SEE SHEET 2 FOR INDEX OF SHEETS

SL 494
FUNCTION CLASSIFICATION:
URBAN MINOR ARTERIAL

DESIGN SPEED
MAINLANES .....50 MPH
DESIGN ADT
MAINLANES 2022 .....15,200 2042 18,800

FED. RD. DIV. NO.	PROJECT NUMBER		HIGHWAY NUMBER
6	C 177-14-37		SL 494
STATE	DISTRICT	COUNTY	
TEXAS	HOU	MONTGOMERY	
CONTROL	SECTION	JOB	SHEET NO.
0177	14	037	1

STATE OF TEXAS
DEPARTMENT OF TRANSPORTATION

PLANS OF PROPOSED
STATE HIGHWAY IMPROVEMENT

PROJECT NO. : C 177-14-37

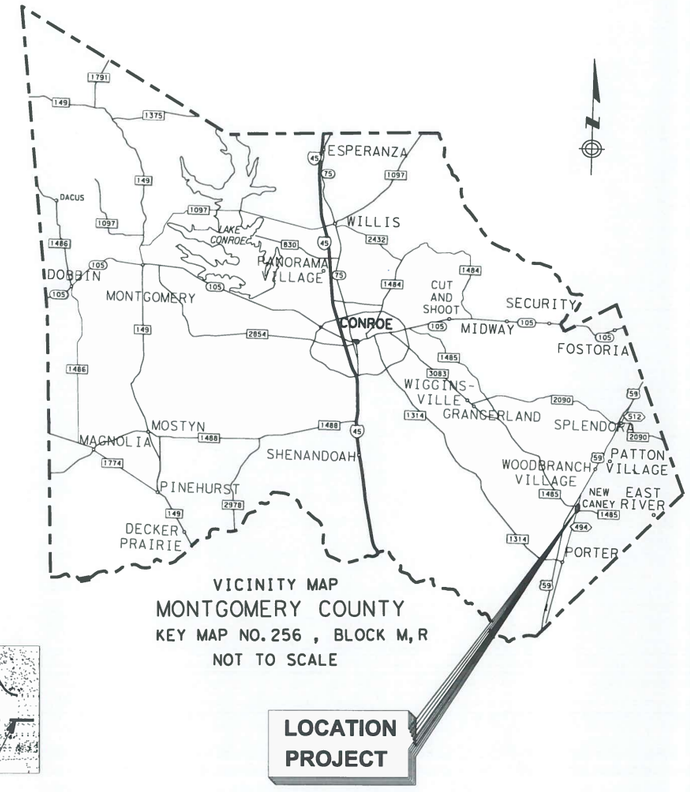
CSJ: 0177-14-037

SL 494

FOR THE CONSTRUCTION OF INTERSECTION IMPROVEMENTS

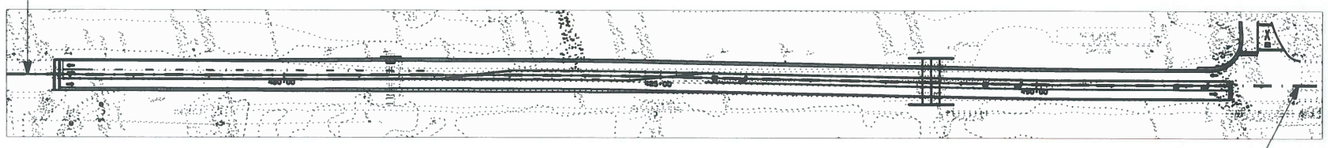
CONSISTING OF GRADING, EMBANKMENT,
CULVERT EXTENSION, CONCRETE PAVING,
TRAFFIC SIGNALS, SIGNING, PAVEMENT MARKINGS, ETC.
LAYMAN'S DESCRIPTION: EXTEND LEFT TURN LANE

CSJ	COUNTY	LIMITS	ROADWAY		BRIDGES		TOTAL	
			FT	MI	FT	MI	FT	MI
0177-14-037	MONTGOMERY	FROM FM 1485 WEST TO FM 1485 EAST	1670.00	0.31	0.00	0.000	1670.00	0.31



VICINITY MAP
MONTGOMERY COUNTY
KEY MAP NO. 256 , BLOCK M, R
NOT TO SCALE

BEGIN PROJECT
CSJ: 0177-14-037
STA. 476+80.00
REF. MARKER: 444-1.23
MILE POINT: 28.75
X: 3914859.0169
Y: 10057448.1455
LAT: 30.1544447
LONG: -95.2117747



PROJECT LOCATION MAP
(NTS)

NO EXCEPTIONS
NO EQUATIONS
NO RAILROAD CROSSINGS

END PROJECT
CSJ: 0177-14-037
STA. 493+50.00
REF. MARKER: 444-0.92
MILE POINT: 29.06
X: 3914439.6920
Y: 10055831.7087
LAT: 30.1501439
LONG: -95.2132784

Texas Department of Transportation

COUNTY MONTGOMERY PROJ. NO. C 177-14-37
HWY. NO. SL 494 LETTING DATE
CONTRACTOR NAME
CONTRACT BEGIN DATE
WORK COMPLETED DATE
DATE OF ACCEPTANCE

CSJ: 0720-02-077

NOTES:

1. HORIZONTAL CONTROL IS BASED ON TXDOT GPS OBSERVATIONS (RTN) FOR ALL CONTROL AND TARGET POINTS. ALL BEARINGS AND COORDINATES ARE BASED ON THE TEXAS COORDINATE SYSTEM, CENTRAL ZONE (4203), NORTH AMERICAN DATUM OF 1983 (NAD 83), (2011), EPOCH 2010.00. ALL DISTANCES AND COORDINATES SHOWN HEREON ARE SURFACE VALUES (U.S. SURVEY FEET) AND MAY BE CONVERTED TO GRID BY DIVIDING BY THE COMBINED ADJUSTMENT FACTOR OF 1.00003.

2. VERTICAL CONTROL IS BASED ON DIGITAL LEVEL LOOPS. STATIC GPS OBSERVATIONS USING TXDOT REGIONAL REFERENCE POINTS TXCN AND TXLI AND NGS CORS STATION ZHU1. ELEVATIONS SHOWN HEREON ARE U.S. SURVEY FEET) REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).

3. SPECIFICATIONS ADOPTED BY THE TEXAS DEPARTMENT OF TRANSPORTATION NOV 1, 2014 AND THE SPECIFICATION ITEMS LISTED AND DATED AS FOLLOWS SHALL GOVERN ON THIS PROJECT: REQUIRED LABOR PROVISION FOR STATE PROJECTS: SP000 - - - 008.

SUBMITTED FOR LETTING: 8/18/21

Abraham M. Dragoman, PE
for AREA ENGINEER

APPROVED FOR LETTING: 8/18/2021

DocuSigned by:
Larry W. Blackburn, P.E.
B992EA0E3B42...
for DISTRICT ENGINEER

CK:
DW:
CK:
DN:

GENERAL

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	2	INDEX OF SHEET
	3-4	SL 494 EXISTING TYPICAL SECTION
	5-6	SL 494 PROPOSED TYPICAL SECTION
	7, 7A-7N	GENERAL NOTES
	8, 8A-8C	ESTIMATE & QUANTITY SHEET
	9	ROADWAY SUMMARY QUANTITY
	10	TCP QUANTITY SUMMARY
	11	SW3P SUMMARY SHEET
	11A	OUTFALL QUANTITIES
	12	PAVEMENT MARKING QUANTITY SUMMARY
	13	SUMMARY OF SMALL SIGNS
	14	TRAFFIC SIGNAL QUANTITY SUMMARY

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	75B	SL 494 AT FM 1485 DITCH COMPUTATIONS (5-YEAR)
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STATE OF TEXAS
MICAH J. SCHLUTER
136908
LICENSED
PROFESSIONAL ENGINEER

Micah J. Schluter, P.E.

09.04.21

SL 494
INDEX SHEET

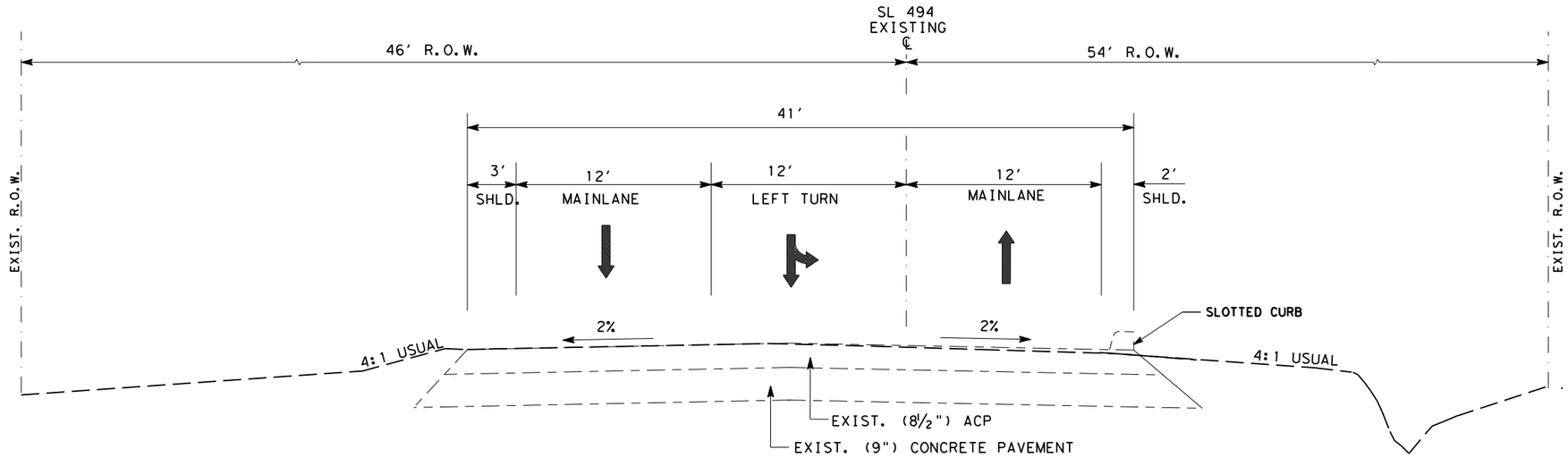
THE STANDARD SHEETS SPECIFICALLY IDENTIFIED BY AN ASTERISK (*) ABOVE HAVE BEEN SELECTED BY ME, OR UNDER MY RESPONSIBLE SUPERVISION, AS BEING APPLICABLE TO THIS PROJECT.

SHEET 1 OF 1

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		2

DATE: 09/04/2021 10:03 AM
FILE:



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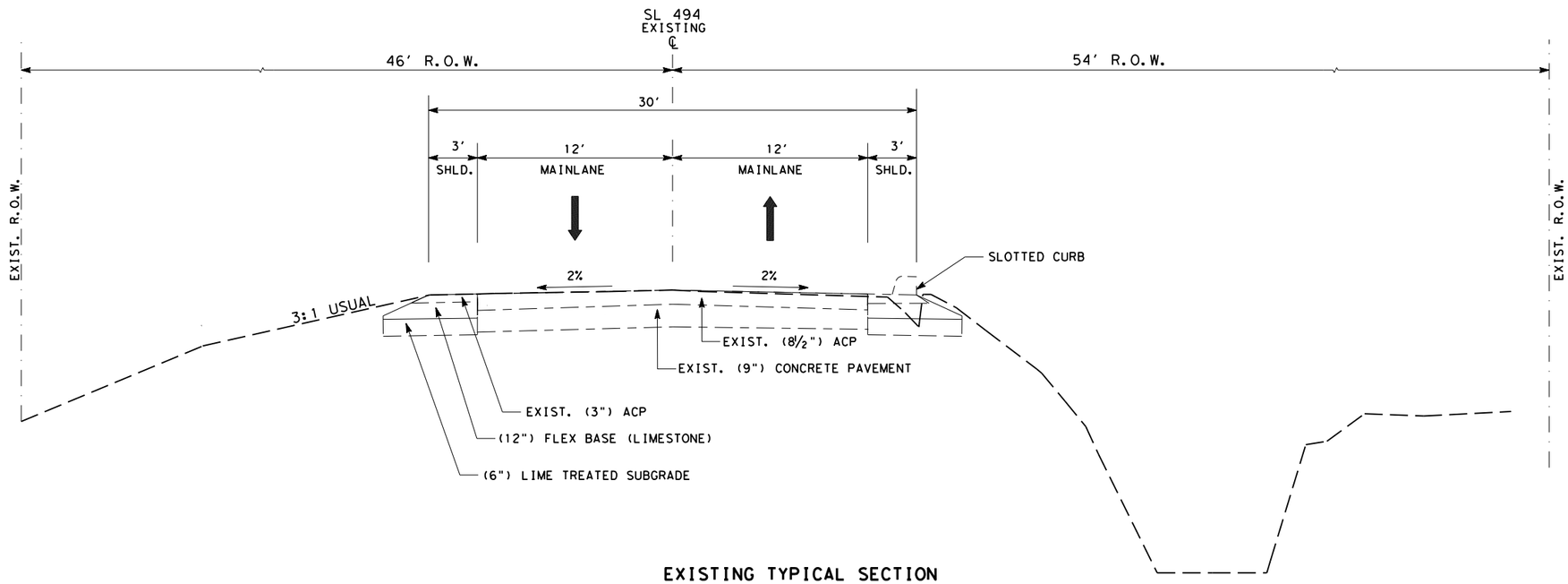


EXISTING TYPICAL SECTION

FROM STA 479+93.00 TO STA 486+07.00

STATE OF TEXAS
MICAH J. SCHLUTER
136908
LICENSED
PROFESSIONAL ENGINEER

Micah J. Schluter, P.E.

07.30.21

SL 494

EXISTING TYPICAL SECTION

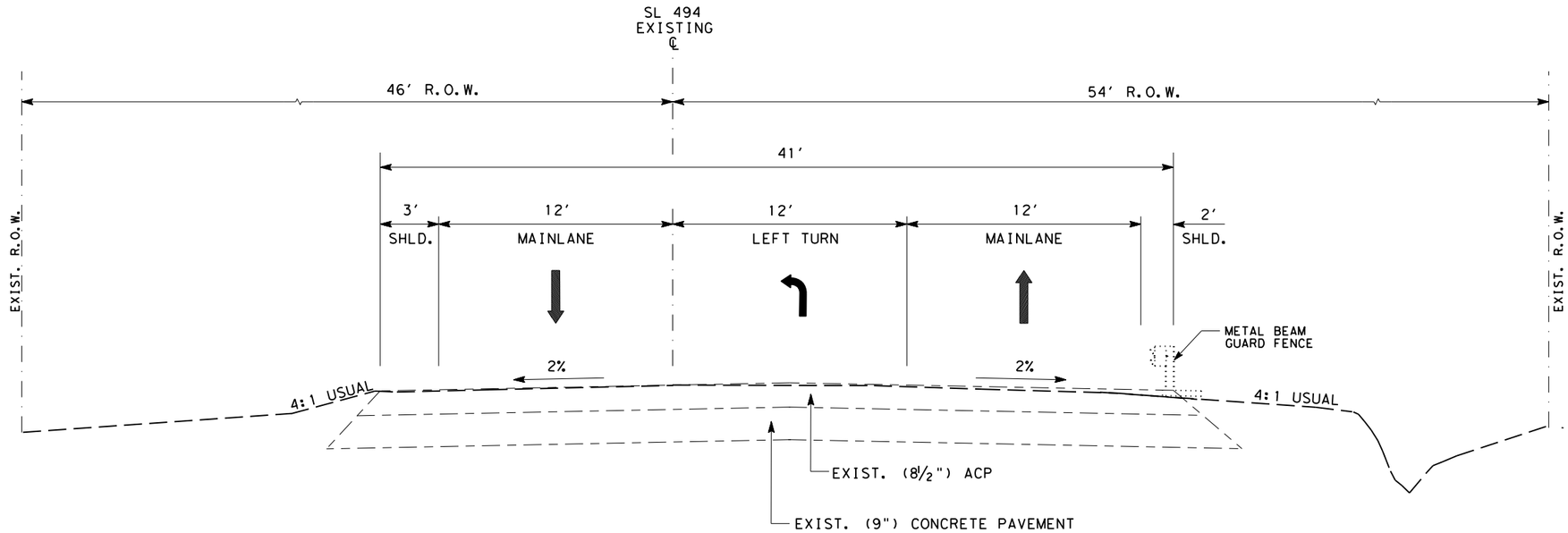
N. T. S.

SHEET 1 OF 2

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		3

DATE: DATE TIME
FILE: DOCUMENT NAME



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STATE OF TEXAS
MICAH J. SCHLUTER
136908
LICENSED
PROFESSIONAL ENGINEER

Micah J. Schluter, P.E.

07.30.21

SL 494

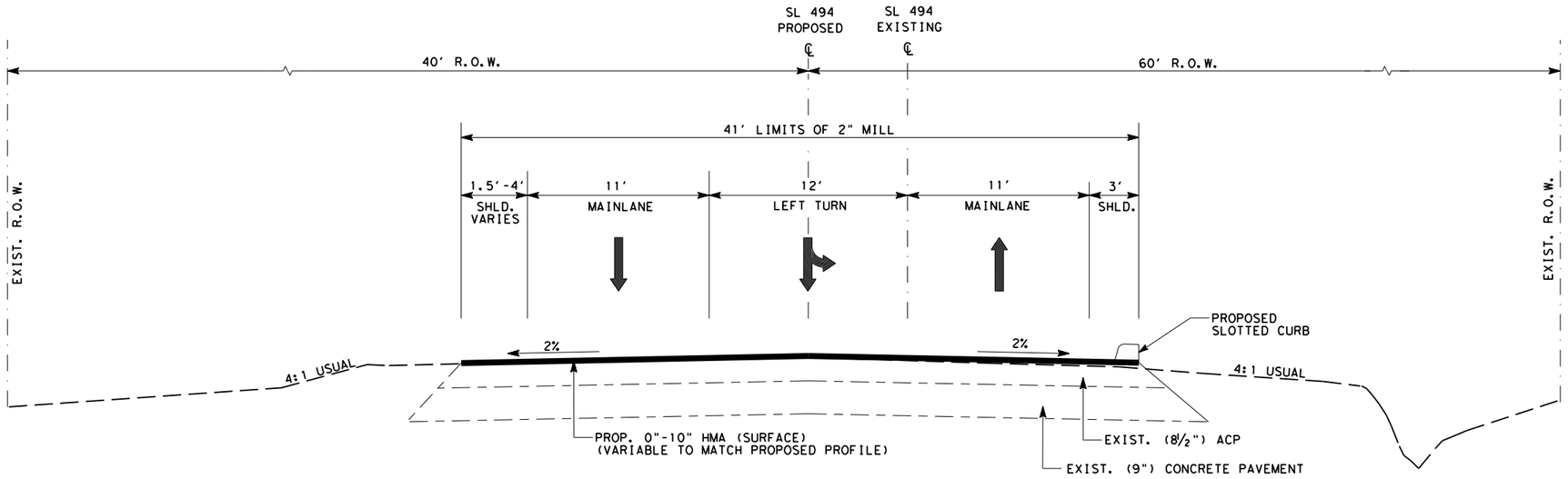
EXISTING TYPICAL SECTION

N.T.S

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		4

DATE: DATE TIME
FILE: DOCUMENT NAME



PROPOSED TYPICAL SECTION

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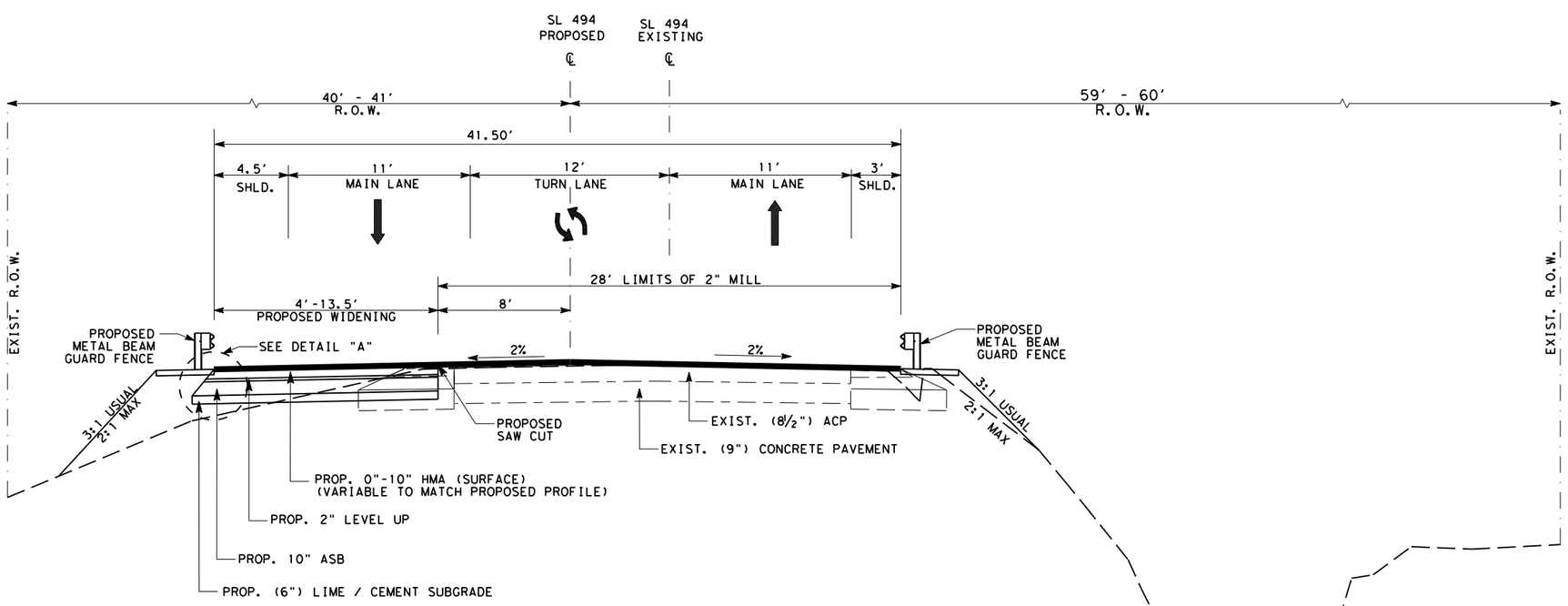

PROPOSED TYPICAL SECTION

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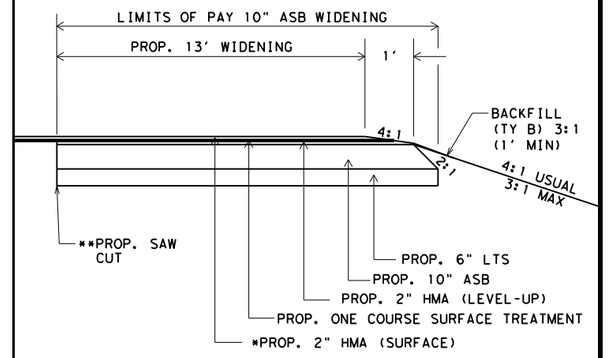


TYPICAL DETAIL "A"

N. T. S.

*THE RIDE QUALITY SURFACE TEST TYPE B PAY ADJUSTMENT SCHEDULE 2 IS APPLICABLE FOR THIS PROJECT

**SAW CUT WILL NOT BE PAID DIRECTLY, BUT WILL BE CONSIDERED SUBSIDIARY TO THE VARIOUS BID ITEMS

NOTE:

1. SEE RDWY LAYOUTS FOR LOCATIONS OF MBGF

2. SAW CUT WILL NOT BE PAID DIRECTLY BUT WILL BE CONSIDERED INCIDENTAL TO THE VARIOUS BID ITEMS

STATE OF TEXAS
MICAH J. SCHLUTER
136908
LICENSED
PROFESSIONAL ENGINEER

Micah J. Schluter, P.E.

07.30.21

SL 494

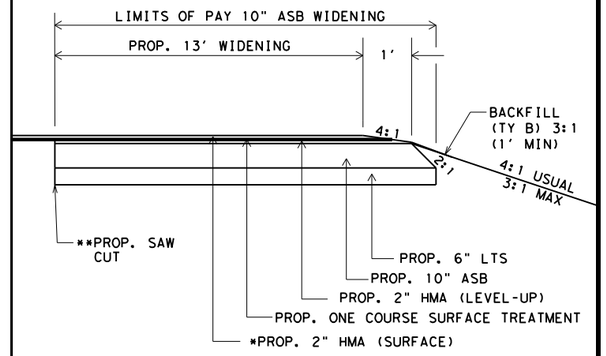
PROPOSED TYPICAL SECTION

N. T. S. SHEET 1 OF 2

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		5

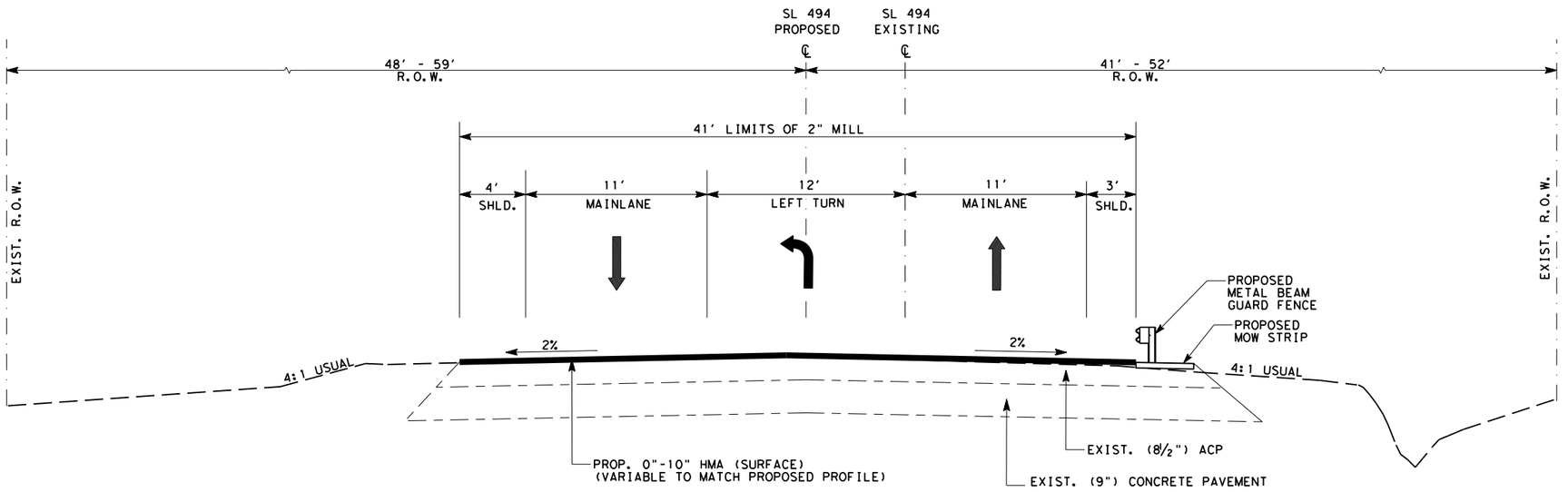
DATE: DATE TIME
FILE: DOCUMENT NAME



TYPICAL DETAIL "A"

N. T. S.

*THE RIDE QUALITY SURFACE TEST TYPE B PAY ADJUSTMENT SCHEDULE 2 IS APPLICABLE FOR THIS PROJECT
**SAW CUT WILL NOT BE PAID DIRECTLY, BUT WILL BE CONSIDERED SUBSIDIARY TO THE VARIOUS BID ITEMS



PROPOSED TYPICAL SECTION

FROM STA 484+59.00 TO STA 492+59.00

NOTE:

1. SEE RDWY LAYOUTS FOR LOCATIONS OF MBGF

2. SAW CUT WILL NOT BE PAID DIRECTLY BUT WILL BE CONSIDERED INCIDENTAL TO THE VARIOUS BID ITEMS

STATE OF TEXAS
MICAH J. SCHLUTER
136908
LICENSED
PROFESSIONAL ENGINEER

Micah J. Schluter, P.E.

07.30.21

SL 494

PROPOSED TYPICAL SECTION

N. T. S

SHEET 2 OF 2

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		6

DATE: DATE TIME
FILE: DOCUMENT NAME

General:

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

Adam C. Galland, P.E. Adam.Galland@txdot.gov
Abraham M. Guzman, P.E. Abe.Guzman@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.

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.

Grade street intersections and median openings for surface drainage.

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.

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.

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.

The Contractor may make the electrical grounding connections and permissible splices using the thermal fusion process, Cadweld, ThermOweld, or approved equal, instead of bolted connections and splices.

The Area Engineer will arrange with the Contractor, an inspection of the completed electrical systems for the highway lighting systems before final acceptance for compliance with plans and specifications. The inspection will be made with personnel from the electrical section of the Department's District Transportation Operations Office. The city's electrical division personnel will also inspect lighting systems within the city limits. Portions of the work found to be deficient during this inspection will not be accepted.

County: Houston District **Control: 0177-14-037**

Highway: LP 494

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

County: Houston District **Control: 0177-14-037**

Highway: LP 494

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 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.

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 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	Y	Y	Y	B	SD

	(Prstrs Bms)					
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	Y	Y	Y	T	SD

	(Steel) (Non-Standard only)					
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
Montgomery Area Office	HOU-MONTAShpDrwgs@txdot.gov
Traffic Systems Construction Office	HOU-TSCShpDrwgs@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

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.

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.

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

If the work is on or in the vicinity of an at-grade railroad crossing, involves incidental work on railroad right of way, or involves construction of a railroad grade separation structure, notify the railroad company’s Division Engineer and the Department’s Project Engineer at least 30 days before performing any work on the railroad right of way and make arrangements for railroad flaggers unless otherwise shown in the contract. Obtain the required Railroad Right of Entry Permit from the railroad company. Payment of applicable permit fees is the responsibility of the Contractor. Acquiring the Railroad Right of Entry Permit is a lengthy process, allow sufficient time for this.

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.

No significant traffic generator events have been identified.

Item 8: Prosecution and Progress

The road-user cost liquidated damages are $ *327* per day. After the project is substantially complete, the liquidated damages become those based on contract administration costs.

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 *standard* workweek in accordance with Section 8.3.3.3.2.2.

The maximum number of days the time charges on this contract may be suspended due to contractor mobilization, and material fabrication/accumulation or processing delays is 120 days. The Engineer and the Contractor may mutually agree, in writing, to decrease this maximum number of days.

The Lane Closure Assessment Fee is $ *400.00*. 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.

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.

Obtain a secured site for the stockpile of the treated material to be salvaged from this project. Haul and stockpile the unused material as directed. This work 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.

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.

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

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 8 and a maximum Plasticity Index (PI) of 30, 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.

Item 134: Backfilling Pavement Edges

Quantity by station includes both sides of the roadway.

The Contractor has the option of selecting the type of backfill material consisting of Reclaimable Asphalt Pavement (RAP), Flex Base, or Crushed Concrete provided that it meets the requirements listed below.

For Permeable Friction Courses (PFC), the backfill material chosen must meet the requirements of Department Test Method Tex-246-F.

If using salvaged asphalt concrete pavement, size it so that all the material, passes the 2-in. sieve. Use RAP that does not contain deleterious material such as clay or organic material.

Flex Base must meet the requirements of Item 247, Type A, Grade 1-2. Department Test Method Tex-117-E will not be required.

Crushed concrete must meet the requirements of Item 247, Grade 1-2. Department Test Methods Tex-116-E and Tex-117-E will not be required.

Place emulsified asphalt (SS-1, CSS-1, or CSS-1H) at an application rate of 0.25 gal/sq. yard.

Item 162: Sodding 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.

If using Type A aggregate in accordance with the Item, “Flexible Base,” use only crushed stone, Grade 1.

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.

Item 340: Dense-Graded Hot Mix Asphalt (Small Quantity)

Dilution of tack coat is not allowed.

Taper the asphalt concrete pavement at the beginning and ending points.

Use a maximum 6H:1V slope for the asphalt concrete pavement edge.

Where the 6H:1V ACP edge taper extends over onto the unsurfaced shoulders, blade off the loose existing shoulder material to provide a solid base for the outside taper edge. After placing the ACP overlay, blade this material back against the edge taper. This work is subsidiary to the various bid items.

The stockpile will be the point of sampling of coarse aggregate for test method TEX-217-F (Part II, decantation).

Place the asphalt concrete pavement in courses as shown on the typical sections.

Do not use petroleum-based solvents in the beds of hot mix asphalt delivery vehicles.

Dilution of tack coat is not allowed.

Do not use Surface Aggregate Classification (SAC) C for this project.

For determining the Asphalt Content, only ignition ovens will be allowed.

The tack coat rate shown on the "Basis of Estimate" is an average rate for calculating tack coat quantities. Vary the rate based on the pavement conditions and other factors such as manufacturer's recommendations and weather.

Item 351: Flexible Pavement Structure Repair

Use asphalt stabilized base for the base material.

For base repair, place the asphalt stabilized base in compacted lifts of 4 in. maximum, unless otherwise directed.

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 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 462: Concrete Box Culverts and Drains

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)."

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 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."

If a section is not complete before the end of the workday, pull back the base material to the existing pavement edge on a 6H: 1V slope. Edge drop-offs during the hours of darkness are not permitted.

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 Closure

Day	Daytime Closure Hours	Nighttime Closure Hours	Restricted Hours Subject to Lane Assessment Fee
Monday	8:30 AM – 3:30 PM	9:00 PM – 5:00 AM	5:00 AM – 8:30 AM 3:30 PM – 9:00 PM
Tuesday	8:30 AM – 3:30 PM	9:00 PM – 5:00 AM	5:00 AM – 8:30 AM 3:30 PM – 9:00 PM
Wednesday	8:30 AM – 3:30 PM	9:00 PM – 5:00 AM	5:00 AM – 8:30 AM 3:30 PM – 9:00 PM
Thursday	8:30 AM – 3:30 PM	9:00 PM – 5:00 AM	5:00 AM – 8:30 AM 3:30 PM – 9:00 PM
Friday	8:30 AM – 3:30 PM	9:00 PM – 11:59 AM	5:00 AM – 8:30 AM 3:30 PM – 9:00 PM
Saturday/ Sunday	No Weekend Closures	No Weekend Closures	12:00 AM – 11:59 PM

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.

During construction, remove, cover, adjust, or replace overhead sign panels to correspond with each current traffic control phase. The desirable size of letters for freeways is 10 in., the minimum is 8 in. This work is subsidiary to Item 502.

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. The disturbed area is less than one acre and use of erosion control measures is not anticipated. If physical conditions encountered at the job site require necessary controls, BMP installation, maintenance, and removal will be paid as extra work on a force account basis per Articles 4.4 and 9.7. 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.

Item 512: Portable Traffic Barrier

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.

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.

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

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.

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 metal beam guard fence rail elements and posts.

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

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 or asphalt 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.

For all other roads (cross streets and intersections), use Surface Test Type A.

Item 618: Conduit
Item 620: Electrical Conductors
Item 628: Electrical Services

If the specifications for electrical items require UL-listed products, this means UL-listed or CSA-listed.

Item 618: Conduit

When backfilling bore pits, ensure that the conduit is not damaged during installation or due to settling backfill material. Compact select backfill in 3 equal lifts to the bottom of the conduit; or if using sand, place it 2 in. above the conduit. Ensure backfill density is equal to that of the existing soil. Prevent material from entering the conduit.

Construct bore pits a minimum of 5 ft. from the edge of the base or pavement. Close the bore pit holes overnight.

Unless otherwise shown on the plans, install underground conduit a minimum of 24 in. deep. Install the conduit in accordance with the latest National Electrical Code (NEC) and applicable Department standard sheets. Place conduit under driveways or roadways a minimum of 24 in. below the pavement surface.

If using casing to place bored conduit, the casing is subsidiary to the conduit.

Where PVC, duct cable, and HDPE conduit 1 in. and larger is allowed and installed per Department standards, provide a PVC elbow in place of the galvanized rigid metal elbow required by the Electrical Details standards. Ensure the PVC elbow is of the same schedule rating as the conduit to which it is connected. Use only a flat, high tensile strength polyester fiber pull tape to pull conductors through the PVC conduit system.

Remove conductor and conduit to be abandoned to 1 ft. below the ground level. This work is subsidiary to the various bid items.

Do not use cast iron junction boxes in concrete traffic barriers and single slope traffic barriers. Use polymer concrete junction boxes in place of the cast iron junction boxes shown on standard sheets CTBI (3), CTBI (4), and SSCB (4). Mount the junction boxes flush (+ 0 in., - 1/2 in.) with the concrete surface of the concrete barrier.

Locate the underground utilities within the project limits. Provide the equipment necessary for locating these utilities, locate, and mark them before starting any excavation work in the area. This work is subsidiary to the various bid items. If the Contractor damages or cause damage to any existing underground utilities, repair such damage at no cost to the Department.

Ensure the interconnection of new equipment to the existing system does not interfere with the operation of the remaining system components. Ensure the system remains completely operational between the hours of 6:00 a.m. Monday and 12:00 a.m. (midnight) Saturday.

Do not interrupt system operation without coordinating with the Department's operations personnel at Houston Transtar (Mr. Carlton Allen) at (713) 881-3285.

Perform work to be done on cables during weekends only.

Provide Liquid-Tight Flexible Metal (LTFM) conduit if the plans refer to flexible metal conduit. Do not use flexible metal conduit.

Unless otherwise shown on the plans, place conduit runs behind curbs at locations where curbs exist.

Use schedule 80 PVC conduit to house conductor runs under paved riprap, roadway, or driveways, unless otherwise shown on the plans.

Use Rigid Metal Conduit (RMC) for exposed conduit.

Before backfilling conduit trenches, place a detectable underground metalized mylar marking tape above the conduit and concrete encasement. Imprint the marking tape with, "TxDOT CONDUIT AND FIBER OPTIC CABLE SYSTEM. CALL (713) 802-5909 BEFORE PROCEEDING" every 18 in. Supplying and installing the marking tapes is subsidiary to the various bid items.

Conduit elbows and rigid metal extensions required when installing PVC conduit systems are subsidiary to the various bid items.

Install a continuous bare or green insulated copper wire No. 8 AWG or larger in every conduit throughout the electrical system in accordance with the Electrical Detail Standard Sheets, and the latest edition of the NEC.

Provide a single 1/C #14 insulated wire in conduit runs which have been identified in the plans to carry fiber optic cable. Provide UL-listed solid copper wire with orange color low density polyethylene insulation, suitable for conduit installation, rated for a temperature range of -20 C to +60 C and a voltage rating of 600V. This wire will serve as a tracer, or locate, wire for locating underground conduit containing fiber optic cabling and will be paid for under Item 620, "Electrical Conductors."

Item 620: Electrical Conductors

Test each wire of each cable or conductor after installation. Incomplete circuits or damage to the wire or the cable are cause for immediate rejection of the entire cable being tested. Remove and replace the entire cable at no expense to the Department. Also test the replacement cable after installation.

When pulling cables or conductors through the conduit, do not exceed the manufacturer's recommended pulling tensions. Lubricate the cables or conductors with a lubricant recommended by the cable manufacturer.

For both transformer and shoe-base type illumination poles, provide double-pole breakaway fuse holders as shown on the Department's Construction Division (CST) material producers list. Check the latest link on the Department's website for this list. The category is "Roadway Illumination and Electrical Supplies." The fuse holder is shown on the list under Items 610 and 620. Provide 10 Amp time delay fuses.

Ensure that circuits test clear of faults, grounds, and open circuits.

Split bolt connectors are allowed only for splices on the grounding conductors.

For Roadside Flashing Beacon Assemblies (Item 685) and Pedestal Pole Assemblies (Item 687) within the project, provide single-pole breakaway disconnects as shown on the Construction Division (CST) material producers list. Check the latest link on the Department's website for

this list. The category is "Roadway Illumination and Electrical Supplies." The fuse holder is shown on the list under Item 685. For underground (hot) conductors, install a breakaway connector with a dummy fuse (slug). Provide dummy fuse (slug). For grounded (neutral) conductors, install a breakaway connector with a white colored marking and a permanently installed dummy fuse (slug).

For electrical licensing and electrical certification requirements for this project, see Item 7 of the Standard Specifications and any applicable special provisions to Item 7.

Item 624: Ground Boxes

The ground box locations are approximate. Alternate ground box locations may be used as directed, to avoid placing in sidewalks or driveways.

Ground metal ground box covers. Bond the ground box cover and ground conductors to a ground rod located in the ground box and to the system ground.

Ground the existing metal ground box covers as shown on the latest standard sheet ED (4)-14.

During construction and until project completion, provide personnel and equipment necessary to remove ground box lids for inspection. Provide this assistance within 24 hours of notification.

Construct concrete aprons in accordance with the latest standard sheet ED (4)-14. Make the depth of the concrete apron the same as the depth of the ground box, except for Type 1 and Type 2 ground boxes. For Type 1 or Type 2 ground boxes, construct the concrete apron in accordance with details shown on the "Ground Box Details Installations" standard.

Item 628: Electrical Services

Verify and coordinate the electrical service location with the engineering section of the appropriate utility district or company.

Identify the electrical service pole with an address number assigned by the Utility Service Provider. Provide 2-in. numerals visible from the highway. Provide numbers cut out aluminum figures nailed to wood poles or painted figures on steel poles or service cabinets.

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.

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 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."

Do not use raised pavement markers as optional work zone pavement markings on final asphalt surfaces.

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 662: Work Zone Pavement Markings
Item 666: Reflectorized Pavement Markings

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.

For roadways with asphalt surfaces to be striped with work zone or permanent thermoplastic markings, the Contractor has the option to apply paint and beads markings for a maximum 30-day period until placing the thermoplastic markings, or until starting the succeeding phase of work on the striped area. Maintain the paint and beads markings, at no expense to the

Department, until placing the thermoplastic markings or starting the succeeding phase of work on the striped area. The work zone markings, whether paint and beads or thermoplastic, are paid under the Item, "Work Zone Pavement Markings" and the markings are paid for only once for the given phase of construction.

If using paint and bead markings as described above, purchase the traffic paint from the open market.

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 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 680: Highway Traffic Signals

Clearly mark or highlight on the shop drawings the items being furnished for this project.

Furnish labor, tools, equipment, and materials as shown on the plans and specifications for a complete and operating signal installation.

Furnish the type of controller cabinet specified on the plans. Refer to the table shown in the Departmental Material Specifications (DMS-11170, Fully Actuated, Solid-State Traffic Signal Controller Assembly), Section 11170.6.A, Type 2 cabinet, page 4 of 39, regarding the size of the cabinet, back panel configuration, and the size of the load bay. Use the following website to view this specification: http://www.txdot.gov/business/resources/dms.html

Complete traffic signal construction work, including correcting discrepancies shown on the Department inspector's "Traffic Signal Installation Inspection Report" before the beginning of the test period.

Provide a full-time qualified traffic signal technician responsible for installing, maintaining, or replacing traffic signal devices.

Staking in the field is subject to approval.

Make adjustments in project construction, if needed, due to conflicts with underground utilities.

Do not aim the luminaire arms mounted on traffic signal poles into the intersection. Aim each arm perpendicular to the centerline of the roadway it is intended to cover, to develop the proper illumination pattern for the intersection.

Allow the electrical work to be inspected by the City. Complying with the provisions and requirements of the City electrical ordinance is not required. Such inspection does not make the City a party to this contract.

Provide continuous conductors without splices from signal controller to signal heads. Route the conductors for luminaires to the service enclosure. Splices or attachments to the terminal block in the access compartment of the mast arm pole are not permitted except for the luminaire cable.

Abrasions to the conductor insulation caused while pulling cable for the traffic signal system are cause for immediate rejection. Remove and replace the entire damaged cable at no expense to the Department.

When pulling cables or conductors through conduit, do not exceed the manufacturer's recommended pulling tensions. Lubricate the cables or conductors with a lubricant as recommended by the cable manufacturer.

Bond the controller housing, signal poles, conduit, and spans to a minimum No. 6 AWG stranded copper conductor. An equipment grounding conductor is required in every conduit to form a continuous grounding system. Effectively connect the grounding system to ground rods or concrete encased grounding electrodes as indicated in the plans.

Wrap signal heads with dark plastic or suitable material to conceal the signal faces from the time of installation until placing into operation. Do not use burlap.

Furnish signal heads from the same manufacturer.

Use Type B (high intensity prismatic) or Type D (diamond grade) retroreflective sheeting for signs mounted under or adjacent to the signal heads.

The Contractor may use ready mix concrete.

Apply membrane curing on concrete work in accordance with Section 420.4.10.3, "Membrane Curing."

The standard 4.5-in. galvanized pipe type poles, except the breakaway type, are subject only to the Engineer's inspection for their acceptance. Mill test reports or documentation will not be required.

Item 682: Vehicle and Pedestrian Signal Heads

Install two set screws on vehicle signal head mounting hardware fittings.

Furnish black housings for vehicle and pedestrian signals. Furnish black vehicle signal head back plates with 2 in. retroreflective yellow borders.

Item 686: Traffic Signal Pole Assemblies (Steel)

For a steel mast arm or steel strain pole assembly, hold the anchor bolts and conduits rigidly in place with a welded steel template.

Leave a minimum of one full diameter thread exposed on each anchor bolt securing a signal pole.

Set the anchor bolts for the steel strain poles so that two are in compression and two are in tension.

Use a Texas Cone Penetrometer reading of 10. The drilled shaft length is from the surface elevation to the bottom of the drilled shaft. Provide an additional length of the pole foundation from the surface level to the roadway level, if required for unusual locations. Provide the drilled shaft depth regardless of the length of the pole foundation. The pole foundation depth from the surface level to the roadway level is a maximum of 4 ft., or as approved.

County: Houston District **Control: 0177-14-037**

Highway: LP 494

Locate traffic signal pole assembly foundations a minimum of 4 ft. from the roadway curb or pavement edge, or as shown on the plans.

Place steel strain poles at a 10 ft. desirable minimum distance from the roadway curb or pavement edge.

After the traffic signal pole assembly is plumb and the nuts are tight, tack-weld each anchor bolt nut in two places to its washer. Tack-weld each washer to the base plate in two places. Do not weld components to the bolt. Perform tack-welding in accordance with the Item, "Steel Structures." After tack-welding, repair galvanizing damage on bolts, nuts, and washers in accordance with Section 445.3.5, "Repairs."

The Department may test the anchor bolts using ultrasonic methods for traffic signal poles after they are installed. Replace faulty anchor bolts as directed. Do not weld the anchor bolts.

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.

County: Houston District **Control: 0177-14-037**

Highway: LP 494

Basis of Estimate

Item	Description	Limit and Rate	Unit
134	Backfilling Pavement Edges • Asphalt Emulsion	 0.25 Gal. / Sq. Yd.	STA
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
340	Dense-Graded Hot Mix Asphalt (Small Quantity) • Asphalt • Aggregate Tack Coat • Applied on new HMA • Applied on Existing HMA • Applied on Milled HMA	110 Lb. / Sq. Yd.-In. 6 % by weight 94 % by weight 0.06 Gal. / Sq. Yd. 0.09 Gal. / Sq. Yd. 0.11 Gal. / Sq. Yd.	TON

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

Estimate & Quantity Sheet

CONTROLLING PROJECT ID 0177-14-037 **DISTRICT** Houston **COUNTY** Montgomery
HIGHWAY SL 494

						TOTAL EST.	TOTAL FINAL
		CONTROL SECTION JOB		**0177-14-037**			
		PROJECT ID		**A00126426**			
		COUNTY		**Montgomery**			
		HIGHWAY		**SL 494**			
ALT	**BID CODE**	**DESCRIPTION**	**UNIT**	EST.	FINAL		
	100-6002	PREPARING ROW	STA	17.000		17.000	
	104-6017	REMOVING CONC (DRIVEWAYS)	SY	472.000		472.000	
	104-6029	REMOVING CONC (CURB OR CURB & GUTTER)	LF	882.000		882.000	
	104-6054	REMOVING CONCRETE(MOW STRIP)	LF	700.000		700.000	
	105-6039	REMOVE STAB BASE AND ASPH PAV (6"-20")	SY	189.000		189.000	
	110-6001	EXCAVATION (ROADWAY)	CY	254.000		254.000	
	110-6002	EXCAVATION (CHANNEL)	CY	636.200		636.200	
	132-6006	EMBANKMENT (FINAL)(DENS CONT)(TY C)	CY	664.000		664.000	
	134-6004	BACKFILL (TY A OR B)	STA	17.000		17.000	
	164-6048	STRAW/HAY MLCH SEED(TEMP)(WARM)	AC	2.000		2.000	
	164-6049	STRAW/HAY MLCH SEED(TEMP)(COOL)	SY	2,600.000		2,600.000	
	166-6001	FERTILIZER	AC	2.000		2.000	
	168-6001	VEGETATIVE WATERING	MG	240.000		240.000	
	169-6003	SOIL RETENTION BLANKETS (CL 1) (TY C)	SY	787.000		787.000	
	260-6006	LIME TRT (EXST MATL) (6")	SY	560.000		560.000	
	260-6012	LIME(HYD,COM OR QK)(SLRY)OR QK(DRY)	TON	15.120		15.120	
	275-6001	CEMENT	TON	15.120		15.120	
	275-6002	CEMENT TREAT (EXIST MATL) (6")	SY	560.000		560.000	
	292-6003	ASPHALT STAB BASE (GR 2)(PG 70)	TON	620.000		620.000	
	340-6122	D-GR HMA(SQ) TY-D PG70-22	TON	343.340		343.340	
	340-6247	D-GR HMA (SQ) TY-D PG 70-22(LEVEL-UP)	TON	123.000		123.000	
	351-6005	FLEXIBLE PAVEMENT STRUCTURE REPAIR(9")	SY	98.220		98.220	
	354-6045	PLANE ASPH CONC PAV (2")	SY	4,912.000		4,912.000	
	400-6002	STRUCT EXCAV (BOX)	CY	13.000		13.000	
	400-6005	CEM STABIL BKFL	CY	100.000		100.000	
	400-6006	CUT & RESTORING PAV	SY	144.000		144.000	
	401-6001	FLOWABLE BACKFILL	CY	3.700		3.700	
	403-6001	TEMPORARY SPL SHORING	SF	1,208.000		1,208.000	
	416-6032	DRILL SHAFT (TRF SIG POLE) (36 IN)	LF	58.000		58.000	
	432-6003	RIPRAP (CONC)(6 IN)	CY	54.000		54.000	
	432-6031	RIPRAP (STONE PROTECTION)(12 IN)	CY	122.000		122.000	
	432-6045	RIPRAP (MOW STRIP)(4 IN)	CY	57.530		57.530	
	450-6032	RAIL (TY C223)	LF	92.000		92.000	
	462-6030	CONC BOX CULV (10 FT X 6 FT)	LF	126.000		126.000	
	462-6046	CONC BOX CULV (3 FT X 3 FT)(EXTEND)	LF	18.000		18.000	
	464-6007	RC PIPE (CL III)(30 IN)	LF	340.000		340.000	
	465-6002	MANH (COMPL)(PRM)(48IN)	EA	1.000		1.000	

Estimate & Quantity Sheet

CONTROLLING PROJECT ID 0177-14-037 **DISTRICT** Houston **COUNTY** Montgomery
HIGHWAY SL 494

			CONTROL SECTION JOB		**0177-14-037**	TOTAL EST.	TOTAL FINAL
			PROJECT ID		**A00126426**		
			COUNTY		**Montgomery**		
			HIGHWAY		**SL 494**		
ALT	**BID CODE**	**DESCRIPTION**	**UNIT**	EST.	FINAL		
	465-6054	INLET (COMPL)(PSL)(SL)(3FTX3FT)	EA	4.000		4.000	
	466-6169	WINGWALL (FW - S) (HW=8 FT)	EA	2.000		2.000	
	466-6180	WINGWALL (PW - 1) (HW=5 FT)	EA	1.000		1.000	
	500-6001	MOBILIZATION	LS	1.000		1.000	
	502-6001	BARRICADES, SIGNS AND TRAFFIC HANDLING	MO	7.000		7.000	
	506-6038	TEMP SEDMT CONT FENCE (INSTALL)	LF	3,006.000		3,006.000	
	506-6039	TEMP SEDMT CONT FENCE (REMOVE)	LF	3,006.000		3,006.000	
	506-6041	BIODEG EROSN CONT LOGS (INSTL) (12")	LF	56.000		56.000	
	506-6043	BIODEG EROSN CONT LOGS (REMOVE)	LF	56.000		56.000	
	508-6001	CONSTRUCTING DETOURS	SY	1,356.000		1,356.000	
	512-6010	PORT CTB (FUR & INST)(LOW PROF)(TY 2)	LF	80.000		80.000	
	512-6021	PORT CTB (DES SOURCE)(LOW PROF)(TY 1)	LF	340.000		340.000	
	512-6033	PORT CTB (MOVE)(LOW PROF)(TY 1)	LF	140.000		140.000	
	512-6034	PORT CTB (MOVE)(LOW PROF)(TY 2)	LF	40.000		40.000	
	512-6057	PORT CTB (REMOVE)(LOW PROF)(TY 1)	LF	340.000		340.000	
	512-6058	PORT CTB (REMOVE)(LOW PROF)(TY 2)	LF	80.000		80.000	
	529-6012	CONC CURB (SLOTTED)	LF	1,159.000		1,159.000	
	530-6005	DRIVEWAYS (ACP)	SY	143.000		143.000	
	540-6001	MTL W-BEAM GD FEN (TIM POST)	LF	662.500		662.500	
	540-6002	MTL W-BEAM GD FEN (STEEL POST)	LF	50.000		50.000	
	540-6006	MTL BEAM GD FEN TRANS (THRIE-BEAM)	EA	3.000		3.000	
	540-6014	SHORT RADIUS	LF	25.000		25.000	
	542-6001	REMOVE METAL BEAM GUARD FENCE	LF	800.000		800.000	
	544-6001	GUARDRAIL END TREATMENT (INSTALL)	EA	4.000		4.000	
	618-6046	CONDT (PVC) (SCH 80) (2")	LF	155.000		155.000	
	618-6047	CONDT (PVC) (SCH 80) (2") (BORE)	LF	240.000		240.000	
	618-6053	CONDT (PVC) (SCH 80) (3")	LF	20.000		20.000	
	618-6058	CONDT (PVC) (SCH 80) (4")	LF	25.000		25.000	
	620-6009	ELEC CONDR (NO.6) BARE	LF	375.000		375.000	
	620-6011	ELEC CONDR (NO.4) BARE	LF	45.000		45.000	
	620-6012	ELEC CONDR (NO.4) INSULATED	LF	85.000		85.000	
	621-6005	TRAY CABLE (4 CONDR) (12 AWG)	LF	415.000		415.000	
	624-6009	GROUND BOX TY D (162922)	EA	7.000		7.000	
	624-6028	REMOVE GROUND BOX	EA	4.000		4.000	
	628-6145	ELC SRV TY D 120/240 060(NS)SS(E)SP(O)	EA	1.000		1.000	
	636-6003	ALUMINUM SIGNS (TY O)	SF	31.000		31.000	
	636-6007	REPLACE EXISTING ALUMINUM SIGNS(TY A)	SF	15.000		15.000	

Estimate & Quantity Sheet

CONTROLLING PROJECT ID 0177-14-037 **DISTRICT** Houston **COUNTY** Montgomery
HIGHWAY SL 494

			CONTROL SECTION JOB		**0177-14-037**	TOTAL EST.	TOTAL FINAL
			PROJECT ID		**A00126426**		
			COUNTY		**Montgomery**		
			HIGHWAY		**SL 494**		
ALT	**BID CODE**	**DESCRIPTION**	**UNIT**	EST.	FINAL		
	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	5.000		5.000	
	644-6006	IN SM RD SN SUP&AM TY10BWG(1)SA(T-EXAL)	EA	2.000		2.000	
	644-6076	REMOVE SM RD SN SUP&AM	EA	3.000		3.000	
	658-6014	INSTL DEL ASSM (D-SW)SZ (BRF)CTB (BI)	EA	5.000		5.000	
	658-6067	INSTL DEL ASSM (D-DW)SZ 1(BRF)GF2	EA	50.000		50.000	
	658-6100	INSTL OM ASSM (OM-2Z)(WFLX)GND(BI)	EA	1.000		1.000	
	662-6005	WK ZN PAV MRK NON-REMOV (W)6"(BRK)	LF	456.000		456.000	
	662-6008	WK ZN PAV MRK NON-REMOV (W)6"(SLD)	LF	9,936.000		9,936.000	
	662-6012	WK ZN PAV MRK NON-REMOV (W)8"(SLD)	LF	2,223.000		2,223.000	
	662-6014	WK ZN PAV MRK NON-REMOV (W)12"(SLD)	LF	240.000		240.000	
	662-6016	WK ZN PAV MRK NON-REMOV (W)24"(SLD)	LF	216.000		216.000	
	662-6017	WK ZN PAV MRK NON-REMOV (W)(ARROW)	EA	6.000		6.000	
	662-6018	WK ZN PAV MRK NON-REMOV (W)(DBL ARW)	EA	3.000		3.000	
	662-6023	WK ZN PAV MRK NON-REMOV (W)(RR XING)	EA	3.000		3.000	
	662-6029	WK ZN PAV MRK NON-REMOV(W)(WORD)	EA	6.000		6.000	
	662-6035	WK ZN PAV MRK NON-REMOV (Y)6"(BRK)	LF	318.000		318.000	
	662-6037	WK ZN PAV MRK NON-REMOV (Y)6"(SLD)	LF	10,758.000		10,758.000	
	662-6048	WK ZN PAV MRK REMOV (REFL) TY I-C	EA	133.000		133.000	
	662-6050	WK ZN PAV MRK REMOV (REFL) TY II-A-A	EA	522.000		522.000	
	666-6036	REFL PAV MRK TY I (W)8"(SLD)(100MIL)	LF	741.000		741.000	
	666-6042	REFL PAV MRK TY I (W)12"(SLD)(100MIL)	LF	80.000		80.000	
	666-6048	REFL PAV MRK TY I (W)24"(SLD)(100MIL)	LF	72.000		72.000	
	666-6054	REFL PAV MRK TY I (W)(ARROW)(100MIL)	EA	2.000		2.000	
	666-6057	REFL PAV MRK TY I(W)(DBL ARROW)(100MIL)	EA	1.000		1.000	
	666-6078	REFL PAV MRK TY I (W)(WORD)(100MIL)	EA	2.000		2.000	
	666-6093	REFL PAV MRK TY I (W)(RR XING)(100MIL)	EA	1.000		1.000	
	666-6162	RE PV MRK TY I(BLACK)6"(SHADOW)(100MIL)	LF	110.000		110.000	
	666-6306	RE PM W/RET REQ TY I (W)6"(BRK)(100MIL)	LF	110.000		110.000	
	666-6309	RE PM W/RET REQ TY I (W)6"(SLD)(100MIL)	LF	3,242.000		3,242.000	
	666-6318	RE PM W/RET REQ TY I (Y)6"(BRK)(100MIL)	LF	106.000		106.000	
	666-6321	RE PM W/RET REQ TY I (Y)6"(SLD)(100MIL)	LF	3,590.000		3,590.000	
	672-6007	REFL PAV MRKR TY I-C	EA	44.000		44.000	
	672-6009	REFL PAV MRKR TY II-A-A	EA	177.000		177.000	
	678-6002	PAV SURF PREP FOR MRK (6")	LF	7,368.000		7,368.000	
	678-6004	PAV SURF PREP FOR MRK (8")	LF	741.000		741.000	
	678-6006	PAV SURF PREP FOR MRK (12")	LF	80.000		80.000	

Estimate & Quantity Sheet

CONTROLLING PROJECT ID 0177-14-037 **DISTRICT** Houston **COUNTY** Montgomery
HIGHWAY SL 494

			CONTROL SECTION JOB		**0177-14-037**	TOTAL EST.	TOTAL FINAL
			PROJECT ID		**A00126426**		
			COUNTY		**Montgomery**		
			HIGHWAY		**SL 494**		
ALT	**BID CODE**	**DESCRIPTION**	**UNIT**	EST.	FINAL		
	678-6008	PAV SURF PREP FOR MRK (24")	LF	72.000		72.000	
	678-6009	PAV SURF PREP FOR MRK (ARROW)	EA	2.000		2.000	
	678-6010	PAV SURF PREP FOR MRK (DBL ARROW)	EA	1.000		1.000	
	678-6016	PAV SURF PREP FOR MRK (WORD)	EA	2.000		2.000	
	678-6020	PAV SURF PREP FOR MRK (RR XING)	EA	1.000		1.000	
	680-6003	INSTALL HWY TRF SIG (SYSTEM)	EA	1.000		1.000	
	680-6004	REMOVING TRAFFIC SIGNALS	EA	1.000		1.000	
	682-6001	VEH SIG SEC (12")LED(GRN)	EA	8.000		8.000	
	682-6002	VEH SIG SEC (12")LED(GRN ARW)	EA	2.000		2.000	
	682-6003	VEH SIG SEC (12")LED(YEL)	EA	8.000		8.000	
	682-6004	VEH SIG SEC (12")LED(YEL ARW)	EA	2.000		2.000	
	682-6005	VEH SIG SEC (12")LED(RED)	EA	8.000		8.000	
	682-6006	VEH SIG SEC (12")LED(RED ARW)	EA	4.000		4.000	
	682-6054	BACKPLATE W/REF BRDR(3 SEC)(VENT)ALUM	EA	8.000		8.000	
	682-6055	BACKPLATE W/REF BRDR(4 SEC)(VENT)ALUM	EA	2.000		2.000	
	684-6012	TRF SIG CBL (TY A)(12 AWG)(7 CONDR)	LF	1,190.000		1,190.000	
	684-6017	TRF SIG CBL (TY A)(12 AWG)(12 CONDR)	LF	60.000		60.000	
	686-6035	INS TRF SIG PL AM(S)1 ARM(32')LUM	EA	1.000		1.000	
	686-6037	INS TRF SIG PL AM(S)1 ARM(36')	EA	1.000		1.000	
	686-6045	INS TRF SIG PL AM(S)1 ARM(44')	EA	1.000		1.000	
	686-6047	INS TRF SIG PL AM(S)1 ARM(44')LUM	EA	1.000		1.000	
	6001-6001	PORTABLE CHANGEABLE MESSAGE SIGN	DAY	100.000		100.000	
	6058-6001	BBU SYSTEM (EXTERNAL BATT CABINET)	EA	1.000		1.000	
	6062-6034	ITS RADIO (DUAL)(5 GHZ/5 GHZ)-I-U	EA	1.000		1.000	
	6062-6043	REMOVE ITS RADIO	EA	1.000		1.000	
	6185-6002	TMA (STATIONARY)	DAY	50.000		50.000	
	6185-6003	TMA (MOBILE OPERATION)	HR	80.000		80.000	
	6292-6004	RVDS(PRESENCE DET ONLY)(INSTALL ONLY)	EA	4.000		4.000	
	6292-6005	RVDS(ADVANCE DET ONLY)(INSTALL ONLY)	EA	2.000		2.000	
	6414-6004	WWD CELLULAR MODEM	EA	1.000		1.000	
	06	MATERIAL FURNISHED BY STATE	LS	1.000		1.000	
	08	SAFETY CONTINGENCY (NON-PART)	LS	1.000		1.000	
		EROSION CONTROL MAINTENANCE (NON-PART)	LS	1.000		1.000	
		LAW ENFORCEMENT	LS	1.000		1.000	

ROADWAY QUANTITY SUMMARY

CSJ 0177-14-037	100 6002 PREPARING ROW STA	110 6001 EXCAVATION (ROADWAY) CY	132 6006 EMBANKMENT (FINAL)(DENS CONT)(TY C) CY	134 6004 BACKFILL (TY A OR B) STA	260 6006 LIME TRT (EXST MATL) (6") SY	260 6012 LIME(HYD,COM OR QK)(SLRY)OR QK(DRY) TON	275 6001 CEMENT SY	275 6002 CEMENT TREAT (EXIST MATL) (6") SY
SHEET 1 OF 3	6	51		6	62	3	3	62
SHEET 2 OF 3	6	127	327	6	318	6	6	318
SHEET 3 OF 3	5	76	337	5	180	6.12	6.12	180
PROJECT TOTALS	**17.00**	**254.00**	**664**	**17**	**560**	**15.12**	**15.12**	**560**

CSJ 0177-14-037	292 6003 ASPHALT STAB BASE (GR 2)(PG 70) TON	340 6122 D-GR HMA(SQ) TY-D PG70-22 TON	340 6247 D-GR HMA (SQ) TY-D PG 70-22(LEVEL-UP) TON	400 6005 CEM STABIL BKFL CY	403 6001 TEMPORARY SPL SHORING SF	432 6045 RIPRAP (MOW STRIP)(4 IN) CY	450 6032 RAIL (TY C223) LF
SHEET 1 OF 3	150	40	16	15		6.35	
SHEET 2 OF 3	260	153.34	88	50	768	25.98	27
SHEET 3 OF 3	210	150	19	35	440	25.2	65
PROJECT TOTALS	**620**	**343.34**	**123**	**100**	**1208**	**57.53**	**92**

CSJ 0177-14-037	464 6007 RC PIPE (CL III)(30 IN) LF	465 6002 MANH (COMPL)(PRM)(48IN) EA	465 6054 INLET (COMPL)(PSL)(SL)(3FTX3FT) EA	466 6169 WINGWALL (FW - S) (HW=8 FT) EA	466 6180 WINGWALL (PW - 1) (HW=5 FT) EA	529 6012 CONC CURB (SLOTTED) LF	530 6005 DRIVEWAYS (ACP) SY
SHEET 1 OF 3							143
SHEET 2 OF 3					1	579	
SHEET 3 OF 3	340	1	4	2		580	
PROJECT TOTALS	**340**	**1**	**4**	**2**	**1**	**909**	**143**

CSJ 0177-14-037	540 6001 MTL W-BEAM GD FEN (TIM POST) LF	540 6002 MTL W-BEAM GD FEN (STEEL POST) LF	540 6006 MTL BEAM GD FEN TRANS (THRIE-BEAM) EA	540 6014 SHORT RADIUS LF	544 6001 GUARDRAIL END TREATMENT (INSTALL) EA	658 6014 INSTL DEL ASSM (D-SW)SZ (BRF)CTB (BI) EA	658 6067 INSTL DEL ASSM (D-DW)SZ 1(BRF)GF2 EA	658 6100 INSTL OM ASSM (OM-2Z)(WFL X)GND(BI) EA
SHEET 1 OF 3					1	5	17	
SHEET 2 OF 3	251.5	50	1		3		17	1
SHEET 3 OF 3	411		2	25			16	
PROJECT TOTALS	**662.5**	**50**	**3**	**25**	**4**	**5**	**50**	**1**

DEMOLITION QUANTITY SUMMARY

CSJ 0177-14-037	104 6017 REMOVING CONC (DRIVEWAYS) SY	104 6029 REMOVING CONC (CURB OR CURB & GUTTER) LF	104 6054 REMOVING CONCRETE(MOW STRIP) LF	105 6039 REMOVE STAB BASE AND ASPH PAV (6"-20") SY	354 6045 PLANE ASPH CONC PAV (2") SY	542 6001 REMOVE METAL BEAM GUARD FENCE LF
SHEET 1 OF 3				80	1700	
SHEET 1 OF 3		440	350	40	1700	400
SHEET 1 OF 3	472	442	350	69	1512	400
PROJECT TOTALS	**472**	**882**	**700**	**189**	**4912**	**800**

SL 494
ROADWAY QUANTITY SUMMARY

SHEET 1 OF 1

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		9

DATE:
FILE:

TRAFFIC CONTROL QUANTITY SUMMARY

SUMMARY OF WORKZONE TRAFFIC CONTROL ITEMS												
	351 6005	354 6023	508 6001	512 6021	512 6010	512 6033	512 6034	512 6057	512 6058	6001 6001	6185 6002	6185 6003
CSJ 0177-14-037	FLEXIBLE PAVEMENT STRUCTURE REPAIR(9")	PLANE ASPH CONC PAV(0" TO 4")	CONSTRUCTING DETOURS	PORT CTB (DES SOURCE)(LOW PROF)(TY 1)	PORT CTB (FUR & INST)(LOW PROF)(TY 2)	PORT CTB (MOVE)(LOW PROF)(TY 1)	PORT CTB (MOVE)(LOW PROF)(TY 2)	PORT CTB (REMOVE)(LOW PROF)(TY 1)	PORT CTB (REMOVE)(LOW PROF)(TY 2)	PORTABLE CHANGEABLE MESSAGE SIGN	TMA (STATIONARY)	TMA (MOBILE OPERATION)
	SY	SY	SY	LF	LF	LF	LF	LF	LF	DAY	DAY	HR
SHEET 1 OF 3	30	2000	200									
SHEET 2 OF 3	20	1000	606	100	40							
SHEET 3 OF 3	48.22	1912	550	240	40	140	40	340	80			
PROJECT TOTALS	**98.22**	**4912**	**1356**	**340**	**80**	**140**	**40**	**340**	**80**	**100**	**50**	**80**

SL 494
TCP
QUANTITY
SUMMARY

SHEET 1 OF 1

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		10

CK:
DW:
CK:
DN:

SW3P QUANTITY SUMMARY

CSJ 0177-14-037	164 6048	164 6049	166 6001	168 6001	169 6003	506 6038	506 6039	506 6041	506 6043
	STRAW/HAY MLCH SEED(TEMP)(WARM)	STRAW/HAY MLCH SEED(TEMP)(COOL)	FERTILIZER	VEGETATIVE WATERING	SOIL RETENTION BLANKETS (CL 1) (TY C)	TEMP SEDMT CONT FENCE (INSTALL)	TEMP SEDMT CONT FENCE (REMOVE)	BIODEG EROSN CONT LOGS (INSTL) (12")	BIODEG EROSN CONT LOGS (REMOVE)
	AC	SY	SY	SY	SY	LF	LF	LF	LF
SHEET 1 OF 3	1	706	1	120	252	975	975		
SHEET 2 OF 3	1	1894	1	120	535	2031	2031	56	56
SHEET 3 OF 3									
PROJECT TOTALS	**2**	**2600**	**2**	**240**	**787**	**3006**	**3006**	**56**	**56**

DRAINAGE QUANTITY SUMMARY

CJS 0177-14-037	110 6002	400 6002	400 6006	401 6001	432 6003	462 6030	462 6046
	EXCAVATION (CHANNEL)	STRUCT EXCAV (BOX)	CUT & RESTORING PAV	FLOWABLE BACKFILL	RIPRAP (CONC)(6 IN)	CONC BOX CULV (10 FT X 6 FT)	CONC BOX CULV (3 FT X 3 FT)(EXTEND)
	CY	CY	SY	CY	CY	LF	LF
SHEET 1 OF 3	28						18
SHEET 2 OF 3							
SHEET 3 OF 3	485.8	13	144	3.7	54	126	
PROJECT TOTALS	**513.8**	**13**	**144**	**3.7**	**54**	**126**	**18**

DATE:
FILE:

SL 494
SW3P & DRAINAGE QUANTITY SUMMARY

SHEET 1 OF 1

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		11

Jurisdictional Waterways

Items Over Ordinary High Water Elevation (OHWE)

CHANNEL DESIGN VELOCITY LESS THAN 6 FT/S

CHANNEL DESIGN VELOCITY 6 FT/S TO 12 FT/S

		OUTFALL NAME	OUTFALL NAME	OUTFALL NAME	
					TOTALS
ITEM 110-2002 EXCAVATION (CHANNEL) ▦	CY				
ITEM 432-2019 RIPRAP(STONE PROTECTION) (12 IN)	CY				
ITEM 432-2021 RIPRAP(STONE PROTECTION) (18 IN)	CY				
ORDINARY HIGH WATER ELEVATION					

Items Under Ordinary High Water Elevation (OHWE)

CHANNEL DESIGN VELOCITY LESS THAN 6 FT/S

CHANNEL DESIGN VELOCITY 6 FT/S TO 12 FT/S

		BRIDGE-CLASS CULVERT SOUTH			TOTALS
ITEM 110-6002 EXCAVATION (CHANNEL) ▦	CY	94.00			94.00
ITEM 432-6031 RIPRAP(STONE PROTECTION) (12 IN)	CY	94.00			94.00 (PQ)
ITEM 432-6033 RIPRAP(STONE PROTECTION) (18 IN)	CY				(PQ)

COE PERMIT ITEM

COE PERMIT ITEM

(BB)

Non-Jurisdictional Waterways (Total Quantities Including Above and Below Normal Water Elevation)

CHANNEL DESIGN VELOCITY LESS THAN 6 FT/S

CHANNEL DESIGN VELOCITY 6 FT/S TO 12 FT/S

		OUTFALL NAME	OUTFALL NAME	OUTFALL NAME	
		CULVERT NORTH			TOTALS
ITEM 110-6002 EXCAVATION (CHANNEL) ▦	CY	28.20			28.20
ITEM 432-6031 RIPRAP(STONE PROTECTION) (12 IN)	CY	28.20			28.20
ITEM 432-6033 RIPRAP(STONE PROTECTION) (18 IN)	CY				

(BB)

DESIGNERS:
CONCRETE RIPRAP AND/OR INTERLOCKING ARTICULATING CONCRETE BLOCKS ARE ALSO CONSIDERED FILL. BEFORE INSTALLING THIS OR ANY OTHER ITEM UNDER OHWM (ORDINARY HIGH WATER MARK), OBTAIN APPROVAL FROM ENVIRONMENTAL SECTION.

(PQ) PERMIT QUANTITIES

▦ BOTTOM AND SIDE SLOPE EXCAVATION (SEE OUTFALL DETAILS FOR BRAZORIA, FORT BEND, GALVESTON, MONTGOMERY, AND WALLER COUNTIES)

Texas Department of Transportation
Houston District

(BRAZORIA, FORT BEND, GALVESTON, MONTGOMERY AND WALLER COUNTIES)

OUTFALL QUANTITIES

OQ

REVISIONS
5/1/2015

DN:	CK:	DW:	CK:	
DISTRICT	PROJECT NO.			SHEET
HOU				11A
COUNTY	CONTROL	SECTION	JOB	HIGHWAY
MONTGOMERY	0177	14	037	SL 494

STD G6C

PAVEMENT MARKING QUANTITY SUMMARY

SUMMARY OF PAVEMENT MARKING ITEMS

CSJ 0177-14-037	662 6005	662 6008	662 6012	662 6014	662 6016	662 6017	662 6018	662 6023	662 6029	662 6035	662 6037	662 6048
	WK ZN PAV MRK NON-REMOV (W)6"(BRK)	WK ZN PAV MRK NON-REMOV (W)6"(SLD)	WK ZN PAV MRK NON-REMOV (W)8"(SLD)	WK ZN PAV MRK NON-REMOV (W)12"(SLD)	WK ZN PAV MRK NON-REMOV (W)24"(SLD)	WK ZN PAV MRK NON-REMOV (W)(ARROW)	WK ZN PAV MRK NON-REMOV (W)(DBL ARW)	WK ZN PAV MRK NON-REMOV (W)(RR XING)	WK ZN PAV MRK NON-REMOV (W)(WORD)	WK ZN PAV MRK NON-REMOV (Y)6"(BRK)	WK ZN PAV MRK NON-REMOV (Y)6"(SLD)	WK ZN PAV MRK REMOV (REFL) TY I-C
	LF	LF	LF	LF	LF	EA	EA	EA	EA	LF	LF	EA
SHEET 1 OF 3	456	2976	120	240	72		3				2964	27
SHEET 2 OF 3		3600	726			3			3	318	4788	37
SHEET 3 OF 3		3360	1377		144	3		3	3		3006	69
PROJECT TOTALS	**456**	**9936**	**2223**	**240**	**216**	**6**	**3**	**3**	**6**	**318**	**10758**	**133**

SUMMARY OF PAVEMENT MARKING ITEMS

CSJ 0177-14-037	662 6050	666 6036	666 6042	666 6048	666 6054	666 6057	666 6078	666 6093	666 6162	666 6306	666 6309	666 6318
	WK ZN PAV MRK REMOV (REFL) TY II-A-A	REFL PAV MRK TY I (W)8"(SLD) (100MIL)	REFL PAV MRK TY I (W)12"(SLD) (100MIL)	REFL PAV MRK TY I (W)24"(SLD)(100MIL)	REFL PAV MRK TY I (W)(ARROW)(100MIL)	REFL PAV MRK TY I(W)(DBL ARROW)(100M IL)	REFL PAV MRK TY I (W)(WORD)(1 00MIL)	REFL PAV MRK TY I (W)(RR XING)(100MIL)	RE PV MRK TY I(BLACK)6 "(SHADOW)(	RE PM W/RET REQ TY I (W)6"(BRK	RE PM W/RET REQ TY I (W)6"(SLD	RE PM W/RET REQ TY I (Y)6"(BRK
	EA	LF	LF	LF	EA	EA	EA	EA	LF	LF	LF	LF
SHEET 1 OF 3	150	40	80	24		1			110	110	992	
SHEET 2 OF 3	216	242			1		1				1200	106
SHEET 3 OF 3	156	459		48	1		1	1			1050	
PROJECT TOTALS	**522**	**741**	**80**	**72**	**2**	**1**	**2**	**1**	**110**	**110**	**3242**	**106**

SUMMARY OF PAVEMENT MARKING ITEMS

CSJ 0177-14-037	666 6321	672 6007	672 6009	678 6002	678 6004	678 6006	678 6008	678 6009	678 6010	678 6016	678 6020
	RE PM W/RET REQ TY I (Y)6"(SLD)(100MIL)	REFL PAV MRKR TY I-C	REFL PAV MRKR TY II-A-A	PAV SURF PREP FOR MRK (6")	PAV SURF PREP FOR MRK (8")	PAV SURF PREP FOR MRK (12")	PAV SURF PREP FOR MRK (24")	PAV SURF PREP FOR MRK (ARROW)	PAV SURF PREP FOR MRK (DBL ARROW)	PAV SURF PREP FOR MRK (WORD)	PAV SURF PREP FOR MRK (RR XING)
	LF	EA	EA	LF	LF	LF	LF	EA	EA	EA	EA
SHEET 1 OF 3	992	9	48	2204	40	80	24		1		
SHEET 2 OF 3	1596	12	77	2902	242			1		1	
SHEET 3 OF 3	1002	23	52	2262	459		48	1		1	1
PROJECT TOTALS	**3590**	**44**	**177**	**7368**	**741**	**80**	**72**	**2**	**1**	**2**	**1**

SL 494
PAVEMENT MARKING QUANTITY SUMMARY

SHEET 1 OF 1

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		12

SUMMARY OF SMALL SIGNS

LAYOUT SHEET NO.	SIGN NO.	SIGN TYPE	SIGN TEXT	SIGN DIMENSIONS (IN)	PLYWOOD SIGNS	ALUMINUM SIGNS TYPE A	644 - INS SM RD SN SUP & AM — TYPE OF MOUNT: 6001 10BWG (1) SA (P) 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	6076 REMOVE SM RD SN SUP&AM EA	636 - REPLACE EXISTING SIGNS — TYPE OF SIGNS: 6003 (TY O) SF
1	1		FM 1485	59" X 12"		X									4.92
	2		LOOP 494	68" X 12"		X									5.66
	3		FM 1485	59" X 12"		X									4.92
	4	R1-2	YIELD SIGN	48" X 36"		X		X							
	5	M3-4	WEST	24" X 12"		X				X				X	
		M1-6F	FARM TO MARKET RD 1485	36" X 36"		X									
		M6-1L	ARROW, LEFT	21" X 15"		X									
		M3-1	NORTH	24" X 12"		X									
		M1-6L	LOOP 494	24" X 12"		X									
		M6-3	ARROW STRAIGHT	21" X 15"		X									
	6	R2-1	SPEED LIMIT 50	36" X 36"		X		X						X	
	7	R3-8MS	ADVANCE INTERSECTION LANE CONTROL	36" X 36"		X		X							
	8	R2-1	SPEED LIMIT 50	36" X 36"		X		X							
	9	M3-4	WEST	24" X 12"		X				X					
		M1-6F	FARM TO MARKET RD 1485	36" X 36"		X									
		M6-1L	ARROW, LEFT	21" X 15"		X									
		M3-1	NORTH	24" X 12"		X									
		M1-6L	LOOP 494	24" X 12"		X									
		M6-3	ARROW STRAIGHT	21" X 15"		X									
2	10	M2-1	JCT	30" X 24"		X	X								
		M1-6F	FARM TO MARKET RD 1485	36" X 36"		X									
	11	W10-3R	GRADE CROSSING & INTERSECTION ADVANCE	36" X 36"		X		X							
	12	M2-1	JCT	30" X 24"		X	X								
		M1-6F	FARM TO MARKET RD 1485	36" X 36"		X									
3	13	D7-5TL	LAKE HOUSTON PARK, ARROW LEFT	48" X 24"		X								X	
	14		FM 1485	59" X 12"		X									4.92
	15		LOOP 494	68" X 12"		X									5.66
	16		FM 1485	59" X 12"		X									4.92
			TOTAL			28	2	5		2				3	31

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 BLANKS(TY 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

STATE DISTRICT	FEDERAL REGION	PROJECT NO.			SHEET
HOU	6				13
COUNTY		CONTROL	SECTION	JOB	HIGHWAY NO.
MONTGOMERY		0177	14	037	SL 494

STD-N29

MATERIALS FOR HIGHWAY TRAFFIC SIGNAL - LOOP 494 AT FM 1485

ITEM	DESC CODE	DESCRIPTION	UNIT	QUANTITY	TOTAL
0416	6032	DRILL SHAFT (TRF SIG POLE) (36 IN)	LF	58	58
0529	6012	CONC CURB (SLOTTED)	LF	250	250
0542	6001	REMOVE METAL BEAM GUARD FENCE	LF	100	100
0618	6046	CONDT (PVC) (SCH 80) (2")	LF	155	155
0618	6047	CONDT (PVC) (SCH 80) (2") (BORE)	LF	240	240
0618	6053	CONDT (PVC) (SCH 80) (3")	LF	20	20
0618	6058	CONDT (PVC) (SCH 80) (4")	LF	25	25
0620	6009	ELEC CONDR (NO.6) BARE	LF	375	375
0620	6011	ELEC CONDR (NO.4) BARE	LF	45	45
0620	6012	ELEC CONDR (NO.4) INSULATED	LF	85	85
0621	6005	TRAY CABLE (4 CONDR) (12 AWG)	LF	415	415
0624	6009	GROUND BOX TY D (162922)	EA	7	7
0624	6028	REMOVE GROUND BOX	EA	4	4
0628	6145	ELC SRV TY D 120/240 060(NS)SS(E)SP(O)	EA	1	1
0636	6007	REPLACE EXISTING ALUMINUM SIGNS(TY A)	SF	15	15
		*SIGN "DO NOT STOP ON TRACKS" (R8-8)(30" X 24")(5.0 SF)	EA	2	2
		*SIGN "RAIL ROAD" (W10-1)(30" X 30")(5.0 SF)	EA	1	1
0644	6001	IN SM RD SN SUP&AM TY10BWG(1)SA(P)	EA	3	3
0680	6003	INSTALL HWY TRF SIG (SYSTEM)	EA	1	1
		*CONTROLLER FULL-ACTUATED W/CABINET	EA	1	1
		*TRAFFIC SIGNAL CONTROLLER FOUNDATION	EA	1	1
		*ROD 5/8 X 10' COPPER GROUND (CONTROLLER ONLY)	EA	1	1
		*DETECTOR CARD RACK (8 SLOT)	EA	1	1
		*DETECTOR UNIT (DUAL CHANNEL)	EA	12	12
		*SIGN "FM 1485" (54" x 18")	EA	2	2
		* SIGN "LOOP 494" (66" x 18")	EA	2	2
		*MAST ARM DAMPER	EA	4	4
		* 18" CABINET BASE EXTENSIONS	EA	1	1
		*SIGN, "LEFT TURN SIGNAL" (R10-10L)(24"X30")(16.0 SF)	EA	2	2
		*LED RDWY LUMINAIRE (250W HPS EQ)	EA	2	2
		*CELLULAR MODEM	EA	1	1
0680	6004	REMOVING TRAFFIC SIGNALS	EA	1	1
0682	6001	VEH SIG SEC (12")LED(GRN)	EA	8	8
0682	6002	VEH SIG SEC (12")LED(GRN ARW)	EA	2	2
0682	6003	VEH SIG SEC (12")LED(YEL)	EA	8	8
0682	6004	VEH SIG SEC (12")LED(YEL ARW)	EA	2	2
0682	6005	VEH SIG SEC (12")LED(RED)	EA	8	8
0682	6006	VEH SIG SEC (12")LED(RED ARW)	EA	4	4
0682	6054	BACKPLATE W/REF BRDR(3 SEC)(VENT)ALUM	EA	8	8
0682	6055	BACKPLATE W/REF BRDR(4 SEC)(VENT)ALUM	EA	2	2
0684	6012	TRF SIG CBL (TY A)(12 AWG)(7 CONDR)	LF	1190	1,190
0684	6017	TRF SIG CBL (TY A)(12 AWG)(12 CONDR)	LF	60	60
0686	6035	INS TRF SIG PL AM(S)1 ARM(32')LUM	EA	1	1
0686	6037	INS TRF SIG PL AM(S)1 ARM(36')	EA	1	1
0686	6045	INS TRF SIG PL AM(S)1 ARM(44')	EA	1	1
0686	6047	INS TRF SIG PL AM(S)1 ARM(44')LUM	EA	1	1

MATERIALS FOR HIGHWAY TRAFFIC SIGNAL - LOOP 494 AT FM 1485

ITEM	DESC CODE	DESCRIPTION	UNIT	QUANTITY	TOTAL
6058	6001	BBU SYSTEM (EXTERNAL BATT CABINET)	EA	1	1
6062	6034	ITS RADIO (DUAL)(5 GHZ/5 GHZ)-I-U	EA	1	1
6062	6043	REMOVE ITS RADIO	EA	1	1
6292	6004	RVDS(PRESENCE DET ONLY)(INSTALL ONLY)	EA	4	4
		*CABLE (22/4C AWG)(COM)/(18/2C AWG)(POWER)	LF	785	785
6292	6005	RVDS(ADVANCE DET ONLY)(INSTALL ONLY)	EA	2	2
		*CABLE (22/4C AWG)(COM)/(18/2C AWG)(POWER)	LF	395	395
6414	6114	WWD CELLULAR MODEM	EA	1	1

LOOP 494 AT FM 1485 TRAFFIC SIGNAL PROPOSED LAYOUT

0 20 40 FT

SCALE: 1" = 40'

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0177	14	037	FM 1485
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		14

DATE: 8/30/2021 2:26:17 PM
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DN: | CK: | DW: | CK:

TRAFFIC CONTROL PLAN NOTES AND PRINCIPAL OBJECTIVES

1. MINIMIZE IMPACT TO SL 494 TRAFFIC
2. MAINTAIN ALL MOVEMENTS OR PROVIDE SHORT TERM DETOURS IN ALL PHASES.
3. ENSURE ACCESS TO ADJACENT PROPERTY.
4. THE CONTRACTOR MAY COMBINE OR ALTER PHASING TO IMPROVE OPERATIONS BASED ON FIELD CONDITIONS AND UPON ENGINEER'S APPROVAL.

PHASE 1- INSTALL EAST CULVERTS, BUILD PERM CONSTRUCTION, AND CONSTRUCT TEMPORARY DETOURS
PHASE 2- SHIFT TRAFFIC EAST AND INSTALL PERM BOX CULVERTS ON WEST SIDE
PHASE 3- MILL, OVERLAY, INSTALL TRAFFIC SIGNALS, INSTALL SIGNS AND PERM STRIPING

INITIAL TASKS
PRINCIPAL OBJECTIVE: PREPARE ROW
TRAFFIC: INSTALL ADVANCED WARNING SIGNS AND SWP3 DEVICES
CONSTRUCTION: PREPARE ROW

PHASE 1
PRINCIPAL OBJECTIVE: CONSTRUCT PERM PAVEMENT & TEMPORARY DETOUR ON EAST SIDE
TRAFFIC: TRAFFIC REMAINS IN EXISTING PATTERNS
CONSTRUCTION: INSTALL EAST 10' X 6' BOX CULVERTS, WINGWALLS AND PROP WIDENING

PHASE 2
PRINCIPAL OBJECTIVE: CONSTRUCT 10' X 6' BOX CULVERT
TRAFFIC: SHIFT MAINLANE TRAFFIC TO TEMP DETOUR
CONSTRUCTION: CONSTRUCT EAST PORTION 10' X 6' BOX CULVERT AND WINGWALL

PHASE 3
PRINCIPAL OBJECTIVE: MILL 2", OVERLAY, AND ENSURE TRAFFIC SIGNAL IS OPERATIONAL
TRAFFIC: USE TCP(1-3)-18 AND TCP(2-2)-18 STANDARDS
CONSTRUCTION: PLACE FINAL PAVING, PAVEMENT MARKING, INSTALL SIGNS, AND TRAFFIC SIGNAL

STATE OF TEXAS
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136908
LICENSED
PROFESSIONAL ENGINEER

Micah J. Schluter, P.E.

07.30.21

SL 494
CONSTRUCTION SEQUENCE

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		15

DATE: 04/26/2019 07:21 PM
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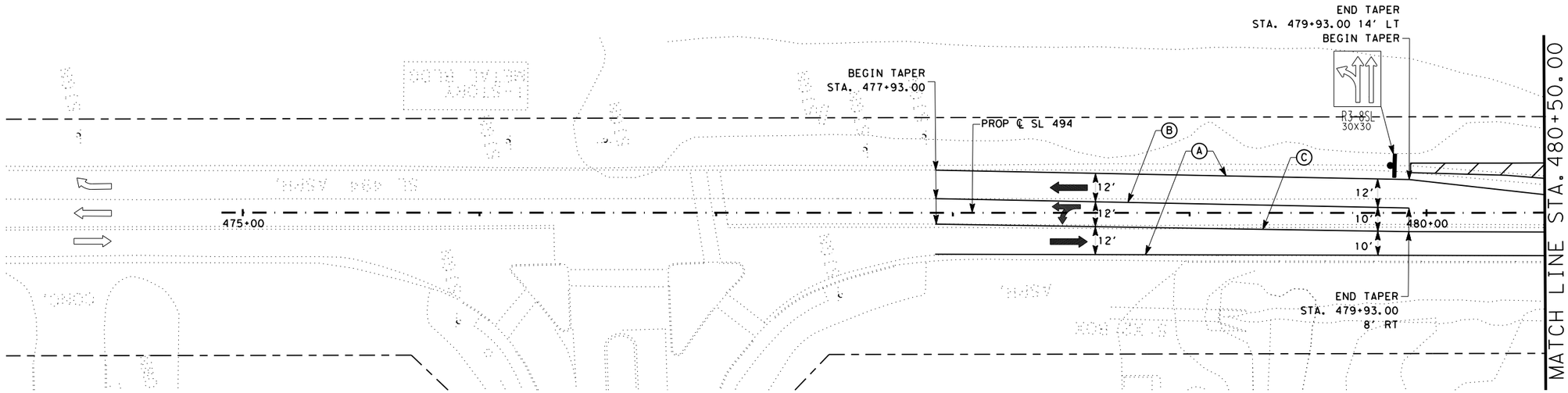

LEGEND

- LOW PROFILE CONC BARRIER (LPCB)
- WATERWAY THIS STEP
- DRUMS
- TYPE III BARRICADE
- CONSTRUCTION SIGN
- DIRECTION OF TRAFFIC FLOW (EXISTING)
- DIRECTION OF TRAFFIC FLOW (PROPOSED)
- PERMANENT CONSTRUCTION THIS STEP
- TEMPORARY PAVEMENT
- EXISTING PAVEMENT
- PAVEMENT COMPLETED IN PREVIOUS PHASE(S)

PAVEMENT MARKERS

- (A) WRK ZN PAV MRK NON-REMOV (W) (4") (SLD)
- (B) WRK ZN PAV MRK NON-REMOV (W) (4") (BRK)
- (C) WRK ZN PAV MRK NON-REMOV (Y) (4") (SLD)
- (D) WRK ZN PAV MRK NON-REMOV (Y) (4") (BRK)

NOTE:

1. SAWING IS NOT PAID FOR DIRECTLY, BUT IT SUBSIDIARY TO VARIOUS PAVEMENT ITEMS.

0 25 50
SCALE IN FEET

STATE OF TEXAS
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136908
LICENSED
PROFESSIONAL ENGINEER

Micah J. Schluter, P.E.

07.30.21

SL 494
TCP
PHASE 1

SHEET 1 OF 3

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		16

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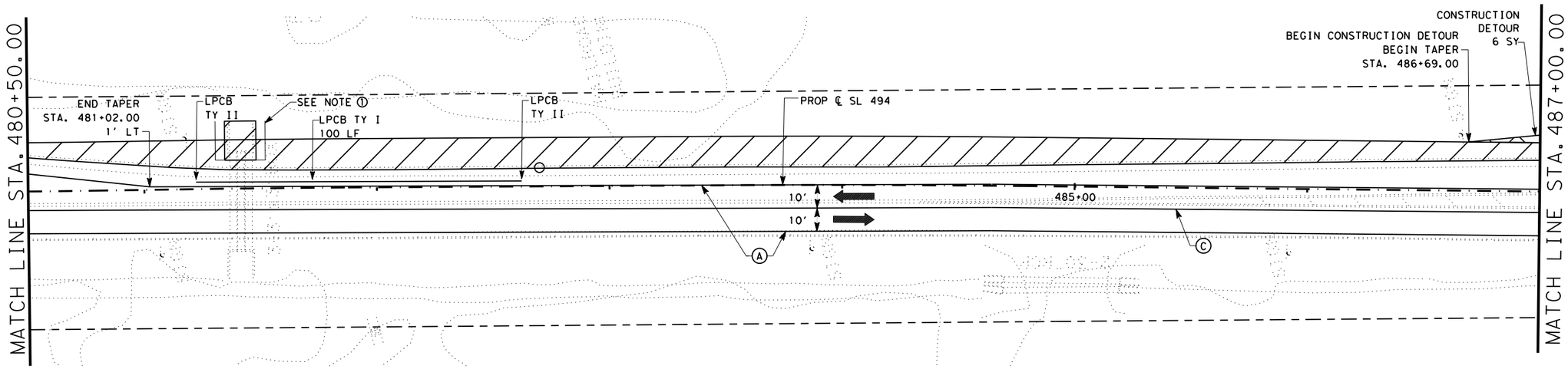

LEGEND

- LOW PROFILE CONC BARRIER (LPCB)
- WATERWAY THIS STEP
- DRUMS
- TYPE III BARRICADE
- CONSTRUCTION SIGN
- DIRECTION OF TRAFFIC FLOW (EXISTING)
- DIRECTION OF TRAFFIC FLOW (PROPOSED)
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PAVEMENT MARKERS

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- (C) WRK ZN PAV MRK NON-REMOV (Y) (4") (SLD)
- (D) WRK ZN PAV MRK NON-REMOV (Y) (4") (BRK)

NOTE:

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NOTES:

① TEMPORARY SPECIAL SHORING
QUANTITY= 440 SF

0 25 50
SCALE IN FEET

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SL 494
TCP
PHASE 1

SHEET 2 OF 3

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		17

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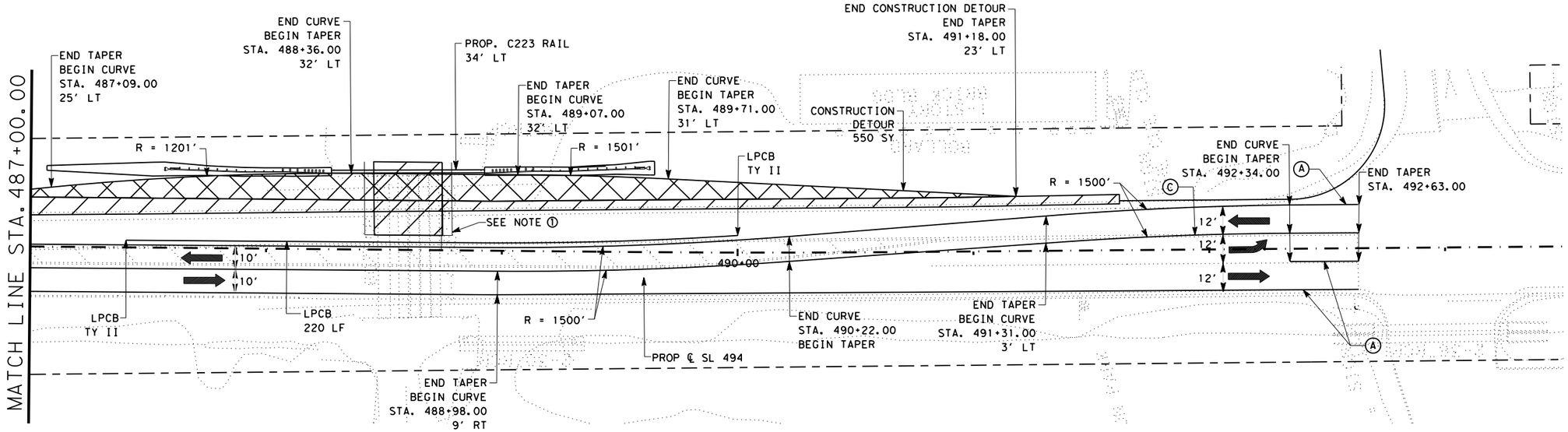

LEGEND

- LOW PROFILE CONC BARRIER (LPCB)
- WATERWAY THIS STEP
- DRUMS
- TYPE III BARRICADE
- CONSTRUCTION SIGN
- DIRECTION OF TRAFFIC FLOW (EXISTING)
- DIRECTION OF TRAFFIC FLOW (PROPOSED)
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- (C) WRK ZN PAV MRK NON-REMOV (Y) (4") (SLD)
- (D) WRK ZN PAV MRK NON-REMOV (Y) (4") (BRK)

NOTE:

1. SAWING IS NOT PAID FOR DIRECTLY, BUT IT SUBSIDIARY TO VARIOUS PAVEMENT ITEMS.

NOTES:

① TEMPORARY SPECIAL SHORING
QUANTITY= 792 SF

0 25 50
SCALE IN FEET

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SL 494
TCP
PHASE 1

SHEET 3 OF 3

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		18

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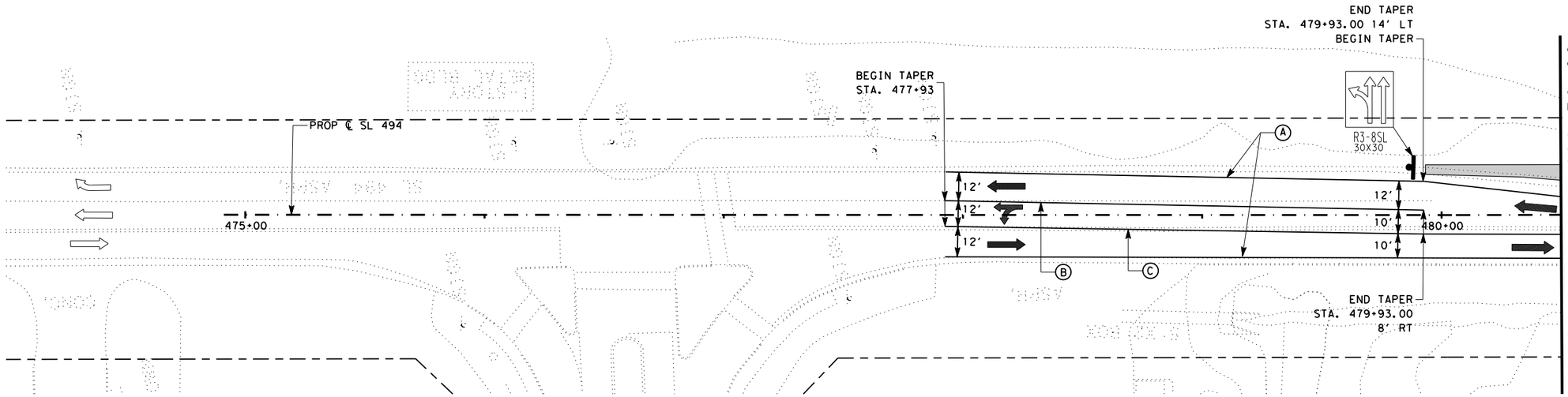

LEGEND

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- DRUMS
- TYPE III BARRICADE
- CONSTRUCTION SIGN
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- DIRECTION OF TRAFFIC FLOW (PROPOSED)
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SL 494
TCP
PHASE 2

SHEET 1 OF 3

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		19

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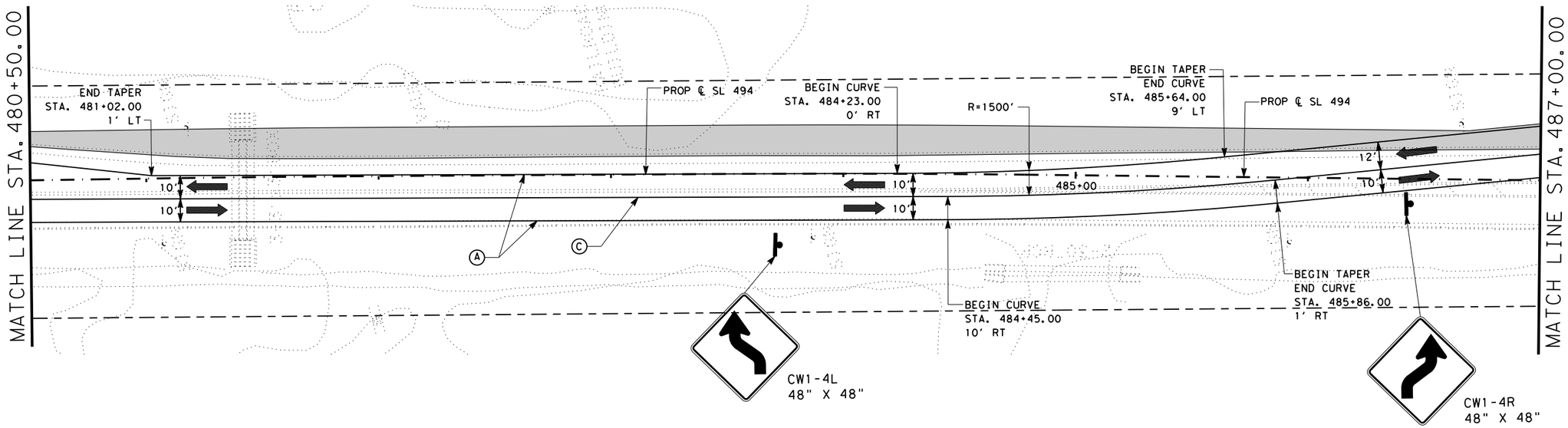

LEGEND

- LOW PROFILE CONC BARRIER (LPCB)
- WATERWAY THIS STEP
- DRUMS
- TYPE III BARRICADE
- CONSTRUCTION SIGN
- DIRECTION OF TRAFFIC FLOW (EXISTING)
- DIRECTION OF TRAFFIC FLOW (PROPOSED)
- PERMANENT CONSTRUCTION THIS STEP
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0 25 50
SCALE IN FEET

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SL 494
TCP
PHASE 2

SHEET 2 OF 3

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		20

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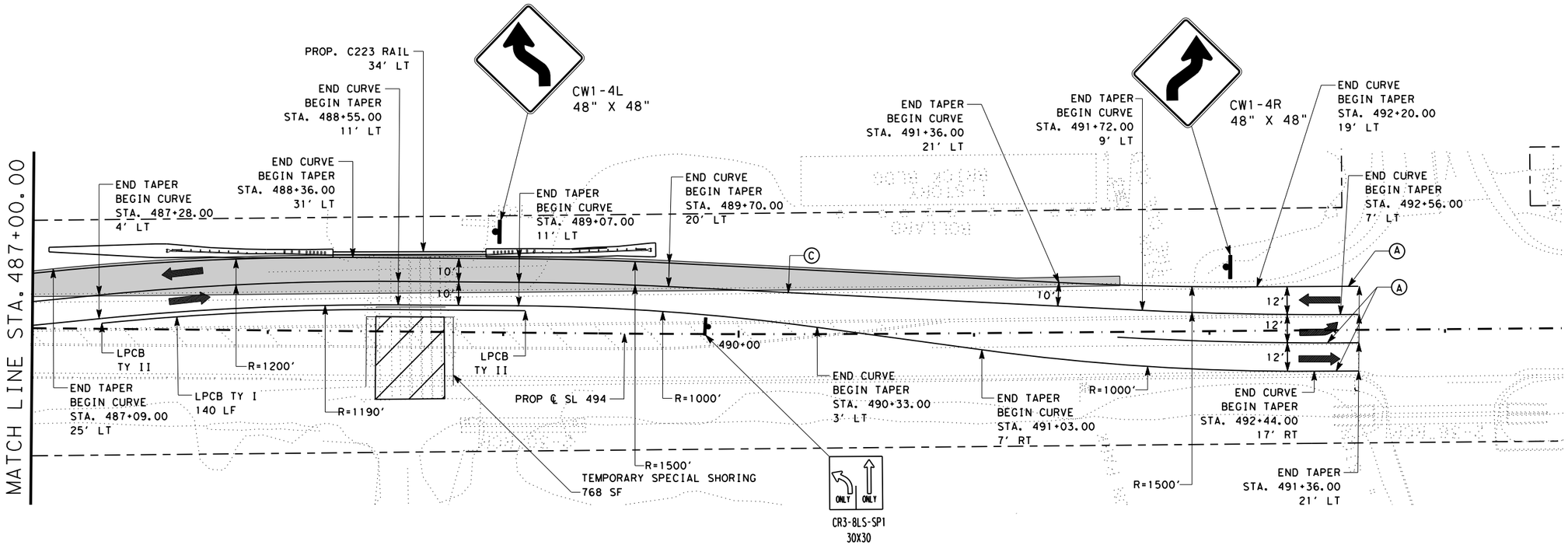

LEGEND

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- DRUMS
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SCALE IN FEET

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SL 494
TCP
PHASE 2

SHEET 3 OF 3

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		21

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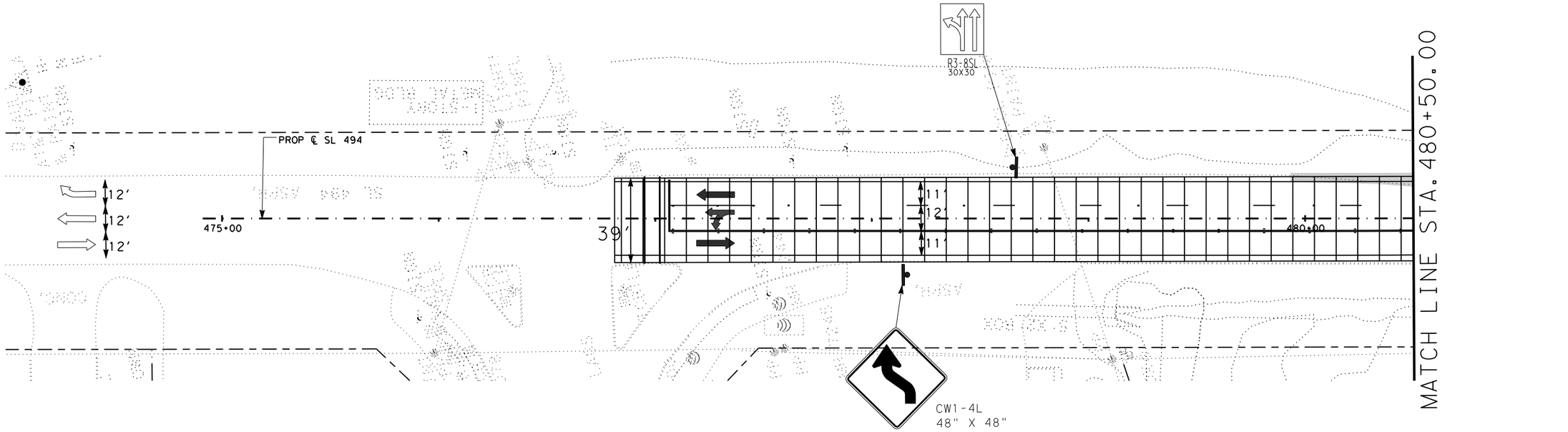

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0 25 50
SCALE IN FEET

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SL 494
TCP
PHASE 3

SHEET 1 OF 3

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		22

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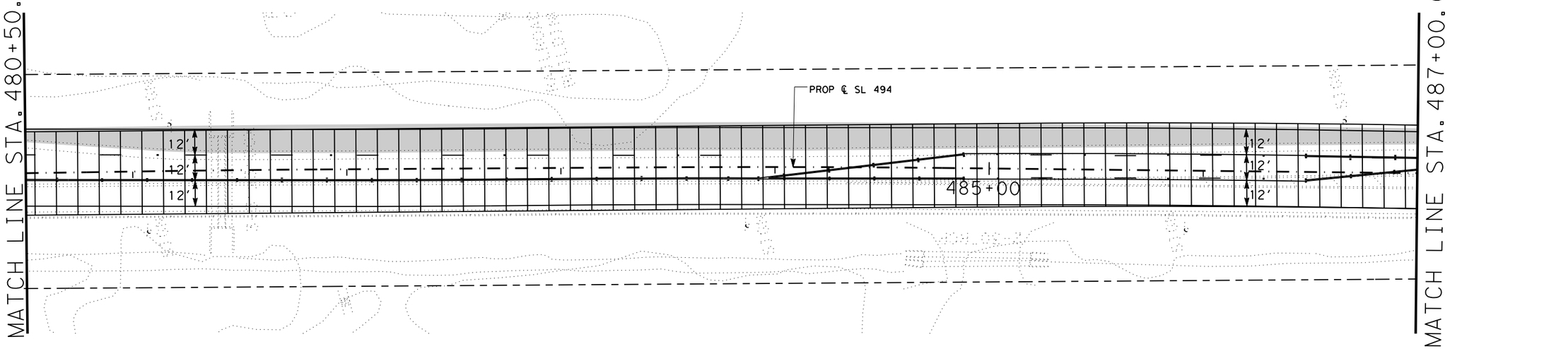

LEGEND

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0 25 50
SCALE IN FEET

STATE OF TEXAS
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Micah J. Schluter, P.E.

07.30.21

SL 494
TCP
PHASE 3

SHEET 2 OF 3

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		23

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DW'D
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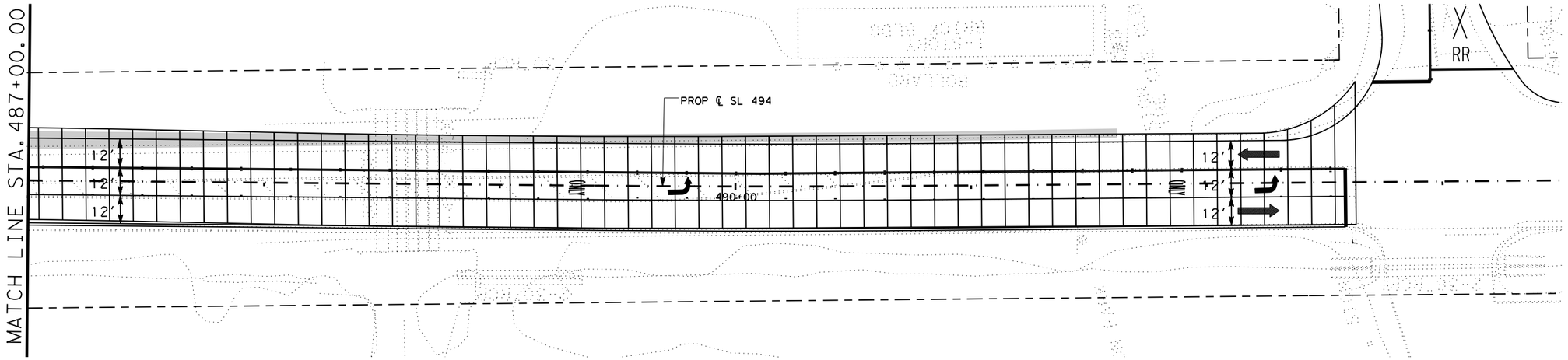

LEGEND

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PAVEMENT MARKERS

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0 25 50
SCALE IN FEET

STATE OF TEXAS
MICAH J. SCHLUTER
136908
LICENSED
PROFESSIONAL ENGINEER

Micah J. Schluter, P.E.

07.30.21

SL 494
TCP
PHASE 3

SHEET 3 OF 3

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		24

DATE: 07/28/2021 3:01:49 PM
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BARRICADE AND CONSTRUCTION (BC) STANDARD SHEETS GENERAL NOTES:

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

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

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

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

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

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

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

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

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

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

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

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

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

WORKER SAFETY NOTES:

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

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

COMPLIANT WORKZONE TRAFFIC CONTROL DEVICES

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

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

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

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION GENERAL NOTES AND REQUIREMENTS

BC(1)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
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	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY		25

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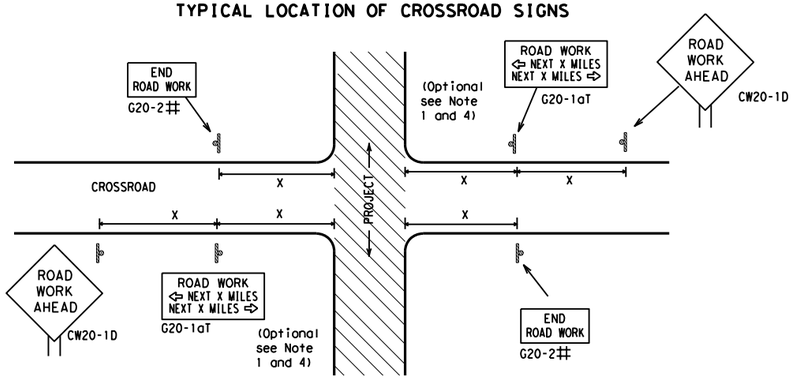
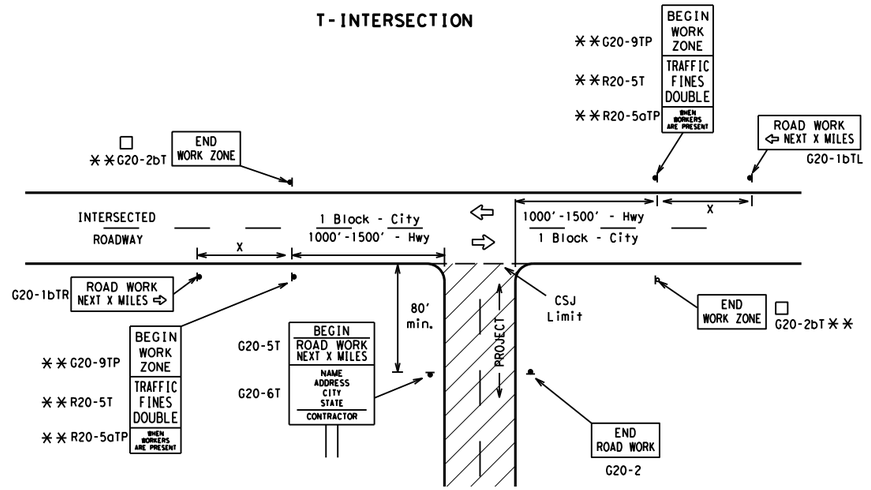
TYPICAL LOCATION OF CROSSROAD SIGNS



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

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

T-INTERSECTION



CSJ LIMITS AT T-INTERSECTION

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

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

SIZE

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

SPACING

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

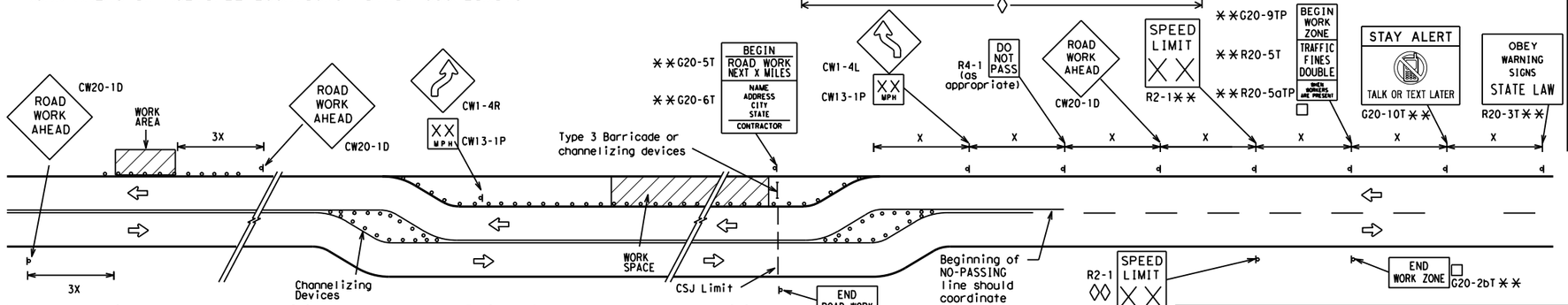
* For typical sign spacings on divided highways, expressways and freeways, see Part 6 of the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD) typical application diagrams or TCP Standard Sheets.

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

GENERAL NOTES

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

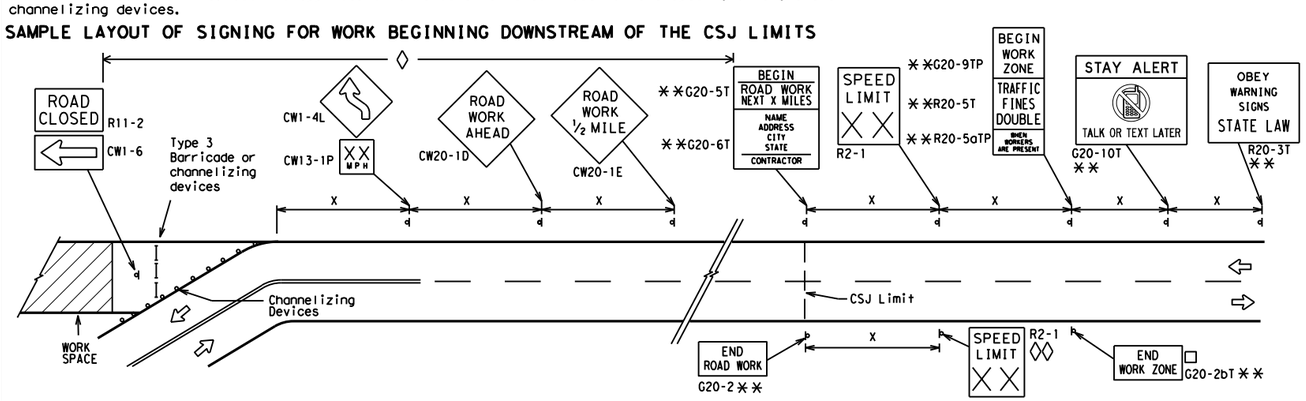
WORK AREAS IN MULTIPLE LOCATIONS WITHIN CSJ LIMITS



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

SAMPLE LAYOUT OF SIGNING FOR WORK BEGINNING AT THE CSJ LIMITS

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



NOTES

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

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

** CSJ limit signing is required for highway construction and maintenance work, with the exception of mobile operations.

◊ Area for placement of "ROAD WORK AHEAD" (CW20-1D)sign and other signs or devices as called for on the Traffic Control Plan.

◊◊ Contractor will install a regulatory speed limit sign at the end of the work zone.

LEGEND

⊢⊣	Type 3 Barricade
○ ○ ○	Channelizing Devices
▬	Sign
X	See Typical Construction Warning Sign Size and Spacing chart or the TMUTCD for sign spacing requirements.

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PROJECT LIMIT

BC(2)-21

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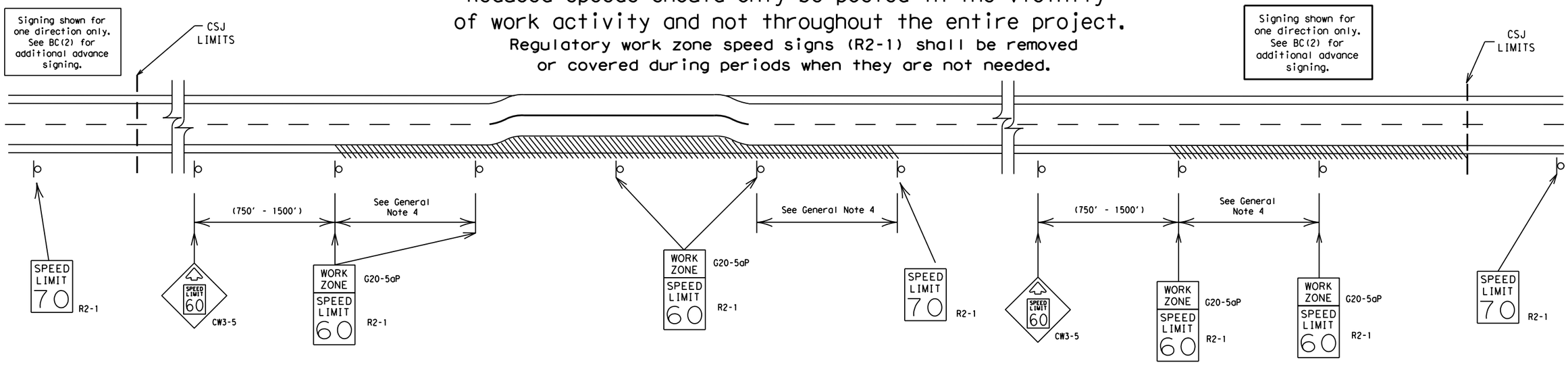
TYPICAL APPLICATION OF WORK ZONE SPEED LIMIT SIGNS

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

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

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



GUIDANCE FOR USE:

LONG/INTERMEDIATE TERM WORK ZONE SPEED LIMITS

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

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

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

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

SHORT TERM WORK ZONE SPEED LIMITS

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

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

GENERAL NOTES

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

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION WORK ZONE SPEED LIMIT

BC(3)-21

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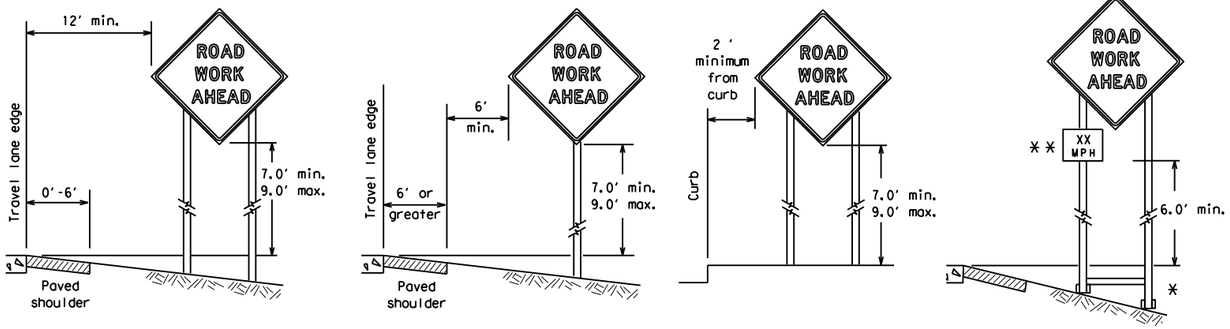
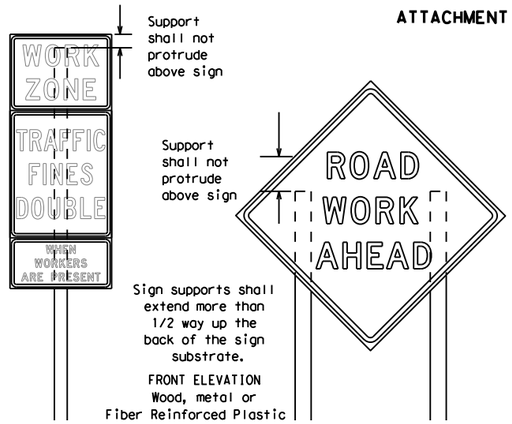
TYPICAL MINIMUM CLEARANCES FOR LONG TERM AND INTERMEDIATE TERM SIGNS

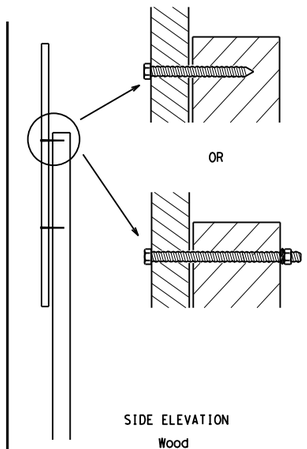


* When placing skid supports on unlevel ground, the leg post lengths must be adjusted so the sign appears straight and plumb. Objects shall NOT be placed under skids as a means of leveling.

