

# STATE OF TEXAS DEPARTMENT OF TRANSPORTATION

## PLANS OF PROPOSED HIGHWAY ROUTINE MAINTENANCE CONTRACT

### TYPE OF WORK:

#### GENERAL MAINTENANCE

PROJECT NO. : RMC6399-15-001  
HIGHWAY : SH99 (SEGMENTS H, I-1 AND I2A)  
LIBERTY AND CHAMBERS COUNTIES

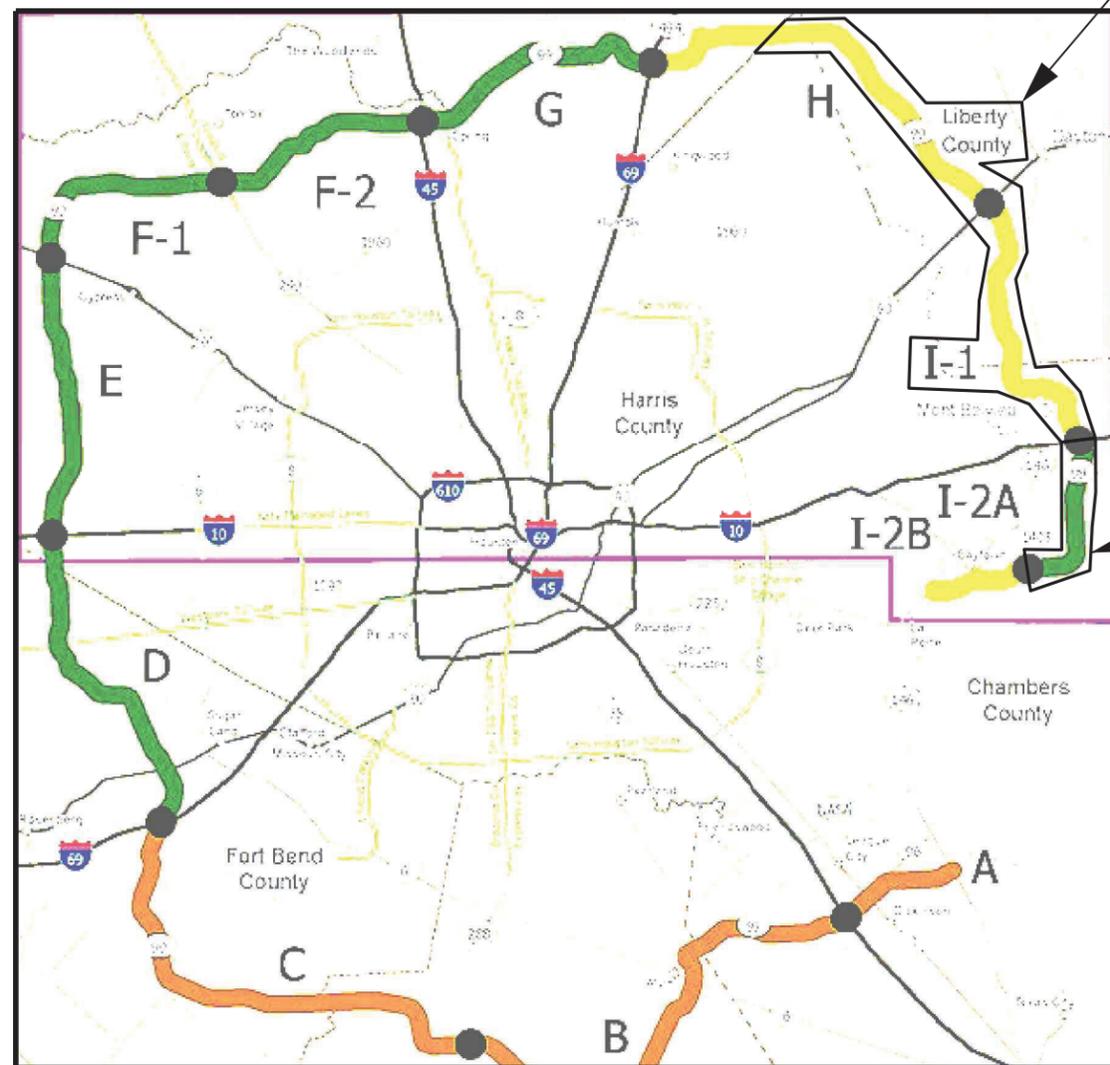
FED. RD. DIV. NO.	MAINTENANCE PROJECT NO.	SHEET NO.
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STATE	STATE DIST.	COUNTY
TEXAS	BMT	LIBERTY, ETC.
CONT.	SECT.	JOB
6399	15	001
		HIGHWAY NO.
		SH99

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SHEET NO.	DESCRIPTION
SEE SHEET NO. 2	



HWY	SEGMENT	FROM	TO	REF MRKRS	MILES
SH 99	H (LIBERTY)	HARRIS C/L	US 90	761-755	14.09
SH 99	I-1 (LIBERTY)	US 90	CHAMBERS C/L	755-765	9.35
SH 99	I-1 (CHAMBERS)	LIBERTY C/L	I-10	765-770	5.42
SH 99	I-2A	I-10	FM 1405	770-779	9.08



**LOCATION AND VICINITY MAP**

LIBERTY COUNTY  
SH99 GRAND PARKWAY  
SEGMENT I-1+H

CHAMBERS COUNTY  
SH99 GRAND PARKWAY  
SEGMENT I-2A

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SUBMITTED FOR LETTING: 08/01/2022

*Suzumb .P.E*

PROJECT ENGINEER

RECOMMENDED FOR LETTING: 8/1/2022

DocuSigned by:  
*Chris Henry, P.E.*

DIRECTOR OF MAINTENANCE

APPROVED FOR LETTING: 8/1/2022

DocuSigned by:  
*Mark W. Goff, P.E.*

DISTRICT ENGINEER

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

EXCEPTIONS: NONE  
EQUATIONS: NONE

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*Signature*, P.E.

6/29/2022



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STATE	STATE DIST. NO.	COUNTY
TEXAS	20	LIBERTY, ETC
CONT	SECT.	JOB
6399	15	001
		HIGHWAY NO.
		SH99

\*\* The standard sheets specifically identified above have been selected by me or under my responsible supervision as being applicable to this project."

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Project Number: RMC 639915001

County: LIBERTY, ETC.

Highway: SH 99

Control: 6399-15-001

## GENERAL MAINTENANCE CONTRACT

### GENERAL NOTES:

#### SUPERVISION:

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

**Area Engineer:** Noel S. Salac, P.E. [noel.salac@txdot.gov](mailto:noel.salac@txdot.gov)

**Assistant Area Engineer:** Roberto M. Rodriguez, P.E. [roberto.m.rodriguez@txdot.gov](mailto:roberto.m.rodriguez@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.

All work will be scheduled and directed by, and request for payment addressed to:

#### **Maintenance Section Supervisor for Liberty County or Designee:**

Tyrone Alexander, Liberty County Office, Email: [Tyrone.Alexander@txdot.gov](mailto:Tyrone.Alexander@txdot.gov)

Address: 209 LAYL DR, LIBERTY, TX 77575, Phone: 936/336-5669

#### **Maintenance Section Supervisor for Chambers County or Designee:**

Teddy G Hickman, ANAHUAC Office, Email: [Teddy.Hickman@txdot.gov](mailto:Teddy.Hickman@txdot.gov)

Address: 503 N ROSS STERLING, ANAHUAC, TX 77514 Phone: 409/658-9458

This is a Routine Maintenance Non-Site-Specific Call-Out contract.

Designate in writing a competent, English-speaking Superintendent employed by the Contractor. The Superintendent must be experienced with the work being performed and capable of reading and understanding the Contract. Ensure the Superintendent is always available and able to receive instructions from the Engineer or authorized Department representatives and to act for the Contractor. The Engineer may suspend work without suspending working day charges if a Superintendent is not available or does not meet the above criteria.

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Work orders will be issued for no less than \$1,000.00 per day plus callout and emergency costs when applicable.

Work requests are made on a call out basis. Contractor shall begin work within 48 hours of notification. Contractor shall begin work within 3 hours of notification for emergency calls. Failure to begin work within 48 hours of notification (3 hours for emergency calls), will result in the assessment of liquidated damages. Liquidated damages will also be assessed for failure to complete the contract, work order, or call out work.

The Contractor will begin call out work within the required time for each work order. Work orders are expected to be completed per the contract plans within the number of days allowed for each work order. All call out work orders will have a begin date and number of working days. The Contractor will begin work within 48 hours of notification for routine call outs, unless otherwise approved by the Engineer. Work will be completed within the required number of working days. The Contractor will begin work within 4 hours of notification for emergency call outs and complete within 48 hours, unless otherwise approved by the Engineer. Failure to begin work within the required time and proceed to completion within the required time will result in the assessment of liquidated damages.

Refer to Items 545 and 636 for specific response times.

Perform work on as-needed basis where directed.

Notify the Department by 7:30 am, when scheduled work is cancelled.

Tolls incurred by the contractor are incidental to the various bid items.

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

As-built plans are available upon request to the Engineer.

Work orders for routine maintenance will be issued weekly. Work orders for emergencies will be issued on an as-needed basis.

Contractor may be required to run multiple crews simultaneously. Accordingly, contractor shall have sufficient crew to run multiple operations. Contractor shall not remove workers from currently running operations to start new operations unless under emergency circumstances.

#### **General:**

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.

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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.

**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.

**General: Site Management**

Do not mix or store materials, 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.

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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  
Elgin White Wing  
Elgin Pelican

M-B Cruiser II  
Wayne Model 945  
Mobile TE-3  
Mobile TE-4  
Murphy 4042

**General: Utilities**

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

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

Be aware that an operational Computerized Transportation Management System (CTMS) exists within the limits of this project and that the system must remain operational throughout construction. If the Contractor damages or causes damage to this system, repair such damage within 8 hours of occurrence at no cost to the Department. In the event of system damage, notify the Director of Traffic Management Systems at 409/898-5768 within one hour of occurrence. Failure of the Contractor to repair damage to the main fiber optic cable and CCTV cable trunk lines, which convey all corridor information to TranStar, will result in the Contractor being billed for the full cost of emergency repairs.

At least 72 hours before starting work, make arrangements for locating existing Department-owned above ground and underground fiber optic, communications, power, illumination, and traffic signal cabling and conduit. Do this by calling the Department’s Beaumont District Traffic Signal Operations Office at 409/898-5768, to schedule marking of underground lines on the ground. Use caution if working in these areas to avoid damaging or interfering with existing facilities.

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

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.

**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.

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

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

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

Existing pavement markings removed or damaged by more than 20 ft. will be replaced with temporary striping. Temporary striping shall be paint based unless otherwise directed by the engineer. This work will be considered incidental to the item of work.

**Item 5 Control of the Work**

Verify all horizontal and vertical control, approach grades to structures and driveways before beginning work. Notify the Engineer immediately if discrepancies are discovered.

Furnish, to the Engineer, a list of the final centerline elevations based on the alignment stationing shown on the plans.

When a precast or cast-in-place concrete element is included in the plans, a precast concrete alternate may be submitted in accordance with "Standard Operating Procedure for Alternate Precast Proposal Submission" found online at <https://www.txdot.gov/inside-txdot/forms-publications/consultants-contractors/publications/bridge.html#design>. Acceptance or denial of

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an alternate is at the sole discretion of the Engineer. Impact to the project schedule and any additional costs resulting from the use of alternates are the sole responsibility of the Contractor.

**Item 7: Legal Relations and Responsibilities**

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.

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 Beaumont District Environmental Section. Obtain this approval well in advance of the planned use. Contact the Beaumont District Environmental Section at 409-898-5830. The cost of this work is subsidiary to the various bid items.

**Item 8 Prosecution and Progress**

Working days will be computed and charged based on a Calendar Day workweek in accordance with Section 8.3.1.5

Adjoining projects may be in progress during the construction of a portion of this project. Plan and prosecute the sequence of construction and the traffic control plan with adjacent construction projects, if applicable. Manage construction of all phases to minimize disruption to traffic.

Notify the Engineer 72 hours in advance of any temporary or permanent lane, ramp or connector affected by closures, detours, or restrictions to lane widths, alterations to vertical clearances or modifications to alignment/radii. Any other modification to the roadway that may adversely affect the mobility of oversized/overweight trucks will require 5 business day advance written notice to the Engineer.

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For all travel lanes, ramps, or connector closures, provide information regarding dates, times, typical work hours, type of closure, reason for closure, and expected project duration to the Liberty Area Office. This information will be provided 72 hours in advance of the closure to the Liberty Area Office. If approved, the Liberty Area Office will forward the information to the Public Information Officer for the Beaumont District.

No simultaneous daytime and nighttime work will be allowed unless otherwise approved.

Night work may be required on all projects. If required, nighttime hours will be defined as 9:00 PM until 5:00 AM, Sunday night thru Thursday night. Ensure all lanes are reopened by 5:00 A.M.

Night work will be allowed.

Maintain one lane open to traffic during construction, unless otherwise approved.

Schedule work so that all travel lanes are open during non-working hours, nights and weekends, unless otherwise approved.

Limit lane closures to 1 mile unless otherwise approved.

Supplemental lighting in addition to lighting on equipment and work vehicles will be required to insure adequate lighting for workers safety and inspection. All operations including planning and ACP placement must be adequately lighted using supplemental lighting. All supplemental lights are subject to the approval of the Engineer. Supplemental lighting will be added to the milling machine, asphalt distributor, aggregate spreader, rollers and laydown machine unless otherwise approved. This is considered subsidiary to the various bid Items of the contract.

All edges must be backfilled by the end of the day with a 3:1 or flatter slope. No drop offs will be left overnight.

Complete all work at one location before proceeding to a new location unless otherwise approved. If additional locations are approved, erect barricades only for those additional locations. Maintain barricades at each of these locations until all work at the site is completed and accepted.

Work will not be permitted when impending bad weather or low temperatures may impair the quality of work.

This project will consist of work at multiple site locations. The work at most locations will be performed during daytime hours and other locations may require nighttime work.

The construction sequence may be modified as directed and approved.

Complete work on one side of one structure before beginning work on the other side of the structure or before beginning work on another structure, unless approved otherwise.

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Law enforcement will be considered for this contract under the following conditions unless otherwise directed:

- Work involving controlled access facilities,
- Night work operations that create substantial traffic safety risks for workers and/or road users,
- Major traffic shifts involving high speed (greater than 55 MPH) and/or high-volume roadways (ADT exceeds 10,000),
- Traffic shifts at intersections where unexpected or sudden queuing is anticipated,
- Complex intersections where flaggers may not be able to maintain adequate traffic control.

Provide full-time, off-duty uniformed officer(s), with transportation jurisdiction and full police powers in the county or city in which the project is located, during construction as directed. The officer(s) must be able to show proof of certification by the Texas Commission on Law Enforcement Officers Standards.

Officer(s) will be paid by force account and must be approved. The vehicle used must be a marked law enforcement vehicle in the city or county where the project is located. Complete the daily tracking form provided by the Department and submit invoices that agree with the tracking form for payment at the end of each month approved services were provided.

#### **HURRICANE**

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

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

No significant traffic generator events identified.

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In the event of the declaration of a hurricane watch, warning, other severe weather warning or national or state emergency that requires the roadways in the vicinity be used as evacuation routes, cease all work that requires the Contractor's, sub-contractors' or material suppliers' vehicles to enter the stream of traffic on these primary or secondary evacuation routes. This work includes material hauling and delivery, and mobilization or demobilization of equipment.

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

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

In the event of the declaration of a hurricane watch, warning, other severe weather warning or national or state emergency that requires the roadways in the vicinity be used as evacuation routes, cease all work that requires the Contractor's, sub-Contractors' or material suppliers' vehicles to enter the stream of traffic on these primary or secondary evacuation routes. This work includes material hauling and delivery, and mobilization or demobilization of equipment.

#### **Item 104 Removing Concrete**

Salvage concrete removed. Dispose of by stockpiling and/or depositing salvaged concrete at sites indicated on the plans or as directed for the purpose of erosion prevention

Shape the broken concrete to deposit it for erosion prevention. Compact the concrete by pushing and walking with a bulldozer or other suitable equipment to meet plan lines and grades. Plan set shows the stockpile sites. Consider this work to be subsidiary to the various bid items of the contract.

Saw the longitudinal break-back line when removing the existing concrete pavement for stage construction. Saw depth to be approximately two (2) inches. The saw depth is to increase, if the edge of the existing concrete pavement to remain in place is not reasonably straight or as directed. Consider this work to be subsidiary to the various bid items of the contract.

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Provide full depth saw cutting for removal of existing concrete driveways that conflict with the proposed widening. Consider this work to be subsidiary to the various bid items of the contract.

Remove the existing concrete curb and rebar flush with the concrete pavement. Limits of riprap and/or mow strip removal will be as directed.

#### **Item 134 Backfilling Pavement Edges**

Use RAP salvaged from within the project limits to the maximum extent possible. Size RAP so that all material passes the two-inch sieve. Use RAP that does not contain deleterious material such as clay or organic material.

Embankment quantity by station includes both sides of the roadway. No deduction in payment will be made when in the opinion of the Engineer only one side of a roadbed section requires backfilling.

Backfill the pavement edges daily so that no drop-off conditions exist. Type A or B material will meet one of the following requirements:

1. Item 132, Type C
2. Use material from subgrade widening for backfilling pavement edges.

Embankment Type C will conform to the following specification requirements:

Liquid Limit – 40 maximum

Plasticity Index – 25 maximum, 8 minimum

A cohesionless sand will not be permitted

#### **Item 150: Blading**

Blade the shoulders in accordance with this Item and as directed.

Perform blading for ditch grading to ensure proper drainage between the existing and proposed ditches.

If using native soil for reshaping the shoulders, no separate payment for materials will be made.

#### **Item 162 Sodding for Erosion Control**

Furnish and place Bermudagrass sod. Furnish and place St. Augustine sod.

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#### **Item 164 Seeding for Erosion Control**

Final grading and stabilization (seeding) will be achieved as soon as possible and not scheduled only for the end of the project. Final grading and stabilization should be initiated as the overall work progresses.

Multiple mobilizations of the seeding crews will be expected to comply with the Construction General Permit of the Texas Pollution Elimination Discharge System requirements for re-vegetating disturbed soils.

Eliminate seeding in areas of natural growth determined to have enough cover.

#### **Item 166 Fertilizer**

Fertilize all the seeded or sodded areas of project.

#### **Item 168 Vegetative Watering**

Equip water trucks with sprinkler systems capable of covering the entire area to be seeded or sodded from the roadway.

Water all newly placed sod or seeded areas the same day of installation. Thereafter, maintain the sod or seeded areas in a well-watered condition and at no time allow the areas to dry to the condition that water stress is evident.

Mechanical watering may not be required during periods of adequate moisture as determined.

Furnish and apply water at a rate of 6.788 Mega gallons per acre per cycle or as directed on the plans.

Comply with stabilization requirements for 70% grass coverage; uniform vegetative coverage is required. During this period, meter and operate water equipment under pumping pressure capable of delivering the required quantities of water necessary. For Permanent seeding each cycle will be executed weekly for 12 weeks, unless directed otherwise. For Temporary seeding each cycle will be executed weekly for 6 weeks, unless directed otherwise.

Provide a logbook showing daily water usage and receipts of water applied, in addition to metering the water equipment.

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#### **Item 351 Flexible Pavement Structure Repair**

The repair areas will require full depth saw-cut when milling is not used. Consider this work to be subsidiary to the various bid items of the contract.

Provide Flexible Pavement Repair with Item 3076, Type B (PG 64-22) unless approved otherwise. Place Hot Mix with a constant longitudinal surface grade and tie in flush with the existing surface at each end and both sides of the repair area.

Unless otherwise directed, place new ASB with maximum 4" lifts. The minimum patch sizes will be 6' in width and 10' in length. Use asphalt stabilized base for the base material or as directed by the Engineer.

Match the existing cross slope in the repair areas, unless directed otherwise.

All repair locations must be filled the same day they are excavated. No open cut areas will be allowed overnight.

All excavated materials will be removed from the project daily.

Ordinary compaction will be used on this project.

Station limits may be adjusted as directed to meet varying field conditions

For repair locations located in areas to be planed, perform flexible pavement repairs after planing operations.

Seal the perimeter of the repair areas with hot poured rubber in accordance with Item 712. Consider this work to be subsidiary to the various bid items of the contract.

#### **Item 361 Repair of Concrete Pavement**

Schedule work so that concrete placement follows full-depth saw-cutting by no more than 72 hours on typical roadways unless otherwise approved. Repairs located within bridge approach slabs are to be replaced the day after sawing unless otherwise approved.

Complete repairs so that longitudinal joints fall on edge of travel lane or center of travel lane. No joints will be allowed in the wheel paths.

All material generated, including concrete slurry, as a result of saw cutting will be collected and kept from entering waterways, culverts, roadway inlets, and ditches.

Work will be conducted in such a manner so that all materials will be collected before the end of each day and especially before any rainfall event. Material from saw cutting will not be allowed to be tracked by traffic to other areas. Adequate sweeping,

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vacuuming and hauling equipment will be maintained on the project to conduct material collection and recovery on a continuous basis. Curb inlets will be blocked and protected during grinding and sweeping operations, but fully opened before a rainfall event. Disposal of the material produced by the sawing operation will be to a solid waste facility authorized to handle such material. The Contractor will, before beginning operations, provide a plan outlining the method of collection and disposal of this material for approval. The plan will also include the name and location of the facility receiving the solid waste. All work, equipment, materials and fees necessary to collect and dispose of this material will be considered subsidiary to this item and not paid for directly.

Provide Class HES concrete. The coarse aggregate will be either Grade 2 or 3. A set accelerating admixture or high range water reducer may be necessary to meet the compressive strength requirements: this will require the written approval of the Engineer and will be subsidiary to the bid item. A satisfactory work plan for control must be submitted by the Contractor and approved before use. An evaluation of the concrete containing the admixture will be performed by the Engineer. Design the Class HES concrete to meet the requirements of Class P and a minimum average compressive strength of 1800 psi in 4 hours.

Where repairs in jointed pavement require the removal of a longitudinal tine joint, construct a new joint at the same location.

Where patches in jointed pavement require the removal of an existing dowel basket assembly, install a new basket in the same location.

Provide a concrete finish consisting of a carpet drag and longitudinal tine as per the 2014 Standard Specification book Item 360 on patches which are not to be overlaid or seal coated, unless otherwise directed. Provide a standard broom finish on all other pavements. Place the final riding surface on the patch before opening the patch to traffic.

Saw-cutting will not be paid for directly but will be considered subsidiary to this Item. Schedule work, such that concrete placement follows full-depth saw-cutting by no more than three days. Saw-cutting of existing concrete pavement across existing cracks will not be allowed unless approved.

Placement of removed slabs onto concrete pavement which is to remain in place will not be allowed. All removed portions of concrete will be removed from the project the same day as removed from the roadway. Breaking removed portions of concrete on the top of the existing pavement will not be allowed.

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Concrete removal will not be permitted when impending weather conditions may result in rainfall which will delay the concrete placement. If rainfall should occur after concrete placement operations have commenced, the Contractor will have ample covering on hand to protect the work.

For all concrete patches without an asphaltic concrete pavement overlay or seal coat, provide a vibratory screed at least two (2) feet longer than the width of the pavement to be used in finishing all repaired areas ten (10) feet or longer in length.

The size, location, and number of patches are approximate and subject to change as directed. Any additional sawing required as a result of these changes will not be paid for directly but will be considered subsidiary to this Item.

Salvage and stockpile any removed material that is within the limit of the project.

Saw and seal completed patches around the perimeter of the patch (Method B) for all patches without an asphaltic concrete pavement overlay. Fill all joints with Class 3 hot poured rubber and backer rod for all patches without an asphaltic concrete pavement overlay. This work will not be paid for directly but will be considered subsidiary to this Item.

#### **Maturity Testing**

Maturity testing, Tex-426-A, will be allowed for concrete pavement. Unless otherwise approved, use the maturity method in accordance with test method Tex-426-A to estimate concrete strength. The Maturity system will not be paid for directly but is considered subsidiary to this item.

Provide to the Engineer, the Intellirock or Command Center maturity system (or approved equivalent) for testing concrete maturity. This system will include the logger/sensor, handheld reader, and software. The Intellirock system can be obtained from Nomadics Construction Labs (405-372-9535) and the Command Center system can be obtained from the Transtec Group (512- 451-6233). Provide two (2) sensors per mix design and one (1) sensor to be placed in the last concrete pour per location site per day. Up to ten (10) additional sensors may be required and placed as directed. Furnish the concrete necessary to establish the maturity curve for testing. This work is to be performed before any concrete being placed and will not be paid for directly but will be considered subsidiary to this Item.

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**Item 500: Mobilization**

This contract consists of weekly Call-out Mobilization for routine work and Emergency Mobilization for any emergency or unexpected work. Mobilization (Callout) will be paid once per work order, regardless of the number of locations listed on the work order.

**Item 502 Barricades, Signs, and Traffic Handling**

Construct all work zone signs, sign supports, and barricades from material other than wood unless approved otherwise. Metal posts, if used, are to be galvanized. Aluminum signs, if used, will meet the following minimum thickness requirements:

<u>Square Feet</u>	<u>Minimum Thickness</u>
Less than 7.5	0.080 inches
7.5 to 15	0.100 inches
Greater than 15	0.125 inches

The Contractor Force Account “Safety Contingency” that has been established for this project is intended to be used 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.

Arrange asphalt laydown schedule to meet plan striping requirements. Limit length of lane closures to 2 miles unless otherwise approved.

Any work being done above travel lanes on an overhead sign bridge will require the lanes to be closed for traffic safety.

Remove all traffic control devices from the right of way when they are not in use. Devices scheduled to be used within 3 days may be placed along the shoulder of the roadway or along the right of way when not in use or stored in other approved areas on the project. Cover any construction signs that are not in effect and are installed in a fashion that will not allow them to be removed from the right of way easily.

Provide construction fencing as approved at all work locations to protect pedestrian or bicycle traffic. This material and its placement will be considered subsidiary to Item 502.

Arrange construction operations to prevent the hauling of materials through the completed pavement sections unless otherwise approved.

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Provide all flaggers and pilot vehicle drivers with two-way radio communication capability. Provide flaggers at each side road intersection.

**Item 506 Temporary Erosion, Sedimentation, and Environmental Controls**

Construct all side slopes on rock filter dams with 6:1 slope.

It is not anticipated that any erosion, sedimentation, or environmental control devices will be needed on this project. The Contractor Force Account “SW3P Contingency” that has been established for this project is intended to be used if such controls become necessary. The SW3P for this project will consist of the use of any temporary erosion control measures deemed necessary and as specified under this Item. This work will be paid for in accordance with Article 4.4., "Changes in the Work.

The Contractor is prohibited from removing grass vegetation throughout the entire project limits and then ceasing construction for long periods, typically over three weeks. The Contractor schedule will be developed based on staged vegetation removal, limiting disturbed soil to no more than 25 percent at one time, unless otherwise approved. Should the Contractor not be able to adequately control sediment and erosion for areas disturbed, the Department will substantially reduce the size of areas that the Contractor may disturb soil.

Should the project be evaluated to have sediment control problems as a result of the Contractor disturbing excessive amounts of soil, the Contractor will be required to immediately re-vegetate (seed and water) those disturbed areas at no cost to the Department.

**Item 529: Concrete Curb, Gutter, and Combined Curb and Gutter**

An air-entraining admixture is not required.

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

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

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

**Item 540 Metal Beam Guard Fence**

Provide Type II galvanization metal beam rail elements.

Provide round timber posts.

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Provide timber posts on all metal beam guard fence installations except where CRT low-fill culvert posts are required in accordance with details shown on the Long Span Metal Beam Guard Fence standard sheet.

Field fabricate low-fill culvert posts to insure proper metal beam guard fence height.

At the close of work each day, protect the ends of metal beam guard fence in an approved manner, so that no blunt ends are exposed to approaching traffic.

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

#### **Item 542: Removing Metal Beam Guard Fence**

Remove and assume ownership of unsalvageable metal beam guard fence rail elements and posts. Transport and store any functional, salvageable rail elements, including steel posts, which are not reused in this project, to the Department stockpile located at the TXDOT Liberty Area Office.

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

#### **Item 543 Cable Barrier System**

Payment for Removal of Cable Barrier System will include removal of mow strips.

#### **Item 545 Crash Cushion Attenuators**

See standards in the plan set for information describing the attenuator's details: direction of traffic, design speed, foundation, backup support, backup width, and/or transition options.

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

Payment for D&OM(VIA)-20, and all required object markers and barrier reflectors on the attenuators will be considered subsidiary to this Item.

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Unless otherwise shown on the plans, Crash Cushion Attenuators (CCA) tested for 70 mph are required for temporary and permanent CCA installations on freeways where the backup support width is 36 in. or less. Test Level TL-3 is required for temporary and permanent CCA installations at other locations requiring a CCA.

Removal of existing crash cushion attenuator units is incidental. Once salvageable units are removed, they shall be delivered to the Area Office Maintenance yard as directed, at no cost to the Department.

SGT systems, guardrail and crash attenuator damage shall be secured within 4 hours of notification during normal work hours.

Repairs shall be made within 48 hours of notification.

Securing of the site shall be incidental.

#### **Item 636 Signs and/or Item 644 Small Roadside Sign Assemblies and/or Item 647 Large Roadside Sign Supports and Assemblies**

Remove and stockpile all existing signs and sign posts within the project that are not to remain, at a stockpile location designated by the Engineer. Remove the signs from the posts. Replace any signs or post damaged by the Contractor at his/her entire expense. Consider this work to be subsidiary to the various bid items of the contract.

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

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

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.

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

STOP signs and YIELD signs shall be repaired within 2 hours of notification. DO NOT ENTER and WRONG WAY signs shall be repaired within 24 hours of notification. All other regulatory signs shall be repaired within 48 hours of notification. WARNING signs shall be repaired within 48 hours of notification. GUIDE signs shall be repaired within 7 days of notification.

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SMALL SIGNS/TYPE OF DAMAGE	USE BID CODE(S)
Sign down and/or loose - no damage	6044-6001
Sign good, post and/or foundation damage	6044-6002
Sign damaged, post and/or foundation damage	6044-6002 and 636-6001
Upgrading and/or installing new sign. Removal of the existing sign, furnishing and installing new sign.	6044-6004
Sign damaged/Faded, post and/or foundation good	636-6001

LARGE SIGNS/TYPE OF DAMAGE	USE BID CODE(S)
Sign down and /or loose - no damage	6043-6001
Sign good, post and/or foundation damaged	6043-6002
Sign damaged, post and/or foundation damaged	6043-6002 and 636-6002
Upgrading and/or installing new sign. Removal of the existing sign, furnishing and installing new sign.	6043-6004
Sign damaged/Faded, post and/or foundation good	636-6002
Overhead sign damaged or faded	636-6003

For all EXIT sign repairs, contractor shall close the exit and shall use TMAs during the repair process. As a result of said closure requirement, contractor shall notify TxDOT inspectors office so that they (TxDOT) can notify the Beaumont District Public Information Office and the Toll Operations Division (if applicable) 7 days prior to closure in accordance with Item 502 above.

TxDOT reserves the right to have the contractor pull up approximately 5% of the installed bases to insure proper depth and coverage of the concrete. Assume expense and replace all bases on each work order if proper depth and coverage is not found. If proper coverage is found, TxDOT will assume the expense of replacement of the pulled bases.

**Item 658 Delineator and Object Marker Assemblies**

Use Type A reflector unit (sheeting) on delineator assemblies attached to concrete barrier.

Mount reflectors on a steel or concrete bridge rail, where the bridge is greater than 200’ in length, at a height of 6” from the top of the rail to the bottom of the reflector.

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Mount reflectors on a steel or concrete bridge rail, where the bridge is 200’ or less in length, at the same height as the butterfly reflectors in the MBGF rail element.

Use bolt-on attachment for delineator assemblies attached to guard fence.

Install delineators when directed. This may require installation of delineators on portions of guardrail and bridge rail that is not being repaired in order to maintain consistency with adjacent sections.

MBGF will receive GF2 delineators installed on 100’ maximum spacing.

Type C delineators will be installed using Adhesive 795A manufactured by Davidson Traffic Control Products or an equivalent approved in writing.

**Item 666 Retro reflectorized Pavement Markings**

Furnish Type II drop-on glass beads.

Use Type III glass beads for thermoplastic pavement markings.

Use a 0.90 in. (90 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.

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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.

Use PREFAB PAV MRK TY C – For main lanes and TY 1 – for service roads.

For elimination and surface preparation of lane drop arrow, payment will be subsidiary under Item 677-6008 and Item 678-6009.

Items 666-6180 and 666-6212 are intended for painting curbs.

Words are paid by each word and number respectively and not by letter or digit.

#### **Item 672: Raised Pavement Markers**

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

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

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

#### **Item 677 Eliminating Existing Pavement Markings and Markers**

Remove all contaminates and loose material. Consider this work to be subsidiary to the related bid items of the contract.

Remove existing raised pavement markers before the addition of the asphaltic pavement or seal coat. Dispose of the removed markers from the project at the end of each workday. Consider this work to be subsidiary to the various bid items of the contract.

#### **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.

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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 700: Pothole Repair**

All work on this item is callout work and a work order will be issued as work is needed to be performed.

If notified of an emergency repair, begin work within 3 hours of notification.

Once work has started, continuously prosecute the work until all work on the work order is satisfactorily completed. Liquidated Damages will be assessed for any day charged beyond the authorized time on each work order as per the Schedule of Liquidated Damages in the Contract.

