMS WITH STIRRUP LOCKS



U-BEAMS WITH WELD ANCHORS

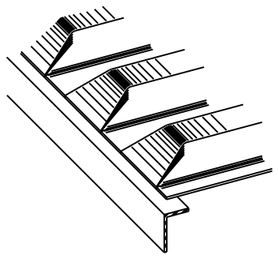


STEEL BEAMS AT COMPRESSION FLANGES



STEEL BEAMS AT TENSION FLANGES (2)

TYPICAL TRANSVERSE SECTIONS



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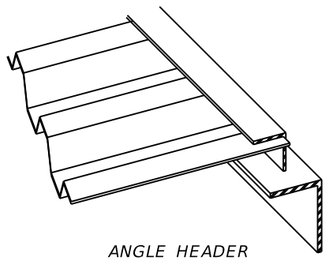
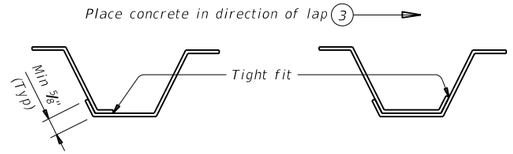


ANGLE HEADER

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

TYPES OF END CLOSURES



SIDE LAP DETAILS

(1) Slab thickness minus 5/8" if corrugations match reinforcing bars.

(2) Welding of form supports to tension flanges will not be permitted. Other methods of providing wind hold down resistance for PMDF in tension flange zones will be considered. At least one layer of sheet metal must be provided between the flange and the weld joint.

(3) The direction of concrete placement will be such that the upper layer of the form overlap is loaded first.

(4) See Span details for cover requirements.

FOR PRESTR CONC U-BEAM AND STEEL GIRDER BRIDGES:
Unless shown elsewhere in the plans, size, spacing, and orientation of bottom mat of slab reinforcement must match the top mat of reinforcing shown on the span details except all bottom mat bars are to be #5. Bottom mat reinforcement and additional concrete is subsidiary to Item 422 "Concrete Superstructures."

FOR PRESTR CONC TX-GIRDER BRIDGES:
See Miscellaneous Slab Details, Prestr Concrete I-Girders (IGMS) standard sheet for bottom mat reinforcing.

GENERAL NOTES:

Steel for Permanent Metal Deck Forms (PMDF) and support angles shall conform to ASTM A653, structural steel (SS), with coating designation G165. Steel must have a minimum yield strength of 33 ksi. Minimum thickness of PMDF is 20 gage and that of support angles and protective angles is 12 gage.

Submit two copies of forming plans for PMDF to the Engineer. These plans must show all essential details of proposed form sheets, closures, fasteners, supports, connectors, special conditions and size and location of welds. These plans must clearly show areas of tension flanges for steel beams and provisions for protecting the tension flanges from welding notch effects by inclusion of separating sheet metal or other positive method. These plans must be designed, signed, and sealed by a licensed professional engineer. Department approval of these plans is not required, but the Department reserves the right to require modifications to the plans. The Contractor is responsible for the adequacy of these plans.

The details and notes shown on this standard are to be used as a guide in preparation of the forming plans.

All material, labor, tools and incidentals necessary to form a bridge deck with Permanent Metal Deck Forms is considered subsidiary to Item 422, "Concrete Superstructures".

DESIGN NOTES:

As a minimum, PMDF and support angles must be designed for the dead load of the form, reinforcement and concrete plus 50 psf for construction loads. Flexural stresses due to these design loads must not exceed 75 percent of the yield strength of the steel. Allowable stress for weld metal must be 12,400 psi.

Maximum deflection under the weight of forms, reinforcement and concrete or 120 psf, whichever is greater, shall not exceed the following:

1/180 of the form design span, but not more than 0.50", for design spans of 10' or less.

1/240 of the form design span, but not more than 0.75", for design spans greater than 10'.

The form design span must not be less than the clear distance between beam flanges, measured parallel to the form flutes, minus 2".

CONSTRUCTION NOTES:

Form sheets must not be permitted to rest directly on the top of beam flanges. Form sheets must be securely fastened to form supports and must have a minimum bearing length of one inch at each end. Form supports must be placed in direct contact with beam flanges.

All attachments must be made by permissible welds, screws, bolts, clips or other means shown on the the forming plans. All sheet metal assembly screws must be installed with torque-limiting devices to prevent stripping. Only welds or bolts must be used to support vertical loads.

Welding and welds must be in accordance with the provisions of Item 448, "Structural Field Welding", pertaining to fillet welds. All welds must be made by a qualified welder in accordance with Item 448.

All permanently exposed form metal, where the galvanized coating has been damaged, must be thoroughly cleaned and repaired in accordance with Item 445, "Galvanizing". Minor heat discoloration in areas of welds need not be touched up.

Flutes must line up uniformly across the entire width of the structure where main reinforcing steel is located in the flute.

Construction joints will not be permitted unless shown on the plans. The location of and forming details for any construction joint used must be shown on the forming plans. Forms below a construction joint must be removed after curing of the slab.

A sequence for uniform vibration of concrete must be approved by the Engineer prior to concrete placement. Attention must be given to prevent damage to the forms, yet provide proper vibration to prevent voids or honeycomb in the flutes and at headers and/or construction joints.

Texas Department of Transportation

Bridge Division Standard

PERMANENT METAL DECK FORMS

PMDF

FILE: pmdfste1-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
02-20: Modified box note by adding steel beams/girders and subsidiary.	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		208

DATE:
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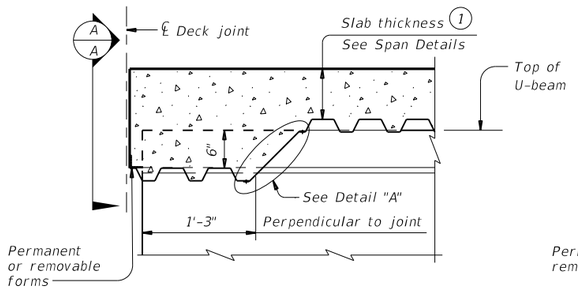
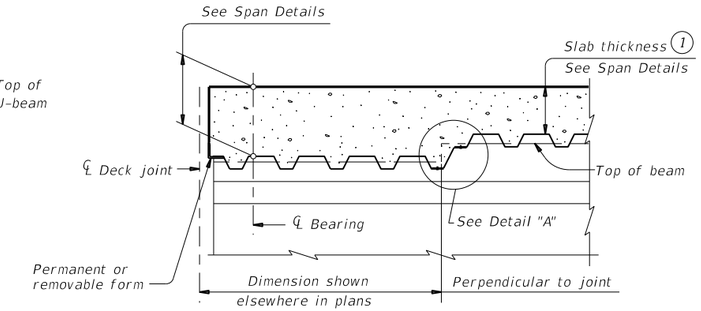
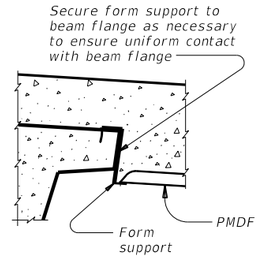


AT THICKENED SLAB END FOR U-BEAMS

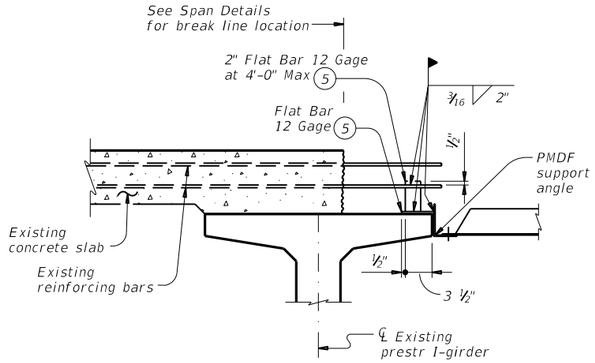


AT THICKENED SLAB END FOR PRESTRESSED I-BEAMS, I-GIRDERS AND STEEL BEAMS

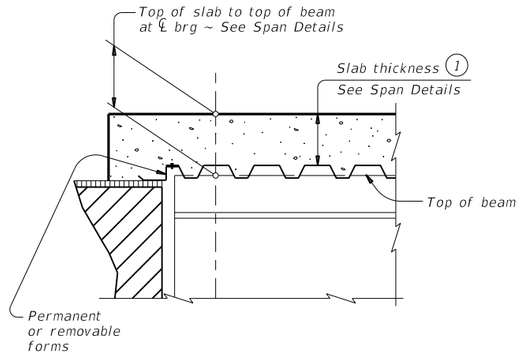
Showing I-beam block-out. No block-out for I-girders or steel beams.



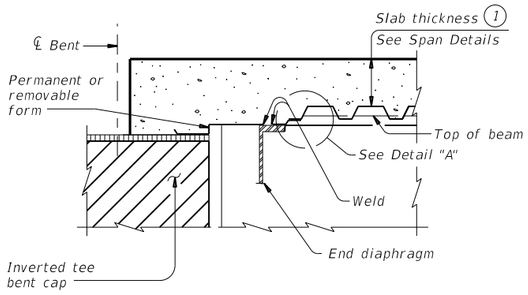
SECTION A-A



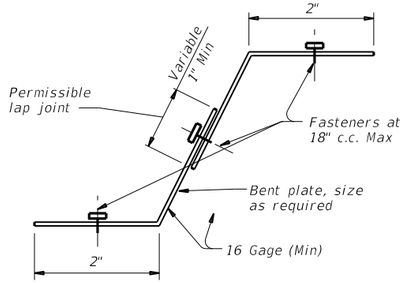
SHOWING PRESTRESSED CONCRETE I-BEAMS, I-GIRDERS AND U-BEAMS



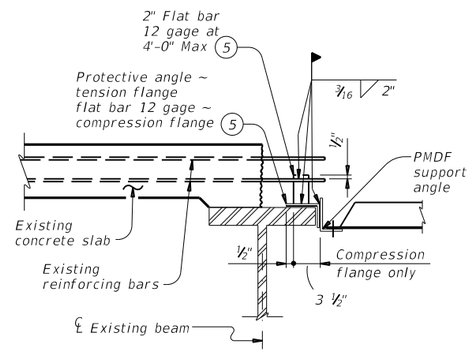
AT SLAB OVER ABUT BKWL OR INV TEE STEM FOR CONC BEAMS WITHOUT THICKENED SLAB END



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

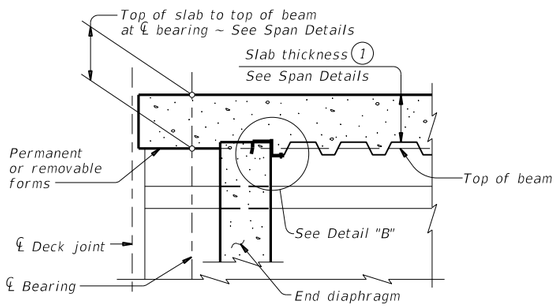


DETAIL "A"

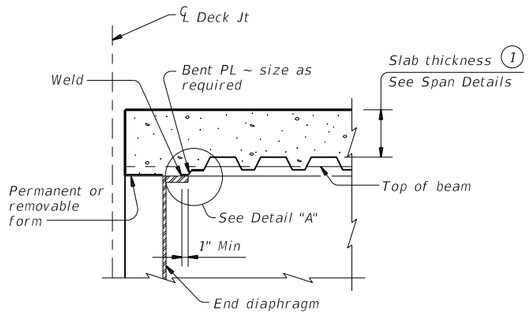


SHOWING STEEL BEAMS

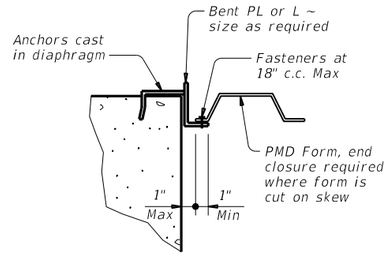
WIDENING DETAILS



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



AT END DIAPHRAGM FOR STEEL BEAMS WITHOUT THICKENED SLAB END



DETAIL "B"

(1) Slab thickness minus 5/8" if corrugations match reinforcing bars

(5) Minimum yield stress of 12 gage bars shall be 40 ksi

DETAILS AT ENDS OF BEAMS

SHEET 2 OF 2

Texas Department of Transportation

Bridge Division Standard

PERMANENT METAL DECK FORMS

PMDF

FILE: pmdfste1-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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REVISIONS	0110	05	126	IH 45
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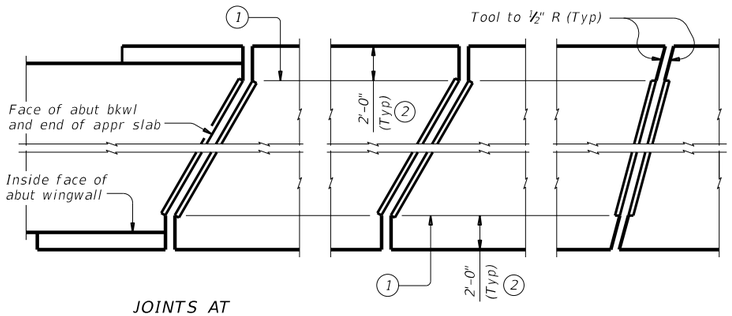
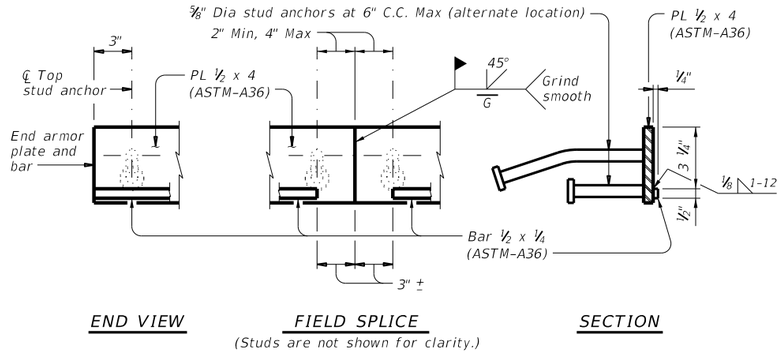
	HOU	HARRIS		209

DATE:
FILE:



JOINTS AT ABUTMENTS | SKEWS OVER 15° | SKEWS THRU 15°

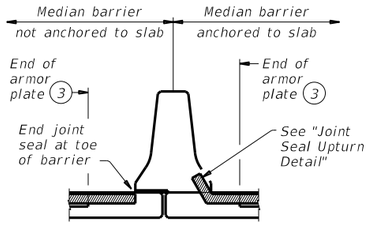
PLANS OF ARMOR PLATES



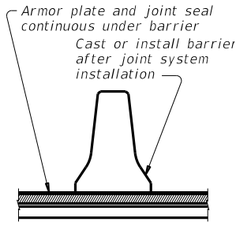
END VIEW | FIELD SPLICE | SECTION

(Studs are not shown for clarity.)

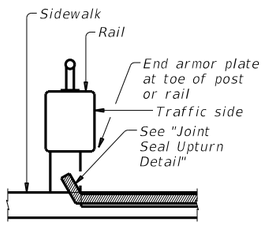
ELEVATION OF ARMOR PLATE



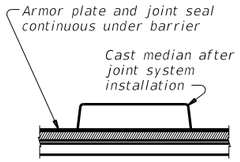
WITH OPEN DECK JOINT BELOW MEDIAN BARRIER



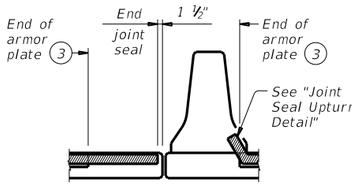
AT MEDIAN BARRIER



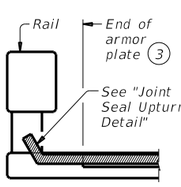
AT SIDEWALK BEHIND BRIDGE RAIL



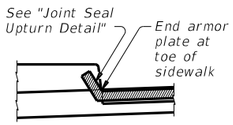
AT RAISED MEDIAN



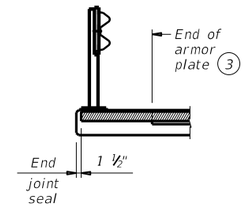
WITH OPEN DECK JOINT ADJACENT TO MEDIAN BARRIER



AT CONCRETE BRIDGE RAIL

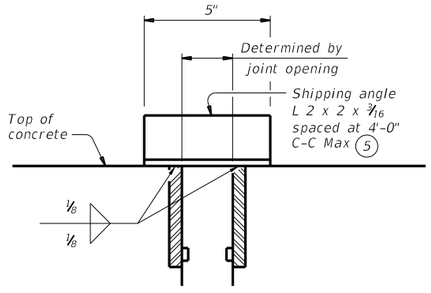


AT SIDEWALK



AT STEEL POST BRIDGE RAIL

TYPICAL SECTIONS OF ARMOR PLATES AND SEALS (4)

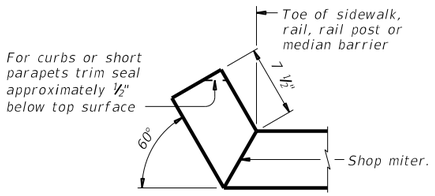


SHOWING ARMOR PLATE

(Studs not shown for clarity)

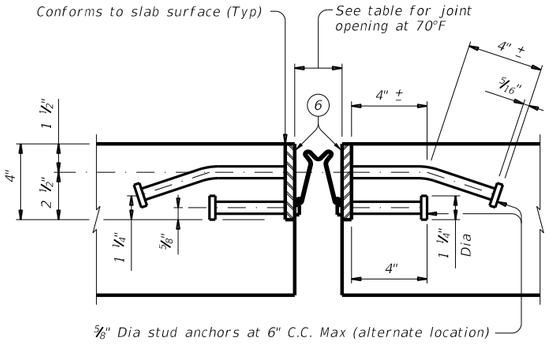
SHIPPING ANGLE

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



JOINT SEAL UPTURN DETAIL

Upturn seal only. Terminate armor plates as shown in "Plans of Armor Plates" and "Typical Sections of Armor Plates & Seals."



JOINT SECTION

Showing R J Watson strip seal. Other strip seals are similar.

TABLE OF SEALED EXPANSION JOINT INFORMATION

MANUFACTURER	STEEL SECTION (7)	STRIP SEAL 4" JOINT	
		Seal Type	Joint Opening (8)
D.S. Brown	As shown	V-400	2 ¼"
R.J. Watson	As shown	SF-400	2 ½"
SSI	As shown	SSS-400	2 ½"
Watson Bowman Acme	As shown	SPS-400	2"

REDUCED LONGITUDINAL MOVEMENT RANGE

SKEW (deg)	JOINT SIZE 4"
0	4.0"
15	4.0"
30	3.5"
45	2.8"

DESIGN NOTES:

Joints installed on a skew have reduced ability to accommodate longitudinal movement. Use table values to determine the correct joint size for skewed installations.

For other skews over 25 degrees, calculate reduced movement range by multiplying joint size by cosine (skew).

(1) At Fabricator's option, armor plate may extend up to 6" beyond this point for skews through 15°.

(2) Unless shown otherwise, terminate armor plate at slab break point if break is more than 2'-0" from slab edge.

(3) See "Plans of Armor Plates".

(4) Other conditions affecting the joint profile should be noted elsewhere.

(5) Align shipping angle perpendicular to joint.

(6) Coat with Manufacturer's supplied epoxy primer above bar before installing sealant.

(7) Shape of steel section shown is typical. Variations in sections must be approved by the Engineer.

(8) These openings are also the recommended minimum installation openings.

FABRICATION NOTES:

Temporarily shop assemble corresponding sections of sealed expansion joints (SEJ), check for fit, and match mark for shipment. Secure corresponding sections together for shipment with shipping angle. Do not use erection bolts.

The seal must be continuous and included in the price bid for sealed expansion joint.

Ship steel sections in convenient lengths of 10'-0" Min and 24'-0" Max unless necessary for staged construction or widenings. One shop splice is permitted in each shipping length provided no piece is less than 2'-0" long and sufficient studs are added to limit the stud to shop splice distance to 2" Min and 4" Max.

Weld studs in accordance with AWS D1.1.

Butt weld all shop and field splices and grind smooth areas in contact with seal. Make all necessary field splice joint preparations in the shop.

Paint the entire steel section with System II or IV primer in accordance with Item 446, "Feild Cleaning and Painting Steel." Provide paints in accordance with Item 446.2. Prepare steel and apply paint in accordance with Item 446.4.7.3 and 446.4.7.4.

Shop drawings for the fabrication of sealed expansion joints will not require the Engineer's approval if fabrication is in accordance with the details shown on this standard.

CONSTRUCTION NOTES:

Secure the sealed expansion joint in position and place to the proper grade and alignment by welding braces to adjacent reinforcing steel, to prestressed beam stirrups, or to anchors cast in concrete diaphragms. Include cost of temporary bracing in the price bid for sealed expansion joint.

Remove shipping angle immediately after each joint half is secured in place. Grind smooth, and touch up with organic zinc-rich paint.

Clean and prepare seal cavity for seal installation as per the Manufacturer's installation procedures.

Splice and install seal in accordance with the Manufacturer's directions and with the adhesive provided by the Manufacturer.

Splice in joint seal may be performed in the field.

GENERAL NOTES:

Provide sealed expansion joints in the size and at locations shown on the plans.

Minimum slab and overhang thickness required for the use of SEJ-B is 6 ½".

Texas Department of Transportation

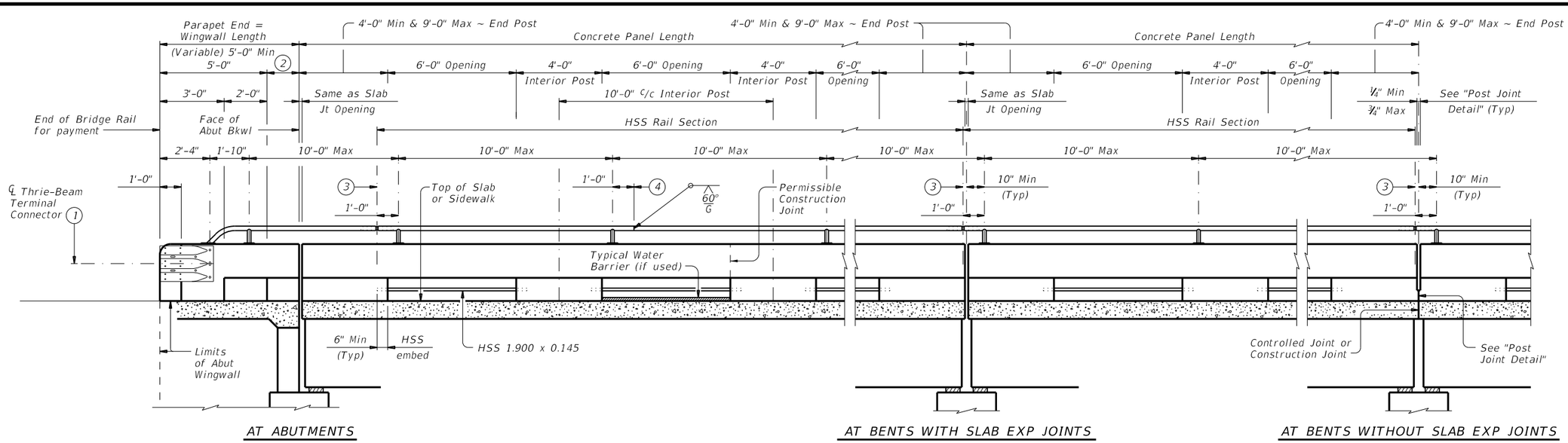
Bridge Division Standard

SEALED EXPANSION JOINT TYPE B WITHOUT OVERLAY

SEJ-B

FILE: sejbste1-19.dgn	DN: TxDOT	CK: TxDOT	DW: JTR	CK: JMH
©TxDOT April 2019 REVISIONS	CONT	SECT	JOB	HIGHWAY
	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		210

DATE:
FILE:



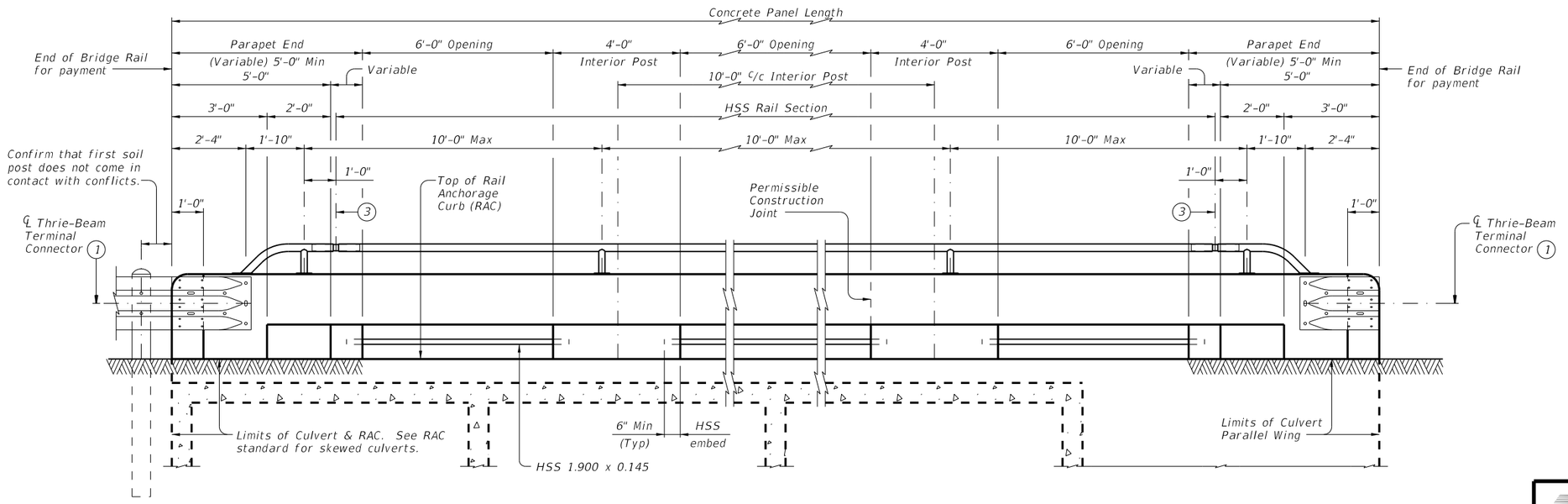
AT ABUTMENTS

AT BENTS WITH SLAB EXP JOINTS

AT BENTS WITHOUT SLAB EXP JOINTS

ROADWAY ELEVATION OF RAIL ON BRIDGE

(Showing without raised sidewalk)



AT STRAIGHT OR FLARED WINGS

AT PARALLEL WINGS

ROADWAY ELEVATION OF RAIL ON BOX CULVERTS

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

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

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

(3) ℄ Splice Jt or Exp Jt

(4) One shop splice per HSS rail section is permitted with minimum 85 percent penetration. The weld may be square groove or single vee groove. Grind smooth.

Texas Department of Transportation

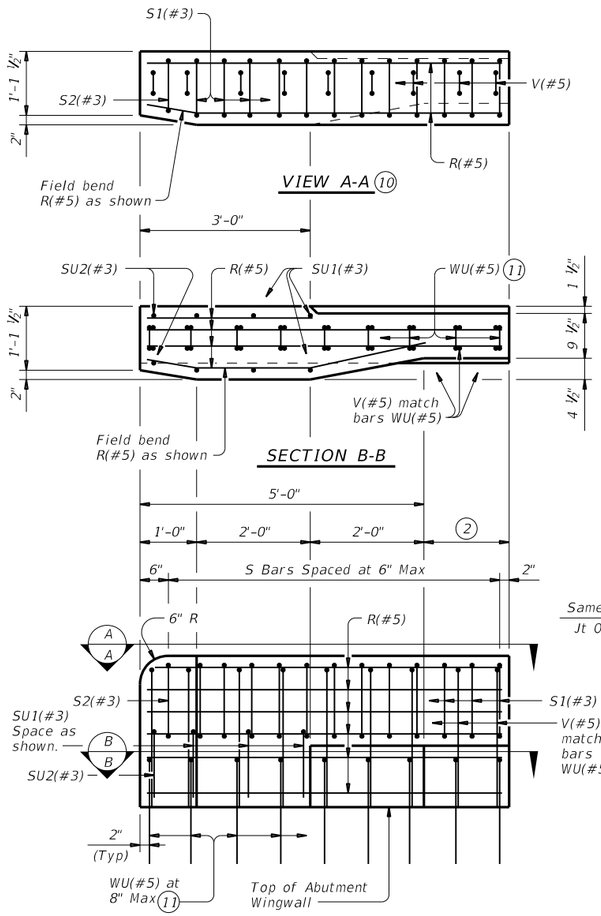
Bridge Division Standard

COMBINATION RAIL

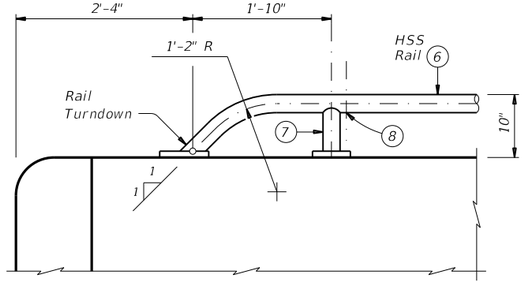
TYPE C223

FILE: rlstd019-19.dgn	DN: TxDOT	CK: TxDOT	DW: JTR	CK: AES
©TxDOT September 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		211

DATE:
FILE:

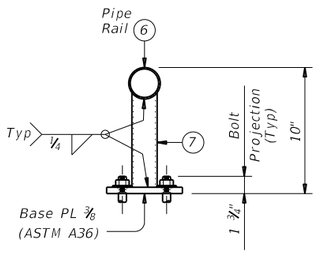


PARAPET END AT ABUT WINGWALL (11)

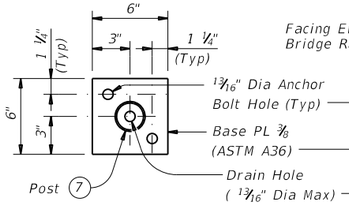


Note that at least two anchor points (as shown) are required for the Bridge Rail on the Abutment Wingwall. Longer Wingwalls may require more than two Rail anchorages.

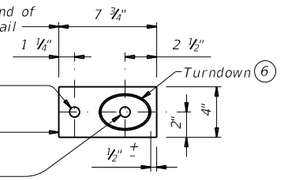
HSS RAIL TERMINAL DETAIL



TRANSVERSE SECTION

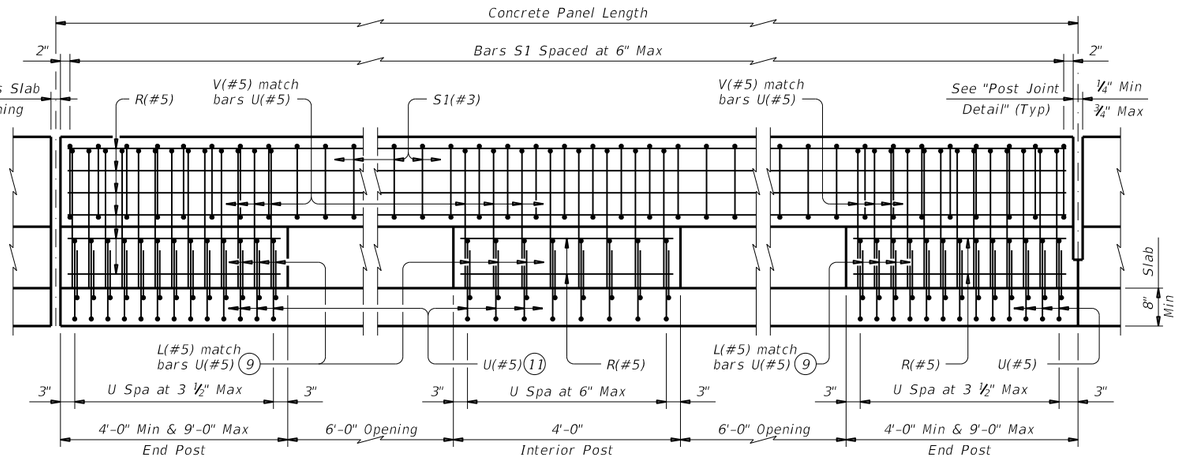


POST BASE PLATE PLAN



RAIL TURNDOWN BASE PLATE PLAN

HSS RAIL DETAILS



AT BENTS WITH SLAB EXP JOINTS

AT 4' INTERIOR POST

AT BENTS WITHOUT SLAB EXP JOINTS

ELEVATION SHOWING TYPICAL REINFORCING PLACEMENT

Showing rail on slab and without raised sidewalk. Rail on box culvert similar. HSS not shown for clarity.

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

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

(5) Increase 2" for structures with overlay.

(6) HSS 2.875 x 0.203

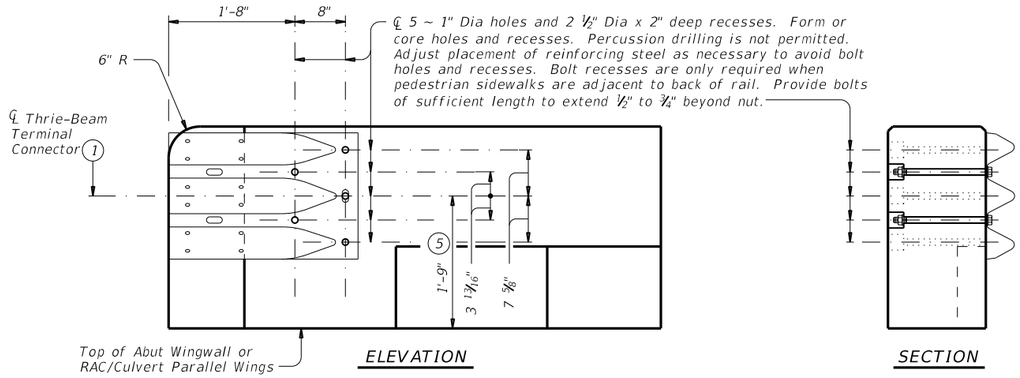
(7) HSS 2.375 x 0.154

(8) ⅜" Dia Hole in bottom of HSS rail (Minimum 1 hole between posts ~ Typ)

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

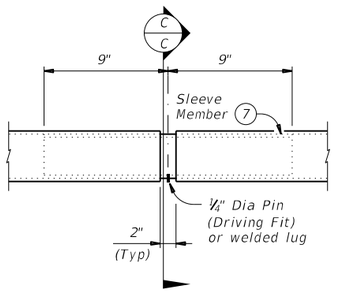
(10) Bars SU1(#3), SU2(#3) and WU(#5) not shown for clarity.

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

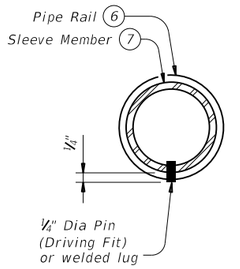


ELEVATION

SECTION



AT SPLICE OR EXP JTS



SECTION C-C

TERMINAL CONNECTION DETAILS

PIPE SPLICE DETAILS

SHEET 2 OF 4

Texas Department of Transportation

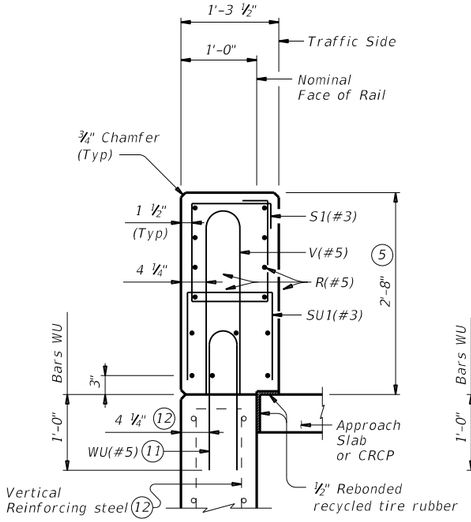
Bridge Division Standard

COMBINATION RAIL

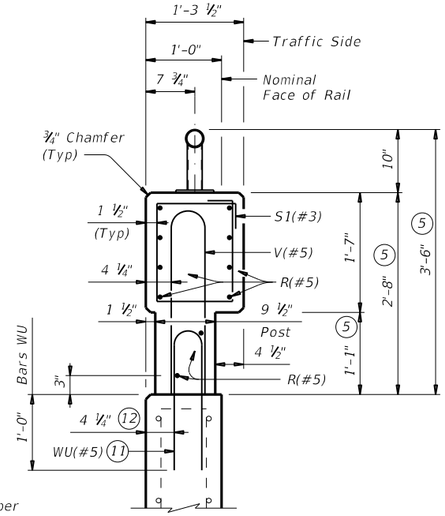
TYPE C223

FILE: rlstd019-19.dgn	DN: TxDOT	CK: TxDOT	DW: JTR	CK: AES
©TxDOT September 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		212

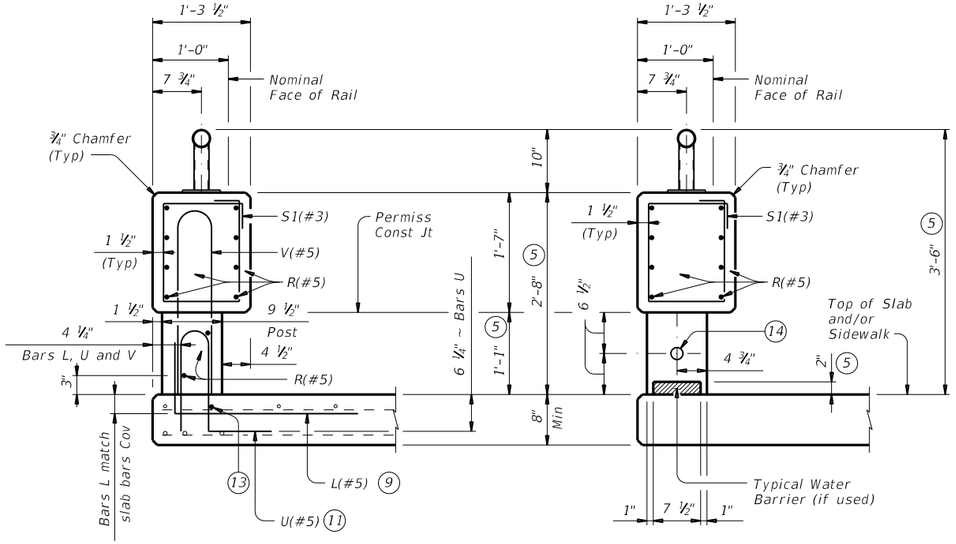
DATE:
FILE:



SECTION D-D
ON ABUTMENT WINGWALLS
OR CIP RETAINING WALLS

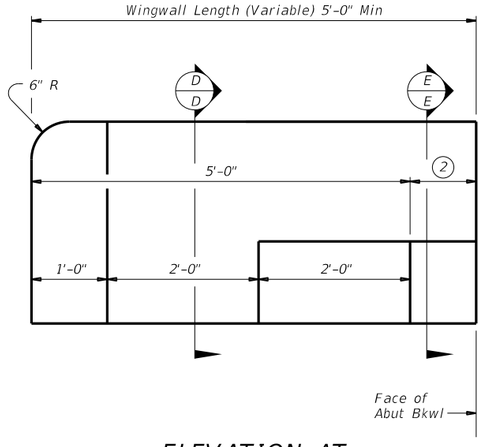


SECTION E-E
ON ABUTMENT WINGWALLS
OR CIP RETAINING WALLS



AT POST
ON BRIDGE SLAB

AT OPENING
ON BRIDGE SLAB

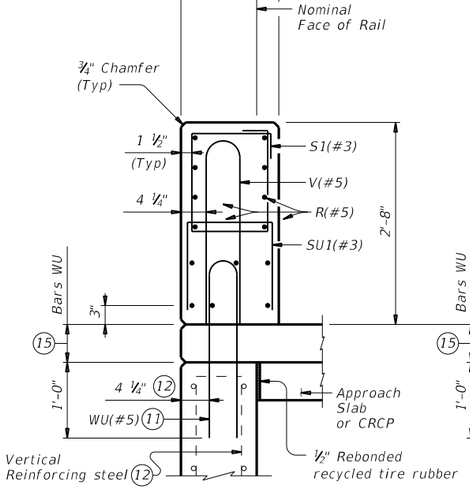


ELEVATION AT
ABUTMENT WINGWALL

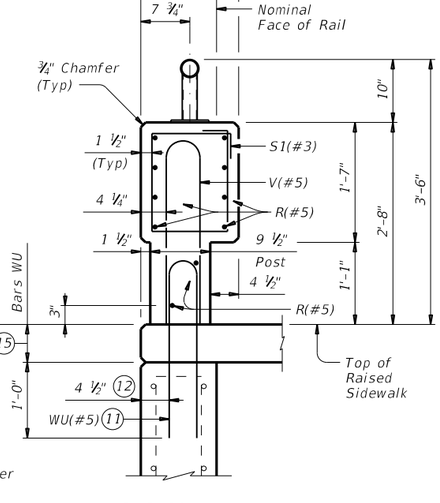
Box culvert parallel wings or rail anchorage curb similar.
HSS rail not shown for clarity.

SECTIONS THRU RAIL WITHOUT RAISED SIDEWALK

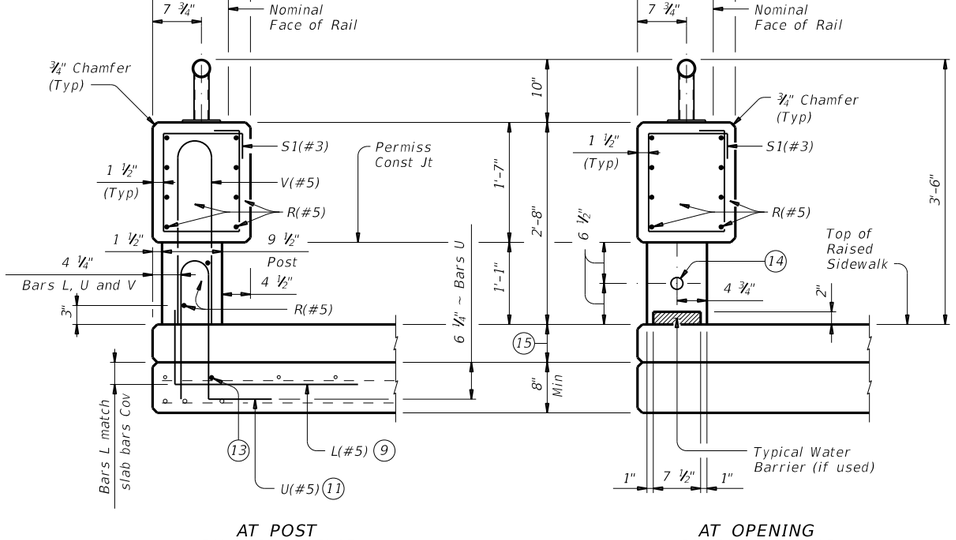
Sections on box culvert similar.



SECTION D-D
ON ABUTMENT WINGWALLS
OR CIP RETAINING WALLS

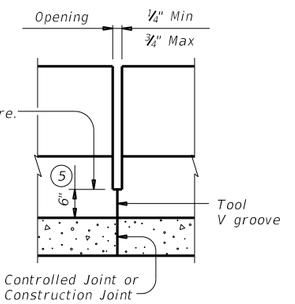


SECTION E-E
ON ABUTMENT WINGWALLS
OR CIP RETAINING WALLS



AT POST
ON BRIDGE SLAB

AT OPENING
ON BRIDGE SLAB



POST JOINT DETAIL

(Showing without raised sidewalk)
Provide at all interior bents without slab expansion joints.

SECTIONS THRU RAIL WITH RAISED SIDEWALK

Sections on box culvert similar.

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

(5) Increase 2" for structures with overlay.

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

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

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

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

(14) HSS 1.900 x 0.145

(15) Raised Sidewalk.

Texas Department of Transportation

Bridge Division Standard

COMBINATION RAIL

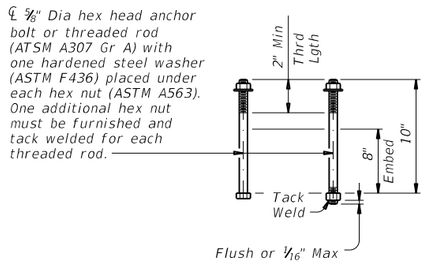
TYPE C223

FILE:	r1std019-19.dgn	DN: TxDOT	CK: TxDOT	DW: JTR	CK: AES
©TxDOT	September 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS		0110	05	126	IH45
		DIST	COUNTY		SHEET NO.
		HOU	HARRIS		213

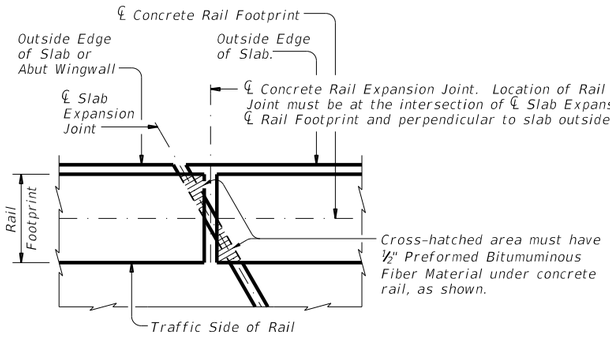
DATE:
FILE:

RAIL DATA FOR HORIZONTAL CURVES

	RADIUS TO FACE OF RAIL	MAX CHORD LENGTH	CONSTRUCT OR FABRICATE
HSS Rail	Over 2800'	29'-0"	Straight rail sections
	Over 1400' thru 2800'	14'-6"	To required radius or to chords shown
	Over 700' thru 1400'	7'-3"	
	Thru 700'	Zero	To required radius



CAST-IN-PLACE ANCHOR BOLT OPTIONS (16)



PLAN OF RAIL AT EXPANSION JOINTS

Example showing Slab Expansion Joints without breakbacks.

(5) Increase 2" for structures with overlay.

(16) See "Material Notes" for anchor bolt information.

(17) For raised sidewalks, add sidewalk height to total bar height. Use sidewalk height at rail's location.

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

CONSTRUCTION NOTES:

Face of rail, posts and parapet must be vertical transversely unless otherwise approved by the Engineer. HSS rail posts and opening end faces must be perpendicular to top of adjacent concrete parapet grade. Use epoxy mortar under HSS rail post base plates if gaps larger than 1/16" exist.

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

HSS rail sections must not include less than two posts, and no more than four (except at Abutments).

Round or chamfer exposed edges of HSS rail and HSS rail posts to approximately 1/16" by grinding.

Test adhesive anchors in accordance with Item 450.3.3, "Tests". Test 3 anchors per 100 anchors installed. Perform corrective measures to provide adequate capacity if any of the tests do not meet the required test load. Repair damage from testing as directed.

At the Contractor's option anchor bolts may be cast with the parapet. See "Material Notes".

Chamfer all exposed corners.

MATERIAL NOTES:

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

Provide Grade 60 reinforcing steel.

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

Provide ASTM A1085, A500 Gr B or A53 Gr B for all HSS.

Galvanize all metal components of steel rail system. Apply additional coatings when shown elsewhere on the plans. When plans require paint over gavanizing, follow the requirements for painting galvanized steel in Item 445, "Galvanizing" and when field painting, Item 446, "Field Cleaning and Painting Steel". Sleeve members and anchor bolts must receive galvanization prior to installation and only field paint after installation unless directed otherwise by Engineer.

Deformed Welded Wire Reinforcing (WWR) (ASTM A1064) of equal size and spacing may be substituted for Bars U, V, and WU unless noted otherwise.

Anchor bolts must be ⅝" Dia ASTM A307 Gr A fully threaded rods with one hex nut and one hardened steel washer (ASTM F436) each. Nuts must conform to ASTM A563 requirements. Embed fully threaded rods into parapet wall with a Type III, Class C, D, E, or F anchor adhesive. Minimum adhesive anchor embedment depth is 3". Anchor adhesive chosen must be able to achieve a nominal bond strength in tension of a single anchor, Na, of 5 kips (edge distance must be accounted for). Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use. Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing".

Optional cast-in-place anchor bolts must be ⅝" Dia ASTM A307 Gr A bolts (or threaded rods with one tack welded hex nut each) with one hex nut and one hardened steel washer (ASTM F436) at each bolt. Nuts must conform to ASTM A563 requirements.

Provide bar laps, where required, as follows:
Uncoated or galvanized ~ #5 = 2'-0"
Epoxy coated ~ #5 = 3'-0"

GENERAL NOTES:

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

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

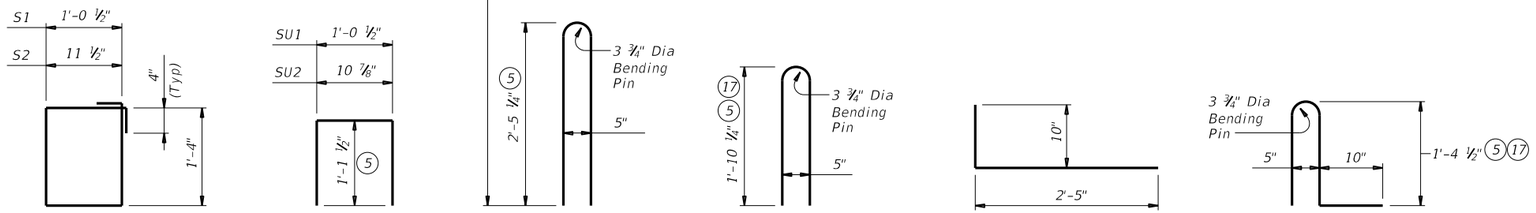
Rail anchorage details shown on this standard may require modification for select structure types.

See appropriate details elsewhere in plans for these modifications.

Submit erection drawings showing panel lengths, HSS rail post spacing, and anchor bolt setting to the Engineer for approval.

Average weight of railing with no overlay:
370 plf total
358 plf (Conc)
12 plf (Steel)

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



BARS S (#3) | BARS SU (#3) | BARS V (#5) (18) | BARS WU (#5) | BARS L (#5) | BARS U (#5) (18)

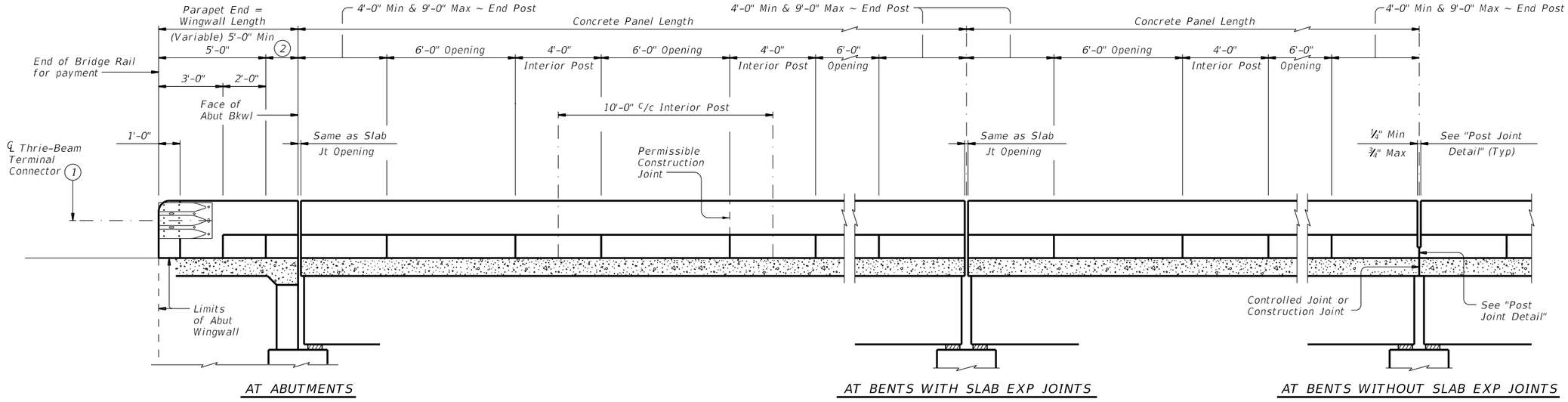
SHEET 4 OF 4

Texas Department of Transportation | Bridge Division Standard

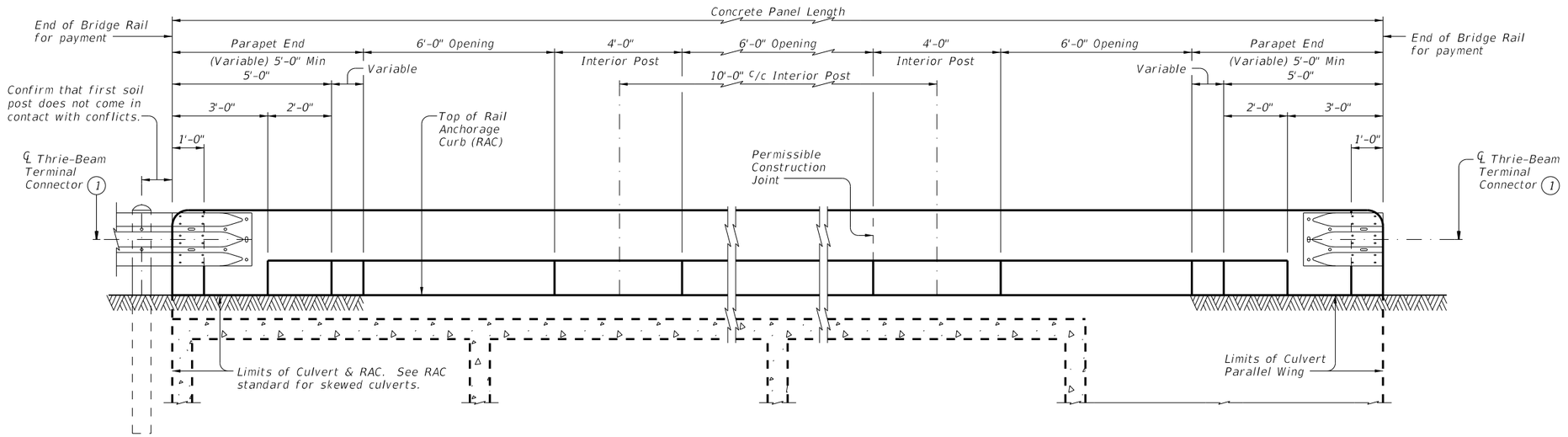
COMBINATION RAIL

TYPE C223

FILE:	rlstd019-19.dgn	DN: TxDOT	CK: TxDOT	DW: JTR	CK: AES
©TxDOT September 2019		CONT	SECT	JOB	HIGHWAY
REVISIONS		0110	05	126	IH45
		DIST	COUNTY		SHEET NO.
		HOU	HARRIS		214



ROADWAY ELEVATION OF RAIL ON BRIDGE



ROADWAY ELEVATION OF RAIL ON BOX CULVERTS

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

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

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

DATE:
FILE:

SHEET 1 OF 3

Texas Department of Transportation

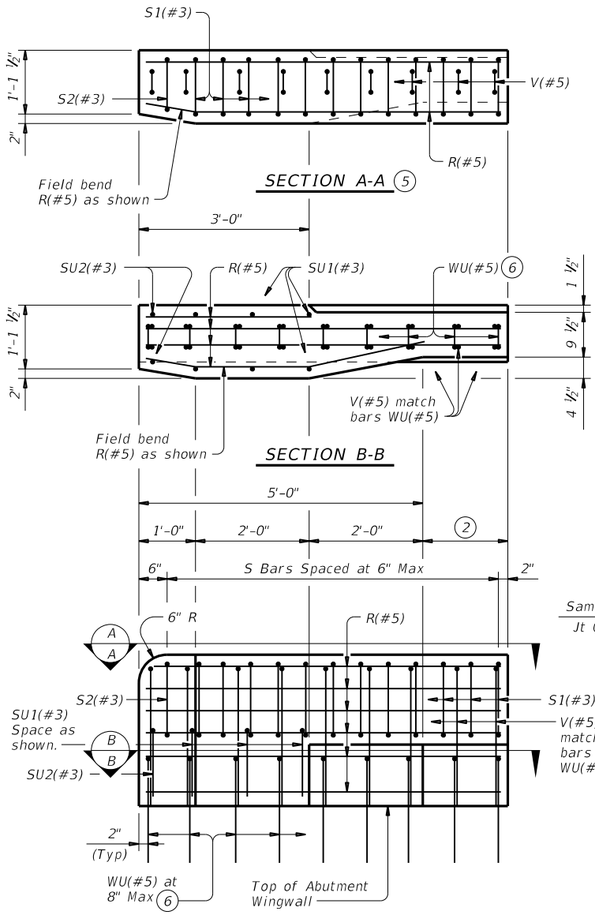
Bridge Division Standard

TRAFFIC RAIL

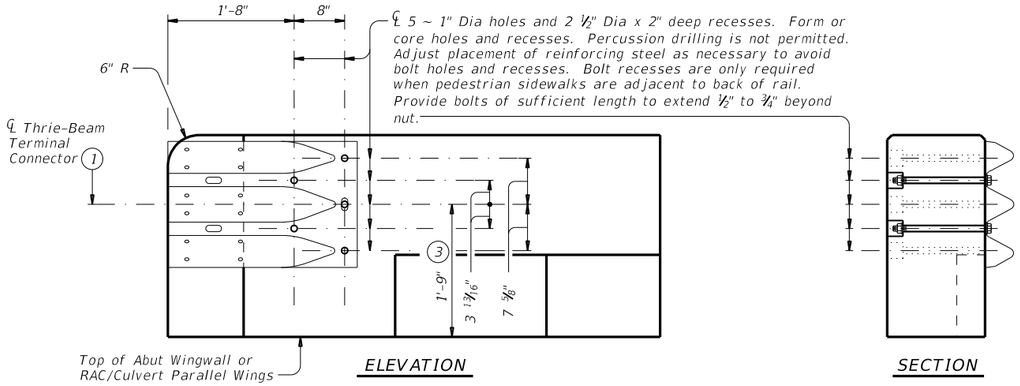
TYPE T223

FILE: rlstd005-19.dgn	DN: TxDOT	CK: TxDOT	DW: JTR	CK: AES
©TxDOT September 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		215

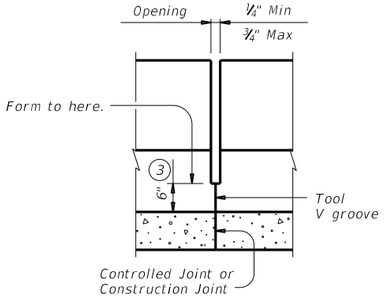
DATE:
FILE:



PARAPET END AT ABUT WINGWALL (6)

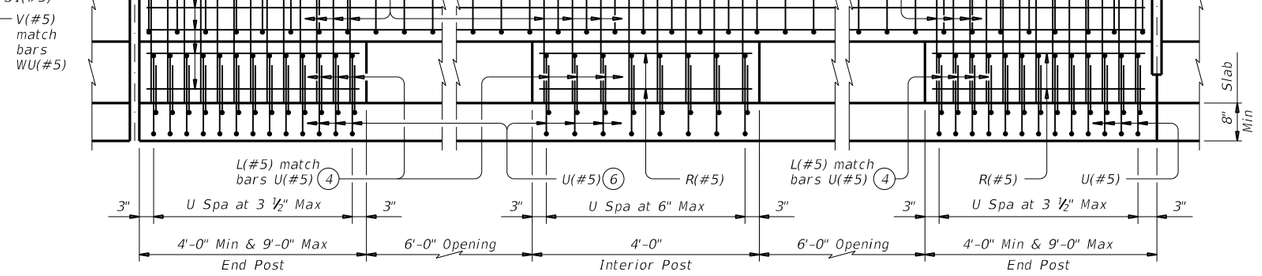


TERMINAL CONNECTION DETAILS



POST JOINT DETAIL

Provide at all interior bents without slab expansion joints.