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

ATTACHMENT FOR SIGN SUPPORTS





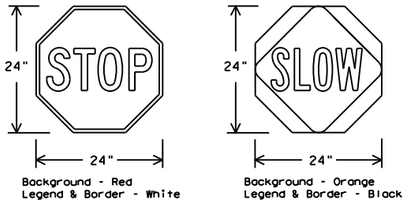
Attachment to wooden supports will be by bolts and nuts or screws. Use TxDOT's or manufacturer's recommended procedures for attaching sign substrates to other types of sign supports

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

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

STOP/SLOW PADDLES

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



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

CONTRACTOR REQUIREMENTS FOR MAINTAINING PERMANENT SIGNS WITHIN THE PROJECT LIMITS

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

GENERAL NOTES FOR WORK ZONE SIGNS

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

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

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

SIGN MOUNTING HEIGHT

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

SIZE OF SIGNS

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

SIGN SUBSTRATES

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

REFLECTIVE SHEETING

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

SIGN LETTERS

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

REMOVING OR COVERING

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

SIGN SUPPORT WEIGHTS

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

FLAGS ON SIGNS

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

Texas Department of Transportation | Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION TEMPORARY SIGN NOTES

BC(4)-21

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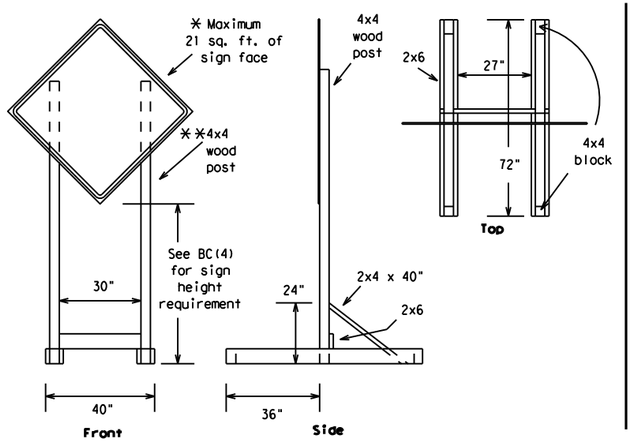
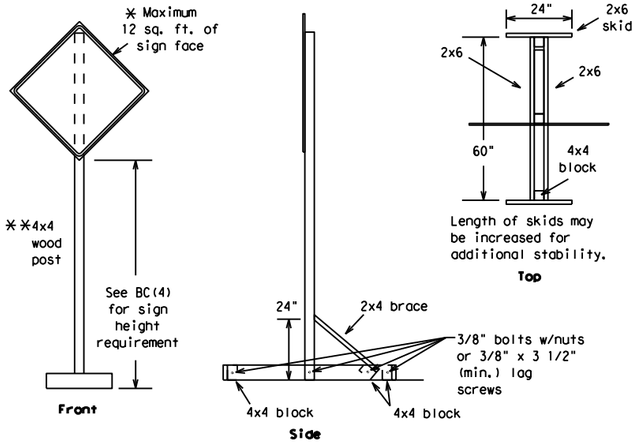
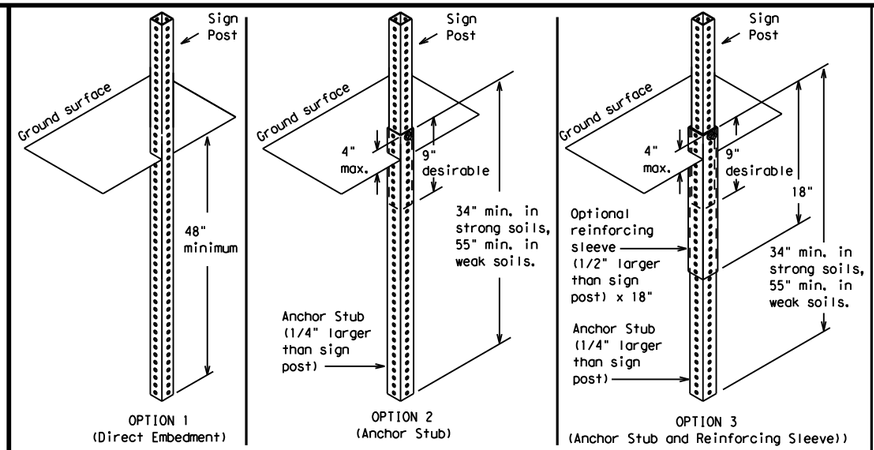




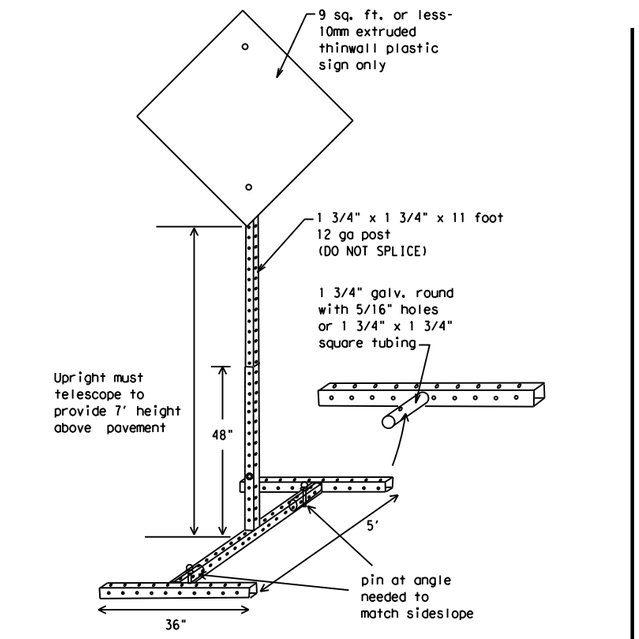
SKID MOUNTED WOOD SIGN SUPPORTS

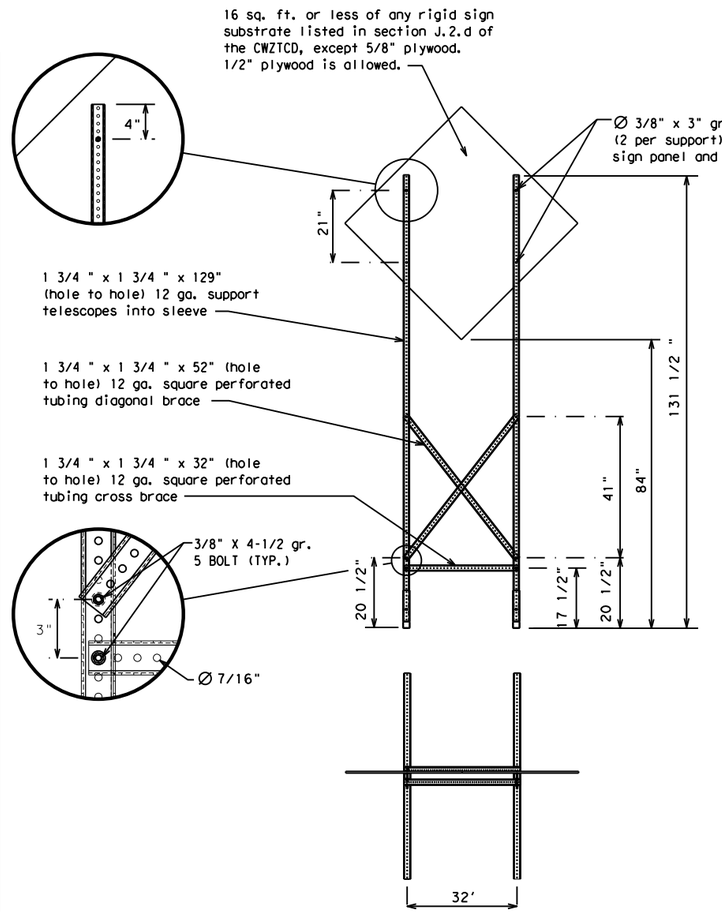
* LONG/INTERMEDIATE TERM STATIONARY - PORTABLE SKID MOUNTED SIGN SUPPORTS

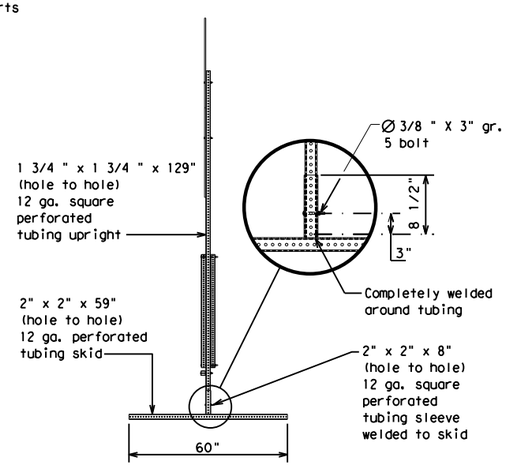


GROUND MOUNTED SIGN SUPPORTS

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







SKID MOUNTED PERFORATED SQUARE STEEL TUBING SIGN SUPPORTS

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

WEDGE ANCHORS

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

OTHER DESIGNS

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

GENERAL NOTES

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

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

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

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

Texas Department of Transportation | Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION TYPICAL SIGN SUPPORT

BC(5)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	0177	14	037	SL 494
9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	HOU	MONTGOMERY		29

DATE:
FILE:

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

PORTABLE CHANGEABLE MESSAGE SIGNS

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

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

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

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

RECOMMENDED PHASES AND FORMATS FOR PCMS MESSAGES DURING ROADWORK ACTIVITIES

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

Phase 1: Condition Lists

Road/Lane/Ramp Closure List

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

Other Condition List

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

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

Phase 2: Possible Component Lists

Action to Take/Effect on Travel List

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

Location List

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

Warning List

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

** Advance Notice List

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

** See Application Guidelines Note 6.

APPLICATION GUIDELINES

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

WORDING ALTERNATIVES

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

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

FULL MATRIX PCMS SIGNS

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

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PORTABLE CHANGEABLE MESSAGE SIGN (PCMS)

BC(6)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	0177	14	037	SL 494
9-07 8-14	DIST	COUNTY		SHEET NO.
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100

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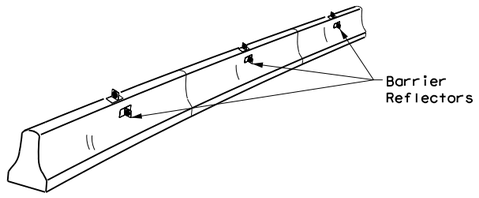
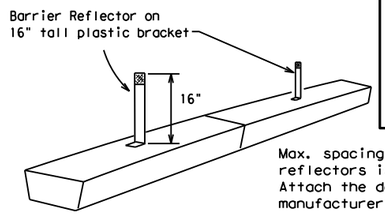
1. Barrier Reflectors shall be pre-qualified, and conform to the color and reflectivity requirements of DMS-8600. A list of prequalified Barrier Reflectors can be found at the Material Producer List web address shown on BC(1).
2. Color of Barrier Reflectors shall be as specified in the TMUTCD. The cost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



CONCRETE TRAFFIC BARRIER (CTB)

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

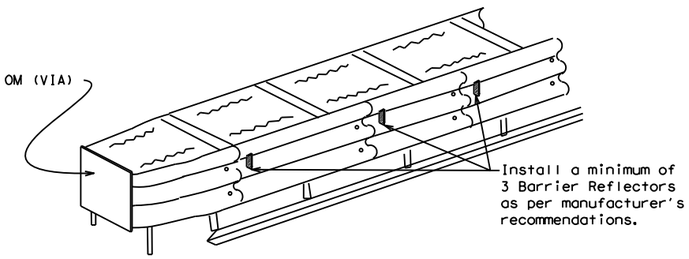


Max. spacing of barrier reflectors is 20 feet. Attach the delineators as per manufacturer's recommendations.

LOW PROFILE CONCRETE BARRIER (LPCB) 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)

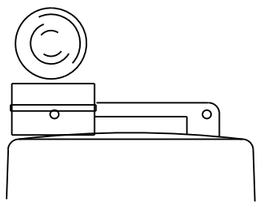


DELINEATION OF END TREATMENTS

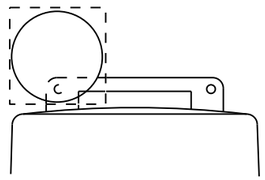
END TREATMENTS FOR CTB'S USED IN WORK ZONES

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

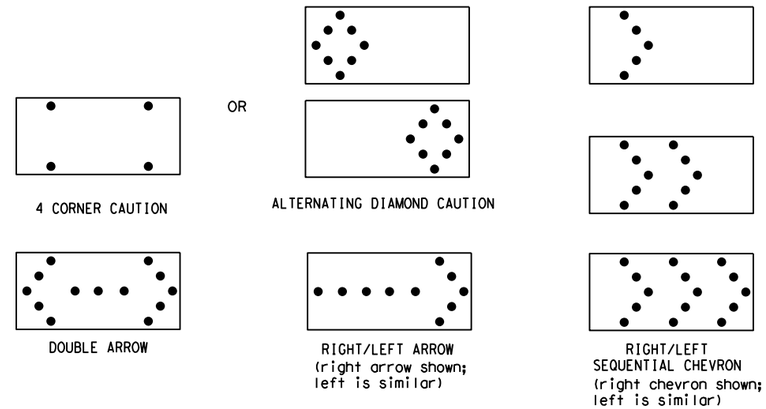
1. Type A flashing warning lights are intended to warn drivers that they are approaching or are in a potentially hazardous area.
2. Type A random flashing warning lights are not intended for delineation and shall not be used in a series.
3. A series of sequential flashing warning lights placed on channelizing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

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	0177	14	037	SL 494
9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	HOU	MONTGOMERY		31

101

DATE:
FILE:

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:

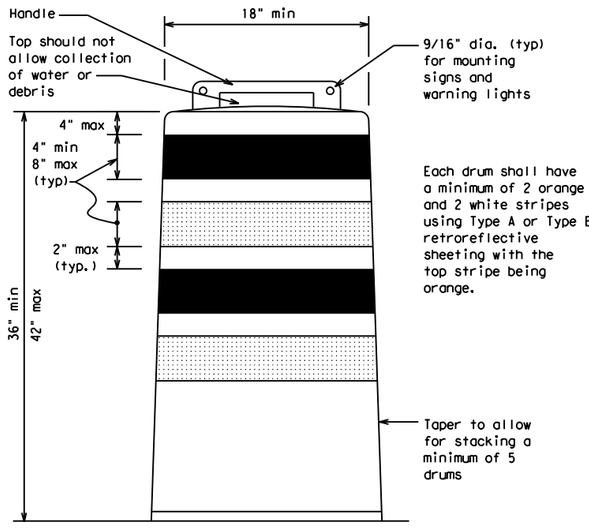
1. Plastic drums shall be a two-piece design; the "body" of the drum shall be the top portion and the "base" shall be the bottom.
2. The body and base shall lock together in such a manner that the body separates from the base when impacted by a vehicle traveling at a speed of 20 MPH or greater but prevents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

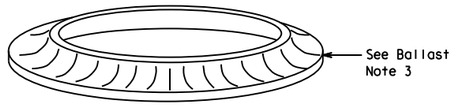
RETROREFLECTIVE SHEETING

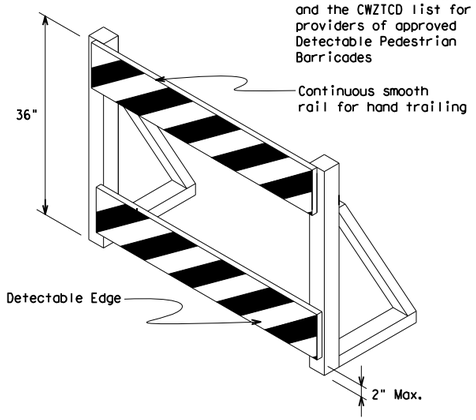
1. The stripes used on drums shall be constructed of sheeting meeting the color and retroreflectivity requirements of Departmental Materials Specification DMS-8300, "Sign Face Materials," Type A or Type B reflective sheeting shall be supplied unless otherwise specified in the plans.
2. The sheeting shall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

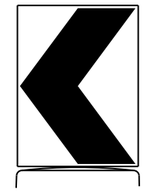




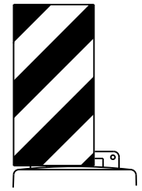


DETECTABLE PEDESTRIAN BARRICADES

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.

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Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC(8)-21

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7-13				

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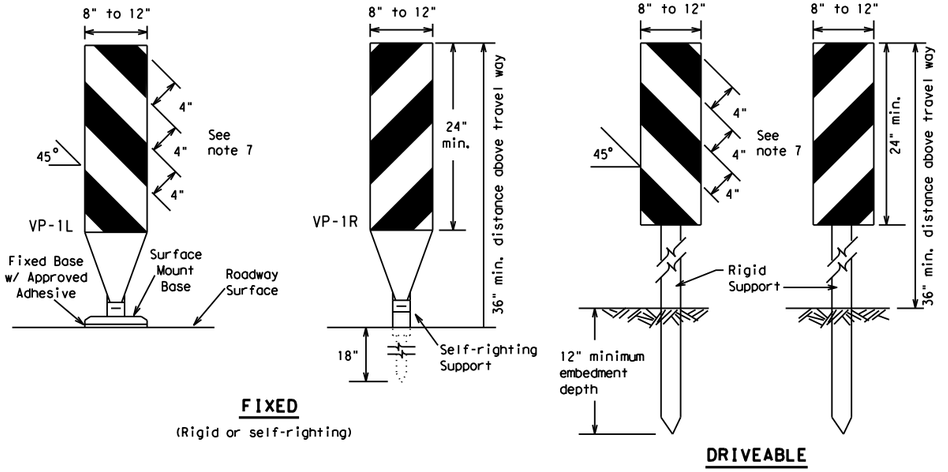
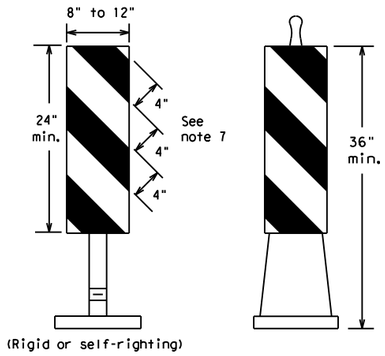


FIXED
(Rigid or self-righting)

DRIVEABLE

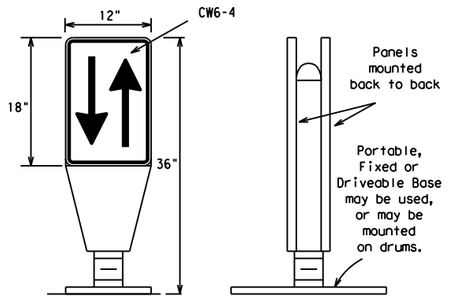


(Rigid or self-righting)

PORTABLE

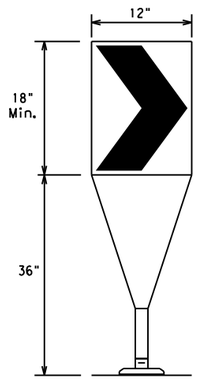
VERTICAL PANELS (VPs)

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)



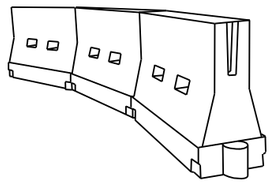
Fixed Base w/ Approved Adhesive
(Driveable Base, or Flexible Support can be used)

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

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BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC(9)-21

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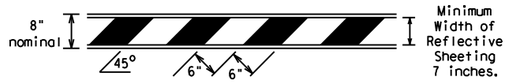
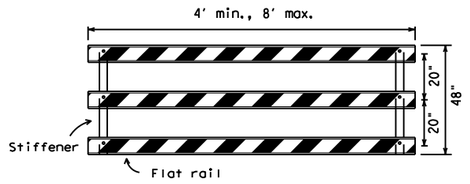
TYPE 3 BARRICADES

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.



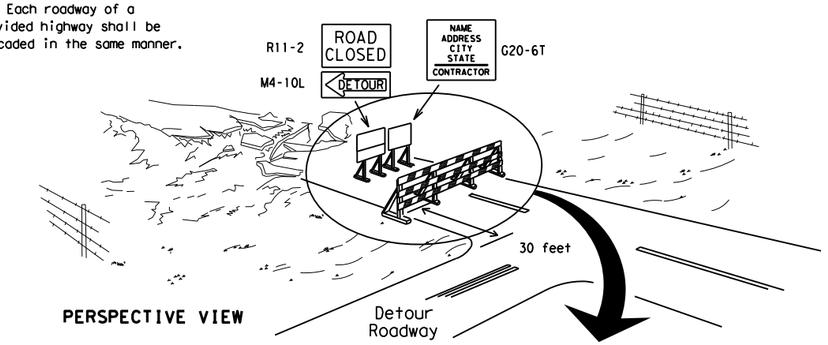
TYPICAL STRIPING DETAIL FOR BARRICADE RAIL



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

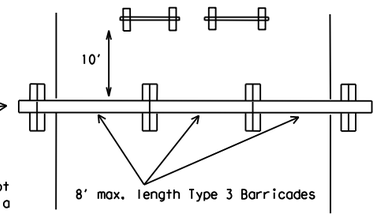
TYPICAL PANEL DETAIL FOR SKID OR POST TYPE BARRICADES

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



PERSPECTIVE VIEW

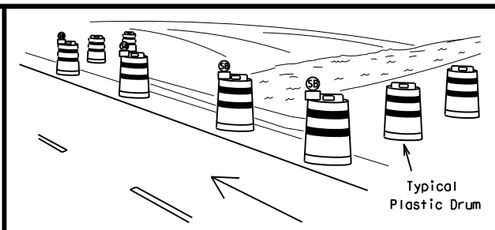
The three rails on Type 3 barricades shall be reflectorized orange and reflective white stripes on one side facing one-way traffic and both sides for two-way traffic.
Barricade striping should slant downward in the direction of detour.



PLAN VIEW

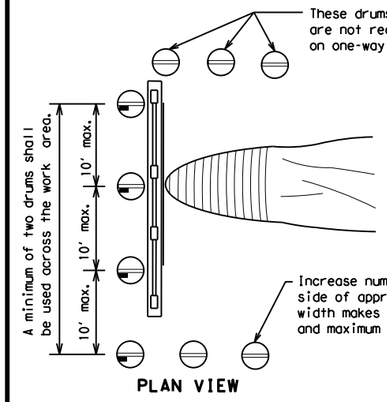
1. Signs should be mounted on independent supports at a 7 foot mounting height in center of roadway. The signs should be a minimum of 10 feet behind Type 3 Barricades.
2. Advance signing shall be as specified elsewhere in the plans.

TYPE 3 BARRICADE (POST AND SKID) TYPICAL APPLICATION



PERSPECTIVE VIEW

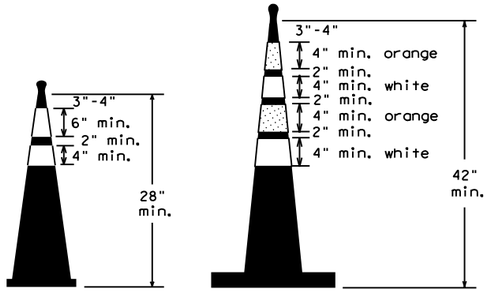
1. Where positive redirectional capability is provided, drums may be omitted.
2. Plastic construction fencing may be used with drums for safety as required in the plans.
3. Vertical Panels on flexible support may be substituted for drums when the shoulder width is less than 4 feet.
4. When the shoulder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



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

PLAN VIEW

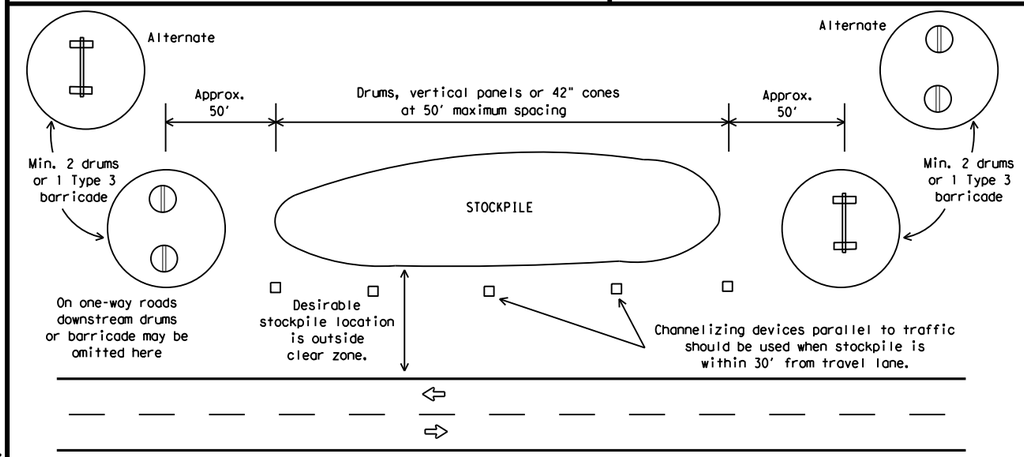
CULVERT WIDENING OR OTHER ISOLATED WORK WITHIN THE PROJECT LIMITS



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

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

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

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BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

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WORK ZONE PAVEMENT MARKINGS

GENERAL

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

RAISED PAVEMENT MARKERS

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

PREFABRICATED PAVEMENT MARKINGS

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

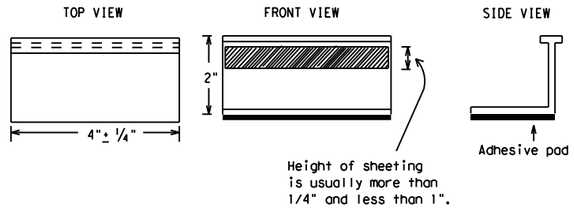
MAINTAINING WORK ZONE PAVEMENT MARKINGS

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

REMOVAL OF PAVEMENT MARKINGS

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

Temporary Flexible-Reflective Roadway Marker Tabs



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

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

RAISED PAVEMENT MARKERS USED AS GUIDEMARKS

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

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

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

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

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PAVEMENT MARKINGS

BC(11)-21

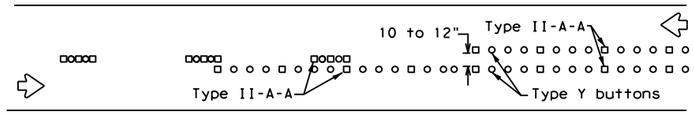
FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS 2-98 9-07 5-21 1-02 7-13 11-02 8-14	0177	14	037	SL 494
	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY		35

105

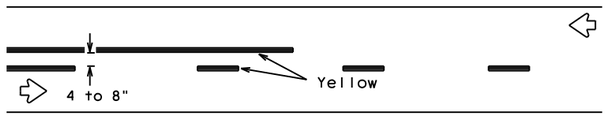
DATE:
FILE:

PAVEMENT MARKING PATTERNS

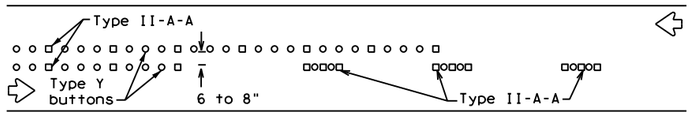
REFLECTORIZED PAVEMENT MARKINGS - PATTERN A



RAISED PAVEMENT MARKERS - PATTERN A



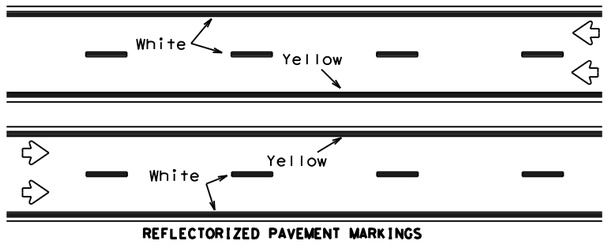
REFLECTORIZED PAVEMENT MARKINGS - PATTERN B



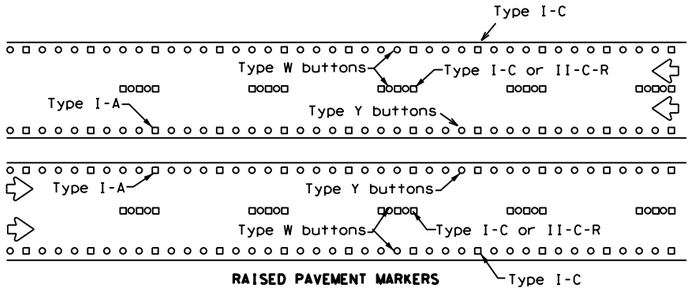
RAISED PAVEMENT MARKERS - PATTERN B

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



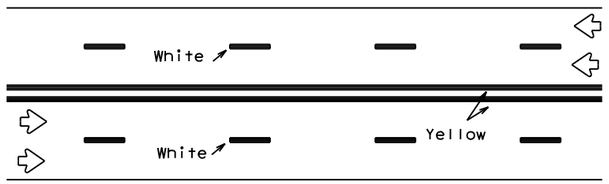
REFLECTORIZED PAVEMENT MARKINGS



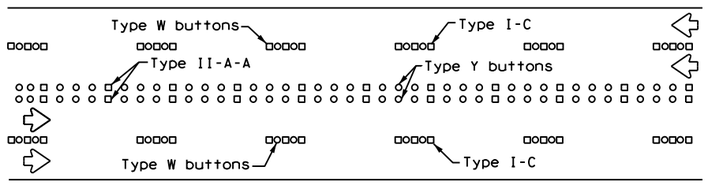
RAISED PAVEMENT MARKERS

Prefabricated markings may be substituted for reflectorized pavement markings.

EDGE & LANE LINES FOR DIVIDED HIGHWAY



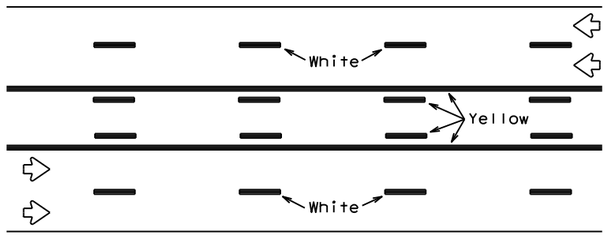
REFLECTORIZED PAVEMENT MARKINGS



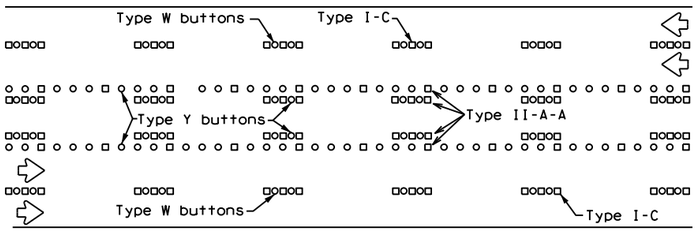
RAISED PAVEMENT MARKERS

Prefabricated markings may be substituted for reflectorized pavement markings.

LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



REFLECTORIZED PAVEMENT MARKINGS



RAISED PAVEMENT MARKERS

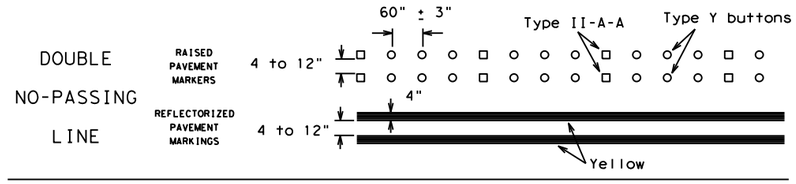
Prefabricated markings may be substituted for reflectorized pavement markings.

TWO-WAY LEFT TURN LANE

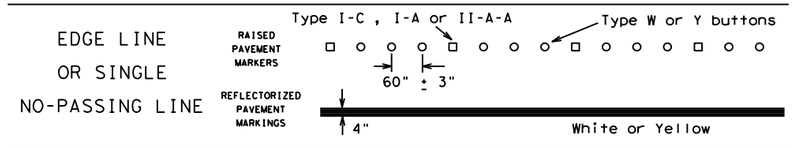
STANDARD WORK ZONE PAVEMENT MARKINGS DETAILS

SOLID LINES

DOUBLE NO-PASSING LINE

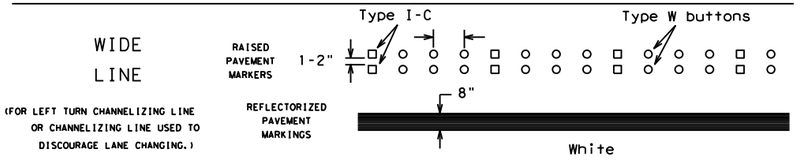


EDGE LINE OR SINGLE NO-PASSING LINE



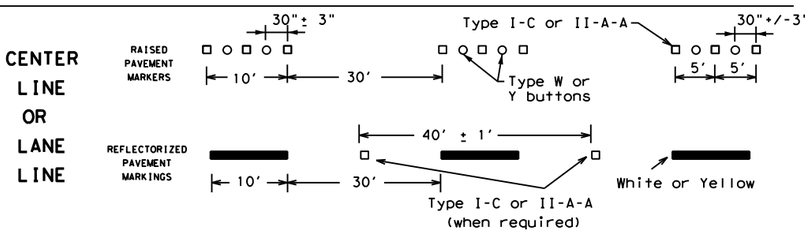
WIDE LINE

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

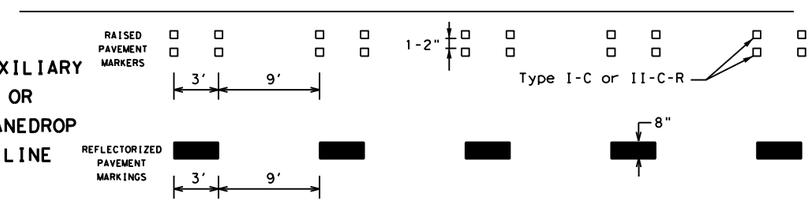


BROKEN LINES

CENTER LINE OR LANE LINE

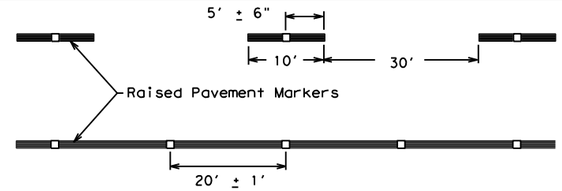


AUXILIARY OR LANEDROP LINE



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."

SHEET 12 OF 12

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PAVEMENT MARKING PATTERNS

BC(12)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS 1-97 9-07 5-21 2-98 7-13 11-02 8-14	0177	14	037	SL 494
	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY		36

106

DATE:
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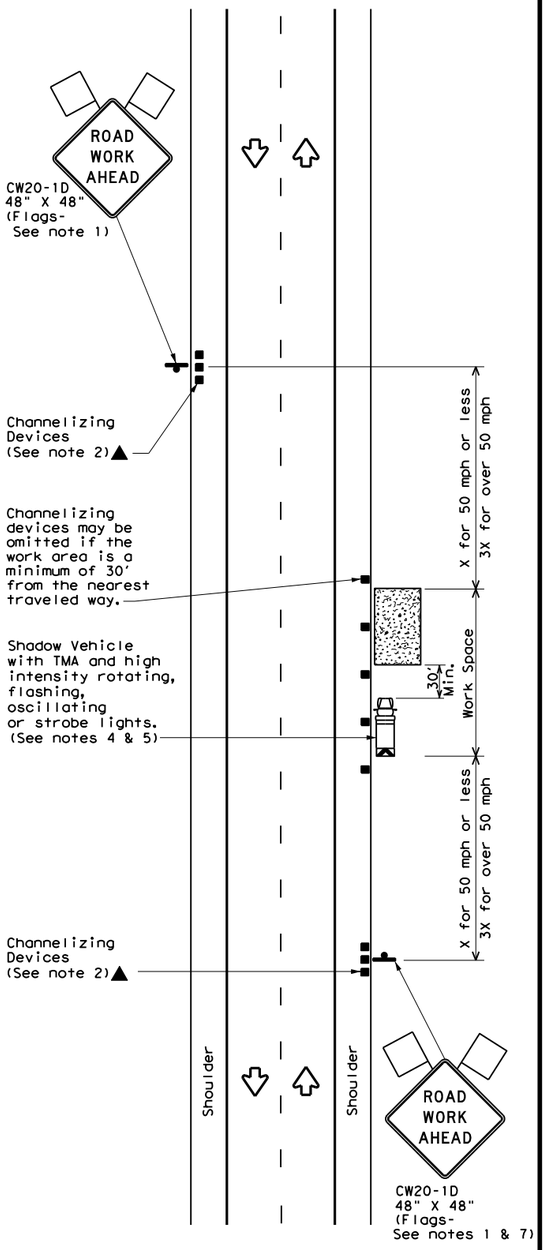
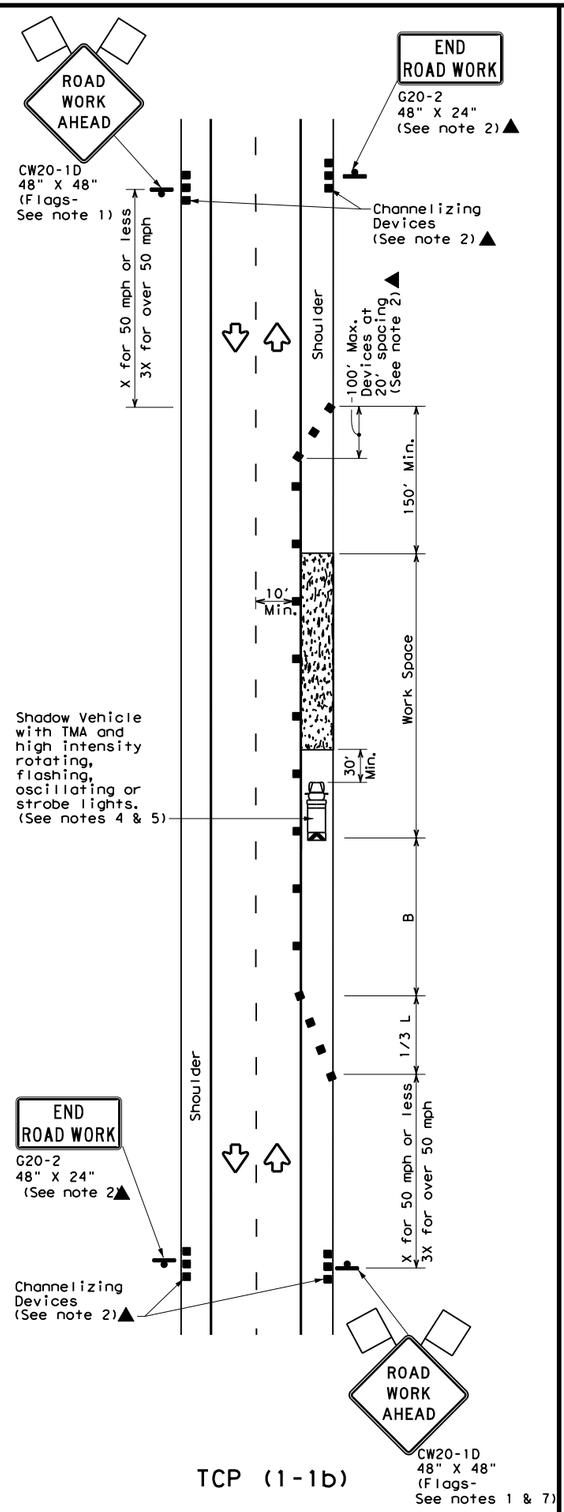


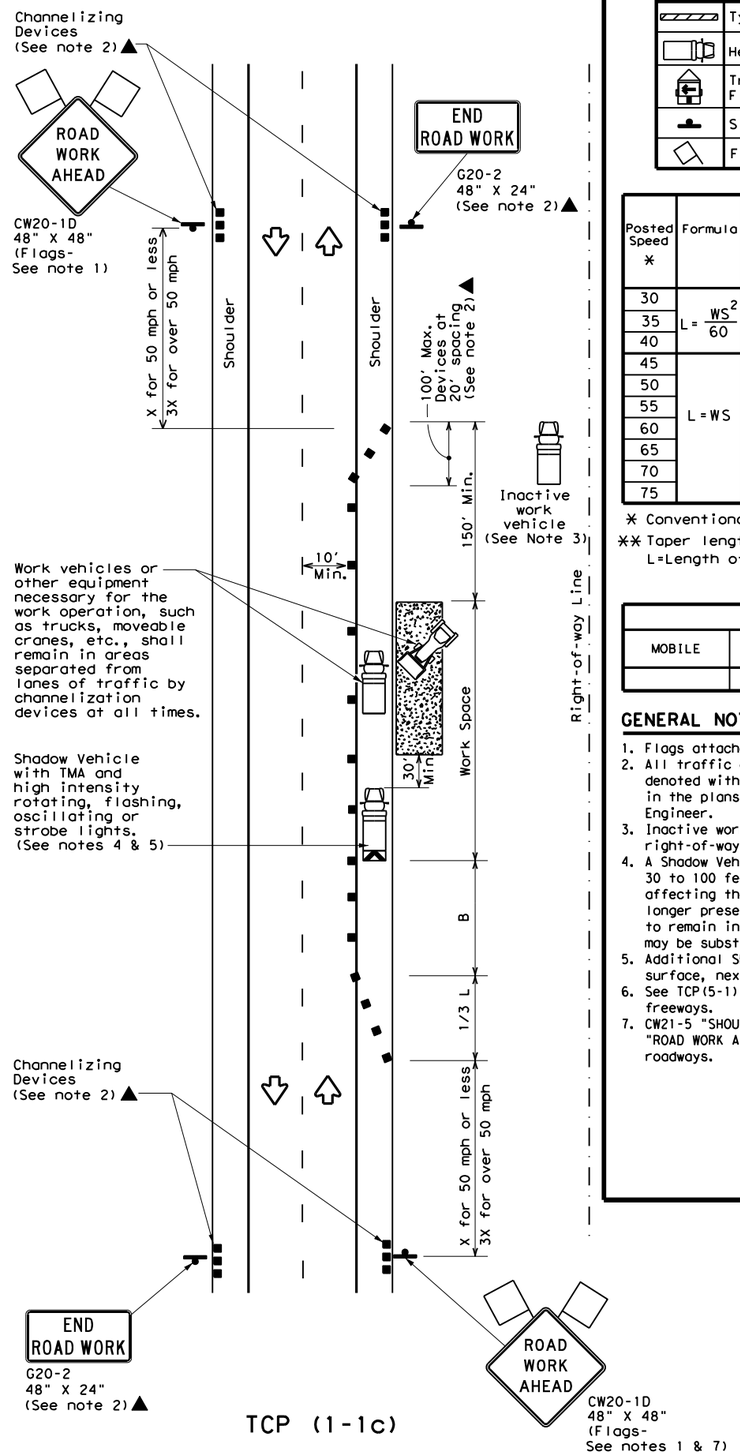
TCP (1-1a)

WORK SPACE NEAR SHOULDER
Conventional Roads



TCP (1-1b)

WORK SPACE ON SHOULDER
Conventional Roads



TCP (1-1c)

WORK VEHICLES ON SHOULDER
Conventional Roads

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

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

* Conventional Roads Only

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

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

GENERAL NOTES

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

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL PLAN CONVENTIONAL ROAD SHOULDER WORK

TCP(1-1)-18

FILE: tcp1-1-18.dgn	DN:	CK:	DW:	CK:
© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS 2-94 4-98 8-95 2-12 1-97 2-18	0177	14	037	SL 494
	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY		37

DATE:
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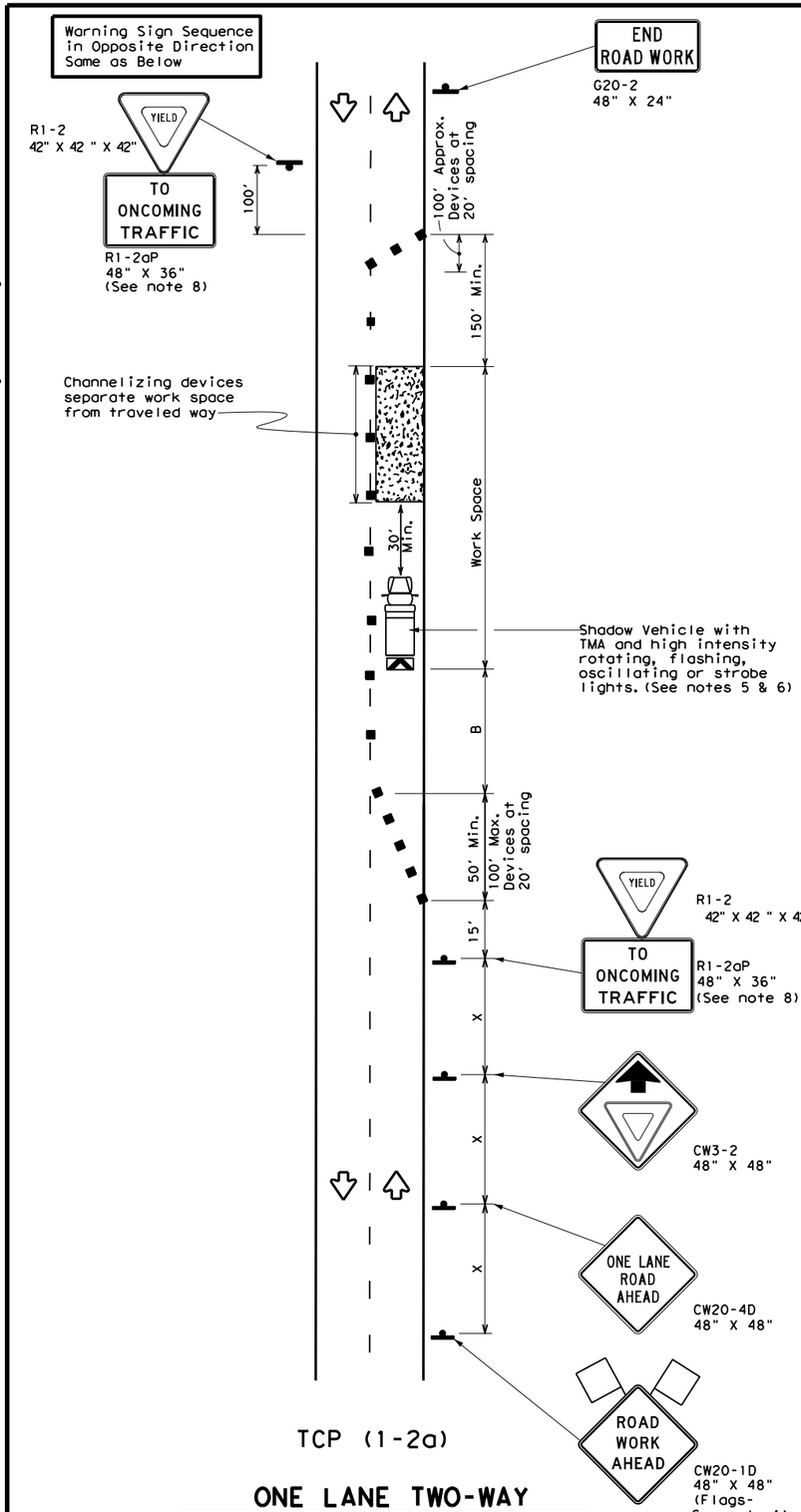
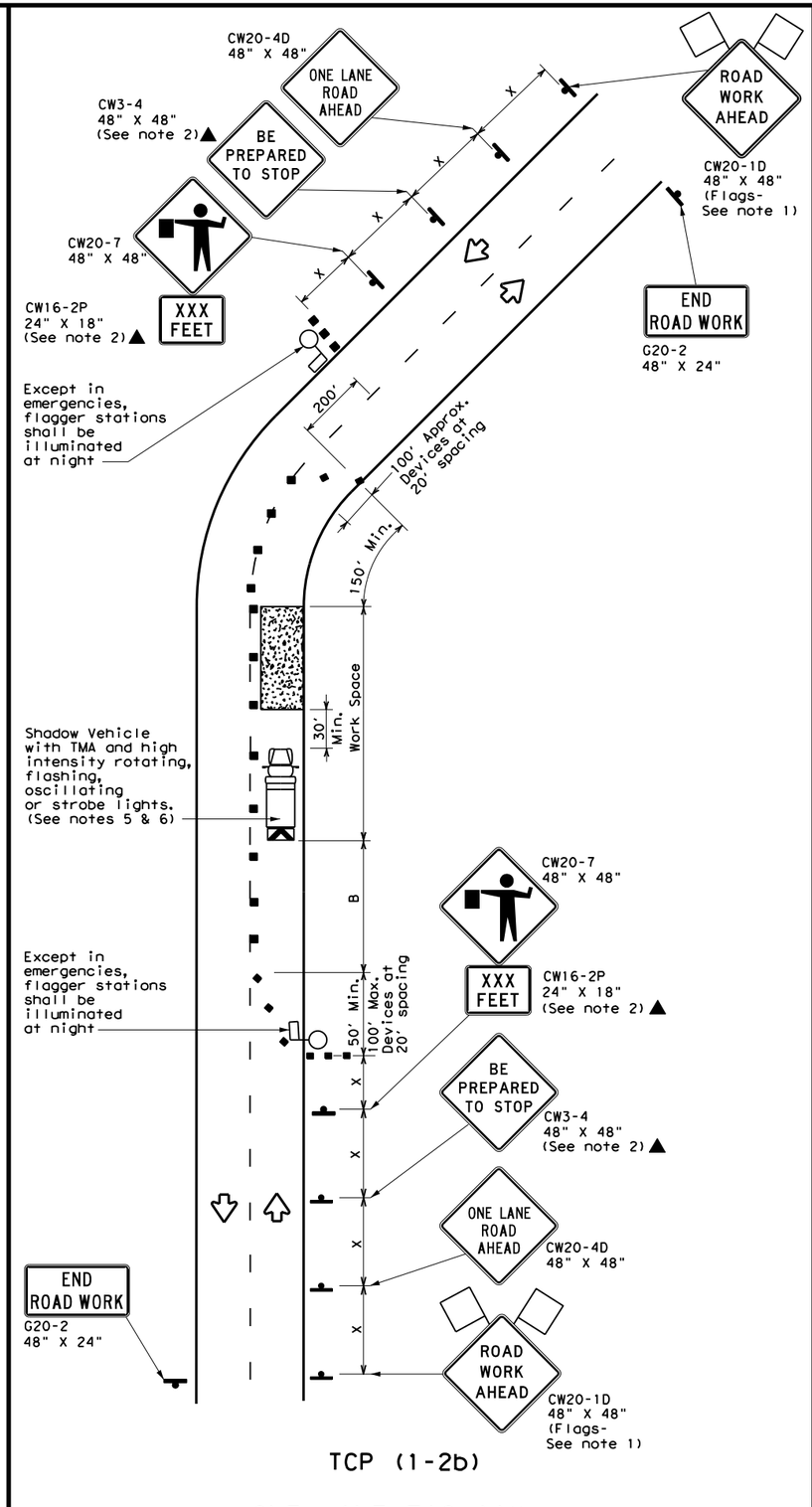


TCP (1-2a)

ONE LANE TWO-WAY CONTROL WITH YIELD SIGNS

(Less than 2000 ADT - See note 7)



TCP (1-2b)

ONE LANE TWO-WAY CONTROL WITH FLAGGERS

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

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

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

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

GENERAL NOTES

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

TCP (1-2a)

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

TCP (1-2b)

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

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL PLAN ONE-LANE TWO-WAY TRAFFIC CONTROL

TCP(1-2)-18

FILE: tcp1-2-18.dgn	DN:	CK:	DW:	CK:
© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS	0177	14	037	SL 494
4-90 4-98	DIST	COUNTY		SHEET NO.
2-94 2-12	HOU	MONTGOMERY		38
1-97 2-18				

DATE:
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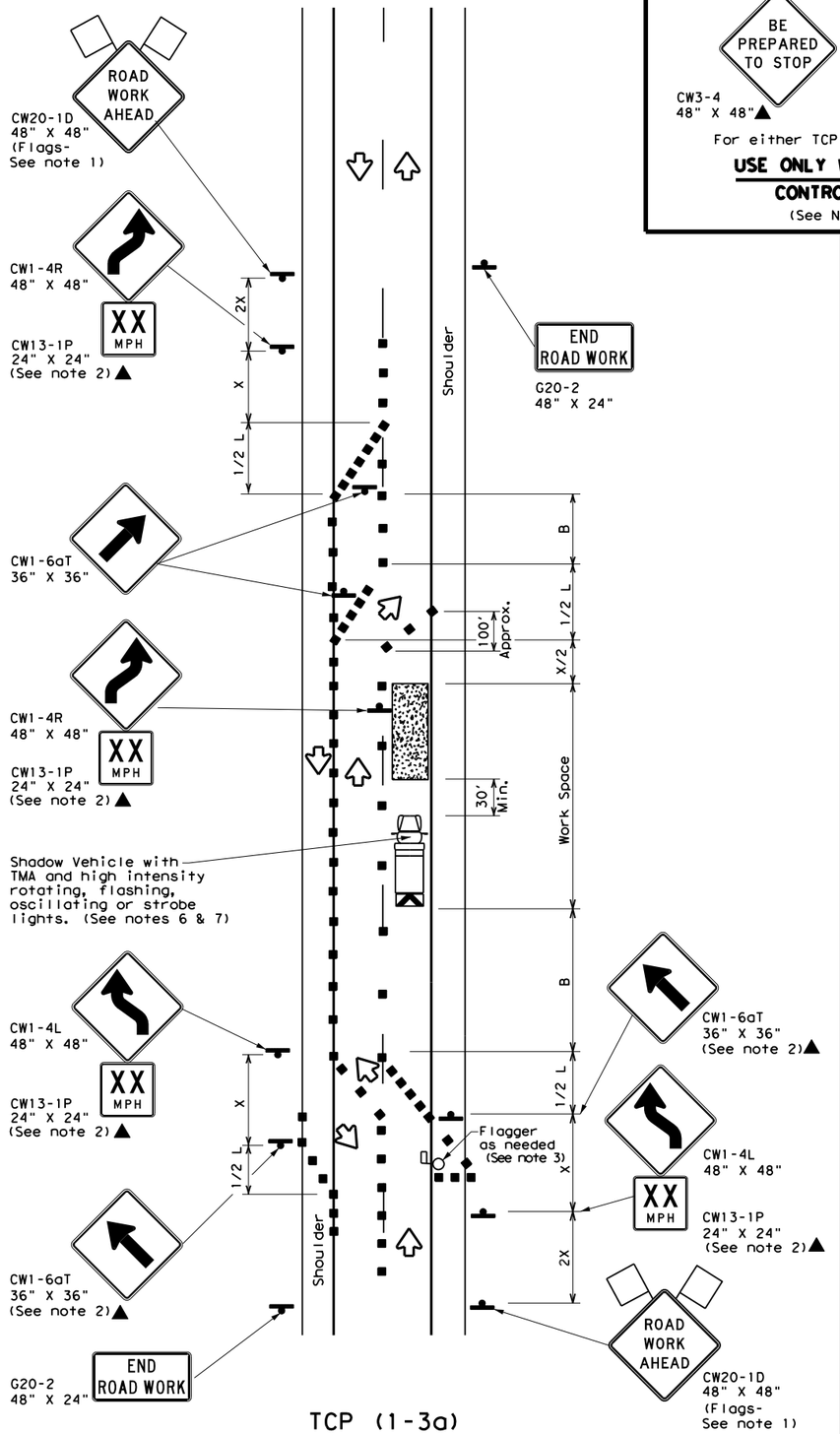
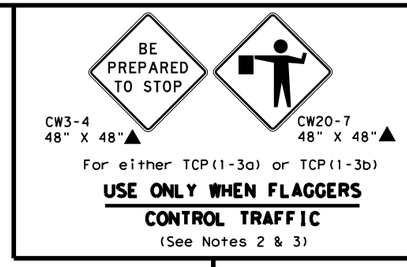


TCP (1-3a)
2-LANE ROADWAY WITH PAVED SHOULDERS

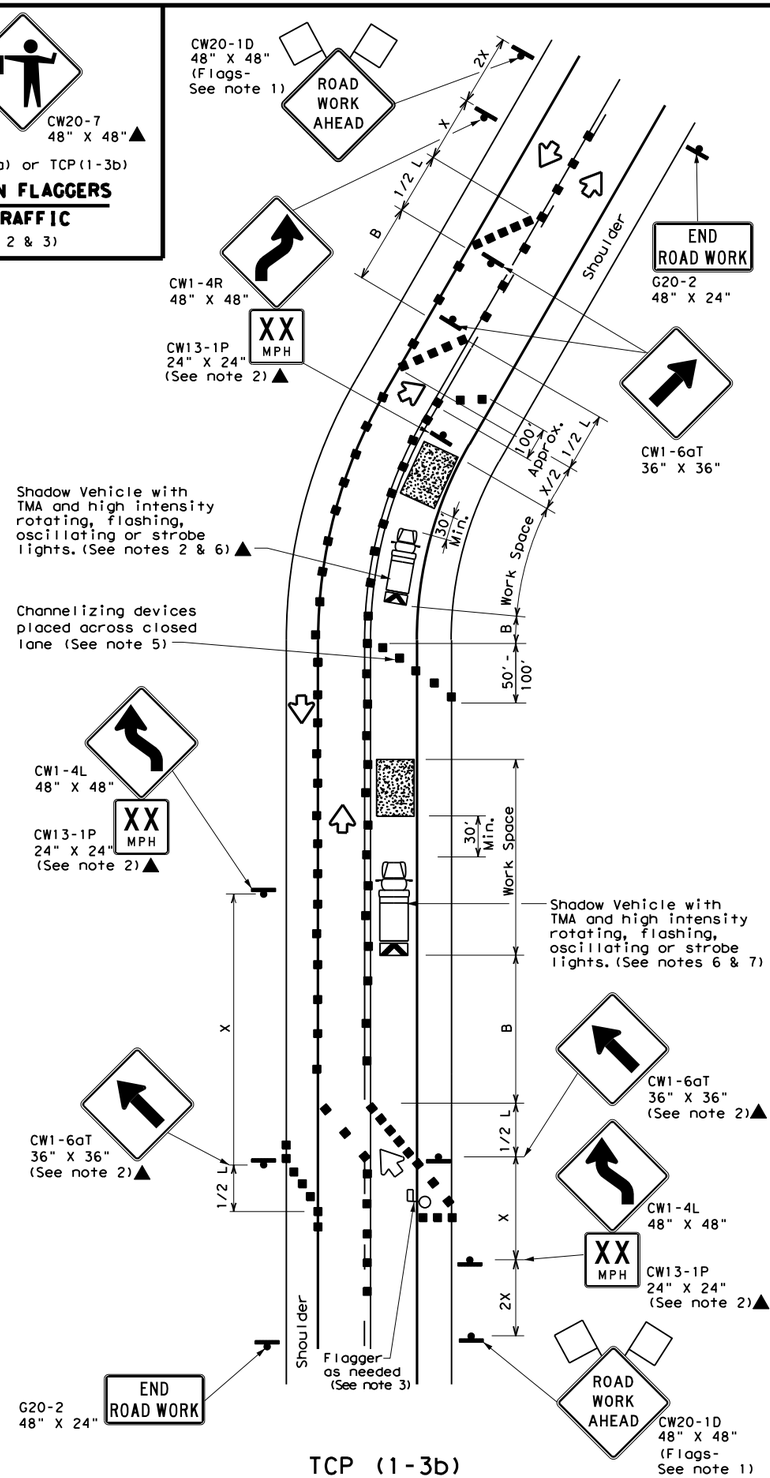
ONE LANE CLOSED
ADEQUATE FIELD OF VIEW



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

USE ONLY WHEN FLAGGERS CONTROL TRAFFIC

(See Notes 2 & 3)



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

ONE LANE CLOSED
INADEQUATE FIELD OF VIEW

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

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

* Conventional Roads Only

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

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

GENERAL NOTES

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

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL PLAN
TRAFFIC SHIFTS ON TWO LANE ROADS

TCP(1-3)-18

FILE: tcp1-3-18.dgn	DN:	CK:	DW:	CK:
© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS	0177	14	037	SL 494
2-94 4-98	DIST	COUNTY		SHEET NO.
8-95 2-12	HOU	MONTGOMERY		39
1-97 2-18				

DATE:
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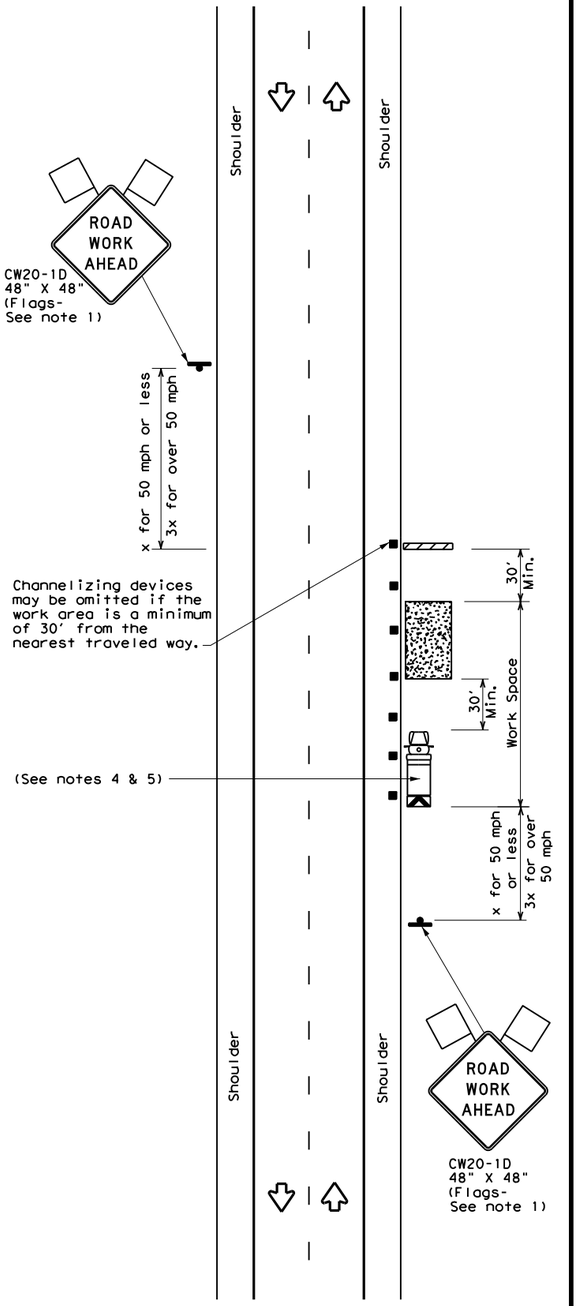
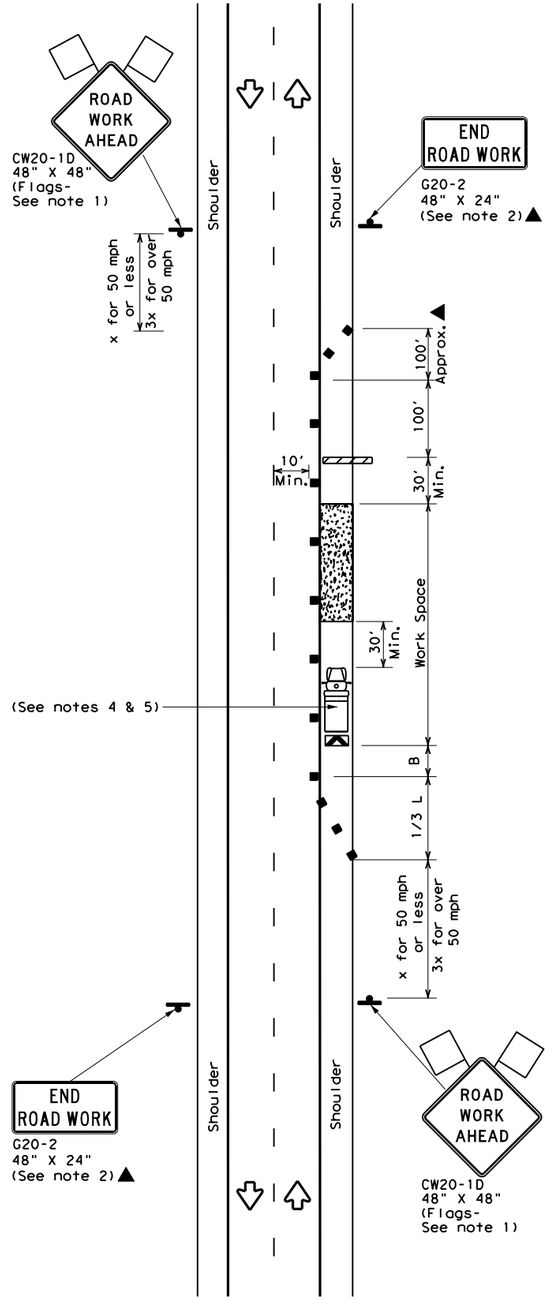


TCP (2-1a)

WORK SPACE NEAR SHOULDER

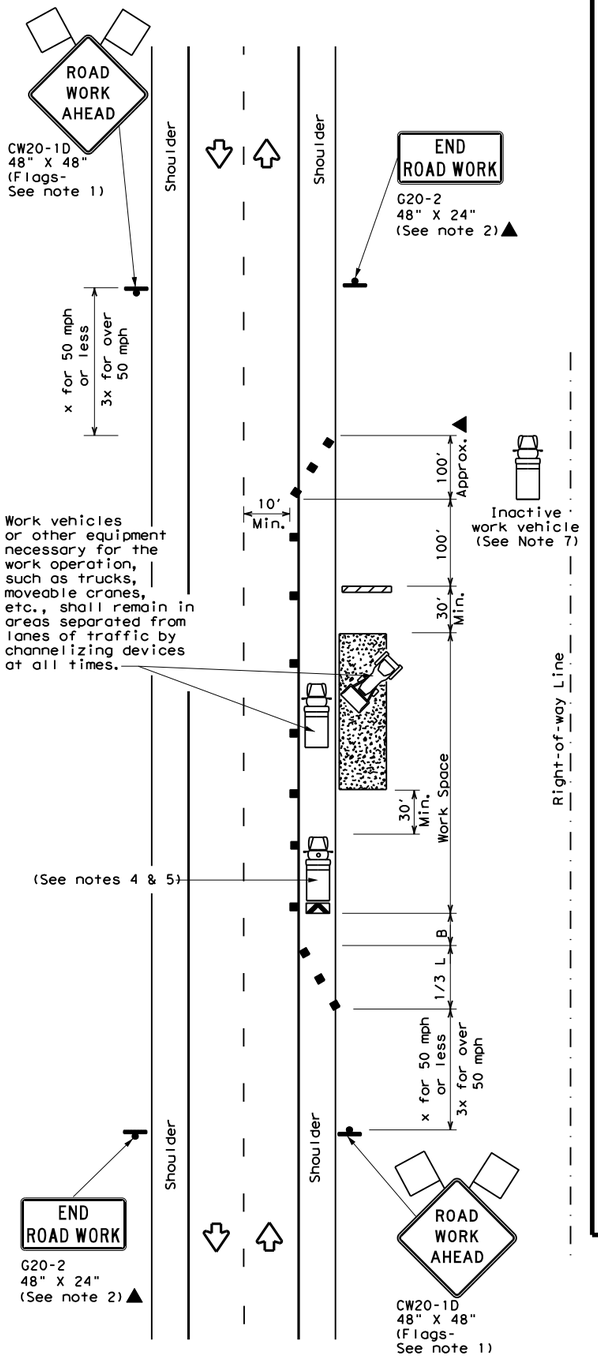
Conventional Roads



TCP (2-1b)

WORK SPACE ON SHOULDER

Conventional Roads



TCP (2-1c)

WORK VEHICLES ON SHOULDER

Conventional Roads

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

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

* Conventional Roads Only

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

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

GENERAL NOTES

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

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© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
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8-95 2-12	HOU	MONTGOMERY		40
1-97 2-18				

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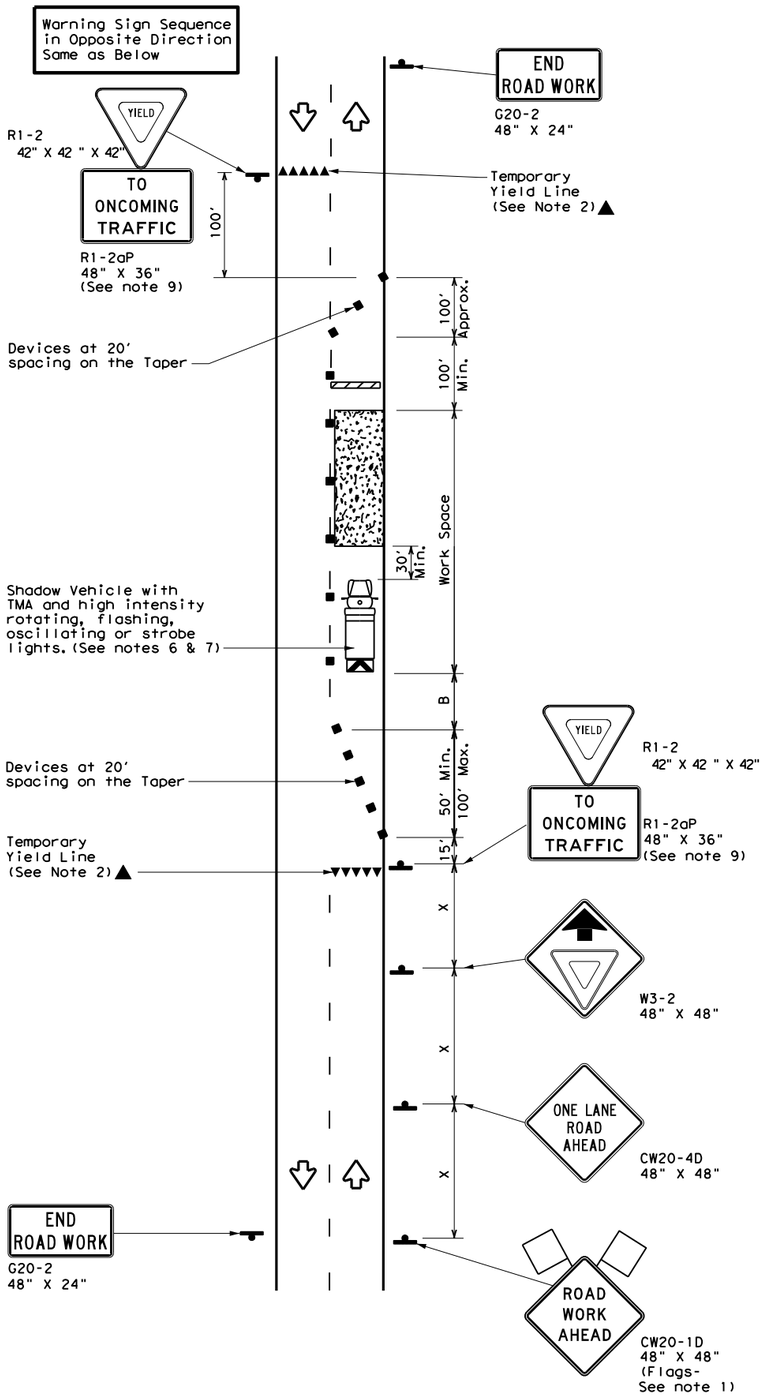
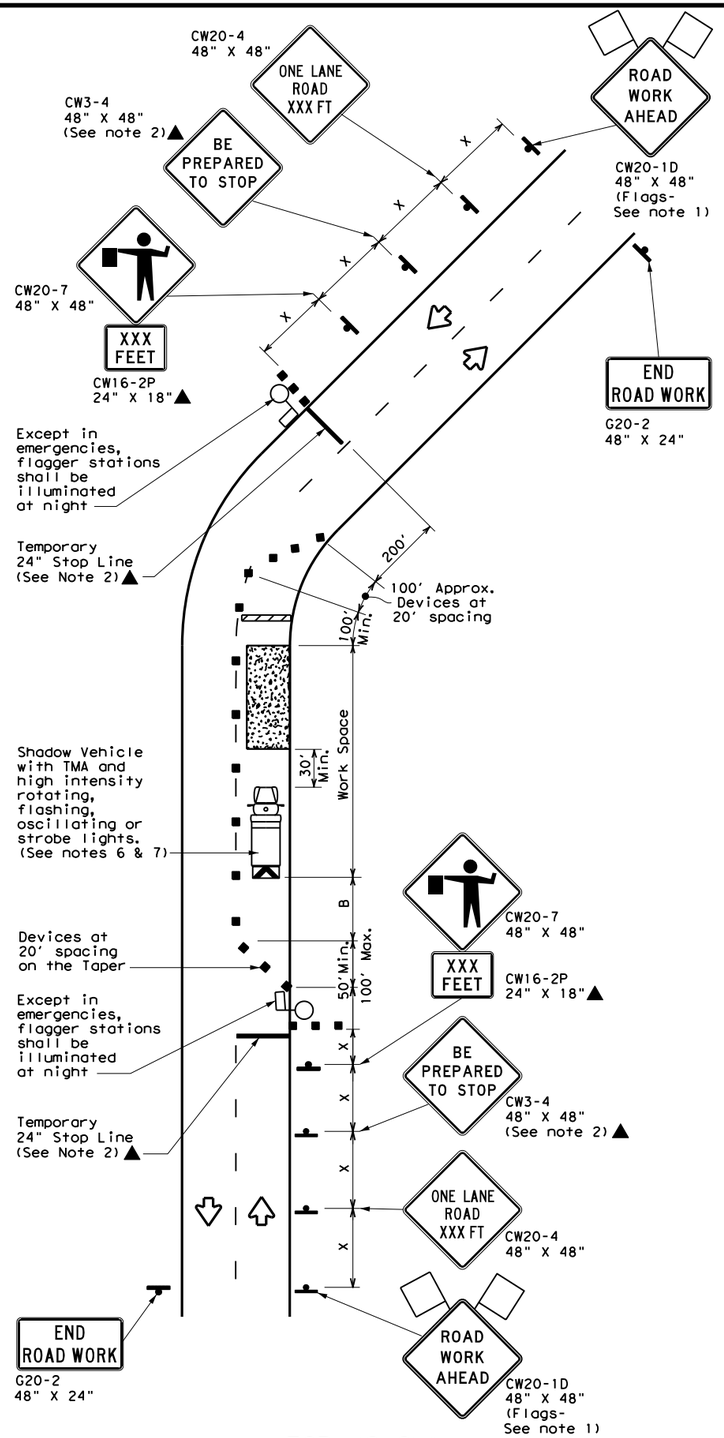


TCP (2-2a)
2-LANE ROADWAY WITHOUT PAVED SHOULDERS
ONE LANE TWO-WAY
CONTROL WITH YIELD SIGNS
(Less than 2000 ADT - See Note 9)



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

LEGEND

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

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

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

TYPICAL USAGE

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

GENERAL NOTES

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

TCP (2-2a)

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

TCP (2-2b)

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

Texas Department of Transportation
Traffic Operations Division Standard

TRAFFIC CONTROL PLAN
ONE-LANE TWO-WAY
TRAFFIC CONTROL

TCP(2-2)-18

FILE: tcp2-2-18.dgn	DN:	CK:	DW:	CK:
© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS 8-95 3-03	0177	14	037	SL 494
1-97 2-12	DIST	COUNTY		SHEET NO.
4-98 2-18	HOU	MONTGOMERY		41

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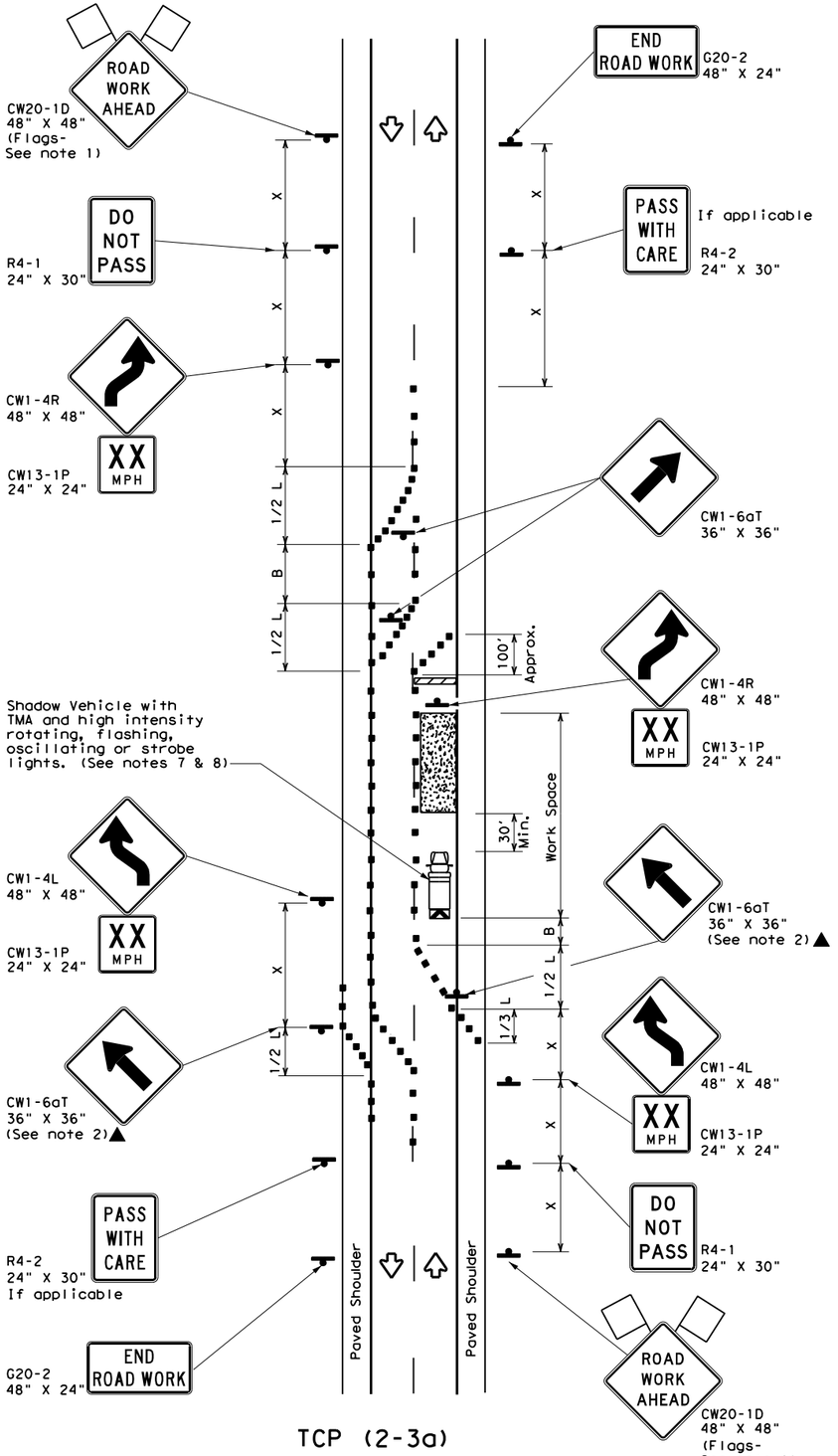
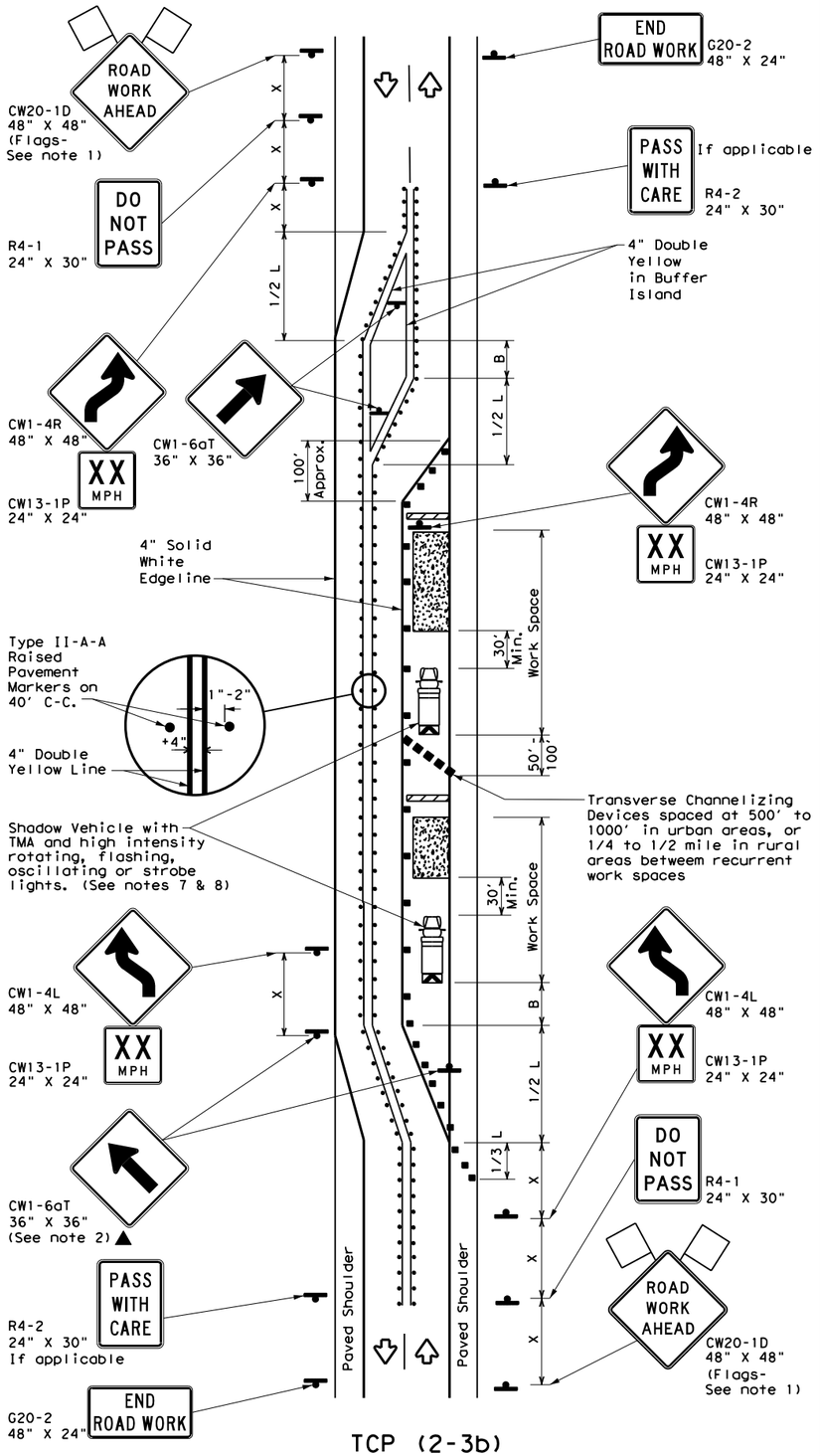


TCP (2-3a)
2-LANE ROADWAY WITH PAVED SHOULDERS

ONE LANE CLOSED
ADEQUATE FIELD OF VIEW



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

ONE LANE CLOSED
INADEQUATE FIELD OF VIEW

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

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

* Conventional Roads Only

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

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

GENERAL NOTES

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

TCP (2-3a)

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

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL PLAN TRAFFIC SHIFTS ON TWO-LANE ROADS

TCP(2-3)-18

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© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
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1-97 2-12	HOU	MONTGOMERY		42
4-98 2-18				

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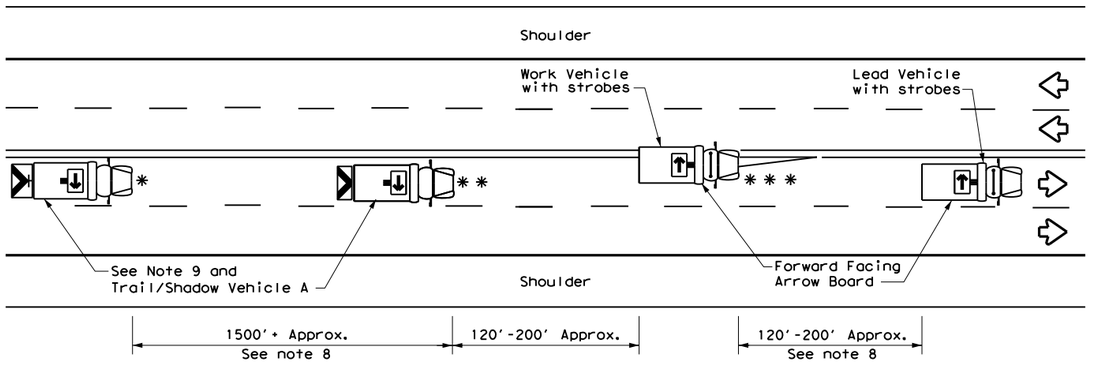
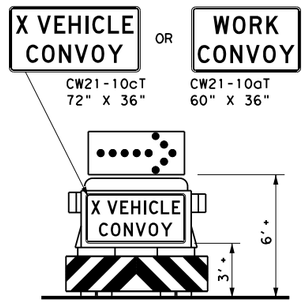


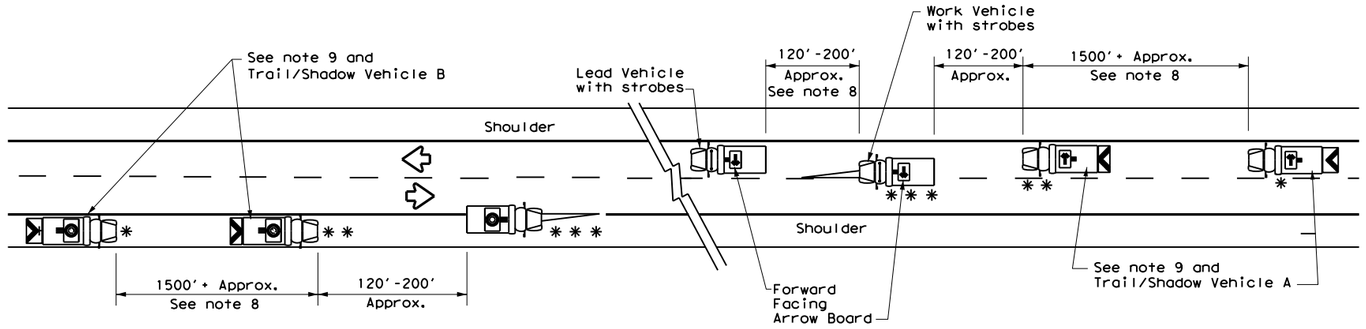
TCP (3-1a)

UNDIVIDED MULTILANE ROADWAY



TRAIL/SHADOW VEHICLE A

with RIGHT Directional display Flashing Arrow Board

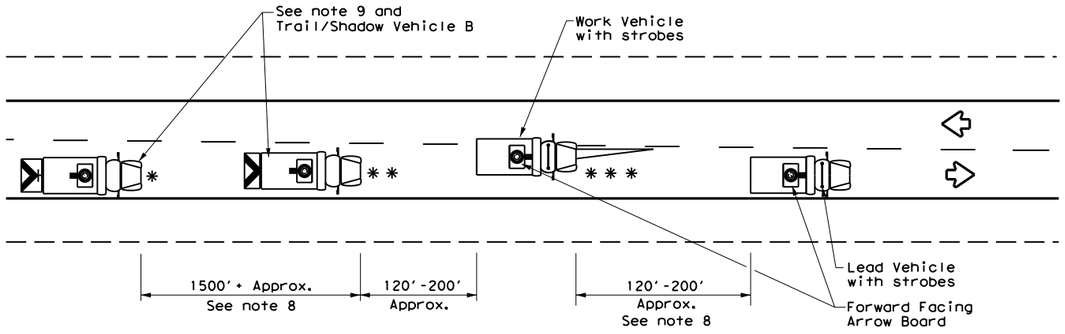


WORK ON SHOULDER

WORK ON TRAVEL LANE

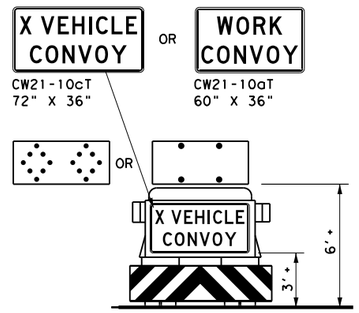
TCP (3-1b)

TWO-WAY ROADWAY WITH PAVED SHOULDERS



TCP (3-1c)

TWO-WAY ROADWAY WITHOUT PAVED SHOULDERS



TRAIL/SHADOW VEHICLE B

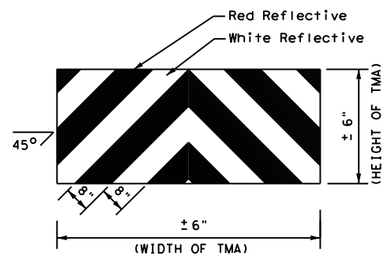
with Flashing Arrow Board in CAUTION display

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



STRIPING FOR TMA

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL PLAN MOBILE OPERATIONS UNDIVIDED HIGHWAYS

TCP(3-1)-13

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© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
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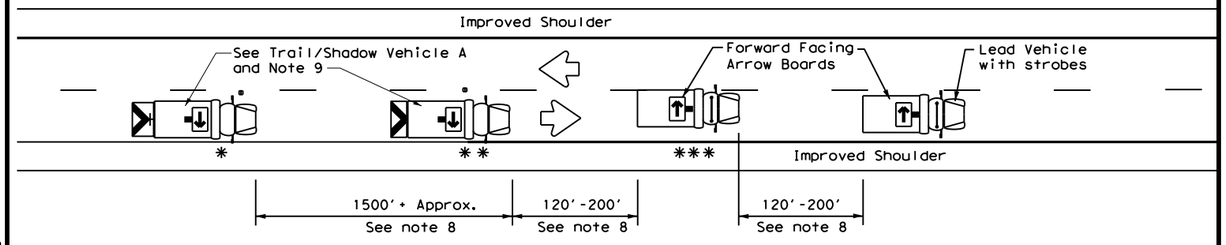
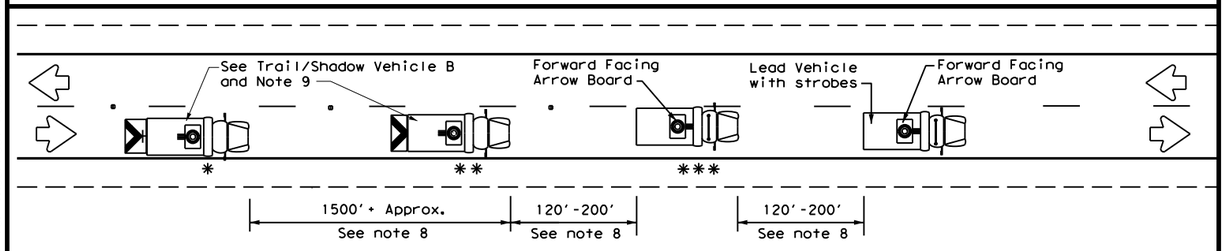
2-94 4-98 8-95 7-13 1-97	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY		43



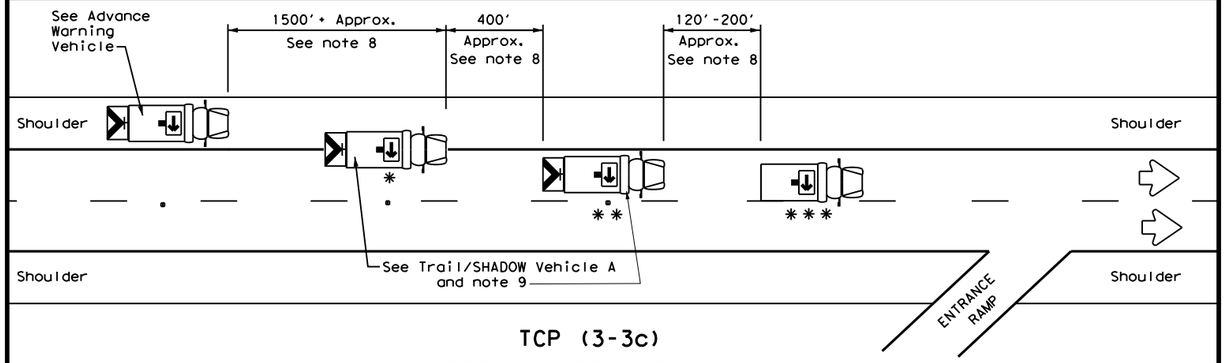
TCP (3-3a)

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



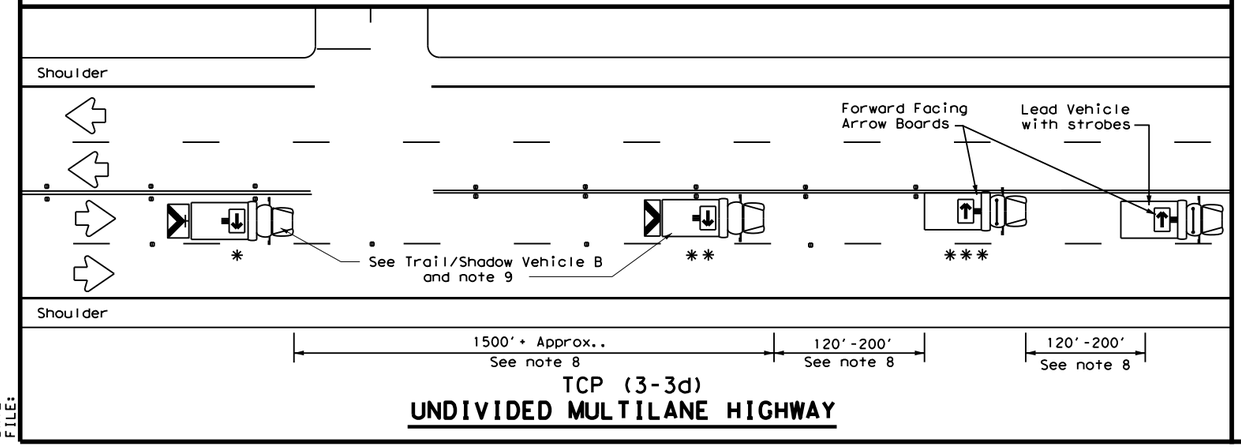
TCP (3-3b)

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



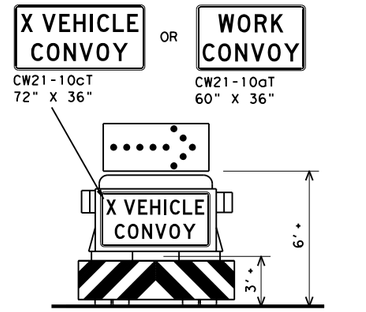
TCP (3-3c)

DIVIDED MULTILANE HIGHWAY



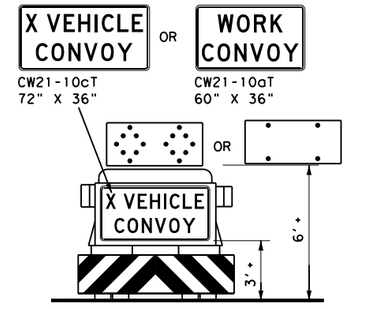
TCP (3-3d)

UNDIVIDED MULTILANE HIGHWAY



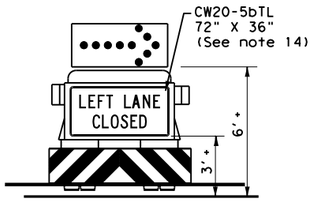
TRAIL/SHADOW VEHICLE A

with RIGHT Directional display
Flashing Arrow Board

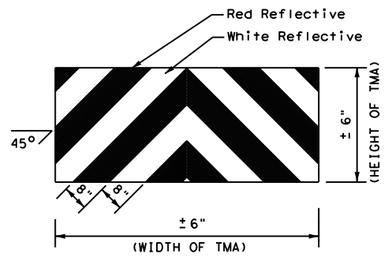


TRAIL/SHADOW VEHICLE B

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	0177	14	037	SL 494
2-94 4-98	DIST	COUNTY		SHEET NO.
8-95 7-13	HOU	MONTGOMERY		44
1-97 7-14				

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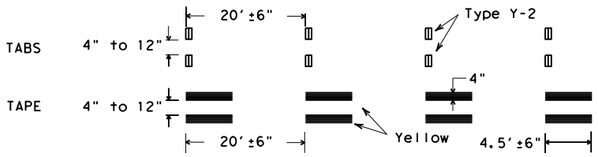
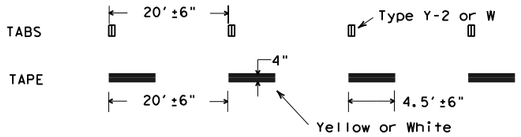
WORK ZONE SHORT TERM PAVEMENT MARKINGS DETAILS

SOLID LINES

DOUBLE NO-PASSING LINE

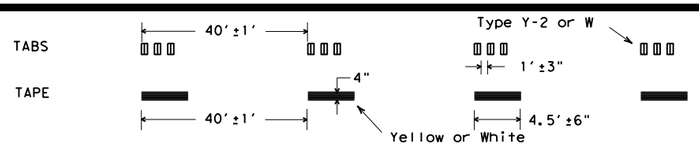


SINGLE NO-PASSING LINE or CHANNELIZATION LINE



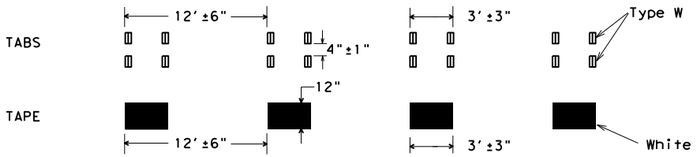
BROKEN LINES

(FOR CENTER LINE OR LANE LINE)

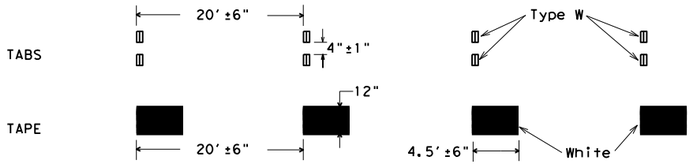


WIDE DOTTED LINES

(FOR LANE DROP LINES)



WIDE GORE MARKINGS



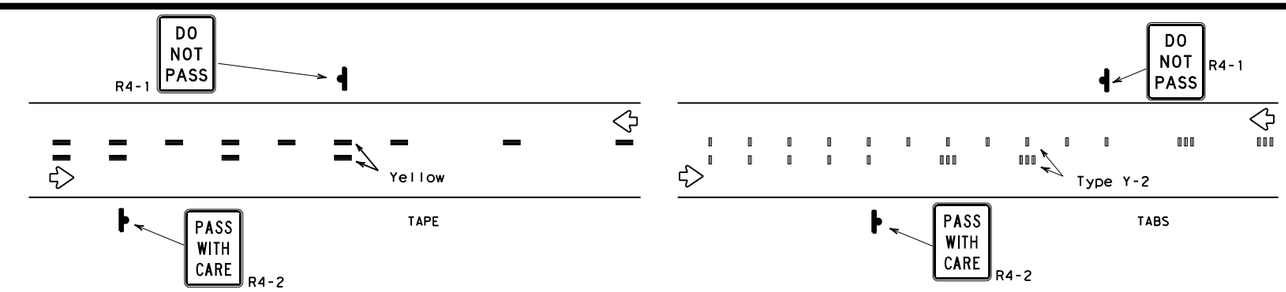
NOTES:

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.

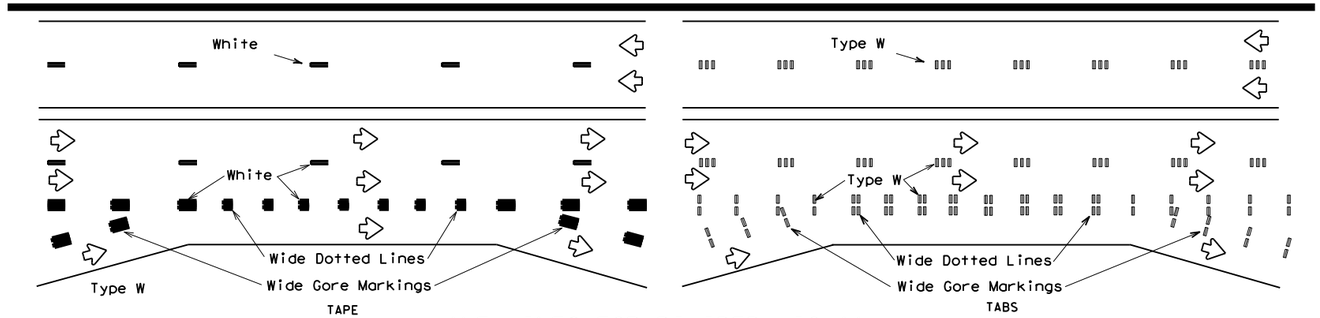
TEMPORARY FLEXIBLE, REFLECTIVE ROADWAY MARKER TABS (TABS)

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.

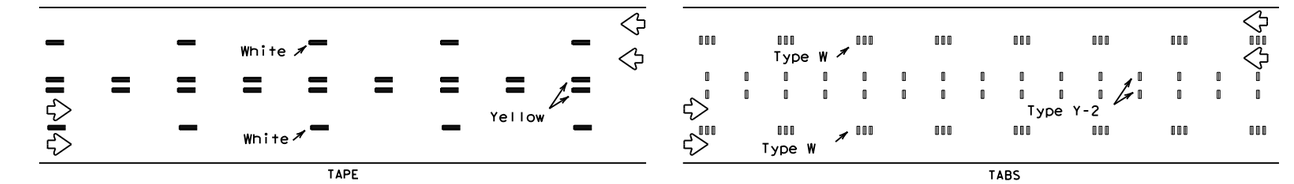
WORK ZONE SHORT TERM PAVEMENT MARKINGS PATTERNS



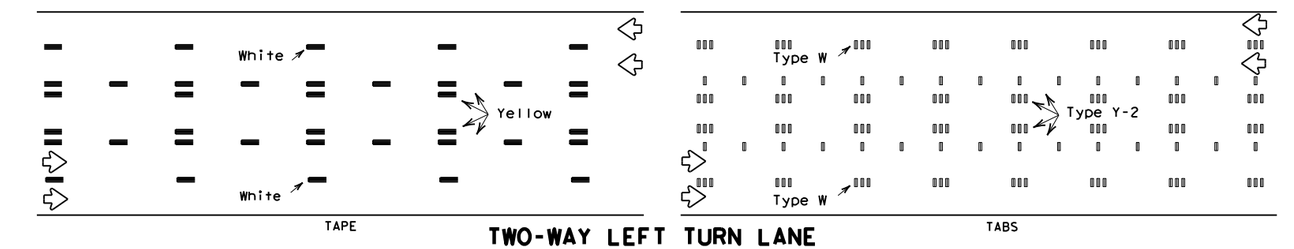
CENTER LINE & NO-PASSING ZONE BARRIER LINES FOR TWO LANE TWO-WAY HIGHWAYS



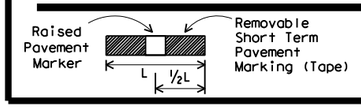
LANE LINES FOR DIVIDED HIGHWAY



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

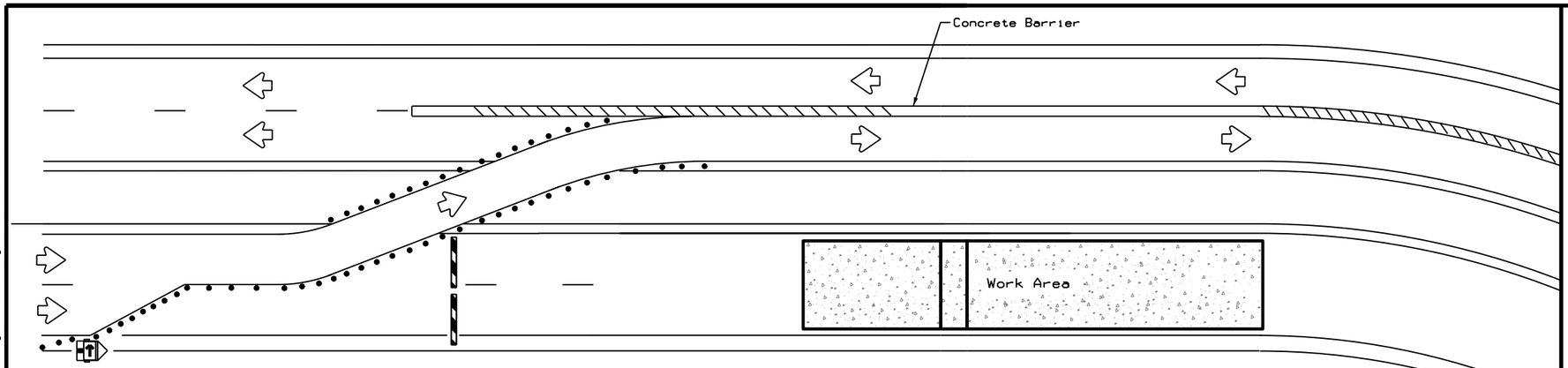
Texas Department of Transportation

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		0177	14	037	SL 494
1-97		DIST	COUNTY		SHEET NO.
3-03		HOU	MONTGOMERY		45
7-13					



NOTES:

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

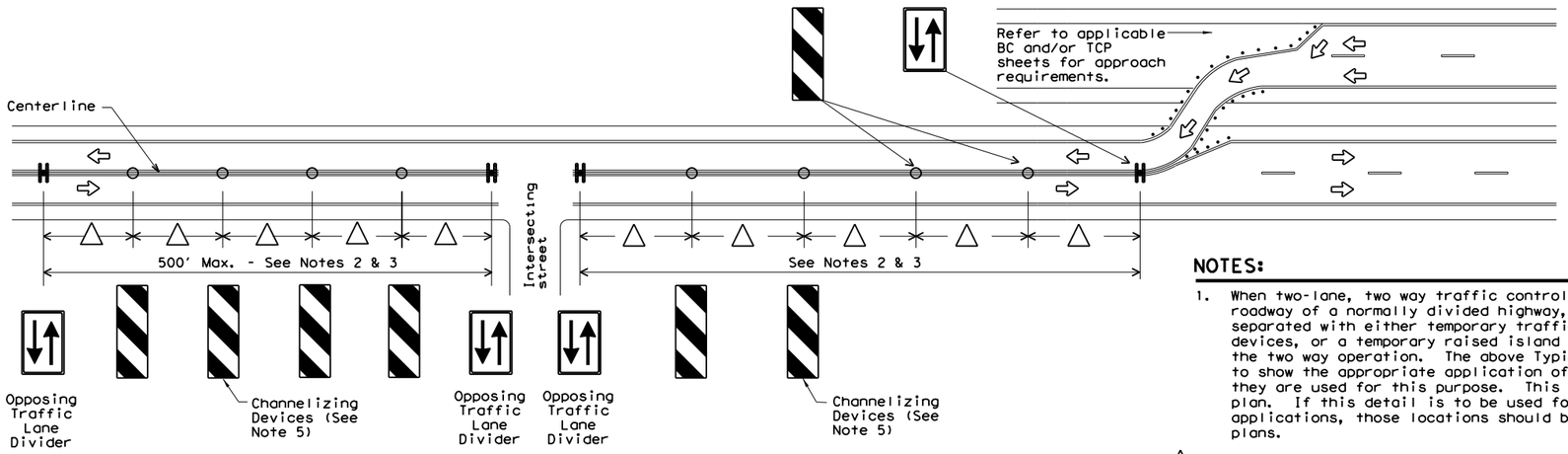
BARRIER DELINEATION WITH MODULAR GLARE SCREENS

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

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

Only pre-qualified products shall be used. A copy of the Compliant Work Zone Traffic Control Devices List" CWZTCD)describes pre-qualified products and their sources and may be found at the following web address:

http://www.txdot.gov/business/resources/producer-list.html



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

NOTES:

1. When two-lane, two way traffic control must be maintained on one roadway of a normally divided highway, opposing traffic shall be separated with either temporary traffic barriers, channelizing devices, or a temporary raised island throughout the length of the two way operation. The above Typical Application is intended to show the appropriate application of channelizing devices when they are used for this purpose. This is not a traffic control plan. If this detail is to be used for other types of roads or applications, those locations should be stated elsewhere in the plans.

△2. Space devices according to the Tangent Spacing shown on the Device Spacing table on BC(9) but not exceeding 100'.

3. Every fifth device should be an OTLD except when spaced closer to accommodate an intersection. An OTLD should be the first device on each side of intersecting streets or roads.
4. Locations where surface mount bases with adhesives or self-righting devices will be required in order to maintain them in their proper position should be noted elsewhere in the plans.
5. Channelizing devices are to be vertical panels, 42" cones or tubular markers that are at least 36" tall. Tubular markers used to separate traffic should have a rubber base weighing at least 30 pounds. Tubular markers that are 42" tall or more shall have four bands of reflective material as detailed for 42" cones on BC(10). Tubular markers less than 42" but at least 36" tall shall have three bands of 3" wide white reflective material spaced 2" apart. Reflective material shall meet DMS-8300, Type A.

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL PLAN TYPICAL DETAILS

WZ(TD)-17

FILE: wztd-17.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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	HOU	MONTGOMERY		46

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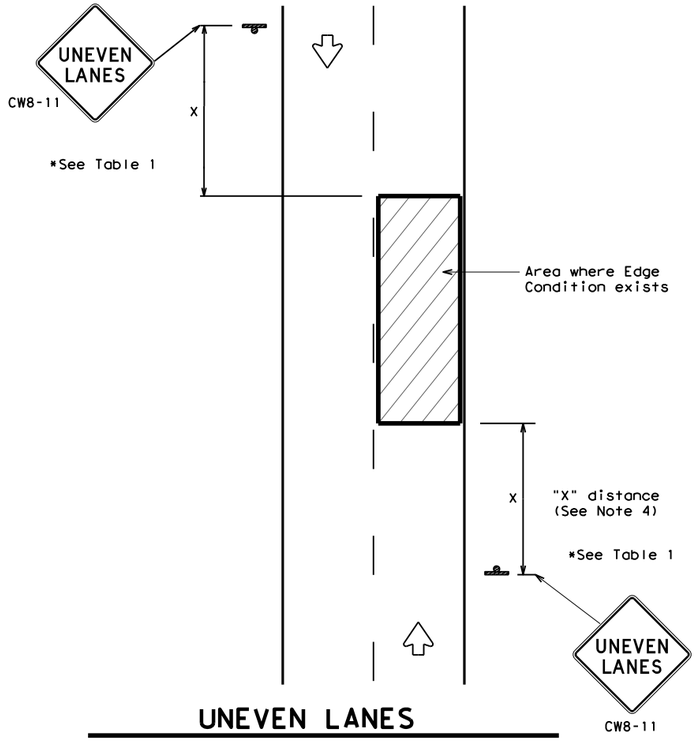
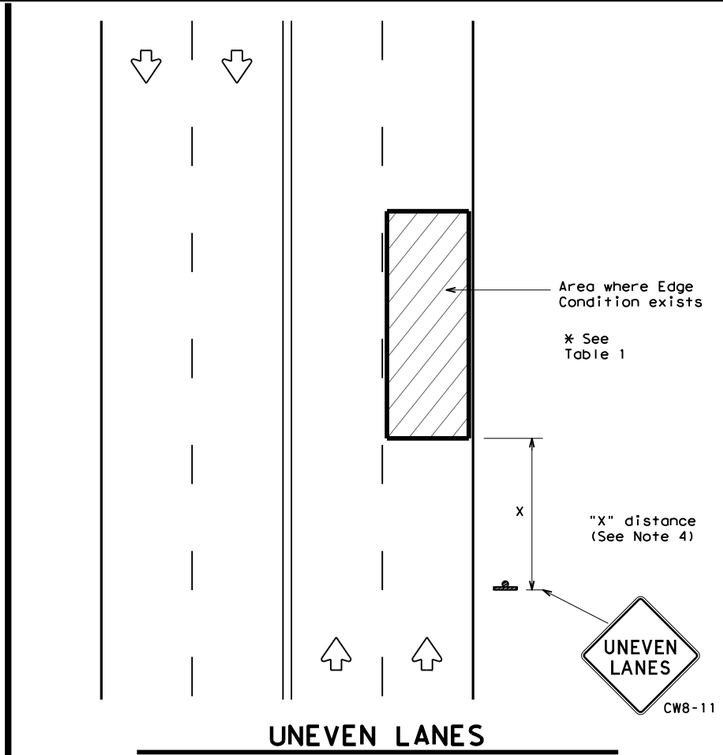
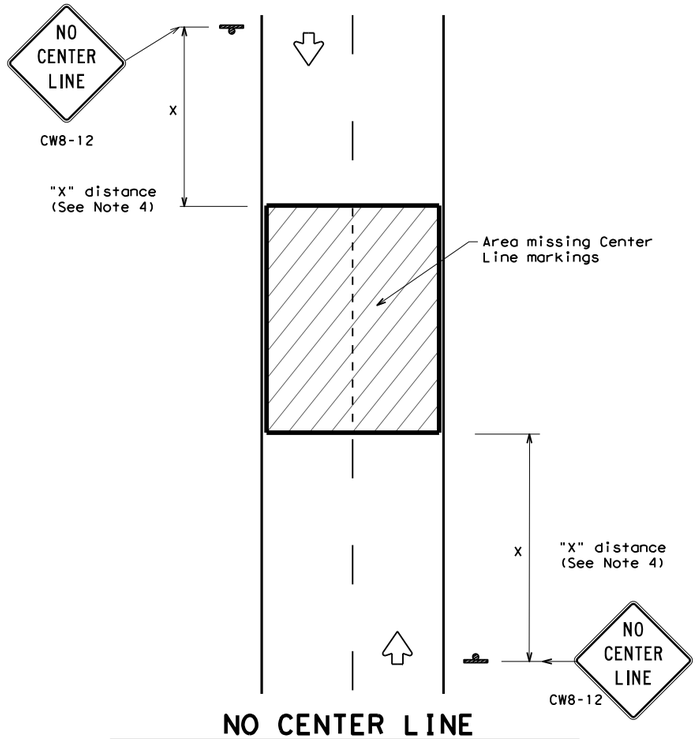


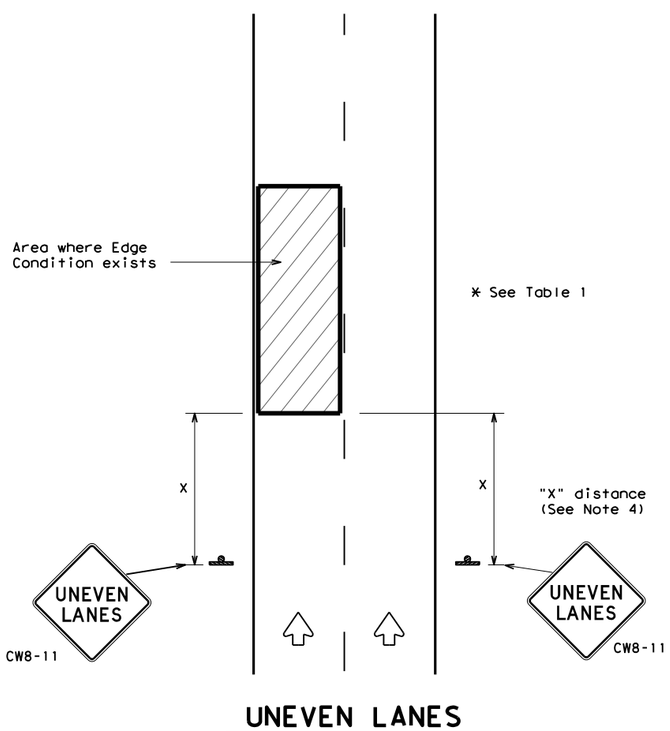
UNEVEN LANES
TWO LANE CONVENTIONAL ROAD



UNEVEN LANES
FOUR LANE CONVENTIONAL ROAD



NO CENTER LINE
TWO LANE CONVENTIONAL ROAD



UNEVEN LANES
DIVIDED ROADWAY

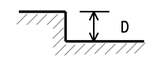
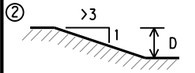
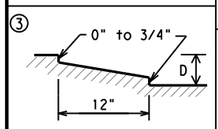
DEPARTMENTAL MATERIAL SPECIFICATIONS	
PERMANENT PREFABRICATED PAVEMENT MARKINGS	DMS-8240
TEMPORARY (REMOVABLE) PREFABRICATED PAVEMENT MARKINGS	DMS-8241
SIGN FACE MATERIALS	DMS-8300

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
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1-97 3-03	HOU	MONTGOMERY		47

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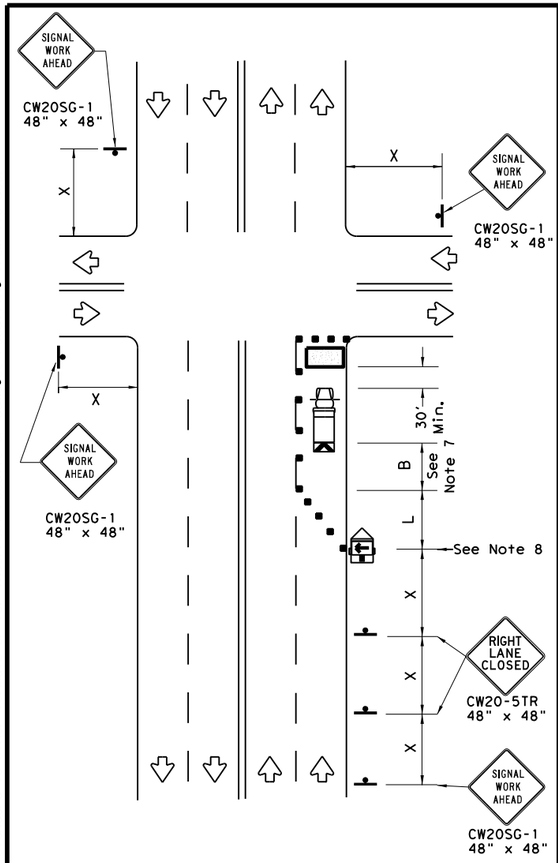
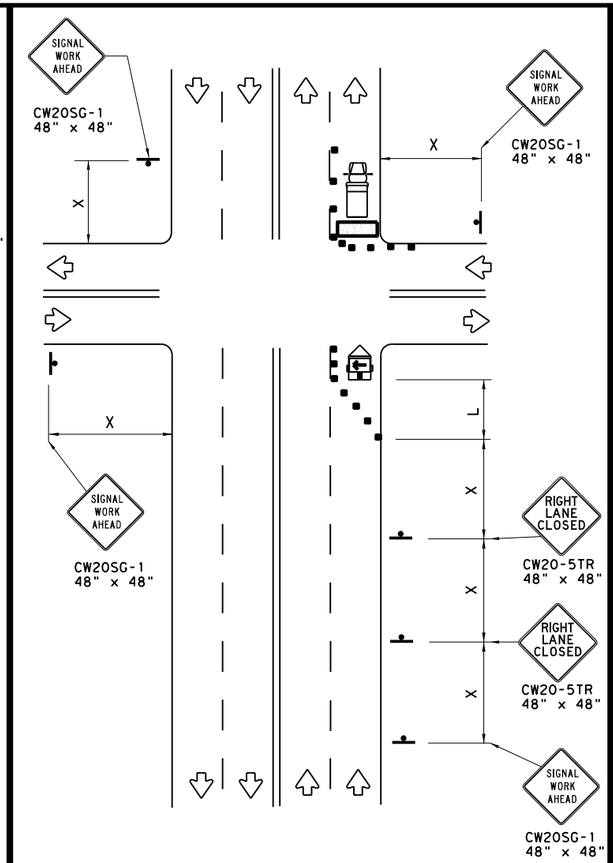


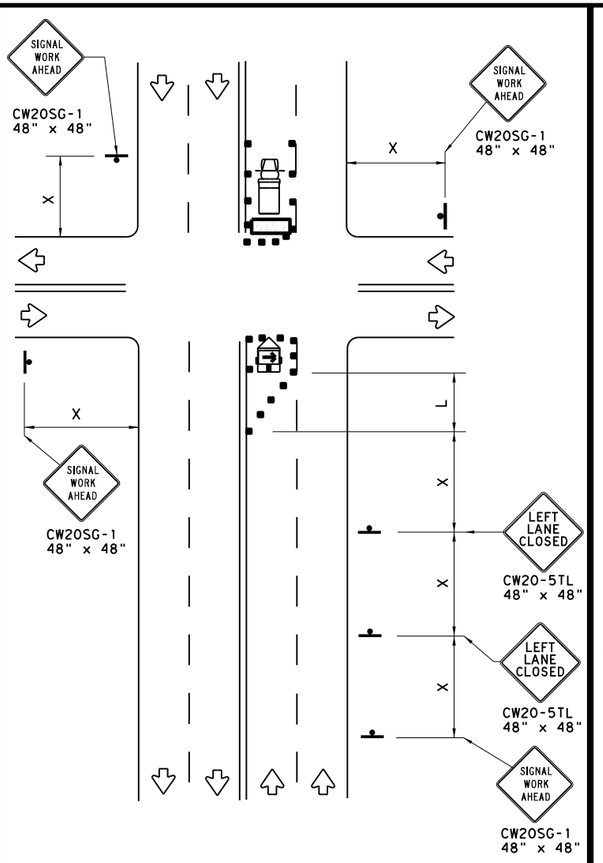
NEAR SIDE LANE CLOSURE

SHORT DURATION OR SHORT TERM STATIONARY



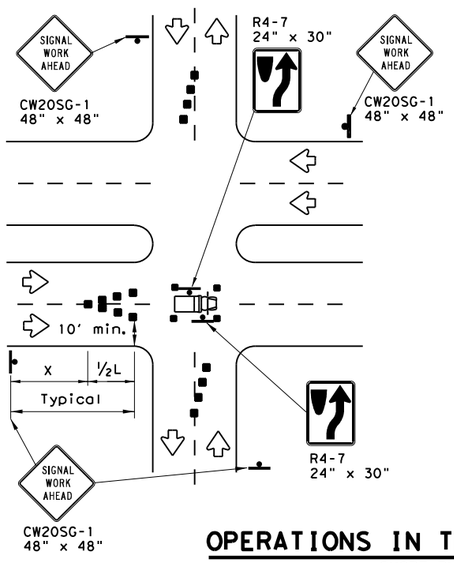
FAR SIDE RIGHT LANE CLOSURE

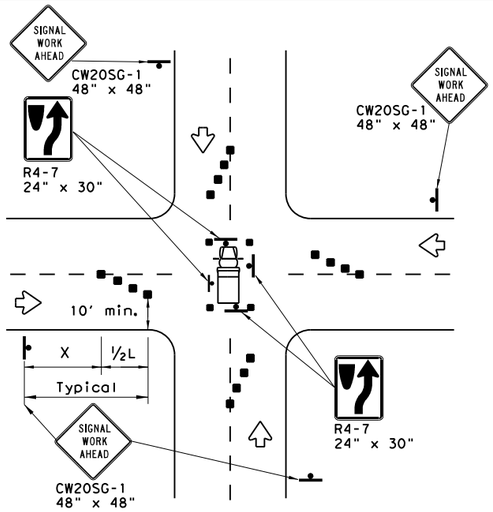
SHORT DURATION OR SHORT TERM STATIONARY



FAR SIDE LEFT LANE CLOSURE

SHORT DURATION OR SHORT TERM STATIONARY





OPERATIONS IN THE INTERSECTION

SHORT DURATION

GENERAL NOTES

1. The minimum size channelizing device is the 28" cone. 42" Two-piece cones, drums, vertical panels or barricades will be required when the device must be left unattended at night.
2. Obstructions or hazards at the work area shall be clearly marked and delineated at all times.
3. Flaggers and Flagger Symbol (CW20-7) signs may be required according to field conditions.
4. Vehicles parked in roadway shall be equipped with at least two high intensity rotating, flashing, oscillating or strobe type lights.
5. High level warning devices (flag trees) may be used at corners of the vehicle.
6. When work operations are performed on existing signals, the signals may be placed in flashing red mode when approved by the engineer. If existing signals do not have power, All-Way Stop (R1-1 and R1-3P) signs may be implemented when approved by the engineer.
7. For Short-Term Stationary work the buffer space "B" from the above table should be used if field conditions permit. For Short Duration (less than 1 hour) any buffer space provided will enhance the safety of the setup.
8. The arrow board at this location may be omitted for Short Duration work if the work vehicle has an arrow board in operation. As an option, the arrow board may be placed at the end of the taper in the closed lane if space is not available at the beginning of the taper.
9. Signs and devices for the NEAR SIDE LANE CLOSURE may be altered for a left lane closure by using a LEFT LANE CLOSED (CW20-5TL) and adding channelizing devices on the centerline to protect the work space from opposing traffic.