One EA Item 500-6033 "Mobilization (Callout)" will be paid per work order regardless of number of locations on that work order for non-emergency pothole repair.

One EA Item 500-6034 "Emergency Mobilization" will be paid for each emergency work request.

#### **Item 730: Roadside Mowing**

Adjust mowers for a cutting height of approximately 5-in. or as directed. Trim around all poles, signs, trees, and other appurtenances located within the R.O.W. Hand trimming is required; cut and/or trim the grass to the height of 5 inches. The limits of these roadways will be determined by the Area Engineer and shall be given in the written notification to the Contractor.

*Mowing will be completed in increments known as a cycle. A cycle is defined as a group of mowing tracts or areas that must be completed one time within the time period specified herein.*

Weather permitting, Contractor may NOT abandon work on this contract before any cycle is completed to perform work on another project.

Written notifications will be given on each call out work and when to begin each mowing cycle. Within the written notification the following will be given; the specified areas (tracts) to be

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mowed, number of acres required for the mowing cycle, the number of working days allowed to complete the mowing cycle, and the date when the time charges for that mowing cycle will begin. The Engineer may, at his/her discretion, reduce or alter the limits of each cycle. Time charge information will be documented in the project diary and other documents related to this contract. This information will be provided to the contractor upon request.

The required minimum mowing acres per normal working day is 75 acres. This production rate was used to determine the completion time for each cycle and will be used to adjust the allowable completion time period should mowing areas be added to or removed from the cycle.

Payment, at the discretion of the Engineer, may be withheld for a complete tract of land until all mowing is entirely completed for that tract to the satisfaction of the Engineer. This includes all required hand trimming as required (partial payment of any tract or portion of land will be withheld if not to the satisfaction of the Engineer.) The Engineer will make the determination in the quantities for which payments will not be made. The Contractor will be notified of all deficiencies and will be given one week notice to correct all deficiencies.

If the Contractor fails to finish the mowing necessary to complete the subject cycle in the working days specified, a time charge will be made for each working day thereafter. Working days established for the completion of a cycle is an essential element of the contract. For each working day that any work remains uncompleted after the expiration of time specified for a given cycle, the amount per day in the Special Provision "Schedule of Liquidated Damages" (000-1243) will be deducted from the money due the Contractor, not as a penalty, but as liquidated damages.

In the event it becomes necessary not to mow construction areas, the subject quantities of the contract will be decreased in accordance with the terms and conditions of this contract.

The Engineer reserves the right to reduce or increase the number of acres to be completed each cycle. An adjustment in the time required to complete the mowing cycle will be made based on the production rate defined herein (75 acres per day).

Provide a portable pressure washer with a minimum operating pressure of 1,500 psi to wash mowing equipment. All equipment will be pressure washed prior to beginning work and before leaving the job sites.

Payment for those tracts of a cycle that has been completed (all mowing and trimming) will be made at the end of the pay period for that work completed within the pay period.

Complete hand trimming on each roadway within 24 hr. of mowing. Ensure trees and shrubs are not damaged.

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Conduct mowing operations in a manner that will not damage State right-of-way. The Engineer reserves the right to suspend mowing work when areas are too wet to mow without damage to State right-of-way occurring.

Avoid mowing over large items of litter. On roads where the mowing cycle coincides with the litter pickup cycle, cooperate with others to avoid mowing of litter as directed. Contractor shall direct all coordination of these activities. Delays may occur to allow the litter pickup to advance ahead of the mowers.

In addition to debris removal, mud that is tracked or dragged onto the roadway by mowers shall be removed immediately.

Right of way that cannot be mowed with a rotary mower will be mowed with another approved piece of equipment to the satisfaction of the Engineer. All right of way that does not receive the entire mowing specified will be considered for partial payment as directed.

Mow the pass closest to the travel way in the direction with the flow of traffic. If some circumstances make mowing with the flow of traffic impractical, discuss these circumstances with the Engineer. No change in direction will be allowed without prior approval of the Engineer.

Outfall ditch and detention pond mowing is paid for under Item 730 "Full Width Mowing". Keep equipment off all pavement surfaces while mowing.

There are some areas with minimal to no access for equipment. Therefore, these areas shall be maintained via handwork.

Do not use 15 ft wide Batwing rotary mowers where the width of the State right of way is less than 15 ft.

Mow areas of existing vegetation, collect and dispose of litter, and sweep the roadway within the project limits according to the chart in the plan set for the duration of the project or as directed. This work is paid for under their respective bid items.

The limits of each cycle will be defined in the "Summary of Roadway Locations and Acreage" and "Summary of Ditch Locations and Acreage" tables shown in the plans.

Acreage for detention ponds is included in the full width mowing for each tract.

Herbicide must be applied 14 days before any mowing operations OR 14 days after any mowing operations.

Mowing will occur at a rate of 5 cycles per year, to be performed in the months of August,

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September, October, November/ June, and July or as directed.

**Item 731: Herbicide Treatment**

In addition to the standard spraying operations, Contractor shall spray fence lines around all ponds. Broadcast application of herbicides shall be made with the flex-5 unit on the truck when Johnson grass appears after the first mowing cycle and/or anytime Johnson grass is present to improve safety and maintenance efficiency.

Applications should begin in June when the Johnson grass is beginning to grow or in boot stage. This operation should continue until October 15th as needed. Blue dye may be required on specific applications as overspray and shall be mixed per the manufacture's recommended standards. Rates for the broadcast application may change during this contract. All applications will follow TXDOT's latest herbicide operations manual.

Contractor's licensed personnel will be responsible for the calibration of the contractor's herbicide equipment including herbicide spray unit, trailer unit, handguns, etc. Prior to performing work and provided to TXDOT for verification.

TXDOT's supervision affidavit will not relieve the license applicator of the responsibilities set forth under item 731.3.

Broadcast application treatment must follow the same sequence as the previous mowing cycle unless otherwise directed.

Herbicide application record book will be supplied by TXDOT. Herbicide application record book will be completed as directed. A sample for proper record keeping is presented in the herbicide records book. Submit a copy of the herbicide records on the next business day following the application. Submit a final copy of the herbicide records upon completion of each herbicide application.

TXDOT shall inspect all equipment prior to start of any services under the contract. The inspection of the equipment will determine the condition of the equipment and the capability of the equipment to perform the required services.

Equipment found to be deficient or incapable of performing the required services, at the sole discretion of TXDOT shall be repaired to TXDOT's satisfaction or may be rejected for use under this contract. Rejection of equipment does not relieve the contractor of the responsibility to perform the required services.

All equipment shall be equipped with the manufacturer safety devices to prevent damage to property cause by leaks, spills, or drift. All application equipment shall be kept in good operating condition and shall be maintained to always provide a precise calibrated application pattern.

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The contractor shall ensure that all vehicles utilized in pesticide application operations are manufactured for the broadcast application of pesticides in roadside vegetation management operations. All equipment shall be leak free and equipped with electronic shut off valves.

All application equipment shall be fully functional and correctly calibrated for each operation being performed. Calibration shall be demonstrated when requested by TXDOT representative. Operations shall be suspended if calibrations are found to be incorrect or if the operator is incapable of demonstrating calibration. Services shall remain suspended until equipment is correctly calibrated and calibration is demonstrated to TXDOT as correct.

Equipment shall:

1. Meet all state and federal requirements
2. Meet all Texas laws governing pesticide application
3. Meet all dot requirements and guidelines
4. All vehicles and vehicular equipment shall meet all osha specifications.

Vehicles used in the application of pesticides shall meet or exceed the following requirements.

The chemical application head shall be capable of applying solutions from either side of the truck and capable of delivering prescribed chemicals or combination of chemicals at prescribed increments in width for production application.

1. Applying herbicide while in a parked position or any speed not exceeding eleven (11) miles per hour. No applications shall be performed at speeds greater than eleven (11) miles per hour.
2. Applying a solution to varying widths from .5 feet wide to thirty-six (36) feet wide in increments as described below:
  - A. The applicator shall be capable of changing widths 'on the go' while maintaining calibration and water output.
  - B. The applicator(s) shall be capable of applying chemicals or combination of up to three chemicals simultaneously with the ability to apply two separate operations at once. (i.e., applying a 'non-selective' 'along a shoulder while simultaneously applying a 'selective' behind a guardrail.)
  - C. Pesticide solutions shall be applied at the rates recommended by the product labels per acre and approved by TxDOT representative prior to being applied.
  - D. The application vehicle shall be capable of applying chemical both thru a nozzle array and/or handgun with 150 feet of hose rated for pressure created by the application equipment.

Equipment maintenance – herbicide trucks:

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1. Independent pump motor on rear of truck shall be serviced every 50 hours of use.
2. Calibration should be done prior to any spraying activity. At least annually.
3. Check agitation stems inside mixing tank daily.
4. Check filters daily and clean if needed.
5. Check pressure on gauges prior to spraying.
6. Check all components to ensure that they are not leaking.

**Item 734: Litter Removal**

Pickup whole tires and dispose of as directed at the maintenance office indicated above. Once work has started on an item, proceed in a timely manner until all work is complete on that item, unless otherwise directed.

The number of cycles per month stated in the plans is an estimate. The Department will determine the number of cycles required per month in any given month. Only the Department may alter the schedule.

Correct discrepancies pointed out by the Department within 24 hours or as set forth in the Conflict Resolution Schedule.

**Item 735: Debris Removal**

Debris shall include dead animals.

Debris removal on the direct connector ramps from SH 99 and to SH 99 is included as a part of each debris removal cycle.

**Item 738: Cleaning and Sweeping Highways**

Refer to the **sweeping** chart in the plans for the highways, the limits, and the number of times to be swept, and the approximate length of each roadway.

Use trail vehicles with TMA(s) for all main lanes shoulder work during all debris and handwork, cleaning and sweeping operations. Do not reduce the existing number of lanes open to traffic except as directed by the Engineer.

The Contractor shall provide the schedule for all roadways to be cleaned and swept, including the cleaning of drain slots. Alterations of this schedule will be as directed.

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Sweeping of the direct connector ramps of SH 99 limits is included as a part of each sweeping cycle.

Debris is defined as trash, garbage or refuse and includes but is not limited to all scrap tires, rubber products (including whole tires), rags, paper, wood, glass, mattresses, scrap metals, furniture and auto parts. Remove all debris from the designated areas to the satisfaction of the Engineer. Debris removal is incidental to Item 738 Cleaning and Sweeping Highways.

In the event that aggregate is placed on roadways as part of a deicing operation, the Contractor will be required to remove all aggregate from the roadway. This work will be considered incidental to the Item "Cleaning and Sweeping Highways".

The emergency response time for the Item 738, "Spot Sweeping," will be 2 hours after verbal notice.

Any "Concrete Traffic Barrier" (CTB), T5 or T501 rail with drain openings will be cleaned quarterly as directed.

The Handwork areas include bull pens, cross walks, islands, slopes, U-turns, drain slots, concrete flumes, and riprap and other areas as directed.

**Item 740: Graffiti Removal and Anti-Graffiti Coating**

Graffiti shall be removed within 7 days of notification. If paint is used it shall match the existing colors which are Sherwin Williams #2243 for the DARK color and Sherwin Williams #6141 for the LIGHT color.

Anti-Graffiti Coating will be "Clear" in color on exposed aggregate surfaces.

Repairs of a sensitive nature to the general public will begin within a 2 hour notification and will be considered emergency call out.

When painting over graffiti on a concrete or metal surface match the color of the existing surface and texture. Paint the treated area to blend with the appearance over the entire surface area.

**Item 764: Pump Station and Drainage System Cleaning**

Follow confined space procedures as outlined in OSHA Standard 29 CFR 1910.146. Provide a copy of the entry permit at the work site whenever entering a confined workspace.

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The Contractor will supply all pipe plugs to stop any flow as needed. This work is subsidiary to Item 764.

Remove and replace culvert grates. Bolting and unbolting is subsidiary to Item 764. The State will furnish nuts, bolts, and washers, as replacements for those that are no longer usable.

Remove and dispose of all debris, dirt, silt, litter, lumber, auto parts, paper, grass clippings, etc. from the designated area.

Have tested, debris or wash water removed that smells of volatiles or shows signs of environmental contamination by an approved laboratory. For material testing positive for contamination, provide written receipts showing disposal at licensed disposal facilities.

The Department will verify and note daily in the project diary prior to any work, the vector truck is clean and empty. A small amount of normal wash in the tank will be permitted.

A list of water availability at the work site may be requested for records.

#### **Item 770: Guard Fence Repair**

All new holes for guardrail connections to any concrete structure (wingwalls, CTB, etc.) which require drilling will be considered subsidiary to the various bid items. This will include holes required when rising or upgrading guardrail.

Repair of Thrie-Beam Terminal Connection is paid for under Item 770-6002 "Repair Rail Element (Thrie-Beam)". Repair of damaged curb is subsidiary to the bid item.

If, in the opinion of the Engineer, a terminal anchor post is beyond repair, replace the entire terminal anchor in accordance with the standard detail sheet.

For purposes of guardrail repair post replacement, a mow strip is considered a foundation. When replacing posts, replace a damaged mowing strip with a matching new one. Supply all materials used to repair mow strip. This will not be paid for directly but will be considered incidental to the various bid items. Repair of the mow strip will require repairing the leave out as shown on the plans.

Securing of the damaged site shall be incidental.

When notified either by email or telephonically, the Contractor shall begin repair work within 48 hours unless it is an emergency call. If the call IS an emergency call, the Contractor must begin work within 4 hours of being notified.

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#### **Item 6043: Repair, Replace and Relocate Large Signs & Support Assemblies**

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.

Repair will include stubs, posts, signs, sign supports and other components to complete the assembly. In all instances, match existing materials.

#### **Item 6044: Repair, Replace and Relocate Small Signs & Support Assemblies**

Furnish aluminum Type A signs instead of plywood signs.

Repair will include stubs, posts, signs, sign supports and other components to complete the assembly. In all instances, match existing materials.

#### **Item 6185: Truck Mounted Attenuators (TMA)**

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.

A total of one (1) shadow vehicle with a TMA/TA is required for the work with the exception of Pavement Marking Operations. 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.

A total of three (3) shadow vehicles with a TMA/TA are required for Pavement Marking Operations. 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.

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.

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**Item 6224: Incident Management**

Notification for response to perform Traffic Control operations for Incident Management will be by phone. Provide a telephone number to be used for response to Incident Management that will be accessible 24 hours per day.

Portable changeable message signs (PCMSs) and arrow boards used for incident management must be truck mounted or pull behind arrowboards with LED full matrix signs in accordance with applicable Barricade and Construction standard sheets, unless otherwise directed by the Engineer.

**Types of Incident Management**

Type	Description
A	Incident Management - 1 Main Lane Closure
B	Incident Management - 2 Main Lane Closure
C	Incident Management - 3 Main Lane Closure
D	Incident Management - 4 Main Lane Closure
E	Incident Management - 1 Complete Closure of Freeway
F	Incident Management - 1 Closure of an Exit or Entrance Ramp
G	Incident Management - 1 Lane Frontage Road Closure
H	Incident Management - 2 Lane Frontage Road Closure
I	Incident Management - 1 Complete Closure of Frontage Road
J	Incident Management – Flagger
K	Incident Management – 1 Lane Connector Ramp Closure
L	Incident Management – 2 Lane Connector Ramp Closure
M	Incident Management – Detour Signs Setup

Item 500-6034 “Mobilization (Emergency)” EA will be paid for each occurrence of an Incident where traffic control will be performed for this item.

Failure to respond within the designated time as stated in Special Specification 6224 will result in a penalty of \$8,000 per hour assessed to the Contractor until all required equipment and personnel have been deployed.

This Item is intended for major incidents that’s not associated with any state damage items on the contract.

**Item 7093: Snow and Ice Removal**

Contractor shall have the following equipment available (on standby) during the months of December, January, and February:

Truck with V Box – 6 each

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Shadow Vehicle – 6 each (additional TMAs may be required if sanding and spraying operations are simultaneous at different locations)

Loader – 1 each

Spray Rig – 6 each (minimum 500-gallon units) (if unit can cover 2 lanes or more then only 3 each spray rigs will be required versus 6 each).

Contractor shall ensure that the quantity of such vehicles is sufficient to service the entire corridor encompassed by this contract i.e., Segments H (Liberty County), Segment I-1 (Liberty County) and Segment I-2A (Chambers County).

De-icing brine shall be applied approximately every 2 hours. Contractor shall have sufficient manpower to operate for multiple days. Locations of brine and sanding materials are:



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PROJECT ID				A00186087			
COUNTY				Liberty			
HIGHWAY				SH0146			
ALT	BID CODE	DESCRIPTION	UNIT	EST.	FINAL		
	104-6009	REMOVING CONC (RIPRAP)	SY	100.000		100.000	
	104-6021	REMOVING CONC (CURB)	LF	50.000		50.000	
	134-6008	BACKFILL (TY A OR B)	CY	500.000		500.000	
	150-6001	BLADING	STA	100.000		100.000	
	162-6001	SPOT SODDING	SY	300.000		300.000	
	162-6002	BLOCK SODDING	SY	500.000		500.000	
	164-6001	BROADCAST SEED (PERM) (RURAL) (SANDY)	SY	1,000.000		1,000.000	
	166-6001	FERTILIZER	AC	5.000		5.000	
	168-6001	VEGETATIVE WATERING	MG	30.000		30.000	
	351-6008	FLEXIBLE PAVEMENT STRUCTURE REPAIR(12")	SY	100.000		100.000	
	351-6019	FLEXIBLE PAVEMENT STRUCTURE REPAIR(3")	SY	100.000		100.000	
	361-6051	FULL-DPTH REP(BR APPROACH SLAB)(9"-13")	SY	200.000		200.000	
	361-6052	FULL - DEPTH REPAIR CRCP (8"-14")	SY	200.000		200.000	
	401-6001	FLOWABLE BACKFILL	CY	100.000		100.000	
	429-6007	CONC STR REPAIR (VERTICAL & OVERHEAD)	SF	150.000		150.000	
	429-6009	CONC STR REPAIR (STANDARD)	SF	75.000		75.000	
	432-6003	RIPRAP (CONC)(6 IN)	CY	150.000		150.000	
	432-6006	RIPRAP (CONC)(CL B)	CY	60.000		60.000	
	432-6017	RIPRAP (STONE TY R)(DRY)(18 IN)	CY	100.000		100.000	
	432-6031	RIPRAP (STONE PROTECTION)(12 IN)	CY	100.000		100.000	
	432-6045	RIPRAP (MOW STRIP)(4 IN)	CY	30.000		30.000	
	438-6001	CLEANING AND SEALING EXISTING JOINTS	LF	10.000		10.000	
	500-6033	MOBILIZATION (CALLOUT)	EA	104.000		104.000	
	500-6034	MOBILIZATION (EMERGENCY)	EA	104.000		104.000	
	506-6026	EMBANK (EROSN & SEDMT CONT, IN PLACE)	CY	500.000		500.000	
	506-6027	EXCAV (EROSN & SEDMT CONT, IN VEH)	CY	500.000		500.000	
	512-6013	PORT CTB (DES SOURCE)(SGL SLP)(TY 1)	LF	60.000		60.000	
	512-6025	PORT CTB (MOVE)(SGL SLP)(TY 1)	LF	510.000		510.000	
	512-6037	PORT CTB (STKPL)(SGL SLP)(TY 1)	LF	560.000		560.000	
	528-6004	LANDSCAPE PAVERS	SY	400.000		400.000	
	528-6006	REMOVE AND RELAY PAVERS	SY	400.000		400.000	
	529-6002	CONC CURB (TY II)	LF	500.000		500.000	
	531-6001	CONC SIDEWALKS (4")	SY	100.000		100.000	
	540-6002	MTL W-BEAM GD FEN (STEEL POST)	LF	300.000		300.000	
	540-6016	DOWNSTREAM ANCHOR TERMINAL SECTION	EA	24.000		24.000	
	542-6001	REMOVE METAL BEAM GUARD FENCE	LF	300.000		300.000	
	543-6001	CABLE BARRIER SYSTEM (TL-3)	LF	500.000		500.000	



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ALT	BID CODE	DESCRIPTION	UNIT	EST.	FINAL		
	544-6001	GUARDRAIL END TREATMENT (INSTALL)	EA	3.000		3.000	
	544-6007	GDRAIL END TRT(INSTALL)(HBA POST)	EA	3.000		3.000	
	545-6002	CRASH CUSH ATTEN (DES SOURCE)	EA	2.000		2.000	
	545-6003	CRASH CUSH ATTEN (MOVE & RESET)	EA	6.000		6.000	
	545-6004	CRASH CUSH ATTEN (STKPL)	EA	6.000		6.000	
	545-6005	CRASH CUSH ATTEN (REMOVE)	EA	6.000		6.000	
	550-6002	CHAIN LINK FENCE (REPAIR) (6')	LF	1,000.000		1,000.000	
	550-6004	GATE (INSTALL) (DOUBLE) (6' X 14')	EA	1.000		1.000	
	550-6005	GATE (REPAIR) (DOUBLE) (6' X 14')	EA	2.000		2.000	
	636-6001	ALUMINUM SIGNS (TY A)	SF	100.000		100.000	
	636-6002	ALUMINUM SIGNS (TY G)	SF	100.000		100.000	
	636-6003	ALUMINUM SIGNS (TY O)	SF	100.000		100.000	
	636-6007	REPLACE EXISTING ALUMINUM SIGNS(TY A)	SF	300.000		300.000	
	636-6008	REPLACE EXISTING ALUMINUM SIGNS(TY G)	SF	750.000		750.000	
	636-6009	REPLACE EXISTING ALUMINUM SIGNS(TY O)	SF	200.000		200.000	
	658-6013	INSTL DEL ASSM (D-SW)SZ (BRF)CTB	EA	65.000		65.000	
	658-6015	INSTL DEL ASSM (D-SW)SZ (BRF)GF1	EA	65.000		65.000	
	658-6026	INSTL DEL ASSM (D-SY)SZ (BRF)CTB	EA	65.000		65.000	
	658-6028	INSTL DEL ASSM (D-SY)SZ (BRF)GF1	EA	65.000		65.000	
	658-6080	INSTL DEL ASSM (D-SW)SZ 1(WFLX)GND	EA	45.000		45.000	
	658-6092	INSTL DEL ASSM (D-DW)SZ 1(WFLX)GND	EA	35.000		35.000	
	658-6099	INSTL OM ASSM (OM-2Z)(WFLX)GND	EA	60.000		60.000	
	666-6018	REFL PAV MRK TY I (W)6"(DOT)(100MIL)	LF	1,500.000		1,500.000	
	666-6033	REFL PAV MRK TY I (W)8"(LNDP)(100MIL)	LF	1,000.000		1,000.000	
	666-6036	REFL PAV MRK TY I (W)8"(SLD)(100MIL)	LF	9,000.000		9,000.000	
	666-6039	REFL PAV MRK TY I (W)12"(LNDP)(100MIL)	LF	1,000.000		1,000.000	
	666-6042	REFL PAV MRK TY I (W)12"(SLD)(100MIL)	LF	9,000.000		9,000.000	
	666-6048	REFL PAV MRK TY I (W)24"(SLD)(100MIL)	LF	3,000.000		3,000.000	
	666-6054	REFL PAV MRK TY I (W)(ARROW)(100MIL)	EA	48.000		48.000	
	666-6057	REFL PAV MRK TY I(W)(DBL ARROW)(100MIL)	EA	32.000		32.000	
	666-6063	REFL PAV MRK TY I(W)(UTURN ARW)(100MIL)	EA	26.000		26.000	
	666-6072	REFL PAV MRK TY I(W)(LNDP ARW)(100MIL)	EA	8.000		8.000	
	666-6078	REFL PAV MRK TY I (W)(WORD)(100MIL)	EA	48.000		48.000	
	666-6081	REFL PAV MRK TY I(W)(ENTR GORE)(100MIL)	EA	7.000		7.000	
	666-6084	REFL PAV MRK TY I(W)(EXIT GORE)(100MIL)	EA	7.000		7.000	
	666-6138	REFL PAV MRK TY I (Y)8"(SLD)(100MIL)	LF	1,000.000		1,000.000	
	666-6141	REFL PAV MRK TY I (Y)12"(SLD)(100MIL)	LF	1,000.000		1,000.000	



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PROJECT ID				A00186087			
COUNTY				Liberty			
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ALT	BID CODE	DESCRIPTION	UNIT	EST.	FINAL		
	666-6147	REFL PAV MRK TY I (Y)24"(SLD)(100MIL)	LF	200.000		200.000	
	666-6162	RE PV MRK TY I(BLACK)6"(SHADOW)(100MIL)	LF	2,000.000		2,000.000	
	666-6180	REFL PAV MRK TY II (W) 12" (SLD)	LF	100.000		100.000	
	666-6212	REFL PAV MRK TY II (Y) 12" (SLD)	LF	200.000		200.000	
	666-6231	PAVEMENT SEALER (ARROW)	EA	48.000		48.000	
	666-6232	PAVEMENT SEALER (WORD)	EA	48.000		48.000	
	666-6234	PAVEMENT SEALER (DBL ARROW)	EA	32.000		32.000	
	666-6236	PAVEMENT SEALER (UTURN ARROW)	EA	26.000		26.000	
	666-6237	PAVEMENT SEALER (LNDP ARROW)	EA	8.000		8.000	
	666-6239	PAVEMENT SEALER (ENTR GORE)	EA	7.000		7.000	
	666-6240	PAVEMENT SEALER (EXIT GORE)	EA	7.000		7.000	
	666-6303	RE PM W/RET REQ TY I (W)4"(SLD)(100MIL)	LF	200.000		200.000	
	666-6306	RE PM W/RET REQ TY I (W)6"(BRK)(100MIL)	LF	3,000.000		3,000.000	
	666-6309	RE PM W/RET REQ TY I (W)6"(SLD)(100MIL)	LF	3,000.000		3,000.000	
	666-6315	RE PM W/RET REQ TY I (Y)4"(SLD)(100MIL)	LF	200.000		200.000	
	666-6321	RE PM W/RET REQ TY I (Y)6"(SLD)(100MIL)	LF	4,000.000		4,000.000	
	668-6010	PREFAB PAV MRK TY B (W)(6")(BRK)CNTST	LF	1,000.000		1,000.000	
	668-6059	PREFAB PAV MRK TY B (MULTI)(SHIELD)	EA	10.000		10.000	
	672-6006	REFL PAV MRKR TY I-A	EA	40.000		40.000	
	672-6007	REFL PAV MRKR TY I-C	EA	40.000		40.000	
	672-6009	REFL PAV MRKR TY II-A-A	EA	100.000		100.000	
	672-6010	REFL PAV MRKR TY II-C-R	EA	350.000		350.000	
	677-6001	ELIM EXT PAV MRK & MRKS (4")	LF	50.000		50.000	
	677-6002	ELIM EXT PAV MRK & MRKS (6")	LF	50.000		50.000	
	677-6003	ELIM EXT PAV MRK & MRKS (8")	LF	50.000		50.000	
	677-6005	ELIM EXT PAV MRK & MRKS (12")	LF	50.000		50.000	
	677-6008	ELIM EXT PAV MRK & MRKS (ARROW)	EA	48.000		48.000	
	677-6009	ELIM EXT PAV MRK & MRKS (DBL ARROW)	EA	32.000		32.000	
	677-6012	ELIM EXT PAV MRK & MRKS (WORD)	EA	48.000		48.000	
	677-6013	ELIM EXT PAV MRK & MRKS (ENTR GORE)	EA	7.000		7.000	
	677-6014	ELIM EXT PAV MRK & MRKS (EXIT GORE)	EA	7.000		7.000	
	677-6022	ELIM EXT PAV MRK & MRKS (SHEILD)	EA	6.000		6.000	
	677-6036	ELIM EXT PAV MRK & MRKS (UTURN ARROW)	EA	26.000		26.000	
	678-6001	PAV SURF PREP FOR MRK (4")	LF	50.000		50.000	
	678-6002	PAV SURF PREP FOR MRK (6")	LF	50.000		50.000	
	678-6004	PAV SURF PREP FOR MRK (8")	LF	50.000		50.000	
	678-6006	PAV SURF PREP FOR MRK (12")	LF	50.000		50.000	



DISTRICT	COUNTY	CCSJ	SHEET
Houston	Liberty	6399-15-001	4-C



CONTROLLING PROJECT ID 6399-15-001

DISTRICT Beaumont  
HIGHWAY SH0099

COUNTY Liberty

# Estimate & Quantity Sheet

CONTROL SECTION JOB				6399-15-001		TOTAL EST.	TOTAL FINAL
PROJECT ID				A00186087			
COUNTY				Liberty			
HIGHWAY				SH0146			
ALT	BID CODE	DESCRIPTION	UNIT	EST.	FINAL		
	678-6009	PAV SURF PREP FOR MRK (ARROW)	EA	48.000		48.000	
	678-6010	PAV SURF PREP FOR MRK (DBL ARROW)	EA	32.000		32.000	
	678-6012	PAV SURF PREP FOR MRK (UTURN ARR)	EA	26.000		26.000	
	678-6016	PAV SURF PREP FOR MRK (WORD)	EA	48.000		48.000	
	678-6017	PAV SURF PREP FOR MRK (ENTR GORE)	EA	7.000		7.000	
	678-6018	PAV SURF PREP FOR MRK (EXIT GORE)	EA	7.000		7.000	
	678-6025	PAV SURF PREP FOR MRKS (SHIELD)	EA	6.000		6.000	
	678-6033	PAV SURF PREP FOR MRK (RPM)	EA	530.000		530.000	
	700-6001	POTHOLE REPAIR (STANDARD)	SY	25.000		25.000	
	720-6001	SPALLING REPAIR (HYDRAULIC CEMENT)	CF	60.000		60.000	
	720-6003	SPALLING REPAIR (POLYMERIC) (SEMIRIGID)	GAL	5.000		5.000	
	721-6002	FIBER REINFORCED POLYMER PATCHING MATLS	LB	10.000		10.000	
	730-6003	SPOT MOWING	AC	6.000		6.000	
	730-6054	FULL - WIDTH MOWING - TRACT (1)	AC	5,112.000		5,112.000	
	730-6055	FULL - WIDTH MOWING - TRACT (2)	AC	3,660.000		3,660.000	
	730-6056	FULL - WIDTH MOWING - TRACT (3)	AC	2,064.000		2,064.000	
	731-6007	PAVEMENT EDGES, STRUCTURES & FIXTURES	MI	218.000		218.000	
	731-6011	BROADCAST APPLICATION	AC	100.000		100.000	
	731-6015	WICK APPLICATION OF HERBICIDE	AC	75.000		75.000	
	734-6003	LITTER REMOVAL (SPOT)	AC	20.000		20.000	
	734-6054	LITTER REMOVAL - TRACT (1)	CYC	48.000		48.000	
	734-6055	LITTER REMOVAL - TRACT (2)	CYC	48.000		48.000	
	734-6056	LITTER REMOVAL - TRACT (3)	CYC	48.000		48.000	
	735-6068	DEBRIS-CNTR MEDIANS/MAINLANES-AREA (1)	CYC	72.000		72.000	
	735-6069	DEBRIS-CNTR MEDIANS/MAINLANES-AREA (2)	CYC	72.000		72.000	
	735-6070	DEBRIS-CNTR MEDIANS/MAINLANES-AREA (3)	CYC	72.000		72.000	
	738-6011	CLEANING / SWEEPING (HANDWORK)	SY	35,000.000		35,000.000	
	738-6094	CLEAN / SWEEP - CENTER MEDIAN - AREA(1)	CYC	24.000		24.000	
	738-6095	CLEAN / SWEEP - CENTER MEDIAN - AREA(2)	CYC	24.000		24.000	
	738-6096	CLEAN / SWEEP - CENTER MEDIAN - AREA(3)	CYC	24.000		24.000	
	738-6114	CLEAN / SWEEP-OUTSIDE MAIN LANE-AREA(1)	CYC	24.000		24.000	
	738-6115	CLEAN / SWEEP-OUTSIDE MAIN LANE-AREA(2)	CYC	24.000		24.000	
	738-6116	CLEAN / SWEEP-OUTSIDE MAIN LANE-AREA(3)	CYC	24.000		24.000	
	738-6134	CLEAN / SWEEP - FRONTAGE ROAD - AREA(1)	CYC	12.000		12.000	
	738-6135	CLEAN / SWEEP - FRONTAGE ROAD - AREA(2)	CYC	12.000		12.000	
	738-6136	CLEAN / SWEEP - FRONTAGE ROAD - AREA(3)	CYC	12.000		12.000	
	738-6154	CLEAN / SWEEP - (ENTR /EXT RMP)(AREA 1)	CYC	12.000		12.000	