AT SLAB EXPANSION JOINTS

AT 4' INTERIOR POST

AT BENTS WITHOUT SLAB EXPANSION JOINTS

ELEVATION SHOWING TYPICAL REINFORCING PLACEMENT

Showing rail on slab. Rail on box culvert similar.

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

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

(3) Increase 2" for structures with overlay.

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

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

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

Texas Department of Transportation

Bridge Division Standard

TRAFFIC RAIL

TYPE T223

FILE:	rlstd005-19.dgn	DN: TxDOT	CK: TxDOT	DW: JTR	CK: AES
©TxDOT	September 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS		0110	05	126	IH 45
		DIST	COUNTY		SHEET NO.
		HOU	HARRIS		216

DATE:
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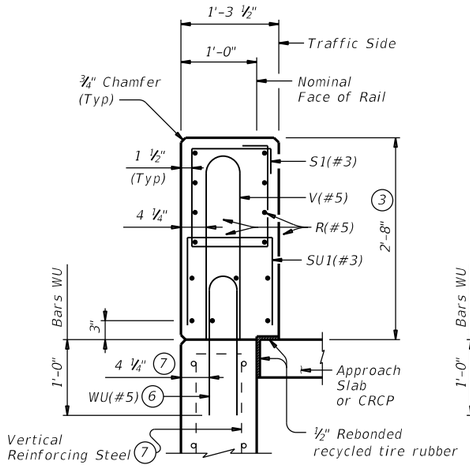
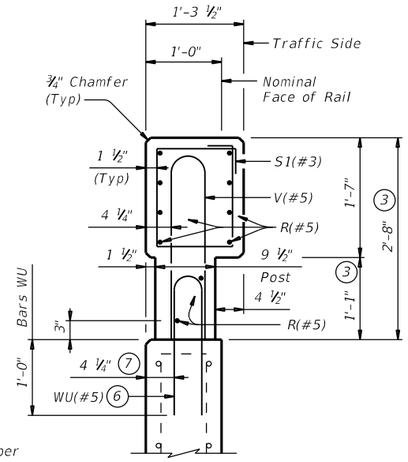
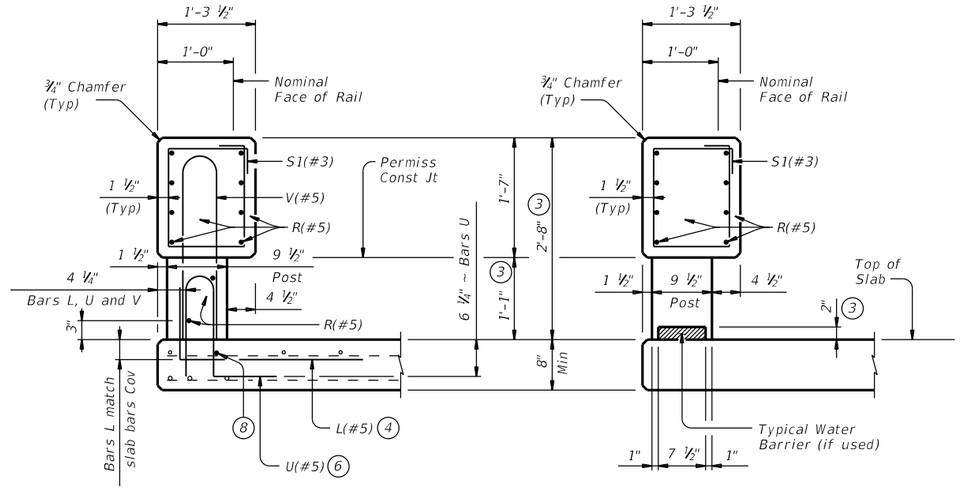


SECTION C-C
ON ABUTMENT WINGWALLS
OR CIP RETAINING WALLS



SECTION D-D
ON ABUTMENT WINGWALLS
OR CIP RETAINING WALLS

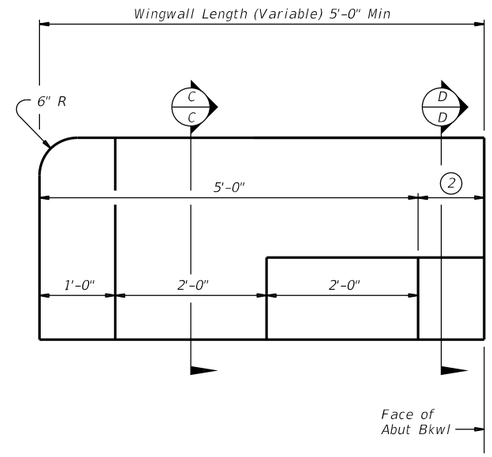


AT POST
ON BRIDGE SLAB

AT OPENING
ON BRIDGE SLAB

SECTIONS THRU RAIL

Sections on box culverts similar.



ELEVATION AT ABUTMENT WINGWALL

Box culvert parallel wings or rail anchorage curb similar.

CONSTRUCTION NOTES:

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

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

Chamfer all exposed corners.

MATERIAL NOTES:

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

Provide Grade 60 reinforcing steel.

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

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

Provide bar laps, where required, as follows:

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

Epoxy coated ~ #5 = 3'-0"

GENERAL NOTES:

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

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

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

Shop drawings are not required for this rail.

Average weight of railing with no overlay is 358 plf.

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

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

(3) Increase 2" for structures with overlay.

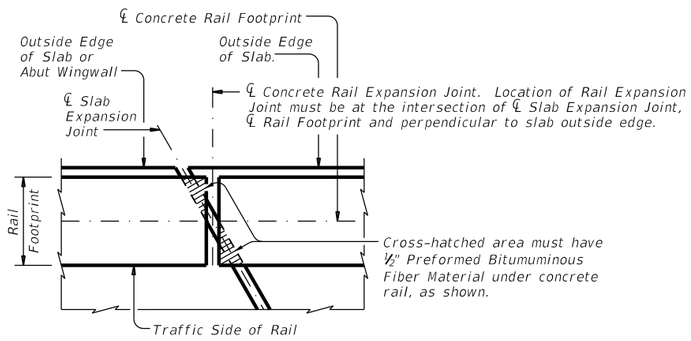
(4) Bars L(#5) are part of rail reinforcing and are included in unit price bid for railing. Space with Bars U. Bars L match slab bar cover. Bars L may be bundled with top slab reinforcing if spacing is equivalent.

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

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

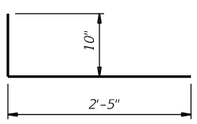
(8) Top longitudinal slab bar may be adjusted laterally 3" plus or minus to tie reinforcing.

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

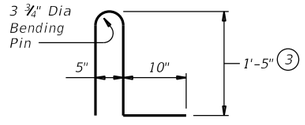


PLAN OF RAIL AT EXPANSION JOINTS

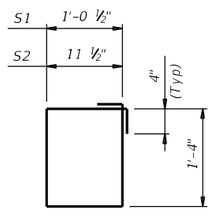
Example showing Slab Expansion Joints without breakbacks.



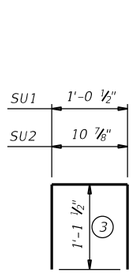
BARS L (#5)



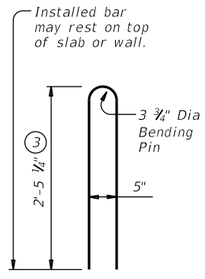
BARS U (#5) (9)



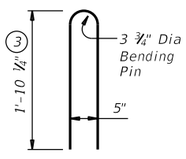
BARS S (#3)



BARS SU (#3)



BARS V (#5) (9)



BARS WU (#5)

SHEET 3 OF 3

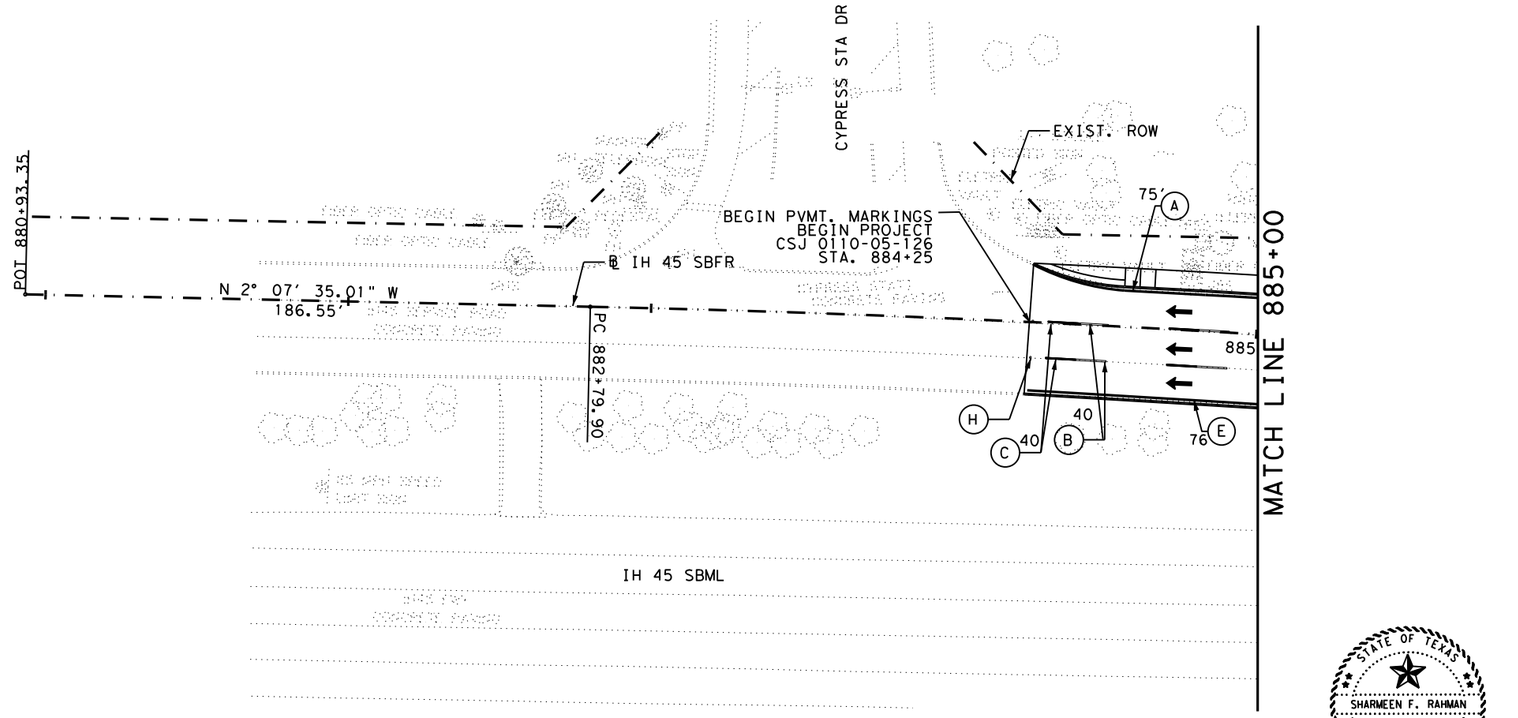
Texas Department of Transportation

Bridge Division Standard

TRAFFIC RAIL

TYPE T223

FILE: rlstd005-19.dgn	DN: TxDOT	CK: TxDOT	DW: JTR	CK: AES
©TxDOT September 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		217



LEGEND

- (A) MULTIPOLYMER PAV MRK (W)(6")(SLD)
- (B) MULTIPOLYMER PAV MRK (W)(6")(BRK)
- (C) MULTIPOLYMER PAV MRK (BLK)(6")(BRK)
- (D) MULTIPOLYMER PAV MRK (W)(8")(SLD)
- (E) MULTIPOLYMER PAV MRK (Y)(6")(SLD)
- (F) MULTIPOLYMER PAV MRK (Y)(8")(SLD)
- (G) MULTIPOLYMER PAV MRK (Y)(12")(SLD)
- (H) REFL PAV TY II-C-R
- (I) REFL PAV TY I-A

- ⬡ PROPOSED SMALL SIGN
- ◯ PROPOSED LARGE SIGN
- ☐ RELOCATE EXISTING SIGN

NOTE:

REMOVAL OF RAISED PAVEMENT MARKERS WILL NOT BE PAID FOR DIRECTLY AND WILL BE SUBSIDIARY TO THE PERTINENT BID ITEMS.

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED
PROFESSIONAL ENGINEER

Sharmeen Rahman, P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

PAVEMENT MARKING LAYOUT

SCALE: HORIZ. 1"= 50

SHEET 1 OF 5

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		218

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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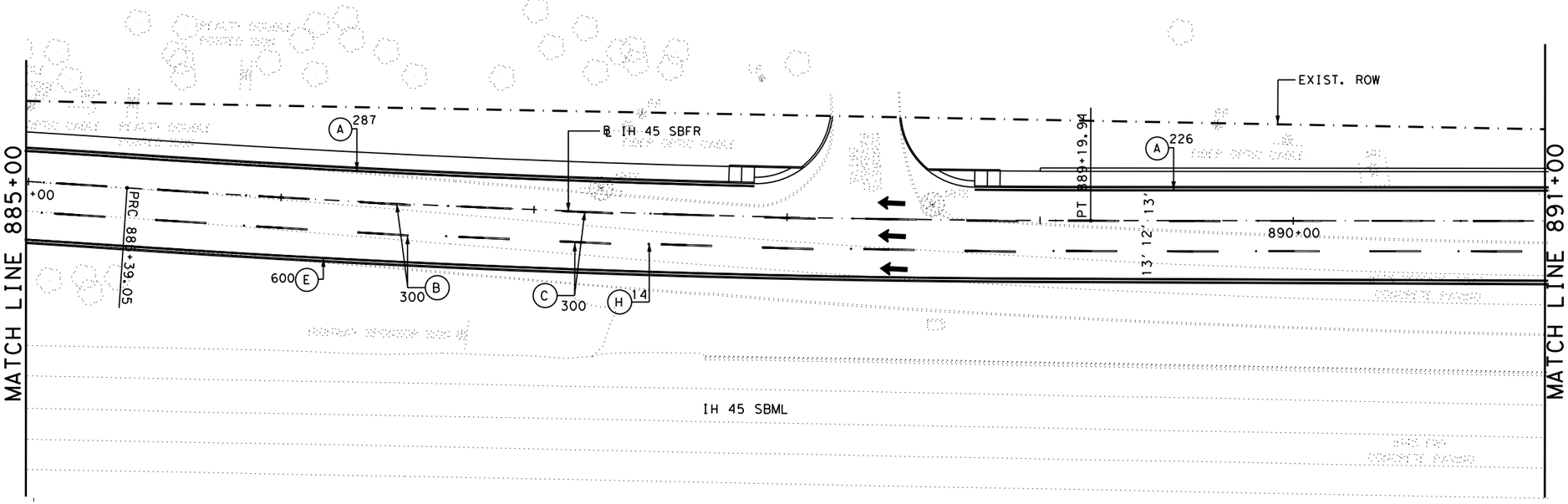

LEGEND

- (A) MULTIPOLYMER PAV MRK (W)(6")(SLD)
- (B) MULTIPOLYMER PAV MRK (W)(6")(BRK)
- (C) MULTIPOLYMER PAV MRK (BLK)(6")(BRK)
- (D) MULTIPOLYMER PAV MRK (W)(8")(SLD)
- (E) MULTIPOLYMER PAV MRK (Y)(6")(SLD)
- (F) MULTIPOLYMER PAV MRK (Y)(8")(SLD)
- (G) MULTIPOLYMER PAV MRK (Y)(12")(SLD)
- (H) REFL PAV TY II-C-R
- (I) REFL PAV TY I-A

- ⬡ PROPOSED SMALL SIGN
- ◯ PROPOSED LARGE SIGN
- □ RELOCATE EXISTING SIGN

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STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED
PROFESSIONAL ENGINEER

Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

PAVEMENT MARKING LAYOUT

SCALE: HORIZ. 1"= 50

SHEET 2 OF 5

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		219

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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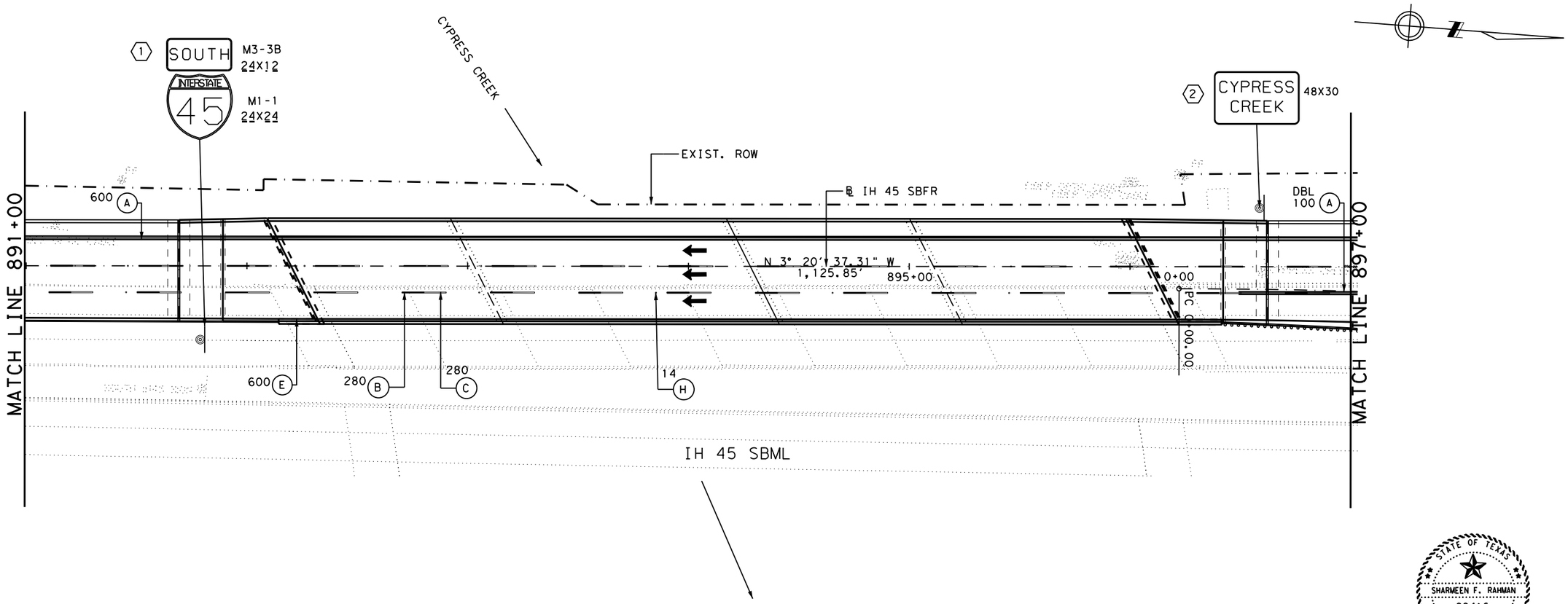

LEGEND

- (A) MULTIPOLYMER PAV MRK (W)(6")(SLD)
- (B) MULTIPOLYMER PAV MRK (W)(6")(BRK)
- (C) MULTIPOLYMER PAV MRK (BLK)(6")(BRK)
- (D) MULTIPOLYMER PAV MRK (W)(8")(SLD)
- (E) MULTIPOLYMER PAV MRK (Y)(6")(SLD)
- (F) MULTIPOLYMER PAV MRK (Y)(8")(SLD)
- (G) MULTIPOLYMER PAV MRK (Y)(12")(SLD)
- (H) REFL PAV TY II-C-R
- (I) REFL PAV TY I-A

- ⬡ PROPOSED SMALL SIGN
- ◯ PROPOSED LARGE SIGN
- ☐ RELOCATE EXISTING SIGN

NOTE:

REMOVAL OF RAISED PAVEMENT MARKERS WILL NOT BE PAID FOR DIRECTLY AND WILL BE SUBSIDIARY TO THE PERTINENT BID ITEMS.

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED
PROFESSIONAL ENGINEER

Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

PAVEMENT MARKING LAYOUT

SCALE: HORIZ. 1"= 50

SHEET 3 OF 5

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		220

STATE	DIST	COUNTY	
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0110	05	126	IH 45

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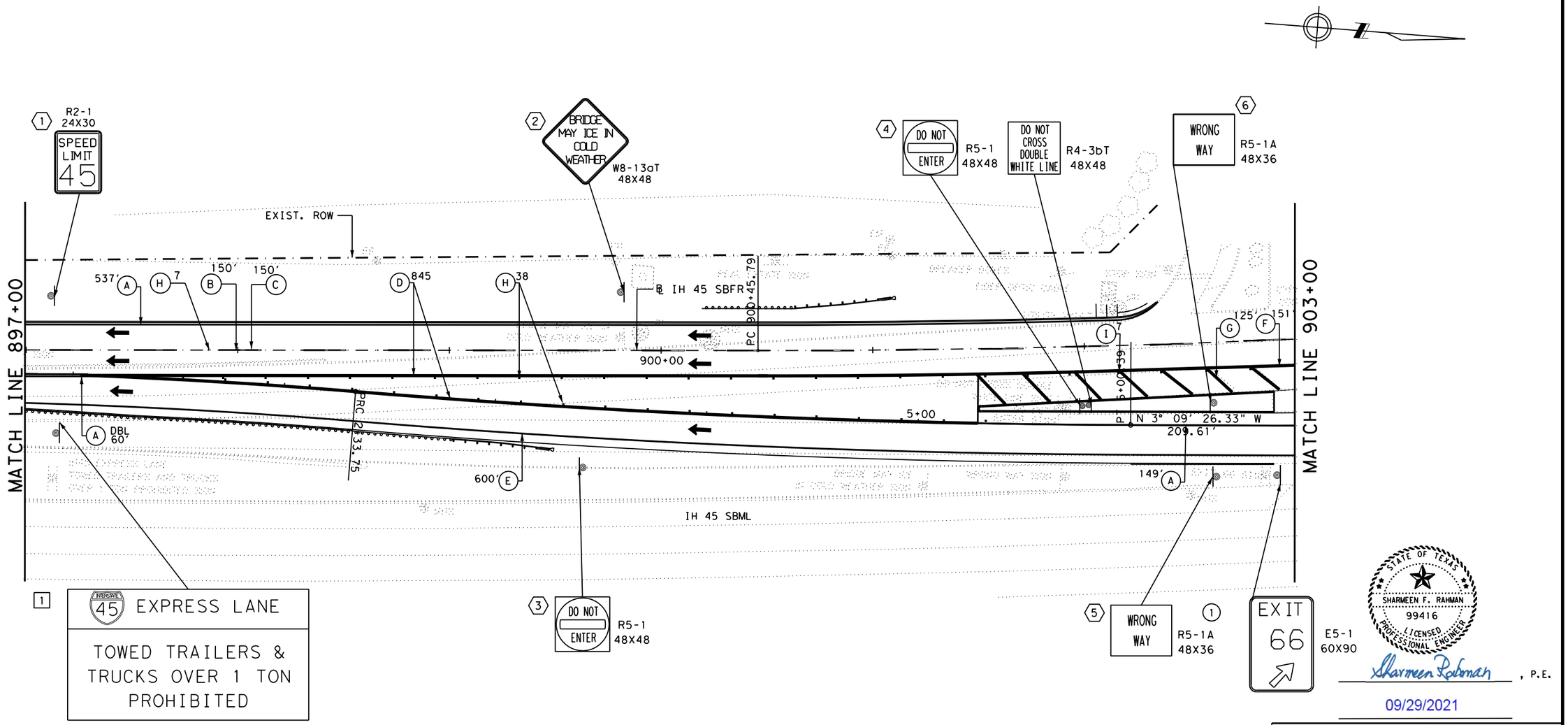

LEGEND

- (A) MULTIPOLYMER PAV MRK (W)(6")(SLD)
- (B) MULTIPOLYMER PAV MRK (W)(6")(BRK)
- (C) MULTIPOLYMER PAV MRK (BLK)(6")(BRK)
- (D) MULTIPOLYMER PAV MRK (W)(8")(SLD)
- (E) MULTIPOLYMER PAV MRK (Y)(6")(SLD)
- (F) MULTIPOLYMER PAV MRK (Y)(8")(SLD)
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- (H) REFL PAV TY II-C-R
- (I) REFL PAV TY I-A

- ⬡ PROPOSED SMALL SIGN
- ◯ PROPOSED LARGE SIGN
- ☐ RELOCATE EXISTING SIGN

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STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED PROFESSIONAL ENGINEER

Sharmeen Rahman, P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

PAVEMENT MARKING LAYOUT

SCALE: HORIZ. 1"= 50

SHEET 4 OF 5

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		221

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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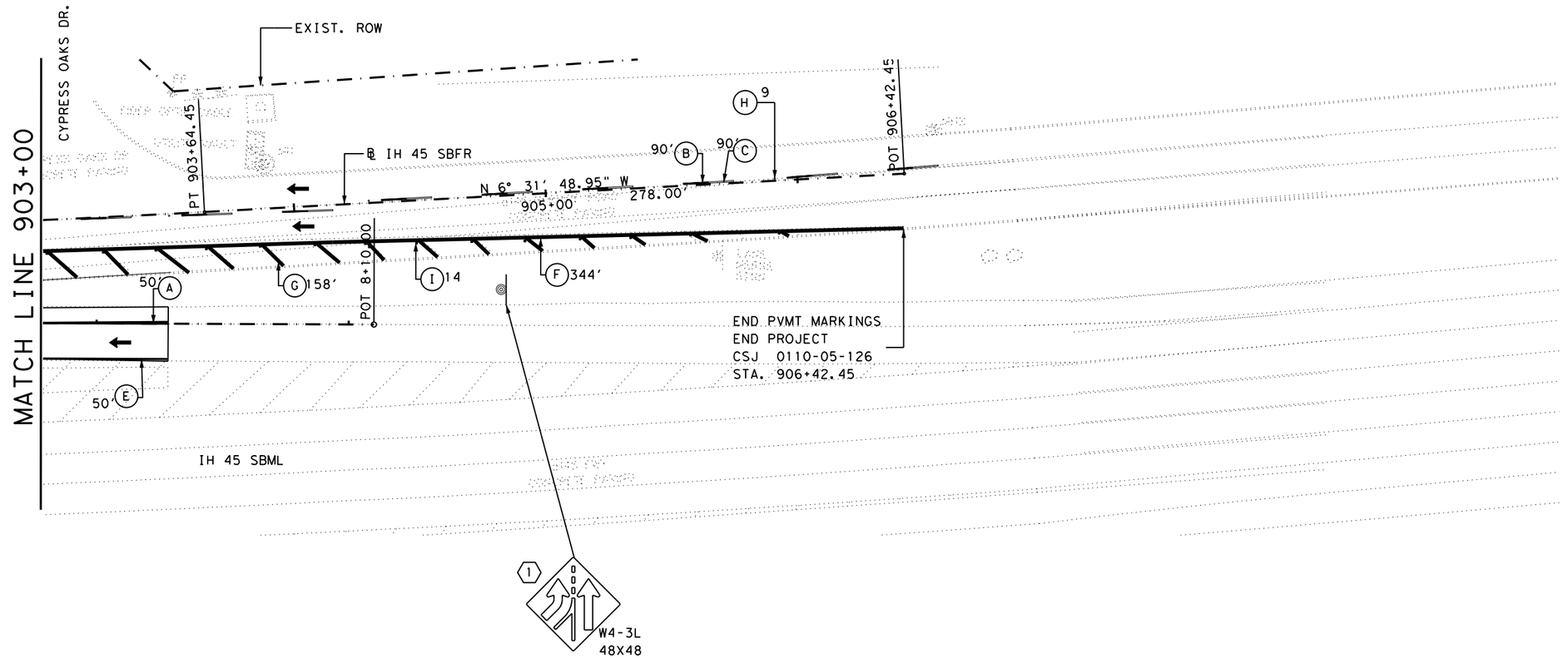

LEGEND

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- (C) MULTIPOLYMER PAV MRK (BLK)(6")(BRK)
- (D) MULTIPOLYMER PAV MRK (W)(8")(SLD)
- (E) MULTIPOLYMER PAV MRK (Y)(6")(SLD)
- (F) MULTIPOLYMER PAV MRK (Y)(8")(SLD)
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STATE OF TEXAS
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Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

PAVEMENT MARKING LAYOUT

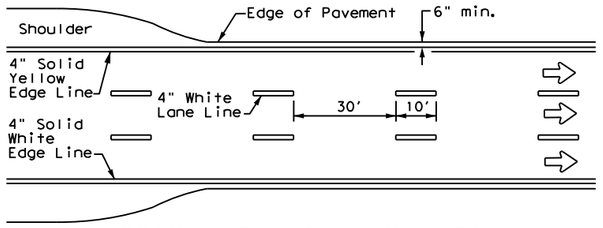
SCALE: HORIZ. 1"= 50

SHEET 5 OF 5

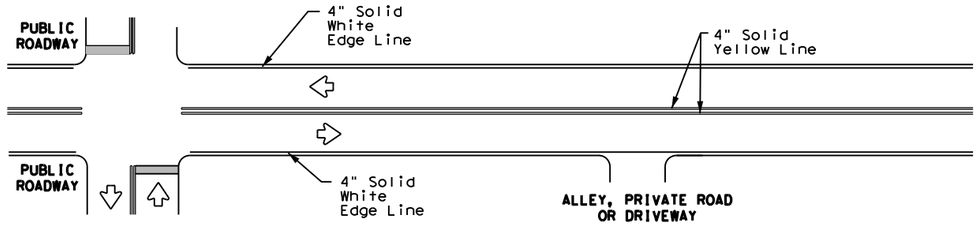
FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		222

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

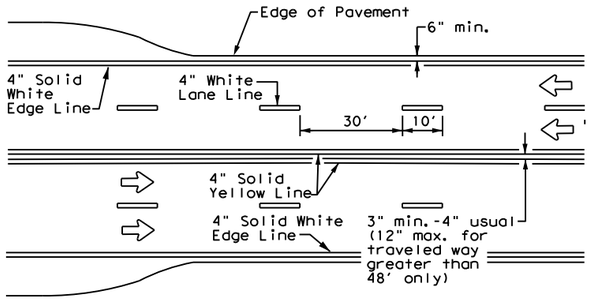
9/28/2021 10:37:40 AM
T:\HUM-AO\Design\Roadway\IH 45\0110-05-126 Cypress Creek\DGN\PVMT MRKGS\222 PAVEMENT MARKING LAYOUT (SHEET 5 OF 5).DGN



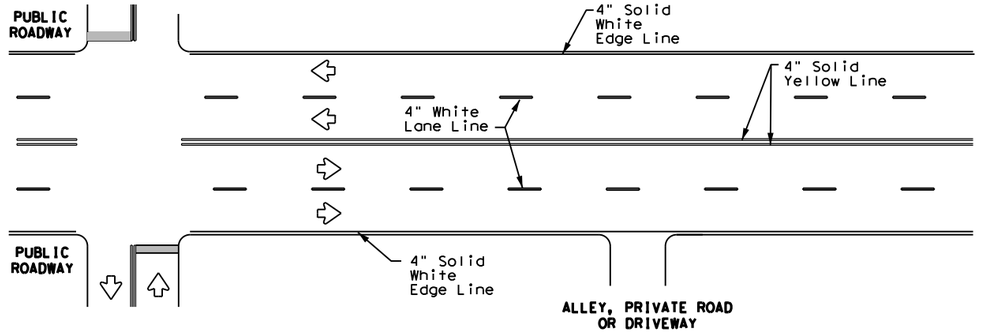
EDGE LINE AND LANE LINES ONE-WAY ROADWAY WITH OR WITHOUT SHOULDERS



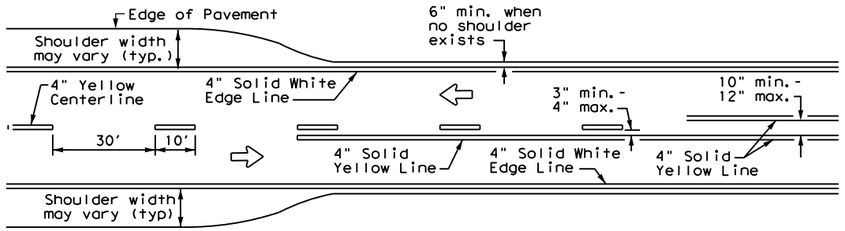
TYPICAL TWO-LANE, TWO-WAY PAVEMENT MARKINGS THROUGH INTERSECTIONS



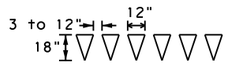
CENTERLINE AND LANE LINES FOUR LANE TWO-WAY ROADWAY WITH OR WITHOUT SHOULDERS



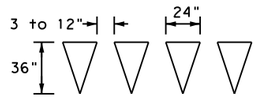
TYPICAL MULTI-LANE, TWO-WAY PAVEMENT MARKINGS THROUGH INTERSECTIONS



TWO LANE TWO-WAY ROADWAY WITH OR WITHOUT SHOULDERS

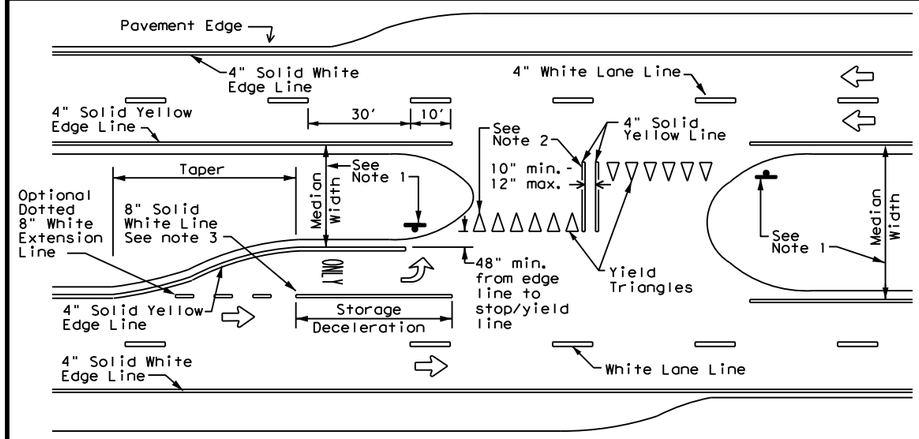


For posted speed on road being marked equal to or less than 40 MPH.



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

YIELD LINES



FOUR LANE DIVIDED ROADWAY CROSSOVERS

NOTES

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 are optional as determined by the Engineer.

2. Install median striping (double yellow centerlines and stop bars/yield triangles) when a 50' or greater median centerline can be placed. Stop bars shall only be used with stop signs. Yield traingles 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.

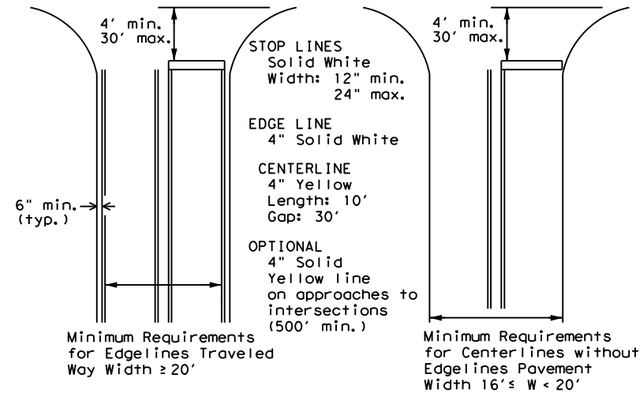
GENERAL NOTES

1. Edgeline striping shall be as shown in the plans or as directed by the Engineer. The edgeline should not be placed less less than 6 inches from the edge of pavement. This distance may vary due to pavement raveling or other conditions. Edgelines are not required in curb and gutter sections of roadways.

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 inside of edgeline to the inside of edgeline of a two lane roadway.

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

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



GUIDE FOR PLACEMENT OF STOP LINES, EDGE LINE & CENTERLINE

Based on Traveled Way and Pavement Widths for Undivided Highways

Texas Department of Transportation

Traffic Safety Division Standard

TYPICAL STANDARD PAVEMENT MARKINGS

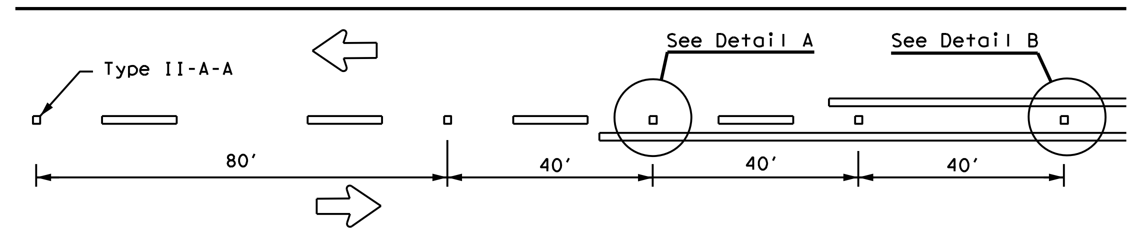
PM(1)-20

FILE: pm1-20.dgn	DN:	CK:	DW:	CK:
© TxDOT November 1978	CONT	SECT	JOB	HIGHWAY
REVISIONS 8-95 3-03	0110	05	126	IH 45
5-00 2-12	DIST	COUNTY		SHEET NO.
8-00 6-20	HOU	HARRIS		223

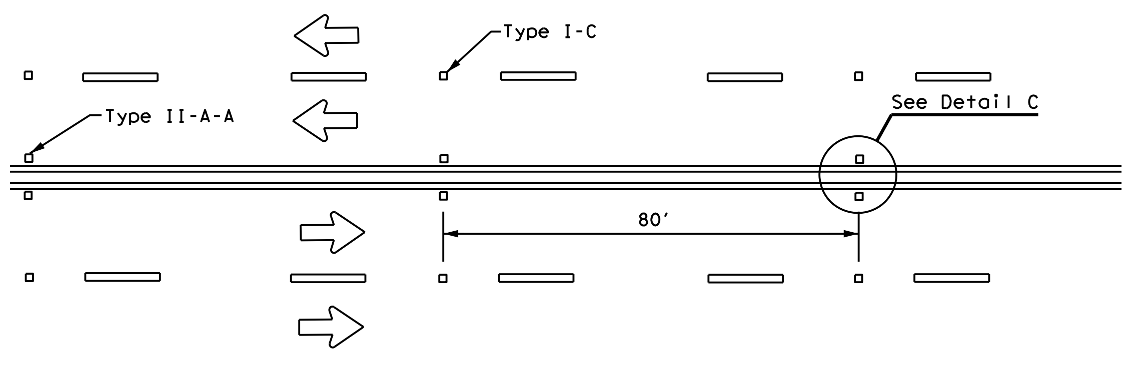
22A

DATE:
FILE:

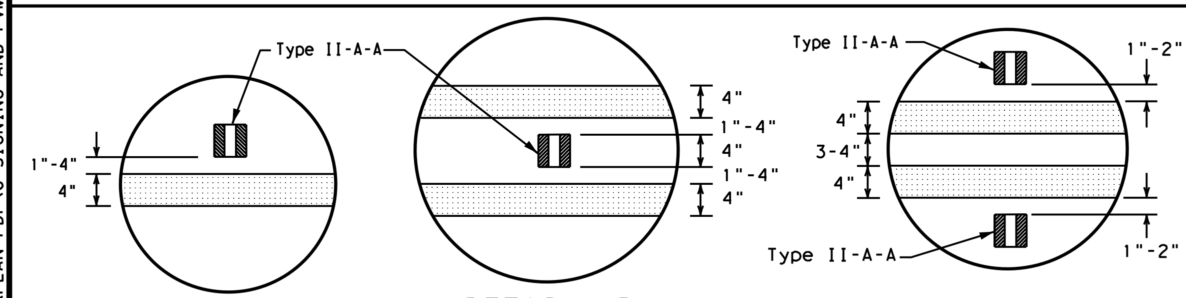
REFLECTIVE RAISED PAVEMENT MARKERS FOR VEHICLE POSITIONING GUIDANCE



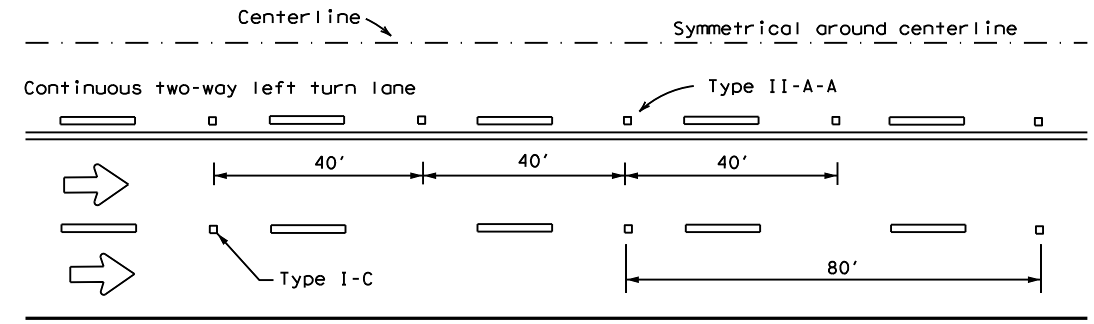
CENTERLINE FOR ALL TWO LANE ROADWAYS



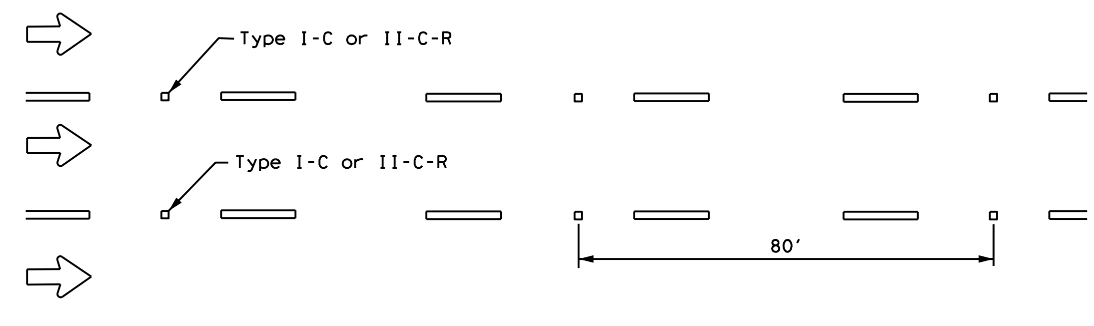
CENTERLINE & LANE LINES FOR FOUR LANE TWO-WAY HIGHWAYS



DETAIL "A" DETAIL "B" DETAIL "C"



CENTERLINE AND LANE LINES FOR TWO-WAY LEFT TURN LANE

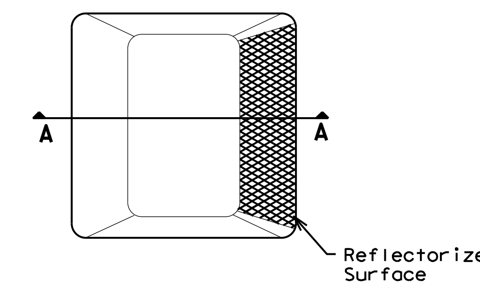


LANE LINES FOR ONE-WAY ROADWAY (NON-FREEWAY FACILITIES)

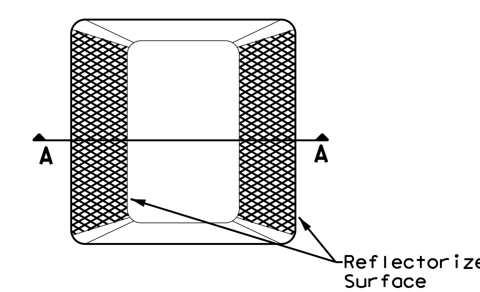
Raised pavement markers Type II-C-R shall have clear face toward normal traffic and red face toward wrong-way traffic.

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

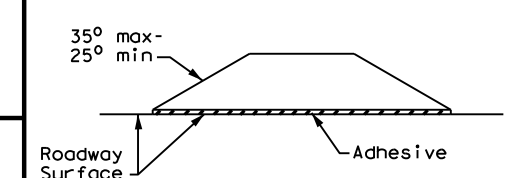
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



Type I (Top View)

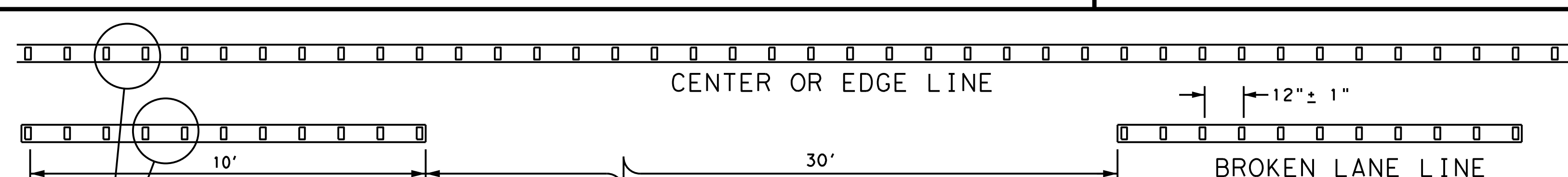


Type II (Top View)



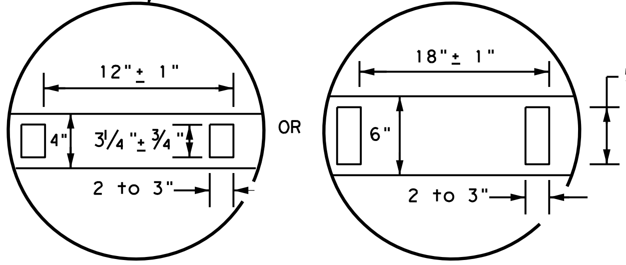
SECTION A

RAISED PAVEMENT MARKERS



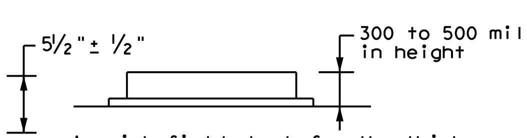
REFLECTORIZED PROFILE PATTERN DETAIL

USING REFLECTIVE PROFILE PAVEMENT MARKINGS



4" EDGE LINE, CENTER LINE OR LANE LINE

OPTIONAL 6" EDGE LINE, CENTER LINE OR LANE LINE



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.

NOTE

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

GENERAL NOTES

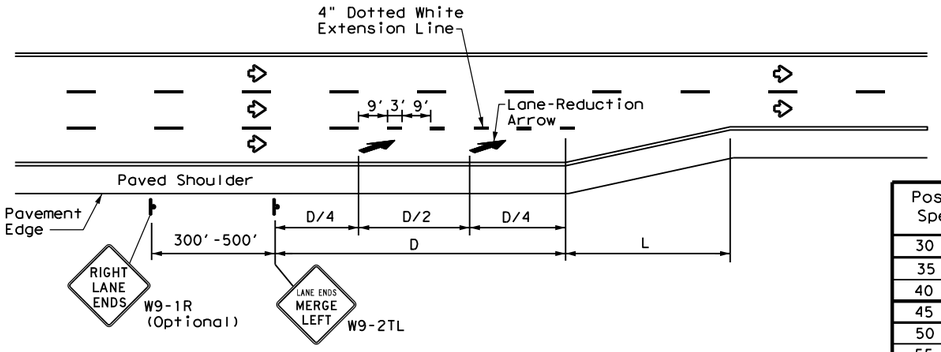
1. All raised pavement markers placed in broken lines shall be placed in line with and midway between the stripes.
2. On concrete pavements the raised pavement markers should be placed to one side of the longitudinal joints.

Texas Department of Transportation — Traffic Safety Division Standard

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

FILE: pm2-20.dgn	DN:	CK:	DW:	CK:
© TxDOT April 1977	CONT 12	SECT	JOB	HIGHWAY
REVISIONS 4-92 2-10 5-00 2-12 8-00 6-20	0110	05	126	IH 45
	DIST HOU		COUNTY HARRIS	SHEET NO. 224

228

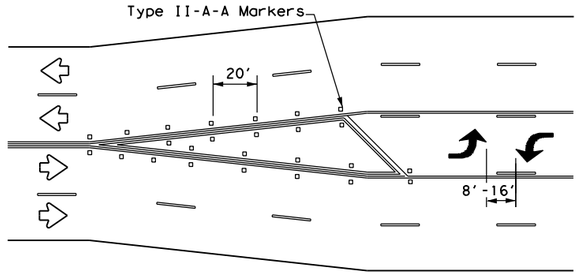


LANE REDUCTION

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	

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 W9-1R "RIGHT LANE ENDS" 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.



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.

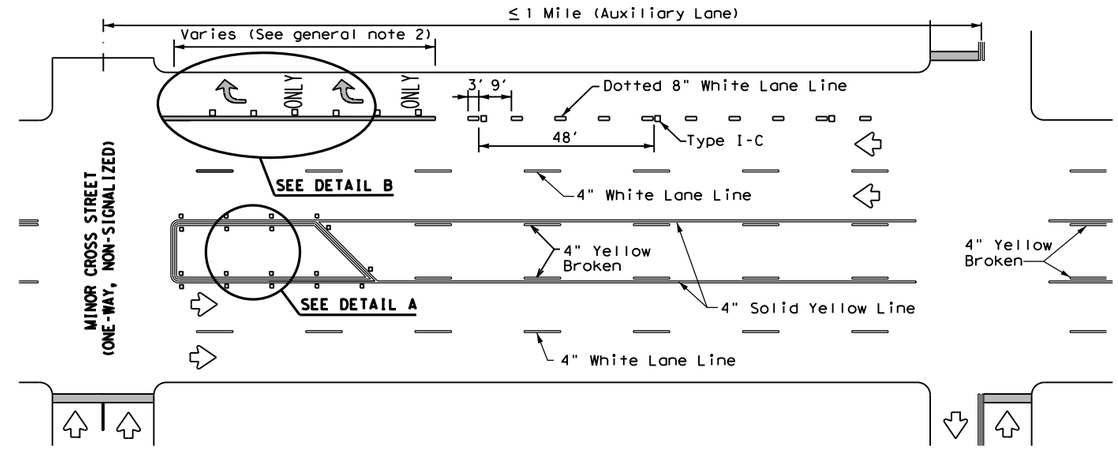
TYPICAL TRANSITION FOR TWLTL AND DIVIDED HIGHWAY

GENERAL NOTES

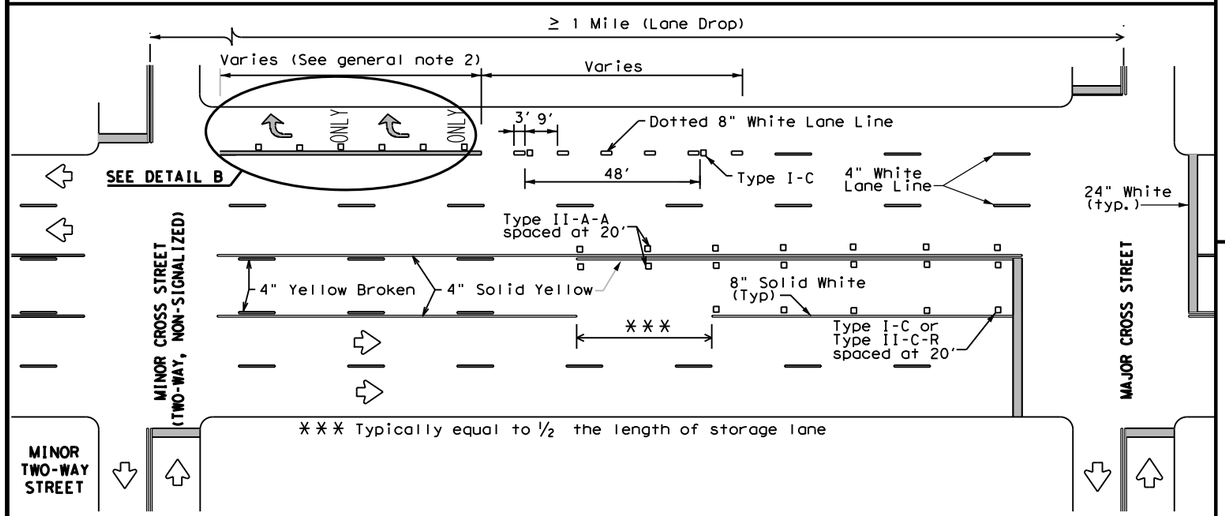
1. Lane use word and arrow markings shall be used where through lanes approaching an intersection become mandatory turn lanes. Lane use word and arrow markings should be used in auxiliary lanes of substantial length. Lane use arrow markings or word and arrow markings may be used in other lanes and turn 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.

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

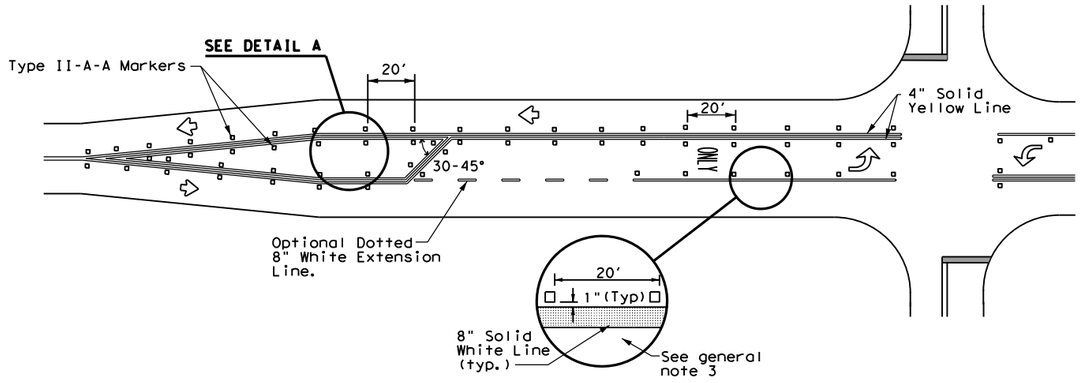
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



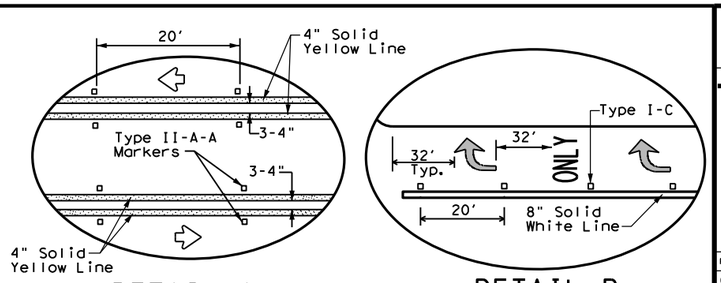
TYPICAL TWLTL AT ONE-WAY STREET AND RIGHT TURN AUXILIARY LANE



TYPICAL TWLTL AT TWO-WAY CROSS STREET AND RIGHT TURN LANE DROP



TYPICAL TWO-LANE HIGHWAY INTERSECTION WITH LEFT TURN BAYS



Texas Department of Transportation

Traffic Safety Division Standard

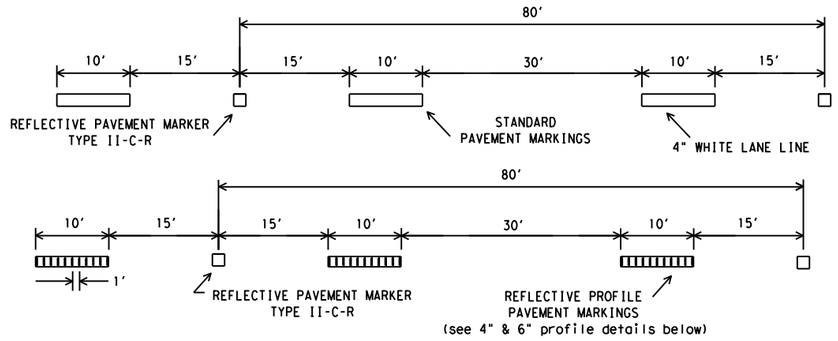
TWO-WAY LEFT TURN LANES, RURAL LEFT TURN BAYS, AND LANE REDUCTION PAVEMENT MARKINGS

PM(3)-20

FILE: pm3-20.dgn	DN:	CK:	DW:	CK:
© TxDOT April 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
5-00 2-10	DIST	COUNTY		SHEET NO.
8-00 2-12	HOU	HARRIS		225
3-03 6-20				

22C

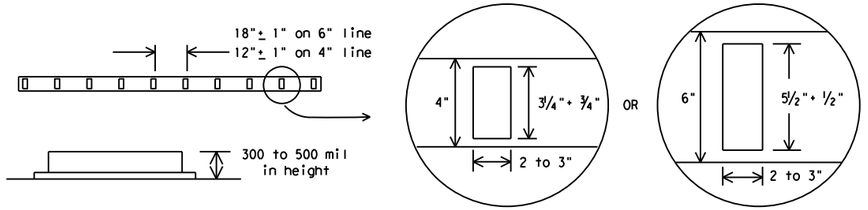
DATE:
FILE:



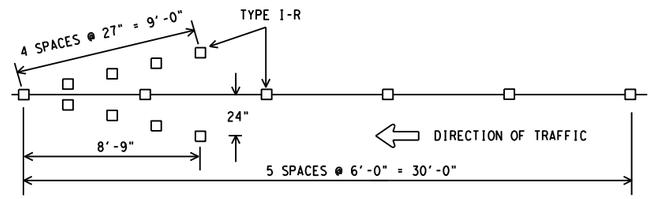
PAVEMENT MARKERS (REFL) TYPE II-C-R SHALL BE SPACED ON 80' CENTERS WITH THE CLEAR FACE TOWARD NORMAL TRAFFIC AND THE RED FACE TOWARD WRONG WAY TRAFFIC.

TRAFFIC LANE LINES PAVEMENT MARKING DETAILS

EDGELINES SHOULD TYPICALLY BE 4" WIDE AND THE MATERIALS SHALL BE AS SPECIFIED IN THE PLANS.
IF RAISED PROFILE PAVEMENT MARKINGS ARE USED SEE DETAILS BELOW.



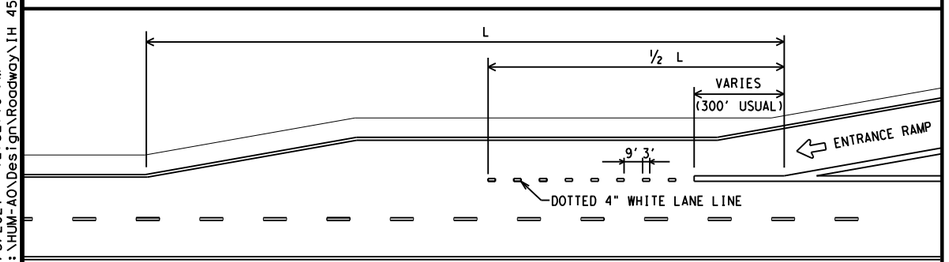
EDGELINE PAVEMENT MARKINGS



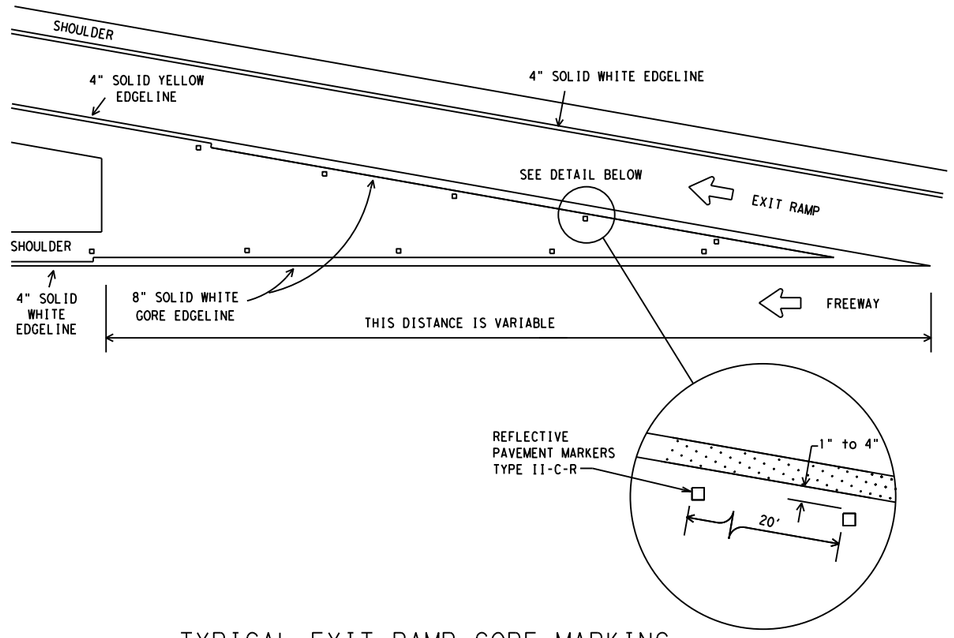
ALL RAISED MARKERS IN THE WRONG WAY ARROW SHALL BE TYPE I-R REFLECTORIZED PAVEMENT MARKERS WITH THE REFLECTORIZED SURFACE FACING THE WRONG WAY TRAFFIC. TYPE II-C-R SHALL NOT BE USED.