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)

WORKERS IN BUCKET TRUCKS SHALL NOT WORK ABOVE OPEN LANES OF TRAFFIC.

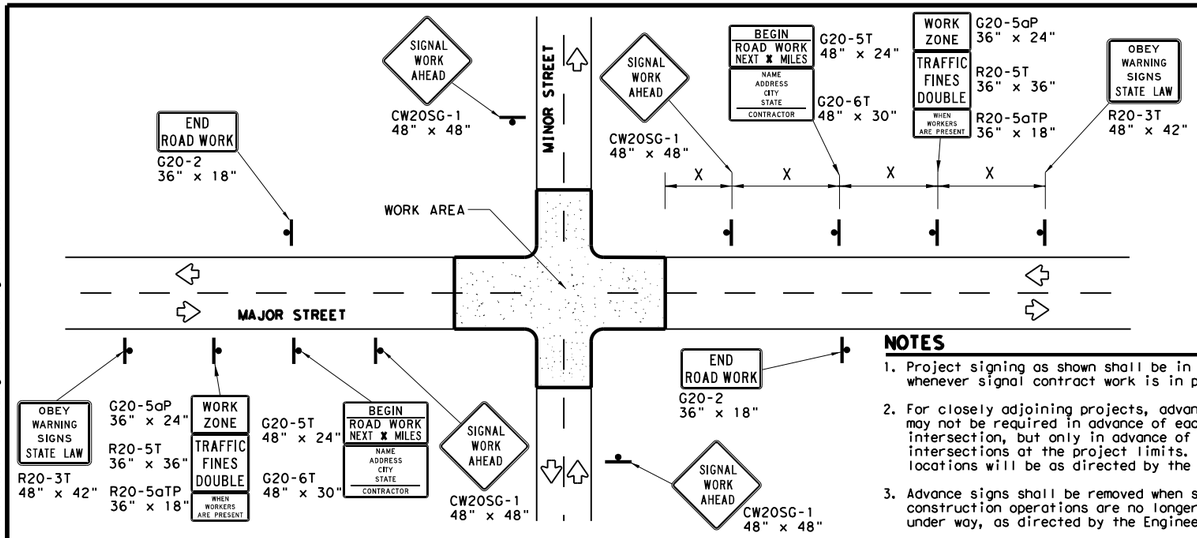
Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC SIGNAL WORK TYPICAL DETAILS

WZ(BTS-1)-13

FILE: wzbts-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT April 1992	CONT	SECT	JOB	HIGHWAY
REVISIONS	0177	14	037	SL 494
2-98 10-99 7-13	DIST	COUNTY		SHEET NO.
4-98 3-03	HOU	MONTGOMERY		48



TYPICAL ADVANCE SIGNAL PROJECT SIGNING

FOR LONG TERM and INTERMEDIATE-TERM STATIONARY WORK OPERATIONS

NOTES

1. Project signing as shown shall be in place whenever signal contract work is in progress.
2. For closely adjoining projects, advance signing may not be required in advance of each intersection, but only in advance of the intersections at the project limits. Actual locations will be as directed by the Engineer.
3. Advance signs shall be removed when signal construction operations are no longer under way, as directed by the Engineer.
4. Warning sign spacing shown is typical for both directions.
5. See the Table on sheet 1 of 2 for Typical warning sign spacing.

GENERAL NOTES FOR WORK ZONE SIGNS

1. Signs shall be installed and maintained in a straight and plumb condition.
2. Wooden sign posts shall be painted white.
3. Barricades shall NOT be used as sign supports.
4. Nails shall NOT be used to attach signs to any support.
5. All signs shall be installed in accordance with the plans or as directed by the Engineer.
6. The Contractor shall furnish the sign design shown in the plans or in the "Standard Highway Sign Designs for Texas" (SHSD).
7. The Contractor shall furnish sign supports and substrates listed in the "Compliant Work Zone Traffic Control Device List" (CWZTCD), installed as per the manufacturer's recommendations.
8. Temporary signs that have damaged or cracked substrates and/or damaged or marred reflective sheeting shall be replaced as directed by the Engineer.
9. Identification markings may be shown only on the back of the sign substrate. The maximum height of letters and/or company logos used for identification shall be 1".
10. Damaged wood posts shall be replaced. Splicing wood posts will not be allowed.

DURATION OF WORK

1. Work zone durations are defined in Part 6, Section 6G.02 of the Texas Manual on Uniform Traffic Control Devices (TMUTCD).

SIGN MOUNTING HEIGHT

1. Sign height of Long-term/Intermediate-term warning signs shall be as shown on Figure 6F-1 of the TMUTCD.
2. Sign height of Short-term/Short Duration warning signs shall be as shown on Figure 6F-2 of the TMUTCD.
3. Regulatory signs shall be mounted at least 7 feet, but not more than 9 feet, above the paved surface regardless of work duration.

REMOVING OR COVERING

1. When sign messages may be confusing or do not apply, the signs shall be removed or completely covered, unless otherwise approved by the Engineer.
2. 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. Burlap, or heavy materials such as plywood or aluminum shall not be used to cover signs.
3. Duct tape or other adhesive material shall NOT be affixed to a sign face.
4. Signs and anchor stubs shall be removed and holes back filled upon completion of the work.

REFLECTIVE SHEETING

1. All signs shall be retroreflective and constructed of sheeting meeting the requirements of the DMS and color usage table shown on this sheet.

SIGN SUPPORT WEIGHTS

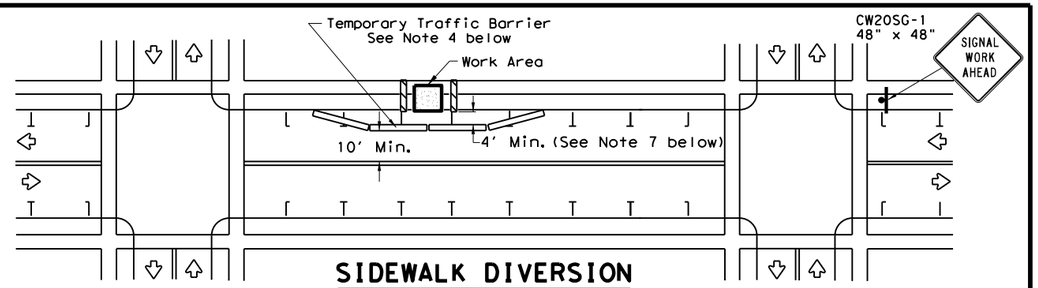
1. Weights used to keep signs from turning over should be sandbags filled with dry, cohesionless material.
2. The sandbags will be tied shut to keep the sand from spilling and to maintain a constant weight.
3. Rock, concrete, iron, steel or other solid objects will not be permitted for use as sign support weights.
4. Sandbags should weigh a minimum of 35 lbs and a maximum of 50 lbs.
5. Sandbags shall be made of a durable material that tears upon vehicular impact. 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 fastners. 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.

LEGEND	
	Sign
	Channelizing Devices
	Type 3 Barricade

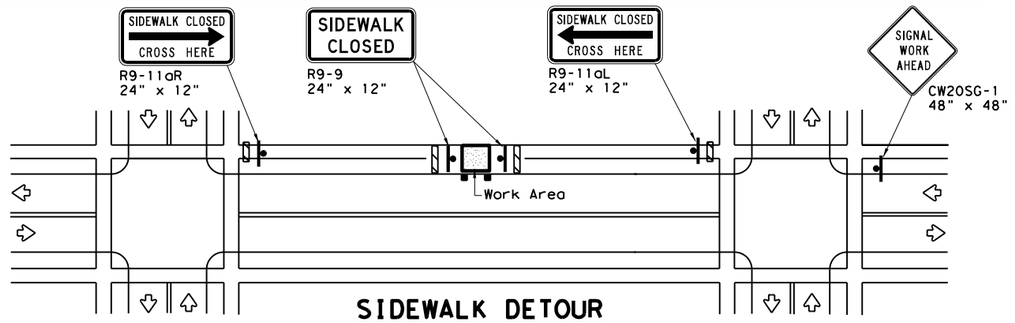
DEPARTMENTAL MATERIAL SPECIFICATIONS	
SIGN FACE MATERIALS	DMS-8300
FLEXIBLE ROLL-UP REFLECTIVE SIGNS	DMS-8310

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

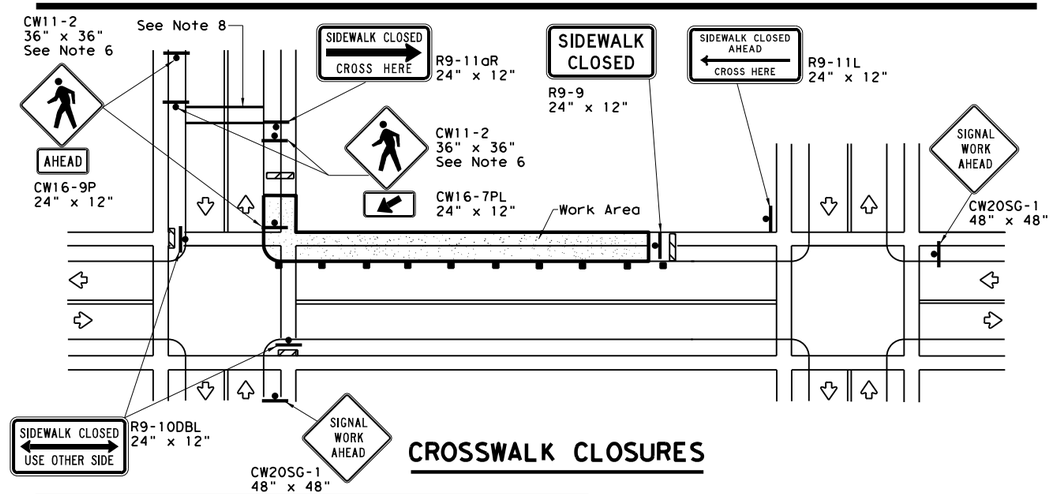
Only pre-qualified products shall be used. A copy of the "Compliant Work Zone Traffic Control Devices List" (CWZTCD) describes pre-qualified products and their sources and may be found at the following web address:
http://www.txdot.gov/txdot_library/publications/construction.htm



SIDEWALK DIVERSION



SIDEWALK DETOUR



CROSSWALK CLOSURES

PEDESTRIAN CONTROL

1. Holes, trenches or other hazards shall be adequately protected by covering, delineating or surrounding the hazard with orange plastic pedestrian fencing or longitudinal channelizing devices, or as directed by the Engineer.
2. "CROSSWALK CLOSURES" as detailed above will require the Engineer's approval prior to installation.
3. R9 series signs shown may be placed on supports detailed on the BC standards or CWZTCD list, or when fabricated from approved lightweight plastic substrates, they may be mounted on top of a plastic drum at or near the location shown.
4. For speeds less than 45 mph longitudinal channelizing devices may be used instead of traffic barriers when approved by the Engineer. Attenuation of blunt ends and installation of water filled devices shall be as per BC(9) and manufacturer's recommendations.
5. Location of devices are for general guidance. Actual device spacing and location must be field adjusted to meet actual conditions.
6. Where pedestrians with visual disabilities normally use the closed sidewalk Detectable Pedestrian Barricades should be used instead of the Type 3 Barricades shown.
7. The width of existing sidewalk should be maintained if practical.
8. Pavement markings for mid-block crosswalks shall be paid for under the appropriate bid items.
9. When crosswalks or other pedestrian facilities are closed or relocated, temporary facilities shall be detectable and shall include accessibility features consistent with the features present in the existing pedestrian facility.

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC SIGNAL WORK BARRICADES AND SIGNS

WZ(BTS-2)-13

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4-98 3-03	HOU	MONTGOMERY		49

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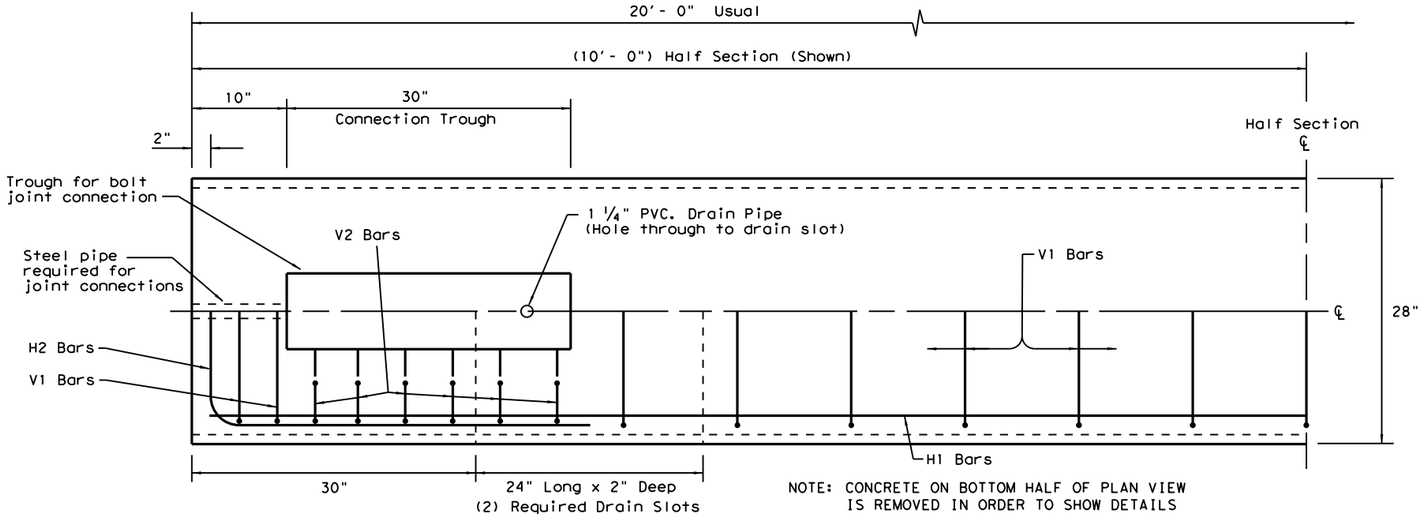
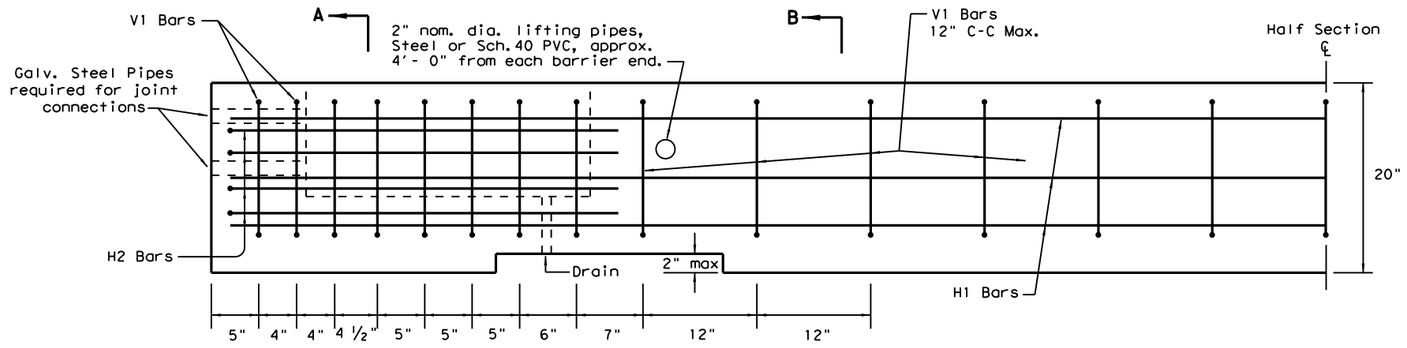
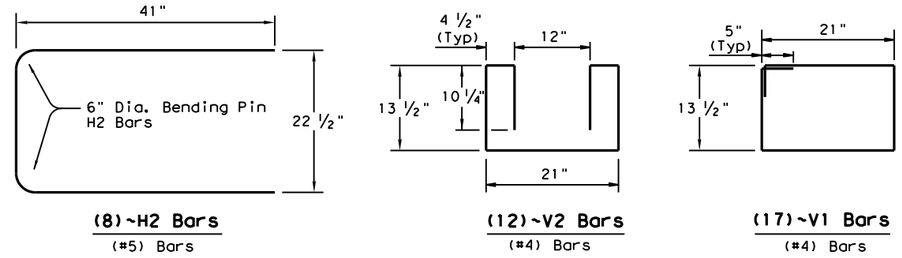


PLAN
(TYPE 1) BARRIER SEGMENT
(SYMMETRICAL ABOUT CENTER LINES)



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



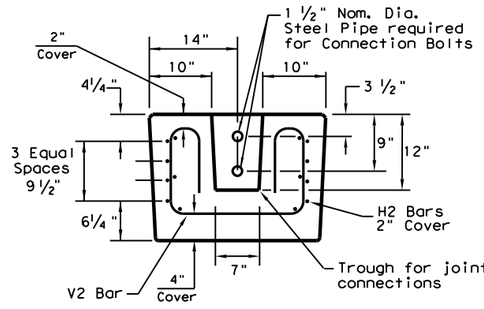
(8)~H2 Bars (#5) Bars

(12)~V2 Bars (#4) Bars

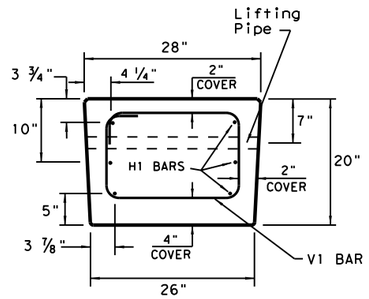
(17)~V1 Bars (#4) Bars

REINFORCING STEEL DETAILS
TYPE 1 - BARRIER SEGMENT

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



SECTION A-A



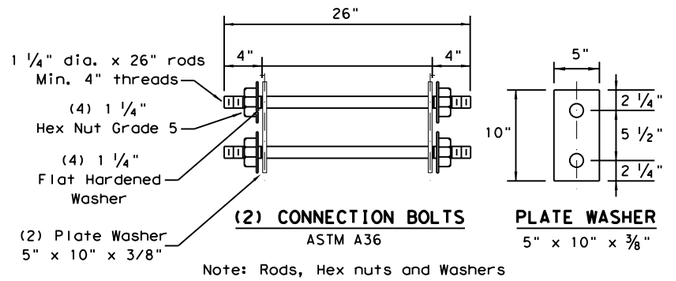
SECTION B-B

GENERAL NOTES

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

FOR CONTRACTORS INFORMATION ONLY

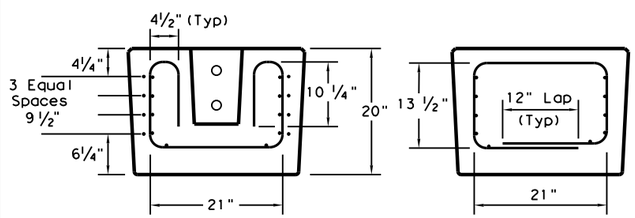
(TYPE 1) APPROX. QUANTITIES 20 FT. SECTION		
CONCRETE	CY	2.6
REINFORCING STEEL	LBS	330
TOTAL BARRIER WT.	LBS	11000



(2) CONNECTION BOLTS ASTM A36

PLATE WASHER 5" x 10" x ⅜"

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



SECTION A-A **SECTION B-B**

(WWR) GENERAL NOTES

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

REQUIRED (WWR) WIRE DESIGN

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

WELDED WIRE REINFORCEMENT (WWR)- OPTIONAL REINFORCING

SHEET 1 OF 2

Texas Department of Transportation — Design Division Standard

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

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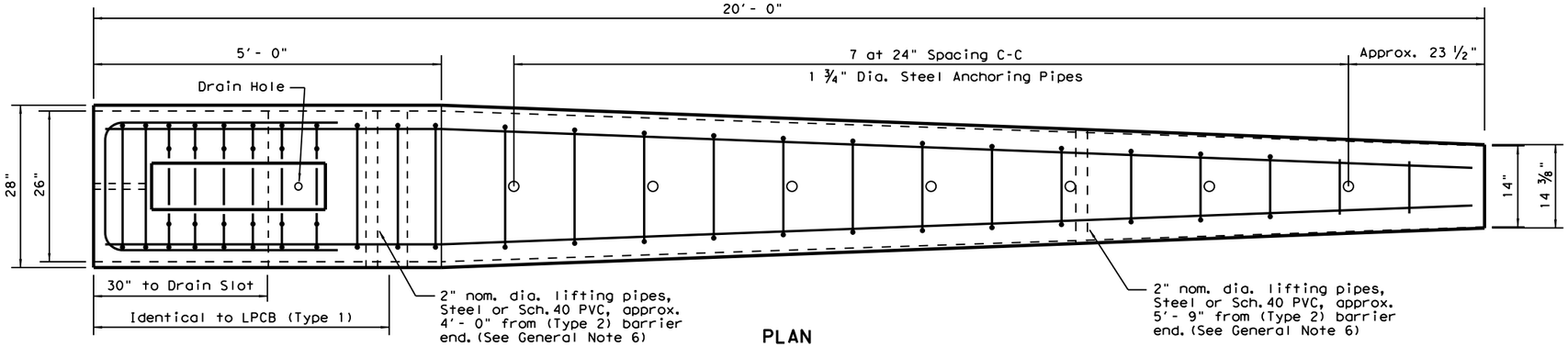
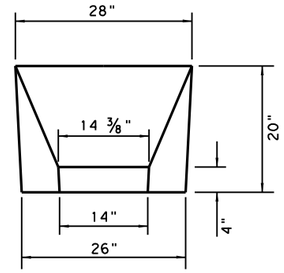
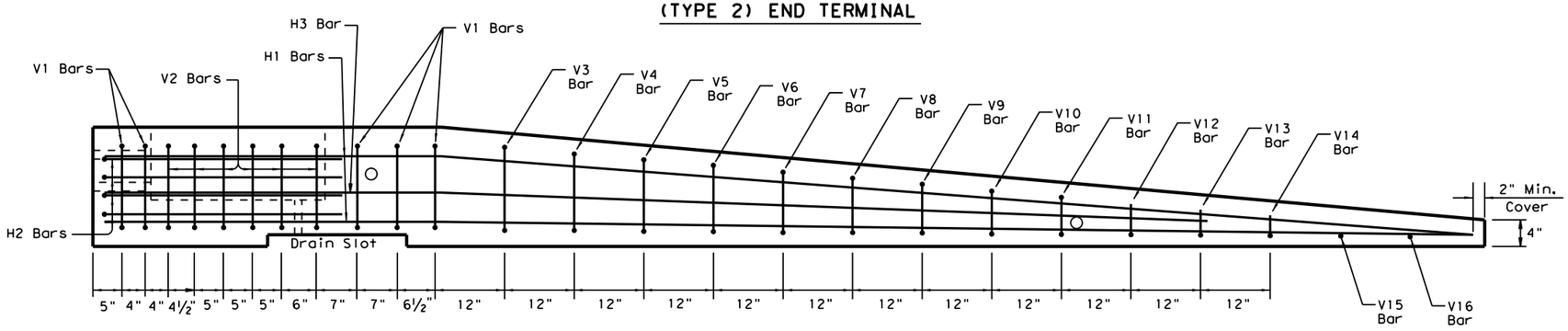


PLAN
(TYPE 2) END TERMINAL



APPROACH VIEW

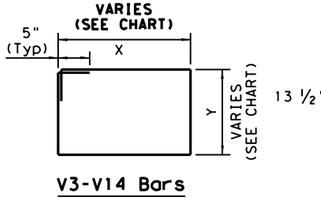


ELEVATION
(TYPE 2) END TERMINAL

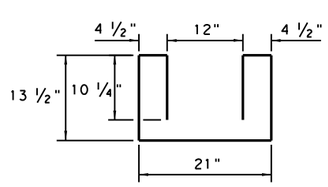
Note:
Anchoring pipes not shown in Elevation View

TYPE 2 - NOTES

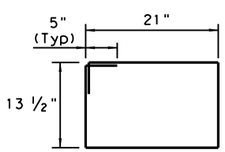
1. Welded wire reinforcment (WWR) is "not" an option for Type 2 Barrier.
2. Type 2 Barrier shall be used as an end treatment for the Type 1 barrier segments, when applicable.
3. The end treatment can be used without the anchor pins in locations that can accommodate approximately 4 ft. of lateral displacement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



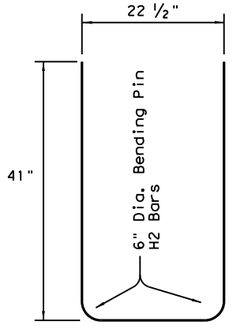
V3-V14 Bars



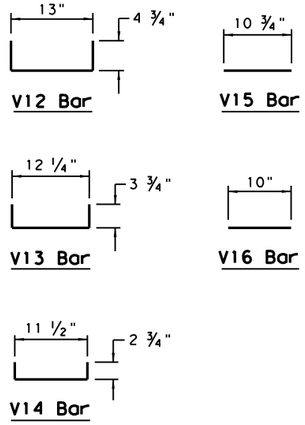
(6)~V2 Bars



(5)~V1 Bars



(4)~H2 Bars
(#5) Bars



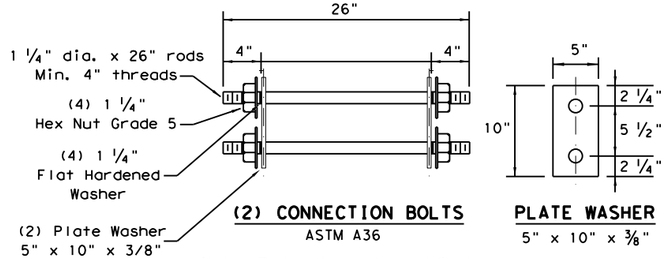
Note: All V Bars are (#4)

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

REINFORCING STEEL DETAILS
TYPE 2 - END TERMINAL

Section A-A
(Head of Anchoring Pin)

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

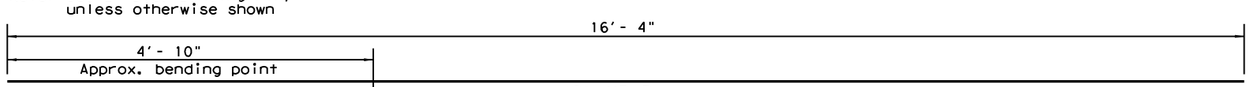


(2) CONNECTION BOLTS
ASTM A36

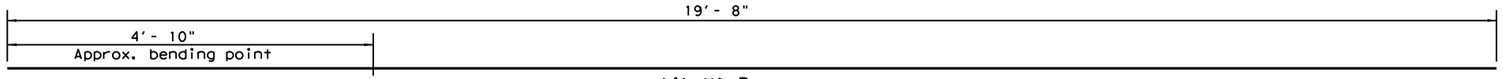
PLATE WASHER
5" x 10" x ⅜"

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

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



(2)~H3 Bars
(#5) Bar



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

(4)~H1 Bars
(#5) Bar

FOR CONTRACTORS INFORMATION ONLY

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

Texas Department of Transportation

Design Division Standard

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

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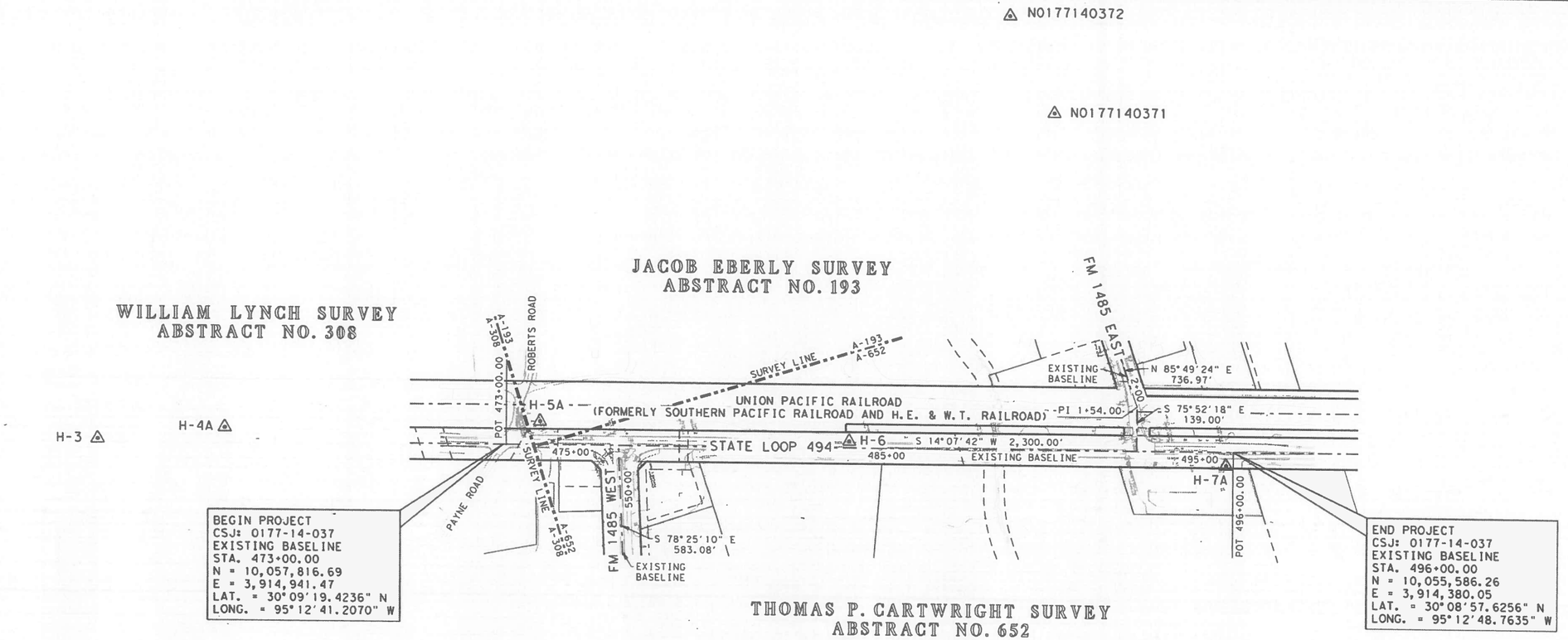


CONTROL MONUMENTATION TABLE				
POINT	NORTHING(Y)	EASTING(X)	ELEVATION	DESCRIPTION
H-3	10,060,071.14	3,915,516.11	89.73'	FND. 5/8" IRON ROD W/TXDOT ALUMINUM CAP
H-4A	10,058,669.72	3,915,202.87	88.38'	FND. 5/8" IRON ROD W/TXDOT ALUMINUM CAP IN CONCRETE
H-5A	10,057,696.53	3,914,986.85	93.62'	SET 5/8" IRON ROD W/TXDOT ALUMINUM CAP
H-6	10,056,759.67	3,914,696.70	94.47'	FND. MAG NAIL IN GRAVEL
H-7A	10,055,618.85	3,914,344.17	94.26'	SET 5/8" IRON ROD W/TXDOT ALUMINUM CAP
N0177140371	10,055,880.83	3,915,553.83	89.98'	SET 5/8" IRON ROD W/TXDOT ALUMINUM CAP IN CONCRETE
N0177140372	10,056,028.65	3,916,620.30	88.17'	SET 5/8" IRON ROD W/TXDOT ALUMINUM CAP IN CONCRETE

SURVEY CONTROL MONUMENT INVERSE TABLE			
FROM POINT	BEARING	DISTANCE	TO POINT
H-3	S 12°35'57" W	1,435.99'	H-4A
H-4A	S 12°30'54" W	996.88'	H-5A
H-5A	S 17°12'29" W	980.77'	H-6
H-6	S 17°10'20" W	1,194.04'	H-7A
H-7A	N 77°46'47" E	1,237.71'	N0177140371
N0177140371	N 82°06'32" E	1,076.67'	N0177140372

0 200 400
SCALE: 1"=400'

UNIT OF MEASURE: U.S. SURVEY FEET

NOTES:

1. ALL BEARINGS AND COORDINATES ARE BASED ON THE TEXAS COORDINATE SYSTEM, CENTRAL ZONE, (4203), NORTH AMERICAN DATUM OF 1983 (NAD 83), 2011 ADJUSTMENT, EPOCH 2010.00. ALL DISTANCES AND COORDINATES SHOWN ARE SURFACE VALUES AND MAY BE CONVERTED TO GRID BY DIVIDING BY THE COMBINED ADJUSTMENT FACTOR OF 1.00003.
2. TXDOT REGIONAL REFERENCE POINTS TXCN AND TXLI AND NGS CORS STATION ZHU1 WERE USED AS BASE STATIONS TO PROCESS STATIC GPS TO ESTABLISH THE HORIZONTAL CONTROL POSITION OF TXDOT MONUMENT H-4A. HORIZONTAL SURVEY METHOD: STATIC GPS AND GPS RTN (TXDOT VRS).
3. ALL ELEVATIONS HEREON ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
4. TXDOT REGIONAL REFERENCE POINTS TXCN AND TXLI AND NGS CORS STATION ZHU1 WERE USED AS BASE STATIONS TO PROCESS STATIC GPS TO ESTABLISH THE VERTICAL CONTROL POSITION OF TXDOT MONUMENT H-4A. VERTICAL SURVEY METHOD: STATIC GPS AND DIGITAL LEVELING.
5. FIELD SURVEYS WERE COMPLETED IN DECEMBER, 2019.

STATE OF TEXAS
MICAH J. SCHLUTER
136908
LICENSED
PROFESSIONAL ENGINEER

07.30.21 Micah J. Schluter, P.E.

THIS SURVEY INFORMATION HAS BEEN ACCEPTED INTO THIS PS&E.

01/29/2020

STATE OF TEXAS
REGISTERED
WILLIAM R. WOLFRAM III
6244
PROFESSIONAL
LAND SURVEYOR

THE CONTROL POINTS SHOWN HEREIN WERE DETERMINED BY A SURVEY MADE ON THE GROUND UNDER MY SUPERVISION. SURVEY DATE: DECEMBER, 2019.

Texas Department of Transportation

LANDTECH
2525 North Loop West, Suite 300,
Houston, Texas 77008
T: 713-861-7068 F: 713-861-4131
TBPE Registration No. F-1364; TBPLS Registration No. 10019100

STATE LOOP 494
SURVEY CONTROL INDEX SHEET

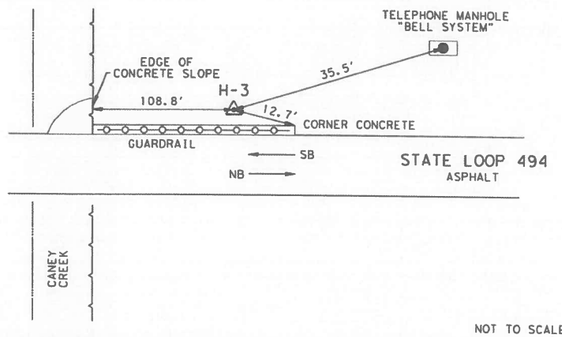
SHEET 1 OF 1

FED. RD. DIV. NO.	STATE	FEDERAL AID PROJECT NO.	HIGHWAY NO.
6	TX		SL 494

STATE DIST. NO.	COUNTY	CONTROL NO.	SECTION NO.	JOB NO.	SHEET NO.
HOU	MONTGOMERY	0177	14	037	52

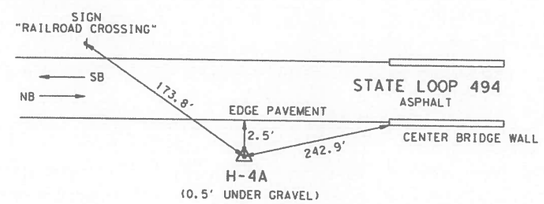
S:\2019\1920133\01 - SL 494\Cadd\0177140374PS&E Survey Index.dgn

H-3
FND. 5/8" I.R. W/TXDOT
ALUMINUM CAP
N= 10,060,071.14
E= 3,915,516.11
ELEV.=89.73'



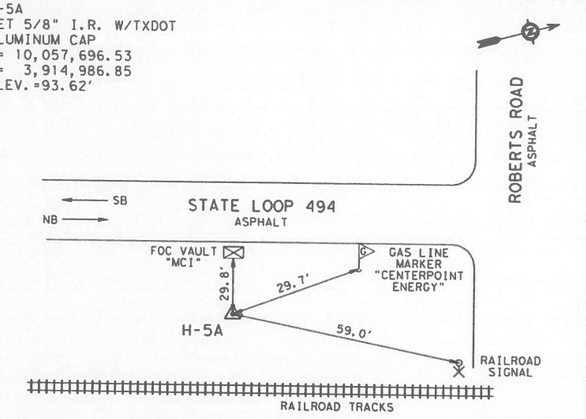
H-3: LOCATED ON THE WEST SIDE OF SL 494, APPROXIMATELY 400 FEET NORTH OF CANEY CREEK AND 1,400 FEET SOUTH OF THE INTERSECTION OF SL 494 AND IH 69

H-4A
FND. SET 5/8" I.R. W/TXDOT
ALUMINUM CAP IN CONCRETE
N= 10,058,669.72
E= 3,915,202.87
ELEV.=88.38'



H-4A: LOCATED ON THE EAST SIDE OF SL 494, APPROXIMATELY 1,250 FEET NORTH OF FM 1485 WEST AND 1,050 FEET SOUTH OF CANEY CREEK

H-5A
SET 5/8" I.R. W/TXDOT
ALUMINUM CAP
N= 10,057,696.53
E= 3,914,986.85
ELEV.=93.62'

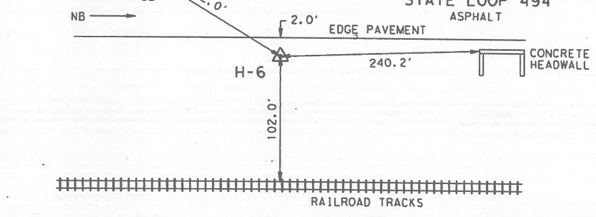


H-5A: LOCATED AT THE SOUTHEAST CORNER OF THE INTERSECTION OF SL 494 AND ROBERTS ROAD ON THE WEST SIDE OF UNION PACIFIC RAILROAD, APPROXIMATELY 250 FEET NORTH OF FM 1485 WEST

NOTES:

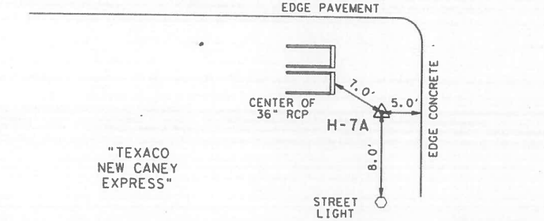
1. ALL BEARINGS AND COORDINATES ARE BASED ON THE TEXAS COORDINATE SYSTEM, CENTRAL ZONE, (4203), NORTH AMERICAN DATUM OF 1983 (NAD 83), 2011 ADJUSTMENT, EPOCH 2010.00. ALL DISTANCES AND COORDINATES SHOWN ARE SURFACE VALUES AND MAY BE CONVERTED TO GRID BY DIVIDING BY THE COMBINED ADJUSTMENT FACTOR OF 1.00003.
2. TXDOT REGIONAL REFERENCE POINTS TXCN AND TXLI AND NGS CORS STATION ZHU1 WERE USED AS BASE STATIONS TO PROCESS STATIC GPS TO ESTABLISH THE HORIZONTAL CONTROL POSITION OF TXDOT MONUMENT H-4A. HORIZONTAL SURVEY METHOD: STATIC GPS AND GPS RTN (TXDOT VRS).
3. ALL ELEVATIONS HEREON ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
4. TXDOT REGIONAL REFERENCE POINTS TXCN AND TXLI AND NGS CORS STATION ZHU1 WERE USED AS BASE\ STATIONS TO PROCESS STATIC GPS TO ESTABLISH THE VERTICAL CONTROL POSITION OF TXDOT MONUMENT H-4A. VERTICAL SURVEY METHOD: STATIC GPS AND DIGITAL LEVELING.
5. UNIT OF MEASURE: U.S. SURVEY FEET.

H-6
FND. MAG NAIL IN GRAVEL
N= 10,056,759.67
E= 3,914,696.70
ELEV.=94.47'



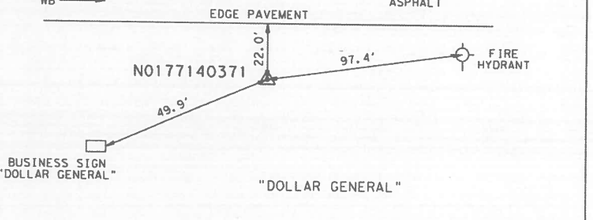
H-6: LOCATED ON THE EAST SIDE OF SL 494, APPROXIMATELY 740 FEET SOUTH OF FM 1485 WEST AND 900 FEET NORTH OF FM 1485 EAST

H-7A
SET 5/8" I.R. W/TXDOT
ALUMINUM CAP
N= 10,055,618.85
E= 3,914,344.17
ELEV.=94.26'



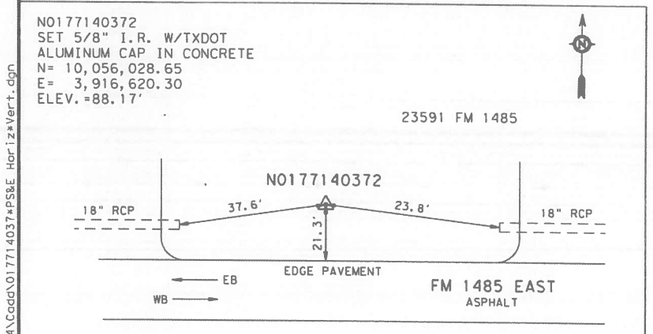
H-7A: LOCATED ON THE WEST SIDE OF SL 494, APPROXIMATELY 280 FEET SOUTH OF FM 1485 EAST AND 5 FEET NORTH OF THE EDGE OF A CONCRETE DRIVE TO TEXACO

NO177140371
SET 5/8" I.R. W/TXDOT
ALUMINUM CAP IN CONCRETE
N= 10,055,880.83
E= 3,915,553.83
ELEV.=89.98'



NO177140371: LOCATED ON THE SOUTH SIDE OF FM 1485 EAST, APPROXIMATELY 1,100 FEET EAST OF SL 494

NO177140372
SET 5/8" I.R. W/TXDOT
ALUMINUM CAP IN CONCRETE
N= 10,056,028.65
E= 3,916,620.30
ELEV.=88.17'



LOCATED ON THE NORTH SIDE OF FM 1485 EAST, APPROXIMATELY 2,200 FEET EAST OF SL 494

STATE OF TEXAS
MICAH J. SCHLUTER
136908
LICENSED
PROFESSIONAL ENGINEER

07.30.21 Micah J. Schluter, P.E.

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STATE OF TEXAS
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WILLIAM R. WOLFRAM III
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THE CONTROL POINTS SHOWN HEREIN WERE DETERMINED BY A SURVEY MADE ON THE GROUND UNDER MY SUPERVISION. SURVEY DATE: DECEMBER, 2019.

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2525 North Loop West, Suite 300,
Houston, Texas 77008
T: 713-861-7068 F:713-861-4131
TBPE Registration No. F-1364; TBPLS Registration No. 10019100

STATE LOOP 494
HORIZONTAL AND VERTICAL CONTROL SHEET

SHEET 1 OF 1

FED. RD. DIV. NO.	STATE	FEDERAL AID PROJECT NO.				HIGHWAY NO.
6	TX					SL 494
STATE DIST. NO.	COUNTY	CONTROL NO.	SECTION NO.	JOB NO.		SHEET NO.
HOU	MONTGOMERY	0177	14	037		53

S:\2019\1920133\01 - SL 494\Cadd\0177140371+PS&E Horiz+Vert.dgn

Beginning chain SL494_BCC description
Feature: Road_Centerline

Point 5 X 3,914,905.4729 Y 10,057,631.2852 Sta 474+91.06

Course from 5 to PC SL494_BCC_3 S 14° 14′ 01.15" W Dist 514.9708

Curve Data

Curve SL494_BCC_3						
P.I. Station		480+42.23	X	3,914,769.9532	Y	10,057,097.0365
Delta	=	0° 31′ 30.22"	(LT)			
Degree	=	0° 43′ 30.95"				
Tangent	=	36.1982				
Length	=	72.3959				
Radius	=	7,900.0000				
External	=	0.0829				
Long Chord	=	72.3957				
Mid. Ord.	=	0.0829				
P.C. Station		480+06.03	X	3,914,778.8536	Y	10,057,132.1235
P.T. Station		480+78.43	X	3,914,761.3749	Y	10,057,061.8694
C.C.			X	3,922,436.3323	Y	10,055,189.6972
Back	= S	14° 14′ 01.15" W				
Ahead	= S	13° 42′ 30.93" W				
Chord Bear	= S	13° 58′ 16.04" W				

Course from PT SL494_BCC_3 to PC SL494_BCC_6 S 13° 42′ 30.93" W Dist 36.7272

Curve Data

Curve SL494_BCC_6						
P.I. Station		481+51.35	X	3,914,744.0927	Y	10,056,991.0214
Delta	=	0° 31′ 30.22"	(RT)			
Degree	=	0° 43′ 30.95"				
Tangent	=	36.1982				
Length	=	72.3959				
Radius	=	7,900.0000				
External	=	0.0829				
Long Chord	=	72.3957				
Mid. Ord.	=	0.0829				
P.C. Station		481+15.15	X	3,914,752.6711	Y	10,057,026.1884
P.T. Station		481+87.55	X	3,914,735.1924	Y	10,056,955.9344
C.C.			X	3,907,077.7137	Y	10,058,898.3607
Back	= S	13° 42′ 30.93" W				
Ahead	= S	14° 14′ 01.15" W				
Chord Bear	= S	13° 58′ 16.04" W				

Course from PT SL494_BCC_6 to PC SL494_BCC_9 S 14° 14′ 01.15" W Dist 155.8607

Curve Data

Curve SL494_BCC_9						
P.I. Station		484+10.71	X	3,914,680.3226	Y	10,056,739.6252
Delta	=	0° 58′ 34.21"	(RT)			
Degree	=	0° 43′ 30.95"				
Tangent	=	67.2992				
Length	=	134.5952				
Radius	=	7,900.0000				
External	=	0.2867				
Long Chord	=	134.5935				
Mid. Ord.	=	0.2866				
P.C. Station		483+43.41	X	3,914,696.8699	Y	10,056,804.8585
P.T. Station		484+78.01	X	3,914,662.6663	Y	10,056,674.6834
C.C.			X	3,907,039.3912	Y	10,058,747.2847
Back	= S	14° 14′ 01.15" W				
Ahead	= S	15° 12′ 35.36" W				
Chord Bear	= S	14° 43′ 18.25" W				

Course from PT SL494_BCC_9 to PC SL494_BCC_12 S 15° 12′ 35.36" W Dist 462.4112

Curve Data

Curve SL494_BCC_12						
P.I. Station		490+10.08	X	3,914,523.0745	Y	10,056,161.2480
Delta	=	1° 00′ 37.58"	(LT)			
Degree	=	0° 43′ 30.95"				
Tangent	=	69.6619				
Length	=	139.3202				
Radius	=	7,900.0000				
External	=	0.3071				
Long Chord	=	139.3184				
Mid. Ord.	=	0.3071				
P.C. Station		489+40.42	X	3,914,541.3506	Y	10,056,228.4697
P.T. Station		490+79.74	X	3,914,505.9866	Y	10,056,093.7144
C.C.			X	3,922,164.6257	Y	10,054,155.8684
Back	= S	15° 12′ 35.36" W				
Ahead	= S	14° 11′ 57.78" W				
Chord Bear	= S	14° 42′ 16.57" W				

Course from PT SL494_BCC_12 to 6 S 14° 11′ 57.78" W Dist 179.0293

Point 6 X 3,914,462.0713 Y 10,055,920.1548 Sta 492+58.77

Ending chain SL494_BCC description

Beginning profile 494CL12921 description:

	STATION	ELEV	GRADE	TOTAL L	BACK L	AHEAD L
VPI 1	476+85.36	94.1125				
VPC	485+76.46	95.7612	0.1850	K = 84.0	SSD = 4392.0	
VPI 2	485+86.80	95.7804		20.6854	10.3427	10.3427
High Point	485+92.00	95.7756				
VPT	485+97.14	95.7740	-0.0612			
VPI 3	492+58.77	95.3689	-0.0612			

Ending profile 494CL12921 description

STATE OF TEXAS
MICAH J. SCHLUTER
136908
LICENSED
PROFESSIONAL ENGINEER

Micah J. Schluter, P.E.

07.30.21

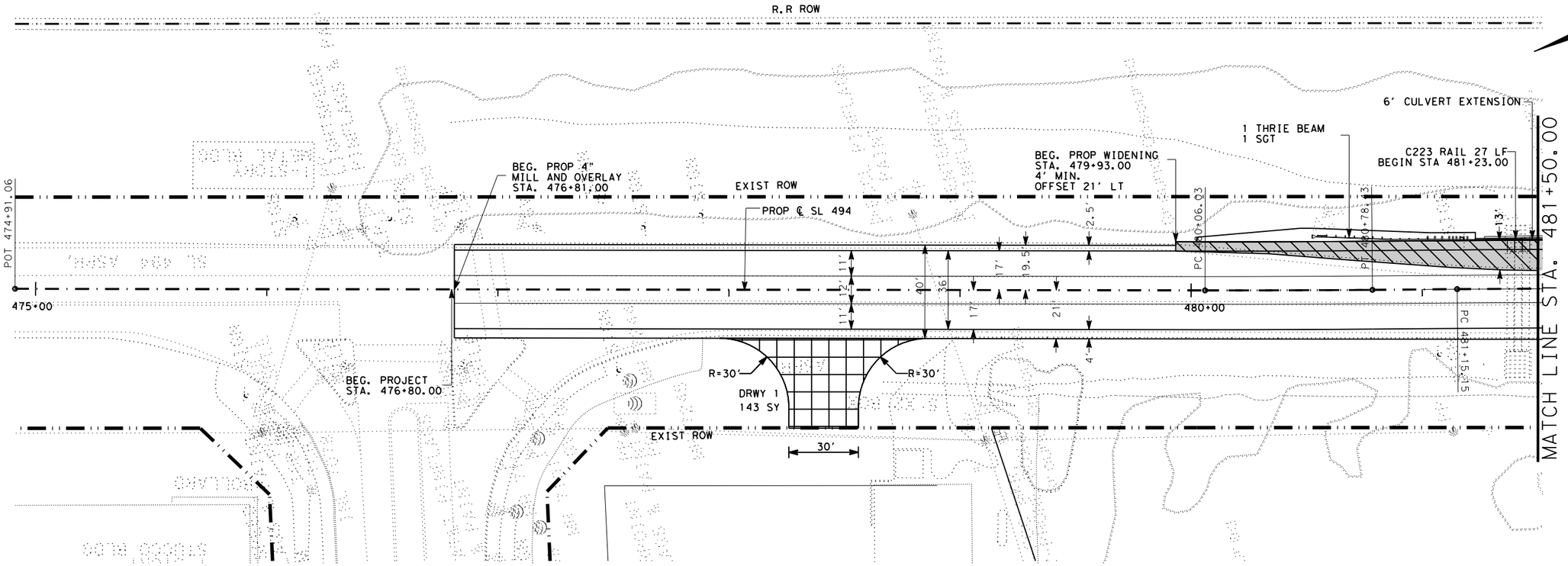
SL 494
HORIZONTAL AND VERTICAL ALIGNMENT DATA

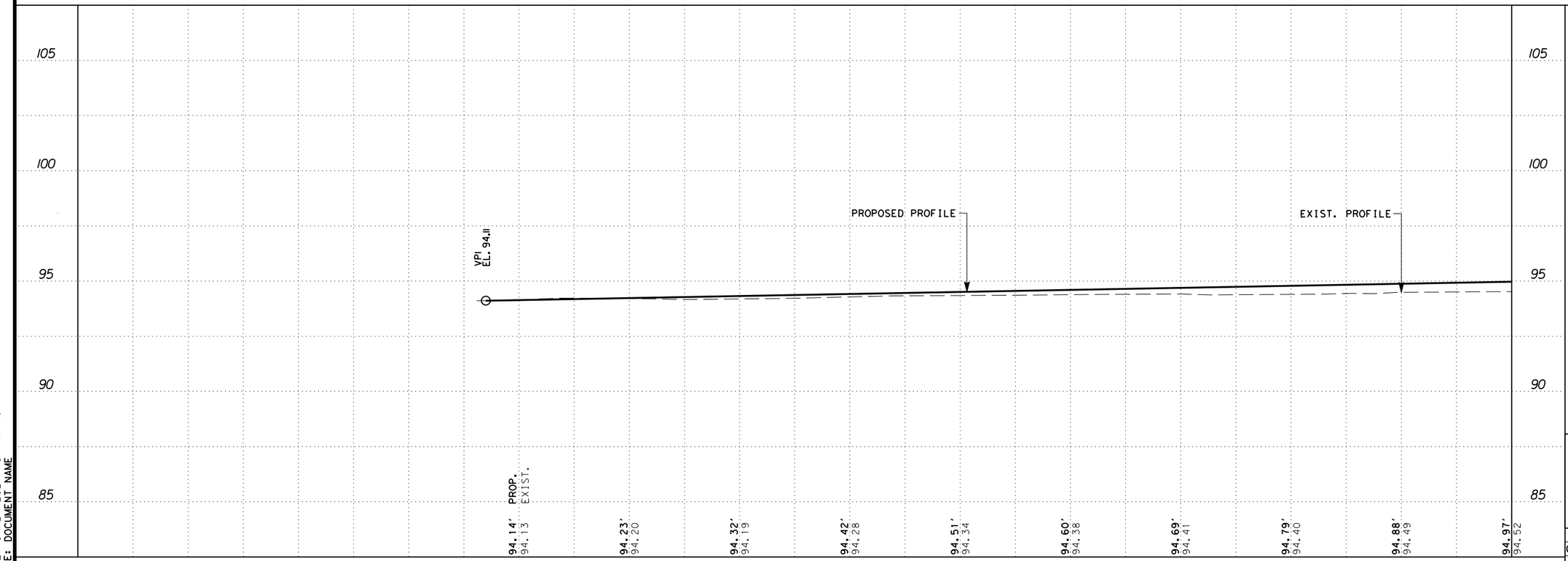
SHEET 1 OF 1

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		54

DATE:
FILE:





STATE OF TEXAS
MICAH J. SCHLUTER
136908
LICENSED
PROFESSIONAL ENGINEER

Micah J. Schluter, P.E.

07.30.21

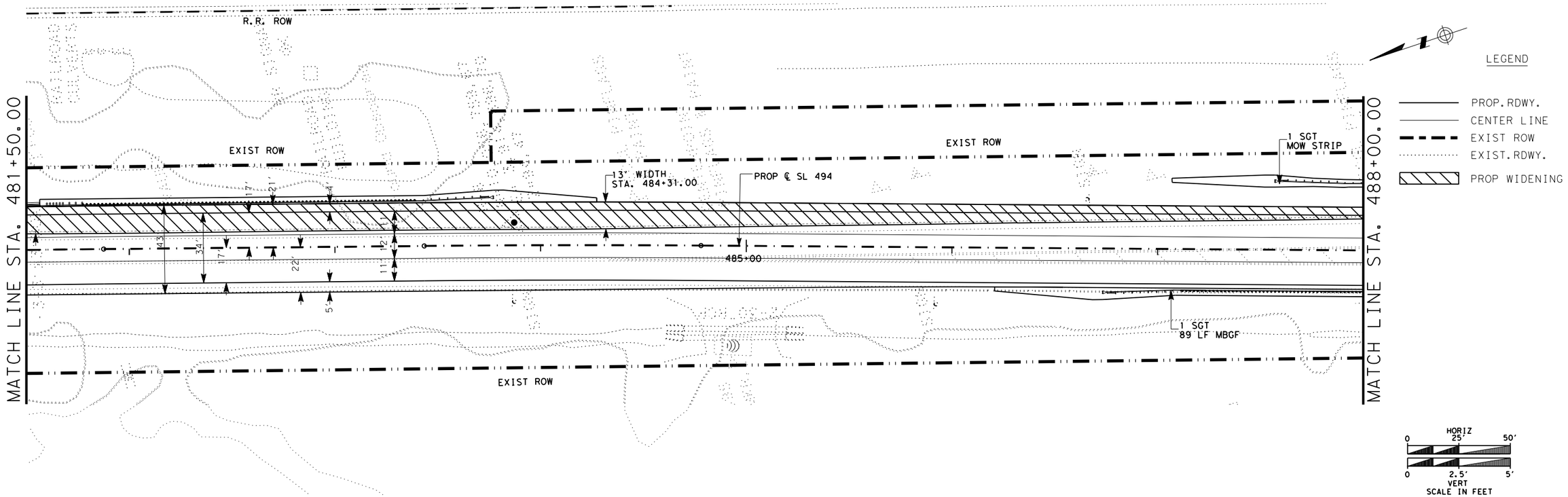
SL 494
PLAN & PROFILE LAYOUT

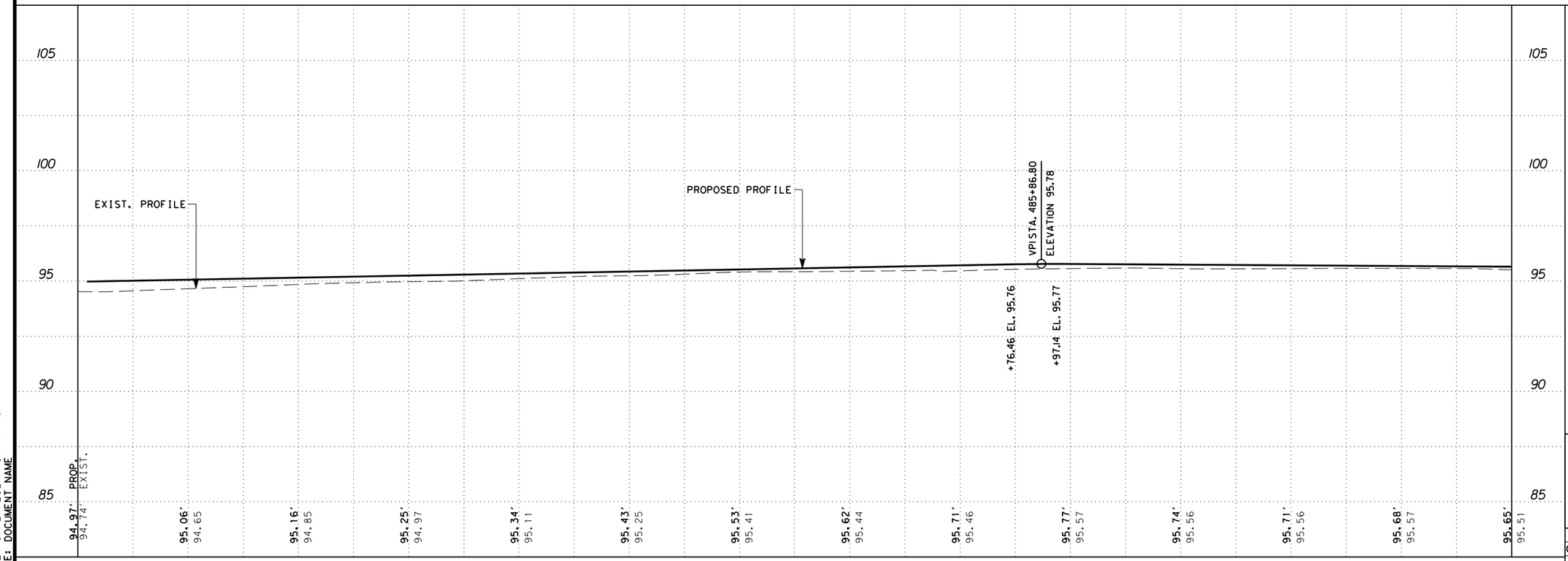
SHEET 1 OF 3

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		55

DATE: 07/24/2021 04:44 PM
FILE: DOCUMENT NAME





DATE: 07/24/2021 04:44 PM
FILE: DOCUMENT NAME

STATE OF TEXAS
MICAH J. SCHLUTER
136908
LICENSED
PROFESSIONAL ENGINEER

Micah J. Schluter, P.E.

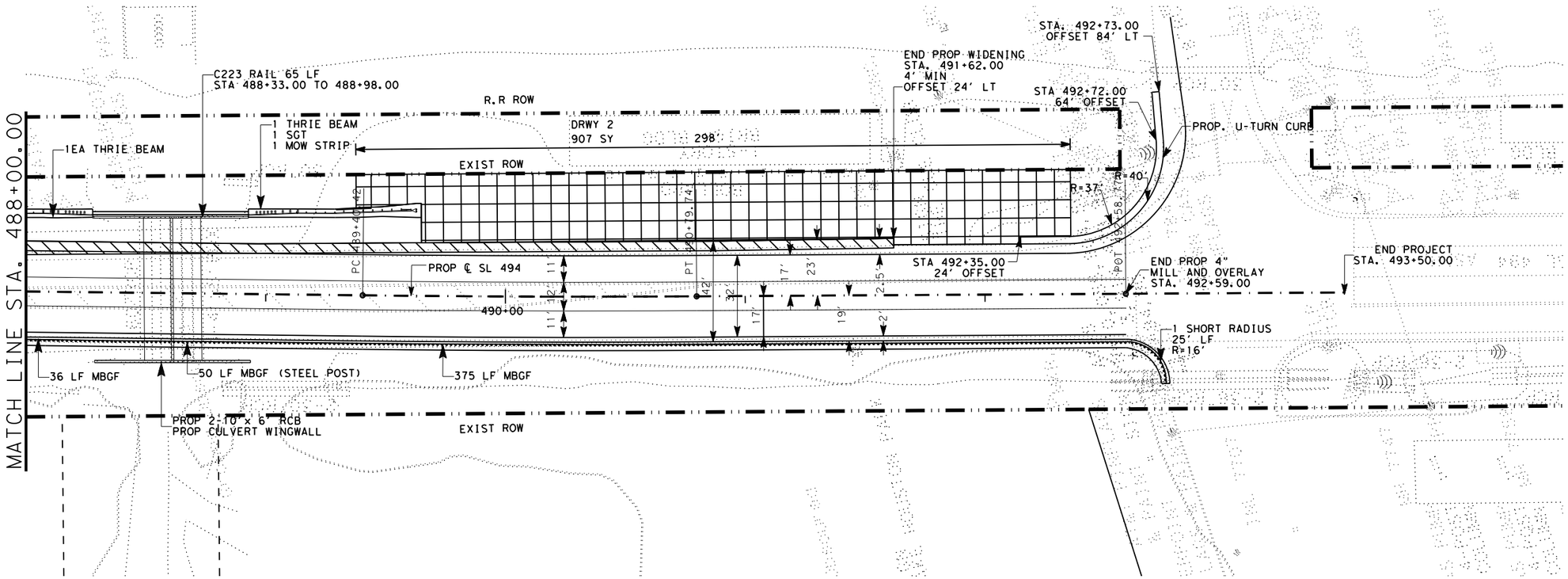
07.30.21

SL 494
PLAN & PROFILE LAYOUT

SHEET 2 OF 3

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		56



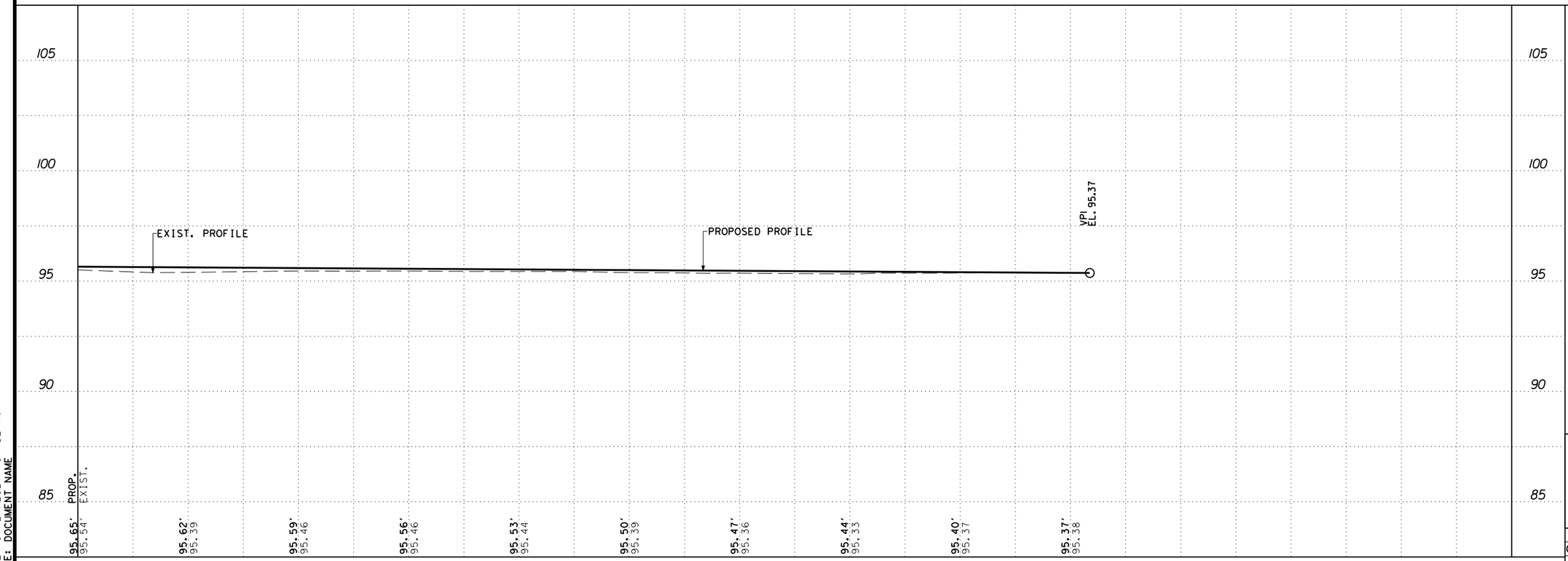
LEGEND

- PROP. RDWY.
- CENTER LINE
- EXIST ROW
- EXIST. RDWY.
- PROP WIDENING

NOTE:

1. SEE BOX CULVERT LAYOUT SHEETS FOR LOCATION DETAILS
2. BOLT MBGF TO 10X6 BOX CULVERTS

HORIZ
0 25' 50'
0 2.5' 5'
VERT
SCALE IN FEET



STATE OF TEXAS
MICAH J. SCHLUTER
136908
LICENSED
PROFESSIONAL ENGINEER

Micah J. Schluter, P.E.

07.30.21

SL 494
PLAN & PROFILE LAYOUT

SHEET 3 OF 3

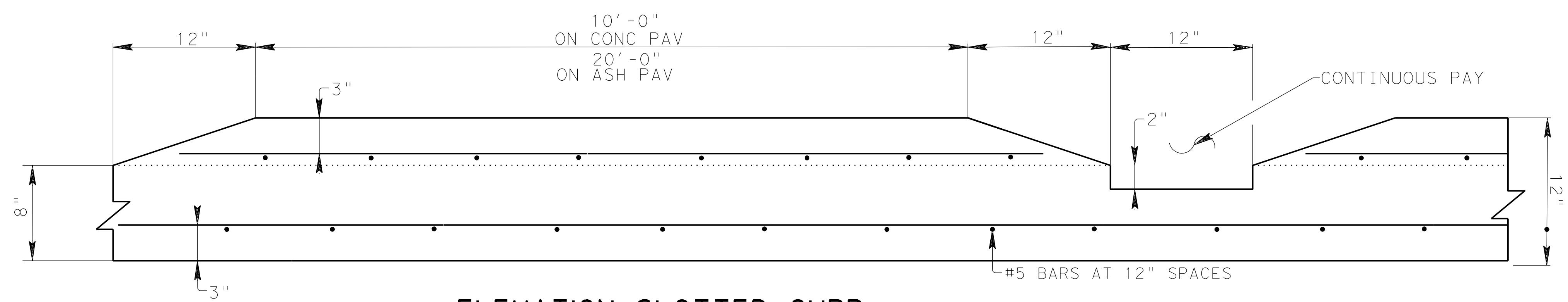
Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		57

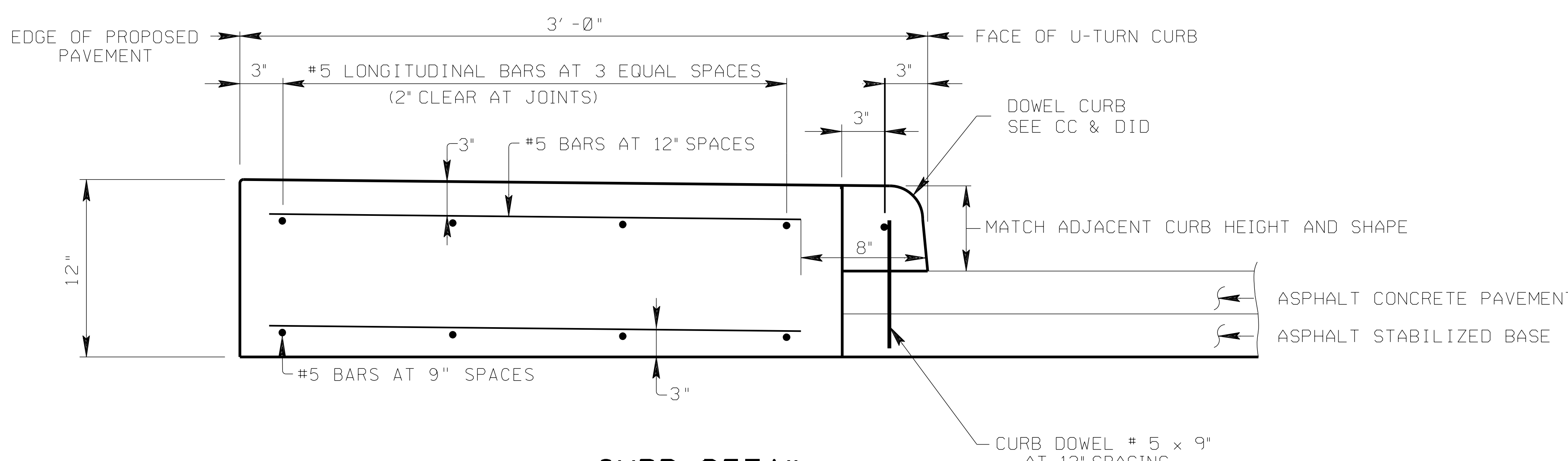
DATE: 07/24/2021 04:52 PM
FILE: DOCUMENT NAME

NOTE:

1. CURB MEASURED BY THE FOOT ALONG THE FACE OF THE CURB.
2. MOW STRIP PORTION OF CURB INCLUDES .093 CY OF CONCRETE PER LF OF CURB.



ELEVATION SLOTTED CURB



CURB DETAIL

STATE OF TEXAS
MICAH J. SCHLUTER
136908
LICENSED
PROFESSIONAL ENGINEER

Micah J. Schluter, P.E.
07.30.21

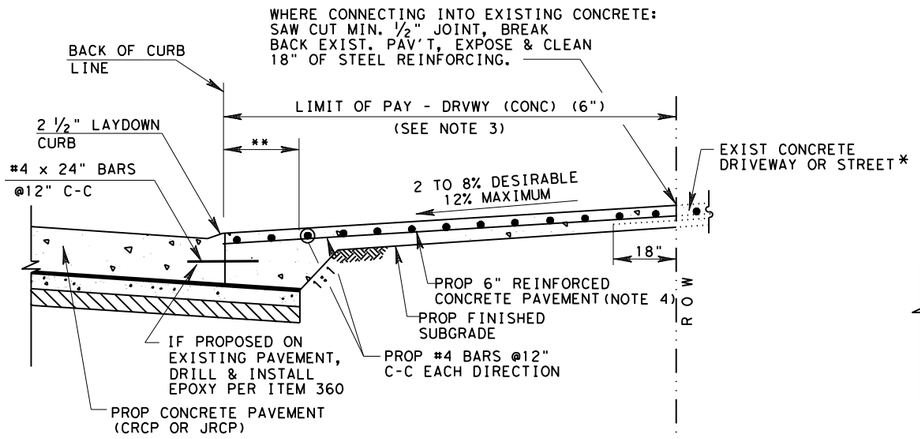
U-TURN CURB DETAIL

SHEET 1 OF 1

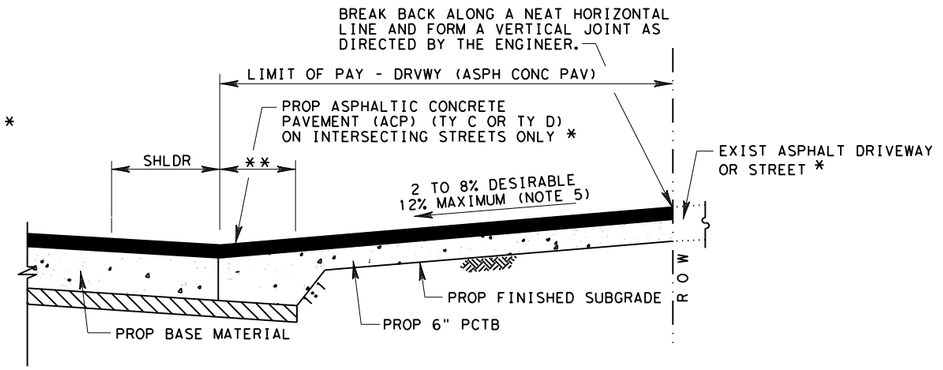
®2021

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		58



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

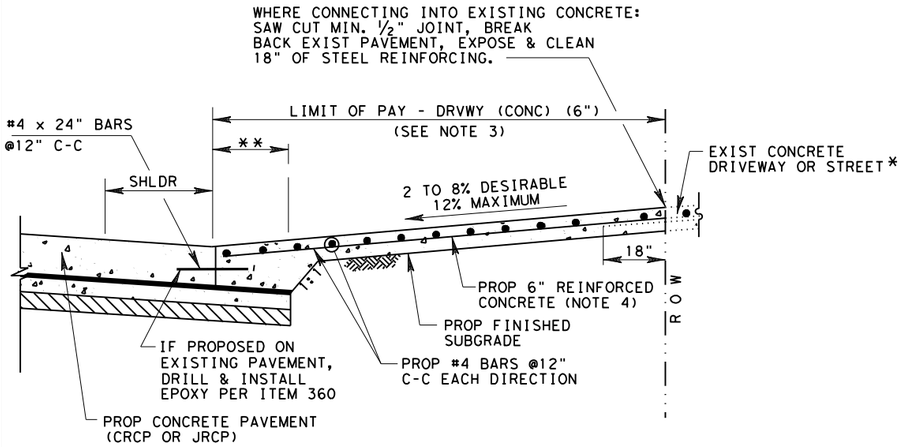
JRCP- JOINTED REINFORCED CONCRETE PAVEMENT

CRCP- CONTINUOUSLY REINFORCED CONCRETE PAVEMENT

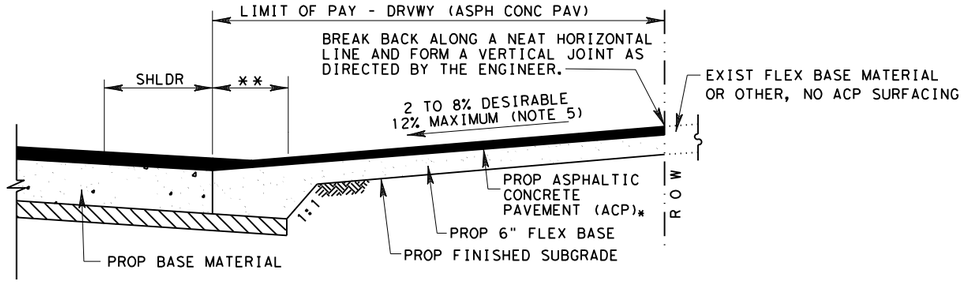
ACP- ASPHALTIC CONCRETE PAVEMENT

* 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

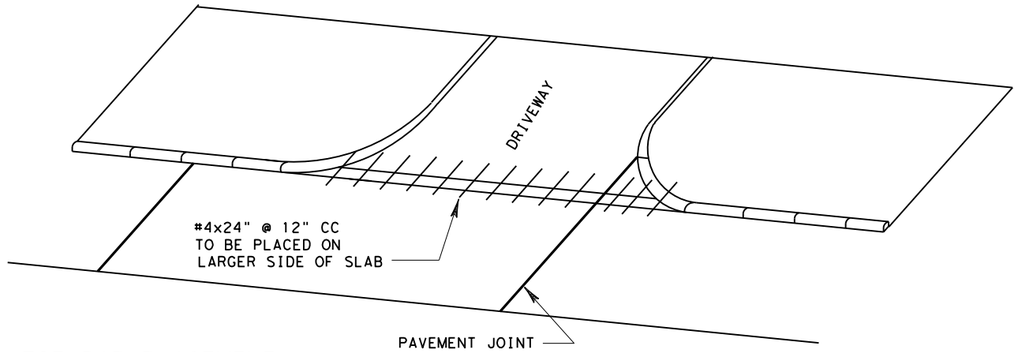
Texas Department of Transportation
Houston District

DRIVEWAY DETAILS

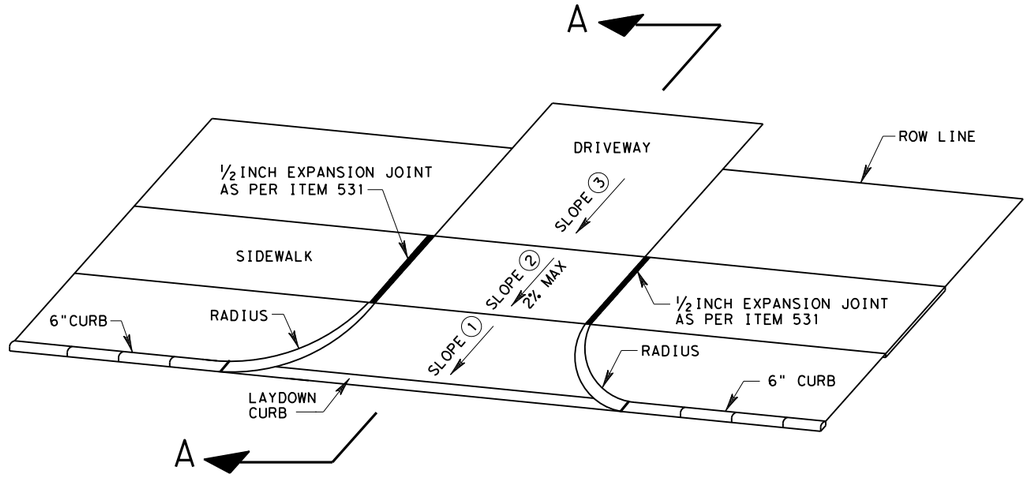
DD

FILE: STDB-8a.dgn	DN:	CK:	DW:	CK:	
© TxDOT SEPT. 2004	DIST	FED REG	PROJECT NO.		SHEET
REVISIONS	HOU	6			59
11/15 ADDED NOTE FOR PCTB	COUNTY		CONTROL	SECT	JOB	HIGHWAY
3/17 MODIFIED PAVEMENT SLOPES	MONTGOMERY		0177	14	037	SL 494

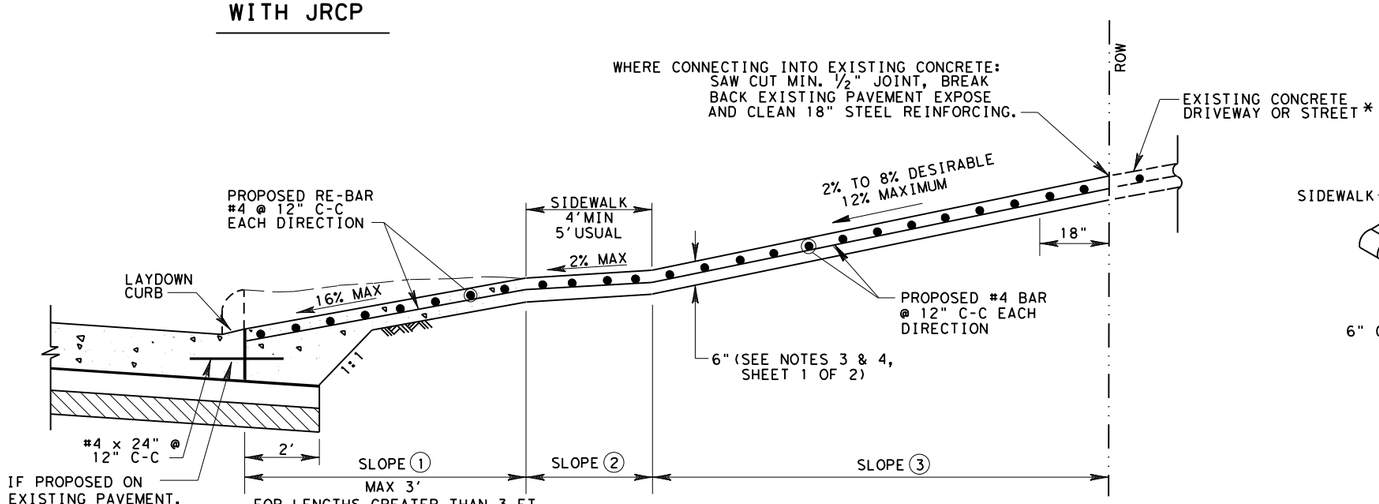
STDB8A



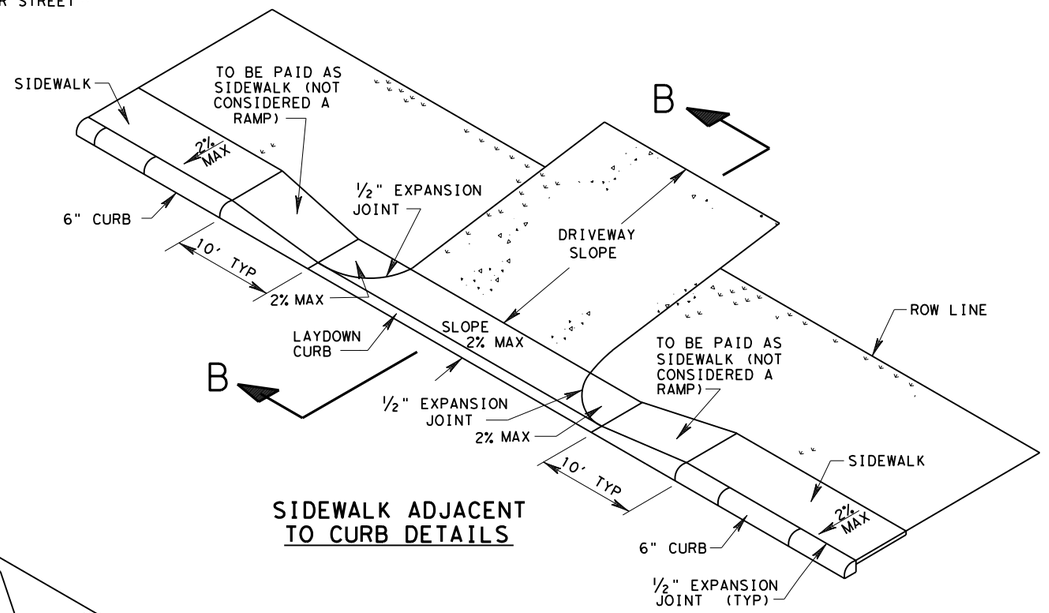
TIE BAR PLACEMENT WITH JRCP



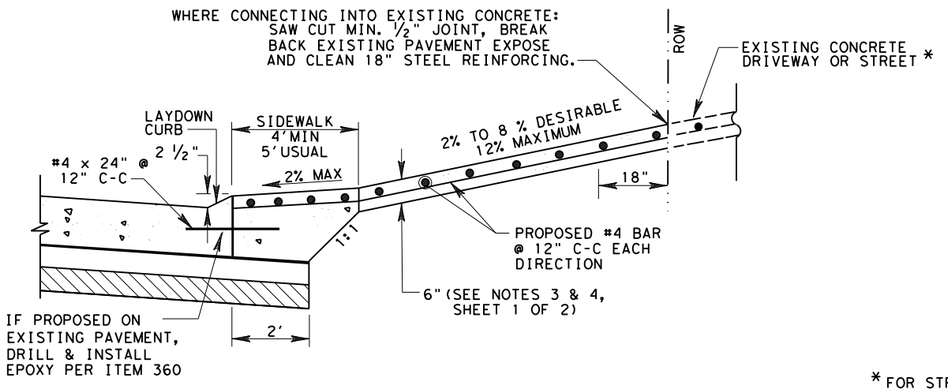
SIDEWALK OFFSET FROM CURB DETAILS



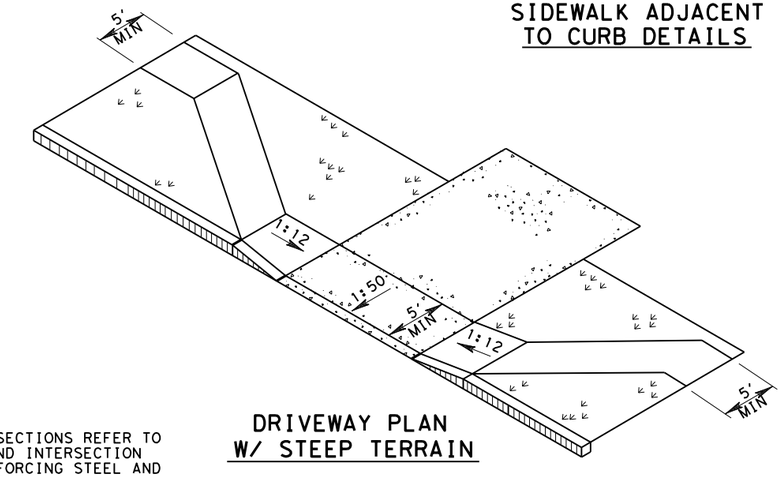
SLOPES W/ SIDEWALKS OFFSET FROM CURB (SECTION A-A)



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

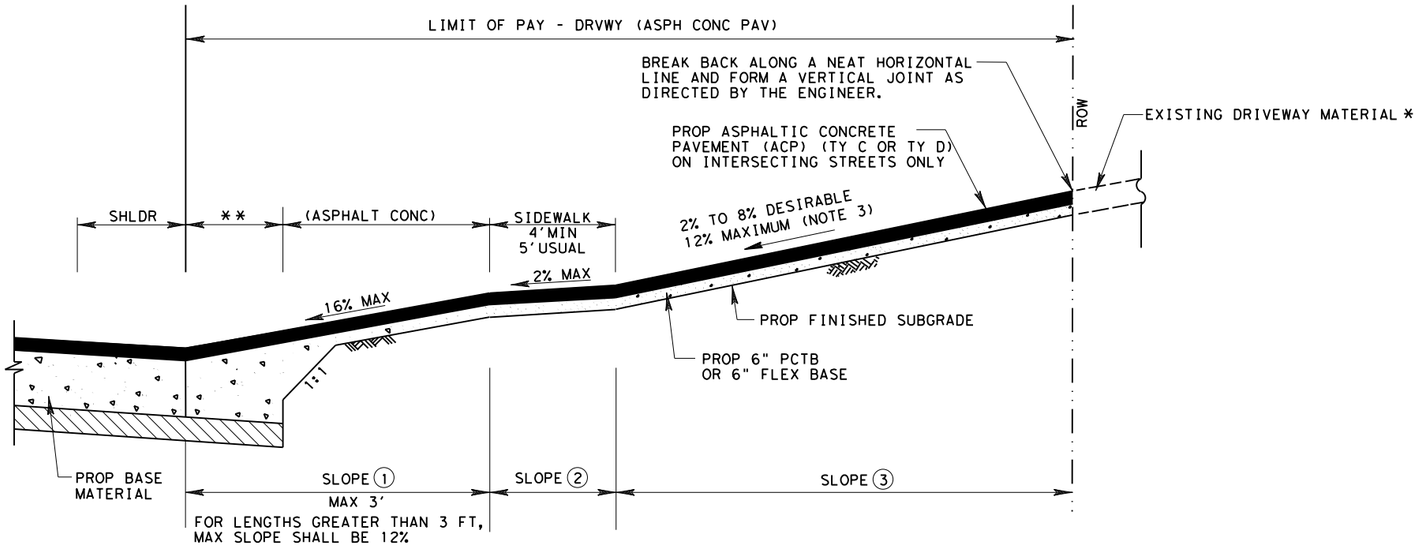
Texas Department of Transportation
Houston District

DRIVEWAY DETAILS

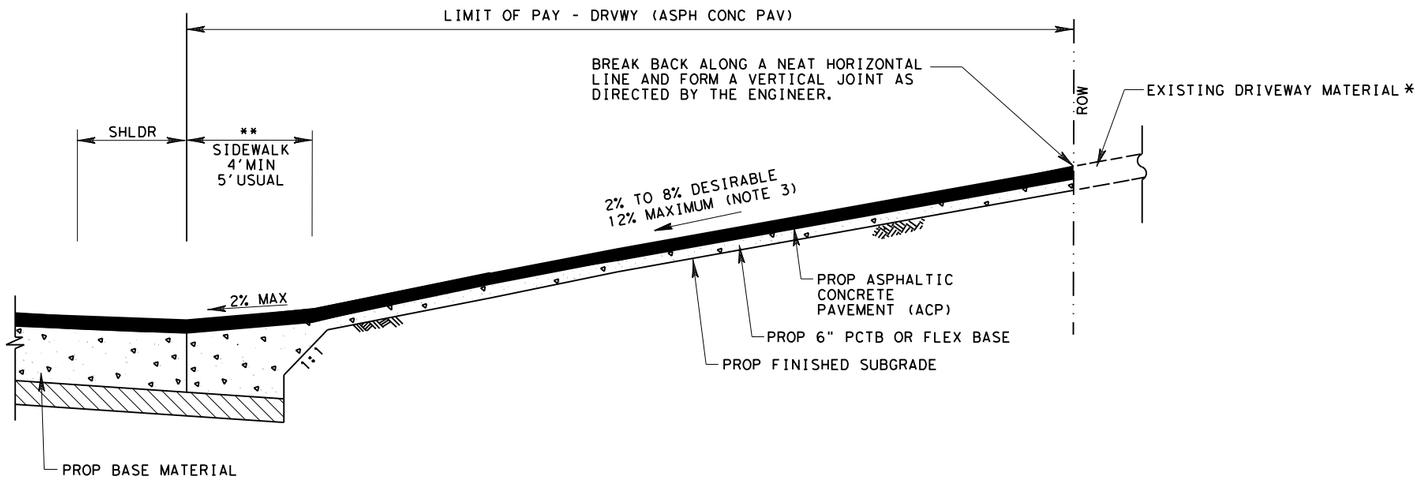
DD

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				60
	COUNTY		CONTROL	SECT	JOB	HIGHWAY
	MONTGOMERY		0177	14	037	SL 494

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

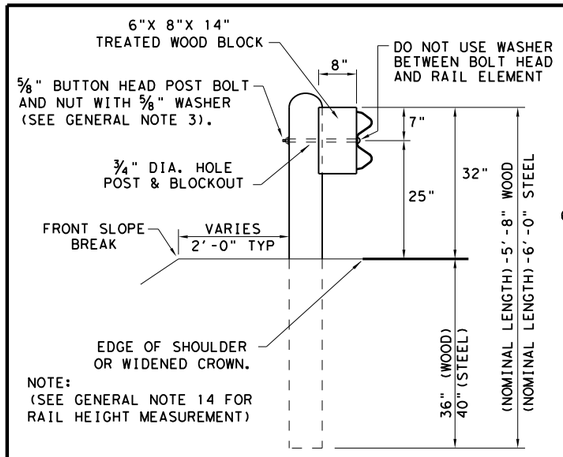
DRIVEWAY DETAILS

DD

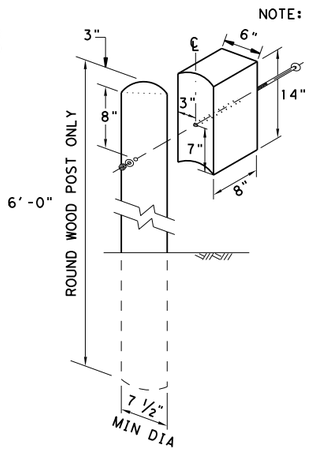
FILE: STDB-8c.dgn	DN:	CK:	DW:	CK:		
© TxDOT SEPT. 2004	DIST	FED REG	PROJECT NO.			SHEET
REVISIONS 11/15 ADDED NOTE FOR PCTB 3/17 MODIFIED PAVEMENT SLOPES	HOU	6				61
	COUNTY		CONTROL	SECT	JOB	HIGHWAY
	MONTGOMERY		0177	14	037	SL 494

STDB8C

DATE:
FILE:

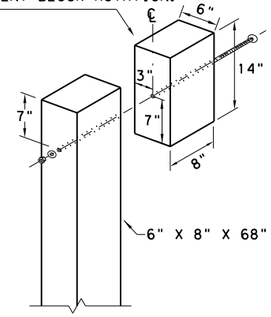


TYPICAL POST PLACEMENT

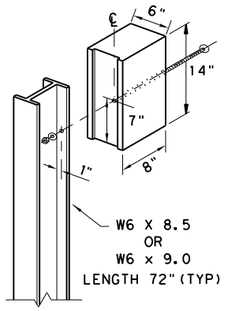


WOOD BLOCK TO ROUND WOOD POST

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

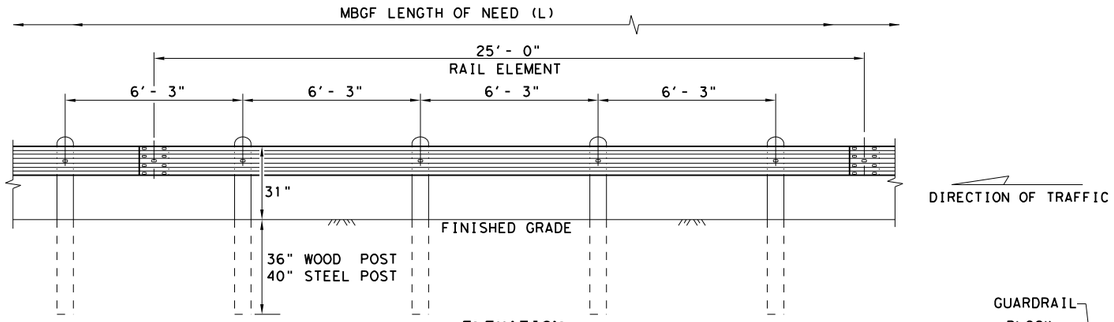


WOOD BLOCK TO RECTANGULAR WOOD POST



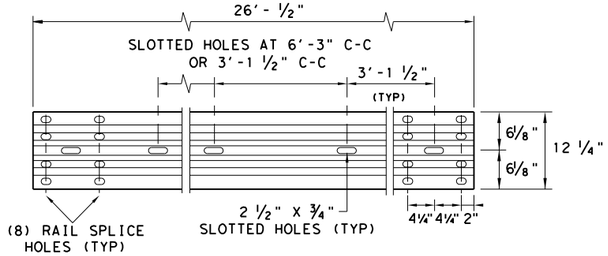
ROUTED WOOD BLOCK TO I-BEAM STEEL POST

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



ELEVATION
MID-SPAN RAIL SPLICE

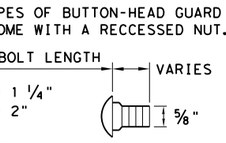
SHOWING A 25'- 0" SECTION OF W-BEAM RAIL. (SEE GENERAL NOTE 2)



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

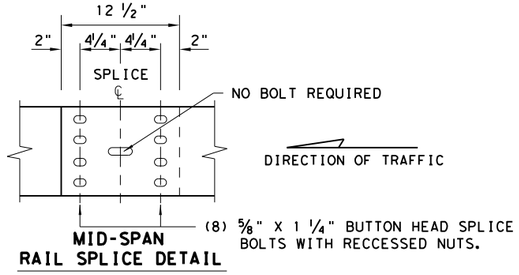
NOTES: SEE GENERAL NOTE 2 FOR ALLOWABLE RAIL TYPES.
SEE RAIL SPLICE DETAIL FOR REQUIRED HARDWARE.

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



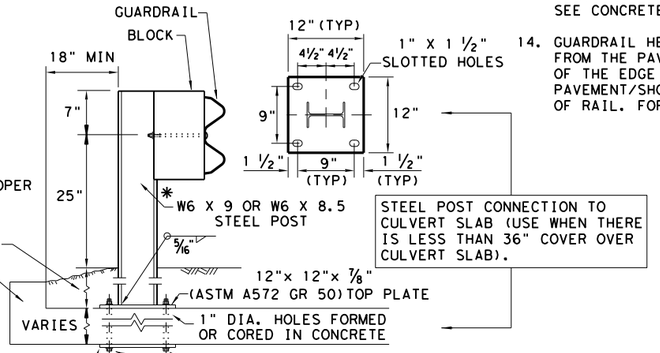
BUTTON HEAD BOLT

NOTE: SEE GENERAL NOTE 3 FOR SPLICE & POST BOLT DETAILS.



MID-SPAN RAIL SPLICE DETAIL

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



LOW FILL CULVERT POST

NOTE: TWO INSTALLATION OPTIONS.

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

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

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

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

GENERAL NOTES

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

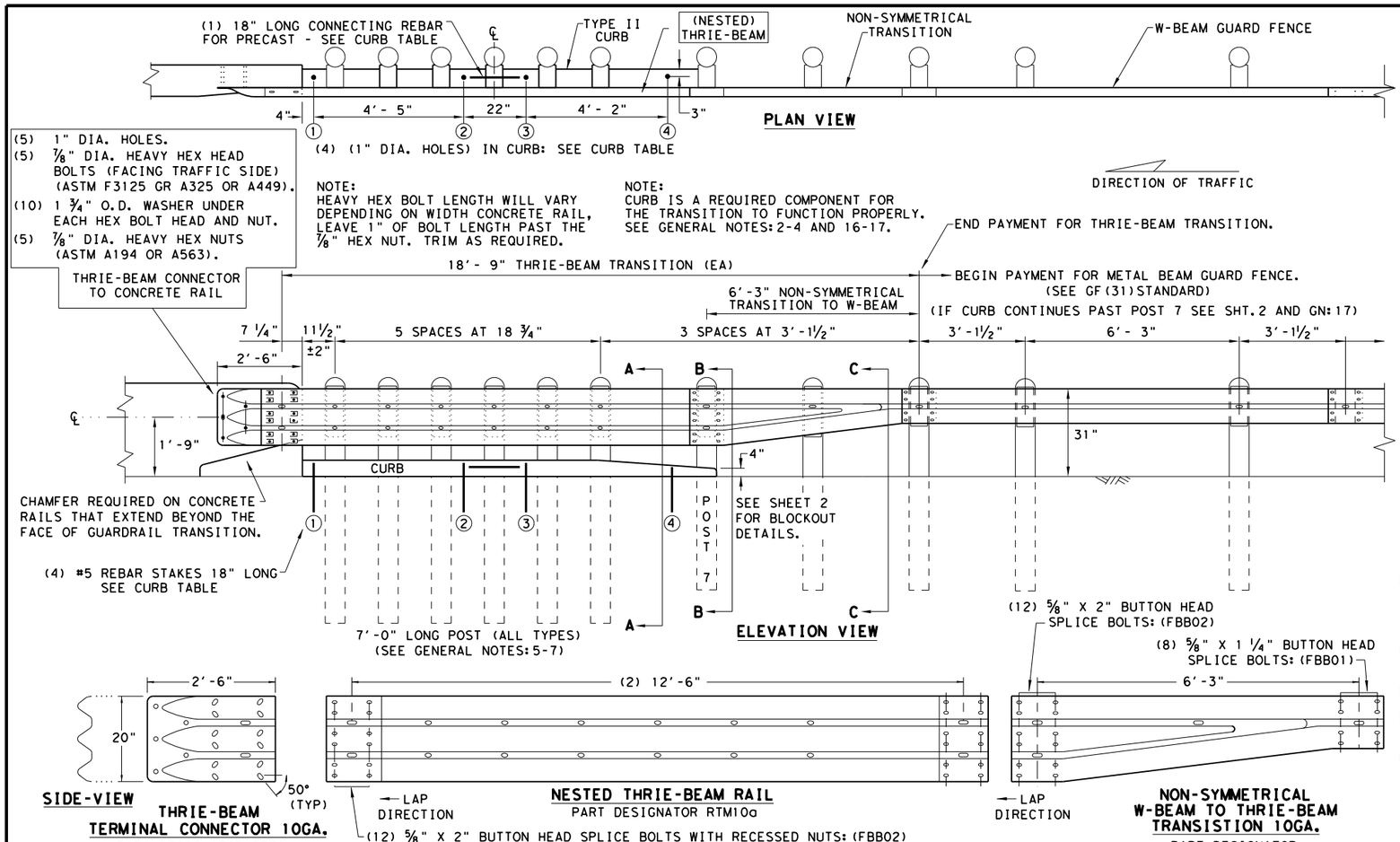
Texas Department of Transportation

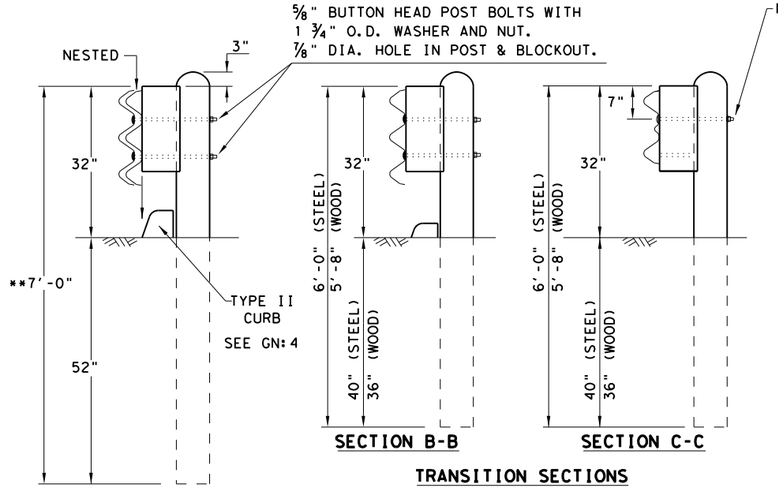
Design Division Standard

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

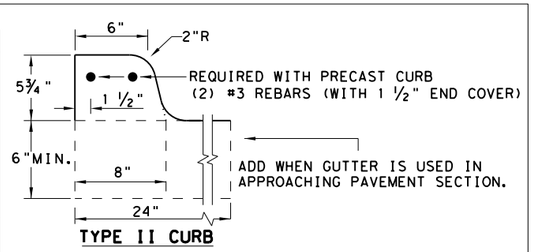
FILE: gf3119.dgn	DN: TxDOT	CK: KM	DW: VP	CK: CGL/AG	
©TxDOT: NOVEMBER 2019	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0177	14	037	SL 494	
	DIST	COUNTY		SHEET NO.	
	HOU	MONTGOMERY		62	

DATE:
FILE:





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

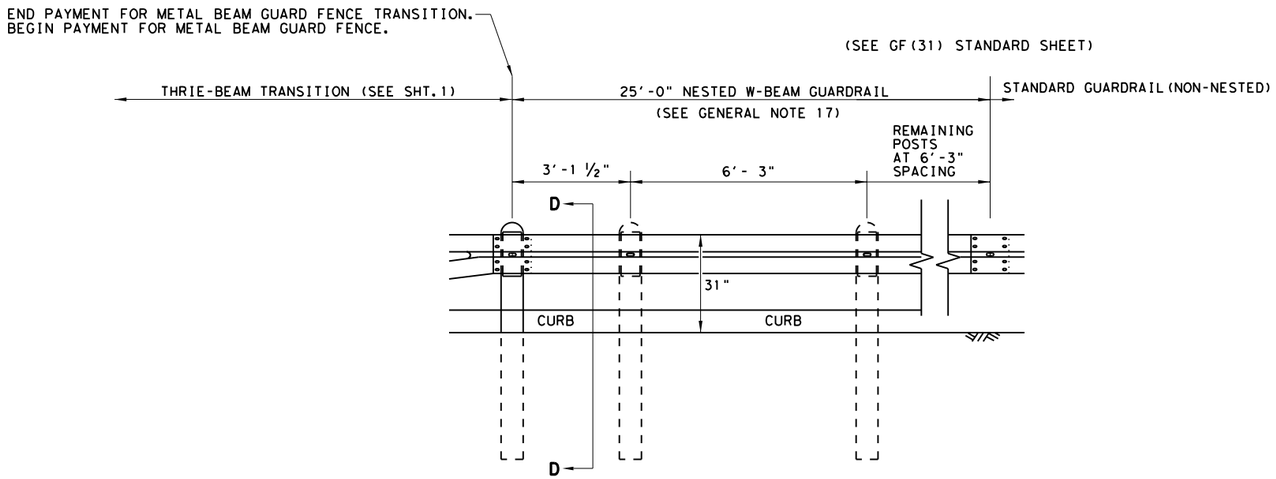
METAL BEAM GUARD FENCE THRIE-BEAM TRANSITION TL-3 MASH COMPLIANT

GF(31)TR TL3-20

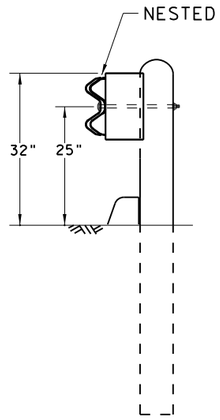
FILE: gf31trt1320.dgn	DN: TxDOT	CK: KM	DW: VP	CK: CGL/AG		
©TxDOT: NOVEMBER 2020	CONT	SECT	JOB	HIGHWAY		
REVISIONS	0177	14	037	SL 494		
	DIST	COUNTY		SHEET NO.		
	HOU	MONTGOMERY		63		

DATE:
FILE:

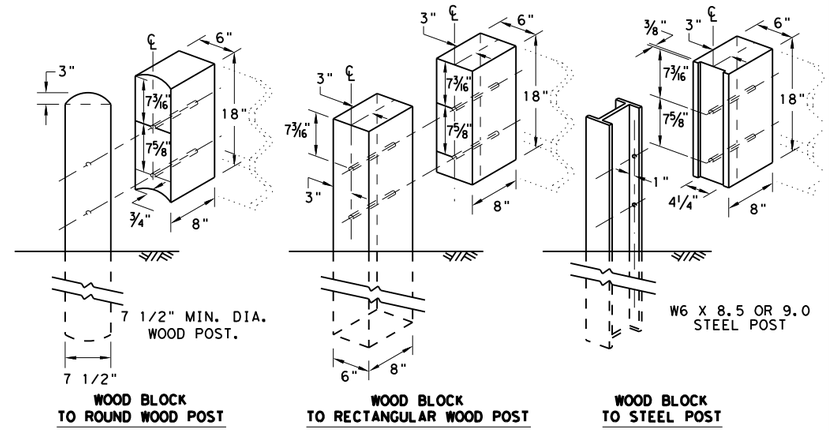
REQUIRED ALTERNATIVE FOR CONTINUOUS CURB EXTENDING PAST POST 7 (SEE SHT. 1 GENERAL NOTE 17)



ELEVATION VIEW



SECTION D-D



THRIE BEAM TRANSITION BLOCKOUT DETAILS

HIGH-SPEED TRANSITION

SHEET 2 OF 2

Texas Department of Transportation | Design Division Standard

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

GF(31)TR TL3-20

FILE: gf31tr1320.dgn	DN: TxDOT	CK: KM	DW: KM	CK: CGL/AG	
©TxDOT: NOVEMBER 2020	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0177	14	037	SL 494	
	DIST	COUNTY		SHEET NO.	
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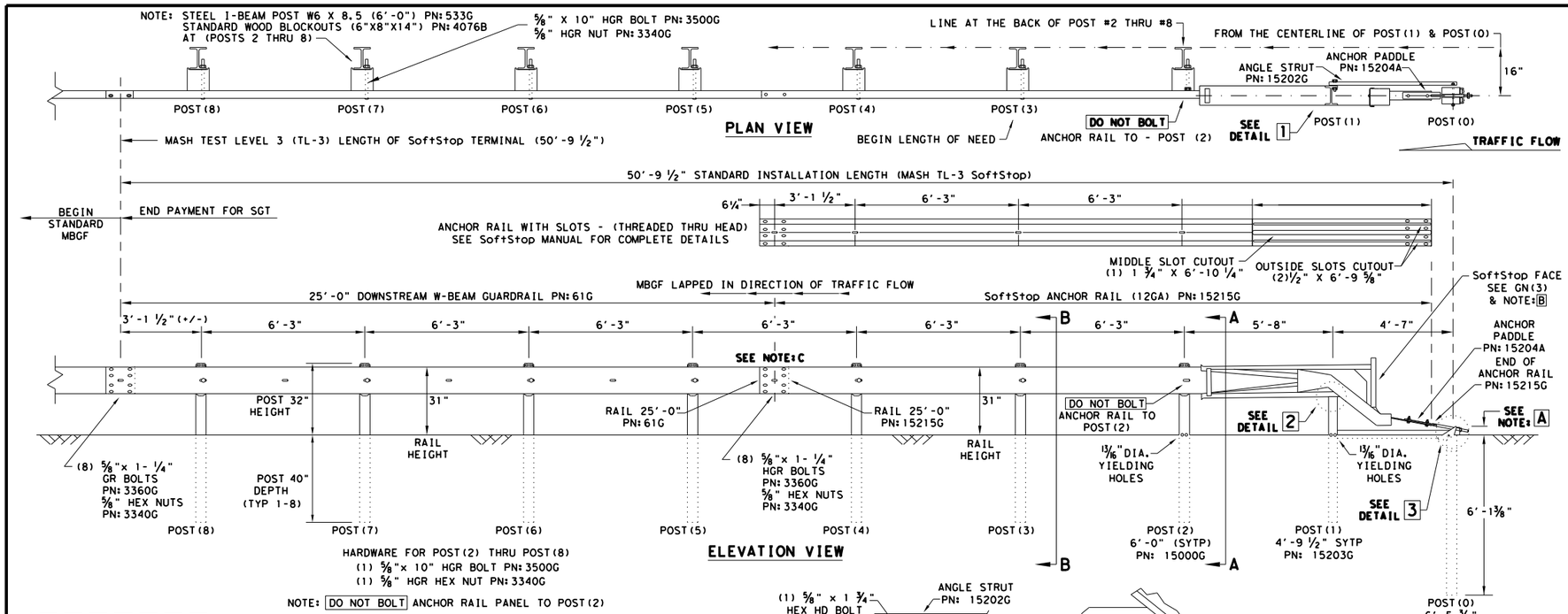

GENERAL NOTES

1. FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: TRINITY HIGHWAY AT 1(888)323-6374. 2525 N. STEMMONS FREEWAY, DALLAS, TX 75207
2. FOR INSTALLATION, REPAIR AND MAINTENANCE REFER TO THE; SoftStop END TERMINAL, PRODUCT DESCRIPTION ASSEMBLY MANUAL. PN: 620237B
3. APPLY HIGH INTENSITY REFLECTIVE SHEETING, "OBJECT MARKER" ON THE FRONT FACE OF THE DEVICE PER MANUFACTURER'S RECOMMENDATIONS. OBJECT MARKER SHALL CONFORM TO THE STANDARDS REQUIRED IN TEXAS MUTCD.
4. FOR POST (LEAVE-OUT) INSTALLATION AND GUIDANCE SEE TXDOT'S LATEST ROADWAY MOW STRIP STANDARD.
5. HARDWARE (BOLTS, NUTS, & WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING". FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
6. A COMPOSITE MATERIAL BLOCKOUT THAT MEETS THE REQUIREMENTS OF DMS-7210, MAY BE SUBSTITUTED FOR BLOCKOUTS OF SIMILAR DIMENSIONS. SEE CONSTRUCTION DIVISION MATERIAL PRODUCER LIST (MPL) FOR CERTIFIED PRODUCERS.
7. IF SOLID ROCK IS ENCOUNTERED SEE THE MANUFACTURER'S INSTALLATION MANUAL AND REFER TO THE LATEST ROADWAY MBGF STANDARD FOR INSTALLATION GUIDANCE.
8. POSTS SHALL NOT BE SET IN CONCRETE.
9. IT IS ACCEPTABLE TO INSTALL THE SoftStop IMPACT HEAD PARALLEL TO THE GRADE LINE OR WITH AN UPWARD TILT.
10. DO NOT ATTACH THE SoftStop SYSTEM DIRECTLY TO A RIGID BARRIER.
11. UNDER NO CIRCUMSTANCES SHALL THE GUARDRAIL WITHIN THE SoftStop SYSTEM BE CURVED.
12. A FLARE RATE OF UP TO 25:1 MAY BE USED TO PREVENT THE TERMINAL HEAD FROM ENCROACHING ON THE SHOULDER. THE FLARE MAY BE DECREASED OR ELIMINATED FOR SPECIFIC INSTALLATIONS, IF DIRECTED BY THE ENGINEER.

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

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

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

Texas Department of Transportation

Design Division Standard

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

FILE: sgt10s3116	DN: TxDOT	CK: KM	DW: VP	CK: MB/VP		
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY		
REVISIONS	0177	14	037	SL 494		
	DIST	COUNTY		SHEET NO.		
	HOU	MONTGOMERY		65		

DATE:
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(SEE GN NOTE 15)
STANDARD 31" MBGF

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

FIELD-SIDE
(RAIL 3)

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

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

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

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

ITEM (10)
CABLE ASSEMBLY

ITEM (2)
GROUNDSTRUT

NO BLOCKOUT
AT (POST 1)

RAIL 4 RAIL 3 RAIL 2 RAIL 1

CABLES

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

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

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

PLAN VIEW

MBGF RAIL 2

INSTALL GUARD FENCE RECESSED HEX NUTS ON TRAFFIC-SIDE

MBGF RAIL 1

DETAIL (C)

TRAFFIC FLOW

END PAYMENT (SGT) BY EACH

DO NOT BOLT
RAIL TO POST 6

BEGIN LENGTH OF NEED

INSTALLATION LENGTH 55'- ½"

49'-8 ⅝"

6'-3" 6'-3" 6'-3" 6'- ¾" 6'-3" 6'-3" 6'-3" 37 ½" 5'-3 ⅜"

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

RAIL HEIGHT 31"

ARROWS

RAIL HEIGHT 31"

HEAD HEIGHT

DETAIL (B)

32-¼"

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

DETAIL (D)

CABLES

FINISHED GRADE FINISHED GRADE

ITEM (10)
CABLE ASSEMBLY

ITEM (2)
GROUNDSTRUT

68-⅛"

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

ITEM (4)
I-BEAM
W6 X 9

NO BLOCKOUT
AT (POST 1)

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

ELEVATION VIEW

SOIL ANCHOR POST
ITEM (1)

A

A

TSS PANEL
GALVANIZED
ITEM (5)

RSS PLATE
GALVANIZED
ITEM (8)

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

TSS PANEL AND RSS PLATE

DETAIL (D)

HEAD HEIGHT 32-¼"

TOP OF POST

31-⅞"

FINISHED GRADE

40-⅛"

68-⅛"
ANCHOR POST
DEPTH

ITEM (1)
ANCHOR

ITEM (11)
LINE POSTS
2 THRU 9
(NOTE: ITEM (4) POST 1 (NOT SHOWN), TO BE INSTALLED AT SAME DEPTH AS LINE POSTS.)

SOIL ANCHOR, POST 1 & LINE POST 2 THRU 9

SECTION VIEW A-A

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

7 ⅝"

2 ⅛"

UPPER CABLE
(BACK SIDE)

LOWER CABLE
(TRAFFIC SIDE)

DETAIL (B)

CABLE
FRICTION PLATE
HEAD UNIT
ITEM (9)

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

ITEM (24)

ITEM (21)

ITEM (20)
8X

ITEM (17)
8X

ITEM (23)
6X
3 SCREWS
EACH SIDE

(RAIL 1)

ITEM (22)
BRACKET
SHIPPED FLAT

ITEM (3)

ITEM (16)
4X

✱ ITEM (25)
HIGH INTENSITY
REFLECTIVE SHEETING

NOTE: DELINEATION MARKER IN ACCORDANCE WITH TEXAS MUTCD.

SPLICE FOR IMPACT-HEAD TO GUARD FENCE (RAIL1)

DETAIL (A)

✱ TO BE PROVIDED BY DISTRIBUTOR OR CONTRACTOR.