DISTRICT	COUNTY	CCSJ	SHEET
Houston	Liberty	6399-15-001	4-D



CONTROLLING PROJECT ID 6399-15-001

DISTRICT Beaumont  
HIGHWAY SH0099

COUNTY Liberty

# Estimate & Quantity Sheet

CONTROL SECTION JOB				6399-15-001		TOTAL EST.	TOTAL FINAL
PROJECT ID				A00186087			
COUNTY				Liberty			
HIGHWAY				SH0146			
ALT	BID CODE	DESCRIPTION	UNIT	EST.	FINAL		
	738-6155	CLEAN / SWEEP - (ENTR /EXT RMP)(AREA 2)	CYC	12.000		12.000	
	738-6156	CLEAN / SWEEP - (ENTR /EXT RMP)(AREA 3)	CYC	12.000		12.000	
	740-6001	GRAFFITI REMOVAL (BLAST CLEANING)	SF	1,500.000		1,500.000	
	740-6002	GRAFFITI REMOVAL (PAINTING)	SF	1,500.000		1,500.000	
	740-6003	GRAFFITI REMOVAL (CHEMICAL CLEANING)	SF	300.000		300.000	
	740-6004	ANTI - GRAFFITI COATING(PERMNENT-TY II)	SF	1,500.000		1,500.000	
	740-6005	ANTI - GRAFFITI COATNG(PERMNENT-TY III)	SF	1,500.000		1,500.000	
	752-6003	TREE TRIMMING / BRUSH REMOVAL	MI	24.000		24.000	
	752-6004	TREE TRIMMING / BRUSH REMOVAL(CHANNELS)	AC	10.000		10.000	
	752-6005	TREE REMOVAL (4" - 12" DIA)	EA	15.000		15.000	
	752-6006	TREE REMOVAL (12" - 18" DIA)	EA	15.000		15.000	
	752-6007	TREE REMOVAL (18" - 24" DIA)	EA	15.000		15.000	
	752-6008	TREE REMOVAL (24" - 30" DIA)	EA	15.000		15.000	
	752-6009	TREE REMOVAL (30" - 36" DIA)	EA	6.000		6.000	
	752-6010	TREE REMOVAL (36" - 42" DIA)	EA	6.000		6.000	
	752-6011	TREE REMOVAL (42" - 48" DIA)	EA	6.000		6.000	
	752-6014	STUMP REMOVAL	EA	6.000		6.000	
	752-6015	TREE AND BRUSH REMOVAL	AC	10.000		10.000	
	760-6001	DITCH CLEANING AND RESHAPING (FOOT)	LF	1,000.000		1,000.000	
	760-6003	DITCH CLEAN/RESHAPING(CU YD IN VEHICLE)	CY	1,000.000		1,000.000	
	764-6001	DRAIN INLET CLEANING	EA	50.000		50.000	
	764-6006	STORM SEWER CLEANING (PIPE) (<12" DIA)	LF	100.000		100.000	
	764-6007	STORM SEWER CLEANING (PIPE)(12"-18"DIA)	LF	900.000		900.000	
	764-6008	STORM SEWER CLEANING (PIPE)(19"-24"DIA)	LF	1,400.000		1,400.000	
	764-6009	STORM SEWER CLEANING (PIPE)(25"-30"DIA)	LF	950.000		950.000	
	764-6010	STORM SEWER CLEANING (PIPE)(31"-36"DIA)	LF	900.000		900.000	
	764-6011	STORM SEWER CLEANING (PIPE)(37"-42"DIA)	LF	400.000		400.000	
	764-6012	STORM SEWER CLEANING (PIPE)(43"-54"DIA)	LF	200.000		200.000	
	764-6016	STORM SEWER CLEAN (BOX CULV) (6-<12 SF)	LF	110.000		110.000	
	764-6017	STORM SEWER CLEAN (BOX CULV)(12-<24 SF)	LF	100.000		100.000	
	764-6018	STORM SEWER CLEAN (BOX CULV)(24-<48 SF)	LF	90.000		90.000	
	764-6019	STORM SEWER CLEAN (BOX CULV)(48-<96 SF)	LF	50.000		50.000	
	770-6001	REPAIR RAIL ELEMENT (W - BEAM)	LF	5,000.000		5,000.000	
	770-6002	REPAIR RAIL ELEMENT (THRIE - BEAM)	LF	300.000		300.000	
	770-6003	REP RAIL ELMNT(THRIE-BM TRANS TO W -BM)	LF	300.000		300.000	
	770-6004	REPAIR RAIL ELEMENT (CURVED RAIL)	LF	150.000		150.000	
	770-6010	REM / REPL TIMBER/STL POST W/O CONC FND	EA	30.000		30.000	



DISTRICT	COUNTY	CCSJ	SHEET
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CONTROLLING PROJECT ID 6399-15-001

DISTRICT Beaumont  
HIGHWAY SH0099

COUNTY Liberty

# Estimate & Quantity Sheet

CONTROL SECTION JOB				6399-15-001		TOTAL EST.	TOTAL FINAL
PROJECT ID				A00186087			
COUNTY				Liberty			
HIGHWAY				SH0146			
ALT	BID CODE	DESCRIPTION	UNIT	EST.	FINAL		
	770-6011	REM / REPL TIMBER / STL POST W/CONC FND	EA	450.000		450.000	
	770-6017	REALIGN POSTS	EA	120.000		120.000	
	770-6021	REPLACE SINGLE GDRAIL TERMINAL RAIL	LF	1,500.000		1,500.000	
	770-6022	REPLACE SINGLE GDRAIL TERMINAL POST	EA	300.000		300.000	
	770-6028	REPL SINGLE GDRAIL TERM IMPACT HEAD	EA	30.000		30.000	
	770-6029	REM & RESET SGT IMPACT HEAD	EA	30.000		30.000	
	770-6030	REPLACE SGT CABLE ASSEMBLY	EA	18.000		18.000	
	770-6031	REPLACE SGT CABLE ANCHOR	EA	24.000		24.000	
	770-6032	REPLACE SGT STRUT	EA	12.000		12.000	
	770-6033	REPLACE SGT OBJECT MARKER	EA	20.000		20.000	
	770-6052	REPAIR STEEL POST WITH BASE PLATE	EA	6.000		6.000	
	771-6001	REPLACE POSTS (TL-3)	EA	350.000		350.000	
	771-6003	CABLE SPLICE / TURNBUCKLE (TL-3)	EA	16.000		16.000	
	771-6005	REPAIR CONCRETE FOUNDATION (TL-3)	EA	20.000		20.000	
	771-6007	REPR OR REPLC CABLE BARR TERM SEC(TL-3)	EA	13.000		13.000	
	771-6009	REPLACE CABLE (TL-3)	LF	9,500.000		9,500.000	
	771-6011	CHECK / RE-TENSION CABLE	EA	25.000		25.000	
	772-6003	POST AND CABLE FENCE (NEW INSTALLATION)	LF	300.000		300.000	
	774-6006	REPAIR (TRACC)	EA	3.000		3.000	
	774-6023	REPAIR REACT (N) (MISC HARDWARE)	EA	35.000		35.000	
	774-6027	REPAIR REACT (N) (CYLINDERS)	EA	21.000		21.000	
	774-6036	REPAIR REACT (W) (MISC) (HARDWARE)	EA	12.000		12.000	
	774-6037	REPAIR REACT (W) (CYLINDERS)	EA	4.000		4.000	
	774-6049	REPAIR REACT (W) (DIAPHRAGM)	EA	4.000		4.000	
	774-6065	REPAIR TAU II (N) (MISC HARDWARE)	EA	4.000		4.000	
	774-6066	REPAIR TAU II (N)	LF	9.000		9.000	
	2001-6002	INSTL TIED CONCRETE EROSN CONTROL MATS	SF	2,000.000		2,000.000	
	6000-6001	INSTALL ABOVE-GROUND CONDUIT	LF	300.000		300.000	
	6000-6003	REPLACE ABOVE-GROUND CONDUIT	LF	100.000		100.000	
	6000-6004	INSTALL UNDERGROUND CONDUIT	LF	1,000.000		1,000.000	
	6000-6005	REMOVE UNDERGROUND CONDUIT	LF	200.000		200.000	
	6000-6006	REPLACE UNDERGROUND CONDUIT	LF	1,000.000		1,000.000	
	6000-6007	INSTALL CONDUCTOR	LF	15,000.000		15,000.000	
	6000-6008	REMOVE CONDUCTOR	LF	1,000.000		1,000.000	
	6000-6009	REPLACE CONDUCTOR	LF	10,000.000		10,000.000	
	6000-6016	INSTALL ELECTRICAL SPLICE	EA	50.000		50.000	
	6000-6020	ROAD BORE	LF	1,000.000		1,000.000	



DISTRICT	COUNTY	CCSJ	SHEET
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CONTROLLING PROJECT ID 6399-15-001

DISTRICT Beaumont  
HIGHWAY SH0099

COUNTY Liberty

# Estimate & Quantity Sheet

CONTROL SECTION JOB				6399-15-001		TOTAL EST.	TOTAL FINAL
PROJECT ID				A00186087			
COUNTY				Liberty			
HIGHWAY				SH0146			
ALT	BID CODE	DESCRIPTION	UNIT	EST.	FINAL		
	6000-6022	REMOVE ROADWAY ILLUM ASSEMBLY (HPS)	EA	59.000		59.000	
	6000-6024	INSTALL ROADWAY ILLUM ASSEMBLY (LED)	EA	75.000		75.000	
	6000-6028	REMOVE UNDERPASS LUMINAIRE (HPS)	EA	16.000		16.000	
	6000-6030	INSTALL UNDERPASS LUMINAIRE (LED)	EA	44.000		44.000	
	6000-6032	REPLACE UNDERPASS LUMINAIRE (LED)	EA	6.000		6.000	
	6000-6041	REPLACE LUMINAIRE FIXTURE (LED)	EA	35.000		35.000	
	6000-6043	REPLACE LUMINAIRE POLE	EA	30.000		30.000	
	6000-6044	REPLACE LUMINAIRE ARMS	EA	10.000		10.000	
	6000-6052	REPLACE ELECTRICAL SERVICE	EA	10.000		10.000	
	6000-6054	REPLACE STEEL SERVICE POLE	EA	5.000		5.000	
	6000-6057	INSTALL GROUND BOX W/APRON	EA	10.000		10.000	
	6000-6058	REMOVE GROUND BOX	EA	5.000		5.000	
	6000-6059	INSTALL FOUNDATION	EA	15.000		15.000	
	6000-6060	REMOVE FOUNDATION	EA	10.000		10.000	
	6000-6061	REPLACE TRANSFORMER BASE	EA	20.000		20.000	
	6000-6062	REPLACE TRANSFORMER BASE COVER	EA	20.000		20.000	
	6000-6063	REPLACE HAND HOLE COVER	EA	10.000		10.000	
	6000-6064	INSTALL GROUND ROD	EA	20.000		20.000	
	6000-6065	REPLACE BALLAST	EA	10.000		10.000	
	6000-6068	REPLACE FUSED DISCONNECT	EA	25.000		25.000	
	6000-6072	REPLACE LAMP (POLE MOUNT FIXTURE)	EA	100.000		100.000	
	6000-6073	REPLACE LAMP (UNDERPASS FIXTURE)	EA	25.000		25.000	
	6000-6074	REPLACE LAMP (WALL PACK FIXTURE)	EA	10.000		10.000	
	6000-6076	REPLACE WALL PACK LUMINAIRE	EA	10.000		10.000	
	6000-6077	REPLACE LENS (POLE MOUNTED FIXTURE)	EA	5.000		5.000	
	6000-6078	REPLACE LENS (UNDERPASS FIXTURE)	EA	5.000		5.000	
	6000-6079	REPLACE LENS (WALL PACK FIXTURE)	EA	5.000		5.000	
	6000-6081	REPLACE WALL PACK GUARD	EA	2.000		2.000	
	6000-6082	REPLACE FUSE	EA	100.000		100.000	
	6000-6083	REPLACE FUSE HOLDER	EA	5.000		5.000	
	6000-6084	REPLACE BREAKAWAY FUSE HOLDER	EA	150.000		150.000	
	6000-6085	REPLACE STARTING AID	EA	10.000		10.000	
	6000-6086	REPLACE PHOTOCCELL AND BRACKET	EA	50.000		50.000	
	6000-6088	REPLACE CONTROL TRANS (ELECT SERVICE)	EA	1.000		1.000	
	6000-6090	REPLACE CONTROL CIRCUIT (ELECT SERVICE)	EA	1.000		1.000	
	6000-6091	REPLACE AVIATION WARNING FIXTURE	EA	5.000		5.000	
	6000-6092	REPLACE AVIATION WARNING LAMP	EA	5.000		5.000	



DISTRICT	COUNTY	CCSJ	SHEET
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DISTRICT Beaumont  
HIGHWAY SH0099

COUNTY Liberty

# Estimate & Quantity Sheet

CONTROL SECTION JOB				6399-15-001		TOTAL EST.	TOTAL FINAL
PROJECT ID				A00186087			
COUNTY				Liberty			
HIGHWAY				SH0146			
ALT	BID CODE	DESCRIPTION	UNIT	EST.	FINAL		
	6000-6093	REPLACE HAND-OFF-AUTO SWITCH	EA	20.000		20.000	
	6000-6094	REPLACE CONTACTOR	EA	25.000		25.000	
	6000-6095	REPLACE METER BASE	EA	25.000		25.000	
	6000-6096	REPLACE TIME CLOCK	EA	10.000		10.000	
	6000-6097	REPLACE BREAKER PANEL	EA	15.000		15.000	
	6000-6099	REPLACE CIRCUIT BREAKER	EA	50.000		50.000	
	6000-6101	REPLACE TWIST LOCK CONNECTOR	EA	10.000		10.000	
	6000-6102	REPLACE SAFETY LANYARD	LF	5.000		5.000	
	6000-6104	RE-STRAP EXISTING CONDUIT	EA	100.000		100.000	
	6000-6105	REPLACE NUTS, WASHERS & OTHER HARDWARE	EA	10.000		10.000	
	6000-6106	TROUBLESHOOT FOR REPAIRS	HR	300.000		300.000	
	6000-6108	REPLACE LUMINAIRES	EA	10.000		10.000	
	6000-6143	REPLACE LAMP FOR UNDERPASS FIXTURE 150W	EA	10.000		10.000	
	6001-6001	PORTABLE CHANGEABLE MESSAGE SIGN	DAY	28.000		28.000	
	6038-6004	MULTIPOLYMER PAV MRK (W)(6")(SLD)	LF	3,000.000		3,000.000	
	6038-6005	MULTIPOLYMER PAV MRK (W)(6")(BRK)	LF	2,000.000		2,000.000	
	6038-6006	MULTIPOLYMER PAV MRK (W)(6")(DOT)	LF	1,500.000		1,500.000	
	6038-6007	MULTIPOLYMER PAV MRK (W)(8")(SLD)	LF	2,000.000		2,000.000	
	6038-6009	MULTIPOLYMER PAV MRK (W)(8")(DOT)	LF	1,000.000		1,000.000	
	6038-6011	MULTIPOLYMER PAV MRK (W)(12")(SLD)	LF	1,000.000		1,000.000	
	6038-6012	MULTIPOLYMER PAV MRK (W)(12")(LNDP)	LF	1,000.000		1,000.000	
	6038-6013	MULTIPOLYMER PAV MRK (W)(24")(SLD)	LF	500.000		500.000	
	6038-6017	MULTIPOLYMER PAV MRK (Y)(6")(SLD)	LF	3,000.000		3,000.000	
	6038-6018	MULTIPOLYMER PAV MRK (Y)(6")(BRK)	LF	2,000.000		2,000.000	
	6038-6020	MULTIPOLYMER PAV MRK (Y)(8")(SLD)	LF	1,000.000		1,000.000	
	6038-6021	MULTIPOLYMER PAV MRK (Y)(12")(SLD)	LF	100.000		100.000	
	6038-6022	MULTIPOLYMER PAV MRK (Y)(24")(SLD)	LF	200.000		200.000	
	6043-6001	REPAIR LG RDSB SIGN SUPT & ASSEMBLIES	EA	100.000		100.000	
	6043-6002	RELOC LG RDSB SIGN SUPT & ASSEMBLIES	EA	50.000		50.000	
	6043-6004	REMOV LARGE RDSB SIGN SUPP & ASSEM	EA	50.000		50.000	
	6044-6001	REPAIR SMALL RDSB SIGN SUPT & ASSEM	EA	100.000		100.000	
	6044-6002	RELOC SMALL RDSB SIGN SUPT & ASSEM	EA	50.000		50.000	
	6044-6004	REMOV SMALL RDSB SIGN SUPP & ASSEM	EA	6.000		6.000	
	6185-6002	TMA (STATIONARY)	DAY	156.000		156.000	
	6185-6003	TMA (MOBILE OPERATION)	HR	2,000.000		2,000.000	
	6185-6004	TMA (MOBILE OPERATIONS) (SNOW & ICE)	HR	100.000		100.000	
	6224-6001	INCIDENT MANAGEMENT (TYPE A)	HR	8.000		8.000	



DISTRICT	COUNTY	CCSJ	SHEET
Houston	Liberty	6399-15-001	4-H



# Estimate & Quantity Sheet

CONTROLLING PROJECT ID 6399-15-001

DISTRICT **Beaumont**  
HIGHWAY **SH0099**

COUNTY **Liberty**

CONTROL SECTION JOB				6399-15-001		TOTAL EST.	TOTAL FINAL
PROJECT ID				A00186087			
COUNTY				Liberty			
HIGHWAY				SH0146			
ALT	BID CODE	DESCRIPTION	UNIT	EST.	FINAL		
	6224-6002	INCIDENT MANAGEMENT (TYPE B)	HR	8.000		8.000	
	6224-6005	INCIDENT MANAGEMENT (TYPE E)	HR	8.000		8.000	
	6224-6006	INCIDENT MANAGEMENT (TYPE F)	HR	8.000		8.000	
	6224-6007	INCIDENT MANAGEMENT (TYPE G)	HR	8.000		8.000	
	6224-6008	INCIDENT MANAGEMENT (TYPE H)	HR	8.000		8.000	
	6224-6009	INCIDENT MANAGEMENT (TYPE I)	HR	8.000		8.000	
	6224-6010	INCIDENT MANAGEMENT (TYPE J)	HR	8.000		8.000	
	6224-6011	INCIDENT MANAGEMENT (TYPE K)	HR	8.000		8.000	
	6224-6012	INCIDENT MANAGEMENT (TYPE L)	HR	8.000		8.000	
	6224-6013	INCIDENT MANAGEMENT (TYPE M)	EA	4.000		4.000	
	7013-6002	VACUUM CLEANING OF BRIDGE JOINTS	CYC	2.000		2.000	
	7093-6001	SNOW AND ICE CONTROL (TRUCK)	HR	72.000		72.000	
	7093-6002	SNOW AND ICE CONTROL (SHADOW VEHICLE)	HR	216.000		216.000	
	7093-6003	SNOW AND ICE CONTROL (LOADER)	HR	72.000		72.000	
	7093-6004	SNOW AND ICE CONTROL (SEASON)	MO	6.000		6.000	
	7093-6005	SNOW AND ICE CONTROL (SPRAY RIG)	HR	144.000		144.000	

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ITEM	104	104	134	150	162	162	164	166	168	351	351	361	361	401
DESC CODE	6009	6021	6008	6001	6001	6002	6001	6001	6001	6019	6008	6051	6052	6001
DESCRIPTION	REMOVING CONC (RIPRAP)	REMOVING CONC (CURB)	BACKFILL (TY A OR B)	BLADING	SPOT SODDING	BLOCK SODDING	BROADCAST SEED (PERM) (RURAL) (SANDY)	FERTILIZER	VEGETATIVE WATERING	FLEXIBLE PAVEMENT STRUCTURE REPAIR(3")	FLEXIBLE PAVEMENT STRUCTURE REPAIR(12")	FULL-DPTH REP(BR APPROACH SLAB)(9"-13")	FULL - DEPTH REPAIR CRCP (8"-14")	FLOWABLE BACKFILL
UNIT	SY	LF	CY	STA	SY	SY	SY	AC	MG	SY	SY	SY	SY	CY
QUANTITY	100	50	500	100	300	500	1000	5	30	100	100	200	200	100

PROJECT TOTALS	100	50	500	100	300	500	1000	5	30	100	100	200	200	100
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ITEM	429	429	432	432	432	432	432	438	500	500	506	506	512	512
DESC CODE	6007	6009	6003	6006	6017	6031	6045	6001	6033	6034	6026	6027	6013	6025
DESCRIPTION	CONC STR REPAIR (VERTICAL & OVERHEAD)	CONC STR REPAIR (STANDARD)	RIPRAP (CONC)(6 IN)	RIPRAP (CONC)(CL B)	RIPRAP (STONE TY R)(DRY)(18 IN)	RIPRAP (STONE PROTECTION)(12 IN)	RIPRAP (MOW STRIP)(4 IN)	CLEANING AND SEALING EXISTING JOINTS	MOBILIZATION (CALLOUT)	MOBILIZATION (EMERGENCY)	EMBANK (EROSN & SEDMT CONT, IN PLACE)	EXCAV (EROSN & SEDMT CONT, IN VEH)	PORT CTB (DES SOURCE)(SGL SLP)(TY 1)	PORT CTB (MOVE)(SGL SLP)(TY 1)
UNIT	SF	SF	CY	CY	CY	CY	CY	LF	EA	EA	CY	CY	LF	LF
QUANTITY	150	75	150	60	100	100	30	10	104	104	500	500	60	510

PROJECT TOTALS	150	75	150	60	100	100	30	10	104	104	500	500	60	510
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ITEM	512	528	528	529	531	540	540	542	543	544	544	545	545	545
DESC CODE	6037	6004	6006	6002	6001	6016	6002	6001	6001	6001	6007	6002	6003	6004
DESCRIPTION	PORT CTB (STKPL)(SGL SLP)(TY 1)	LANDSCAPE PAVERS	REMOVE AND RELAY PAVERS	CONC CURB (TY II)	CONC SIDEWALKS (4")	DOWNSTREAM ANCHOR TERMINAL SECTION	MTL W-BEAM GD FEN (STEEL POST)	REMOVE METAL BEAM GUARD FENCE	CABLE BARRIER SYSTEM (TL-3)	GUARDRAIL END TREATMENT (INSTALL)	GDRAIL END TRT(INSTALL) (HBA POST)	CRASH CUSH ATTEN (DES SOURCE)	CRASH CUSH ATTEN (MOVE & RESET)	CRASH CUSH ATTEN (STKPL)
UNIT	LF	SY	SY	LF	SY	EA	LF	LF	LF	EA	EA	EA	EA	EA
QUANTITY	560	400	400	500	100	24	300	300	500	3	3	2	6	6

PROJECT TOTALS	560	400	400	500	100	24	300	300	500	3	3	2	6	6
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ITEM	545	550	550	550	636	636	636	636	636	636	658	658	658	658
DESC CODE	6005	6002	6004	6005	6001	6002	6003	6007	6008	6009	6013	6015	6026	6028
DESCRIPTION	CRASH CUSH ATTEN (REMOVE)	CHAIN LINK FENCE (REPAIR) (6')	GATE (INSTALL) (DOUBLE) (6' X 14')	GATE (REPAIR) (DOUBLE) (6' X 14')	ALUMINUM SIGNS (TY A)	ALUMINUM SIGNS (TY G)	ALUMINUM SIGNS (TY O)	REPLACE EXISTING ALUMINUM SIGNS(TY A)	REPLACE EXISTING ALUMINUM SIGNS(TY G)	REPLACE EXISTING ALUMINUM SIGNS(TY O)	INSTL DEL ASSM (D-SW)SZ (BRF)CTB	INSTL DEL ASSM (D-SW)SZ (BRF)GF1	INSTL DEL ASSM (D-SY)SZ (BRF)CTB	INSTL DEL ASSM (D-SY)SZ (BRF)GF1
UNIT	EA	LF	EA	EA	SF	SF	SF	SF	SF	SF	EA	EA	EA	EA
QUANTITY	6	1000	1	2	100	100	100	300	750	200	65	65	65	65

PROJECT TOTALS	6	1000	1	2	100	100	100	300	750	200	65	65	65	65
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## SUMMARY SHEET - 1



FED. RD. DIV. NO.	MAINTENANCE PROJECT NO.		SHEET NO.
6	RMC6399-15-001		5-A
STATE	STATE DIST. NO.	COUNTY	
TEXAS	20	LIBERTY, ETC	
CONT	SECT.	JOB	HIGHWAY NO.
6399	15	001	SH99

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ITEM	658	658	658	666	666	666	666	666	666	666	666	666	666	666
DESC CODE	6080	6092	6099	6018	6033	6036	6039	6042	6048	6054	6057	6063	6072	6078
DESCRIPTION	INSTL DEL ASSM (D-SW)SZ 1(WFLX)GND	INSTL DEL ASSM (D-DW)SZ 1(WFLX)GND	INSTL OM ASSM (OM-2Z)(WFLX)GND	REFL PAV MRK TY I (W)6"(DOT)(100MIL)	REFL PAV MRK TY I (W)8"(LNDP)(100MIL)	REFL PAV MRK TY I (W)8"(SLD)(100MIL)	REFL PAV MRK TY I (W)12"(LNDP)(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)(100MIL)	REFL PAV MRK TY I(W)(UTURN ARW)(100MIL)	REFL PAV MRK TY I(W)(LNDP ARW)(100MIL)	REFL PAV MRK TY I (W)(WORD)(100MIL)
UNIT	EA	EA	EA	LF	LF	LF	LF	LF	LF	EA	EA	EA	EA	EA
QUANTITY	45	35	60	1500	1000	9000	1000	9000	3000	48	32	26	8	48

PROJECT TOTALS	45	35	60	1500	1000	9000	1000	9000	3000	48	32	26	8	48
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ITEM	666	666	666	666	666	666	666	666	666	666	666	666	666	666
DESC CODE	6081	6084	6138	6141	6147	6162	6180	6212	6231	6232	6234	6236	6237	6239
DESCRIPTION	REFL PAV MRK TY I(W)(ENTR GORE)(100MIL)	REFL PAV MRK TY I(W)(EXIT GORE)(100MIL)	REFL PAV MRK TY I (Y)8"(SLD)(100MIL)	REFL PAV MRK TY I (Y)12"(SLD)(100MIL)	REFL PAV MRK TY I (Y)24"(SLD)(100MIL)	RE PV MRK TY I(BLACK)6" (SHADOW)(100MIL)	REFL PAV MRK TY II (W) 12" (SLD)	REFL PAV MRK TY II (Y) 12" (SLD)	PAVEMENT SEALER (ARROW)	PAVEMENT SEALER (WORD)	PAVEMENT SEALER (DBL ARROW)	PAVEMENT SEALER (UTURN ARROW)	PAVEMENT SEALER (LNDP ARROW)	PAVEMENT SEALER (ENTR GORE)
UNIT	EA	EA	LF	LF	LF	LF	LF	LF	EA	EA	EA	EA	EA	EA
QUANTITY	7	7	1000	1000	200	2000	100	200	48	48	32	26	8	7

PROJECT TOTALS	7	7	1000	1000	200	2000	100	200	48	48	32	26	8	7
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ITEM	666	666	666	666	666	666	668	668	672	672	672	672	677	677
DESC CODE	6240	6303	6306	6309	6315	6321	6010	6059	6006	6007	6009	6010	6001	6002
DESCRIPTION	PAVEMENT SEALER (EXIT GORE)	RE PM W/RET REQ TY I (W)4"(SLD)(100MIL)	RE PM W/RET REQ TY I (W)6"(BRK)(100MIL)	RE PM W/RET REQ TY I (W)6"(SLD)(100MIL)	RE PM W/RET REQ TY I (Y)4"(SLD)(100MIL)	RE PM W/RET REQ TY I (Y)6"(SLD)(100MIL)	PREFAB PAV MRK TY B (W)(6")(BRK) CNTST	PREFAB PAV MRK TY B (MULTI)(SHIELD)	REFL PAV MRKR TY I-A	REFL PAV MRKR TY I-C	REFL PAV MRKR TY II-A-A	REFL PAV MRKR TY II-C-R	ELIM EXT PAV MRK & MRKS (4")	ELIM EXT PAV MRK & MRKS (6")
UNIT	EA	LF	LF	LF	LF	LF	LF	EA	EA	EA	EA	EA	LF	LF
QUANTITY	7	200	3000	3000	200	4000	1000	10	40	40	100	350	50	50

PROJECT TOTALS	7	200	3000	3000	200	4000	1000	10	40	40	100	350	50	50
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ITEM	677	677	677	677	677	677	677	677	677	678	678	678	678	678
DESC CODE	6003	6005	6008	6009	6012	6013	6014	6022	6036	6001	6002	6004	6006	6009
DESCRIPTION	ELIM EXT PAV MRK & MRKS (8")	ELIM EXT PAV MRK & MRKS (12")	ELIM EXT PAV MRK & MRKS (ARROW)	ELIM EXT PAV MRK & MRKS (DBL ARROW)	ELIM EXT PAV MRK & MRKS (WORD)	ELIM EXT PAV MRK & MRKS (ENTR GORE)	ELIM EXT PAV MRK & MRKS (EXIT GORE)	ELIM EXT PAV MRK & MRKS (SHEILD)	ELIM EXT PAV MRK & MRKS (UTURN ARROW)	PAV SURF PREP FOR MRK (4")	PAV SURF PREP FOR MRK (6")	PAV SURF PREP FOR MRK (8")	PAV SURF PREP FOR MRK (12")	PAV SURF PREP FOR MRK (ARROW)
UNIT	LF	LF	EA	EA	EA	EA	EA	EA	EA	LF	LF	LF	LF	EA
QUANTITY	50	50	48	32	48	7	7	6	26	50	50	50	50	48

PROJECT TOTALS	50	50	48	32	48	7	7	6	26	50	50	50	50	48
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## SUMMARY SHEET-2



FED. RD. DIV. NO.	MAINTENANCE PROJECT NO.		SHEET NO.
6	RMC6399-15-001		5-B
STATE	STATE DIST. NO.	COUNTY	
TEXAS	20	LIBERTY, ETC.	
CONT	SECT.	JOB	HIGHWAY NO.
6399	15	001	SH99

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ITEM	678	678	678	678	678	678	678	700	720	720	721	730	730	730
DESC CODE	6010	6012	6016	6017	6018	6025	6033	6001	6001	6003	6002	6003	6054	6055
DESCRIPTION	PAV SURF PREP FOR MRK (DBL ARROW)	PAV SURF PREP FOR MRK (UTURN ARR)	PAV SURF PREP FOR MRK (WORD)	PAV SURF PREP FOR MRK (ENTR GORE)	PAV SURF PREP FOR MRK (EXIT GORE)	PAV SURF PREP FOR MRKS (SHIELD)	PAV SURF PREP FOR MRK (RPM)	POTHOLE REPAIR (STANDARD)	SPALLING REPAIR (HYDRAULIC CEMENT)	SPALLING REPAIR (POLYMERIC) (SEMIRIGID)	FIBER REINFORCED POLYMER PATCHING MATLS	SPOT MOWING	FULL - WIDTH MOWING - TRACT (1)	FULL - WIDTH MOWING - TRACT (2)
UNIT	EA	EA	EA	EA	EA	EA	EA	SY	CF	GAL	LB	AC	AC	AC
QUANTITY	32	26	48	7	7	6	530	25	60	5	10	6	5112	3660
PROJECT TOTALS	32	26	48	7	7	6	530	25	60	5	10	6	5112	3660

ITEM	730	731	731	731	734	734	734	734	734	735	735
DESC CODE	6056	6007	6011	6015	6003	6054	6055	6056	6056	6068	6069
DESCRIPTION	FULL - WIDTH MOWING - TRACT (3)	PAVEMENT EDGES, STRUCTURES & FIXTURES	BROADCAST APPLICATION	WICK APPLICATION OF HERBICIDE	LITTER REMOVAL (SPOT)	LITTER REMOVAL - TRACT (1)	LITTER REMOVAL - TRACT (2)	LITTER REMOVAL - TRACT (3)	LITTER REMOVAL - TRACT (3)	DEBRIS-CNTR MEDIANS/MAIN LANES-AREA (1)	DEBRIS-CNTR MEDIANS/MAIN LANES-AREA (2)
UNIT	AC	MI	AC	AC	AC	CYC	CYC	CYC	CYC	CYC	CYC
QUANTITY	2064	218	100	75	20	48	48	48	48	72	72
PROJECT TOTALS	2064	218	100	75	20	48	48	48	48	72	72

ITEM	735	738	738	738	738	738	738	738	738	738	738	738
DESC CODE	6070	6011	6094	6095	6096	6114	6115	6116	6134	6135	6136	6154
DESCRIPTION	DEBRIS-CNTR MEDIANS/MAIN LANES-AREA (3)	CLEANING / SWEEPING (HANDWORK)	CLEAN / SWEEP - CENTER MEDIAN - AREA(1)	CLEAN / SWEEP - CENTER MEDIAN - AREA(2)	CLEAN / SWEEP - CENTER MEDIAN - AREA(3)	CLEAN / SWEEP-OUTSIDE MAIN LANE-AREA(1)	CLEAN / SWEEP-OUTSIDE MAIN LANE-AREA(2)	CLEAN / SWEEP-OUTSIDE MAIN LANE-AREA(3)	CLEAN / SWEEP - FRONTAGE ROAD - AREA(1)	CLEAN / SWEEP - FRONTAGE ROAD - AREA(2)	CLEAN / SWEEP - FRONTAGE ROAD - AREA(3)	CLEAN / SWEEP - (ENTR / EXT RMP)(AREA 1)
UNIT	CYC	SY	CYC									
QUANTITY	72	35000	24	24	24	24	24	24	12	12	12	12
PROJECT TOTALS	72	35000	24	24	24	24	24	24	12	12	12	12