REFLECTORIZED WRONG WAY ARROWS, NOT TO EXCEED TWO, MAY BE PLACED ON EXIT RAMPS.
LOCATION OF THE ARROWS SHALL BE AS SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER.

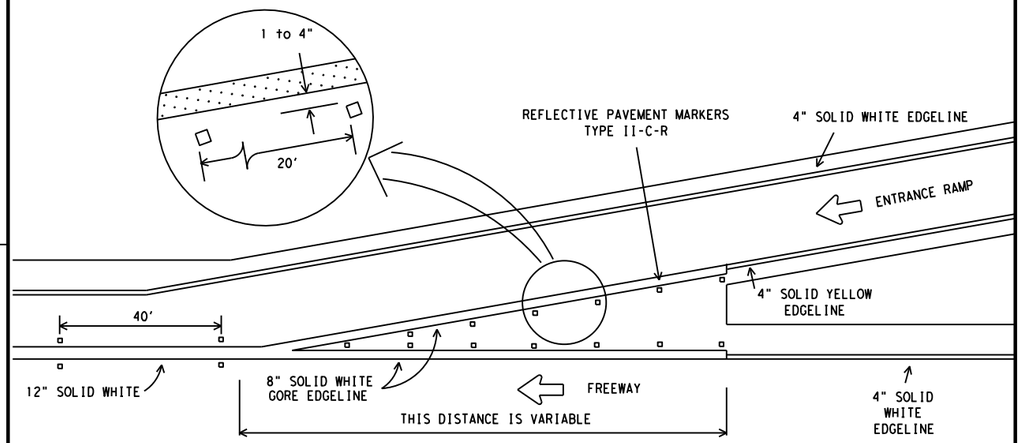
WRONG WAY ARROW DETAIL



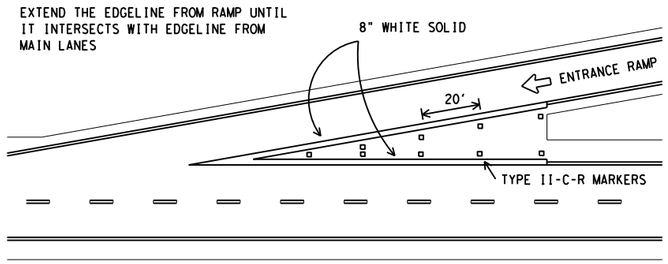
PARALLEL ACCELERATION LANE



TYPICAL EXIT RAMP GORE MARKING



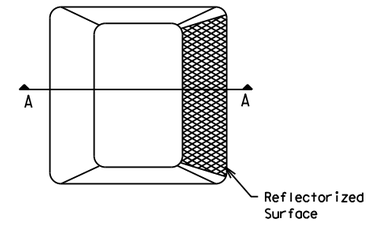
TYPICAL ENTRANCE RAMP GORE MARKING



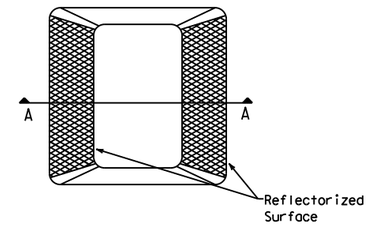
TAPERED ACCELERATION LANE

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

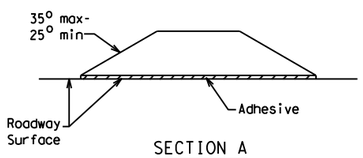
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



Type I (Top View)



Type II (Top View)



SECTION A

RAISED PAVEMENT MARKERS

Texas Department of Transportation
Traffic Operations Division

TYPICAL STANDARD FREEWAY PAVEMENT MARKINGS WITH RAISED PAVEMENT MARKERS

FPM(1)-12

DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

REVISIONS		CONT	SECT	JOB	HIGHWAY
4-92	2-10	0110	05	126	IH 45
5-00	2-12	DIST	COUNTY		SHEET NO.
8-00		HOU	HARRIS		226
2-08					

23A

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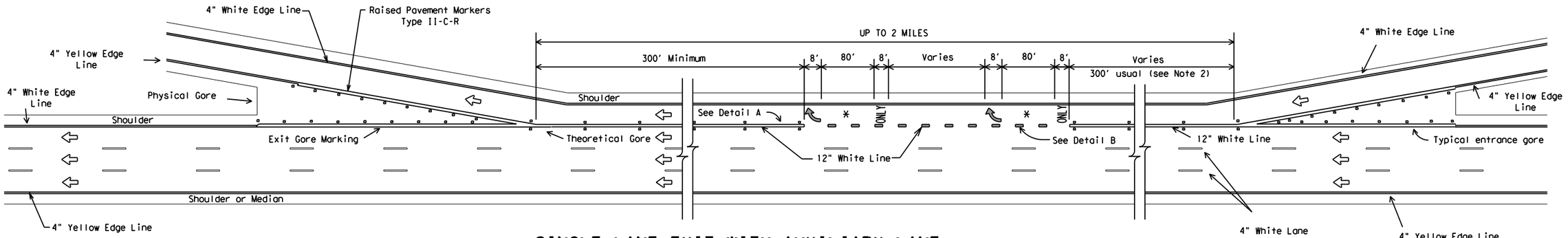
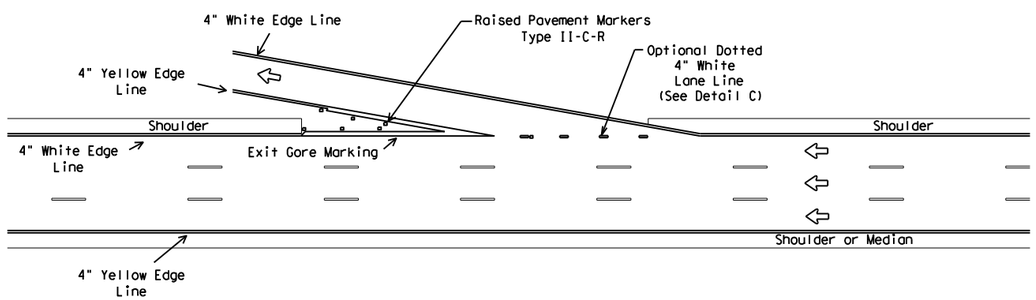
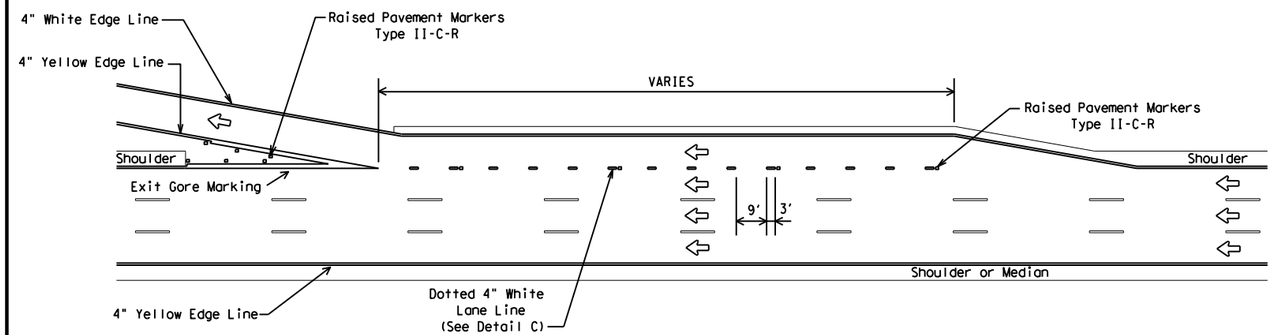


SINGLE LANE EXIT WITH AUXILIARY LANE

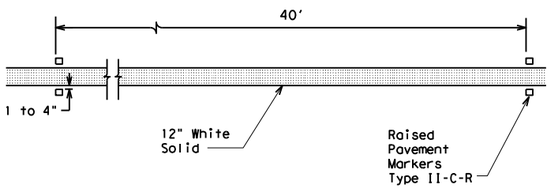
(See Note 2)



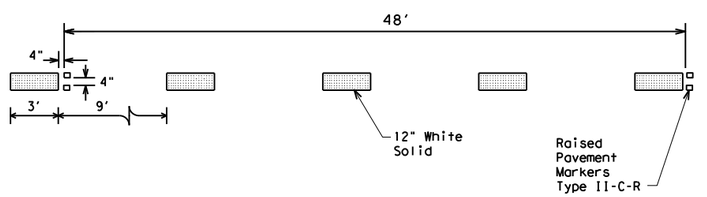
TAPERED DECELERATION LANE



PARALLEL DECELERATION LANE

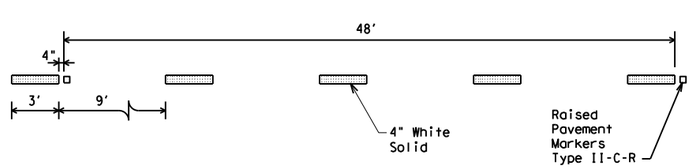


DETAIL A



DETAIL B

Wide (12") Dotted Lane Line (See Note 3)



DETAIL C

Normal (4") Dotted Lane Line (See Note 4)

GENERAL NOTES

1. Pavement markings shall be white except as otherwise noted.
2. Length of 12" white line may vary depending on location.
3. Wide (12") Dotted Lane Line (See Detail B) is used to separate a through lane from a lane drop at normal exit ramp and from an auxiliary lane between an entrance and exit ramp.
4. Normal (4") Dotted Lane Line (See Detail C) is used at parallel acceleration and deceleration lanes.

LEGEND	
⇦	Denotes direction of traffic.
↱	Pavement marking arrows (white)
✳	Arrow markings are optional, however "ONLY" is required if arrow is used

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.

Texas Department of Transportation
Traffic Operations Division

TYPICAL STANDARD FREEWAY PAVEMENT MARKINGS ENTRANCE AND EXIT RAMPS

FPM(2)-12

DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

REVISIONS
4-92 2-10
8-95 2-12
5-00
8-00

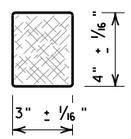
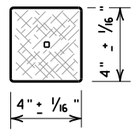
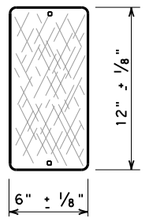
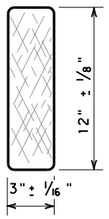
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

DIST	COUNTY	SHEET NO.
HOU	HARRIS	227

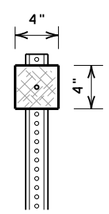
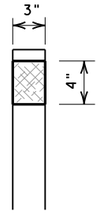
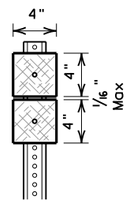
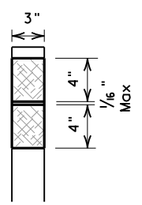
23B

DATE: 8/10/2021 1:20:17 PM
FILE: T:\HOU-AO\Design\Roadway\IH 45\0110-05-126 Cypress Creek\PLAN PDF\6-SFGNTN8 &MD

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

DEVICE	SINGLE		DOUBLE	
				
	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

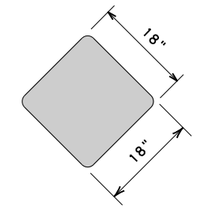
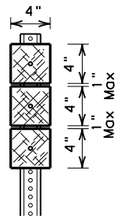
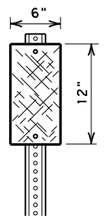
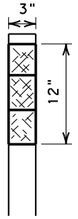
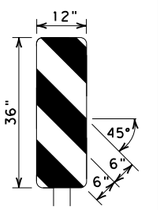
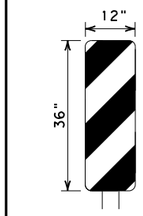
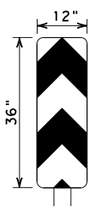
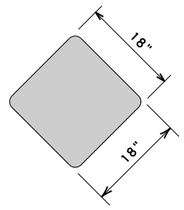
NUMBER OF REFLECTORS OR DIRECTION
X = 3-Size 2 reflector units (Type 2 only)
Y = 1-Size 3 reflector unit (Type 2 only)
Z = 3-Size 1 or 1-Size 4 reflector unit(s)(Type 2 only)
L = Left Side (Type 3 Object Marker only)
R = Right Side (Type 3 Object Marker only)
C = Center (Type 3 Object Marker only)

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

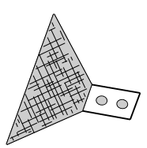
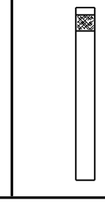
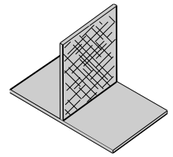
OBJECT MARKERS

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

DEPARTMENTAL MATERIAL SPECIFICATIONS

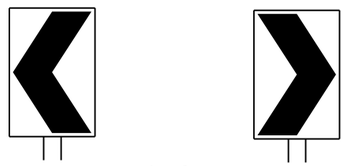
FLEXIBLE DELINEATOR & OBJECT MARKER POSTS (EMBEDDED & SURFACE MOUNT TYPES)	DMS-4400
SIGN FACE MATERIALS	DMS-8300
DELINEATORS, OBJECT MARKERS AND BARRIER REFLECTORS	DMS-8600

BARRIER REFLECTORS (BRF)

DEVICE	GF1	GF2	CTB
			
	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

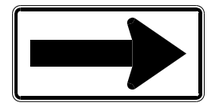


SIZE (W x L)	18"x 24" (Conventional)	24"x 30" (Conventional Oversize)	30"x 36" (Expressway)	36" x 48" (Freeway)
MOUNTING HEIGHT	4'-0" or 7'-0"		7'-0" Only	

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



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

NOTE:

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

Texas Department of Transportation

Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER MATERIAL DESCRIPTION

D & OM(1)-20

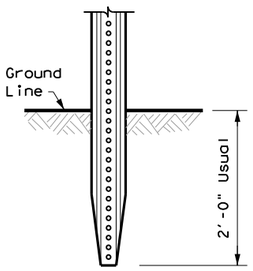
FILE: dom1-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
©TxDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
10-09 3-15	DIST	COUNTY		SHEET NO.
4-10 7-20	HOU	HARRIS		228

20A

POST TYPE AND SUPPORT FOUNDATION DETAILS

WING CHANNEL (WC)

GND

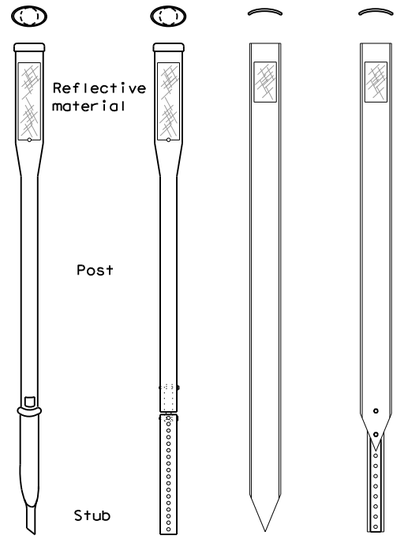


NOTES

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

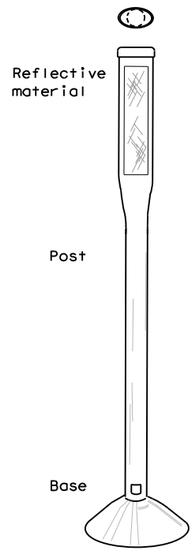
FLEXIBLE POSTS (YFLX, WFLX)

GND



EMBEDDED

SRF



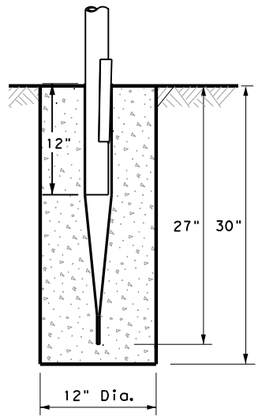
SURFACE MOUNT

NOTES

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

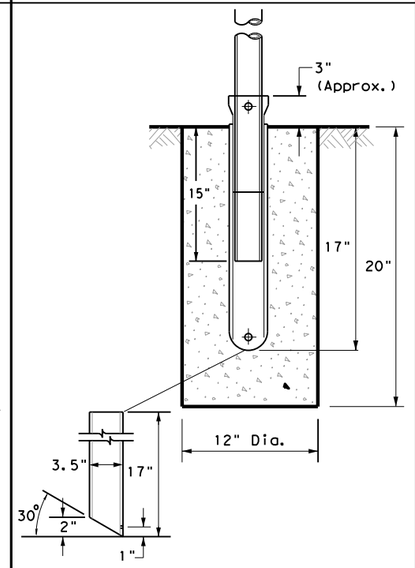
WEDGE ANCHOR SYSTEMS

WAS



STEEL

WAP



PLASTIC

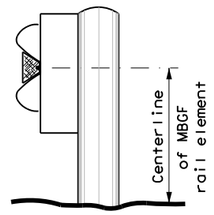
NOTE

1. Install per manufacturer's recommendations.

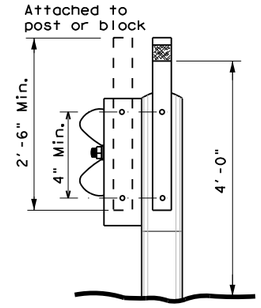
TYPE OF BARRIER MOUNTS

GUARD FENCE ATTACHMENT

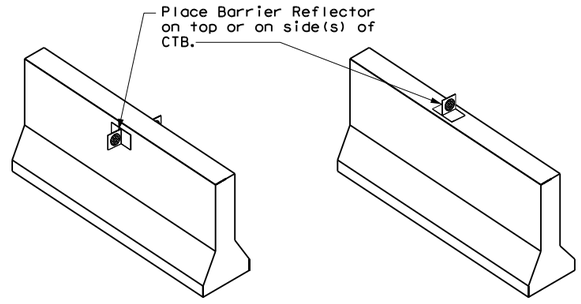
GF1



GF2



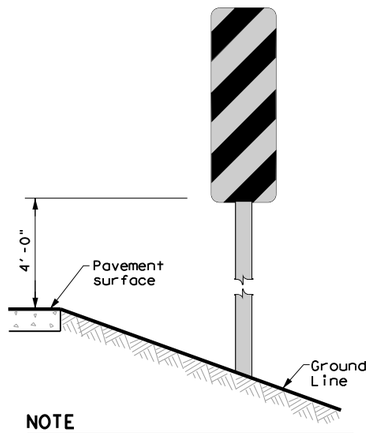
CONCRETE TRAFFIC BARRIER (CTB)



GENERAL NOTES

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

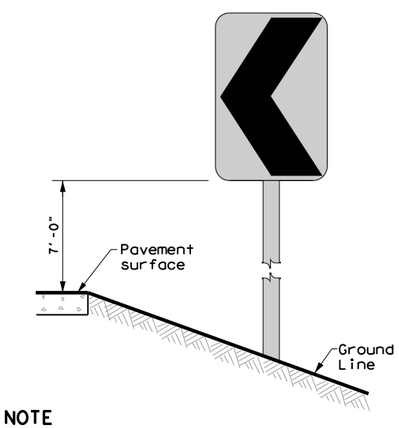
TYPES 1, 3, AND 4 OBJECT MARKERS AND CHEVRONS



NOTE

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

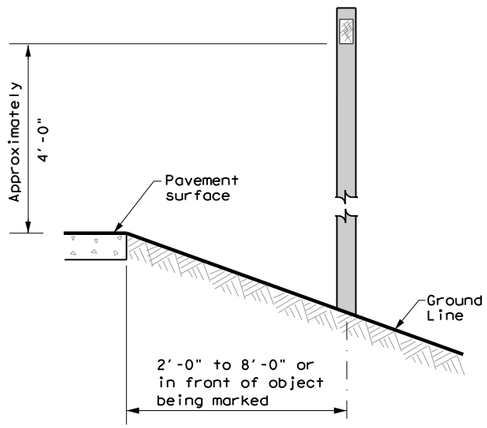
CHEVRONS AND ONE DIRECTION LARGE ARROW SIGN



NOTE

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

DELINEATORS AND TYPE 2 OBJECT MARKERS



See general notes 1, 2 and 3.

Texas Department of Transportation

Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER INSTALLATION

D & OM(2)-20

FILE: dom2-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
© TxDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
10-09 3-15	DIST	COUNTY		SHEET NO.
4-10 7-20	HOU	HARRIS		229

20B

DATE: 8/10/2021 1:20:20 PM
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DATE: 8/10/2021 1:20:22 PM
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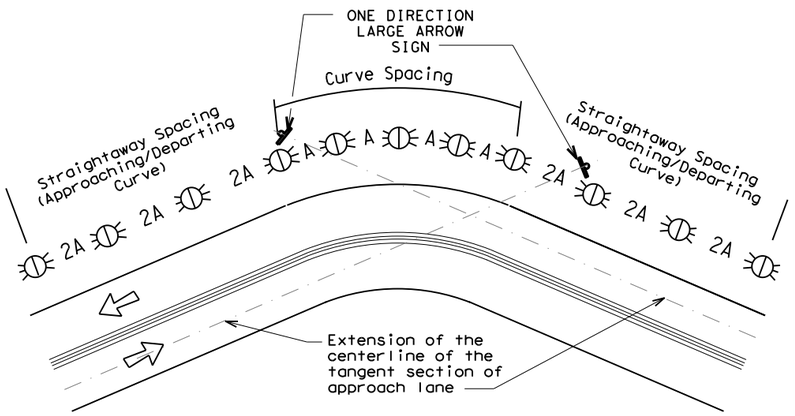
MINIMUM WARNING DEVICES AT CURVES WITH ADVISORY SPEEDS

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

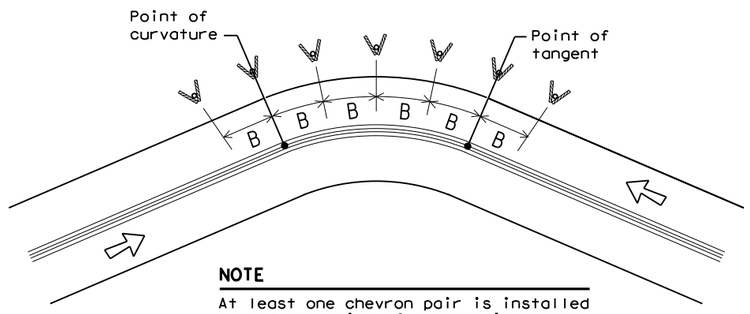
SUGGESTED SPACING FOR DELINEATORS ON HORIZONTAL CURVES



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
©TxDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
3-15 8-15	DIST	COUNTY		SHEET NO.
8-15 7-20	HOU	HARRIS		230

20C

DATE: 8/10/2021 1:20:27 PM
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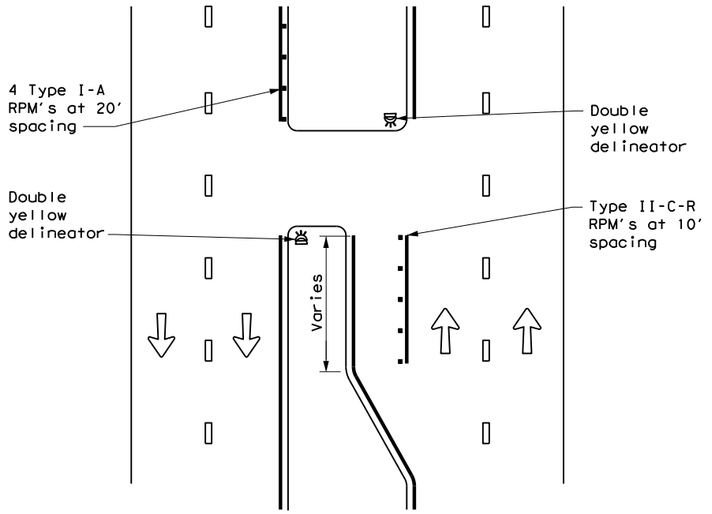
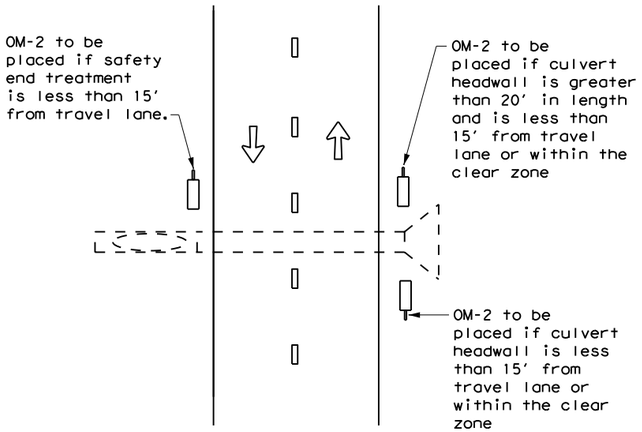
CROSSOVERS



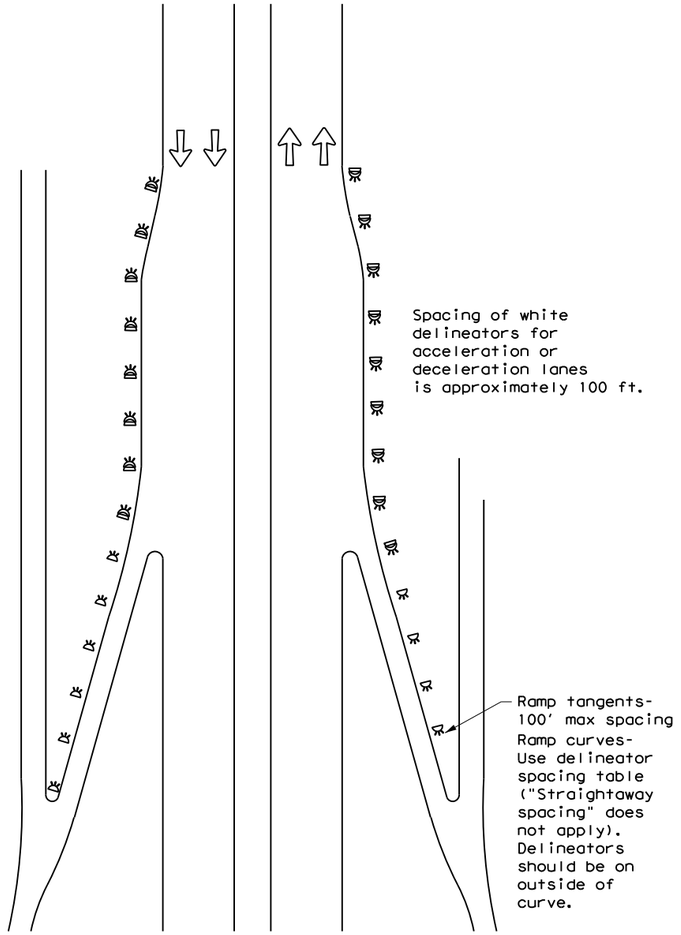
DETAIL 1

FOR CULVERTS WITHOUT MBGF



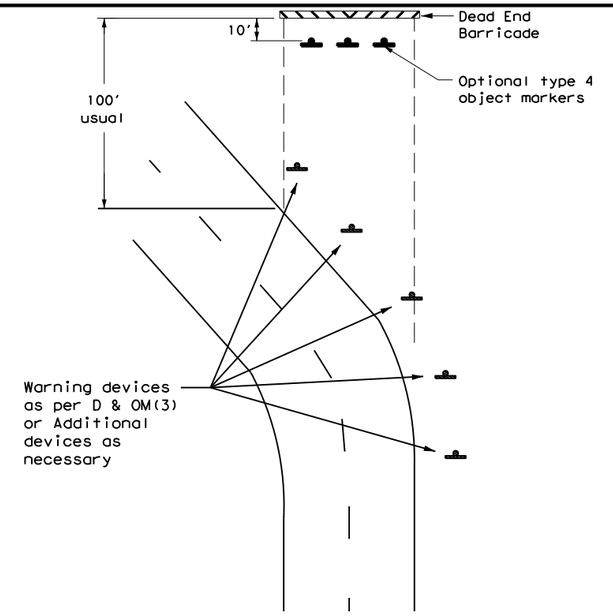
DETAIL 2

FREEWAY DELINEATION FOR RAMPS AND ACCELERATION/DECELERATION LANES



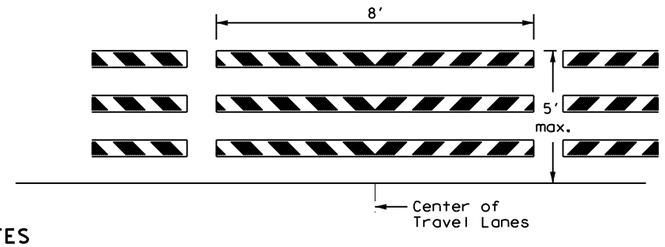
DETAIL 3

TYPICAL APPLICATION OF DEAD END BARRICADE



DETAIL 4

TYPICAL DEAD END BARRICADE INSTALLATION



NOTES

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

DETAIL 5

LEGEND

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

Texas Department of Transportation

Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

D & OM(4)-20

FILE: dom4-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
© TxDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
3-15	DIST	COUNTY		SHEET NO.
7-20	HOU	HARRIS		231

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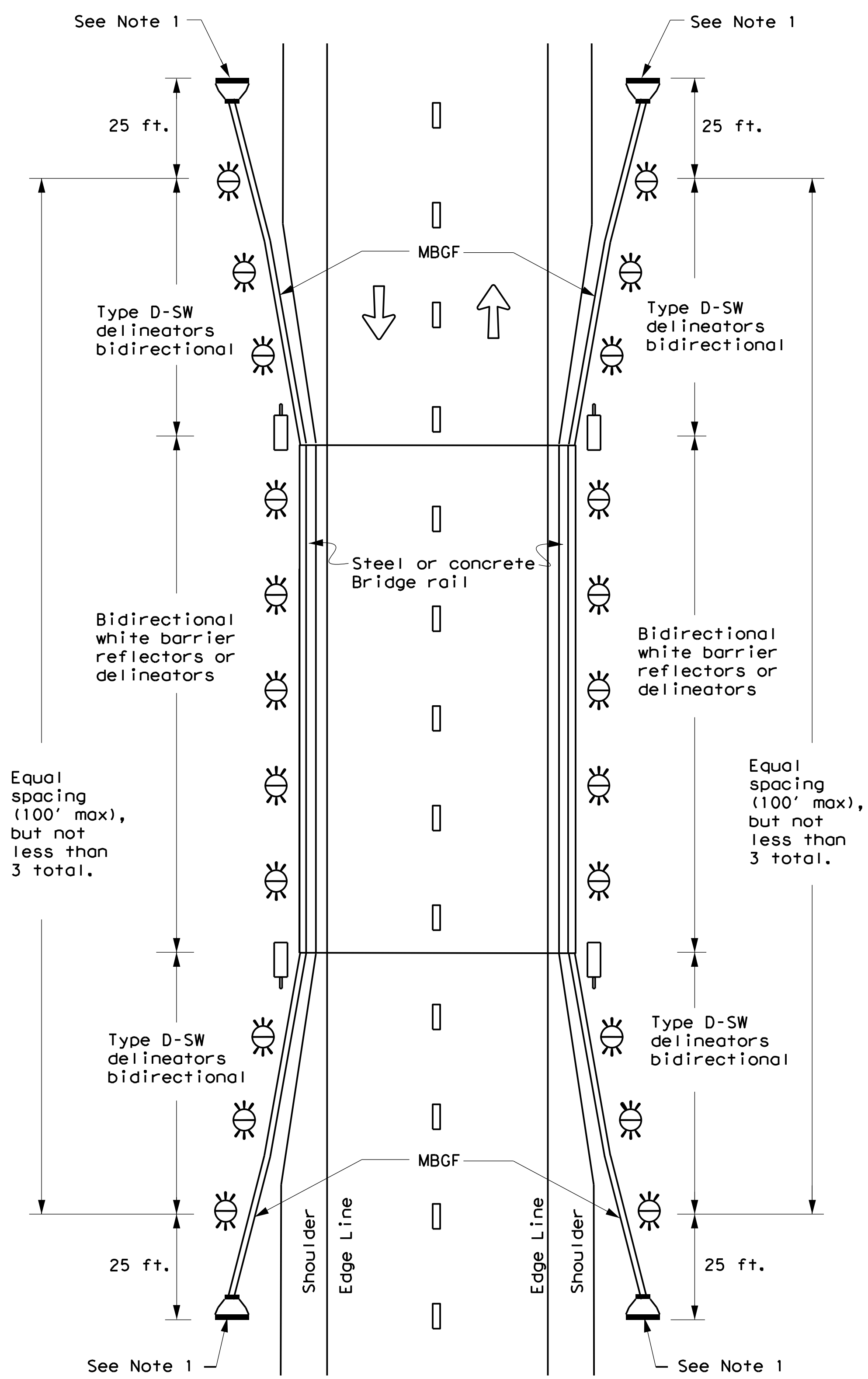
DATE: 8/10/2021 1:20:31 PM
FILE: T:\HUM-AO\Design\Roadway\IH 45\0110-05-126 Cypress Creek\PLAN PDF\6-SIGNING AND PAVT

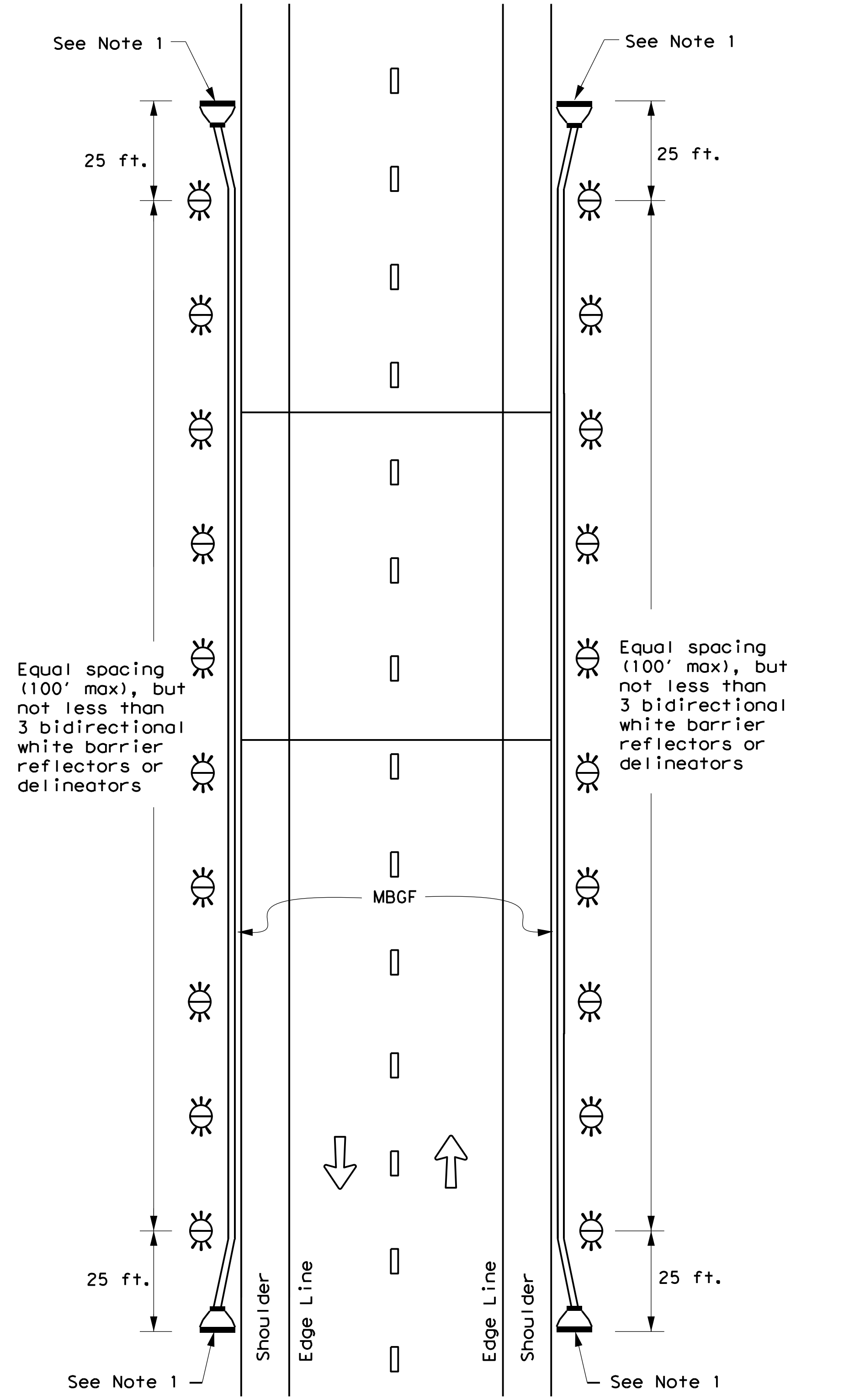
TWO-WAY, TWO LANE ROADWAY WITH REDUCED WIDTH APPROACH RAIL



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.

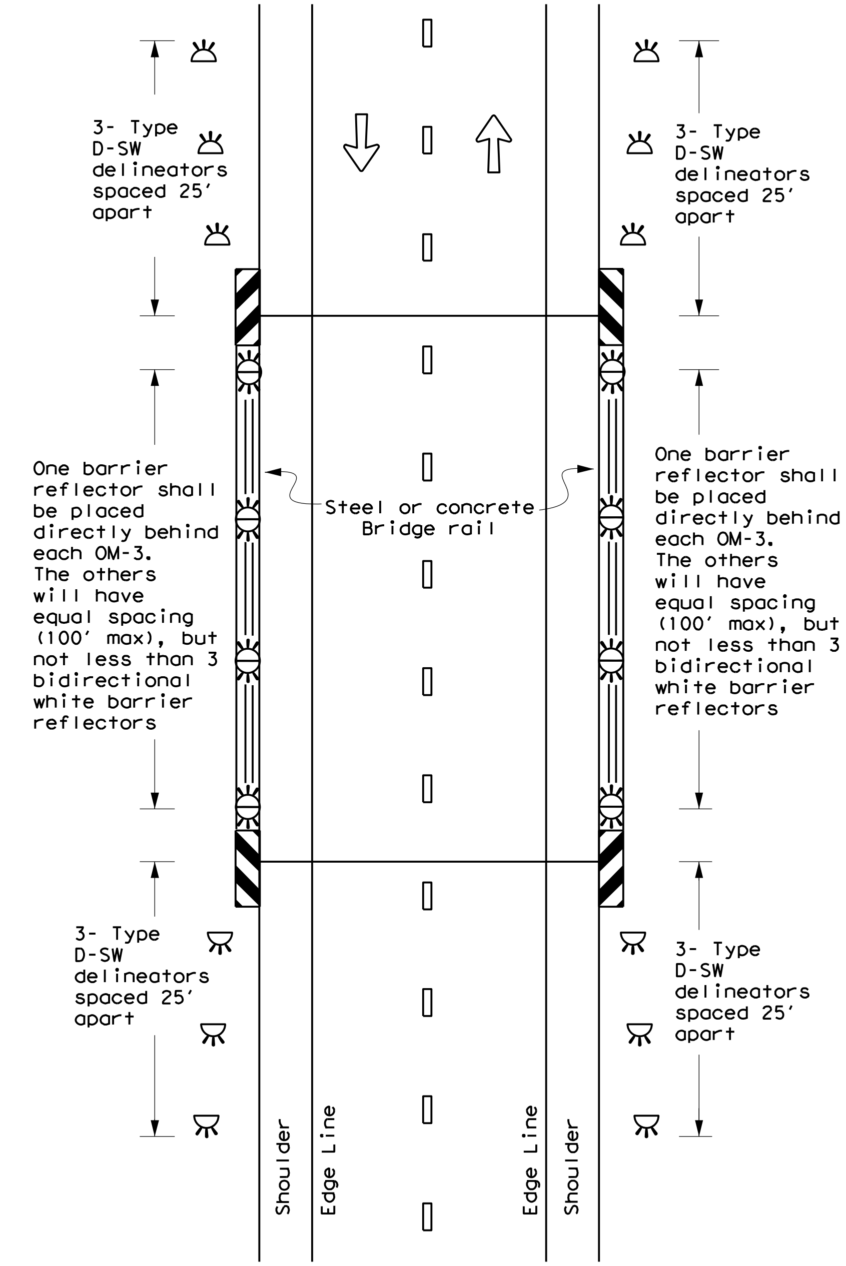
TWO-WAY, TWO LANE ROADWAY WITH METAL BEAM GUARD FENCE (MBGF)



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

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

Texas Department of Transportation

Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

D & OM(5)-20

FILE: dom5-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT August 2015	CONT 0110	SECT 05	JOB 126	HIGHWAY IH 45
REVISIONS 7-20	DIST HOU		COUNTY HARRIS	SHEET NO. 232

20E

DATE: 8/10/2021 1:20:34 PM
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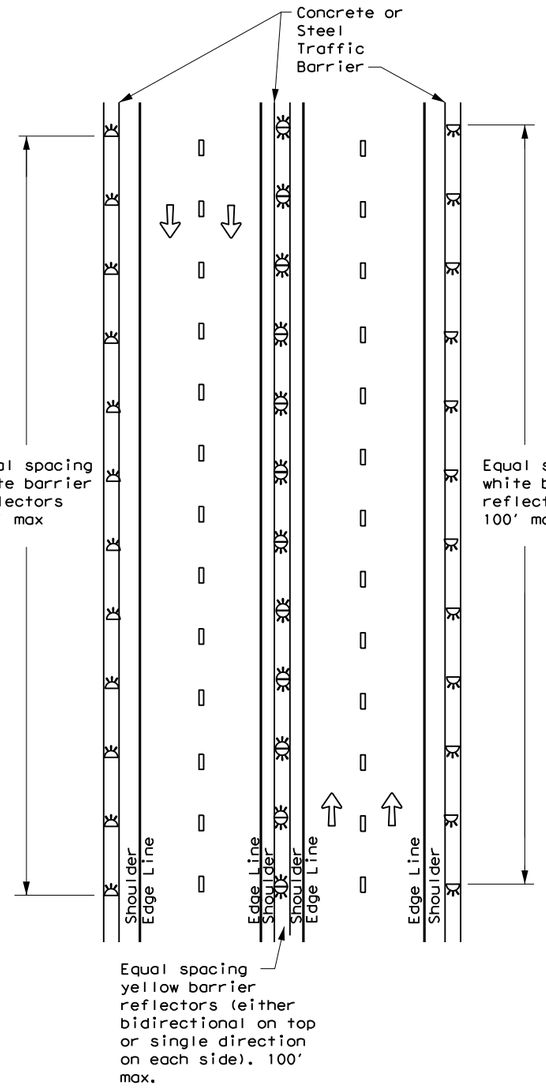
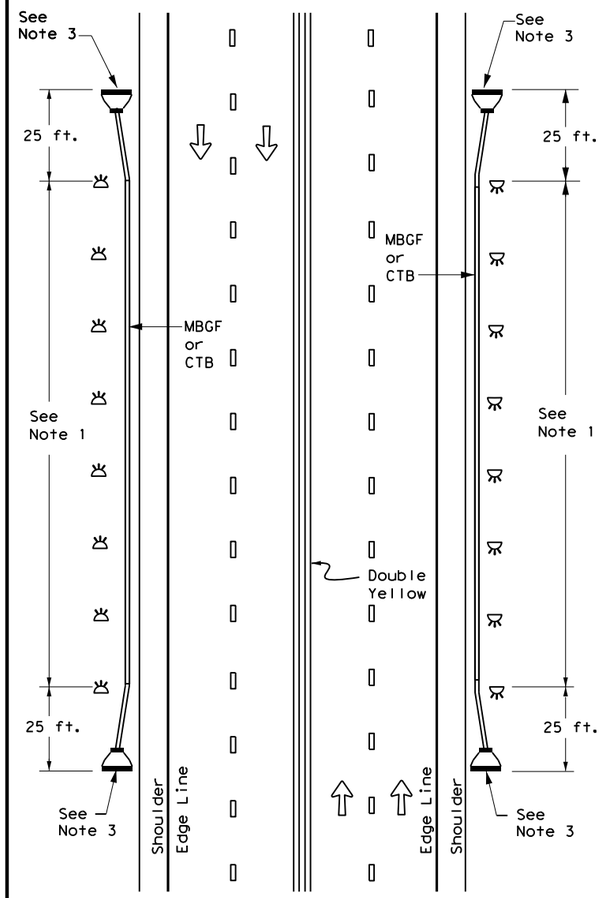
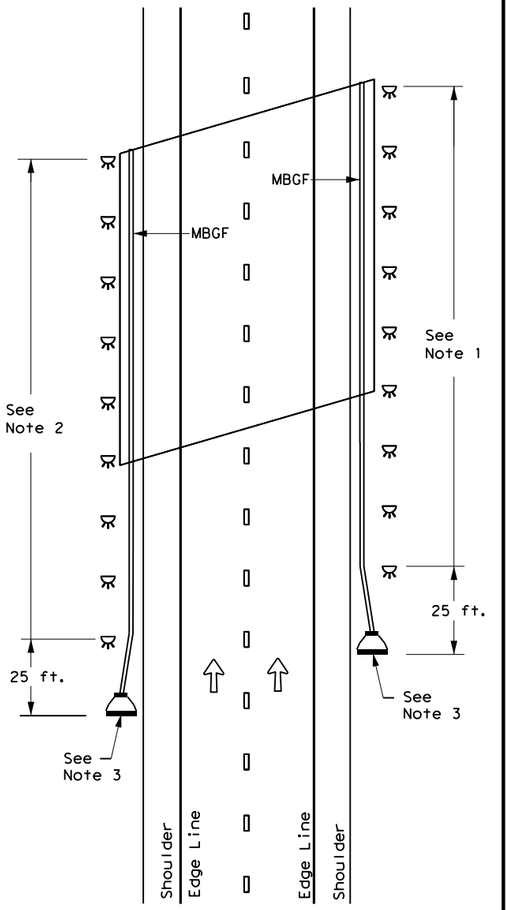
CONTINUOUS CONCRETE OR STEEL BARRIER



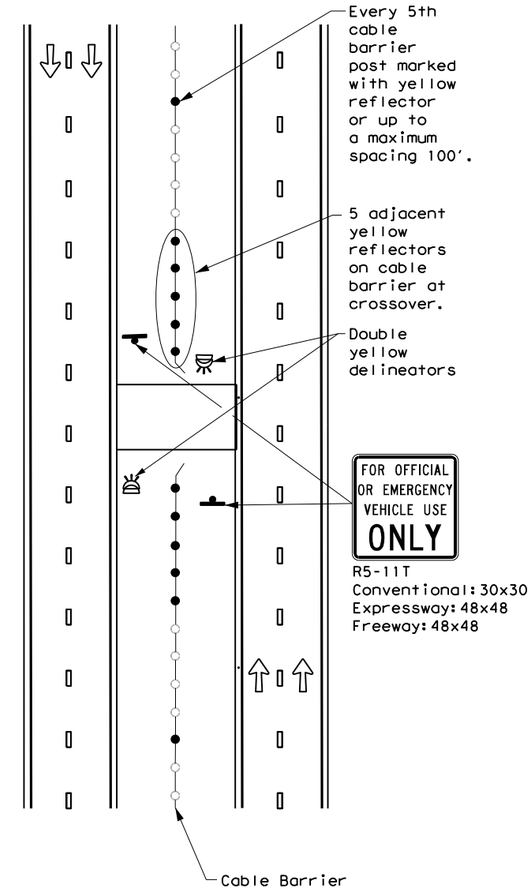
MULTI-LANE UNDIVIDED, TWO-WAY ROADWAY WITH METAL BEAM GUARD FENCE (MBGF)



DIVIDED ROADWAY WITH METAL BEAM GUARD FENCE (MBGF)



EMERGENCY CROSSOVER



NOTES

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

LEGEND

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

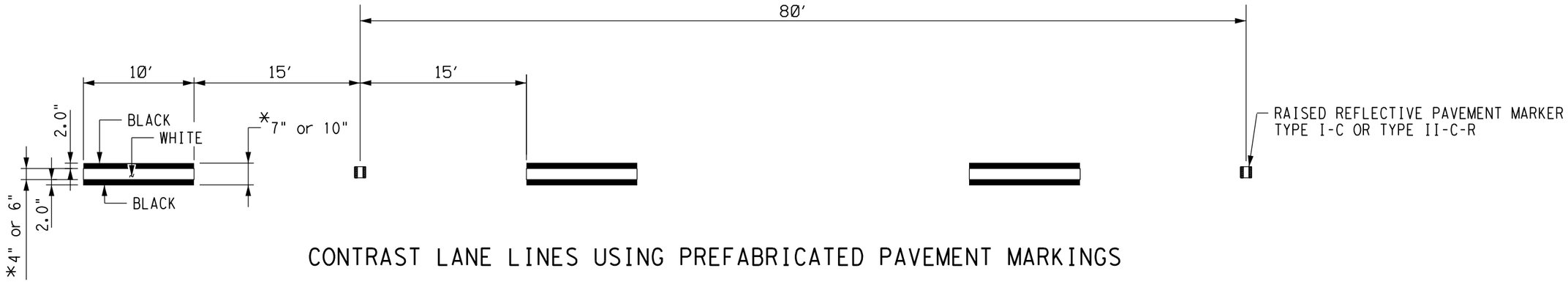
Texas Department of Transportation

Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

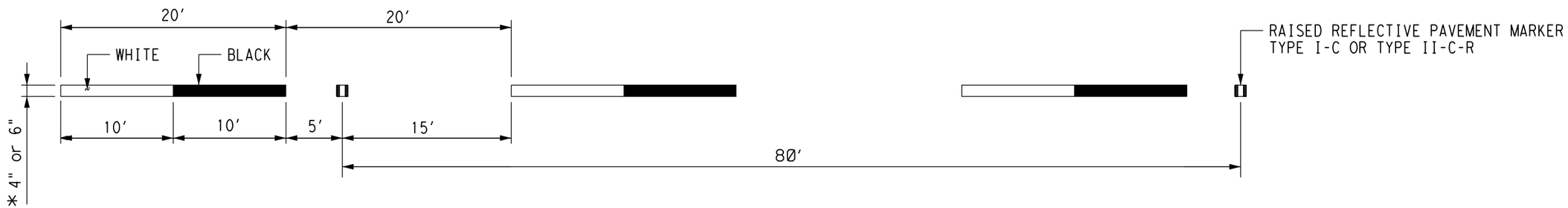
D & OM(6)-20

FILE: dom6-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT August 2015	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
7-20	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		233



CONTRAST LANE LINES USING PREFABRICATED PAVEMENT MARKINGS

DIRECTION OF TRAFFIC



CONTRAST LANE LINES USING LIQUID APPLICATIONS
(MULTIPOLYMER, THERMOPLASTIC, ETC.)

* AS SHOWN ON THE PLANS.

Texas Department of Transportation
Houston District

PAVEMENT MARKINGS
(CONTRAST LANE LINES)

PM(CLL)-14

FILE:	DN:	CK:	DW:	CK:	
© TxDOT 2003	DIST	FED REG	PROJECT NO.		SHEET
REVISIONS 01-10-06 02-12-08 10-2019 9" to 10"	HOU	6			234
	COUNTY		CONTROL	SECT JOB	HIGHWAY
	HARRIS		0110	05 126	IH 45

STD N-30

DATE: 8/10/2021 1:20:40 PM
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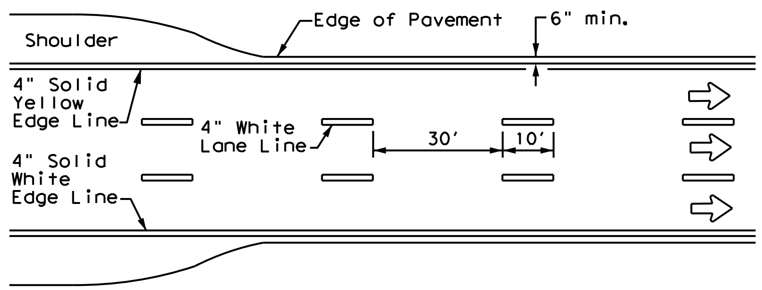
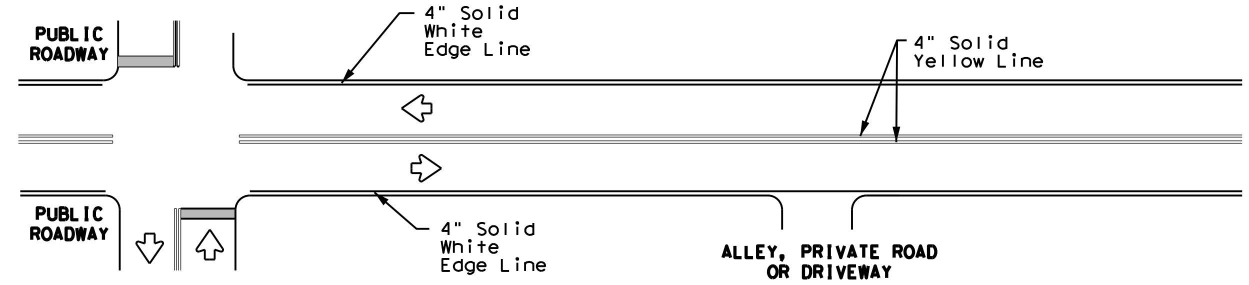
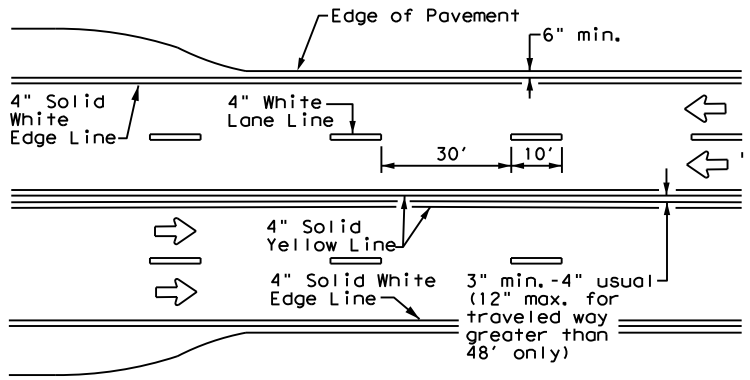


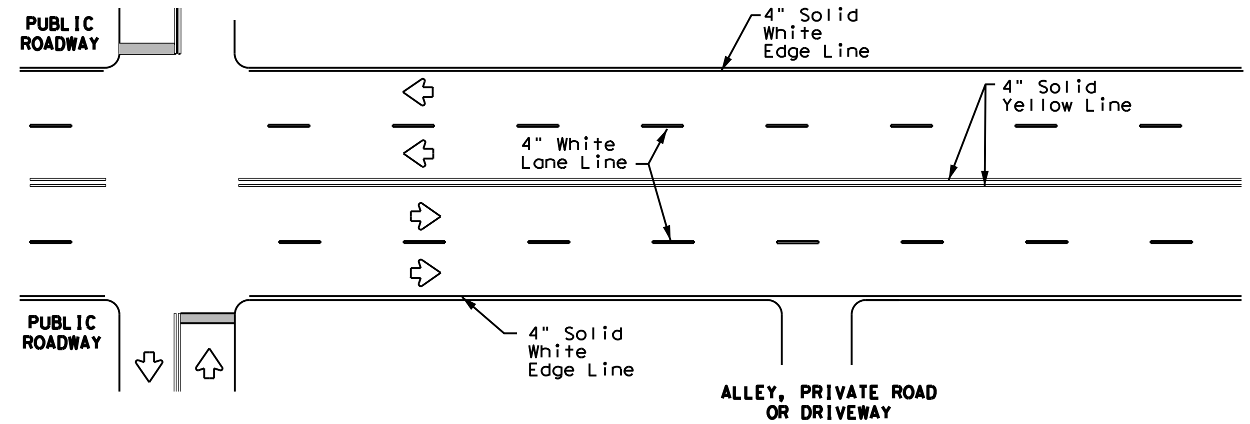
EDGE LINE AND LANE LINES ONE-WAY ROADWAY WITH OR WITHOUT SHOULDERS



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



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



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

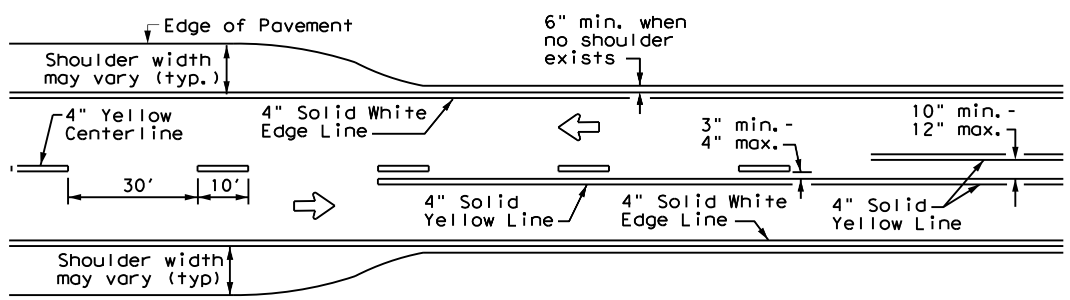
GENERAL NOTES

1. Edgeline striping shall be as shown in the plans or as directed by the Engineer. The edgeline should not be placed less less than 6 inches from the edge of pavement. This distance may vary due to pavement raveling or other conditions. Edgelines are not required in curb and gutter sections of roadways.

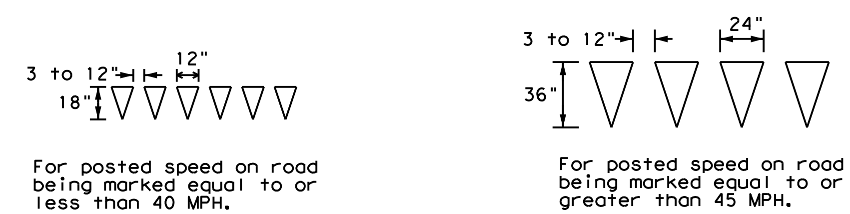
2. The traveled way includes only that portion of the roadway used for vehicular travel. It does not include the parking lanes, sidewalks, berms and shoulders. The traveled ways shall be measured from the inside of edgeline to the inside of edgeline of a two lane roadway.