✱✱ ALTERNATIVE ITEMS NOT SHOWN.
ITEM(26) 8" WOOD-BLOCKOUTS
ITEM(27) 25'GUARD FENCE PANELS

STANDARD
MBGF

APPROX 5'-10"

5'-0"

50' APPROACH GRADING

2'-0"

EDGE OF PAVEMENT

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

2'-0" MAX.
RAIL OFFSET

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

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

APPROACH GRADING AT GUARDRAIL END TREATMENTS

TRAFFIC FLOW

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

GENERAL NOTES

1. FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: 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

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
REVISIONS	0177	14	037	SL 494
	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY		66

DATE:
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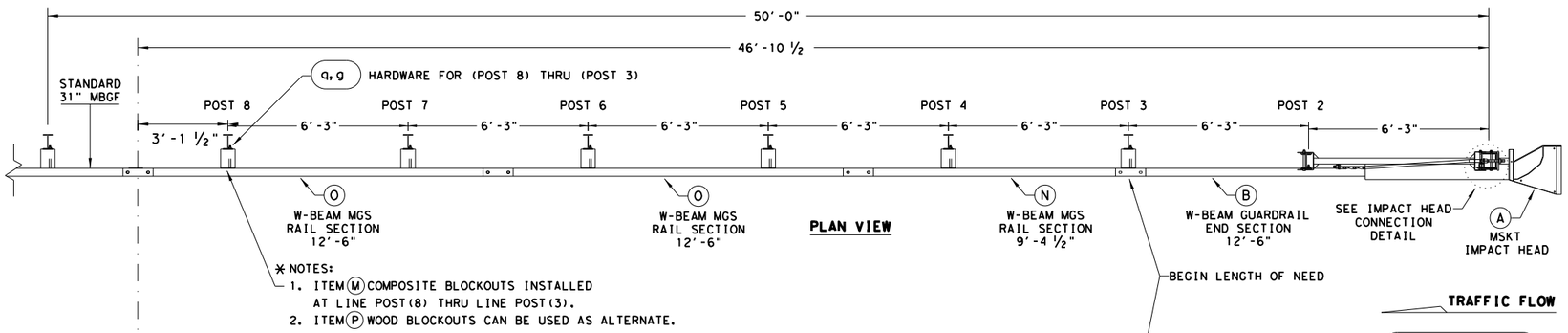
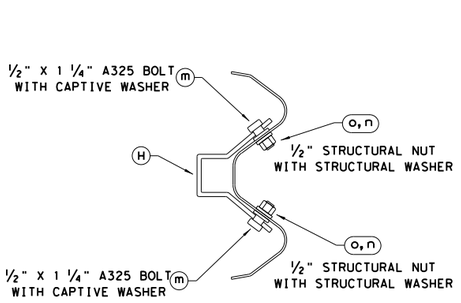
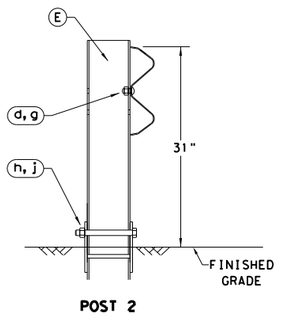


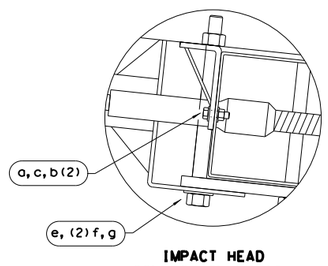
NOTE: SEE (GENERAL NOTE 14) FOR DRIVING CAP INFORMATION.



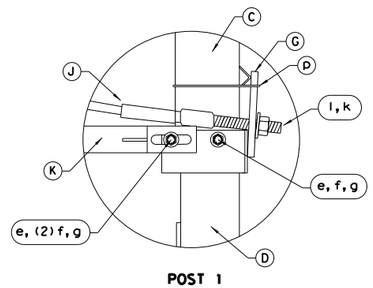
SECTION B-B
ANCHOR BRACKET



POST 2
SECTION A-A



IMPACT HEAD
CONNECTION DETAIL



POST 1
CONNECTION DETAIL

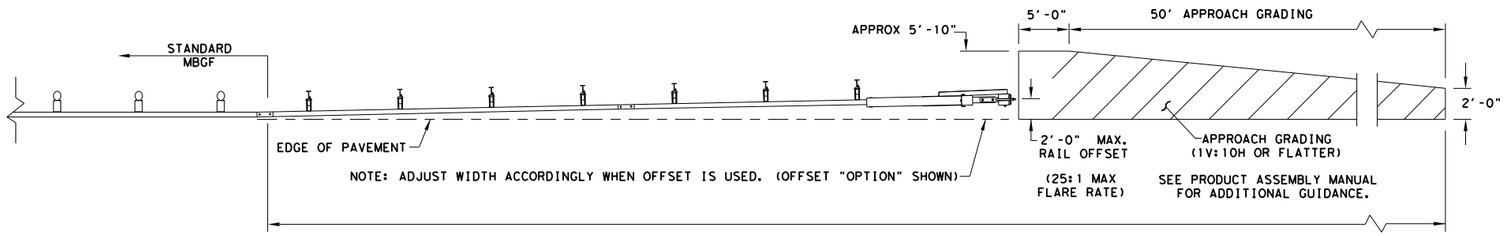
SEE NOTES: *

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

GENERAL NOTES

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

ITEM	QTY	MAIN SYSTEM COMPONENTS	ITEM NUMBERS
A	1	MSKT IMPACT HEAD	MS3000
B	1	W-BEAM GUARDRAIL END SECTION, 12 Ga.	SF1303
C	1	POST 1 - TOP (6" X 6" X ⅛" TUBE)	MTPHP1A
D	1	POST 1 - BOTTOM (6' W6X15)	MTPHP1B
E	1	POST 2 - ASSEMBLY TOP	UHP2A
F	1	POST 2 - ASSEMBLY BOTTOM (6' W6X9)	HP2B
G	1	BEARING PLATE	E750
H	1	CABLE ANCHOR BOX	S760
J	1	BCT CABLE ANCHOR ASSEMBLY	E770
K	1	GROUND STRUT	MS785
L	6	W6x9 OR W6x8.5 STEEL POST	P621
M	6	COMPOSITE BLOCKOUTS	CBSP-14
N	1	W-BEAM MGS RAIL SECTION (9'-4 ½")	G12025
O	2	W-BEAM MGS RAIL SECTION (12'-6")	G1203A
P	6	WOOD BLOCKOUT 6" X 8" X 14"	P675
Q	1	W-BEAM MGS RAIL SECTION (25'-0")	G1209
		SMALL HARDWARE	
a	2	⅝" x 1" HEX BOLT (GRD 5)	B5160104A
b	4	⅝" WASHER	W0516
c	2	⅝" HEX NUT	N0516
d	25	⅝" Dia. x 1 ¼" SPLICE BOLT (POST 2)	B580122
e	2	⅝" Dia. x 9" HEX BOLT (GRD A449)	B580904A
f	3	⅝" WASHER	W050
g	33	⅝" Dia. H.G.R NUT	N050
h	1	¾" Dia. x 8 ½" HEX BOLT (GRD A449)	B340854A
j	1	¾" Dia. HEX NUT	N030
k	2	1 ANCHOR CABLE HEX NUT	N100
l	2	1 ANCHOR CABLE WASHER	W100
m	8	½" x 1 ¼" A325 BOLT WITH CAPTIVE WASHER	SB12A
n	8	½" STRUCTURAL NUTS	N012A
o	8	1 1/16" O.D. x 9/16" I.D. STRUCTURAL WASHERS	W012A
p	1	BEARING PLATE RETAINER TIE	CT-100ST
q	6	⅝" x 10" H.G.R. BOLT	B581002
r	1	OBJECT MARKER 18" X 18"	E3151



APPROACH GRADING AT GUARDRAIL END TREATMENTS

TRAFFIC FLOW

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

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

Texas Department of Transportation

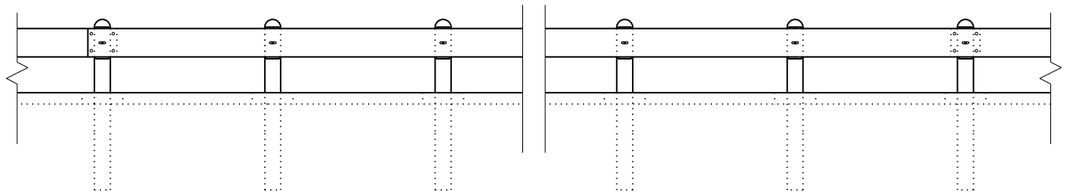
Design Division Standard

SINGLE GUARDRAIL TERMINAL

MSKT-MASH-TL-3

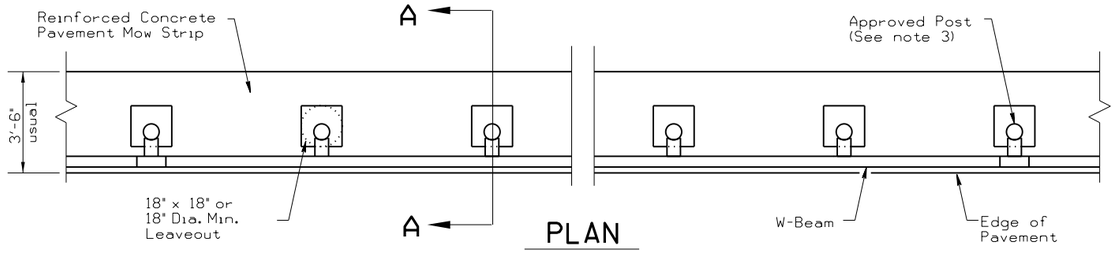
SGT(12S)31-18

FILE: sgt12s3118.dgn	DN: TxDOT	CK: KM	DW: VP	CK: CL	
© TxDOT: APRIL 2018	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0177	14	037	SL 494	
	DIST	COUNTY		SHEET NO.	
	HOU	MONTGOMERY		67	



ELEVATION

TRAFFIC



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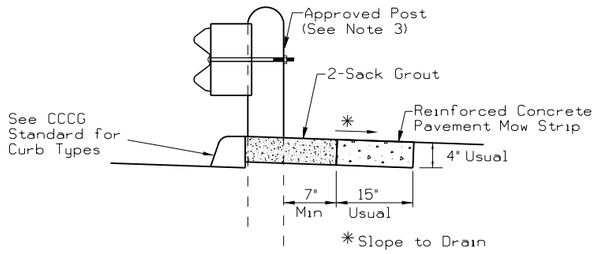
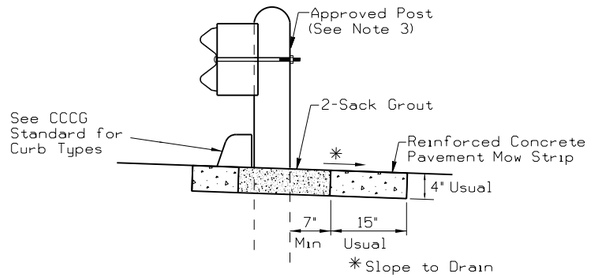


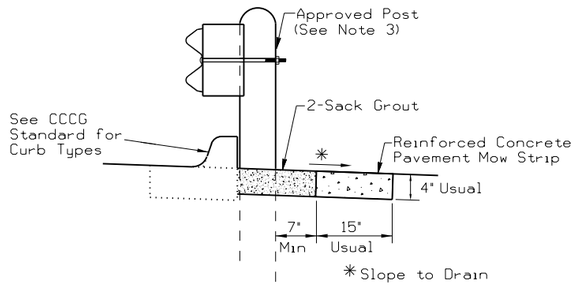
CURB OPTION (1)

Shown at Curbed Location

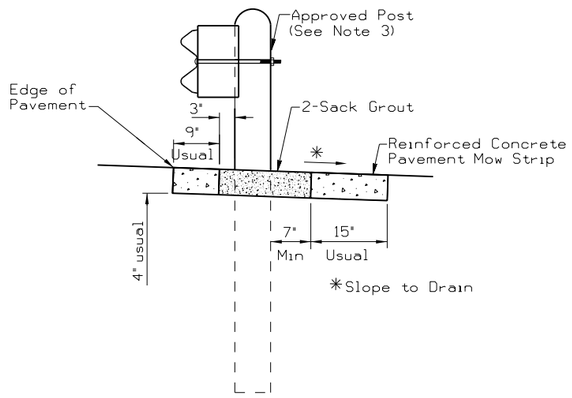


CURB OPTION (2)

Curb Shown on Top of Mow Strip

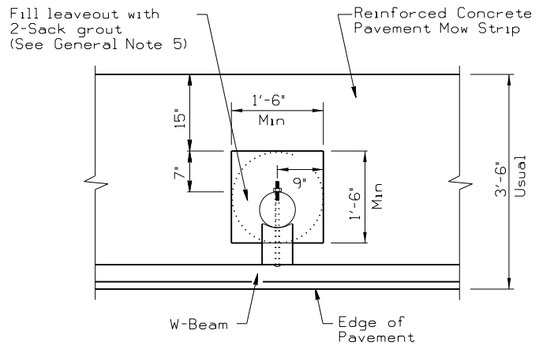


CURB OPTION (3)



SECTION A-A

Typical



MOW STRIP DETAIL

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

GENERAL NOTES

1. Place concrete riprap mow strips at all Metal Beam Guard Fence locations, and in accordance with Item 432, "Riprap". Use Class B Concrete, reinforced with No. 3 bars spaced at 18 in. centers each direction and 2 in. below the surface.
2. Provide a minimum of 7 in. leave out behind the post. Do not place concrete in the leave out.
3. The type of approved post is shown elsewhere on the plans. See the applicable standard sheets for additional details and information.
4. Other curb placement options may be used. Curbs are not considered part of the mow strip and are paid for under other pertinent bid items.
5. Fill the leave outs with no more than a 2-sack grout mixture and place in accordance with Section 421.2.7, ""Mortar and Grout." Payment for furnishing and placing the grout mixture is subsidiary to the Item 432, "RIPRAP."
6. Place the mow strip the entire length of the guard fence plus any Terminal Anchor Section (TAS) or Single Guardrail Terminal (SGT) to 2 ft. beyond the face of the object marker at the end of the SGT. Do not allow concrete to adhere to the ground line strut shown on the SGT standard sheet.

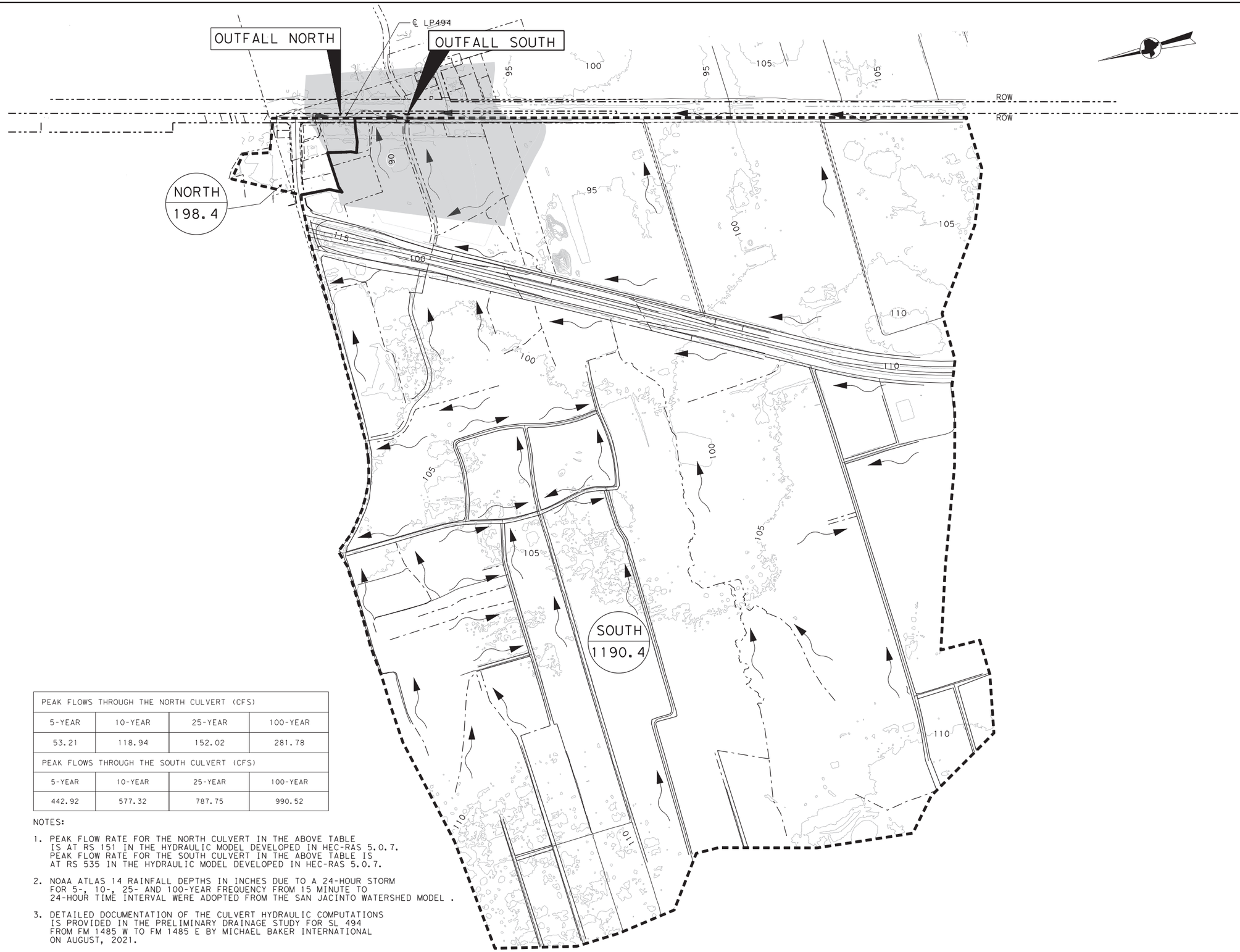
Texas Department of Transportation
Houston District

MOW STRIP

MS

FILE:	DN:	CK:	DW:	CK:	
© TxDOT 2014	DIST	FED REG	PROJECT NO.		SHEET
REVISIONS	HOU	6			68
03/15 2014 SPECS	COUNTY		CONTROL	SECT	JOB	HIGHWAY
	MONTGOMERY		Ø177	14	Ø37	SL494

STDE5.DGN



LEGEND

- ℄ PROPOSED DITCH/FLOWLINE
- DRAINAGE AREA BOUNDARY
- DIRECTION OF FLOW
- ID / 000 — DRAINAGE AREA ID / DRAINAGE AREA ACREAGE
- 110 — 5' CONTOURS
- 100 YEAR FLOODPLAIN
- FLOWPATH
- ROW LINE

0' 500' 1000'
SCALE IN FEET

PEAK FLOWS THROUGH THE NORTH CULVERT (CFS)			
5-YEAR	10-YEAR	25-YEAR	100-YEAR
53.21	118.94	152.02	281.78
PEAK FLOWS THROUGH THE SOUTH CULVERT (CFS)			
5-YEAR	10-YEAR	25-YEAR	100-YEAR
442.92	577.32	787.75	990.52

NOTES:

1. PEAK FLOW RATE FOR THE NORTH CULVERT IN THE ABOVE TABLE IS AT RS 151 IN THE HYDRAULIC MODEL DEVELOPED IN HEC-RAS 5.0.7. PEAK FLOW RATE FOR THE SOUTH CULVERT IN THE ABOVE TABLE IS AT RS 535 IN THE HYDRAULIC MODEL DEVELOPED IN HEC-RAS 5.0.7.
2. NOAA ATLAS 14 RAINFALL DEPTHS IN INCHES DUE TO A 24-HOUR STORM FOR 5-, 10-, 25- AND 100-YEAR FREQUENCY FROM 15 MINUTE TO 24-HOUR TIME INTERVAL WERE ADOPTED FROM THE SAN JACINTO WATERSHED MODEL .
3. DETAILED DOCUMENTATION OF THE CULVERT HYDRAULIC COMPUTATIONS IS PROVIDED IN THE PRELIMINARY DRAINAGE STUDY FOR SL 494 FROM FM 1485 W TO FM 1485 E BY MICHAEL BAKER INTERNATIONAL ON AUGUST, 2021.

NO	DATE	REVISION	APPROVED

STATE OF TEXAS
THOMAS POULOSE
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PROFESSIONAL ENGINEER
08/04/2021
F-2677

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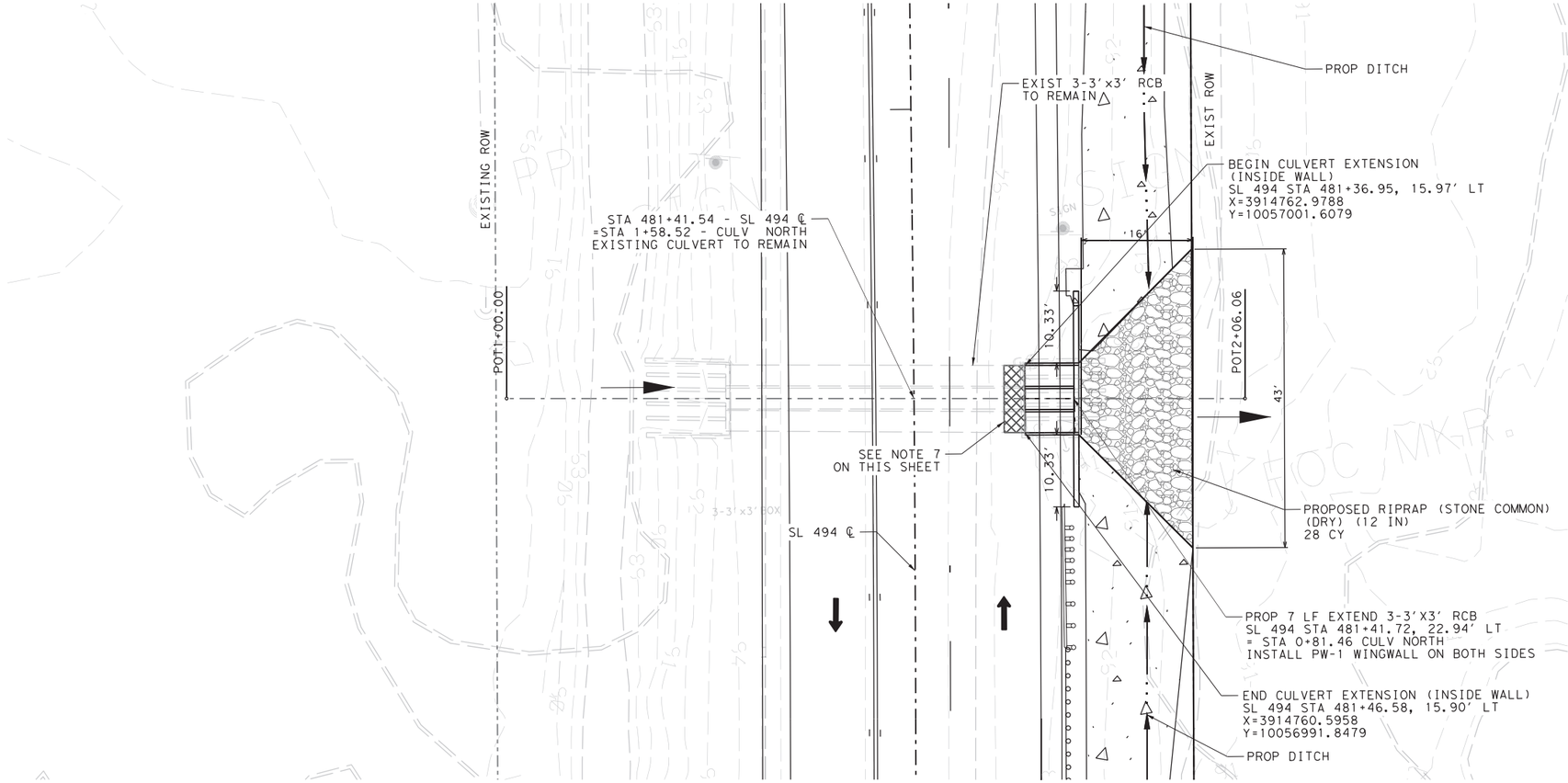
Suite 325
Katy, TX 77449
TBPE Registration No. 2677

SL 494 AT FM 1485 DRAINAGE AREA MAP

SHEET 1 OF 1

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		69

STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY	
CONT.	SECT.	JOB	HIGHWAY NO.
0177	14	037	SL 494

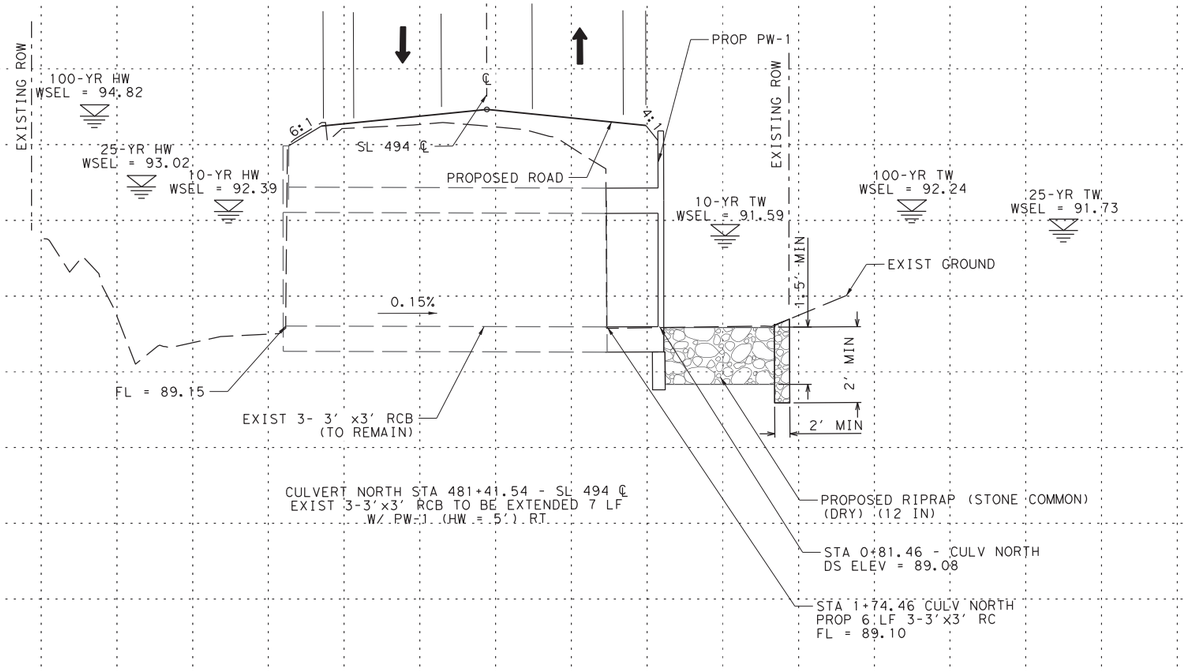


NOTES:

1. THE NORTH CULVERT WAS MODELED IN HEC-RAS VERSION 5.0.7.
2. THE HEC-RAS MODEL IS BASED ON GIS LIDAR AND TOPOGRAPHICAL SURVEY DATA IN NORTH AMERICAL VERTICAL DATUM OF 1988 (NAVD 88).
3. TAILWATER ELEVATIONS WERE DETERMINED BY A NORMAL DEPTH COMPUTATION USING A CHANNEL BED SLOPE OF 0.0065 FT/FT.
4. ALL RISES IN THE WATER SURFACE ELEVATIONS ARE CONTAINED WITHIN THE RIGHT OF WAY.
5. THE ALLOWABLE HEADWATER FOR NORTH CULVERT CARRYING SL 494 OVER CANEY CREEK TRIBUTARY 1 IS 94.87 FT.
6. SEE DRAINAGE PLAN AND PROFILE SHEETS FOR PROPOSED DITCH INFORMATION.
7. BREAK BACK EXISTING NORTH CULVERT 3 FEET,KEEPING EXISTING REINFORCEMENT INTACT, AND EXTEND IN ACCORDANCE WITH SECTION 420.4.8 OF TXDOT SPECIFICATIONS.
8. SEE TRAFFIC CONTROL PLANS FOR TEMPORARY PAVEMENT EXTENTS.
9. SLAB THICKNESS OF THE EXISTING CULVERT AND THE PROPOSED LENGTHENING SHOWN IN THIS PLAN SHEET IS PER CURRENT STANDARD MC-3-23. THE CONTRACTOR SHALL FIELD-VERIFY THE ACTUAL THICKNESS OF THE EXISTING CULVERT PRIOR TO THE CONSTRUCTION OF THE EXTENSIONS.

HORIZ. SCALE IN FEET
0′ 10′ 20′
0′ 2′ 4′
VERT. SCALE IN FEET

DESIGN YEAR	10	25	100
HW (FT)	92.39	93.02	94.82
TW (FT)	91.59	91.73	92.24
OUTLET VELOCITY (FT/S)	5.48	6.79	9.39
PEAK DISCHARGE (CFS)	119	152	251



NO	DATE	REVISION	APPROVED

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PROFESSIONAL ENGINEER
01/26/2021
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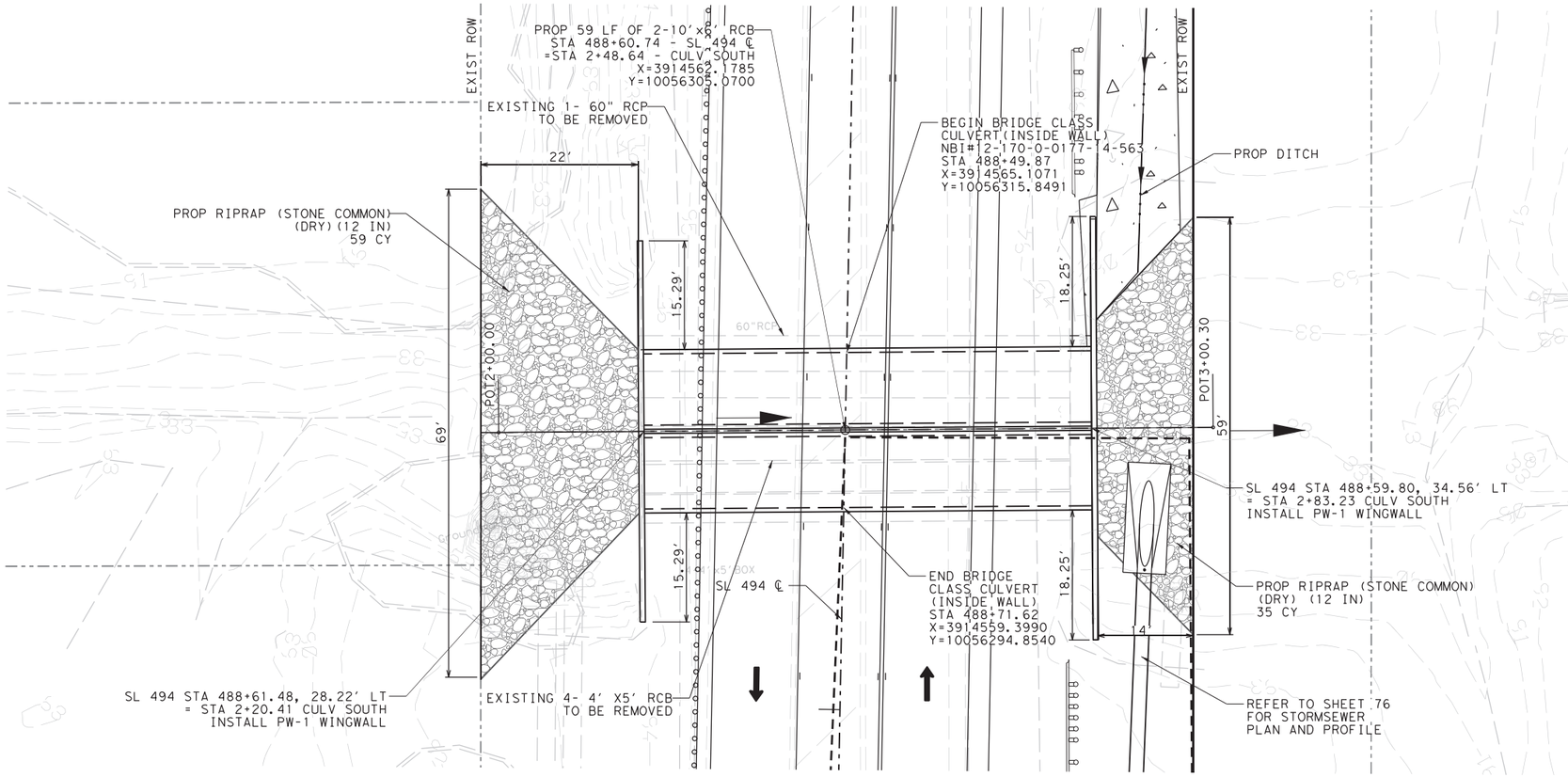
SL 494 AT FM 1485 CROSS CULVERT LAYOUT CULVERT NORTH

SHEET 1 OF 1

FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
6		70

STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY	
CONT.	SECT.	JOB	HIGHWAY NO.
0177	14	037	SL 494

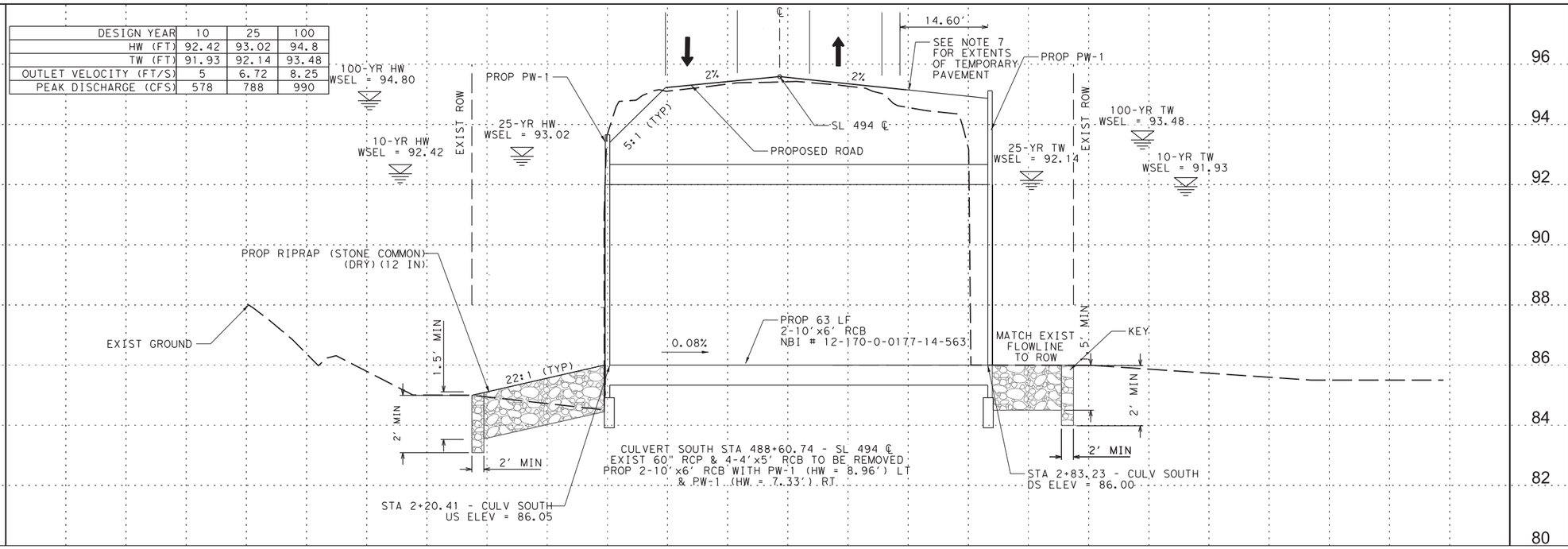


NOTES:

1. THE SOUTH CULVERT WAS MODELED IN HEC-RAS VERSION 5.0.7.
2. THE HEC-RAS MODEL IS BASED ON GIS LIDAR AND TOPOGRAPHICAL SURVEY DATA IN NORTH AMERICAL VERTICAL DATUM OF 1988 (NAVD 88).
3. TAIL WATER ELEVATIONS WERE DETERMINED BY A NORMAL DEPTH COMPUTATION USING A CHANNEL BED SLOPE OF 0.0075 FT/FT.
4. ALL RISES IN THE WATER SURFACE ELEVATIONS ARE CONTAINED WITHIN THE RIGHT OF WAY.
5. THE ALLOWABLE HEADWATER FOR SOUTH CULVERT CARRYING SL 494 OVER CANEY CREEK TRIBUTARY 1 IS 94.84 FT.
6. SEE DRAINAGE PLAN AND PROFILE SHEETS FOR PROPOSED DITCH INFORMATION.
7. SEE TRAFFIC CONTROL PLANS FOR TEMPORARY PAVEMENT EXTENTS.
8. THE NBI NUMBER ASSIGNED TO THE SOUTH CULVERT IS 12-170-0-0177-14-563.

HORIZ. SCALE IN FEET
0' 10' 20'
0' 2' 4'
VERT. SCALE IN FEET

DESIGN YEAR	10	25	100
HW (FT)	92.42	93.02	94.8
TW (FT)	91.93	92.14	93.48
OUTLET VELOCITY (FT/S)	5	6.72	8.25
PEAK DISCHARGE (CFS)	578	788	990



NO	DATE	REVISION	APPROVED

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SL 494 AT FM 1485 BRIDGE CLASS CULVERT LAYOUT CULVERT SOUTH

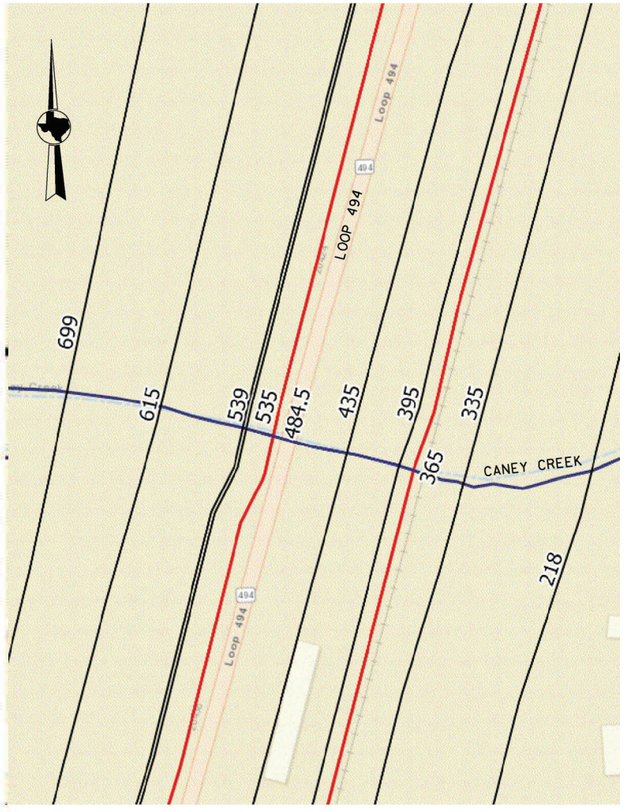
SHEET 1 OF 1

FED.RD. DIV.NO.	PROJECT NO.		SHEET NO.
6			71
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY	
CONT.	SECT.	JOB	HIGHWAY NO.
0177	14	037	SL 494

EXISTING AND PROPOSED RIVER STATION	FREQUENCY STORM	WSEL COMPARISON			EXISTING CONDITION				PROPOSED CONDITION			
		EXISTING WSEL	PROPOSED WSEL	DIFFERENCE IN WSEL	ENERGY GRADE ELEVATION	TOTAL FLOW	VELOCITY CHANNEL	FLOW AREA	ENERGY GRADE ELEVATION	TOTAL FLOW	VELOCITY CHANNEL	FLOW AREA
	(YRS)	(FT)	(FT)	(FT)	(FT)	(CFS)	(FT/S)	(SQ FT)	(FT)	(CFS)	(FT/S)	(SQ FT)
699	100	94.84	94.80	-0.04	94.84	1174±10	0.40	6905.35	94±80	1170±70	0±41	6776±92
	25	93.10	92.98	-0.12	93.11	786.76	0.82	2703.79	92.98	787.87	0.89	2468.71
615	100	94.84	94.79	-0.05	94.84	1173.98	0.38	6808.55	94.80	1170.67	0.39	6680.95
	25	93.10	92.97	-0.13	93.10	786.67	0.58	2993.68	92.98	787.79	0.62	2775.40
539*	100	94.84	94.79	-0.05	94.84	1173.89	0.56	6223.03	94.79	1170.61	0.57	6100.83
	25	93.09	92.97	-0.12	93.10	786.62	0.97	2835.35	92.97	787.75	1.02	2665.69
535	100	94.84	94.79	-0.05	94.84	1173.90	0.69	5034.25	94.80	1170.60	0.70	4936.99
	25	93.06	92.94	-0.12	93.15	786.62	2.31	351.01	93.02	787.75	2.37	342.73
484.5	CULVERT											
435*	100	93.50	93.48	-0.02	93.67	1173.41	3.31	354.88	93.65	1170±19	3±31	353.72
	25	92.14	92.14	0.00	92.28	786.59	2.93	268.80	92.28	787.74	2.93	268.83
395	100	93.22	93.20	-0.02	93.64	1173.51	5.33	252.16	93.63	1170.23	5.35	250.68
	25	91.90	91.91	0.01	92.19	712.02	4.30	170.34	92±19	712.18	4.30	170.41
365	BRIDGE											
335	100	91.68	91.67	-0.01	92.20	1173.38	5.88	230.54	92.20	1170.07	5.87	230.15
	25	91.21	91.22	0.01	91.53	786.57	4.49	178.92	91.53	787.69	4.50	179.07
218	100	91.50	91.49	-0.01	91.79	1173.39	4.71	492.32	91.78	1170.09	4.71	489.98
	25	90.98	90.98	0.00	91.23	786.57	4.27	270.33	91.24	787.69	4.27	270.78
54	100	90.66	90.66	0.00	91.14	1173.37	5.60	260.57	91.13	1170.07	5.60	259.70
	25	90.17	90.17	0.00	90.53	786.57	4.82	175.14	90.53	787.68	4.82	175.35

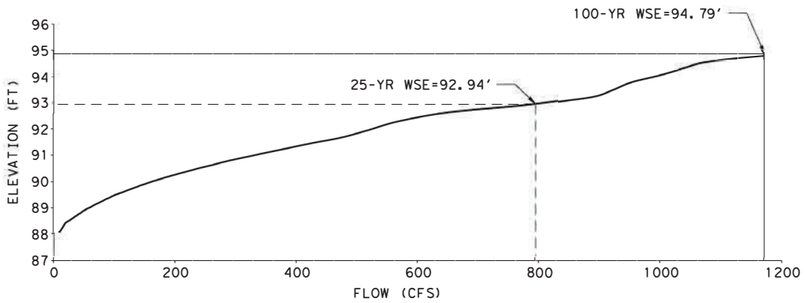
* RIGHT OF WAY LOCATION

HEC-RAS INFORMATION



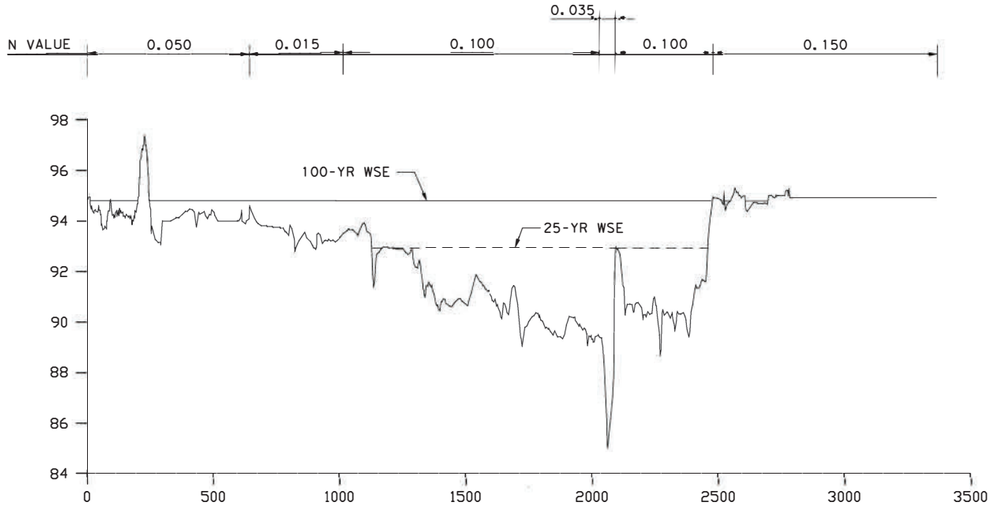
HEC-RAS CROSS SECTION LAYOUT

SCALE: NONE



CROSS SECTION UPSTREAM OF PROPOSED BRIDGE-CLASS CULVERT SOUTH (RS 535)

SCALE: NONE



CROSS SECTON UPSTREAM OF PROPOSED BRIDGE (RS 535)

SCALE: VERT. 1" = 20'
HORIZ. 1" = 600'

NOTES:

1. SEE SL 494 AT FM 1485 DRAINAGE AREA MAP FOR THE SOUTH CULVERT DRAINAGE AREA DELINEATION.
2. SL 494 AT FM 1485 SOUTH CULVERT DESIGN FREQUENCY = 25-YR.
3. THE BOUNDARY CONDITION USED FOR THE EXISTING AND PROPOSED HEC-RAS ANALYSIS WAS NORMAL DEPTH.
4. ALL BEARINGS AND COORDINATES SHOWN ARE BASED ON THE TEXAS STATE PLANE COORDINATE SYSTEM, CENTRAL ZONE (4203) NAD83 AS DETERMINED BY GPS OBERVATIONS USING THE TXDOT VRS NETWORK. ALL COORDINATES SHOWN ARE SURFACE AND MAY BE CONVERTED TO GRID BY DIVIDING BY A TXDOT COMBINED ADJUSTMENT FACTOR OF 1.000030.
5. ALL PROJECT ELEVATIONS ARE BASED ON NAVD88 (GEOID12A) AS DETERMINED BY GPS OBSERVATIONS OF CONTORL POINT 2003 USING THE TXDOT VRS NETWORK. ELEVATIONS OF ALL OTHER CONTROL POINTS WERE DETERMINED BY CONVENTIONAL THIRD ORDER LOOPS.
6. SL 494 AT FM 1485 SOUTH BRIDGE CLASS CULVERT IS LOCATED ON FIRM NUMBER 48339C0600G, EFFECTIVE DATE 18 AUGUST 2014. THIS CROSSING IS LOCATED IN ZONE AE.
7. NO DOWNSTREAM WSE OR FLOW IMPACTS OCCUR DUE TO SL 494 BRIDGE CLASS CULVERT REPLACEMENT. REFER TO SL 494 FROM FM 1485 W TO FM 1485 E DRAINAGE REPORT FOR ADDITIONAL INFORMATION.
8. SEE SL 494 AT FM 1485 BRIDGE CLASS CULVERT LAYOUT CULVERT SOUTH FOR CULVERT PROFILE AND PLAN.

NO	DATE	REVISION	APPROVED

STATE OF TEXAS
THOMAS POULOSE
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08/04/2021
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SL 494 AT FM 1485 BRIDGE CLASS CULVERT SOUTH HEC-RAS HYDRAULIC DATA

SHEET 1 OF 1

FED. RD. DIV. NO.	PROJECT NO.		SHEET NO.
6			71A
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY	
CONT.	SECT.	JOB	HIGHWAY NO.
0177	14	037	SL 494

Culvert Station and/or Creek Name followed by applicable end (Lt, Rt or Both)	Description of Box Culvert No. Spans ~ Span X Height	Max Fill Height (Ft)	Applicable Box Culvert Standard (4)	Applicable Wingwall or End Treatment Standard	Skew Angle (0°,15°, 30° or 45°)	Side Slope or Channel Slope Ratio (SL:1)	T Culvert Top Slab Thickness (In)	U Culvert Wall Thickness (In)	C Estimated Curb Height (Ft)	Hw Height of Wingwall (1) (Ft)	A Curb to End of Wingwall (Ft)	B Offset of End of Wingwall (Ft)	Lw Length of Longest Wingwall (Ft)	Ltw Culvert Toewall Length (Ft)	Atw Anchor Toewall Length (Ft)	Riprap Apron (CY)	Class "C" Conc (Curb) (2) (CY)	Class "C" Conc (Wingwall) (3) (CY)	Total Wingwall Area (SF)
BRIDGE CLASS CULVERT (SOUTH)(US)(RT)	2 ~ 10'X 6'	1.5'	MC-10-7	PW-1	0	2:1	8"	7"	0.979	7.646	N/A	N/A	15.29	21.75	N/A	0.0	0.8	16.8	234
BRIDGE CLASS CULVERT (SOUTH)(DS)(LT)	2 ~ 10'X 6'	1.5'	MC-10-7	PW-1	0	2:1	8"	7"	2.458	9.125	N/A	N/A	18.25	21.75	N/A	0.0	2.0	23.1	333
NORTH CULVERT (DS)(LT)	3 ~ 3' X 3'	1.5'	MC-3-23	PW-1	0	2:1	8"	7"	1.500	5.167	N/A	N/A	10.33	11.33	N/A	0.0	0.6	7.8	107

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

DATE:
FILE:

NOTES:
Skew = 0° on SW-0, FW-0, SETB-CD, SETB-SW-0, and SETB-FW-0 standard sheets;
30° maximum for safety end treatment

SL:1 = Horizontal : 1 Vertical
· Side slope at culvert for flared or straight wingwalls.
· Channel slope for parallel wingwalls.
· Slope must be 3:1 or flatter for safety end treatments.

T = Box culvert top slab thickness. Dimension can be found on the applicable box culvert standard sheet.

U = Box culvert wall thickness. Dimension can be found on the applicable box culvert standard sheet.

C = Curb height

See applicable wing or end treatment standard sheets for calculations of Hw, A, B, Lw, Ltw, Atw, and Total Wingwall Area.

Hw = Height of wingwall

A = Distance from face of curb to end of wingwall (not applicable to parallel or straight wingwalls)

B = Offset of end of wingwall (not applicable to parallel or straight wingwalls)

Lw = Length of longest wingwall.

Ltw = Length of culvert toewall (not applicable when using riprap apron)

Atw = Length of anchor toewall (applicable to safety end treatment only)
Total Wingwall Area = Wingwall area in sq. ft. for two wingwalls (one structure end) if Lt or Rt.
Area for four wingwalls (two structure ends) if Both.

(1) Round the wall heights shown to the nearest foot for bidding purposes.

(2) Concrete volume shown is for box culvert curb only. For curbs using the Box Culvert Rail Mounting Details (RAC) standard sheet quantities shown must be increased by a factor of 2.25. If Class S concrete is required for the top slab of the culvert, also provide Class S concrete for the curb. Curb concrete is considered part of the Box Culvert for payment.

(3) Concrete volume shown is total of wings, footings, culvert toewall (if any), anchor toewalls (if any) and wingwall toewalls. Riprap aprons, culverts, and curb quantities are not included.

(4) Regardless of the type of culvert shown on this sheet, the Contractor has the option of furnishing cast-in-place or precast culverts unless otherwise shown elsewhere on the plans. If the Contractor elects to provide culverts of a different type than those shown on this sheet, it is the Contractor's responsibility to make the necessary adjustments to the dimensions and quantities shown.

SPECIAL NOTE:

This sheet is a supplement to the box culvert standards. It is to be filled out by the culvert specifier and provides dimensions for the construction of the box culvert wingwalls and safety end treatments.

An Excel 2010 spreadsheet to assist in completing this table can be downloaded from the Bridge Standards (English) web page on the TxDOT web site. The completed sheet must be signed, sealed, and dated by a licensed Professional Engineer.

STATE OF TEXAS
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139719
LICENSED
PROFESSIONAL ENGINEER
07/26/2021
F-2677

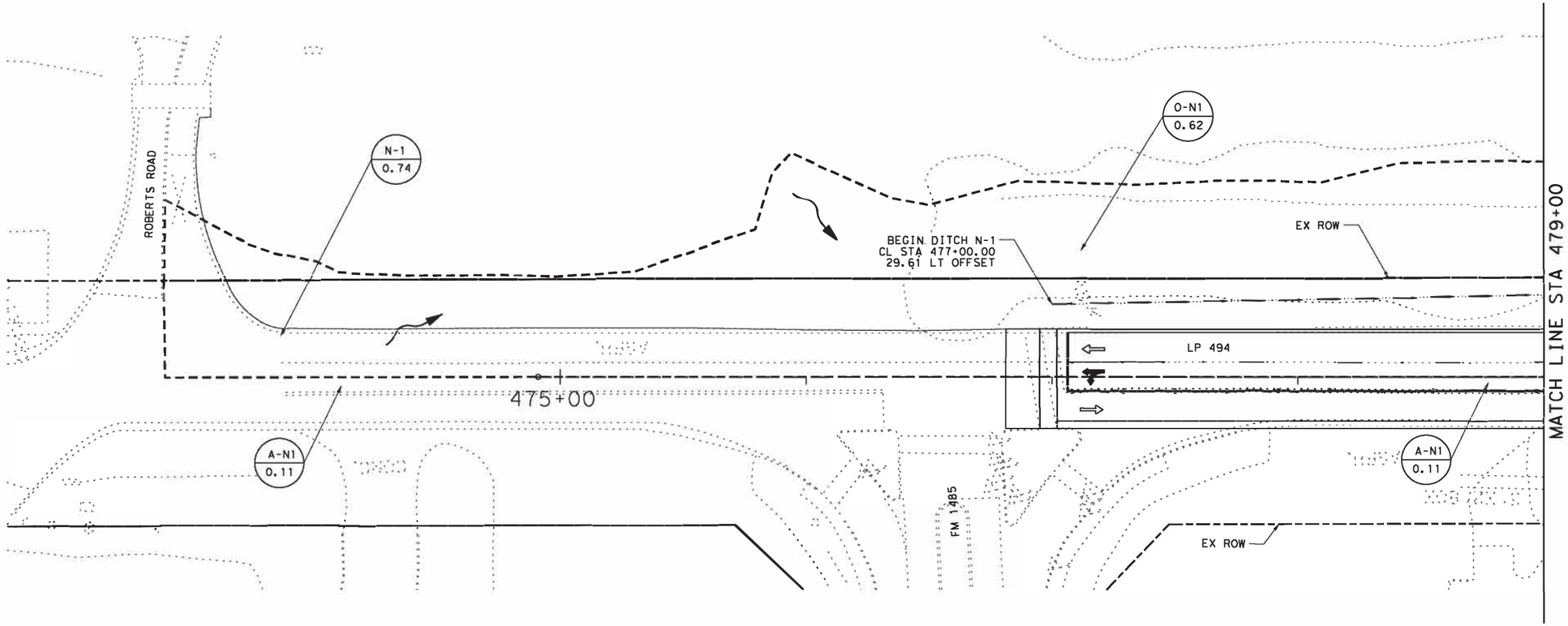
Texas Department of Transportation

Bridge Division Standard

BOX CULVERT SUPPLEMENT
WINGS AND END TREATMENTS

BCS

FILE: bcssldet-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0177	14	037	SL 494
	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY		71B

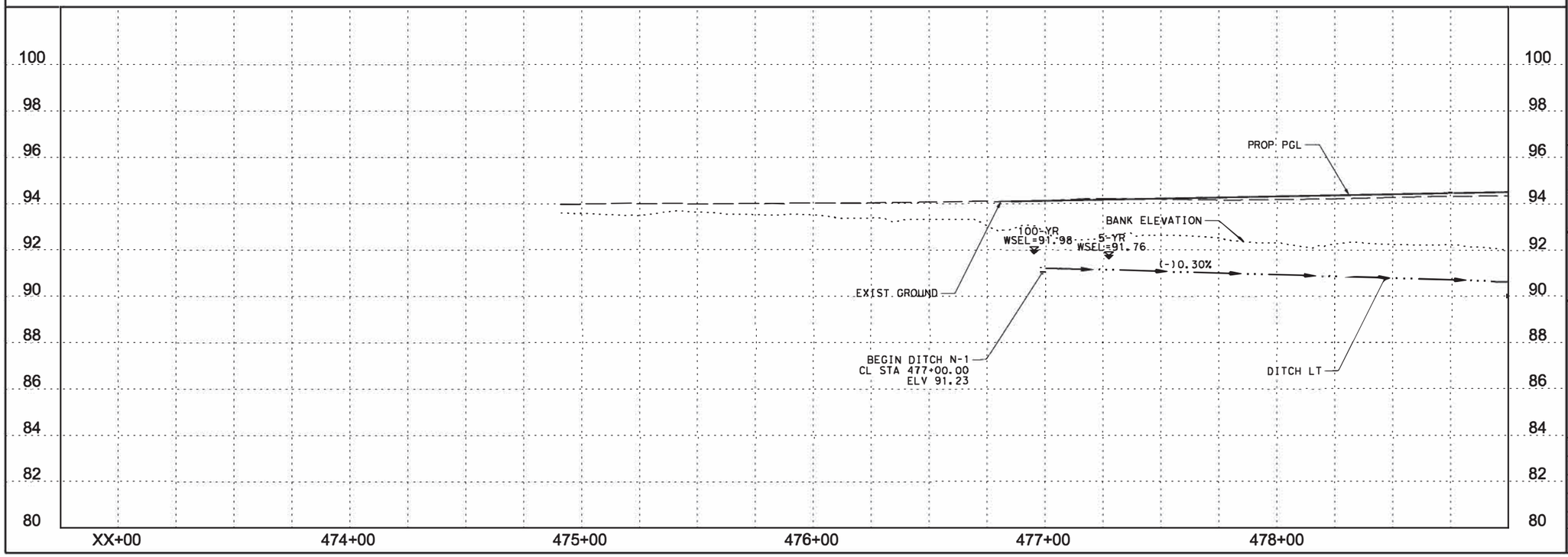


LEGEND

- ℄ PROPOSED DITCH/FLOWLINE
- DRAINAGE AREA BOUNDARY
- DIRECTION OF FLOW
- ID / 000 — DRAINAGE AREA ID / DRAINAGE AREA ACREAGE

NOTE:

1. REFER TO DITCH TABLES FOR DITCH DIMENSIONS



HORIZ. SCALE IN FEET
0′ 25′ 50′
0′ 2.5′ 5′
VERT. SCALE IN FEET

NO	DATE	REVISION	APPROVED

STATE OF TEXAS
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07/26/2021
F-2677

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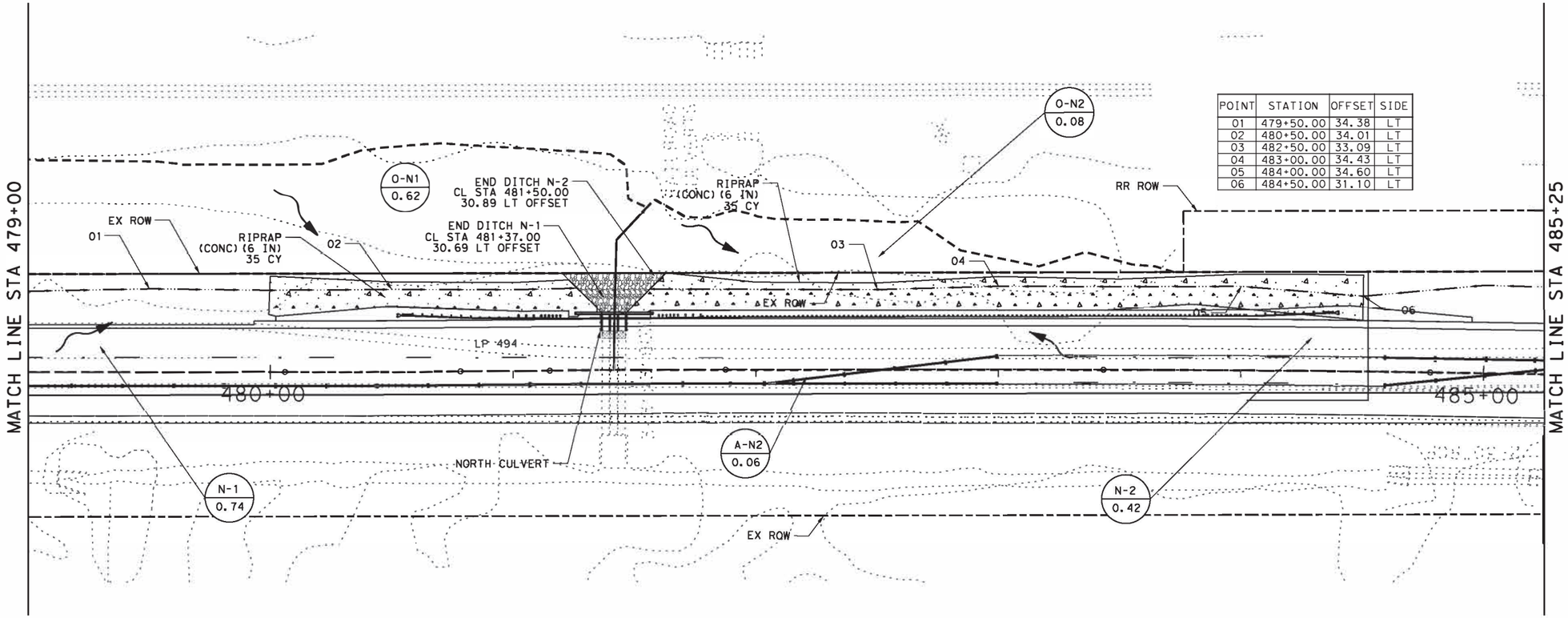
SL 494 AT FM 1485 DRAINAGE PLAN AND PROFILE

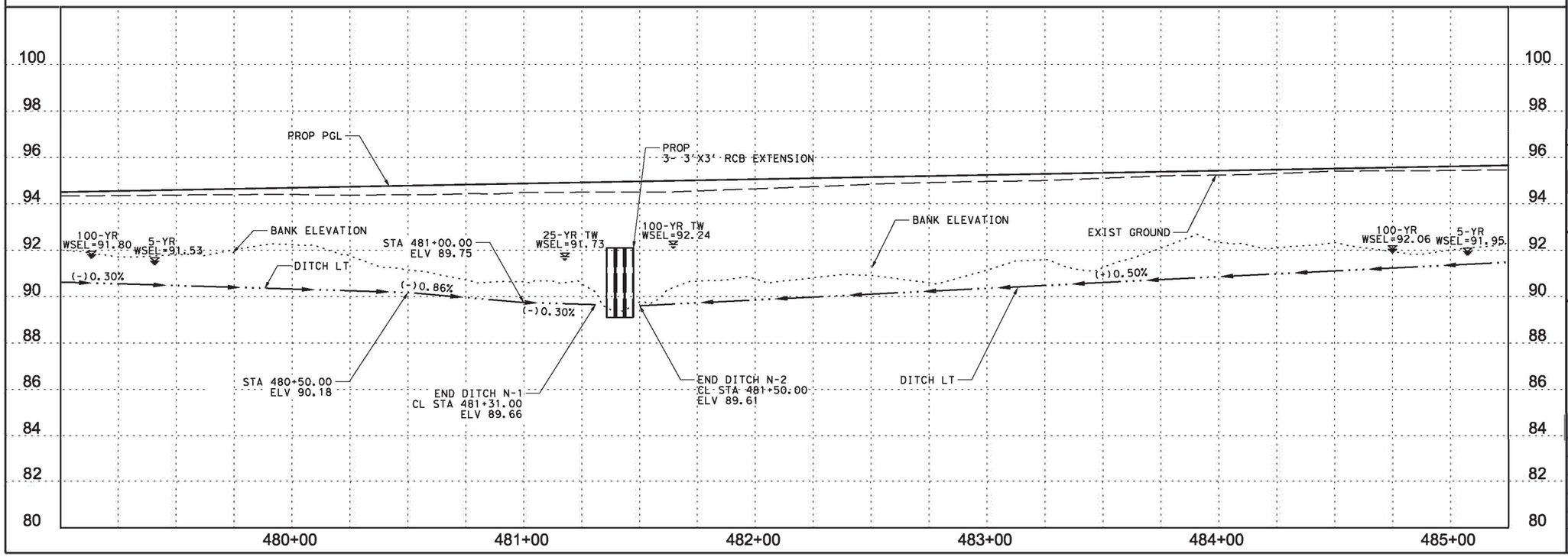
BEGIN TO STA 479+00

SHEET 1 OF 4

FED. RD. DIV. NO.	PROJECT NO.		SHEET NO.
6			72
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY	
CONT.	SECT.	JOB	HIGHWAY NO.
0177	14	037	SL 494



POINT	STATION	OFFSET	SIDE
01	479+50.00	34.38	LT
02	480+50.00	34.01	LT
03	482+50.00	33.09	LT
04	483+00.00	34.43	LT
05	484+00.00	34.60	LT
06	484+50.00	31.10	LT



LEGEND

- ℄ PROPOSED DITCH/FLOWLINE
- DRAINAGE AREA BOUNDARY
- DIRECTION OF FLOW
- ID / 000 — DRAINAGE AREA ID / DRAINAGE AREA ACREAGE

NOTES:

1. CONCRETE RIPRAP (6 IN) REQUIRED FROM STA 480+00 TO STA 481+31 AND FROM STA 481+50 TO STA 484+00
2. REFER TO DITCH TABLES FOR DITCH DIMENSIONS

HORIZ. SCALE IN FEET
0′ 25′ 50′
0′ 2.5′ 5′
VERT. SCALE IN FEET

NO	DATE	REVISION	APPROVED

STATE OF TEXAS
NILESH D. SHRINGARPURE
139719
LICENSED
PROFESSIONAL ENGINEER
07/26/2021
F-2677

Michael Baker INTERNATIONAL
2002 W. Grand Parkway N.
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Katy, TX 77449
TBPE Registration No. 2677

SL 494 AT FM 1485 DRAINAGE PLAN AND PROFILE

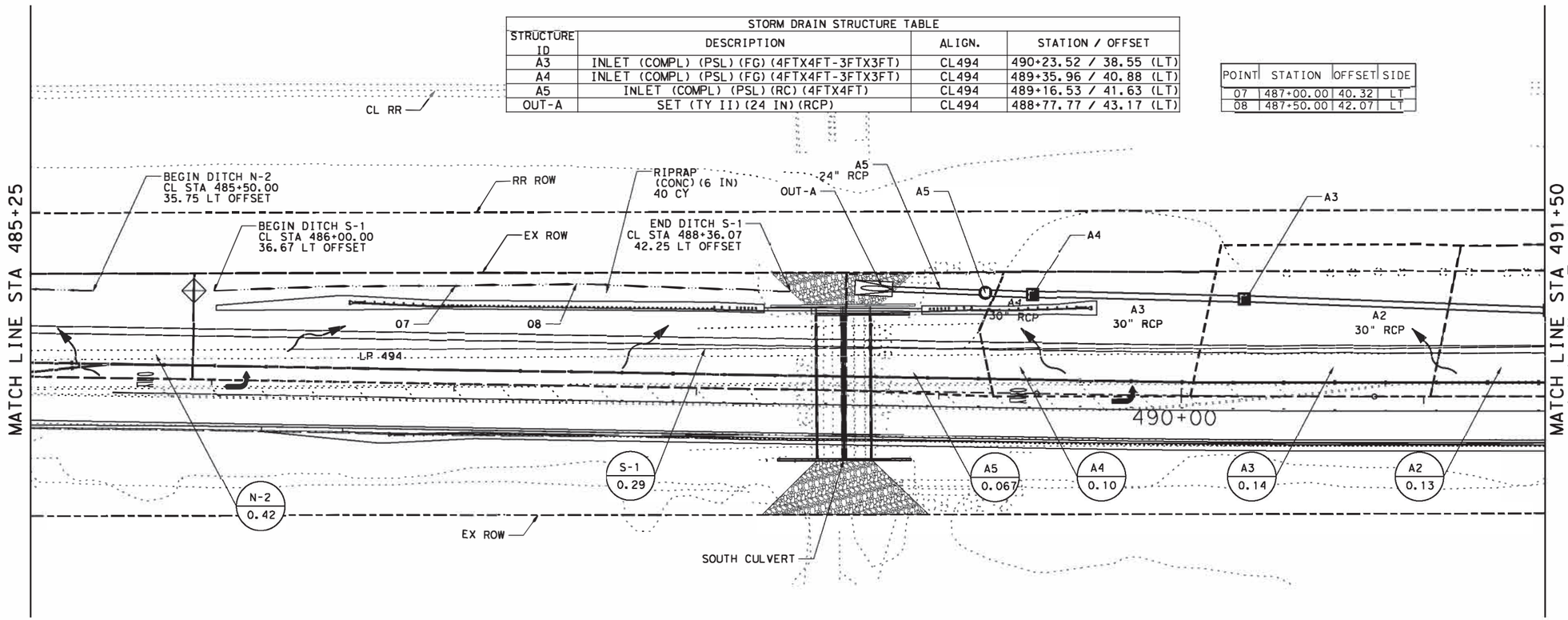
STA 479+00 TO STA 485+25

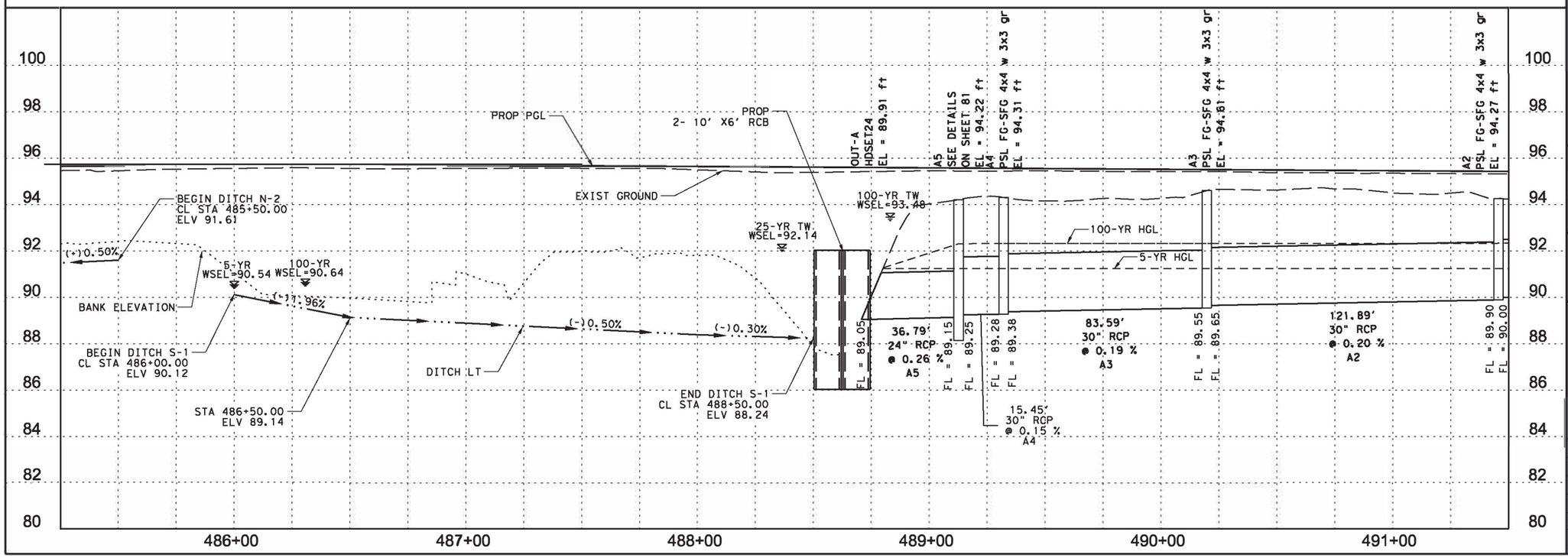
SHEET 2 OF 4

FED. RD. DIV. NO.	PROJECT NO.		SHEET NO.
6			73
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY	
CONT.	SECT.	JOB	HIGHWAY NO.
0177	14	037	SL 494

STORM DRAIN STRUCTURE TABLE			
STRUCTURE ID	DESCRIPTION	ALIGN.	STATION / OFFSET
A3	INLET (COMPL) (PSL) (FG) (4FTX4FT-3FTX3FT)	CL494	490+23.52 / 38.55 (LT)
A4	INLET (COMPL) (PSL) (FG) (4FTX4FT-3FTX3FT)	CL494	489+35.96 / 40.88 (LT)
A5	INLET (COMPL) (PSL) (RC) (4FTX4FT)	CL494	489+16.53 / 41.63 (LT)
OUT-A	SET (TY II) (24 IN) (RCP)	CL494	488+77.77 / 43.17 (LT)

POINT	STATION	OFFSET	SIDE
07	487+00.00	40.32	LT
08	487+50.00	42.07	LT





LEGEND

- ℄ PROPOSED DITCH/FLOWLINE
- DRAINAGE AREA BOUNDARY
- DIRECTION OF FLOW
- ID / 000 — DRAINAGE AREA ID / DRAINAGE AREA ACREAGE

NOTES:
1. CONCRETE RIPRAP (6IN) REQUIRED FROM 487+00 TO 488+50
2. REFER TO DITCH TABLES FOR DITCH DIMENSIONS
3. REFER TO OUTLET CONTROL DETAIL SHEET FOR STRUCTURE A5
4. PARKING LOT, WHERE PROPOSED INLETS A1, A2, A3, AND A4 ARE LOCATED, TO BE GRADED AND PAVED BY OTHERS. CONTRACTOR TO ENSURE THAT POSITIVE DRAINAGE PATH IS ESTABLISHED TO EACH INLET BY ADJUSTING THE TOP OF CASTING ELEVATIONS.

HORIZ. SCALE IN FEET
0′ 25′ 50′
0′ 2.5′ 5′
VERT. SCALE IN FEET

NO	DATE	REVISION	APPROVED

STATE OF TEXAS
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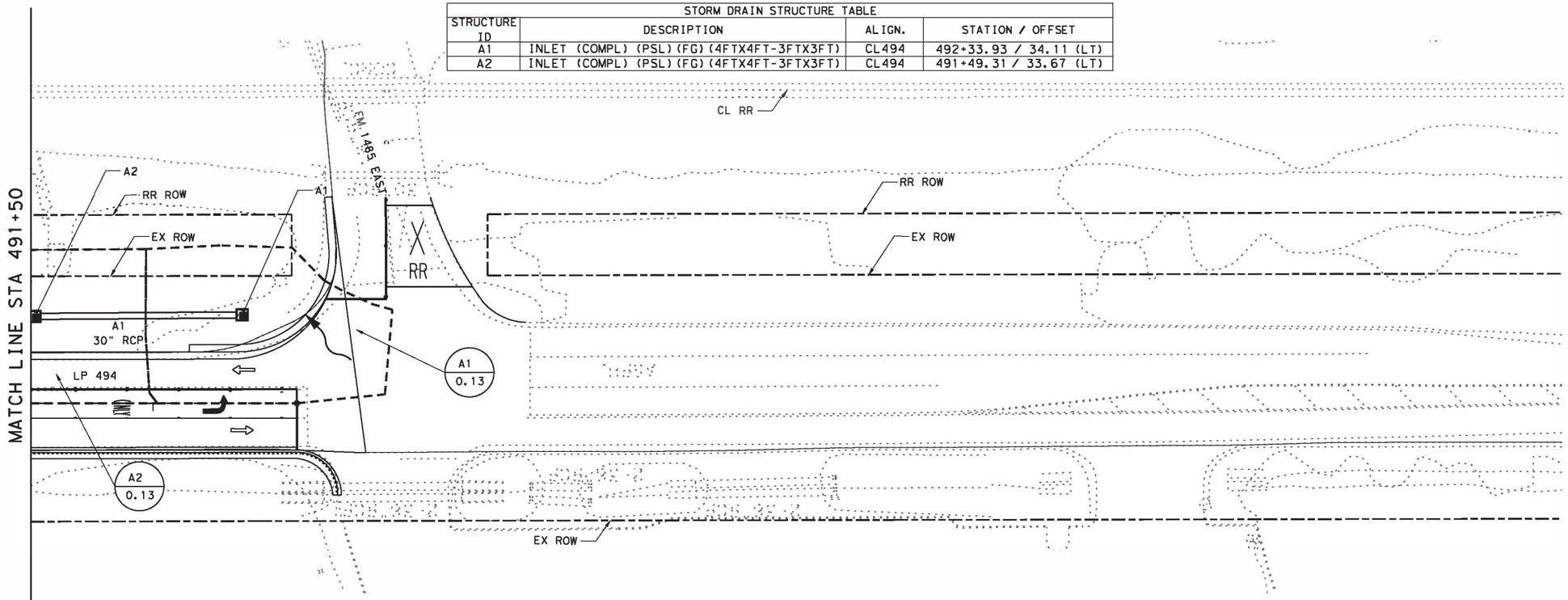
SL 494 AT FM 1485 DRAINAGE PLAN AND PROFILE

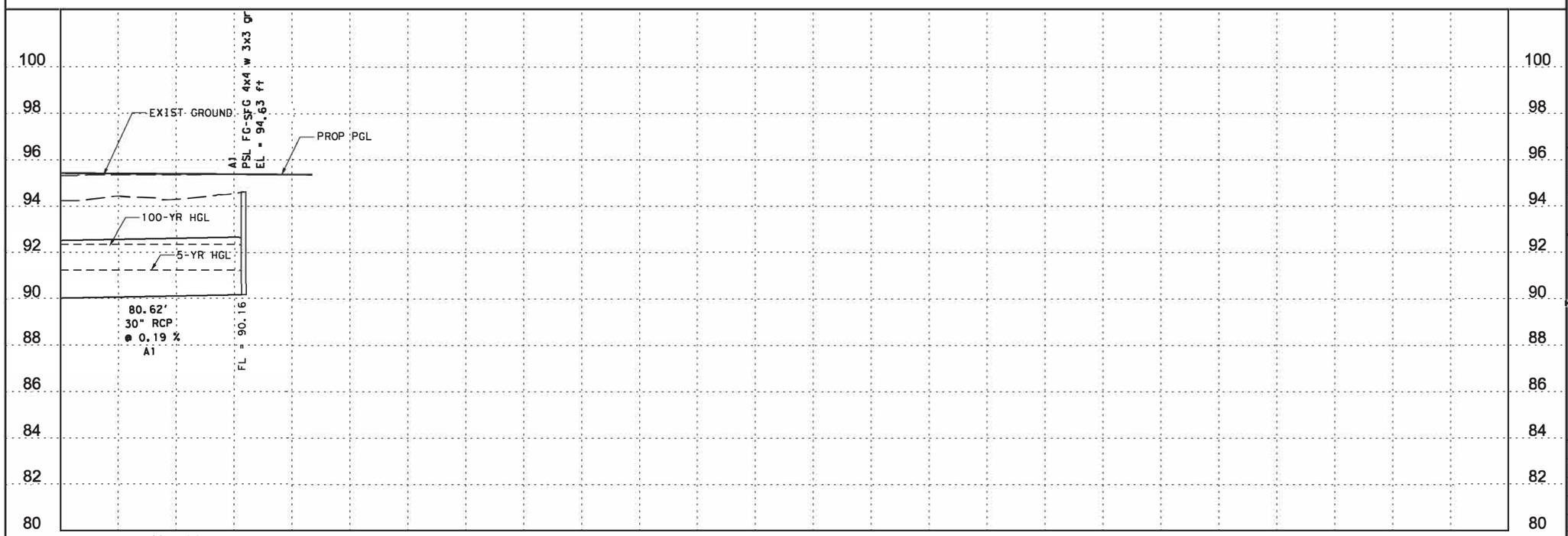
STA 485+25 TO STA 491+50

SHEET 3 OF 4

FED. RD. DIV. NO.	PROJECT NO.		SHEET NO.
6			74
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY	
CONT.	SECT.	JOB	HIGHWAY NO.
0177	14	037	SL 494

STORM DRAIN STRUCTURE TABLE			
STRUCTURE ID	DESCRIPTION	ALIGN.	STATION / OFFSET
A1	INLET (COMPL) (PSL) (FG) (4FTX4FT-3FTX3FT)	CL494	492+33.93 / 34.11 (LT)
A2	INLET (COMPL) (PSL) (FG) (4FTX4FT-3FTX3FT)	CL494	491+49.31 / 33.67 (LT)





LEGEND

- ℄ PROPOSED DITCH/FLOWLINE
- DRAINAGE AREA BOUNDARY
- DIRECTION OF FLOW
- ID / 000 — DRAINAGE AREA ID / DRAINAGE AREA ACREAGE

HORIZ. SCALE IN FEET
0′ 25′ 50′
0′ 2.5′ 5′
VERT. SCALE IN FEET

NO	DATE	REVISION	APPROVED

STATE OF TEXAS
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SL 494 AT FM 1485 DRAINAGE PLAN AND PROFILE

STA 491+50 TO END

SHEET 4 OF 4

FED. RD. DIV. NO.	PROJECT NO.		SHEET NO.
6			75
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY	
CONT.	SECT.	JOB	HIGHWAY NO.
0177	14	037	SL 494

DRAINAGE AREA COMPUTATIONS FOR 5-YEAR DESIGN STORM						
AREA - ID	TIME OF CONCENTRATION	DISCHARGE	INTENSITY	COMPOSITE C VALUE	DRAINAGE AREA	COMMENTS
	MIN.	CFS	IN/HR		AC	
LINE A						
A4	10.00	0.62	6.96	0.85	0.10	
A3	10.00	0.84	6.96	0.85	0.14	
A2	10.00	0.75	6.96	0.85	0.13	
A1	10.00	0.76	6.96	0.85	0.13	

LINK COMPUTATIONS FOR 5-YEAR DESIGN STORM																			
LINK ID	UPSTREAM NODE	DOWNSTREAM NODE	RISE	SPAN	ACTUAL LENGTH	HYDRAULIC LENGTH	SLOPE	INVERT UPSTREAM	INVERT DOWNSTREAM	DISCHARGE	CAPACITY	SOFFIT UPSTREAM	HGL UPSTREAM	EGL UPSTREAM	SOFFIT DOWNSTREAM	HGL DOWNSTREAM	EGL DOWNSTREAM	ACTUAL VELOCITY UPSTREAM	ACTUAL VELOCITY DOWNSTREAM	UPSTRM NODE RIM ELEV.
			FT	FT	FT	FT	%	FT	FT	CFS	CFS	FT	FT	FT	FT	FT	FT	FPS	FPS	FT
LINE A																				
A5	A5	OUT-A	2.00	n/a	36.79	38.79	0.26	89.15	89.05	2.97	13.39	91.15	91.07	91.10	91.05	91.05	91.08	0.96	0.95	94.22
A4	A4	A5	2.50	n/a	15.45	19.45	0.15	89.28	89.25	2.97	18.77	91.78	91.07	91.09	91.75	91.07	91.10	0.80	0.78	94.31
A3	A3	A4	2.50	n/a	83.59	87.59	0.19	89.55	89.38	2.35	21.06	92.05	91.08	91.10	91.88	91.07	91.09	0.76	0.67	94.61
A2	A2	A3	2.50	n/a	121.89	125.89	0.20	89.90	89.65	1.51	21.30	92.40	91.10	91.11	92.15	91.08	91.10	0.67	0.53	94.27
A1	A1	A2	2.50	n/a	80.62	84.62	0.19	90.16	90.00	0.76	20.78	92.66	91.11	91.11	92.50	91.10	91.11	0.47	0.38	94.63

INLET COMPUTATIONS FOR 5-YEAR DESIGN STORM															
INLET ID	DISCHARGE	BY PASS NODE ID	BY PASS FLOW	CAPACITY	TYPE	PROFILE TYPE	REFERENCE STATION	STATION	OFFSET	ELEVATION	LONGITUDINAL SLOPE	COMPUTED PONDED WIDTH	MAX PONDED WIDTH	COMPOSITE SPREAD SLOPE	COMMENTS
	CFS		CFS	CFS					FT	FT	%	FT	FT	FT/FT	
LINE A															
OUT-A	0.74		0.00	0.74	Outlet	On Grade	CL494	488+77.77	-43.17	89.91	0.00	11.31	26.00	0.06	
A5	0.74		0.00	0.74	Junctian	On Grade	CL494	489+16.53	-41.63	94.22	0.20	11.31	26.00	0.06	
A4	0.62		0.00	6.91	Grate	Sag	CL494	489+35.96	-40.88	94.31	n/a	8.15	26.00	0.06	
A3	0.84		0.00	6.91	Grate	Sag	CL494	490+23.52	-38.55	94.61	n/a	9.15	26.00	0.06	
A2	0.75		0.00	6.91	Grate	Sag	CL494	491+49.31	-33.67	94.27	n/a	8.77	26.00	0.06	
A1	0.76		0.00	6.91	Grate	Sag	CL494	492+33.93	-34.11	94.63	n/a	6.29	14.00	0.02	

NO	DATE	REVISION	APPROVED

STATE OF TEXAS
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07/26/2021
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TBPE Registration No. 2677

SL 494 AT FM 1485 DRAINAGE

HYDRAULIC COMPUTATIONS
AREAS, INLETS, AND
STORM SEWER PIPES

SHEET 1 OF 1

FED. RD. DIV. NO.	PROJECT NO.	SHEET NO.
6		75A

STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY	
CONT.	SECT.	JOB	HIGHWAY NO.
0177	14	037	SL 494

DITCH NAME	ALIGNMENT NAME	SIDE	STATION		DITCH SECTION				GRADE OF DITCH SECTION	FLOW DEPTH (FT)	CROSS SECTIONAL FLOW AREA (SF)	WETTED PERIMETER (FT)	HYDRAULIC RADIUS (FT)	MANNING'S N	VELOCITY (FPS)	VELOCITY HEAD (FT)	DESIGN FLOW (CFS)	FULL-FLOW DITCH CAPACITY (CFS)	COMMENTS
			FROM	TO	FORESLOPE (X:1)	BOTTOM WIDTH	BACKSLOPE (X:1)	DEPTH OF DITCH PROVIDED											
S-1*1	CL SL494	LT	486+00	486+50	3	0	3	0.83	1.96%	0.42	0.53	2.66	0.20	0.03	2.37	0.08729	1.26	7.70	
S-1*2	CL SL494	LT	486+50	487+00	3	0	3	1.94	0.50%	0.54	0.88	3.43	0.26	0.03	1.42	0.03134	1.25	37.41	
S-1*3	CL SL494	LT	487+00	487+50	1	0	2	1.94	0.50%	0.53	0.43	1.95	0.22	0.013	2.94	0.13433	1.26	39.23	CONCRETE RIPRAP LINING
S-1*4	CL SL494	LT	487+50	488+00	1	0	1	3.40	0.50%	0.64	0.42	1.82	0.23	0.013	3.02	0.14174	1.27	105.63	CONCRETE RIPRAP LINING
S-1*5	CL SL494	LT	488+00	488+50	1	0	1	3.40	0.30%	0.71	0.50	2.01	0.25	0.013	2.50	0.09713	1.25	81.82	CONCRETE RIPRAP LINING

DITCH NAME	ALIGNMENT NAME	SIDE	STATION		DITCH SECTION				GRADE OF DITCH SECTION	FLOW DEPTH (FT)	CROSS SECTIONAL FLOW AREA (SF)	WETTED PERIMETER (FT)	HYDRAULIC RADIUS (FT)	MANNING'S N	VELOCITY (FPS)	VELOCITY HEAD (FT)	DESIGN FLOW (CFS)	FULL-FLOW DITCH CAPACITY (CFS)	COMMENTS
			FROM	TO	FORESLOPE (X:1)	BOTTOM WIDTH	BACKSLOPE (X:1)	DEPTH OF DITCH											
N-1*1	CL SL494	LT	477+00	477+50	4	0	4	1.54	0.30%	0.89	3.17	7.34	0.43	0.03	1.55	0.03734	4.91	21.19	
N-1*2	CL SL494	LT	477+50	478+00	4	0	4	1.38	0.30%	0.89	3.17	7.34	0.43	0.03	1.55	0.03734	4.91	15.81	
N-1*3	CL SL494	LT	478+00	478+50	4	0	4	1.47	0.30%	0.89	3.17	7.34	0.43	0.03	1.55	0.03734	4.91	18.72	
N-1*4	CL SL494	LT	478+50	479+00	4	0	4	1.38	0.30%	0.89	3.17	7.34	0.43	0.03	1.55	0.03734	4.91	15.81	
N-1*5	CL SL494	LT	479+00	479+50	4	0	4	1.32	0.30%	0.89	3.17	7.34	0.43	0.03	1.55	0.03734	4.91	14.05	
N-1*6	CL SL494	LT	479+50	480+00	3	0	3	1.80	0.30%	1.00	2.98	6.31	0.47	0.03	1.65	0.04231	4.92	23.73	
N-1*7	CL SL494	LT	480+00	480+50	2	0	2	1.76	0.30%	0.86	1.48	3.85	0.38	0.013	3.32	0.17129	4.91	33.06	CONCRETE RIPRAP LINING
N-1*8	CL SL494	LT	480+50	481+00	2	0	2	1.12	0.86%	0.71	1.00	3.16	0.32	0.013	4.93	0.37771	4.93	16.77	CONCRETE RIPRAP LINING
N-1*9	CL SL494	LT	481+00	481+31	2	0	2	1.04	0.30%	0.86	1.48	3.85	0.38	0.013	3.32	0.17129	4.91	8.13	CONCRETE RIPRAP LINING

DITCH NAME	ALIGNMENT NAME	SIDE	STATION		DITCH SECTION				GRADE OF DITCH SECTION	FLOW DEPTH (FT)	CROSS SECTIONAL FLOW AREA (SF)	WETTED PERIMETER (FT)	HYDRAULIC RADIUS (FT)	MANNING'S N	VELOCITY (FPS)	VELOCITY HEAD (FT)	DESIGN FLOW (CFS)	FULL-FLOW DITCH CAPACITY (CFS)	COMMENTS
			FROM	TO	FORESLOPE (X:1)	BOTTOM WIDTH	BACKSLOPE (X:1)	DEPTH OF DITCH											
N-2*1	CL SL494	LT	485+50	485+00	4	0	4	0.67	0.50%	0.59	1.40	4.88	0.29	0.03	1.53	0.03638	2.14	2.97	
N-2*2	CL SL494	LT	485+00	484+50	4	0	4	0.94	0.50%	0.59	1.40	4.88	0.29	0.03	1.53	0.03638	2.14	7.33	
N-2*3	CL SL494	LT	484+50	484+00	2.5	0	2.5	1.52	0.50%	0.66	1.32	4.19	0.32	0.03	1.62	0.04078	2.14	19.52	CONCRETE RIPRAP LINING
N-2*4	CL SL494	LT	484+00	483+50	2.5	0	2.5	1.50	0.50%	0.52	0.68	2.81	0.24	0.013	3.15	0.15420	2.14	35.72	CONCRETE RIPRAP LINING
N-2*5	CL SL494	LT	483+50	483+00	2.5	0	2.5	0.73	0.50%	0.52	0.68	2.81	0.24	0.013	3.15	0.15420	2.14	5.23	CONCRETE RIPRAP LINING
N-2*6	CL SL494	LT	483+00	482+50	2.5	0	2.5	0.73	0.50%	0.52	0.68	2.81	0.24	0.013	3.15	0.15420	2.14	5.23	CONCRETE RIPRAP LINING
N-2*7	CL SL494	LT	482+50	482+00	2	0	2	0.94	0.50%	0.57	0.66	2.56	0.26	0.013	3.27	0.16617	2.16	8.02	CONCRETE RIPRAP LINING
N-2*8	CL SL494	LT	482+00	481+50	2	0	2	1.01	0.50%	0.57	0.66	2.56	0.26	0.013	3.27	0.16617	2.16	9.71	CONCRETE RIPRAP LINING

NO	DATE	REVISION	APPROVED

STATE OF TEXAS
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01/26/2021
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TBPE Registration No. 2677

SL 494 AT FM 1485
DITCH COMPUTATIONS
(5-YEAR)

SHEET 1 OF 1

FED. RD. DIV. NO.	PROJECT NO.	SHEET NO.
6		75B

STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY	
CONT.	SECT.	JOB	HIGHWAY NO.
0177	14	037	SL 494

		FROM			TO								
			ALIGNMENT CHAIN	LT RT		ALIGNMENT CHAIN	LT, RT, M	LENGTH	LONGITUDINAL PERCENT SLOPE	BASE WIDTH (FEET)	SIDE SLOPE (X:1)	DITCH DEPTH (FT)	DITCH TOP WIDTH (FT)
1	STATION ELEVATION	477+00 91.23	CL	LT	477+50 91.08	CL	LT	50	0.30%	0	4 4	1.540	12.3
2	STATION ELEVATION	477+50 91.08	CL	LT	478+00 90.93	CL	LT	50	0.30%	0	4 4	1.380	11.0
3	STATION ELEVATION	478+00 90.93	CL	LT	478+50 90.78	CL	LT	50	0.30%	0	4 4	1.470	11.8
4	STATION ELEVATION	478+50 90.78	CL	LT	479+00 90.63	CL	LT	50	0.30%	0	4 4	1.380	11.0
5	STATION ELEVATION	479+00 90.63	CL	LT	479+50 90.48	CL	LT	50	0.30%	0	4 4	1.320	10.6
6	STATION ELEVATION	479+50 90.48	CL	LT	480+00 90.33	CL	LT	50	0.30%	0	3 3	1.800	10.8
7	STATION ELEVATION	480+00 90.33	CL	LT	480+50 90.18	CL	LT	50	0.30%	0	2 2	1.760	7.0
8	STATION ELEVATION	480+50 90.18	CL	LT	481+00 89.75	CL	LT	50	0.86%	0	2 2	1.124	4.5
9	STATION ELEVATION	481+00 89.75	CL	LT	481+31 89.66	CL	LT	31	0.30%	0	2 2	1.040	4.2

		FROM			TO								
			ALIGNMENT CHAIN	LT RT		ALIGNMENT CHAIN	LT, RT, M	LENGTH	LONGITUDINAL PERCENT SLOPE	BASE WIDTH (FEET)	SIDE SLOPE (X:1)	DITCH DEPTH (FT)	DITCH TOP WIDTH (FT)
1	STATION ELEVATION	485+50 91.61	CL	LT	485+00 91.36	CL	LT	50	0.50%	0	4 4	0.670	5.4
2	STATION ELEVATION	485+00 91.36	CL	LT	484+50 91.11	CL	LT	50	0.50%	0	4 4	0.940	7.5
3	STATION ELEVATION	484+50 91.11	CL	LT	484+00 90.86	CL	LT	50	0.50%	0	2.50 2.50	1.520	7.6
4	STATION ELEVATION	484+00 90.86	CL	LT	483+50 90.61	CL	LT	50	0.50%	0	2.50 2.50	1.500	7.5
5	STATION ELEVATION	483+50 90.61	CL	LT	483+00 90.36	CL	LT	50	0.50%	0	2.50 2.50	0.730	3.7
6	STATION ELEVATION	483+00 90.36	CL	LT	482+50 90.11	CL	LT	50	0.50%	0	2.5 2.5	0.730	3.7
7	STATION ELEVATION	482+50 90.11	CL	LT	482+00 89.86	CL	LT	50	0.50%	0	2 2	0.940	3.8
8	STATION ELEVATION	482+00 89.86	CL	LT	481+50 89.61	CL	LT	50	0.50%	0	2 2	1.010	4.0

		FROM			TO								
			ALIGNMENT CHAIN	LT RT		ALIGNMENT CHAIN	LT, RT, M	LENGTH	LONGITUDINAL PERCENT SLOPE	BASE WIDTH (FEET)	SIDE SLOPE (X:1) ON D/S END	DITCH DEPTH (FT)	DITCH TOP WIDTH (FT)
1	STATION	486+00	CL	LT	486+50	CL	LT	50	1.96%	0	3	0.830	5.0
	ELEVATION	90.12			89.14						3		
2	STATION	486+50	CL	LT	487+00	CL	LT	50	0.50%	0	3	1.940	11.6
	ELEVATION	89.14			88.89						3		
3	STATION	487+00	CL	LT	487+50	CL	LT	50	0.50%	0	1	1.940	5.8
	ELEVATION	88.89			88.64						2		
4	STATION	487+50	CL	LT	488+00	CL	LT	50	0.50%	0	1	3.400	6.8
	ELEVATION	88.64			88.39						1		
5	STATION	488+00	CL	LT	488+50	CL	LT	50	0.30%	0	1	3.400	6.8
	ELEVATION	88.39			88.24						1		

NO	DATE	REVISION	APPROVED

STATE OF TEXAS
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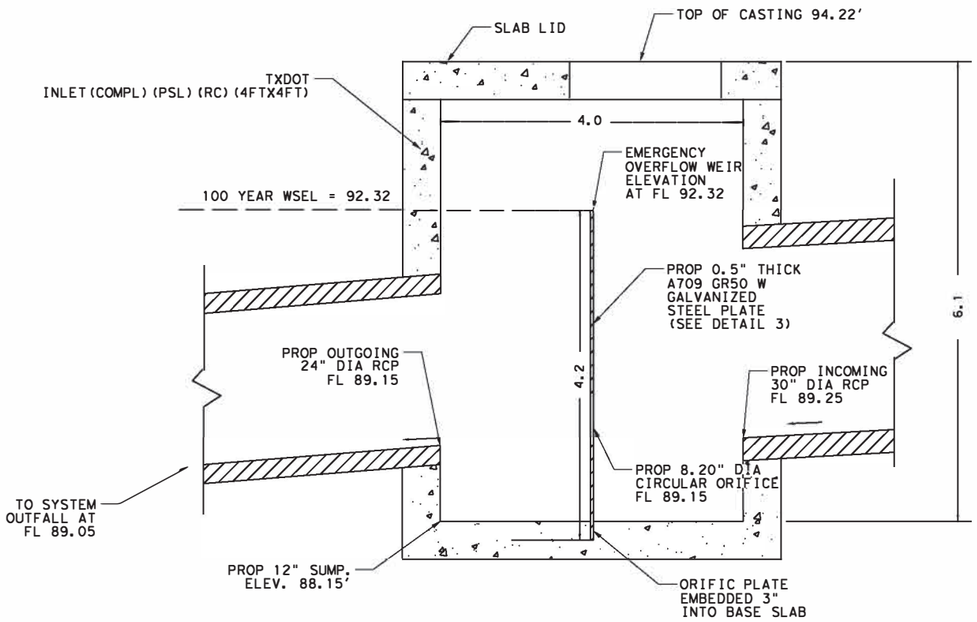
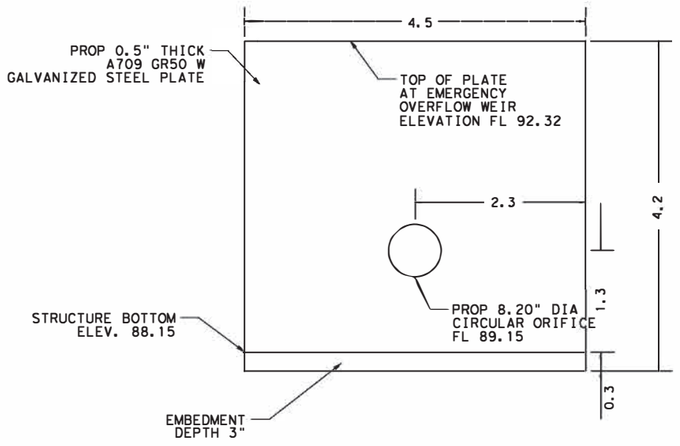
SL 494 AT FM 1485
DITCH TABLES

SHEET 1 OF 1

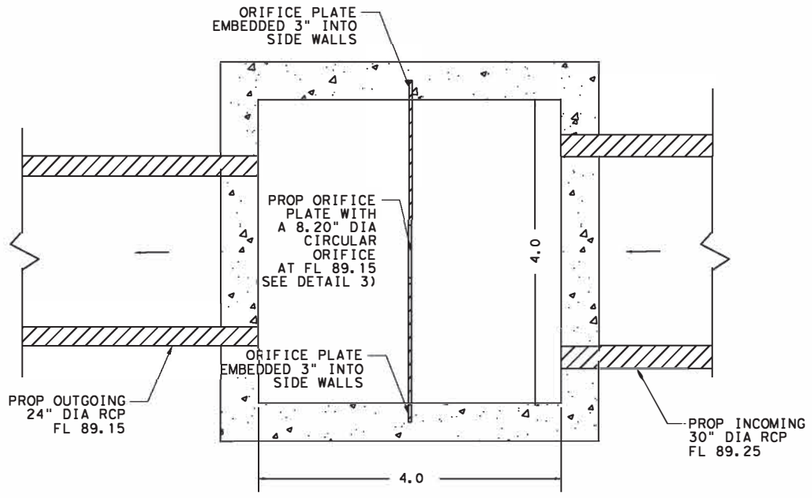
FED. RD. DIV. NO.	PROJECT NO.		SHEET NO.
6			75C
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY	
CONT.	SECT.	JOB	HIGHWAY NO.
0177	14	037	SL 494



DETAIL 1 - OUTLET STRUCTURE AS SECTION VIEW



DETAIL 3
PROPOSED GALVANIZED
STEEL ORIFICE PLATE



DETAIL 2 - OUTLET STRUCTURE A5 PLAN VIEW

DETAILS ARE NOT TO SCALE

NO	DATE	REVISION	APPROVED

STATE OF TEXAS
NILESH D. SHRINGARPURE
139719
LICENSED
PROFESSIONAL ENGINEER
07/26/2021
F-2677

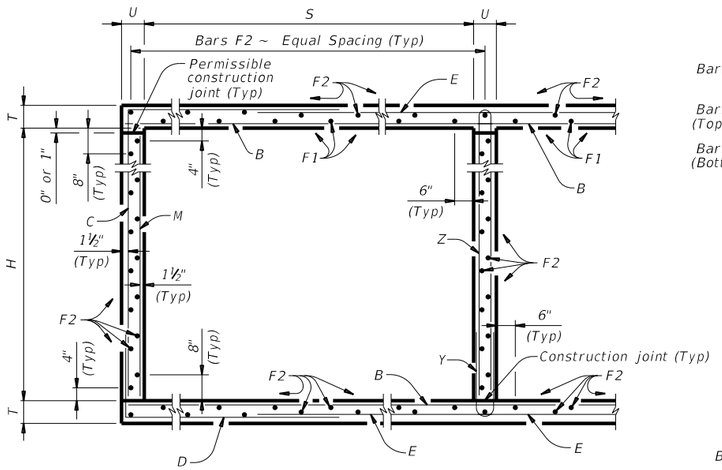
Michael Baker INTERNATIONAL
2002 W. Grand Parkway N.
Suite 325
Katy, TX 77449
TBPE Registration No. 2677

SL 494 AT FM 1485 STRUCTURE AS OUTLET CONTROL STRUCTURE DETAILS

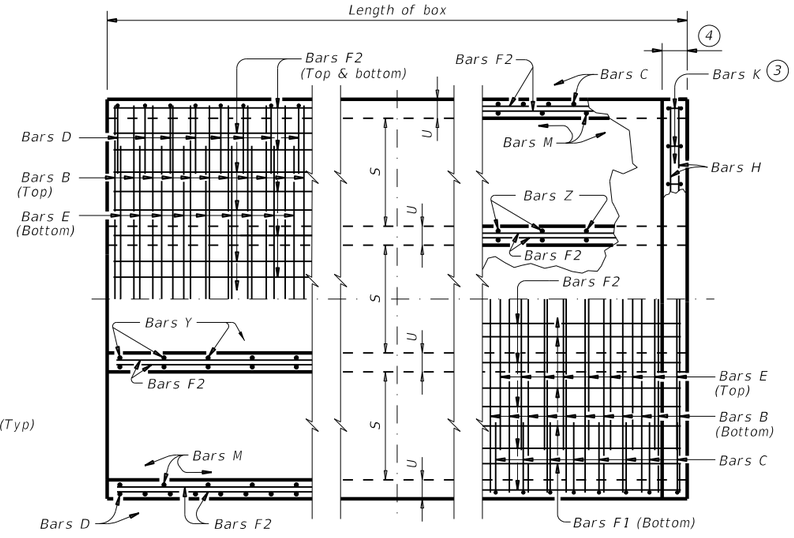
SHEET 1 OF 1

FED. RD. DIV. NO.	PROJECT NO.		SHEET NO.
6			75D
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY	
CONT.	SECT.	JOB	HIGHWAY NO.
0177	14	037	SL 494

DATE:
FILE:

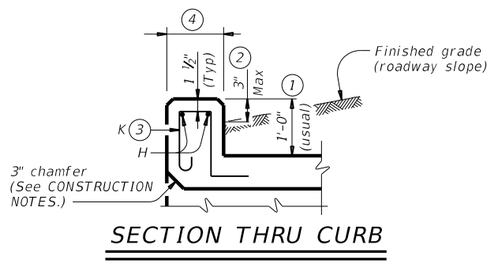


TYPICAL SECTION



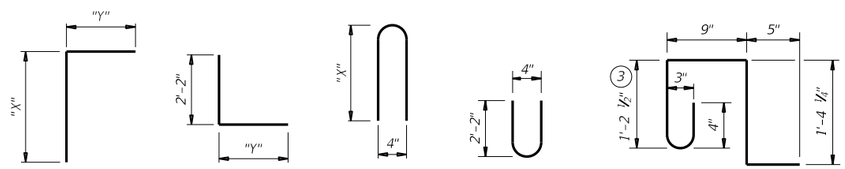
BOTTOM SLAB TOP SLAB

PART PLANS



SECTION THRU CURB

TABLE OF BAR DIMENSIONS		
H	"X"	"Y"
2'-0"	2'-6 ½"	2'-8"
3'-0"	3'-6 ½"	3'-8"



BARS C BARS D BARS Z BARS Y

BARS K (#4)
(Spa = 1'-0" Max)
(Length = 4'-2")

1. 0" Min to 5'-0" Max. Estimated curb heights are shown elsewhere in the plans. For structures with pedestrian rail or curbs taller than 1'-0", refer to the Extended Curb Details (ECD) standard sheet. For structures with T631 or T631LS bridge rail, refer to the Mounting Details for T631 & T631LS Rails (T631-CM) standard sheet. Refer to the Rail Anchorage Curb (RAC) standard sheet for structures with bridge rail other than T631 or T631LS.

2. For vehicle safety, the following requirements must be met:
   - For structures without bridge rail, construct curbs no more than 3" above finished grade.
   - For structures with bridge rail, construct curbs flush with finished grade.

   Reduce curb heights, if necessary, to meet the above requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.

3. For curbs less than 1'-0" high, tilt Bars K or reduce bar height as necessary to maintain cover. For curbs less than 3" high, Bars K may be omitted.

4. 1'-0" typical. 2'-3" when the Rail Anchorage Curb (RAC) standard sheet is referred to elsewhere in the plans.

The Contractor may replace Bars B, C, D, E, F1, F2, M, Y, and/or Z with deformed welded wire reinforcement (WWR) meeting the requirements of ASTM A1064. The area of required reinforcement may be reduced by the ratio of 60 ksi / 70 ksi. Spacing of WWR is limited to 4" Min and 18" Max. When required, provide lap splices in the WWR of the same length required for the equivalent bar size, rounded up for wire sizes between conventional bar sizes. The lap length required for WWR is never less than the lap length required for uncoated #4 bars.

Example conversion: Replacing No. 6 Gr 60 at 6" Spacing with WWR
Required WWR = (0.44 sq. in. per 0.5 ft.) x (60 ksi / 70 ksi) = 0.755 sq. in. per ft.
If D30.6 wire is used to meet the 0.755 sq. in. per ft. requirement in this example, the required spacing = (0.306 sq. in.) / (0.755 sq. in. per ft.) x (12 in. per ft.) = 4.86" Max spacing. Required lap length for the provided D30.6 wire is 2'-1" (the same minimum lap length required for uncoated #5 bars, as listed under MATERIAL NOTES).

CONSTRUCTION NOTES:

Do not use permanent forms.
Chamfer the bottom edge of the top slab 3" at the entrance.
Optionally, raise construction joints shown at the flow line by a maximum of 6". If this option is taken, Bars M may be cut off or raised, Bars C and D may be reversed, and Bars Y and Z may be reversed.

MATERIAL NOTES:

Provide Grade 60 reinforcing steel.
Provide galvanized reinforcing steel if required elsewhere in the plans.
Provide Class C concrete (f'c = 3,600 psi) for culvert barrel and curb, with the following exceptions: provide Class S concrete (f'c = 4,000 psi) for top slabs of:
- culverts with overlay,
- culverts with 1-to-2 course surface treatment, or
- culverts with the top slab as the final riding surface.

Provide bar laps, where required, as follows:
- Uncoated or galvanized ~ #4 = 1'-8" Min
- Uncoated or galvanized ~ #5 = 2'-1" Min

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications for the range of fill heights shown.
See the Multiple Box Culverts Cast-In-Place Miscellaneous Detail (MC-MD) standard sheet for details pertaining to skewed ends, angle sections, and lengthening.

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

Use this standard only when lengthening existing multiple box culverts.

HL93 LOADING

Texas Department of Transportation

Bridge Division Standard

MULTIPLE BOX CULVERTS CAST-IN-PLACE
3'-0" SPAN
0' TO 23' FILL
FOR LENGTHENING ONLY
MC-3-23

FILE: mc323ste-20.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0177	14	037	SL 494
	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY		76

NUMBER OF SPANS	SECTION DIMENSIONS				BILLS OF REINFORCING STEEL (For Box Length = 40 feet)																																QUANTITIES					
					Bars B					Bars C & D							Bars E					Bars F1 ~ #4				Bars F2 ~ #4				Bars M ~ #4				Bars Y & Z ~ #4						Bars H 4 ~ #4		Bars K		Per Foot of Barrel		Curb		Total	
	S	H	T	U	No.	Size	Spa	Length	Wt	No.	Size	Spa	Bars C		Bars D		No.	Size	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Bars Y		Bars Z		Length	Wt	No.	Wt	Conc (CY)	Renf (Lb)	Conc (CY)	Renf (Lb)	Conc (CY)	Renf (Lb)
													Length	Wt	Length	Wt																					Length	Wt	Length	Wt										
2	3' – 0"	2' – 0"	8"	7"	108	#5	9"	7' – 6"	845	108	#4	9"	5' – 4"	385	5' – 0"	361	108	#4	9"	5' – 11"	427	6	18"	39' – 9"	159	32	18"	39' – 9"	850	108	9"	2' – 0"	144	54	9"	4' – 7"	165	5' – 3"	189	7' – 6"	20	18	50	0.512	88.1	0.6	70	21.1	3,595
3	3' – 0"	2' – 0"	8"	7"	108	#5	9"	11' – 1"	1,248	108	#4	9"	5' – 4"	385	5' – 0"	361	108	#4	9"	9' – 6"	685	9	18"	39' – 9"	239	45	18"	39' – 9"	1,195	108	9"	2' – 0"	144	108	9"	4' – 7"	331	5' – 3"	379	11' – 1"	30	26	72	0.733	124.2	0.8	102	30.2	5,069
4	3' – 0"	2' – 0"	8"	7"	108	#5	9"	14' – 8"	1,652	108	#4	9"	5' – 4"	385	5' – 0"	361	108	#4	9"	13' – 1"	944	12	18"	39' – 9"	319	58	18"	39' – 9"	1,540	108	9"	2' – 0"	144	162	9"	4' – 7"	496	5' – 3"	568	14' – 8"	39	32	89	0.953	160.2	1.1	128	39.2	6,537
5	3' – 0"	2' – 0"	8"	7"	108	#5	9"	18' – 3"	2,056	108	#4	9"	5' – 4"	385	5' – 0"	361	108	#4	9"	16' – 8"	1,202	15	18"	39' – 9"	398	71	18"	39' – 9"	1,885	108	9"	2' – 0"	144	216	9"	4' – 7"	661	5' – 3"	758	18' – 3"	49	40	111	1.173	196.3	1.4	160	48.3	8,010
6	3' – 0"	2' – 0"	8"	7"	108	#5	9"	21' – 10"	2,459	108	#4	9"	5' – 4"	385	5' – 0"	361	108	#4	9"	20' – 3"	1,461	18	18"	39' – 9"	478	84	18"	39' – 9"	2,230	108	9"	2' – 0"	144	270	9"	4' – 7"	827	5' – 3"	947	21' – 10"	58	46	128	1.393	232.3	1.6	186	57.4	9,478
2	3' – 0"	3' – 0"	8"	7"	108	#5	9"	7' – 6"	845	108	#4	9"	6' – 4"	457	5' – 0"	361	108	#4	9"	5' – 11"	427	6	18"	39' – 9"	159	38	18"	39' – 9"	1,009	108	9"	3' – 0"	216	54	9"	4' – 7"	165	7' – 3"	262	7' – 6"	20	18	50	0.577	97.5	0.6	70	23.7	3,971
3	3' – 0"	3' – 0"	8"	7"	108	#5	9"	11' – 1"	1,248	108	#4	9"	6' – 4"	457	5' – 0"	361	108	#4	9"	9' – 6"	685	9	18"	39' – 9"	239	53	18"	39' – 9"	1,407	108	9"	3' – 0"	216	108	9"	4' – 7"	331	7' – 3"	523	11' – 1"	30	26	72	0.819	136.7	0.8	102	33.6	5,569
4	3' – 0"	3' – 0"	8"	7"	108	#5	9"	14' – 8"	1,652	108	#4	9"	6' – 4"	457	5' – 0"	361	108	#4	9"	13' – 1"	944	12	18"	39' – 9"	319	68	18"	39' – 9"	1,806	108	9"	3' – 0"	216	162	9"	4' – 7"	496	7' – 3"	785	14' – 8"	39	32	89	1.061	175.9	1.1	128	43.5	7,164
5	3' – 0"	3' – 0"	8"	7"	108	#5	9"	18' – 3"	2,056	108	#4	9"	6' – 4"	457	5' – 0"	361	108	#4	9"	16' – 8"	1,202	15	18"	39' – 9"	398	83	18"	39' – 9"	2,204	108	9"	3' – 0"	216	216	9"	4' – 7"	661	7' – 3"	1,046	18' – 3"	49	40	111	1.302	215.0	1.4	160	53.4	8,761
6	3' – 0"	3' – 0"	8"	7"	108	#5	9"	21' – 10"	2,459	108	#4	9"	6' – 4"	457	5' – 0"	361	108	#4	9"	20' – 3"	1,461	18	18"	39' – 9"	478	98	18"	39' – 9"	2,602	108	9"	3' – 0"	216	270	9"	4' – 7"	827	7' – 3"	1,308	21' – 10"	58	46	128	1.544	254.2	1.6	186	63.4	10,355

DATE:
FILE:

Use this standard only when lengthening existing multiple box culverts.

HL93 LOADING

Texas Department of Transportation

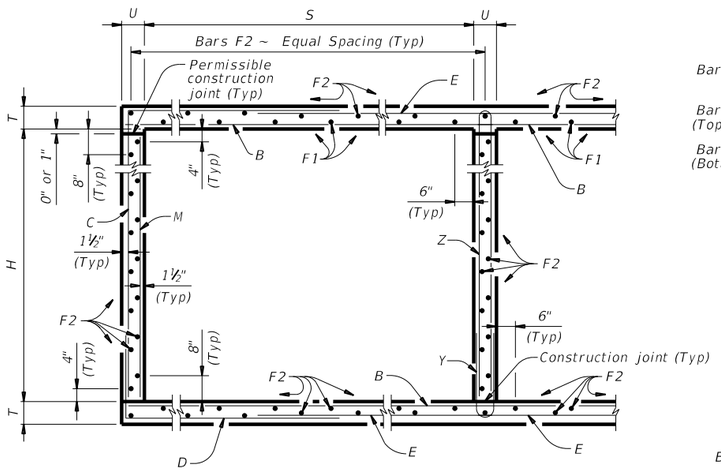
Bridge Division Standard

MULTIPLE BOX CULVERTS CAST-IN-PLACE 3'-0" SPAN 0' TO 23' FILL FOR LENGTHENING ONLY

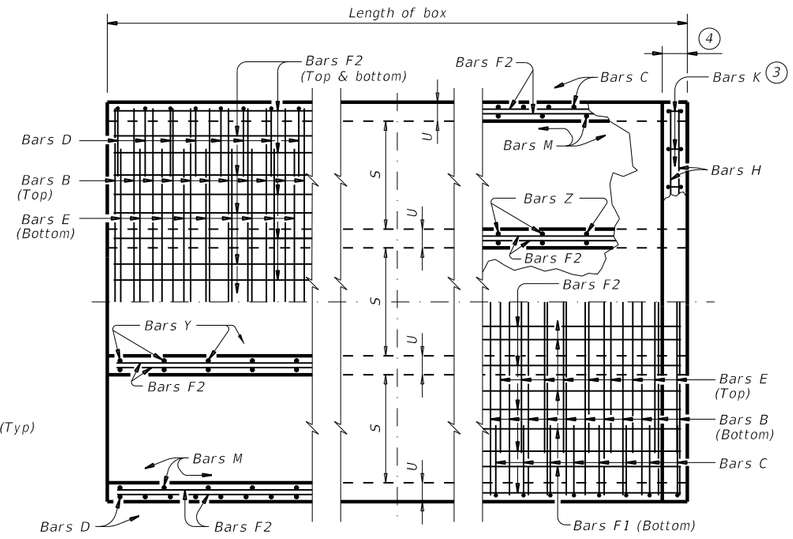
MC-3-23

FILE: mc323ste-20.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0177	14	037	SL 494
	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY		77

DATE:
FILE:



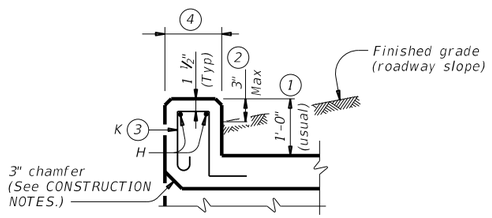
TYPICAL SECTION



BOTTOM SLAB

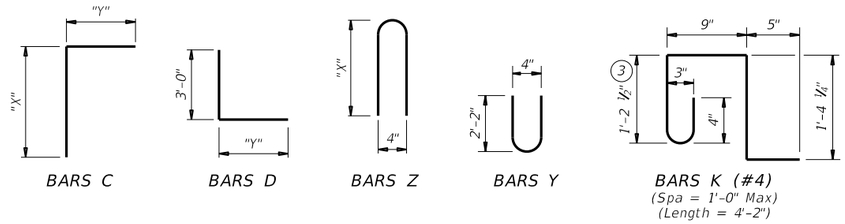
TOP SLAB

PART PLANS



SECTION THRU CURB

TABLE OF BAR DIMENSIONS		
H	"X"	"Y"
4'-0"	4'-6 ½"	5'-9"
5'-0"	5'-6 ½"	5'-9"
6'-0"	6'-6 ½"	5'-9"
7'-0"	7'-6 ½"	5'-9"
8'-0"	8'-6 ½"	5'-9"
9'-0"	9'-6 ½"	5'-9"
10'-0"	10'-6 ½"	5'-9"



1. 0" Min to 5'-0" Max. Estimated curb heights are shown elsewhere in the plans. For structures with pedestrian rail or curbs taller than 1'-0", refer to the Extended Curb Details (ECD) standard sheet. For structures with T631 or T631LS bridge rail, refer to the Mounting Details for T631 & T631LS Rails (T631-CM) standard sheet. Refer to the Rail Anchorage Curb (RAC) standard sheet for structures with bridge rail other than T631 or T631LS.

2. For vehicle safety, the following requirements must be met:
   - For structures without bridge rail, construct curbs no more than 3" above finished grade.
   - For structures with bridge rail, construct curbs flush with finished grade.

   Reduce curb heights, if necessary, to meet the above requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.

3. For curbs less than 1'-0" high, tilt Bars K or reduce bar height as necessary to maintain cover. For curbs less than 3" high, Bars K may be omitted.

4. 1'-0" typical. 2'-3" when the Rail Anchorage Curb (RAC) standard sheet is referred to elsewhere in the plans.

The Contractor may replace Bars B, C, D, E, F1, F2, M, Y, and/or Z with deformed welded wire reinforcement (WWR) meeting the requirements of ASTM A1064. The area of required reinforcement may be reduced by the ratio of 60 ksi / 70 ksi. Spacing of WWR is limited to 4" Min and 18" Max. When required, provide lap splices in the WWR of the same length required for the equivalent bar size, rounded up for wire sizes between conventional bar sizes. The lap length required for WWR is never less than the lap length required for uncoated #4 bars.

Example conversion: Replacing No. 6 Gr 60 at 6" Spacing with WWR
Required WWR = (0.44 sq. in. per 0.5 ft.) x (60 ksi / 70 ksi) = 0.755 sq. in. per ft.
If D30.6 wire is used to meet the 0.755 sq. in. per ft. requirement in this example, the required spacing = (0.306 sq. in.) / (0.755 sq. in. per ft.) x (12 in. per ft.) = 4.86" Max spacing. Required lap length for the provided D30.6 wire is 2'-1" (the same minimum lap length required for uncoated #5 bars, as listed under MATERIAL NOTES).

CONSTRUCTION NOTES:

Do not use permanent forms.
Chamfer the bottom edge of the top slab 3" at the entrance.
Optionally, raise construction joints shown at the flow line by a maximum of 6". If this option is taken, Bars M may be cut off or raised, Bars C and D may be reversed, and Bars Y and Z may be reversed.

MATERIAL NOTES:

Provide Grade 60 reinforcing steel.
Provide galvanized reinforcing steel if required elsewhere in the plans.
Provide Class C concrete (f'c = 3,600 psi) for culvert barrel and curb, with the following exceptions: provide Class S concrete (f'c = 4,000 psi) for top slabs of:
- culverts with overlay,
- culverts with 1-to-2 course surface treatment, or
- culverts with the top slab as the final riding surface.

Provide bar laps, where required, as follows:
- Uncoated or galvanized ~ #4 = 1'-8" Min
- Uncoated or galvanized ~ #5 = 2'-1" Min
- Uncoated or galvanized ~ #6 = 2'-6" Min

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications for the range of fill heights shown.
See the Multiple Box Culverts Cast-In-Place Miscellaneous Detail (MC-MD) standard sheet for details pertaining to skewed ends, angle sections, and lengthening.