ITEM	738	738	740	740	740	740	740	752	752	752	752	752	752	752
DESC CODE	6155	6156	6001	6002	6003	6004	6005	6003	6004	6005	6006	6007	6008	6009
DESCRIPTION	CLEAN / SWEEP - (ENTR / EXT RMP)(AREA 2)	CLEAN / SWEEP - (ENTR / EXT RMP)(AREA 3)	GRAFFITI REMOVAL (BLAST CLEANING)	GRAFFITI REMOVAL (PAINTING)	GRAFFITI REMOVAL (CHEMICAL CLEANING)	ANTI - GRAFFITI COATING(PER MNENT-TY II)	ANTI - GRAFFITI COATING(PER MNENT-TY III)	TREE TRIMMING / BRUSH REMOVAL	TREE TRIMMING / BRUSH REMOVAL(CH ANNELS)	TREE REMOVAL (4" - 12" DIA)	TREE REMOVAL (12" - 18" DIA)	TREE REMOVAL (18" - 24" DIA)	TREE REMOVAL (24" - 30" DIA)	TREE REMOVAL (30" - 36" DIA)
UNIT	CYC	CYC	SF	SF	SF	SF	SF	MI	AC	EA	EA	EA	EA	EA
QUANTITY	12	12	1500	1500	300	1500	1500	24	10	15	15	15	15	6
PROJECT TOTALS	12	12	1500	1500	300	1500	1500	24	10	15	15	15	15	6

## SUMMARY SHEET - 3



FED. RD. DIV. NO.	MAINTENANCE PROJECT NO.		SHEET NO.
6	RMC6399-15-001		5-C
STATE	STATE DIST. NO.	COUNTY	
TEXAS	20	LIBERTY, ETC.	
CONT	SECT.	JOB	HIGHWAY NO.
6399	15	001	SH99

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<b>ITEM</b>	752	752	752	752	760	760	764	764	764	764	764	764	764	764
<b>DESC CODE</b>	6010	6011	6014	6015	6001	6003	6001	6006	6007	6008	6009	6010	6011	6012
<b>DESCRIPTION</b>	TREE REMOVAL (36" - 42" DIA)	TREE REMOVAL (42" - 48" DIA)	STUMP REMOVAL	TREE AND BRUSH REMOVAL	DITCH CLEANING AND RESHAPING (FOOT)	DITCH CLEAN/RESHAPING(CU YD IN VEHICLE)	DRAIN INLET CLEANING	STORM SEWER CLEANING (PIPE) (<12" DIA)	STORM SEWER CLEANING (PIPE)(12"-18" DIA)	STORM SEWER CLEANING (PIPE)(19"-24" DIA)	STORM SEWER CLEANING (PIPE)(25"-30" DIA)	STORM SEWER CLEANING (PIPE)(31"-36" DIA)	STORM SEWER CLEANING (PIPE)(37"-42" DIA)	STORM SEWER CLEANING (PIPE)(43"-54" DIA)
<b>UNIT</b>	EA	EA	EA	AC	LF	CY	EA	LF	LF	LF	LF	LF	LF	LF
<b>QUANTITY</b>	6	6	6	10	1000	1000	50	100	900	1400	950	900	400	200

<b>PROJECT TOTALS</b>	6	6	6	10	1000	1000	50	100	900	1400	950	900	400	200
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<b>ITEM</b>	764	764	764	764	770	770	770	770	770	770	770	770	770	770
<b>DESC CODE</b>	6016	6017	6018	6019	6001	6002	6003	6004	6010	6011	6017	6021	6022	6028
<b>DESCRIPTION</b>	STORM SEWER CLEAN (BOX CULV) (6-<12 SF)	STORM SEWER CLEAN (BOX CULV)(12-<24 SF)	STORM SEWER CLEAN (BOX CULV)(24-<48 SF)	STORM SEWER CLEAN (BOX CULV)(48-<96 SF)	REPAIR RAIL ELEMENT (W-BEAM)	REPAIR RAIL ELEMENT (THRIE - BEAM)	REP RAIL ELMNT(THRIE -BM TRANS TO W-BM)	REPAIR RAIL ELEMENT (CURVED RAIL)	REM / REPL TIMBER/STL POST W/O CONC FND	REM / REPL TIMBER / STL POST W/CONC FND	REALIGN POSTS	REPLACE SINGLE GDRAIL TERMINAL RAIL	REPLACE SINGLE GDRAIL TERMINAL POST	REPL SINGLE GDRAIL TERM IMPACT HEAD
<b>UNIT</b>	LF	LF	LF	LF	LF	LF	LF	LF	EA	EA	EA	LF	EA	EA
<b>QUANTITY</b>	110	100	90	50	5000	300	300	150	30	450	120	1500	300	30

<b>PROJECT TOTALS</b>	110	100	90	50	5000	300	300	150	30	450	120	1500	300	30
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<b>ITEM</b>	770	770	770	770	770	770	771	771	771	771	771	771	772	774
<b>DESC CODE</b>	6029	6030	6031	6032	6033	6052	6001	6003	6005	6007	6009	6011	6003	6006
<b>DESCRIPTION</b>	REM & RESET SGT IMPACT HEAD	REPLACE SGT CABLE ASSEMBLY	REPLACE SGT CABLE ANCHOR	REPLACE SGT STRUT	REPLACE SGT OBJECT MARKER	REPAIR STEEL POST WITH BASE PLATE	REPLACE POSTS (TL-3)	CABLE SPLICE / TURNBUCKLE (TL-3)	REPAIR CONCRETE FOUNDATION (TL-3)	REPR OR REPLC CABLE BARR TERM SEC(TL-3)	REPLACE CABLE (TL-3)	CHECK / RE-TENSION CABLE	POST AND CABLE FENCE (NEW INSTALLATION)	REPAIR (TRACC)
<b>UNIT</b>	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	LF	EA	LF	EA
<b>QUANTITY</b>	30	18	24	12	20	6	350	16	20	13	9500	25	300	3

<b>PROJECT TOTALS</b>	30	18	24	12	20	6	350	16	20	13	9500	25	300	3
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<b>ITEM</b>	774	774	774	774	774	774	774	2001	6000	6000	6000	6000	6000	6000
<b>DESC CODE</b>	6023	6027	6036	6037	6049	6065	6066	6002	6001	6003	6004	6005	6006	6007
<b>DESCRIPTION</b>	REPAIR REACT (N) (MISC HARDWARE)	REPAIR REACT (N) (CYLINDERS)	REPAIR REACT (W) (MISC) (HARDWARE)	REPAIR REACT (W) (CYLINDERS)	REPAIR REACT (W) (DIAPHRAGM)	REPAIR TAU II (N) (MISC HARDWARE)	REPAIR TAU II (N)	INSTL TIED CONCRETE EROSN CONTROL MATS	INSTALL ABOVE-GROUND CONDUIT	REPLACE ABOVE-GROUND CONDUIT	INSTALL UNDERGROUND CONDUIT	REMOVE UNDERGROUND CONDUIT	REPLACE UNDERGROUND CONDUIT	INSTALL CONDUCTOR
<b>UNIT</b>	EA	EA	EA	EA	EA	EA	LF	SF	LF	LF	LF	LF	LF	LF
<b>QUANTITY</b>	35	21	12	4	4	4	9	2000	300	100	1000	200	1000	15000

<b>PROJECT TOTALS</b>	35	21	12	4	4	4	9	2000	300	100	1000	200	1000	15000
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## SUMMARY SHEET - 4



FED. RD. DIV. NO.	MAINTENANCE PROJECT NO.		SHEET NO.
6	RMC6399-15-001		5-D
STATE	STATE DIST. NO.	COUNTY	
TEXAS	20	LIBERTY, ET C.	
CONT	SECT.	JOB	HIGHWAY NO.
6399	15	001	SH99

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ITEM DESC CODE	6000 6008	6000 6009	6000 6016	6000 6020	6000 6022	6000 6024	6000 6028	6000 6030	6000 6032	6000 6041	6000 6043	6000 6044	6000 6052	6000 6054
DESCRIPTION	REMOVE CONDUCTOR	REPLACE CONDUCTOR	INSTALL ELECTRICAL SPLICE	ROAD BORE	REMOVE ROADWAY ILLUM ASSEMBLY (HPS)	INSTALL ROADWAY ILLUM ASSEMBLY (LED)	REMOVE UNDERPASS LUMINAIRE (HPS)	INSTALL UNDERPASS LUMINAIRE (LED)	REPLACE UNDERPASS LUMINAIRE (LED)	REPLACE LUMINAIRE FIXTURE (LED)	REPLACE LUMINAIRE POLE	REPLACE LUMINAIRE ARMS	REPLACE ELECTRICAL SERVICE	REPLACE STEEL SERVICE POLE
UNIT	LF	LF	EA	LF	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA
QUANTITY	1000	10000	50	1000	59	75	16	44	6	35	30	10	10	5

PROJECT TOTALS	1000	10000	50	1000	59	75	16	44	6	35	30	10	10	5
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ITEM DESC CODE	6000 6057	6000 6058	6000 6059	6000 6060	6000 6061	6000 6062	6000 6063	6000 6064	6000 6065	6000 6068	6000 6072	6000 6073	6000 6074	6000 6076
DESCRIPTION	INSTALL GROUND BOX W/APRON	REMOVE GROUND BOX	INSTALL FOUNDATION	REMOVE FOUNDATION	REPLACE TRANSFORMER BASE	REPLACE TRANSFORMER BASE COVER	REPLACE HAND HOLE COVER	INSTALL GROUND ROD	REPLACE BALLAST	REPLACE FUSED DISCONNECT	REPLACE LAMP (POLE MOUNT FIXTURE)	REPLACE LAMP (UNDERPASS FIXTURE)	REPLACE LAMP (WALL PACK FIXTURE)	REPLACE WALL PACK LUMINAIRE
UNIT	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA
QUANTITY	10	5	15	10	20	20	10	20	10	25	100	25	10	10

PROJECT TOTALS	10	5	15	10	20	20	10	20	10	25	100	25	10	10
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ITEM DESC CODE	6000 6077	6000 6078	6000 6079	6000 6081	6000 6082	6000 6083	6000 6084	6000 6085	6000 6086	6000 6088	6000 6090	6000 6091	6000 6092	6000 6093
DESCRIPTION	REPLACE LENS (POLE MOUNTED FIXTURE)	REPLACE LENS (UNDERPASS FIXTURE)	REPLACE LENS (WALL PACK FIXTURE)	REPLACE WALL PACK GUARD	REPLACE FUSE	REPLACE FUSE HOLDER	REPLACE BREAKAWAY FUSE HOLDER	REPLACE STARTING AID	REPLACE PHOTOCELL AND BRACKET	REPLACE CONTROL TRANS (ELECT SERVICE)	REPLACE CONTROL CIRCUIT (ELECT SERVICE)	REPLACE AVIATION WARNING FIXTURE	REPLACE AVIATION WARNING LAMP	REPLACE HAND-OFF-AUTO SWITCH
UNIT	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA
QUANTITY	5	5	5	2	100	5	150	10	50	1	1	5	5	20

PROJECT TOTALS	5	5	5	2	100	5	150	10	50	1	1	5	5	20
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ITEM DESC CODE	6000 6094	6000 6095	6000 6096	6000 6097	6000 6099	6000 6101	6000 6102	6000 6104	6000 6105	6000 6106	6000 6108	6000 6143	6001 6001	6038 6004
DESCRIPTION	REPLACE CONTACTOR	REPLACE METER BASE	REPLACE TIME CLOCK	REPLACE BREAKER PANEL	REPLACE CIRCUIT BREAKER	REPLACE TWIST LOCK CONNECTOR	REPLACE SAFETY LANYARD	RE-STRAP EXISTING CONDUIT	REPLACE NUTS, WASHERS & OTHER HARDWARE	TROUBLESHOOT FOR REPAIRS	REPLACE LUMINAIRES	REPLACE LAMP FOR UNDERPASS FIXTURE 150W	PORTABLE CHANGEABLE MESSAGE SIGN	MULTIPOLYMER PAV MRK (W)(6")(SLD)
UNIT	EA	EA	EA	EA	EA	EA	LF	EA	EA	HR	EA	EA	DAY	LF
QUANTITY	25	25	10	15	50	10	5	100	10	300	10	10	28	3000

PROJECT TOTALS	25	25	10	15	50	10	5	100	10	300	10	10	28	3000
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## SUMMARY SHEET-5



FED. RD. DIV. NO.	MAINTENANCE PROJECT NO.		SHEET NO.
6	RMC6399-15-001		5-E
STATE	STATE DIST. NO.	COUNTY	
TEXAS	20	LIBERTY, ETC.	
CONT	SECT.	JOB	HIGHWAY NO.
6399	15	001	SH99

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ITEM	6038	6038	6038	6038	6038	6038	6038	6038	6038	6038	6038	6038	6043	6043
DESC CODE	6005	6006	6007	6009	6011	6012	6013	6017	6018	6020	6021	6022	6001	6002
DESCRIPTION	MULTIPOLYMER PAV MRK (W)(6")(BRK)	MULTIPOLYMER PAV MRK (W)(6")(DOT)	MULTIPOLYMER PAV MRK (W)(8")(SLD)	MULTIPOLYMER PAV MRK (W)(8")(DOT)	MULTIPOLYMER PAV MRK (W)(12")(SLD)	MULTIPOLYMER PAV MRK (W)(12")(LNDP)	MULTIPOLYMER PAV MRK (W)(24")(SLD)	MULTIPOLYMER PAV MRK (Y)(6")(SLD)	MULTIPOLYMER PAV MRK (Y)(6")(BRK)	MULTIPOLYMER PAV MRK (Y)(8")(SLD)	MULTIPOLYMER PAV MRK (Y)(12")(SLD)	MULTIPOLYMER PAV MRK (Y)(24")(SLD)	REPAIR LG RDSG SIGN SUPT & ASSEMBLIES	RELOC LG RDSG SIGN SUPT & ASSEMBLIES
UNIT	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	EA	EA
QUANTITY	2000	1500	2000	1000	1000	1000	500	3000	2000	1000	100	200	100	50
PROJECT TOTALS	2000	1500	2000	1000	1000	1000	500	3000	2000	1000	100	200	100	50

ITEM	6043	6044	6044	6044	6185	6185	6185	6224	6224	6224	6224	6224	6224	6224
DESC CODE	6004	6001	6002	6004	6002	6003	6004	6001	6002	6005	6006	6007	6008	6009
DESCRIPTION	REMOV LARGE RDSG SIGN SUPP & ASSEM	REPAIR SMALL RDSG SIGN SUPT & ASSEM	RELOC SMALL RDSG SIGN SUPT & ASSEM	REMOV SMALL RDSG SIGN SUPT & ASSEM	TMA (STATIONARY)	TMA (MOBILE OPERATION)	TMA (MOBILE OPERATIONS) (SNOW & ICE)	INCIDENT MANAGEMENT (TYPE A)	INCIDENT MANAGEMENT (TYPE B)	INCIDENT MANAGEMENT (TYPE E)	INCIDENT MANAGEMENT (TYPE F)	INCIDENT MANAGEMENT (TYPE G)	INCIDENT MANAGEMENT (TYPE H)	INCIDENT MANAGEMENT (TYPE I)
UNIT	EA	EA	EA	EA	DAY	HR	HR	HR	HR	HR	HR	HR	HR	HR
QUANTITY	50	100	50	6	156	2000	100	8	8	8	8	8	8	8
PROJECT TOTALS	50	100	50	6	156	2000	100	8	8	8	8	8	8	8

ITEM	6224	6224	6224	6224	7013	7093	7093	7093	7093	7093
DESC CODE	6010	6011	6012	6013	6002	6001	6002	6003	6004	6005
DESCRIPTION	INCIDENT MANAGEMENT (TYPE J)	INCIDENT MANAGEMENT (TYPE K)	INCIDENT MANAGEMENT (TYPE L)	INCIDENT MANAGEMENT (TYPE M)	VACUUM CLEANING OF BRIDGE JOINTS	SNOW AND ICE CONTROL (TRUCK)	SNOW AND ICE CONTROL (SHADOW VEHICLE)	SNOW AND ICE CONTROL (LOADER)	SNOW AND ICE CONTROL (SEASON)	SNOW AND ICE CONTROL (SPRAY RIG)
UNIT	HR	HR	HR	EA	CYC	HR	HR	HR	MO	HR
QUANTITY	8	8	8	4	2	72	216	72	6	144
PROJECT TOTALS	8	8	8	4	2	72	216	72	6	144

## SUMMARY SHEET-6

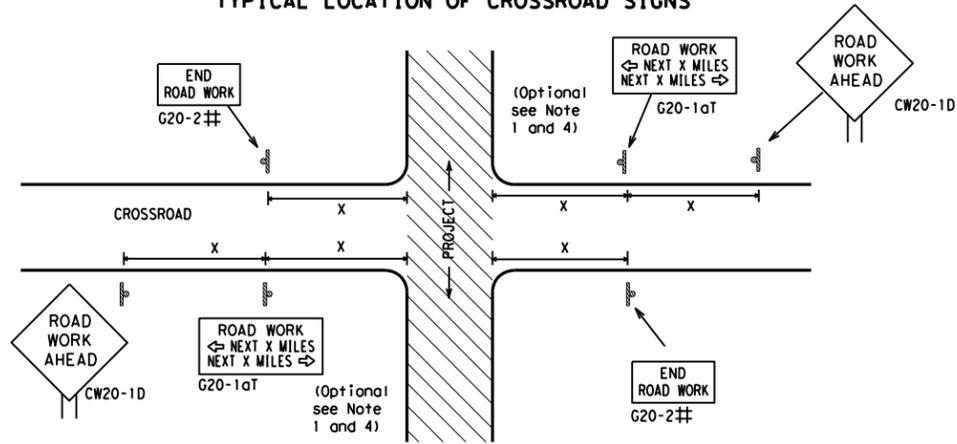


FED. RD. DIV. NO.	MAINTENANCE PROJECT NO.		SHEET NO.
6	RMC6399-15-001		5-F
STATE	STATE DIST. NO.	COUNTY	
TEXAS	20	LIBERTY, ETC.	
CONT	SECT.	JOB	HIGHWAY NO.
6399	15	001	SH99



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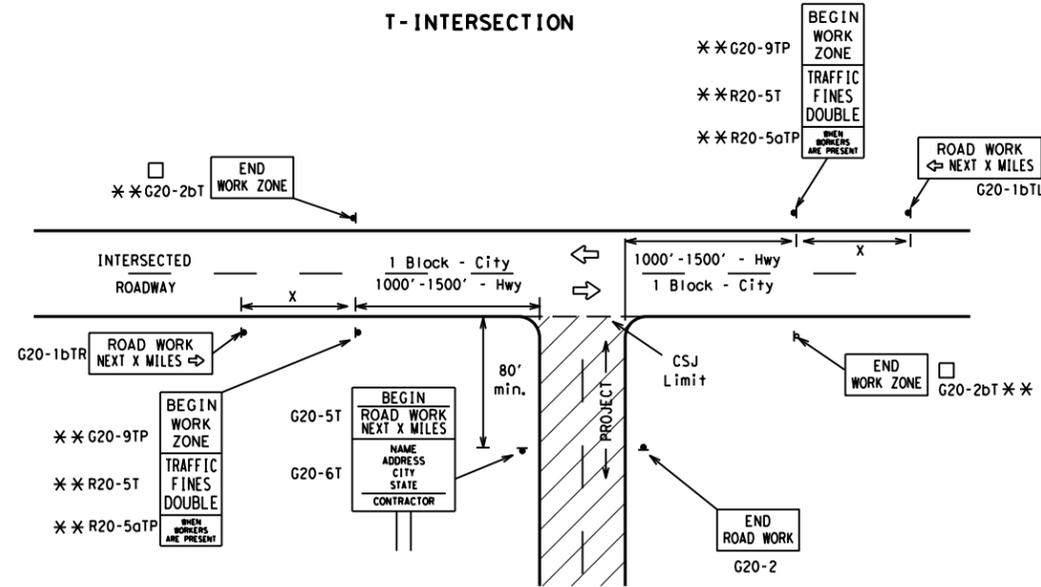
**TYPICAL LOCATION OF CROSSROAD SIGNS**



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

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

**T-INTERSECTION**



**CSJ LIMITS AT T-INTERSECTION**

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

**TYPICAL CONSTRUCTION WARNING SIGN SIZE AND SPACING<sup>1,5,6</sup>**

Sign Number or Series	SIZE		SPACING	
	Conventional Road	Expressway/Freeway	Posted Speed MPH	Sign Δ Spacing "x" Feet (Apprx.)
CW20 <sup>4</sup>	48" x 48"	48" x 48"	30	120
CW21			35	160
CW22			40	240
CW23			45	320
CW25			50	400
CW1, CW2, CW7, CW8, CW9, CW11, CW14	36" x 36"	48" x 48"	55	500 <sup>2</sup>
CW3, CW4, CW5, CW6, CW8-3, CW10, CW12	48" x 48"	48" x 48"	60	600 <sup>2</sup>
			65	700 <sup>2</sup>
			70	800 <sup>2</sup>
			75	900 <sup>2</sup>
			80	1000 <sup>2</sup>
			*	* <sup>3</sup>

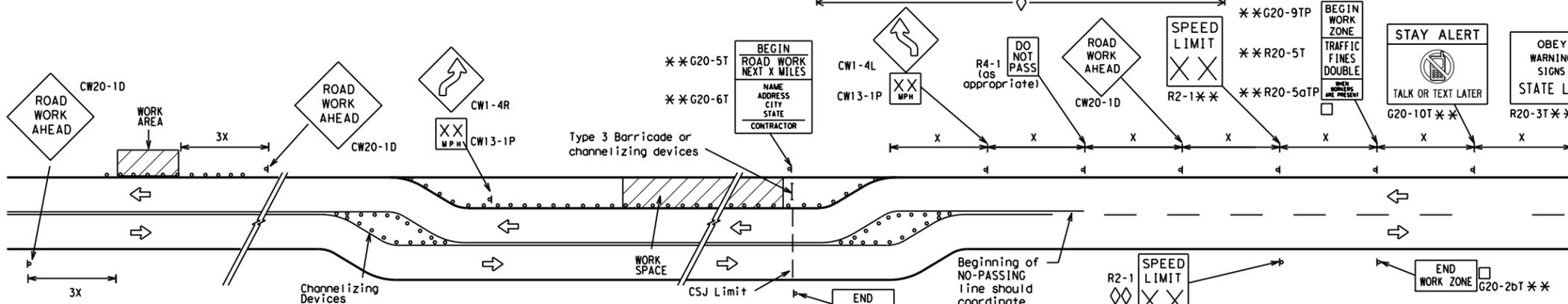
\* For typical sign spacings on divided highways, expressways and freeways, see Part 6 of the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD) typical application diagrams or TCP Standard Sheets.

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

**GENERAL NOTES**

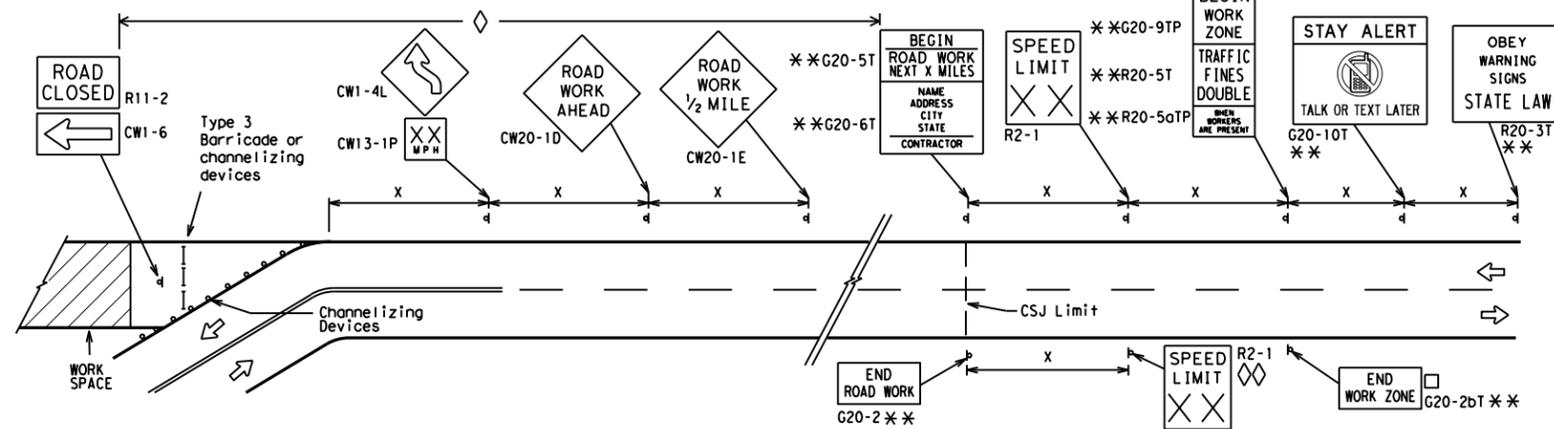
- Special or larger size signs may be used as necessary.
- Distance between signs should be increased as required to have 1500 feet advance warning.
- Distance between signs should be increased as required to have 1/2 mile or more advance warning.
- 36" x 36" "ROAD WORK AHEAD" (CW20-1D) signs may be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

**WORK AREAS IN MULTIPLE LOCATIONS WITHIN CSJ LIMITS**

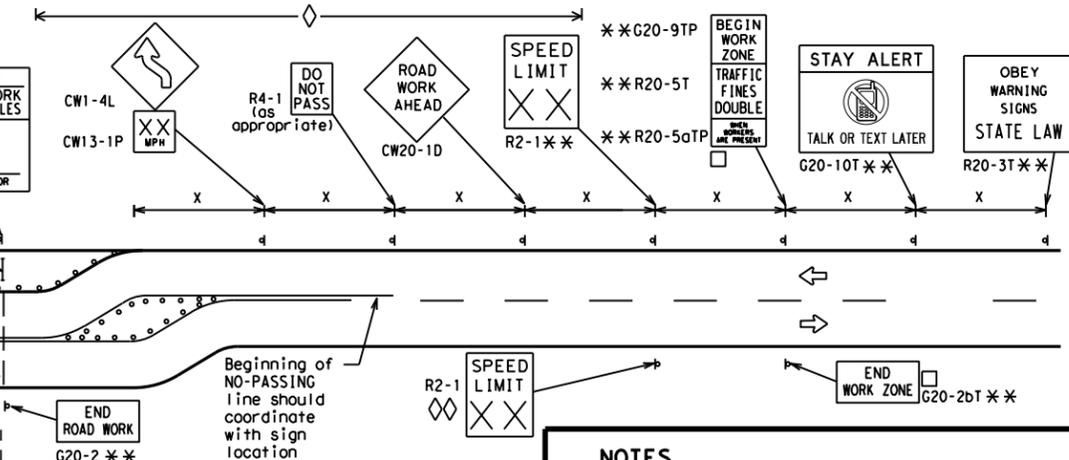


When extended distances occur between minimal work spaces, the Engineer/Inspector should ensure additional "ROAD WORK AHEAD" (CW20-1D) signs are placed in advance of these work areas to remind drivers they are still within the project limits. See the applicable TCP sheets for exact location and spacing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

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



**SAMPLE LAYOUT OF SIGNING FOR WORK BEGINNING AT THE CSJ LIMITS**



**NOTES**

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

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

SHEET 2 OF 12



**BARRICADE AND CONSTRUCTION PROJECT LIMIT**

**BC(2)-21**

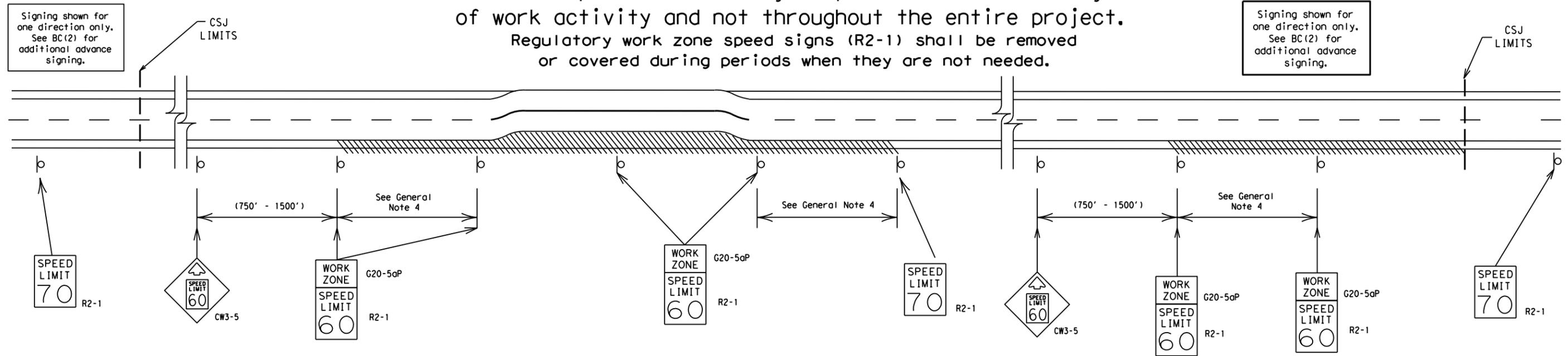
FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CR: TxDOT
© TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	6399	15	001	SH99
9-07 8-14	DIST	COUNTY	SHEET NO.	
7-13 5-21	BMT	LIBERTY, ETC.	7	

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# TYPICAL APPLICATION OF WORK ZONE SPEED LIMIT SIGNS

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

Reduced speeds should only be posted in the vicinity of work activity and not throughout the entire project. Regulatory work zone speed signs (R2-1) shall be removed or covered during periods when they are not needed.



## GUIDANCE FOR USE:

### LONG/INTERMEDIATE TERM WORK ZONE SPEED LIMITS

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

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

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

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

### SHORT TERM WORK ZONE SPEED LIMITS

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

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

### GENERAL NOTES

- Regulatory work zone speed limits should be used only for sections of construction projects where speed control is of major importance.
- Regulatory work zone speed limit signs shall be placed on supports at a 7 foot minimum mounting height.
- Speed zone signs are illustrated for one direction of travel and are normally posted for each direction of travel.
- Frequency of work zone speed limit signs should be:
 

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

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SHEET 3 OF 12



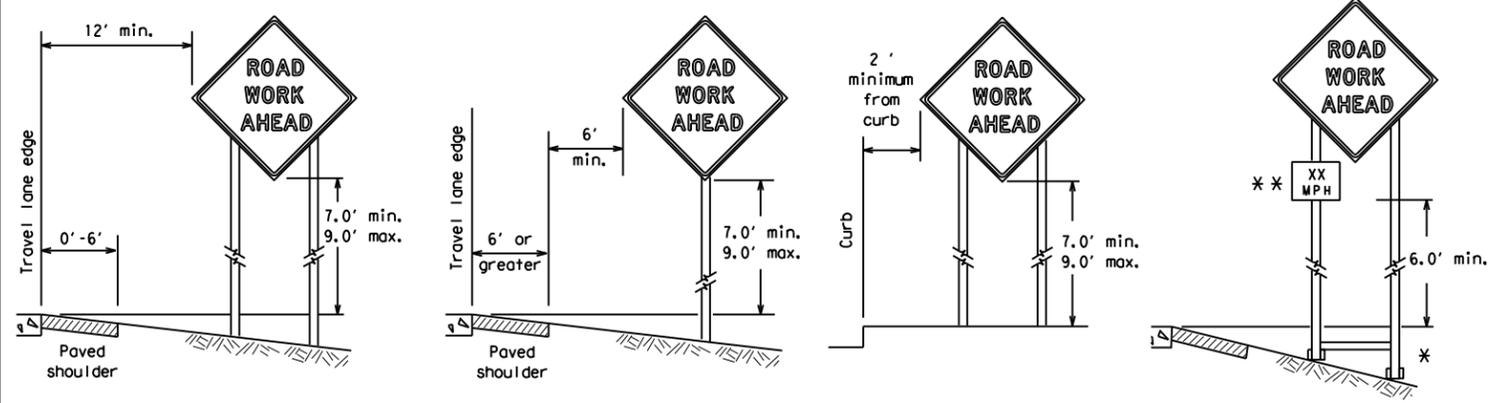
## BARRICADE AND CONSTRUCTION WORK ZONE SPEED LIMIT

BC (3) -21

FILE:	bc-21.dgn	DW:	TxDOT	CK:	TxDOT	DW:	TxDOT	CK:	TxDOT
© TxDOT	November 2002	CONT	SECT	JOB	HIGHWAY				
REVISIONS		6399	15	001	SH99				
9-07	8-14	DIST	COUNTY	SHEET NO.					
7-13	5-21	BMT	LIBERTY, ETC.	8					

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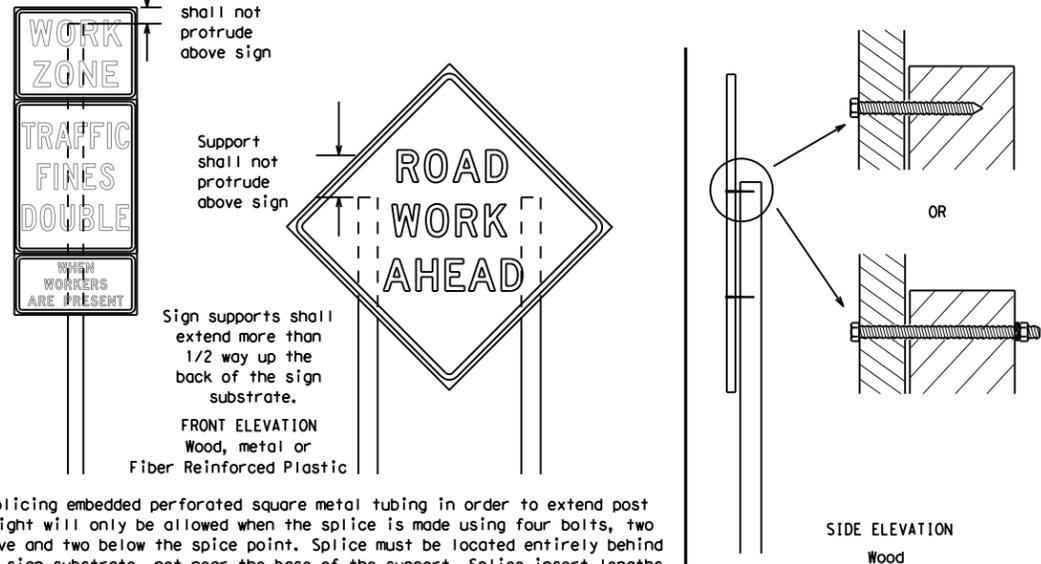
**TYPICAL MINIMUM CLEARANCES FOR LONG TERM AND INTERMEDIATE TERM SIGNS**



\* 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**



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

**GENERAL NOTES FOR WORK ZONE SIGNS**

- Contractor shall install and maintain signs in a straight and plumb condition and/or as directed by the Engineer.
- Wooden sign posts shall be painted white.
- Barricades shall NOT be used as sign supports.
- All signs shall be installed in accordance with the plans or as directed by the Engineer. Signs shall be used to regulate, warn, and guide the traveling public safely through the work zone.
- The Contractor may furnish either the sign design shown in the plans or in the "Standard Highway Sign Designs for Texas" (SHSD). The Engineer/Inspector may require the Contractor to furnish other work zone signs that are shown in the TMUTCD but may have been omitted from the plans. Any variation in the plans shall be documented by written agreement between the Engineer and the Contractor's Responsible Person. All changes must be documented in writing before being implemented. This can include documenting the changes in the Inspector's TxDOT diary and having both the Inspector and Contractor initial and date the agreed upon changes.
- The 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.
- 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.
- 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.
- 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)**

- 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.
  - Long-term stationary - work that occupies a location more than 3 days.
  - 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.
  - Short-term stationary - daytime work that occupies a location for more than 1 hour in a single daylight period.
  - Short, duration - work that occupies a location up to 1 hour.
  - Mobile - work that moves continuously or intermittently (stopping for up to approximately 15 minutes.)