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

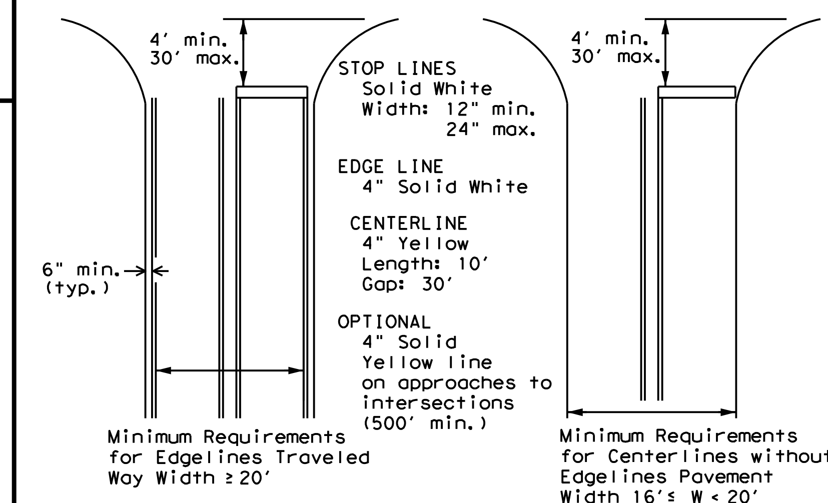
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



TWO LANE TWO-WAY ROADWAY WITH OR WITHOUT SHOULDERS

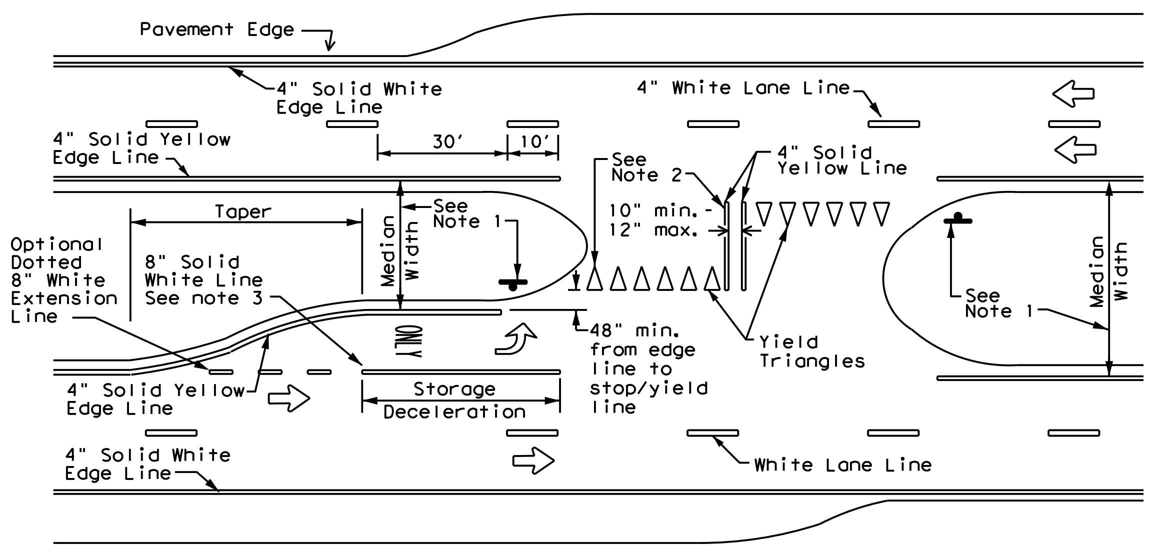


YIELD LINES



GUIDE FOR PLACEMENT OF STOP LINES, EDGE LINE & CENTERLINE

Based on Traveled Way and Pavement Widths for Undivided Highways



FOUR LANE DIVIDED ROADWAY CROSSOVERS

NOTE:

1. Irrespective of shoulder, use 6in width lines (edge lines).

2. Use 4 in. width lines (edge and lane lines) when lane width is 10 ft. or less; and 6 in. width lines when lane width is greater than 10 ft.

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 are optional as determined by the Engineer.

2. Install median striping (double yellow centerlines and stop bars/yield triangles) when a 50' or greater median centerline can be placed. Stop bars shall only be used with stop signs. Yield traingles 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.

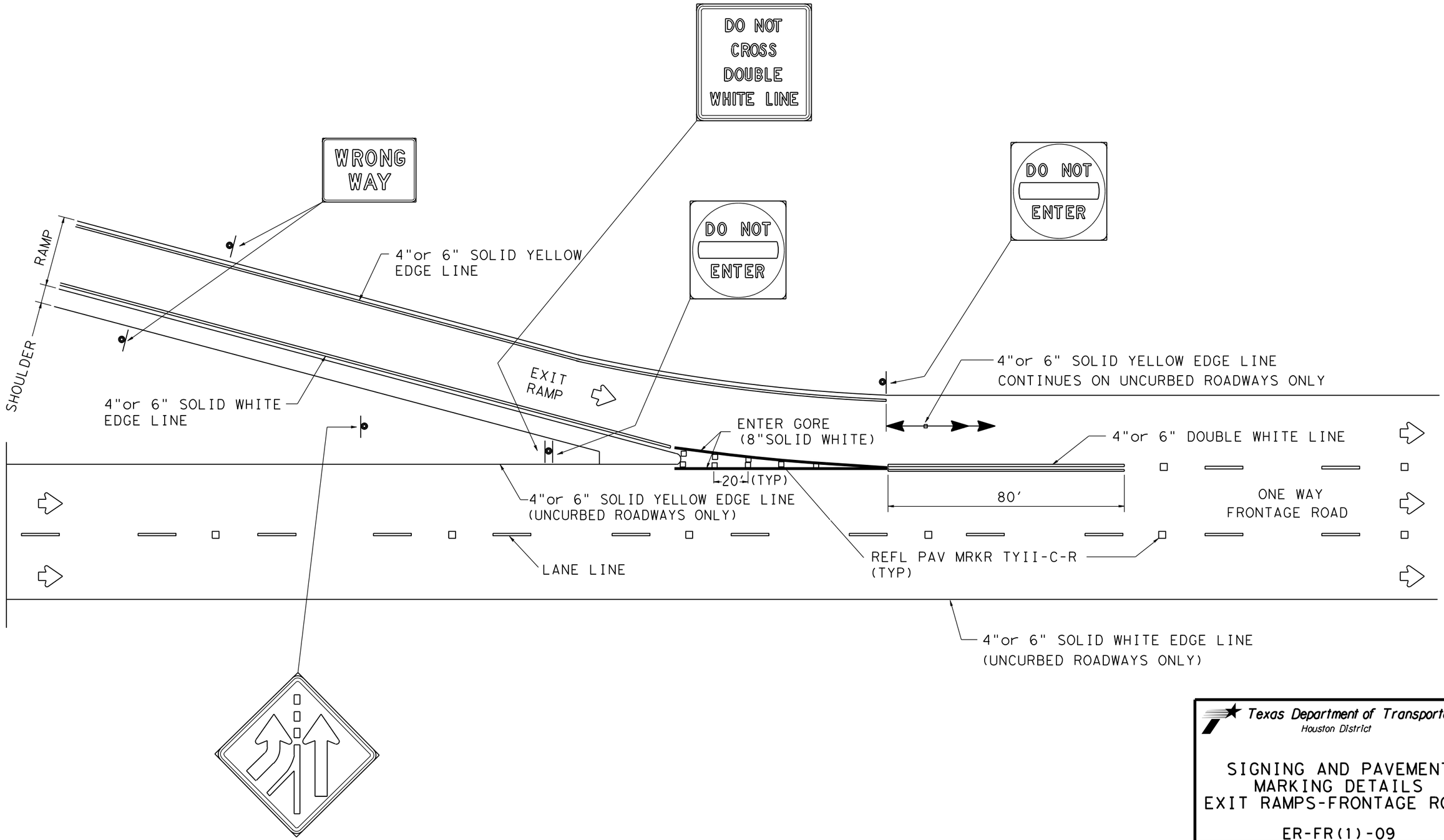
Texas Department of Transportation
HOUSTON DISTRICT STANDARD

TYPICAL STANDARD PAVEMENT MARKINGS

PM-20

© TxDOT NOVEMBER 1978	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
REVISIONS	CONT	SECT	JOB	HIGHWAY
8-95 2-12	0110	05	126	IH 45
5-00 8-16	DIST	COUNTY		SHEET NO.
8-00 7-20 / 3-03	HOU	HARRIS		235

STD N-5a



DRAWING SCALE: NONE

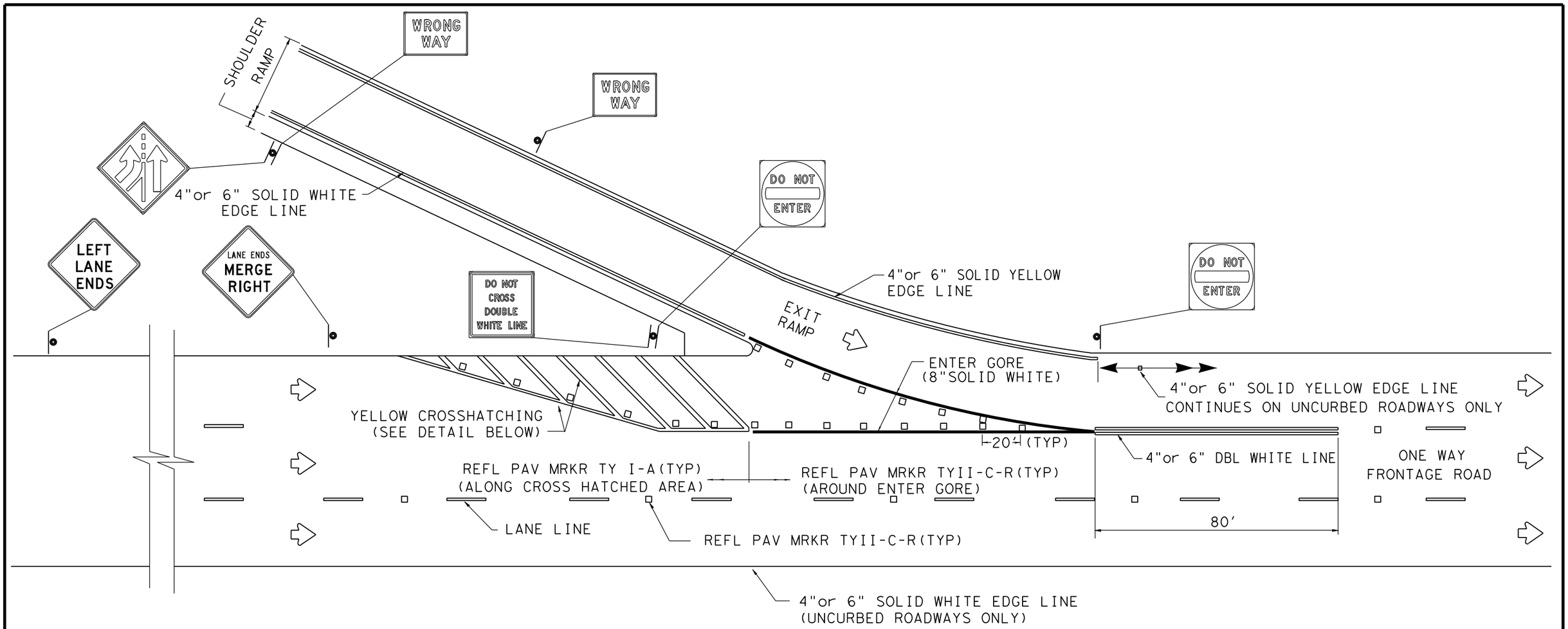
Texas Department of Transportation
Houston District

SIGNING AND PAVEMENT MARKING DETAILS EXIT RAMPS-FRONTAGE ROAD

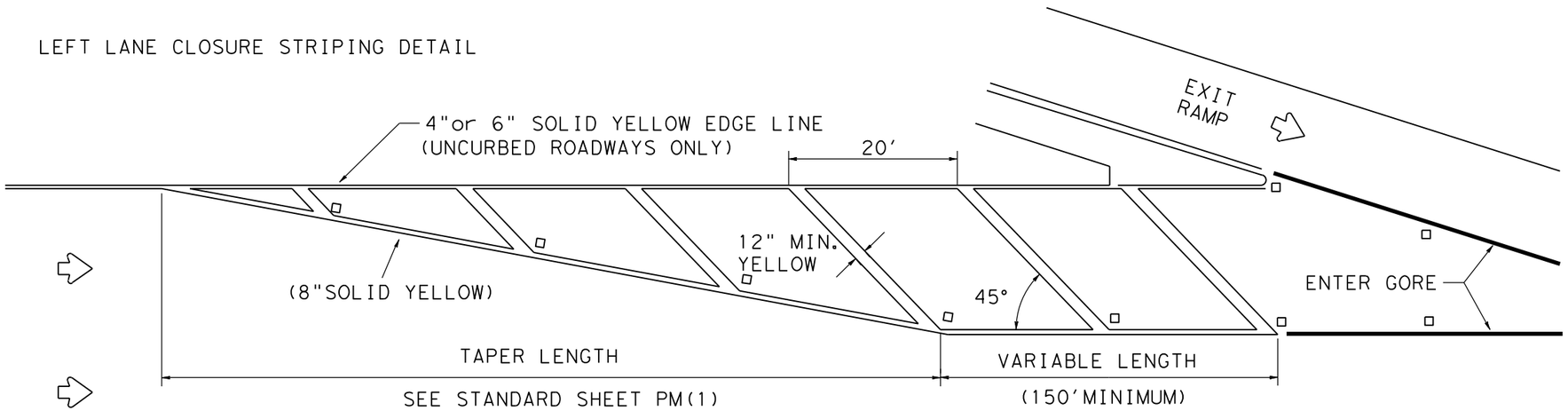
ER-FR(1)-09

FILE:	DN:	CK:	DW:	CK:
© TxDOT 1998	DIST	FED REG	PROJECT NO.	SHEET
REVISIONS FEB., 2008 DEC., 2009	HOU	6		236
	COUNTY	CONTROL	SECT	JOB	HIGHWAY
	HARRIS	0110	05	126	IH 45

STD N-25



LEFT LANE CLOSURE STRIPING DETAIL



DRAWING SCALE: NONE

Texas Department of Transportation
Houston District

SIGNING AND PAVEMENT MARKING DETAILS EXIT RAMPS-FRONTAGE ROAD

ER-FR(2)-09

FILE:	DN:	CK:	DW:	CK:
© TxDOT 1998	DIST	FED REG	PROJECT NO.	SHEET
REVISIONS FEB., 2008 DEC., 2009	HOU	6		237
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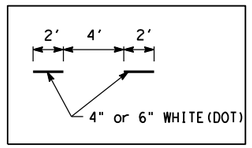
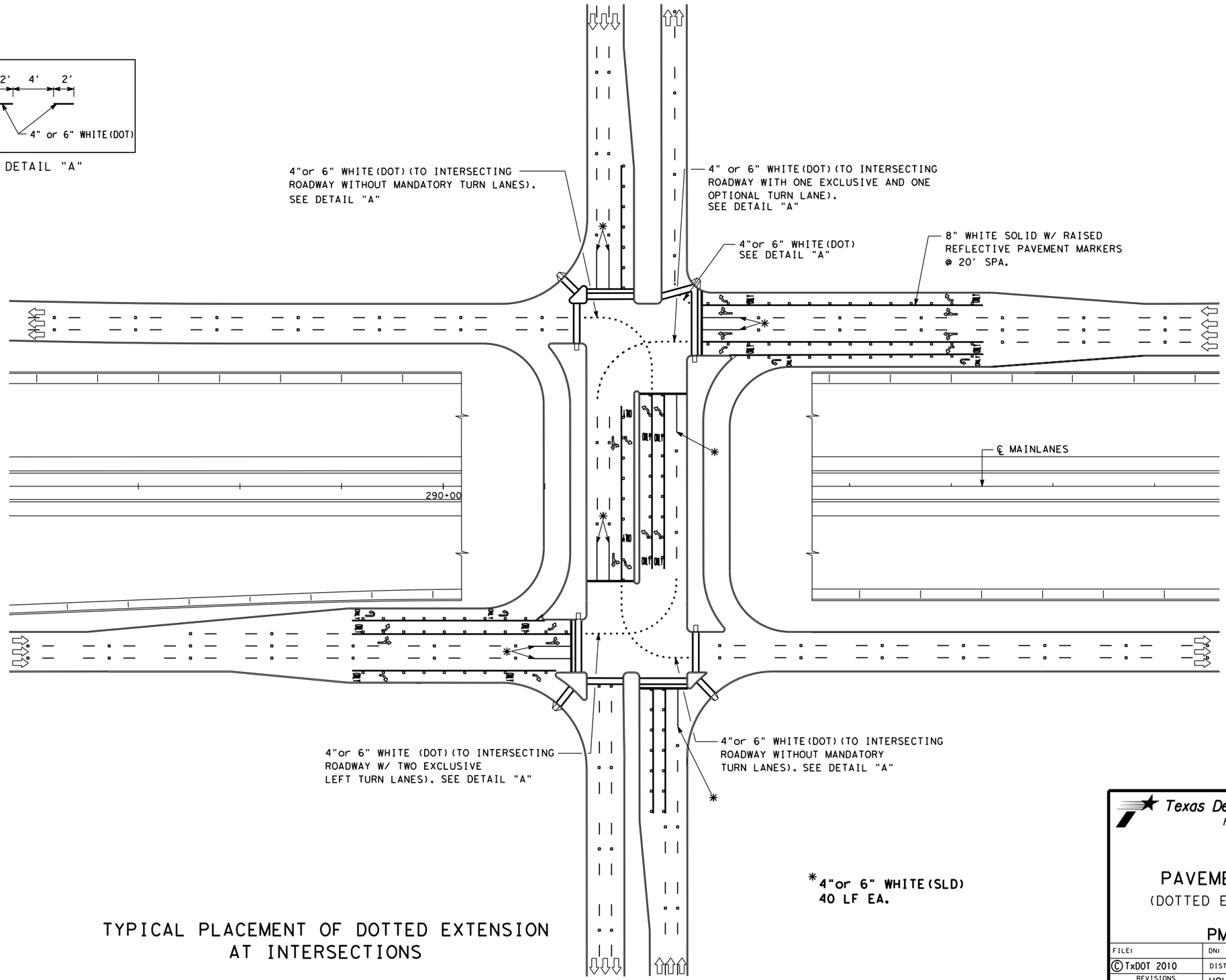
	HARRIS	0110	05	126	IH 45

STD N-26



DETAIL "A"



*4"or 6" WHITE(SLD) 40 LF EA.

TYPICAL PLACEMENT OF DOTTED EXTENSION AT INTERSECTIONS

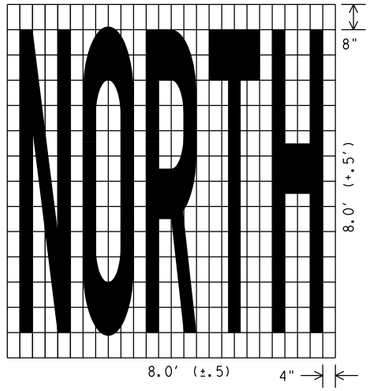
Texas Department of Transportation
Houston District

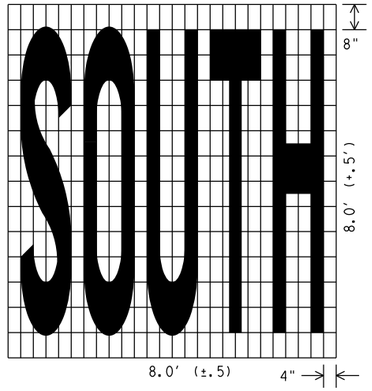
PAVEMENT MARKINGS
(DOTTED EXTENSION DETAILS)

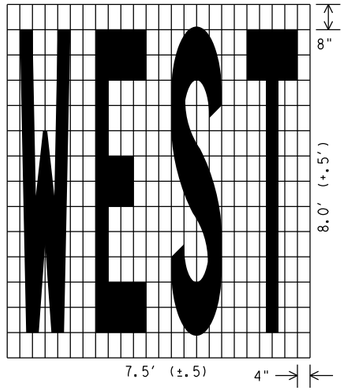
PM(DOT)-11

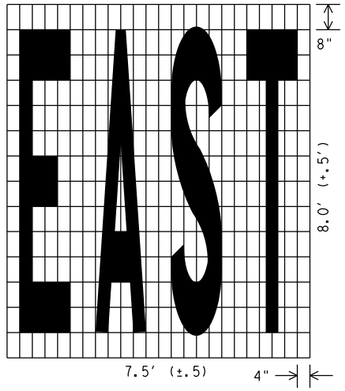
FILE:	DN:	CK:	DW:	CK:	
© TxDOT 2010	DIST	FED REG	PROJECT NO.		SHEET
REVISIONS 4/2010 4/2011	HOU	6			238
	COUNTY	CONTROL	SECT	JOB	HIGHWAY
	HARRIS	0110	05	126	IH 45

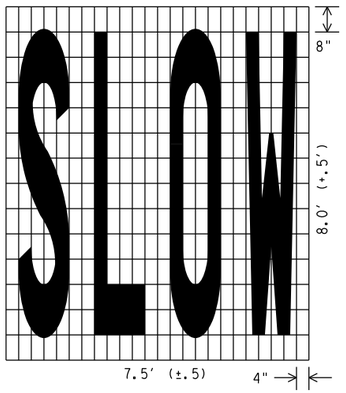
STD N-28

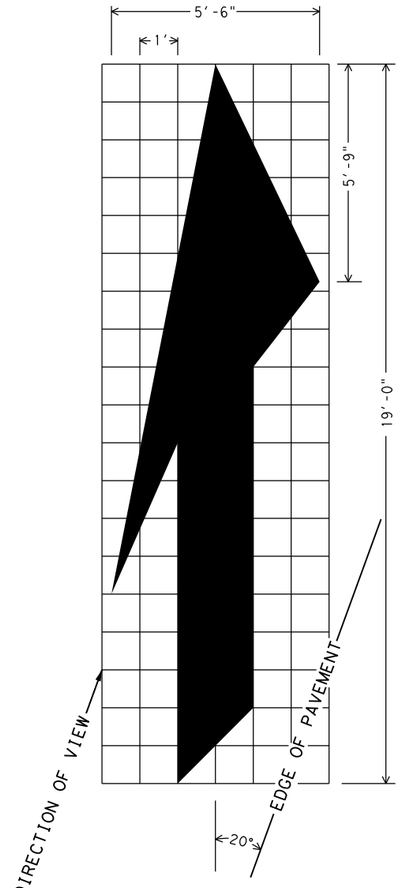






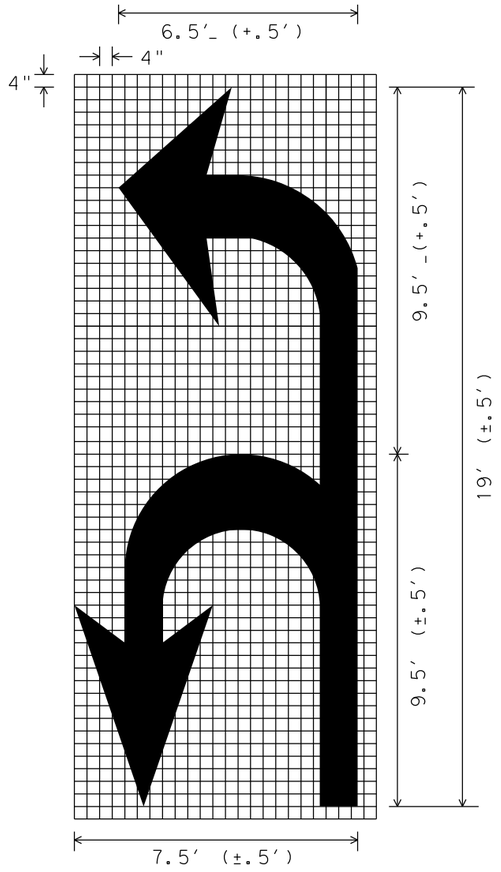




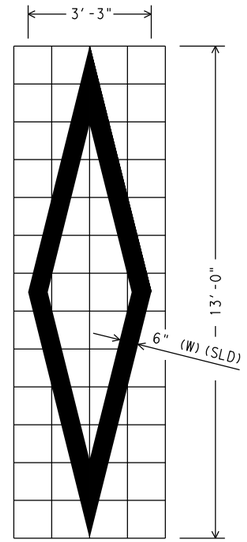


ISOMETRIC ARROW

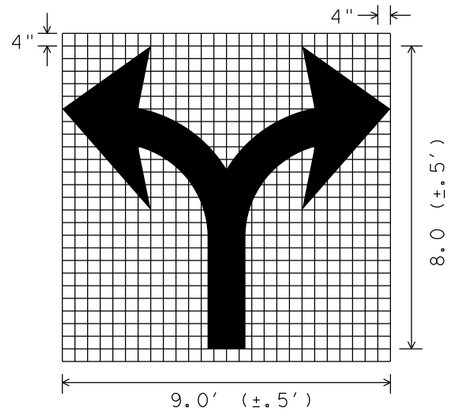
12 INCH GRID
AREA = 42 SQ. FT.
RIGHT LANE DROP ARROW
(FOR LEFT LANE, USE MIRROR IMAGE)



U-L ARROW



DIAMOND SYMBOL



SCALE 1/4" = 1′

Texas Department of Transportation
Houston District

PAVEMENT MARKINGS (WORDS, ARROWS & SYMBOLS)

PM(WAS)-07

FILE:	DN:	CK:	DW:	CK:
© TxDOT 2007	DIST	FED REG	PROJECT NO.	SHEET
REVISIONS 03-19-07	HOU	6		239
	COUNTY	CONTROL	SECT JOB	HIGHWAY
	HARRIS	0110	05 126	IH 45

STD-N31

DATE: 8/10/2021 1:20:53 PM
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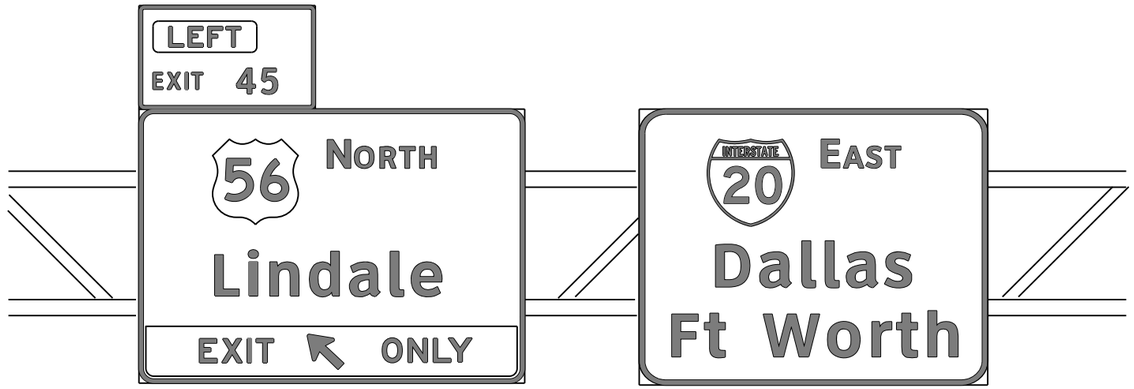
REQUIREMENTS FOR OVERHEAD AND LARGE GROUND-MOUNTED SIGNS

TYPICAL EXAMPLES



GENERAL NOTES

1. Signs to be furnished shall be as detailed elsewhere in the plans and/or as shown on sign summary sheet. Standard sign designs and arrow dimensions can be found in the "Standard Highway Sign Designs for Texas" (SHSD).
2. Black legend shall use the Federal Highway Administration (FHWA) Standard Highway Alphabets (B, C, D, E, Emod, or F).
   White legend shall use the Clearview Alphabet.
   The following Clearview fonts shall be used to replace the existing white FHWA lettering, when not specified in the SHSD or in the plans.

B	CV-1W
C	CV-2W
D	CV-3W
E	CV-4W
Emod	CV-5WR
F	CV-6W

3. Lateral spacing between letters and numerals shall conform with the SHSD, and any approved changes thereto. Lateral spacing of legend shall provide a balanced appearance when spacing is not shown.
4. Black legend shall be applied by screening process or cut-out acrylic non-reflective black film to background sheeting, or combination thereof.
5. White legend and borders shall be cut-out white sheeting applied to colored background sheeting.
6. Information regarding borders and radii for signs is found in the "Standard Highway Sign Designs for Texas". Dimensions shown and described for borders and corner radii on parent sign are nominal. Borders may vary in width as much as 1/2 inch. Corner radii above 3 inches may vary in width as much as 1 inch. Borders and corner radii within a parent sign must be of matching widths. The sign area outside the corner radius need not be trimmed or rounded if fabricated from an extruded material.
7. Sign substrate for ground-mounted signs shall be any material that meets the Departmental Material Specification requirements of DMS-7110 or approved alternative. Sign substrate for overhead signs shall be any material that meets DMS-7110. Exit Number Panels attached above the parent sign shall be made with the same substrate and sheeting as the parent sign.
8. Mounting details of attachments to parent sign face are shown on Standard Plan Sheet TSR(5). Mounting details of exit number panels above parent sign are shown in the "SMD series" Standard Plan Sheets.
9. Background sheeting shall be applied to the substrate per sheeting manufacturer's recommendations. Sheeting will not be allowed to bridge the horizontal gap between panels.
10. Cut all legend, symbols, borders, and direct applied sign attachments at panel joints.

DEPARTMENTAL MATERIAL SPECIFICATIONS	
ALUMINUM SIGN BLANKS	DMS-7110
SIGN FACE MATERIALS	DMS-8300

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

http://www.txdot.gov/

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	WHITE	TYPE B OR C SHEETING
BACKGROUND	ALL OTHERS	TYPE B OR C SHEETING
LEGEND & BORDERS	WHITE	TYPE D SHEETING
LEGEND & BORDERS	BLACK	ACRYLIC NON-REFLECTIVE FILM

Texas Department of Transportation

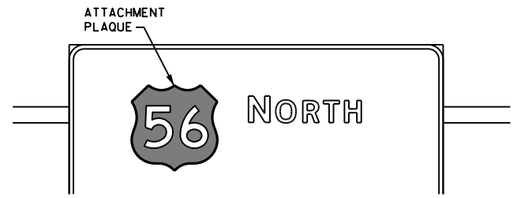
Traffic Operations Division Standard

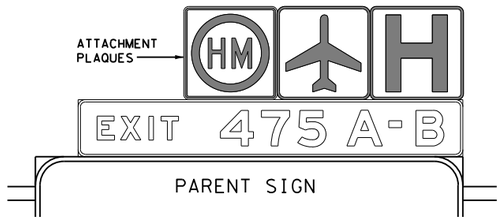
TYPICAL SIGN REQUIREMENTS

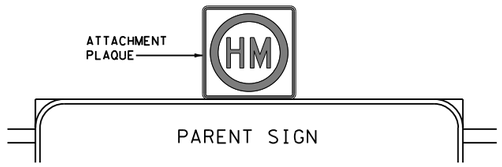
TSR(1)-13

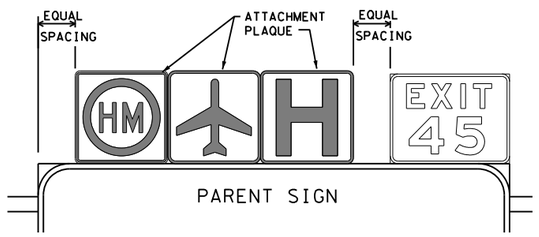
FILE: tsr1-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT October 2003	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
12-03 7-13	DIST	COUNTY		SHEET NO.
9-08	HOU	HARRIS		240

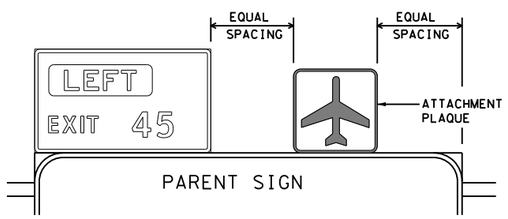
REQUIREMENTS FOR ATTACHMENTS TO OVERHEAD AND LARGE GROUND MOUNTED SIGNS











TYPICAL EXAMPLES

DEPARTMENTAL MATERIAL SPECIFICATIONS	
ALUMINUM SIGN BLANKS	DMS-7110
SIGN FACE MATERIALS	DMS-8300

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	ALL	TYPE B OR C SHEETING
LEGEND & BORDERS	BLACK	ACRYLIC NON-REFLECTIVE FILM
LEGEND & BORDERS	ALL OTHERS	TYPE B OR C SHEETING

GENERAL NOTES

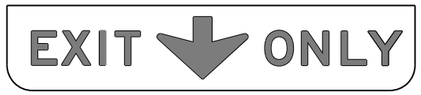
1. Signs to be furnished shall be as detailed elsewhere in the plans and/or as shown on sign tabulation sheet. Standard sign designs and arrow dimensions can be found in the "Standard Highway Sign Designs for Texas" (SHSD).
2. Route Marker legends (ie. IH, US, SH and FM shields) shall use the Federal Highway Administration (FHWA) Standard Highway Alphabets (B, C, D, E, Emod, or F).
3. Lateral spacing between letters and numerals shall conform with the SHSD, and any approved changes thereto. Lateral spacing of legend shall provide a balanced appearance when spacing is not shown.
4. Black legend and borders shall be applied by screening process or cut-out acrylic non-reflective black film to background sheeting, or combination thereof.
5. White legend and borders shall be applied by screening process with transparent colored ink, transparent colored overlay film to white background sheeting or cut-out white sheeting to colored background sheeting, or combination thereof.
6. Colored legend and borders shall be applied by screening process with transparent colored ink, transparent colored overlay film or colored sheeting to white background sheeting, or combination thereof.
7. Route markers and other attachments within the parent sign face shall be direct applied unless otherwise specified in the plans. Attachments not direct applied shall use 0.063 inch thick one piece sheet aluminum signs (Type A).
8. General Service Plaques shall be 0.080 inch thick and Routing Plaques shall be 0.100 inch thick.
9. The priority for Routing Plaques shall be (left to right) Hazardous Material, Airport then Hospital. See examples for mounting location.
10. Mounting details of attachments to parent signs face are shown on Standard Plan Sheet TSR(5). Mounting details of sign plaque attachments above and below parent sign are shown in the "SMD series" Standard Plan Sheets.
11. Plaques shall be horizontally centered at the top of the parent sign. If an exit number panel exists, the plaque shall be centered between the edge of the parent sign and the edge of the exit number panel. The plaque may be placed above the exit number panel when there is insufficient space.

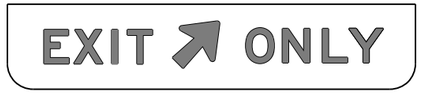
TYPICAL EXAMPLES

REQUIREMENTS FOR EXIT ONLY AND LEFT EXIT PANELS

DEPARTMENTAL MATERIAL SPECIFICATIONS	
ALUMINUM SIGN BLANKS	DMS-7110
SIGN FACE MATERIALS	DMS-8300

SHEETING REQUIREMENTS FOR OVERHEAD EXIT PANELS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	FLUORESCENT YELLOW	TYPE B_{FL} OR C_{FL} SHEETING
LEGEND	BLACK	ACRYLIC NON-REFLECTIVE FILM





TYPICAL EXAMPLES

GENERAL NOTES

1. Signs to be furnished shall be as detailed elsewhere in the plans and/or as shown on sign tabulation sheet. Standard sign designs and arrow dimensions can be found in the "Standard Highway Sign Designs for Texas" (SHSD). Individual panel sizes shown in the plans may be adjusted to fit actual parent sign sizes if necessary.
2. Exit Panel legend shall use the Federal Highway Administration (FHWA)Standard Highway Alphabets E Series.
3. Lateral spacing between letters and numerals shall conform with the SHSD, and any approved changes thereto. Lateral spacing of legend shall provide a balanced appearance when spacing is not shown.
4. Black legend shall be applied by screening process or cut-out acrylic non-reflective black film to yellow background sheeting, or combination thereof.
5. Exit Only and Left Exit panels within the parent sign face shall be direct applied unless otherwise specified in the plans. Panels not direct applied shall use 0.063 inch thick one piece sheet aluminum signs (Type A).
6. Mounting details of Exit Only and Left Exit panel attachments to parent signs face are shown on Standard Plan Sheet TSR(5).

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

http://www.txdot.gov/

Texas Department of Transportation

Traffic Operations Division Standard

TYPICAL SIGN REQUIREMENTS

TSR(2)-13

FILE: tsr2-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT October 2003	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
12-03 7-13	DIST	COUNTY		SHEET NO.
9-08	HOU	HARRIS		241

2

DATE: 8/10/2021 1:20:55 PM
FILE: I:\HUM-AO\Design\Roadway\IH 45\0110-05-126 Cypress Creek\PLAN PDF\6-SIGNING AND PVMT\0110-05-126_TSR2-13.dgn

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DATE: 8/10/2021 1:20:57 PM
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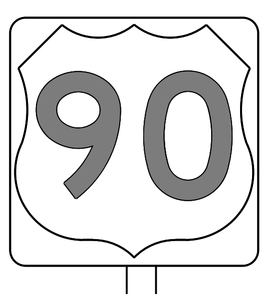
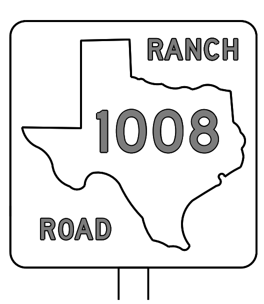
REQUIREMENTS FOR INDEPENDENT MOUNTED ROUTE SIGNS

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	WHITE	TYPE A SHEETING
BACKGROUND	ALL OTHERS	TYPE B OR C SHEETING
LEGEND & BORDERS	WHITE	TYPE A SHEETING
LEGEND & BORDERS	BLACK	ACRYLIC NON-REFLECTIVE FILM
LEGEND & BORDERS	ALL OTHERS	TYPE B or C SHEETING

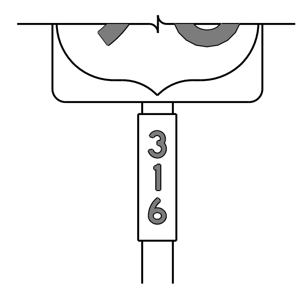


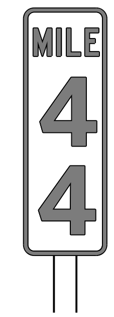


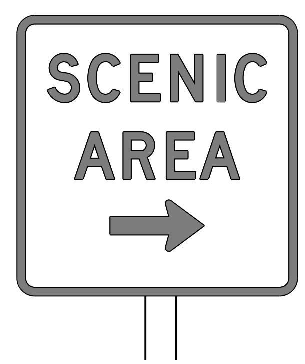
TYPICAL EXAMPLES

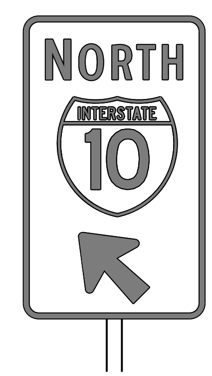
REQUIREMENTS FOR BLUE, BROWN & GREEN D AND I SERIES GUIDE SIGNS

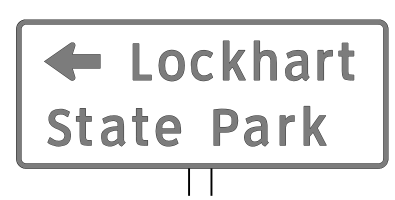
SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	ALL	TYPE B OR C SHEETING
LEGEND & BORDERS	WHITE	TYPE D SHEETING
LEGEND, SYMBOLS & BORDERS	ALL OTHERS	TYPE B OR C SHEETING

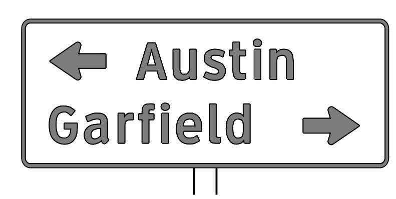












TYPICAL EXAMPLES

GENERAL NOTES

1. Signs to be furnished shall be as detailed elsewhere in the plans and/or as shown on sign tabulation sheet. Standard sign designs and arrow dimensions can be found in the "Standard Highway Sign Designs for Texas" (SHSD).

2. White legend shall use the Clearview Alphabet. The following Clearview fonts shall be used to replace the existing white Federal Highway Administration (FHWA) Standard Highway Alphabets, when not specified in the SHSD, or in the plans.

B	CV-1W
C	CV-2W
D	CV-3W
E	CV-4W
Emod	CV-5WR
F	CV-6W

3. Route sign legend (ie. IH, US, SH and FM shields) shall use the Federal Highway Administration (FHWA) Standard Highway Alphabets B, C, D, E, Emod or F).

4. Lateral spacing between letters and numerals shall conform with the SHSD, and any approved changes thereto. Lateral spacing of legend shall provide a balanced appearance when spacing is not shown.

5. Independent mounted route sign with white or colored legend and borders shall be applied by screening process with transparent color ink, transparent colored overlay film to white background sheeting or cut-out white sheeting to colored background sheeting, or combination thereof. White legend, symbols and borders on all other signs shall be cut-out white sheeting applied to colored background sheeting.

6. Information regarding borders and radii for signs is found in the "Standard Highway Sign Designs for Texas". Dimensions shown and described for borders and corner radii on parent sign are nominal. Borders may vary in width as much as 1/2 inch. Corner radii above 3 inches may vary in width as much as 1 inch. Borders and corner radii within a parent sign must be of matching widths. The sign area outside the corner radius should be trimmed or rounded.

7. Sign substrate shall be any material that meets the Departmental Material Specification requirements of DMS-7110 or approved alternative.

8. Mounting details of roadside signs are shown in the "SMD series" Standard Plan Sheets.

DEPARTMENTAL MATERIAL SPECIFICATIONS	
ALUMINUM SIGN BLANKS	DMS-7110
SIGN FACE MATERIALS	DMS-8300

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/

Texas Department of Transportation | Traffic Operations Division Standard

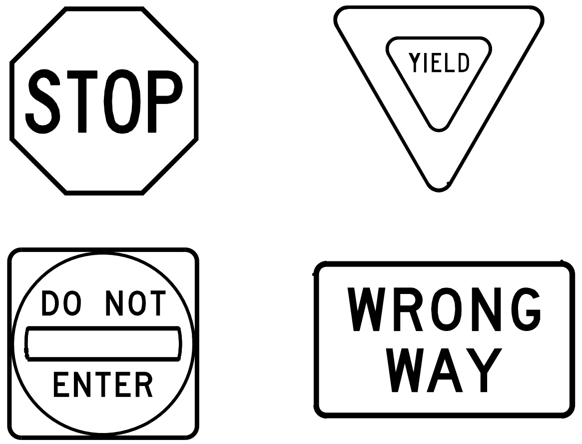
TYPICAL SIGN REQUIREMENTS

TSR(3)-13

FILE: tsr3-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT October 2003	CONT 0110	SECT 05	JOB 126	HIGHWAY IH 45
REVISIONS 12-03 7-13 9-08	DIST HOU		COUNTY HARRIS	SHEET NO. 242

3

REQUIREMENTS FOR RED BACKGROUND REGULATORY SIGNS
(STOP, YIELD, DO NOT ENTER AND WRONG WAY SIGNS)



REQUIREMENTS FOR FOUR SPECIFIC SIGNS ONLY

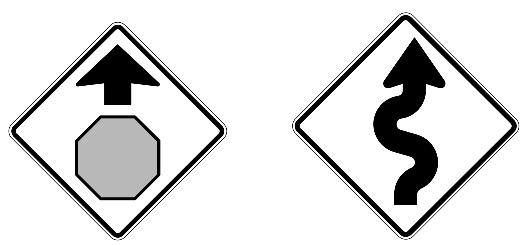
SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	RED	TYPE B OR C SHEETING
BACKGROUND	WHITE	TYPE B OR C SHEETING
LEGEND & BORDERS	WHITE	TYPE B OR C SHEETING
LEGEND	RED	TYPE B OR C SHEETING

REQUIREMENTS FOR WHITE BACKGROUND REGULATORY SIGNS
(EXCLUDING STOP, YIELD, DO NOT ENTER AND WRONG WAY SIGNS)

TYPICAL EXAMPLES

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	WHITE	TYPE A SHEETING
BACKGROUND	ALL OTHERS	TYPE B OR C SHEETING
LEGEND, BORDERS AND SYMBOLS	BLACK	ACRYLIC NON-REFLECTIVE FILM
LEGEND, BORDERS AND SYMBOLS	ALL OTHER	TYPE B OR C SHEETING

REQUIREMENTS FOR WARNING SIGNS



TYPICAL EXAMPLES

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	FLOURESCENT YELLOW	TYPE B_{FL} OR C_{FL} SHEETING
LEGEND & BORDERS	BLACK	ACRYLIC NON-REFLECTIVE FILM
LEGEND & SYMBOLS	ALL OTHER	TYPE B OR C SHEETING

REQUIREMENTS FOR SCHOOL SIGNS

TYPICAL EXAMPLES

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	WHITE	TYPE A SHEETING
BACKGROUND	FLOURESCENT YELLOW GREEN	TYPE B_{FL} OR C_{FL} SHEETING
LEGEND, BORDERS AND SYMBOLS	BLACK	ACRYLIC NON-REFLECTIVE FILM
SYMBOLS	RED	TYPE B OR C SHEETING

GENERAL NOTES

1. Signs to be furnished shall be as detailed elsewhere in the plans and/or as shown on sign tabulation sheet. Standard sign designs and arrow dimensions can be found in the "Standard Highway Sign Designs for Texas" (SHSD).
2. Sign legend shall use the Federal Highway Administration (FHWA) Standard Highway Alphabets (B, C, D, E, Emod or F).
3. Lateral spacing between letters and numerals shall conform with the SHSD, and any approved changes thereto. Lateral spacing of legend shall provide a balanced appearance when spacing is not shown.
4. Black legend and borders shall be applied by screening process or cut-out acrylic non-reflective black film to background sheeting, or combination thereof.
5. White legend and borders shall be applied by screening process with transparent colored ink, transparent colored overlay film to white background sheeting or cut-out white sheeting to colored background sheeting, or combination thereof.
6. Colored legend shall be applied by screening process with transparent colored ink, transparent colored overlay film or colored sheeting to background sheeting, or combination thereof.
7. Sign substrate shall be any material that meets the Departmental Material Specification requirements of DMS-7110 or approved alternative.
8. Mounting details for roadside mounted signs are shown in the "SMD series" Standard Plan Sheets.

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

DEPARTMENTAL MATERIAL SPECIFICATIONS	
ALUMINUM SIGN BLANKS	DMS-7110
SIGN FACE MATERIALS	DMS-8300

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

http://www.txdot.gov/

Texas Department of Transportation

Traffic Operations Division Standard

TYPICAL SIGN REQUIREMENTS

TSR(4)-13

FILE: tsr4-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT October 2003	CONT	SECT	JOB	HIGHWAY
REVISIONS 12-03 7-13 9-08	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		243

DATE: 8/10/2021 1:21:03 PM
FILE: T:\HUM-AOV\Design\Roadway\IH 45\0110-05-126 Cypress Creek\PLAN PDF\6-SIGNING AND PVMT STANDARDS\244 SMD(GEN)-08.dgn

SIGN SUPPORT DESCRIPTIVE CODES

(Descriptive Codes correspond to project estimate and quantities sheets)

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

Post Type

FRP = Fiberglass Reinforced Plastic Pipe (see SMD(FRP))
TWT = Thin-Walled Tubing (see SMD(TWT))
10BWG = 10 BWG Tubing (see SMD(SLIP-1) to (SLIP-3))
S80 = Schedule 80 Pipe (see SMD(SLIP-1) to (SLIP-3))

Number of Posts (1 or 2)

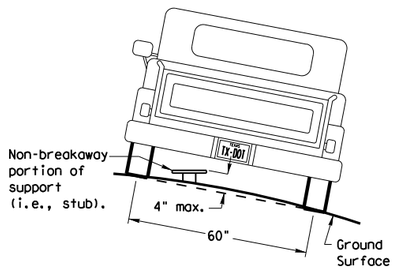
Anchor Type

UA = Universal Anchor - Concreted (see SMD(FRP) and (TWT))
UB = Universal Anchor - Bolted down (see SMD(FRP) and (TWT))
WS = Wedge Anchor Steel - (see SMD(TWT))
WP = Wedge Anchor Plastic (see SMD(TWT))
SA = Slipbase - Concreted (see SMD(SLIP-1) to (SLIP-3))
SB = Slipbase - Bolted Down (see SMD(SLIP-1) to (SLIP-3))

Sign Mounting Designation

P = Prefab. "Plain" (see SMD(SLIP-1) to (SLIP-3), (TWT), (FRP))
T = Prefab. "T" (see SMD(SLIP-1) to (SLIP-3), (TWT))
U = Prefab. "U" (see SMD(SLIP-1) to (SLIP-3))
IF REQUIRED
1EXT or 2EXT = Number of Extensions (see SMD(SLIP-1) to (SLIP-3), (TWT))
BM = Extruded Wind Beam (see SMD(SLIP-1) to (SLIP-3))
WC = 1.12 #/ft Wing Channel (see SMD(SLIP-1) to (SLIP-3))
EXAL = Extruded Aluminum Sign Panels (see SMD(SLIP-1))

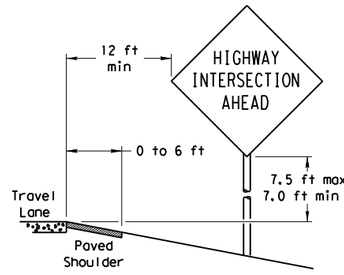
REQUIRED CLEARANCE FOR BREAKAWAY SUPPORT



To avoid vehicle undercarriage snagging, any substantial remains of a breakaway support, when it is broken away, should not project more than 4 inches above a 60-inch chord (i.e., typical space between wheel paths).

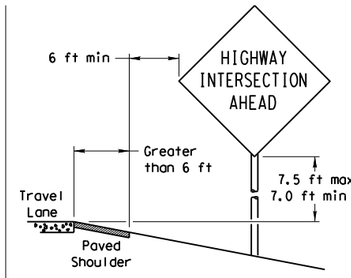
SIGN LOCATION

PAVED SHOULDERS



LESS THAN 6 FT. WIDE

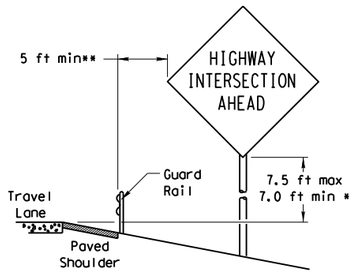
When the shoulder is 6 ft. or less in width, the sign must be placed at least 12 ft. from the edge of the travel lane.



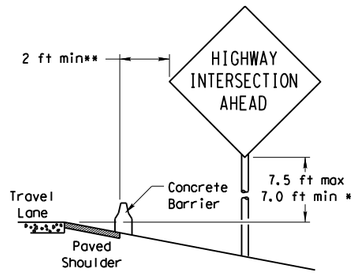
GREATER THAN 6 FT. WIDE

When the shoulder is greater than 6 ft in width, the sign must be placed at least 6 ft. from the edge of the shoulder.

BEHIND BARRIER



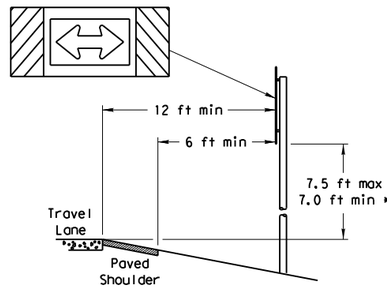
BEHIND GUARDRAIL



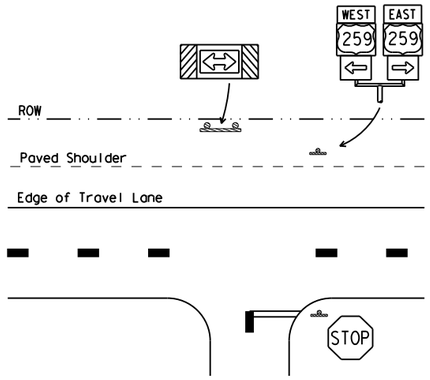
BEHIND CONCRETE BARRIER

****Sign clearance based on distance required for proper guard rail or concrete barrier performance.**

T-INTERSECTION



When this sign is needed at the end of a two-lane, two way roadway, the right edge of the sign should be in line with the centerline of the roadway. Place as close to ROW as practical.



* Signs shall be mounted using the following condition that results in the greatest sign elevation:

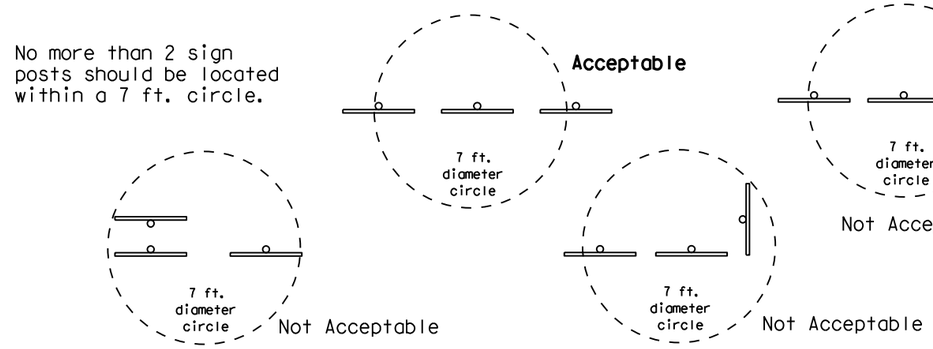
(1) a minimum of 7 to a maximum of 7.5 feet above the edge of the travel lane or

(2) a minimum of 7 to a maximum of 7.5 feet above the grade at the base of the support when sign is installed on the backslope.

The maximum values may be increased when directed by the Engineer.

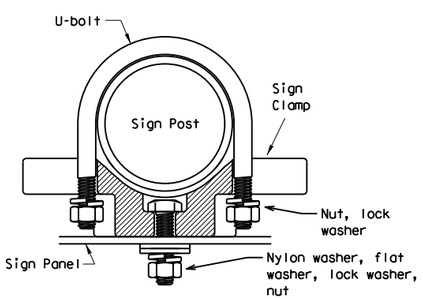
See the Traffic Operations Division website for detailed drawings of sign clamps, Triangular Slipbase System components and Wedge Anchor System components.

The website address is:
http://www.txdot.gov/publications/traffic.htm



TYPICAL SIGN ATTACHMENT DETAIL

Single Signs

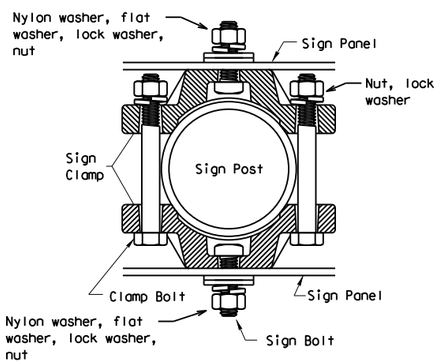


Bolts used to mount sign panels to the clamp are 5/16-18 UNC galvanized square head with nut, nylon washer, flat washer and lock washer. The bolt length is 1 inch for aluminum.

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.

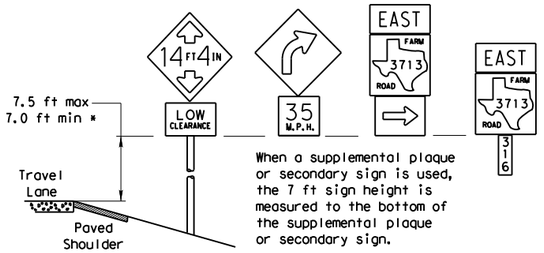
Sign clamps may be either the specific size clamp or the universal clamp.

Back-to-Back Signs



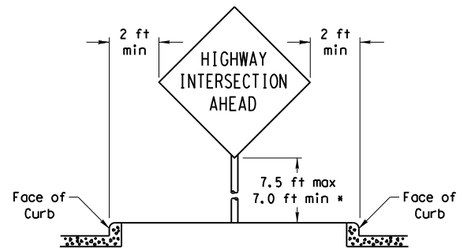
Pipe Diameter	Approximate Bolt Length	
	Specific Clamp	Universal Clamp
2" nominal	3"	3 or 3 1/2"
2 1/2" nominal	3 or 3 1/2"	3 1/2 or 4"
3" nominal	3 1/2 or 4"	4 1/2"

SIGNS WITH PLAQUES



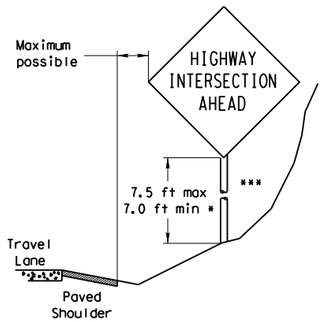
When a supplemental plaque or secondary sign is used, the 7 ft sign height is measured to the bottom of the supplemental plaque or secondary sign.

CURB & GUTTER OR RAISED ISLAND



RESTRICTED RIGHT-OF-WAY

(When 6 ft min. is not possible.)



Right-of-way restrictions may be created by rocks, water, vegetation, forest, buildings, a narrow island, or other factors.

In situations where a lateral restriction prevents the minimum horizontal clearance from the edge of the travel lane, signs should be placed as far from the travel lane as practical.

*** Post may be shorter if protected by guardrail or if Engineer determines the post could not be hit due to extreme slope.

Texas Department of Transportation
Traffic Operations Division

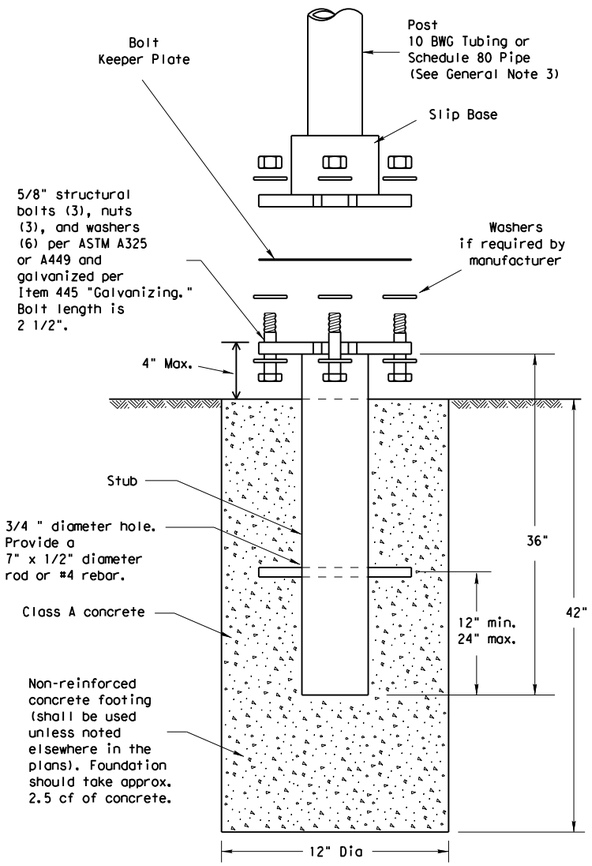
SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS GENERAL NOTES & DETAILS

SMD(GEN)-08

REVISIONS	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
9-08	CONT	SECT	JOB	HIGHWAY
	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		244

DATE: 8/10/2021 1:21:06 PM
FILE: T:\HOU-AO\Design\Roadway\IH 45\0110-05-126 Cypress Creek\PLAN PDF\6-SIGNING AND PVMT STANDARDS\245 SMD(SLIP-1)-08.dgn

TRIANGULAR SLIPBASE INSTALLATION GENERAL REQUIREMENTS



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

NOTE

There are various devices approved for the Triangular Slipbase System. Please reference the Material Producer List for approved slip base systems. http://www.txdot.gov/business/producer_list.htm The devices shall be installed per manufacturers' recommendations. Installation procedures shall be provided to the Engineer by Contractor.