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

HL93 LOADING

Texas Department of Transportation

Bridge Division Standard

MULTIPLE BOX CULVERTS CAST-IN-PLACE
10'-0" SPAN
0' TO 7' FILL

MC-10-7

FILE: mc107ste-20.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0177	14	037	SL494
	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY		78

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DATE:
FILE:

NUMBER OF SPANS	SECTION DIMENSIONS				BILLS OF REINFORCING STEEL (For Box Length = 40 feet)																														QUANTITIES					
					Bars B (5)					Bars C & D							Bars E					Bars F1 ~ #4				Bars F2 ~ #4				Bars M ~ #4				Bars Y & Z ~ #4						Bars H 4 ~ #4 (5)		Bars K		Per Foot of Barrel		Curb		Total	
												Bars C		Bars D																				Bars Y		Bars Z											
	S	H	T	U	No.	Size	Spa	Length	Wt	No.	Size	Spa	Length	Wt	Length	Wt	No.	Size	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	Length	Wt	No.	Wt	Conc (CY)	Renf (Lb)	Conc (CY)	Renf (Lb)	Conc (CY)	Renf (Lb)
2	10' – 0"	4' – 0"	8"	7"	162	#6	6"	21' – 6"	5,231	108	#6	9"	10' – 4"	1,676	8' – 10"	1,433	162	#6	6"	15' – 4"	3,731	14	18"	39' – 9"	372	66	18"	39' – 9"	1,752	108	9"	4' – 0"	289	54	9"	4' – 7"	165	9' – 3"	334	21' – 6"	57	46	128	1.333	374.6	1.6	185	54.9	15,168
3	10' – 0"	4' – 0"	8"	7"	162	#6	6"	32' – 1"	7,807	108	#6	9"	10' – 4"	1,676	8' – 10"	1,433	162	#6	6"	25' – 11"	6,306	21	18"	39' – 9"	558	95	18"	39' – 9"	2,523	108	9"	4' – 0"	289	108	9"	4' – 7"	331	9' – 3"	667	32' – 1"	86	68	189	1.942	539.8	2.4	275	80.1	21,865
4	10' – 0"	4' – 0"	8"	7"	162	#6	6"	42' – 8"	10,382	108	#6	9"	10' – 4"	1,676	8' – 10"	1,433	162	#6	6"	36' – 6"	8,881	28	18"	39' – 9"	743	124	18"	39' – 9"	3,293	108	9"	4' – 0"	289	162	9"	4' – 7"	496	9' – 3"	1,001	42' – 8"	114	88	245	2.551	704.9	3.2	359	105.2	28,553
5	10' – 0"	4' – 0"	8"	7"	162	#6	6"	53' – 3"	12,957	108	#6	9"	10' – 4"	1,676	8' – 10"	1,433	162	#6	6"	47' – 1"	11,457	35	18"	39' – 9"	929	153	18"	39' – 9"	4,063	108	9"	4' – 0"	289	216	9"	4' – 7"	661	9' – 3"	1,335	53' – 3"	142	110	306	3.160	870.0	3.9	448	130.3	35,248
6	10' – 0"	4' – 0"	8"	7"	162	#6	6"	66' – 4"	16,140	108	#6	9"	10' – 4"	1,676	8' – 10"	1,433	162	#6	6"	57' – 8"	14,032	42	18"	39' – 9"	1,115	182	18"	39' – 9"	4,833	108	9"	4' – 0"	289	270	9"	4' – 7"	827	9' – 3"	1,668	65' – 6"	175	130	362	3.770	1,050.3	4.7	537	155.5	42,550
2	10' – 0"	5' – 0"	8"	7"	162	#6	6"	21' – 6"	5,231	108	#6	9"	11' – 4"	1,838	8' – 10"	1,433	162	#6	6"	15' – 4"	3,731	14	18"	39' – 9"	372	72	18"	39' – 9"	1,912	108	9"	5' – 0"	361	54	9"	4' – 7"	165	11' – 3"	406	21' – 6"	57	46	128	1.398	386.2	1.6	185	57.5	15,634
3	10' – 0"	5' – 0"	8"	7"	162	#6	6"	32' – 1"	7,807	108	#6	9"	11' – 4"	1,838	8' – 10"	1,433	162	#6	6"	25' – 11"	6,306	21	18"	39' – 9"	558	103	18"	39' – 9"	2,735	108	9"	5' – 0"	361	108	9"	4' – 7"	331	11' – 3"	812	32' – 1"	86	68	189	2.029	554.5	2.4	275	83.5	22,456
4	10' – 0"	5' – 0"	8"	7"	162	#6	6"	42' – 8"	10,382	108	#6	9"	11' – 4"	1,838	8' – 10"	1,433	162	#6	6"	36' – 6"	8,881	28	18"	39' – 9"	743	134	18"	39' – 9"	3,558	108	9"	5' – 0"	361	162	9"	4' – 7"	496	11' – 3"	1,217	42' – 8"	114	88	245	2.659	722.7	3.2	359	109.5	29,268
5	10' – 0"	5' – 0"	8"	7"	162	#6	6"	53' – 3"	12,957	108	#6	9"	11' – 4"	1,838	8' – 10"	1,433	162	#6	6"	47' – 1"	11,457	35	18"	39' – 9"	929	165	18"	39' – 9"	4,381	108	9"	5' – 0"	361	216	9"	4' – 7"	661	11' – 3"	1,623	53' – 3"	142	110	306	3.290	891.0	3.9	448	135.5	36,088
6	10' – 0"	5' – 0"	8"	7"	162	#6	6"	66' – 4"	16,140	108	#6	9"	11' – 4"	1,838	8' – 10"	1,433	162	#6	6"	57' – 8"	14,032	42	18"	39' – 9"	1,115	196	18"	39' – 9"	5,204	108	9"	5' – 0"	361	270	9"	4' – 7"	827	11' – 3"	2,029	65' – 6"	175	130	362	3.921	1,074.5	4.7	537	161.6	43,516
2	10' – 0"	6' – 0"	8"	7"	162	#6	6"	21' – 6"	5,231	108	#6	9"	12' – 4"	2,001	8' – 10"	1,433	162	#6	6"	15' – 4"	3,731	14	18"	39' – 9"	372	78	18"	39' – 9"	2,071	108	9"	6' – 0"	433	54	9"	4' – 7"	165	13' – 3"	478	21' – 6"	57	46	128	1.463	397.9	1.6	185	60.1	16,100
3	10' – 0"	6' – 0"	8"	7"	162	#6	6"	32' – 1"	7,807	108	#6	9"	12' – 4"	2,001	8' – 10"	1,433	162	#6	6"	25' – 11"	6,306	21	18"	39' – 9"	558	111	18"	39' – 9"	2,947	108	9"	6' – 0"	433	108	9"	4' – 7"	331	13' – 3"	956	32' – 1"	86	68	189	2.115	569.3	2.4	275	87.0	23,047
4	10' – 0"	6' – 0"	8"	7"	162	#6	6"	42' – 8"	10,382	108	#6	9"	12' – 4"	2,001	8' – 10"	1,433	162	#6	6"	36' – 6"	8,881	28	18"	39' – 9"	743	144	18"	39' – 9"	3,824	108	9"	6' – 0"	433	162	9"	4' – 7"	496	13' – 3"	1,434	42' – 8"	114	88	245	2.767	740.7	3.2	359	113.8	29,986
5	10' – 0"	6' – 0"	8"	7"	162	#6	6"	53' – 3"	12,957	108	#6	9"	12' – 4"	2,001	8' – 10"	1,433	162	#6	6"	47' – 1"	11,457	35	18"	39' – 9"	929	177	18"	39' – 9"	4,700	108	9"	6' – 0"	433	216	9"	4' – 7"	661	13' – 3"	1,912	53' – 3"	142	110	306	3.420	912.1	3.9	448	140.7	36,931
6	10' – 0"	6' – 0"	8"	7"	162	#6	6"	66' – 4"	16,140	108	#6	9"	12' – 4"	2,001	8' – 10"	1,433	162	#6	6"	57' – 8"	14,032	42	18"	39' – 9"	1,115	210	18"	39' – 9"	5,576	108	9"	6' – 0"	433	270	9"	4' – 7"	827	13' – 3"	2,390	65' – 6"	175	130	362	4.072	1,098.7	4.7	537	167.6	44,484
2	10' – 0"	7' – 0"	8"	7"	162	#6	6"	21' – 6"	5,231	108	#6	9"	13' – 4"	2,163	8' – 10"	1,433	162	#6	6"	15' – 4"	3,731	14	18"	39' – 9"	372	78	18"	39' – 9"	2,071	108	9"	7' – 0"	505	54	9"	4' – 7"	165	15' – 3"	550	21' – 6"	57	46	128	1.528	405.5	1.6	185	62.7	16,406
3	10' – 0"	7' – 0"	8"	7"	162	#6	6"	32' – 1"	7,807	108	#6	9"	13' – 4"	2,163	8' – 10"	1,433	162	#6	6"	25' – 11"	6,306	21	18"	39' – 9"	558	111	18"	39' – 9"	2,947	108	9"	7' – 0"	505	108	9"	4' – 7"	331	15' – 3"	1,100	32' – 1"	86	68	189	2.202	578.8	2.4	275	90.5	23,425
4	10' – 0"	7' – 0"	8"	7"	162	#6	6"	42' – 8"	10,382	108	#6	9"	13' – 4"	2,163	8' – 10"	1,433	162	#6	6"	36' – 6"	8,881	28	18"	39' – 9"	743	144	18"	39' – 9"	3,824	108	9"	7' – 0"	505	162	9"	4' – 7"	496	15' – 3"	1,650	42' – 8"	114	88	245	2.876	751.9	3.2	359	118.2	30,436
5	10' – 0"	7' – 0"	8"	7"	162	#6	6"	53' – 3"	12,957	108	#6	9"	13' – 4"	2,163	8' – 10"	1,433	162	#6	6"	47' – 1"	11,457	35	18"	39' – 9"	929	177	18"	39' – 9"	4,700	108	9"	7' – 0"	505	216	9"	4' – 7"	661	15' – 3"	2,200	53' – 3"	142	110	306	3.549	925.1	3.9	448	145.9	37,453
6	10' – 0"	7' – 0"	8"	7"	162	#6	6"	66' – 4"	16,140	108	#6	9"	13' – 4"	2,163	8' – 10"	1,433	162	#6	6"	57' – 8"	14,032	42	18"	39' – 9"	1,115	210	18"	39' – 9"	5,576	108	9"	7' – 0"	505	270	9"	4' – 7"	827	15' – 3"	2,750	65' – 6"	175	130	362	4.223	1,113.5	4.7	537	173.7	45,078
2	10' – 0"	8' – 0"	8"	7"	162	#6	6"	21' – 6"	5,231	108	#6	9"	14' – 4"	2,325	8' – 10"	1,433	162	#6	6"	15' – 4"	3,731	14	18"	39' – 9"	372	84	18"	39' – 9"	2,230	108	9"	8' – 0"	577	54	9"	4' – 7"	165	17' – 3"	622	21' – 6"	57	46	128	1.593	417.2	1.6	185	65.3	16,871
3	10' – 0"	8' – 0"	8"	7"	162	#6	6"	32' – 1"	7,807	108	#6	9"	14' – 4"	2,325	8' – 10"	1,433	162	#6	6"	25' – 11"	6,306	21	18"	39' – 9"	558	119	18"	39' – 9"	3,160	108	9"	8' – 0"	577	108	9"	4' – 7"	331	17' – 3"	1,244	32' – 1"	86	68	189	2.288	593.5	2.4	275	93.9	24,016
4	10' – 0"	8' – 0"	8"	7"	162	#6	6"	42' – 8"	10,382	108	#6	9"	14' – 4"	2,325	8' – 10"	1,433	162	#6	6"	36' – 6"	8,881	28	18"	39' – 9"	743	154	18"	39' – 9"	4,089	108	9"	8' – 0"	577	162	9"	4' – 7"	496	17' – 3"	1,867	42' – 8"	114	88	245	2.984	769.8	3.2	359	122.5	31,152
5	10' – 0"	8' – 0"	8"	7"	162	#6	6"	53' – 3"	12,957	108	#6	9"	14' – 4"	2,325	8' – 10"	1,433	162	#6	6"	47' – 1"	11,457	35	18"	39' – 9"	929	189	18"	39' – 9"	5,019	108	9"	8' – 0"	577	216	9"	4' – 7"	661	17' – 3"	2,489	53' – 3"	142	110	306	3.679	946.2	3.9	448	151.1	38,295
6	10' – 0"	8' – 0"	8"	7"	162	#6	6"	66' – 4"	16,140	108	#6	9"	14' – 4"	2,325	8' – 10"	1,433	162	#6	6"	57' – 8"	14,032	42	18"	39' – 9"	1,115	224	18"	39' – 9"	5,948	108	9"	8' – 0"	577	270	9"	4' – 7"	827	17' – 3"	3,111	65' – 6"	175	130	362	4.374	1,137.7	4.7	537	179.7	46,045
2	10' – 0"	9' – 0"	8"	7"	162	#6	6"	21' – 6"	5,231	162	#6	6"	15' – 4"	3,731	8' – 10"	2,149	162	#6	6"	15' – 4"	3,731	14	18"	39' – 9"	372	90	18"	39' – 9"	2,390	108	9"	9' – 0"	649	54	9"	4' – 7"	165	19' – 3"	694	21' – 6"	57	46	128	1.657	477.8	1.6	185	67.9	19,297
3	10' – 0"	9' – 0"	8"	7"	162	#6	6"	32' – 1"	7,807	162	#6	6"	15' – 4"	3,731	8' – 10"	2,149	162	#6	6"	25' – 11"	6,306	21	18"	39' – 9"	558	127	18"	39' – 9"	3,372	108	9"	9' – 0"	649	108	9"	4' – 7"	331	19' – 3"	1,389	32' – 1"	86	68	189	2.374	657.3	2.4	275	97.3	26,567
4	10' – 0"	9' – 0"	8"	7"	162	#6	6"	42' – 8"	10,382	162	#6	6"	15' – 4"	3,731	8' – 10"	2,149	162	#6	6"	36' – 6"	8,881	28	18"	39' – 9"	743	164	18"	39' – 9"	4,355	108	9"	9' – 0"	649	162	9"	4' – 7"	496	19' – 3"	2,083	42' – 8"	114	88	245	3.092	836.7	3.2	359	126.8	33,828
5	10' – 0"	9' – 0"	8"	7"	162	#6	6"	53' – 3"	12,957	162	#6	6"	15' – 4"	3,731	8' – 10"	2,149	162	#6	6"	47' – 1"	11,457	35	18"	39' – 9"	929	201	18"	39' – 9"	5,337	108	9"	9' – 0"	649	216	9"	4' – 7"	661	19' – 3"	2,778	53' – 3"	142	110	306	3.809	1,016.2	3.9	448	156.3	41,096
6	10' – 0"	9' – 0"	8"	7"	162	#6	6"	66' – 4"	16,140	162	#6	6"	15' – 4"	3,731	8' – 10"	2,149	162	#6	6"	57' – 8"	14,032	42	18"	39' – 9"	1,115	238	18"	39' – 9"	6,320	108	9"	9' – 0"	649	270	9"	4' – 7"	827	19' – 3"	3,472	65' – 6"	175	130	362	4.526	1,210.9	4.7	537	185.8	48,972
2	10' – 0"	10' – 0"	8"	7"	162	#6	6"	21' – 6"	5,231	162	#6	6"	16' – 4"	3,974	8' – 10"	2,149	162	#6	6"	15' – 4"	3,731	14	18"	39' – 9"	372	90	18"	39' – 9"	2,390	108	9"	10' – 0"	721	54	9"	4' – 7"	165	21' – 3"	767	21' – 6"	57	46	128	1.722	487.5	1.6	185	70.5	19,685
3	10' – 0"	10' – 0"	8"	7"	162	#6	6"	32' – 1"	7,807	162	#6	6"	16' – 4"	3,974	8' – 10"	2,149	162	#6	6"	25' – 11"	6,306	21	18"	39' – 9"	558	127	18"	39' – 9"	3,372	108	9"	10' – 0"	721	108	9"	4' – 7"	331	21' – 3"	1,533	32' – 1"	86	68	189	2.461	668.8	2.4	275	100.8	27,026
4	10' – 0"	10' – 0"	8"	7"	162	#6	6"	42' – 8"	10,382	162	#6	6"	16' – 4"	3,974	8' – 10"	2,149	162	#6	6"	36' – 6"	8,881	28	18"	39' – 9"	743	164	18"	39' – 9"	4,355	108	9"	10' – 0"	721	162	9"	4' – 7"	496	21' – 3"	2,300	42' – 8"	114	88	245	3.200	850.0	3.2	359	131.2	34,360
5	10' – 0"	10' – 0"	8"	7"	162	#6	6"	53' – 3"	12,957	162	#6	6"	16' – 4"	3,974	8' – 10"	2,149	162	#6	6"	47' – 1"	11,457	35	18"	39' – 9"	929	201	18"	39' – 9"	5,337	108	9"	10' – 0"	721	216	9"	4' – 7"	661	21' – 3"	3,066	53' – 3"	142	110	306	3.938	1,031.3	3.9	448	161.5	41,699
6	10' – 0"	10' – 0"	8"	7"	162	#6	6"	66' – 4"	16,140	162	#6	6"	16' – 4"	3,974	8' – 10"	2,149	162	#6	6"	57' – 8"	14,032	42	18"	39' – 9"	1,115	238	18"	39' – 9"	6,320	108	9"	10' – 0"	721	270	9"	4' – 7"	827	21' – 3"	3,833	65' – 6"	175	130	362	4.677	1,227.8	4.7	537	191.8	49,648

(5) Bar lengths over 60' include one bar lap; refer to MATERIAL NOTES for minimum lap lengths.

HL93 LOADING

Texas Department of Transportation

Bridge Division Standard

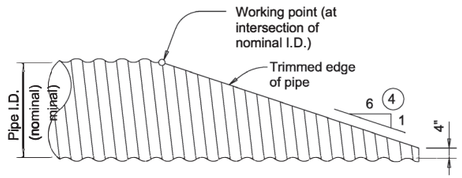
MULTIPLE BOX CULVERTS CAST-IN-PLACE

10'-0" SPAN

0' TO 7' FILL

MC-10-7

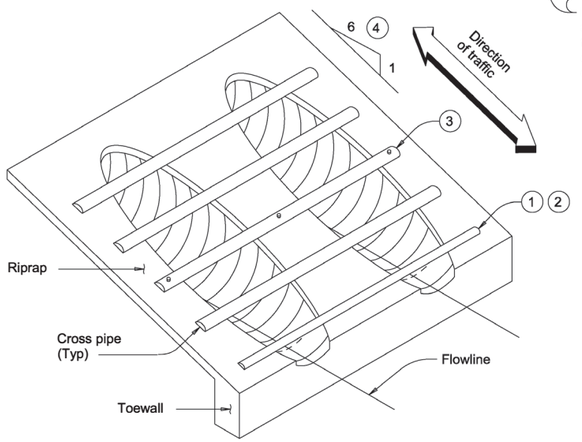
FILE: mc107ste-20.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0177	14	037	SL 494
	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY		79



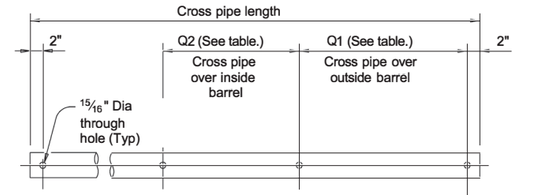
NOTE: All cross pipes, calculations, and dimensions are based on the pipe culverts mitered as shown in this detail. Alternate styles of mitered ends will require that appropriate adjustments be made to the values presented on this standard.

SIDE ELEVATION OF TYPICAL PIPE CULVERT MITER

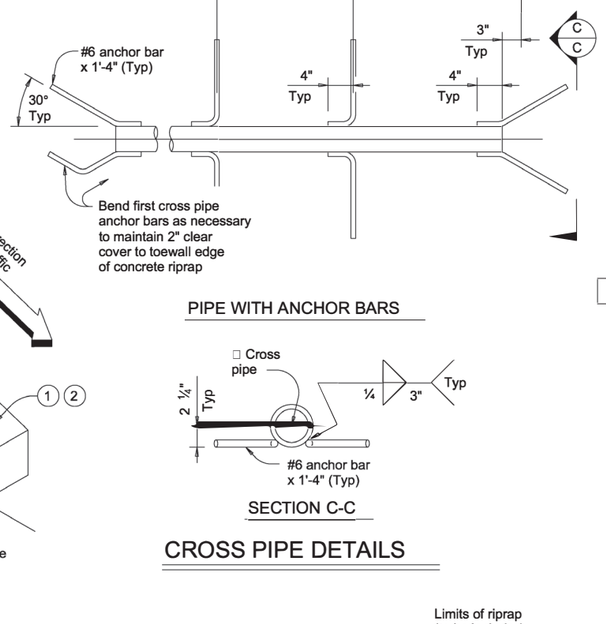
(Showing corrugated metal pipe (CMP) culvert Details at reinforced concrete pipe (RCP) culvert are similar.)



ISOMETRIC VIEW OF TYPICAL INSTALLATION



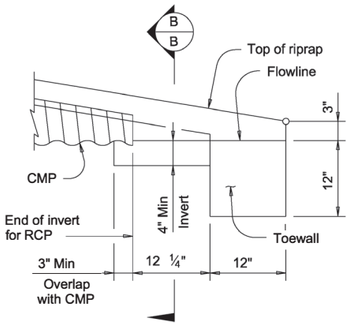
PIPE WITH BOLTED ANCHOR



PIPE WITH ANCHOR BARS

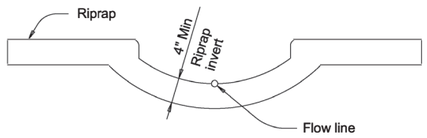
SECTION C-C

CROSS PIPE DETAILS



DETAIL "A"

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



SECTION B-B

(Cross pipes not shown for clarity.)

CROSS PIPE LENGTHS, REQUIRED PIPE SIZES, AND RIPRAP QUANTITIES (2)

Nominal Culvert I.D.	Conc Riprap (CY) (6)	Pipe Culvert Spa ~ G	Single Barrel ~ Q1	Multi-Barrel ~ Q1	Q2	Conditions for Use of Cross Pipes	Cross Pipe Sizes
12"	0.6	0' - 9"	N/A	2' - 1"	1' - 9"	3 or more pipe culverts	3" Std (3.500" O.D.)
15"	0.7	0' - 11"	N/A	2' - 5"	2' - 2"		
18"	0.8	1' - 2"	N/A	2' - 10"	2' - 8"		
21"	0.9	1' - 4"	N/A	3' - 2"	3' - 1"		
24"	0.9	1' - 7"	N/A	3' - 6"	3' - 7"		
27"	1.0	1' - 8"	N/A	3' - 10"	3' - 11"	3 or more pipe culverts	3 ½" Std (4.000" O.D.)
30"	1.1	1' - 10"	N/A	4' - 2"	4' - 4"	2 or more pipe culverts	
33"	1.2	1' - 11"	4' - 2"	4' - 5"	4' - 8"	All pipe culverts	
36"	1.3	2' - 1"	4' - 5"	4' - 9"	5' - 1"	All pipe culverts	4" Std (4.500" O.D.)
42"	1.5	2' - 4"	4' - 11"	5' - 5"	5' - 10"		
48"	1.7	2' - 7"	5' - 5"	6' - 0"	6' - 7"	All pipe culverts	5" Std (5.563" O.D.)
54"	2.0	3' - 0"	5' - 11"	6' - 9"	7' - 6"		
60"	2.2	3' - 3"	6' - 5"	7' - 4"	8' - 3"		
66"	2.4	3' - 3"	6' - 11"	7' - 10"	8' - 9"		
72"	2.7	3' - 4"	7' - 5"	8' - 5"	9' - 4"		

(1) The proper installation of the first cross pipe is critical for vehicle safety. Place the top of the first cross pipe no more than 6" above the flow line.

(2) Provide cross pipes, except the first bottom pipe, of the size shown in the table. Provide a 3 1#2" standard pipe (4" O.D.) for the first bottom pipe.

(3) Install the third cross pipe from the bottom of the culvert using a bolted connection. Ensure that riprap concrete does not flow into the cross pipe so as to permit disassembly of the bolted connection to allow cleanout access. At the Contractor's option, install all other cross pipes using the bolted connection details.

(4) Match cross slope as shown elsewhere in the plans. Cross slope of 6:1 or flatter is required for vehicle safety.

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

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

MATERIAL NOTES:

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

Provide cross pipes that meet the requirements of ASTM A53 (Type E or S, Gr B), ASTM A500 (Gr B), or API 5LX52.

Provide ASTM A307 bolts and nuts.

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

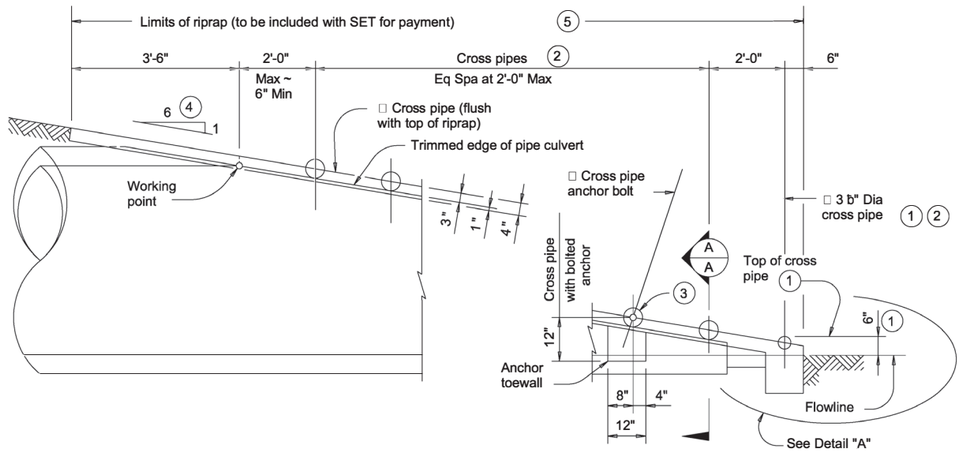
GENERAL NOTES:

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

Safety end treatments (SET) shown herein are intended for use in those installations where out of control vehicles are likely to traverse the openings approximately perpendicular to the cross pipes.

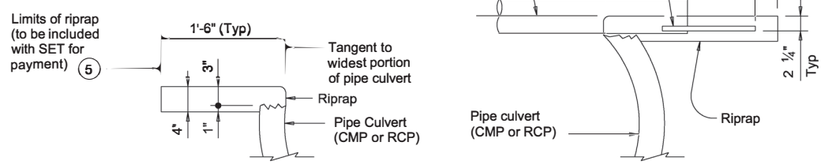
Construct concrete riprap and all necessary inverts in accordance with the requirements of Item 432, "Riprap".

Payment for riprap and toewall is included in the Price Bid for each Safety End Treatment.



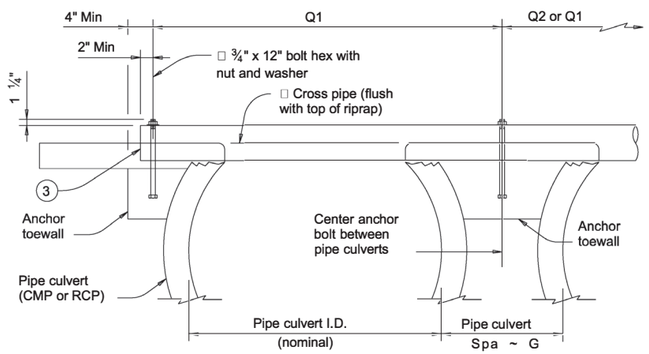
SIDE ELEVATION OF CAST-IN-PLACE CONCRETE

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



SHOWING CROSS PIPE WITH ANCHOR BAR

SHOWING TYPICAL PIPE CULVERT AND RIPRAP



SHOWING CROSS PIPE WITH BOLTED ANCHOR

SECTION A-A

Texas Department of Transportation

Bridge Division Standard

SAFETY END TREATMENT

FOR 12" DIA TO 72" DIA
PIPE CULVERTS
TYPE II ~ PARALLEL DRAINAGE

SETP-PD

FILE: setppdse-20.dgn	DN: GAF	CK: CAT	DW: JRP	CK: GAF
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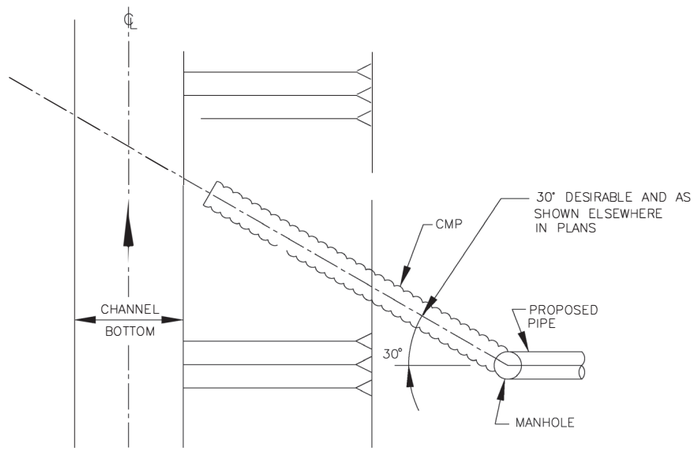
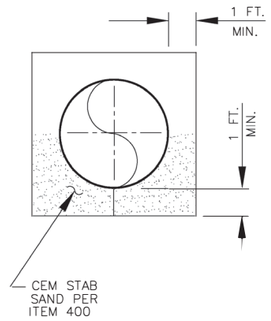


PLAN

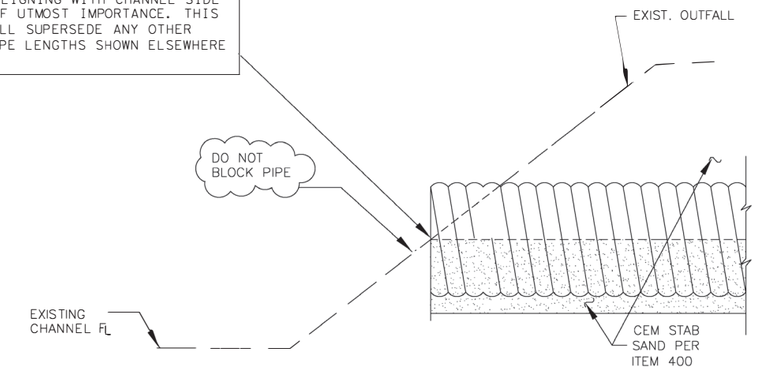


A SECTION

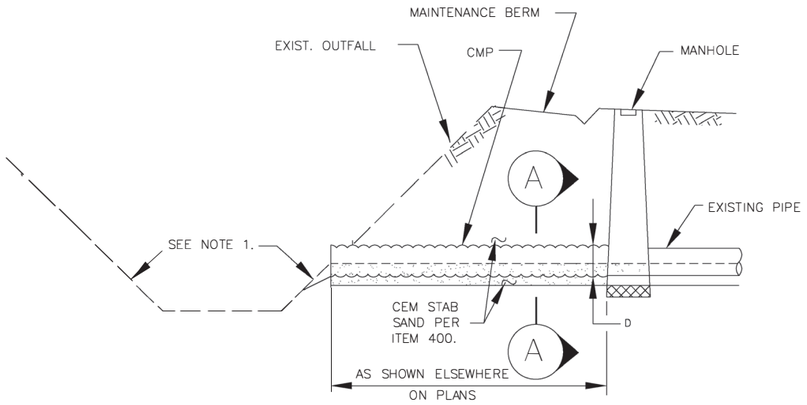
BEDDING
CMP DETAIL

NOTE AA

THIS DETAIL OF CENTERLINE OF ANY PIPE END ALIGNING WITH CHANNEL SIDE SLOPE IS OF UTMOST IMPORTANCE. THIS DETAIL SHALL SUPERSEDE ANY OTHER DETAILS/PIPE LENGTHS SHOWN ELSEWHERE IN PLANS.



TYPICAL SECTION



SECTION

TYPICAL STORM SEWER OUTFALL

STRUCTURE LAYOUT

STORM SEWER OUTFALL NOTES

1. SET FLOWLINE OF OUTFALLS AT ELEVATION SPECIFIED ELSEWHERE IN PLANS (TYPICALLY 1 FOOT ABOVE CHANNEL FLOWLINE OR 1 FOOT ABOVE NORMAL WATER SURFACE ELEVATION, WHICHEVER IS HIGHEST)

(A) THESE ARE GENERAL DETAILS AND NOTES. IF THERE ARE ANY DISCREPANCIES BETWEEN THIS STANDARD AND THE DETAILED SEALED DRAINAGE PLANS. THE SEALED PLANS WILL OVERIDE. THE ONLY EXCEPTION IS NOTE AA ABOVE.

(B) DESIGNER TO CONSULT WITH DISTRICT ENVIRONMENTAL SECTION TO DETERMINE IF OUTFALL IS OR IS NOT JURISDICTIONAL. IF JURISDICTIONAL REQUEST ORDINARY HIGH WATER MARK AND CORPS OF ENGINEERS PERMIT FROM ENVIROMENTAL SECTION FOR ANY WORK BELOW ORDINARY HIGH WATER MARK.

SHEET 1 OF 1

Texas Department of Transportation
Houston District

MINOR OUTFALL DETAILS

(BRAZORIA, FORT BEND, GALVESTON, MONTGOMERY AND WALLER COUNTIES)

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STD G6B

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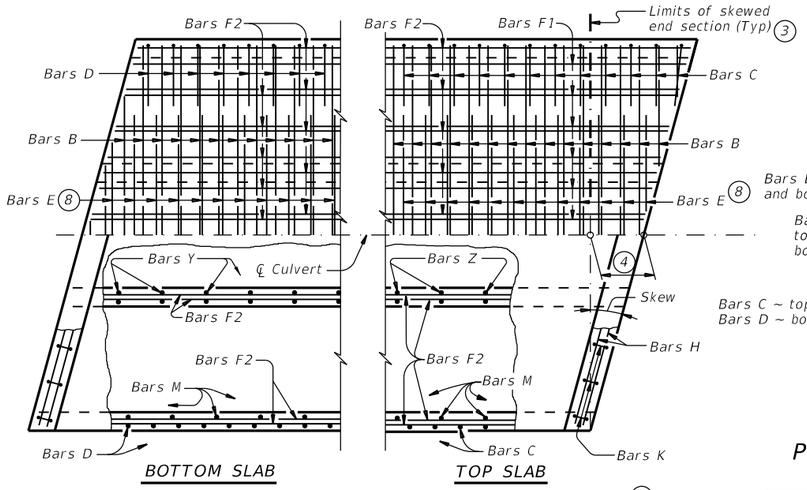
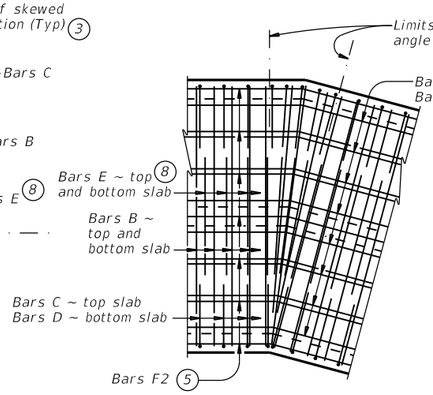
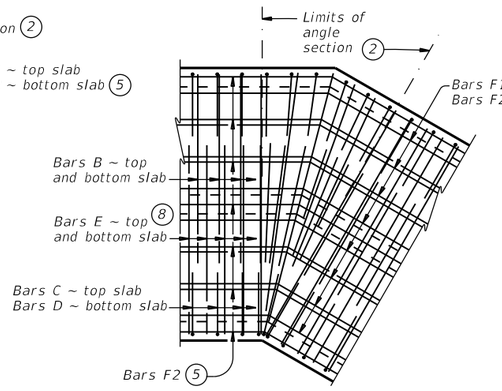


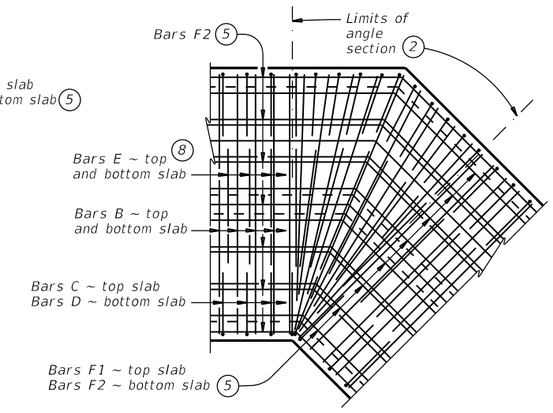
PLAN OF SKEWED ENDS ~ FROM 0° TO 15° 7



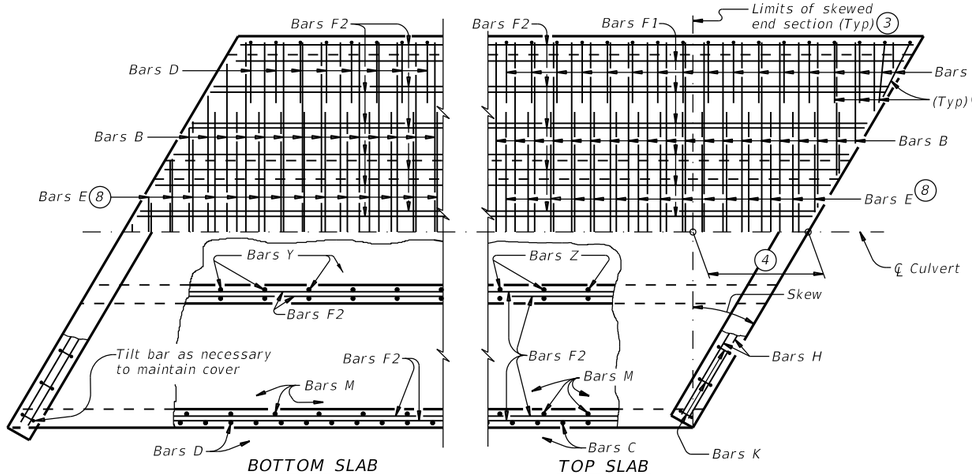
PLAN OF ANGLE SECTION ~ FROM 0° TO 15°



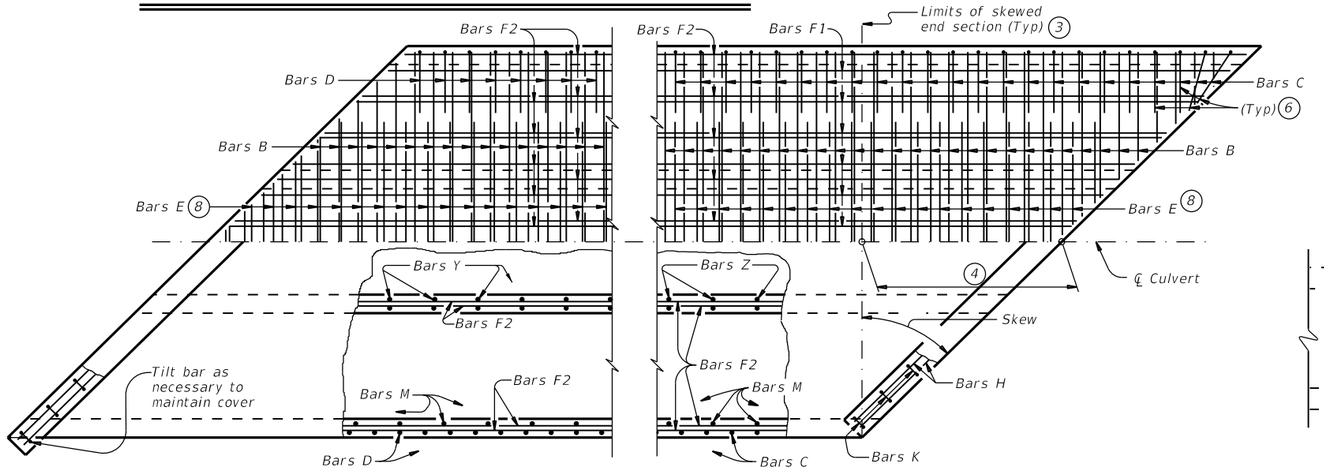
PLAN OF ANGLE SECTION ~ OVER 15° TO 30°



PLAN OF ANGLE SECTION ~ OVER 30° TO 45°



PLAN OF SKEWED ENDS ~ OVER 15° TO 30°



PLAN OF SKEWED ENDS ~ OVER 30° TO 45°

1 For skewed box culverts with less than 2'-0" of fill, break back the top slab to provide a 1'-10" minimum lap of the existing longitudinal bars with the longitudinal bars in the extension.

For non-skewed box culverts with less than 2'-0" of fill and for skewed or non-skewed culverts with a fill depth of 2'-0" or greater, break back the top slab to provide a 1'-10" minimum lap of the existing longitudinal bars with the longitudinal bars in the extension. Alternatively, if the box is non-skewed, embed #6 anchor bars with a Type III, Class C, D, E, or F anchor adhesive into the existing walls, top and bottom slab at 1'-6" center-to-center spacing. Minimum embedment depth is 8". Anchor adhesive chosen must be able to achieve a basic bond strength in tension, Nba, of 26.4 kips. Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use. Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing." Test adhesive anchors in accordance with Item 450.3.3, "Tests." Test 3 anchors per 100 anchors installed.

Break back wings and apron as necessary to install the extension. Clean and extend the exposed wingwall and apron reinforcing into the extension. When lengthening existing box culverts with dimensions different than current standard dimensions, form horizontal and vertical transitions as directed by the Engineer. Match bottom slabs to maintain an uninterrupted flow line. Field bend existing and new reinforcing into transitions and maintain specified cover requirements. For top slabs of culverts with overlay, with 1-to-2 course surface treatment, or with the top slab as the final riding surface, adjust the "H" dimension to provide a smooth riding surface.

2 When the spacing between Bars B or Bars E becomes less than half of the normal spacing, cut bars to avoid conflict.

3 The length of Bars B and Bars E will vary in the skewed end sections.

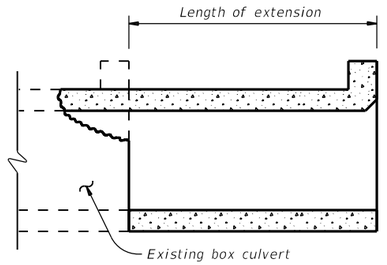
4 [One half of overall width] x [tangent of the skew angle]

5 Place Bars F1 and F2 continuously through the angle section. Bend Bars F1 and F2 to remain parallel to the walls of the box culvert.

6 When necessary to avoid conflict in acute corners, shorten the slab extension leg of Bars C and Bars D to a minimum of 1'-6" for skews of 30° thru 45°.

7 At the Contractor's option, for skews of 15° or less, place Bars B, C, D, and E parallel to the skewed end while maintaining spacing along centerline of box. Increase lengths of Bars B and Bars E shown on the Multiple Box Culverts Cast-In-Place (MC) standard sheets to accommodate the skew.

8 Extend Bars E as shown on the MC standard sheet for direct traffic culverts.



LENGTHENING DETAIL 1

CONSTRUCTION NOTES:

Do not use permanent forms.
When required, lap Bars H 1'-8" for uncoated or galvanized bars.
Provide a minimum of 1 ½" clear cover.

MATERIAL NOTES:

Provide Grade 60 reinforcing steel.
Provide galvanized reinforcing steel, if required elsewhere in the plans.
Provide Class C concrete (f'c = 3,600 psi) with these exceptions: provide Class S concrete (f'c = 4,000 psi) for top slabs of culverts with overlay, with 1-to-2 course surface treatment, or with the top slab as the final riding surface.

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.
Refer to Multiple Box Culverts Cast-in-Place (MC) standard sheets for details of straight sections of culvert.
For skewed sections and angle sections, refer to Multiple Box Culverts Cast-in-Place (MC) standard sheets for slab and wall dimensions, bar sizes, maximum bar spacing, and any other details not shown.
For skewed ends with curbs, adjust length of Bars H, number of Bars K, curb concrete volume, and reinforcing steel weight by dividing the values shown on the Multiple Box Culverts Cast-In-Place (MC) standard sheets by the cosine of the skew angle.

Cover dimensions are clear dimensions, unless noted otherwise.

HL93 LOADING

Texas Department of Transportation

Bridge Division Standard

MULTIPLE BOX CULVERTS CAST-IN-PLACE MISCELLANEOUS DETAILS

MC-MD

FILE: mc-mdste-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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	HOU	MONTGOMERY		82

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TABLE OF DIMENSIONS AND REINFORCING STEEL
(Wings for one structure end)

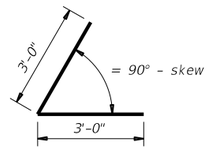
Dimensions					Variable Reinforcing				Estimated Quantities per ft of wing (2–wings) (4)		Estimated Quantities per ft of Toewall (1–toewall)	
					Bars J1		Bars J2					
Maximum Wingwall Height Hw	W	X	Y	Z	Size	Spa	Size	Spa	Reinf (Lb/Ft)	Conc (CY/Ft)	Reinf (Lb/Ft)	Conc (CY/Ft)
2'–6"	2'–10"	10"	1'–0"	7"	#4	1'–0"	#4	1'–0"	48.64	0.406	6.85	0.071
2'–9"	2'–10"	10"	1'–0"	7"	#4	1'–0"	#4	1'–0"	49.31	0.424	6.85	0.071
3'–0"	2'–10"	10"	1'–0"	7"	#4	1'–0"	#4	1'–0"	49.98	0.444	6.85	0.071
3'–3"	2'–10"	10"	1'–0"	7"	#4	1'–0"	#4	1'–0"	53.32	0.462	6.85	0.071
3'–6"	2'–10"	10"	1'–0"	7"	#4	1'–0"	#4	1'–0"	53.98	0.480	6.85	0.071
4'–0"	3'–2"	1'–2"	1'–0"	7"	#4	1'–0"	#4	1'–0"	55.77	0.532	6.85	0.071
4'–6"	3'–2"	1'–2"	1'–0"	7"	#4	1'–0"	#4	1'–0"	59.77	0.568	6.85	0.071
5'–0"	3'–9"	1'–7"	1'–2"	7"	#4	1'–0"	#4	1'–0"	63.45	0.632	6.96	0.075
5'–6"	3'–9"	1'–7"	1'–2"	7"	#4	1'–0"	#4	1'–0"	67.46	0.668	6.96	0.075
6'–0"	4'–4"	2'–0"	1'–4"	7"	#5	1'–0"	#5	1'–0"	80.67	0.730	7.07	0.078
6'–6"	4'–4"	2'–0"	1'–4"	7"	#5	1'–0"	#5	1'–0"	85.05	0.768	7.07	0.078
7'–0"	5'–0"	2'–3"	1'–9"	8"	#5	1'–0"	#5	1'–0"	92.15	0.864	8.07	0.093
7'–6"	5'–0"	2'–3"	1'–9"	8"	#5	1'–0"	#5	1'–0"	96.54	0.902	8.07	0.093
8'–0"	5'–6"	2'–8"	1'–10"	8"	#5	6"	#5	6"	139.04	0.962	8.13	0.095
8'–6"	5'–6"	2'–8"	1'–10"	8"	#5	6"	#5	6"	144.47	1.000	8.13	0.095
9'–6"	6'–0"	2'–10"	2'–2"	9"	#5	6"	#5	6"	156.93	1.136	8.41	0.110
10'–6"	6'–5"	3'–0"	2'–5"	9"	#6	6"	#5	6"	196.27	1.234	8.57	0.117
11'–6"	7'–2"	3'–6"	2'–8"	11"	#6	6"	#6	6"	230.13	1.438	9.52	0.140
12'–6"	7'–8"	3'–9"	2'–11"	1'–0"	#7	6"	#6	6"	283.41	1.592	9.74	0.157
13'–6"	8'–2"	4'–0"	3'–2"	1'–2"	#8	6"	#6	6"	348.72	1.804	10.02	0.186
14'–6"	8'–10"	4'–5"	3'–5"	1'–4"	#9	6"	#6	6"	432.94	2.046	10.30	0.218
15'–6"	9'–6"	4'–10"	3'–8"	1'–6"	#9	6"	#7	6"	489.52	2.302	11.24	0.253
16'–0"	9'–11"	5'–0"	3'–11"	1'–7"	#9	6"	#7	6"	505.72	2.448	11.47	0.279

TABLE OF WINGWALL REINFORCING
(2–wings)

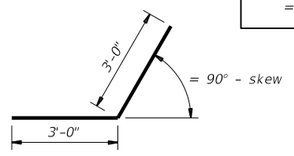
Bar	Size	No.	Spa
D1	#6	~	1'–0"
D2	#6	~	1'–0"
E1	#4	~	1'–0"
F	#4	~	1'–0"
G	#6	~	8"
M1	#4	4	~
P	#4	~	1'–0"
V	#4	~	1'–0"

TABLE OF TOEWALL REINFORCING

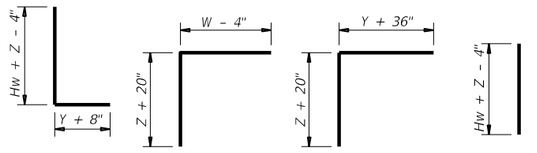
Bar	Size	No.	Spa
J3	#4	~	1'–0"
M2	#4	2	~
E2	#4	~	1'–0"



BARS D1



BARS D2



BARS J1 BARS J2 BARS J3 BARS V

WING DIMENSION FORMULAS:
(All values are in feet.)

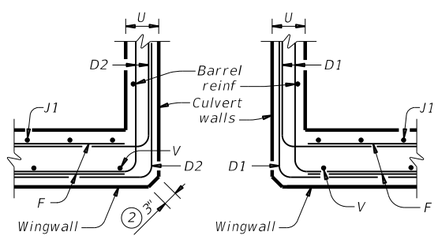
Hw = H + T + C
Lw = (Hw) (SL) ÷ cosine (θ) for Type PW–1
= (Hw – 1') (SL) ÷ cosine (θ) for Type PW–2 and Hw ≥ 4'
= (Hw – 0.5') (SL) ÷ cosine (θ) for Type PW–2 and Hw < 4'

For cast–in–place culverts:
Ltw = [(N) (S) + (N + 1) (U)] ÷ cosine (θ)

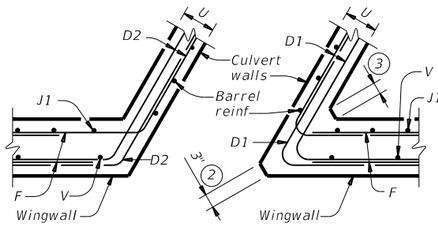
For precast culverts:
Ltw = [(N) (2 U + S) + (N – 1) (0.5')] ÷ cosine (θ)
Total Wingwall Area (two wings ~ SF)
= (2)(Hw)(Lw) for Type PW–1
= (2)(Hw)(Lw) – 6 SF for Type PW–2 and Hw ≥ 4'
= (2)(Hw)(Lw) – 1.5 SF for Type PW–2 and Hw < 4'

Hw = Height of wingwall
Lw = Length of wingwall
Ltw = Culvert toewall length
N = Number of culvert spans
SL:1 = Channel slope ratio. (horizontal: 1 vertical, usual value is 2:1)
θ = Culvert skew

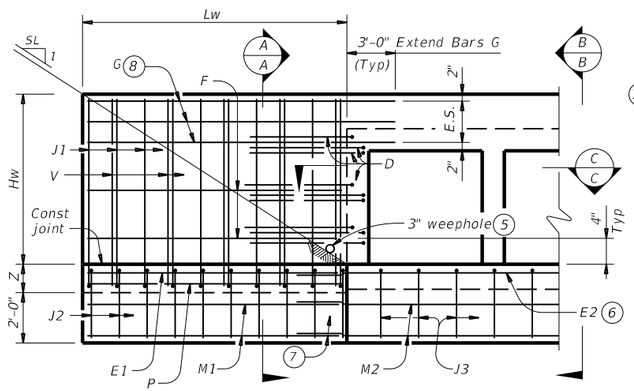
See applicable box culvert standard sheet for S, H, T, and U values.



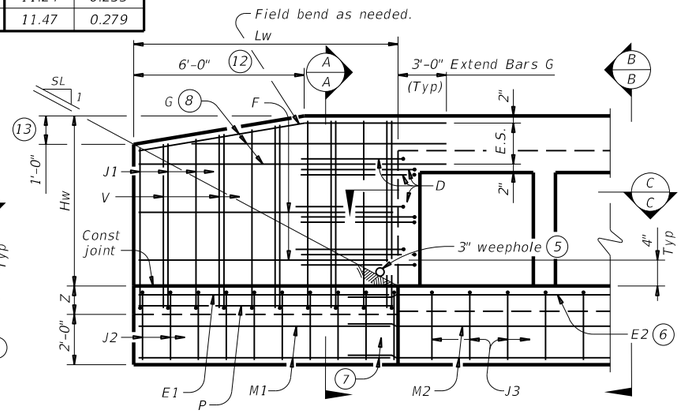
SECTION C-C - PW-1



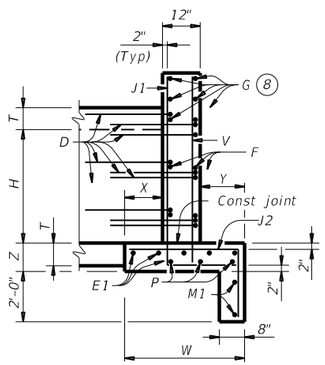
SECTION C-C - PW-2



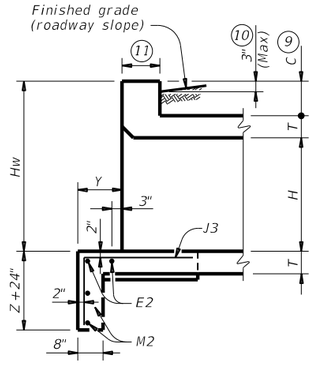
PARTIAL ELEVATION - PW-1



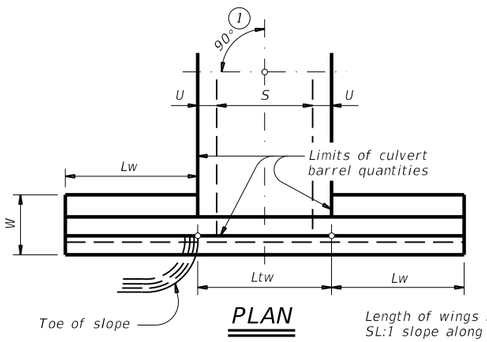
PARTIAL ELEVATION - PW-2



SECTION A-A
(Showing wing reinforcement.)

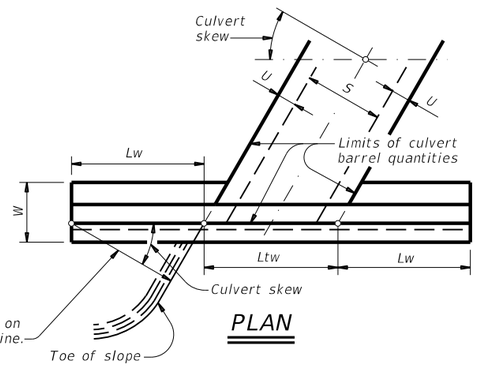


SECTION B-B
(Showing wing reinforcement.)



PLAN

DETAILS FOR NON-SKEWED BOX CULVERTS



PLAN

DETAILS FOR SKEWED BOX CULVERTS
(Showing 30° skew.)

1. Skew = 0°
2. At discharge end, chamfer may be ¾" minimum.
3. For 15° skew ~ 1"
   For 30° skew ~ 2"
   For 45° skew ~ 3"
4. Quantities shown are for two Type PW–1 wings. Adjust concrete volume for Type PW–2 wings. To determine estimated quantities for two wings, multiply the tabulated values by Lw. Quantities shown do not include weight of Bars D.
5. Provide weepholes for Hw = 5'–0" and greater. Fill around weepholes with coarse gravel.
6. Extend Bars E2 1'–6" minimum into the wingwall footing.
7. Lap Bars M1 1'–6" minimum with Bars M2.
8. Place Bars G as shown, equally spaced at 8" maximum. Provide at least two pairs of Bars G per wing.
9. 0" Min to 5'–0" Max. Estimated curb heights are shown elsewhere in the plans. For structures with pedestrian rail or curbs taller than 1'–0, refer to the Extended Curb Details (ECD) standard sheet. For structures with T631 or T631LS bridge rail, refer to the Mounting Details for T631 & T631LS Rails (T631–CM) standard sheet. Refer to the Box Culvert Rail Mounting Details (RAC) standard sheet for structures with bridge rail other than T631 or T631LS.
10. For vehicle safety, the following requirements must be met:
    - For structures without bridge rail, construct curbs no more than 3" above finished grade.
    - For structures with bridge rail, construct curbs flush with finished grade.

    Reduce curb heights, if necessary, to meet the above requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.
11. 1'–0" typical. 2'–3" when the Box Culvert Rail Mounting Details (RAC) standard sheet is referred to elswhere in the plans.
12. 3'–0" for Hw < 4'.
13. 6" for Hw < 4'.

DESIGNER NOTES:
Type PW–1 can be used for all applications and must be used if railing is to be mounted to the wingwall.
Type PW–2 can only be used for applications without a railing mounted to the wingwall.

MATERIAL NOTES:
Provide Class C concrete (f'c=3,600 psi).
Provide Grade 60 reinforcing steel.
Provide galvanized reinforing steel if required elsewhere in the plans.

GENERAL NOTES:
Designed in accordance with AASHTO LRFD Bridge Design Specifications.
Depth of toewalls for wingwalls and culverts may be reduced or eliminated when founded on solid rock, when directed by the Engineer.
See Box Culvert Supplement (BCS) standard sheet for wingwall type and additional dimensions and information.
Quantities for concrete and reinforcing steel resulting from the formulas given on this sheet are for the Contractor's information only.

Cover dimensions are clear dimensions, unless noted otherwise. Reinforcing dimensions are out–to–out of bars.

Texas Department of Transportation

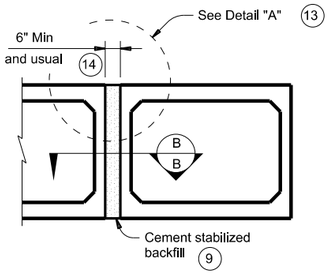
Bridge Division Standard

CONCRETE WINGWALLS
WITH PARALLEL WINGS FOR BOX CULVERTS
TYPES PW-1 AND PW-2

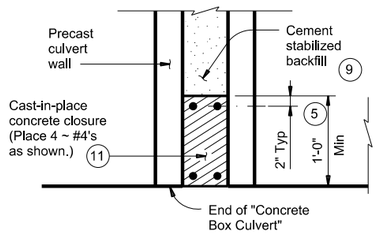
PW

FILE:	pwstde01-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: TxDOT
©TxDOT	February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS		0177	14	037	SL 494
		DIST	COUNTY		SHEET NO.
		HOU	MONTGOMERY		83

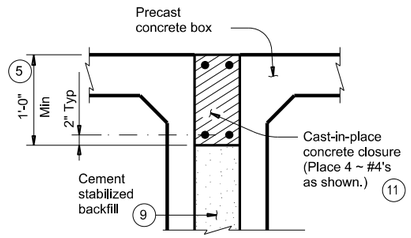
DATE:
FILE:



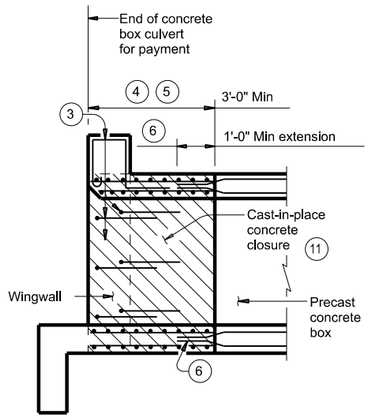
MULTIPLE UNIT PLACEMENT



SECTION B-B

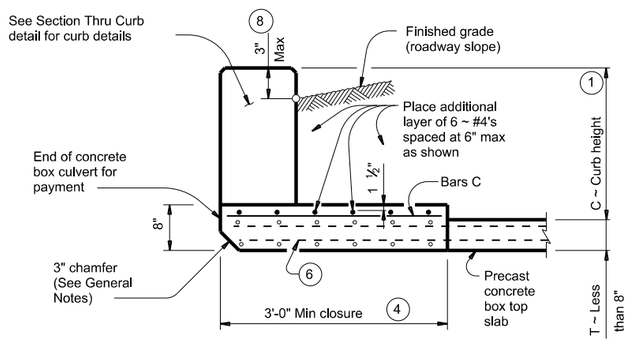


DETAIL "A" (13)

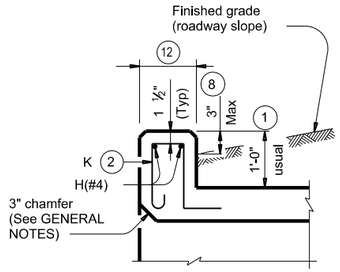


WINGWALL CONNECTION

(Also applies to safety end treatment.)

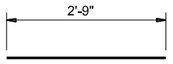


SECTION THRU TOP SLABS LESS THAN 8"

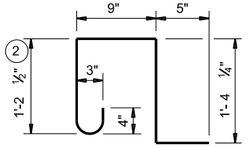


SECTION THRU CURB

QUANTITIES PER FOOT OF CURB (10)	
Reinforcing Steel	4.12 Lb
Concrete	0.037 CY



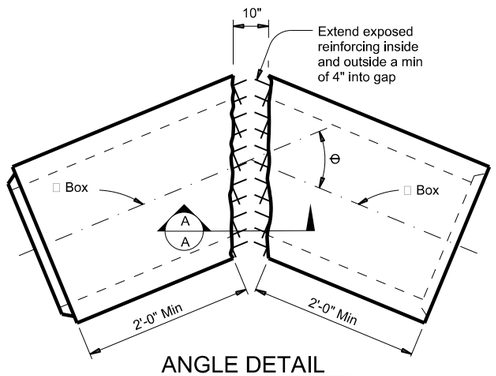
BARS C (#4)
(Spa = 1'-0" Max)



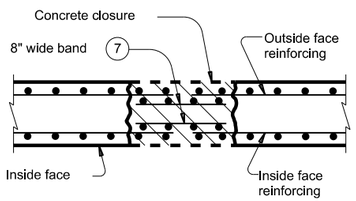
BARS K (#4)
(Spa = 1'-0" Max)
(Length = 4'-2")

1. 0" Min to 5'-0" Max. Estimated curb heights are shown elsewhere in the plans. For structures with pedestrian rail, bicycle rail, or curbs taller than 1'-0, refer to the Extended Curb Details (ECD) standard sheet. For structures with T631 or T631LS bridge rail, refer to the Mounting Details for T631 & T631LS Rails (T631-CM) standard sheet. Refer to the Box Culvert Rail Mounting Details (RAC) standard sheet for structures with bridge rail other than T631 or T631LS.
2. For curbs less than 1'-0" high, tilt Bars K or reduce bar height as necessary to maintain cover. For curbs less than 3" high, Bars K may be omitted.
3. Extend curb, wingwall, or safety end treatment reinforcing into concrete closure. Bend or trim, as necessary, any reinforcing that does not fit into closure area.
4. Provide a 3'-0" Min cast-in-place concrete closure. Break back boxes in the field or cast boxes short. Provide bands of reinforcing in the closure that are the same size and spacing as in the precast box section. Provide #4 longitudinal reinforcement spaced at 12 inches Max within the closure. Except where shown otherwise, construct the cast-in-place closure flush with the inside and outside faces of the precast box section.
5. For multiple unit placements, adjust the length of the closure for the interior walls as necessary. Provide a 3'-0" Min cast-in-place closure in the top slab, bottom slab, and exterior wall. See Section B-B detail when interior walls are cast full length.
6. Extend precast box reinforcing a minimum of 1'-0" into concrete closure (Typ).
7. Place bands of reinforcing matching the inside and outside face reinforcing in the gaps of the top and bottom slabs. Place a band matching the outside face reinforcing of the wall in the gaps of the walls (placed in the outside face only). Tack weld the bands to the exposed reinforcing at each point of contact.
8. For vehicle safety, the following requirements must be met:
   - For structures without bridge rail, construct curbs no more than 3" above finished grade.
   - For structures with bridge rail, construct curbs flush with finished grade.

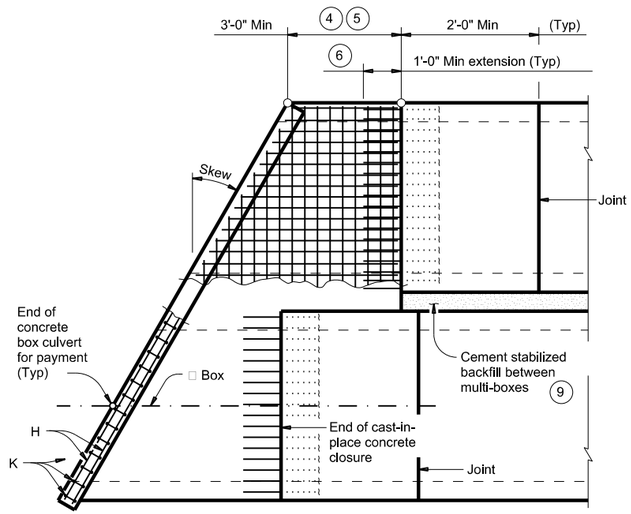
   Reduce curb heights, if necessary, to meet the above requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.
9. Cement stabilized backfill between boxes is considered part of the box culvert for payment.
10. All curb concrete and reinforcing is considered part of the box culvert for payment.
11. Any additional concrete and reinforcing required for the closures will be considered subsidiary to the box culvert for payment.
12. 1'-0" typical. 2'-3" when the Box Culvert Rail Mounting Details (RAC) standard sheet is referred to elsewhere in the plans.
13. For multiple unit placement with overlay, with 1 to 2 course surface treatment, or with the top slab as the final riding surface, provide wall closure as shown in Detail "A".
14. This dimension may be increased with approval of the Engineer to allow the precast boxes to be tunneled or jacked in accordance with Item 476, "Jacking, Boring, or Tunneling Pipe or Box". No payment will be made for any additional material in the gap between adjacent boxes.



ANGLE DETAIL



SECTION A-A



PLAN OF SKEWED ENDS

(Showing multi-box placement.)

MATERIAL NOTES:

Provide Grade 60 reinforcing steel.
Provide ASTM A1064 welded wire reinforcement.
Provide Class C concrete (f'c = 3,600 psi) for the closures.
Provide cement stabilized backfill meeting the requirements of Item 400, "Excavation and Backfill for Structures."
Any additional concrete required for the closures will be considered subsidiary to the box culvert.

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.
Refer to the Single Box Culverts Precast (SCP) standard sheets for details and notes not shown.
Chamfer the bottom edge of the top slab closure 3 inches at culvert closure ends.

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

HL93 LOADING

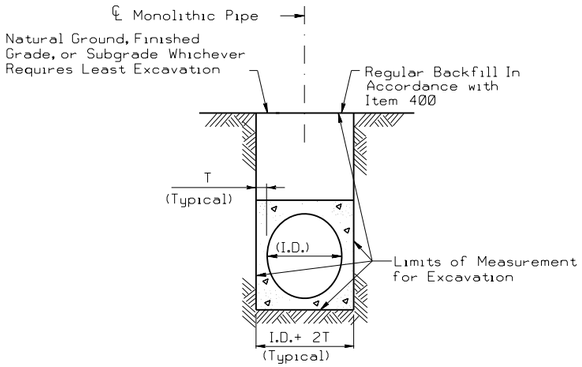
Texas Department of Transportation

Bridge Division Standard

BOX CULVERTS PRECAST MISCELLANEOUS DETAILS

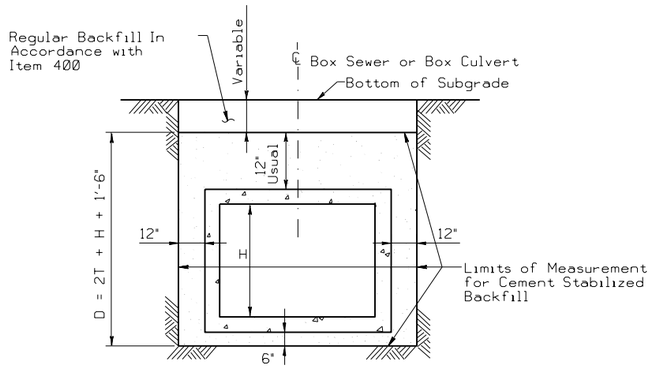
SCP-MD

FILE: scpmdsts-20.dgn	DN: GAF	CK: LMW	DW: BWH/TxDOT	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0177	14	037	SL 494
	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY		84



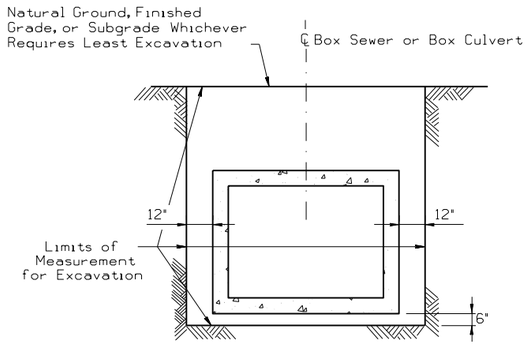
EXCAVATION DETAIL

MONOLITHIC PIPE
IN A PAVED OR GRADED AREA



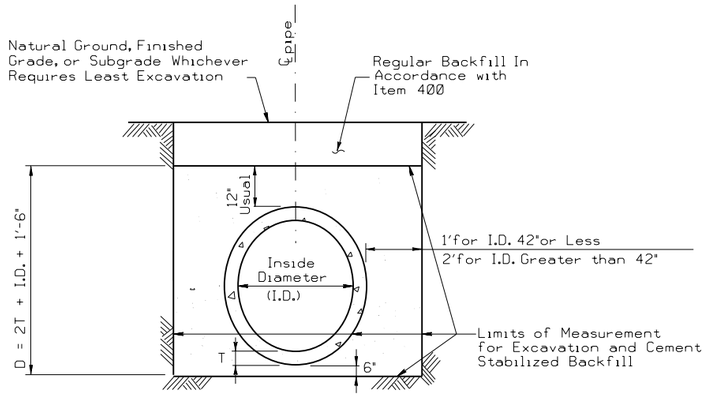
BACKFILL DETAIL

BOX CULVERTS
IN A GRADED OR PAVED AREA
INCLUDING DETOURS *



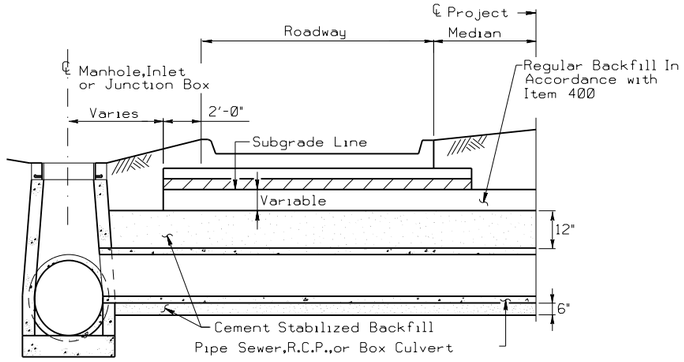
EXCAVATION DETAIL

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

D = Depth
H = Height
T = Thickness
R = Radius
Dia = Diameter

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.

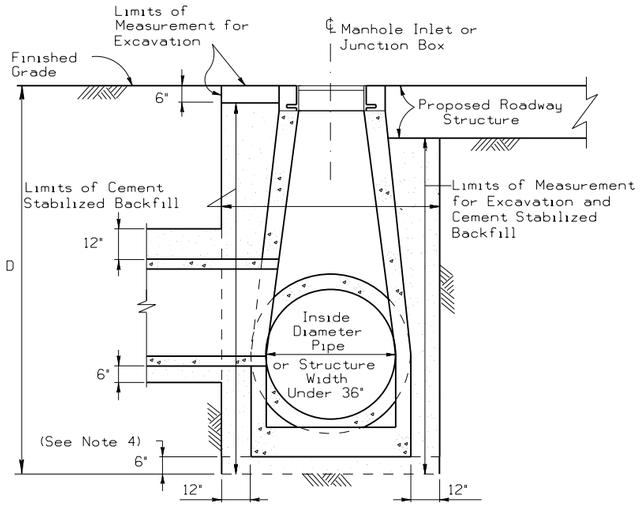
* Backfill with cement stabilized material will be required for all structures under detours unless noted otherwise in the General Notes.

Texas Department of Transportation
Houston District

EXCAVATION AND BACKFILL DIAGRAMS

E&BD

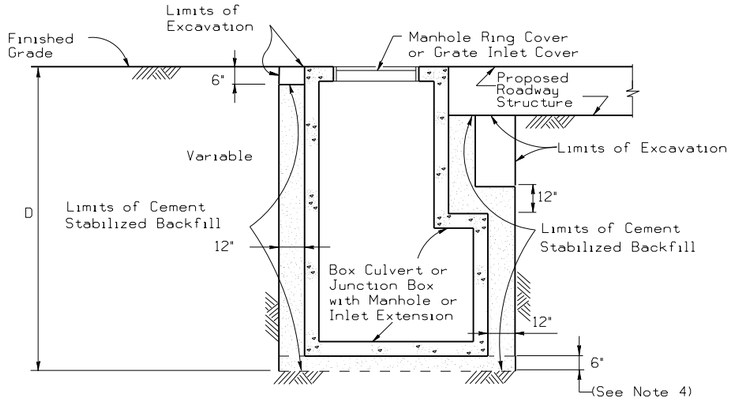
FILE: STDE1.DGN	DN: TxDot	CK: TxDot	DW: TxDot	CK: TxDot
© TxDOT FEB 2010	DIST	FED REG	PROJECT NO.	SHEET
REVISIONS REVISED 11/05 REVISED 2/2010 Added note to Table 1,Sht 2 of 2. REVISED 6/12 REVISED 9/14	HOU	6		85
	COUNTY		CONTROL SECT JOB	HIGHWAY
	MONTGOMERY		0177 14 037	SL494



EXCAVATION AND BACKFILL DETAIL

MANHOLES SMALLER THAN 36 IN.
IN A PAVED OR GRADED AREAS

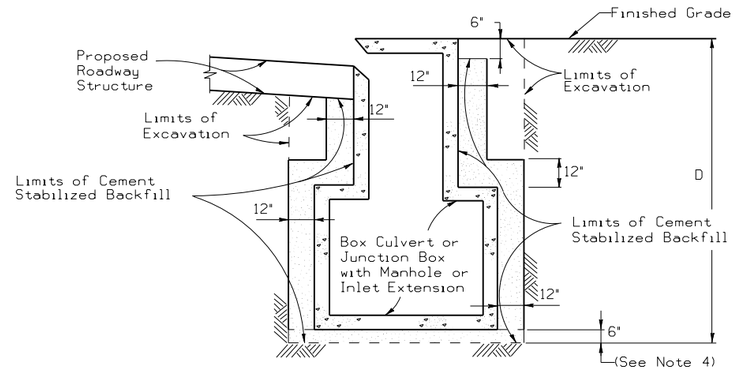
N.T.S.



EXCAVATION AND BACKFILL DETAIL

JUNCTION BOXES IN A
PAVED OR GRADED AREA

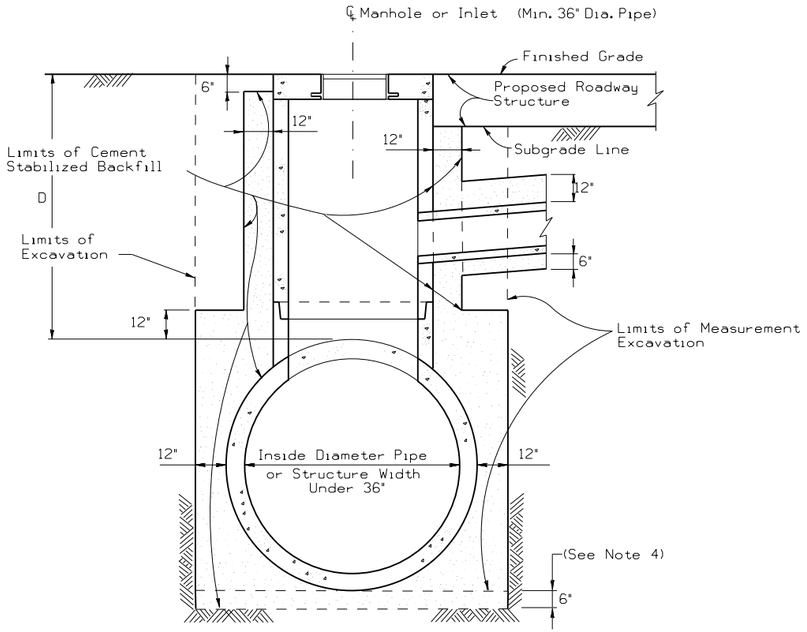
N.T.S.



EXCAVATION AND BACKFILL DETAIL

INLET EXTENSIONS ON A BOX CULVERT
IN A PAVED OR GRADED AREA

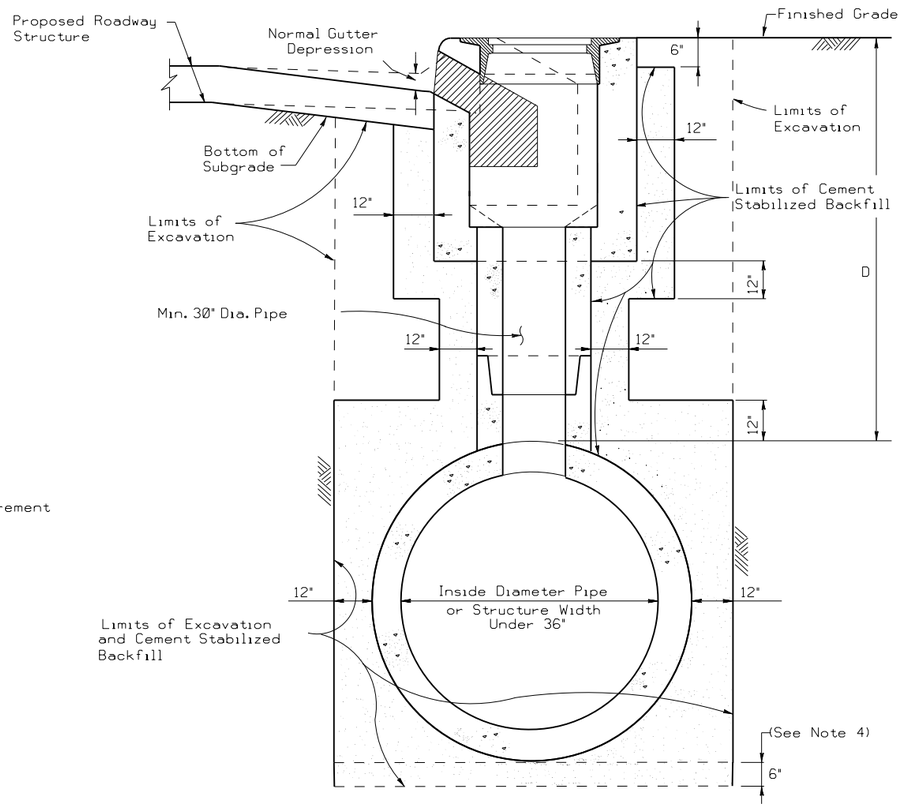
N.T.S.



EXCAVATION AND BACKFILL DETAIL

MANHOLES 36 IN. AND GREATER
IN A PAVED OR GRADED AREA

N.T.S.



EXCAVATION AND BACKFILL DETAIL

CURB INLETS IN A PAVED OR GRADED AREA

N.T.S.

TABLE 1

SCHEDULE FOR PAY QUANTITIES OF CEMENT STABILIZED BACKFILL (SEE NOTE 1)

MANHOLE OR INLET DEPTH (D) IN FEET	CEMENT STABILIZED BACKFILL IN CUBIC YARDS
Ø through 5	5.75
> 5 through 10	8.25
greater than 10	12.75

TO BE PAID UNDER ITEM 400-6009 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 2/2010 Added note to Table 1. REVISED 6/12 REVISED 9/14 REVISED 3/15	HOU	6		85A
	COUNTY		CONTROL	SECT	JOB	HIGHWAY
	MONTGOMERY		0177	14	037	SL494

CONDUIT AND CONDUCTOR RUNS

RUN NO.	CONDUIT (618)								CONDUCTORS (620)						TRAY CABLE (621)		CABLES (684)				RADAR (6292)		RADAR (6292)	
	PVC								POWER		GROUND				LUMINAIRE		RAILROAD		SIGNAL		PRES. RADAR		ADV. RADAR	
	2" (SCHD 80)				3" (SCHD 80)		4" (SCHD 80)		#4 INSULATED		#4 BARE		#6 BARE		#12/4C Tray Cable		#12/12C		#12/7C		# 18/2C & #22/4C		# 18/2C & #22/4C	
	(6046)		(6047)		(6053)		(6058)		(6012)		(6011)		(6009)		(6005)		(6017)		(6012)		(6004)		(6005)	
	NO.	TRENCH	NO.	BORE	NO.	TRENCH	NO.	TRENCH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH
	EA	LF	EA	LF	EA	LF	EA	LF	EA	LF	EA	LF	EA	LF	EA	LF	EA	LF	EA	LF	EA	LF	EA	LF
1					1	5							1	5										
2					1	10			2	10	1	10			2	10			6	10	4	10	2	10
3	1	45											1	45			1	45						
4							1	20					1	20	2	20			6	20	4	20	2	20
5	1	10											1	10	1	10			2	10	1	10	1	10
6	1	20	1	80									1	100	1	100			3	100	2	100	1	100
7	1	10											1	10					1	10	1	10		
8			1	70									1	70	1	80			2	80	1	80	1	80
9	1	5											1	5	1	5			2	5	1	5	1	5
10			1	75									1	75					1	75	1	75		
11	1	5											1	5					1	5	1	5		
12	1	10											1	10										
13	1	30							2	30	1	30			2	30								
14	1	10															1	10						
Pole A																			1	20	1	20		
Mast Arm 36'																			1	35	1	35		
Pole B															1	40			2	20	1	20	1	20
Mast Arm 44'																			2	45	1	45	1	45
Pole C																			2	20	1	20		
Mast Arm 44'																			2	45	1	45		
Pole D															1	40			1	20	1	20	1	20
Mast Arm 32'																			1	35	1	35	1	35
TOTAL (LF)		145		225		15		20		80		40		355		395		55		1130		745		375
EST. TOTAL		**155**		**240**		**20**		**25**		**85**		**45**		**375**		**415**		**60**		**1190**		**785**		**395**

NOTES:

-RECONNECT PROPOSED SIGNAL CONTROLLER CABINET TO EXISTING RAIL ROAD HOUSE USING PROPOSED #12/12C PREEMPTION CABLE AND 2" PVC PROPOSED CONDUIT

STATE OF TEXAS
MICHAEL A. OLIVO
108793
LICENSED PROFESSIONAL ENGINEER
P.E.

07/26/2021

LOOP 494 AT FM 1485 TRAFFIC SIGNAL PROPOSED LAYOUT

0 20 40 FT
SCALE: 1" = 40'

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0177	14	037	FM 1485
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		86

DATE: 7/26/2021 10:39:34 AM
FILE: \\FS-HOUHQ.dot.state.tx.us\Data4\data\engdata\TrfSignals\Greg Sosa\SL 494 at FM 1485_Layout 3.dgn

LEGEND:

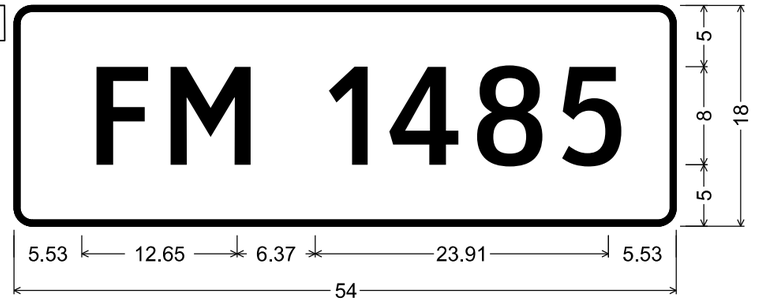
- PROPOSED ELECTRICAL SERVICE POLE
- TRAFFIC DIRECTION
- PP — POWER POLE
- PP/T — POWER POLE W/TRANSFORMER
- OP — OVERHEAD POWER LINE
- PROPOSED MAST ARM POLE
- PROPOSED FULLY- ACTUATED CONTROLLER W/CABINET, AND BBU (BATTERY BACKUP)
- PROPOSED CONDUIT (TRENCH)
- PROPOSED CONDUIT (BORE)
- PROPOSED TRAFFIC SIGNAL HEAD
- PROPOSED GROUND BOX
- S1 — PROPOSED STREET NAME SIGN

PROPOSED RADAR DETECTIONS SCHEDULE:

ADV1	DESIGNATED FOR NORTHBOUND APPROACHING VEHICLES (LOOP 494)
ADV2	DESIGNATED FOR SOUTHBOUND APPROACHING VEHICLES (LOOP 494)
PRE1	DESIGNATED FOR SOUTHBOUND VEHICLES (LOOP 494)
PRE2	DESIGNATED FOR NORTHBOUND VEHICLES (LOOP 494)
PRE3	DESIGNATED FOR WESTBOUND VEHICLES (FM 1485)
PRE4	DESIGNATED FOR EASTBOUND VEHICLES (FM 1485)

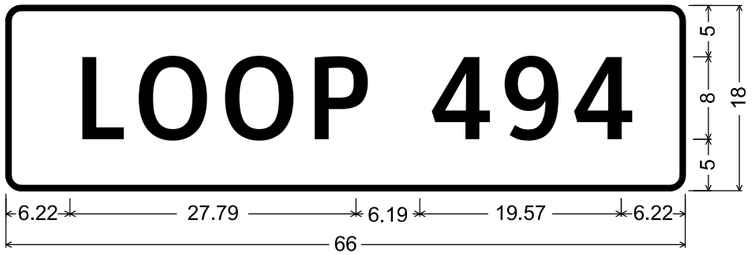
PROPOSED STREET NAME SIGNS:

S1



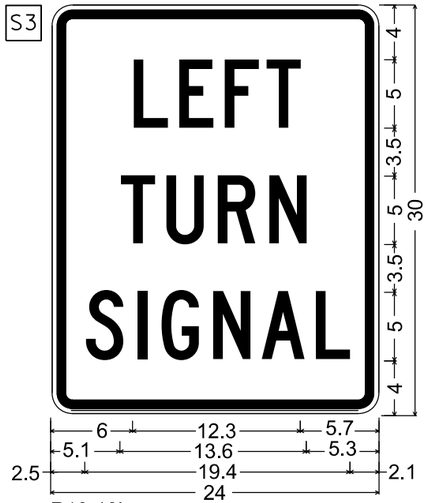
1.500" Radius, 0.500" Border, White on, Green;
"FM 1485", ClearviewHwy-3-W;

S2



1.500" Radius, 0.500" Border, White on, Green;
"LOOP 494", ClearviewHwy-3-W;

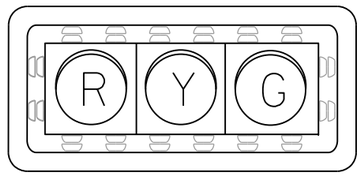
S3



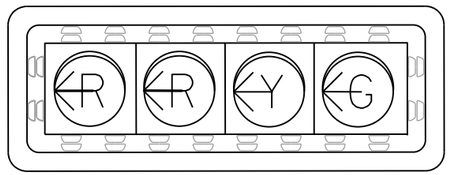
R10-10L;
1.5" Radius, 0.6" Border, 0.4" Indent, Black on, White;
"LEFT", C; "TURN", C 99% spacing; "SIGNAL", C;

CALLOUTS	DESCRIPTION
A	PROPOSED 36′ MAST ARM POLE WITH PRESENCE RADAR (1 EA)
B	PROPOSED 44′ MAST ARM POLE WITH LUMINAIRE (1 EA), PRESENCE RADAR (1 EA), AND ADVANCED RADAR (1 EA)
C	PROPOSED 44′ MAST ARM POLE WITH PRESENCE RADAR (1 EA)
D	PROPOSED 32′ MAST ARM POLE WITH LUMINAIRE (1 EA), PRESENCE RADAR (1 EA), AND ADVANCED RADAR (1 EA)
F	PROPOSED FULLY ACTUATED CONTROLLER WITH CABINET, BBU
G	PROPOSED SLOTTED CURB
H	PROPOSED SERVICE POLE TY D WITH SERVICE (12/240 VOLTS), METER, SERVICE ENCLOSURE AND SERVICE DISONNECT

PROPOSED SIGNAL HEADS SCHEDULE:



B, C, D, E, G, H, I, J



A, F

ELECTRICAL SERVICE DATA:

ELECTRICAL SERVICE NAME	CALLOUT	ELECTRICAL SERVICE DESCRIPTION (SEE ED 5, 6, 7, 8)	SERVICE CONDUIT SIZE (RMC)	SERVICE CONDUCTORS NO./SIZE	SAFETY SWITCH AMPS	MAIN CKT. BRK. POLE/AMP	TWO-POLE CONTACTOR AMPS	PANELBD./ LOADCENTER AMP RATING (MIN)	CIRCUIT NO.	BRANCH CKT. BRK. POLE/AMPS	BRANCH CIRCUIT AMPS	KVA LOAD
LOOP 494 AT FM 2855	(H)	ELEC SERV TY D (120/240)060(NS)SS(E)SP(O)	1 1/4"	3/#6	N/A	2P/60		100	TRF. SIG	1P/50	40	<5.2
							30		LIGHTING	2P/20	3	

STATE OF TEXAS
MICHAEL A. OLIVO
108793
LICENSED
PROFESSIONAL ENGINEER
P.E.

07/26/2021

LOOP 494 AT FM 1485 TRAFFIC SIGNAL PROPOSED LAYOUT

0 20 40 FT
SCALE: 1" = 40′

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0177	14	037	FM 1485
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		87

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LEGEND:

- EXISTING TRAFFIC SIGNAL HEAD
- TRAFFIC DIRECTION
- PP — POWER POLE
- PP/T — POWER POLE W/TRANSFORMER
- OP — OVERHEAD POWER LINE
- EXISTING LUMINAIRE (LED)
- EXISTING LUMINAIRE
- EXISTING GROUND BOX
- EXISTING SIGNAL CONTROLLER
- EXISTING RAILROAD SIGNAL
- EXISTING RAILROAD TRACK
- EXISTING RADIO
- RIGHT OF WAY
- EXISTING VIVDS CAMERA
- EXISTING RAILROAD SIGN
- EXISTING DRAIN INLET
- EXISTING LOOP DETECTOR (TO BE REMOVED)

(A) EXIST. 34' STEEL STRAIN SIGNAL POLE W/VIVDS CAMERA (2 EA)(TO BE REMOVED)

(B) EXIST. 34' STEEL STRAIN SIGNAL POLE W/LUMINAIRE, VIVDS CAMERA (1 EA), RADIO, SERVICE ENCLOSURE, AND METER (TO BE REMOVED)

(C) EXIST. 34' STEEL STRAIN SIGNAL POLE W/ VIVDS CAMERA (2 EA) (TO BE REMOVED)

(D) EXIST. 34' STEEL STRAIN SIGNAL POLE W/LUMINAIRE (TO BE REMOVED)

(E) EXIST. RAILROAD SIGN (TO BE REMOVED)

(F) EXIST. SIGNAL CONTROLLER (TO BE REMOVED)

N

WEST R.O.W. US HWY 59
DITCH
ONLY
EAST R.O.W. US HWY 59
RAILROAD R.O.W.
EXIST. METAL GUARD
EXIST. METER POLE
PP
EXISTING PREEMPTION CABLE
EXIST. RR HOUSE
AT&T UTILITY
WM UTILITY
CC UTILITY
EAST R.O.W.
FM 1485 (45 MPH)
CNP UTILITY
GAS STATION
PUMP AWNING
SL 494 (50 MPH)
CROWN CASTLE UTILITY
PP/T
RR

NOTES:

- THE CONTRACTOR SHALL LOCATE ALL UTILITIES PRIOR TO COMMENCING WORK. THE CONTRACTOR SHALL CONTACT PUBLIC AND PRIVATE UTILITIES FOR LOCATION OF UNDERGROUND FACILITIES AT LEAST 72 HOURS PRIOR TO ANY DRILLING, BORING, TRENCHING OR EXCAVATING. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY DAMAGE CAUSED BY CONTRACTOR'S FAILURE TO LOCATE AND PRESERVE THESE UTILITIES WHETHER UNDERGROUND, ABOVE GROUND OR OVERHEAD. UTILITIES ARE SHOWN IN APPROXIMATE LOCATIONS.
- REMOVE ALL GROUND BOX, ABANDON CONDUIT AND CABLE THAT WILL NOT BE REUSED AS PART OF PROPOSED SIGNAL INSTALLATION.
- VERIFY LOCATION OF THE EXISTING RAILROAD PREEMPTION WIRE AND RECONNECT TO PROPOSED SIGNAL CONTROLLER
- THE EXISTING BROADBAND RADIO EQUIPMENT TO BE REMOVED BY CONTRACTOR PRIOR TO CONSTRUCTION AND TO INSTALL A NEW RADIO BY CONTRACTOR ONCE THE CONSTRUCTION IS COMPLETED. CONTRACTOR TO COORDINATE INSTALLATION OF THE RADIO EQUIPMENT WITH THE MONTGOMERY COUNTY AREA ENGINEER.

SL 494
AT FM 1485
TRAFFIC SIGNAL
EXISTING LAYOUT

0 20 40 FT
SCALE: 1" = 40'

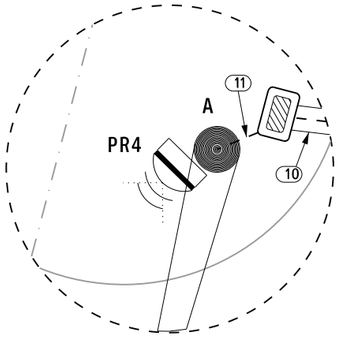
STATE OF TEXAS
MICHAEL A. OLIVO
108793
LICENSED PROFESSIONAL ENGINEER
P.E.

07/26/2021

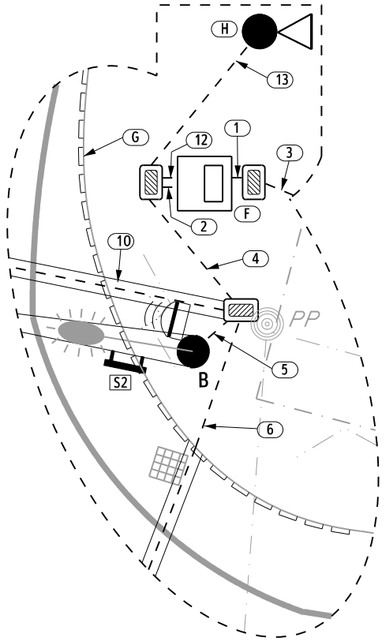
Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0177	14	037	FM 1485
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		88

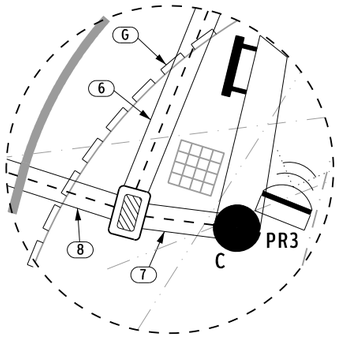
DETAIL A

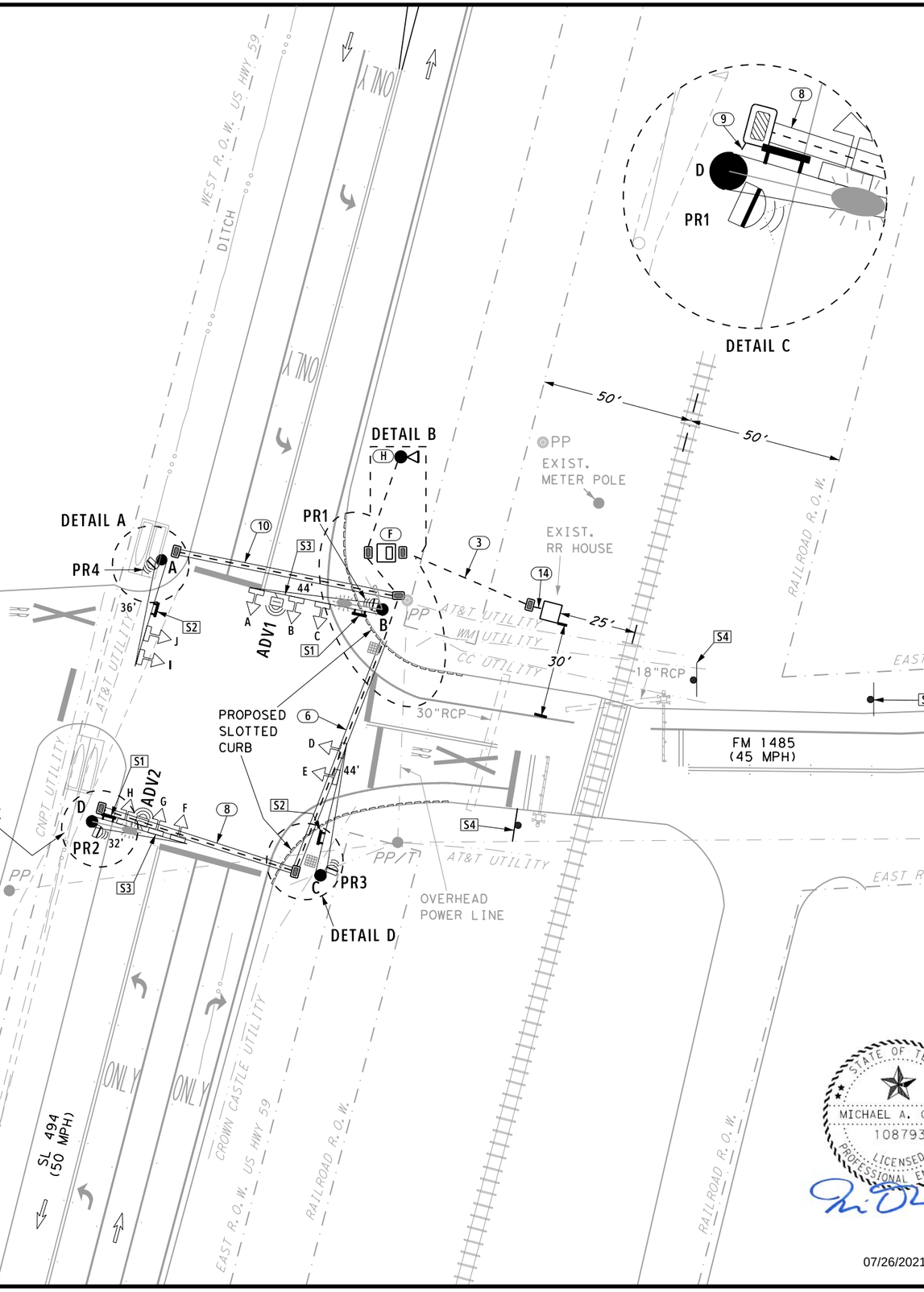


DETAIL B



DETAIL D





NOTES:

- THE CONTRACTOR SHALL LOCATE ALL UTILITIES PRIOR TO COMMENCING WORK. THE CONTRACTOR SHALL CONTACT PUBLIC AND PRIVATE UTILITIES FOR LOCATION OF UNDERGROUND FACILITIES AT LEAST 72 HOURS PRIOR TO ANY DRILLING, BORING, TRENCHING OR EXCAVATING. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY DAMAGE CAUSED BY CONTRACTOR'S FAILURE TO LOCATE AND PRESERVE THESE UTILITIES WHETHER UNDERGROUND, ABOVE GROUND OR OVERHEAD. UTILITIES ARE SHOWN IN APPROXIMATE LOCATIONS.
- VERIFY THE CORRECT MAST ARM POLE SIZE FOR EACH SIGNALIZED INTERSECTION PRIOR TO ORDERING EQUIPMENT.
- THE EXISTING BROADBAND RADIO EQUIPMENT TO BE REMOVED BY CONTRACTOR PRIOR TO CONSTRUCTION AND TO INSTALL A NEW RADIO BY CONTRACTOR ONCE THE CONSTRUCTION IS COMPLETED. CONTRACTOR TO COORDINATE INSTALLATION OF THE RADIO EQUIPMENT WITH THE MONTGOMERY COUNTY AREA ENGINEER.

SL 494
AT FM 1485
TRAFFIC SIGNAL
PROPOSED LAYOUT

0 20 40 FT
SCALE: 1" = 40'

STATE OF TEXAS
MICHAEL A. OLIVO
108793
LICENSED
PROFESSIONAL ENGINEER
P.E.

07/26/2021

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0177	14	037	FM 1485
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		89

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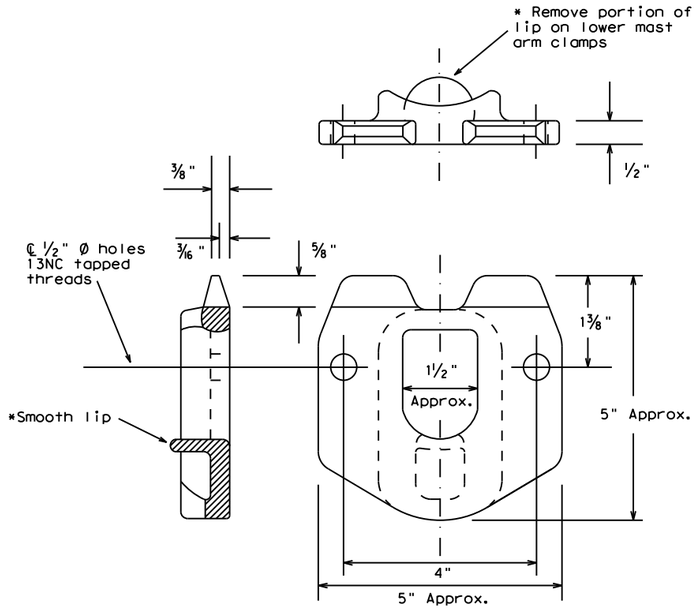


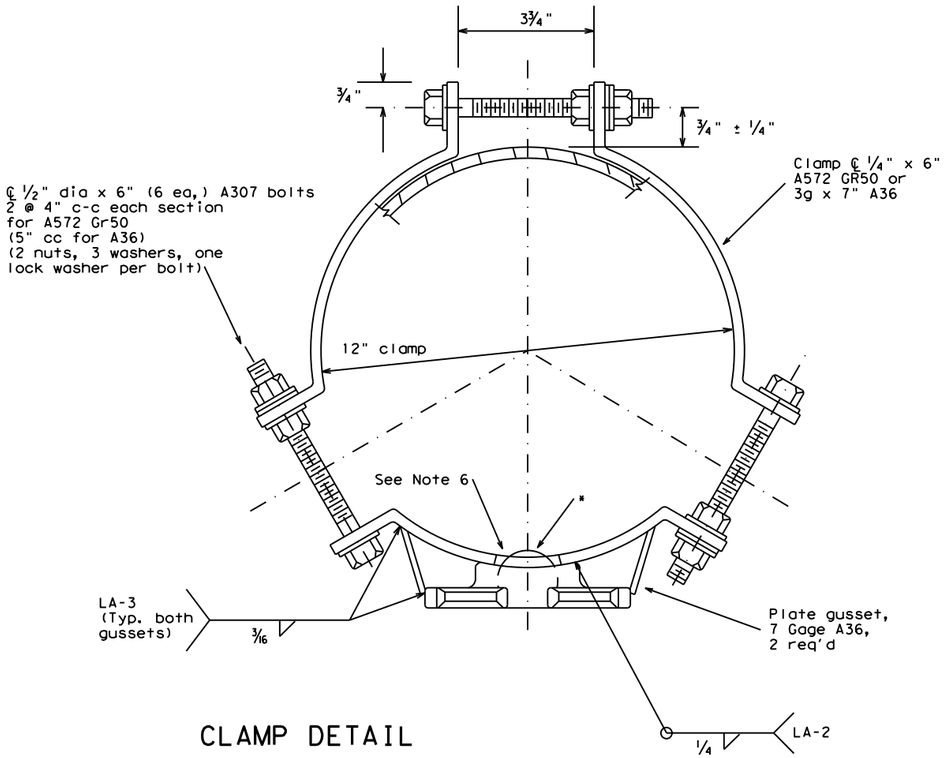
POLE SIMPLEX DETAILS

OTHER MATERIALS:

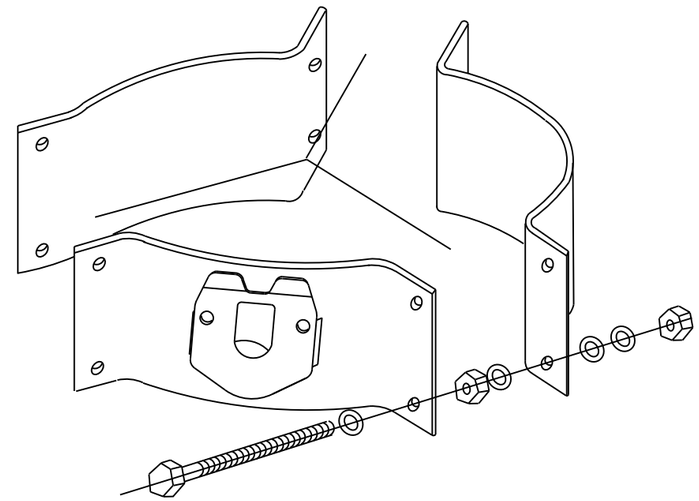
1. Pole simplex shall be ASTM A27 GR65-35 or A148 GR80-50 or A576 GR1021. ASTM A576 must be suitable for forging and also meet minimum tensile of 65ksi, minimum yield of 35ksi, and a minimum elongation of 22 percent in 2 inches.
2. Welded tabs and backplates shall be ASTM A-36 steel or better.
3. Nylon insert locknuts shall conform to ASTM A563.

GENERAL NOTES:

1. Materials and fabrication shall be in accordance with Standard Sheet "MA-C" and with the details, dimensions, and weld procedures shown herein. Weld references call for preapproved weld procedures which the Fabricator must obtain prior to fabrication. In the absence of specified fabrication tolerances, dimensions shall be within the tolerances generally obtainable in normal fabrication practice.
2. All parts shall be galvanized after fabrication in accordance with Item 445, "Galvanizing". The throat of the Simplex shall be made free of all rough or sharp edges resulting from the galvanizing process.
3. Each simplex fitting shall be supplied with 2 ASTM A325 bolts, ½in. X 1½in. and 2 lock washers. The bolts and lock washers shall be secured to the clamp with the other hardware items. The Fabricator shall ship clamp assembly together in a single package, including all bolts, nuts, and washers required for the clamp and simplex fitting.
4. Design conforms to 1994 AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals" and interim revisions thereto. Design Wind Speed equals 80 mph plus a 1.3 gust factor. Clamps are designed to support a 60 lb. luminaire having an effective projected area (actual area times drag coefficient) of 1.6 sq.ft.,12 ft. maximum arm length.
5. Each assembly shall consist of one upper piece simplex fitting having a smooth lip and one lower piece simplex fitting with the lip removed.
6. Approximately 2 in. diameter hole in upper mast arm clamp.



CLAMP DETAIL



PROJECTION

For 8.9 - 12 inch diameter Signal Poles
(Two req'd for each mast arm)

Texas Department of Transportation
Traffic Operations Division

CLAMP ON FITTING ASSEMBLY FOR LUMINAIRE MAST ARM

CFA-12

© TxDOT	DN: KAB	CK: RES	DW: FDN	CK: CAL
REVISIONS	CONT	SECT	JOB	HIGHWAY
11-99	0177	14	037	SL 494
1-12	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY		91

DATE:
FILE:

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GENERAL NOTES FOR ALL ELECTRICAL WORK

1. The location of all conduits, junction boxes, ground boxes, and electrical services is diagrammatic and may be shifted to accommodate field conditions.

2. Provide new and unused materials. Ensure that all materials and installations comply with the applicable articles of the National Electrical Code (NEC), TxDOT standards and specifications, National Electrical Manufacturers Association (NEMA), and are listed by Underwriters Laboratories (UL) or a Nationally Recognized Testing Lab (NRTL). NRTLs such as Canadian Standard Association (CSA), Intertek Testing Services NA Inc., or FM Approvals LLC can be considered equivalent to UL. Where reference is made to NEMA listed devices, International Electrotechnical Commission (IEC) listed devices will not be considered an acceptable equal to a NEMA listed device. Acceptable devices may have both a NEMA and IEC listing. Faulty fabrication or poor workmanship in any material, equipment, or installation is justification for rejection. Replace or reinstall rejected material or equipment at no additional cost to the Department.

3. Miscellaneous nuts, bolts and hardware, except for high strength bolts, may be stainless steel when plans specify galvanized, provided the bolt size is ½ in. or less in diameter.

4. Provide the following test equipment as required by the Engineer to confirm compliance with the contract and the NEC: voltmeter, ammeter, megohm meter (1000 volt DC), ground resistance tester, torque wrenches, and torque screwdrivers. Ensure all equipment has been properly calibrated within the last year. Provide calibration certification to the Engineer upon request. Operate test equipment during inspection as requested by the Engineer.

5. Install grounding as shown on the plans and in accordance with the NEC. Ensure all metallic conduits; metal poles; luminaires; and metal enclosures are bonded to the equipment grounding conductor. Provide stranded bare copper or green insulated grounding conductors. Ground rods, connectors, and bonding jumpers are subsidiary to the various bid items.

6. When required by the Engineer, notify the Department in writing of materials from the Material Producers List (MPL) intended for use on each project. Prequalified materials are listed on the MPL on TxDOT's website under "Roadway Illumination and Electrical Supplies." No substitutions will be allowed for materials on this list.

CONDUIT

A. MATERIALS

1. Provide conduit, junction boxes, fittings, and hardware as per TxDOT Departmental Material Specification (DMS) 11030 "Conduit" and Item 618 "Conduit" of TxDOT's "Standard Specifications For Construction And Maintenance Of Highways, Streets, And Bridges," latest edition. Provide conduits listed under Item 618 on the MPL under "Roadway Illumination and Electrical Supplies." Provide conduit types according to the descriptive code or as shown on the plans. Do not substitute other types of conduits for those shown. Provide liquidtight flexible metal conduit (LFMC) when flexible conduit is called for on galvanized steel rigid metallic conduit (RMC) systems. Provide liquidtight flexible nonmetallic conduit (LFNC) when flexible conduit is called for on polyvinyl chloride (PVC) systems.

2. Provide galvanized steel RMC for all exposed conduits, unless otherwise shown on the plans. Properly bond all metal conduits.

3. Unless otherwise shown on the plans, provide junction boxes with a minimum size as shown in the following table, which applies to the greatest number of conductors entering the box through one conduit with no more than four conduits per box. When a mixture of conductor sizes is present, count the conductors as if all are of the larger size. For situations not applicable to the table, size junction boxes in accordance with NEC.

AWG	3 CONDUCTORS	5 CONDUCTORS	7 CONDUCTORS
#1	10" x 10" x 4"	12" x 12" x 4"	16" x 16" x 4"
#2	8" x 8" x 4"	10" x 10" x 4"	12" x 12" x 4"
#4	8" x 8" x 4"	10" x 10" x 4"	10" x 10" x 4"
#6	8" x 8" x 4"	8" x 8" x 4"	10" x 10" x 4"
#8	8" x 8" x 4"	8" x 8" x 4"	8" x 8" x 4"

4. Junction boxes with an internal volume of less than 100 cu. in. and supported by entering raceways must have threaded entries or hubs identified for the intended purpose and supported by connection of two or more rigid metal conduits. Secure conduit within 3 ft. of the enclosure or within 18 in. of the enclosure if all conduit entries are on the same side. Mechanically secure all junction boxes with an internal volume greater than 100 cu. inches.

5. Provide hot dipped galvanized cast iron or sand cast aluminum outlet boxes for junction boxes containing only 10 AWG or 12 AWG conductors. Do not use die cast aluminum boxes. Size outlet boxes according to the NEC.

6. Do not use intermediate metal conduit (IMC) or electrical metallic tubing (EMT) unless specifically required by the plan sheets. When EMT is called for, provide junction boxes made from galvanized steel sheeting, listed and approved for outdoor use, unless otherwise noted on the plans. Size all galvanized steel junction boxes in accordance with the NEC. Provide junction boxes for IMC conduit systems that meet the same requirements for junction boxes used with RMC systems.

7. Provide PVC junction boxes intended for outdoor use on PVC conduit systems, unless otherwise noted on the plans.

8. Provide PVC elbows in PVC conduit systems, unless otherwise shown on the plans. Use only a flat, high tensile strength polyester fiber pull tape for pulling conductors through the PVC conduit system. When galvanized steel RMC elbows are specifically called for in the plans and any portion of the RMC elbow is buried less than 18 in., ground the RMC elbow by means of a grounding bushing on a rigid metal extension. Grounding of the rigid metal elbow is not required if the entire RMC elbow is encased in a minimum of 2 in. of concrete. PVC extensions are allowed on these concrete encased rigid metal elbows. RMC or PVC elbows are subsidiary to various bid items.

9. When required, provide High-Density Polyethylene (HDPE) conduit with factory installed internal conductors according to Item 622 "Duct Cable." At the Contractor's request and with approval by the Engineer, substitute HDPE conduit with no conductors for bored schedule 40 or schedule 80 PVC conduit bid under Item 618. Ensure bored HDPE substituted for PVC is schedule 40 and of the same size PVC called for in the plans. Ensure the substituted HDPE meets the requirements of Item 622, except that the conduit is supplied without factory-installed conductors. Make the transition of the HDPE conduit to PVC (or RMC elbow when required) at the bore pit. Provide conduit of the size and schedule as shown on the plans. Do not extend substituted conduit into ground boxes or foundations. Provide PVC or galvanized steel RMC elbows as called for at all ground boxes and foundations.

10. Use two-hole straps when supporting 2 in. and larger conduits. On electrical service poles, properly sized stainless steel or hot dipped galvanized one-hole standoff straps are allowed on the service riser conduit.

B. CONSTRUCTION METHODS

1. Provide and install expansion joint conduit fittings on all structure-mounted conduits at the structure's expansion joints to allow for movement of the conduit. In addition, provide and install expansion joint fittings on all continuous runs of galvanized steel RMC conduit externally exposed on structures such as bridges at maximum intervals of 150 ft. When requested by the project Engineer, supply manufacturer's specification sheet for expansion joint conduit fittings. Repair or replace expansion joint fittings that do not allow for movement at no additional cost to the Department. Provide the method of determining the amount of expansion to the Engineer upon request. Do not use LFMC or LFNC as a substitute for the required expansion conduit fittings.

2. Space all conduit supports at maximum intervals of 5 ft. Install conduit spacers when attaching metal conduit to surface of concrete structures. See "Conduit Mounting Options" on ED(2). Install conduit support within 3 ft. of all enclosures and conduit terminations.

3. Do not attach conduit supports directly to pre-stressed concrete beams except as shown specifically in the plans or as approved by the Engineer.

4. Unless otherwise shown on the plans, jack or bore conduit placed beneath existing roadways, driveways, sidewalks, or after the base or surfacing operation has begun. Backfill and compact the bore pits below the conduit per Item 476 "Jacking, Boring, or Tunneling Pipe or Box" prior to installing conduit or duct cable to prevent bending of the connections.

5. When placing conduit in the sub-grade of new roadways, backfill all trenches with excavated material unless otherwise noted on the plans. When placing conduit in the sub-base of new roadways, backfill all trenches with cement-stabilized base as per requirements of Items 110 "Excavation", 400 "Excavation and Backfill for Structures", 401 "Flowable Backfill", 402 "Trench Excavation Protection", and 403 "Temporary Special Shoring."

6. Provide and place warning tape approximately 10 in. above all trenched conduit as per Item 618.

7. During construction, temporarily cap or plug open ends of all conduit and raceways immediately after installation to prevent entry of dirt, debris and animals. Temporary caps constructed of durable duct tape are allowed. Tightly fix the tape to the conduit opening. Clean out the conduit and prove it clear in accordance with Item 618 prior to installing any conductors.

8. Ensure conduit entry into the top of any enclosure is waterproof by installing conduit sealing hubs or using boxes with threaded bosses. This includes surface mounted safety switches, meter cans, service enclosures, auxiliary enclosures and junction boxes. Grounding bushings on water tight sealing hubs are not required.

9. Fit the ends of all PVC conduit terminations with bushings or bell end fittings. Provide and install a grounding type bushing on all metal conduit terminations.

10. Install a bonding jumper from each grounding bushing to the nearest ground rod, grounding lug, or equipment grounding conductor. Ensure all bonding jumpers are the same size as the equipment grounding conductor. Bonding of conduit used as a casing under roadways for duct cable is not required, if the duct extends the full length through the casing.

11. At all electrical services, install a 6 AWG solid copper grounding electrode conductor.

12. Place conduits entering ground boxes so that the conduit openings are between 3 in. and 6 in. from the bottom of the box. See the ground box detail on sheet ED(4).

13. Seal ends of all conduits with duct seal, expandable foam, or by other methods approved by the Engineer. Seal conduit immediately after completion of conductor installation and pull tests. Do not use duct tape as a permanent conduit sealant. Do not use silicone caulk as a conduit sealant.

14. File smooth the cut ends of all mounting strut and conduit. Before installing, paint the field cut ends of all mounting strut and RMC (threaded or non-threaded) with zinc rich paint (94% or more zinc content) to alleviate overspray. Use zinc rich paint to touch up galvanized material as allowed under Item 445 "Galvanizing." Do not paint non-galvanized material with a zinc rich paint as an alternative for materials required to be galvanized.

Texas Department of Transportation

Traffic Operations Division Standard

ELECTRICAL DETAILS CONDUITS & NOTES

ED(1)-14

FILE:	ed1-14.dgn	DN:	CK:	DW:	CK:
© TxDOT	October 2014	CONT	SECT	JOB	HIGHWAY
	REVISIONS	0177	14	037	SL 494
		DIST	COUNTY		SHEET NO.
		HOU	MONTGOMERY		92

71A

DATE:
FILE:

ELECTRICAL CONDUCTORS

A. MATERIAL INFORMATION

1. Provide Type XHHW insulated conductors in accordance with Departmental Material Specification (DMS)11040 "Conductors" and Item 620 "Electrical Conductors." Provide conductors as listed on the Material Producers List (MPL) on the Department web site under "Roadway Illumination and Electrical Supplies" Item 620. Color code insulated conductors in conformance with the NEC. Identify grounded (neutral) conductors with white insulation. Identify grounding conductors (ground wires) with green insulation or bare conductors. Identify ungrounded (hot) conductors with any color insulation except green, white, or gray. Keep color scheme consistent throughout the wiring system. Identify conductors 6 American Wire Gauge (AWG) and smaller by continuous color jacket. Identify electrical conductors 4 AWG and larger by continuous color jacket or by colored tape. When identifying conductors with colored tape, mark at least 6 in. of the conductor's insulation with half laps of tape.

2. Provide a solid copper 6 AWG grounding electrode conductor to bond the electrical service equipment to the concrete encased grounding electrode or the ground rod at the service location. Connect the grounding electrode conductor to the ground rod with a UL listed connector in accordance with DMS 11040. Connect the grounding electrode conductor to the concrete encased grounding electrode as shown in the plans.

3. Where two or more circuits are present in one conduit or enclosure, permanently identify the conductors of each branch circuit by attaching a non-metallic tag around both circuit conductors at each accessible location. Provide tags with two straps, large enough to indicate circuit number, letter, or other identification as shown in the plans. Print circuit identification on the tag with a permanent marker.

4. Use listed compression or screw type pressure connectors, terminal blocks, or split bolt connectors for splicing as specified in DMS 11040. Use hot melt adhesive tape to fill the gap and seal the ends of heat shrink tubing. Provide UL listed gel-filled insulating splice covers. Splicing materials, insulating materials, breakaway disconnects, splice covers, and fuse holders are subsidiary to various bid items.

B. CONSTRUCTION METHODS

1. Use only a flat, high tensile strength polyester fiber pull tape for pulling conductors through the conduit system. After installing conductors in conduit, perform conductor pull test. If a conductor cannot be freely pulled, make any needed alterations or repairs at no additional cost to the department. Perform insulation resistance tests in accordance with Item 620. Coordinate with the Engineer to witness the tests.

2. Leave 2 ft. minimum, 3 ft. maximum length for each conductor up to the splice in ground boxes. Leave 3 ft. minimum, 4 ft. maximum length of conductor in ground boxes when pulled through with no splice. Leave 1 ft. minimum, 1.5 ft. maximum length of conductor at enclosures, weatherheads and pole bases.

3. Make splices only in junction boxes, ground boxes, pole bases, or electrical enclosures and use only listed compression or screw type pressure connectors, terminal blocks, or split bolt connectors. Insulate splices with heavy wall heat shrink tubing or gel-filled insulating splice covers to provide a watertight splice. Overlap conductor insulation with heat shrink tubing a minimum of 2 in. past both sides of the splice. Where heat shrink tubing may not shrink sufficiently to provide a watertight seal around the individual conductors, prior to heating the tubing, increase the diameter of the conductor insulation using hot melt adhesive tape to provide a watertight seal between the individual conductors and the heat shrink tubing. Ensure the tape extends past the heat shrink tubing. Use hot melt adhesive tape to fill the gap and seal the ends of heat shrink tubing. Heat shrink tubing that appears to have been burned, or overheated, is considered defective and must be replaced.

4. Size and install gel-filled insulating splice covers according to manufacturer's specifications when used in place of heat shrink tubing.

5. Wire nuts with factory applied waterproof sealant may be used for 8 AWG or smaller conductors in above ground junction boxes, but not in pole bases or ground boxes. Install wire nuts in an upright position to prevent the accumulation of water.

6. Support conductors in illumination poles with a J-hook at the top of the pole.

7. When terminating conductors, remove the insulation and jacketing material without nicking the individual strands of the conductor. Conductors with nicked individual conductor strands or removed strands will be considered damaged.

8. Replace conductors and cables that are damaged beyond repair or that fail an insulation resistance test at no additional cost to the department.

9. Do not repair damaged conductors with duct tape, electrical tape, or wire nuts. Use only approved splicing methods.

10. Do not terminate more than one conductor under a single connector, unless the connector is rated for multiple conductors. Do not exceed the pressure connector's listing for maximum number and size of conductors allowed.

11. Install breakaway connectors on conductors bid under Item 620 whenever those conductors pass through a breakaway support device. Follow manufacturer's instructions when terminating conductors to breakaway connectors. Properly torque threaded connections. Proper terminations are critical to the safe operation of breakaway devices. Trim waterproofing boots on breakaway connectors to fit snugly around the conductor to ensure waterproof connection. Only one conductor may enter a single opening in a boot. Provide waterproof boots with the correct number of openings. Leave unused openings factory sealed. Use prequalified breakaway connectors as shown on the MPL.

12. Provide and install a separate stranded equipment grounding conductor (EGC) in all conduits that contain circuit wiring of 50 volts or more. Unless shown elsewhere, size the EGC to be the same size as the largest current carrying conductor contained in the conduit. Ensure all EGCs are bonded together at every accessible location. For traffic signal installations, provide a minimum size 8 AWG EGC. The EGC is paid for under Item 620.

C. TEMPORARY WIRING

1. Install temporary conductors and electrical equipment in accordance with the NEC article "Temporary Installations" and Department standard sheets.

2. Provide a ground fault circuit interrupter (GFCI) for power outlets for portable electrical equipment, power tools, ice machines, ice storage bins and refrigerators located outdoors at grade. GFCI may be any one of the following: molded cord and plug set, receptacle, or circuit breaker type.