**SIGN MOUNTING HEIGHT**

- 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.
- 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.
- Long-term/Intermediate-term Signs may be used in lieu of Short-term/Short Duration signing.
- 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.
- 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**

- 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**

- 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.
- "Mesh" type materials are NOT an approved sign substrate, regardless of the tightness of the weave.
- 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**

- 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).
- White sheeting, meeting the requirements of DMS-8300 Type A, shall be used for signs with a white background.
- Orange sheeting, meeting the requirements of DMS-8300 Type B<sub>FL</sub> or Type C<sub>FL</sub>, shall be used for rigid signs with orange backgrounds.

**SIGN LETTERS**

- 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**

- When sign messages may be confusing or do not apply, the signs shall be removed or completely covered.
- 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.
- 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.
- 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 shall NOT be used to cover signs.
- Duct tape or other adhesive material shall NOT be affixed to a sign face.
- Signs and anchor stubs shall be removed and holes backfilled upon completion of work.

**SIGN SUPPORT WEIGHTS**

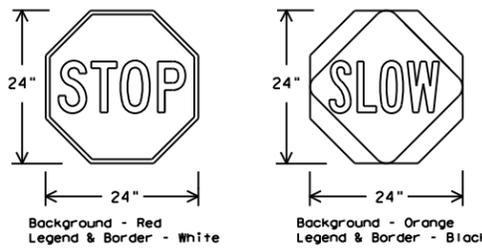
- Where sign supports require the use of weights to keep from turning over, the use of sandbags with dry, cohesionless sand should be used.
- The sandbags will be tied shut to keep the sand from spilling and to maintain a constant weight.
- Rock, concrete, iron, steel or other solid objects shall not be permitted for use as sign support weights.
- Sandbags should weigh a minimum of 35 lbs and a maximum of 50 lbs.
- Sandbags shall be made of a durable material that tears upon vehicular impact. Rubber (such as tire inner tubes) shall NOT be used.
- 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.
- 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.
- Sandbags shall NOT be placed under the skid and shall not be used to level sign supports placed on slopes.

**FLAGS ON SIGNS**

- 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.

**STOP/SLOW PADDLES**

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



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

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

- 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.
- 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.
- When existing permanent signs are moved and relocated due to construction purposes, they shall be visible to motorists at all times.
- 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.
- 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.
- 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.

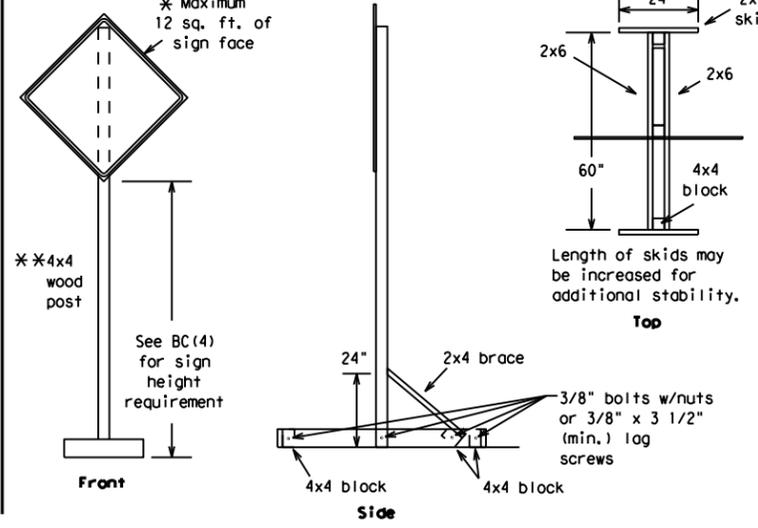
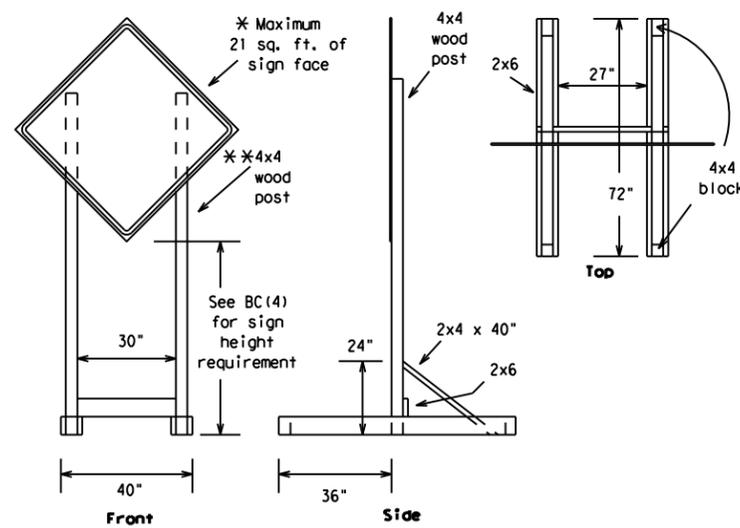


**BARRICADE AND CONSTRUCTION TEMPORARY SIGN NOTES**

**BC (4) - 21**

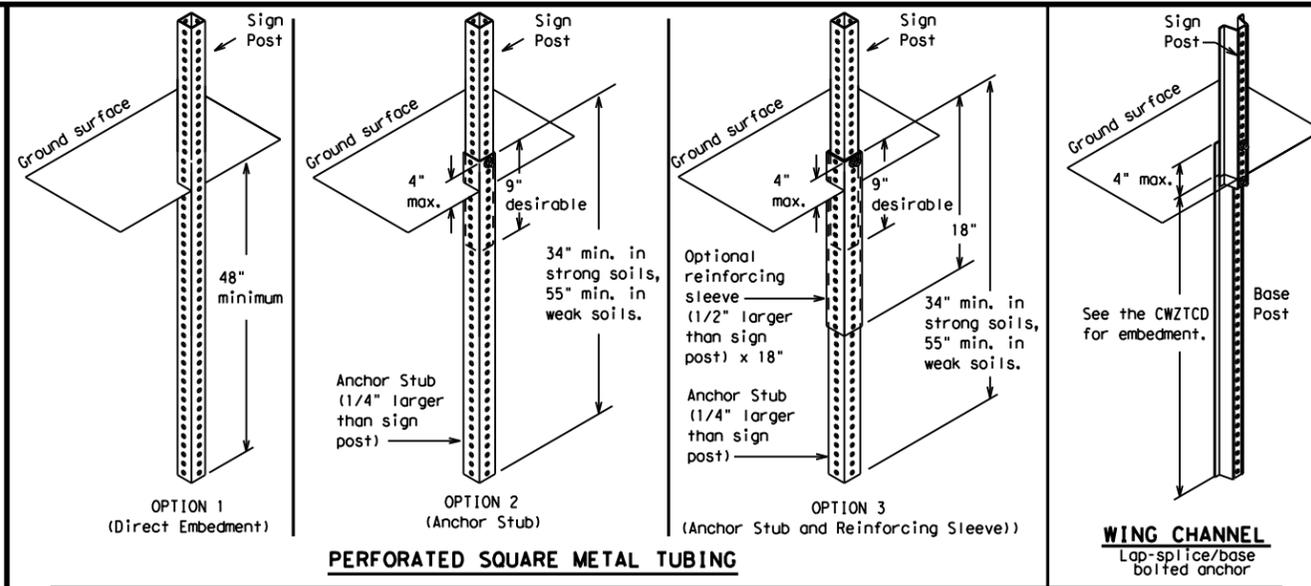
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© TxDOT	November 2002	CONT	SECT	JOB	HIGHWAY				
REVISIONS		6399	15	001	SH99				
9-07	8-14	DIST	COUNTY	SHEET NO.					
7-13	5-21	BMT	LIBERTY, ETC.	9					

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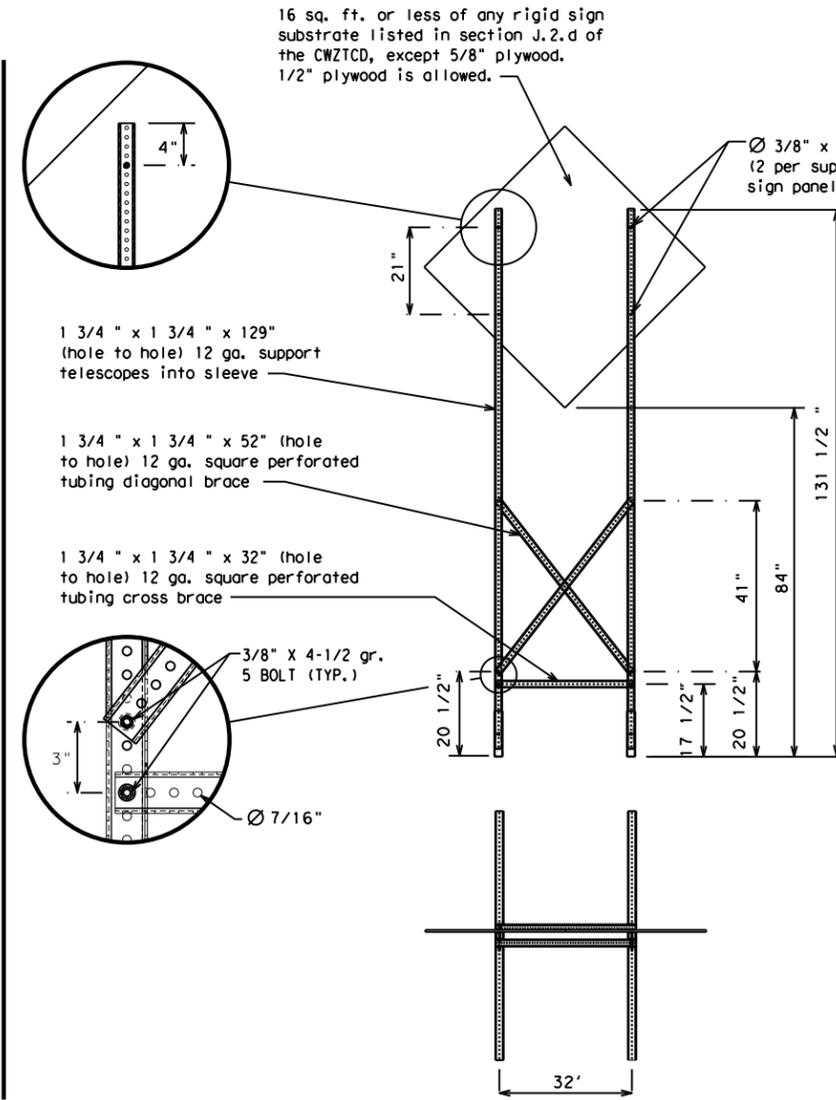
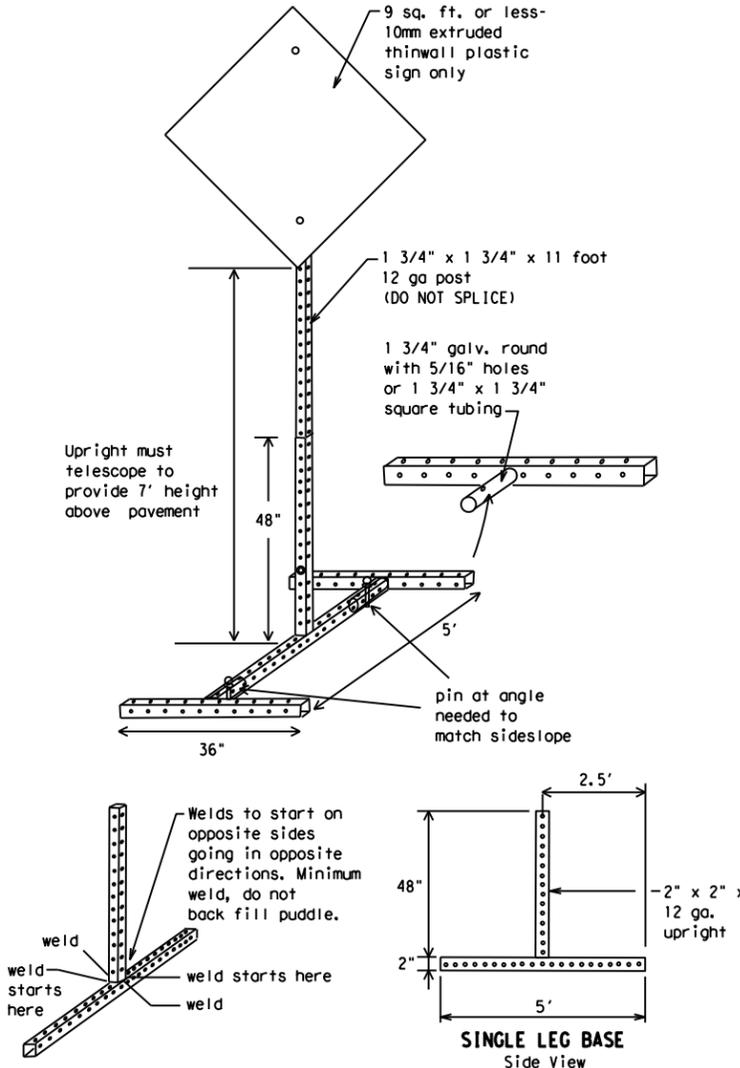
### SKID MOUNTED WOOD SIGN SUPPORTS

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



### GROUND MOUNTED SIGN SUPPORTS

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



### SKID MOUNTED PERFORATED SQUARE STEEL TUBING SIGN SUPPORTS

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

### WEDGE ANCHORS

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

### OTHER DESIGNS

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

### GENERAL NOTES

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

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

SHEET 5 OF 12



## BARRICADE AND CONSTRUCTION TYPICAL SIGN SUPPORT

BC(5) - 21

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9-07	8-14	DIST	COUNTY	SHEET NO.					
7-13	5-21	BMT	LIBERTY, ETC.	10					

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DATE: 5/12/2022  
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

# RECOMMENDED PHASES AND FORMATS FOR PCMS MESSAGES DURING ROADWORK ACTIVITIES

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

## PORTABLE CHANGEABLE MESSAGE SIGNS

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

## 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
XXXXXXXX TO XXXXXX
US XXX TO FM XXXX

### Warning List

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

### \*\* Advance Notice List

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

\*\* See Application Guidelines Note 6.

## APPLICATION GUIDELINES

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

## WORDING ALTERNATIVES

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

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

## FULL MATRIX PCMS SIGNS

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

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

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



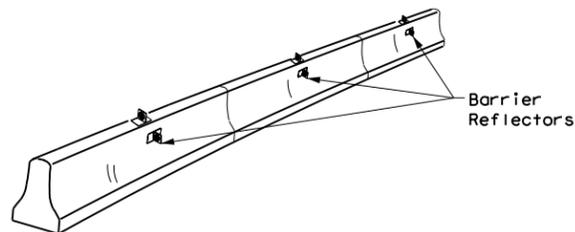
## BARRICADE AND CONSTRUCTION PORTABLE CHANGEABLE MESSAGE SIGN (PCMS)

BC (6) - 21

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9-07 8-14	DIST	COUNTY	SHEET NO.	
7-13 5-21	BMT	LIBERTY, ETC.	11	

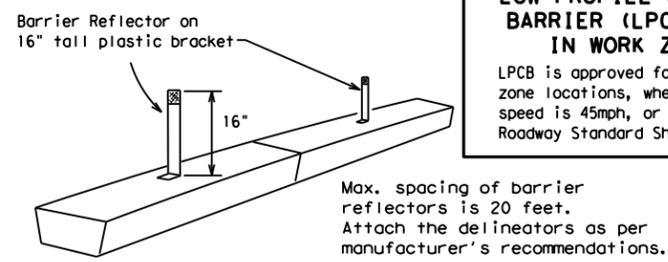
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- Barrier Reflectors shall be pre-qualified, and conform to the color and reflectivity requirements of DMS-8600. A list of prequalified Barrier Reflectors can be found at the Material Producer List web address shown on BC(1).
- Color of Barrier Reflectors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



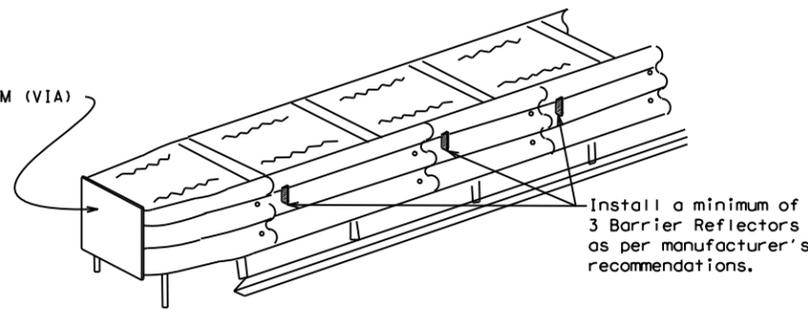
**CONCRETE TRAFFIC BARRIER (CTB)**

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



**LOW PROFILE CONCRETE BARRIER (LPCB) USED IN WORK ZONES**  
 LPCB is approved for use in work zone locations, where the posted speed is 45mph, or less. See Roadway Standard Sheet LPCB.

**LOW PROFILE CONCRETE BARRIER (LPCB)**



**DELINEATION OF END TREATMENTS**

**END TREATMENTS FOR CTB'S USED IN WORK ZONES**  
 End treatments used on CTB's in work zones shall meet the appropriate crashworthy standards as defined in the Manual for Assessing Safety Hardware (MASH). Refer to the CWZTCD List for approved end treatments and manufacturers.

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

**WARNING LIGHTS**

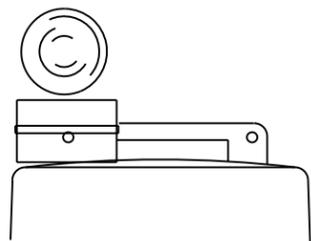
- Warning lights shall meet the requirements of the TMUTCD.
- Warning lights shall NOT be installed on barricades.
- Type A-Low Intensity Flashing Warning Lights are commonly used with drums. They are intended to warn of or mark a potentially hazardous area. Their use shall be as indicated on this sheet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

**WARNING LIGHTS MOUNTED ON PLASTIC DRUMS**

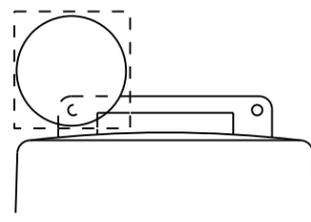
- Type A flashing warning lights are intended to warn drivers that they are approaching or are in a potentially hazardous area.
- Type A random flashing warning lights are not intended for delineation and shall not be used in a series.
- A series of sequential flashing warning lights placed on channelizing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

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

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



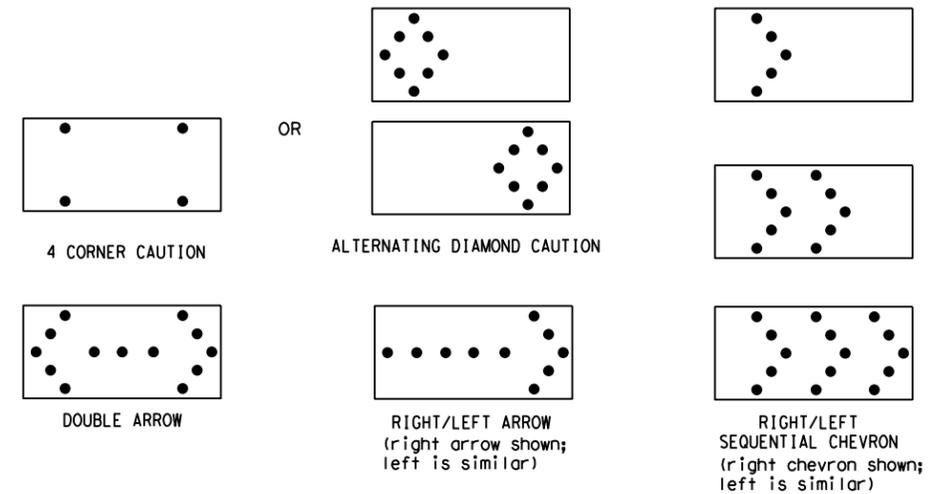
Type C Warning Light or approved substitute mounted on a drum adjacent to the travel way.



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

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

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



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

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

**ATTENTION**  
 Flashing Arrow Boards shall be equipped with automatic dimming devices.

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

**FLASHING ARROW BOARDS**

SHEET 7 OF 12

**TRUCK-MOUNTED ATTENUATORS**

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



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

**BC (7) -21**

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**GENERAL NOTES**

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

**GENERAL DESIGN REQUIREMENTS**

Pre-qualified plastic drums shall meet the following requirements:

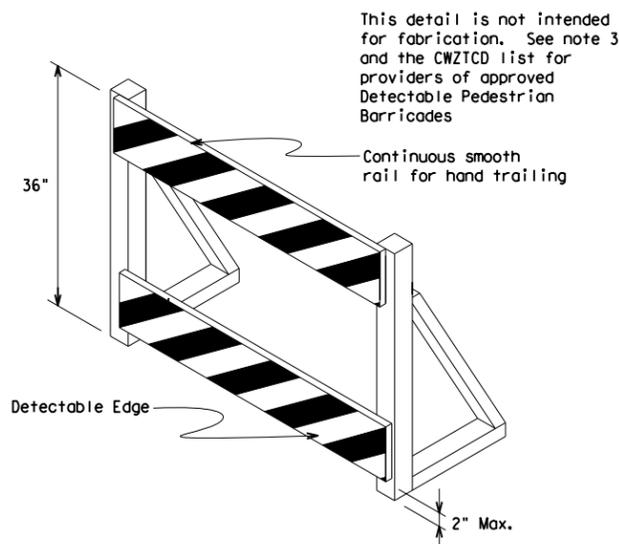
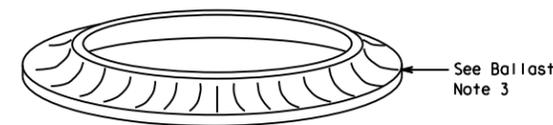
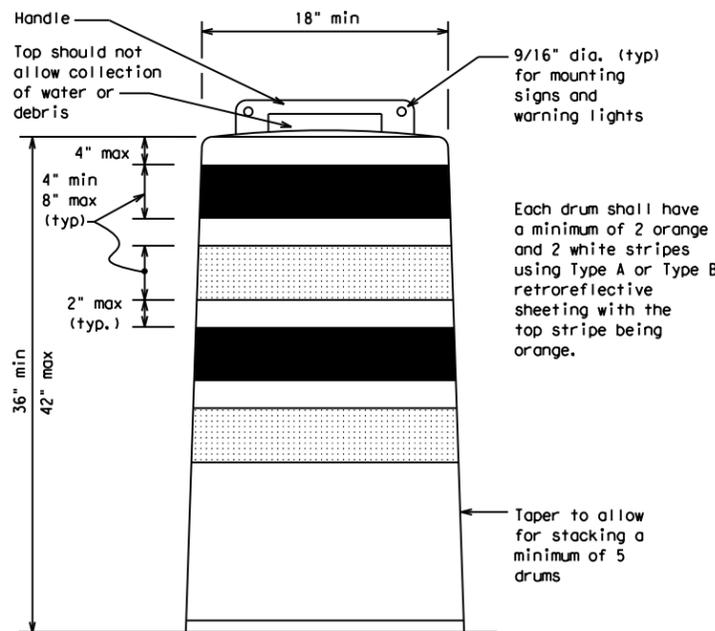
- Plastic drums shall be a two-piece design; the "body" of the drum shall be the top portion and the "base" shall be the bottom.
- The body and base shall lock together in such a manner that the body separates from the base when impacted by a vehicle traveling at a speed of 20 MPH or greater but prevents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

**RETROREFLECTIVE SHEETING**

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

**BALLAST**

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

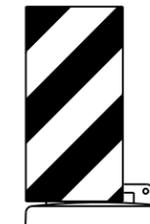


**DETECTABLE PEDESTRIAN BARRICADES**

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



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



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

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

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

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

SHEET 8 OF 12



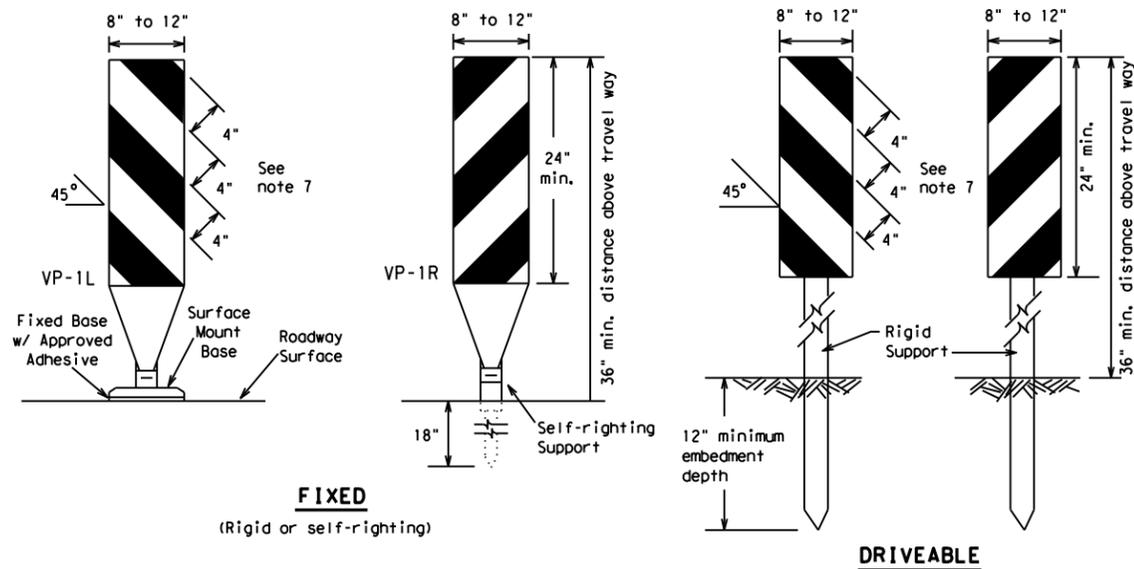
**BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES**

**BC (8) - 21**

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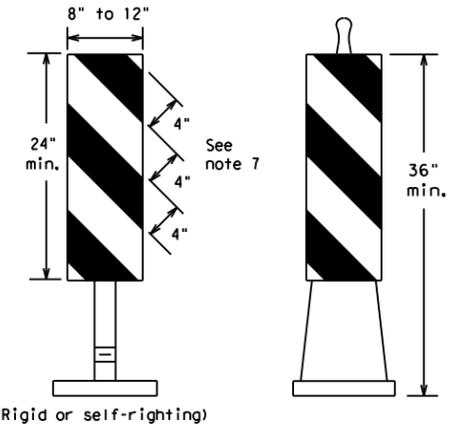
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**FIXED**  
(Rigid or self-righting)

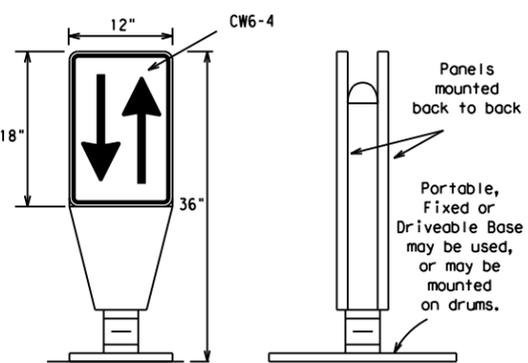
**DRIVEABLE**



**PORTABLE**

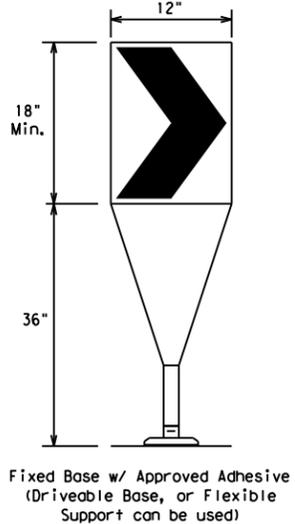
**VERTICAL PANELS (VPs)**

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



**OPPOSING TRAFFIC LANE DIVIDERS (OTLD)**

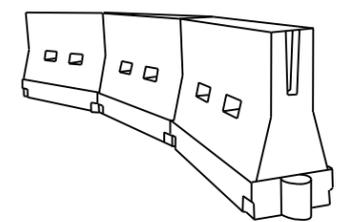
- Opposing Traffic Lane Dividers (OTLD) are delineation devices designed to convert a normal one-way roadway section to two-way operation. OTLD's are used on temporary centerlines. The upward and downward arrows on the sign's face indicate the direction of traffic on either side of the divider. The base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



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

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

**CHEVRONS**



**LONGITUDINAL CHANNELIZING DEVICES (LCD)**

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

**WATER BALLASTED SYSTEMS USED AS BARRIERS**

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

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

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

**GENERAL NOTES**

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

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

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

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

SHEET 9 OF 12



**BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES**

**BC (9) - 21**

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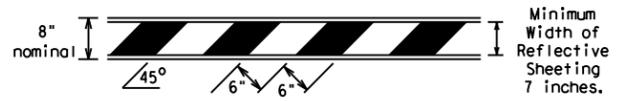
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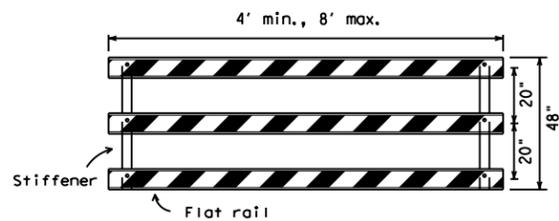
**TYPE 3 BARRICADES**

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.



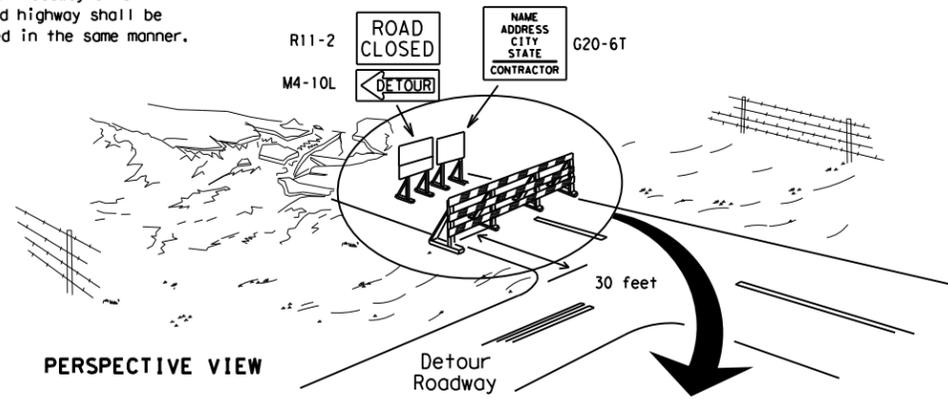
**TYPICAL STRIPING DETAIL FOR BARRICADE RAIL**



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

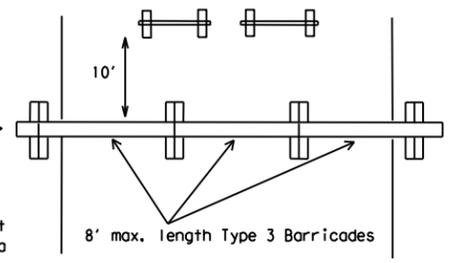
**TYPICAL PANEL DETAIL FOR SKID OR POST TYPE BARRICADES**

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



PERSPECTIVE VIEW

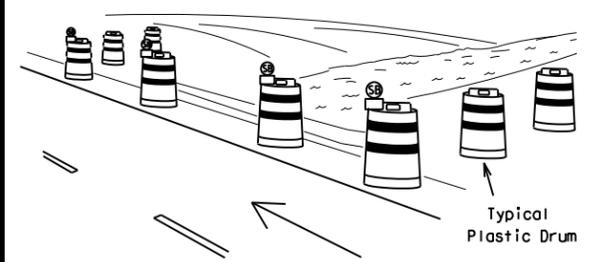
The three rails on Type 3 barricades shall be reflectorized orange and reflective white stripes on one side facing one-way traffic and both sides for two-way traffic. Barricade striping should slant downward in the direction of detour.