GENERAL NOTES:

1. Slip base shall be permanently marked to indicate manufacturer. Method, design, and location of marking are subject to approval of the TxDOT Traffic Standards Engineer.
2. Material used as post with this system shall conform to the following specifications:
   10 BWG Tubing (2.875" outside diameter)
   - 0.134" nominal wall thickness
   - Seamless or electric-resistance welded steel tubing or pipe
   - Steel shall be HSLAS Gr 55 per ASTM A1011 or ASTM A1008
   - Other steels may be used if they meet the following:
     - 55,000 PSI minimum yield strength
     - 70,000 PSI minimum tensile strength
     - 20% minimum elongation in 2"
   - Wall thickness (uncoated) shall be within the range of 0.122" to 0.138"
   - Outside diameter (uncoated) shall be within the range of 2.867" to 2.883"
   - Galvanization per ASTM A123 or ASTM A653 G210. For precoated steel tubing (ASTM A653), recoat tube outside diameter weld seam by metallizing with zinc wire per ASTM B833.

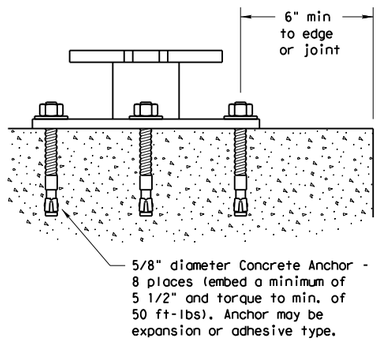
   Schedule 80 Pipe (2.875" outside diameter)
   - 0.276" nominal wall thickness
   - Steel tubing per ASTM A500 Gr C
   - Other seamless or electric-resistance welded steel tubing or pipe with equivalent outside diameter and wall thickness may be used if they meet the following:
     - 46,000 PSI minimum yield strength
     - 62,000 PSI minimum tensile strength
     - 21% minimum elongation in 2"
   - Wall thickness (uncoated) shall be within the range of 0.248" to 0.304"
   - Outside diameter (uncoated) shall be within the range of 2.855" to 2.895"
   - Galvanization per ASTM A123
3. See the Traffic Operations Division website for detailed drawings of sign clamps and Texas Universal Triangular Slipbase System components. The website address is: http://www.txdot.gov/publications/traffic.htm
4. Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.

ASSEMBLY PROCEDURE

Foundation
1. Prepare 12-inch diameter by 42-inch deep hole. If solid rock is encountered, the depth of the foundation may be reduced such that it is embedded a minimum of 18 inches into the solid rock.
2. The Engineer may permit batches of concrete less than 2 cubic yards to be mixed with a portable, motor-driven concrete mixer. For small placements less than 0.5 cubic yards, hand mixing in a suitable container may be allowed by Engineer. Concrete shall be Class A.
3. Push the pipe end of the slip base stub into the center of the concrete. Rotate the stub back and forth while pushing it down into the concrete to assure good contact between the concrete and stub. Continue to work the stub into the concrete until it is between 2 to 4 inches above the ground.
4. Plumb the stub. Allow a minimum of 4 days to set, unless otherwise directed by the Engineer.
5. The triangular slipbase system is multidirectional and is designed to release when struck from any direction.

Support
1. Cut support so that the bottom of the sign will be 7 to 7.5 feet above the edge of the travelway (i.e., edge of the closest lane) when slip plate is below the edge of pavement or 7 to 7.5 feet above slip plate when the slip plate is above the edge of the travelway. The cut shall be plumb and straight.
2. Attach sign to support using connections shown. When multiple signs are installed on the same support, ensure the minimum clearance between each sign is maintained. See SMD(SLIP-2) for clearances based on sign types.

CONCRETE ANCHOR



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

Concrete anchor consists of 5/8" diameter stud bolt with UNC series bolt threads on the upper end. Heavy hex nut per ASTM A563, and hardened washer per ASTM F436. The stud bolt shall have a minimum yield and ultimate tensile strength of 50 and 75 KSI, respectively. Nuts, bolts and washers shall be galvanized per Item 445, "Galvanizing." Adhesive type anchors shall have stud bolts installed with Type III epoxy per DMS-6100, "Epoxies and Adhesives." Adhesive anchors may be loaded after adequate epoxy cure time per the manufacturer's recommendations. Top of bolt shall extend at least flush with top of the nut when installed. The anchor, when installed in 4000 psi normal-weight concrete with a 5 1/2" minimum embedment, shall have a minimum allowable tension and shear of 3900 and 3100 psi, respectively.

Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS TRIANGULAR SLIPBASE SYSTEM

SMD(SLIP-1)-08

REVISIONS	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
9-08	CONT	SECT	JOB	HIGHWAY
	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		245

DATE: 8/10/2021 1:21:09 PM
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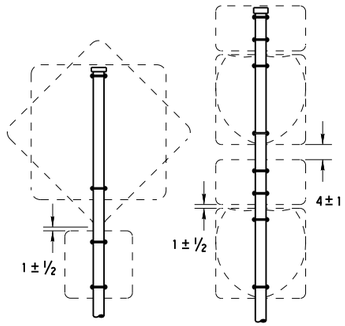
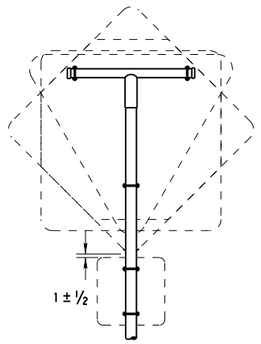
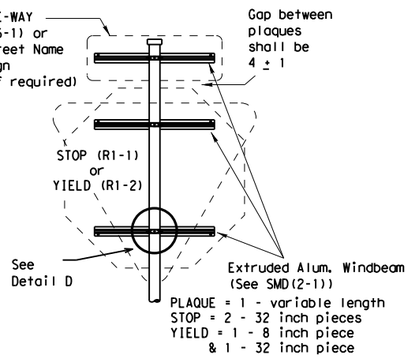


SM RD SGN ASSM TY XXXXX(1)XX(P)



SM RD SGN ASSM TY XXXXX(1)XX(T)



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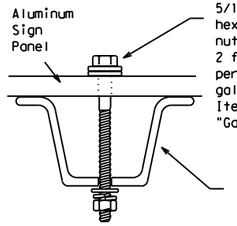
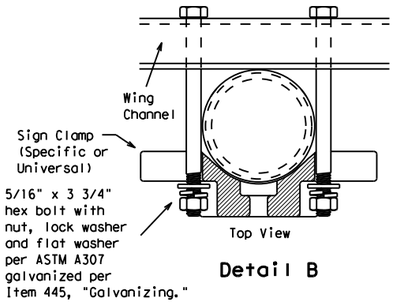
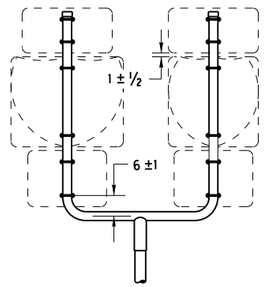


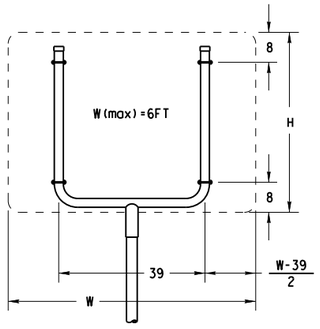
Detail A



Detail B



SM RD SGN ASSM TY XXXXX(1)XX(U)



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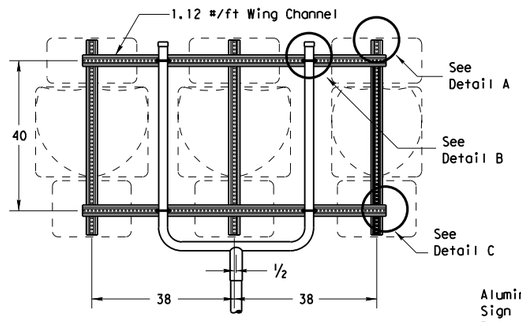
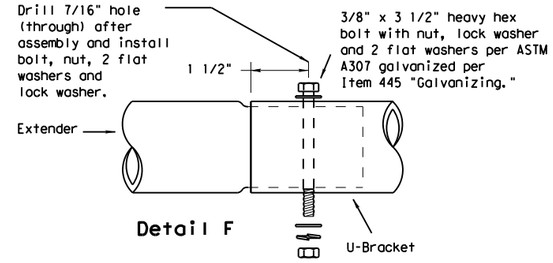
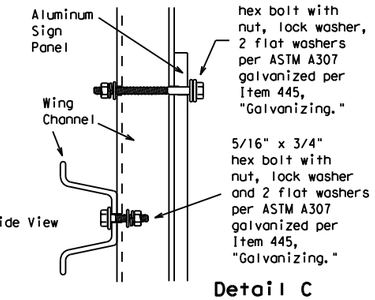


SM RD SGN ASSM TY XXXXX(1)XX(U-WC)
(See Note 11)

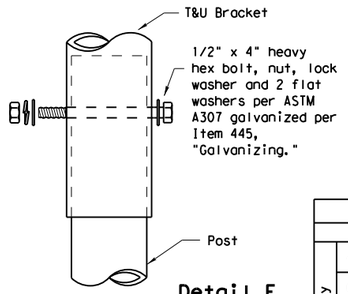


Detail F

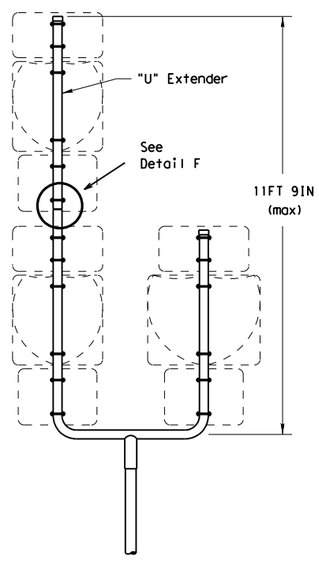
Splices shall only be allowed behind the sign substrate.



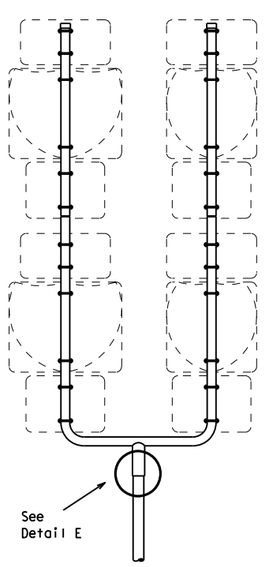
Detail C



Detail E



SM RD SGN ASSM TY S80(1)XX(U-1EXT)



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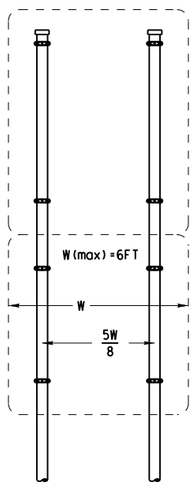
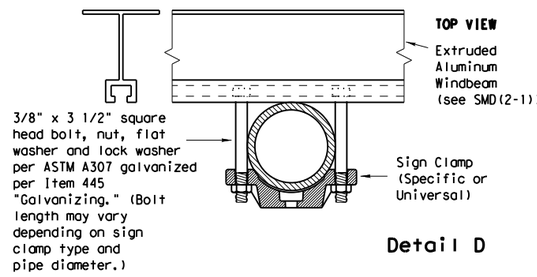
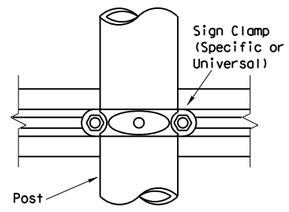


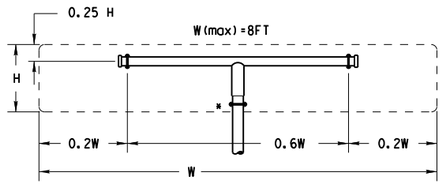
SM RD SGN ASSYM TY XXXXX(2)XX(P)

SIDE VIEW



Detail D

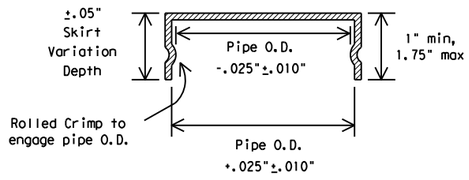




All dimensions are in english unless detailed otherwise.

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.

GENERAL NOTES:

1.

SIGN SUPPORT	# OF POSTS	MAX. SIGN AREA
10 BWG	1	16 SF
10 BWG	2	32 SF
Sch 80	1	32 SF
Sch 80	2	64 SF

2. The Engineer may require that a Schedule 80 post be used in place of a 10 BWG where a sign height is abnormally high due to a fill slope.
3. Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.
4. Aluminum sign blanks shall conform to Departmental Material Specifications DMS-7110 and shall have the following minimum thicknesses: 0.080 for signs less than 7.5 sq. ft., 0.100 for signs 7.5 to 15 sq. ft., and 0.125 for signs greater than 15 sq. ft.
5. Signs that require specific supports due to reasons in addition to windloading are indicated on the "REQUIRED SUPPORT" table on this sheet.
6. For horizontal rectangular signs fabricated from flat aluminum, T-brackets are used for signs 24 inches or less in height. U-brackets are used for signs of greater height.
7. When two triangular slipbase supports are used to support a single sign, they shall not be "rigidly" connected to each other except through the sign panel. This will allow each support to act independently when impacted by an errant vehicle.
8. Wing channel shall meet ASTM A 1011 SS Gr 50 and be galvanized per ASTM A 123.
9. Excess pipe, wing channel, or windbeam shall be cut off so that it does not extend beyond the sign panel (i.e., excess support shall not be visible when the sign is viewed from the front.) Repair galvanized coating at cut support ends per Item 445, "Galvanizing."
10. Additional route markers may be added vertically, provided the total sign area does not exceed the maximum allowable amount per Note 1.
11. Additional sign clamp required on the "T-bracket" post for 24 inch height signs. Place the clamp 3 inches above bottom of sign when possible.
12. Post open ends shall be fitted with Friction Caps.
13. Sign blanks shall be the sizes and shapes shown on the plans.

REQUIRED SUPPORT

	SIGN DESCRIPTION	SUPPORT
Regulatory	48-inch STOP sign (R1-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	60-inch YIELD sign (R1-2)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	48x16-inch ONE-WAY sign (R6-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	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-2)-08

REVISIONS	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
9-08	CONT	SECT	JOB	HIGHWAY
	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		246

DATE: 8/10/2021 1:21:11 PM
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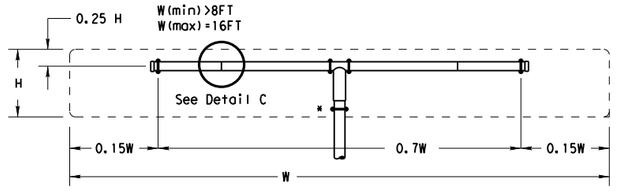
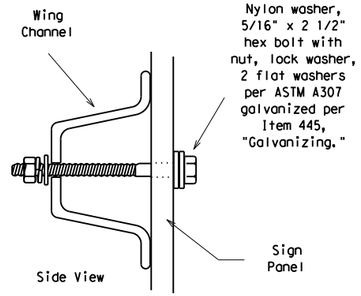
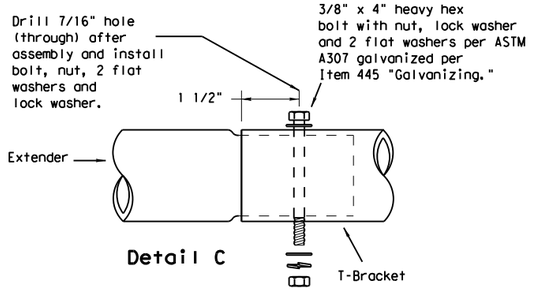


SM RD SGN ASSM TY XXXXX(1)XX(T-2EXT)
(* - See Note 12)



Detail B



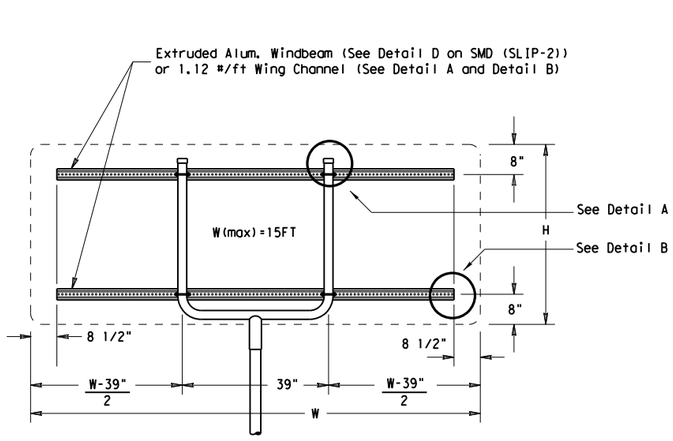
Detail C

Splices shall only be allowed behind the sign substrate.

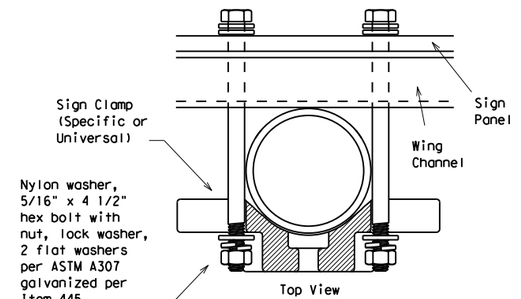
GENERAL NOTES:

SIGN SUPPORT	# OF POSTS	MAX. SIGN AREA
10 BWG	1	16 SF
10 BWG	2	32 SF
Sch 80	1	32 SF
Sch 80	2	64 SF

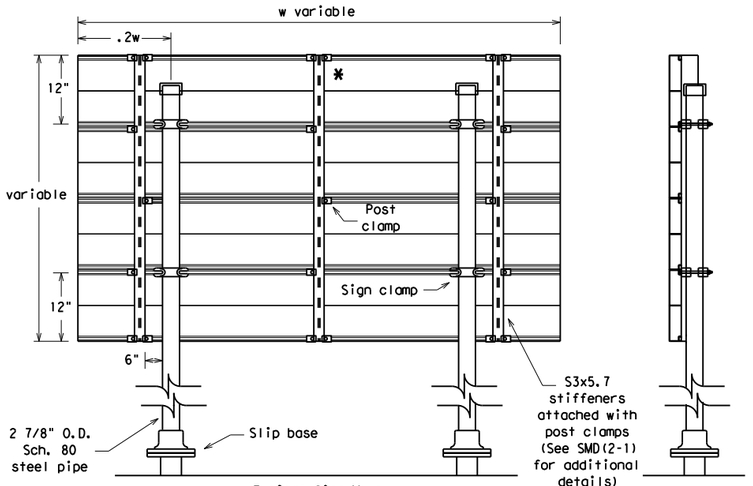
2. The Engineer may require that a Schedule 80 post be used in place of a 10 BWG where a sign height is abnormally high due to a fill slope.
3. Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.
4. Aluminum sign blanks shall conform to Departmental Material Specifications DMS-7110 and shall have the following minimum thicknesses: 0.080 for signs less than 7.5 sq. ft., 0.100 for signs 7.5 to 15 sq. ft., and 0.125 for signs greater than 15 sq. ft.
5. Signs that require specific supports due to reasons in addition to windloading are indicated on the "REQUIRED SUPPORT" table on this sheet.
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. Sign blanks shall be the sizes and shapes shown on the plans.
11. Additional sign clamp required on the "T-bracket" post for 24 inch high signs. Place the clamp 3 inches above bottom of sign when possible.
12. Post open ends shall be fitted with Friction Caps.



SM RD SGN ASSM TY XXXXX(1)XX(U-XX)



Detail A

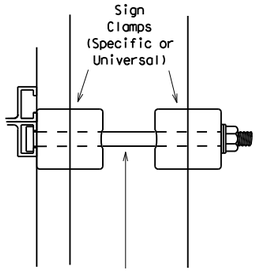


Typical Sign Mount

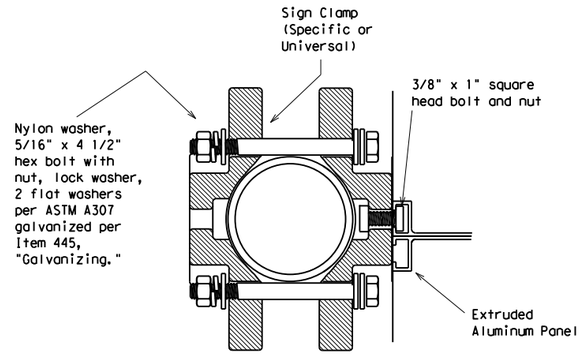
SM RD SGN ASSM TY S80(2)XX(P-EXAL)

* Additional stiffener placed at approximate center of signs when sign width is greater than 10'.

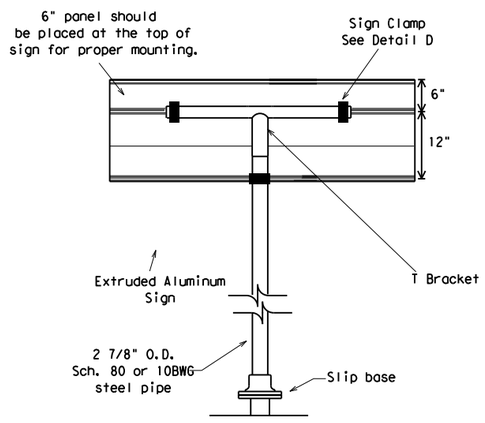
See Detail E
for clamp installation



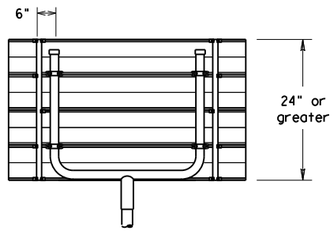
Detail E



Detail D
EXTRUDED ALUMINUM SIGN WITH T BRACKET



Extruded Aluminum Sign
With T Bracket



Use Extruded Alum. Windbeam as stiffeners
See SMD (2-1) for additional details

See Detail E
for clamp installation

REQUIRED SUPPORT

	SIGN DESCRIPTION	SUPPORT
Regulatory	48-inch STOP sign (R1-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	60-inch YIELD sign (R1-2)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	48x16-inch ONE-WAY sign (R6-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	36x48, 48x36, and 48x48-inch signs	TY 10BWG(1)XX(T)
	48x60-inch signs	TY S80(1)XX(T)
Warning	48x48-inch signs (diamond or square)	TY 10BWG(1)XX(T)
	48x60-inch signs	TY S80(1)XX(T)
	48-inch Advance School X-ing sign (S1-1)	TY 10BWG(1)XX(T)
	48-inch School X-ing sign (S2-1)	TY 10BWG(1)XX(T)
	Large Arrow sign (W1-6 & W1-7)	TY 10BWG(1)XX(T)

Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS TRIANGULAR SLIPBASE SYSTEM

SMD(SLIP-3)-08

DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

REVISIONS
9-08

CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

DIST	COUNTY	SHEET NO.
HOU	HARRIS	247

DATE: 8/10/2021 1:21:13 PM
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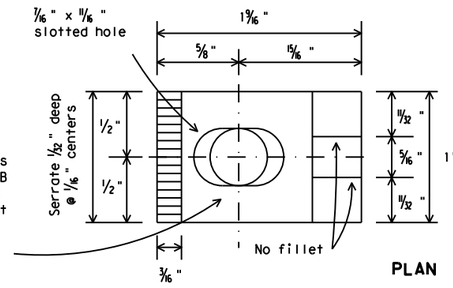
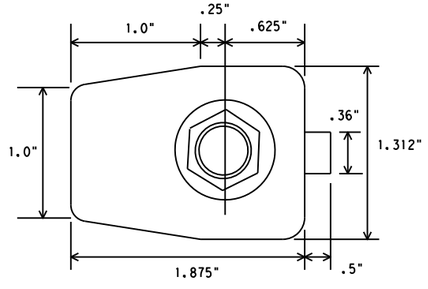
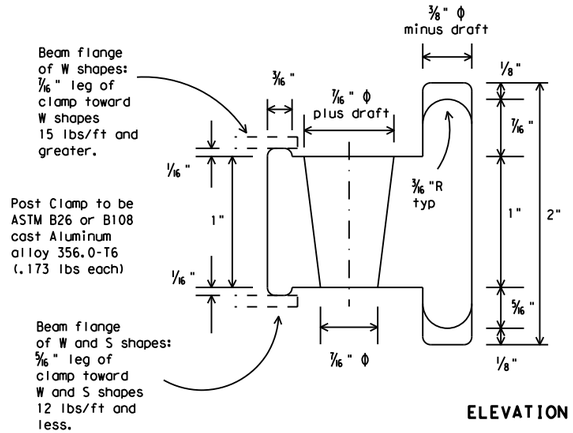
NOTE: centerline of hole for 3/8" diameter squarehead bolt x 2 1/4" long with a flat washer and self-locking nut, or lock washer and hex. nut. Bolt head dimensions shall be in accordance with ANSI B 18.2.1 as referred to in the AISC Manual of steel construction. Bolt assembly shall be galvanized.



PLAN

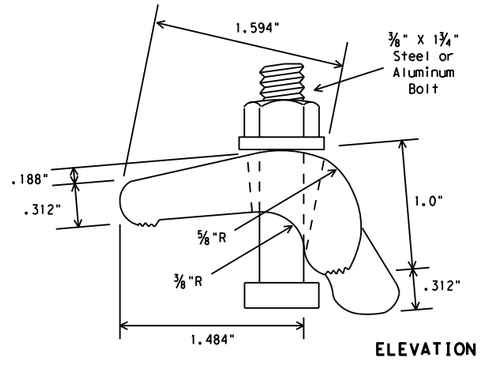


PLAN



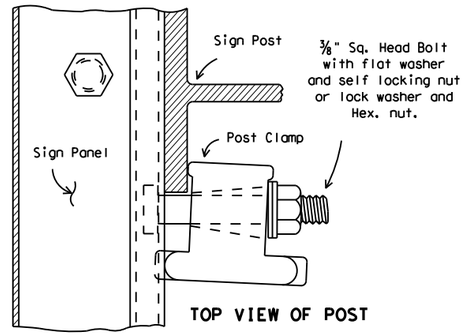
ELEVATION

POST CLAMP DETAIL

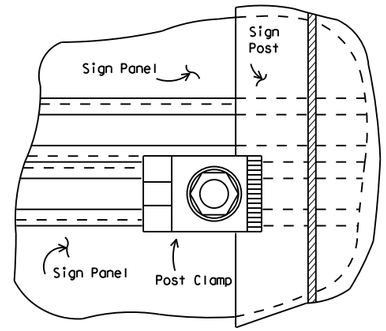


ELEVATION

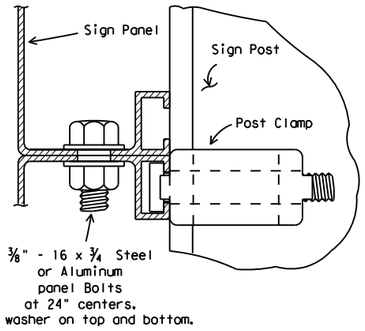
ALTERNATE POST CLAMP DETAIL



TOP VIEW OF POST



TOP VIEW OF CLAMP



SIDE VIEW OF PANELS

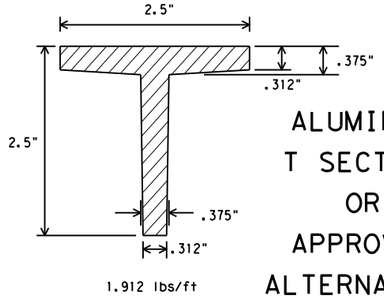
CONNECTION DETAILS

DEPARTMENTAL MATERIAL SPECIFICATIONS

SIGN HARDWARE	DMS-7120

GENERAL NOTES:

1. Design conforms with AASHTO Specifications for the design and construction of structural supports for highway signs.
2. Materials and fabrication shall conform to the requirements of the Department material specifications.
3. Structural steel shall be "low-alloy steel" for non-bridge structures per Item 442, "Metal For Structures."
4. For fiberglass substrate connection details, see manufacturer's recommendations.

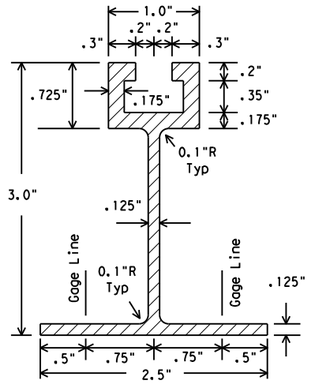


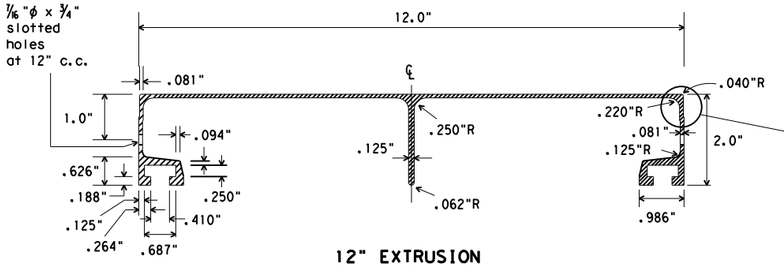
1.912 lbs/ft

ALUMINUM T SECTION OR APPROVED ALTERNATIVE

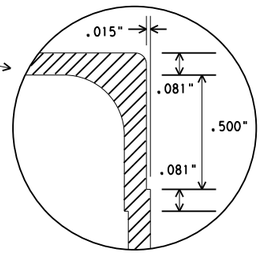
WINDBEAM CROSS SECTION

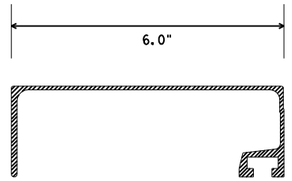
Windbeam to be extruded aluminum (1.175 lbs/ft) or approved alternative





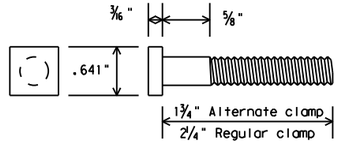
12" EXTRUSION





6" EXTRUSION

ALUMINUM SIGN PANEL EXTRUSION DETAILS



POST CLAMP BOLT DETAIL

Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS- EXTRUDED ALUMINUM SIGN PANELS & HARDWARE

SMD(2-1)-08

DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

REVISIONS	CONT	SECT	JOB	HIGHWAY
9-08	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		248

DATE: 8/10/2021 1:21:16 PM
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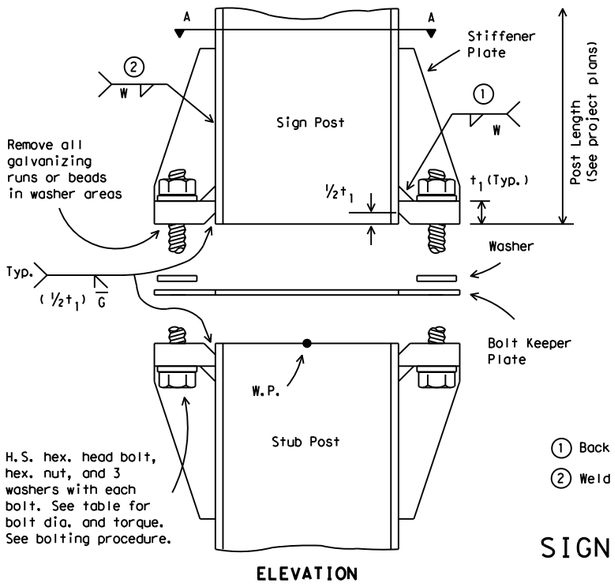
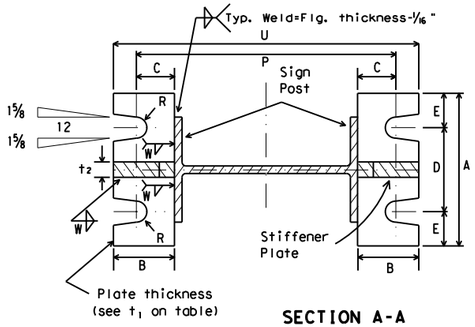
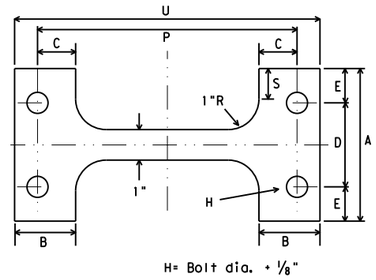


ELEVATION

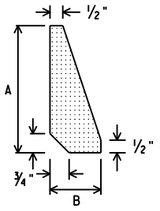


SECTION A-A



H= Bolt dia. + ⅛"

BOLT KEEPER PLATE
30 Ga galv. sheet steel

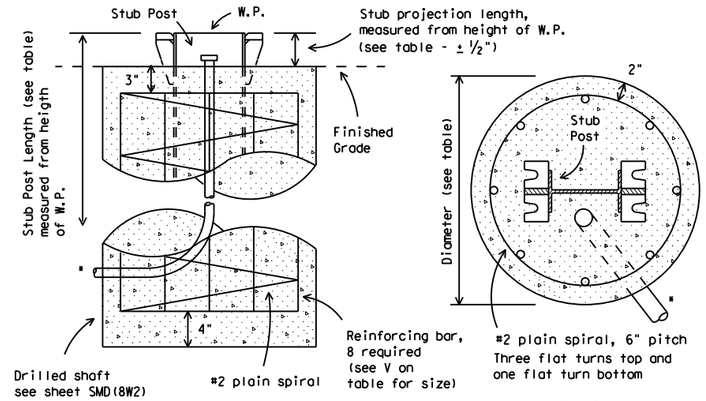


① Back up weld to be made before installing stiffener plate

② Weld W may be continued across clips to seal joint

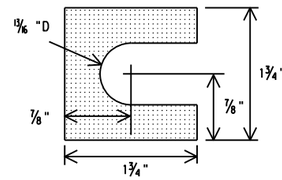
SIGN POST AND STUB POST
(For W Shapes)

STIFFENER PLATE DETAIL
Steel Plate (thickness = t_2)
(See table for dimensions)



ELEVATION PLAN

FOUNDATION DETAIL
*Note: For signs with electrical apparatus, see ED(10) for conduit required in founation.

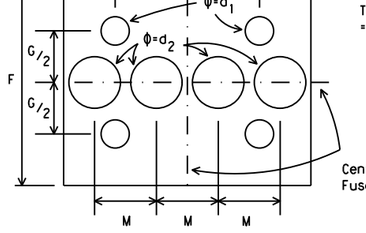


SHIM DETAIL
Furnish two .012"+ thick and two .032"+ thick shims per post. Shims shall be fabricated from brass shim stock or strip conforming to ASTM B36.

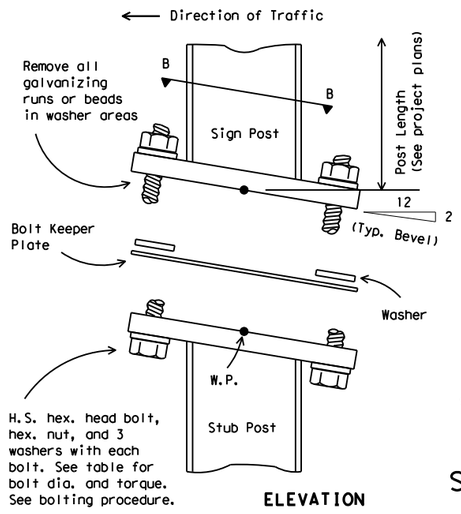
BOLTING PROCEDURE FOR ASSEMBLY OF BASE CONNECTION:
1. Assemble sign post, BOLT KEEPER PLATE and stub post with bolts and three flat washers per bolt as shown.
2. Shim as required to plumb post.
3. Tighten all bolts the maximum possible with a 12 to 15 inch wrench to clean bolt threads and to bed washers and shims.
4. Loosen each bolt in sequence and retighten bolts in a systematic order to the prescribed torque. Do not overtighten.
5. To prevent nut loosening, burr threads of bolt at junction with nut using a center punch.

Dimensions / Post Size	Base Connection Data Table: Bolt Size & Torque	A	B	C	D	E	t_1	t_2	W	R	Perforated Fuse Plate Data Table: F	G	J	K	M	d_1	d_2	t_3	Bolt Dia.	Wt. (ea.) (lbs.)	Bolt length	Bolt Keeper Data: P	S	U	Foundation Data: Stub length	Stub projection	Dr. Shaft diameter	Bar V Size
W6x9	⅝"ϕ x 2¾" 440-450 inch pounds 36-38 foot pounds	5"	2"	1¼"	2¾"	1⅛"	¾"	½"	¼"	11/32"	4¼"	2"	4"	2¼"	1"	9/16"	¾"	¼"	½"	1.01	1½"	8⅜"	1"	9⅞"	2'-0"	3"	24"	#5
W6x12																						8½"		10"	2'-0"	3"		#5
W6x15											5"	2½"	6"	3½"	1½"	11/16"	1¼"	⅜"	⅝"	2.51	2¼"	8½"		10"	2'-6"	3"		#6
W8x18											5"	2½"	5¼"	2¾"	1¼"	11/16"	1 1/16"	⅜"	⅝"	2.26	2¼"	10⅝"		12⅛"	2'-6"	3"		#7
W8x21	¾"ϕ x 3½" 740-750 inch pounds 62-63 foot pounds	6"	2¼"	1⅜"	3½"	1¼"	1"	¾"	5/16"	13/32"	5½"	2½"	5¼"	2¾"	1¼"	13/16"	1"	½"	¾"	3.35	2¼"	11"	1½"	12¾"	3'-0"	2½"		#8
W10x22											6"	3"	5¾"	2¾"	1⅜"	13/16"	1⅛"	½"	¾"	4.03	2¼"	12⅞"		14⅝"	3'-0"	2½"		#9
W10x26																						13⅛"		14⅞"	3'-0"	2½"		#10
W12x26											6"	3"	6½"	3½"	1⅝"	13/16"	1 5/16"	½"	¾"	4.47	2¼"	15"		16¾"	3'-0"	2½"		#11
S3x5.7	½"ϕ x 2½" 440-450 inch pounds 36-38 foot pounds	See Detail Below									3¾"	1½"	2⅝"	1½"	⅝"	9/16"	⅜"	¼"	½"	0.60	1½"	See Detail Below			3'-3½"	3½"	12"	Non-reinforced ③
S4x7.7																												

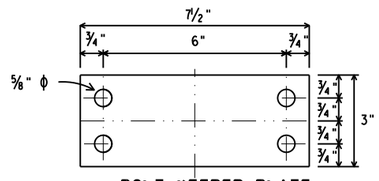
③ Foundation design shall be Type G Mount, see SMD (TY G).



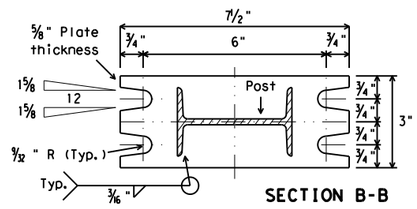
PERFORATED FUSE PLATE DETAIL
Use H.S. hex head bolts, hex head nut and bevel or flat washer (where req'd) under nut. All holes shall be drilled, sub-punched and reamed. All plate cuts shall preferably be saw cuts. However, flame cutting will be permitted provided all edges are ground. Metal projecting beyond the plane of the plate face will not be permitted. Steel fuse plates shall conform to the requirements of ASTM A36. ASTM A572 Grade 50 or ASTM A588 may be substituted for A36 at the option of the fabricator. Mill test reports shall be submitted for Fuse Plates. Steel used shall have an ultimate tensile strength not to exceed 80 KSI. For alternative Fuse Plate contact Traffic Operations Division.



ELEVATION

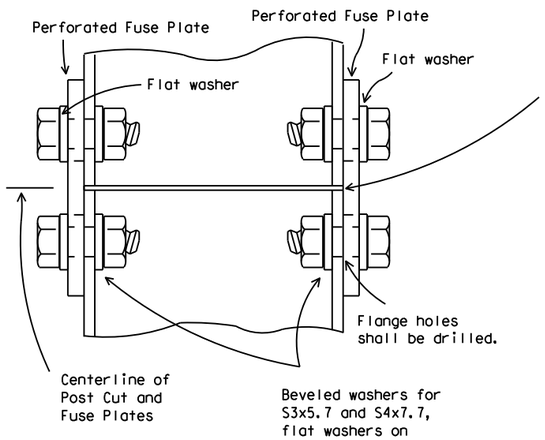


BOLT KEEPER PLATE
30 Ga galv. sheet steel



SECTION B-B

SIGN POST AND STUB POST
(For S4x7.7 and S3x5.7)



DETAIL "A"

Parts shall be saw cut either before galvanizing and the galvanized cut cleaned of zinc build-up, or saw cut after galvanizing and the cut surface repaired per Item 445, "Galvanizing."

Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS- LARGE ROADSIDE SIGNS FOUNDATION & STUB

SMD(2-2)-08

DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

REVISIONS
4-98
9-08

CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

DIST	COUNTY	SHEET NO.
HOU	HARRIS	249

DATE: 8/10/2021 1:21:18 PM
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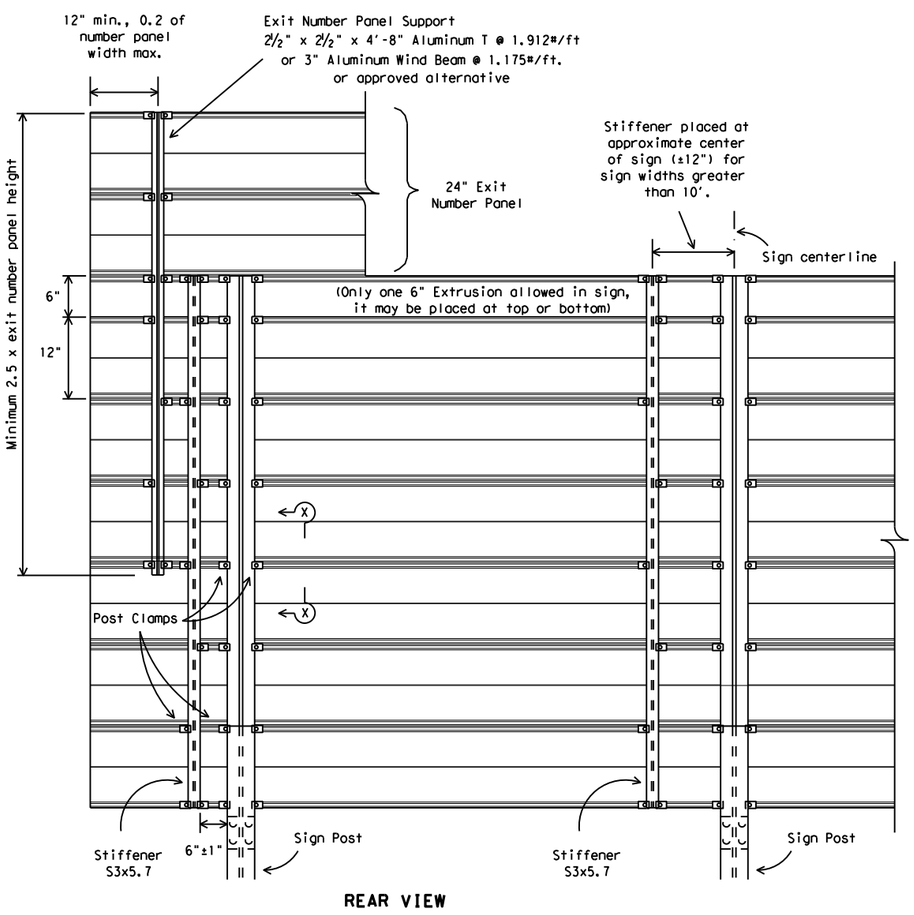
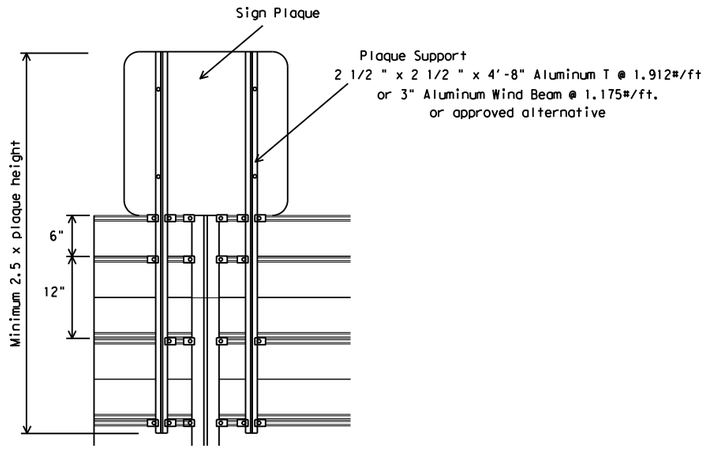
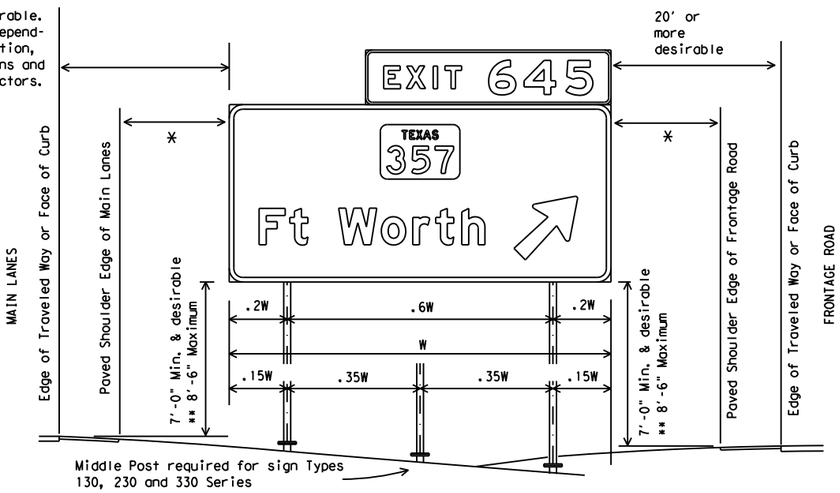


ALUMINUM PARENT SIGN & EXIT NUMBER PANEL MOUNTING DETAILS



SIGN PLAQUE MOUNTING DETAIL TO ALUMINUM PARENT SIGN

30' or more desirable. May be reduced depending on cross section, viewing conditions and other related factors.



TYPICAL SIGN INSTALLATION AND LOCATION

LATERAL CLEARANCE NOTES:

Lateral clearances of signs mounted on median side of main lanes are the same as shown above where space will permit.

Where a sign is to be located behind guardrail, an allowable minimum clearance of five feet may be used, measured from the face of the guardrail to the near edge of sign.

* - 6' minimum and desirable may be used only in areas of limited lateral clearance and when approved by the Engineer.

POST SPACING NOTES:

Post spacing on a two post sign may vary a maximum of plus or minus 10% of total sign width to fit field conditions.

Post spacing on a three post sign may vary a maximum of plus or minus 5% of total sign width to fit field conditions.

SIGN HEIGHT NOTES:

** The 8' 6" maximum may be exceeded when placing signs on extreme slopes. In these conditions, a 7' minimum from natural ground to bottom of sign must be maintained.

DEPARTMENTAL MATERIAL SPECIFICATIONS

ALUMINUM SIGN BLANKS	DMS-7110
SIGN HARDWARE	DMS-7120

GENERAL NOTES:

1. Exit number panel shall be mounted to the right hand side of the parent sign for right exits and to the left hand side for left exits. The number panel shall be mounted with two uprights so its right edge is even with the right edge of the parent sign or vice-versa for left hand exits.
2. Exit number panel support shall be symmetrical about number panel centerline.
3. Exit number panel support shall be ASTM A36 structural steel galvanized after fabrication, or ASTM B221 aluminum alloy 6061-T6 or approved alternative.
4. All bolts, nuts and washers shall be galvanized per ASTM Designation: B695 Class 50, or A153 Class C or D.
5. Posts, parent sign panels, and exit number panels shall comply with notes on sheets SMD(2-1) and SMD(2-2).
6. Signs (such as exit number panels) attached above a parent sign shall be made of the same type material as the parent sign. General Service and Routing signs may be fabricated from flat sheet aluminum.
7. Exit number panel support and other connection hardware required to fasten exit number panel to parent sign shall be subsidiary to "Aluminum Signs" or "Fiberglass Signs."
8. For fiberglass sign installation details, see manufacturer's recommendations.

Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS-LARGE ROADSIDE SIGNS

SMD(2-3)-08

DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

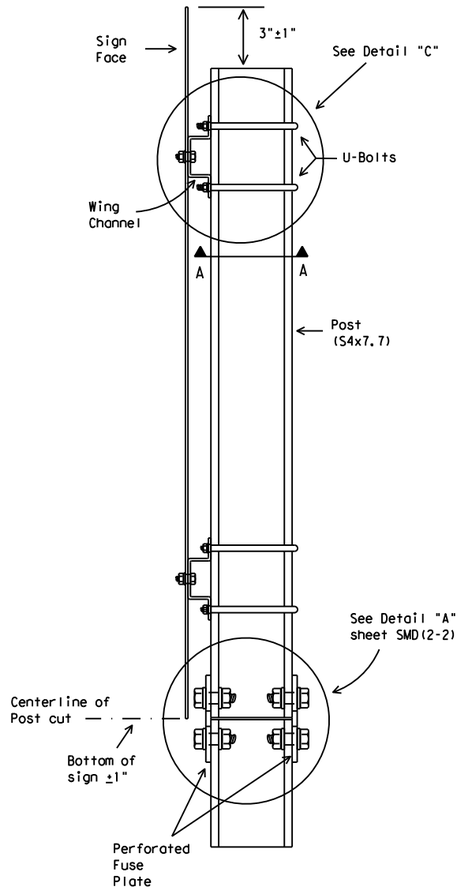
REVISIONS
9-08

CONT.	SECT	JOB	HIGHWAY
0110	05	126	IH 45

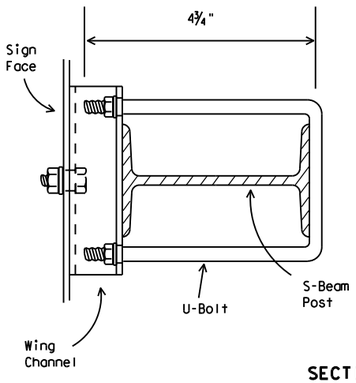
DIST	COUNTY	SHEET NO.
HOU	HARRIS	250

DATE: 8/31/2021 3:52:20 PM
FILE: T:\HUM-AO\Design\Roadway\IH 45\0110-05-126 Cypress Creek\PLAN PDF\6-SIGNING AND PVMT STANDARDS\251 SMD(TY G)-08.dgn

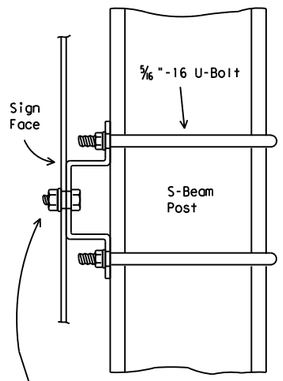
WING CHANNEL CLAMP DETAIL FOR TYPE G MOUNT



SIDE VIEW

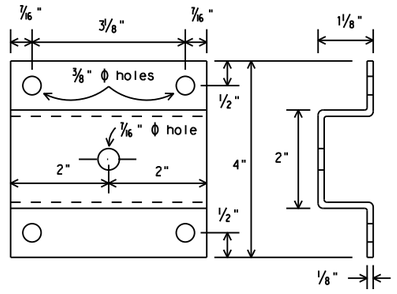


SECTION A-A



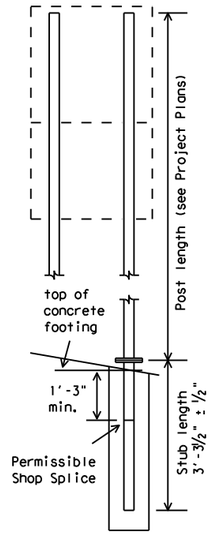
Galvanized steel or aluminum self-locking hex. head nut. 3/8 " - 16 x 3/4 " hex. head bolt for sheet metal. 3/8 " - 16 x 1 1/4 " hex. head bolt for plywood. 3/8 " galvanized medium washer.

DETAIL "C"

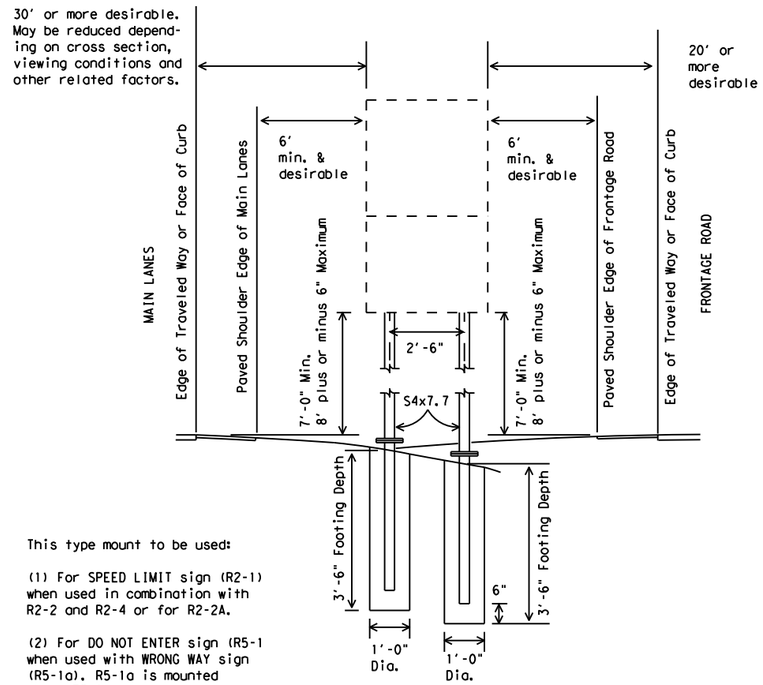


WING CHANNEL

Wing channel, 4" width x 1⅛" depth x ⅛" thickness, shall be aluminum (ASTM B221 6061-T6 or B308 6061-T6), galvanized steel (ASTM A36) or stainless steel (ASTM A167 type 304, No. 2B finish).



The weight of one S4x7.7 post is equal to 112.2 lbs. plus 7.7 lbs./ft x (post length in feet minus 10 ft). The weight of 112.2 lbs. includes 10 feet of post length, post foundation stub, related connection plates, friction fuse plate, and all high strength bolts, nuts and washers.



This type mount to be used:

(1) For SPEED LIMIT sign (R2-1) when used in combination with R2-2 and R2-4 or for R2-2A.

(2) For DO NOT ENTER sign (R5-1 when used with WRONG WAY sign (R5-1a). R5-1a is mounted above R5-1.

DEPARTMENTAL MATERIAL SPECIFICATIONS
SIGN HARDWARE DMS-7120

GENERAL NOTES:

1. Design conforms with AASHTO Specifications for the design and construction of structural supports for highway signs.
2. Materials and fabrication shall conform to the requirements of the Department material specifications.
3. Structural steel shall be "Low-Alloy Steel" for non-bridge structures per Item 442, "Metal For Structures."
4. Parts shall be saw cut either before galvanizing and the galvanized cut cleaned of zinc build-up, or saw cut after galvanizing and the cut surface repaired per Item 445, "Galvanizing." (Cut surface will not be treated until plate is installed and all bolts fully tightened.)

Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS, TYPE G SUPPORT

SMD(TY G)-08

DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

REVISIONS
1-97
9-08

CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45
DIST	COUNTY		SHEET NO.
HOU	HARRIS		251

DATE: 8/31/2021 3:51:50 PM
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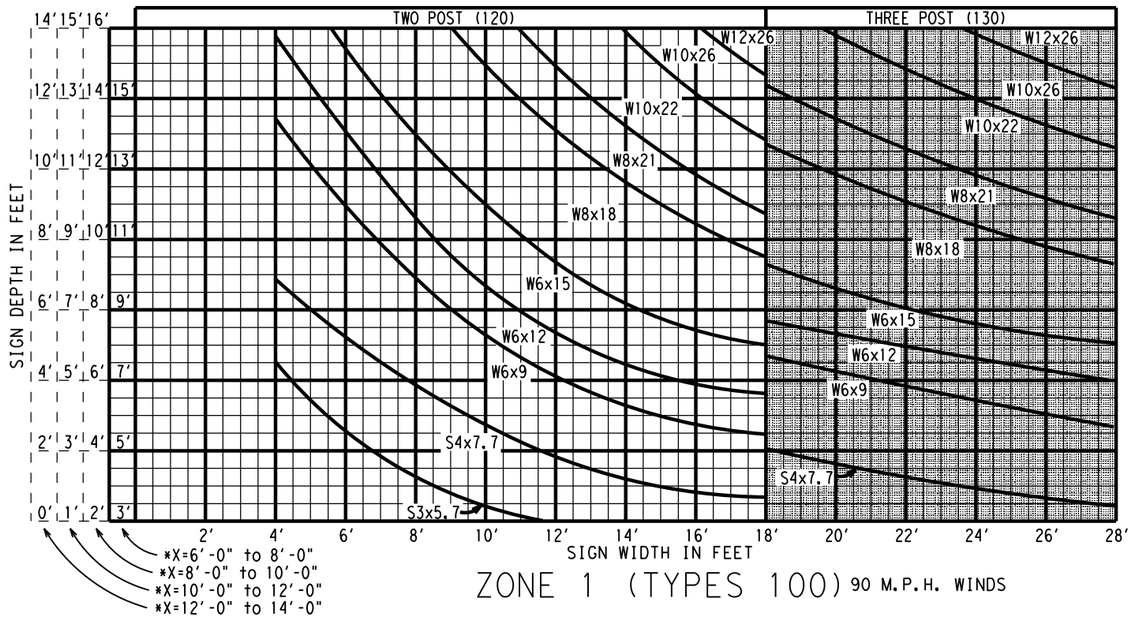
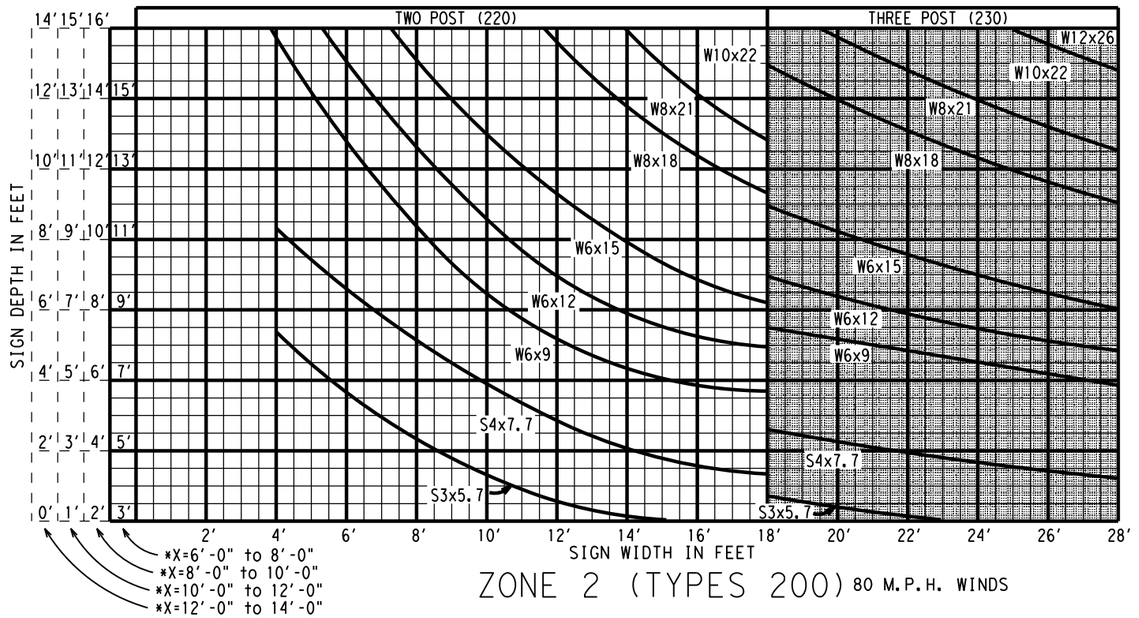
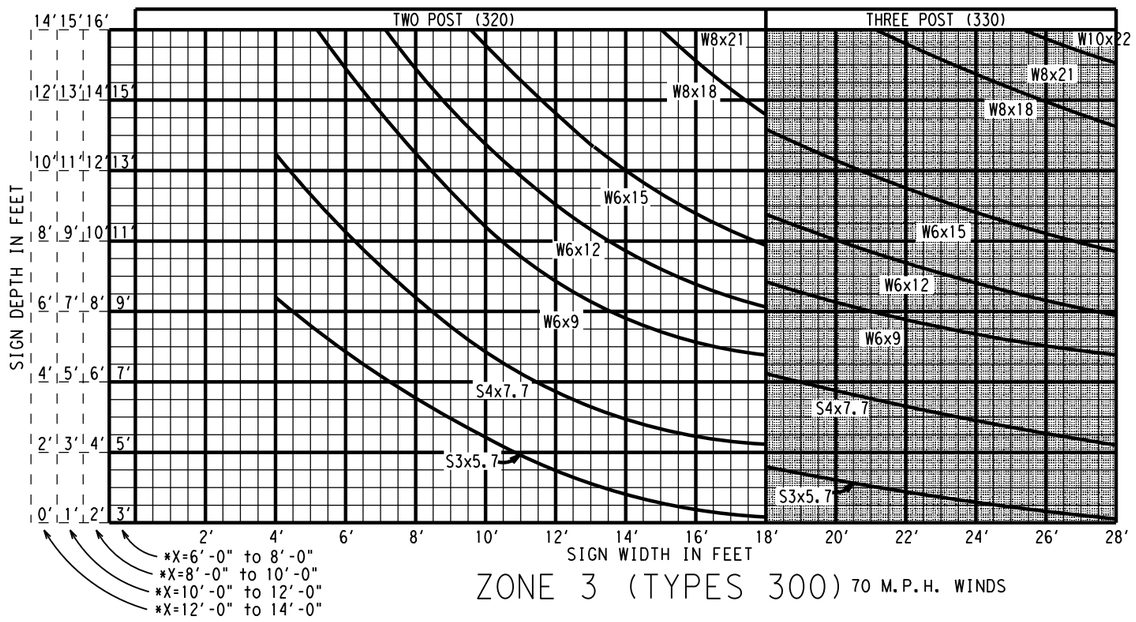


ZONE 1 (TYPES 100) 90 M.P.H. WINDS



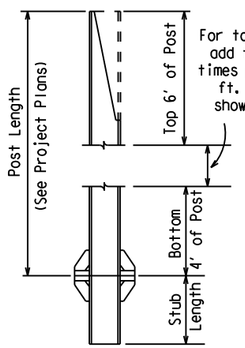
ZONE 2 (TYPES 200) 80 M.P.H. WINDS



ZONE 3 (TYPES 300) 70 M.P.H. WINDS

* NOTE: "X" EQUALS THE AVERAGE HEIGHT FROM THE GROUND LINE TO THE BOTTOM EDGE OF THE SIGN.