3. Use listed wire nuts with factory applied sealant for temporary wiring where approved.

4. Enclose conductor splices within a listed enclosure or ground box, or ensure the splices are more than 10 ft. above grade vertically and more than 5 ft. horizontally from any metal structure. Where installing temporary conductors in areas subject to vehicle traffic or mobile construction equipment, ensure the vertical clearance to ground is at least 18 ft. when measured at the lowest point. Ground messenger wires that support power conductors in conformance with the NEC.

5. Protect and when necessary repair any existing electrical conduits uncovered during the construction process in a timely manner and in conformance with the NEC.

GROUND RODS & GROUNDING ELECTRODES

A. MATERIAL INFORMATION

1. Provide and install a grounding electrode at electrical services. Provide ground rods according to DMS 11040 and the plans. Larger diameter or longer length rods may be called for in some specific locations, see the individual plans sheets. Concrete encased grounding electrodes may be called for in specific locations including electrical service, see individual plan sheets.

B. CONSTRUCTION METHODS

1. Furnish auxiliary ground rods for lightning protection and install in soil, concrete, or both, as called for in the plans. For ground rods installed in concrete, ensure the connection of the conductor to the ground rod is readily accessible for inspection or repairs. For ground rods installed in soil, ensure that the upper end is between 2 to 4 in. below finished grade.

2. Do not place ground rods in the same drilled hole as a timber pole.

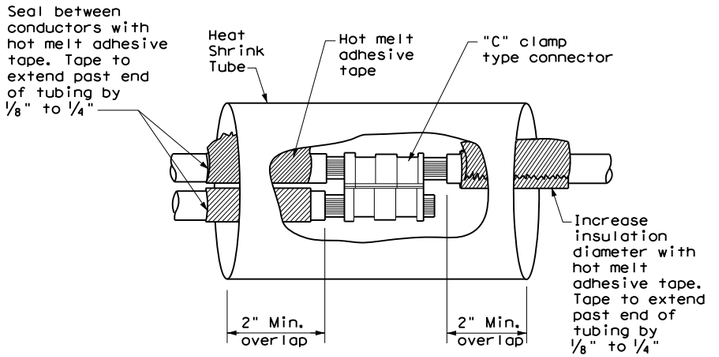
3. Install ground rods so the imprinted part number is at the upper end of the rod.

4. Remove all non-conductive coatings such as concrete splatter from the rod at the clamp location.

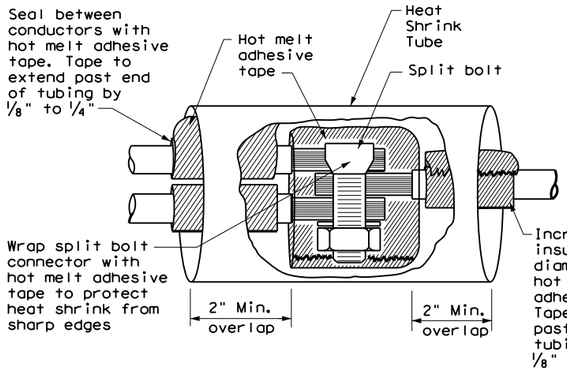
5. Route all conductors as short and straight as possible for connection to lightning protection ground rods. When a bend is required, ensure a minimum radius bend of four inches for these conductors.

6. Unless otherwise called for in the plans, protect grounding electrode conductors with non-metallic conduit. When protecting grounding electrode conductors with metal conduit, provide and install a grounding type bushing and properly sized bonding jumper on each end of the metal conduit.

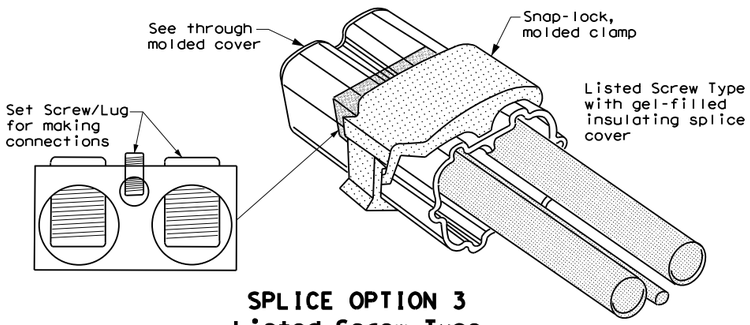
7. Written authorization is required before installing a ground rod in a horizontal trench for rocky soil or a solid rock bottom.



SPLICE OPTION 1
Compression Type



SPLICE OPTION 2
Split Bolt Type



SPLICE OPTION 3
Listed Screw Type

Texas Department of Transportation

Traffic Operations Division Standard

ELECTRICAL DETAILS CONDUCTORS

ED(3)-14

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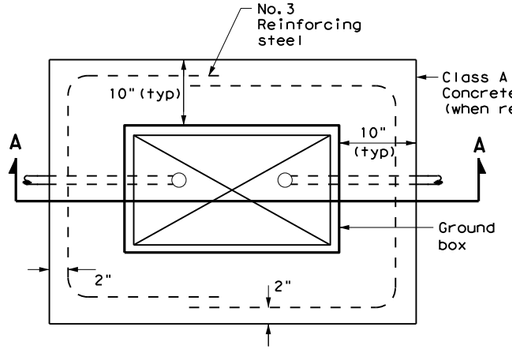
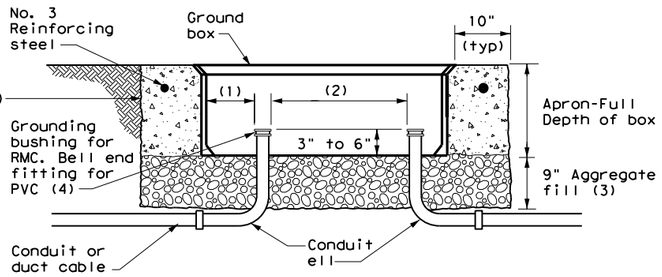


PLAN VIEW



SECTION A - A

APRON FOR GROUND BOX

(1) Uniformly space ends of conduits within the ground box. Position ends of conduits so that ground box walls do not interfere with the installation of grounding bushings or bell end fittings.

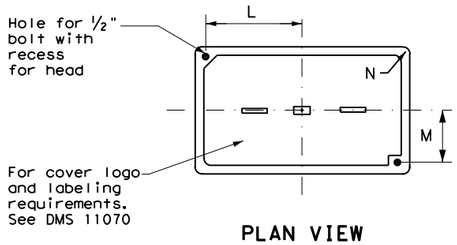
(2) Maintain sufficient space between conduits to allow for proper installation of bushing.

(3) Place aggregate under the box, not in the box. Aggregate should not encroach on the interior volume of the box.

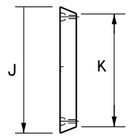
(4) Install a grounding bushing on the upper end of all RMC terminating in a ground box. Ground RMC elbows when any part of the elbow is less than 18 in. below the bottom of the ground box. Install a PVC bushing or bell end fitting on the upper end of all PVC conduits terminating in a ground box.

GROUND BOX DIMENSIONS	
TYPE	OUTSIDE DIMENSIONS (INCHES) (Width x Length X Depth)
A	12 X 23 X 11
B	12 X 23 X 22
C	16 X 29 X 11
D	16 X 29 X 22
E	12 X 23 X 17

GROUND BOX COVER DIMENSIONS								
TYPE	DIMENSIONS (INCHES)							
	H	I	J	K	L	M	N	P
A, B & E	23 1/4	23	13 3/4	13 1/2	9 7/8	5 1/8	1 3/8	2
C & D	30 1/2	30 1/4	17 1/2	17 1/4	13 1/4	6 3/4	1 3/8	2



PLAN VIEW



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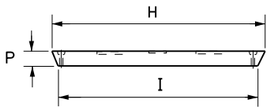

SIDE

GROUND BOX COVER

GROUND BOXES

A. MATERIALS

1. Provide polymer concrete ground boxes measuring 16x30x24 in. (WxLxD) or smaller in accordance with Departmental Material Specification (DMS) 11070 "Ground Boxes" and Item 624 "Ground Boxes."

2. Provide Type A, B, C, D, and E ground boxes as shown in the plans, and as listed on the Material Producers List (MPL) on the Department web site under "Roadway Illumination and Electrical Supplies," Item 624.

3. Ensure ground box cover is correctly labeled in accordance with DMS 11070.

4. Provide larger ground boxes in accordance with Item 624 and as shown in the plans.

B. CONSTRUCTION METHODS

1. Remove all gravel and dirt from conduit. Cap all conduits prior to placing aggregate and setting ground box. Provide Grade 3 or 4 coarse aggregate as shown on Table 2 of Item 302 "Aggregates for Surface Treatments." Ensure aggregate bed is in place and at least 9 inches deep, prior to setting the ground box. Install ground box on top of aggregate.

2. Cast ground box aprons in place. Reinforcing steel may be field bent. Ensure the depth of concrete for the apron extends from finished grade to the top of the aggregate bed under the box. Ground box aprons, including concrete and reinforcing steel, are subsidiary to ground boxes when called for by descriptive code.

3. Keep bolt holes in the box clear of dirt. Bolt covers down when not working in ground boxes.

4. Install all conduits and ells in a neat and workmanlike manner. Uniformly space conduits so grounding bushings and bell end fittings can easily be installed.

5. Temporarily seal all conduits in the ground box until conductors are installed.

6. Permanently seal conduits immediately after the completion of conductor installation and pull tests. Permanently seal the ends of all conduits with duct seal, expandable foam, or other method as approved. Do not use duct tape as a permanent conduit sealant. Do not use silicone caulk as a sealant.

7. When a ground rod is present in a ground box, bond all equipment grounding conductors together and to the ground rod with listed connectors.

8. When a type B or D ground box is stacked to meet volume requirements, it is allowable to cut an appropriately sized hole for conduit entry in the side wall at least 18 inches below grade.

9. If an existing ground box in the contract has a metal cover, bond the cover to the equipment grounding conductor with a 3 ft. long stranded bonding jumper the same size as the grounding conductor. The bonding jumper is subsidiary to various bid items. Verify existing ground boxes with metal covers are shown on the plans, with notes fully describing the work required.

10. If other ground boxes with metal covers are within the project limits but are not part of the contract, the Engineer may direct the Contractor to bond the metal covers, identifying the specific boxes in writing. This work will be paid for separately.

11. Bond metal ground box covers to the grounding conductor with a tank ground type lug.

Texas Department of Transportation

Traffic Operations Division Standard

ELECTRICAL DETAILS
GROUND BOXES

ED(4)-14

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ELECTRICAL SERVICES NOTES

1. Provide new materials. Ensure installation and materials comply with the applicable provisions of the National Electrical Code (NEC) and National Electrical Manufacturers Association (NEMA) standards. Ensure material is Underwriters Laboratories (UL) listed. Provide and install electrical service conduits, conductors, disconnects, contactors, circuit breaker panels, and branch circuit breakers as shown on the Electrical Service Data chart in the plans. Faulty fabrication or poor workmanship in material, equipment, or installation is justification for rejection. Where manufacturers provide warranties and guarantees as a customary trade practice, furnish these to the State.

2. Provide electrical services in accordance with Electrical Details standard sheets, Departmental Material Specification (DMS) 11080 "Electrical Services,"DMS 11081 "Electrical Services-Type A," DMS 11082 "Electrical Services-Type C," DMS 11083 "Electrical Services-Type D," DMS 11084 "Electrical Services-Type T," DMS 11085 "Electrical Services-Pedestal (PS)", and Item 628 "Electrical Services" of the Standard Specifications. Provide electrical service types A, C, and D, as listed on the Material Producers List (MPL) on the Department web site under "Roadway Illumination and Electrical Supplies," Item 628. Provide other service types as detailed on the plans.

3. Provide all work, materials, services, and any incidentals needed to install a complete electrical service as specified in the plans.

4. Coordinate with the Engineer and the utility provider for metering and compliance with utility requirements. Primary line extensions, connection charges, meter charges, and other charges by the utility company to provide power to the location are paid for in accordance with Item 628. Get approval for the costs associated with these charges prior to engaging the utility company to do the work. Consult with the utility provider to determine costs and requirements, and coordinate the work as approved.

5. The enclosure manufacturer will provide Master Lock Type 2 with brass tumblers keyed #2195 for all custom electrical enclosures. Installing Contractor is to provide Master Lock #2195 Type 2 with brass tumblers for "off the shelf" enclosures. Master Lock #2195 keys and locks become property of the State. Unless otherwise approved, do not energize electrical service equipment until locks are installed.

6. Enclosures with external disconnects that de-energize all equipment inside the enclosure do not need a dead front trim. Protect incoming line terminations from incidental contact as required by the NEC.

7. When galvanized is specified for nuts, screws, bolts or miscellaneous hardware, stainless steel may be used.

8. Provide wiring and electrical components rated for 75°C. Provide red, black, and white colored XHHW service entrance conductors of minimum size 6 American Wire Gauge (AWG). Identify size 6 AWG conductors by continuous color jacket. Identify electrical conductors sized 4 AWG and larger by continuous color jacket or by colored tape. Mark at least 6 inches of the conductor's insulation with half laps of colored tape, when identifying conductors. Ensure each service entrance conductor exits through a separately bushed non-metallic opening in the weatherhead. The lengths of the conductors outside the weatherhead are to be 12 inches minimum, 18 inches maximum, or as required by utility.

9. All electrical service conduit and conductors attached to the electrical service including the riser or the elbow below ground are subsidiary to the electrical service. For an underground utility feed, all service conduit and conductors after the elbow, including service conduit and conductors for the utility pole riser when furnished by the Contractor, will be paid for separately.

10. Provide rigid metal conduit (RMC) for all conduits on service, except for the ½ in. PVC conduit containing the electrical service grounding electrode conductor. Size the service entrance conduit as shown in the plans. Ensure conduit for branch circuit entry to enclosure is the same size as that shown on the layout sheets for branch circuit conduit. Extend all rigid metal conduits a minimum of 6 inches underground and then couple to the type and schedule of the conduit shown on the layout for that particular branch circuit. Install a grounding bushing on the RMC where it terminates in the service enclosure.

11. Use of liquidtight flexible metal conduit (LFMC) is allowed between the meter and service enclosure when they are mounted 90 to 180 degrees to each other. Size the LFMC the same size as service entrance conduit. LFMC must not exceed 3 feet in length. Strap LFMC within 1 foot of each end. LFMC less than 12 inches in length need not be strapped. Each end of LFMC must have a grounding bushing or be terminated with a grounding fitting. The LFMC must contain a grounded (neutral) conductor. Ensure any bend in LFMC never exceeds 180 degrees. A pull test is required on all installed conductors, with at least six inches of free conductor movement demonstrated to the satisfaction of the Engineer.

12. Ensure all mounting hardware and installation details of services conform to utility company specifications.

13. For all electrical service enclosures listed under Item 628 on the MPL, the UL 508 enclosure manufacturers will prepare and submit a schematic drawing unique to each service. Before shipment to the job site, place the applicable laminated schematic drawings and the laminated plan sheet showing the electrical service data chart used to build the enclosure in the enclosure's data pocket. The installing contractor will copy and laminate the actual project plan sheets detailing all equipment and branch circuits supplied by that service. The laminated plan sheets are to be placed in the service enclosure's document pocket. Reduce 11 in. x 17 in. plan sheets to 8 ½ in. x 11 in. before laminating. If the installation differs from the plan sheets, the installing contractor is to redline plan sheets before laminating.

14. When providing an "Off The Shelf" Type D or Type T service, provide laminated plan sheets detailing equipment and branch circuits supplied by that service. Reduce 11 in. x 17 in. plan sheets to 8 ½ in. x 11 in before laminating. Deliver these drawings before completion of the work to the Engineer, instead of placing in enclosure that has no door pocket.

15. Do not install conduit in the back wall of a service enclosure where it would penetrate the equipment mounting panel inside the enclosure. Provide grounding bushings on all metal conduits, and terminate bonding jumpers to grounding bus. Grounding bushings are not required when the end of the metal conduit is fitted with a conduit sealing hub or threaded boss, such as a meter base hub.

SERVICE ASSEMBLY ENCLOSURE

1. Provide threaded hub for all conduit entries into the top of enclosure.

2. Type galvanized steel (GS) enclosures may be used for Type C panelboards and for Type D and T services that do not use an enclosure mounted photocell or lighting contactor. Provide GS enclosures in accordance with DMS 11080, 11082, 11083, and 11084.

3. Provide aluminum (AL) and stainless steel (SS) enclosures for Types A, C, and D in accordance with DMS 11080, 11081, 11082, 11083, and 11084. Do not paint stainless steel.

4. Provide pedestal service (PS) enclosures in accordance with ED(9) and DMS 11080 and 11085. Do not provide GS pedestal services. If GS is shown in the PS descriptive code, provide an AL enclosure.

MAIN DISCONNECT & BRANCH CIRCUIT BREAKERS

1. Field drill flange-mounted remote operator handle if needed, to ensure handle is lockable in both the "On" and "Off" positions.

2. When the utility company provides a transformer larger than 50 KVA, verify that the available fault current is less than the circuit breaker's ampere interrupting capacity (AIC) rating and provide documentation from the electric utility provider to the Engineer.

PHOTOELECTRIC CONTROL

1. Provide photocell as listed on the MPL. Move, adjust, or shield the photocell from stray or ambient night time light to ensure proper operation. Mount photocell facing north when practical. Mount top of pole photocells as shown on Top Mounted Photocell Detail.

*ELECTRICAL SERVICE DATA

Elec. Service ID	Plan Sheet Number	Electrical Service Description	Service Conduit **Size	Service Conductors No./Size	Safety Switch Amps	Main Ckt. Bkr. Pole/Amps	Two-Pole Contractor Amps	Panelbd/ Loadcenter Amp Rating	Branch Circuit ID	Branch Ckt. Bkr. Pole/Amps	Branch Circuit Amps	KVA Load
SB 183	289	ELC SRV TY A 240/480 100(SS)AL(E)SF(U)	2"	3/#2	100	2P/100	100	N/A	Lighting NB	2P/40	26	28.1
									Lighting SB	2P/40	25	
									Underpass	1P/20	15	
NB Access	30	ELC SRV TY D 120/240 060(NS)SS(E)TS(O)	1 ¼"	3/#6	N/A	2P/60		100	Sig. Controller	1P/30	23	5.3
							30		Luminaires	2P/20	9	
									CCTV	1P/20	3	
2nd & Main	58	ELC SRV TY T 120/240 000(NS)GS(N)SP(O)	1 ¼"	3/#6	N/A	N/A	N/A	70	Flashing Beacon 1	1P/20	4	1.0
									Flashing Beacon 2	1P/20	4	

* Example only, not for construction. All new electrical services must have electrical service data chart specific to that service as shown in the plans.

** Verify service conduit size with utility. Size may change due to utility meter requirements. Ensure conduit size meets the National ELectrical Code.

EXPLANATION OF ELECTRICAL SERVICE DESCRIPTIVE CODE

ELEC SERV TY X XXX/XXX XXX (XX) XX (X) XX (X)

Schematic Type

Service Voltage V / V

Disconnect Amp Rating
000 indicates main lug only/
Typically Type T

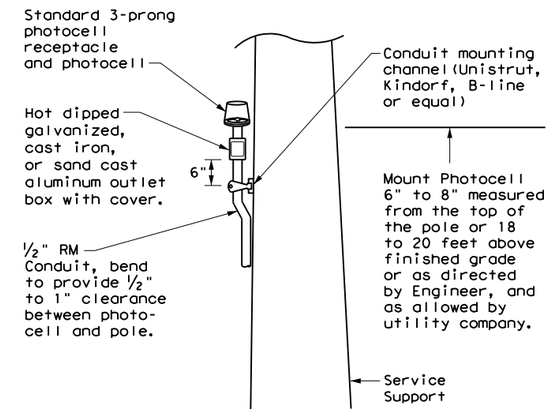
(SS)= Safety Switch Ahead of Meter-Check with Utility
(NS)= No safety Switch Ahead of Meter-Check with Utility

Enclosure Type
GS= Galvanized steel("off the shelf")
SS= Stainless steel(Custom Enclosure)See MPL
AL= Aluminum (Custom Enclosure)See MPL

Photocell Mounting Location
(E)= Inside Service/Enclosure Mounted
(T)= Top of pole
(L)= Luminaire mounted
(N)= None/No Photocell or Lighting Contactor Required

Service Support Type
GC= Granite concrete
OC= Other concrete
TP= Timber pole
SP= Steel pole
SF= Steel frame
OT= Pole by others or paid for separately
EX= Existing pole
TS= Service on traffic signal pole
PS= Pedestal Service

O= Overhead Service Feed from Utility
U= Underground Service Feed from Utility



TOP MOUNTED PHOTOCELL

Install conduit strap maximum 3 feet from box. 5 foot maximum spacing between straps supporting conduit.

Texas Department of Transportation

Traffic Operations Division Standard

ELECTRICAL DETAILS SERVICE NOTES & DATA

ED(5)-14

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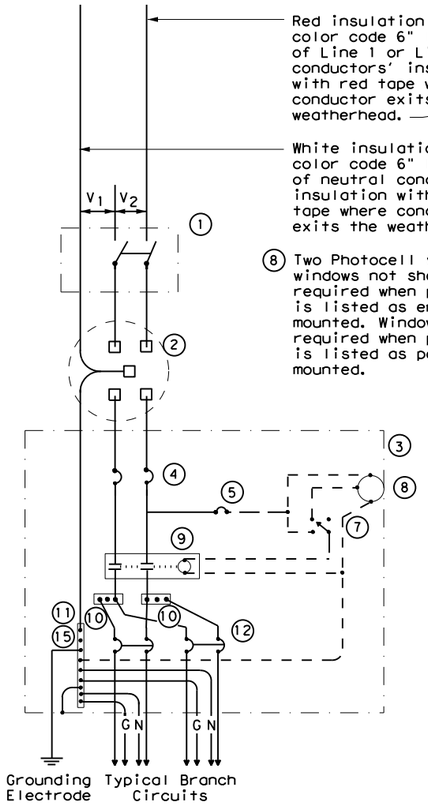
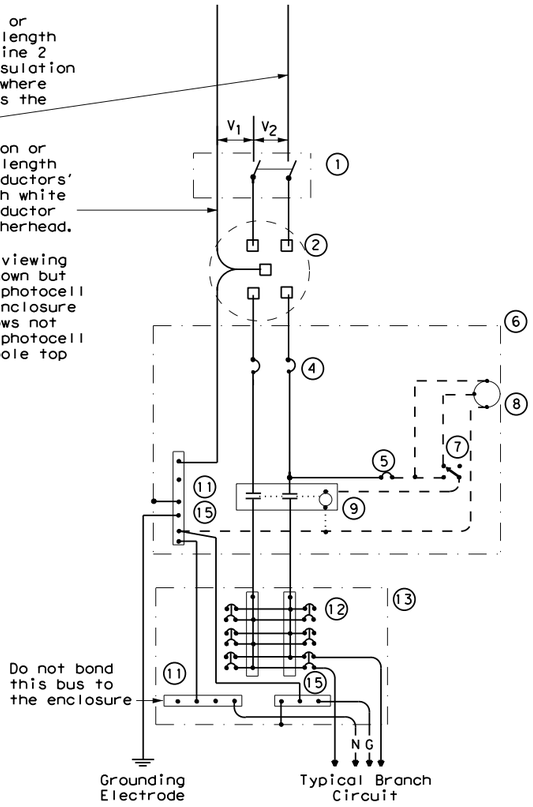
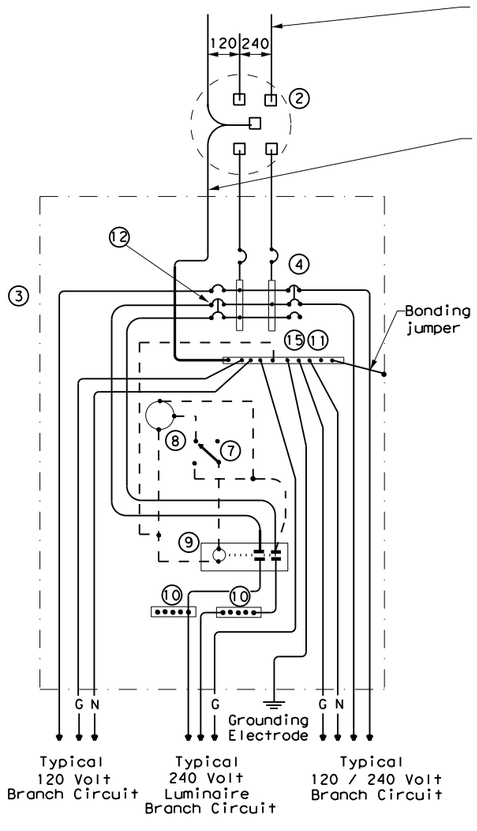


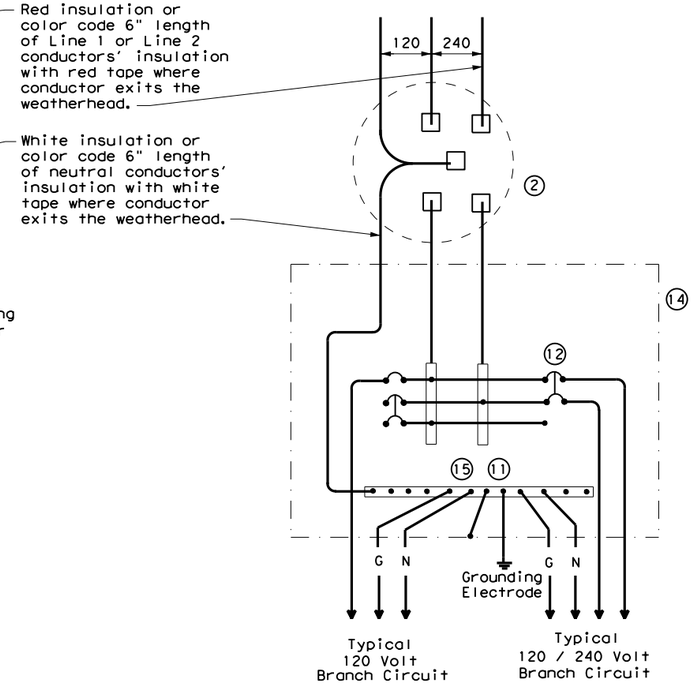
SCHEMATIC TYPE A
THREE WIRE



SCHEMATIC TYPE C
THREE WIRE



SCHEMATIC TYPE D - CUSTOM
120/240 VOLTS - THREE WIRE



SCHEMATIC TYPE T
120/240 VOLTS - THREE WIRE

Galvanized steel-"Buy Off The Shelf" only. When required install photocell top of the pole or on luminaire only, no lighting contractor will be installed.

WIRING LEGEND	
———	Power Wiring
- - - -	Control Wiring
—N—	Neutral Conductor
—G—	Equipment grounding conductor-always required

SCHEMATIC LEGEND	
1	Safety Switch (when required)
2	Meter (when required-verify with electric utility provider)
3	Service Assembly Enclosure
4	Main Disconnect Breaker (See Electrical Service Data)
5	Circuit Breaker, 15 Amp (Control Circuit)
6	Auxiliary Enclosure
7	Control Station ("H-O-A" Switch)
8	Photo Electric Control (enclosure-mounted shown)
9	Lighting Contactor
10	Power Distribution Terminal Blocks
11	Neutral Bus
12	Branch Circuit Breaker (See Electrical Service Data)
13	Separate Circuit Breaker Panelboard
14	Load Center
15	Ground Bus

Texas Department of Transportation

Traffic Operations Division Standard

ELECTRICAL DETAILS SERVICE ENCLOSURE AND NOTES

ED(6)-14

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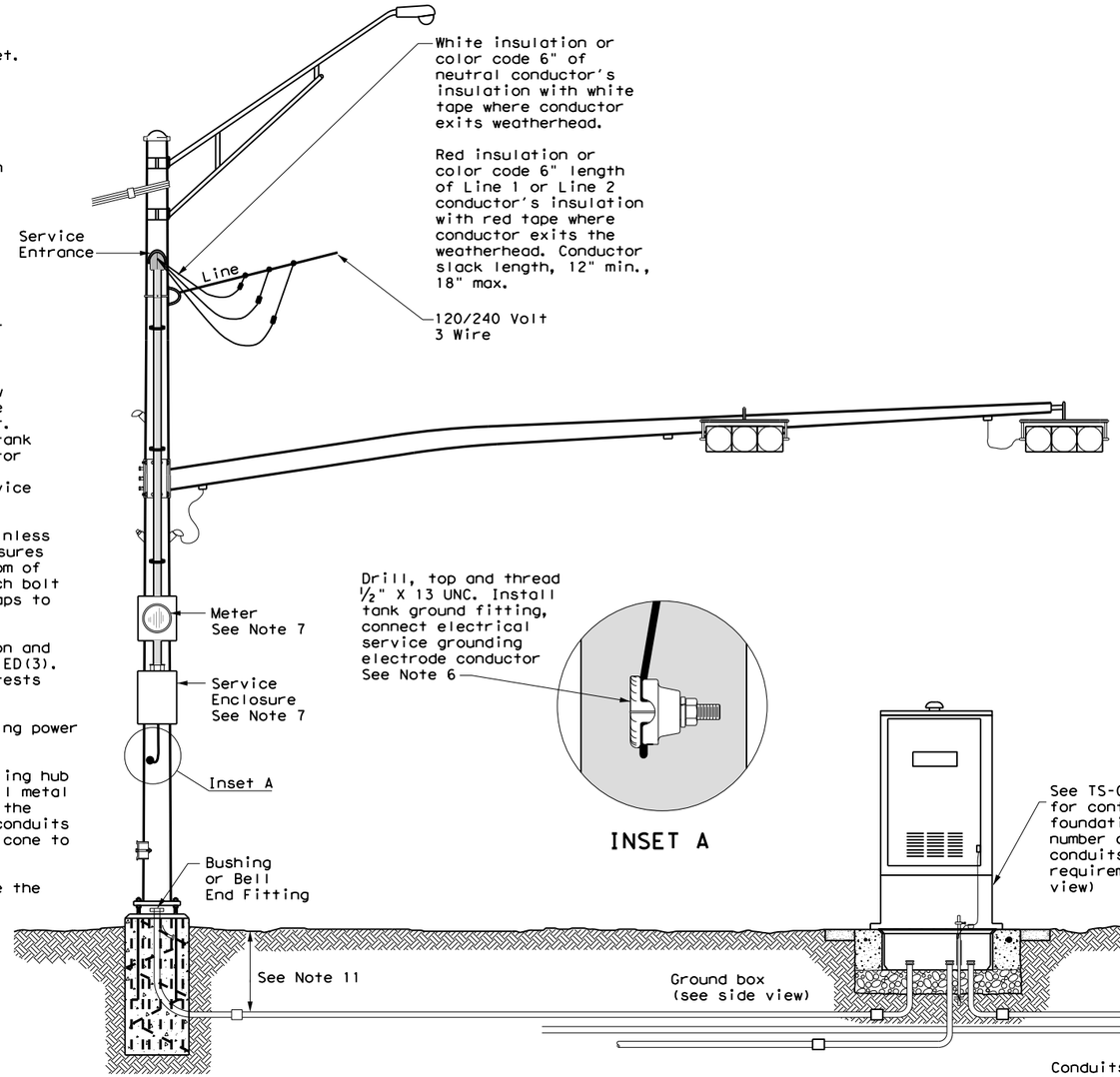
FILE:

TRAFFIC SIGNAL NOTES

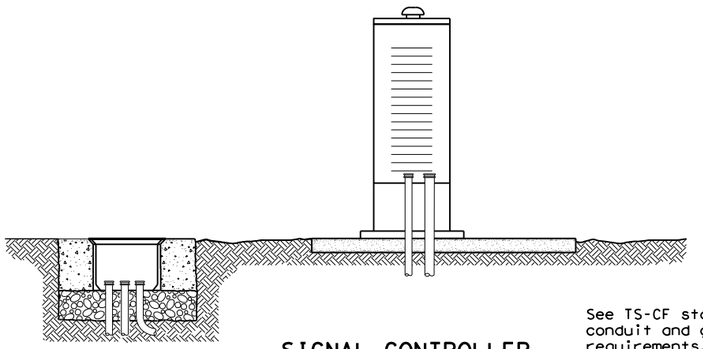
1. Do not pass luminaire conductors through the signal controller cabinet.
2. Include an equipment grounding conductor in all conduits throughout the electrical system. Bond all exposed metal parts to the grounding conductor.
3. Provide roadway luminaires, when required, in accordance with the material and construction sections of Item 610, "Roadway Illumination Assemblies," except for performance testing of luminaires. Test installed roadway luminaires for proper operation as a part of the associated traffic signal system test.
4. If internally illuminated street name signs are approved for use, ground the fixture to the pole with a 12 AWG green XHHW conductor.
5. Bond anchor bolts to rebar cage in two locations using #3 bars or 6 AWG stranded copper conductors. Use listed mechanical connectors rated for embedment in concrete. See TXDOT standard TS-FD for further details.
6. Drill and tap signal poles for ½ in. X 13 UNC tank ground fitting. Provide and install tank ground fitting 4 in. to 6 in. directly below electrical service enclosure. Provide properly sized hole through the bottom of the enclosure for the service grounding electrode conductor. Connect the electrical service grounding electrode conductor to the tank ground fitting. Ensure electrical service grounding electrode conductor is as short and straight as possible from the enclosure to the tank ground fitting. See Inset A detail for further information. Size service entrance conduit and branch circuit conduit as shown in the plans.
7. Mount electrical service enclosure and meter to signal pole with stainless steel bands. Ensure bands are a minimum width of ¾ in. Secure enclosures to bands using two-bolt brackets. Install brackets near top and bottom of each enclosure. Install properly sized stainless steel washers on each bolt in the enclosure. Band or drill and tap properly sized stand-off straps to signal pole for attaching conduit.
8. Conduct pull tests and insulation resistance tests on all illumination and power conductors as required in Item 620 "Electrical Conductors" and ED(3). To prevent electronics damage, do not conduct insulation resistance tests on traffic signal cables after termination.
9. Lock all enclosures and bolt down all ground box covers before applying power to the signal installation.
10. Terminate conduits entering the top of enclosures with a conduit-sealing hub or threaded boss such as meter hub. Install a grounding bushing on all metal conduits not connected to conduit-sealing hub or threaded boss. Bond the grounding bushing to the ground bus with a bonding jumper. Seal all conduits entering enclosures with duct seal or expanding foam. Do not use silicone to seal conduit ends.
11. For all conduits, ensure the burial depth is a minimum of 18". Ensure the minimum burial depth for conduit placed under a roadway is 24".



SIGNAL POLE WITH SERVICE

Type T electrical service mounted on signal pole shown as an example. See electrical details, layout sheets, and electrical service data chart for additional details.

INSET A



SIGNAL CONTROLLER SIDE VIEW

See TS-CF standard for conduit and grounding requirements. See layout sheets for ground box locations and any additional conduits that are required.

SIGNAL CONTROLLER FRONT VIEW

SIGNAL POLE

Texas Department of Transportation

Traffic Operations Division Standard

ELECTRICAL DETAILS TYPICAL TRAFFIC SIGNAL SYSTEM DETAILS

ED(8)-14

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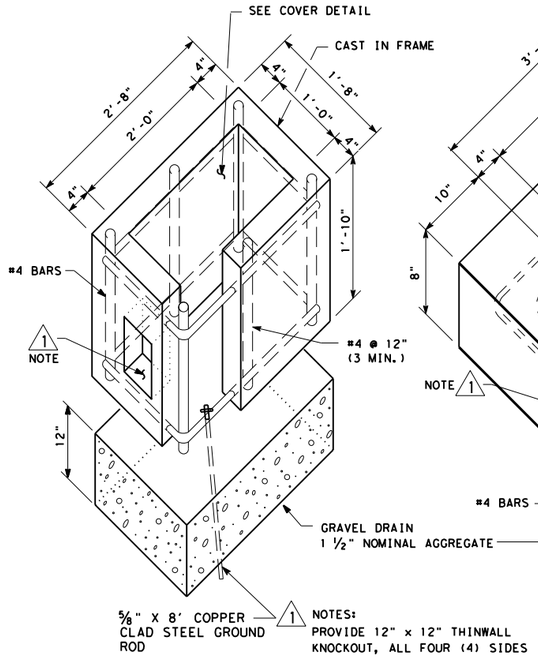
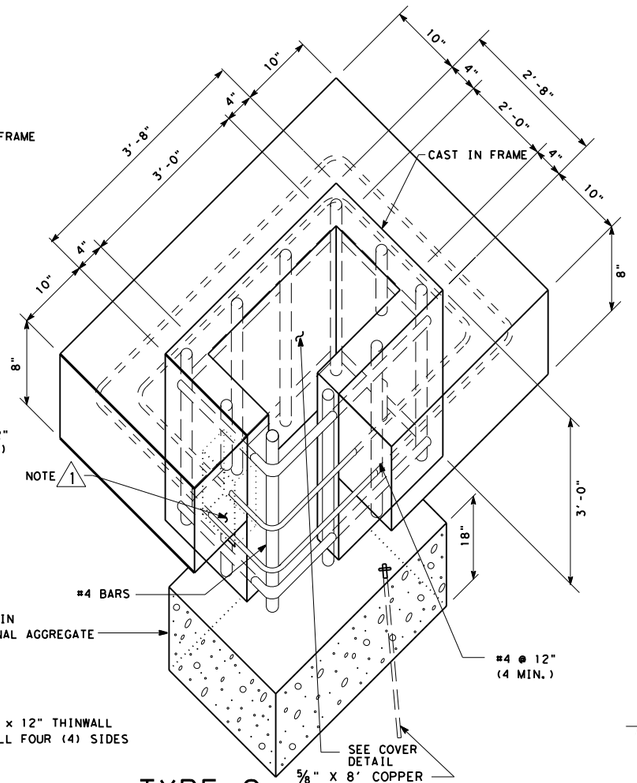
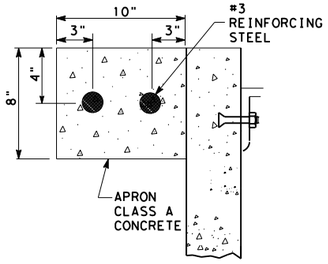


TYPE 1
GROUND BOX



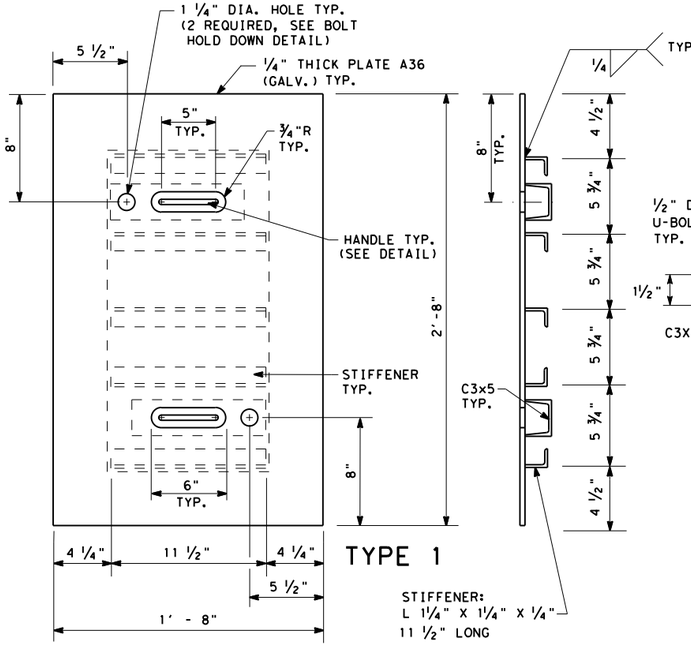
TYPE 2
GROUND BOX
W/APRON



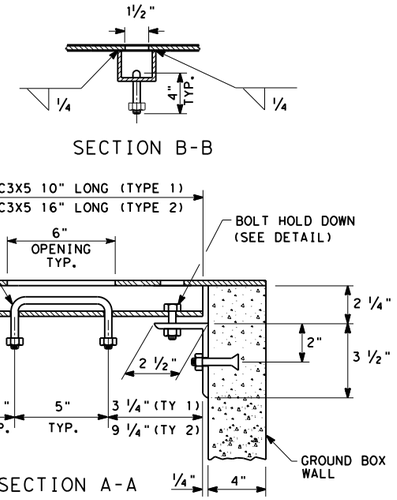
CONCRETE APRON

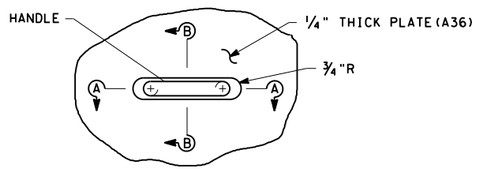
NOTES:

1. FURNISH REINFORCED CONCRETE GROUND BOXES CONSTRUCTED TO THE APPROXIMATE DIMENSIONS SHOWN ON THIS SHEET.
2. FURNISH GALVANIZED STEEL CHECKERED FLOOR PLATE GROUND BOX COVERS WITH 1 IN. RAISED LETTERS READING "TRAFFIC SIGNALS" OR "F. O. CABLE". SECURE COVERS TO THE GROUND BOX AS SHOWN ON THIS SHEET WITH 3/8 IN. DIA. (MIN.) BOLTS.
3. PROVIDE A GROUNDING LUG FOR STEEL COVERS WITH 1/2"-13 UNC FEMALE THREADS ON THE UNDERSIDE OF THE COVER.
4. FURNISH FLEXIBLE METAL BRAID TYPE GROUNDING STRAP. ENSURE THE STRAP IS NO LESS THAN 1 IN. IN WIDTH AND 5 FT. MIN. IN LENGTH TO ALLOW FOR GROUND BOX COVER REMOVAL FROM THE BOX WITHOUT DISCONNECTING THE GROUND STRAP.
5. AFTER PLACING GROUND BOX, FURNISH AND INSTALL BACKFILL FOR THE EXCAVATED AREA AND COMPACT THE FILL TO THE DENSITY OF THE SURROUNDING GROUND AS APPROVED BY THE ENGINEER.
6. AFTER INSTALLING CONDUIT THROUGH KNOCKOUT, GROUT REMAINING OPENING OF KNOCKOUT.
7. PLACE GROUND BOXES AS SHOWN ON LAYOUT SHEET. FURNISH ADDITIONAL GROUND BOXES IF REQUIRED.
8. PLACE TYPE 1 GROUND BOXES AT 350 FT. MAXIMUM SPACING. PLACE TYPE 2 GROUND BOXES AT 1,000 FT. MAXIMUM SPACING OR AS DIRECTED BY THE ENGINEER.
9. FURNISH CLASS "A" CONCRETE.

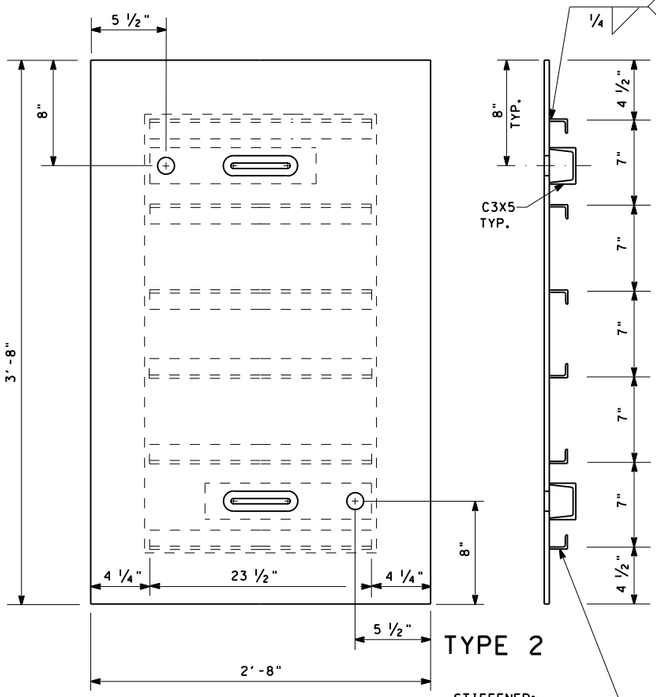


TYPE 1



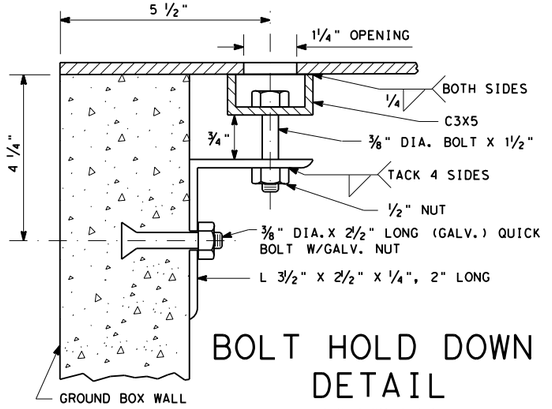


HANDLE DETAIL



TYPE 2

COVER DETAIL



BOLT HOLD DOWN DETAIL

(2 REQUIRED)

Texas Department of Transportation
Houston District

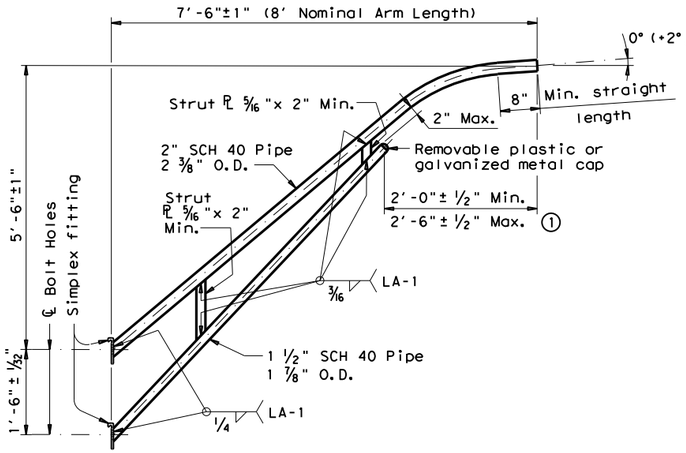
SIGNAL DETAILS/STANDARDS GROUND BOX DETAILS INSTALLATIONS

GBDI

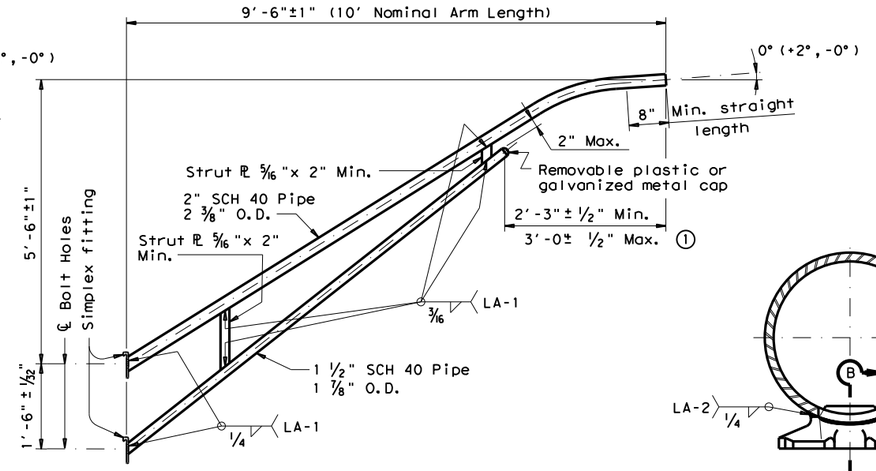
FILE:	DN:	CK:	DW:	CK:	
© TxDOT 2004	DIST	FED REG	PROJECT NO.		SHEET
08-04 REVISIONS	HOU	6			98
04-17 REVISIONS	COUNTY		CONTROL	SECT	JOB	HIGHWAY
	MONTGOMERY		0177	14	037	SL 494

STD-M2

DATE:
FILE:



8-FOOT LUMINAIRE ARM



10-FOOT LUMINAIRE ARM

DIRECT ATTACHMENT DETAIL

MATERIALS	
Pole or Arm Simplex	ASTM A27 Gr.65-35 or A148 Gr.80-50, A576 Gr.1021 (3), or A36 (Arm only)
Arm Pipes	ASTM A53 Gr.B, A501, A1008 HSLAS-F Gr.50 (4), or A1011 HSLAS-F Gr.50 (4)
Arm Strut Plates (2)	ASTM A36, A572 Gr.50 (4), or A588
Misc.	ASTM designations as noted

(1) Dimensional limits are given to show acceptable variation in design. All of a Fabricator's production of a particular arm length shall have the same dimensions within specified tolerances.

(2) Any of the materials listed for plates may be used where the drawings do not specify a particular ASTM designation.

(3) A576 must be suitable for forging and also meet minimum tensile strength of 65 ksi, minimum yield of 35 ksi, and elongation in 2 inches of 22 percent.

(4) ASTM A572, A1008 HSLAS-F, and A1011 HSLAS-F may have higher yield strengths but shall not have less elongation than the grade indicated.

GENERAL NOTES:

Design conforms to 1994 AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals and Interim Revisions thereto. Design Wind Speed equals 90 mph plus a 1.3 gust factor. Arms are designed to support a 60 lb. luminaire having an effective projected area (actual area times drag coefficient) of 1.6 sq. ft.

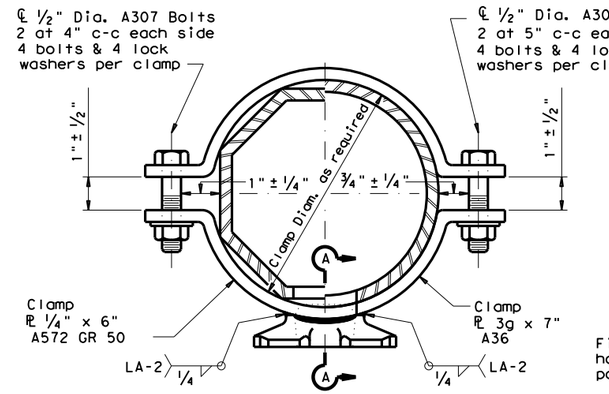
Materials and fabrication shall be in accordance with Item 686, "Traffic Signal Pole Assemblies (Steel)" and with the details, dimensions, and weld procedures shown herein. Weld references call for preapproved weld procedures which the Fabricator must obtain prior to fabrication. In the absense of specified Fabricaton tolerances, dimensions shall be within the tolerances generally obtainable in normal fabrication practice.

Unless otherwise noted, all parts shall be galvanized after fabrication in accordance with Item 445, "Galvanizing".

Deviation from the details and dimensions shown herein require submission of shop drawings in accordance with Item 441, "Steel Structures". Alternate designs are not acceptable.

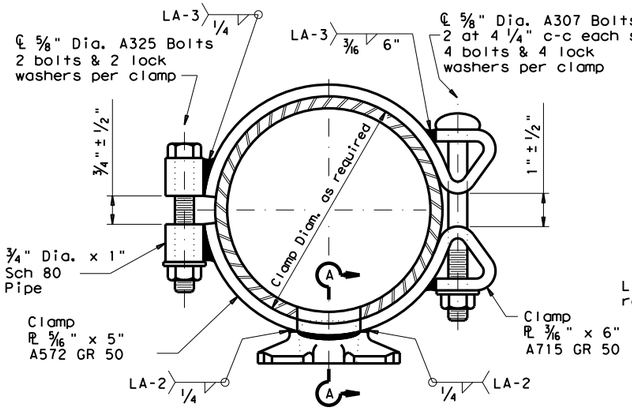
Each pole simplex fitting shall be supplied with 2 ASTM A325 bolts and 2 lock washers of the size specified. The bolts and lock washers shall be secured to the pole with the other hardware items called for in the plans. When clamp attachment is specified, the Fabricator shall ship the clamp assembly securely attached to the pole at the location shown on the plans.

If clamp assemblies are ordered without poles, the Fabricator shall ship one upper and one lower clamp assembly together in a single package, including all nuts and washers required for the clamps and simplex fittings.



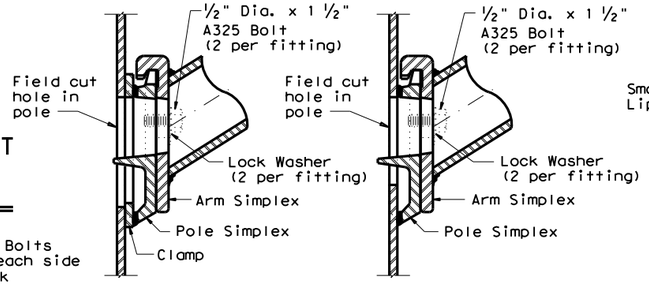
CLAMP ATTACHMENT DETAIL NO. 1 (HALF SECTION)

CLAMP ATTACHMENT DETAIL NO. 2 (HALF SECTION)



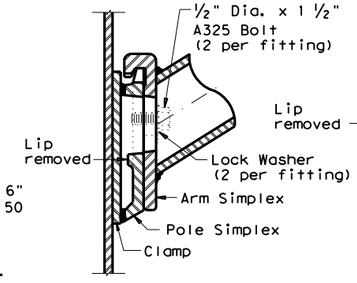
CLAMP ATTACHMENT DETAIL NO. 3 (HALF SECTION)

CLAMP ATTACHMENT DETAIL NO. 4 (HALF SECTION)



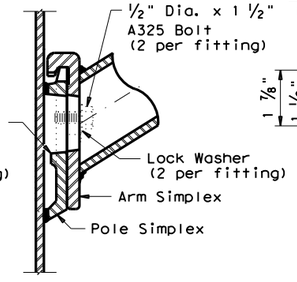
UPPER SIMPLEX FITTING

UPPER SIMPLEX FITTING



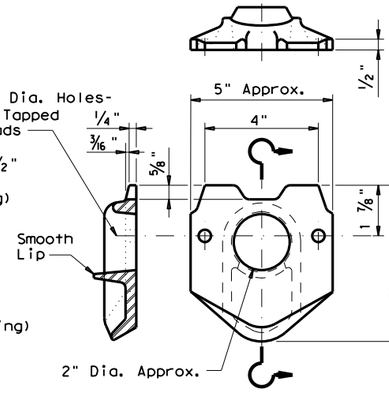
LOWER SIMPLEX FITTING

SECTON A-A

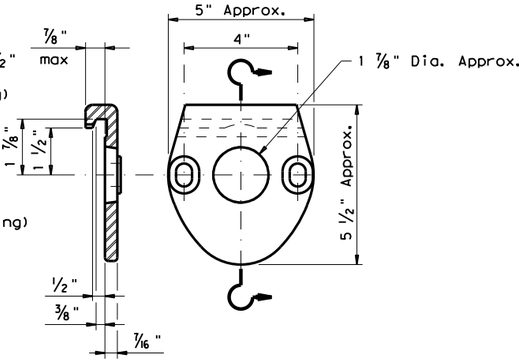


LOWER SIMPLEX FITTING

SECTON B-B



POLE SIMPLEX DETAIL



ARM SIMPLEX DETAIL

Texas Department of Transportation
Traffic Operations Division

STANDARD ASSEMBLY DRAWINGS FOR LUMINAIRE SUPPORT STRUCTURES

ARM DETAILS

LUM-A-12

DN: LEH | CK: JSY | DW: LTT | CK: TEB

REVISIONS
5-96
1-99
1-12

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		99

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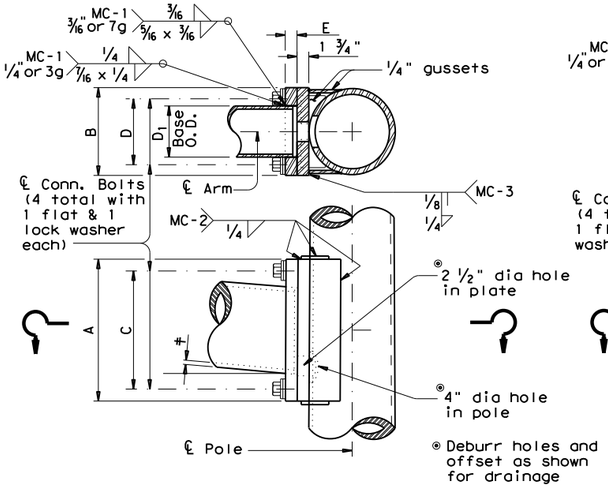
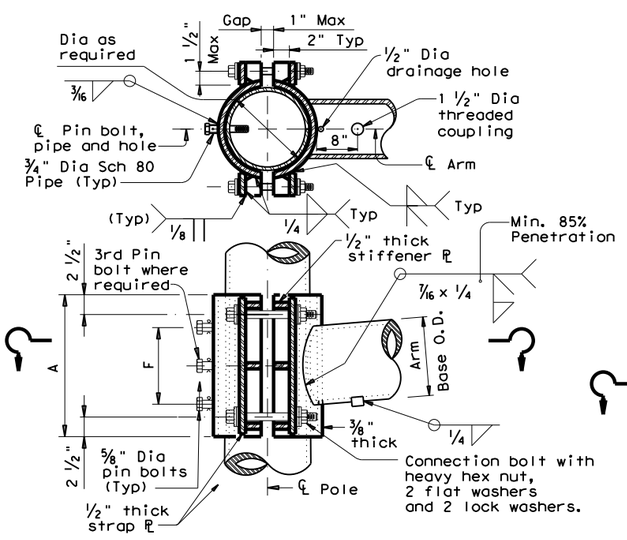
DATE:
FILE:

ARM SIZE D_1	ARM SIZE ϯ	A	B	C	D	E	CONN BOLT DIA
in.	in.	in.	in.	in.	in.	in.	in.
6.5	.179	12	9	9	6	1 ¾	1
7.5	.179	13	9	10	6	1 ¾	1
8.0	.179	14	10	11	7	2	1 ¼
9.0	.179	16	11	13	8	2	1 ¼
9.5	.179	17	12	14	9	2	1 ¼
9.5	.239	18	12	15	9	2	1 ¼
10.0	.239	18	12	15	9	2	1 ¼
10.5	.239	18	13	15	10	3	1 ½
11.0	.239	18	13	15	10	3	1 ½



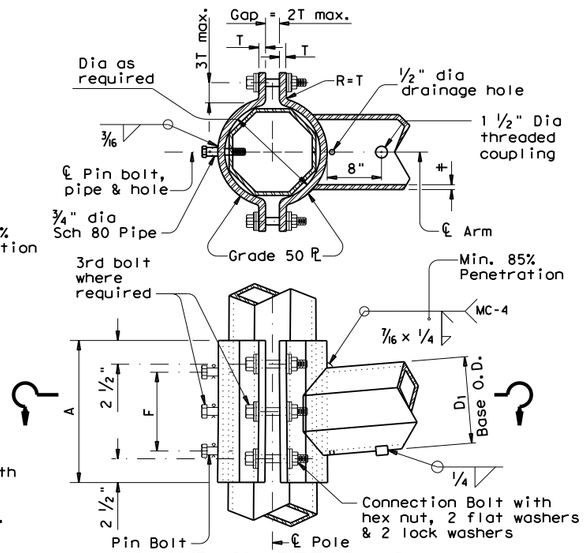
FIXED MOUNT DETAIL 1

ARM SIZE D_1	ARM SIZE ϯ	A	F	CONN. BOLTS No.	CONN. BOLTS Dia	PIN BOLTS No.	PIN BOLTS Dia
in.	in.	in.	in.	ea.	in.	ea.	in.
6.5	.179	12	6	4	1	2	⅝
7.5	.179	14	8	4	1	2	⅝
8.0	.179	14	8	4	1	2	⅝
9.0	.179	16	10	4	1	2	⅝
9.5	.179	18	12	4	1 ¼	3	⅝
9.5	.239	18	12	4	1 ¼	3	⅝
10.0	.239	18	12	4	1 ¼	3	⅝

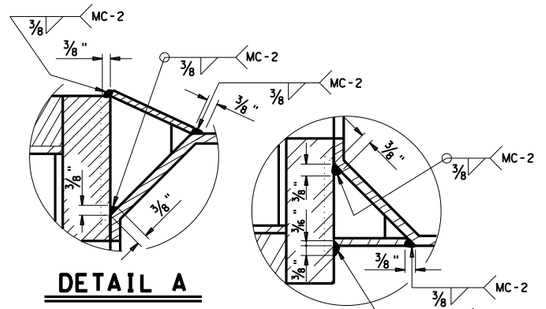


CLAMP-ON DETAIL 1

ARM SIZE D_1	ARM SIZE ϯ	A	F	T	CONN. BOLTS No.	CONN. BOLTS Dia	PIN BOLTS No.	PIN BOLTS Dia
in.	in.	in.	in.	in.	ea.	in.	ea.	in.
7.0	.179	12	6	¾	4	¾	2	⅝
7.5	.179	14	8	¾	4	¾	2	⅝
8.0	.179	14	8	¾	4	¾	2	⅝
9.0	.179	16	10	⅞	4	1	2	⅝
10.0	.179	18	10	⅞	4	1	2	⅝
9.5	.239	18	10	1	6	1	3	⅝
10.0	.239	18	10	1	6	1	3	⅝

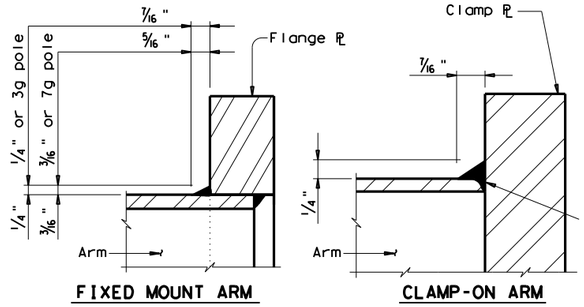


CLAMP-ON DETAIL 2



DETAIL A

DETAIL B

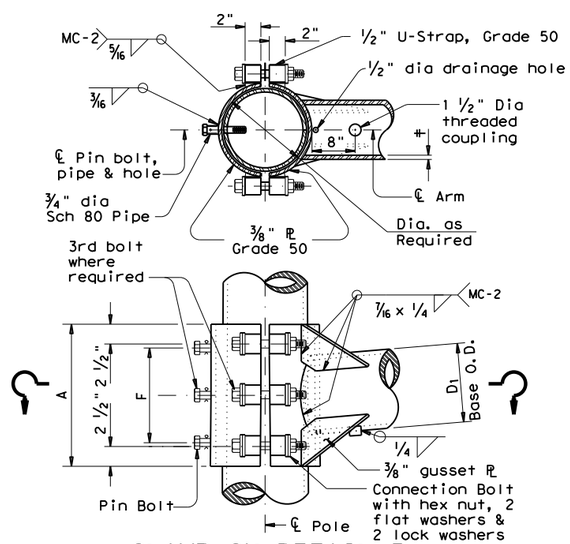


FIXED MOUNT ARM

CLAMP-ON ARM

ARM BASE WELD DETAILS

ARM SIZE D_1	ARM SIZE ϯ	A	F	CONN. BOLTS No.	CONN. BOLTS Dia	PIN BOLTS No.	PIN BOLTS Dia
in.	in.	in.	in.	ea.	in.	ea.	in.
6.5	.179	12	6	4	1	2	⅝
7.5	.179	14	8	4	1	2	⅝
8.0	.179	14	8	4	1	2	⅝
9.0	.179	16	10	4	1	2	⅝
9.5	.179	18	12	6	1	3	⅝
9.5	.239	18	12	6	1	3	⅝
10.0	.239	18	12	6	1	3	⅝



CLAMP-ON DETAIL 3

MATERIALS	
Round Shafts or Polygonal Shafts ①	ASTM A595 Gr.A, A588, A1008 HSLAS Gr.50 Class 2, A1011 HSLAS Gr.50 Class 2, A572 Gr.50 or A1011 SS Gr.50 ②
Plates ①	ASTM A36, A588, or A572 Gr.50
Connection Bolts	ASTM A325 or A449, except where noted
Pin Bolts	ASTM A325
Pipe ①	ASTM A53 Gr.B, A501, A1008 HSLAS-F Gr.50, A1011 HSLAS-F Gr.50
Misc. Hardware	Galvanized steel or stainless steel or as noted

① ASTM A572, A1008 HSLAS, A1011 HSLAS, A1008 HSLAS-F, A1011 HSLAS-F or A1011 SS may have higher yield strengths but shall not have less elongation than the grade indicated.

② ASTM A1011 SS Gr.50 material shall also have a minimum elongation of 18 percent in 8 inches or 23 percent in 2 inches. Material thickness in excess of those stipulated under A1011 SS will be acceptable providing the material meets all other A1011 SS requirements and the requirements of this item.

GENERAL NOTES:

Clamp-on details are used for the second arm on dual mast arm assemblies. A Maximum 1 ½" wide vertical slotted hole shall be cut in the front clamp plate to facilitate drainage during galvanizing. The slot shall be centered behind the arm and shall be no longer than the arm diameter minus 1"

Fixed mount details are used for single mast arm assemblies and for the first arm on dual mast arm assemblies.

Where duplicate parts occur on a detail, welds shown for one part shall apply to all similar parts on the detail.

Pin bolts are required to prevent rotation of clamp-on arms under design wind forces.

NOTE:

Pin bolts shall be A325 with threads excluded from the shear plane. Pin bolt and ¾" dia pipe shall have 9/16" dia holes for a ⅛" dia galvanized cotter pin. Back clamp plate shall be furnished with a ¾" dia hole for each pin bolt. An 11/16" dia hole for each pin bolt shall be field drilled through the pole after arm orientations have been approved by the Engineer.

Texas Department of Transportation
Traffic Operations Division

STANDARD ASSEMBLY FOR TRAFFIC SIGNAL SUPPORT STRUCTURES

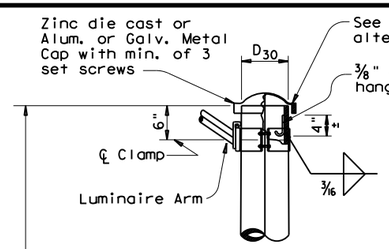
MAST ARM CONNECTIONS

MA-C-12

REVISIONS	DN: MS	CK: JSY	DW: MMF	CK: JSY
5-96	CONT	SECT	JOB	HIGHWAY
5-09	0177	14	037	SL 494
1-12	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY		100

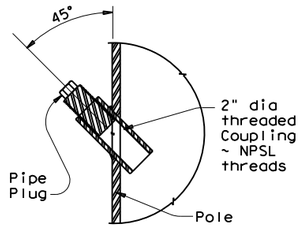
126A

DATE:
FILE:

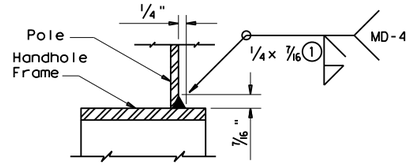


DETAIL A

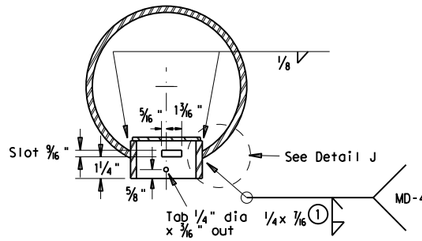
(for pole with luminaire)



POLE COUPLING DETAIL

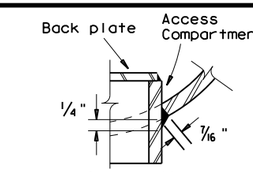


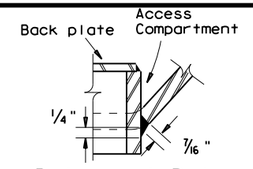
DETAIL G



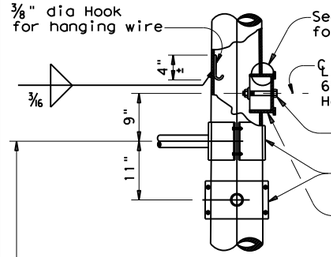
SECTION X-X

Opening for access compartment shall be no more than 1/16 inch wider than the access compartment itself.



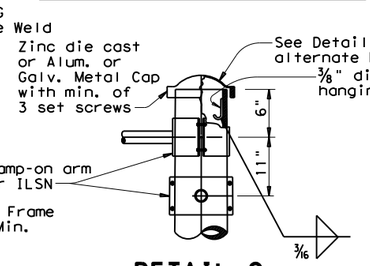


DETAIL J

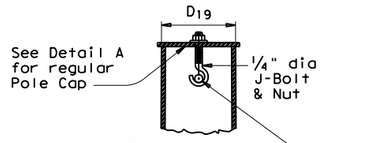


DETAIL B

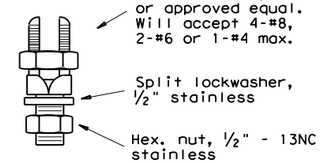
(If ILSN applied)



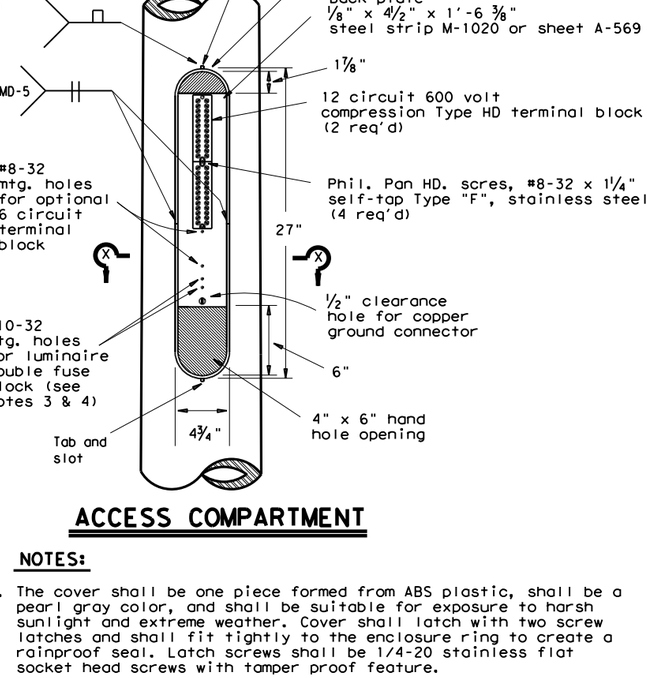
DETAIL C



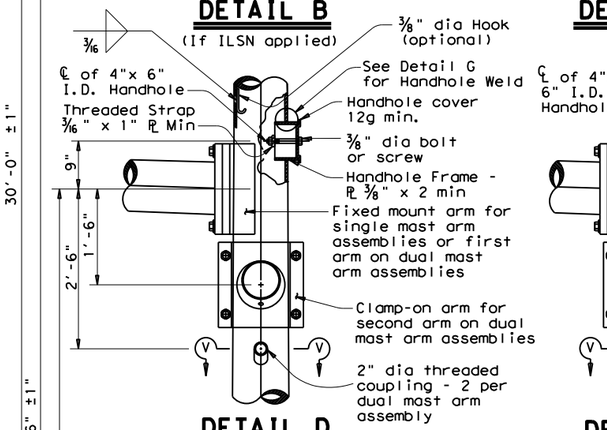
SECTION Y-Y



COPPER GROUND CONNECTOR

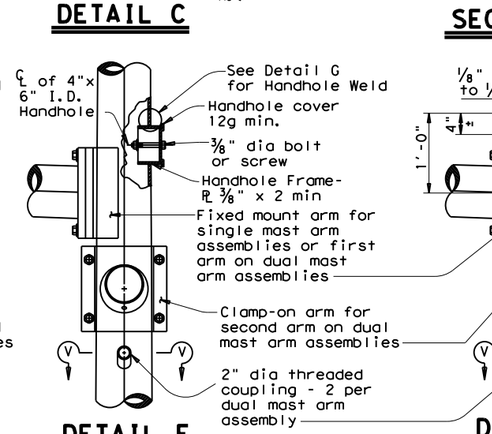


ACCESS COMPARTMENT



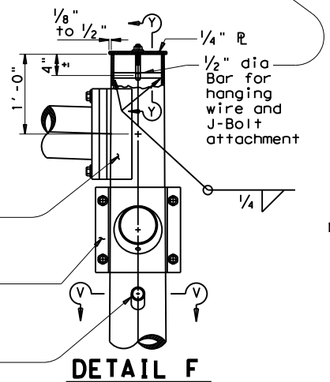
DETAIL D

(for 30' pole with luminaire and ILSN sign)



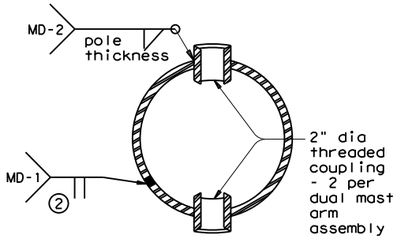
DETAIL E

(for 24' pole with ILSN sign and no luminaire)



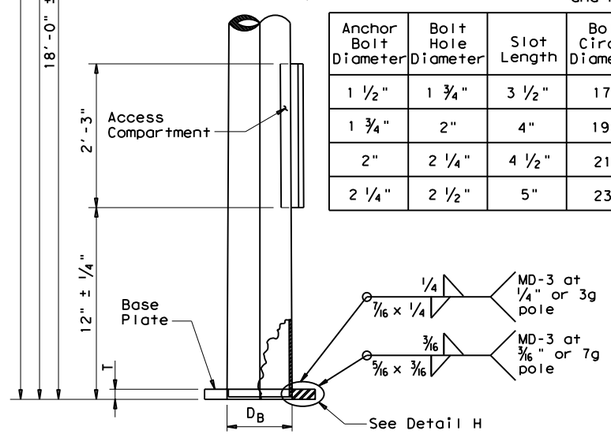
DETAIL F

(for 19' pole with no ILSN sign and no luminaire)

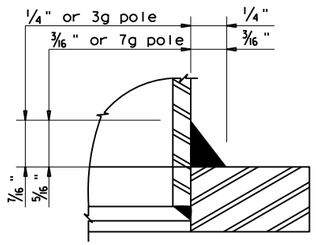


SECTION V-V

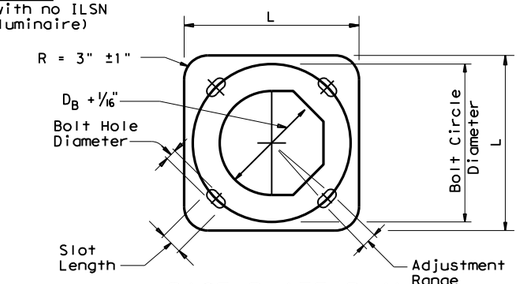
Anchor Bolt Diameter	Bolt Hole Diameter	Slot Length	Bolt Circle Diameter	Base PL Dim. L x T	Adjust. Range
1 1/2"	1 3/4"	3 1/2"	17"	18" x 1 1/2"	13.4°
1 3/4"	2"	4"	19"	20" x 1 3/4"	13.5°
2"	2 1/4"	4 1/2"	21"	22" x 2"	13.6°
2 1/4"	2 1/2"	5"	23"	24" x 2 1/4"	13.7°



POLE ELEVATION



DETAIL H



BASE PLATE PLAN

(1) 85% Min. penetration

(2) 60% Min. penetration 100% pemetration within 6" of circumferential base welds.

NOTES:

1. The cover shall be one piece formed from ABS plastic, shall be a pearl gray color, and shall be suitable for exposure to harsh sunlight and extreme weather. Cover shall latch with two screw latches and shall fit tightly to the enclosure ring to create a rainproof seal. Latch screws shall be 1/4-20 stainless flat socket head screws with tamper proof feature.
2. The pole manufacturer shall provide with each pole a separate kit consisting of: one cover with two latching assemblies, two terminal strips (Marathon #985GP12CU or approved equal), four #8-32 x 1 1/4" self tapping type "F" stainless steel pan head screws, and one ground connector (Blackburn TTC, Burndy KC22J12T13, or Ilsco SSS-5). The traffic signal contractor shall install the kit items in the field.
3. The screw hole spacing on the enclosure back plate shall be for two Marathon #985GP12 terminal strips, one Marathon #985GP06CU terminal strip, and one Bussmann #BM6032B fuse block.
4. Install one Bussmann #BM6032B, Littelfuse #L60030M-2C, or Ferraz-Shawmut #30352 fuse block for poles where luminaires are to be installed.

Texas Department of Transportation
Traffic Operations Division

TRAFFIC SIGNAL SUPPORT STRUCTURES MAST ARM POLE DETAILS

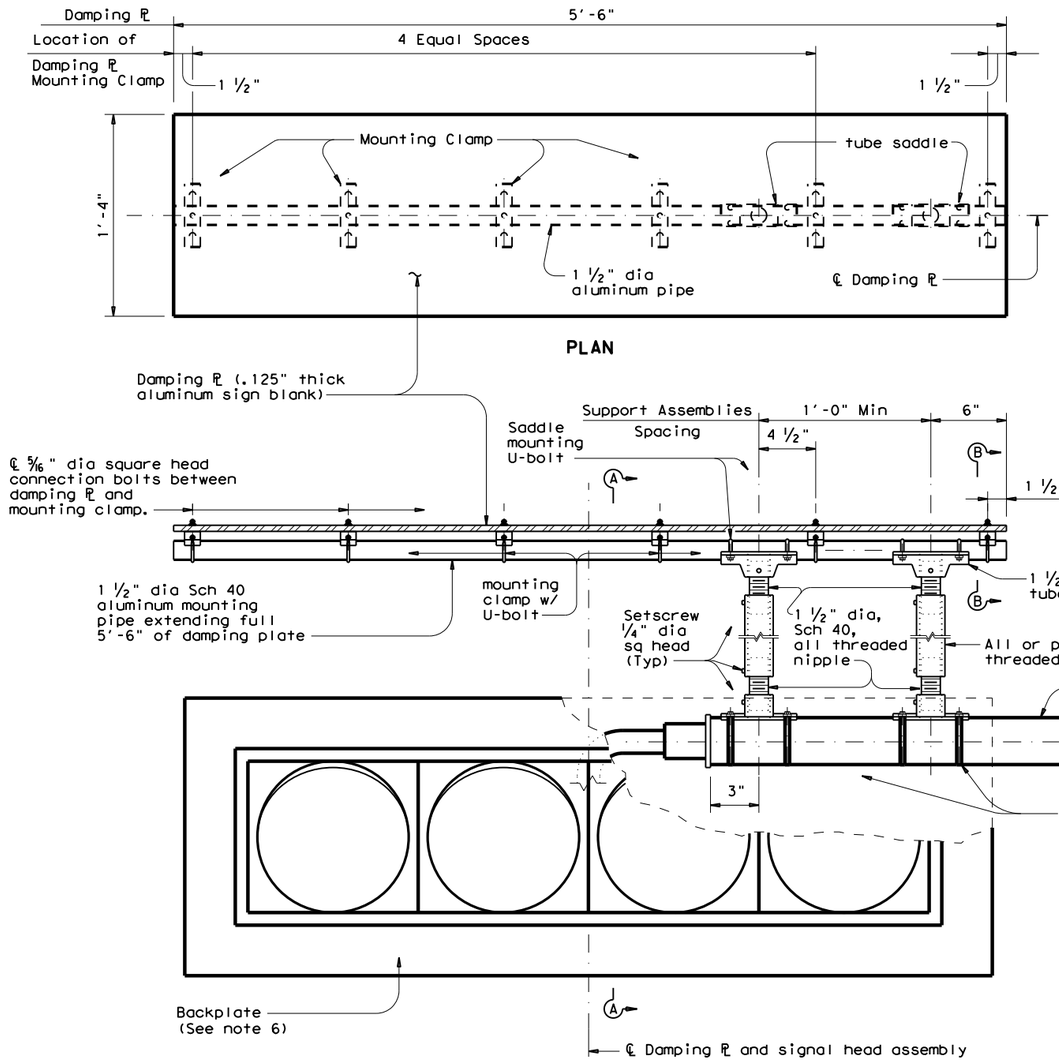
MA-D-12

DN: MS	CK: JSY	DW: FDN	CK: CAL

REVISIONS
8-99
1-12

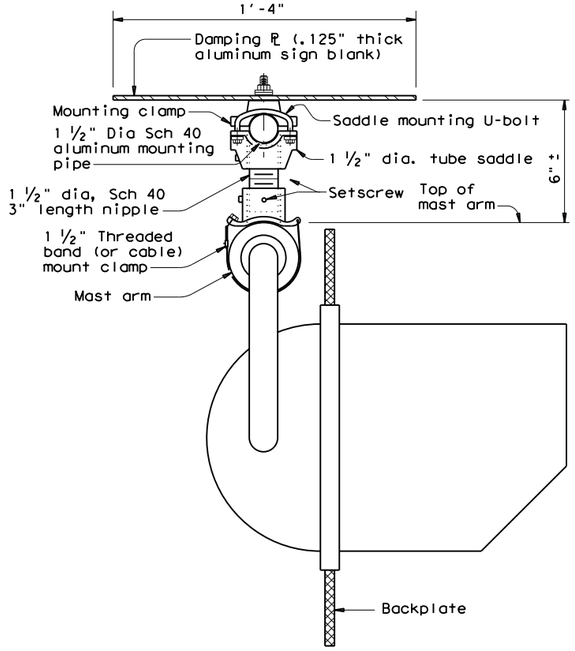
CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		101

DATE:
FILE:



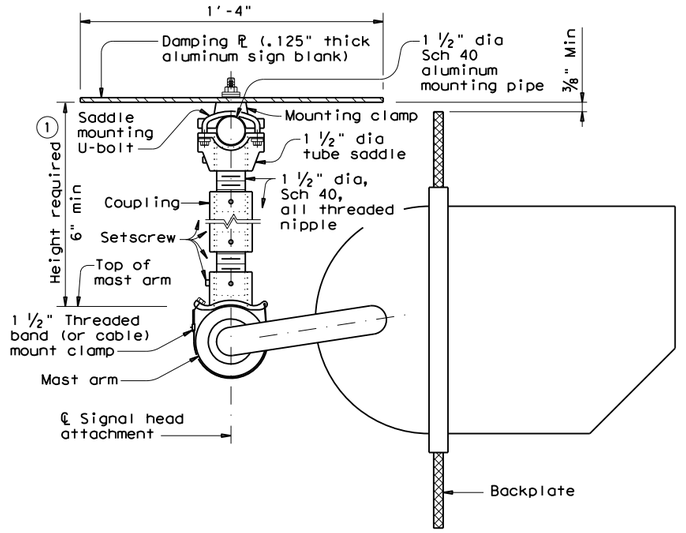
DAMPING PLATE MOUNTING DETAILS

(Showing alternate placement of signal head)



SECTION A-A

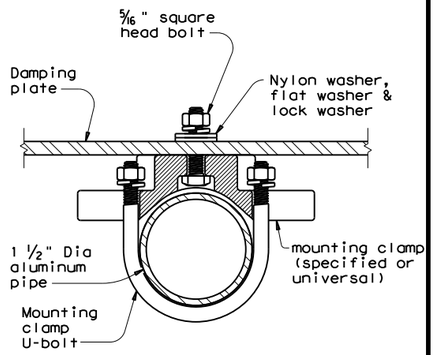
(Showing standard placement of signal head)
(Mounting clamp U-bolt is not shown for clarity)



SECTION A-A

(Showing alternate placement of signal head)
(Mounting clamp U-bolt is not shown for clarity)

① Recommended supporting assemblies to achieve required height for horizontal section heads			
Height required	One nipple each length	Two nipples each length plus	One coupling each length
6"-6 ¾"	3"	-	-
7"-8 ½"	4"	-	-
9"-10 ½"	6"	-	-
11"-15 ½"	-	4"	5"
16"-24"	-	6"	10"



SECTION B-B

(Showing damping plate attachment)

GENERAL NOTES:

1. In accordance with the findings of TxDOT sponsored research, the installation of a damping plate in accordance with the details shown here at the end of signal mast arms of SMA and DMA standard structures reduces excessive harmonic vertical vibration, and thus fatigue damage. Any deviation from these details may reduce the effectiveness of this damping device.
2. Aluminum sign blank for damping plate will conform to Departmental Material Specifications DMS-7110. Materials for mast arm mounting clamp and tube saddle will be aluminum castings or aluminum alloys as in accordance with manufacturers' stipulations. Mounting pipe, pipe nipple and coupling will be aluminum alloy 6061-T6 or 6063-T6. Damping plate mounting clamp and u-bolt assemblies will conform to Standard sheet SMD(GEN). U-bolts for saddle mounting will have a minimum yield strength of 36 ksi.
3. Damping plate will be mounted horizontally. Position centerline of damping plate to align with centerline of mast arm or horizontal signal head assembly. Vertical clearance between signal head (with or without backing plate)and bottom of damping plate will be maintained as shown. The attachments shown here are examples only, other supporting details which meet both alignment and vertical clearance requirements are also acceptable.
4. Unless stipulated by the manufacturers, all steel parts will be galvanized finish in accordance with Standard Specification Item 445, "Galvanizing".
5. Contractor will verify applicable field dimensions before the installation.
6. Backplates are optional for traffic signals. When backplates are used, Backplates will have a 2-inch fluorescent yellow AASHTO Type B_{FL} or C_{FL} retroreflective border conforming to TxDOT DMS-8300 "Sign Face Materials." See Sheet TS-BP-20 for backplate details.

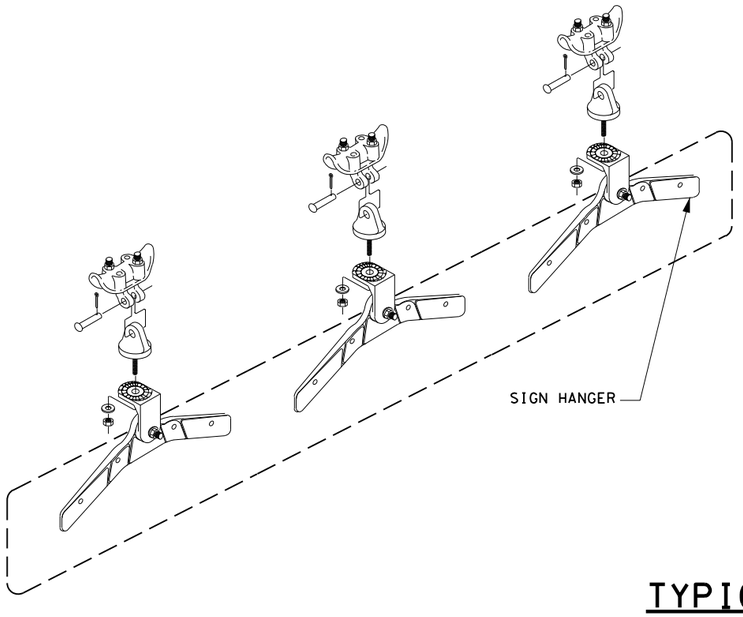
Texas Department of Transportation

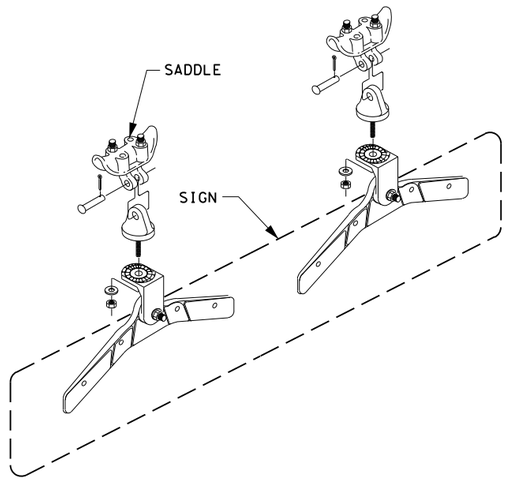
Traffic Safety Division Standard

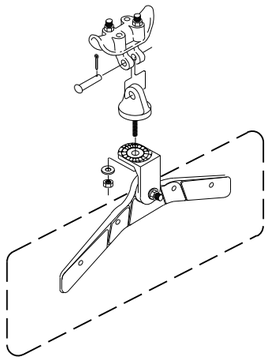
MAST ARM DAMPING PLATE DETAILS

MA-DPD-20

FILE: ma-dpd-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT January 2012	CONT	SECT	JOB	HIGHWAY
REVISIONS	0177	14	037	SL 494
6-20	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY		102

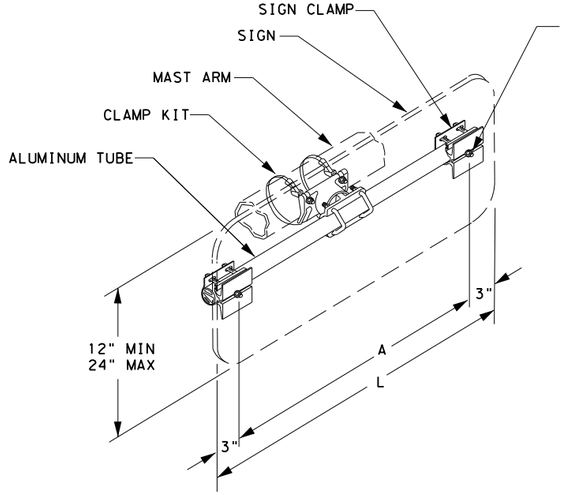


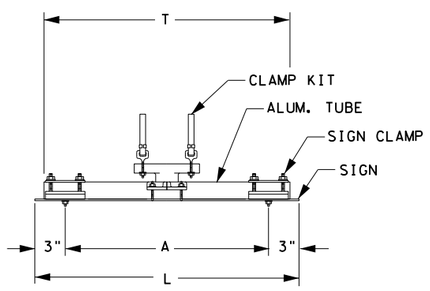


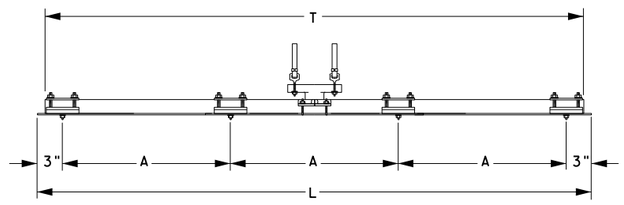


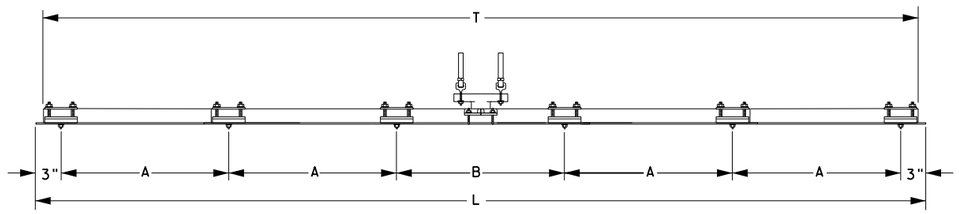
1. USE PELCO PARTS OR APPROVED EQUAL.
2. FURNISH HARDWARE FOR A COMPLETE INSTALLATION.
3. ATTACH THE 90 LB SPAN WIRE CLAMPS (SADDLES) TO TETHERS (SWAY CABLES).
4. FURNISH 1 ADJUSTABLE FREE SWINGING SIGN HANGER PER STREET NAME SIGN SMALLER THAN 3 FT. - 0 IN. SIGNS 3 FT - 0 IN. TO 6 FT.- 0 IN. REQUIRE 2 HANGERS. SIGNS LARGER THAN 6 FT. - 0 IN. REQUIRE 3 HANGERS.

TYPICAL SPAN WIRE SIGN HANGER DETAILS









SIGNS (1'-6" to 3'-0" Long)

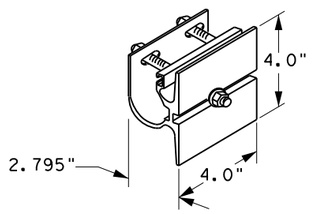
SIGN LENGTH (L)	TUBE LENGTH (T)	A
1'-6"	16"	12"
2'-0"	22"	18"
2'-6"	28"	24"
3'-0"	34"	30"

SIGNS (3'-6" to 8'-0" Long)

SIGN LENGTH (L)	TUBE LENGTH (T)	A
3'-6"	40"	12"
4'-0"	46"	14"
4'-6"	52"	16"
5'-0"	58"	18"
5'-6"	64"	20"
6'-0"	70"	22"
6'-6"	76"	24"
7'-0"	82"	26"
7'-6"	88"	28"
8'-0"	94"	30"

SIGNS (8'-6" to 10'-0" Long)

SIGN LENGTH (L)	TUBE LENGTH (T)	A	B
8'-6"	100"	19"	20"
9'-0"	106"	20"	22"
9'-6"	112"	21"	24"
10'-0"	118"	22"	26"



SIGN CLAMP DETAIL

GUSSETED TUBE CROSS SECTION

TYPICAL MAST ARM SIGN MOUNT DETAILS

Texas Department of Transportation
Houston District

SIGNAL DETAILS/STANDARDS
OVERHEAD STREET NAME SIGN MOUNTING DETAILS

OSNS/MD

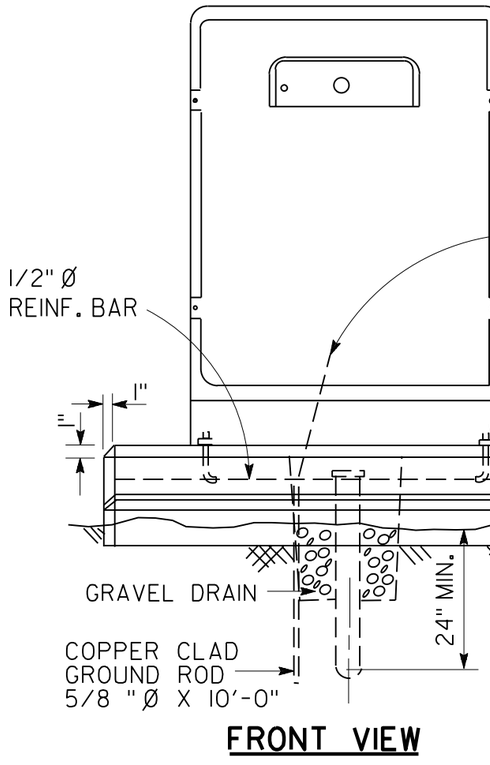
DN:	CK:	DW:	CK:

DIST	FED REG	PROJECT NO.	SHEET
HOU	6		103

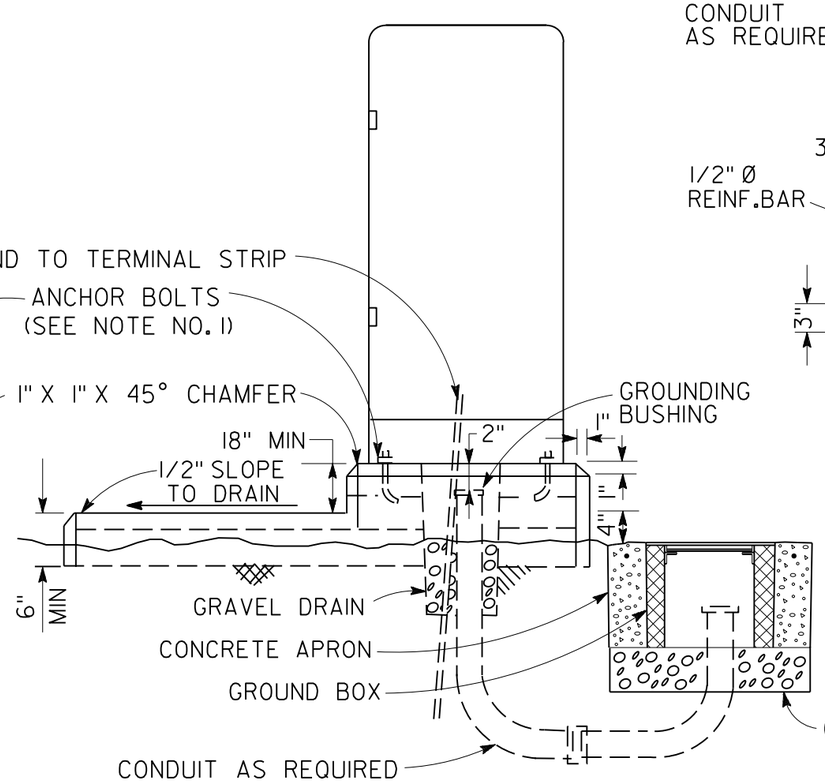
COUNTY	CONTROL	SECT	JOB	HIGHWAY
MONTGOMERY	0177	14	037	SL 494

STD-M12

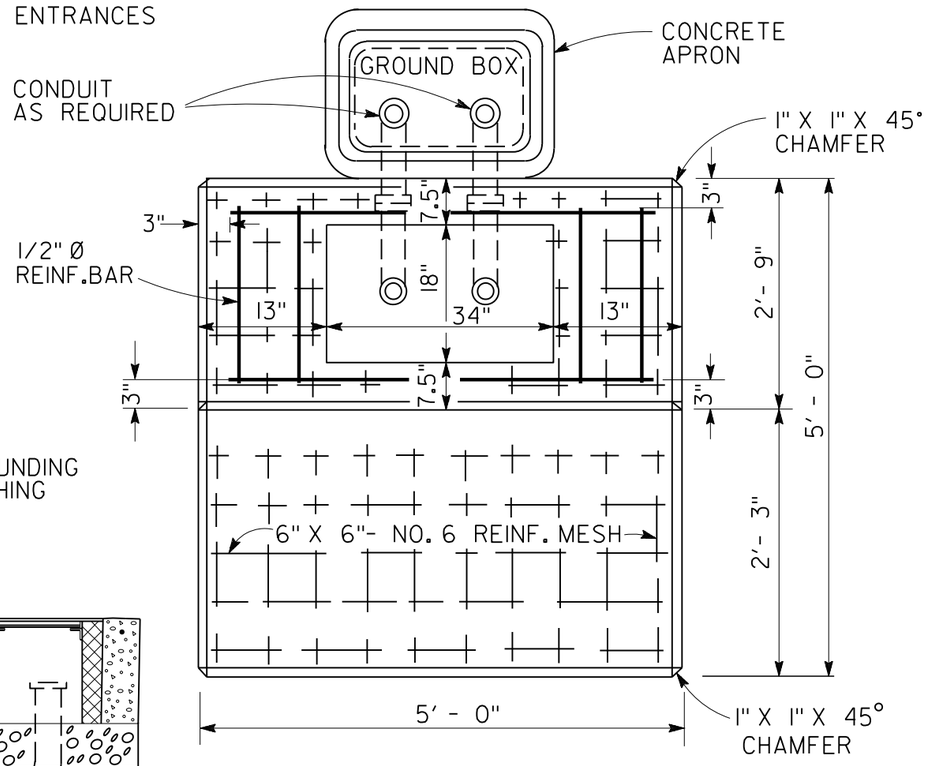
FILE: Overhead-Sign-mount-det-sp04.dgn



FRONT VIEW



SIDE VIEW



TOP VIEW
(LESS CABINET)

NOTES:

1. CABINET MANUFACTURER TO PROVIDE DETAILS OF ANCHOR BOLT LOCATION.
2. MODIFY DIMENSIONS FOR CONCRETE BASE TO FIT EQUIPMENT FURNISHED, IF NECESSARY.
3. PROVIDE GRAVEL DRAIN FOR CONTROLLER AND ALL GROUND BOXES.
4. FURNISH CLASS "B" OR CLASS "C" CONCRETE.
5. SET CONTROLLER FOUNDATION LEVEL WITH THE PAVEMENT SURFACE OR AS APPROVED BY THE ENGINEER.
6. FURNISH AT NO COST TO THE DEPARTMENT ANY ADDITIONAL CONCRETE WHICH MAY BE NECESSARY TO STABILIZE THE FOUNDATION AT UNUSUAL LOCATIONS.
7. PLACE REINFORCING BARS AS DIRECTED.
8. UPON INSTALLING THE CONTROLLER CABINET, APPLY A SILICON-BASED CAULKING COMPOUND AROUND THE BASE OF THE CONTROLLER CABINET.

Texas Department of Transportation
Houston District

SIGNAL DETAILS/STANDARDS CONTROLLER FOUNDATION DETAIL

SD/SCFD

REVISIONS
08-04
03-07

FILE:	DN:	CK:	DW:	CK:
	DIST	FED REG	PROJECT NO.	SHEET
	HOU	6		104
	COUNTY	CONTROL	SECT	JOB	HIGHWAY
	MONTGOMERY	0177	14	037	SL 494

STD-M1

DATE:
FILE:

ELECTRICAL SERVICES NOTES

1. Provide new materials. Ensure installation and materials comply with the applicable provisions of the National Electrical Code (NEC) and National Electrical Manufacturers Association (NEMA) standards. Ensure material is Underwriters Laboratories (UL) listed. Provide and install electrical service conduits, conductors, disconnects, contactors, circuit breaker panels, and branch circuit breakers as shown on the Electrical Service Data chart in the plans. Faulty fabrication or poor workmanship in material, equipment, or installation is justification for rejection. Where manufacturers provide warranties and guarantees as a customary trade practice, furnish these to the State.

2. Provide electrical services in accordance with Electrical Details standard sheets, Departmental Material Specification (DMS) 11080 "Electrical Services,"DMS 11081 "Electrical Services-Type A," DMS 11082 "Electrical Services-Type C," DMS 11083 "Electrical Services-Type D," DMS 11084 "Electrical Services-Type T," DMS 11085 "Electrical Services-Pedestal (PS)", and Item 628 "Electrical Services" of the Standard Specifications. Provide electrical service types A, C, and D, as listed on the Material Producers List (MPL) on the Department web site under "Roadway Illumination and Electrical Supplies," Item 628. Provide other service types as detailed on the plans.

3. Provide all work, materials, services, and any incidentals needed to install a complete electrical service as specified in the plans.

4. Coordinate with the Engineer and the utility provider for metering and compliance with utility requirements. Primary line extensions, connection charges, meter charges, and other charges by the utility company to provide power to the location are paid for in accordance with Item 628. Get approval for the costs associated with these charges prior to engaging the utility company to do the work. Consult with the utility provider to determine costs and requirements, and coordinate the work as approved.

5. The enclosure manufacturer will provide Master Lock Type 2 with brass tumblers keyed #2195 for all custom electrical enclosures. Installing Contractor is to provide Master Lock #2195 Type 2 with brass tumblers for "off the shelf" enclosures. Master Lock #2195 keys and locks become property of the State. Unless otherwise approved, do not energize electrical service equipment until locks are installed.

6. Enclosures with external disconnects that de-energize all equipment inside the enclosure do not need a dead front trim. Protect incoming line terminations from incidental contact as required by the NEC.

7. When galvanized is specified for nuts, screws, bolts or miscellaneous hardware, stainless steel may be used.

8. Provide wiring and electrical components rated for 75°C. Provide red, black, and white colored XHHW service entrance conductors of minimum size 6 American Wire Gauge (AWG). Identify size 6 AWG conductors by continuous color jacket. Identify electrical conductors sized 4 AWG and larger by continuous color jacket or by colored tape. Mark at least 6 inches of the conductor's insulation with half laps of colored tape, when identifying conductors. Ensure each service entrance conductor exits through a separately bushed non-metallic opening in the weatherhead. The lengths of the conductors outside the weatherhead are to be 12 inches minimum, 18 inches maximum, or as required by utility.

9. All electrical service conduit and conductors attached to the electrical service including the riser or the elbow below ground are subsidiary to the electrical service. For an underground utility feed, all service conduit and conductors after the elbow, including service conduit and conductors for the utility pole riser when furnished by the Contractor, will be paid for separately.

10. Provide rigid metal conduit (RMC) for all conduits on service, except for the ½ in. PVC conduit containing the electrical service grounding electrode conductor. Size the service entrance conduit as shown in the plans. Ensure conduit for branch circuit entry to enclosure is the same size as that shown on the layout sheets for branch circuit conduit. Extend all rigid metal conduits a minimum of 6 inches underground and then couple to the type and schedule of the conduit shown on the layout for that particular branch circuit. Install a grounding bushing on the RMC where it terminates in the service enclosure.

11. Use of liquidtight flexible metal conduit (LFMC) is allowed between the meter and service enclosure when they are mounted 90 to 180 degrees to each other. Size the LFMC the same size as service entrance conduit. LFMC must not exceed 3 feet in length. Strap LFMC within 1 foot of each end. LFMC less than 12 inches in length need not be strapped. Each end of LFMC must have a grounding bushing or be terminated with a grounding fitting. The LFMC must contain a grounded (neutral) conductor. Ensure any bend in LFMC never exceeds 180 degrees. A pull test is required on all installed conductors, with at least six inches of free conductor movement demonstrated to the satisfaction of the Engineer.

12. Ensure all mounting hardware and installation details of services conform to utility company specifications.

13. For all electrical service enclosures listed under Item 628 on the MPL, the UL 508 enclosure manufacturers will prepare and submit a schematic drawing unique to each service. Before shipment to the job site, place the applicable laminated schematic drawings and the laminated plan sheet showing the electrical service data chart used to build the enclosure in the enclosure's data pocket. The installing contractor will copy and laminate the actual project plan sheets detailing all equipment and branch circuits supplied by that service. The laminated plan sheets are to be placed in the service enclosure's document pocket. Reduce 11 in. x 17 in. plan sheets to 8 ½ in. x 11 in. before laminating. If the installation differs from the plan sheets, the installing contractor is to redline plan sheets before laminating.

14. When providing an "Off The Shelf" Type D or Type T service, provide laminated plan sheets detailing equipment and branch circuits supplied by that service. Reduce 11 in. x 17 in. plan sheets to 8 ½ in. x 11 in before laminating. Deliver these drawings before completion of the work to the Engineer, instead of placing in enclosure that has no door pocket.

15. Do not install conduit in the back wall of a service enclosure where it would penetrate the equipment mounting panel inside the enclosure. Provide grounding bushings on all metal conduits, and terminate bonding jumpers to grounding bus. Grounding bushings are not required when the end of the metal conduit is fitted with a conduit sealing hub or threaded boss, such as a meter base hub.

SERVICE ASSEMBLY ENCLOSURE

1. Provide threaded hub for all conduit entries into the top of enclosure.

2. Type galvanized steel (GS) enclosures may be used for Type C panelboards and for Type D and T services that do not use an enclosure mounted photocell or lighting contactor. Provide GS enclosures in accordance with DMS 11080, 11082, 11083, and 11084.

3. Provide aluminum (AL) and stainless steel (SS) enclosures for Types A, C, and D in accordance with DMS 11080, 11081, 11082, 11083, and 11084. Do not paint stainless steel.

4. Provide pedestal service (PS) enclosures in accordance with ED(9) and DMS 11080 and 11085. Do not provide GS pedestal services. If GS is shown in the PS descriptive code, provide an AL enclosure.

MAIN DISCONNECT & BRANCH CIRCUIT BREAKERS

1. Field drill flange-mounted remote operator handle if needed, to ensure handle is lockable in both the "On" and "Off" positions.

2. When the utility company provides a transformer larger than 50 KVA, verify that the available fault current is less than the circuit breaker's ampere interrupting capacity (AIC) rating and provide documentation from the electric utility provider to the Engineer.

PHOTOELECTRIC CONTROL

1. Provide photocell as listed on the MPL. Move, adjust, or shield the photocell from stray or ambient night time light to ensure proper operation. Mount photocell facing north when practical. Mount top of pole photocells as shown on Top Mounted Photocell Detail.

* ELECTRICAL SERVICE DATA

Elec. Service ID	Plan Sheet Number	Electrical Service Description	Service Conduit **Size	Service Conductors No./Size	Safety Switch Amps	Main Ckt. Bkr. Pole/Amps	Two-Pole Contractor Amps	Panelbd/ Loadcenter Amp Rating	Branch Circuit ID	Branch Ckt. Bkr. Pole/Amps	Branch Circuit Amps	KVA Load
SB 183	289	ELC SRV TY A 240/480 100(SS)AL(E)SF(U)	2"	3/#2	100	2P/100	100	N/A	Lighting NB	2P/40	26	28.1
									Lighting SB	2P/40	25	
									Underpass	1P/20	15	
NB Access	30	ELC SRV TY D 120/240 060(NS)SS(E)TS(O)	1 ¼"	3/#6	N/A	2P/60		100	Sig. Controller	1P/30	23	5.3
							30		Luminaires	2P/20	9	
									CCTV	1P/20	3	
2nd & Main	58	ELC SRV TY T 120/240 000(NS)GS(N)SP(O)	1 ¼"	3/#6	N/A	N/A	N/A	70	Flashing Beacon 1	1P/20	4	1.0
									Flashing Beacon 2	1P/20	4	

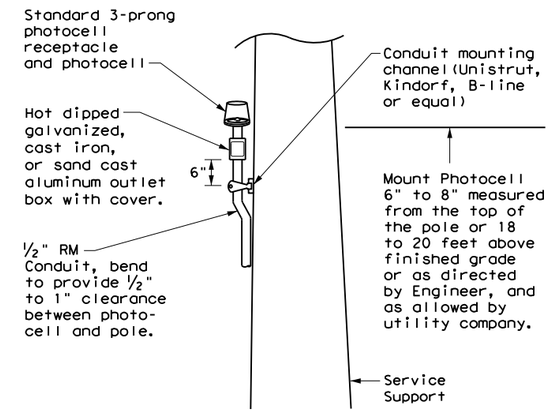
* Example only, not for construction. All new electrical services must have electrical service data chart specific to that service as shown in the plans.

** Verify service conduit size with utility. Size may change due to utility meter requirements. Ensure conduit size meets the National ELectrical Code.

EXPLANATION OF ELECTRICAL SERVICE DESCRIPTIVE CODE

ELEC SERV TY X XXX/XXX XXX (XX) XX (X) XX (X)

- Schematic Type
- Service Voltage V / V
- Disconnect Amp Rating
  000 indicates main lug only/
  Typically Type T
- (SS)= Safety Switch Ahead of Meter-Check with Utility
- (NS)= No safety Switch Ahead of Meter-Check with Utility
- Enclosure Type
  - GS= Galvanized steel("off the shelf")
  - SS= Stainless steel(Custom Enclosure)See MPL
  - AL= Aluminum (Custom Enclosure)See MPL
- Photocell Mounting Location
  - (E)= Inside Service/Enclosure Mounted
  - (T)= Top of pole
  - (L)= Luminaire mounted
  - (N)= None/No Photocell or Lighting Contactor Required
- Service Support Type
  - GC= Granite concrete
  - OC= Other concrete
  - TP= Timber pole
  - SP= Steel pole
  - SF= Steel frame
  - OT= Pole by others or paid for separately
  - EX= Existing pole
  - TS= Service on traffic signal pole
  - PS= Pedestal Service
- O= Overhead Service Feed from Utility
- U= Underground Service Feed from Utility



TOP MOUNTED PHOTOCELL

Install conduit strap maximum 3 feet from box. 5 foot maximum spacing between straps supporting conduit.

Texas Department of Transportation

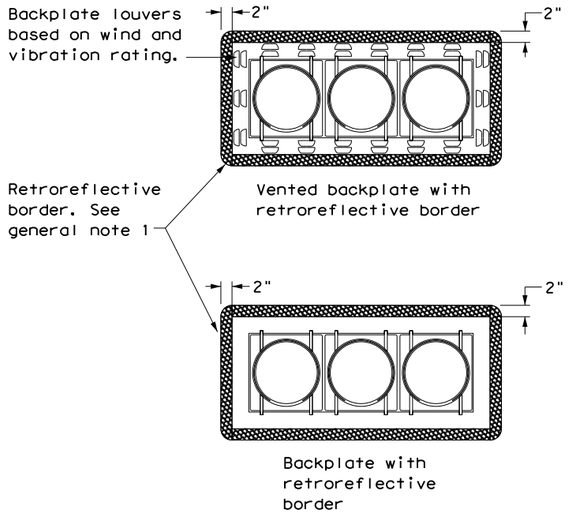
Traffic Operations Division Standard

ELECTRICAL DETAILS SERVICE NOTES & DATA

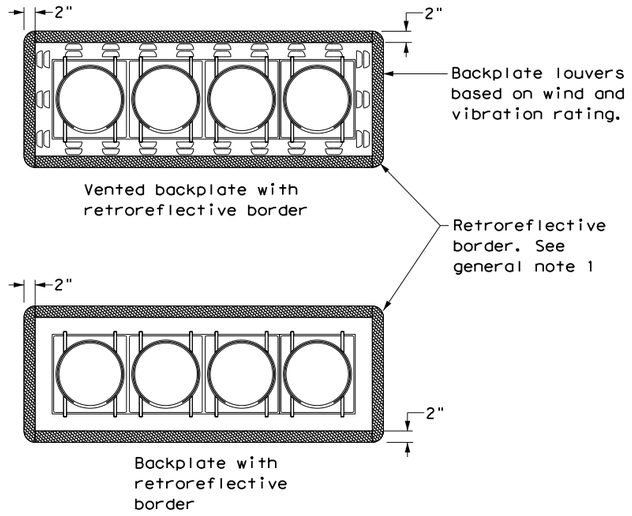
ED(5)-14

FILE: ed5-14.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT October 2014	CONT	SECT	JOB	HIGHWAY
REVISIONS	0177	14	037	SL 494
	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY		105

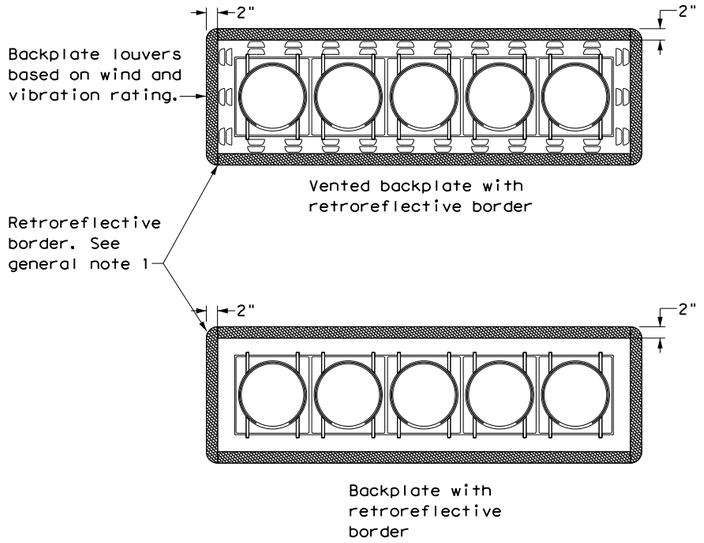
DATE:
FILE:



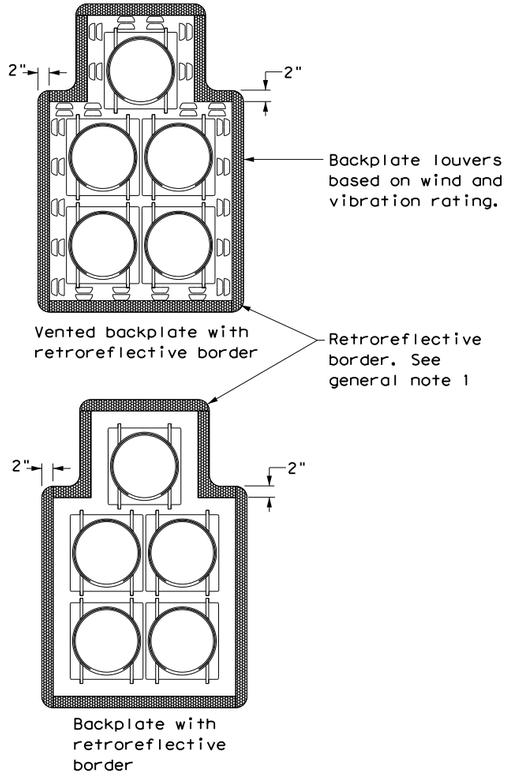
THREE-SECTION HEAD
HORIZONTAL OR VERTICAL



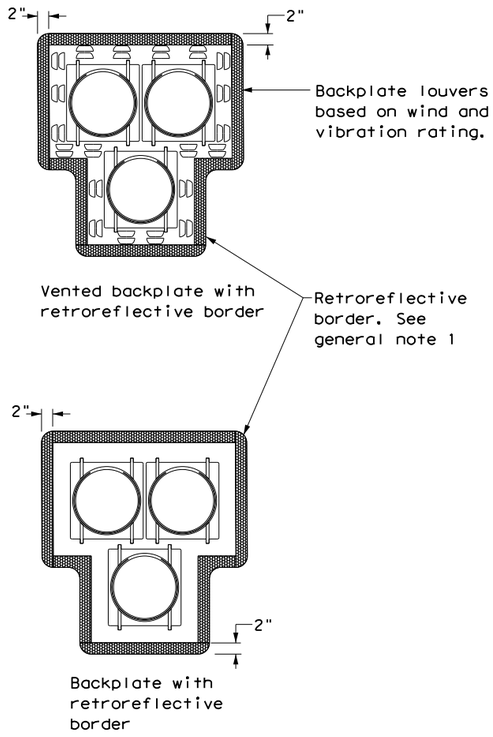
FOUR-SECTION HEAD
HORIZONTAL OR VERTICAL



FIVE-SECTION HEAD
HORIZONTAL OR VERTICAL



FIVE-SECTION HEAD
CLUSTER



PEDESTRIAN HYBRID
BEACON

GENERAL NOTES:

1. Backplates are optional for traffic signals and pedestrian hybrid beacons. When backplates are used, a 2-inch wide fluorescent yellow AASHTO Type B_{FL} or C_{FL} retroreflective border conforming to TxDOT DMS-8300 is required. Place on all approaches when used.
2. Signal head and backplate compatability must be verified by the contractor prior to installation.
3. When using backplates on signal heads, venting is preferred to reduce cyclic vibration stress.
4. When a vented backplate is used, the retroreflective border must not be placed over the louvers.
5. This standard sheet applies to all signal heads with backplates, including but not limited to:
   - Pole mounted
   - Overhead mounted
   - Span wire mounted
   - Mast arm mounted
   - Vertical signal heads
   - Horizontal signal heads
   - Clustered signal heads
   - Pedestrian hybrid beacons

Texas Department of Transportation

Traffic Safety Division Standard

TRAFFIC SIGNAL HEAD WITH BACKPLATE

TS-BP-20

FILE: ts-bp-20.dgn		DN: TxDOT	CK: TxDOT	DW: TxDOT		CK: TxDOT	
©TxDOT June 2020		CONT	SECT	JOB		HIGHWAY	
REVISIONS		0177	14	037		SL 494	
		DIST	COUNTY			SHEET NO.	
		HOU	MONTGOMERY			106	

FOUNDATION DESIGN TABLE

FDN TYPE	DRILLED SHAFT DIA	REINFORCING STEEL		EMBEDDED DRILLED SHAFT LENGTH-ft ④, ⑤, ⑥			ANCHOR BOLT DESIGN ①				FOUNDATION DESIGN LOAD ②		TYPICAL APPLICATION
		VERT BARS	SPIRAL & PITCH	TEXAS CONE PENETROMETER N blows/ft 10	15	40	ANCHOR BOLT DIA	Fy (ksi)	BOLT CIR DIA	ANCHOR TYPE	MOMENT K-ft	SHEAR Kips	
24-A	24"	4- #5	#2 at 12"	5.7	5.3	4.5	¾"	36	12 ¾"	1	10	1	Pedestal pole, pedestal mounted controller.
30-A	30"	8- #9	#3 at 6"	11.3	10.3	8.0	1 ½"	55	17"	2	87	3	Mast arm assembly. (see Selection Table)
36-A	36"	10- #9	#3 at 6"	13.2	12.0	9.4	1 ¾"	55	19"	2	131	5	Mast arm assembly. (see Selection Table) 30' strain pole with or without luminaire.
36-B	36"	12- #9	#3 at 6"	15.2	13.6	10.4	2"	55	21"	2	190	7	Mast arm assembly. (see Selection Table) Strain pole taller than 30' & strain pole with mast arm
42-A	42"	14- #9	#3 at 6"	17.4	15.6	11.9	2 ¼"	55	23"	2	271	9	Mast arm assembly. (see Selection Table)

NOTES:

① Anchor bolt design develops the foundation capacity given under Foundation Design Loads.

② Foundation Design Loads are the allowable moments and shears at the base of the structure.

③ Foundations may be listed separately or grouped according to similarity of location and type. Quantities are for the Contractor's information only.

④ Field Penetrometer readings at a depth of approximately 3 to 5 feet may be used to adjust shaft lengths.

⑤ If rock is encountered, the Drilled Shaft shall extend a minimum of two diameters into solid rock.

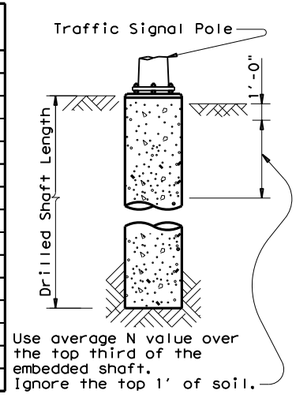
⑥ Decimal lengths in Design Table are to allow interpolation for other penetrometer values. Round to nearest foot for entry into Summary Table.

FOUNDATION SUMMARY TABLE ③

LOCATION IDENTIFICATION	AVG. N BLOW /ft.	FDN TYPE	NO. EA	DRILLED SHAFT LENGTH ⑥ (FEET) 24-A	30-A	36-A	36-B	42-A
TOTAL DRILLED SHAFT LENGTHS								

FOUNDATION SELECTION TABLE FOR STANDARD MAST ARM PLUS ILSN SUPPORT ASSEMBLIES (ft)

		FDN 30-A	FDN 36-A	FDN 36-B	FDN 42-A
80 MPH DESIGN WIND SPEED	MAX SINGLE ARM LENGTH	32'	48'		
	MAXIMUM DOUBLE ARM LENGTH COMBINATIONS	24' X 24'			
		28' X 28'			
		32' X 28'	32' X 32'		
			36' X 36'		
			40' X 36'		
			44' X 28'	44' X 36'	
100 MPH DESIGN WIND SPEED	MAX SINGLE ARM LENGTH		36'	44'	
	MAXIMUM DOUBLE ARM LENGTH COMBINATIONS		24' X 24'		
			28' X 28'		
			32' X 24'	32' X 32'	
				36' X 36'	
				40' x24'	40' X 36'
					44' x 36'



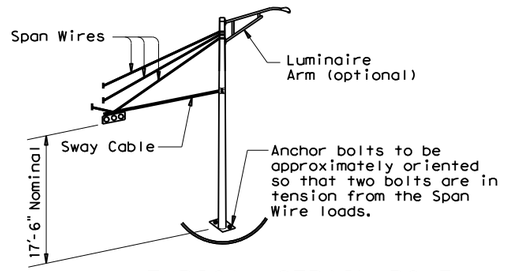
Use average N value over the top third of the embedded shaft. Ignore the top 1' of soil.