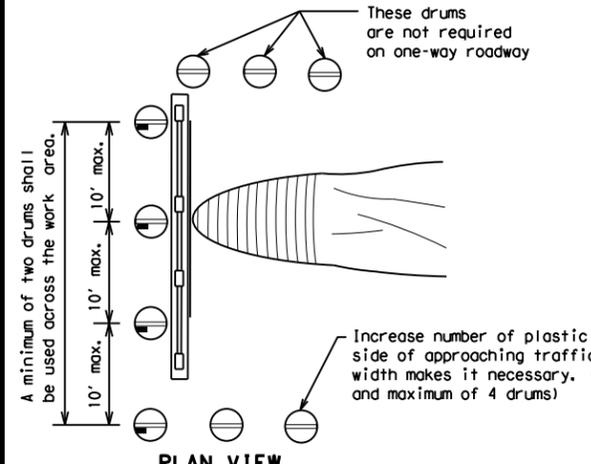
PLAN VIEW

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



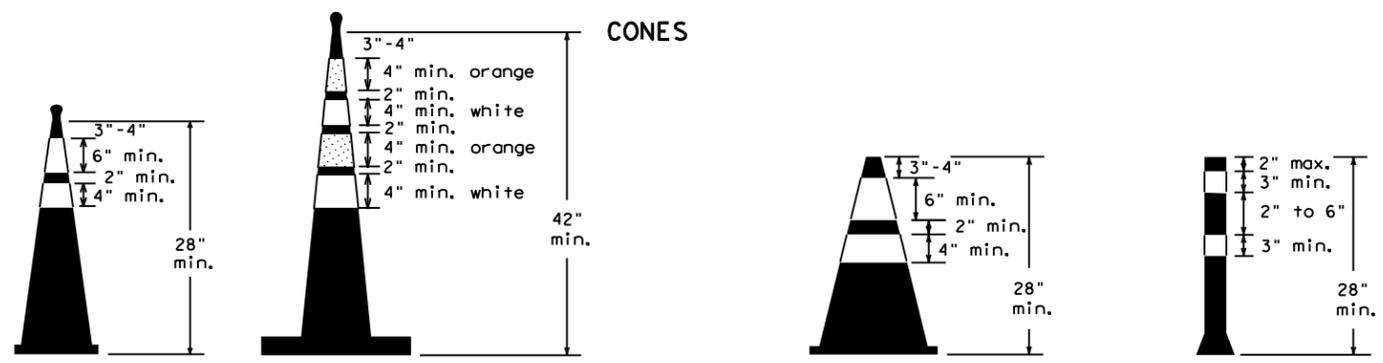
PLAN VIEW

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

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

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

These drums are not required on one-way roadway. Increase number of plastic drums on the side of approaching traffic if the crown width makes it necessary. (minimum of 2 and maximum of 4 drums)



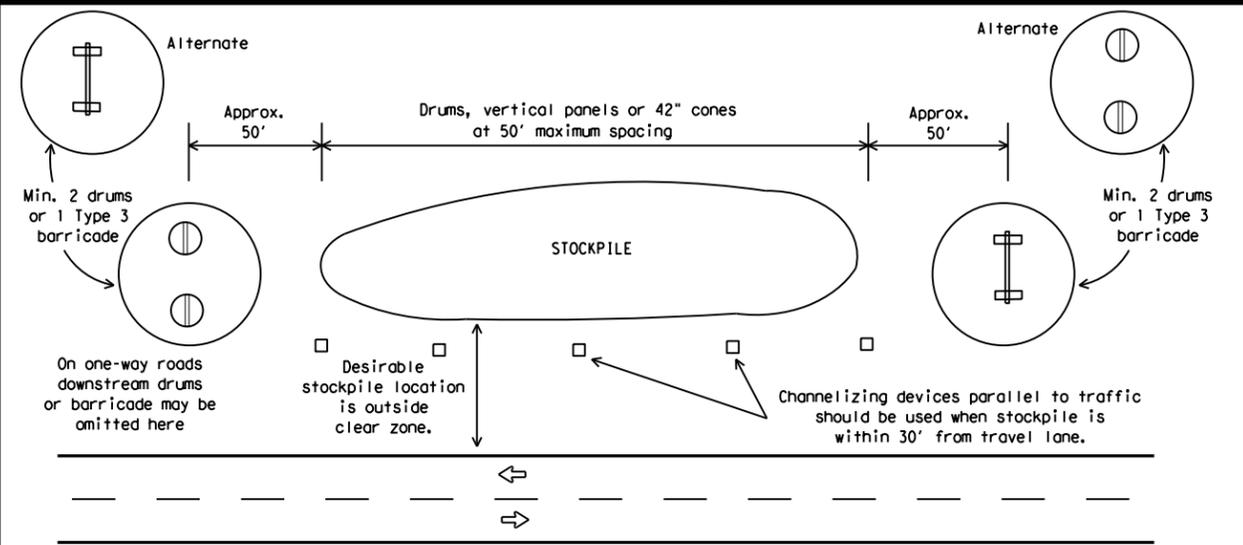
Two-Piece cones

One-Piece cones

Tubular Marker

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

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



**TRAFFIC CONTROL FOR MATERIAL STOCKPILES**



**BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES**

**BC (10) -21**

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## WORK ZONE PAVEMENT MARKINGS

### GENERAL

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

### RAISED PAVEMENT MARKERS

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

### PREFABRICATED PAVEMENT MARKINGS

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

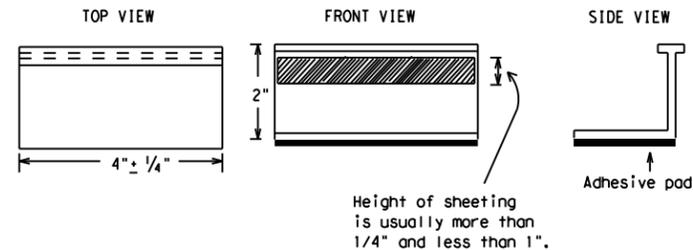
### MAINTAINING WORK ZONE PAVEMENT MARKINGS

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

### REMOVAL OF PAVEMENT MARKINGS

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

## Temporary Flexible-Reflective Roadway Marker Tabs



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

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

### RAISED PAVEMENT MARKERS USED AS GUIDEMARKS

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

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

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

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

SHEET 11 OF 12



## BARRICADE AND CONSTRUCTION PAVEMENT MARKINGS

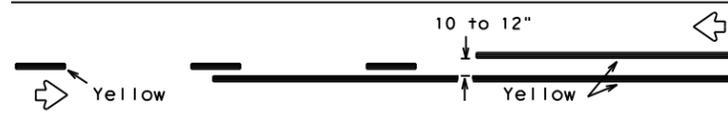
**BC(11)-21**

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CR: TxDOT
© TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS	6399	15	001	SH99
2-98 9-07 5-21	DIST	COUNTY	SHEET NO.	
1-02 7-13	BMT	LIBERTY, ETC.	16	
11-02 8-14				

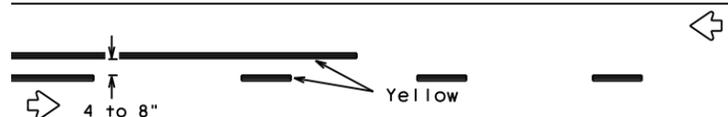
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DATE: 5/12/2022  
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## PAVEMENT MARKING PATTERNS

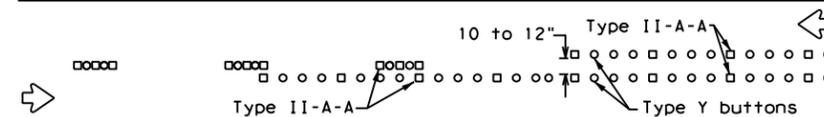


REFLECTORIZED PAVEMENT MARKINGS - PATTERN A

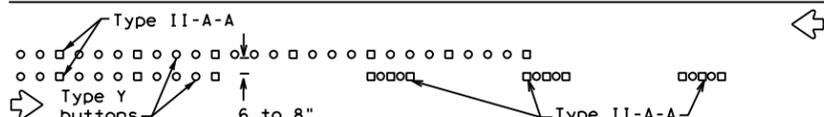


REFLECTORIZED PAVEMENT MARKINGS - PATTERN B

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

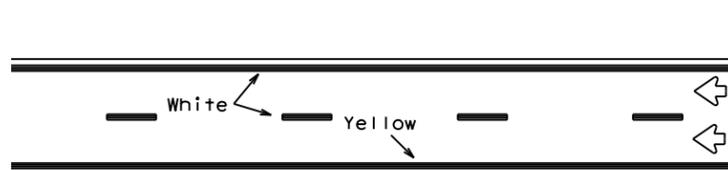


RAISED PAVEMENT MARKERS - PATTERN A



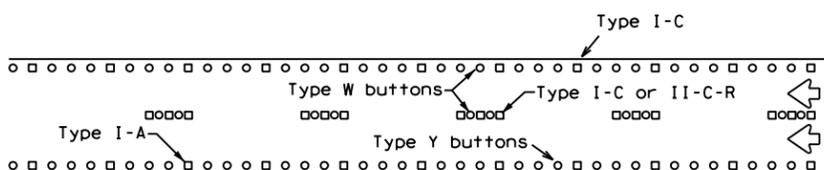
RAISED PAVEMENT MARKERS - PATTERN B

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



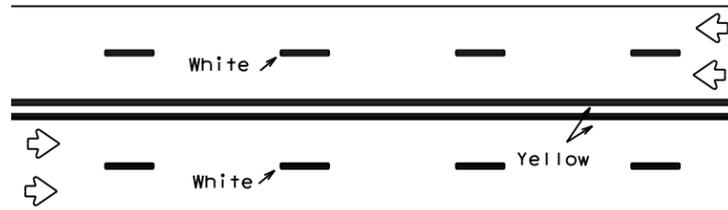
REFLECTORIZED PAVEMENT MARKINGS

Prefabricated markings may be substituted for reflectORIZED pavement markings.



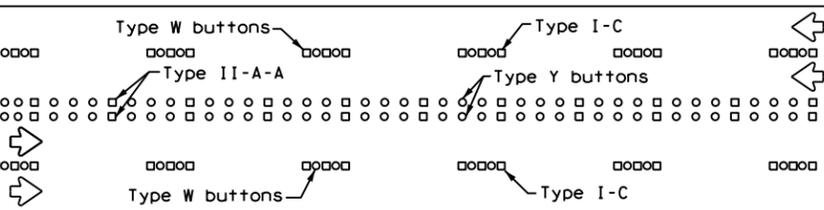
RAISED PAVEMENT MARKERS

## EDGE & LANE LINES FOR DIVIDED HIGHWAY



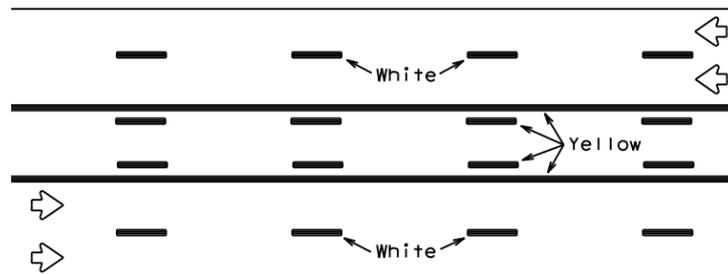
REFLECTORIZED PAVEMENT MARKINGS

Prefabricated markings may be substituted for reflectORIZED pavement markings.



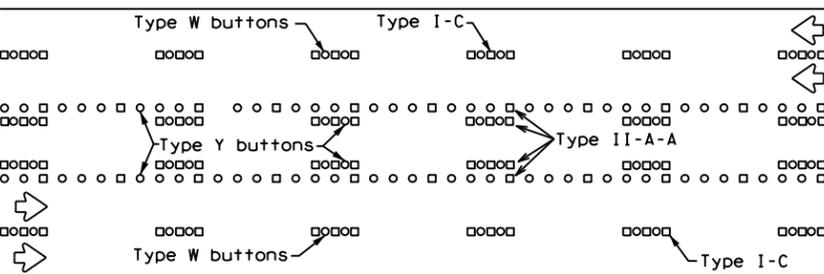
RAISED PAVEMENT MARKERS

## LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



REFLECTORIZED PAVEMENT MARKINGS

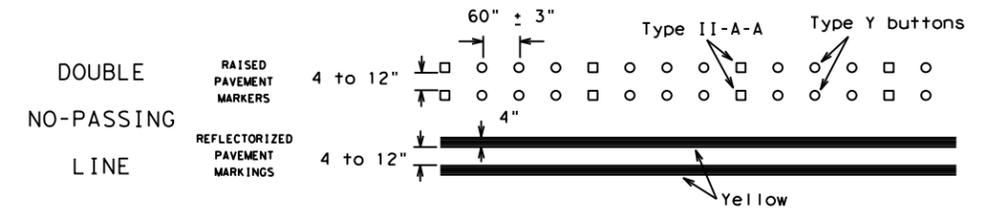
Prefabricated markings may be substituted for reflectORIZED pavement markings.



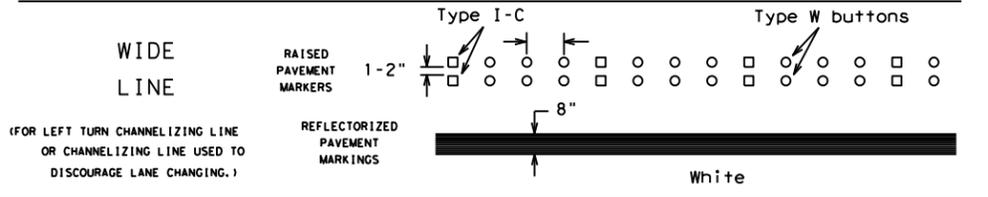
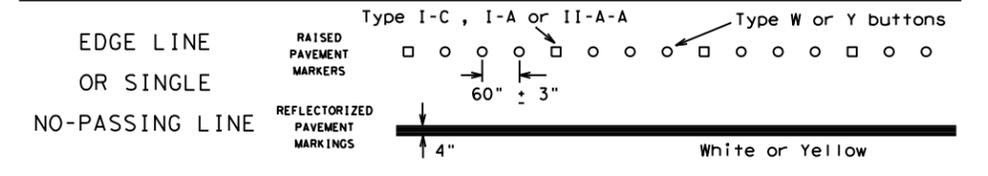
RAISED PAVEMENT MARKERS

## TWO-WAY LEFT TURN LANE

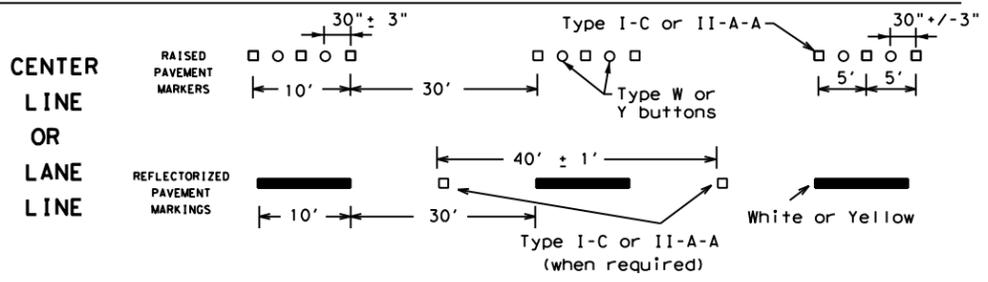
## STANDARD WORK ZONE PAVEMENT MARKINGS DETAILS



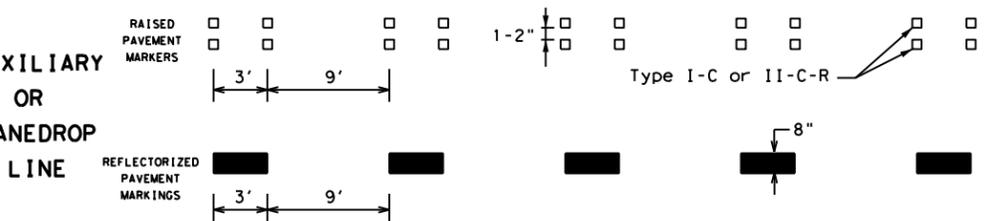
### SOLID LINES



### BROKEN LINES

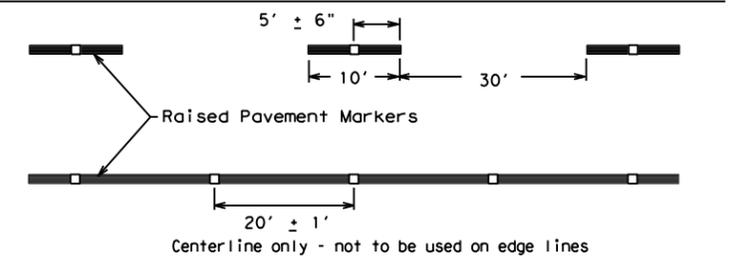


### AUXILIARY OR LANEDROP LINE



### REMOVABLE MARKINGS WITH RAISED PAVEMENT MARKERS

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



SHEET 12 OF 12

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DATE: 5/12/2022  
FILE:

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."



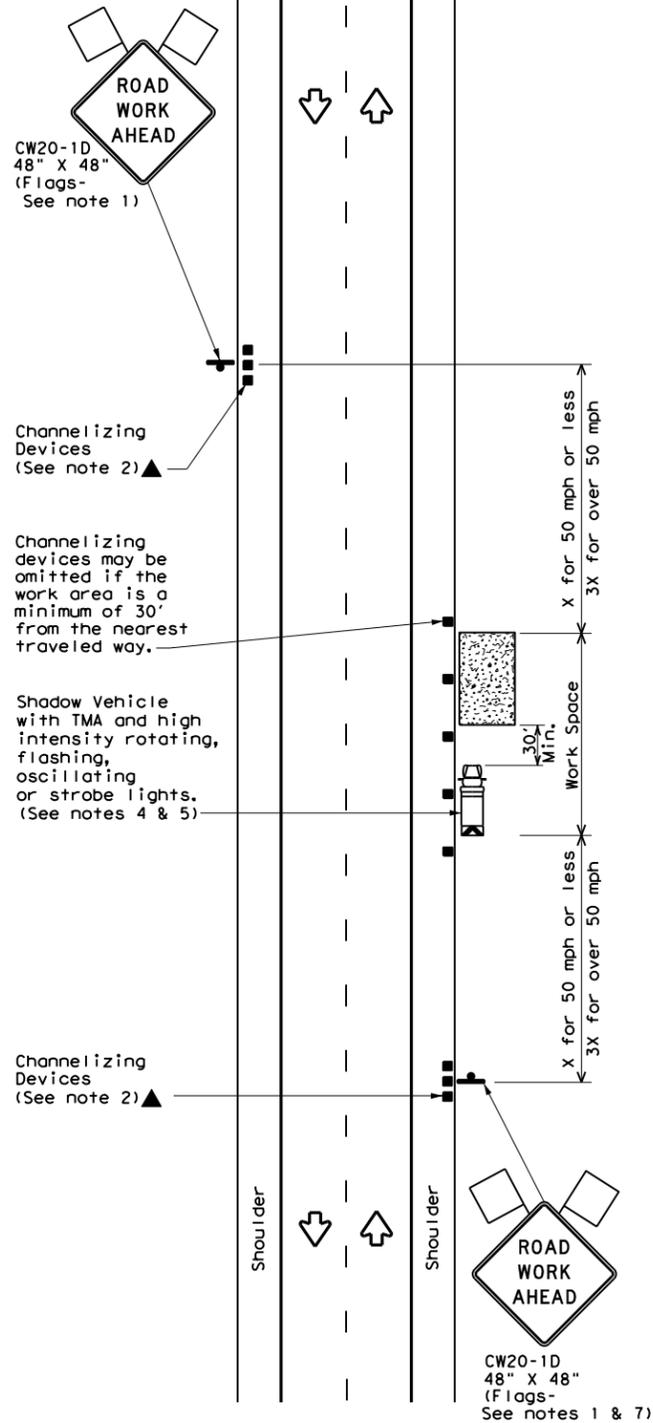
## BARRICADE AND CONSTRUCTION PAVEMENT MARKING PATTERNS

BC(12)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS	6399	15	001	SH99
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2-98 7-13	BMT	LIBERTY, ETC.	17	
11-02 8-14				

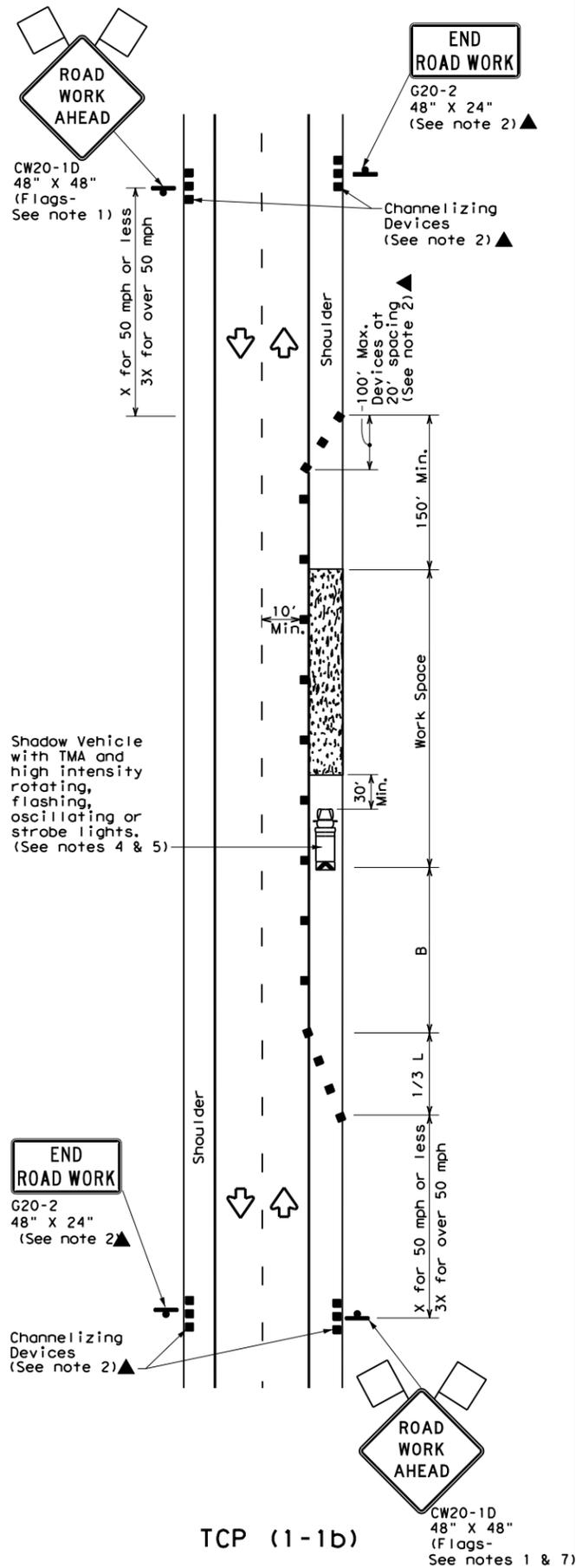
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DATE: 5/12/2022  
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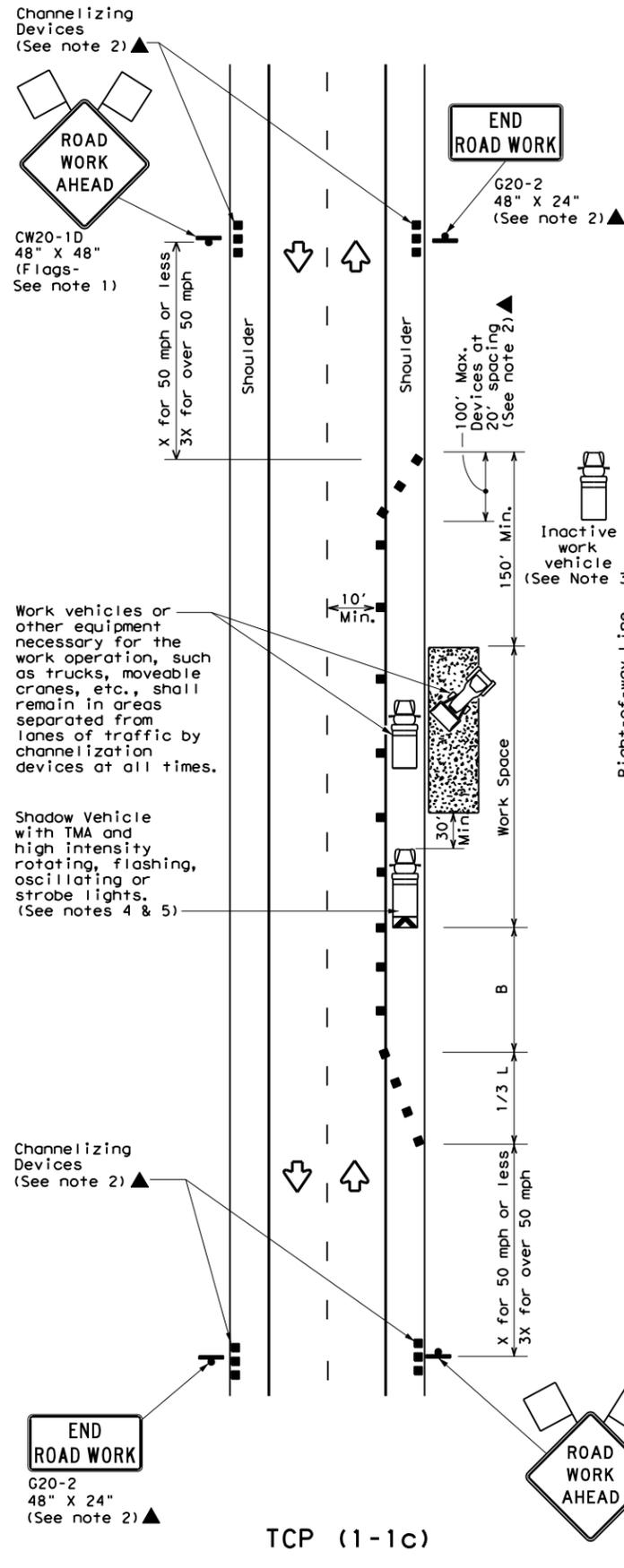
TCP (1-1a)

**WORK SPACE NEAR SHOULDER**  
Conventional Roads



TCP (1-1b)

**WORK SPACE ON SHOULDER**  
Conventional Roads



TCP (1-1c)

**WORK VEHICLES ON SHOULDER**  
Conventional Roads

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

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

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

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

**GENERAL NOTES**

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

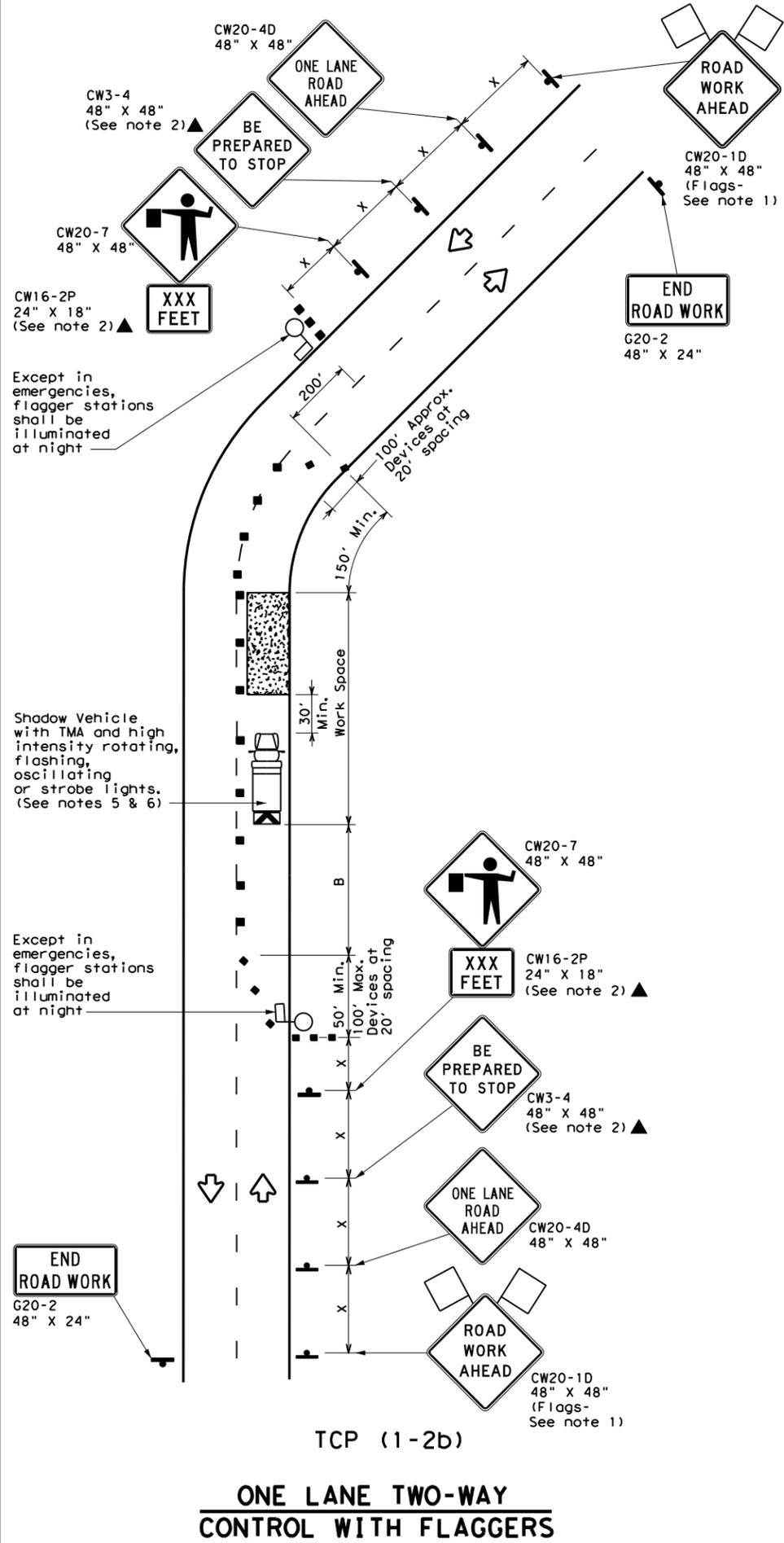
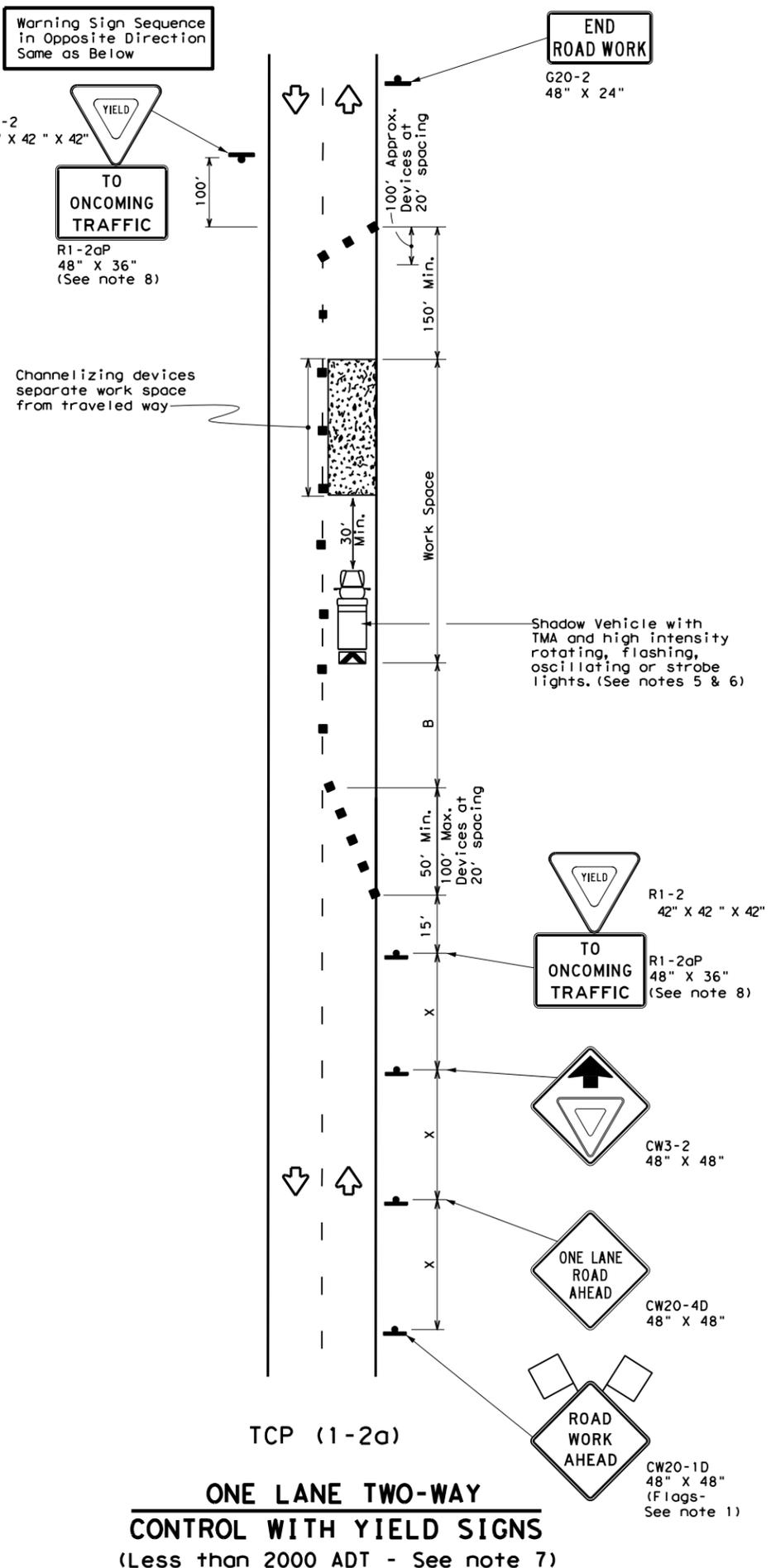
**TRAFFIC CONTROL PLAN**  
**CONVENTIONAL ROAD**  
**SHOULDER WORK**