SHADED AREA DENOTES 3 POST SUPPORTS



POST WEIGHT DATA

POST SIZE	WEIGHT OF ONE POST (#)	WEIGHT OF TWO POSTS (#)	WEIGHT OF THREE POSTS (#)
W6x9*	123.2	246.4	369.6
W6x12*	160.3	320.6	480.9
W6x15*	167.8	335.6	503.4
W8x18*	201.8	403.6	605.4
W8x21*	254.7	509.4	764.1
W10x22*	266.0	532.0	798.0
W10x26*	308.0	616.0	924.0
W12x26*	308.6	617.2	925.8
S3x5.7*	85.9	171.8	257.7
S4x7.7*	112.2	224.4	336.6

*LAST FIGURES=POST WT. PER FT.

Weight Data is the weight of items shown for one, two or three posts - (includes top 6' of post, bottom 4' of post, post foundation stub, related base connection plates and stiffeners, friction fuse plate and all high strength bolts, nuts and washers).

SIGN TYPE

SIGN TYPE 1 3 0
- 1 = Wind Design Zone
- 3 = Series No.
- 0 = Aluminum/Fiberglass
- 1 = Aluminum
- 2 = Fiberglass
- 0 = No. of Posts

Note: Footings for S3x5.7 and S4x7.7 post sizes shall be non-reinforced with Class A concrete, while footing for all other post sizes shall be reinforced with Class C concrete.

Texas Department of Transportation
Traffic Operations Division

LARGE ROADSIDE SIGN SUPPORTS
POST SELECTION
WORKSHEET
SMD(8W1)-08

DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

REVISIONS
1-82
5-01
9-08

CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45
DIST	COUNTY		SHEET NO.
HOU	HARRIS		252

DATE: 8/31/2021 3:50:59 PM
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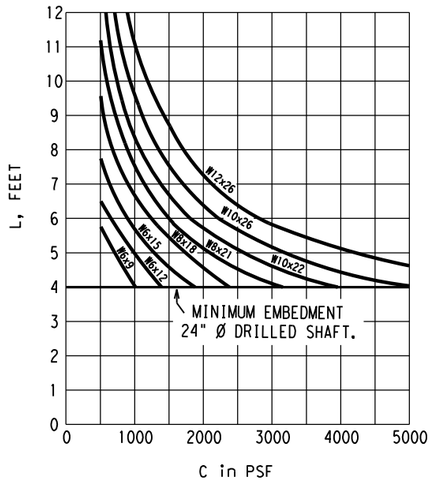
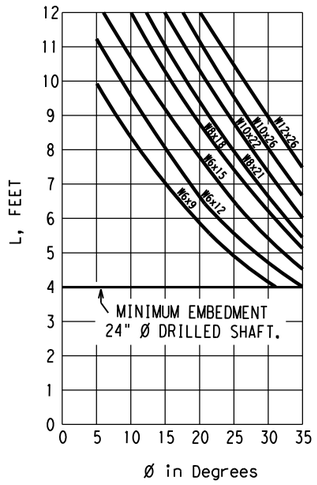
I



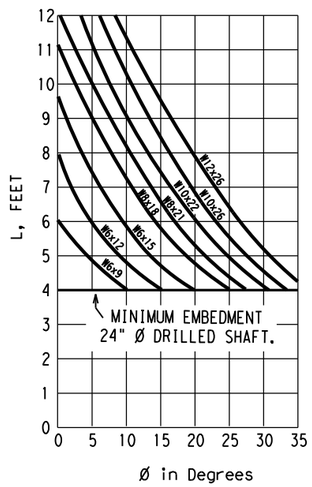
Ø = 0 Degrees

II



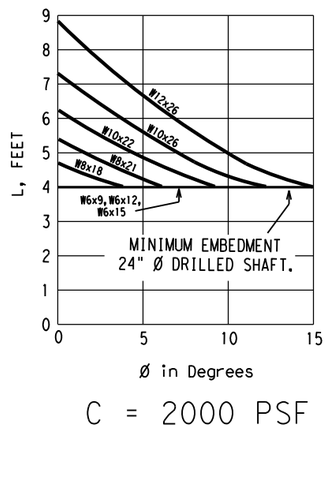
C = 0 PSF

III



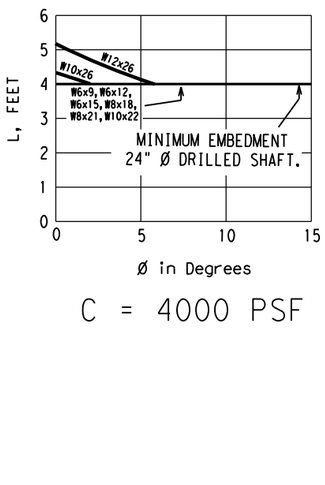
C = 500 PSF

IV



C = 2000 PSF

V



C = 4000 PSF

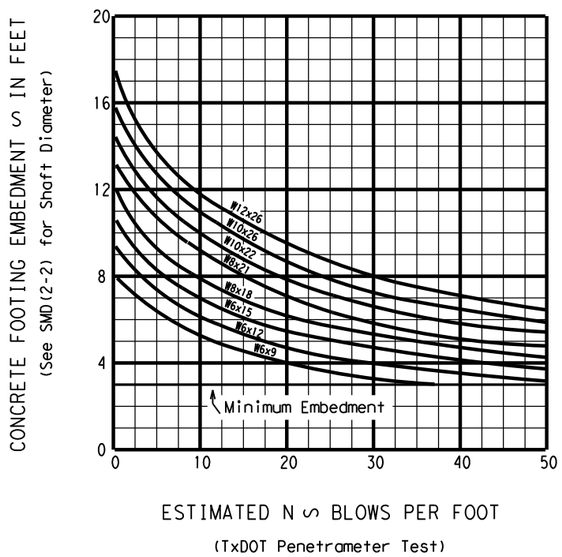
DRILLED CONCRETE FOOTING DEPTH CHART
(COHFRIC DESIGN)

NOTE: THESE CHARTS MAY BE USED AS AN ALTERNATE TO THE CHART BELOW, PROVIDED THAT SOIL COHESION AND INTERNAL FRICTION (COHFRIC) DATA ARE AVAILABLE.

LEGEND:

L = Required embedment of concrete drilled shaft, in feet
C = Cohesive shear strength of soil, in psf
Ø = Angle of internal friction of soil, in degrees

For values of C and Ø which are intermediate to those on the charts, embedments may be determined by straight - line interpolation.



DRILLED CONCRETE FOOTING DEPTH CHART
(TxDOT PENETROMETER DESIGN)

NOTE: ESTIMATED N SHOULD BE BASED AT APPROXIMATELY THE UPPER ONE-THIRD POINT OF THE DRILLED CONCRETE FOOTING BELOW THE GROUND LINE

Note:
1. Curves shown on this sheet are applicable for reinforced concrete footings only.

Texas Department of Transportation
Traffic Operations Division

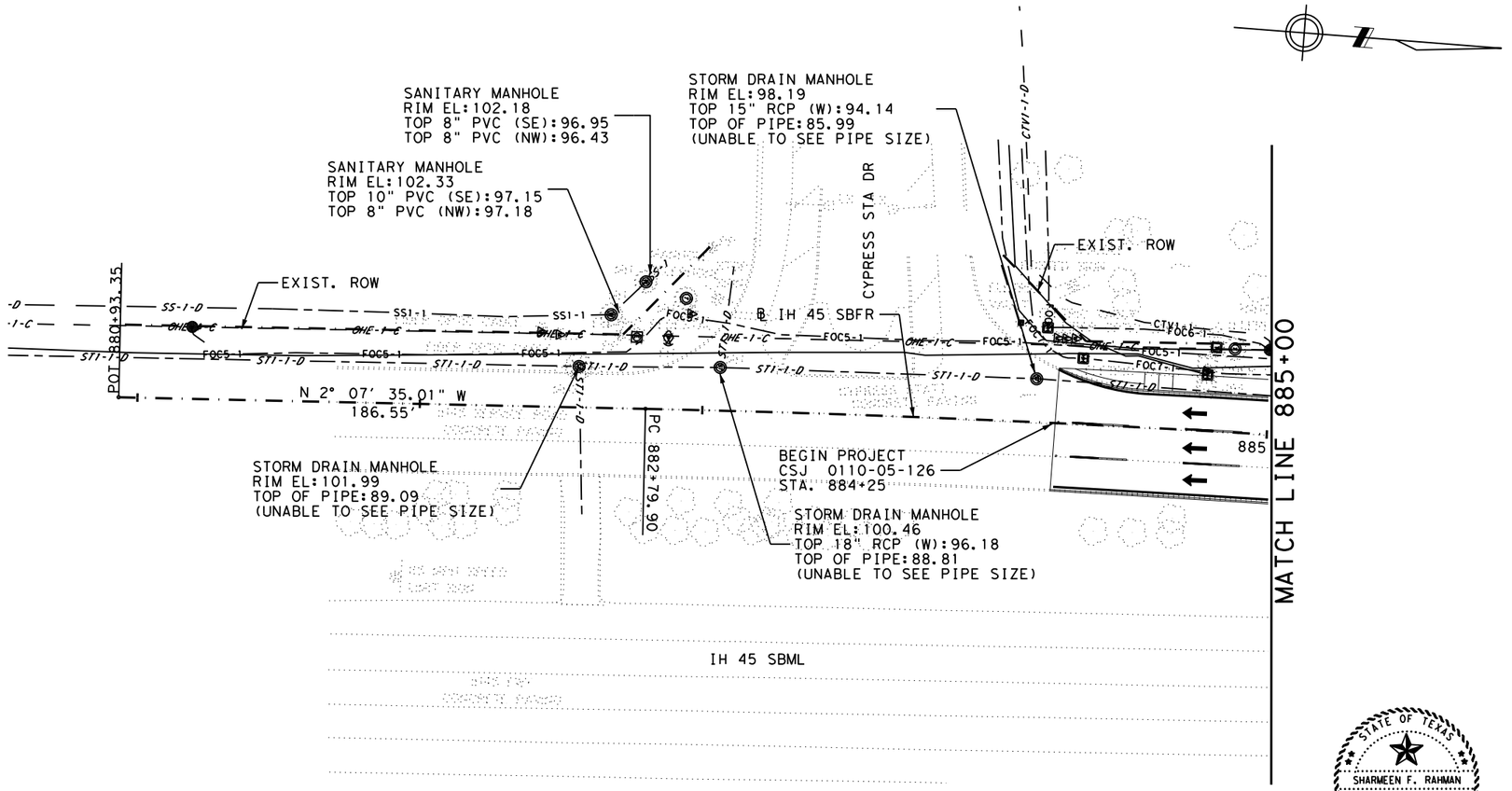
LARGE ROADSIDE SIGN SUPPORTS
FOUNDATION
WORKSHEET
SMD(8W2)-08

REVISIONS
5-74
4-78
9-08

DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

DIST	COUNTY	SHEET NO.
HOU	HARRIS	253



LEGEND

FOC1-1	ATT FOC
T1-1	ATT TELEPHONE
FOC2-1	COMCAST FOC
CTV1-1	COMCAST CTV
FOC3-1	ICTX
	LEVEL 3
FOC5-1	PURESPEED LIGHTWAVE
FOC6-1	PHONOSCOPE
FOC7-1	MCI
G-1	CNP GAS
	CNP ELECTRIC
OHE-1-C	CNP OH ELECTRIC
W-1	NORTH PARK PUD WATER
W1-1	UNKNOWN WATER

	SANITARY MANHOLE
	TELEPHONE MARKER
	TELEPHONE HAND HOLE
	TELEPHONE PEDESTAL
	TELEPHONE MANHOLE
	POWER POLE W RISER
	ELECTRIC METER
	POWER POLE
	ELECTRIC PULL BOX
	STORM DRAIN MANHOLE
	DROP INLET
	WATER METER
	IRRIGATION CONTROL VALVE
	HYDRANT
	WATER VALVE
WVB	WATER VAULT BOX

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED PROFESSIONAL ENGINEER

Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

UTILITY LAYOUT

SCALE: HORIZ. 1"= 50

SHEET 1 OF 5

FED. RD. DIV. NO.	PROJECT NO.	SHEET NO.
6		254

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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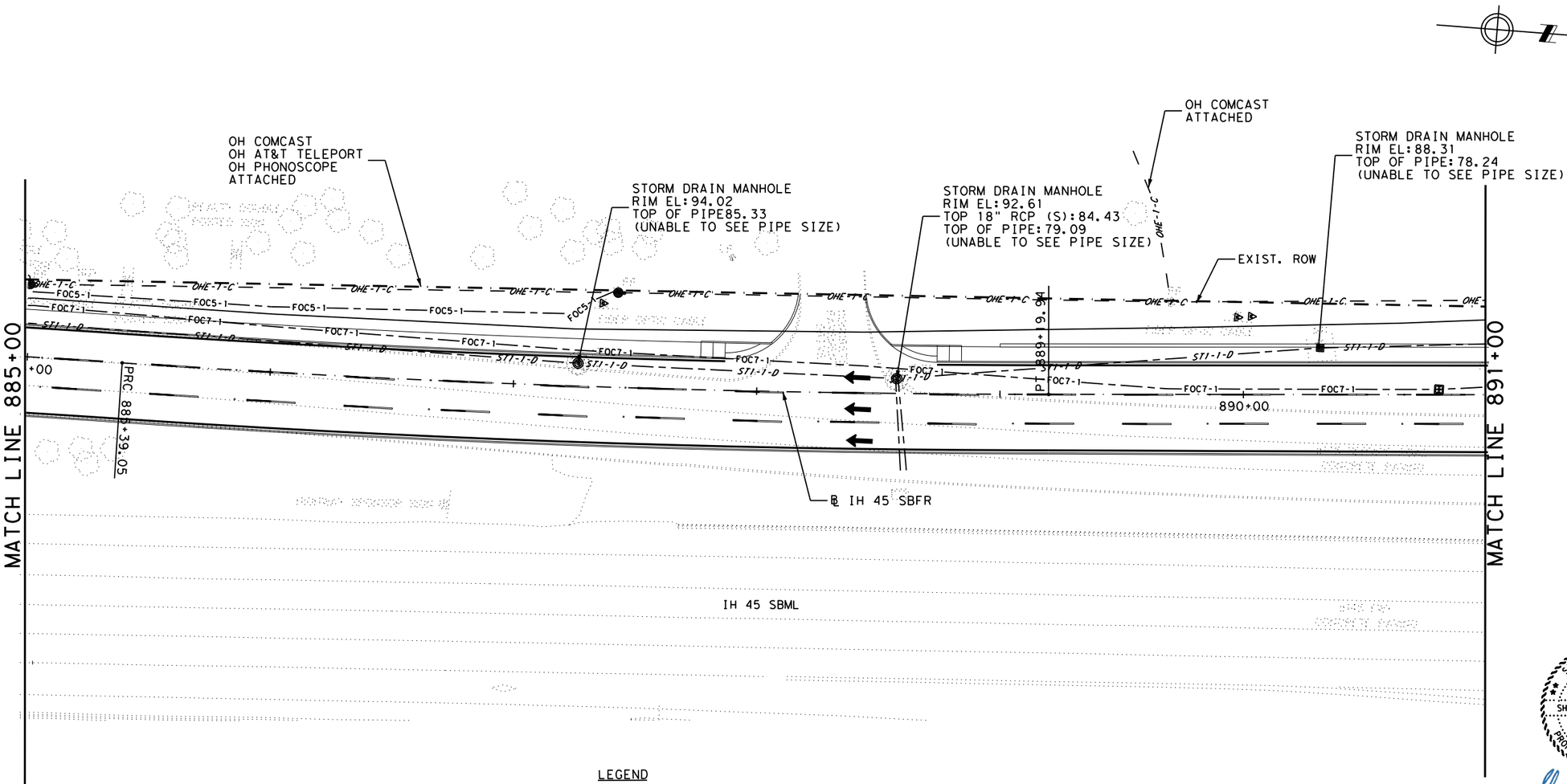

LEGEND

FOC1-1	ATT FOC
T1-1	ATT TELEPHONE
FOC2-1	COMCAST FOC
CTV1-1	COMCAST CTV
FOC3-1	ICTX
	LEVEL 3
FOC5-1	PURESPEED LIGHTWAVE
FOC6-1	PHONOSCOPE
FOC7-1	MCI
G-1	CNP GAS
	CNP ELECTRIC
OHE-1-C	CNP OH ELECTRIC
W-1	NORTH PARK PUD WATER
W1-1	UNKNOWN WATER

	SANITARY MANHOLE
	TELEPHONE MARKER
	TELEPHONE HAND HOLE
	TELEPHONE PEDESTAL
	TELEPHONE MANHOLE
	POWER POLE W RISER
	ELECTRIC METER
	POWER POLE
	ELECTRIC PULL BOX
	STORM DRAIN MANHOLE
	DROP INLET
	WATER METER
	IRRIGATION CONTROL VALVE
	HYDRANT
	WATER VALVE
WVB	WATER VAULT BOX

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED
PROFESSIONAL ENGINEER

Sharmeen Rahman, P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

UTILITY LAYOUT

SCALE: HORIZ. 1"= 50

SHEET 2 OF 5

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		255

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

9/28/2021 10:42:15 AM
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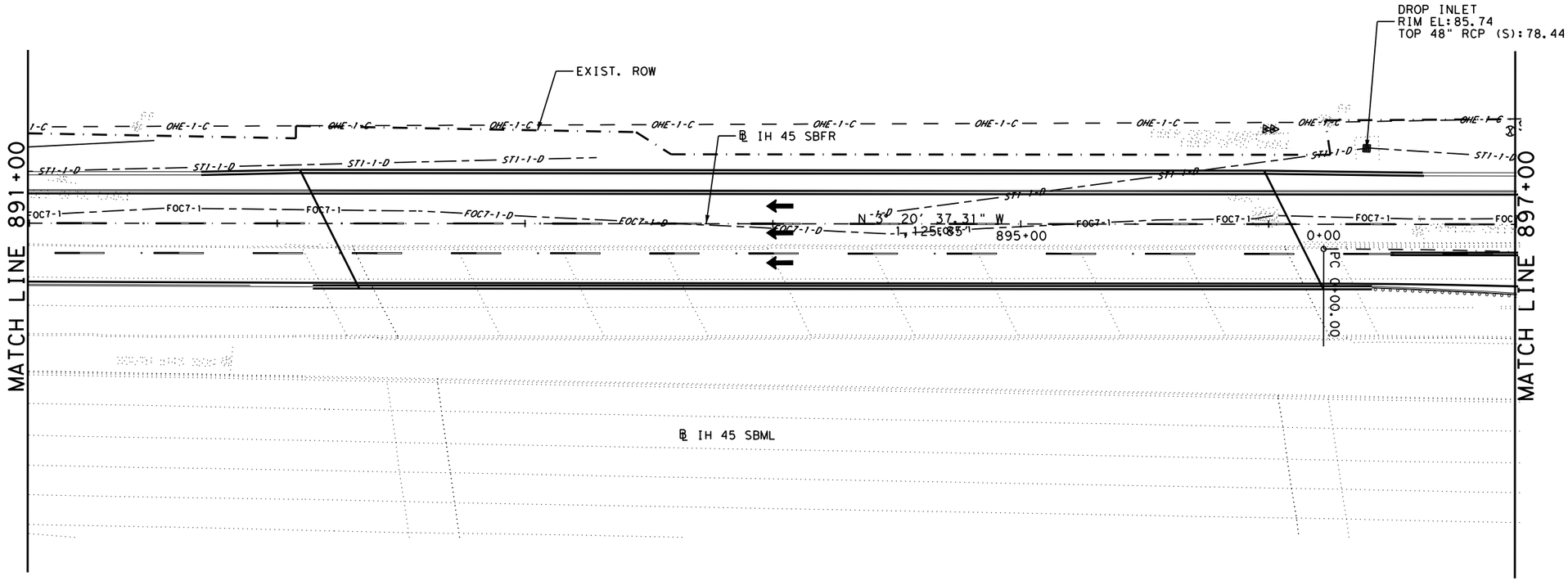

LEGEND

FOC1-1	ATT FOC
T1-1	ATT TELEPHONE
FOC2-1	COMCAST FOC
CTV1-1	COMCAST CTV
FOC3-1	ICTX
	LEVEL 3
FOC5-1	PURESPEED LIGHTWAVE
FOC6-1	PHONOSCOPE
FOC7-1	MCI
G-1	CNP GAS
	CNP ELECTRIC
OHE-1-C	CNP OH ELECTRIC
W-1	NORTH PARK PUD WATER
W1-1	UNKNOWN WATER

	SANITARY MANHOLE
	TELEPHONE MARKER
	TELEPHONE HAND HOLE
	TELEPHONE PEDESTAL
	TELEPHONE MANHOLE
	POWER POLE W RISER
	ELECTRIC METER
	POWER POLE
	ELECTRIC PULL BOX
	STORM DRAIN MANHOLE
	DROP INLET
	WATER METER
	IRRIGATION CONTROL VALVE
	HYDRANT
	WATER VALVE
WVB	WATER VAULT BOX

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED
PROFESSIONAL ENGINEER

Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

UTILITY LAYOUT

SCALE: HORIZ. 1"= 50

SHEET 3 OF 5

FED. RD. DIV. NO.	PROJECT NO.	SHEET NO.
6		256

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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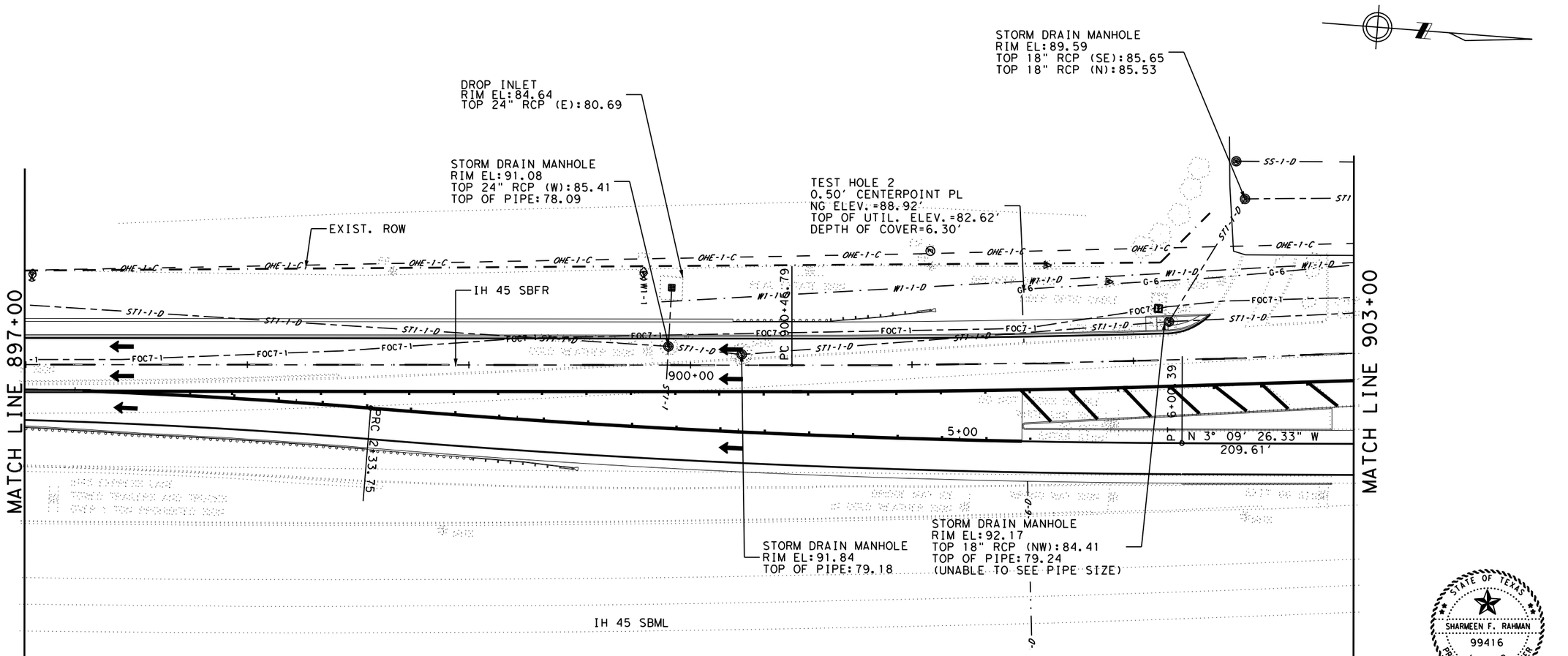

LEGEND

FOC1-1	ATT FOC
T1-1	ATT TELEPHONE
FOC2-1	COMCAST FOC
CTV1-1	COMCAST CTV
FOC3-1	ICTX
	LEVEL 3
FOC5-1	PURESPEED LIGHTWAVE
FOC6-1	PHONOSCOPE
FOC7-1	MCI
G-1	CNP GAS
	CNP ELECTRIC
OHE-1-C	CNP OH ELECTRIC
W-1	NORTH PARK PUD WATER
W1-1	UNKNOWN WATER

	SANITARY MANHOLE
	TELEPHONE MARKER
	TELEPHONE HAND HOLE
	TELEPHONE PEDESTAL
	TELEPHONE MANHOLE
	POWER POLE W RISER
	ELECTRIC METER
	POWER POLE
	ELECTRIC PULL BOX
	STORM DRAIN MANHOLE
	DROP INLET
	WATER METER
	IRRIGATION CONTROL VALVE
	HYDRANT
	WATER VALVE
WVB	WATER VAULT BOX

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED PROFESSIONAL ENGINEER

Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

UTILITY LAYOUT

SCALE: HORIZ. 1"= 50

SHEET 4 OF 5

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		257

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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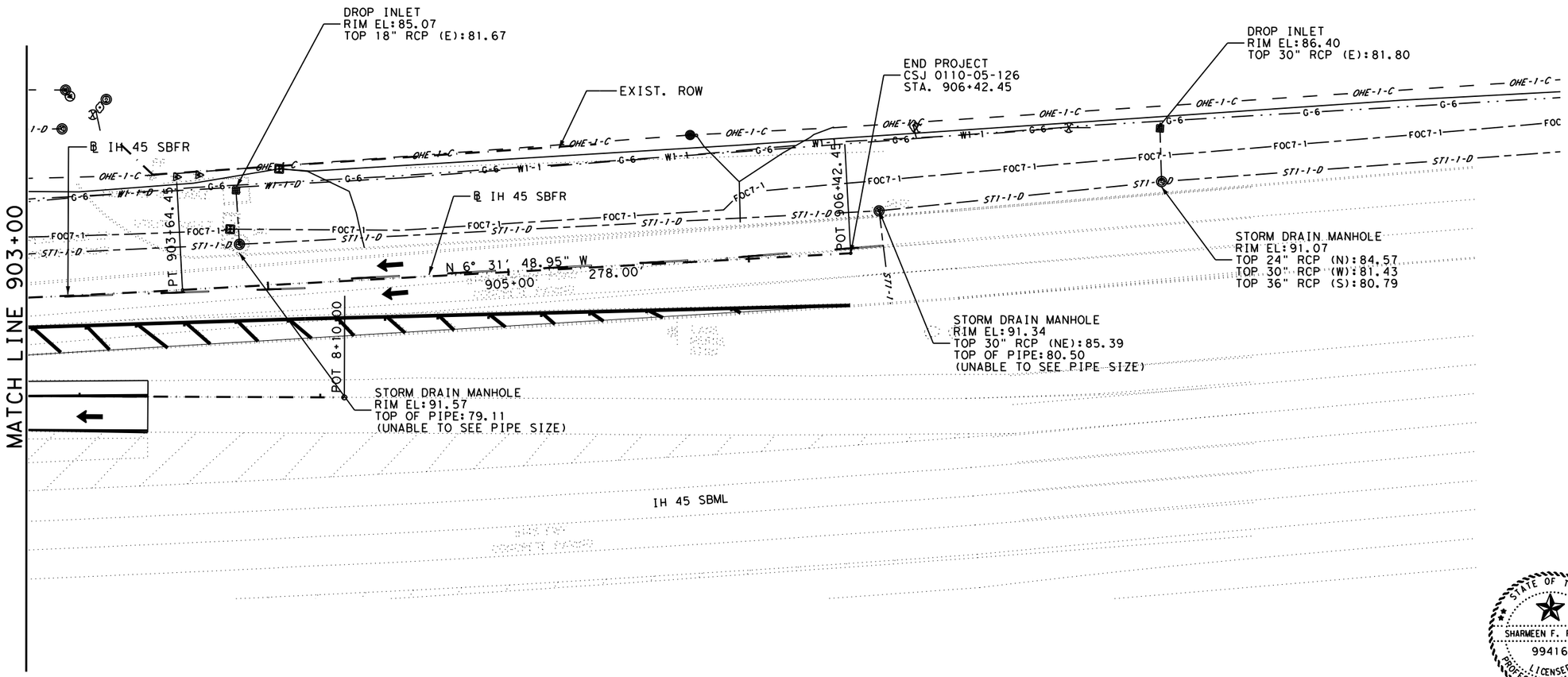

LEGEND

FOC1-1	ATT FOC		SANITARY MANHOLE
T1-1	ATT TELEPHONE		TELEPHONE MARKER
FOC2-1	COMCAST FOC		TELEPHONE HAND HOLE
CTV1-1	COMCAST CTV		TELEPHONE PEDESTAL
FOC3-1	ICTX		TELEPHONE MANHOLE
	LEVEL 3		POWER POLE W RISER
FOC5-1	PURESPEED LIGHTWAVE		ELECTRIC METER
FOC6-1	PHONOSCOPE		POWER POLE
FOC7-1	MCI		ELECTRIC PULL BOX
G-1	CNP GAS		STORM DRAIN MANHOLE
	CNP ELECTRIC		DROP INLET
OHE-1-C	CNP OH ELECTRIC		WATER METER
W-1	NORTH PARK PUD WATER		IRRIGATION CONTROL VALVE
W1-1	UNKNOWN WATER		HYDRANT
			WATER VALVE
		WVB	WATER VAULT BOX

STATE OF TEXAS
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99416
LICENSED
PROFESSIONAL ENGINEER

Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

UTILITY LAYOUT

SCALE: HORIZ. 1"= 50

SHEET 5 OF 5

FED.RD. DIV.NO.	PROJECT NO.		SHEET NO.
6			258
STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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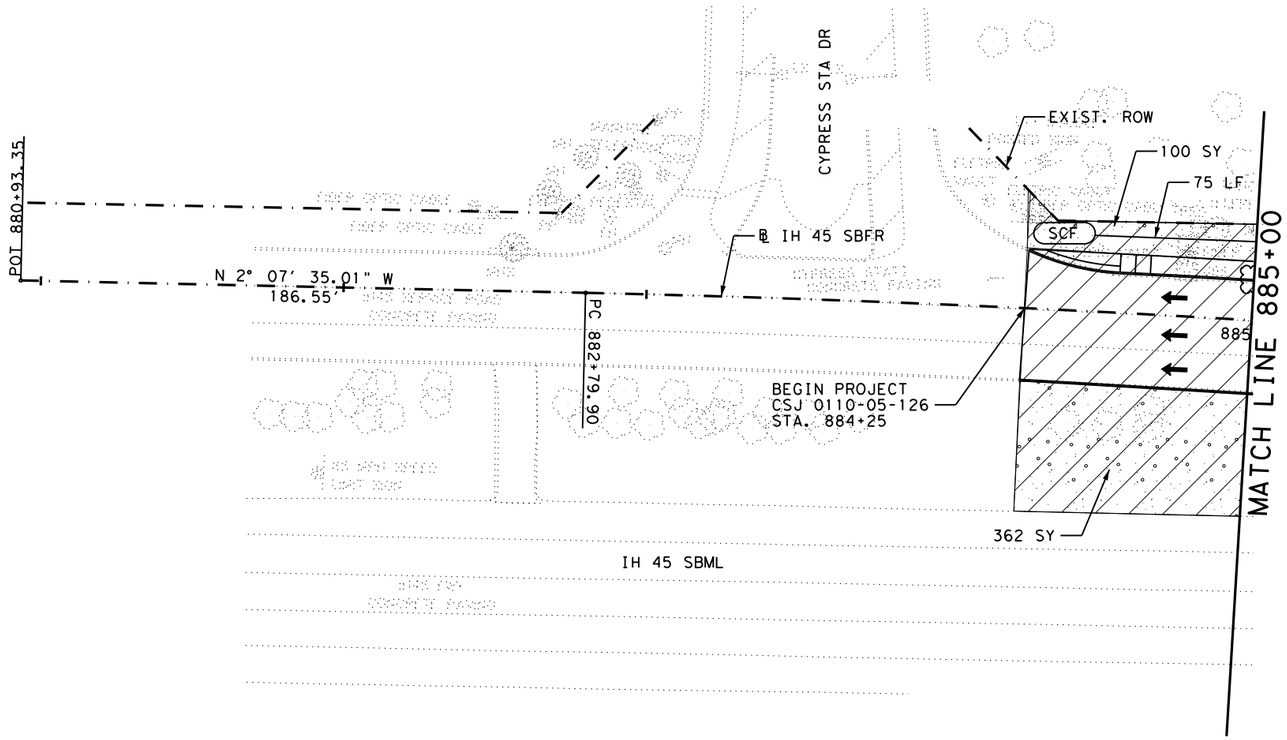

NOTES:

1. REFER TO FERTILIZER, SEED, SOD, STRAW, COMPOST AND WATER STANDARD FOR DRILL SEED, STRAW OR HAY MULCH REQUIREMENTS. ONCE THE PROPSOED PAVEMENT IS COMPLETE, A PERMANENET SEEDING OR SODDING SHOULD BE IN PLACE.

2. CONSTRUCTION EXITS SHALL BE PLACED AT THE CONTRACTOR'S DISCRETION.

LEGEND:

- EROSION CONTROL LOGS (ECL)
- SCF — SEDIMENT CONTROL FENCE
- RFD — ROCK FILTER DAM
- DRILL SEED
- DISTURBED AREA
- DIRECTION OF FLOW

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED
PROFESSIONAL ENGINEER

Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

SWP3 LAYOUT

SCALE: HORIZ. 1"= 50

SHEET 1 OF 5

FED.RD. DIV.NO.	PROJECT NO.		SHEET NO.
6			259
STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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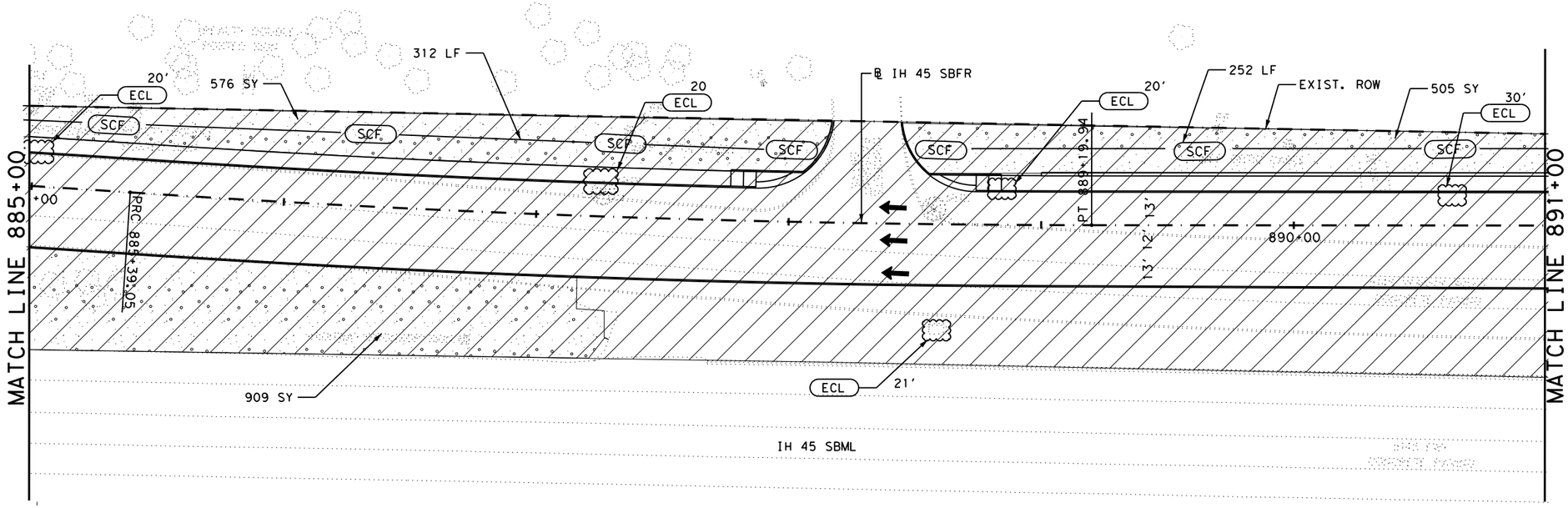

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- DRILL SEED
- DISTURBED AREA
- DIRECTION OF FLOW

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED PROFESSIONAL ENGINEER

Sharmeen Rahman, P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

SWP3 LAYOUT

SCALE: HORIZ. 1"= 50

SHEET 2 OF 5

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		260

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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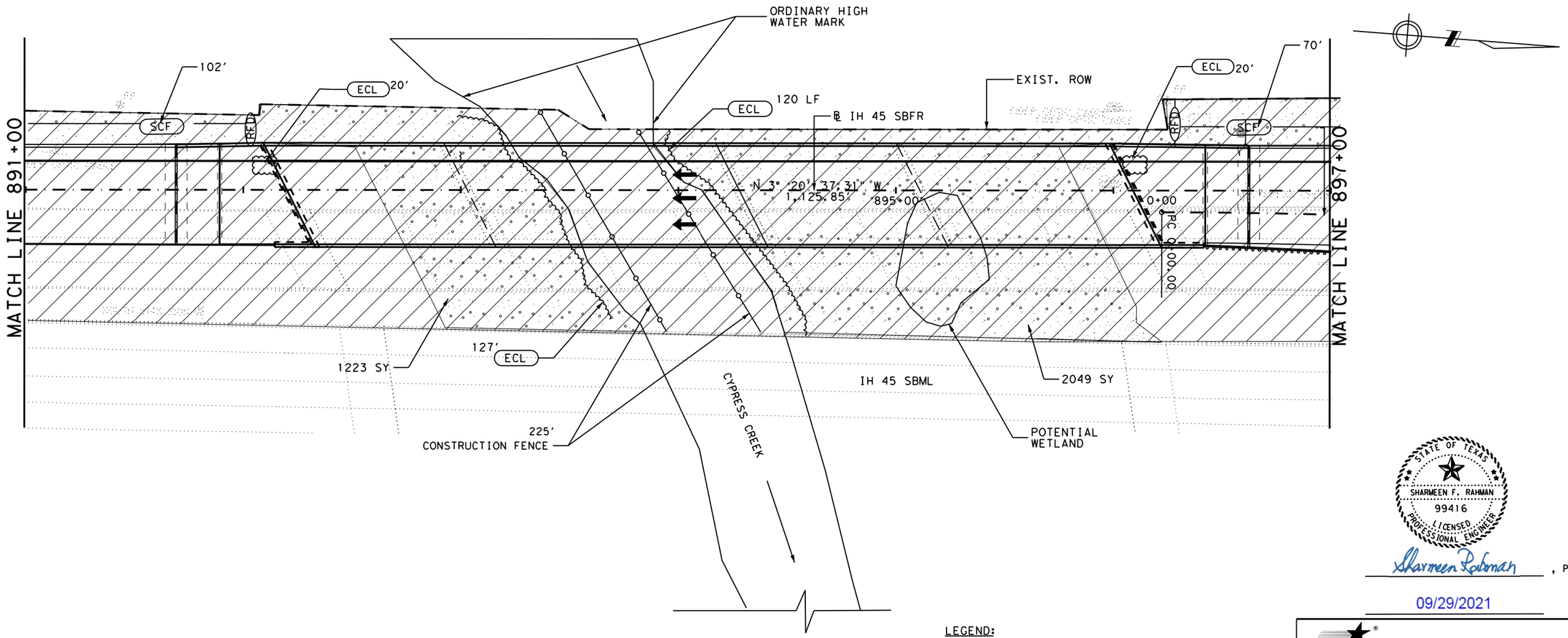

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- DRILL SEED
- DISTURBED AREA
- DIRECTION OF FLOW

STATE OF TEXAS
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99416
LICENSED PROFESSIONAL ENGINEER

Sharmeen Rahman, P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

SWP3 LAYOUT

SCALE: HORIZ. 1"= 50

SHEET 3 OF 5

FED.RD. DIV.NO.	PROJECT NO.		SHEET NO.
6			261
STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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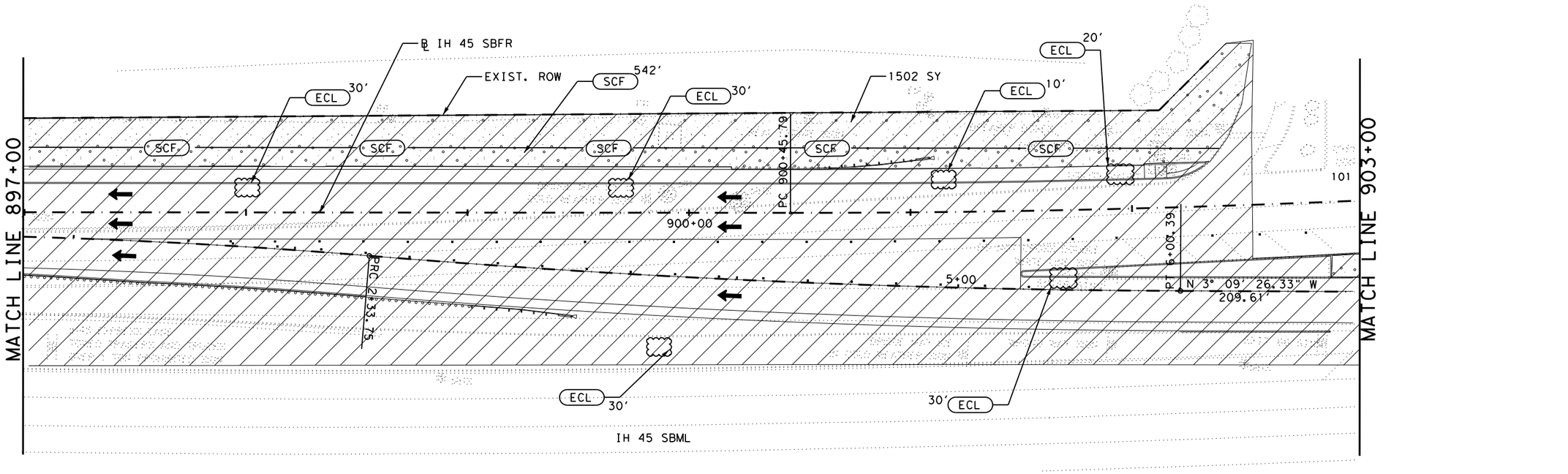

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- DISTURBED AREA
- DIRECTION OF FLOW

STATE OF TEXAS
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99416
LICENSED
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Sharmeen Rahman, P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

SWP3 LAYOUT

SCALE: HORIZ. 1"= 50

SHEET 4 OF 5

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		262

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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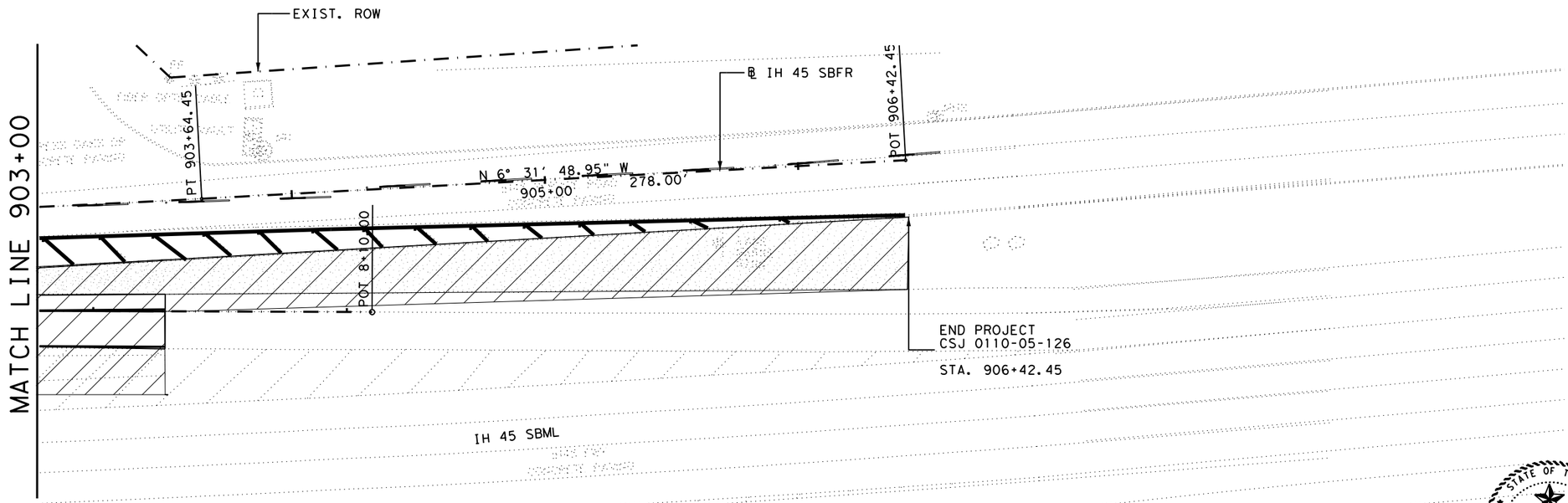

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- DIRECTION OF FLOW

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED
PROFESSIONAL ENGINEER

Sharmeen Rahman, P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

SWP3 LAYOUT

SCALE: HORIZ. 1"= 50

SHEET 5 OF 5

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		263

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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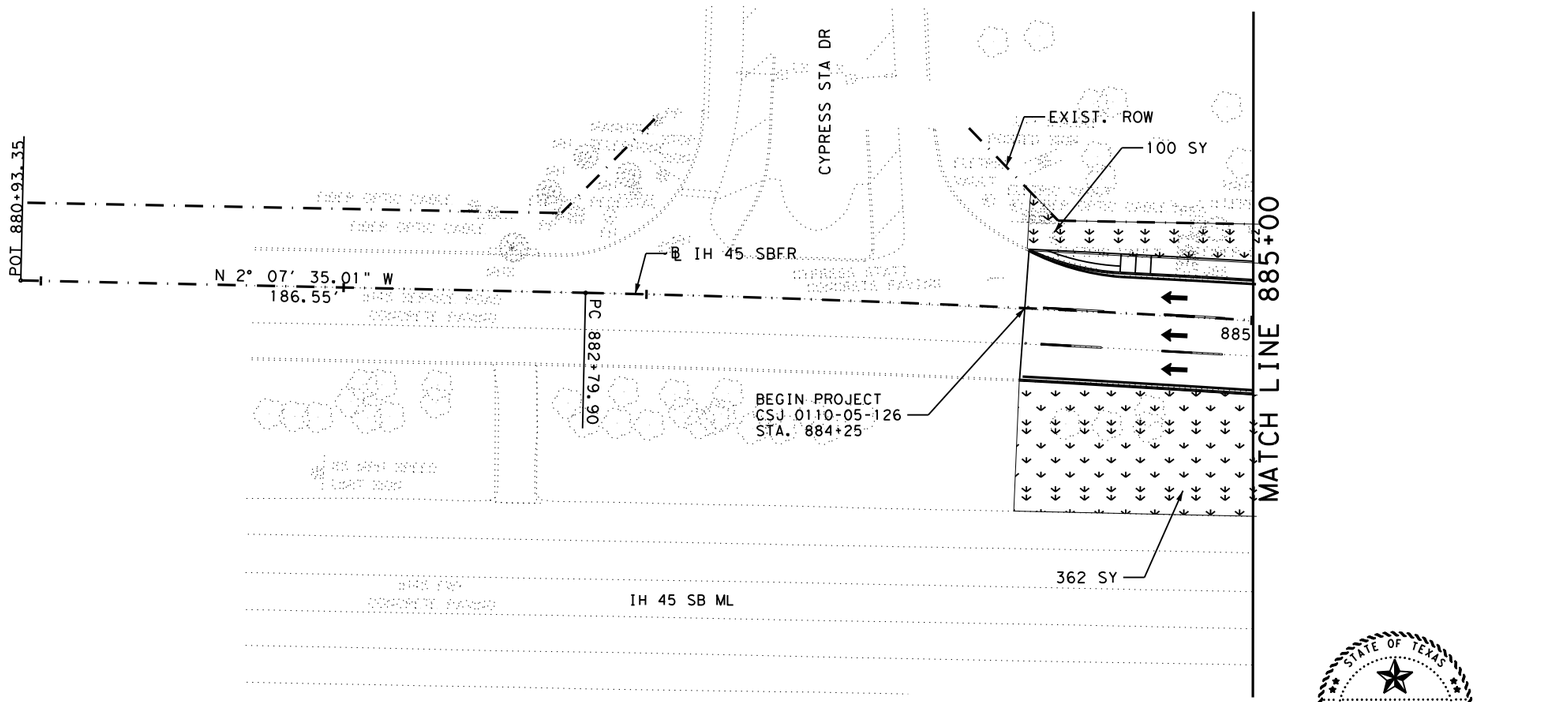

LEGEND:

SOD

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED
PROFESSIONAL ENGINEER

Sharmeen Rahman, P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

SODDING LAYOUT

SCALE: HORIZ. 1"= 50

SHEET 1 OF 5

FED.RD. DIV.NO.	PROJECT NO.		SHEET NO.
6			264
STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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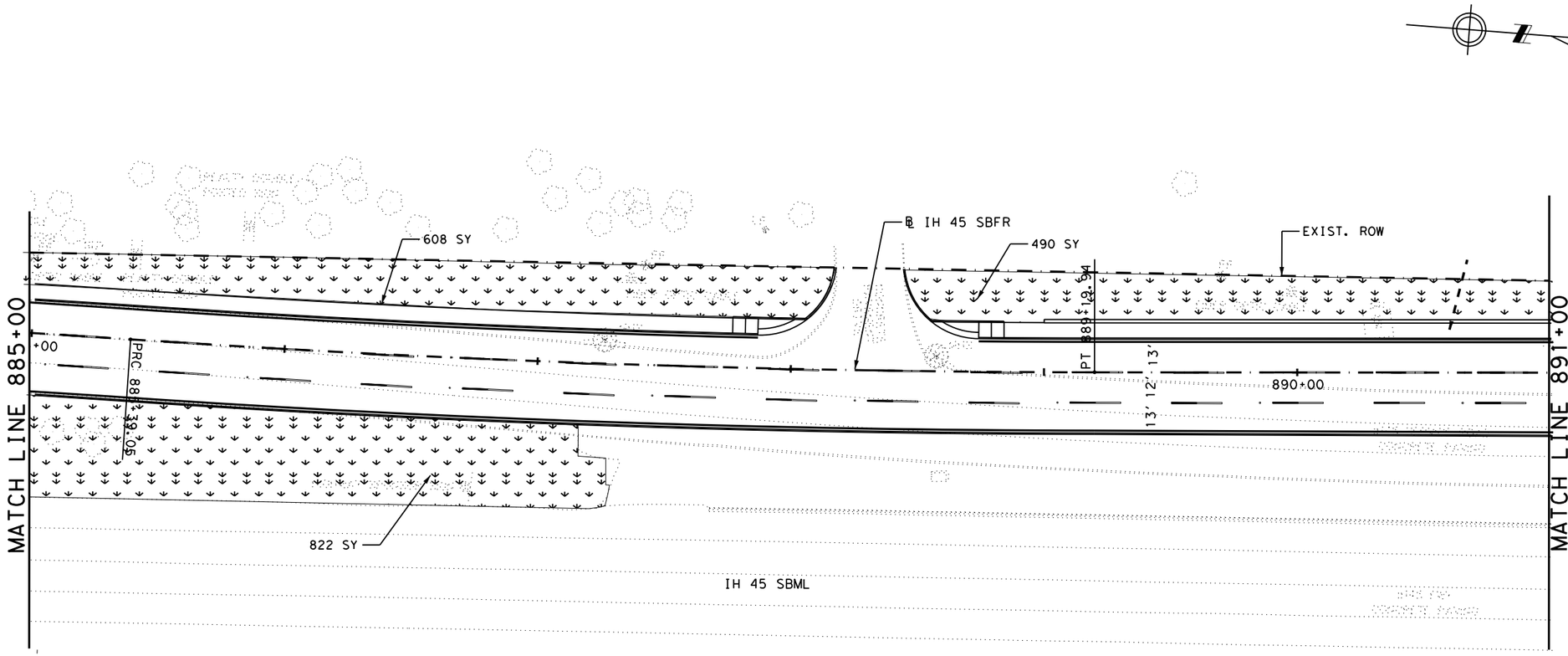

LEGEND:

SOD

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED
PROFESSIONAL ENGINEER

Sharmeen Rahman, P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

SODDING LAYOUT

SHEET 2 OF 5

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		265

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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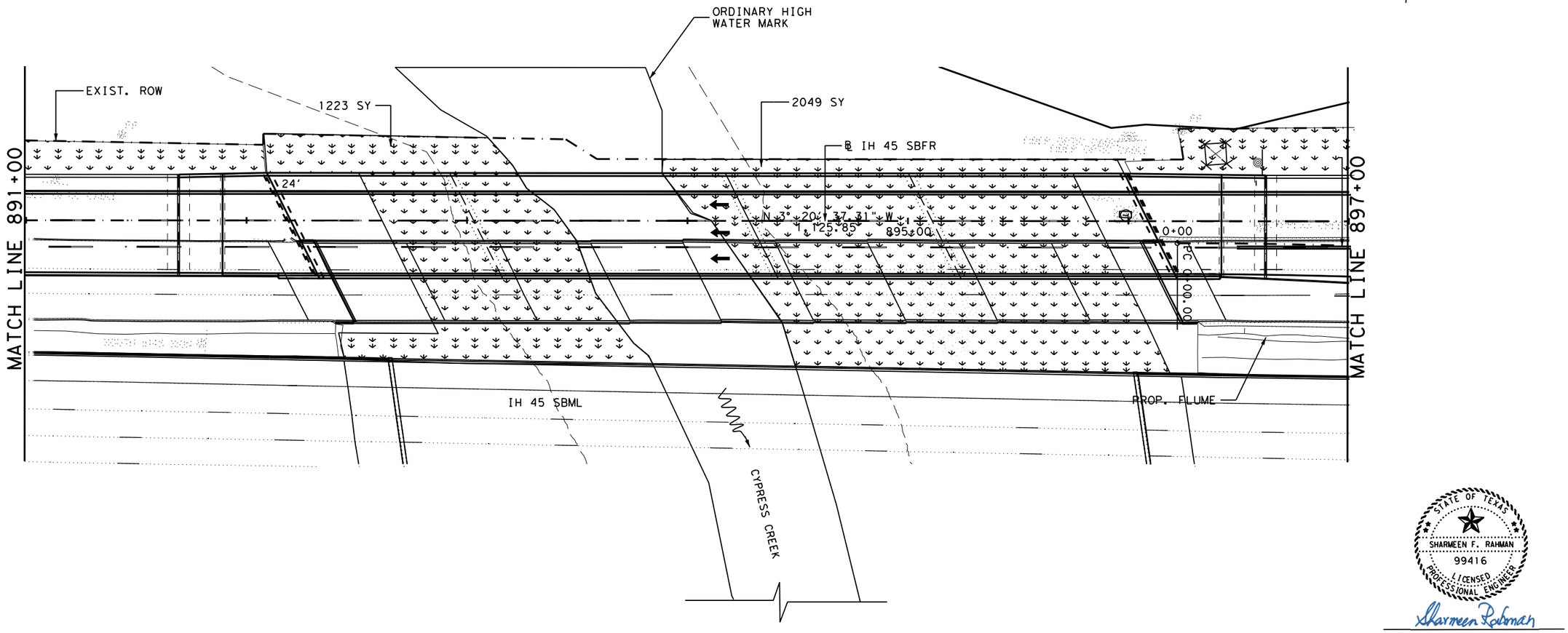

LEGEND:

SOD

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
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Sharmeen Rahman, P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

SODDING LAYOUT

SCALE: HORIZ. 1"= 50

SHEET 3 OF 5

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		266

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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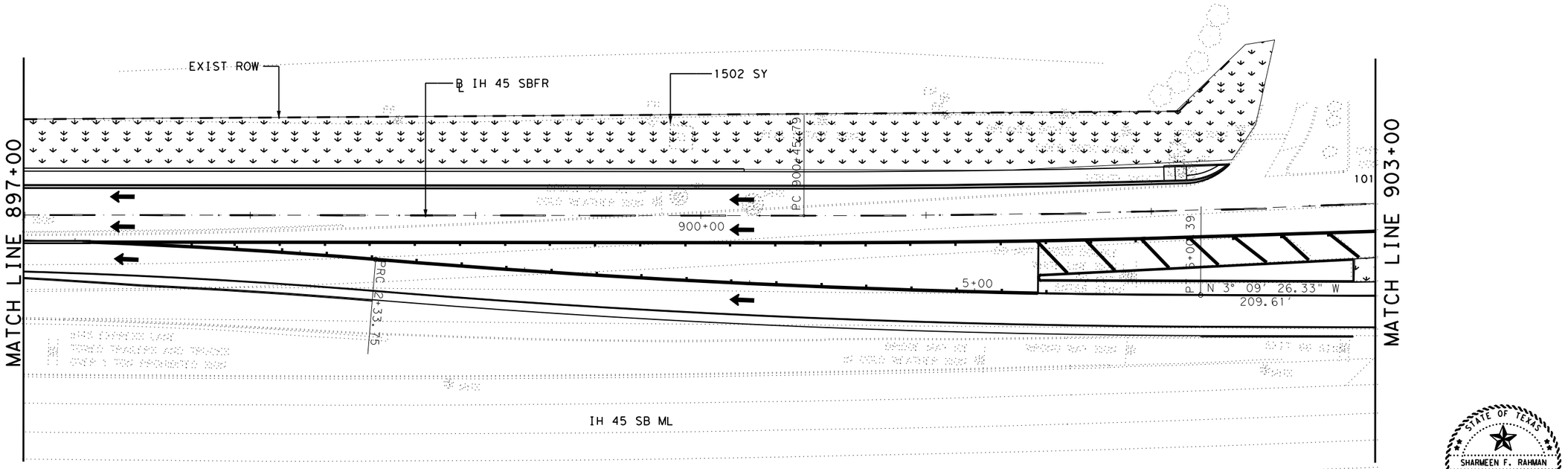

LEGEND:

SOD

STATE OF TEXAS
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PROFESSIONAL ENGINEER

Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

SODDING LAYOUT

SCALE: HORIZ. 1"= 50

SHEET 4 OF 5

FED.RD. DIV.NO.	PROJECT NO.		SHEET NO.
6			267
STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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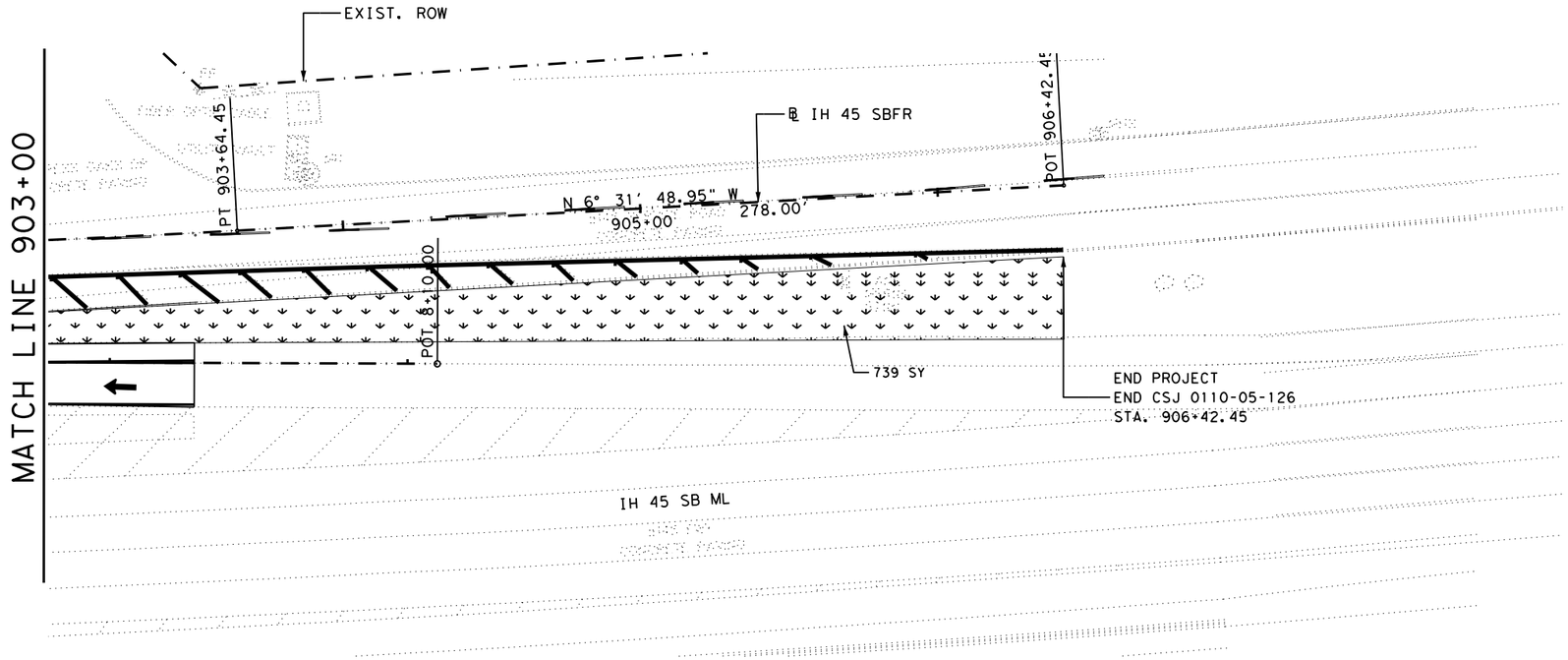

LEGEND:

SOD

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99416
LICENSED
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Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

SODDING LAYOUT

SCALE: HORIZ. 1"= 50

SHEET 5 OF 5

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		268

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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SITE DESCRIPTION

PROJECT LIMITS: CSJ 0116-05-126, From Cypress Station DR. To Cypress Oaks Dr.