ANCHOR BOLT & TEMPLATE SIZES

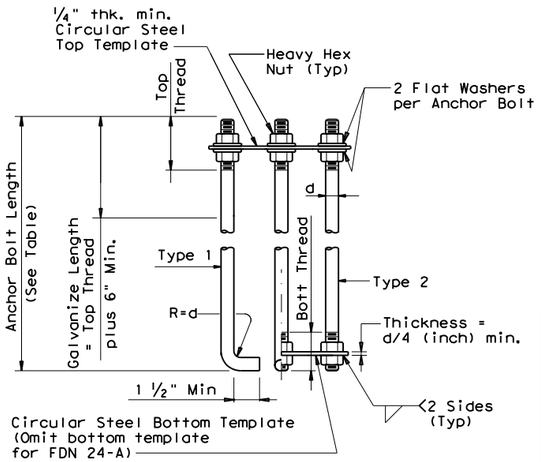
BOLT DIA IN.	⑦ BOLT LENGTH	TOP THREAD	BOTTOM THREAD	BOLT CIRCLE	R2	R1
¾"	1'-6"	3"	—	12 ¾"	7 ⅛"	5 ⅝"
1 ½"	3'-4"	6"	4"	17"	10"	7"
1 ¾"	3'-10"	7"	4 ½"	19"	11 ¼"	7 ¾"
2"	4'-3"	8"	5"	21"	12 ½"	8 ½"
2 ¼"	4'-9"	9"	5 ½"	23"	13 ¾"	9 ¼"

⑦ Min dimensions given, longer bolts are acceptable.

EXAMPLE:
1. For 80mph design wind speed, foundation 30-A can support up to a 32' arm with another arm up to 28'
2. For 100mph design wind speed, foundation 36-A can support a single 36' mast arm.



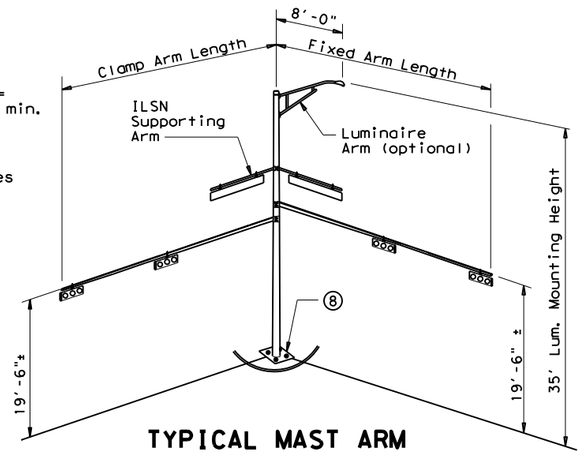
TYPICAL STRAIN POLE ASSEMBLY



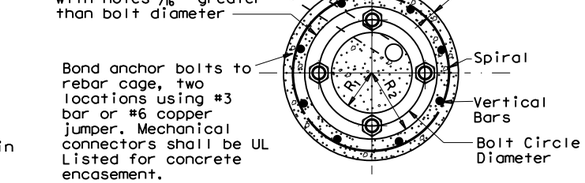
HOOKED ANCHOR (TYPE 1) NUT ANCHOR (TYPE 2)

ANCHOR BOLT ASSEMBLY

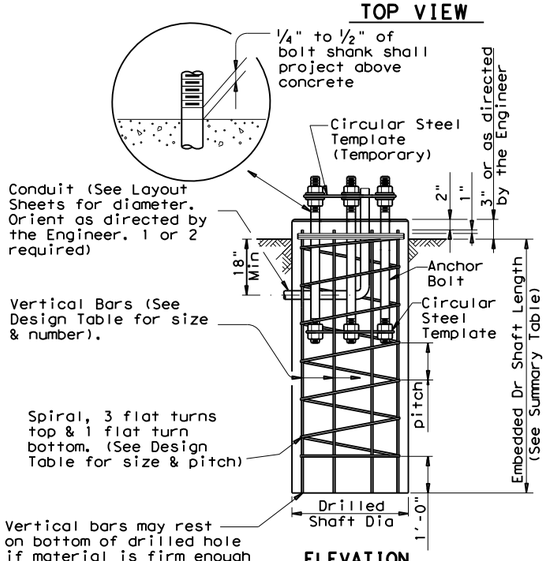
⑧ Orient anchor bolts orthogonal with the fixed arm direction to ensure that two bolts are in tension under dead load.



TYPICAL MAST ARM ASSEMBLY



TOP VIEW



ELEVATION

FOUNDATION DETAILS

GENERAL NOTES:

Design conforms to 1994 AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals and interim revisions thereto.

Reinforcing steel shall conform to Item 440, "Reinforcing Steel".

Concrete shall be Class "C".

Threads for anchor bolts and nuts shall be rolled or cut threads of 8UN series up to 2" in diameter or UNC series for all sizes. Bolts and nuts shall have Class 2A and 2B fit tolerances. Galvanized nuts shall be tapped after galvanizing.

Anchor bolts that are larger than 1" in diameter shall conform to "alloy steel" or "medium-strength mild steel" per Item 449, "Anchor Bolts". Anchor bolts that are 1" in diameter or less shall conform to ASTM A36. Galvanize a minimum of the top end thread length plus 6" for all anchor bolts unless otherwise noted. Exposed washers and exposed nuts shall be galvanized. All galvanizing shall be in accordance with Item 445, "Galvanizing".

Templates and embedded nuts need not be galvanized. Lubricate and tighten anchor bolts when erecting the structure in accordance with Item 449, "Anchor Bolts".

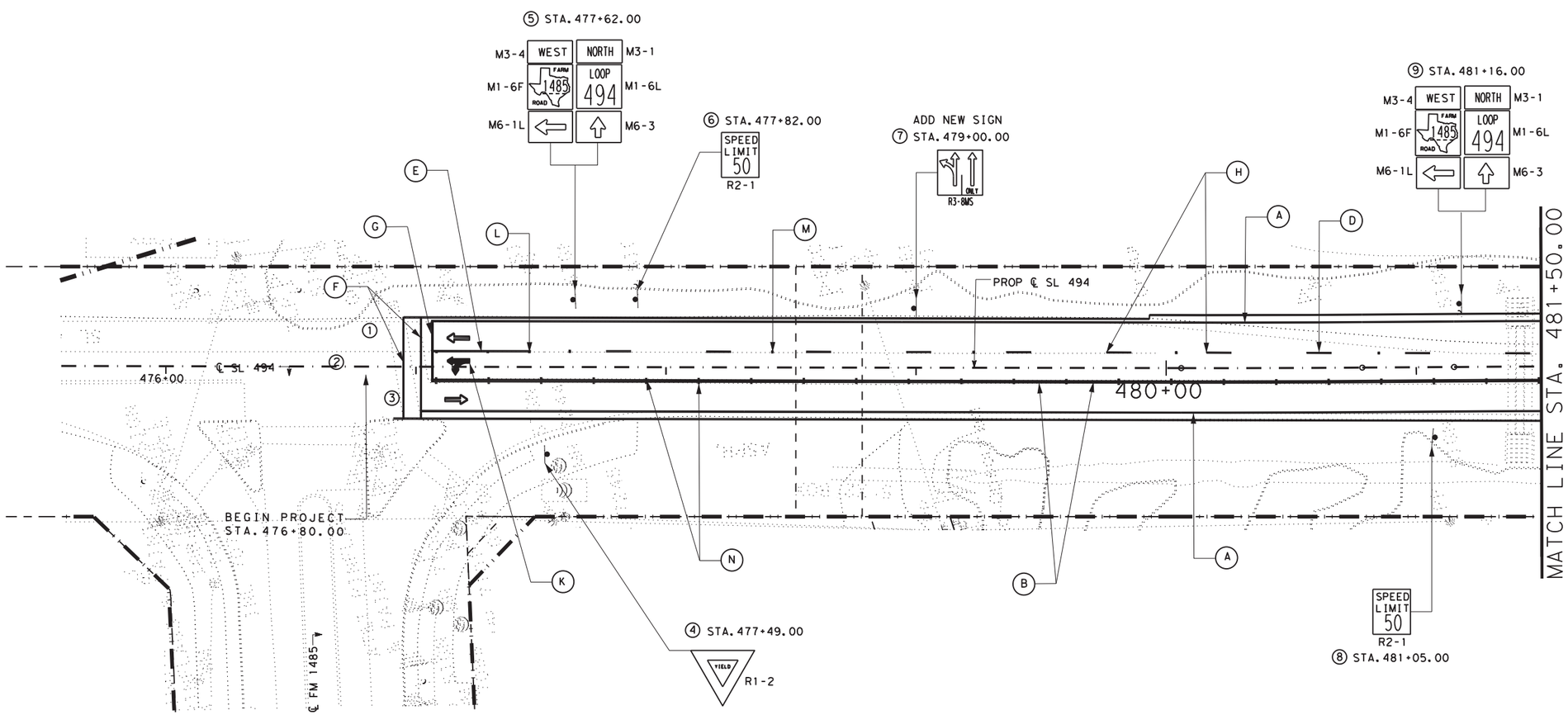
Texas Department of Transportation
Traffic Operations Division

TRAFFIC SIGNAL POLE FOUNDATION

TS-FD-12

REVISIONS	DN: MS	CK: JSY	DW: MAQ/MMF	CK: JSY/TEB
5-96	CONT	SECT	JOB	HIGHWAY
11-99	0177	14	037	SL 494
1-12	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY		107

DATE: $DATE$ $TIME$
FILE: $FILE$



LEGEND

- EXIST. PAVEMENT
- EXIST. ROW
- PROP. PAVEMENT
- TRAFFIC FLOW ARROW
- (A) RE PM W/RET REQ TY I (W)6"(SLD)(100MIL)
- (B) REF PM W/RET REQ TY I (Y)6"(SLD)(100MIL)
- (C) REF PM W/RET REQ TY I (Y)6"(BRK)(100MIL)
- (D) REF PM W/RET REQ TY I (W)6"(BRK)(100MIL)
- (E) PROP.REFL PAV MRK TY I (W) 8" (SLD) (100MIL)
- (F) PROP.REFL PAV MRK TY I (W) 12" (SLD) (100MIL)
- (G) PROP.REFL PAV MRK TY I (W) 24" (SLD)(100MIL)
- (H) RE PV MRK TY I (BLACK)6"(SHADOW)(100MIL)
- (I) PREFAB PAV MRK TY C (W)(WORD)
- (J) PREFAB PAV MRK TY C (W)(ARROW)
- (K) PREFAB PAV MRK TY C (W)(DOUBLE ARROW)
- (L) PROP.REFL PAV MRKR TY I-C SPACED AT 20'
- (M) PROP.REFL PAV MRKR TY I-C SPACED AT 80'
- (N) PROP.REFL PAV MRKR TY II-A-A SPACED AT 20'
- (O) PROP.REFL PAV MRKR TY II-A-A SPACED AT 40'
- (P) PROP.REFL PAV MRK TY I (W)(RR XING) (100MIL)
- (1) LOOP 494
- (2) FM 1485
- (3) FM 1485

** (1) (2) (3) TO BE PLACED ON TRAFFIC SIGNAL MAST ARMS

FOR PAVEMENT MARKINGS AND MARKERS SEE STANDARDS:
PM(1)-20, PM(2)-20, PM(3)-20, PM(WAS)-07
FOR SMALL SIGN INSTALLATION, SEE SIGN MOUNTING DETAIL STANDARDS

0 25 50
SCALE IN FEET

STATE OF TEXAS
PRELIMINARY SUBJECT TO CHANGE
LICENSED PROFESSIONAL ENGINEER

Micah J. Webster, P.E.

07.30.21

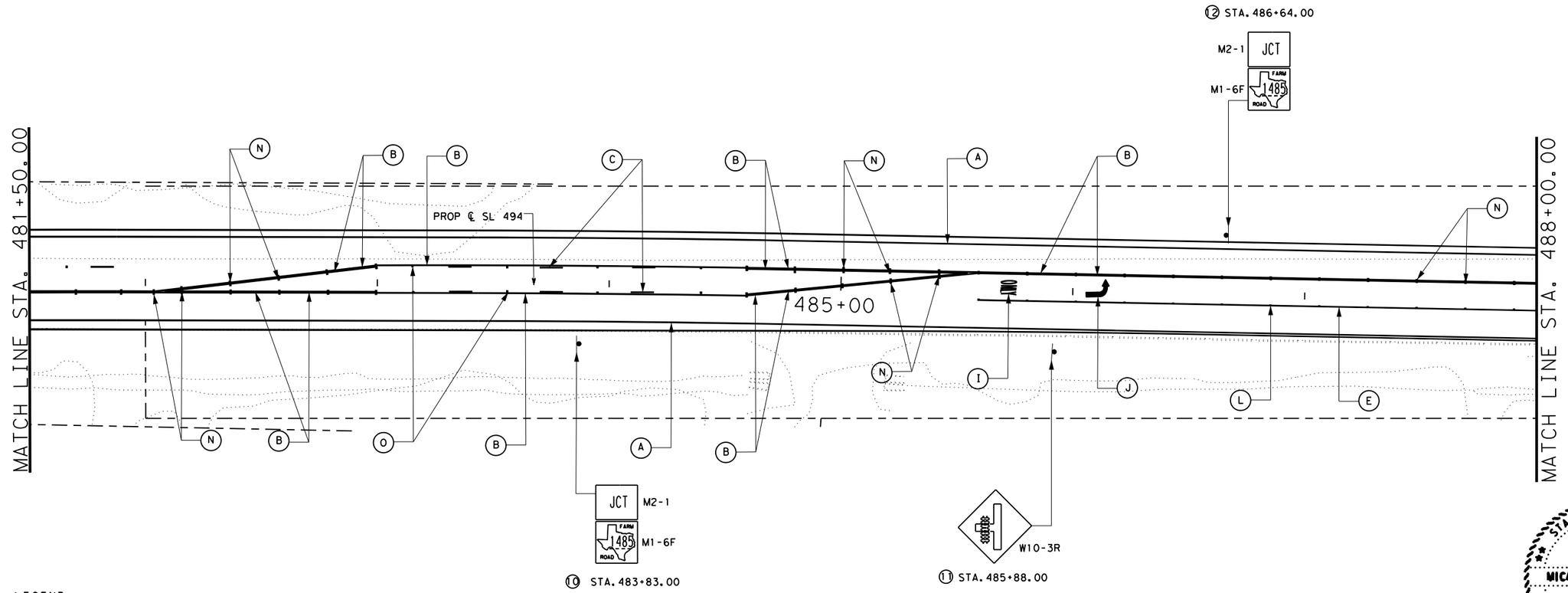
SL 494
PAVEMENT MARKING AND SIGNING LAYOUT

SHEET 1 OF 3

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		108

DATE:
FILE:



LEGEND

- EXIST. PAVEMENT
- EXIST. ROW
- PROP. PAVEMENT
- TRAFFIC FLOW ARROW

(A) RE PM W/RET REQ TY I (W)6"(SLD)(100MIL)

(B) REF PM W/RET REQ TY I (Y)6"(SLD)(100MIL)

(C) REF PM W/RET REQ TY I (Y)6"(BRK)(100MIL)

(D) REF PM W/RET REQ TY I (W)6"(BRK)(100MIL)

(E) PROP.REFL PAV MRK TY I (W) 8" (SLD) (100MIL)

(F) PROP.REFL PAV MRK TY I (W) 12" (SLD) (100MIL)

(G) PROP.REFL PAV MRK TY I (W) 24" (SLD) (100MIL)

(H) RE PV MRK TY I (BLACK)6"(SHADOW)(100MIL)

(I) PREFAB PAV MRK TY C (W)(WORD)

(J) PREFAB PAV MRK TY C (W)(ARROW)

(K) PREFAB PAV MRK TY C (W)(DOUBLE ARROW)

(L) PROP.REFL PAV MRKR TY I-C SPACED AT 20'

(M) PROP.REFL PAV MRKR TY I-C SPACED AT 80'

(N) PROP.REFL PAV MRKR TY II-A-A SPACED AT 20'

(O) PROP.REFL PAV MRKR TY II-A-A SPACED AT 40'

(P) PROP.REFL PAV MRK TY I (W)(RR XING) (100MIL)

FOR PAVEMENT MARKINGS AND MARKERS SEE STANDARDS:
PM(1)-20, PM(2)-20, PM(3)-20, PM(WAS)-07
FOR SMALL SIGN INSTALLATION, SEE SIGN MOUNTING DETAIL STANDARDS

0 25 50
SCALE IN FEET

STATE OF TEXAS
MICAH J. SCHLUTER
136908
LICENSED
PROFESSIONAL ENGINEER

Micah J. Schluter, P.E.

07.30.21

SL 494
PAVEMENT MARKING AND SIGNING LAYOUT

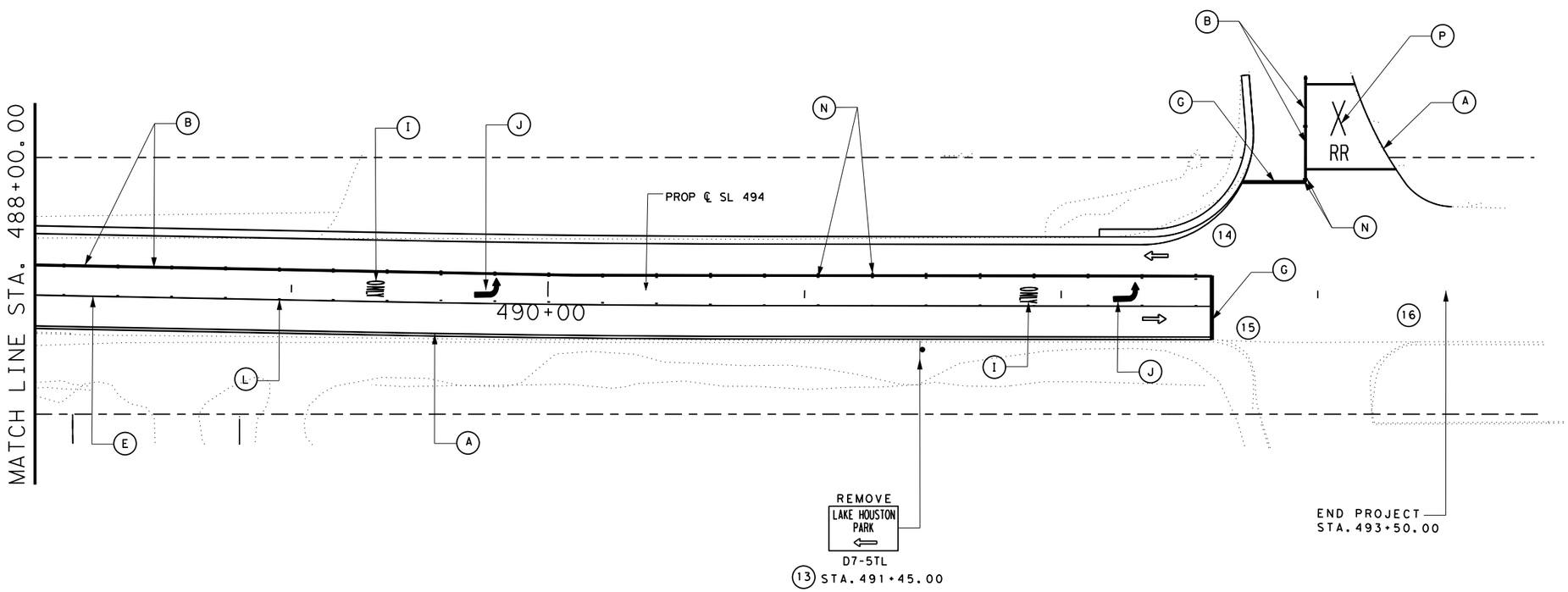
SHEET 2 OF 3

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		109

DATE: 07/27/2021 04:47 PM
FILE:

CK:
DW:
CK:
DN:



LEGEND

- EXIST. PAVEMENT
- EXIST. ROW
- PROP. PAVEMENT
- TRAFFIC FLOW ARROW
- (A) RE PM W/RET REQ TY I (W)6"(SLD)(100MIL)
- (B) REF PM W/RET REQ TY I (Y)6"(SLD)(100MIL)
- (C) REF PM W/RET REQ TY I (Y)6"(BRK)(100MIL)
- (D) REF PM W/RET REQ TY I (W)6"(BRK)(100MIL)
- (E) PROP.REFL PAV MRK TY I (W) 8" (SLD) (100MIL)
- (F) PROP.REFL PAV MRK TY I (W) 12" (SLD) (100MIL)
- (G) PROP.REFL PAV MRK TY I (W) 24"(SLD)(100MIL)
- (H) RE PV MRK TY I (BLACK)6"(SHADOW)(100MIL)
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- (J) PREFAB PAV MRK TY C (W)(ARROW)
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- (L) PROP.REFL PAV MRKR TY I-C SPACED AT 20'
- (M) PROP.REFL PAV MRKR TY I-C SPACED AT 80'
- (N) PROP.REFL PAV MRKR TY II-A-A SPACED AT 20'
- (O) PROP.REFL PAV MRKR TY II-A-A SPACED AT 40'
- (P) PROP.REFL PAV MRK TY I (W)(RR XING)(100MIL)

(14) FM 1485
(15) LOOP 494
(16) FM 1485

** (14) (15) (16) TO BE PLACED ON TRAFFIC SIGNAL MAST ARMS

FOR PAVEMENT MARKINGS AND MARKERS SEE STANDARDS:
PM(1)-20, PM(2)-20, PM(3)-20, PM(WAS)-07
FOR SMALL SIGN INSTALLATION, SEE SIGN MOUNTING DETAIL STANDARDS

0 25 50
SCALE IN FEET

STATE OF TEXAS
MICAH J. SCHLUTER
136908
LICENSED
PROFESSIONAL ENGINEER

Micah J. Schluter, P.E.
07.30.21

SL 494
PAVEMENT MARKING AND SIGNING LAYOUT

SHEET 3 OF 3

Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		110

DATE: 07/23/2021 09:00 PM
FILE:

REFLECTOR UNIT SIZES FOR DELINEATORS AND OBJECT MARKERS

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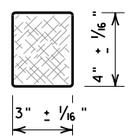
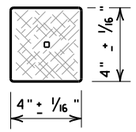
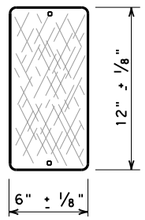
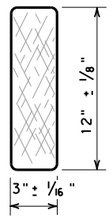
DEVICE				
SHEETING	Yellow, White or Red Type B or C reflective sheeting			
NOTE	1. Size 1 and 4 - Direct applied reflective sheeting for use on flexible post (flx). 2. Size 2 and 3 - For use on wing channel (wc) post only. Use approved metal, plastic or fiberglass backplate with 17/64" mounting holes.			

DELINEATORS

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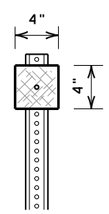
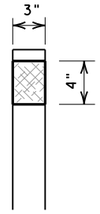
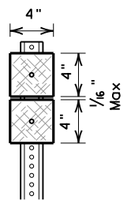
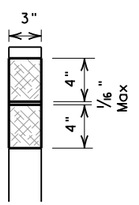
DEVICE				
	1-Size 2 reflector unit	1-Size 1 reflector unit	2-Size 2 reflector units	2-Size 1 reflector units
SHEETING	Yellow, White or Red Type B or C Reflective Sheeting			
POST TYPE	WC	YFLX, WFLX	WC	YFLX, WFLX
MOUNT TYPE	GND	GND, SRF	GND	GND, SRF

D & OM DESCRIPTIVE CODES

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

NUMBER OF REFLECTORS
S = Single
D = Double

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

REFLECTOR UNIT SIZE
1 or 2

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

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

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

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

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

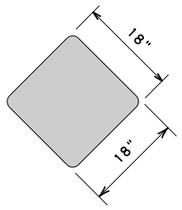
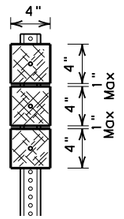
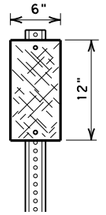
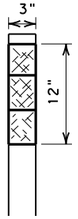
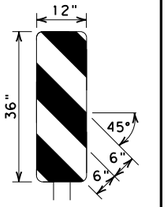
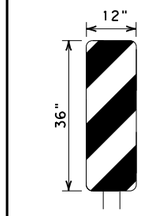
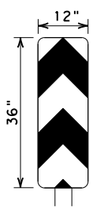
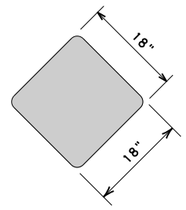
NUMBER OF REFLECTORS OR DIRECTION
X = 3-Size 2 reflector units (Type 2 only)
Y = 1-Size 3 reflector unit (Type 2 only)
Z = 3-Size 1 or 1-Size 4 reflector unit(s)(Type 2 only)
L = Left Side (Type 3 Object Marker only)
R = Right Side (Type 3 Object Marker only)
C = Center (Type 3 Object Marker only)

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

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

DIRECTION
If Required
BI = Bi-Directional

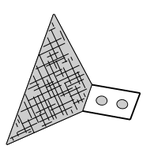
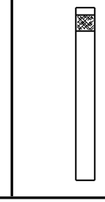
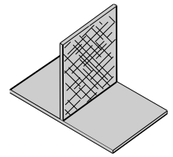
OBJECT MARKERS

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

DEPARTMENTAL MATERIAL SPECIFICATIONS

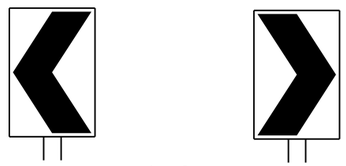
FLEXIBLE DELINEATOR & OBJECT MARKER POSTS (EMBEDDED & SURFACE MOUNT TYPES)	DMS-4400
SIGN FACE MATERIALS	DMS-8300
DELINEATORS, OBJECT MARKERS AND BARRIER REFLECTORS	DMS-8600

BARRIER REFLECTORS (BRF)

	GF1	GF2	CTB
DEVICE			
	1. Barrier reflectors shall meet the requirements of DMS 8600. 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

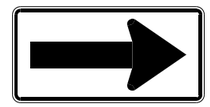


SIZE (W x L)	18"x 24" (Conventional)	24"x 30" (Conventional Oversize)	30"x 36" (Expressway)	36" x 48" (Freeway)
MOUNTING HEIGHT	4'-0" or 7'-0"		7'-0" Only	

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.

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DELINEATOR & OBJECT MARKER MATERIAL DESCRIPTION

D & OM(1)-20

FILE: dom1-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
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REVISIONS	0177	14	037	SL 494
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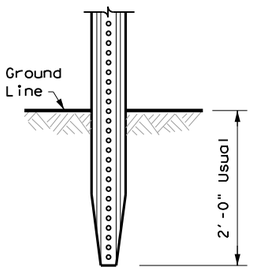
20A

DATE:
FILE:

POST TYPE AND SUPPORT FOUNDATION DETAILS

WING CHANNEL (WC)

GND

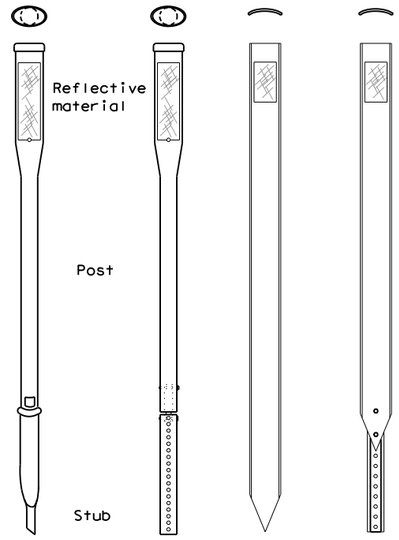


NOTES

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.

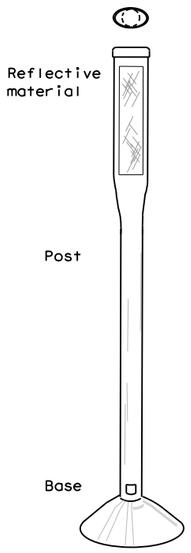
FLEXIBLE POSTS (YFLX, WFLX)

GND



EMBEDDED

SRF



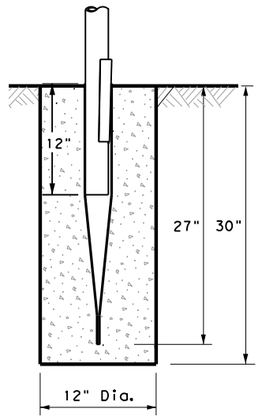
SURFACE MOUNT

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.

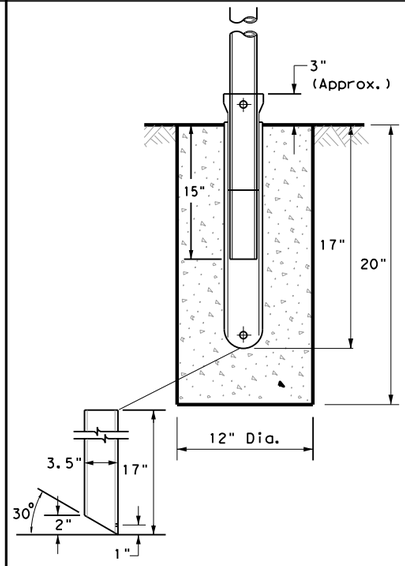
WEDGE ANCHOR SYSTEMS

WAS



STEEL

WAP



PLASTIC

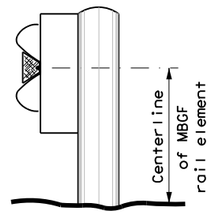
NOTE

1. Install per manufacturer's recommendations.

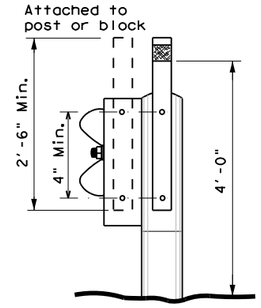
TYPE OF BARRIER MOUNTS

GUARD FENCE ATTACHMENT

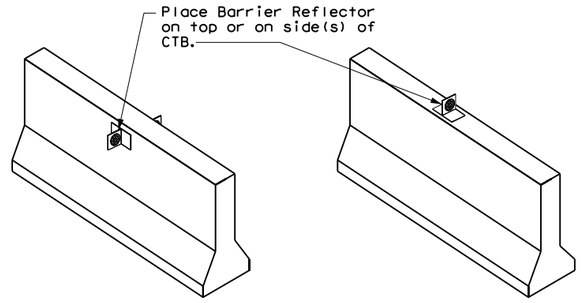
GF1



GF2



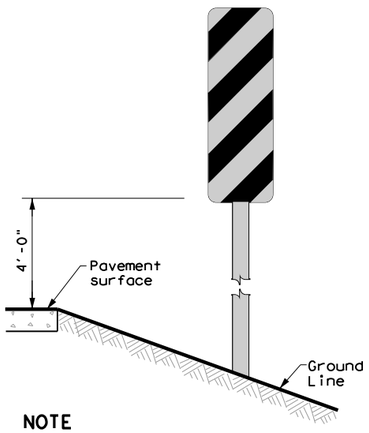
CONCRETE TRAFFIC BARRIER (CTB)



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.

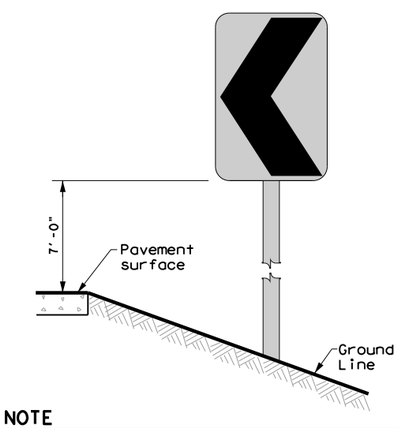
TYPES 1, 3, AND 4 OBJECT MARKERS AND CHEVRONS



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)

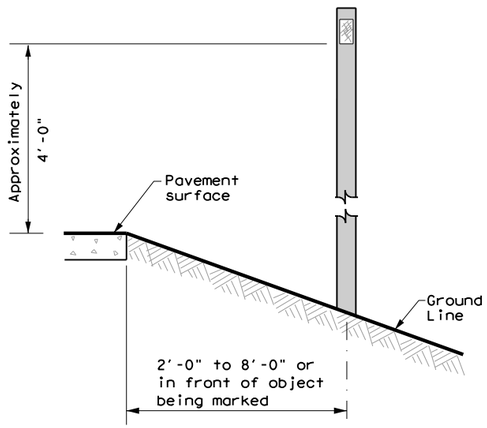
CHEVRONS AND ONE DIRECTION LARGE ARROW SIGN



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
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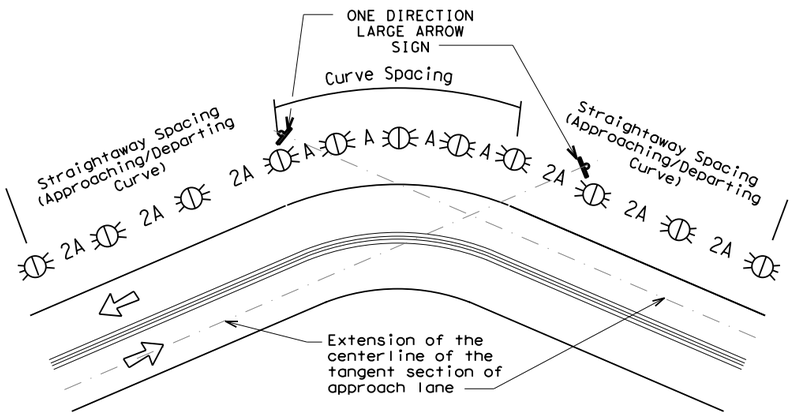
20B

DATE:
FILE:

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

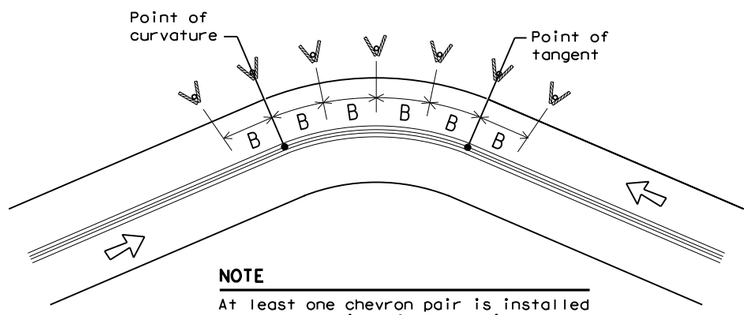
SUGGESTED SPACING FOR DELINEATORS ON HORIZONTAL CURVES



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

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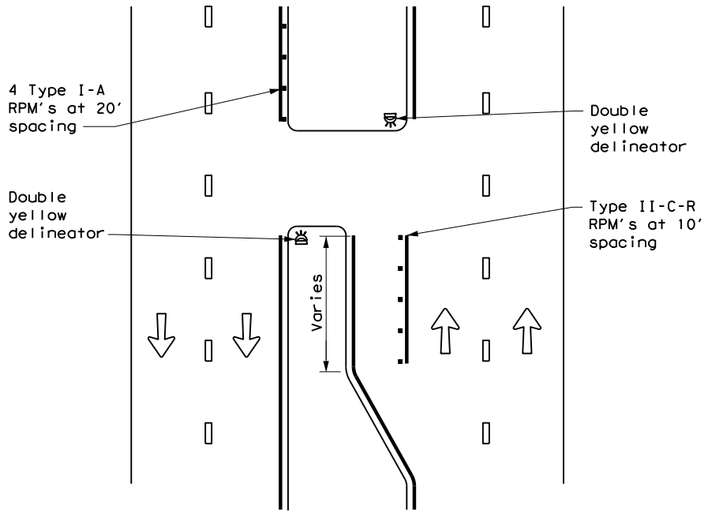
3-15 8-15	DIST	COUNTY		SHEET NO.
8-15 7-20	HOU	MONTGOMERY		113

20C

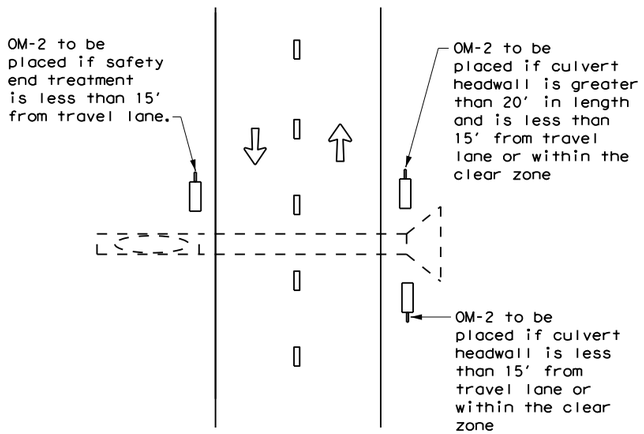
DATE:
FILE:

CROSSOVERS



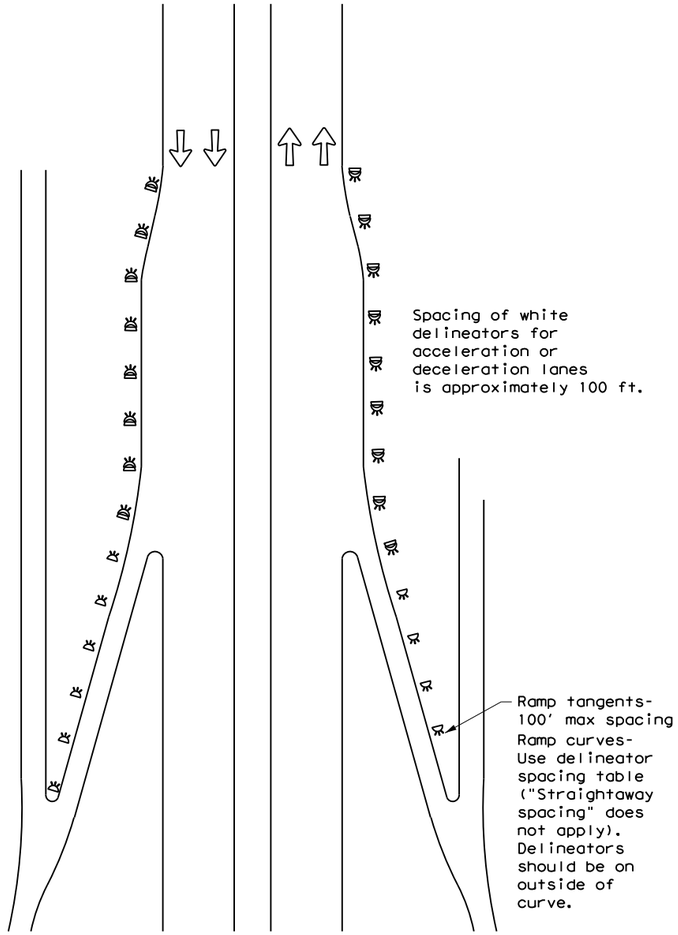
DETAIL 1

FOR CULVERTS WITHOUT MBGF



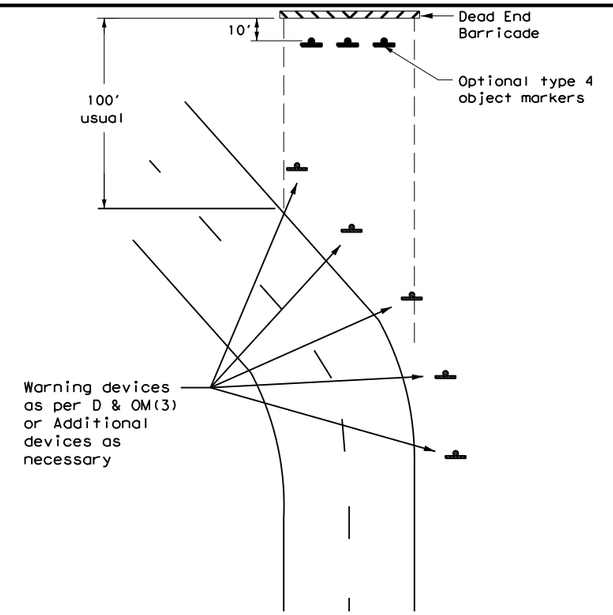
DETAIL 2

FREEWAY DELINEATION FOR RAMPS AND ACCELERATION/DECELERATION LANES



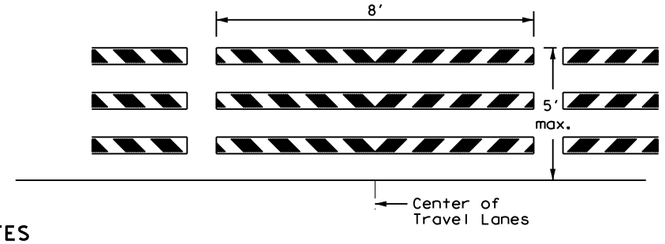
DETAIL 3

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

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DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

D & OM(4)-20

FILE: dom4-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
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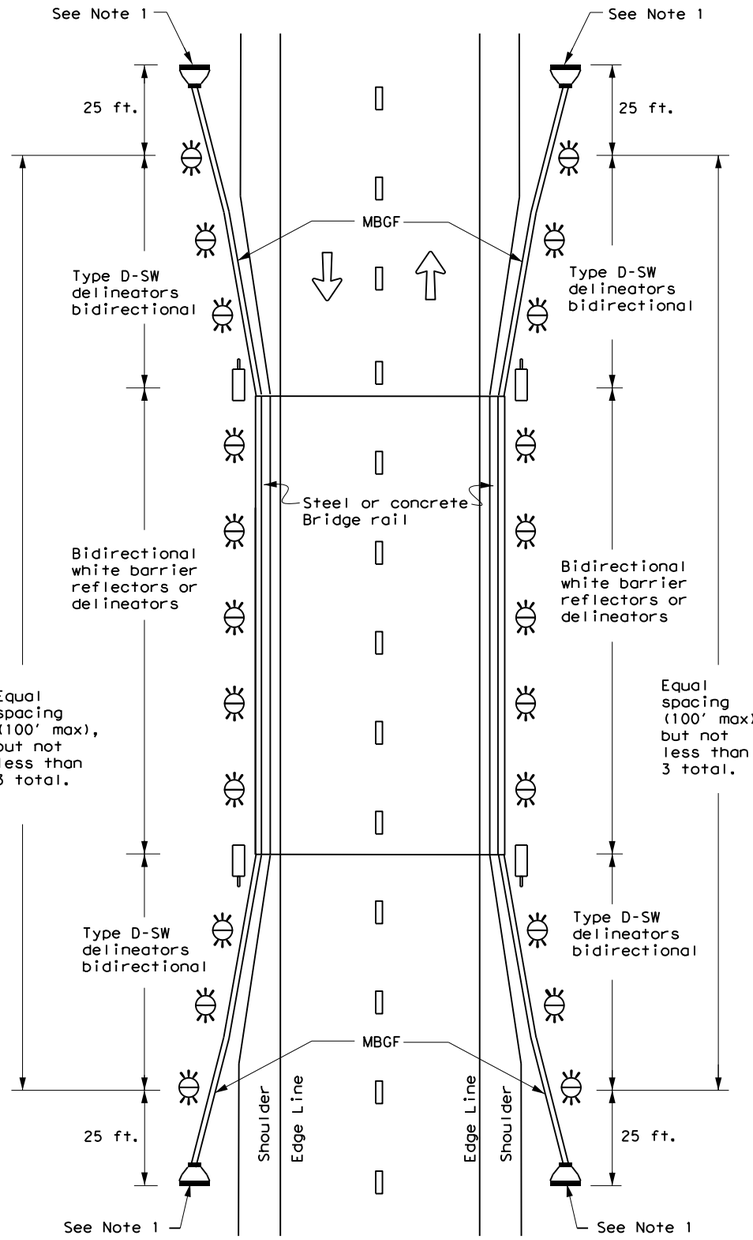
3-15	DIST	COUNTY		SHEET NO.
7-20	HOU	MONTGOMERY		114

DATE:
FILE:

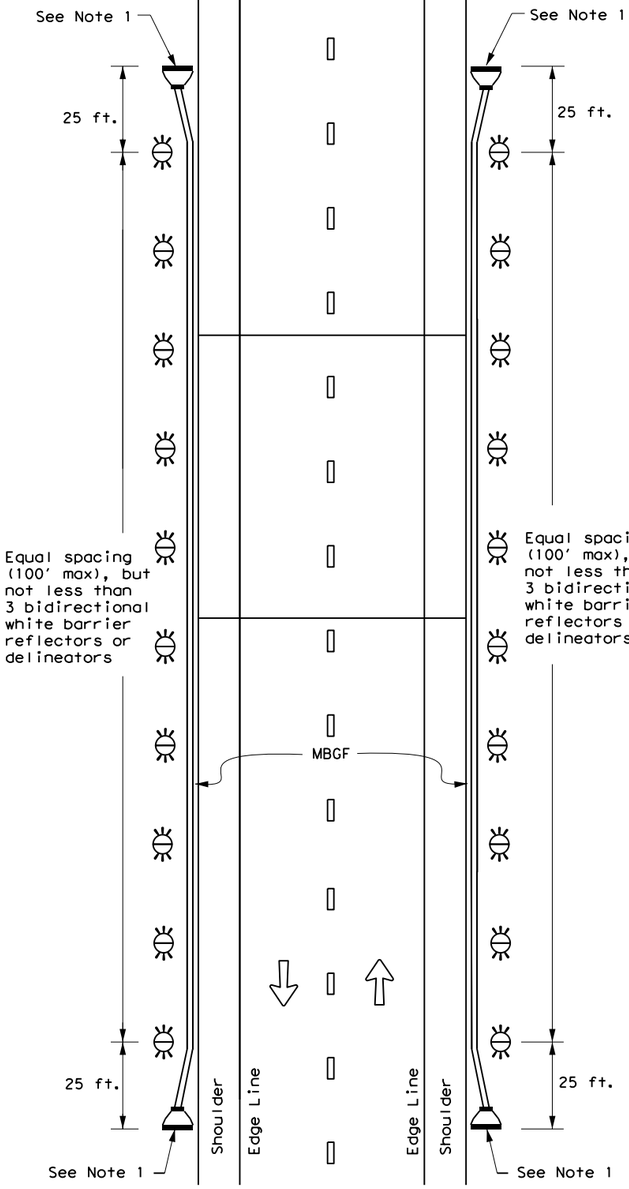
TWO-WAY, TWO LANE ROADWAY WITH REDUCED WIDTH APPROACH RAIL



NOTE:

1. Terminal ends require reflective sheeting provided by manufacturer per D & OM (VIA) or a Type 3 Object Marker (OM-3) in front of the terminal end.

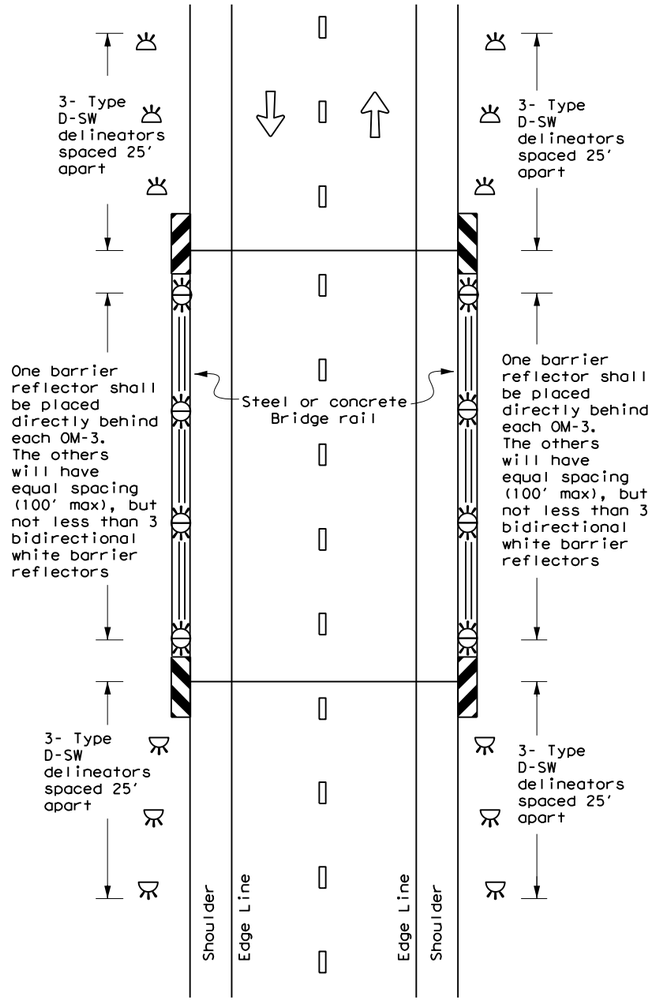
TWO-WAY, TWO LANE ROADWAY WITH METAL BEAM GUARD FENCE (MBGF)



NOTE:

1. Terminal ends require reflective sheeting provided by manufacturer per D & OM (VIA) or a Type 3 Object Marker (OM-3) in front of the terminal end.

TWO-WAY, TWO LANE ROADWAY BRIDGE WITH NO APPROACH RAIL



LEGEND

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

Texas Department of Transportation

Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

D & OM(5)-20

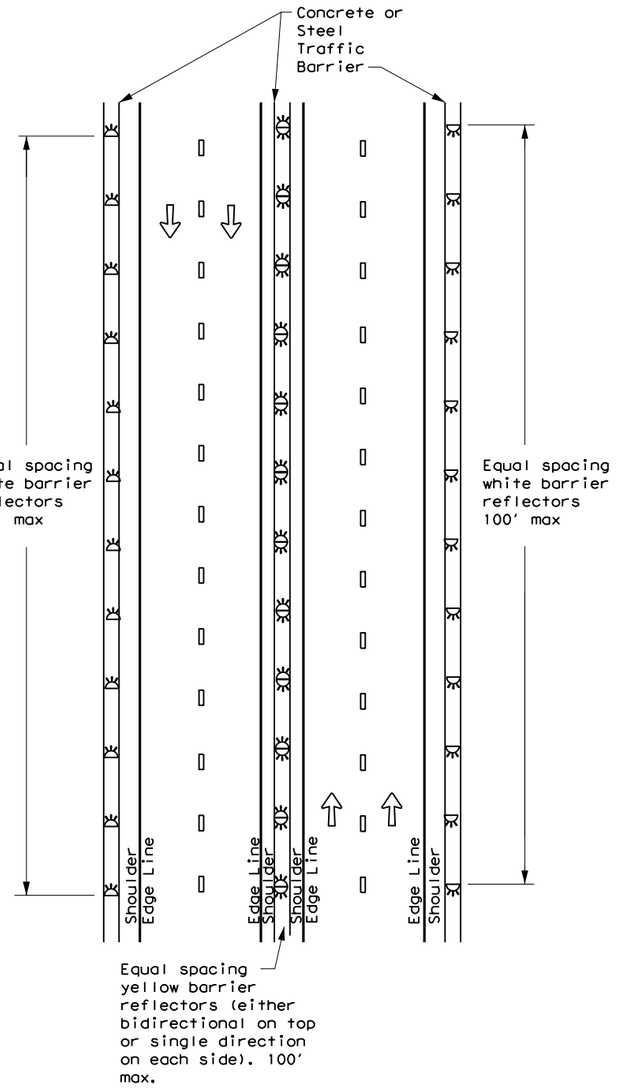
FILE: dom5-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT August 2015	CONT	SECT	JOB	HIGHWAY
REVISIONS	0177	14	037	SL 494
7-20	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY		115

20E

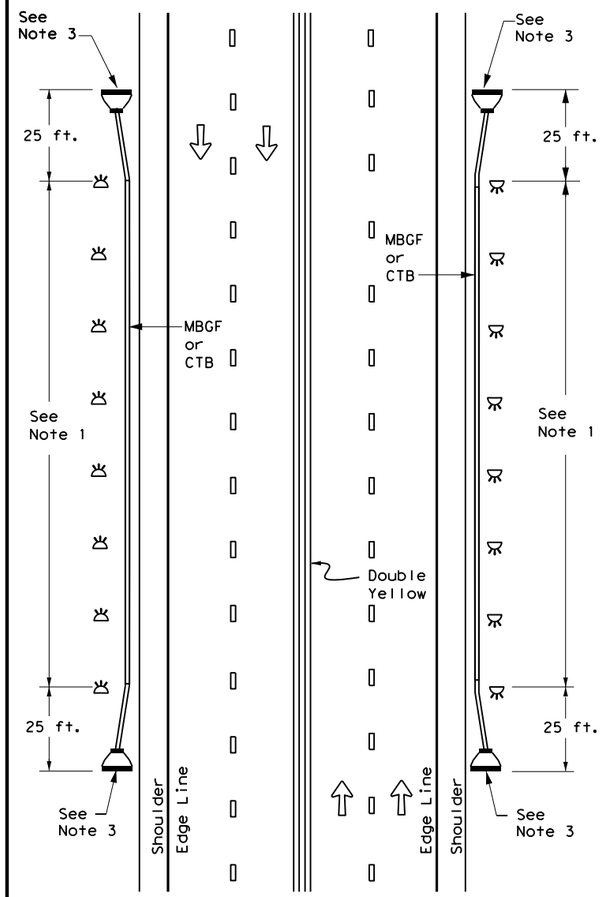
DATE:
FILE:

DATE:
FILE:

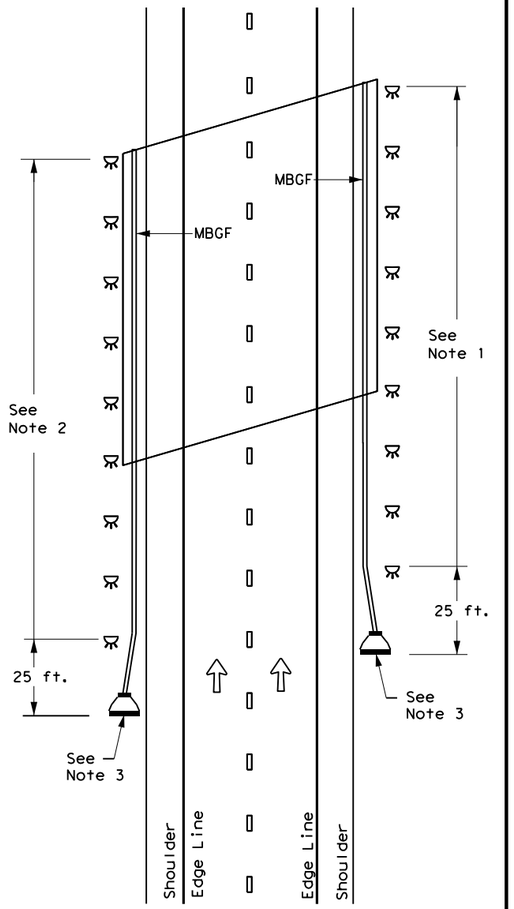
CONTINUOUS CONCRETE OR STEEL BARRIER



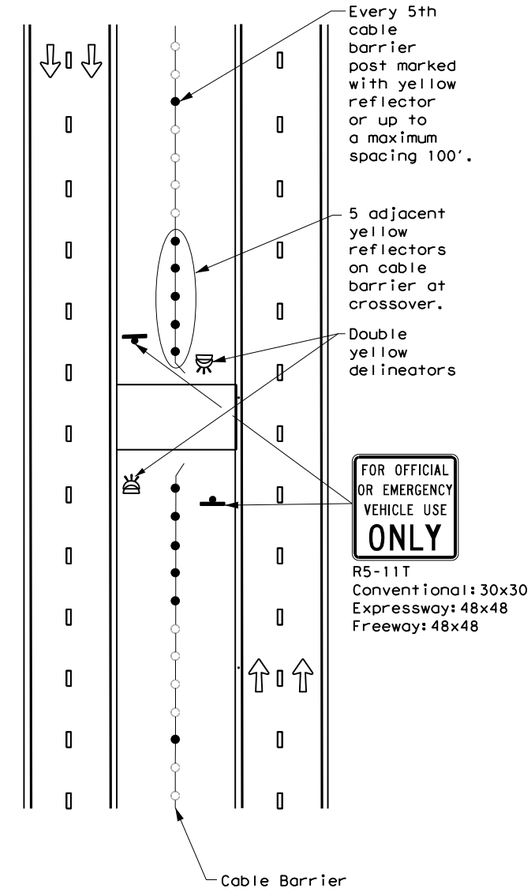
MULTI-LANE UNDIVIDED, TWO-WAY ROADWAY WITH METAL BEAM GUARD FENCE (MBGF)



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

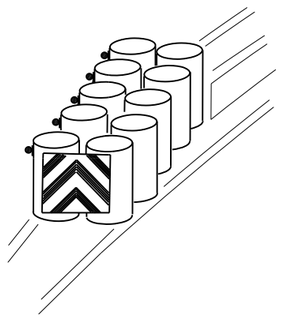
Texas Department of Transportation

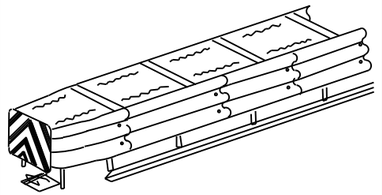
Traffic Safety Division Standard

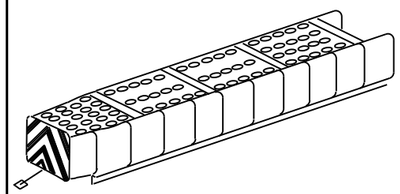
DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

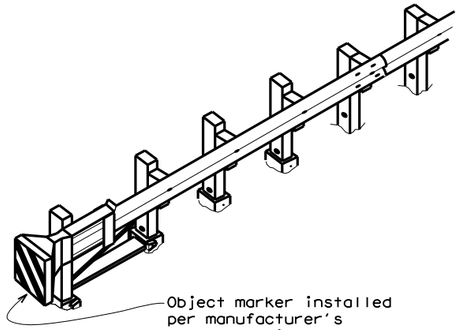
D & OM(6)-20

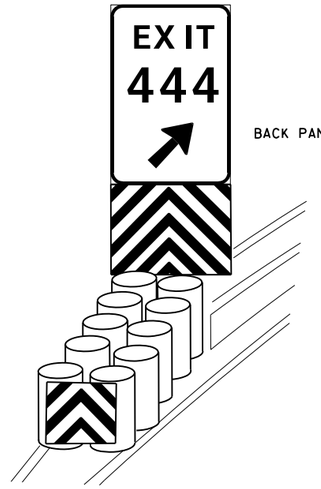
FILE: dom6-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT August 2015	CONT	SECT	JOB	HIGHWAY
REVISIONS	0177	14	037	SL 494
7-20	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY		116

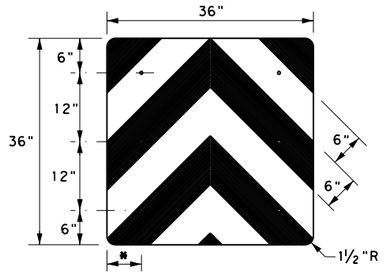


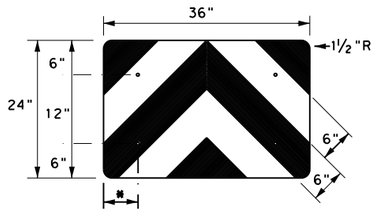




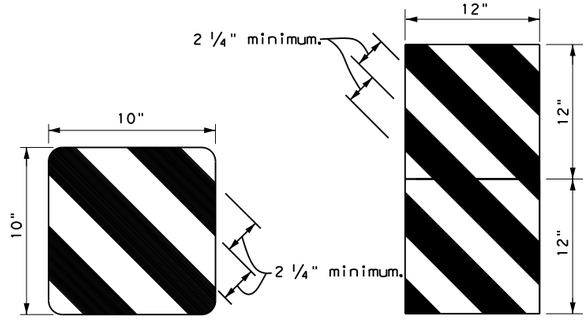




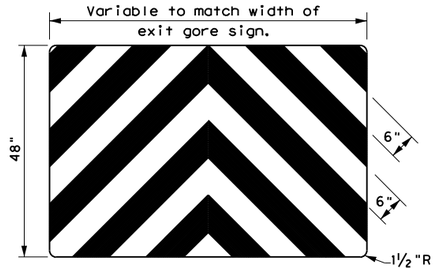


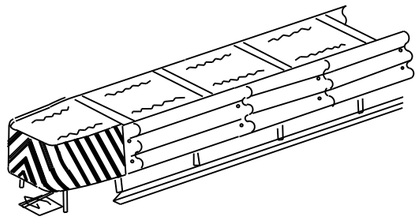


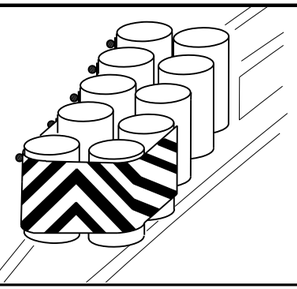
* Adjust to fit attenuator per manufacturer's recommendation, or as directed by the Engineer

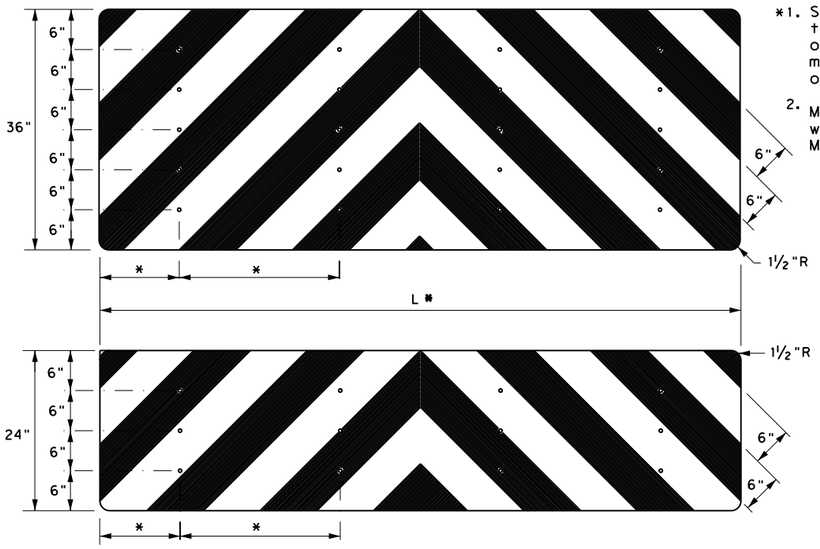


OBJECT MARKERS SMALLER THAN 3 FT^2









NOTES

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

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

NOTES

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

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

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

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

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

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

Texas Department of Transportation

Traffic Safety Division Standard

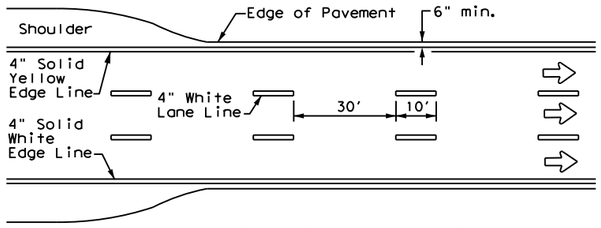
DELINEATOR & OBJECT MARKER FOR VEHICLE IMPACT ATTENUATORS

D & OM(VIA)-20

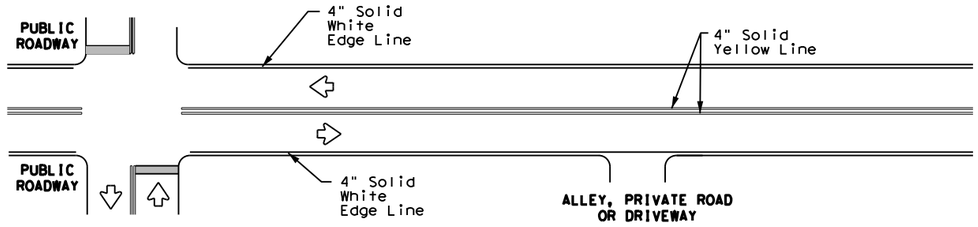
FILE: domvia20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
© TxDOT December 1989	CONT	SECT	JOB	HIGHWAY
REVISIONS	0177	14	037	SL 494
4-92 8-04	DIST	COUNTY		SHEET NO.
8-95 3-15	HOU	MONTGOMERY		117
4-98 7-20				

20G

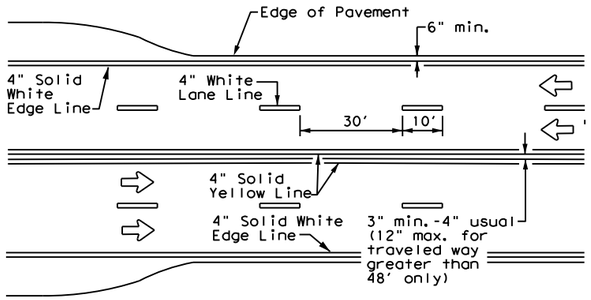
DATE:
FILE:



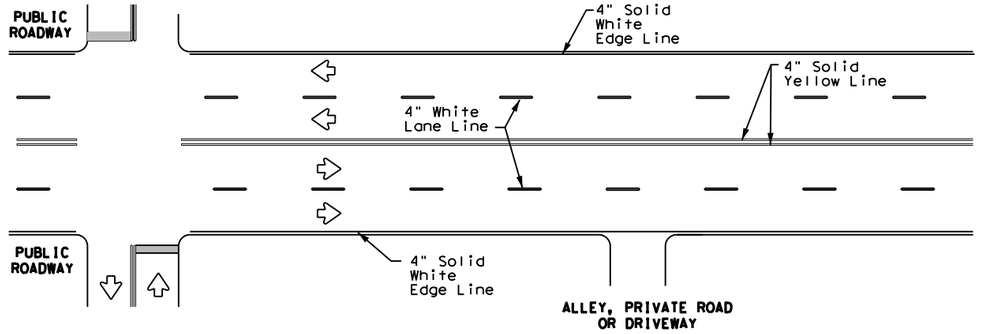
EDGE LINE AND LANE LINES ONE-WAY ROADWAY WITH OR WITHOUT SHOULDERS



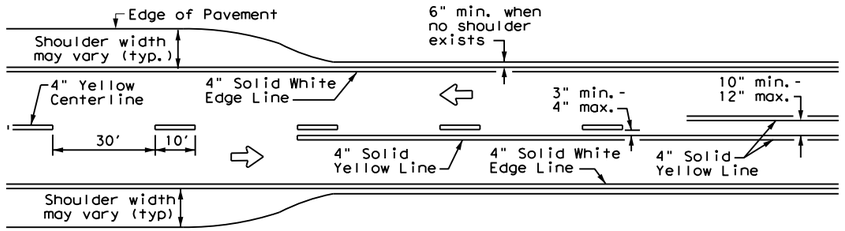
TYPICAL TWO-LANE, TWO-WAY PAVEMENT MARKINGS THROUGH INTERSECTIONS



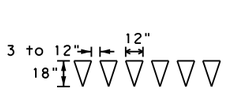
CENTERLINE AND LANE LINES FOUR LANE TWO-WAY ROADWAY WITH OR WITHOUT SHOULDERS



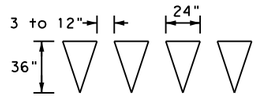
TYPICAL MULTI-LANE, TWO-WAY PAVEMENT MARKINGS THROUGH INTERSECTIONS



TWO LANE TWO-WAY ROADWAY WITH OR WITHOUT SHOULDERS

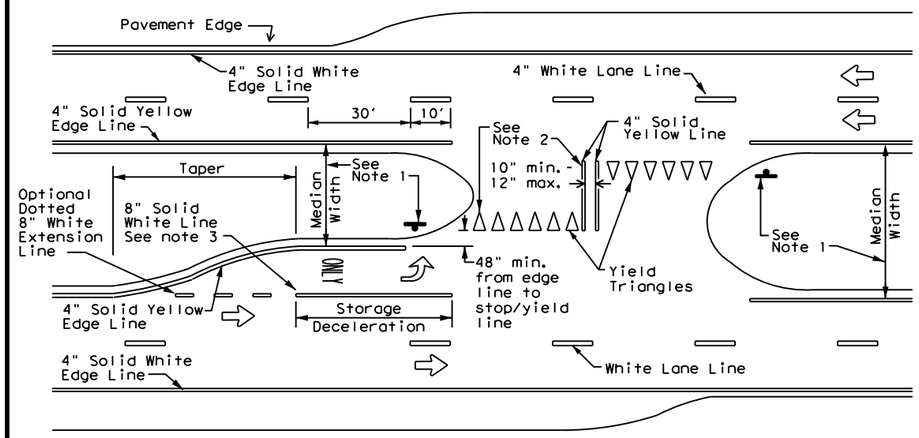


For posted speed on road being marked equal to or less than 40 MPH.



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

YIELD LINES



FOUR LANE DIVIDED ROADWAY CROSSOVERS

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

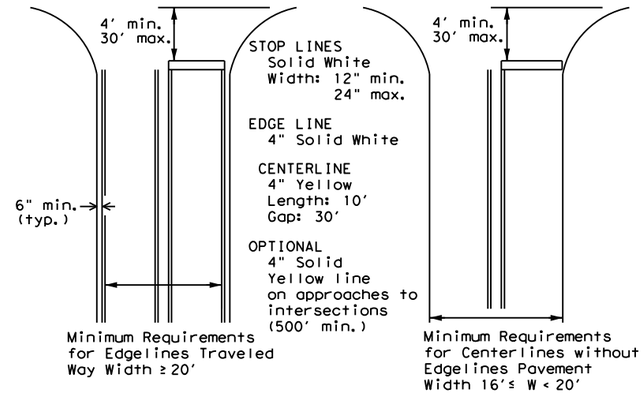
1. Where divided highways are separated by median widths at the median opening itself of 30 feet or more, median openings shall be signed as two separate intersections. Each median opening has two width measurements, with one measurement for each approach. The narrow median width will be the controlling 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.

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
HOUSTON DISTRICT STANDARD

TYPICAL STANDARD PAVEMENT MARKINGS

PM-20

DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

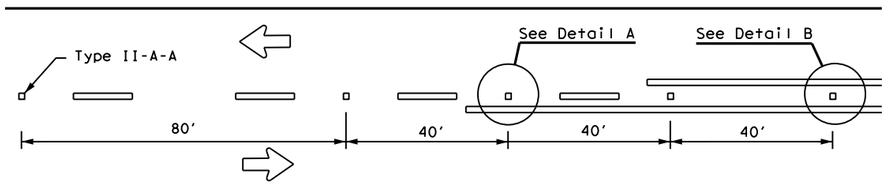
REVISIONS
8-95 2-12
5-00 8-16
8-00 7-20
3-03

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		118

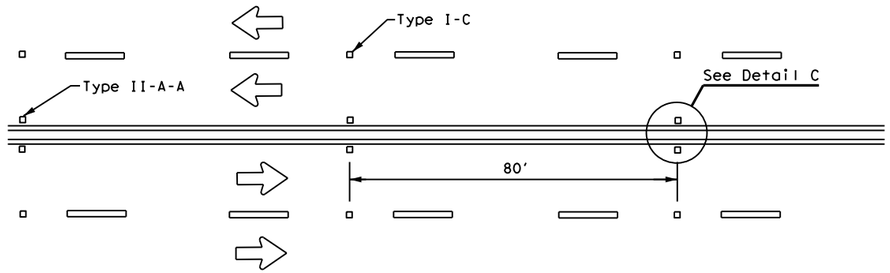
DATE:
FILE:

STD N-5a

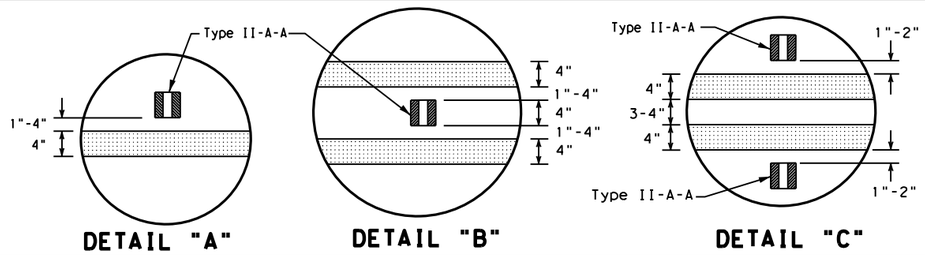
REFLECTIVE RAISED PAVEMENT MARKERS FOR VEHICLE POSITIONING GUIDANCE



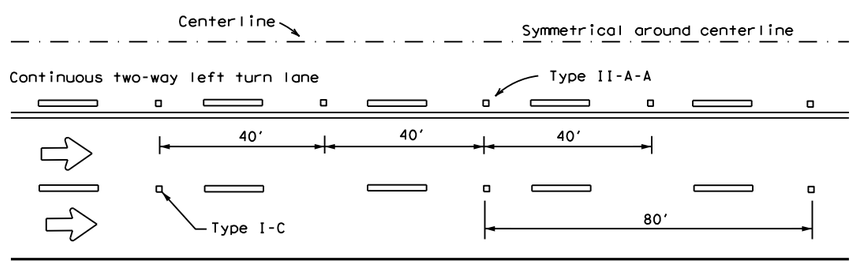
CENTERLINE FOR ALL TWO LANE ROADWAYS



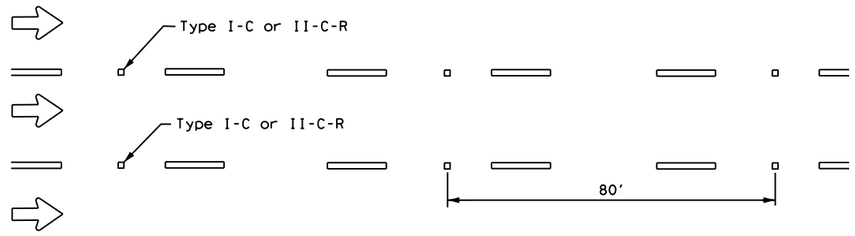
CENTERLINE & LANE LINES FOR FOUR LANE TWO-WAY HIGHWAYS



DETAIL "A" **DETAIL "B"** **DETAIL "C"**

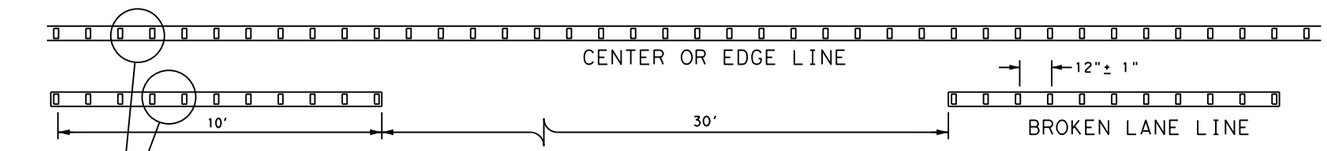


CENTERLINE AND LANE LINES FOR TWO-WAY LEFT TURN LANE



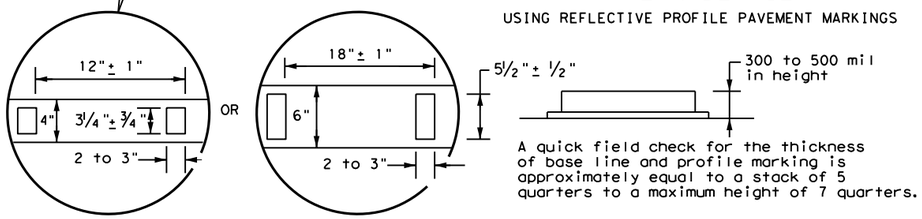
LANE LINES FOR ONE-WAY ROADWAY (NON-FREEWAY FACILITIES)

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



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

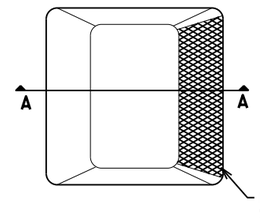
Profile markings shall not be placed on roadways with a posted speed limit of 45 MPH or less.

GENERAL NOTES

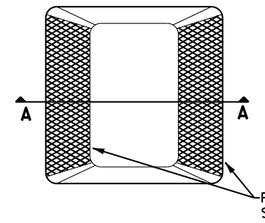
1. All raised pavement markers placed in broken lines shall be placed in line with and midway between the stripes.
2. On concrete pavements the raised pavement markers should be placed to one side of the longitudinal joints.

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

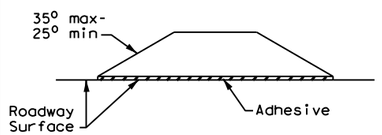
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



Type I (Top View)



Type II (Top View)



SECTION A

RAISED PAVEMENT MARKERS

Texas Department of Transportation

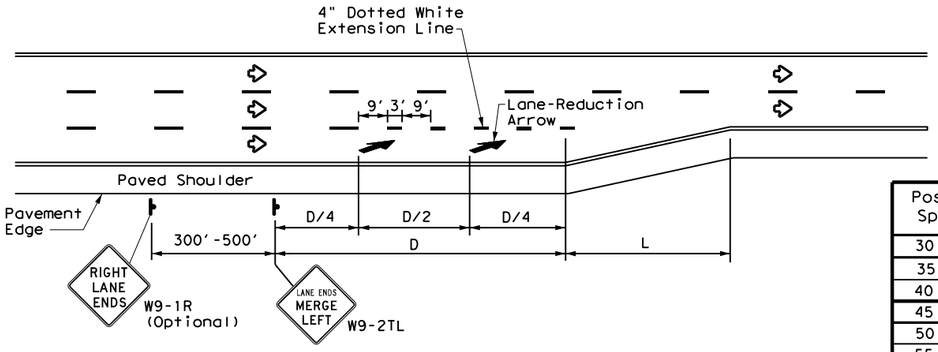
Traffic Safety Division Standard

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

FILE: pm2-20.dgn	DN:	CK:	DW:	CK:
©TxDOT April 1977	CONT	SECT	JOB	HIGHWAY
REVISIONS 4-92 2-10 5-00 2-12 8-00 6-20	0177	14	037	SL 494
	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY		119

22B

DATE:
FILE:

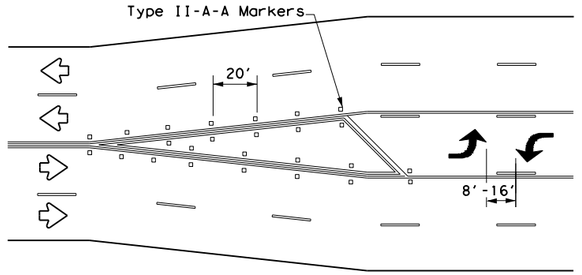


LANE REDUCTION

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.

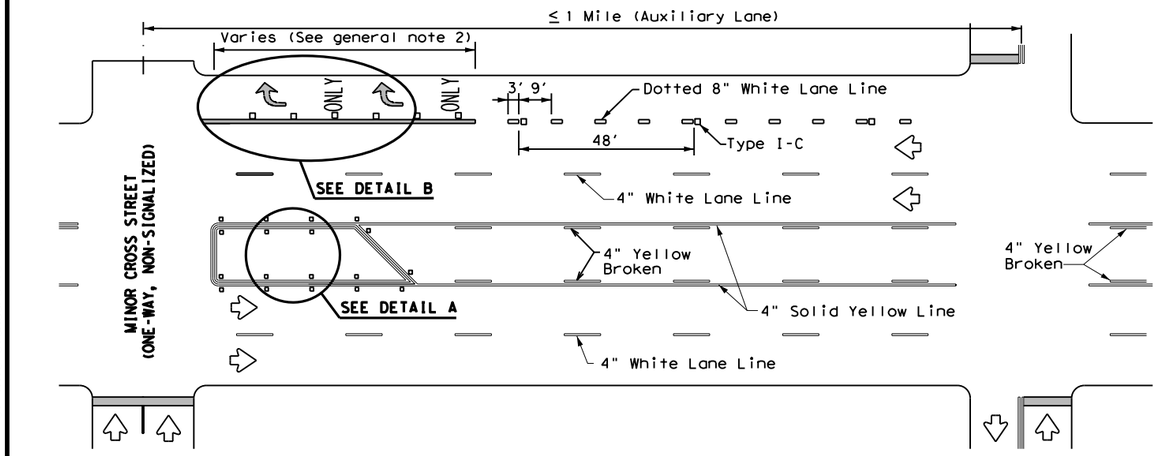
TYPICAL TRANSITION FOR TWLTL AND DIVIDED HIGHWAY

GENERAL NOTES

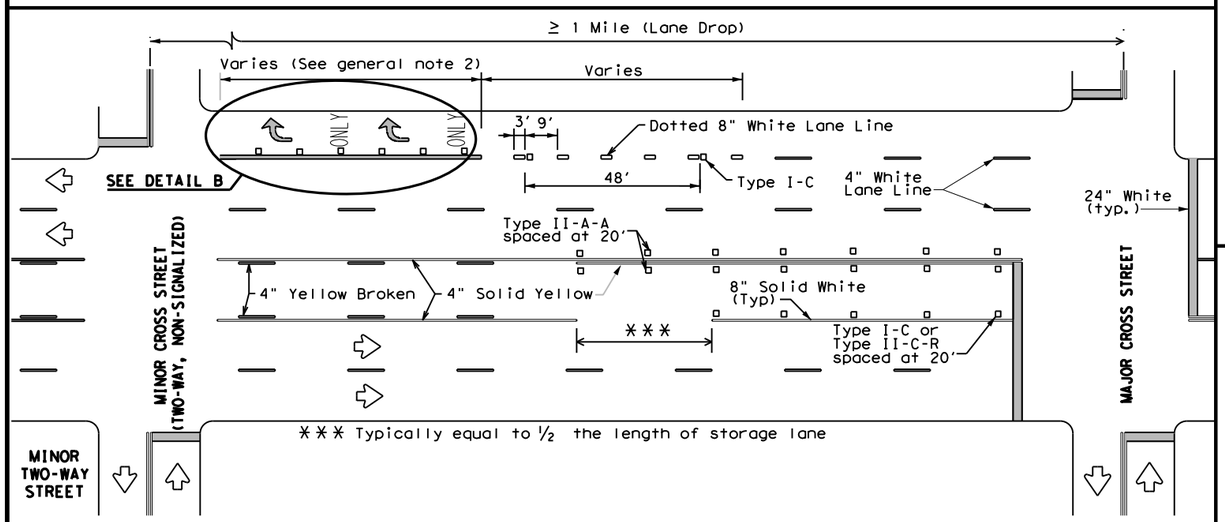
1. Lane use word and arrow markings shall be used where through lanes approaching an intersection become mandatory turn lanes. Lane use word and arrow markings should be used in auxiliary lanes of substantial length. Lane use arrow markings or word and arrow markings may be used in other lanes and turn 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

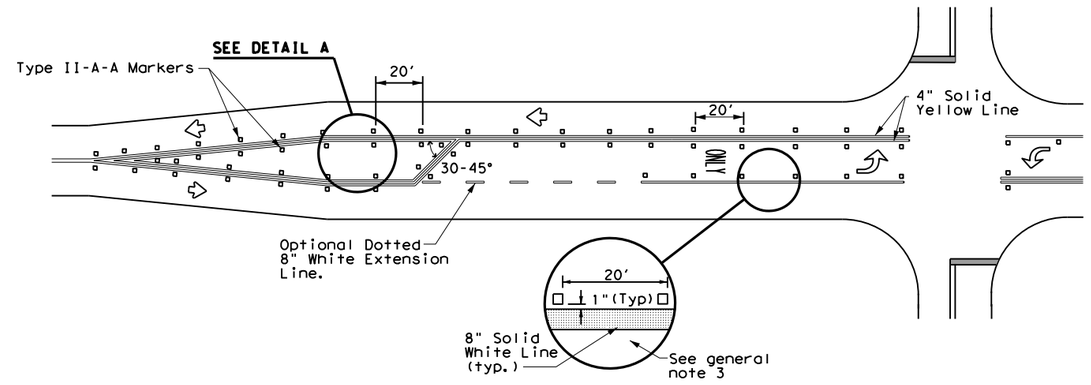
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



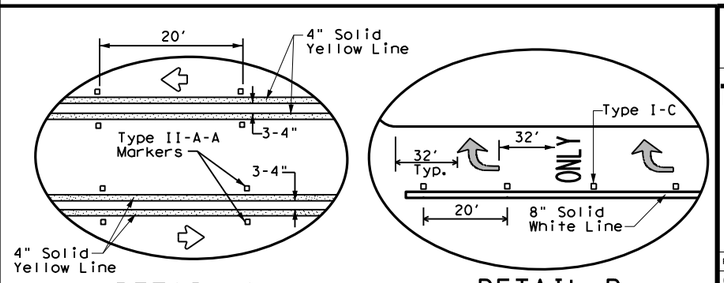
TYPICAL TWLTL AT ONE-WAY STREET AND RIGHT TURN AUXILIARY LANE



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

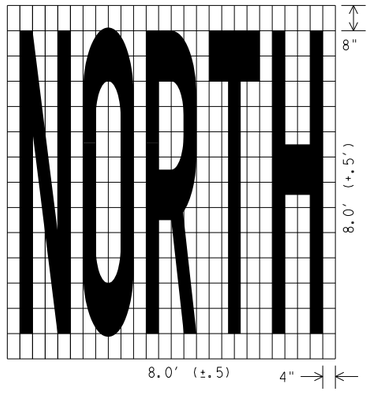
TWO-WAY LEFT TURN LANES, RURAL LEFT TURN BAYS, AND LANE REDUCTION PAVEMENT MARKINGS

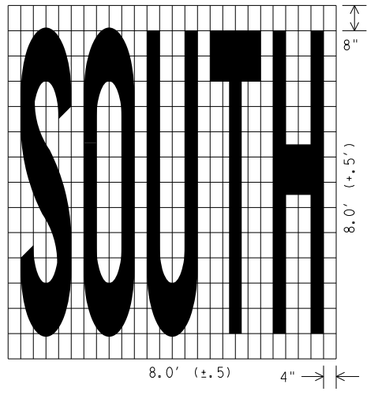
PM(3)-20

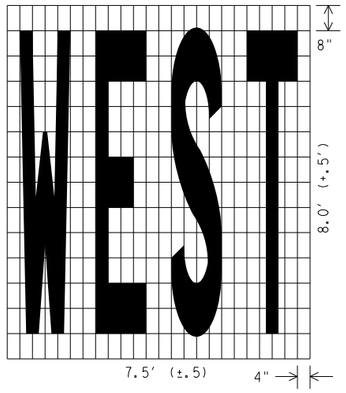
FILE: pm3-20.dgn	DN:	CK:	DW:	CK:
© TxDOT April 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS	0177	14	037	SL 494
5-00 2-10	DIST	COUNTY		SHEET NO.
8-00 2-12	HOU	MONTGOMERY		120
3-03 6-20				

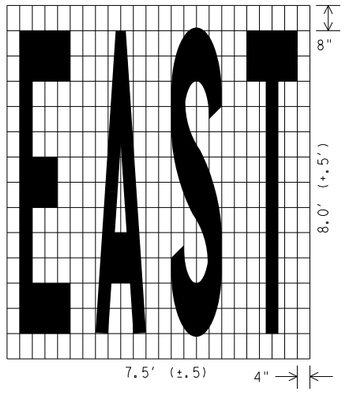
220

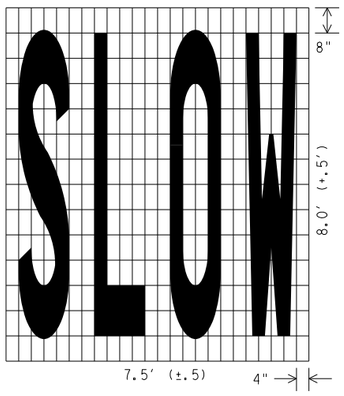
DATE:
FILE:

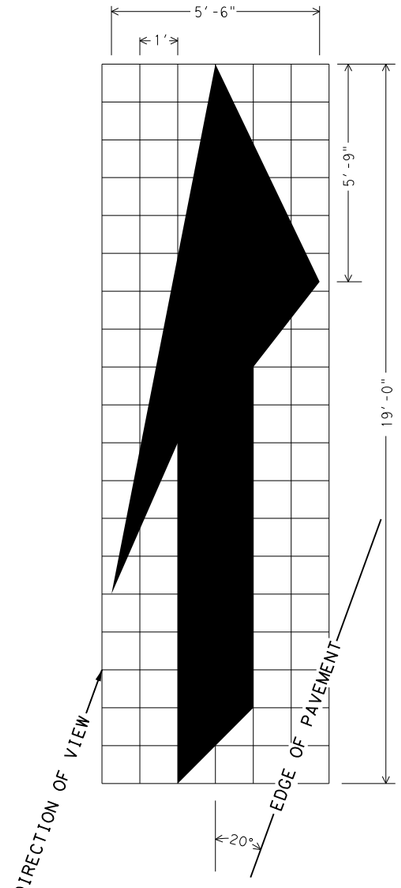






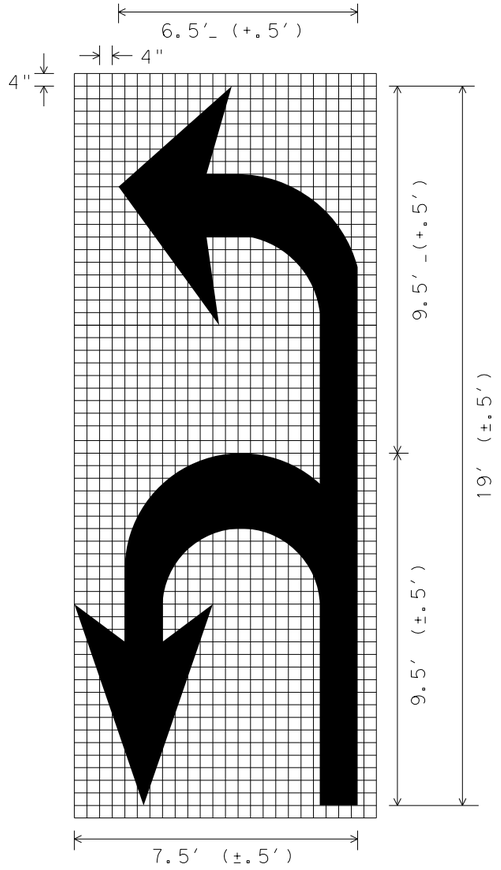




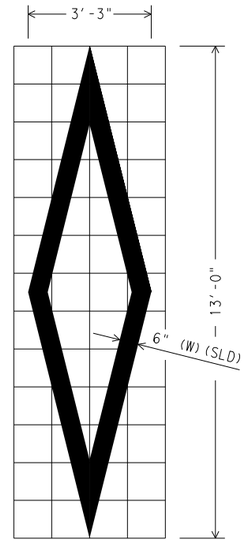


ISOMETRIC ARROW

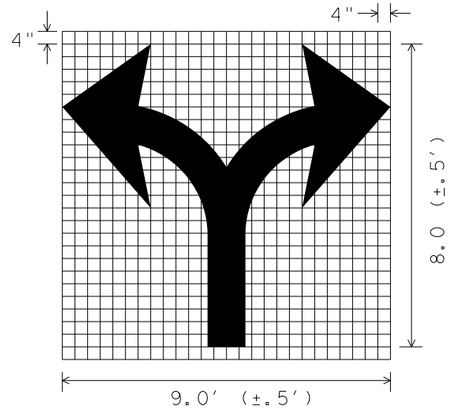
12 INCH GRID
AREA = 42 SQ. FT.
RIGHT LANE DROP ARROW
(FOR LEFT LANE, USE MIRROR IMAGE)



U-L ARROW



DIAMOND SYMBOL



SCALE 1/4" = 1′

Texas Department of Transportation
Houston District

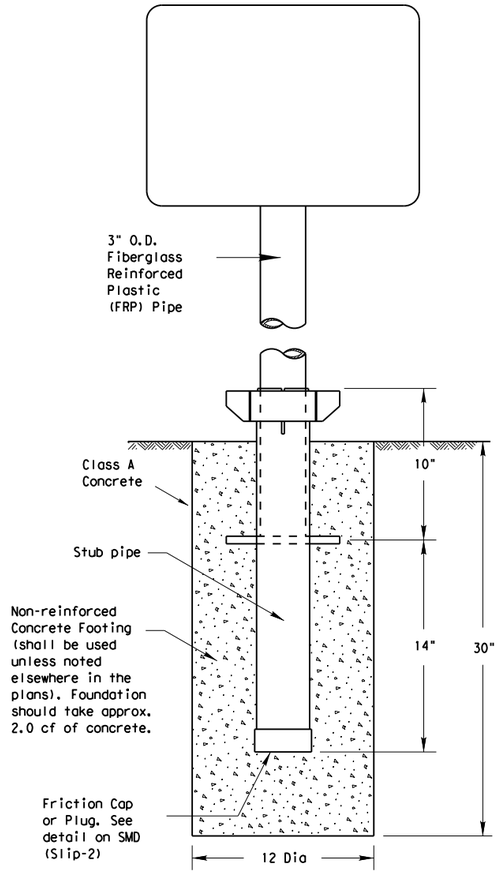
PAVEMENT MARKINGS (WORDS, ARROWS & SYMBOLS)

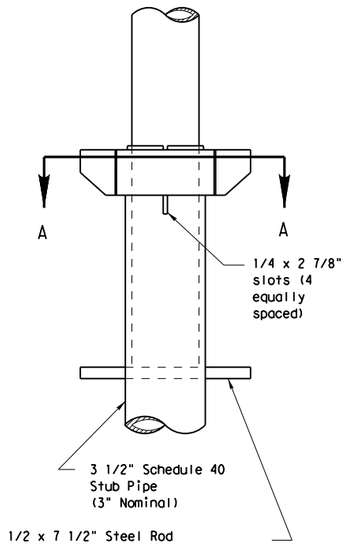
PM(WAS)-07

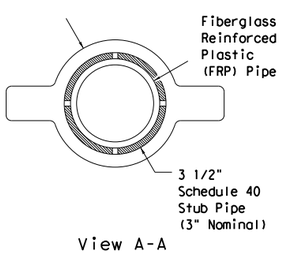
FILE:	DN:	CK:	DW:	CK:
© TxDOT 2007	DIST	FED REG	PROJECT NO.	SHEET
REVISIONS 03-19-07	HOU	6		121
	COUNTY	CONTROL	SECT	JOB	HIGHWAY
	MONTGOMERY	0177	14	037	SL 494

STD-N31

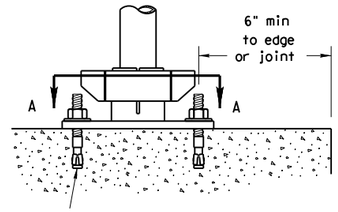
Universal Anchor System with Fiberglass Reinforced Plastic (FRP) Post







SM RD SGN ASSM TY FRP(X)UA(P)



Concrete anchor consists of 5/8" diameter stud bolt with UNC series bolt threads on the upper end. A heavy hex nut per ASTM A563 and hardened washer per ASTM F436. The stud bolt shall have minimum yield and ultimate tensile strengths of 50 and 75 ksi, respectively. Nuts, bolts and washers shall be galvanized per Item 445, "Galvanizing." Top of bolt shall extend at least flush with top of nut when installed. The anchor, when installed in 4000 psi normal-weight concrete with a 3 3/8" minimum embedment, shall have a minimum allowable tension and shear of 2450 and 1525 psi, respectively. 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.

BOLT-DOWN DETAILS

SM RD SGN ASSM TY FRP(X)UB(P)

GENERAL NOTES:

1. FRP sign supports for a single type sign support may be used for signs up to and including 16 square feet. Dual post installation may be used for signs up to and including 32 square feet.
2. All nuts, bolts and washers shall be galvanized per Item 445, "Galvanizing."
3. See the Traffic Operations Division website for detailed drawings of sign clamps. The website address is: http://www.txdot.gov/publications/traffic.htm

FRP POST REQUIREMENTS

1. Materials shall conform to the requirements of Departmental Material Specification DMS-4410 and will be furnished in a yellow or gray color as specified elsewhere in the plans.
2. Thickness of FRP sign support is 0.125" + 0.031", - 0.0".
3. FRP sign supports are prequalified by the Traffic Operations Division. Prequalification procedures are obtained by writing:
   Texas Department of Transportation
   Traffic Operations Division
   125 East 11th Street
   Austin, Texas 78701-2483

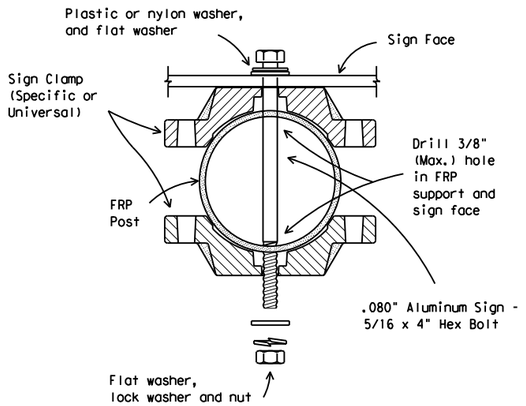
UNIVERSAL ANCHOR SYSTEM INSTALLATION PROCEDURES

1. Dig foundation hole. Where solid rock is encountered at ground level, the foundation shall be a minimum depth of 18". When solid rock is encountered below ground level, the foundation shall extend in the solid rock a minimum depth of 18" or provide a minimum foundation depth of 30". If solid rock is encountered, the socket/stub may be reduced in length as required to a minimum length of 18". Any material removed from the socket/stub shall be from the bottom and the clearance requirements given on SMD(GEN) must be followed. The inner surfaces of the socket/stub must remain free of concrete or other debris.
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. Insert base post in foundation hole to depths shown and fill hole with concrete. Cut base post from bottom and ensure a minimum of 18" embedment if installed in solid rock.
4. Level and plumb the base post with coupler using a torpedo level and let concrete set a minimum of 4 days, unless otherwise directed by Engineer. Bottom of base post slots shall be above the concrete footing.
5. Attach sign to FRP post.
6. Insert sign post into base post. Lower until the post comes to rest on the steel rod.
7. Use hammer to ensure the coupler is firmly seated. Top of coupler should be level with top of base post in most instances.
8. Check sign to ensure there is no twist. If loose, increase the tightening of coupler.

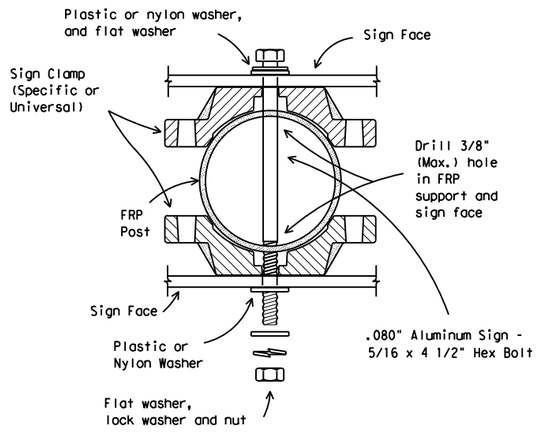
BOLT DOWN SIGN SUPPORT

1. Position base plate with coupler on existing concrete.
2. Drill holes into concrete and insert the 5/8" diameter bolts with wedge anchors, and tighten nuts.
3. Attach sign to FRP post.
4. Insert bottom of sign post into pipe stub.
5. Use hammer to ensure the coupler is firmly seated. Top of coupler should be level with top of base post in most instances.
6. Check sign to ensure there is no twist. If loose, increase the tightening of coupler.

Typical Sign Mounting Detail for FRP Support with Single Sign



Typical Sign Mounting Detail for FRP Support with Back-to-Back Signs



Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS UNIVERSAL ANCHOR SYSTEM WITH FRP POST

SMD(FRP)-08

REVISIONS
9-08

DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494

DIST	COUNTY	SHEET NO.
HOU	MONTGOMERY	122

DATE:
FILE:

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

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)

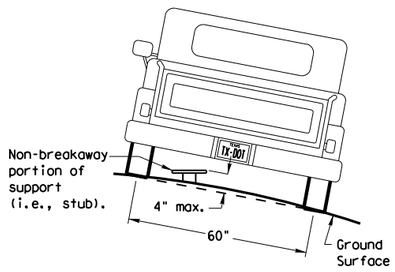
Anchor Type

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) to (SLIP-3))

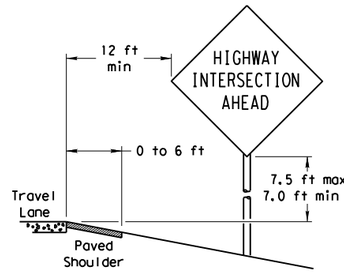
REQUIRED CLEARANCE FOR BREAKAWAY SUPPORT



To avoid vehicle undercarriage snagging, any substantial remains of a breakaway support, when it is broken away, should not project more than 4 inches above a 60-inch chord (i.e., typical space between wheel paths).

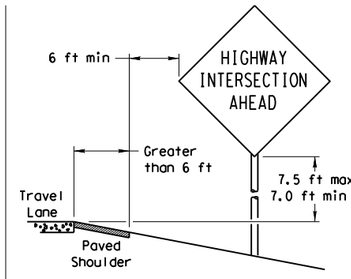
SIGN LOCATION

PAVED SHOULDERS



LESS THAN 6 FT. WIDE

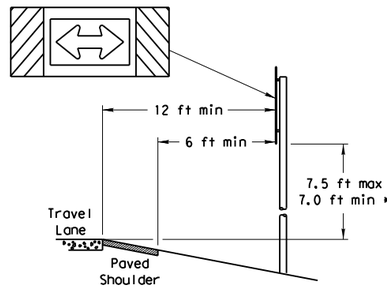
When the shoulder is 6 ft. or less in width, the sign must be placed at least 12 ft. from the edge of the travel lane.



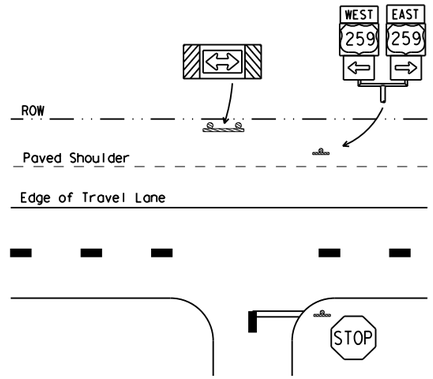
GREATER THAN 6 FT. WIDE

When the shoulder is greater than 6 ft in width, the sign must be placed at least 6 ft. from the edge of the shoulder.

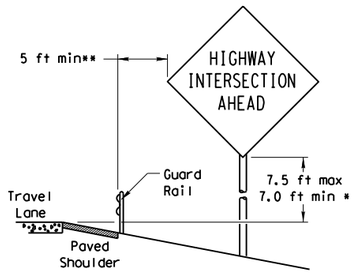
T-INTERSECTION



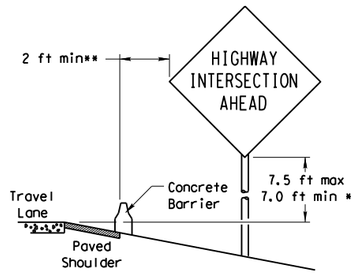
When this sign is needed at the end of a two-lane, two way roadway, the right edge of the sign should be in line with the centerline of the roadway. Place as close to ROW as practical.



BEHIND BARRIER



BEHIND GUARDRAIL



BEHIND CONCRETE BARRIER

**Sign clearance based on distance required for proper guard rail or concrete barrier performance.

* Signs shall be mounted using the following condition that results in the greatest sign elevation:

(1) a minimum of 7 to a maximum of 7.5 feet above the edge of the travel lane or

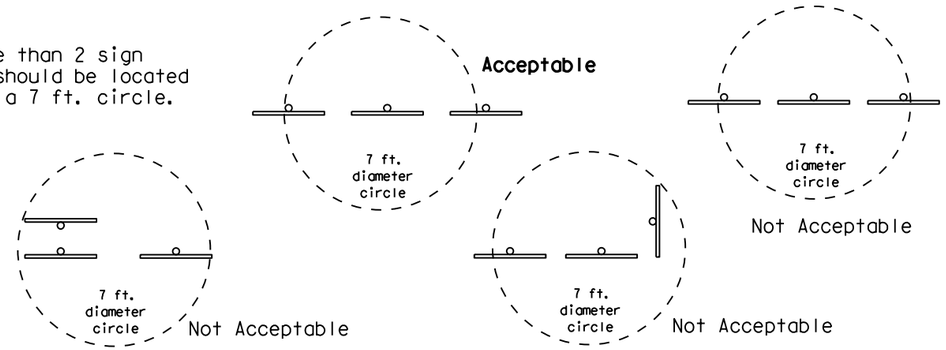
(2) a minimum of 7 to a maximum of 7.5 feet above the grade at the base of the support when sign is installed on the backslope.

The maximum values may be increased when directed by the Engineer.

See the Traffic Operations Division website for detailed drawings of sign clamps, Triangular Slipbase System components and Wedge Anchor System components.

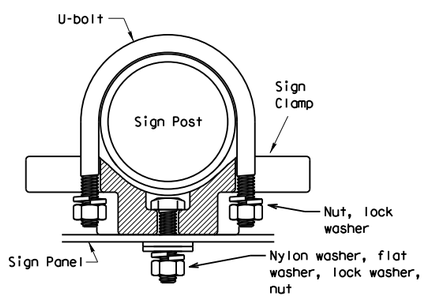
The website address is:
http://www.txdot.gov/publications/traffic.htm

No more than 2 sign posts should be located within a 7 ft. circle.



TYPICAL SIGN ATTACHMENT DETAIL

Single Signs

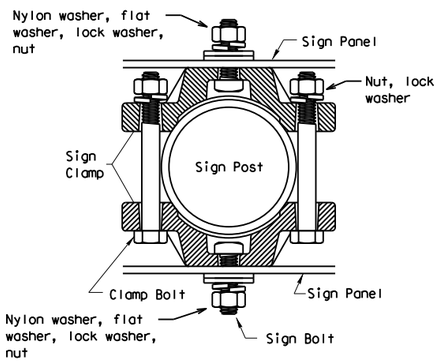


Bolts used to mount sign panels to the clamp are 5/16-18 UNC galvanized square head with nut, nylon washer, flat washer and lock washer. The bolt length is 1 inch for aluminum.

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.

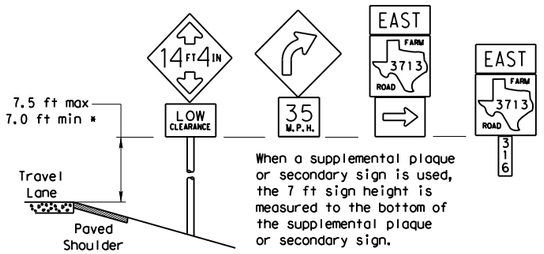
Sign clamps may be either the specific size clamp or the universal clamp.

Back-to-Back Signs



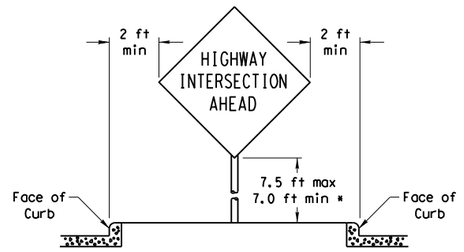
Pipe Diameter	Approximate Bolt Length	
	Specific Clamp	Universal Clamp
2" nominal	3"	3 or 3 1/2"
2 1/2" nominal	3 or 3 1/2"	3 1/2 or 4"
3" nominal	3 1/2 or 4"	4 1/2"

SIGNS WITH PLAQUES



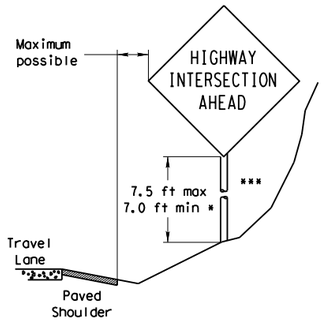
When a supplemental plaque or secondary sign is used, the 7 ft sign height is measured to the bottom of the supplemental plaque or secondary sign.

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

9-08 REVISIONS

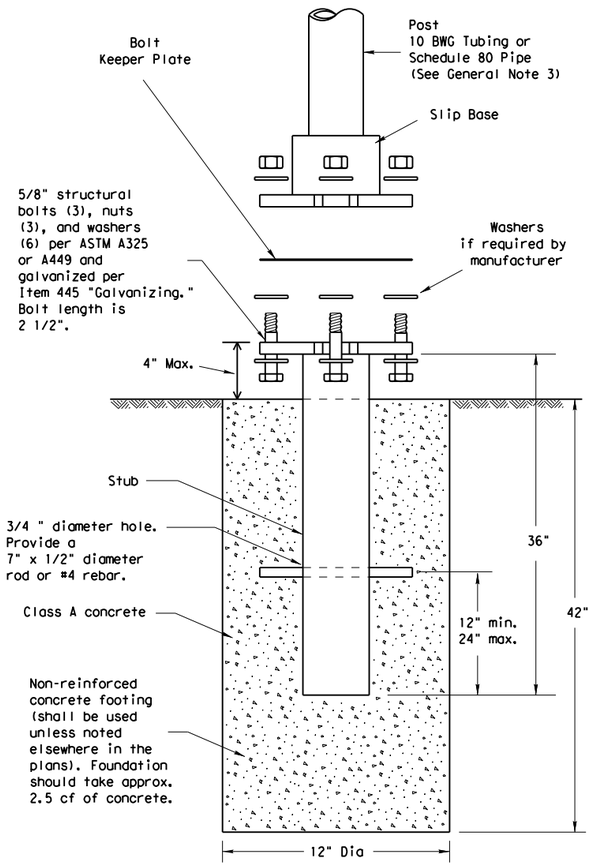
DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		123

26A

DATE:
FILE:

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.

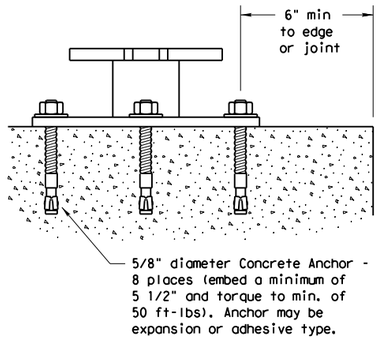
   Schedule 80 Pipe (2.875" outside diameter)
   - 0.276" nominal wall thickness
   - Steel tubing per ASTM A500 Gr C
   - Other seamless or electric-resistance welded steel tubing or pipe with equivalent outside diameter and wall thickness may be used if they meet the following:
     - 46,000 PSI minimum 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

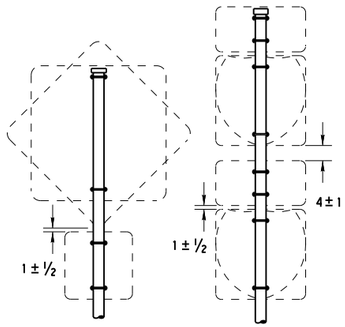
SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS TRIANGULAR SLIPBASE SYSTEM

SMD(SLIP-1)-08

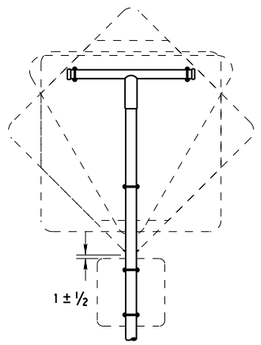
DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
REVISIONS 9-08			

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		124

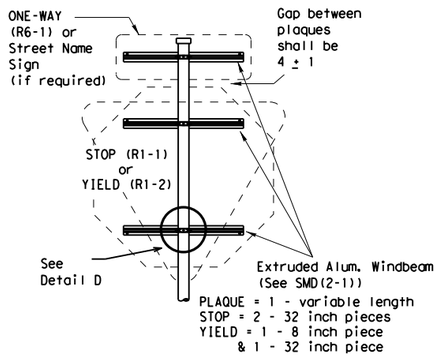
DATE:
FILE:



SM RD SGN ASSM TY XXXXX(1)XX(P)

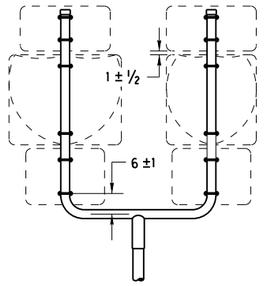


SM RD SGN ASSM TY XXXXX(1)XX(T)

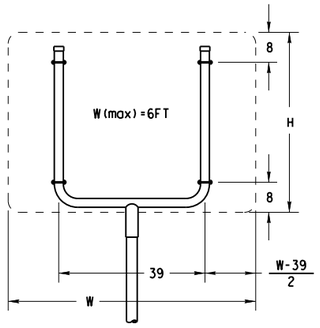


PLAQUE = 1 - variable length
STOP = 2 - 32 inch pieces
YIELD = 1 - 8 inch piece
& 1 - 32 inch piece

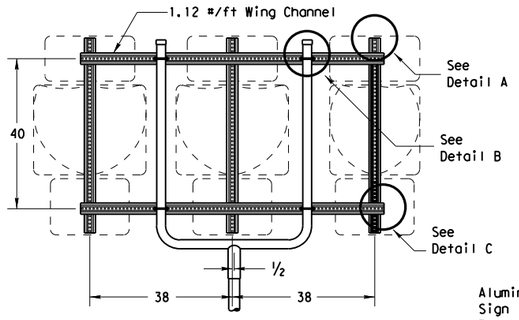
SM RD SGN ASSM TY XXXXX(1)XX(P-BM)



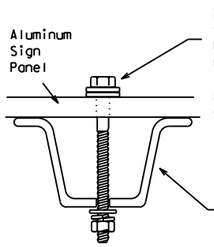
SM RD SGN ASSM TY XXXXX(1)XX(U)



SM RD SGN ASSM TY XXXXX(1)XX(U)

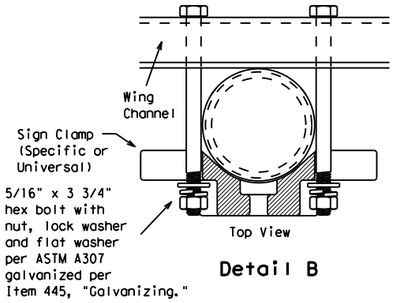


SM RD SGN ASSM TY XXXXX(1)XX(U-WC)
(See Note 11)



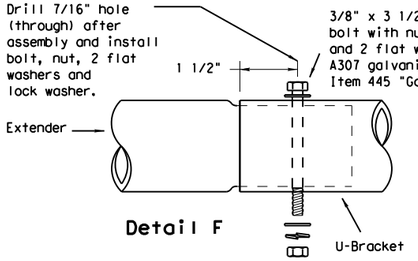
Top View

Detail A



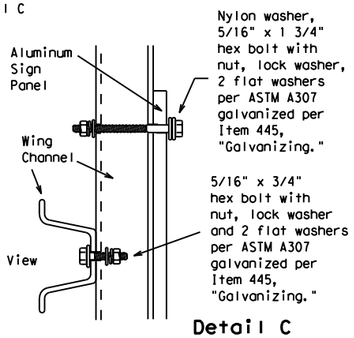
Top View

Detail B

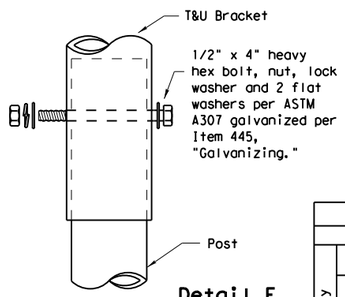


Detail F

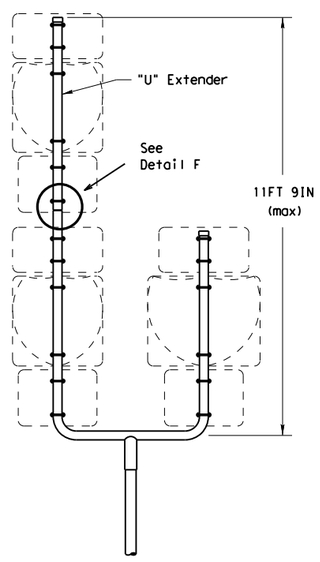
Splices shall only be allowed behind the sign substrate.



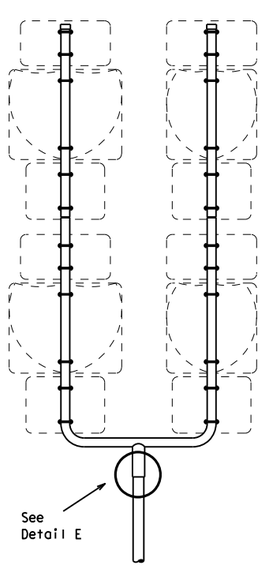
Detail C



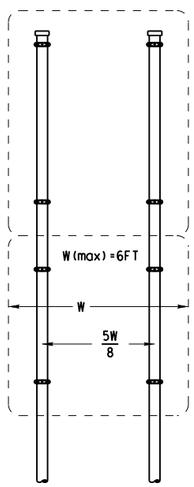
Detail E



SM RD SGN ASSM TY S80(1)XX(U-1EXT)

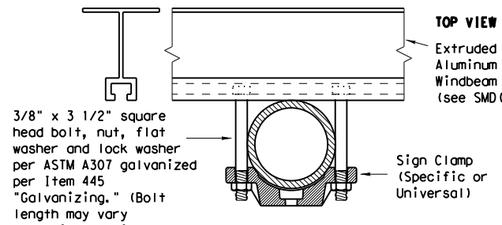


SM RD SGN ASSM TY S80(1)XX(U-2EXT)

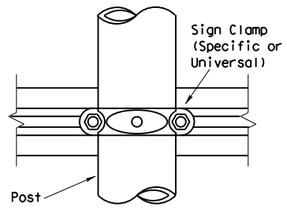


SM RD SGN ASSYM TY XXXXX(2)XX(P)

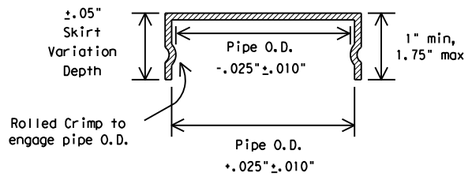
SIDE VIEW



Detail D



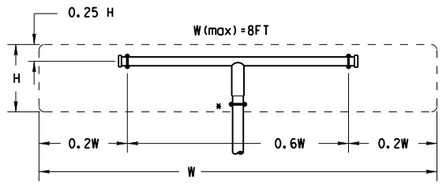
FRICTION CAP DETAIL



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.



All dimensions are in english unless detailed otherwise.

SM RD SGN ASSM TY XXXXX(1)XX(T)
(* - See Note 12)

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

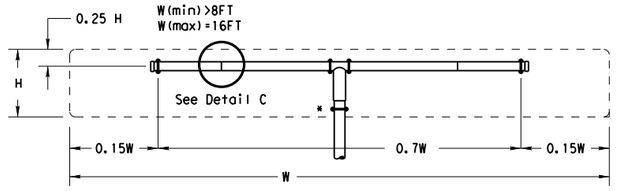
DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		125

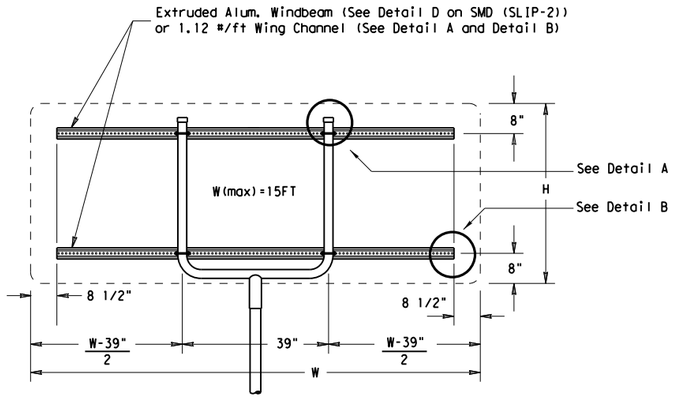
9-08 REVISIONS

DATE:
FILE:

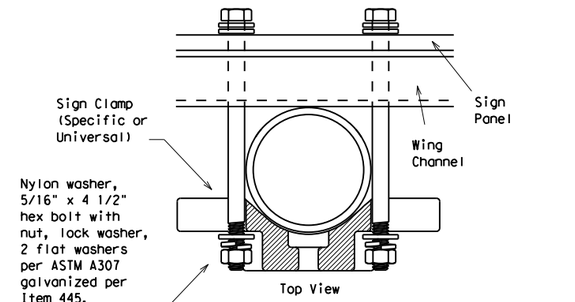
DATE:
FILE:



SM RD SGN ASSM TY XXXXX(1)XX(T-2EXT)
(* - See Note 12)

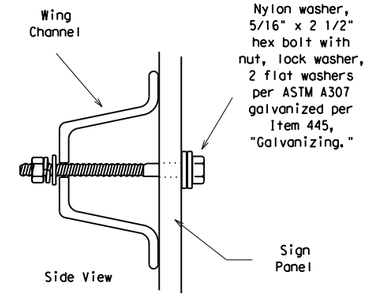


SM RD SGN ASSM TY XXXXX(1)XX(U-XX)

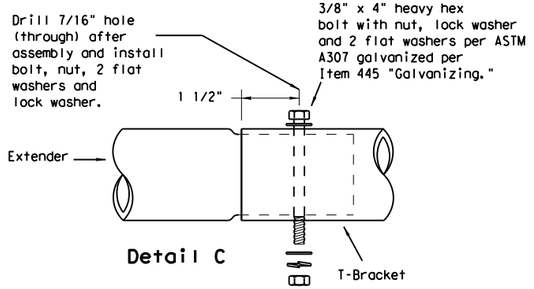


Top View

Detail A

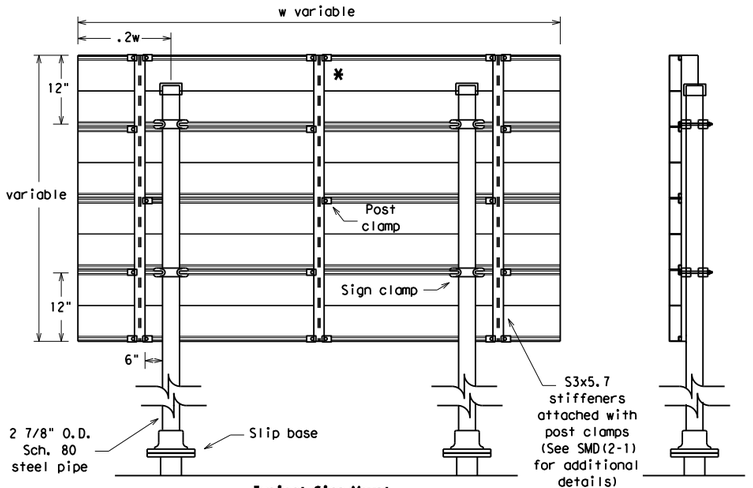


Detail B



Detail C

Splices shall only be allowed behind the sign substrate.