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

FILE: tcp1-1-18.dgn	DN:	CK:	DW:	CK:
© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS	6399	15	001	SH99
2-94 4-98	DIST	COUNTY	SHEET NO.	
8-95 2-12	BMT	LIBERTY, ETC.	18	
1-97 2-18				

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DATE: 5/12/2022  
FILE:



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

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

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

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

**GENERAL NOTES**

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

**TCP (1-2a)**

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

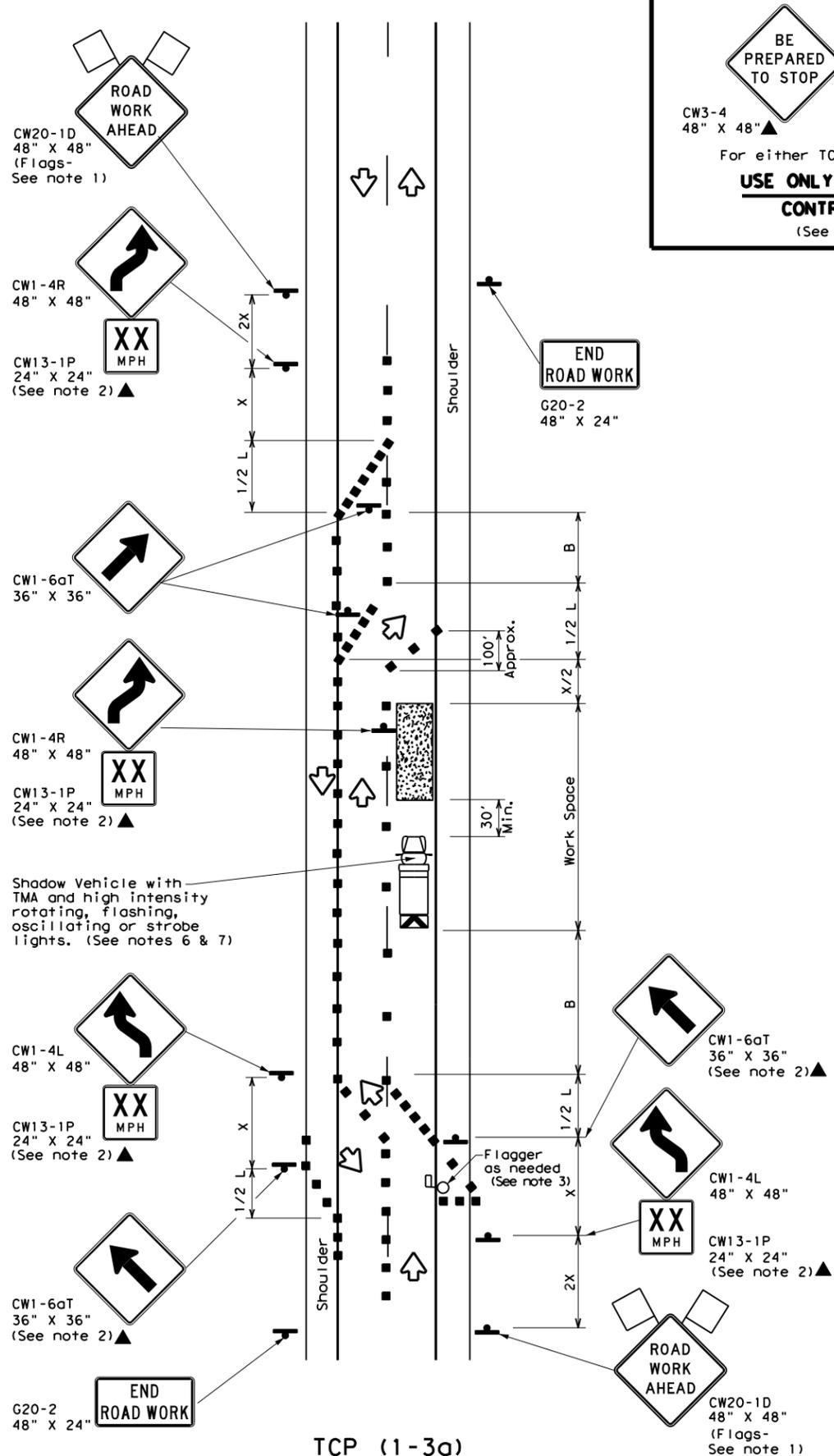
**TCP (1-2b)**

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

		<b>Traffic Operations Division Standard</b>	
<b>TRAFFIC CONTROL PLAN</b> <b>ONE-LANE TWO-WAY</b> <b>TRAFFIC CONTROL</b>			
<b>TCP (1-2) - 18</b>			
FILE: tcp1-2-18.dgn	DN:	CK:	DW:
© TxDOT December 1985	CONT	SECT	JOB
REVISIONS	6399	15	001
4-90 4-98	DIST		COUNTY
2-94 2-12	BMT		LIBERTY, ETC.
1-97 2-18	SHEET NO.		19

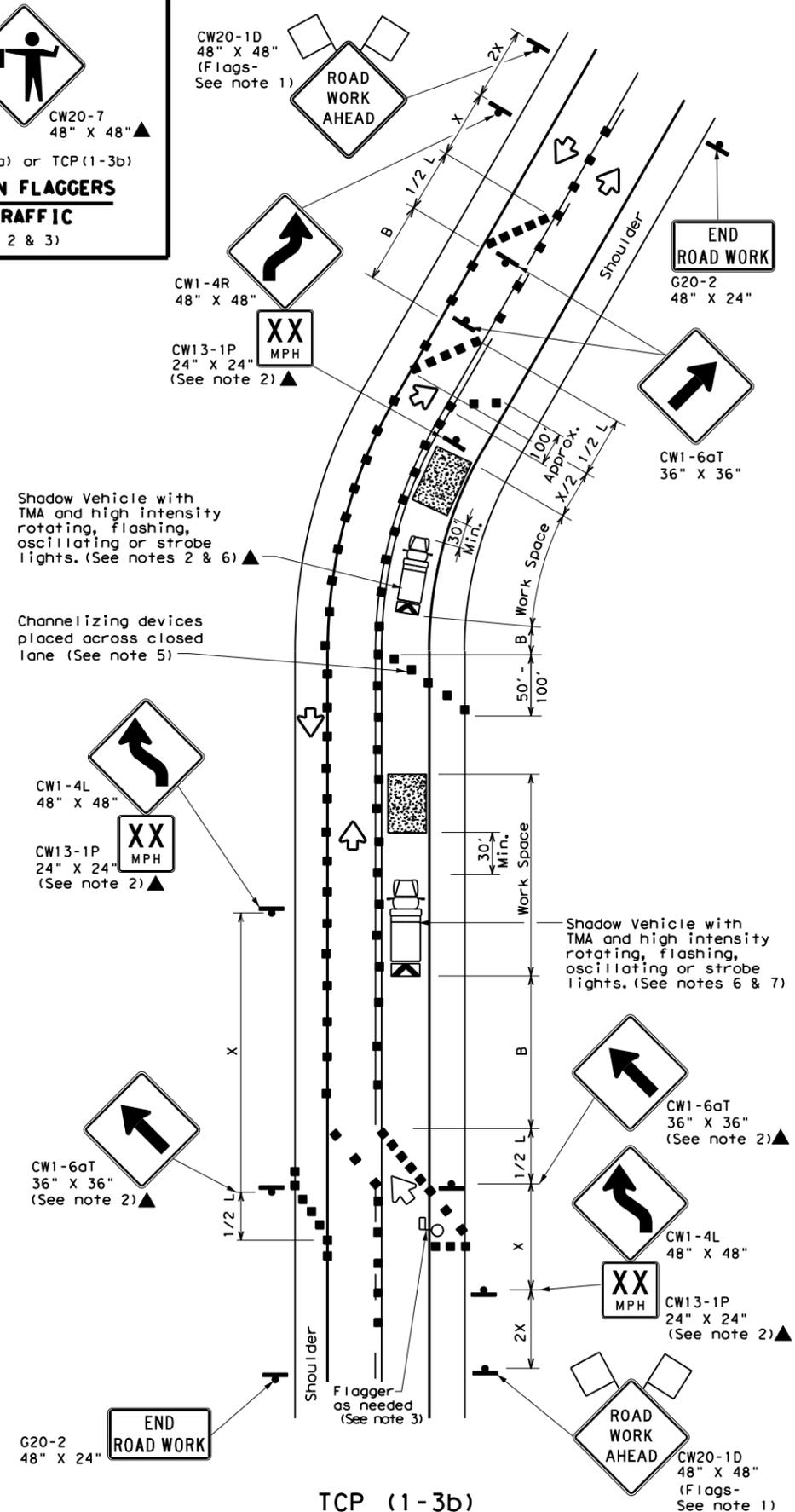
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DATE: 5/12/2022  
FILE:



TCP (1-3a)  
2-LANE ROADWAY WITH PAVED SHOULDERS  
**ONE LANE CLOSED**  
ADEQUATE FIELD OF VIEW

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



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

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

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

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

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

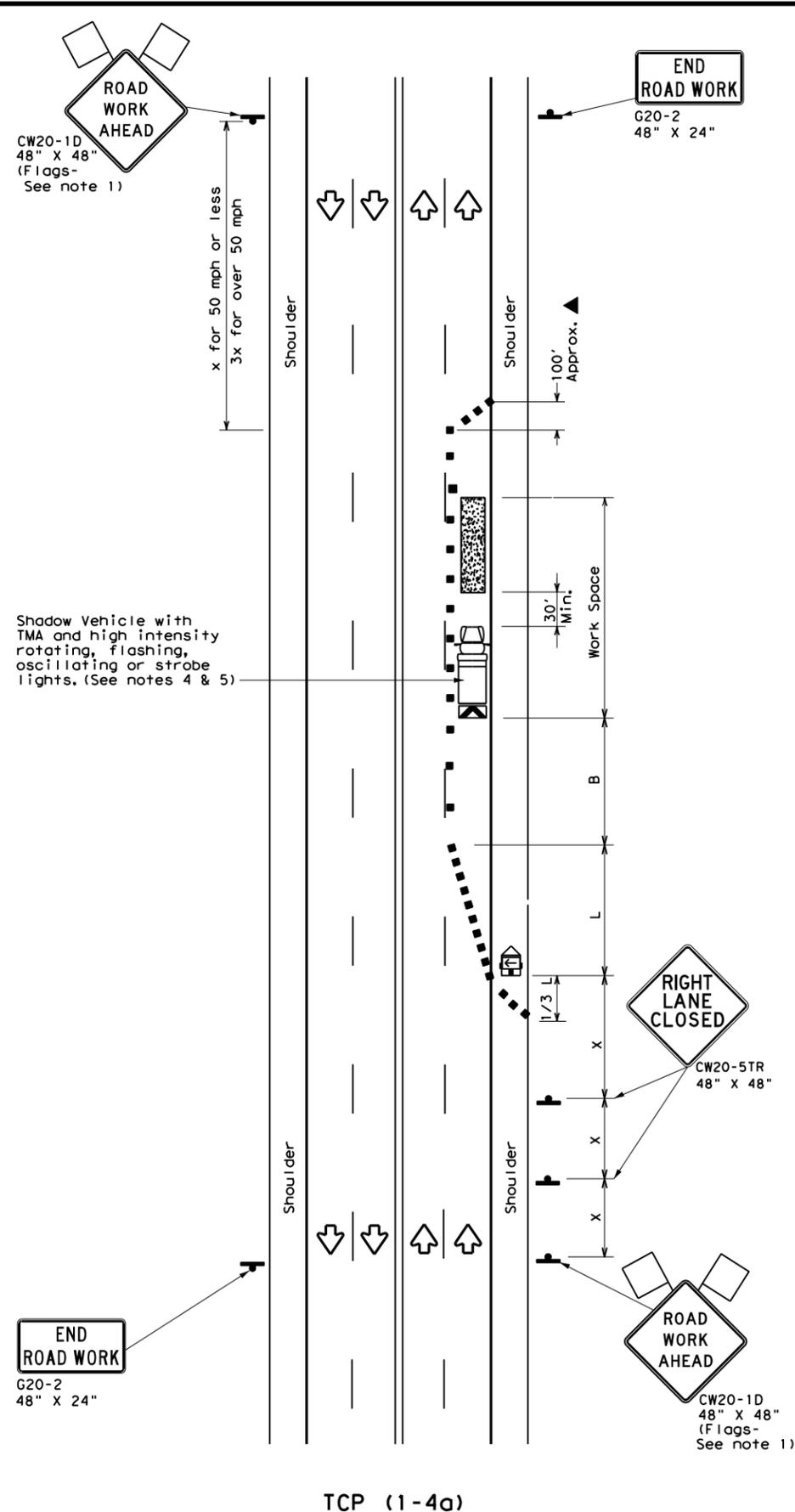
Texas Department of Transportation  
Traffic Operations Division Standard

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

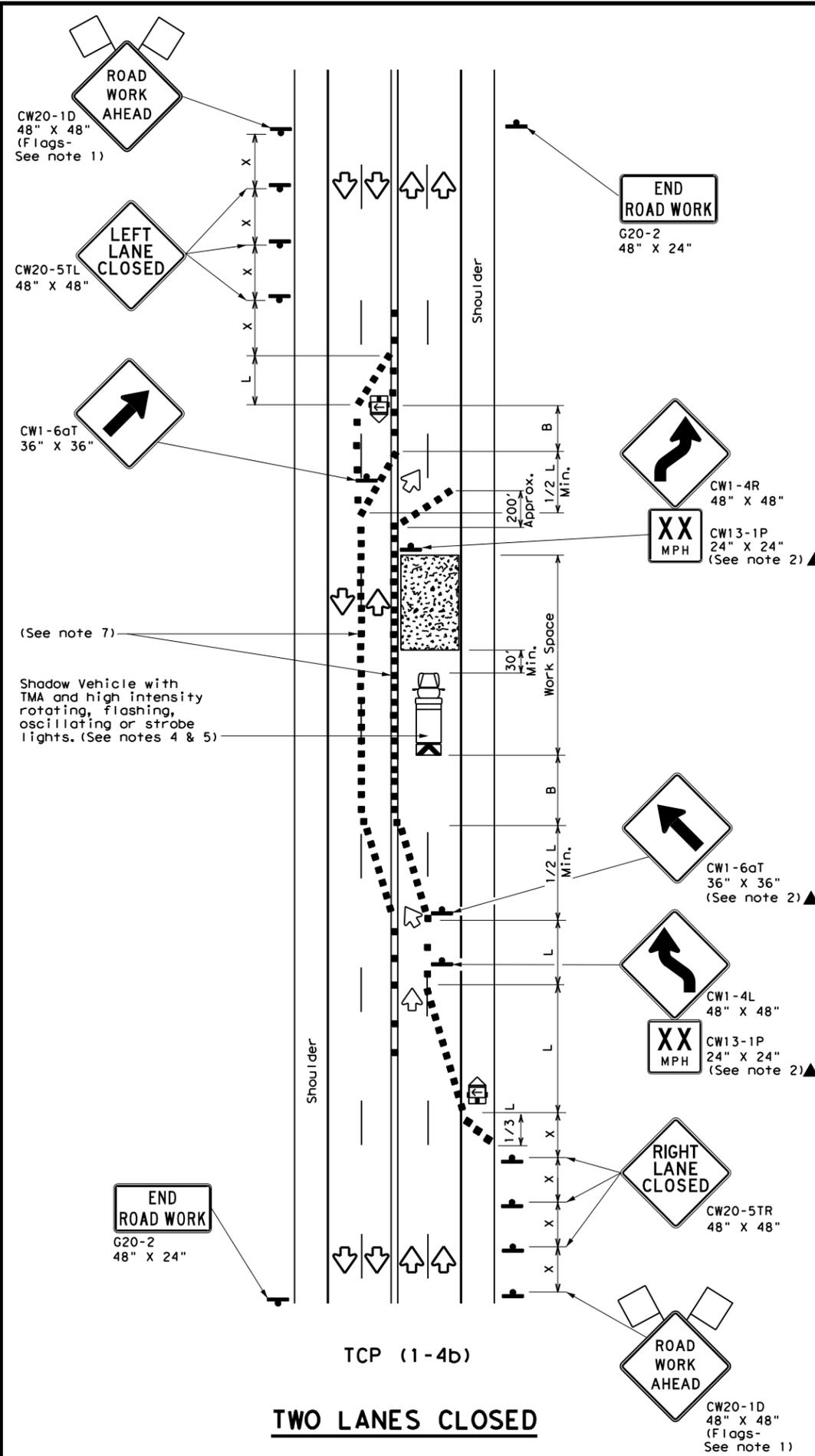
FILE: tcp1-3-18.dgn	DN:	CK:	DW:	CK:
© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS	6399	15	001	SH99
2-94 4-98	DIST	COUNTY	SHEET NO.	
8-95 2-12	BMT	LIBERTY, ETC.	20	
1-97 2-18				

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DATE: 5/12/2022  
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TCP (1-4a)  
**ONE LANE CLOSED**



TCP (1-4b)  
**TWO LANES CLOSED**

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

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

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

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

**GENERAL NOTES**

- Flags attached to signs where shown are REQUIRED.
- All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated elsewhere in the plans, or for routine maintenance work, when approved by the Engineer.
- The CW20-1D "ROAD WORK AHEAD" sign may be repeated if the visibility of the work zone is less than 1500 feet.
- A Shadow Vehicle with a TMA should be used anytime it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the performance or quality of the work. If workers are no longer present but road or work conditions require the traffic control to remain in place, Type 3 Barricades or other channelizing devices may be substituted for the Shadow Vehicle and TMA.
- Additional Shadow Vehicles with TMAs may be positioned off the paved surface, next to those shown in order to protect wider work spaces.

**TCP (1-4a)**

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

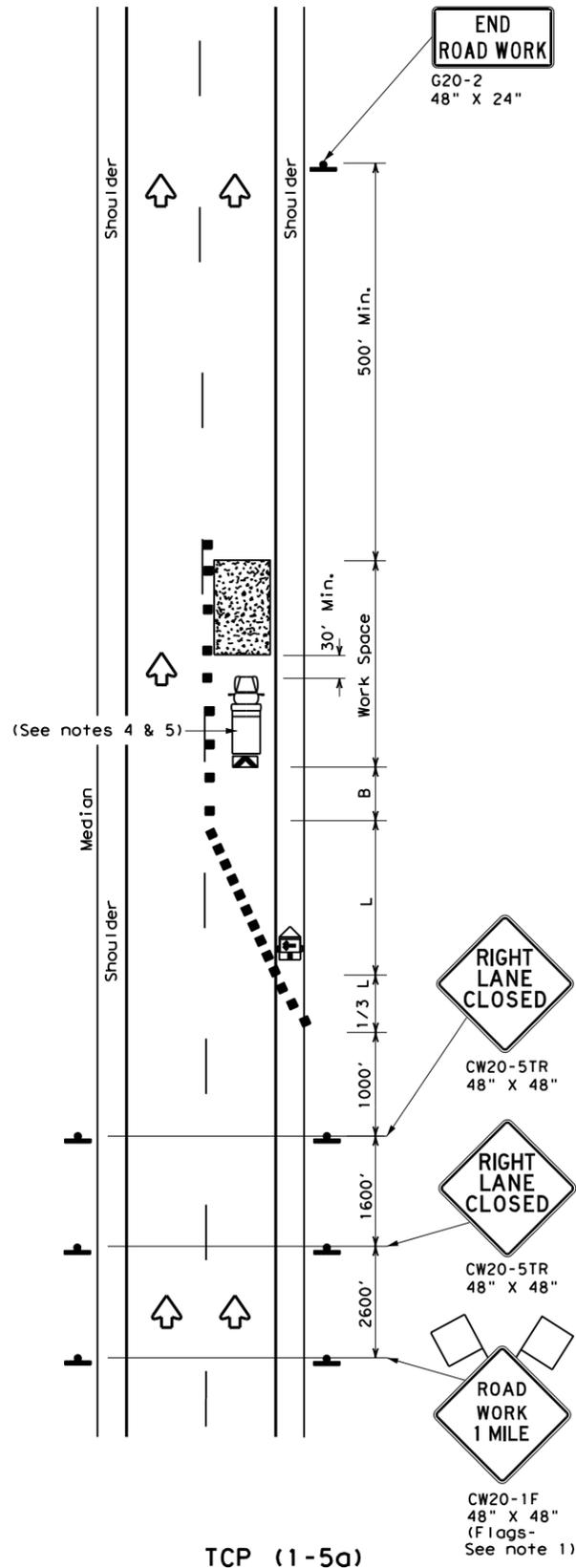
**TCP (1-4b)**

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

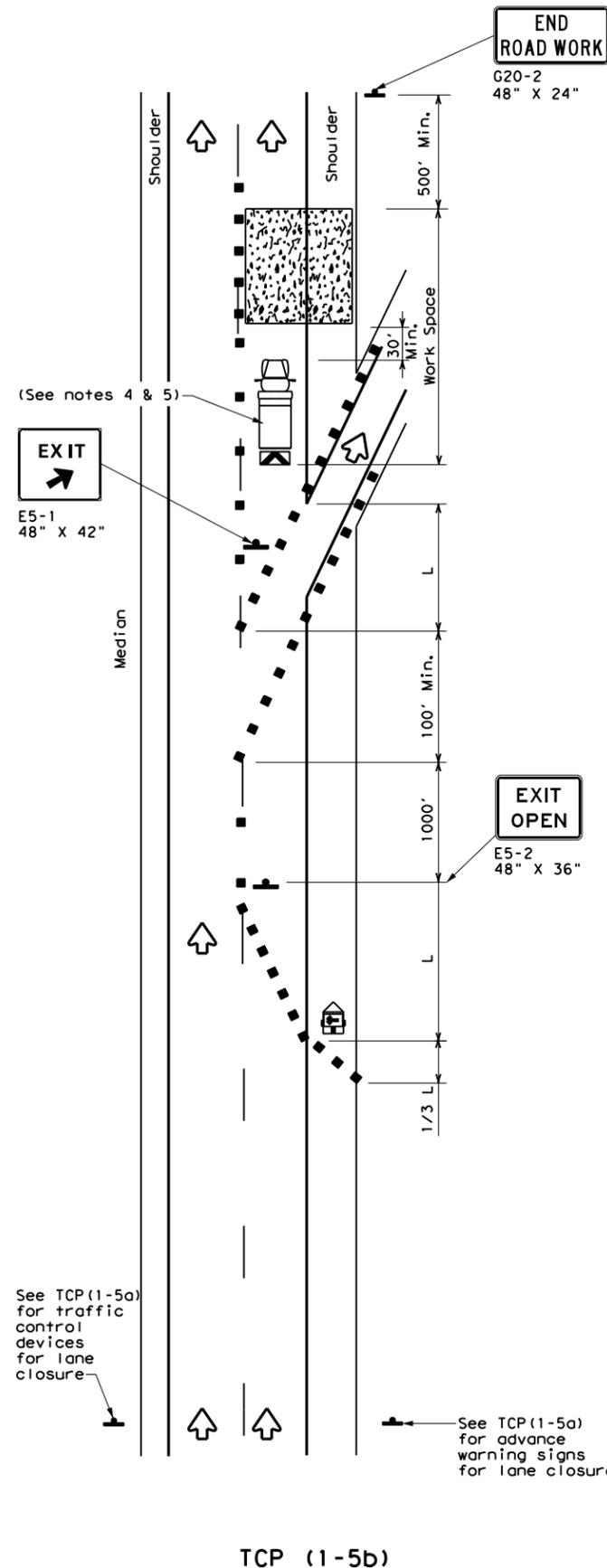
		Traffic Operations Division Standard	
<b>TRAFFIC CONTROL PLAN LANE CLOSURES ON MULTILANE CONVENTIONAL ROADS</b>			
<b>TCP (1-4) - 18</b>			
FILE:	tcp1-4-18.dgn	DN:	CK:
© TxDOT	December 1985	CONT	SECT
REVISIONS		6399	15
2-94	4-98	JOB	001
8-95	2-12	COUNTY	LIBERTY, ETC.
1-97	2-18	SHEET NO.	21

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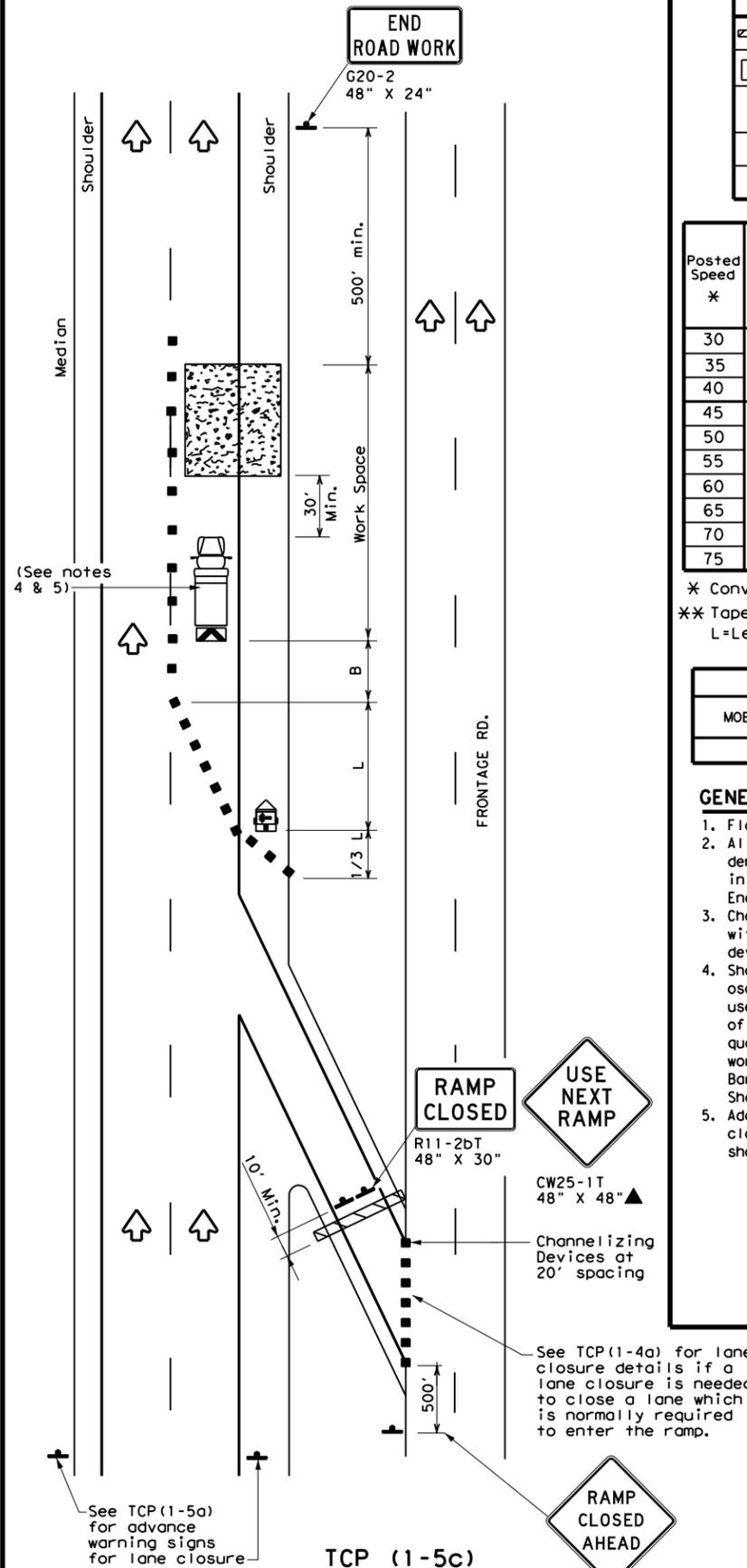
4:31:53 PM  
DATE: 5/12/2022  
FILE:



**ONE LANE CLOSURE**



**LANE CLOSURE NEAR EXIT RAMP**



**LANE CLOSURE NEAR ENTRANCE RAMP**

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

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

\* Conventional Roads Only

\*\* Taper lengths have been rounded off.