PROJECT DESCRIPTION: Replacement of IH 45 SB frontage rd. bridge at Cypress Creek, construction of frontage rd, sidewalk, exit ramp. retaining wall, storm sewer, guard rail and signing and pavement marking.

MAJOR SOIL DISTURBING ACTIVITIES:

Removing existing pavement, existing stabilized base, embankment, excavation, proposed concrete pavement, retaining wall, sidewalk, storm sewer, bridge drill shaft, mbgf will disturb adjacent area of soil.

TOTAL PROJECT AREA: 5.33 AC (APPROX)

TOTAL AREA TO BE DISTURBED: 4.59 AC (APPROX.)

WEIGHTED RUNOFF COEFFICIENT:
(AFTER CONSTRUCTION): runoff coefficient = 0.79

EXISTING CONDITION OF SOIL & VEGETATIVE
COVER AND % OF EXISTING VEGETATIVE COVER:

Existing project has fairly good vegetative soil cover.
Loamy and Clayey soil.

NAME OF RECEIVING WATERS: CYPRESS CREEK, HCFCD UNIT K100-00-00

EROSION AND SEDIMENT CONTROLS

SOIL STABILIZATION PRACTICES:

- [X] TEMPORARY SEEDING
- [X] PERMANENT PLANTING, SODDING, OR SEEDING
- [X] MULCHING
- [ ] SOIL RETENTION BLANKET
- [ ] BUFFER ZONES
- [X] PRESERVATION OF NATURAL RESOURCES

OTHER:

STRUCTURAL PRACTICES:

- [X] SILT FENCES
- [ ] HAY BALES
- [X] ROCK BERMS
- [ ] DIVERSION, INTERCEPTOR, OR PERIMETER DIKES
- [ ] DIVERSION, INTERCEPTOR, OR PERIMETER SWALES
- [ ] DIVERSION DIKE AND SWALE COMBINATIONS
- [ ] PIPE SLOPE DRAINS
- [ ] PAVED FLUMES
- [ ] ROCK BEDDING AT CONSTRUCTION EXIT
- [ ] TIMBER MATTING AT CONSTRUCTION EXIT
- [ ] CHANNEL LINERS
- [ ] SEDIMENT TRAPS
- [ ] SEDIMENT BASINS
- [ ] STORM INLET SEDIMENT TRAP
- [ ] STONE OUTLET STRUCTURES
- [ ] CURBS AND GUTTERS
- [ ] STORM SEWERS
- [ ] VELOCITY CONTROL DEVICES
- [X] EROSION CONTROL LOGS

OTHER:

NARRATIVE - SEQUENCE OF CONSTRUCTION (STORM WATER MANAGEMENT) ACTIVITIES:

-Install silt fence prior to commencing work
-Maintain erosion control measures throughout project duration
-When all work is complete and approved by the Engineer, remove all temporary erosion control measures.

STORM WATER MANAGEMENT:

Any devices required to minimize sediment runoff in the event of a storm will be placed in position before construction begins. The storm water drainage will be provided by the existing systems already in place. Water within the right of way will be carried by ditches to lows in the road profile where it will outfall into receiving waters.

OTHER EROSION AND SEDIMENT CONTROLS:

MAINTENANCE: All erosion and sediment controls will be maintained in good working order. If a repair is necessary it will be done at the earliest date possible, but no later than 7 calender days after the surrounding exposed ground has dried sufficiently to prevent further damage from heavy equipment. The area adjacent to creeks and drainageways shall have priority followed by devices protecting storm sewer inlets.

INSPECTION: All inspections will be performed by a TxDOT inspector per one of the options below as directed by the Area Engineer
1. At least every 7 calendar days
2. At least every 14 days or after 0.5 inches or more of rainfall
An inspection and maintenance report should be made for each inspection. Based on the inspection results, the controls shall be revised according to the inspection report.

WASTE MATERIALS: The dumpster used to store all waste material will meet all state and local city solid waste management regulations. All trash and construction debris will be deposited in the dumpster. The dumpster will be emptied as necessary or as required by local regulation and the trash will be hauled to a local dump. No construction waste material will be buried on site.

HAZARDOUS WASTE (INCLUDING SPILL REPORTING): In the event of a spill which may be considered hazardous, the Houston District Safety Office shall be contacted immediately at 713-802-5962.

SANITARY WASTE: In the event of a sanitary waste spill, the Houston District Safety Office shall be contacted immediately at (713) 802-5962.

OFFSITE VEHICLE TRACKING:

- [ ] HAUL ROADS DAMPENED FOR DUST CONTROL
- [X] LOADED HAUL TRUCKS TO BE COVERED WITH TARPAULIN
- [ ] EXCESS DIRT ON ROAD REMOVED DAILY
- [ ] STABILIZED CONSTRUCTION ENTRANCE

OTHER:

REMARKS: Disposal areas, stockpiles, and haul roads shall be constructed in a manner that will minimize and control the sediment that may enter receiving waterways. Disposal areas shall not be located in any waterway, waterbody or streambed. Construction staging areas and vehicle maintenance areas shall be constructed by the Contractor in a manner which minimizes the runoff of all pollutants. All waterways shall be cleared as soon as practical of temporary embankments, temporary bridges, matting, falsework, piling, debris, and other obstructions placed during construction operations that are not part of the finished work.

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED
PROFESSIONAL ENGINEER

Sharmeen Rahman
09/29/2021

Texas Department of Transportation
Houston District

TxDOT STORM WATER POLLUTION PREVENTION PLAN

SWP3

FILE: STDG1.DGN	DN: TxDot	CK: TxDot	DW: TxDot	CK: TxDot
©TxDOT JANUARY 2007	DIST	FED REG	PROJECT NO.	SHEET
REVISIONS REV. 9/2010 INSPECTION NOTE REV. 9/2013 INSPECTION NOTE REV. 11/2013 SW3P TO SWP3	HOUSTON	6		269
	COUNTY	CONTROL	SECT	JOB	HIGHWAY
	HARRIS	0110	05	126	IH 45

STD G-1

9/28/2021 12:46:48 PM
$FILE$

I. STORMWATER POLLUTION PREVENTION

Texas Pollutant Discharge Elimination System (TPDES) TXR 150000: Stormwater Discharge Permit or Construction General Permit is 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. Refer to Storm Water Pollution Prevention Plan (SWP3) Houston District standard plan.

No Additional Comments

II. WORK IN OR NEAR STREAMS, WATERBODIES AND WETLANDS

United States Army Corps of Engineers (USACE) Permit is required for filling, dredging, excavating or other work in water bodies, rivers, creeks, streams, wetlands or wet areas. The Contractor must adhere to all of the terms and general conditions associated with the following permit(s). If additional work not represented in the plans is required, contact the Engineer immediately.

☐ No United States Army Corps (USACE) Permit Required

☒ Work is authorized by the United States Army Corps of Engineers (USACE) under a Nationwide Permit (NWP) without a Pre-Construction Notification (PCN). Project specific permit was not issued by USACE, therefore is not in the plan set. The USACE general conditions are in the “General Notes."

☐ Work is authorized by the United States Army Corps of Engineers (USACE) under a Nationwide Permit (NWP) with a Pre-Construction Notification (PCN). The project specific permit issued by the United States Army Corps of Engineers (USACE) is included in the plan set. The USACE general conditions are in the “General Notes."

☐ Work is authorized by the United States Army Corps of Engineers (USACE) under a Individual Permit (IP). The project specific permit issued by the United States Army Corps of Engineers (USACE) is included in the plan set.

☐ Work would be authorized by the United States Army Corps of Engineers (USACE) permit. The project specific permit issued by the USACE will be provided to the contractor.

United States Coast Guard (USCG) Permit is required for projects that involve the construction or modification (including changes to lighting) of a bridge or causeway across a water body determined to be navigable by the United States Coast Guard (USCG) under Section 9 of the Rivers and Harbors Act. If additional work not represented in the plans is required, contact the Engineer immediately.

☐ No United States Coast Guard (USCG) Coordination Required

☐ United States Coast Guard (USCG) Permit

☒ United States Coast Guard (USCG) Exemption

Additional Comments

For the removal of existing bents in Cypress Creek and to be in compliance with the USACE NWP 14 without a PCN:

- Minimize the use of equipment in streams and riparian areas during construction. When possible, equipment access should be from banks, bridge decks, or barges.
- When temporary stream crossings are unavoidable, remove stream crossings once they are no longer needed and stabilize banks and soils around the crossing.

All construction for the new bridge should remain outside of the delineated ordinary high water mark of the waters of the US of Cypress Creek. If the contractor determines a need to enter these WOTUS, the contractor will be responsible for acquiring the proper USACE permits.

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 area and contact the Engineer immediately.

No Additional Comments

IV. VEGETATION RESOURCES

Preserve native vegetation to the extent practical. Refer to TxDOT Standard Specifications in order to comply with requirements for invasive species, beneficial landscaping and tree/brush removal.

No Additional Comments

V. FEDERAL LISTED, PROPOSED THREATENED, ENDANGERED SPECIES, CRITICAL HABITAT, STATE LISTED SPECIES, CANDIDATE SPECIES AND MIGRATORY BIRDS

If any of the listed species below are observed, cease work in the area, do not disturb species or habitat and contact the Engineer immediately.

The work may not remove active nests (from bridges, structures, or vegetation adjacent to the roadway, etc.) during nesting season (February 15 to October 1). If removal of structures or vegetation is necessary during the nesting season, the Contractor shall conduct a bird survey no more than 3 days in advance of the clearing/demolish start date. All bird surveys shall be conducted by a Field Biologist and adhere to the guidance document “Avoiding Migratory Birds and Handling Potential Violations” found in the TxDOT Environmental Compliance Toolkits at the time of the survey. (See below for Field Biologist and Ornithologist qualifications)

No Additional Comments

Bat BMPs for Rafinesque's Big-eared Bat:

- For activities that have the potential to impact structures, cliffs or caves, or trees; a qualified biologist will perform a habitat assessment and occupancy survey of the feature(s) with roost potential as early in the planning process as possible or within one year before project letting.
- For roosts where occupancy is strongly suspected but unconfirmed during the initial survey, revisit feature(s) at most four weeks prior to scheduled disturbance to confirm absence of bats.
- If bats are present or recent signs of occupation (i.e., piles of guano, distinct musky odor, or staining and rub marks at potential entry points) are observed, take appropriate measures to ensure that bats are not harmed, such as implementing non-lethal exclusion activities or timing or phasing of construction.
- Exclusion devices can be installed by a qualified individual between September 1 and March 31. Exclusion devices should be used for a minimum of seven days

Field Biologist, Ornithologist – a field biologist is defined as an individual qualified to perform field investigations, presence/absence surveys and habitat surveys for protected avian species or species of concern. A mandatory bachelor’s degree in biology or a related science is required. At a minimum, the Field Biologist, Ornithologist, shall have completed and reported a minimum of three presence/absence and habitat surveys for protected avian species in the past five years. A minimum of three projects must have been conducted in Texas. Surveys shall have been performed for documentation of species in accordance with a protocol approved by USFWS or TPWD, or following generally accepted methodologies.

VI. HAZARDOUS MATERIALS OR CONTAMINATION ISSUES

Refer to TxDOT Standard Specifications in the event potentially contaminated materials are observed, such as dead or distressed vegetation, trash disposal areas, drums, canisters, barrels, leaching or seepage of substances, unusual smells or odors, or stained soil, cease work in the area and contact the Engineer immediately.

No Additional Comments

VII. OTHER ENVIRONMENTAL ISSUES

Comments:

Notify the United State Coast Guard (USCG) for any temporary closures or alterations to navigability 60 days in advance of channel closure.

Notify the TxDOT Engineer immediately if any vessel makes contact with a TxDOT bridge.

Notify TxDOT Engineer when activities permitted under the United States Army Corps of Engineers (USACE) Nationwide Permit (NWP) or Individual Permit (IP) has been completed.

Bat BMPs for Rafinesque's Big-eared Bat continued:

days when minimum nighttime temperatures are above 50°F AND minimum daytime temperatures are above 70°F. Prior to exclusion, ensure that alternate roosting habitat is available in the immediate area. If no suitable roosting habitat is available, installation of alternate roosts is recommended to replace the loss of an occupied roost. If alternate roost sites are not provided, bats may seek shelter in other inappropriate sites, such as buildings, in the surrounding area. See Section 2: Standard Recommendations for recommended acceptable methods for excluding bats from structures.

- If feature(s) used by bats are removed as a result of construction, replacement structures should incorporate bat friendly design or artificial roosts should be constructed to replace these features, as practicable.
- Conversion of property containing cave or cliff features to transportation purposes should be avoided where feasible.
- Avoid unnecessary removal of dead fronds on native and ornamental palm trees in south Texas (Cameron, Hidalgo, Willacy, Kenedy, Brooks, Kleberg, Nueces, and San Patricio counties)

DATE: Sep 02, 2021
FILE:

Version 2.1

Texas Department of Transportation | TxDOT Houston District

ENVIRONMENTAL PERMITS, ISSUES AND COMMITMENTS

EPIC

FILE: EPIC Sheet.dgn	DN:	CK:	DW:	CK:
© TxDOT: March 2017	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
UPDATED section V. text and added definition (10/17) ADDED USCG and USACE notes in Section VII (04/18)	DIST	COUNTY		SHEET NO.
	HOU	Harris		270

VII. OTHER ENVIRONMENTAL ISSUES	VII. OTHER ENVIRONMENTAL ISSUES	VII. OTHER ENVIRONMENTAL ISSUES

Bat BMPs for Rafinesque's Big-eared Bat continued:

from April 1 through October 31. If removal of dead fronds is necessary at other times of the year, limit frond removal to extended warms periods (nighttime temperatures greater than 54°F for at least two consecutive nights), so bats can move away from the disturbance and find new roosts.

- Large hollow trees, snags (dead standing trees), and trees with shaggy bark should be surveyed for colonies and, if found, should not be disturbed until the bats are no longer occupying these features. Post-occupancy surveys should be conducted by a qualified biologist prior to tree removal from the landscape.
- Retain mature, large diameter hardwood forest species and native/ornamental palm trees where feasible.
- In all instances, avoid harm or death to bats. Bats should only be handled as a last resort and after communication with TPWD.
- Bat surveys of structures should include visual inspections of structural fissures (cracked or spalled concrete, damaged or split beams, split or damaged timber railings), crevices (expansion joints, space between parallel beams, spaces above supports piers), and alternative structures (drainage pipes, bolt cavities, open sections between support beams, swallow nests) for the presence of bats.
- Before excluding bats from any occupied structure, bat species, weather, temperature, season, and geographic location must be incorporated into any exclusion plans to avoid unnecessary harm or death to bats. Winter exclusion must entail a survey to confirm either,
  1) bats are absent or
  2) present but active (i.e. continuously active - not intermittently active due to arousals from hibernation).
- Avoid using materials that degrade quickly, like paper, steel wool or rags, to close holes.
- Avoid using products or making structural modifications that may block natural ventilation, like hanging plastic sheeting over an active roost entrance, thereby altering roost micro-climate.
- Avoid using chemical and ultrasonic repellents.
- Avoid use of silicone, polyurethane or similar non-water-based caulk products.
- Avoid use of expandable foam products at occupied sites.
- Avoid the use of flexible netting attached with duct tape.
- In order to avoid entombing bats, exclusion activities should be only implemented by a qualified individual. A qualified individual or company should possess at least the following minimum qualifications:
  - o Experience in bat exclusion (the individual, not just the company).
  - o Proof of rabies pre-exposure vaccinations.
  - o Demonstrated knowledge of the relevant bat species, including maternity season date range and habitat requirements.
  - o Demonstrated knowledge of rabies and histoplasmosis in relation to bat roosts.
- Contact TPWD for additional resources and information to assist in executing successful bat exclusions that will avoid unnecessary harm or death in bats.

DATE: May 09, 2018
FILE:

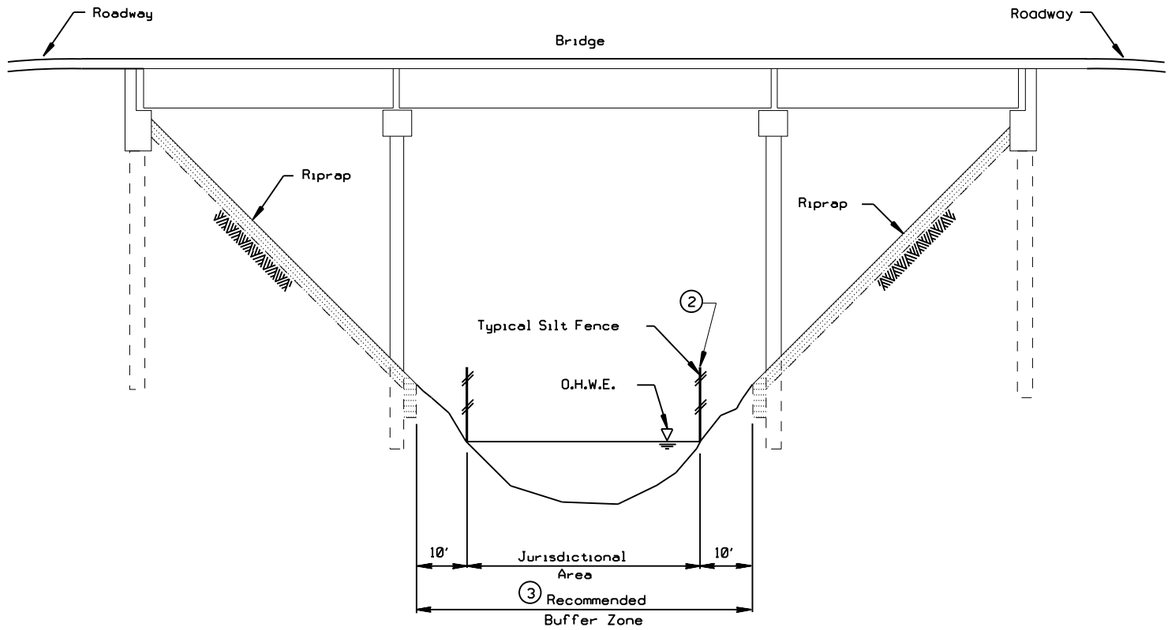
Texas Department of Transportation

TxDOT Houston District

ENVIRONMENTAL PERMITS, ISSUES AND COMMITMENTS

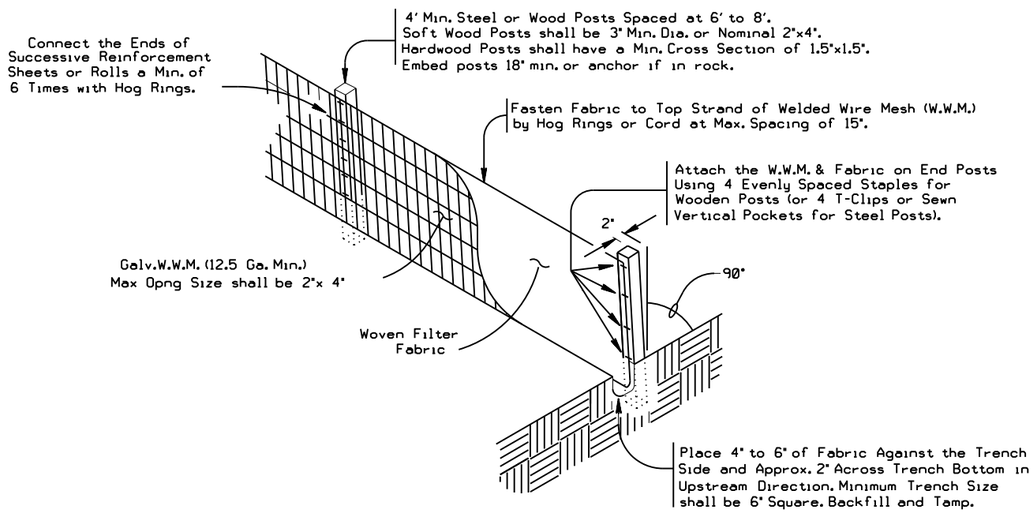
EPIC

FILE: EPIC Additional Comment Sheet.dgn	DN:	CK:	DW:	CK:
© TxDOT: March 2017	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	Harris		271



TYPICAL RELATIONSHIP OF O.H.W.E., SILT FENCE, PILING/DRILL SHAFT & RIPRAP TOE WALLS

N.T.S.



SILT FENCE

1.50" Radius, 0.50" Border, Black on White;
[WETLAND AREA] C; [DO NOT ENTER] C;
CIRCLE, DIAG LINE, RED

GENERAL DESIGN CONSIDERATIONS

1. Ordinary high water elevation (O.H.W.E.) is determined by Environmental Project Manager and elevation is set by Surveyor.
2. All non-permitted jurisdictional wetlands and waters within the project area shall be protected by a silt fence and signage, and shall be avoided.
3. A 10' buffer zone around non-permitted wetlands waters is recommended.
4. The Contractor will be required to obtain the appropriate permits if he/she alters the construction method or deviates from the permit.
5. Signs and fencing shown will not be paid for separately but are considered subsidiary to Item, "Barricades, Signs and Traffic Handling".
6. Any wetlands permitted for impacts/fill and non-permitted wetlands are shown elsewhere on plans or USACE permit.

REVISED 9/2011
ADDED NOTES 11-14.
REVISED 1/2014
REMOVED MISC. TRIANGLES
5/2015 added coordination with floodplain admin.

Texas Department of Transportation
Houston District

ENVIRONMENTAL PERMITS ISSUES AND COMMITMENTS

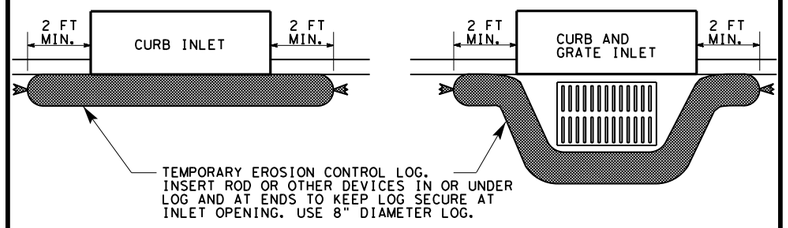
(EPIC)

FILE:	DN:	CK:	DW:	CK:	
© TxDOT 2011	DIST	FED REG	PROJECT NO.		SHEET
REVISIONS REVISED 1/2011 1. ADDED EMBEDMENT DEPTH FOR SILT FENCE POSTS. 2. MINOR CHANGES.	HOU	6			272
	COUNTY	CONTROL	SECT	JOB	HIGHWAY
	HARRIS	0110	05	126	IH 45

STD G-2

CURB INLETS
8" DIAMETER LOGS

ITEM 506-6040 BIODEG EROSN CONT LOGS (INSTL) (8")



MATERIAL REQUIREMENTS

FILL:

Use 100% shredded mulch or other non-compost biodegradable material as fill for logs. No compost or fines.

DO NOT USE MATERIAL WHICH PROHIBITS WATER INFILTRATION.

LOG MESH:
Use mesh with 1/4" openings or larger. Mesh must allow water infiltration but also hold fill material in place.

SEDIMENT BASIN & TRAP USAGE GUIDELINES

A sediment trap (erosion control log) may be used to filter sediment out of runoff draining from an unstabilized area.

Traps: The drainage area for a sediment trap should not exceed 5 acres. The trap capacity should be 1800 CF/Acre (0.5" over the drainage area).

Sediment traps should be placed in the following locations:

1. Within drainage ditches spaced as needed or min. 500' on center
2. Immediately preceding ditch inlets
3. Just before the drainage enters a water course
4. Just before the drainage leaves the right of way

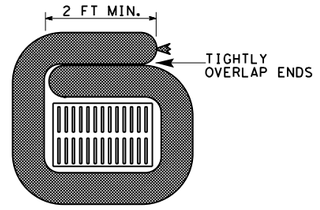
The trap should be cleaned when the capacity has been reduced by 1/2 or the sediment has accumulated to a depth of 1', whichever is less.

REQUIRED ITEMS:

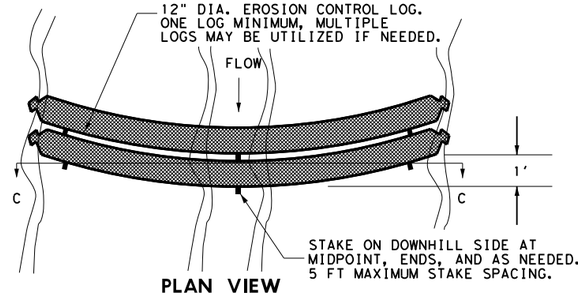
- ITEM 506-6040 BIODEG EROSN CONT LOGS (INSTL) (8") LF
- ITEM 506-6041 BIODEG EROSN CONT LOGS (INSTL) (12") LF
- ITEM 506-6043 BIODEG EROSN CONT LOGS (REMOVE) LF

DROP INLETS AND OTHER LOCATIONS
12" DIAMETER LOGS

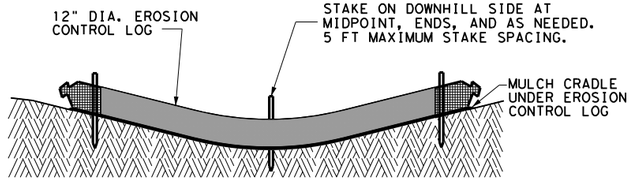
ITEM 506-6041 BIODEG EROSN CONT LOGS (INSTL)(12")



DROP INLETS

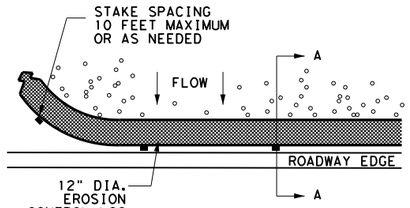


PLAN VIEW

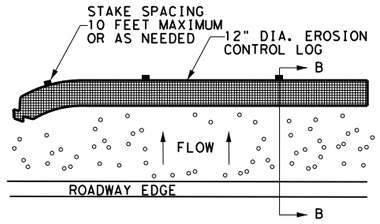


SECTION C-C

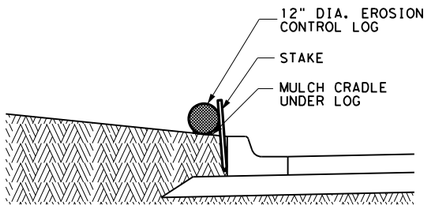
DRAINAGE SWALE OR DITCH



PLAN VIEW

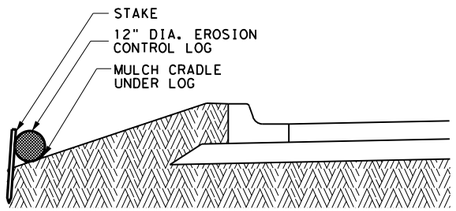


PLAN VIEW



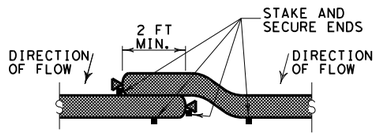
SECTION A-A

SLOPE TO ROADWAY EDGE

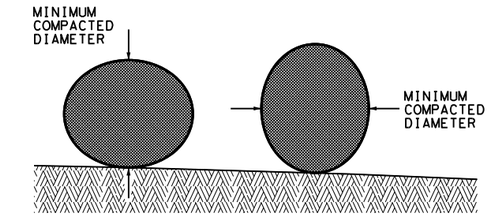


SECTION B-B

SLOPE AWAY FROM ROADWAY EDGE



END OF LOG OVERLAP



DIAMETER MEASUREMENTS OF EROSION CONTROL LOGS SPECIFIED IN PLANS

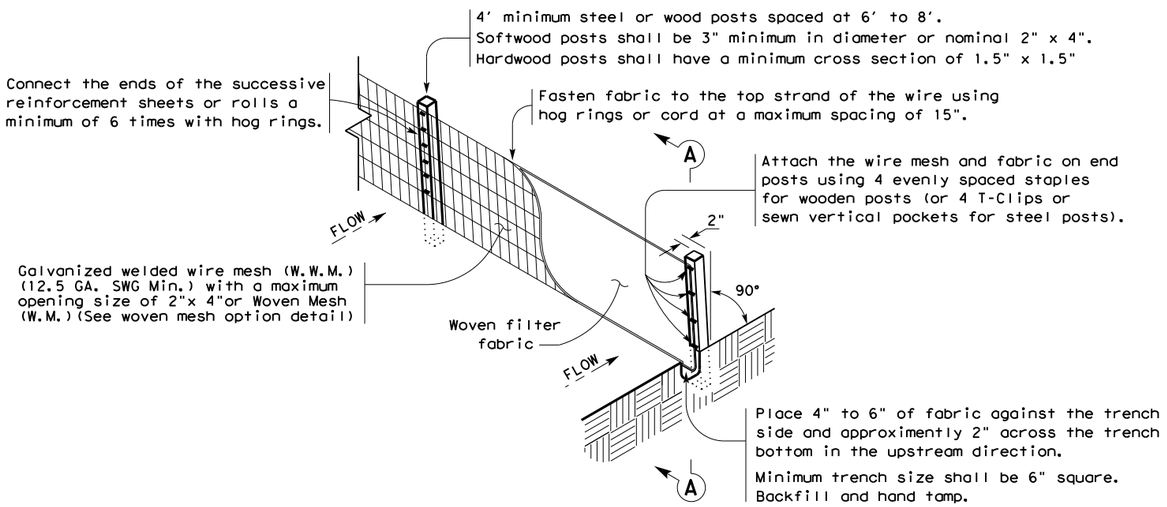
Texas Department of Transportation
Houston District

EROSION CONTROL LOG

ECL-12

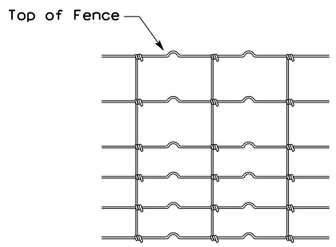
FILE: STDG4a.DGN	DN: TxDot	CK: TxDot	DW: TxDot	CK: TxDot
©TxDOT 2014	DISTRICT	FED REG	PROJECT NUMBER	SHEET
REVISIONS 3/15 MINOR CORRECTIONS	HOU	6		273
	COUNTY	CONTROL	SECT	JOB	HIGHWAY
	HARRIS	0110	05	126	IH 45

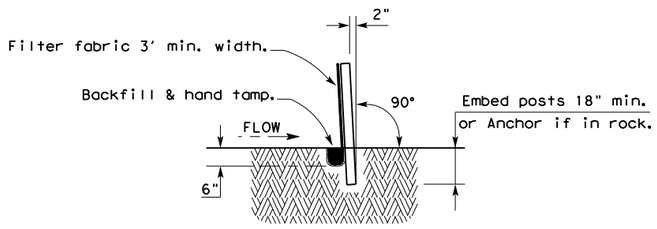
STD G-4A



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.

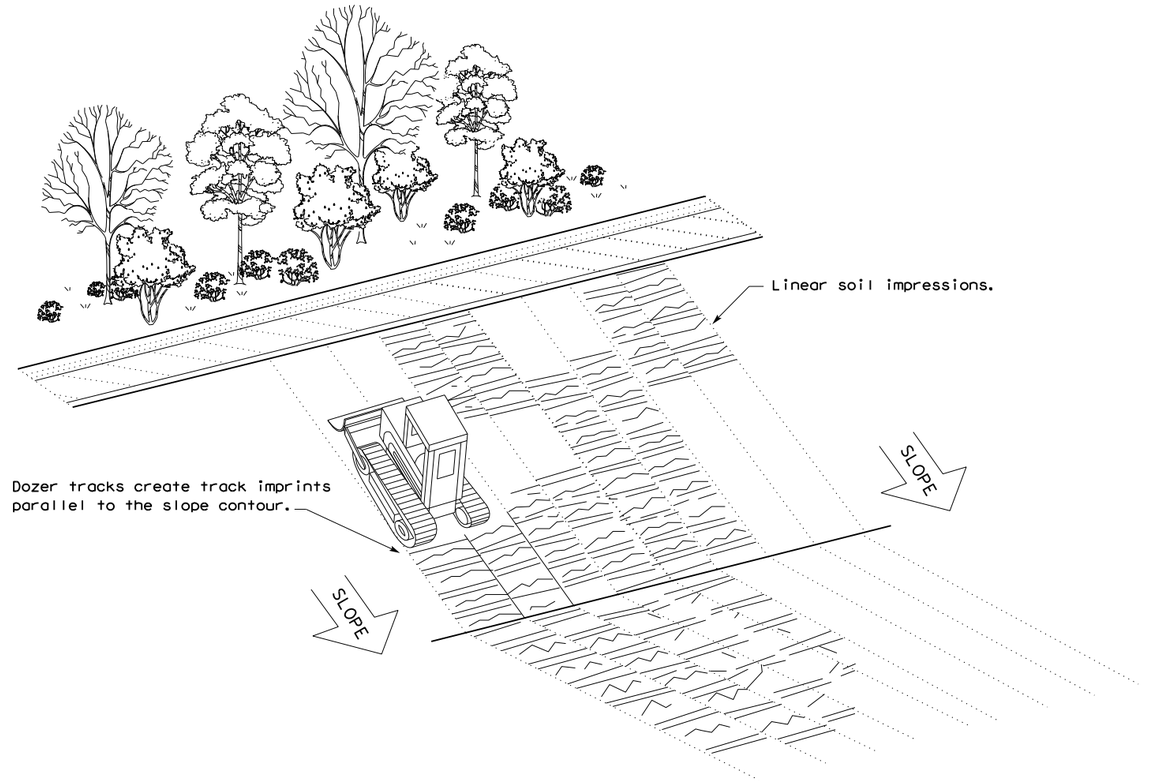
LEGEND

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

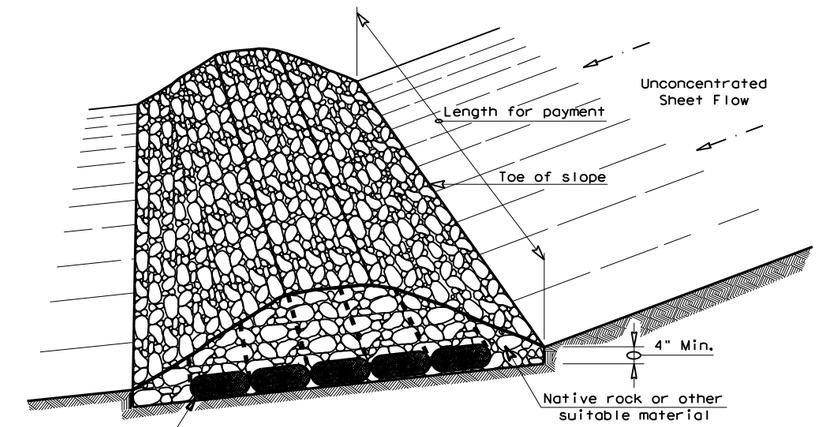
FENCE & VERTICAL TRACKING

EC(1)-16

FILE: ec116	DN: TxDOT		CK: KM	DW: VP		DN/CK: LS
© TxDOT: JULY 2016	CONT	SECT	JOB		HIGHWAY	
REVISIONS	0110	05	126		IH 45	
	DIST	COUNTY				SHEET NO.
	HOU	HARRIS				274

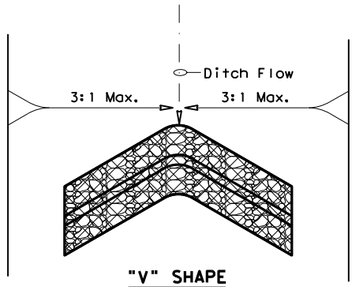
DATE
FILE

DATE:
FILE:

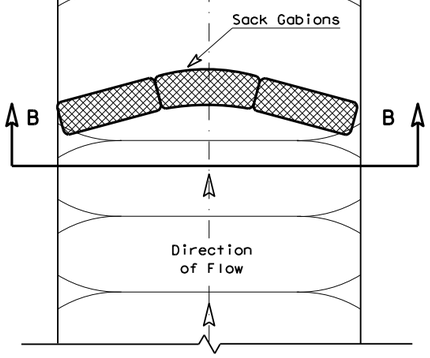


FILTER DAM AT TOE OF SLOPE

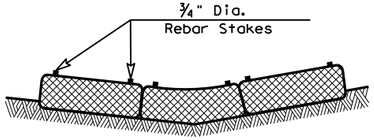
RFD1



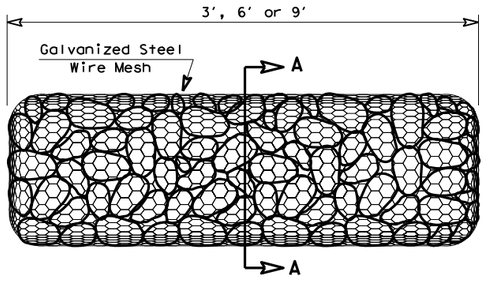
"V" SHAPE PLAN VIEW



PLAN VIEW

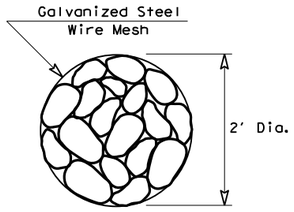


SECTION B-B

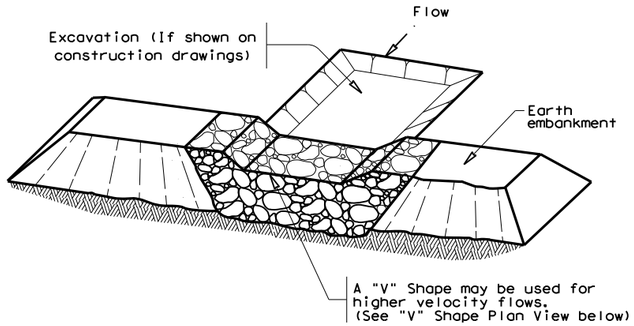


TYPE 4 (SACK GABIONS)

RFD4

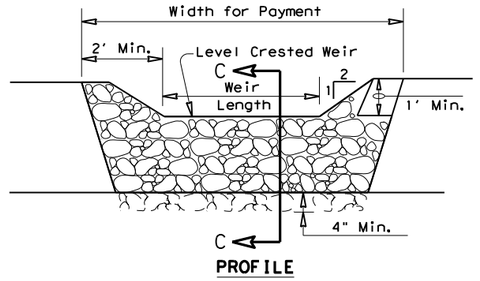


SECTION A-A

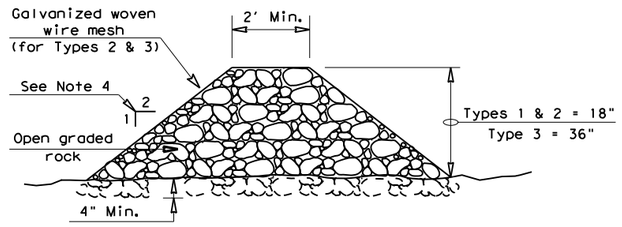


FILTER DAM AT SEDIMENT TRAP

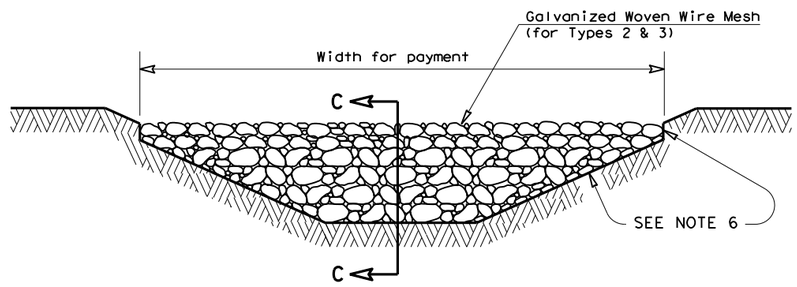
RFD1 — OR — RFD2



PROFILE



SECTION C-C



FILTER DAM AT CHANNEL SECTIONS

RFD1 — OR — RFD2 — OR — RFD3

ROCK FILTER DAM USAGE GUIDELINES

Rock Filter Dams should be constructed downstream from disturbed areas to intercept sediment from overland runoff and/or concentrated flow. The dams should be sized to filter a maximum flow through rate of 60 GPM/FT^2 of cross sectional area. A 2 year storm frequency may be used to calculate the flow rate.

Type 1 (18" high with no wire mesh) (3" to 6" aggregate): Type 1 may be used at the toe of slopes, around inlets, in small ditches, and at dike or swale outlets. This type of dam is recommended to control erosion from a drainage area of 5 acres or less. Type 1 may not be used in concentrated high velocity flows (approximently 8 Ft/Sec or more) in which aggregate wash out may occur. Sandbags may be used at the embedded foundation (4" deep min.) for better filtering efficiency of low flows if called for on the plans or directed by the Engineer.

Type 2 (18" high with wire mesh) (3" to 6" aggregate): Type 2 may be used in ditches and at dike or swale outlets.

Type 3 (36" high with wire mesh) (4" to 8" aggregate): Type 3 may be used in stream flow and should be secured to the stream bed.

Type 4 (Sack gabions) (3" to 6" aggregate): Type 4 May be used in ditches and smaller channels to form an erosion control dam.

Type 5: Provide rock filter dams as shown on plans.

GENERAL NOTES

1. If shown on the plans or directed by the Engineer, filter dams should be placed near the toe of slopes where erosion is anticipated, upstream and/or downstream at drainage structures, and in roadway ditches and channels to collect sediment.
2. Materials (aggregate, wire mesh, sandbags, etc.) shall be as indicated by the specification for "Rock Filter Dams for Erosion and Sedimentation Control".
3. The rock filter dam dimensions shall be as indicated on the SW3P plans.
4. Side slopes should be 2:1 or flatter. Dams within the safety zone shall have sideslopes of 6:1 or flatter.
5. Maintain a minimum of 1' between top of rock filter dam weir and top of embankment for filter dams at sediment traps.
6. Filter dams should be embedded a minimum of 4" into existing ground.
7. The sediment trap for ponding of sediment laden runoff shall be of the dimensions shown on the plans.
8. Rock filter dam types 2 & 3 shall be secured with 20 gauge galvanized woven wire mesh with 1" diameter hexagonal openings. The aggregate shall be placed on the mesh to the height & slopes specified. The mesh shall be folded at the upstream side over the aggregate and tightly secured to itself on the downstream side using wire ties or hog rings. For in stream use, the mesh should be secured or staked to the stream bed prior to aggregate placement.
9. Sack Gabions should be staked down with 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

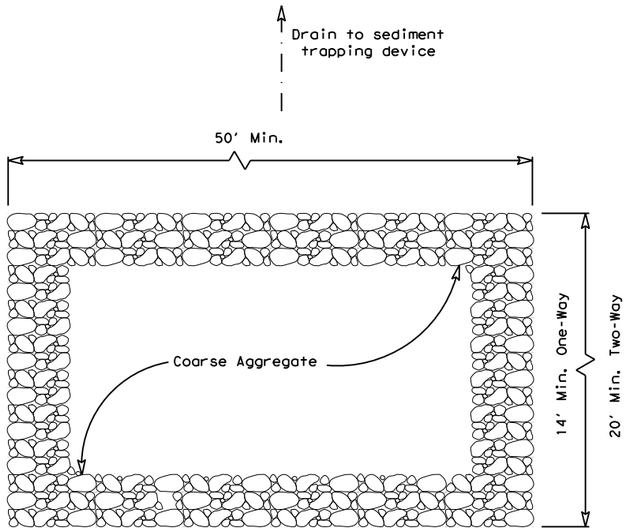
TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

ROCK FILTER DAMS

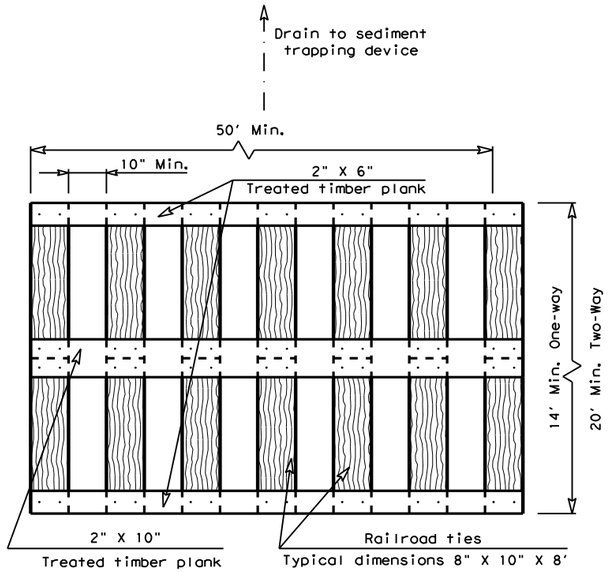
EC(2)-16

FILE: ec216	DN: TxDOT	CK: KM	DW: VP	DN/CK: LS	
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0110	05	126	IH 45	
	DIST	COUNTY		SHEET NO.	
	HOU	HARRIS		275	

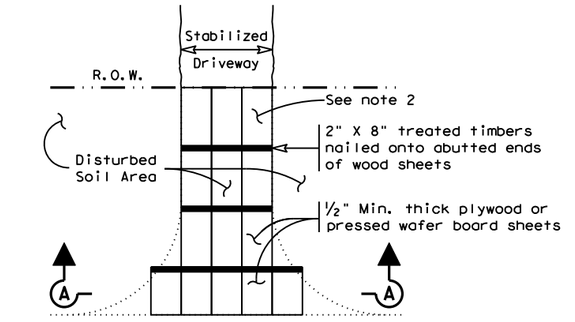
DATE: 9/2/2021
FILE: T:\HOU-AO\Design\Roadway\IH 45\0110-05-126 Cypress Creek\PLAN PDF\7-ENV STANDARDS\276 EC (3)-16.dgn



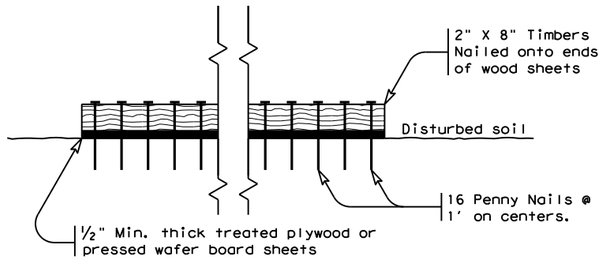
PLAN VIEW



PLAN VIEW



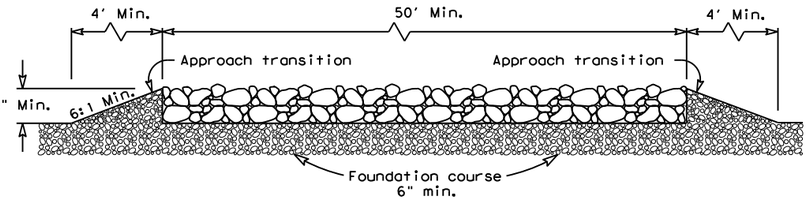
PLAN VIEW



SECTION A-A

CONSTRUCTION EXIT (TYPE 3)

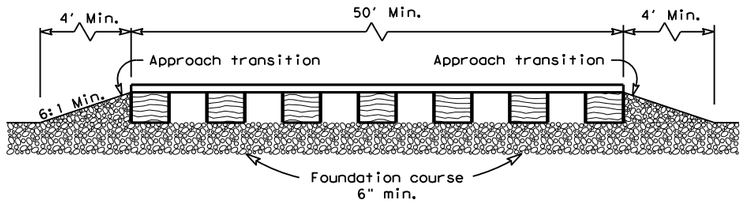
SHORT TERM



ELEVATION VIEW

CONSTRUCTION EXIT (TYPE 1)

ROCK CONSTRUCTION (LONG TERM)



ELEVATION VIEW

CONSTRUCTION EXIT (TYPE 2)

TIMBER 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.

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
©TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	05	126	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		276

TYPE OF WORK — ITEMS AND REQUIREMENTS FOR EACH TYPE OF WORK

SODDING	PERMANENT SEEDING	TEMPORARY SEEDING	Reference Item 161, 162, 164, 166, 168 of the Texas Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges 2014 for specifications, dimensions, volumes and measurements that are not shown. Use latest Houston District, Special Provisions for those items indicated.		
	✓		**161-6017 COMPOST MANUF TOPSOIL (BIP)(4") SY**	APPLICATION RATE Item 161.2.1. Compost Manufactured Topsoil (CMT)	Item 161.2. Materials. Submit quality control (QC) documentation to the Engineer. Compost producer's STA certification must be dated to meet STA requirements (certification must be within 30 or 90 days per STA requirements). Lab analysis performed by an STA-certified lab must be dated within 30 days before delivery of the compost.
✓			**162-6002 BLOCK SODDING SY**	GRASS SPECIES Item 162.2. Materials. Common Bermuda (Cynodon Dactylon)	Item 162.2.1. Block Sod. Use block palletized or roll type sod. **REMOVE PLASTIC BACKING FROM ROLL TYPE SOD.** Place sod within 48 hours of delivery to site. No exceptions. Place sod with joints alternating on each row to prevent continuous joint lines. Peg sod as needed with wood pegs to hold sod in place. Pegging sod is subsidiary to Item 162.
	✓		**164-6066 DRILL SEEDING(PERM)(WARM OR COOL) SY** Item 164.1. Description Provide and install seeding as shown on District Standard	PLANTING MONTH / SEED MIX March, April, May, June, July, August, September, October: Hulled - Bermudagrass (Cynodon dactylon) - 40.0 lbs PLS/acre Foxtail Millet (Setaria italica) - 34.0 lbs PLS/acre Green Sprangletop (Leptochloa dubia) - 4.0 lbs PLS/acre Sideoats Grama (Bouteloua curtipendula) - 3.2 lbs PLS/acre Little Bluestem (Schizachyrium scoparium) - 1.4 lbs PLS/acre November, December, January, February,: Unhulled - Bermudagrass (Cynodon dactylon) - 40.0 lbs PLS/acre Oats (Avena sativa) - 72.0 lbs PLS/acre Green Sprangletop (Leptochloa dubia) - 4.0 lbs PLS/acre Sideoats Grama (Bouteloua curtipendula) - 3.2 lbs PLS/acre Little Bluestem (Schizachyrium scoparium) - 1.4 lbs PLS/acre	PLS (Pure Live Seed) Provide documentation of PLS requirements per Item 164.2.1. CONSTRUCTION. Cultivate the area to a depth of 4 inches before placing the seed unless otherwise directed. When performing permanent seeding after an established temporary seeding, cultivate the seedbed to a depth of 4 inches or mow the area before placement of the permanent seed. Plant the seed and place the straw or hay mulch after the area has been completed to lines and grades as shown on the plans. Drill Seeding. Plant seed or seed mixture uniformly over the area shown on the plans at a depth of 1/4 to 1/3 inch using a cultipacker(turfgrass) type seeder. Plant seed along the contour of the slopes. Use broadcast seeding method where site conditions prevent drill seeding method. Broadcast Seeding. Distribute the dry seed or dry seed mixture uniformly over the areas shown on the plans using hand or mechanical distribution on top of soil.
	✓		**164-6052 BROADCAST SEED(PERM)(SPECIAL MIX) SY** Item 164.1. Description Provide and install seeding as shown on District Standard		
		✓	**164-6051 DRILL SEED(TEMP)(WARM OR COOL) SY** Item 164.1. Description Provide and install seeding as shown on District Standard	PLANTING MONTH / SEED MIX March, April, May, June, July, August, September, October: Foxtail Millet (Setaria italica) - 34.0 lbs PLS/acre November, December, January, February,: Oats (Avena sativa - 72.0 lbs PLS/acre	
		✓	**164-6009 BROADCAST SEED(TEMP)(WARM) SY** Item 164.1. Description Provide and install seeding as shown on District Standard		
	✓	✓	**162-6003 STRAW OR HAY MULCH SY**	APPLICATION RATE Immediately after planting the seed or seed mixture, apply straw or hay mulch uniformly over the seeded area. Apply straw or hay mulch at 2 tons per acre. Use tacking agent with straw or hay mulch as described on this sheet.	Use straw or hay mulch in conformance with Article 162.2.5, "Mulch." Use biodegradable tacking agents only applied at a rate in accordance with manufacturer's recommendations. Use the following products or an approved equal(see note this sheet): Conweb/Contac Guar Gum, Profile Products Corporation, (307) 655-9565, Ramtec/Procol/Viscol Guar Gum, Ramtec Corporation, (800) 366-1180
✓	✓	✓	**166-6001 FERTILIZER AC** Item 166.2. Materials Use fertilizer as shown on District Standard	APPLICATION RATE Deliver and evenly distribute fertilizer at a rate of 4000 lbs/acre.	Use a **NON-CHEMICAL** fertilizer which meets all the following criteria: (1) BRAND NAME must be registered with the Texas State Chemist as a commercial fertilizer. (2) Meets USEPA guidelines for unrestricted use. (3) Derived from biological sources such as, but not limited to: sewage sludge, manures, vegetation, etc. (4) In granular form and essentially dust free. Submit proof of registration and nutrient source to Engineer. Use the following products or an approved equal(see note this sheet): Sigma, SIGMA AgriScience, 281-851-6749 Sustanite-standard grade, Automation Nation, Inc., 713-675-4999 Milorganite, MMSD, 800-287-9645 Agricultural Organic P/L, Ag Org, INC., 713-523-4396
✓	✓	✓	**168-6001 VEGETATIVE WATERING MG**	APPLICATION RATE Item 168.3 Construction. 6000 gallons/acre per working day x 20 consecutive working days = 120,000 gallons total/acre	Begin watering immediately after installation of seed or sod. Replace, fertilize, and water any seed or sod in poor condition due to the failure to apply the specified amount of water within the time allowed at no expense to the Department.