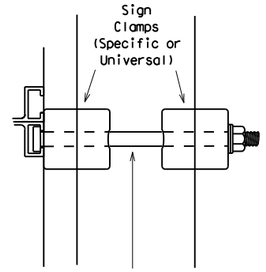


Typical Sign Mount

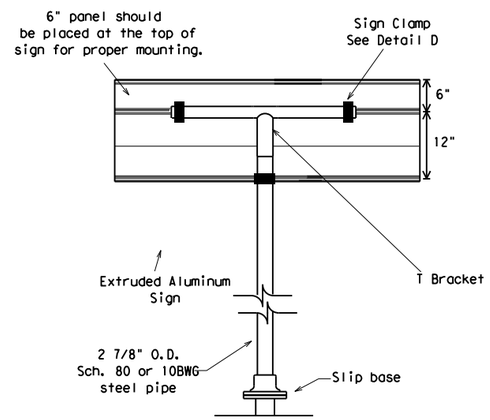
SM RD SGN ASSM TY S80(2)XX(P-EXAL)

* Additional stiffener placed at approximate center of signs when sign width is greater than 10'.

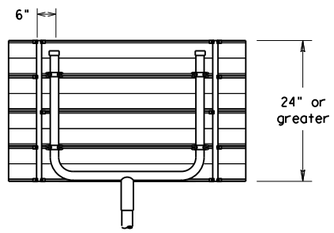
See Detail E
for clamp installation



Detail E



Extruded Aluminum Sign
With T Bracket



Use Extruded Alum. Windbeam as stiffeners
See SMD (2-1) for additional details

See Detail E
for clamp installation

Detail D
EXTRUDED ALUMINUM SIGN WITH T BRACKET

GENERAL NOTES:

SIGN SUPPORT	# OF POSTS	MAX. SIGN AREA
10 BWG	1	16 SF
10 BWG	2	32 SF
Sch 80	1	32 SF
Sch 80	2	64 SF

1. The Engineer may require that a Schedule 80 post be used in place of a 10 BWG where a sign height is abnormally high due to a fill slope.
2. Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.
3. Aluminum sign blanks shall conform to Departmental Material Specifications DMS-7110 and shall have the following minimum thicknesses: 0.080 for signs less than 7.5 sq. ft., 0.100 for signs 7.5 to 15 sq. ft., and 0.125 for signs greater than 15 sq. ft.
4. Signs that require specific supports due to reasons in addition to windloading are indicated on the "REQUIRED SUPPORT" table on this sheet.
5. For horizontal rectangular signs fabricated from flat aluminum, T-brackets are used for signs 24 inches or less in height. U-brackets are used for signs of greater height.
6. When two triangular slipbase supports are used to support a single sign, they shall not be "rigidly" connected to each other except through the sign panel. This will allow each support to act independently when impacted by an errant vehicle.
7. Wing channel shall meet ASTM A 1011 SS Gr 50 and be galvanized per ASTM A 123.
8. Excess pipe, wing channel, or windbeam shall be cut off so that it does not extend beyond the sign panel (i.e., excess support shall not be visible when the sign is viewed from the front.) Repair galvanized coating at cut support ends per Item 445, "Galvanizing."
9. Sign blanks shall be the sizes and shapes shown on the plans.
10. Additional sign clamp required on the "T-bracket" post for 24 inch high signs. Place the clamp 3 inches above bottom of sign when possible.
11. Post open ends shall be fitted with Friction Caps.

REQUIRED SUPPORT		
	SIGN DESCRIPTION	SUPPORT
Regulatory	48-inch STOP sign (R1-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	60-inch YIELD sign (R1-2)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	48x16-inch ONE-WAY sign (R6-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	36x48, 48x36, and 48x48-inch signs	TY 10BWG(1)XX(T)
	48x60-inch signs	TY S80(1)XX(T)
Warning	48x48-inch signs (diamond or square)	TY 10BWG(1)XX(T)
	48x60-inch signs	TY S80(1)XX(T)
	48-inch Advance School X-ing sign (S1-1)	TY 10BWG(1)XX(T)
	48-inch School X-ing sign (S2-1)	TY 10BWG(1)XX(T)
	Large Arrow sign (W1-6 & W1-7)	TY 10BWG(1)XX(T)

Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS
SMALL ROADSIDE SIGNS
TRIANGULAR SLIPBASE SYSTEM

SMD(SLIP-3)-08

DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

REVISIONS
9-08

CONT	SECT	JOB	HIGHWAY
0177	14	037	SL 494
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY		126

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

No Additional Comments

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

See more comment section

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 TxDOT Engineer when activities permitted under the United States Army Corps of Engineers (USACE) Nationwide Permit (NWP) or Individual Permit (IP) has been completed.

DATE: Jul 23, 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	0177	14	037	LP 494
UPDATED section V. text and added definition (10/17) ADDED USCG and USACE notes in Section VII (04/18)	DIST	COUNTY		SHEET NO.
	HOU	Montgomery		127

VII. OTHER ENVIRONMENTAL ISSUES	VII. OTHER ENVIRONMENTAL ISSUES	VII. OTHER ENVIRONMENTAL ISSUES
For the sandbank pocketbook, Freshwater Mussel BMPs and Water Quality BMPs will be incorporated. All Freshwater Mussel and Water Quality BMPs listed in the TPW 2013 MOU Best Management Practices 2017 Revision are directly related to the project and should be followed. For the Woodhouse's toad and the Strecker's chorus frog, Amphibian and Aquatic Reptile BMPs and Water Quality BMPs will be incorporated including the following: -Amphibian and Aquatic Reptile BMPs that will be directly related to this project include (3)(a), (3)(b), (3)(c), (3)(d) (3)(e), and (3)(h) of the TPW 2013 MOU Best Management Practices 2017 Revision. -When water is adjacent to water, Water Quality BMPs will also be incorporated as part of the SWPPP for a construction general permit or any conditions of the 401 water quality certification for the project will be implemented. For the Sabine shiner, Fish BMPs will be incorporated. Because work will be done within the stream, Early Coordination with TPWD is required. Water Quality BMPs will also be incorporated during construction. For the Rafinesque's big-eared bat, the big brown bat, and the southern myotis bat, Bat BMPs will be incorporated. Bat BMPs that will be directly related to the project include the following: -activities that have the potential to impact structures, a qualified biologist will perform habitat assessment and occupancy survey of the features with roost potential as early as possible or within one year before project letting; -if bats are present or there are recent signs of occupation, appropriate measures will be taken to ensure bats are not harmed (this includes non-lethal exclusion activities or timing project construction at times bats are not present); -exclusion devices should be installed by a qualified biologist between Sept 1 and March 31 with exclusion devices being used for a minimum or 7 days when minimum nighttime temperature are above 50 degrees Fahrenheit and minimum daytime temperatures are above 70 degrees Fahrenheit; -if features used by bats are removed as a result of construction, replacement features should incorporate batfriendly design; retain mature, large diameter hardwood forest species 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. For the swamp rabbit, contractors will be advised of potential occurrence in the project area, and to avoid harming the species if encountered. For the Correll's false dragon-head, Vegetation BMPS will be incorporated. Vegetation BMPs that will be directly related to the project include the following: -Minimize the amount of vegetation cleared; -Impacted vegetation should be replaced with in-kind on-site replacement/restoration of native species; -Avoid vegetation clearing activities during the general bird nesting season to minimize adverse impacts to birds. For the eastern box turtle, the slender glass lizard, the timber rattlesnake, and the western box turtle, Terrestrial Reptile BMPs will be incorporated. Reptile BMPs that will be directly related to the project include the following: -apply hydromulching and/or hydroseeding in areas for soil stabilization and/or revegetation of disturbed areas where feasible; -for open trenches and excavated pits, install escape ramps at an angle of 45 degrees or less in areas left uncovered; -visually inspect excavation areas for trapped wildlife prior to backfilling; -inform contractors that if reptiles are found on project site, allow species to safely leave the project area; -avoid or minimize disturbing or removing downed trees, rotting stumps, and leaf litter where feasible; -contractors will be advised of potential occurrence of species within the project area and to avoid harming the species if encountered.		

DATE: May 09, 2018
FILE:

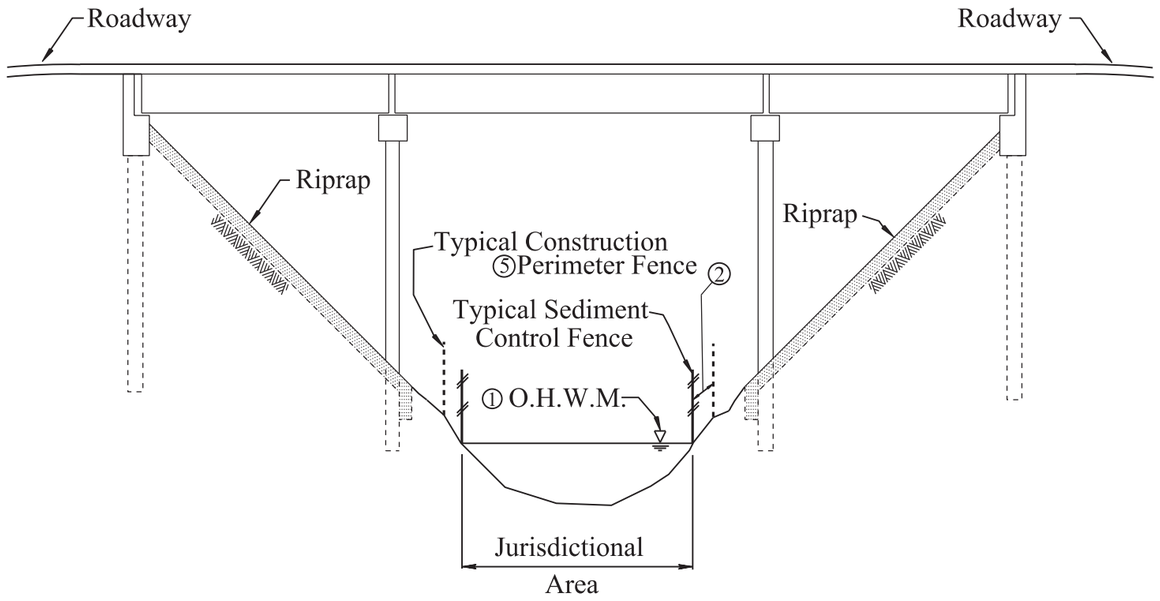
Texas Department of Transportation

TxDOT Houston District

ENVIRONMENTAL PERMITS, ISSUES AND COMMITMENTS

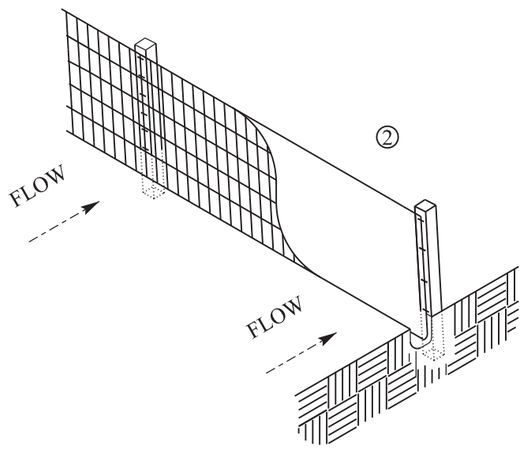
EPIC

FILE: EPIC Additional Comment Sheet.dgn	DN:	CK:	DW:	CK:
© TxDOT: March 2017	CONT	SECT	JOB	HIGHWAY
REVISIONS	0177	14	0347	LP 494
	DIST	COUNTY		SHEET NO.
	HOU	Montgomery		127A



TYPICAL RELATIONSHIP OF O.H.W.M., SEDIMENT CONTROL & CONSTRUCTION FENCING, PILING/DRILL SHAFT & RIPRAP TOE WALLS

N.T.S.



TEMPORARY SEDIMENT CONTROL 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 mark (elevation) (O.H.W.M.) is determined by the Environmental Project Manager and elevation is set by a Surveyor.

2. All non-permitted jurisdictional wetlands and waters within or adjacent to the project area shall be avoided and protected by signage and fencing, including both sediment control and construction fencing (see note 5). Construction equipment, materials/sediment are not allowed in the non-permitted wetlands/waters.

3. Any wetlands permitted for impacts/fill and non-permitted wetlands are shown elsewhere on plans or United States Army Corps of Engineers (USACE) permit.

4. The Contractor will be required to obtain the appropriate permits if she/he alters the construction method or deviates from the permit.

5. See item 506 for temporary sediment control fence and for construction perimeter fence. See item 502 for signs.

Texas Department of Transportation

TxDOT Houston District

ENVIRONMENTAL PERMITS, ISSUES AND COMMITMENTS

EPIC

FILE: Wetland EPIC Sheet.dgn	DN:	CK:	DW:	CK:
© TxDOT: March 2017	CONT	SECT	JOB	HIGHWAY
REVISIONS	0177	14	037	LP 494
ADDED construction fencing (06/17)	DIST	COUNTY		SHEET NO.
UPDATED typical relationship diagram (09/17)	HOU	Montgomery		127B
UPDATED notes 2 and 5 (09/17)				
UPDATED note 5 (05/18)				

DATE:
FILE:

SITE DESCRIPTION

PROJECT LIMITS: FROM FM 1485 WEST TO FM 1485 EAST

PROJECT DESCRIPTION: CONSISTING OF GRADING, EMBANKMENT, CULVERT EXTENSION, CONCRETE PAVING, TRAFFIC SIGNALS, SIGNING, PAVEMENT MARKINGS, ETC.

MAJOR SOIL DISTURBING ACTIVITIES: DITCH WORK, BRIDGE CLASS CULVERT EXTENSION, EMBANKMENT, EXTENDING LEFT TURN LANES, AND TREE CLEARING.

TOTAL PROJECT AREA: 3.41

TOTAL AREA TO BE DISTURBED: 0.21

WEIGHTED RUNOFF COEFFICIENT: (AFTER CONSTRUCTION): 0.59

EXISTING CONDITION OF SOIL & VEGETATIVE COVER AND % OF EXISTING VEGETATIVE COVER: N/A

NAME OF RECEIVING WATERS: CANEY CREEK

EROSION AND SEDIMENT CONTROLS

SOIL STABILIZATION PRACTICES:

- ___ TEMPORARY SEEDING
- X PERMANENT PLANTING, SODDING, OR SEEDING
- ___ MULCHING
- ___ SOIL RETENTION BLANKET
- ___ BUFFER ZONES
- ___ 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
- ___ EROSION CONTROL LOGS

OTHER:

NARRATIVE - SEQUENCE OF CONSTRUCTION (STORM WATER MANAGEMENT) ACTIVITIES:

1. INSTALL SILT FENCE AND ROCK FILTER DAMS.
2. CLEAR TREES, EMBANK, EXTEND LEFT TURN LANES, AND DITCH WORK.
3. REMOVE EROSION CONTROL FEATURES AFTER DISTURBED AREA HAS STABILIZED

STORM WATER MANAGEMENT:

STORM WATER WILL BE CONVEYED VIA EXISTING PARALLEL TO OUTFALLS. THIS SYSTEM WILL CARRY DRAINAGE WITHIN THE RIGHT OF WAY TO WHERE CROSS DRAINAGE OCCURS.

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 calendar 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: ALL SANITARY WASTE WILL BE COLLECTED FROM THE PORTABLE UNITS AS NECESSARY OR AS REQUIRED BY LOCAL REGULATION BY A LICENSED SANITARY WASTE MANAGEMENT CONTRACTOR.

OFFSITE VEHICLE TRACKING:

- X HAUL ROADS DAMPENED FOR DUST CONTROL
- X LOADED HAUL TRUCKS TO BE COVERED WITH TARPAULIN
- X EXCESS DIRT ON ROAD REMOVED DAILY
- X 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

STATE OF TEXAS
MICAH J. SCHLUTER
136908
LICENSED
PROFESSIONAL ENGINEER

Micah J Schluter
07/28/2021

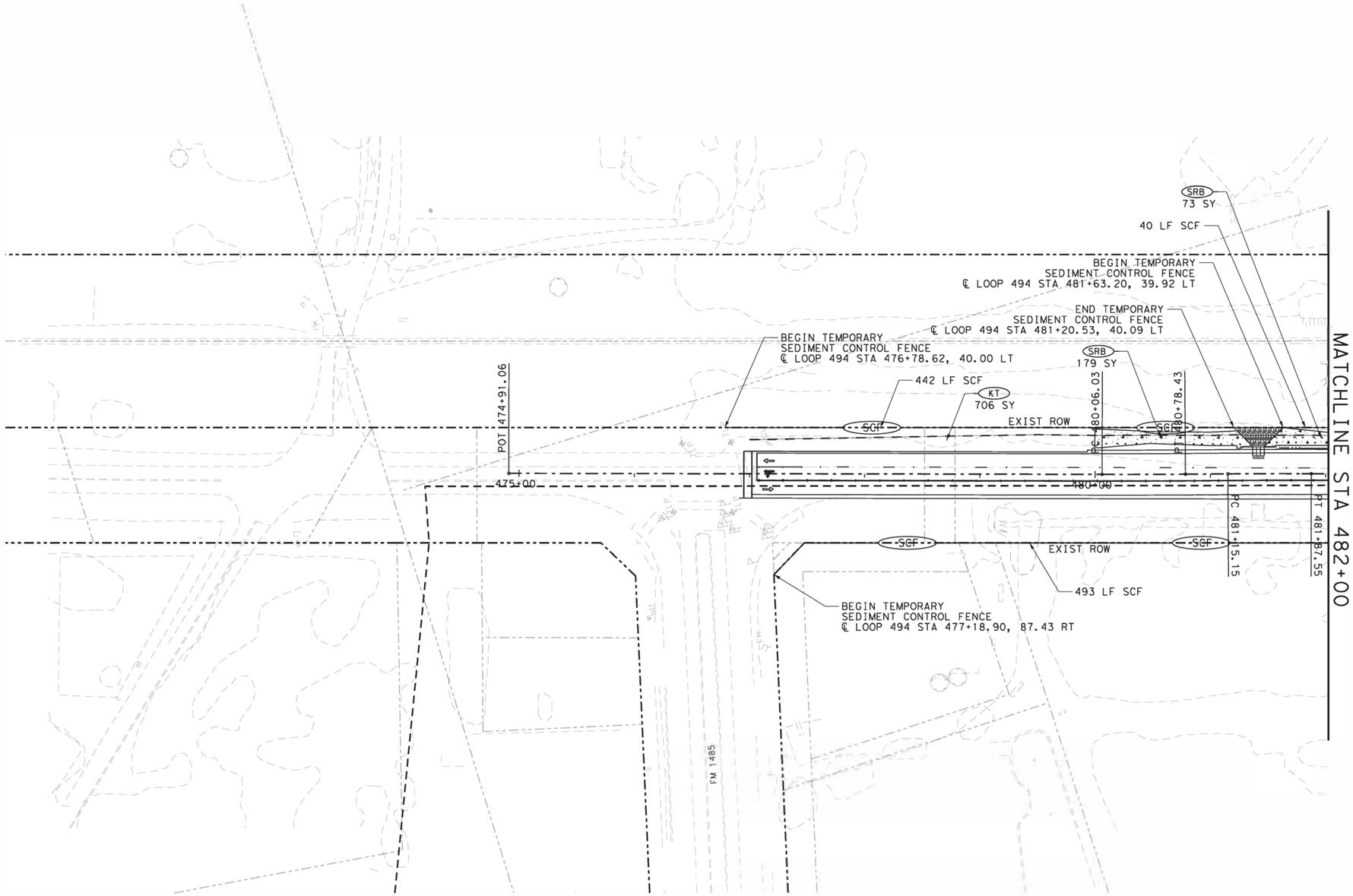
Texas Department of Transportation
Houston District

TxDOT STORM WATER POLLUTION PREVENTION PLAN

SW3P

FILE: ST001.DGN	DW: TxDot	CK: TxDot	DW: TxDot	CK: TxDot
©TxDOT JANUARY 2007	DIST	FED REG	PROJECT NO.	SHEET
REVISIONS	HOU	6		128
9/2010 INSPECTION NOTE 9/2013 INSPECTION NOTE 11/2013 SW3P TO SWP3 03/2015 2014 SPECS	COUNTY		CONTROL	SECT	JOB	HIGHWAY
	MONTGOMERY		0177	14	037	SL494

STD G:1



LEGEND

SCF	TEMP SEDIMENT CONTROL FENCE
CL-D	EROSION CONTROL LOG
RFD2	TYPE 2 ROCK FILTER DAM
RFD3	TYPE 3 ROCK FILTER DAM
	FLOW DIRECTION
KT	TEMPORARY SEEDING
SRB	TY C RETENTION BLANKET

0′ 50′ 100′
SCALE IN FEET

NOTES:

1. SEDIMENT CONTROL FENCING (SCF) AND ROCK FILTER DAMS (RFD) AS SHOWN ARE FOR THE INITIAL PHASE OF CONSTRUCTION.
2. SCF AND RFD LOCATIONS AS SHOWN MAY BE MODIFIED AS DIRECTED BY ENGINEER.
3. SCF AND RFD WILL BE REMOVED AND/OR REMOVED/REPLACED IN PORTIONS BY THE CONTRACTOR AS THE CONSTRUCTION PROGRESSES OR AS DIRECTED BY THE ENGINEER.
4. CONTRACTOR SHALL PLACE EXISTING INLET PROTECTION (EIP) ON ALL EXISTING INLETS WITHIN THE PROJECT AREA PRIOR TO BEGINNING ANY EARTH MOVING OR EXCAVATION OPERATIONS
5. REFER TO THE TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES STANDARD SHEETS FOR ADDITIONAL DETAILS, NOTES, AND OTHER REQUIREMENTS NOT SHOWN HEREON.
6. CONTRACTOR SHALL GRADE CONSTRUCTION EXIT (CE) TO PREVENT RUNOFF FROM PROJECT AND PROVIDE APPROPRIATE TRANSITION FROM CE TO ADJACENT TRAVEL LANE, OR WORK AREA.
7. REFER TO TXDOT STANDARDS EC(1)-16, EC(2)-16, AND TXDOT HOUSTON DISTRICT ECL-12.
8. CONTRACTOR SHALL PLACE EROSION CONTROL BLANKET AFTER FINAL GRADING IS COMPLETE WHERE SLOPES ARE EQUAL TO OR STEEPER THAN 1:3.
9. THE CONTRACTOR SHALL CONSTRUCT CONSTRUCTION EXITS TO PREVENT SEDIMENT FROM LEAVING THE CONSTRUCTION SITE. THE LOCATION SHALL BE SELECTED BY THE CONTRACTOR AND APPROVED BY THE ENGINEER.
10. EXISTING INLET PROTECTION SHALL CONSIST OF EROSION CONTROL LOGS PER ECL-12.
11. FIELD CONDITIONS MAY REQUIRE ALTERATION OF THE LOCATION OF SILT FENCE, ROCK BERMS, AND ANY OTHER APPROVED METHODS WHICH PREVENT CONSTRUCTION SILT AND DEBRIS FROM ENTERING THE WATERS OF TEXAS. THE ENGINEER MAY, AT HIS DISCRETION, DETERMINE NEED AND LOCATION OF ANY SW3P AND MAKE CHANGES TO FIT CONDITIONS.
12. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTROLLING TEMPORARY DRAINAGE DURING CONSTRUCTION.

NO	DATE	REVISION	APPROVED

STATE OF TEXAS
NILESH D. SHRINGARPURE
139719
LICENSED
PROFESSIONAL ENGINEER
07/26/2021
F-2677

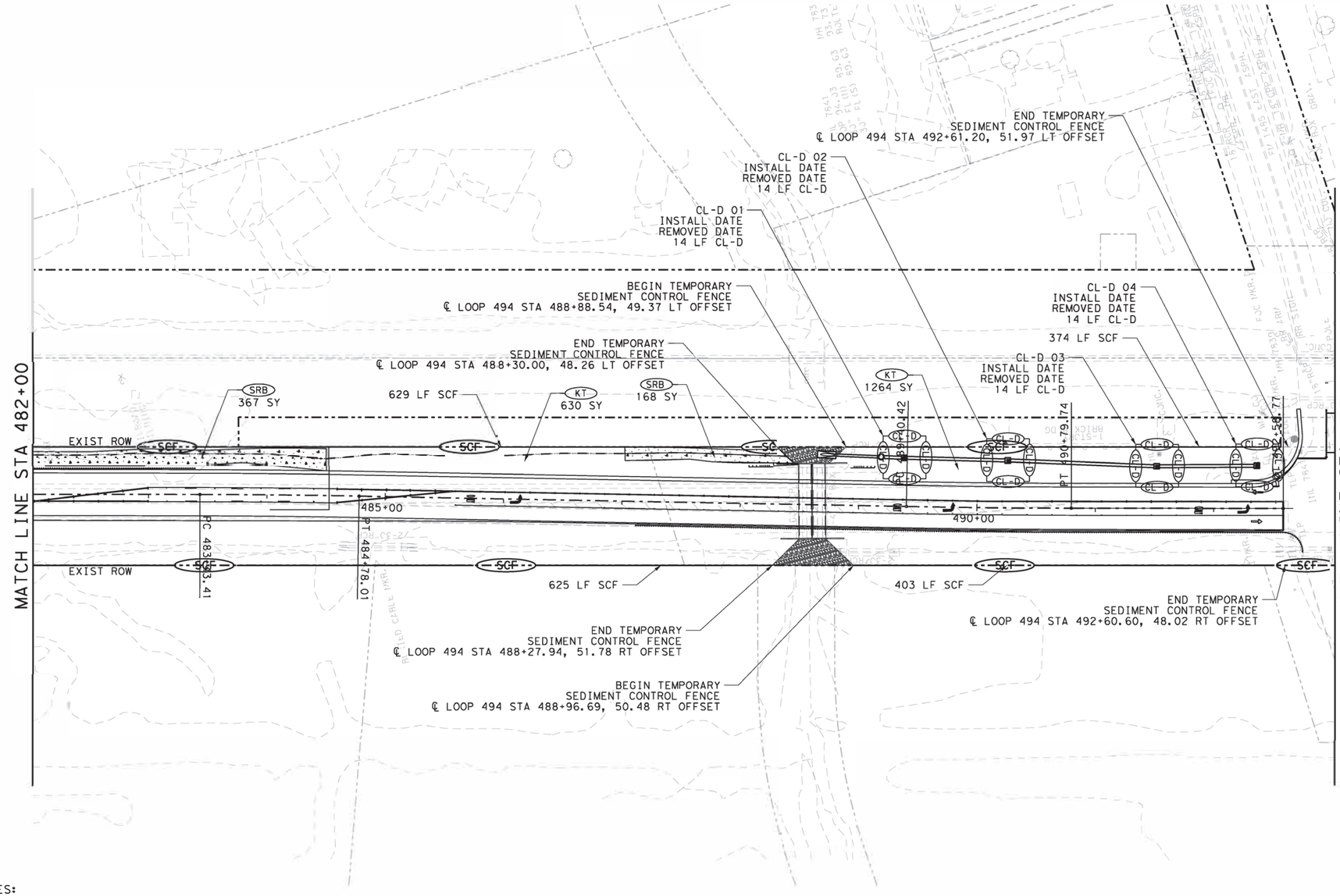
Michael Baker INTERNATIONAL
2002 W. Grand Parkway N.
Suite 325
Katy, TX 77449
TBPE Registration No. 2677

SL 494 AT FM 1485 STORM WATER POLLUTION PREVENTION PLAN

BEGIN TO STA 482+00

SHEET 1 OF 3

FED. RD. DIV. NO.	PROJECT NO.		SHEET NO.
6			129
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY	
CONT.	SECT.	JOB	HIGHWAY NO.
0177	14	037	SL 494



LEGEND

- SCF — TEMP SEDIMENT CONTROL FENCE
- CL-D — EROSION CONTROL LOG
- RFD2 — TYPE 2 ROCK FILTER DAM
- RFD3 — TYPE 3 ROCK FILTER DAM
- FLOW DIRECTION
- KT — TEMPORARY SEEDING
- SRB — TY C RETENTION BLANKET

0′ 50′ 100′
SCALE IN FEET

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NO	DATE	REVISION	APPROVED

STATE OF TEXAS
NILESH D. SHRINGARPURE
139719
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07/26/2021
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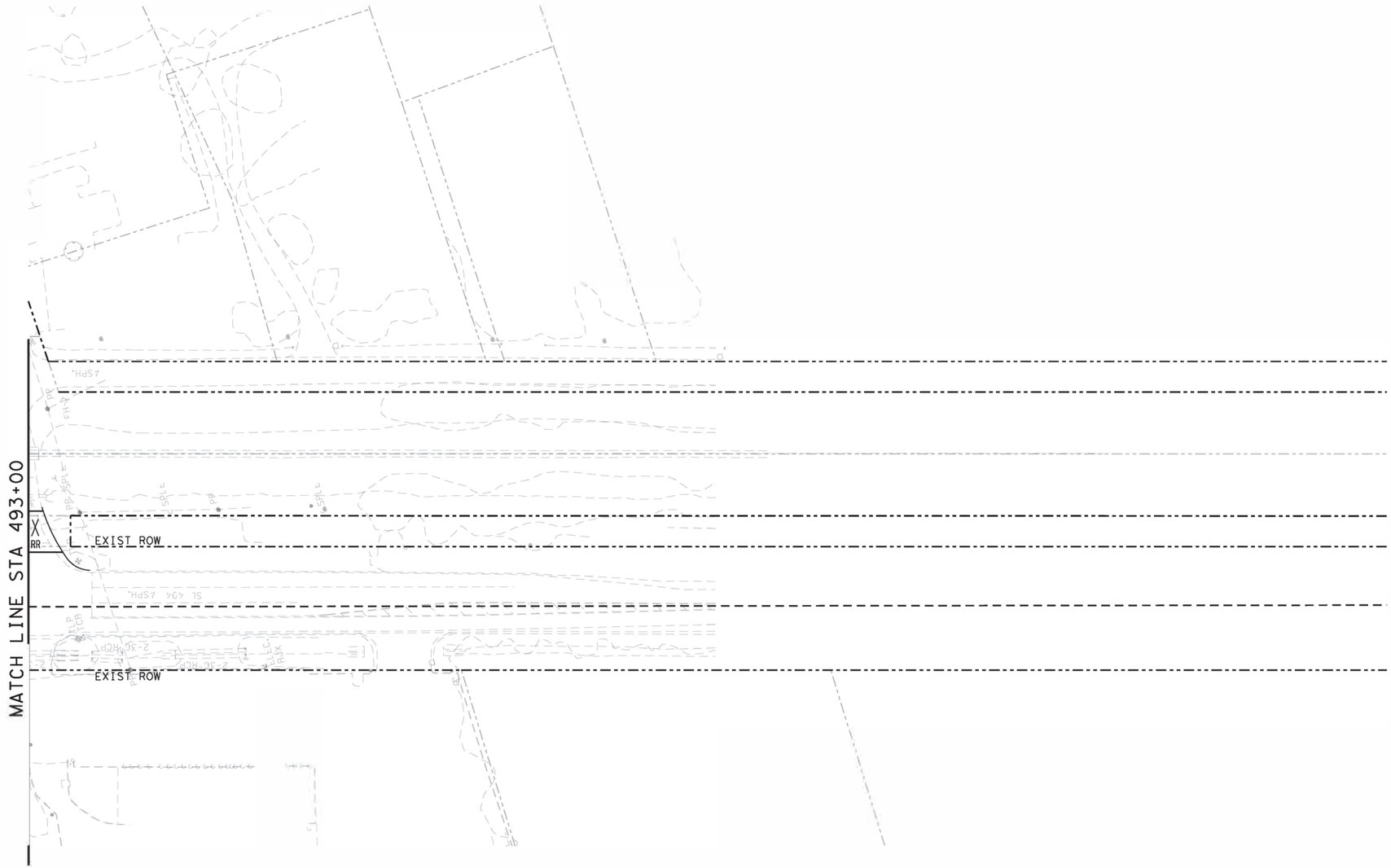
SL 494 AT FM 1485 STORM WATER POLLUTION PREVENTION PLAN

STA 482+00 TO STA 493+00

SHEET 2 OF 3

FED. RD. DIV. NO.	PROJECT NO.		SHEET NO.
6			130
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY	
CONT.	SECT.	JOB	HIGHWAY NO.
0177	14	037	SL 494



LEGEND

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0′ 50′ 100′
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NO	DATE	REVISION	APPROVED

STATE OF TEXAS
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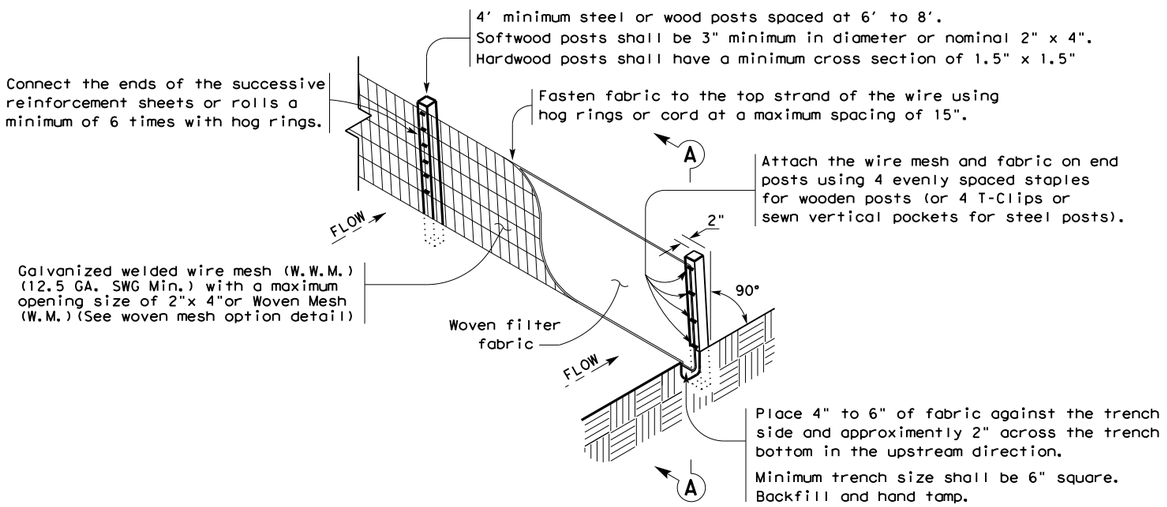
SL 494 AT FM 1485 STORM WATER POLLUTION PREVENTION PLAN

STA 493+00 TO END

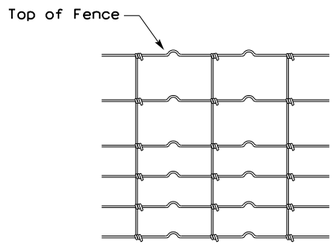
SHEET 3 OF 3

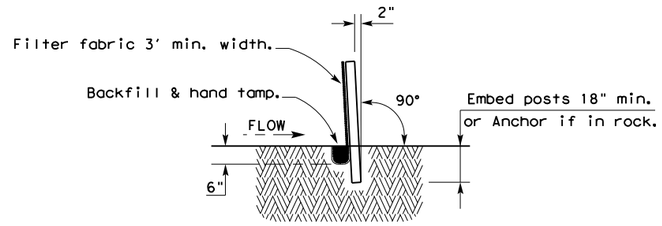
FED. RD. DIV. NO.	PROJECT NO.		SHEET NO.
6			131
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY	
CONT.	SECT.	JOB	HIGHWAY NO.
0177	14	037	SL 494



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.

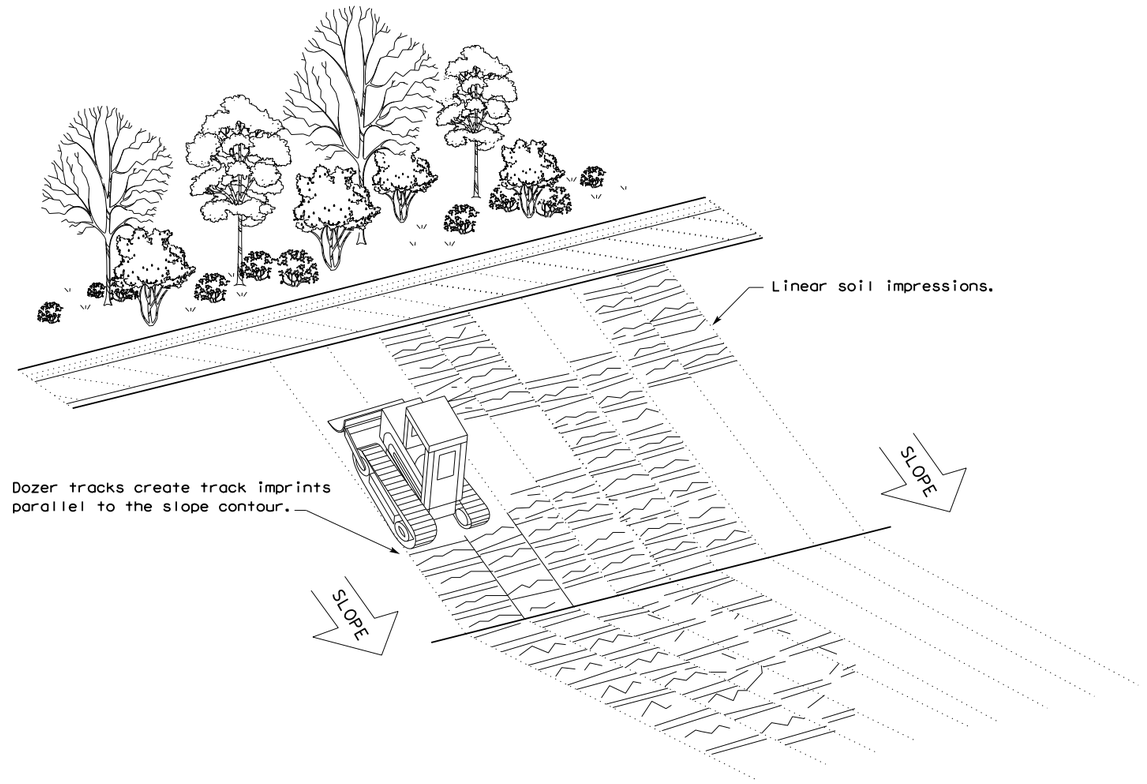
LEGEND

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

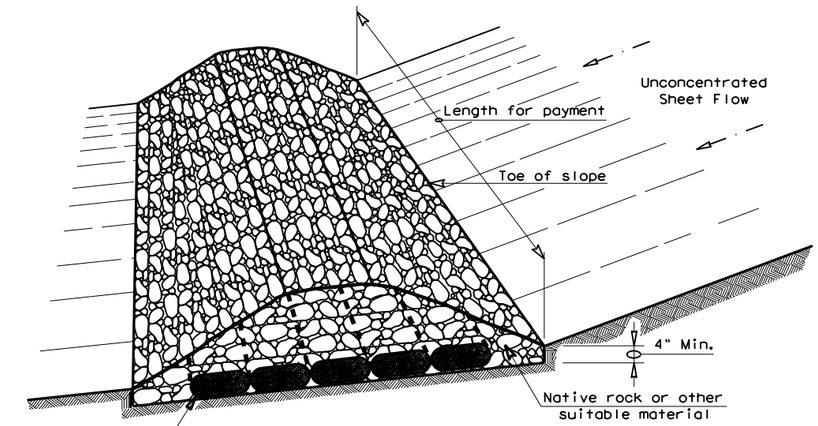
FENCE & VERTICAL TRACKING

EC(1)-16

FILE: ec116	DN: TxDOT		CK: KM		DW: VP		DN/CK: LS
© TxDOT: JULY 2016	CONT	SECT	JOB		HIGHWAY		
REVISIONS	0177	14	037		SL 494		
	DIST	COUNTY			SHEET NO.		
	HOU	MONTGOMERY			132		

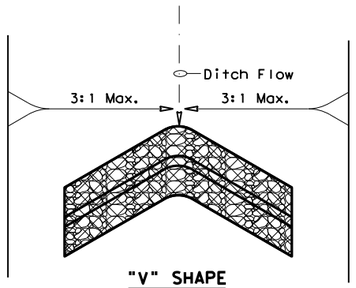
DATE
FILE

DATE:
FILE:

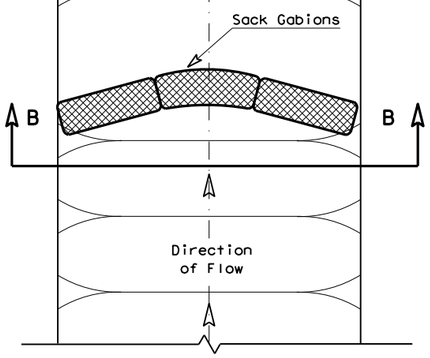


FILTER DAM AT TOE OF SLOPE

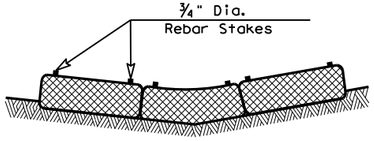
RFD1



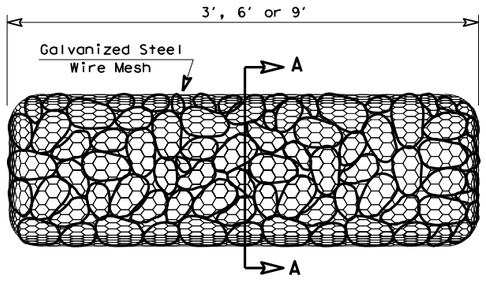
"V" SHAPE PLAN VIEW



PLAN VIEW

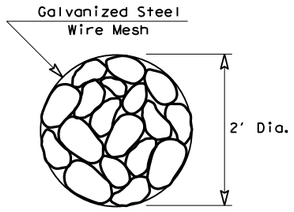


SECTION B-B

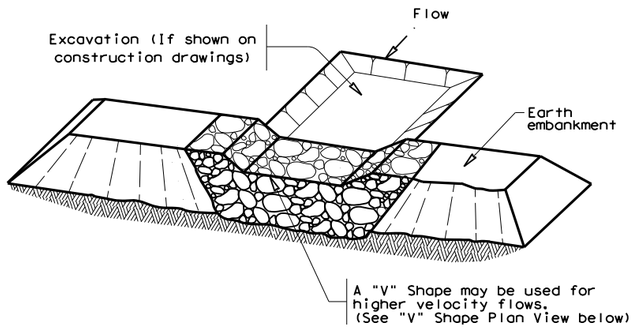


TYPE 4 (SACK GABIONS)

RFD4

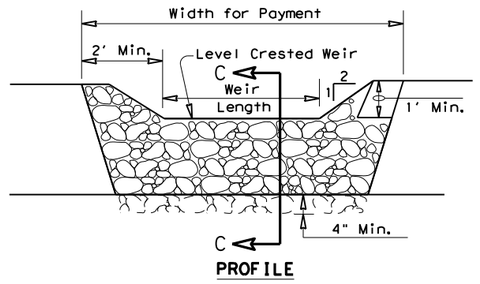


SECTION A-A

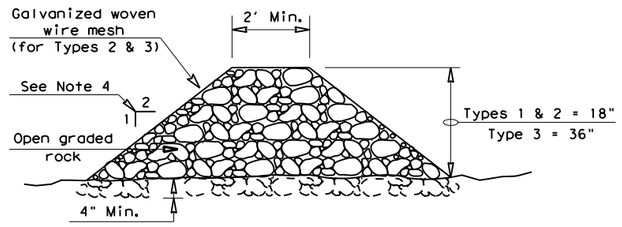


FILTER DAM AT SEDIMENT TRAP

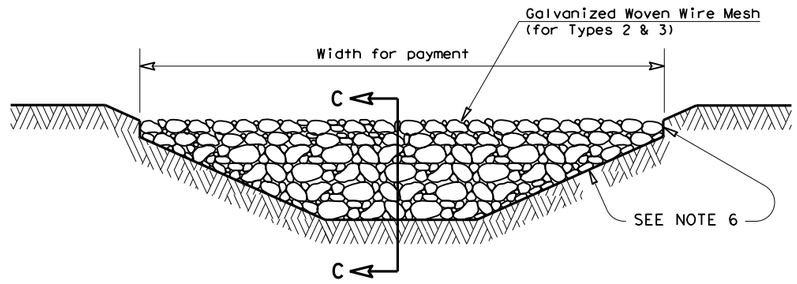
RFD1 OR RFD2



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

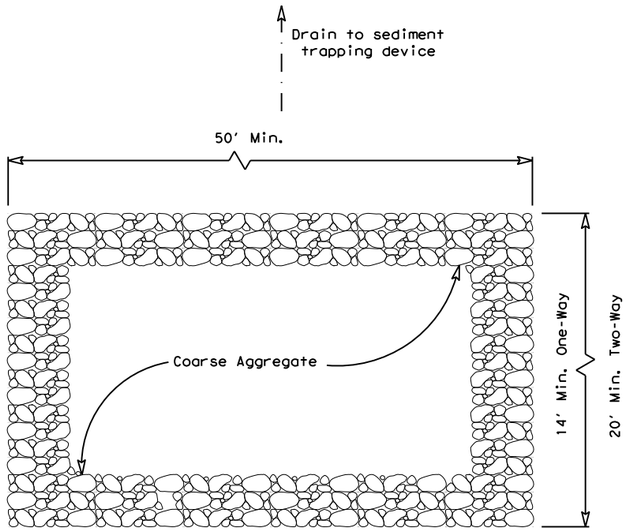
TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

ROCK FILTER DAMS

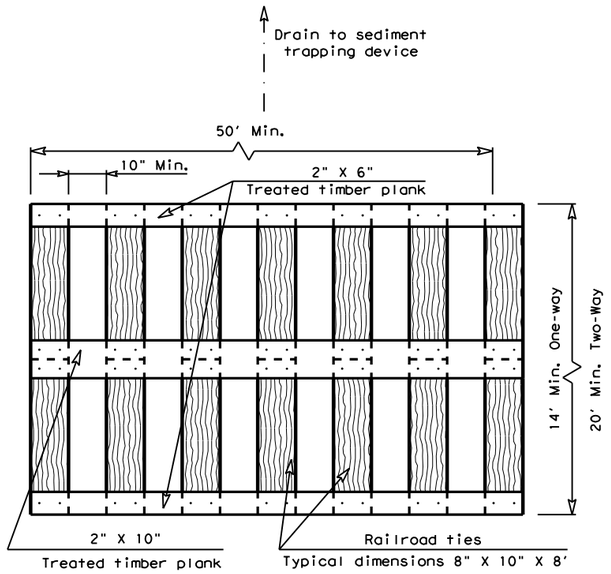
EC(2)-16

FILE: ec216	DN: TxDOT	CK: KM	DW: VP	DN/CK: LS
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY
REVISIONS	0177	14	037	SL 494
	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY		133

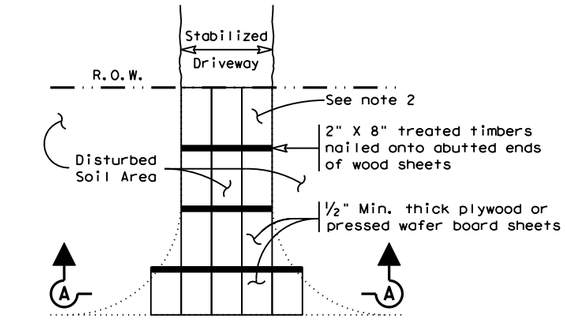
DATE: $DATE$
FILE: $FILE$



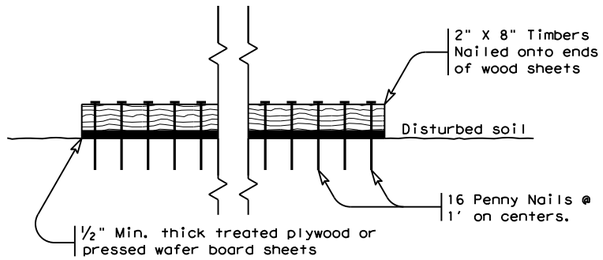
PLAN VIEW



PLAN VIEW



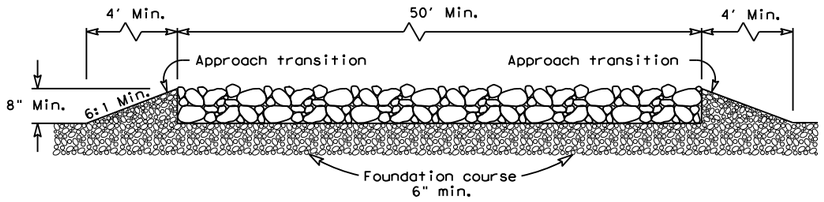
PLAN VIEW



SECTION A-A

CONSTRUCTION EXIT (TYPE 3)

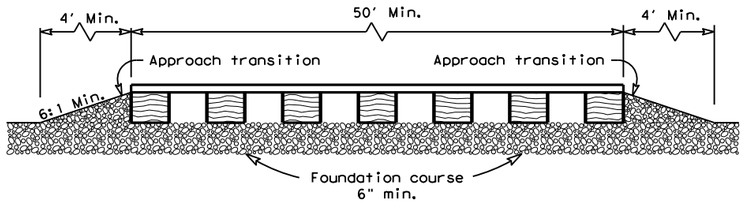
SHORT TERM



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

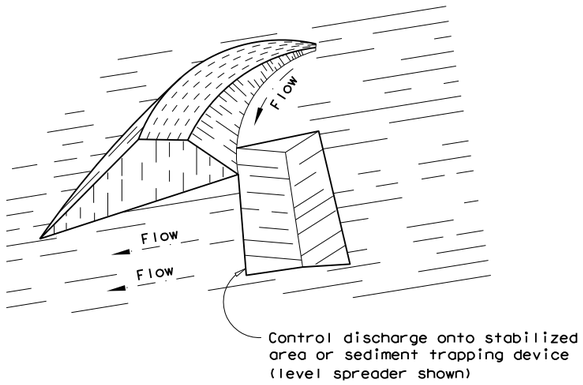
Design Division Standard

TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

CONSTRUCTION EXITS

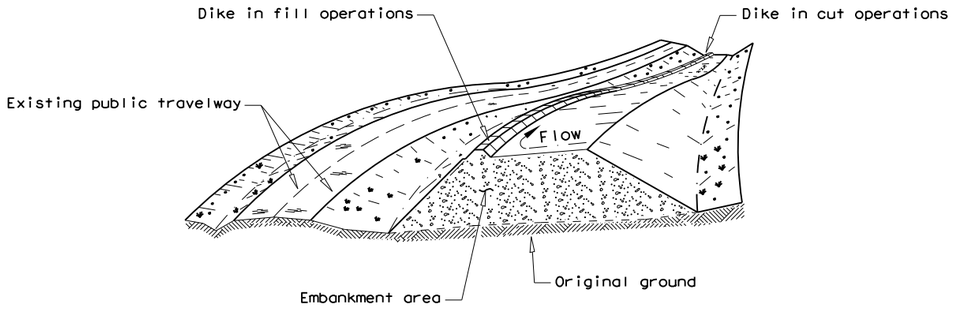
EC(3)-16

FILE: ec316	DN: TxDOT	CK: KM	DW: VP	DN/CK: LS
©TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY
REVISIONS	0177	14	037	SL 494
	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY		134



PERIMETER DIKE

→(D)→

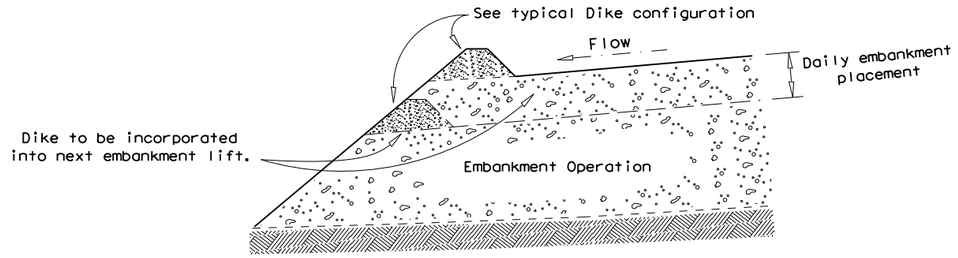


DIVERSION DIKE

→(D)→

GENERAL NOTE

1. Soil used in dike construction shall be machine compacted.
2. Top width and height of dike may be modified with prior approval of the Engineer.
3. Side slopes within the safety clear zone of a roadway shall be 6:1 or flatter.
4. Grading shall be shown elsewhere in the plans or as directed by the Engineer.
5. The Engineer reserves the right to modify the dimensions shown for the dike dependent on runoff volume characteristics.
6. Dikes that are in place for more than 14 calendar days should be stabilized to prevent sediment runoff.
7. The guidelines shown hereon are suggestions only and may be modified by the Engineer.
8. Remove sediment and debris when accumulation affects the performance of the devices, after a rain and when directed by the engineer.



EMBANKMENT SECTION - DIVERSION DIKE

→(D)→

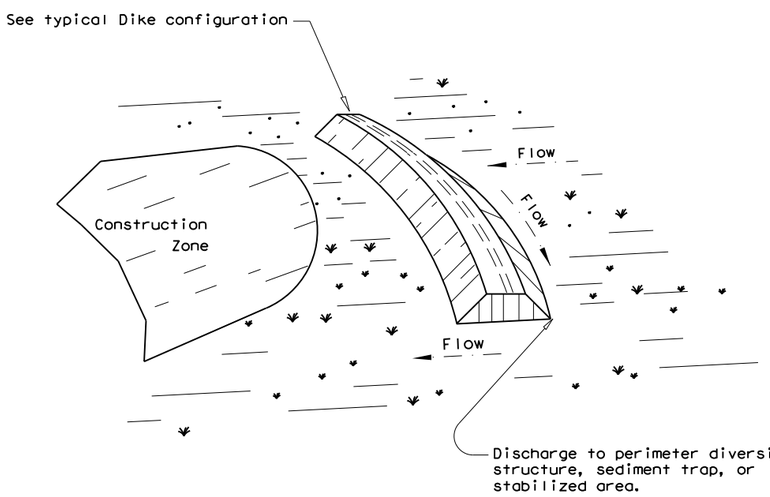
DIKE USAGE GUIDELINES

A Dike may be used to intercept runoff and divert it around unstabilized areas or to divert sediment laden runoff to an erosion control device (sediment basin or trap, rock filter dam, etc.).

The drainage area contributing runoff to a dike should not exceed 5 acres. The spacing of dikes should be as follows:

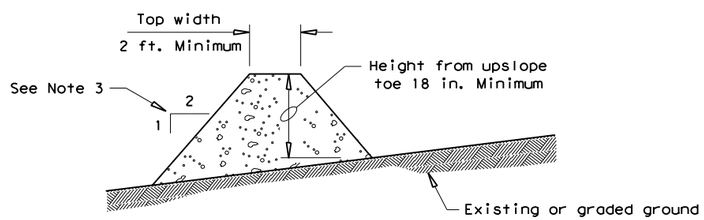
Slope of disturbed areas above dike	greater than 10%	5 - 10%	less than 5%
Maximum distance between dikes	100′	200′	300′

Intercepted runoff flowing along a dike should outlet to a stabilized area (vegetation, rock, etc.).



INTERCEPTOR DIKE

→(D)→



TYPICAL DIKE CONFIGURATION

→(D)→

PLANS SHEET LEGEND

DIKE →(D)→

Texas Department of Transportation

Design Division Standard

TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES DIKES (EARTHWORK FOR EROSION CONTROL)

EC(4)-16

FILE: ec416	DN: TxDOT	CK: KM	DW: VP	DN/CK: LS
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY
REVISIONS	0177	14	037	SL 494
	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY		135

DATE: $DATE$
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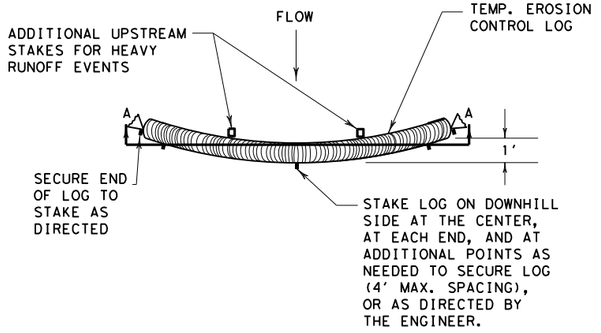
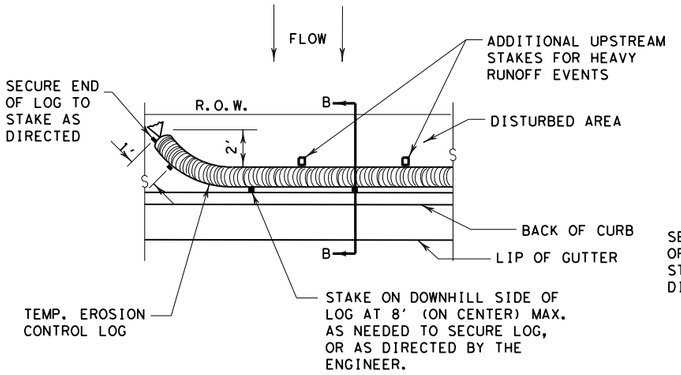
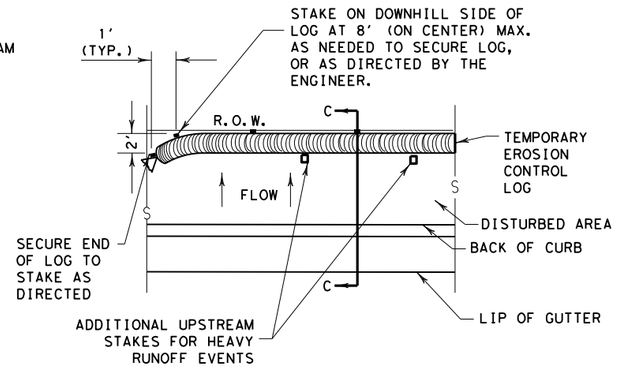


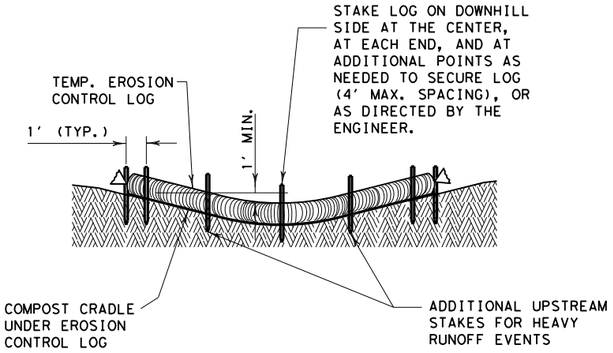
PLAN VIEW



PLAN VIEW



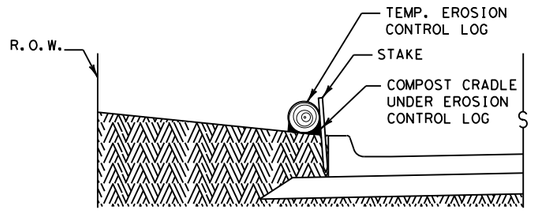
PLAN VIEW



SECTION A-A

EROSION CONTROL LOG DAM

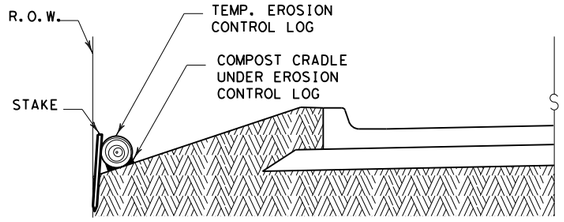
CL-D



SECTION B-B

EROSION CONTROL LOG AT BACK OF CURB

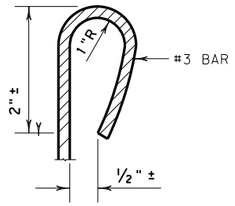
CL-BOC



SECTION C-C

EROSION CONTROL LOG AT EDGE OF RIGHT-OF-WAY

CL-ROW



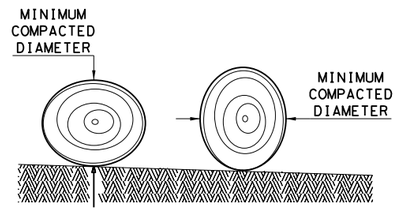
REBAR STAKE DETAIL

LEGEND

CL-D	EROSION CONTROL LOG DAM
CL-BOC	EROSION CONTROL LOG AT BACK OF CURB
CL-ROW	EROSION CONTROL LOG AT EDGE OF RIGHT-OF-WAY
CL-SST	EROSION CONTROL LOGS ON SLOPES STAKE AND TRENCHING ANCHORING
CL-SSL	EROSION CONTROL LOGS ON SLOPES STAKE AND LASHING ANCHORING
CL-DI	EROSION CONTROL LOG AT DROP INLET
CL-CI	EROSION CONTROL LOG AT CURB INLET
CL-GI	EROSION CONTROL LOG AT CURB & GRATE INLET

GENERAL NOTES:

1. EROSION CONTROL LOGS SHALL BE INSTALLED IN ACCORDANCE WITH MANFACTURER'S RECOMMENDATIONS, OR AS DIRECTED BY THE ENGINEER.
2. LENGTHS OF EROSION CONTROL LOGS SHALL BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND AS REQUIRED FOR THE PURPOSE INTENDED.
3. UNLESS OTHERWISE DIRECTED, USE BIODEGRADABLE OR PHOTODEGRADABLE CONTAINMENT MESH ONLY WHERE LOG WILL REMAIN IN PLACE AS PART OF A VEGETATIVE SYSTEM. FOR TEMPORARY INSTALLATIONS, USE RECYCLABLE CONTAINMENT MESH.
4. FILL LOGS WITH SUFFICIENT FILTER MATERIAL TO ACHIEVE THE MINIMUM COMPACTED DIAMETER SPECIFIED IN THE PLANS WITHOUT EXCESSIVE DEFORMATION.
5. STAKES SHALL BE 2" X 2" WOOD OR #3 REBAR, 2'-4' LONG, EMBEDDED SUCH THAT 2" PROTRUDES ABOVE LOG, OR AS DIRECTED BY THE ENGINEER.
6. DO NOT PLACE STAKES THROUGH CONTAINMENT MESH.
7. COMPOST CRADLE MATERIAL IS INCIDENTAL & WILL NOT BE PAID FOR SEPARATELY.
8. SANDBAGS USED AS ANCHORS SHALL BE PLACED ON TOP OF LOGS & SHALL BE OF SUFFICIENT SIZE TO HOLD LOGS IN PLACE.
9. TURN THE ENDS OF EACH ROW OF LOGS UPSLOPE TO PREVENT RUNOFF FROM FLOWING AROUND THE LOG.
10. FOR HEAVY RUNOFF EVENTS, ADDITIONAL UPSTREAM STAKES MAY BE NECESSARY TO KEEP LOG FROM FOLDING IN ON ITSELF.



DIAMETER MEASUREMENTS OF EROSION CONTROL LOGS SPECIFIED IN PLANS

SEDIMENT BASIN & TRAP USAGE GUIDELINES

An erosion control log sediment trap may be used to filter sediment out of runoff draining from an unstabilized area.

Log Traps: The drainage area for a sediment trap should not exceed 5 acres. The trap capacity should be 1800 CF/Acre (0.5" over the drainage area).

Control logs should be placed in the following locations:

1. Within drainage ditches spaced as needed or min. 500' on center
2. Immediately preceding ditch inlets or drain inlets
3. Just before the drainage enters a water course
4. Just before the drainage leaves the right of way
5. Just before the drainage leaves the construction limits where drainage flows away from the project.

The logs should be cleaned when the sediment has accumulated to a depth of 1/2 the log diameter.

Cleaning and removal of accumulated sediment deposits is incidental and will not be paid for separately.

Texas Department of Transportation

Design Division Standard

TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

EROSION CONTROL LOG

EC(9)-16

FILE: ec916	DN: TxDOT	CK: KM	DW: LS/PT	CK: LS	
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY	
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	DIST	COUNTY		SHEET NO.	
	HOU	MONTGOMERY		136	

DATE:
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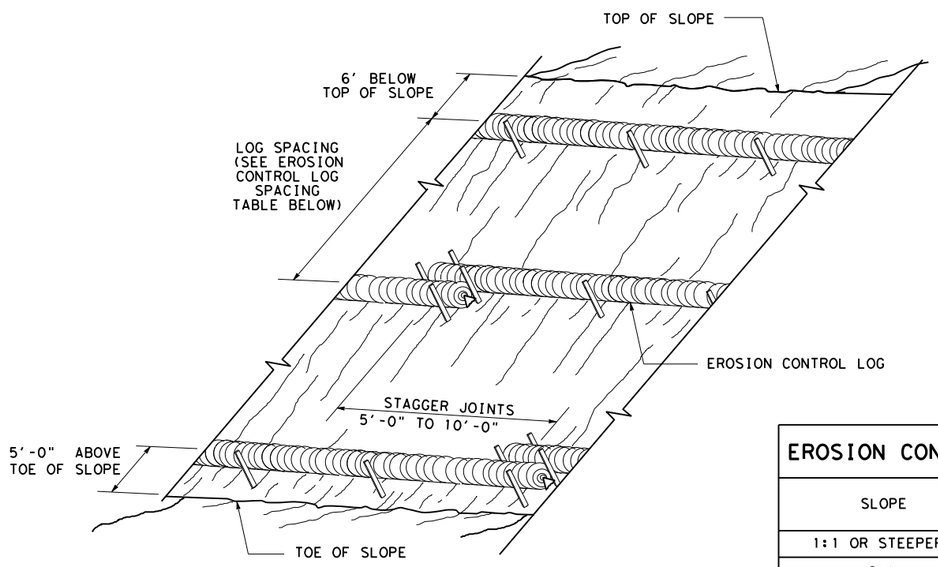
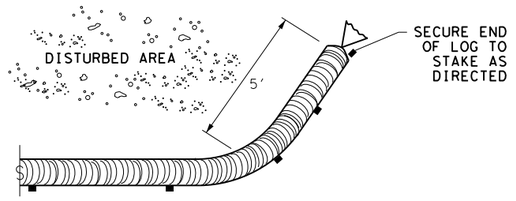


EROSION CONTROL LOGS ON SLOPES
STAKE AND TRENCHING ANCHORING

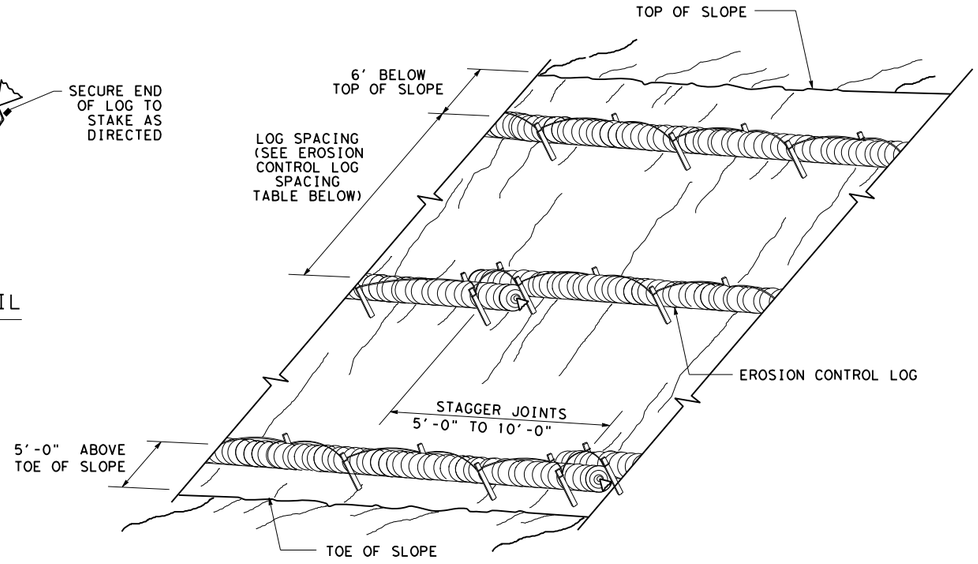
CL-SST



END SECTION RAP DETAIL

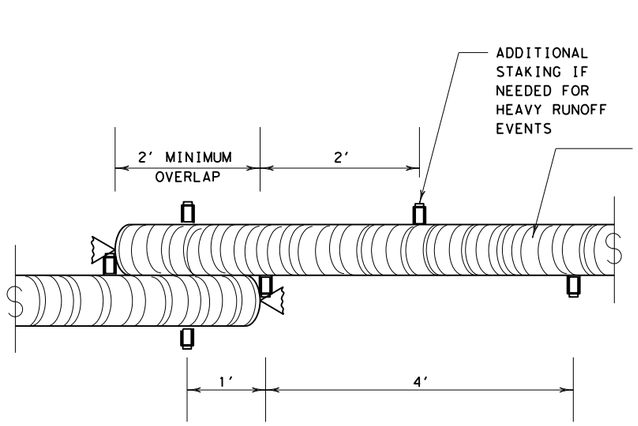
EROSION CONTROL LOG SPACING TABLE				
SLOPE	LOG DIAMETER			
	6"	8"	12"	18"
1:1 OR STEEPER	5'	10'	15'	20'
2:1	10'	20'	30'	40'
3:1	15'	30'	45'	60'
4:1 OR FLATTER	20'	40'	60'	80'

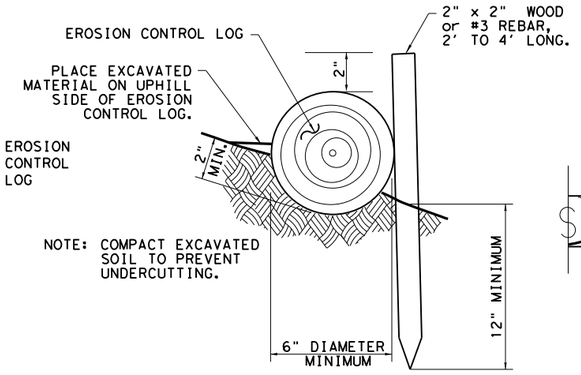
* ADJUSTMENTS CAN BE MADE FOR SOIL TYPE:
SOFT, LOAMY SOILS-ADJUST ROWS CLOSER TOGETHER;
HARD, ROCKY SOILS- ADJUST ROWS FARTHER APART



EROSION CONTROL LOGS ON SLOPES
STAKE AND LASHING ANCHORING

CL-SSL

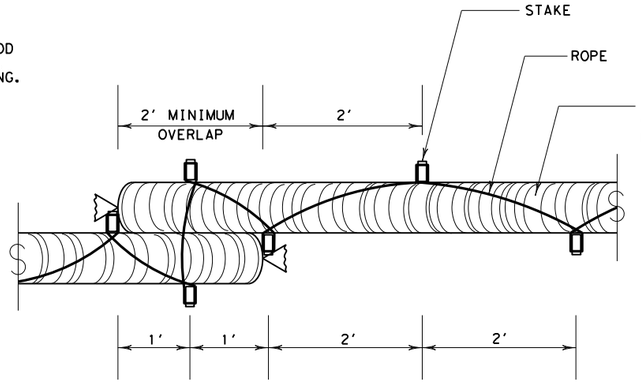


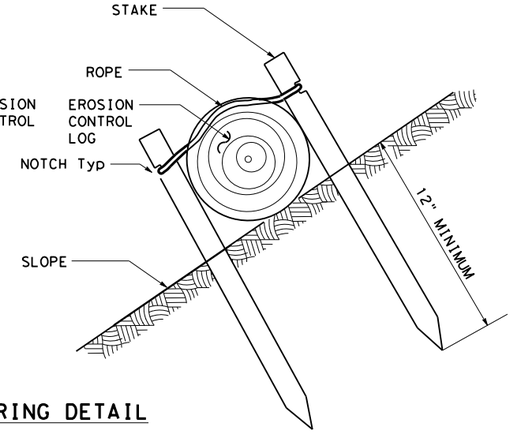


STAKE AND TRENCHING ANCHORING DETAIL

CL-SST

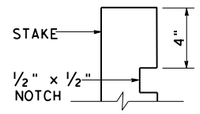
TRENCH DEPTH TABLE	
LOG DIAMETER	DEPTH
6"	2"
8"	3"
12"	4"
18"	5"





STAKE AND LASHING ANCHORING DETAIL

CL-SSL



STAKE NOTCH DETAIL

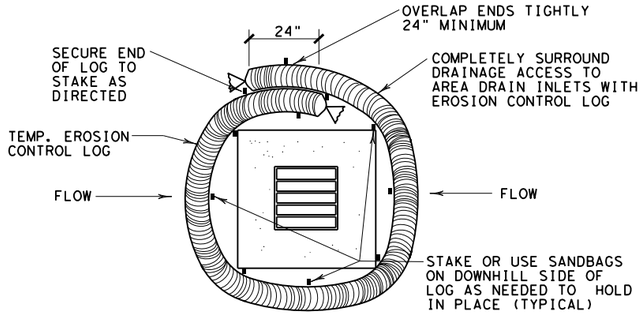
Texas Department of Transportation

Design Division Standard

TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES
EROSION CONTROL LOG
EC(9)-16

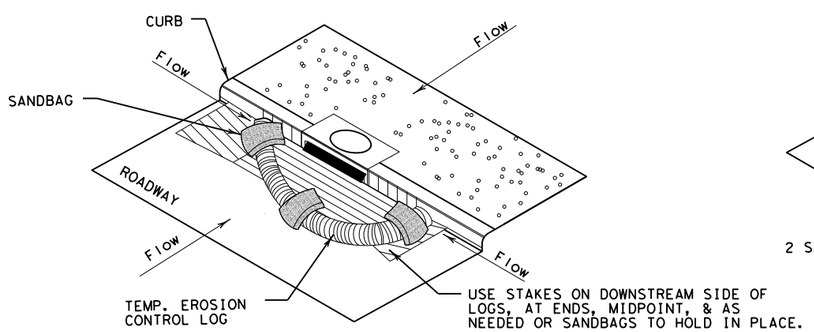
FILE: ec116	DN: TxDOT	CK: KM	DW: LS/PT	CK: LS
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY
REVISIONS	0177	14	037	SL 494
	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY		137

DATE:
FILE:



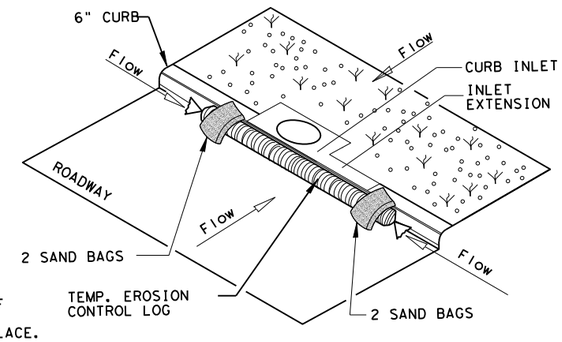
EROSION CONTROL LOG AT DROP INLET

CL-DI



EROSION CONTROL LOG AT CURB INLET

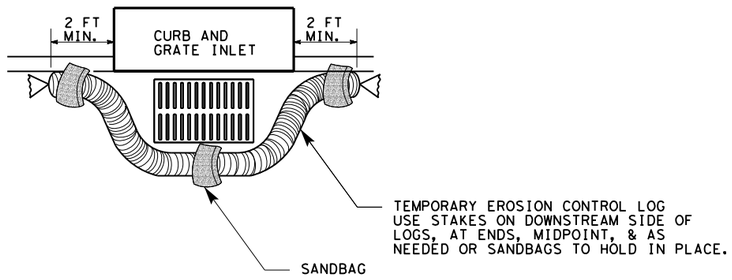
CL-CI



EROSION CONTROL LOG AT CURB INLET

CL-CI

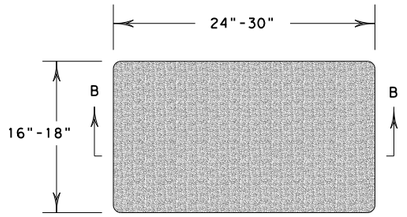
NOTE:
EROSION CONTROL LOGS USED AT CURB INLETS SHOULD ONLY BE USED IF THEY WILL NOT IMPEDE TRAFFIC OR FLOOD THE ROADWAY OR WHEN THE STORM SEWER SYSTEM IS NOT FULLY FUNCTIONAL.



EROSION CONTROL LOG AT CURB & GRADE INLET

CL-GI

SECTION B-B



SANDBAG DETAIL

SHEET 3 OF 3

Texas Department of Transportation

Design Division Standard

TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

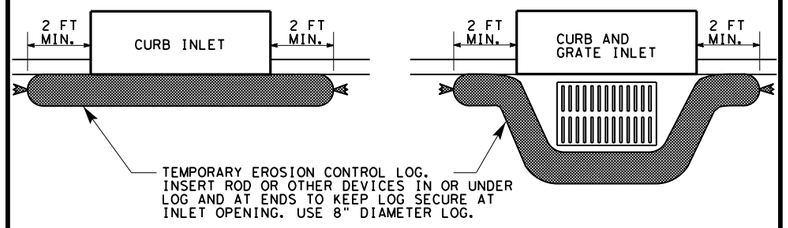
EROSION CONTROL LOG

EC(9)-16

FILE: ec916	DN: TxDOT		CK: KM	DW: LS/PT		CK: LS
© TxDOT: JULY 2016	CONT	SECT	JOB		HIGHWAY	
REVISIONS	0177	14	037		SL 494	
	DIST	COUNTY				SHEET NO.
	HOU	MONTGOMERY				138

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

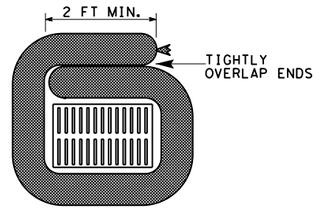
The trap should be cleaned when the capacity has been reduced by 1/2 or the sediment has accumulated to a depth of 1', whichever is less.

REQUIRED ITEMS:

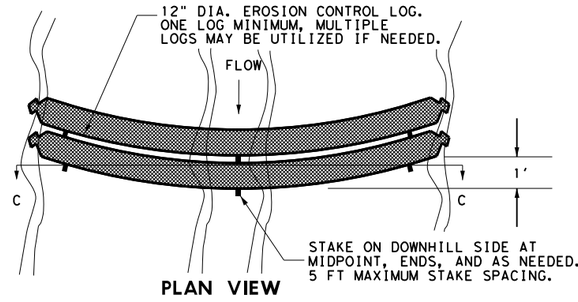
- ITEM 506-6040 BIODEG EROSN CONT LOGS (INSTL) (8") LF
- ITEM 506-6041 BIODEG EROSN CONT LOGS (INSTL) (12") LF
- ITEM 506-6043 BIODEG EROSN CONT LOGS (REMOVE) LF

DROP INLETS AND OTHER LOCATIONS
12" DIAMETER LOGS

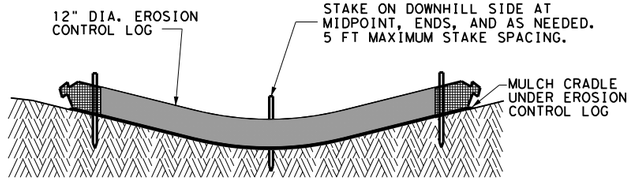
ITEM 506-6041 BIODEG EROSN CONT LOGS (INSTL)(12")



DROP INLETS

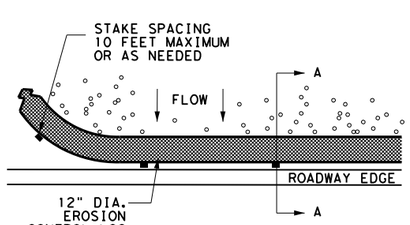


PLAN VIEW

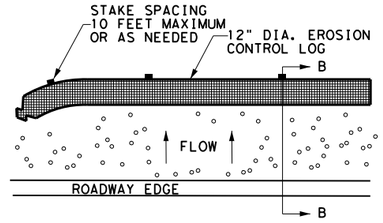


SECTION C-C

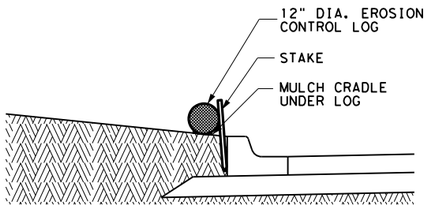
DRAINAGE SWALE OR DITCH



PLAN VIEW

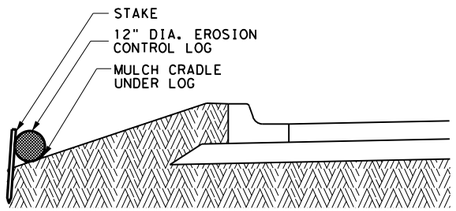


PLAN VIEW



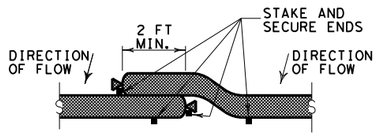
SECTION A-A

SLOPE TO ROADWAY EDGE

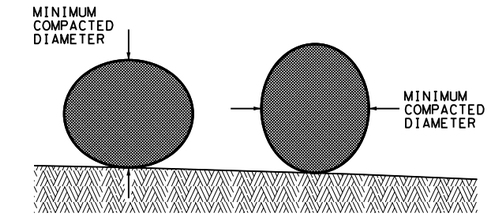


SECTION B-B

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		139
	COUNTY	CONTROL	SECT	JOB	HIGHWAY
	MONTGOMERY	0177	14	037	SL494

STD G-4A

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				140
	ORIGINAL:	DIST	COUNTY	CONTROL	SECT	JOB	HIGHWAY
		12	MONTGOMERY	0177	14	037	SL 494

HOU MONTGOMERY STD K-1

I. WORK AT CROSSING LOCATIONS (AT GRADE, HIGHWAY OVERPASS, HIGHWAY UNDERPASS, PEDESTRIAN, OR CLOSED/ABANDONED)

DOT #: 755892M
Crossing Type: AT GRADE
RR Company Owning Track at Crossing: UNION PACIFIC RAILROAD (UPRR)
Operating RR Company at Track: UPRR
RR MP: 28.020
RR Subdivision: LUFKIN
City: NEW CANEY
County: MONTGOMERY
CSJ at this Crossing: 0177-14-037
Highway/Roadway name crossing the railroad: FM 1485
# of regularly scheduled trains per day at this crossing: 8
# of switching movements per day at this crossing: 0
% of estimated contract cost of work within railroad ROW: 0.001

Scope of Work at this Crossing to Be Performed by State Contractor:

Work inside UPRR ROW:

1. Remove existing railroad preemption wire and reconnect with new conduit and new railroad preemption wire to existing bungalow.

Work outside UPRR ROW:

1. 2" Mill 2. Replacement of the guard rail with slotted curb.
3. Overlay 2" HMA 4. Pavement markings.
5. Remove existing traffic signal strain poles and replace with proposed signal mast arm poles, remove existing controller, install proposed controller.

Scope of Work at this Crossing to Be Performed by Railroad Company:

1. Work by the railroad will consist of inspection and cutover of the traffic signal preemption.

II. OTHER PROJECT WORK WITHIN RAILROAD RIGHTS-OF-WAY (ROW)

N/A

III. FLAGGING & INSPECTION

of Days of Railroad Flagging Expected: 4

On this project, night or weekend flagging is:

☐ Expected
☒ Not Expected

Flagging services will be provided by:

☐ Railroad Company: TxDOT will pay flagging invoices
☒ Outside Party: Contractor will pay flagging invoices, to be reimbursed by TxDOT

Contractor must incorporate flaggers into anticipated construction schedule. The Railroad requires a 30 day notice if their flaggers are to be utilized. If Contractor falls behind schedule due to their own negligence and is not ready for scheduled flaggers, any flagging charges will be paid by Contractor.

Contact Information for Flagging:

☒ UPRR - UP.info@railpros.com
Call Center 877-315-0513, Select #1 for flagging

☐ BNSF - BNSF.info@railpros.com
Call Center 877-315-0513, Select #1 for flagging

☐ KCS - KCS.info@railpros.com
Call Center 877-315-0513, Select #1 for flagging
- Bottom Line On-Track Safety Services
bottomline076@aol.com, 903-767-7630

☐ OTHERS _____

Contractor must incorporate Construction Inspection into anticipated construction schedule.

☒ Not Required

☐ Required: Contact Information for Construction Inspection:

_____
_____
_____

IV. CONSTRUCTION WORK TO BE PERFORMED BY THE RAILROAD

On this project, construction work to be performed by a railroad company is:

☐ Required
☒ Not Required

Coordinate with TxDOT for any work to be performed by the Railroad Company. TxDOT must issue a work order for any work done by the Railroad Company prior to the work being performed.

V. RAILROAD INSURANCE REQUIREMENTS

Railroad reference number shall be provided by TxDOT CST or DO.

The Contractor shall confirm the insurance requirements with the Railroad as the insurance limits are subject to change without notice.

Insurance policies must be issued for and on behalf of the Railroad. Where more than one Railroad Company is operating on the same right of way or where several Railroad Companies are involved and operate on their own separate rights of way, provide separate insurance policies in the name of each Railroad Company.

No direct compensation will be made to the Contractor for providing the insurance coverages shown below or any deductibles. These costs are incidental to the various bid items.

Type of Insurance	Amount of Coverage (Minimum)
Workers Compensation	$500,000 / $500,000 / $500,000
Commercial General Liability	$2,000,000 / $4,000,000
Business Automobile	$2,000,000 combined single limit
Railroad Protective Liability	
☐ Not Required	
☒ Non - Bridge Projects	$2,000,000 / $6,000,000
☐ Bridge Projects	$5,000,000 / $10,000,000
☐ Other	

VI. CONTRACTOR'S RIGHT OF ENTRY (ROE) AGREEMENT

On this project, an ROE agreement is:

☐ Not Required
☒ Required: TxDOT CST to assist in obtaining with the UPRR (see Item 5, Article 8.3)
☐ Required: Contractor to obtain (see Item 5, Article 8.4)

With the following railroad companies: _____

To view previously approved ROE Agreement templates agreed upon between the State and Railroad, see:

http://www.txdot.gov/inside-txdot/division/rail/samples.html

Approved ROE Agreement templates are not to be modified by the Contractor.

Contractor shall not operate within Railroad Right of Way without an executed Construction & Maintenance Agreement between the State and the Railroad and an executed ROE agreement between the Contractor and the Railroad if required on project.

VII. RAILROAD COORDINATION MEETING

On this project, a Railroad Coordination Meeting is:

☒ Not Required
☐ Required

See Item 5, Article 8.1 for more details.

VIII. SUBCONTRACTORS

Contractor shall not subcontract work without written consent of TxDOT. Subcontractors are required to maintain the same insurance coverage as required of the Contractor.

IX. EMERGENCY NOTIFICATION

In Case of Railroad Emergency Call
Union Pacific Railroad (UPRR)
Railroad Emergency Line at 888-877-7267
Location: DOT 755892M
RR Milepost 28.020
Subdivision LUFKIN

Texas Department of Transportation — Rail Division

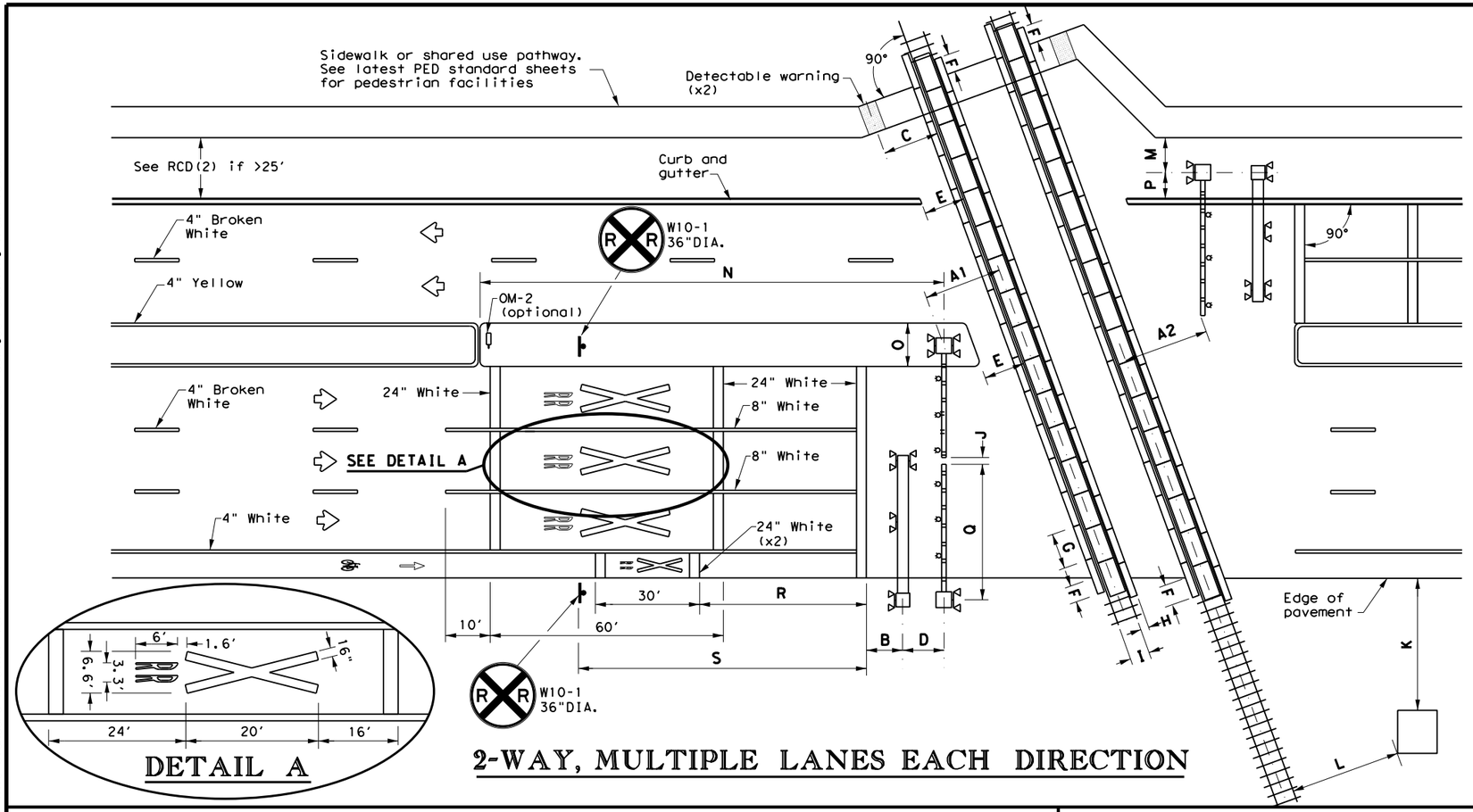
RAILROAD SCOPE OF WORK

PROJECT SPECIFIC DETAILS

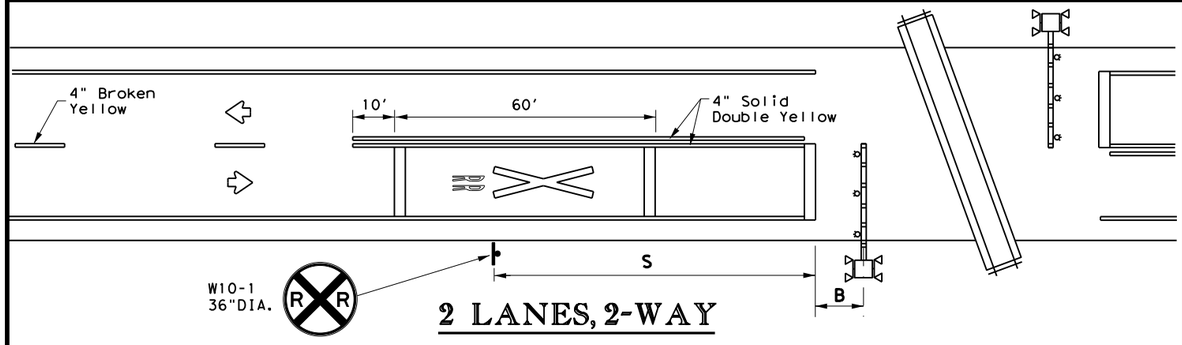
FILE: RR Scope of Work.dgn	DN: TxDOT	CK:	DW:	CK:	
©TxDOT June 2014	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0177	14	037	FM 1485	
3/2020	DIST	COUNTY		SHEET NO.	
	HOU	MONTGOMERY		141	

DATE:
FILE:

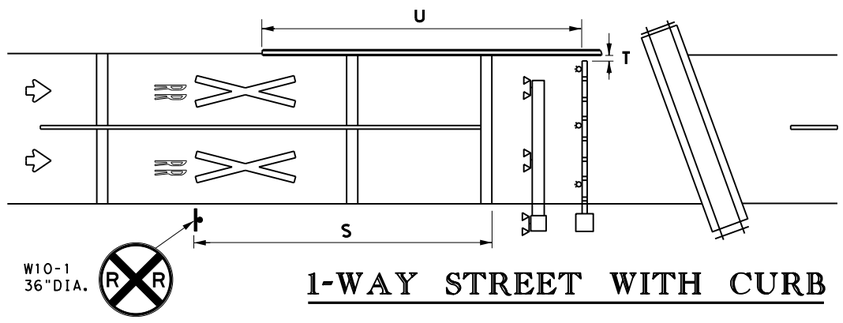
DATE:
FILE:



2-WAY, MULTIPLE LANES EACH DIRECTION



2 LANES, 2-WAY



1-WAY STREET WITH CURB

NOTES

T: Tip of gate to edge of curb: 1' max for Quiet Zone SSM, 90% of traveled way covered by gates for all other locations

U: Non-traversable curb length from gate: 100' min. for a Quiet Zone SSM, 10' min for all other locations.

NOTES

A1: Center of RR mast to center of rail: 12' minimum, 15' typical.

A2: Tip of gate to center of rail: 12' minimum, 15' typical.

B: Center of mast (cantilever, gate, or mast flasher) of nearest active traffic control device to stop line: 8' (NOTE: Stop line may be moved as needed, but should be at least 8' back from gates, if present).

C: Center of detectable warning device to nearest rail: 6' minimum

D: Center of gate mast to center of cantilever mast: 6' typical. NOTE: Cantilever may be located in front or behind gates.

E: Edge of median or curb to nearest rail: 10' typical. NOTE: Design median edge to be parallel with rail.

F: Edge of planking panel from edge of pavement or sidewalk: 3' minimum. NOTE: Field panels need not be in line with gauge panels.

G: Length of panels along rail: 8' typical.

H: Width of field panel: 2' typical (check with railroad company).

I: Distance between rails: 4'-8.5".

J: Tip of gate to tip of gate: 2' maximum for Quiet Zone SSM or 90% of traveled way covered by gates for all other locations.

K: Nearest edge of RR cabin from edge of pavement: 30' typical. NOTE: Cabinet not required to be parallel to edge of pavement.

L: Nearest edge of RR cabin from nearest rail: 25' typical.

M: Center of RR mast to edge of sidewalk: 6' minimum.

N: Center of gate mast to leading edge of non-traversable median: 100' minimum to qualify as a Quiet Zone SSM. NOTE: 60'will suffice if there is a street intersection within the 100' and all street intersections within 60' are closed.

O: Width of median: 8'-6" minimum, 10' typical when using median gates. NOTE: Center of gate mast minimum 4'-3" from face of curb.

P: Center of RR mast to face of curb: 4'-3" minimum.
Center of RR mast to edge of pavement (with shoulder): 6' minimum
Center of RR mast to edge of pavement (no shoulder): 8'-3" minimum
NOTE: BNSF prefers 5'-3", 7', and 9'-3" minimums, respectively.

Q: Gate length: 28' or less typical, but railroad company may allow up to 32'under special circumstances.

R: Stop line to first RR Crossing transverse line (bike lane): 50' typical.

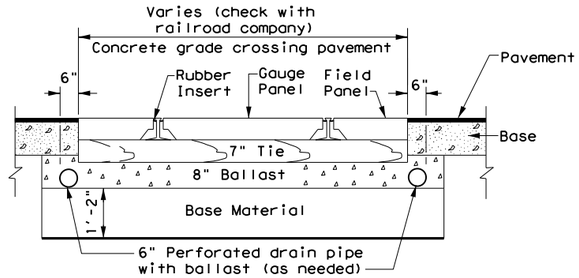
S: Stop line to GRADE CROSSING ADVANCE WARNING (W10-1) sign and adjacent RR Crossing pavement markings. See Table 1. See RCD(2) for other signs.

TABLE 1	
Approach Speed (mph)	Desirable Placement (feet)
20	100
25	100
30	100
35	100
40	125
45	175
50	250
55	325
60	400
65	475
70	550
75	650

LEGEND	
	Sign
	Object Marker
	Traffic Flow
	Cantilever
	Gate Assembly
	Mast Flasher Pair

GENERAL NOTES

1. Medians and curbs must be non-traversable to qualify as a Quiet Zone Supplementary Safety Measure (SSM). Non-traversable curbs in Quiet Zones are 6" tall minimum and used on roadways where speed does not exceed 40 mph.
2. Raised pavement markers may be used to supplement striping. See PM(2) and PM(3) standard sheets.
3. Medians preferred whenever possible to prevent vehicles from driving around gates.
4. Longitudinal edge striping may be continued thru crossing as needed. Illumination may also be considered for nighttime visibility.
5. See SMD standard sheets for sign mounting details.
6. See the Standard Highway Sign Design for Texas (SHSD) manual for sign and pavement marking details.



CROSSING SURFACE CROSS SECTION

Texas Department of Transportation

Traffic Operations Division Standard

RAILROAD CROSSING DETAILS SIGNING, STRIPING, AND DEVICE PLACEMENT RCD(1)-16

FILE: rcd1-16.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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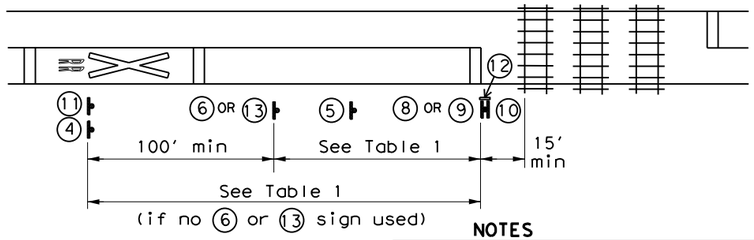
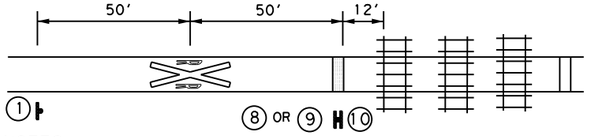


PASSIVE CROSSING

NOTES

1. Stop or yield sign may also be installed to the left of the crossbuck sign, rather than below it.
2. A 2" white retroreflective strip shall be installed on front and back of crossbuck sign post.



NOTES

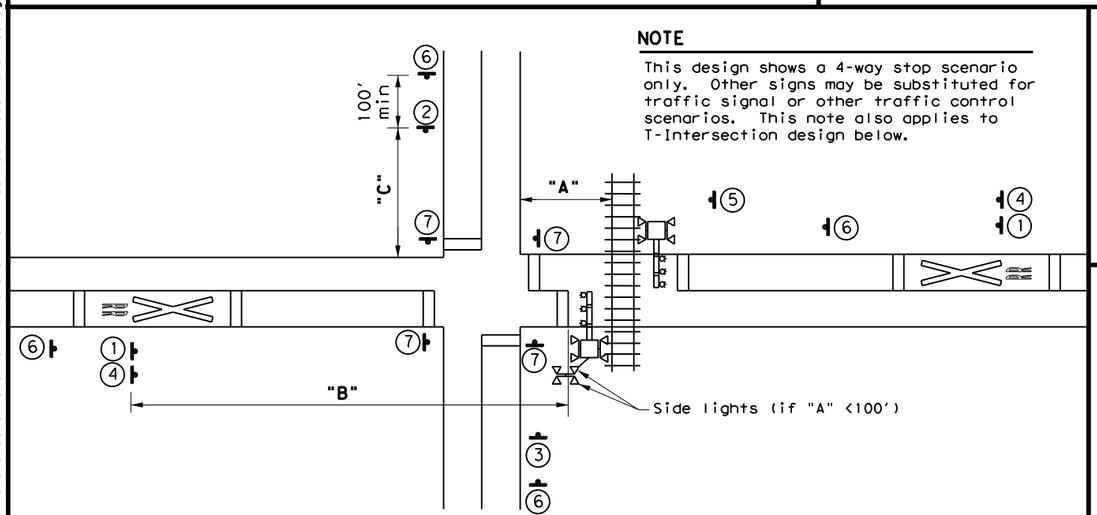
1. A shared use pathway is considered a separate pathway crossing when more than 25' from traveled way of adjacent roadway.
2. Detectable warning used at stop bar.
3. Smaller sign sizes preferred than shown to the right on this sheet.

PATHWAY CROSSING

TABLE 1	
Approach Speed (mph)	Desirable Placement (feet)
20	100
25	100
30	100
35	100
40	125
45	175
50	250
55	325
60	400
65	475
70	550
75	650

GENERAL NOTES

1. Railroad company to provide active traffic control devices, CROSSBUCK (R15-1), NUMBER OF TRACKS Plaque (R15-2P) (if more than 1 track), and EMERGENCY NOTIFICATION (I-13) signs.
2. LOW GROUND CLEARANCE (W10-5) signs may be relocated further upstream of crossing to provide advance warning of alternate route.
3. GRADE CROSSING AND INTERSECTION ADVANCE WARNING (W10-2) signs may be modified as needed to fit roadway geometry.
4. Table 1 placement distances may vary per Sect. 2C.05 of the TMUTCD.
5. See Table 1 to determine placement of STOP AHEAD (W3-1) and YIELD AHEAD (W3-2) signs unless shown otherwise.
6. DO NOT STOP ON TRACKS (R8-8) signs installed when potential for vehicles stopping on tracks is significant as determined by sealing engineer. Install so sign does not block view of RR mast.
7. See the Standard Highway Sign Design for Texas (SHSD) manual for sign and pavement marking details.

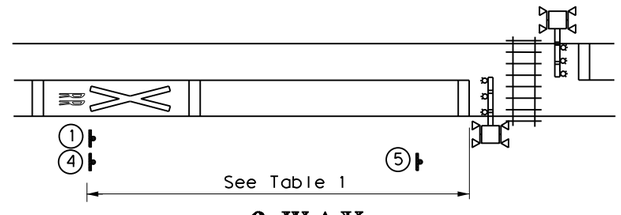


NOTE

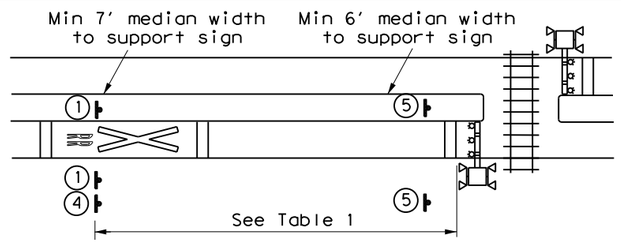
This design shows a 4-way stop scenario only. Other signs may be substituted for traffic signal or other traffic control scenarios. This note also applies to T-Intersection design below.

	"A" <100'	"A" ≥100'
"B"	See Table 1. Place pavement markings and signs on opposite side of intersection from rail if spacing from Table 1 would put markings within intersection.	See Table 1. Place pavement markings and signs between rail and intersection if spacing from Table 1 would put markings within intersection.
"C"	See Table 1.	GRADE CROSSING AND INTERSECTION ADVANCE WARNING (W10-2, W10-3, W10-4) signs should only be installed if W10-1 sign is not between intersection and railroad crossing. If needed, see Table 1.

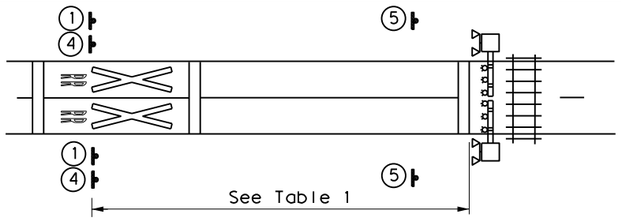
GRADE CROSSING NEAR A PARALLEL STREET



2-WAY



2-WAY WITH MEDIAN



1-WAY

SIGNS

1 W10-1 36"DIA.

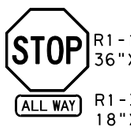
2 W10-2L 36"X36"

3 W10-2R 36"X36"

4 W10-5 36"X36" / W10-5P 30"x24"

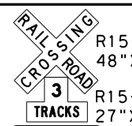
5 R8-8 24"X30"

6 W3-1 30"X30"

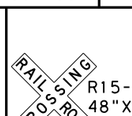


7 R1-1 36"X36" / R1-3P 18"X6"

8 R15-1 48"X9" / R15-2P 27"X18" / R1-1 36"X36"



9 R15-1 48"X9" / R15-2P 27"X18" / R1-2 48"X48"X48"



10 R15-1 48"X9" / R15-2P 27"X18"

11 ** W10-1 36"DIA. / W10-13P 30"X24"

REPORT EMERGENCY OR PROBLEM 1-800-555-5555 CROSSING 836 597 H

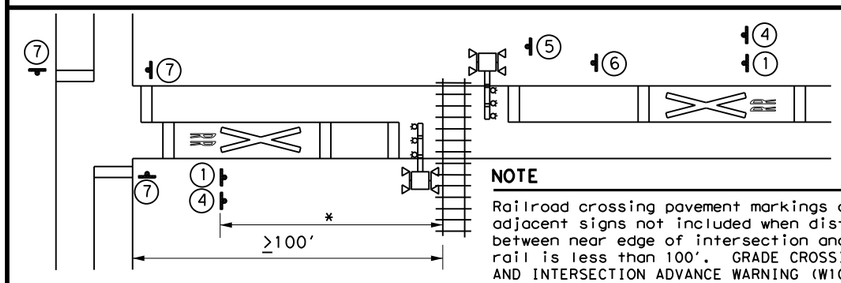
12 I-13 15"X9" — Sign may be placed perpend. to travel lanes.

13 W3-2 30"X30"

** Includes a NO TRAIN HORN Plaque (W10-9P) if crossing is in a Quiet Zone. LOW GROUND CLEARANCE Plaque (W10-5P) if needed is mounted below W10-2/W10-3/W10-4 signs.

W10-9P 30"X24"

W10-5P 30"X24"

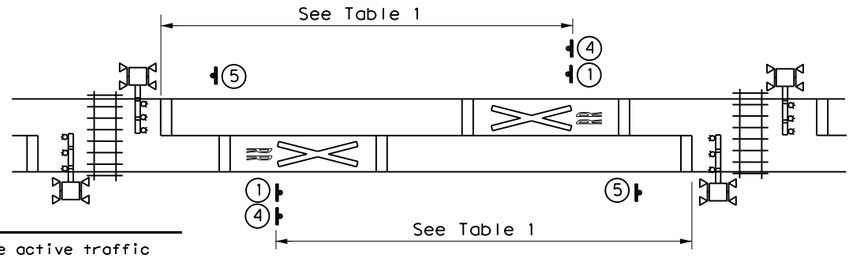


*Use Table 1 if sufficient space exists.

NOTE

Railroad crossing pavement markings and adjacent signs not included when distance between near edge of intersection and near rail is less than 100'. GRADE CROSSING AND INTERSECTION ADVANCE WARNING (W10-3) signs installed on roadway parallel with rail in this case.

T-INTERSECTION



NOTE

Separate active traffic control devices, railroad crossing pavement markings, and adjacent signs required when tracks are more than 100' apart.

2 ADJACENT CROSSINGS

Texas Department of Transportation

Traffic Operations Division Standard

RAILROAD CROSSING DETAILS SIGNING & STRIPING

RCD(2)-16

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PART 1 - GENERAL

1.01 DESCRIPTION

This project includes construction work within the right of way and/or properties of the Railroad and adjacent to its tracks, wire lines and other facilities. These sheets describe the minimum special requirements for coordination with the Railroad when working upon, over or under Railroad Right of Way or when impacting current or future Railroad operations. Coordinate with the Railroad while performing the work outlined herein, and afford the same cooperation with the Railroad as with TxDOT. Complete all submittals and work in accordance with TxDOT Standard Specifications, Railroad Guidelines and AREMA recommendations as modified by these minimum special requirements or as directed in writing by the Railroad Designated Representative.

For purposes of this project, the Railroad Designated Representative is the person or persons designated by the Railroad Manager of Industry and Public Projects to handle specific tasks related to the project.

1.02 REQUEST FOR INFORMATION / CLARIFICATION

Submit Requests for Information ("RFI") involving work within any Railroad Right of Way to the TxDOT Engineer. The TxDOT Engineer will submit the RFI to the Railroad Designated Representative for review and approval for RFI's corresponding to work within Railroad Right of Way. Allow six (6) weeks total time for review and approval, which includes four (4) weeks for review and approval by the Railroad.

1.03 PLANS / SPECIFICATIONS

TxDOT has received written Railroad approval of the plans and specifications for this project. Any revisions or changes in the plans after award of the Contract must have the approval of TxDOT and the Railroad.

PART 2 - UTILITIES AND FIBER OPTIC

Construct all utility installations in accordance with current AREMA recommendations, Railroad, TxDOT and owning utility specifications and requirements. Railroad general guidelines can be found on the Railroad website or by contacting the Railroad Designated Representative.

PART 3 - CONSTRUCTION

3.01 GENERAL

A. Perform all work in compliance with all applicable Railroad, Federal Railroad Administration (FRA), and TxDOT rules and regulations. Arrange and conduct work in a manner that does not endanger or interfere with the safe operation of the tracks and property of the Railroad and the traffic moving on such tracks, or the wires, signals and other property of the Railroad, its tenants or licensees, at or in the vicinity of the Work. The safe operation of railroad train movements takes precedence over any work to be performed by the Contractor. The Contractor is responsible for train delay cost and lost revenue claims due to any delays or interruption of train operations resulting from Contractor's construction or other activities.

B. Construction activities within 15 feet of the operational tracks will only be allowed if absolutely necessary and the Railroad's Designated Representative grants approval. Construction activities within 15 feet of the operational track(s) preferably allow the tracks to stay operational. In such cases, coordination and approval by the Railroad Track Manager is required with regard to schedule, flagging, and slow orders. See Sections 3.07 and 3.08 for additional information.

C. Provide track protection for all work equipment (including rubber tired equipment) operating within 25 feet from nearest rail. When not in use, keep Contractor machinery and materials at least 50 feet from the Railroad's nearest track.

D. Vehicular crossings of railroad track are allowed only at existing crossings, or haul road crossings developed with Railroad approval.

E. The Contractor is also advised that new railroad facilities within the project may be built by the Railroad. If applicable, these facilities are delineated in the plans. Be aware of the limits of responsibilities and coordinate efforts with the Railroad and TxDOT.

F. Railroad requirements do not allow work within 50 feet of track centers when a train passes the work site and all personnel must clear the area within 50 feet of the track centerline and secure all equipment. Additional allowances may be pursued as outlined in 3.02 and 3.03.

G. All permanent clearances shall be verified before project closing.

3.02 RAILROAD OPERATIONS

A. Trains and/or equipment are expected on any track, at any time, in either direction. Become familiar with the train schedules in this location and structure bid assuming intermittent track windows in this period, as defined in Paragraph B that follows.

B. All railroad tracks within and adjacent to the contract site are active, and rail traffic over these facilities shall be maintained throughout the Project. Activities may include both through moves and switching moves to local customers. railroad traffic and operations will occur continuously throughout the day and night on these tracks and shall be maintained at all times as defined herein. Coordinate and schedule the work so that construction activities do not interfere with railroad operations.

C. Coordinate work windows with TxDOT and the Railroad's Designated Representative. Types of work windows include Conditional Work Windows and Absolute Work Windows, as defined below:

1. Conditional Work Window: A Conditional Work Window is a period of time that railroad operations have priority over construction activities. When construction activities may occur on and/or adjacent to the railroad tracks within 25 feet of the nearest track, a railroad flag person will be required. At the direction of the railroad flag person, upon approach of a train, and when trains are present on the tracks, the tracks must be cleared (i.e., no construction equipment, materials or personnel within 25 feet, or as directed by the Railroad Designated Representative, from the tracks). Conditional Work Windows are available for the Project.

2. Absolute Work Window: An Absolute Work Window is a period of time that construction activities are given priority over railroad operations. During this time frame, the designated railroad track(s) will be inactive for train movements and may be fouled by the Contractor. At the end of an Absolute Work Window, the railroad tracks and/or signals must be completely operational for train operations and all Railroad, Public Utilities Commission (PUC) and FRA requirements, codes and regulations for operational tracks must be satisfied. In the situation where the operating tracks and/or signals have been affected, the Railroad will perform inspections of the work prior to placing that track back into service. Railroad flag persons will be required for construction activities requiring an Absolute Work Window. Absolute Work Windows will not generally be granted. Any request will require a detailed explanation for Railroad review.

3.03 RIGHT OF ENTRY, ADVANCE NOTICE AND WORK STOPPAGES

A. Do not perform any work within Railroad Right of Way without a valid executed Right of Entry Agreement if required on this project.

B. Give advance notice to the Railroad as required in the "Contractor's Right of Entry Agreement" before commencing work in connection with construction upon or over Railroad Right of Way and observe the Railroad's rules and regulations with respect thereto.

C. Perform all work upon Railroad Right of Way in a manner to avoid interference with or endanger the operations of the Railroad. Whenever work may affect the operations or safety of trains, submit the work method to the Railroad Designated Representative for approval. Approval does not relieve the Contractor from liability. Do not commence any work which requires flagging service or inspection service until the flagging protection required by the Railroad is available at the job site. See Section 3.15 for railroad flagging requirements.

D. Make requests in writing for both Absolute and Conditional Work Windows, at least 30 days in advance of any work. Include in the written request:
1. Exactly what the work entails.
2. The days and hours that work will be performed.
3. The exact location of work, and proximity to the tracks.
4. The type of window requested and the amount of time requested.
5. The designated contact person.

Provide a written confirmation notice to the Railroad at least 48 hours before commencing work in connection with approved work windows when work is within 25 feet of nearest rail. Perform all work in accordance with previously approved work plans.

E. Make provisions to protect operations and property of the Railroad should a condition arising from, or in connection with the work, require immediate and unusual action. If in the judgment of the Railroad Designated Representative such provisions are insufficient, the Railroad Designated Representative may require or provide such provisions as deemed necessary. In any event, such provisions shall be at the Contractor's expense and without cost to the Railroad or TxDOT. The Railroad or TxDOT shall have the right to order the Contractor to temporarily cease operations in the event of an emergency or, if in the opinion of the Railroad Designated Representative, the Contractor's operations could endanger railroad operations. In the event of such an order, immediately notify TxDOT of the order.

3.04 INSURANCE

Do not begin work upon or over Railroad Right of Way until furnishing the Railroad with the insurance policies, binders, certificates and endorsements required by the "Contractor's Right of Entry Agreement", and until the Railroad Designated Representative has advised TxDOT that such insurance is in accordance with the Agreement.

3.05 RAILROAD SAFETY ORIENTATION

A. Complete the railroad course "Orientation for Contractor's Safety", and maintain current registration prior to working on railroad property. This course is required to be completed annually by Contractor and Subcontractor personnel working on site.

"UPRR, BNSF, KCS/TEXMEX will not accept on-track safety training certificates from other railroads. Refer to Railroad specific contractor right of entry for training information."

B. Know and follow the "Contractor's Right of Entry Agreement" EXHIBIT D, MINIMUM SAFETY REQUIREMENTS regarding clothing, personal protective equipment, and general safety requirements.

3.06 COOPERATION

The Railroad will cooperate with Contractor so that work may be conducted in an efficient manner, and will cooperate with Contractor in enabling use of Railroad Right of Way in performing the work.

3.07 MINIMUM CONSTRUCTION CLEARANCES FOR FALSEWORK AND OTHER TEMPORARY STRUCTURES

Abide by the following minimum temporary clearances during the course of construction:
A. 15' - 0" (BNSF)(UPRR)and 14'-0" (KCS) horizontal from centerline of track
B. 22' (KCS) and 21' - 6" (UPRR & BNSF) vertically above top of rail.

For construction clearance less than listed above, obtain local Railroad Operating Unit review and approval.

3.08 APPROVAL OF REDUCED CLEARANCES

A. Maintain minimum track clearances during construction as specified in Section 3.07.

B. Submit any proposed infringement on the specified minimum clearances to the Railroad Designated Representative through TxDOT at least 30 days in advance of the work. Do not proceed with such infringement without written approval by the Railroad Designated Representative.

C. Do not commence work involving an approved infringement without receiving written assurance from the Railroad Designated Representative that arrangements have been made for any necessary flagging service.

Texas Department of Transportation | Rail Division

RAILROAD REQUIREMENTS FOR NON-BRIDGE CONSTRUCTION PROJECTS

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	HOU	MONTGOMERY		144

DATE:
FILE:

3.09 MAINTENANCE OF RAILROAD FACILITIES

A. Maintain all ditches and drainage structures free of silt or other obstructions resulting from Contractor's operations. Repair eroded areas and any other damage within Railroad Right of Way and repair any other damage to the property of the Railroad, or its tenants.

B. Perform all such maintenance and repair of damages due to the Contractors's operations at Contractor's expense.

C. Submit a proposed method of erosion control for review by the Railroad prior to beginning any grading on the project site. Comply with all applicable local, state and federal regulations when developing and implementing such erosion control.

3.10 SITE INSPECTIONS BY RAILROAD's DESIGNATED REPRESENTATIVE

A. In addition to the office reviews of construction submittals, site inspections may be performed by the Railroad Designated Representative at significant points during construction, including the following if applicable:
   1. Pre-construction meetings.
   2. Pile driving/drilling of caissons or drilled shafts.
   3. Reinforcement and concrete placement for railroad bridge substructure and/or superstructure.
   4. Erection of precast concrete or steel bridge superstructure.
   5. Placement of waterproofing (prior to placing ballast on bridge deck).
   6. Completion of the bridge structure.

B. Site inspection is not limited to the milestone events listed above. Site visits to check progress of the work may be performed at any time throughout the construction as deemed necessary by the Railroad.

C. Provide a detailed construction schedule, including the proposed temporary horizontal and vertical clearances and construction sequence for all work to TxDOT for submittal to the Railroad Designated Representative for review prior to commencement of work. Include the anticipated dates when the above listed events will occur. Update this schedule for the above listed events as necessary and each month at a minimum to allow the Railroad to schedule site inspections.

3.11 RAILROAD REPRESENTATIVES

Railroad representatives, conductors, flag person or watch person will be provided by the Railroad at expense of TxDOT to protect Railroad facilities, property and movements of its trains or engines. In general, the Railroad will furnish such personnel or other protective services as follows:

A. When any part of any equipment is standing or being operated within 25 feet, measured horizontally, from nearest rail of any track on which trains may operate, or when any object is off the ground and any dimension thereof could extend inside the 25 foot limit, or when any erection or construction activities are in progress within such limits, regardless of elevation above or below track.

B. For any excavation below elevation of track subgrade if, in the opinion of the Railroad Designated Representative, track or other railroad facilities may be subject to settlement or movement.

C. During any clearing, grubbing, excavation or grading in proximity to railroad facilities, which, in the opinion of the Railroad Designated Representative, may endanger railroad facilities or operations.

D. During any Contractor's operations when, in the opinion of the Railroad Designated Representative, railroad facilities, including, but not limited to, tracks, buildings, signals, wire lines, or pipe lines, may be endangered.

E. Arrange with the Railroad Designated Representative to provide the adequate number of flag persons to accomplish the work.

3.12 COMMUNICATIONS AND SIGNAL LINES

If required, the Railroad will rearrange its communications and signal lines, its grade crossing warning devices, train signals and tracks, and facilities that are in use and maintained by the Railroad's forces in connection with its operation at expense of TxDOT. This work by the Railroad will be done by its own forces and it is not a part of the Work under this Contract.

3.13 TRAFFIC CONTROL

Coordinate any operations that control traffic across or around railroad facilities with the Railroad Designated Representative.

3.14 CONSTRUCTION EXCAVATIONS AND BORING ACTIVITIES UNDER TRACK

A. Take special precaution and care in connection with excavating and shoring. Excavations for construction of footings, piers, columns, walls or other facilities that require shoring shall comply with requirements of TxDOT, OSHA, AREMA and Railroad "Guidelines for Temporary Shoring".

B. The project plans indicate whether there are fiber optic lines or other such telecommunications systems that require consideration. Regardless, contact the necessary call center to determine if such cable systems are present:

   UPRR 1-800-336-9193
   7:00 AM to 9:00 PM CST Monday-Friday except holidays,
   staffed 24 hrs/day for emergencies
   48 hrs notice required

   BNSF 1-800-533-2891
   24 hour number
   5 working days notice required

   KCS 1-800-344-8377
   Texas One Call, a 24 hour number
   48 hrs notice required, excluding weekends and holidays

   If a telecommunications system is buried anywhere on or near railroad property, coordinate with TxDOT, the Railroad and the Telecommunication Company(ies) to arrange for relocation or protective measures prior to beginning work on or near railroad property. Refer to the project General Notes for additional information.

C. Projects involving a boring or jack and bore operation under track such as drainage pipes or culverts and utilities require an installation plan reviewed and approved by the Railroad and TxDOT prior to proceeding with such construction. A railroad inspector and contractor assisted monitoring of ground and track movement is required to maintain safe passage of rail traffic. Stop installation and do not allow passage of trains if movements in excess of 1/4 inch vertical or horizontal is detected in the tracks. Immediately repair the damage to the satisfaction of TxDOT and the Railroad before proceeding.

3.15 RAILROAD FLAGGING

Per the Right of Entry Agreement for flagging, notify the Railroad Representative at least 10 working days in advance of Contractor's work and at least 30 working days in advance of any Contractor's work in which any person or equipment will be within 25 feet of nearest rail or as specified in the Contractor Right of Entry (CROE).

3.16 CLEANING OF RIGHT-OF-WAY

When work is complete, remove all tools, implements, and other materials brought into Railroad Right of Way and leave the right of Way in a clean and presentable condition to the satisfaction of TxDOT and the Railroad.

Texas Department of Transportation | Rail Division

RAILROAD REQUIREMENTS FOR NON-BRIDGE CONSTRUCTION PROJECTS

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