SEQUENCE OF WORK

BLOCK SOD	PERMANENT SEEDING	TEMPORARY SEEDING
1. FERTILIZER 2. CULTIVATE SOIL (ITEM 162.3) 3. SOD 4. VEGETATIVE WATERING	1. FERTILIZER 2. COMPOST MANUFACTURED TOPSOIL 3. CULTIVATE SOIL (ITEMS 164.3 AND 161.3.1) 4. PERMANENT SEEDING 5. STRAW OR HAY MULCH 6. VEGETATIVE WATERING	1. FERTILIZER 2. CULTIVATE SOIL (PER ITEM 164.3) 3. TEMPORARY SEEDING 4. STRAW OR HAY MULCH 5. VEGETATIVE WATERING

Texas Department of Transportation

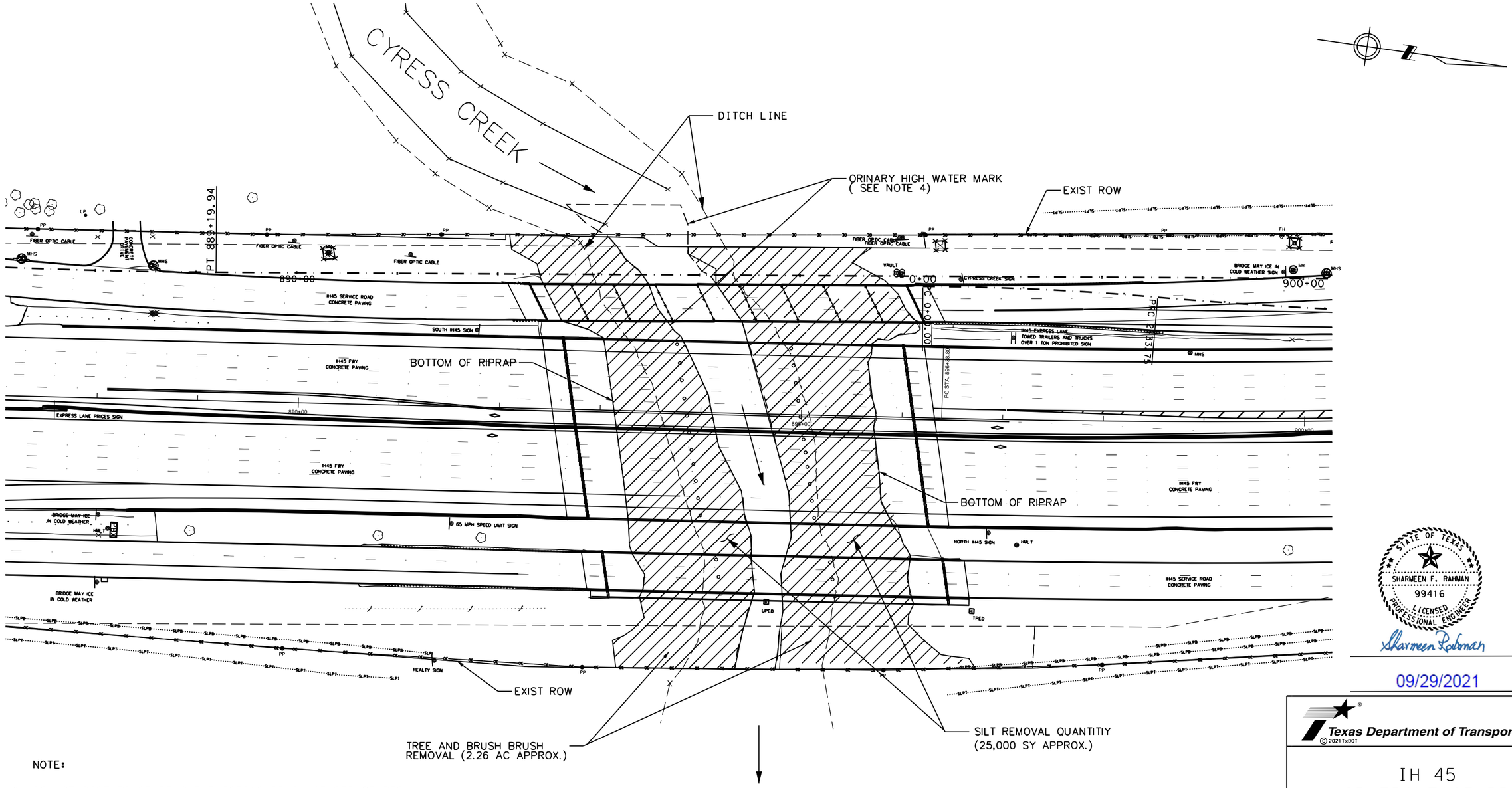
HOUSTON DISTRICT

FERTILIZER, SEED, SOD, STRAW, COMPOST, AND WATER

SHEET 1 OF 1

REVISIONS	FILE:	FED DIV	STATE	PROJECT NUMBER	SHEET
10/2014 UPDATED TO 2014 SPECS 3/2015 MINOR CORRECTIONS	OCT 2014	6	TEXAS		277
	ORIGINAL:	DIST	COUNTY	CONTROL / SECT / JOB	HIGHWAY
		12	HARRIS	0110 / 05 / 126	IH 45

STD K-1



NOTE:

1. DO NOT DISTURB OR REMOVE EXISTING DRAINAGE STRUCTURES UNLESS NOTED OTHERWISE IN PLAN SET.
2. SILT, TREE AND BRUSH REMOVAL LIMITS TO BE VERIFIED BY THE CONTRACTOR.
3. EXISTING SIDE SLOPES OF THE CHANNEL MUST BE MAINTAINED.
4. ORDINARY HIGH WATER MARK NOT TO BE DISTURBED.

LEGEND:

SILT, TREE AND BRUSH REMOVAL

DIRECTION OF FLOW

STATE OF TEXAS
SHARMEEN F. RAHMAN
99416
LICENSED
PROFESSIONAL ENGINEER

Sharmeen Rahman , P.E.

09/29/2021

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

SILT, TREE AND BRUSH REMOVAL LAYOUT

SCALE: HORIZ. 1"= 100

SHEET 1 OF 1

FED. RD. DIV. NO.	PROJECT NO.		SHEET NO.
6			278
STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

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2017 Nationwide Permit General Conditions

Note: To qualify for NWP authorization, the prospective permittee must comply with the following general conditions, as applicable, in addition to any regional or case-specific conditions imposed by the division engineer or district engineer. Prospective permittees should contact the appropriate Corps district office to determine if regional conditions have been imposed on an NWP. Prospective permittees should also contact the appropriate Corps district office to determine the status of Clean Water Act Section 401 water quality certification and/or Coastal Zone Management Act consistency for an NWP. Every person who may wish to obtain permit authorization under one or more NWPs, or who is currently relying on an existing or prior permit authorization under one or more NWPs, has been and is on notice that all of the provisions of 33 CFR 330.1 through 330.6 apply to every NWP authorization. Note especially 33 CFR 330.5 relating to the modification, suspension, or revocation of any NWP authorization.

1. ***Navigation.*** (a) No activity may cause more than a minimal adverse effect on navigation.

(b) Any safety lights and signals prescribed by the U.S. Coast Guard, through regulations or otherwise, must be installed and maintained at the permittee's expense on authorized facilities in navigable waters of the United States.

(c) The permittee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the permittee will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

2. ***Aquatic Life Movements.*** No activity may substantially disrupt the necessary life cycle movements of those species of aquatic life indigenous to the waterbody, including those species that normally migrate through the area, unless the activity's primary purpose is to impound water. All permanent and temporary crossings of waterbodies shall be suitably culverted, bridged, or otherwise designed and constructed to maintain low flows to sustain the movement of those aquatic species. If a bottomless culvert cannot be used, then the crossing should be designed and constructed to minimize adverse effects to aquatic life movements.

3. ***Spawning Areas.*** Activities in spawning areas during spawning seasons must be avoided to the maximum extent practicable. Activities that result in the physical destruction (*e.g.,* through excavation, fill, or downstream smothering by substantial turbidity) of an important spawning area are not authorized.

4. ***Migratory Bird Breeding Areas.*** Activities in waters of the United States that serve as breeding areas for migratory birds must be avoided to the maximum extent practicable.

5. ***Shellfish Beds.*** No activity may occur in areas of concentrated shellfish populations, unless the activity is directly related to a shellfish harvesting activity authorized by NWPs 4 and 48, or is a shellfish seeding or habitat restoration activity authorized by NWP 27.

6. ***Suitable Material.*** No activity may use unsuitable material (*e.g.,* trash, debris, car bodies, asphalt, etc.). Material used for construction or discharged must be free from toxic pollutants in toxic amounts (see section 307 of the Clean Water Act).

7. ***Water Supply Intakes.*** No activity may occur in the proximity of a public water supply intake, except where the activity is for the repair or improvement of public water supply intake structures or adjacent bank stabilization.

8. ***Adverse Effects From Impoundments.*** If the activity creates an impoundment of water, adverse effects to the aquatic system due to accelerating the passage of water, and/or restricting its flow must be minimized to the maximum extent practicable.

9. ***Management of Water Flows.*** To the maximum extent practicable, the pre-construction course, condition, capacity, and location of open waters must be maintained for each activity, including stream channelization, storm water management activities, and temporary and permanent road crossings, except as provided below. The activity must be constructed to withstand expected high flows. The activity must not restrict or impede the passage of normal or high flows, unless the primary purpose of the activity is to impound water or manage high flows. The activity may alter the pre-construction course, condition, capacity, and location of open waters if it benefits the aquatic environment (*e.g.,* stream restoration or relocation activities).

10. ***Fills Within 100-Year Floodplains.*** The activity must comply with applicable FEMA-approved state or local floodplain management requirements.

11. ***Equipment.*** Heavy equipment working in wetlands or mudflats must be placed on mats, or other measures must be taken to minimize soil disturbance.

12. ***Soil Erosion and Sediment Controls.*** Appropriate soil erosion and sediment controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date. Permittees are encouraged to perform work within waters of the United States during periods of low-flow or no-flow, or during low tides.

13. ***Removal of Temporary Fills.*** Temporary fills must be removed in their entirety and the affected areas returned to pre-construction elevations. The affected areas must be revegetated, as appropriate.

14. ***Proper Maintenance.*** Any authorized structure or fill shall be properly maintained, including maintenance to ensure public safety and compliance with applicable NWP general conditions, as well as any activity-specific conditions added by the district engineer to an NWP authorization.

15. ***Single and Complete Project.*** The activity must be a single and complete project. The same NWP cannot be used more than once for the same single and complete project.

16. ***Wild and Scenic Rivers.*** (a) No NWP activity may occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a "study river" for possible inclusion in the system while the river is in an official study status, unless the appropriate Federal agency with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely affect the Wild and Scenic River designation or study status.

(b) If a proposed NWP activity will occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a "study river" for possible inclusion in the system while the river is in an official study status, the permittee must submit a pre-construction notification (see general condition 32). The district engineer will coordinate the PCN with the Federal agency with direct management responsibility for that river. The permittee shall not begin the NWP activity until notified by the district engineer that the Federal agency with direct management responsibility for that river has determined in writing that the proposed NWP activity will not adversely affect the Wild and Scenic River designation or study status.

(c) Information on Wild and Scenic Rivers may be obtained from the appropriate Federal land management agency responsible for the designated Wild and Scenic River or study river (*e.g.,* National Park Service, U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service). Information on these rivers is also available at: *http://www.rivers.gov/*

17. ***Tribal Rights.*** No NWP activity may cause more than minimal adverse effects on tribal rights (including treaty rights), protected tribal resources, or tribal lands.

18. ***Endangered Species.*** (a) No activity is authorized under any NWP which is likely to directly or indirectly jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act (ESA), or which will directly or indirectly destroy or adversely modify the critical habitat of such species. No activity is authorized under any NWP which "may affect" a listed species or critical habitat, unless ESA section 7 consultation addressing the effects of the proposed activity has been completed. Direct effects are the immediate effects on listed species and critical habitat caused by the NWP activity. Indirect effects are those effects on listed species and critical habitat that are caused by the NWP activity and are later in time, but still are reasonably certain to occur.

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

2017 NATIONAL PERMIT
GENERAL CONDITION

SHEET 1 OF 6

FED.RD. DIV.NO.	PROJECT NO.		SHEET NO.
6			279
STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

(b) Federal agencies should follow their own procedures for complying with the requirements of the ESA. If pre-construction notification is required for the proposed activity, the Federal permittee must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements. The district engineer will verify that the appropriate documentation has been submitted. If the appropriate documentation has not been submitted, additional ESA section 7 consultation may be necessary for the activity and the respective federal agency would be responsible for fulfilling its obligation under section 7 of the ESA.

(c) Non-federal permittees must submit a pre-construction notification to the district engineer if any listed species or designated critical habitat might be affected or is in the vicinity of the activity, or if the activity is located in designated critical habitat, and shall not begin work on the activity until notified by the district engineer that the requirements of the ESA have been satisfied and that the activity is authorized. For activities that might affect Federally-listed endangered or threatened species or designated critical habitat, the pre-construction notification must include the name(s) of the endangered or threatened species that might be affected by the proposed activity or that utilize the designated critical habitat that might be affected by the proposed activity. The district engineer will determine whether the proposed activity "may affect" or will have "no effect" to listed species and designated critical habitat and will notify the non-Federal applicant of the Corps' determination within 45 days of receipt of a complete pre-construction notification. In cases where the non-Federal applicant has identified listed species or critical habitat that might be affected or is in the vicinity of the activity, and has so notified the Corps, the applicant shall not begin work until the Corps has provided notification that the proposed activity will have "no effect" on listed species or critical habitat, or until ESA section 7 consultation has been completed. If the non-Federal applicant has not heard back from the Corps within 45 days, the applicant must still wait for notification from the Corps.

(d) As a result of formal or informal consultation with the FWS or NMFS the district engineer may add species-specific permit conditions to the NWPs.

(e) Authorization of an activity by an NWP does not authorize the "take" of a threatened or endangered species as defined under the ESA. In the absence of separate authorization (*e.g.,* an ESA Section 10 Permit, a Biological Opinion with "incidental take" provisions, etc.) from the FWS or the NMFS, the Endangered Species Act prohibits any person subject to the jurisdiction of the United States to take a listed species, where "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. The word "harm" in the definition of "take" means an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering.

(f) If the non-federal permittee has a valid ESA section 10(a)(1)(B) incidental take permit with an approved Habitat Conservation Plan for a project or a group of projects that includes the proposed NWP activity, the non-federal applicant should provide a copy of that ESA section 10(a)(1)(B) permit with the PCN required by paragraph (c) of this general condition. The district engineer will coordinate with the agency that issued the ESA section 10(a)(1)(B) permit to determine whether the proposed NWP activity and the associated incidental take were considered in the internal ESA section 7 consultation conducted for the ESA section 10(a)(1)(B) permit. If that coordination results in concurrence from the agency that the proposed NWP activity and the associated incidental take were considered in the internal ESA section 7 consultation for the ESA section 10(a)(1)(B) permit, the district engineer does not need to conduct a separate ESA section 7 consultation for the proposed NWP activity. The district engineer will notify the non-federal applicant within 45 days of receipt of a complete pre-construction notification whether the ESA section 10(a)(1)(B) permit covers the proposed NWP activity or whether additional ESA section 7 consultation is required.

(g) Information on the location of threatened and endangered species and their critical habitat can be obtained directly from the offices of the FWS and NMFS or their world wide Web pages at *http://www.fws.gov/* or *http://www.fws.gov/ipac* and *http://www.nmfs.noaa.gov/pr/species/esa/* respectively.

19. ***Migratory Birds and Bald and Golden Eagles.*** The permittee is responsible for ensuring their action complies with the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. The permittee is responsible for contacting appropriate local office of the U.S. Fish and Wildlife Service to determine applicable measures to reduce impacts to migratory birds or eagles, including whether "incidental take" permits are necessary and available under the Migratory Bird Treaty Act or Bald and Golden Eagle Protection Act for a particular activity.

20. ***Historic Properties.*** (a) In cases where the district engineer determines that the activity may have the potential to cause effects to properties listed, or eligible for listing, in the National Register of Historic Places, the activity is not authorized, until the requirements of Section 106 of the National Historic Preservation Act (NHPA) have been satisfied.

(b) Federal permittees should follow their own procedures for complying with the requirements of section 106 of the National Historic Preservation Act. If pre-construction notification is required for the proposed NWP activity, the Federal permittee must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements. The district engineer will verify that the appropriate documentation has been submitted. If the appropriate documentation is not submitted, then additional consultation under section 106 may be necessary. The respective federal agency is responsible for fulfilling its obligation to comply with section 106.

(c) Non-federal permittees must submit a pre-construction notification to the district engineer if the NWP activity might have the potential to cause effects to any historic properties listed on, determined to be eligible for listing on, or potentially eligible for listing on the National Register of Historic Places, including previously unidentified properties. For such activities, the pre-construction notification must state which historic properties might have the potential to be affected by the proposed NWP activity or include a vicinity map indicating the location of the historic properties or the potential for the presence of historic properties. Assistance regarding information on the location of, or potential for, the presence of historic properties can be sought from the State Historic Preservation Officer, Tribal Historic Preservation Officer, or designated tribal representative, as appropriate, and the National Register of Historic Places (see 33 CFR 330.4(g)). When reviewing pre-construction notifications, district engineers will comply with the current procedures for addressing the requirements of section 106 of the National Historic Preservation Act. The district engineer shall make a reasonable and good faith effort to carry out appropriate identification efforts, which may include background research, consultation, oral history interviews, sample field investigation, and field survey. Based on the information submitted in the PCN and these identification efforts, the district engineer shall determine whether the proposed NWP activity has the potential to cause effects on the historic properties. Section 106 consultation is not required when the district engineer determines that the activity does not have the potential to cause effects on historic properties (see 36 CFR 800.3(a)). Section 106 consultation is required when the district engineer determines that the activity has the potential to cause effects on historic properties. The district engineer will conduct consultation with consulting parties identified under 36 CFR 800.2(c) when he or she makes any of the following effect determinations for the purposes of section 106 of the NHPA: no historic properties affected, no adverse effect, or adverse effect. Where the non-Federal applicant has identified historic properties on which the activity might have the potential to cause effects and so notified the Corps, the non-Federal applicant shall not begin the activity until notified by the district engineer either that the activity has no potential to cause effects to historic properties or that NHPA section 106 consultation has been completed.

(d) For non-federal permittees, the district engineer will notify the prospective permittee within 45 days of receipt of a complete pre-construction notification whether NHPA section 106 consultation is required. If NHPA section 106 consultation is required, the district engineer will notify the non-Federal applicant that he or she cannot begin the activity until section 106 consultation is completed. If the non- Federal applicant has not heard back from the Corps within 45 days, the applicant must still wait for notification from the Corps.

(e) Prospective permittees should be aware that section 110k of the NHPA (54 U.S.C. 306113) prevents the Corps from granting a permit or other assistance to an applicant who, with intent to avoid the requirements of section 106 of the NHPA, has intentionally significantly adversely affected a historic property to which the permit would relate, or having legal power to prevent it, allowed such significant adverse effect to occur, unless the Corps, after consultation with the Advisory Council on Historic Preservation (ACHP), determines that circumstances justify granting such assistance despite the adverse effect created or permitted by the applicant. If circumstances justify granting the assistance, the Corps is required to notify the ACHP and provide documentation specifying the circumstances, the degree of damage to the integrity of any historic properties affected, and proposed mitigation. This documentation must include any views obtained from the applicant, SHPO/THPO, appropriate Indian tribes if the undertaking occurs on or affects historic properties on tribal lands or affects properties of interest to those tribes, and other parties known to have a legitimate interest in the impacts to the permitted activity on historic properties.

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

2017 NATIONAL PERMIT
GENERAL CONDITION

SHEET 2 OF 6

FED.RD. DIV.NO.	PROJECT NO.		SHEET NO.
6			280
STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

21. ***Discovery of Previously Unknown Remains and Artifacts.*** If you discover any previously unknown historic, cultural or archeological remains and artifacts while accomplishing the activity authorized by this permit, you must immediately notify the district engineer of what you have found, and to the maximum extent practicable, avoid construction activities that may affect the remains and artifacts until the required coordination has been completed. The district engineer will initiate the Federal, Tribal, and state coordination required to determine if the items or remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

22. ***Designated Critical Resource Waters.*** Critical resource waters include, NOAA-managed marine sanctuaries and marine monuments, and National Estuarine Research Reserves. The district engineer may designate, after notice and opportunity for public comment, additional waters officially designated by a state as having particular environmental or ecological significance, such as outstanding national resource waters or state natural heritage sites. The district engineer may also designate additional critical resource waters after notice and opportunity for public comment.

(a) Discharges of dredged or fill material into waters of the United States are not authorized by NWPs 7, 12, 14, 16, 17, 21, 29, 31, 35, 39, 40, 42, 43, 44, 49, 50, 51, and 52 for any activity within, or directly affecting, critical resource waters, including wetlands adjacent to such waters.

(b) For NWPs 3, 8, 10, 13, 15, 18, 19, 22, 23, 25, 27, 28, 30, 33, 34, 36, 37, 38, and 54, notification is required in accordance with general condition 32, for any activity proposed in the designated critical resource waters including wetlands adjacent to those waters. The district engineer may authorize activities under these NWPs only after it is determined that the impacts to the critical resource waters will be no more than minimal.

23. ***Mitigation.*** The district engineer will consider the following factors when determining appropriate and practicable mitigation necessary to ensure that the individual and cumulative adverse environmental effects are no more than minimal:

(a) The activity must be designed and constructed to avoid and minimize adverse effects, both temporary and permanent, to waters of the United States to the maximum extent practicable at the project site (*i.e.,* on site).

(b) Mitigation in all its forms (avoiding, minimizing, rectifying, reducing, or compensating for resource losses) will be required to the extent necessary to ensure that the individual and cumulative adverse environmental effects are no more than minimal.

(c) Compensatory mitigation at a minimum one-for-one ratio will be required for all wetland losses that exceed 1/10-acre and require pre-construction notification, unless the district engineer determines in writing that either some other form of mitigation would be more environmentally appropriate or the adverse environmental effects of the proposed activity are no more than minimal, and provides an activity-specific waiver of this requirement. For wetland losses of 1/10-acre or less that require pre-construction notification, the district engineer may determine on a case-by-case basis that compensatory mitigation is required to ensure that the activity results in only minimal adverse environmental effects.

(d) For losses of streams or other open waters that require pre-construction notification, the district engineer may require compensatory mitigation to ensure that the activity results in no more than minimal adverse environmental effects. Compensatory mitigation for losses of streams should be provided, if practicable, through stream rehabilitation, enhancement, or preservation, since streams are difficult-to-replace resources (see 33 CFR 332.3(e)(3)).

(e) Compensatory mitigation plans for NWP activities in or near streams or other open waters will normally include a requirement for the restoration or enhancement, maintenance, and legal protection (*e.g.,* conservation easements) of riparian areas next to open waters. In some cases, the restoration or maintenance/protection of riparian areas may be the only compensatory mitigation required. Restored riparian areas should consist of native species. The width of the required riparian area will address documented water quality or aquatic habitat loss concerns. Normally, the riparian area will be 25 to 50 feet wide on each side of the stream, but the district engineer may require slightly wider riparian areas to address documented water quality or habitat loss concerns. If it is not possible to restore or maintain/protect a riparian area on both sides of a stream, or if the waterbody is a lake or coastal waters, then restoring or maintaining/protecting a riparian area along a single bank or shoreline may be sufficient. Where both wetlands and open waters exist on the project site, the district engineer will determine the appropriate compensatory mitigation (*e.g.,* riparian areas and/or wetlands compensation) based on what is best for the aquatic environment on a watershed basis. In cases where riparian areas are determined to be the most appropriate form of minimization or compensatory mitigation, the district engineer may waive or reduce the requirement to provide wetland compensatory mitigation for wetland losses.

(f) Compensatory mitigation projects provided to offset losses of aquatic resources must comply with the applicable provisions of 33 CFR part 332.

(1) The prospective permittee is responsible for proposing an appropriate compensatory mitigation option if compensatory mitigation is necessary to ensure that the activity results in no more than minimal adverse environmental effects. For the NWPs, the preferred mechanism for providing compensatory mitigation is mitigation bank credits or in-lieu fee program credits (see 33 CFR 332.3(b)(2) and (3)). However, if an appropriate number and type of mitigation bank or in-lieu credits are not available at the time the PCN is submitted to the district engineer, the district engineer may approve the use of permittee-responsible mitigation.

(2) The amount of compensatory mitigation required by the district engineer must be sufficient to ensure that the authorized activity results in no more than minimal individual and cumulative adverse environmental effects (see 33 CFR 330.1(e)(3)). (See also 33 CFR 332.3(f)).

(3) Since the likelihood of success is greater and the impacts to potentially valuable uplands are reduced, aquatic resource restoration should be the first compensatory mitigation option considered for permittee-responsible mitigation.

(4) If permittee-responsible mitigation is the proposed option, the prospective permittee is responsible for submitting a mitigation plan. A conceptual or detailed mitigation plan may be used by the district engineer to make the decision on the NWP verification request, but a final mitigation plan that addresses the applicable requirements of 33 CFR 332.4(c)(2) through (14) must be approved by the district engineer before the permittee begins work in waters of the United States, unless the district engineer determines that prior approval of the final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation (see 33 CFR 332.3(k)(3)).

(5) If mitigation bank or in-lieu fee program credits are the proposed option, the mitigation plan only needs to address the baseline conditions at the impact site and the number of credits to be provided.

(6) Compensatory mitigation requirements (*e.g.,* resource type and amount to be provided as compensatory mitigation, site protection, ecological performance standards, monitoring requirements) may be addressed through conditions added to the NWP authorization, instead of components of a compensatory mitigation plan (see 33 CFR 332.4(c)(1)(ii)).

(g) Compensatory mitigation will not be used to increase the acreage losses allowed by the acreage limits of the NWPs. For example, if an NWP has an acreage limit of 1/2-acre, it cannot be used to authorize any NWP activity resulting in the loss of greater than 1/2-acre of waters of the United States, even if compensatory mitigation is provided that replaces or restores some of the lost waters. However, compensatory mitigation can and should be used, as necessary, to ensure that an NWP activity already meeting the established acreage limits also satisfies the no more than minimal impact requirement for the NWPs.

(h) Permittees may propose the use of mitigation banks, in-lieu fee programs, or permittee-responsible mitigation. When developing a compensatory mitigation proposal, the permittee must consider appropriate and practicable options consistent with the framework at 33 CFR 332.3(b). For activities resulting in the loss of marine or estuarine resources, permittee-responsible mitigation may be environmentally preferable if there are no mitigation banks or in-lieu fee programs in the area that have marine or estuarine credits available for sale or transfer to the permittee. For permittee-responsible mitigation, the special conditions of the NWP verification must clearly indicate the party or parties responsible for the implementation and performance of the compensatory mitigation project, and, if required, its long-term management.

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

2017 NATIONAL PERMIT
GENERAL CONDITION

SHEET 3 OF 6

FED.RD. DIV.NO.	PROJECT NO.		SHEET NO.
6			281
STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

(i) Where certain functions and services of waters of the United States are permanently adversely affected by a regulated activity, such as discharges of dredged or fill material into waters of the United States that will convert a forested or scrub-shrub wetland to a herbaceous wetland in a permanently maintained utility line right-of-way, mitigation may be required to reduce the adverse environmental effects of the activity to the no more than minimal level.

24. ***Safety of Impoundment Structures.*** To ensure that all impoundment structures are safely designed, the district engineer may require non-Federal applicants to demonstrate that the structures comply with established state dam safety criteria or have been designed by qualified persons. The district engineer may also require documentation that the design has been independently reviewed by similarly qualified persons, and appropriate modifications made to ensure safety.

25. ***Water Quality.*** Where States and authorized Tribes, or EPA where applicable, have not previously certified compliance of an NWP with CWA section 401, individual 401 Water Quality Certification must be obtained or waived (see 33 CFR 330.4(c)). The district engineer or State or Tribe may require additional water quality management measures to ensure that the authorized activity does not result in more than minimal degradation of water quality.

26. ***Coastal Zone Management.*** In coastal states where an NWP has not previously received a state coastal zone management consistency concurrence, an individual state coastal zone management consistency concurrence must be obtained, or a presumption of concurrence must occur (see 33 CFR 330.4(d)). The district engineer or a State may require additional measures to ensure that the authorized activity is consistent with state coastal zone management requirements.

27. ***Regional and Case-By-Case Conditions.*** The activity must comply with any regional conditions that may have been added by the Division Engineer (see 33 CFR 330.4(e)) and with any case specific conditions added by the Corps or by the state, Indian Tribe, or U.S. EPA in its section 401 Water Quality Certification, or by the state in its Coastal Zone Management Act consistency determination.

28. ***Use of Multiple Nationwide Permits.*** The use of more than one NWP for a single and complete project is prohibited, except when the acreage loss of waters of the United States authorized by the NWPs does not exceed the acreage limit of the NWP with the highest specified acreage limit. For example, if a road crossing over tidal waters is constructed under NWP 14, with associated bank stabilization authorized by NWP 13, the maximum acreage loss of waters of the United States for the total project cannot exceed 1/3-acre.

29. ***Transfer of Nationwide Permit Verifications.*** If the permittee sells the property associated with a nationwide permit verification, the permittee may transfer the nationwide permit verification to the new owner by submitting a letter to the appropriate Corps district office to validate the transfer. A copy of the nationwide permit verification must be attached to the letter, and the letter must contain the following statement and signature:

When the structures or work authorized by this nationwide permit are still in existence at the time the property is transferred, the terms and conditions of this nationwide permit, including any special conditions, will continue to be binding on the new owner(s) of the property. To validate the transfer of this nationwide permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below.

(Transferee)

(Date)

30. ***Compliance Certification.*** Each permittee who receives an NWP verification letter from the Corps must provide a signed certification documenting completion of the authorized activity and implementation of any required compensatory mitigation. The success of any required permittee-responsible mitigation, including the achievement of ecological performance standards, will be addressed separately by the district engineer. The Corps will provide the permittee the certification document with the NWP verification letter. The certification document will include:

(a) A statement that the authorized activity was done in accordance with the NWP authorization, including any general, regional, or activity-specific conditions;

(b) A statement that the implementation of any required compensatory mitigation was completed in accordance with the permit conditions. If credits from a mitigation bank or in-lieu fee program are used to satisfy the compensatory mitigation requirements, the certification must include the documentation required by 33 CFR 332.3(l)(3) to confirm that the permittee secured the appropriate number and resource type of credits; and

(c) The signature of the permittee certifying the completion of the activity and mitigation.

The completed certification document must be submitted to the district engineer within 30 days of completion of the authorized activity or the implementation of any required compensatory mitigation, whichever occurs later.

31. ***Activities Affecting Structures or Works Built by the United States.*** If an NWP activity also requires permission from the Corps pursuant to 33 U.S.C. 408 because it will alter or temporarily or permanently occupy or use a U.S. Army Corps of Engineers (USACE) federally authorized Civil Works project (a "USACE project"), the prospective permittee must submit a pre-construction notification. See paragraph (b)(10) of general condition 32. An activity that requires section 408 permission is not authorized by NWP until the appropriate Corps office issues the section 408 permission to alter, occupy, or use the USACE project, and the district engineer issues a written NWP verification.

32. ***Pre-Construction Notification.*** (a) *Timing*. Where required by the terms of the NWP, the prospective permittee must notify the district engineer by submitting a pre-construction notification (PCN) as early as possible. The district engineer must determine if the PCN is complete within 30 calendar days of the date of receipt and, if the PCN is determined to be incomplete, notify the prospective permittee within that 30 day period to request the additional information necessary to make the PCN complete. The request must specify the information needed to make the PCN complete. As a general rule, district engineers will request additional information necessary to make the PCN complete only once. However, if the prospective permittee does not provide all of the requested information, then the district engineer will notify the prospective permittee that the PCN is still incomplete and the PCN review process will not commence until all of the requested information has been received by the district engineer. The prospective permittee shall not begin the activity until either:

(1) He or she is notified in writing by the district engineer that the activity may proceed under the NWP with any special conditions imposed by the district or division engineer; or

(2) 45 calendar days have passed from the district engineer's receipt of the complete PCN and the prospective permittee has not received written notice from the district or division engineer. However, if the permittee was required to notify the Corps pursuant to general condition 18 that listed species or critical habitat might be affected or are in the vicinity of the activity, or to notify the Corps pursuant to general condition 20 that the activity might have the potential to cause effects to historic properties, the permittee cannot begin the activity until receiving written notification from the Corps that there is "no effect" on listed species or "no potential to cause effects" on historic properties, or that any consultation required under Section 7 of the Endangered Species Act (see 33 CFR 330.4(f)) and/or section 106 of the National Historic Preservation Act (see 33 CFR 330.4(g)) has been completed. Also, work cannot begin under NWPs 21, 49, or 50 until the permittee has received written approval from the Corps. If the proposed activity requires a written waiver to exceed specified limits of an NWP, the permittee may not begin the activity until the district engineer issues the waiver. If the district or division engineer notifies the permittee in writing that an individual permit is required within 45 calendar days of receipt of a complete PCN, the permittee cannot begin the activity until an individual permit has been obtained. Subsequently, the permittee's right to proceed under the NWP may be modified, suspended, or revoked only in accordance with the procedure set forth in 33 CFR 330.5(d)(2).

(b) *Contents of Pre-Construction Notification:* The PCN must be in writing and include the following information:

(1) Name, address and telephone numbers of the prospective permittee;

(2) Location of the proposed activity;

(3) Identify the specific NWP or NWP(s) the prospective permittee wants to use to authorize the proposed activity;

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

2017 NATIONAL PERMIT
GENERAL CONDITION

SHEET 4 OF 6

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		282

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

(i) Where certain functions and services of waters of the United States are permanently adversely affected by a regulated activity, such as discharges of dredged or fill material into waters of the United States that will convert a forested or scrub-shrub wetland to a herbaceous wetland in a permanently maintained utility line right-of-way, mitigation may be required to reduce the adverse environmental effects of the activity to the no more than minimal level.

24. ***Safety of Impoundment Structures.*** To ensure that all impoundment structures are safely designed, the district engineer may require non-Federal applicants to demonstrate that the structures comply with established state dam safety criteria or have been designed by qualified persons. The district engineer may also require documentation that the design has been independently reviewed by similarly qualified persons, and appropriate modifications made to ensure safety.

25. ***Water Quality.*** Where States and authorized Tribes, or EPA where applicable, have not previously certified compliance of an NWP with CWA section 401, individual 401 Water Quality Certification must be obtained or waived (see 33 CFR 330.4(c)). The district engineer or State or Tribe may require additional water quality management measures to ensure that the authorized activity does not result in more than minimal degradation of water quality.

26. ***Coastal Zone Management.*** In coastal states where an NWP has not previously received a state coastal zone management consistency concurrence, an individual state coastal zone management consistency concurrence must be obtained, or a presumption of concurrence must occur (see 33 CFR 330.4(d)). The district engineer or a State may require additional measures to ensure that the authorized activity is consistent with state coastal zone management requirements.

27. ***Regional and Case-By-Case Conditions.*** The activity must comply with any regional conditions that may have been added by the Division Engineer (see 33 CFR 330.4(e)) and with any case specific conditions added by the Corps or by the state, Indian Tribe, or U.S. EPA in its section 401 Water Quality Certification, or by the state in its Coastal Zone Management Act consistency determination.

28. ***Use of Multiple Nationwide Permits.*** The use of more than one NWP for a single and complete project is prohibited, except when the acreage loss of waters of the United States authorized by the NWPs does not exceed the acreage limit of the NWP with the highest specified acreage limit. For example, if a road crossing over tidal waters is constructed under NWP 14, with associated bank stabilization authorized by NWP 13, the maximum acreage loss of waters of the United States for the total project cannot exceed 1/3-acre.

29. ***Transfer of Nationwide Permit Verifications.*** If the permittee sells the property associated with a nationwide permit verification, the permittee may transfer the nationwide permit verification to the new owner by submitting a letter to the appropriate Corps district office to validate the transfer. A copy of the nationwide permit verification must be attached to the letter, and the letter must contain the following statement and signature:

When the structures or work authorized by this nationwide permit are still in existence at the time the property is transferred, the terms and conditions of this nationwide permit, including any special conditions, will continue to be binding on the new owner(s) of the property. To validate the transfer of this nationwide permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below.

(Transferee)

(Date)

30. ***Compliance Certification.*** Each permittee who receives an NWP verification letter from the Corps must provide a signed certification documenting completion of the authorized activity and implementation of any required compensatory mitigation. The success of any required permittee-responsible mitigation, including the achievement of ecological performance standards, will be addressed separately by the district engineer. The Corps will provide the permittee the certification document with the NWP verification letter. The certification document will include:

(a) A statement that the authorized activity was done in accordance with the NWP authorization, including any general, regional, or activity-specific conditions;

(b) A statement that the implementation of any required compensatory mitigation was completed in accordance with the permit conditions. If credits from a mitigation bank or in-lieu fee program are used to satisfy the compensatory mitigation requirements, the certification must include the documentation required by 33 CFR 332.3(l)(3) to confirm that the permittee secured the appropriate number and resource type of credits; and

(c) The signature of the permittee certifying the completion of the activity and mitigation.

The completed certification document must be submitted to the district engineer within 30 days of completion of the authorized activity or the implementation of any required compensatory mitigation, whichever occurs later.

31. ***Activities Affecting Structures or Works Built by the United States.*** If an NWP activity also requires permission from the Corps pursuant to 33 U.S.C. 408 because it will alter or temporarily or permanently occupy or use a U.S. Army Corps of Engineers (USACE) federally authorized Civil Works project (a "USACE project"), the prospective permittee must submit a pre-construction notification. See paragraph (b)(10) of general condition 32. An activity that requires section 408 permission is not authorized by NWP until the appropriate Corps office issues the section 408 permission to alter, occupy, or use the USACE project, and the district engineer issues a written NWP verification.

32. ***Pre-Construction Notification.*** (a) *Timing.* Where required by the terms of the NWP, the prospective permittee must notify the district engineer by submitting a pre-construction notification (PCN) as early as possible. The district engineer must determine if the PCN is complete within 30 calendar days of the date of receipt and, if the PCN is determined to be incomplete, notify the prospective permittee within that 30 day period to request the additional information necessary to make the PCN complete. The request must specify the information needed to make the PCN complete. As a general rule, district engineers will request additional information necessary to make the PCN complete only once. However, if the prospective permittee does not provide all of the requested information, then the district engineer will notify the prospective permittee that the PCN is still incomplete and the PCN review process will not commence until all of the requested information has been received by the district engineer. The prospective permittee shall not begin the activity until either:

(1) He or she is notified in writing by the district engineer that the activity may proceed under the NWP with any special conditions imposed by the district or division engineer; or

(2) 45 calendar days have passed from the district engineer's receipt of the complete PCN and the prospective permittee has not received written notice from the district or division engineer. However, if the permittee was required to notify the Corps pursuant to general condition 18 that listed species or critical habitat might be affected or are in the vicinity of the activity, or to notify the Corps pursuant to general condition 20 that the activity might have the potential to cause effects to historic properties, the permittee cannot begin the activity until receiving written notification from the Corps that there is "no effect" on listed species or "no potential to cause effects" on historic properties, or that any consultation required under Section 7 of the Endangered Species Act (see 33 CFR 330.4(f)) and/or section 106 of the National Historic Preservation Act (see 33 CFR 330.4(g)) has been completed. Also, work cannot begin under NWPs 21, 49, or 50 until the permittee has received written approval from the Corps. If the proposed activity requires a written waiver to exceed specified limits of an NWP, the permittee may not begin the activity until the district engineer issues the waiver. If the district or division engineer notifies the permittee in writing that an individual permit is required within 45 calendar days of receipt of a complete PCN, the permittee cannot begin the activity until an individual permit has been obtained. Subsequently, the permittee's right to proceed under the NWP may be modified, suspended, or revoked only in accordance with the procedure set forth in 33 CFR 330.5(d)(2).

(b) *Contents of Pre-Construction Notification:* The PCN must be in writing and include the following information:

(1) Name, address and telephone numbers of the prospective permittee;

(2) Location of the proposed activity;

(3) Identify the specific NWP or NWP(s) the prospective permittee wants to use to authorize the proposed activity;

Texas Department of Transportation

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

2017 NATIONAL PERMIT
GENERAL CONDITION

SHEET 5 OF 6

FED.RD. DIV.NO.	PROJECT NO.		SHEET NO.
6			283
STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

(4) A description of the proposed activity; the activity's purpose; direct and indirect adverse environmental effects the activity would cause, including the anticipated amount of loss of wetlands, other special aquatic sites, and other waters expected to result from the NWP activity, in acres, linear feet, or other appropriate unit of measure; a description of any proposed mitigation measures intended to reduce the adverse environmental effects caused by the proposed activity; and any other NWP(s), regional general permit(s), or individual permit(s) used or intended to be used to authorize any part of the proposed project or any related activity, including other separate and distant crossings for linear projects that require Department of the Army authorization but do not require pre-construction notification. The description of the proposed activity and any proposed mitigation measures should be sufficiently detailed to allow the district engineer to determine that the adverse environmental effects of the activity will be no more than minimal and to determine the need for compensatory mitigation or other mitigation measures. For single and complete linear projects, the PCN must include the quantity of anticipated losses of wetlands, other special aquatic sites, and other waters for each single and complete crossing of those wetlands, other special aquatic sites, and other waters. Sketches should be provided when necessary to show that the activity complies with the terms of the NWP. (Sketches usually clarify the activity and when provided results in a quicker decision. Sketches should contain sufficient detail to provide an illustrative description of the proposed activity (*e.g.,* a conceptual plan), but do not need to be detailed engineering plans);

(5) The PCN must include a delineation of wetlands, other special aquatic sites, and other waters, such as lakes and ponds, and perennial, intermittent, and ephemeral streams, on the project site. Wetland delineations must be prepared in accordance with the current method required by the Corps. The permittee may ask the Corps to delineate the special aquatic sites and other waters on the project site, but there may be a delay if the Corps does the delineation, especially if the project site is large or contains many wetlands, other special aquatic sites, and other waters. Furthermore, the 45 day period will not start until the delineation has been submitted to or completed by the Corps, as appropriate;

(6) If the proposed activity will result in the loss of greater than 1/10-acre of wetlands and a PCN is required, the prospective permittee must submit a statement describing how the mitigation requirement will be satisfied, or explaining why the adverse environmental effects are no more than minimal and why compensatory mitigation should not be required. As an alternative, the prospective permittee may submit a conceptual or detailed mitigation plan.

(7) For non-Federal permittees, if any listed species or designated critical habitat might be affected or is in the vicinity of the activity, or if the activity is located in designated critical habitat, the PCN must include the name(s) of those endangered or threatened species that might be affected by the proposed activity or utilize the designated critical habitat that might be affected by the proposed activity. For NWP activities that require pre-construction notification, Federal permittees must provide documentation demonstrating compliance with the Endangered Species Act;

(8) For non-Federal permittees, if the NWP activity might have the potential to cause effects to a historic property listed on, determined to be eligible for listing on, or potentially eligible for listing on, the National Register of Historic Places, the PCN must state which historic property might have the potential to be affected by the proposed activity or include a vicinity map indicating the location of the historic property. For NWP activities that require pre-construction notification, Federal permittees must provide documentation demonstrating compliance with section 106 of the National Historic Preservation Act;

(9) For an activity that will occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a "study river" for possible inclusion in the system while the river is in an official study status, the PCN must identify the Wild and Scenic River or the "study river" (see general condition 16); and

(10) For an activity that requires permission from the Corps pursuant to 33 U.S.C. 408 because it will alter or temporarily or permanently occupy or use a U.S. Army Corps of Engineers federally authorized civil works project, the pre-construction notification must include a statement confirming that the project proponent has submitted a written request for section 408 permission from the Corps office having jurisdiction over that USACE project.

(c) *Form of Pre-Construction Notification:* The standard individual permit application form (Form ENG 4345) may be used, but the completed application form must clearly indicate that it is an NWP PCN and must include all of the applicable information required in paragraphs (b)(1) through (10) of this general condition. A letter containing the required information may also be used. Applicants may provide electronic files of PCNs and supporting materials if the district engineer has established tools and procedures for electronic submittals.

(d) *Agency Coordination:* (1) The district engineer will consider any comments from Federal and state agencies concerning the proposed activity's compliance with the terms and conditions of the NWPs and the need for mitigation to reduce the activity's adverse environmental effects so that they are no more than minimal.

(2) Agency coordination is required for: (i) All NWP activities that require pre-construction notification and result in the loss of greater than 1/2-acre of waters of the United States; (ii) NWP 21, 29, 39, 40, 42, 43, 44, 50, 51, and 52 activities that require pre-construction notification and will result in the loss of greater than 300 linear feet of stream bed; (iii) NWP 13 activities in excess of 500 linear feet, fills greater than one cubic yard per running foot, or involve discharges of dredged or fill material into special aquatic sites; and (iv) NWP 54 activities in excess of 500 linear feet, or that extend into the waterbody more than 30 feet from the mean low water line in tidal waters or the ordinary high water mark in the Great Lakes.

(3) When agency coordination is required, the district engineer will immediately provide (*e.g.,* via email, facsimile transmission, overnight mail, or other expeditious manner) a copy of the complete PCN to the appropriate Federal or state offices (FWS, state natural resource or water quality agency, EPA, and, if appropriate, the NMFS). With the exception of NWP 37, these agencies will have 10 calendar days from the date the material is transmitted to notify the district engineer via telephone, facsimile transmission, or email that they intend to provide substantive, site-specific comments. The comments must explain why the agency believes the adverse environmental effects will be more than minimal. If so contacted by an agency, the district engineer will wait an additional 15 calendar days before making a decision on the pre-construction notification. The district engineer will fully consider agency comments received within the specified time frame concerning the proposed activity's compliance with the terms and conditions of the NWPs, including the need for mitigation to ensure the net adverse environmental effects of the proposed activity are no more than minimal. The district engineer will provide no response to the resource agency, except as provided below. The district engineer will indicate in the administrative record associated with each pre-construction notification that the resource agencies' concerns were considered. For NWP 37, the emergency watershed protection and rehabilitation activity may proceed immediately in cases where there is an unacceptable hazard to life or a significant loss of property or economic hardship will occur. The district engineer will consider any comments received to decide whether the NWP 37 authorization should be modified, suspended, or revoked in accordance with the procedures at 33 CFR 330.5.

(4) In cases of where the prospective permittee is not a Federal agency, the district engineer will provide a response to NMFS within 30 calendar days of receipt of any Essential Fish Habitat conservation recommendations, as required by section 305(b)(4)(B) of the Magnuson-Stevens Fishery Conservation and Management Act.

(5) Applicants are encouraged to provide the Corps with either electronic files or multiple copies of pre-construction notifications to expedite agency coordination.

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

2017 NATIONAL PERMIT
GENERAL CONDITION

SHEET 6 OF 6

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		284

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

2017 NATIONWIDE PERMIT (NWP) REGIONAL CONDITIONS
FOR THE STATE OF TEXAS

The following regional conditions apply within the entire State of Texas:

1. For all discharges proposed for authorization under nationwide permits (NWP) 3, 6, 7, 12, 14, 18, 19, 21, 23, 25, 27, 29, 39, 40, 41, 42, 43, 44, 49, 51, and 52, into the following habitat types or specific areas, the applicant shall notify the appropriate District Engineer in accordance with the NWP General Condition 32, Pre-Construction Notification (PCN). The Corps of Engineers (Corps) will coordinate with the resource agencies as specified in NWP General Condition 32(d) (PCN). The habitat types or areas are:

   a. Pitcher Plant Bogs: Wetlands typically characterized by an organic surface soil layer and include vegetation such as pitcher plants (*Sarracenia* spp.), sundews (*Drosera* spp.).

   b. Bald Cypress-Tupelo Swamps: Wetlands dominated by bald cypress (*Taxodium distichum*) and/or water tupelo (*Nyssa aquatic*).

2. For all activities proposed for authorization under NWP in Palustrine and Lacustrine aquatic resource types, best management practices (BMPs) are required to reduce the risk of transferring zebra mussels to or from project sites. The following BMPs, as a minimum, will be required:

   a. Clean: Clean both the inside and outside of equipment and gear, by removing all plants, animals, and mud and thoroughly washing the equipment using a high pressure spray nozzle. Equipment operated or stored in a water body on the Texas list of zebra mussel (*Dreissena polymorpha*) infected water bodies shall be decontaminated in accordance with State of Texas law prior to relocation.

   b. Drain: Drain all water from receptacles before leaving the area, including livewells, bilges, ballast, and engine cooling water on boats.

   c. Dry: Allow time for your equipment to dry completely before relocating in other waters. Minimum drying time is one week. Equipment operated or stored in a water body on the Texas list of zebra mussel (*Dreissena polymorpha*) infected water bodies shall be dried a minimum of 20 days prior to relocation. High temperature pressure washing (greater than or equal to 140F) or professional cleaning may be substituted for drying time.

3. For all activities proposed for authorization under NWP at sites approved as compensatory mitigation sites (either permittee-responsible, mitigation bank and/or in-lieu fee) under Section 404 of the Clean Water Act and/or Section 10 of the Rivers and

Harbors Act of 1899, the applicant shall notify the appropriate District Engineer in accordance with the NWP General Condition 32 (Pre-Construction Notification) prior to commencing the activity.

The following regional conditions apply within the Albuquerque, Fort Worth, and Galveston Districts:

4. For all activities proposed for authorization under NWP 12 that involve a discharge of fill material associated with mechanized land clearing of wetlands dominated by woody shrubs, the applicant shall notify the appropriate District Engineer in accordance with the NWP General Condition 32 (Pre-Construction Notification) prior to commencing the activity. For the purpose of this regional condition, a shrub dominated wetland is characterized by woody vegetation less than 3.0 in. in diameter at breast height but greater than 3.2 ft in height, exclusive of woody vines, covering 20 % or more of the area.

The following regional conditions apply within the Albuquerque, District.

5. Nationwide Permit No. 23 – Approved Categorical Exclusions. A PCN to the District Engineer in accordance with General Condition 32 is required for all proposed activities under Nationwide Permit 23.

6. Nationwide Permit No. 27 – Aquatic Habitat Restoration, Establishment, and Enhancement Activities. For all proposed activities under Nationwide Permit 27 that require PCN, a monitoring plan commensurate with the scale of the proposed restoration project and the potential for risk to the aquatic environment must be submitted to the Corps. (See "NWP 27 Guidelines" at http://www.spa.usace.army.mil/Missions/RegulatoryProgramandPermits/NWP.aspx).

7. Channelization. General Condition 9 for Management of Water Flows is amended to add the following: Projects that would result in permanent channelization to previously un-channelized streams require PCN to the District Engineer in accordance with General Condition 32.

8. Dredge and Fill Activities in Intermittent and Perennial Streams, and Special Aquatic Sites: (a) For all activities subject to regulation under the Clean Water Act Section 404 in intermittent and perennial streams, and special aquatic sites (including wetlands, riffle and pool complexes, and sanctuaries and refuges), PCN to the District Engineer is required in accordance with General Condition 32.

9. Springs. For all discharges of dredged or fill material within 100 feet of the point of groundwater discharge of natural springs, PCN is required to the Corps in accordance with General Condition 32. A natural spring is defined as any location where ground water emanates from a point in the ground and has a defined surface water connection to another waters of the United States. For purposes of this regional condition, springs do not include seeps or other groundwater discharges which lack a defined surface water connection.

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

2017 NATIONAL PERMIT
REGIONAL CONDITIONS

SHEET 1 OF 3

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		285

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

10. Suitable Fill. Use of broken concrete as fill or bank stabilization material is prohibited unless the applicant demonstrates that its use is the only practicable material (with respect to cost, existing technology, and logistics). Any applicant who wishes to use broken concrete as bank stabilization must provide notification to the District Engineer in accordance with General Condition 32 (Pre-Construction Notification) along with justification for such use. Use of broken concrete with rebar or used tires (loose or formed into bales) is prohibited in all waters of the United States.

The following regional conditions apply within the Fort Worth District.

11. For all discharges associated with the construction of water intake structures, the applicant shall notify the Fort Worth District Engineer in accordance with General Condition 32 (Pre-Construction Notification).

12. For all discharges proposed for authorization under all NWPs, into the area of Caddo Lake within Texas that is designated as a "Wetland of International Importance" under the Ramsar Convention, the applicant shall notify the Fort Worth District Engineer in accordance with the NWP General Condition 32. The Corps will coordinate with the resource agencies as specified in NWP General Condition 32(d) (Pre-Construction Notification).

13. Compensatory mitigation is required for all losses of waters of the United States that exceed 1/10 acre and for all losses to streams that exceed 300 linear feet. Mitigation thresholds are cumulative irrespective of aquatic resource type. Compensatory mitigation requirements will be determined in accordance with the appropriate district standard operating procedures and processes. The applicant shall notify the appropriate District Engineer in accordance with the NWP General Condition 32 (Pre-Construction Notification) prior to commencing the activity.

14. For all activities proposed for authorization under NWPs 12, 14 and/or NWP 33 that involve a temporary discharge of fill material into 1/2 acre or more of emergent wetland OR 1/10 acre of scrub-shrub/forested wetland, the applicant shall notify the appropriate District Engineer in accordance with the NWP General Condition 32 (Pre-Construction Notification) prior to commencing the activity.

15. For all discharges proposed for authorization under NWPs 51 and 52, the Corps will provide the PCN to the US Fish and Wildlife Service as specified in NWP General Condition 32(d)(2) for its review and comments.

The following regional conditions apply within the Galveston District.

16. No NWPs, except NWP 3, shall be used to authorize discharges into the habitat types or specific areas. The applicant shall notify the appropriate District Engineer in accordance with the NWP General Condition 32, Pre-Construction Notification (PCN) prior to commencing the activity under NWP 3

a. Mangrove Marshes. For the purpose of this regional condition, Mangrove marches are those waters of the United States that are dominated by mangroves (*Avicennia spp., Laguncuaria spp, Conocarpus spp., and Rhizophora spp.).*

b. Coastal Dune Swales. For the purpose of this regional condition, coastal dune swales are wetlands and/or other waters of the United States located within the backshore and dune areas in the coastal zone of Texas. They are formed as depressions within and among multiple beach ridge barriers, dune complexes, or dune areas adjacent to beaches fronting tidal waters of the United States.

c. Columbia Bottomlands. For the purpose of this regional condition, Columbia bottomlands are defined as waters of the United States that are dominated by bottomland hardwoods in the Lower Brazos and San Bernard River basins

17. Compensatory mitigation is required for all special aquatic site losses that exceed 1/10 acre and for all losses to streams that exceed 200 linear feet. Compensatory mitigation requirements will be determined in accordance with the appropriate district standard operating procedures and processes. The applicant shall notify the appropriate District Engineer in accordance with the NWP General Condition 32 (Pre-Construction Notification) prior to commencing the activity.

18. For all seismic testing activities proposed for authorization under NWP 6, the applicant shall notify the Galveston District Engineer in accordance with the NWP General Condition 32 (Pre-Construction Notification). The pre-construction notification must state the time period for which the temporary fill is proposed, and must include a restoration plan for the special aquatic sites. For seismic testing under NWP 6 within the Cowardin Marine System, Subtidal Subsystem; as defined by the U.S. Fish and Wildlife, Classification of Wetlands and Deepwater Habitats of the United States, December 1979/Reprinted 1992, the Corps will coordinate with the resource agencies in accordance with NWP General Condition 32(d) (Pre-Construction Notification).

19. For all NWPs 10 and 11 located in vegetated shallows and coral reefs; as defined by 40 CFR 230.43 and 230.44 respectfully, the applicant shall notify the Galveston District Engineer in accordance with the NWP General Condition 32 (Pre-Construction Notification). Examples include, but are not limited to: seagrass beds; oyster reefs; and coral reefs.

20. NWP 12 shall not be used to authorize discharges within 500 feet of vegetated shallows and coral reefs; as defined by 40 CFR 230.43 and 230.44 respectfully. Examples include, but are not limited to: seagrass beds; oyster reefs; and coral reefs.

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

2017 NATIONAL PERMIT
REGIONAL CONDITIONS

SHEET 2 OF 3

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		286

STATE	DIST	COUNTY	
TEXAS	HOU	HARRIS	
CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45

21. For all activities proposed for authorization under NWP 12 that involve underground placement below a non-navigable river bed and/or perennial stream bed shall be installed with a minimum cover of a minimum of 48 inches (1,219 millimeters) in soil below the river and/or perennial stream thalwag.

22. For all discharges and work proposed below the high tide line under NWPs 14 and 18, the applicant shall notify the Galveston District Engineer in accordance with the NWP General Condition 32 (Pre-Construction Notification). The Corps will coordinate with the resource agencies in accordance with NWP General Condition 32(d) (Pre-Construction Notification).

23. For all activities proposed for authorization under NWP 33 the applicant shall notify the District Engineer in accordance with the NWP General Condition 32, PCN. The PCN must include a restoration plan showing how all temporary fills and structures will be removed and the area restored to pre-project conditions. Activities causing the temporary loss of more than 0.5 acres of tidal waters and/or 200 linear feet of stream will be coordinated with the agencies in accordance with NWP General Condition 32(d)

24. No NWPs, except NWPs 3 and 16, shall be used to authorize discharges, structures, and/or fill within the standard setback and high hazard zones of the Sabine-Neches Waterway as defined in the *Standard Operating Procedure - Permit Setbacks along the Sabine-Neches Waterway*. The applicant shall notify the Galveston District Engineer in accordance with NWP General Condition 32 (Pre-Construction Notification) for all discharge, structures and/or work in medium hazard zones and all NWP 3 applications within the standard setback and high hazard zones of the Sabine-Neches Waterway.

25. No NWPs shall be used to authorize discharges, structures, and/or fill within the standard setback exemptions of the Gulf Intracoastal Waterway as defined in the *Standard Operating Procedure- Department of the Army Permit Evaluation Setbacks along the Gulf Intracoastal Waterway*. The applicant shall notify the Galveston District Engineer in accordance with NWP General Condition 32 (Pre-Construction Notification) for all discharge, structures and/or work within the standard setback, shoreward of the standard setback, and/or standard setback exemption zones.

26. The use of NWPs in the San Jacinto River Waste Pits Area of Concern are revoked.

27. The use of NWP 51 and 52 are revoked within the Galveston District boundaries.

28. NWP 53 will be coordinated with resource agencies as specified in NWP General Condition 32(d).

29. Stream losses exceeding 300 linear feet have more than minimal effect and will require and Individual Permit.

The following regional conditions apply within the Tulsa District.

30. Upland Disposal: Material disposed of in uplands shall be placed in a location and manner that prevents discharge of the material and/or return water into waters or wetlands unless otherwise authorized by the Tulsa District Engineer.

31. Major Rivers: The applicant shall notify the Tulsa District Engineer, in accordance with NWP General Condition 32, for all NWP 14 verifications that encompass activities, within the permit area, crossing major rivers within Tulsa District. For the purposes of this condition, major rivers include the following: Canadian River, Prairie Dog Fork of the Red River, and Red River.

IH 45
SB FRONTAGE RD
AT CYPRESS CREEK

2017 NATIONAL PERMIT
REGIONAL CONDITIONS

SHEET 3 OF 3

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		287

STATE	DIST	COUNTY
TEXAS	HOU	HARRIS

CONT	SECT	JOB	HIGHWAY
0110	05	126	IH 45