L=Length of Taper (FT) W=Width of Offset (FT) S=Posted Speed (MPH)

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

**GENERAL NOTES**

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

Texas Department of Transportation  
Traffic Operations Division Standard

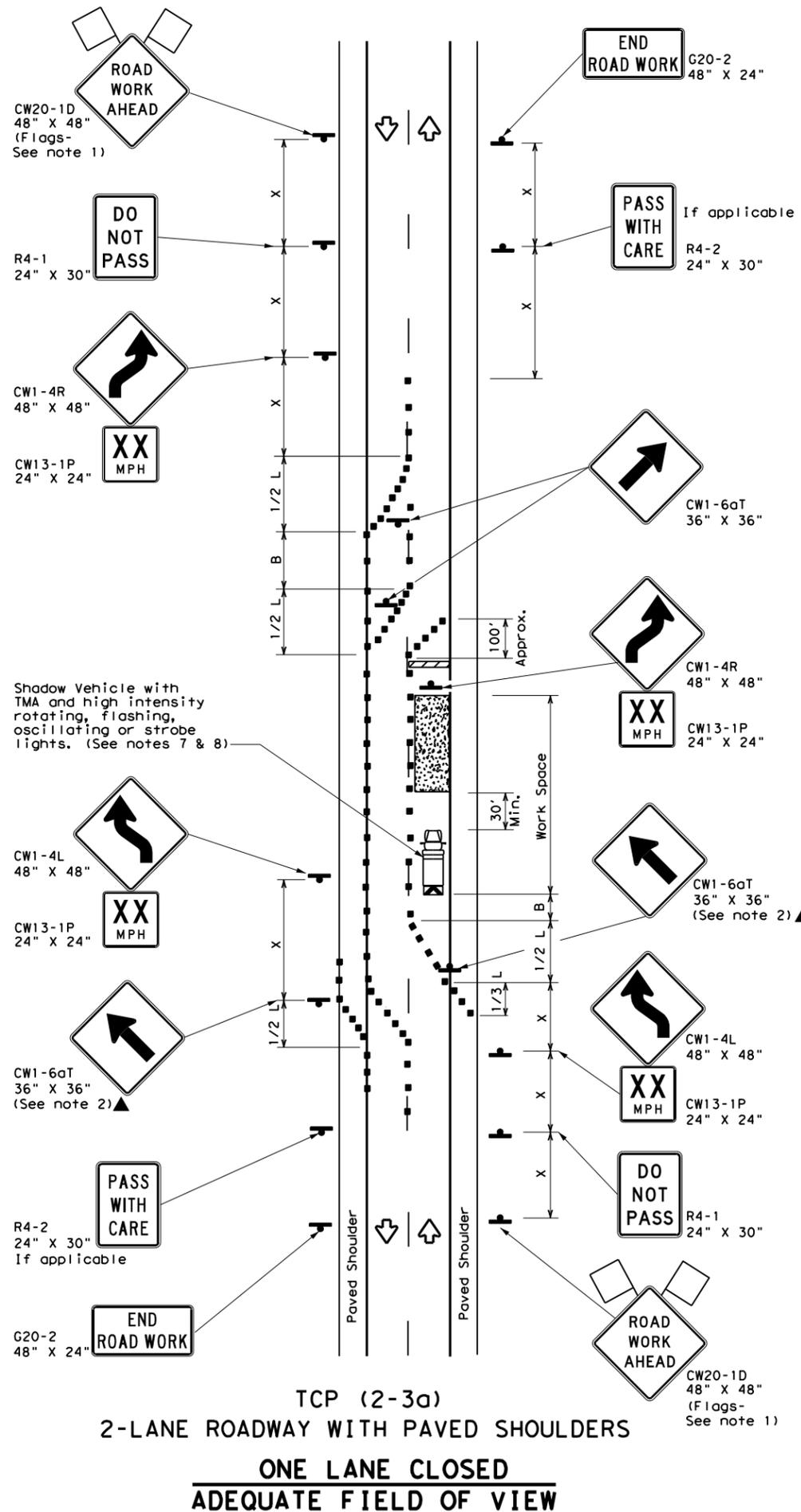
**TRAFFIC CONTROL PLAN  
LANE CLOSURES FOR  
DIVIDED HIGHWAYS**

**TCP (1-5) - 18**

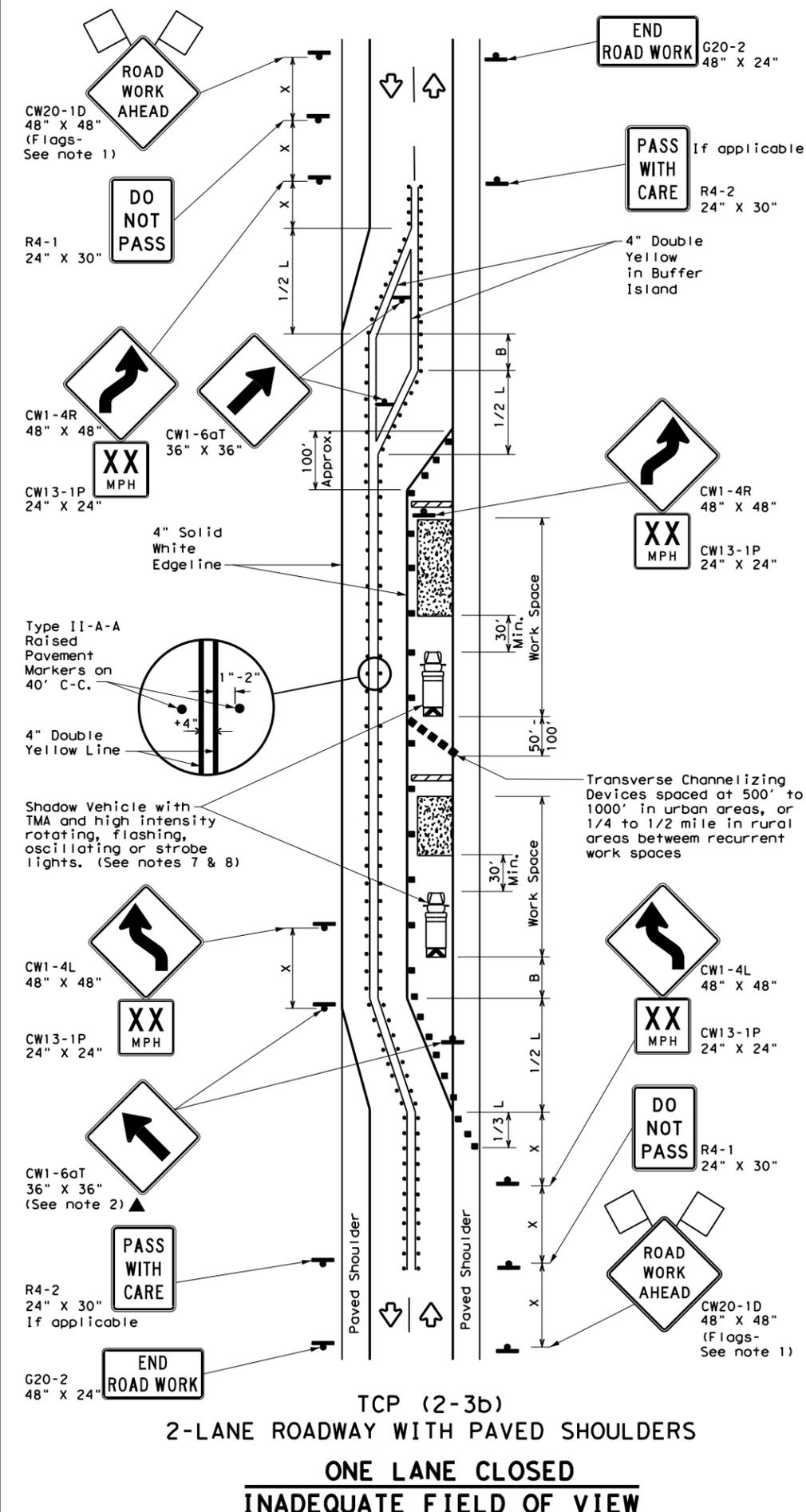
FILE: tcp1-5-18.dgn	DN:	CK:	DW:	CK:
© TxDOT February 2012	CONT	SECT	JOB	HIGHWAY
2-18	REVISIONS	6399	15	001
	DIST	COUNTY	SHEET NO.	
	BMT	LIBERTY, ETC.	22	

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DATE: 5/12/2022  
FILE:



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 **			Suggested Maximum Spacing of Channelizing Devices		Minimum Sign Spacing "x" Distance	Suggested Longitudinal Buffer Space "B"
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent		
30	L = WS <sup>2</sup> / 60	150'	165'	180'	30'	70'	120'	90'
35		205'	225'	245'	35'	80'	160'	120'
40		265'	295'	320'	40'	90'	240'	155'
45	L = WS	450'	495'	540'	45'	100'	320'	195'
50		500'	550'	600'	50'	110'	400'	240'
55		550'	605'	660'	55'	120'	500'	295'
60	L = WS	600'	660'	720'	60'	130'	600'	350'
65		650'	715'	780'	65'	140'	700'	410'
70		700'	770'	840'	70'	150'	800'	475'
75	L = WS	750'	825'	900'	75'	160'	900'	540'
80		800'	880'	960'	80'	170'	1000'	610'
85		850'	935'	1020'	85'	180'	1100'	685'

\* 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**
- Flags attached to signs where shown, are REQUIRED.
  - All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated elsewhere in the plans, or for routine maintenance work, when approved by the Engineer.
  - 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.
  - 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.
  - 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.
  - Conflicting pavement marking shall be removed for long term projects.
  - 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.
  - 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)**
- 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

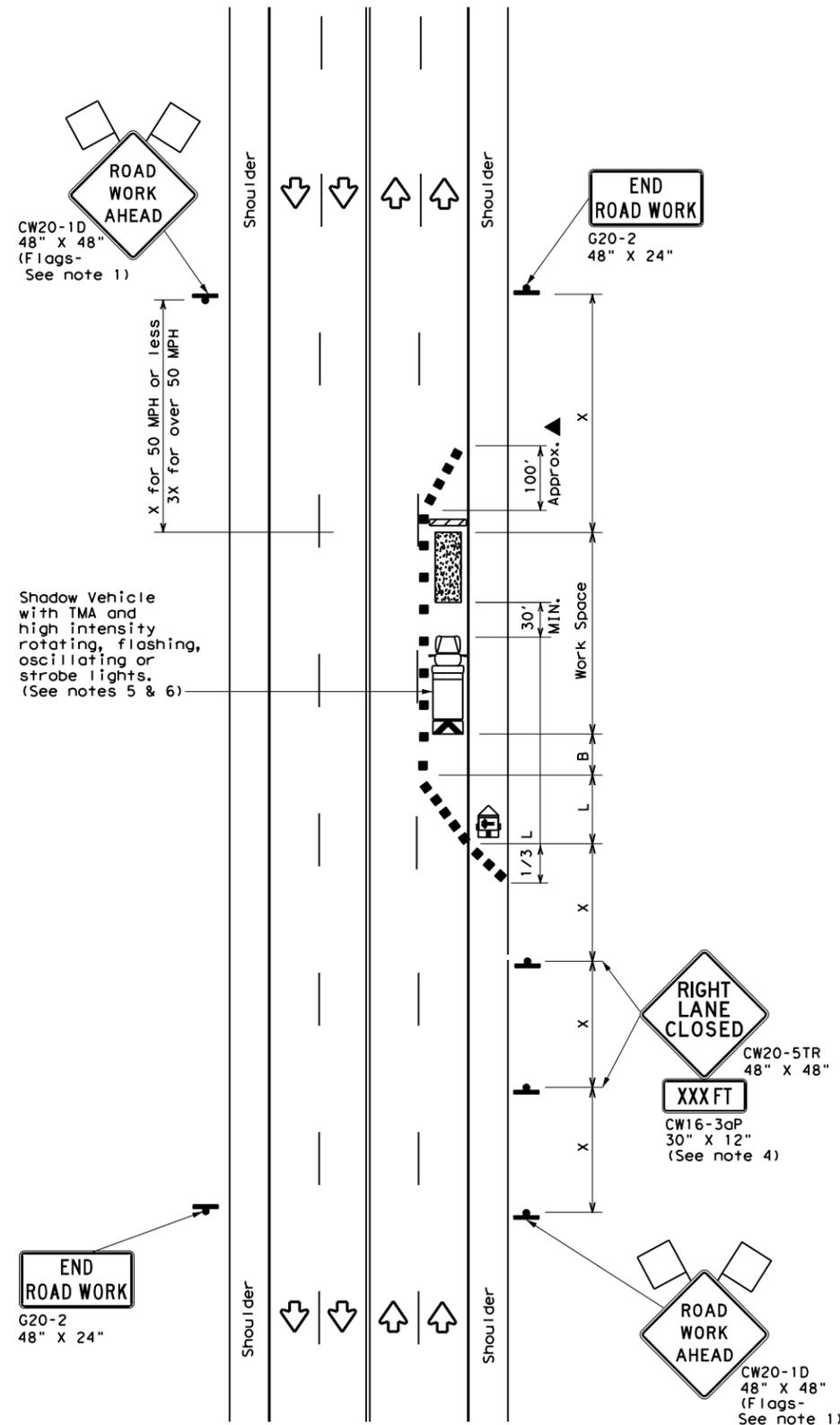
**TRAFFIC CONTROL PLAN**  
**TRAFFIC SHIFTS ON**  
**TWO-LANE ROADS**

**TCP (2-3) - 18**

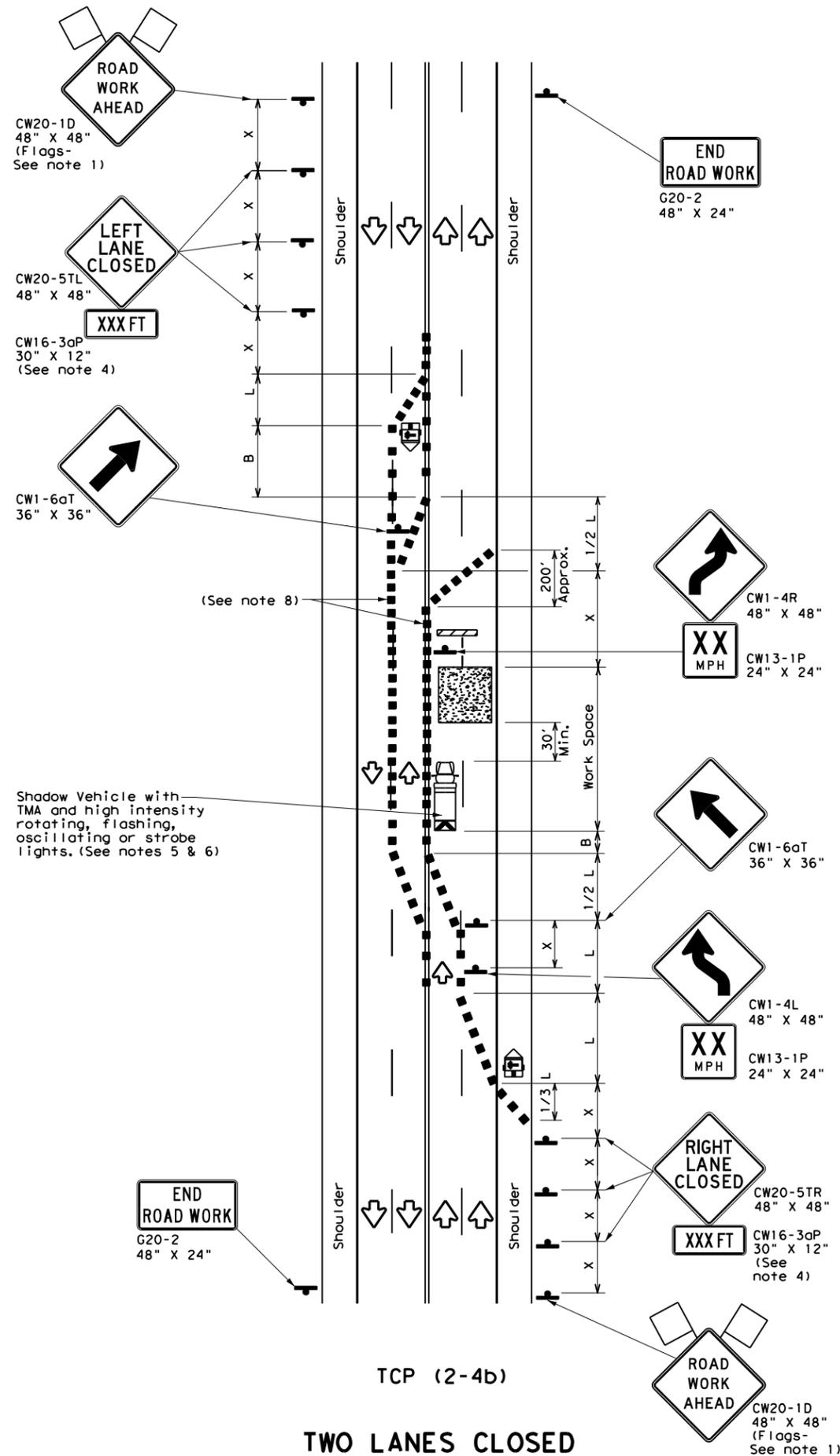
FILE: tcp(2-3)-18.dgn	DN:	CK:	DW:	CK:
© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS	6399	15	001	SH99
8-95 3-03	DIST	COUNTY	SHEET NO.	
1-97 2-12	BMT	LIBERTY, ETC.	23	
4-98 2-18				

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4: 31: 57 PM  
DATE: 5/12/2022  
FILE:



TCP (2-4a)  
**ONE LANE CLOSED**



TCP (2-4b)  
**TWO LANES CLOSED**

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

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

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

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

**GENERAL NOTES**

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

**TCP (2-4a)**

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

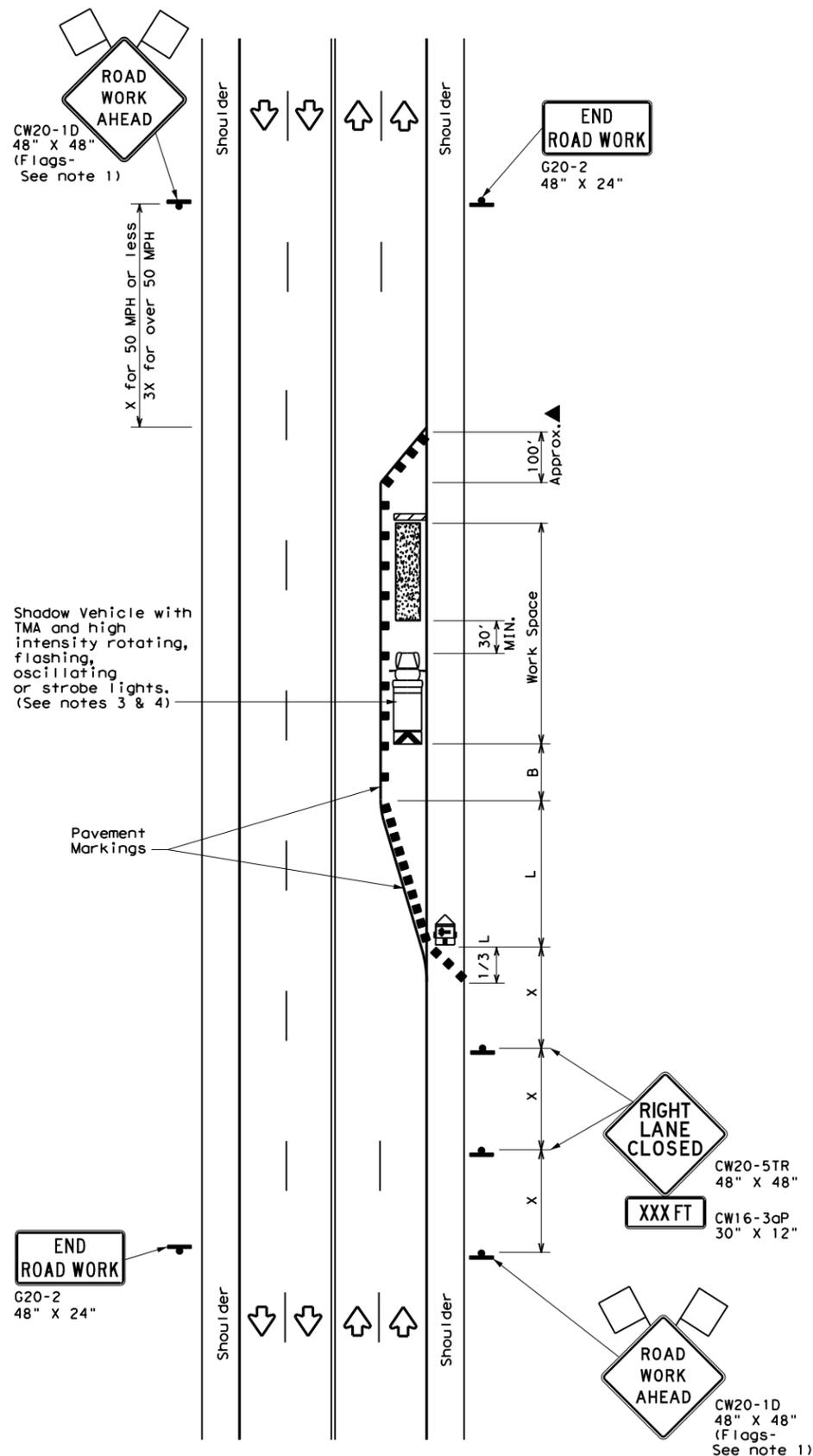
**TCP (2-4b)**

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

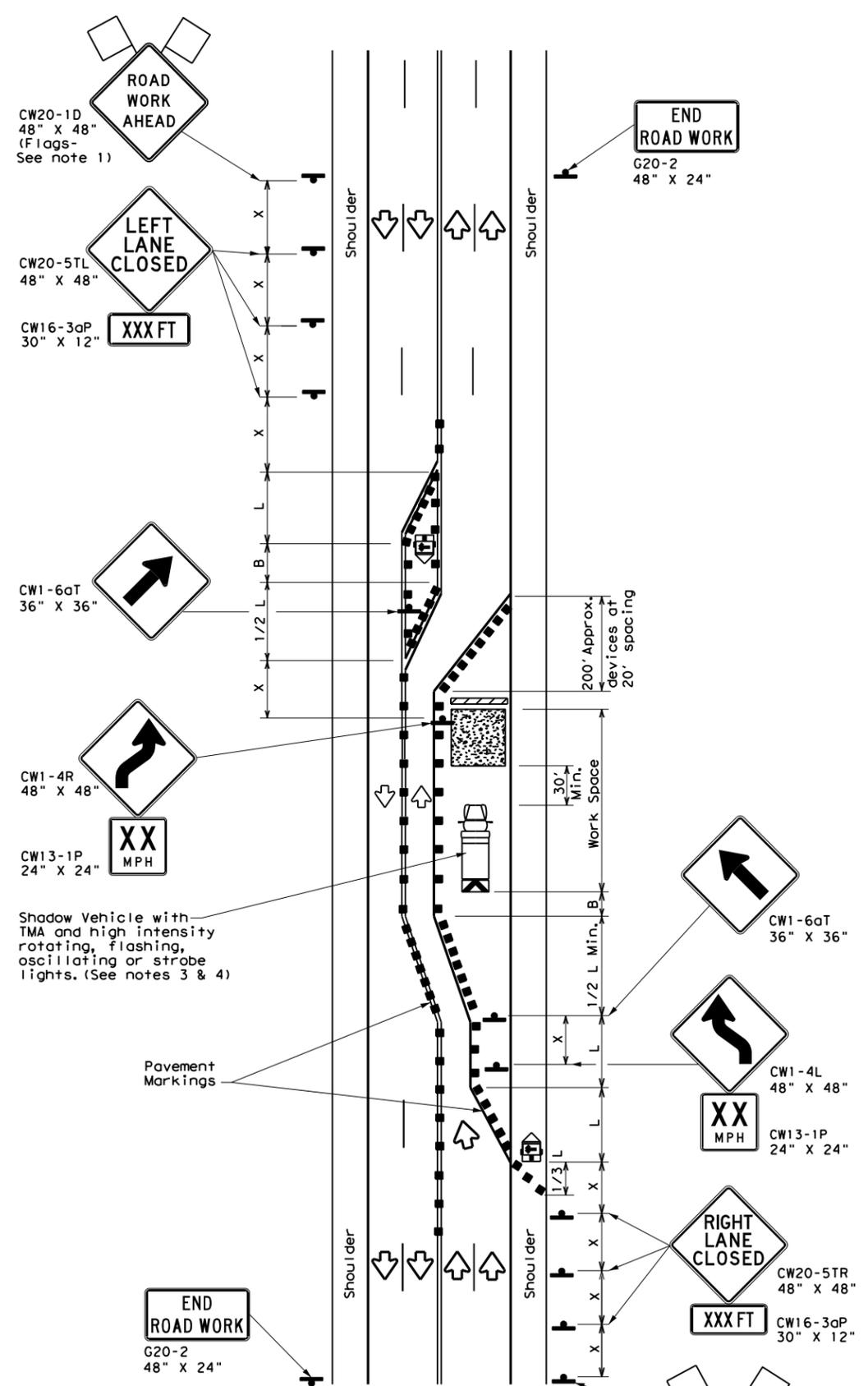
		Traffic Operations Division Standard	
<b>TRAFFIC CONTROL PLAN LANE CLOSURES ON MULTILANE CONVENTIONAL ROADS</b>			
<b>TCP (2-4) - 18</b>			
FILE: tcp2-4-18.dgn	DN:	CK:	DW: CK:
© TxDOT December 1985	CONT	SECT	JOB HIGHWAY
REVISIONS	6399	15	001 SH99
8-95 3-03	DIST	COUNTY	SHEET NO.
1-97 2-12	BMT	LIBERTY, ETC.	24
4-98 2-18			

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4:32:00 PM  
DATE: 5/12/2022  
FILE:



TCP (2-5a)  
**ONE LANE CLOSED**



TCP (2-5b)  
**TWO LANES CLOSED**

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

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

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

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

- GENERAL NOTES**
- Flags attached to signs where shown, are REQUIRED.
  - All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated elsewhere in the plans, or for routine maintenance work, when approved by the Engineer.
  - A Shadow Vehicle with a TMA should be used anytime it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the performance or quality of the work. If workers are no longer present but road or work conditions require the traffic control to remain in place, Type 3 Barricades or other channelizing devices may be substituted for the Shadow Vehicle and TMA.
  - Additional Shadow Vehicles with TMAs may be positioned in each closed lane, on the shoulder or off the paved surface, next to those shown in order to protect a wider work space.
  - The downstream taper is optional. When used, it should be 100 feet approximately per lane, with channelizing devices spaced at 20 feet.

**TCP (2-5a)**

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

**TCP (2-5b)**

- Conflicting pavement markings shall be removed for long-term projects.

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Traffic Operations Division Standard

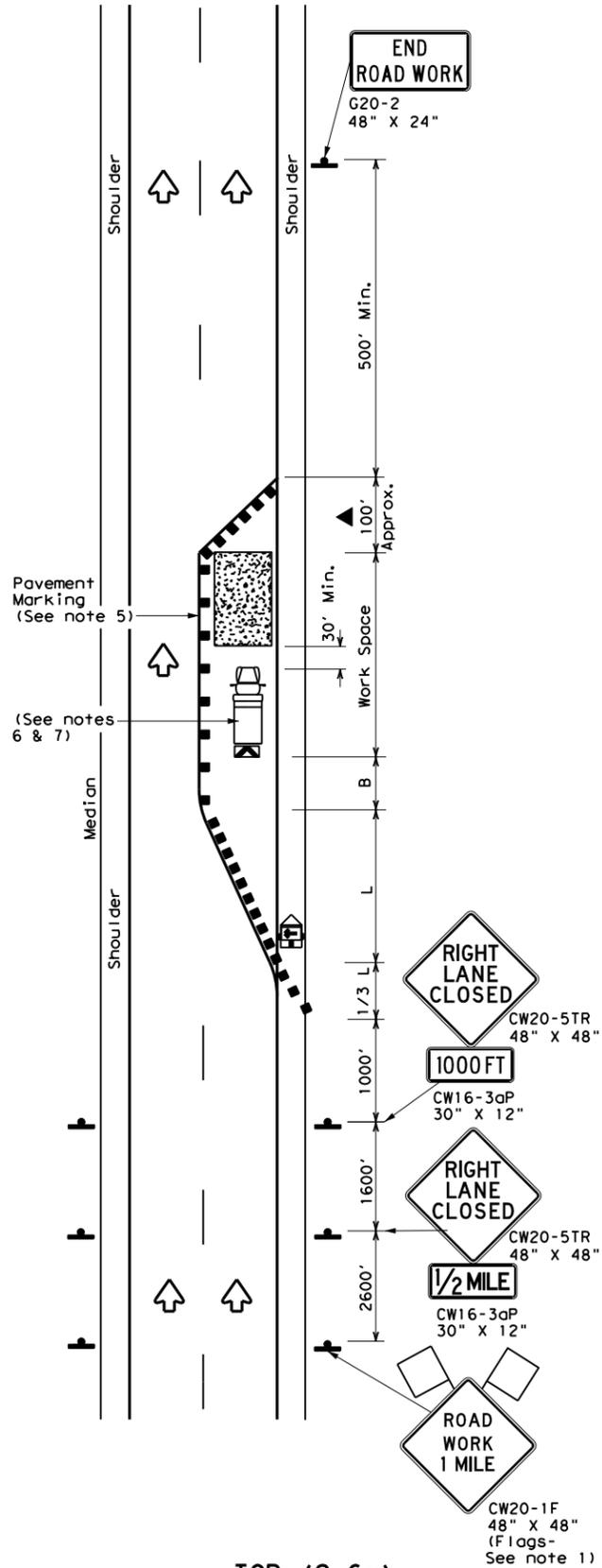
## TRAFFIC CONTROL PLAN LONG TERM LANE CLOSURES MULTILANE CONVENTIONAL RDS.

### TCP (2-5) - 18

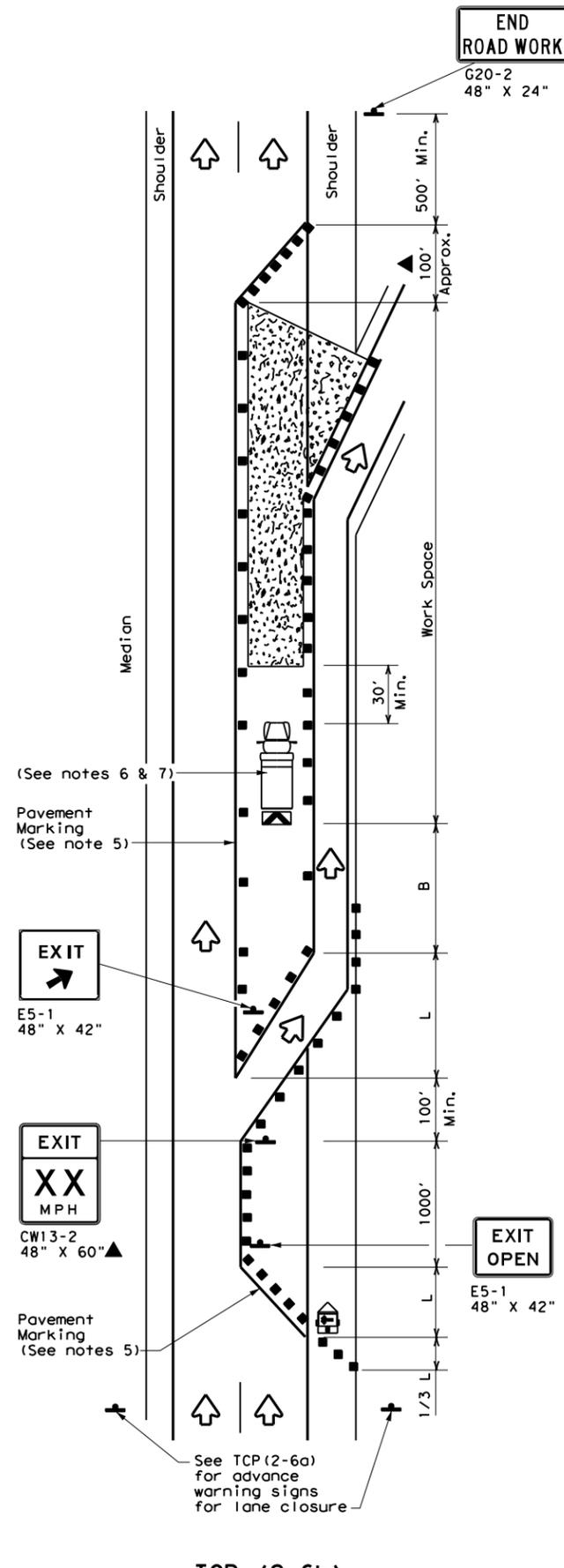
FILE: tcp2-5-18.dgn	DN:	CK:	DW:	CK:
© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS	6399	15	001	SH99
8-95 2-12	DIST	COUNTY	SHEET NO.	
1-97 3-03	BMT	LIBERTY, ETC.	25	
4-98 2-18				

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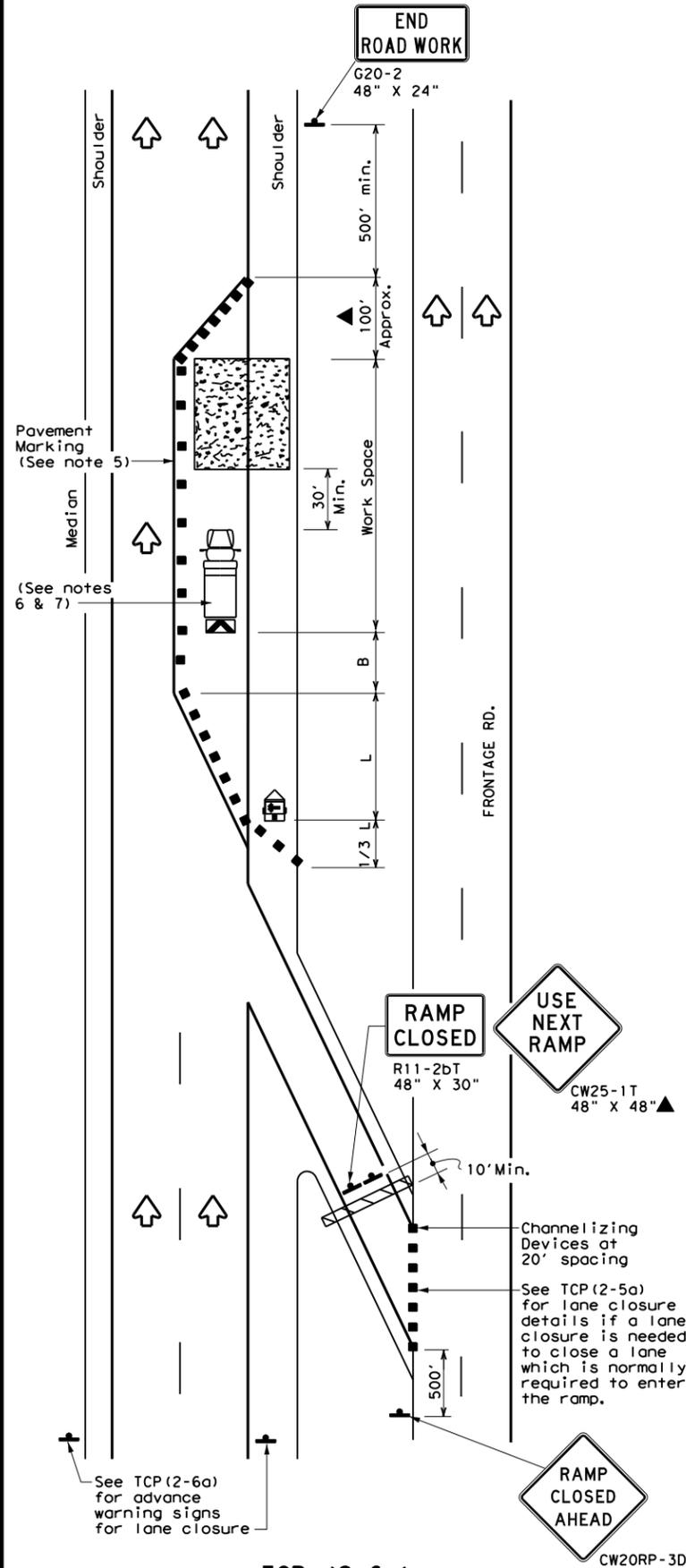
4:32:02 PM  
DATE: 5/12/2022  
FILE:



TCP (2-6a)  
**ONE LANE CLOSURE**



TCP (2-6b)  
**LANE CLOSURE NEAR EXIT RAMP**



TCP (2-6c)  
**LANE CLOSURE NEAR ENTRANCE RAMP**

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

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

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

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

- GENERAL NOTES**
- Flags attached to signs where shown, are REQUIRED.
  - All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated elsewhere in the plans, or for routine maintenance work, when approved by the Engineer.
  - Channelizing devices used to close lanes may be supplemented with the Chevron Alignment Sign placed on every other channelizing device. Chevrons may be attached to plastic drums as per BC Standards.
  - Channelizing devices used along the work space or along tangent sections may be supplemented with vertical panels (VP) placed on every other channelizing device. If night time conditions make it difficult to see at least two VPs, the VPs may be placed on each channelizing device.
  - The placement of pavement markings may be omitted on intermediate-term stationary work zones with the approval of the Engineer.
  - 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.
  - Additional Shadow Vehicles with TMAs may be positioned in each closed lane, on the shoulder or off the paved surface, next to those shown in order to protect a wider work space.

Texas Department of Transportation  
Traffic Operations Division Standard

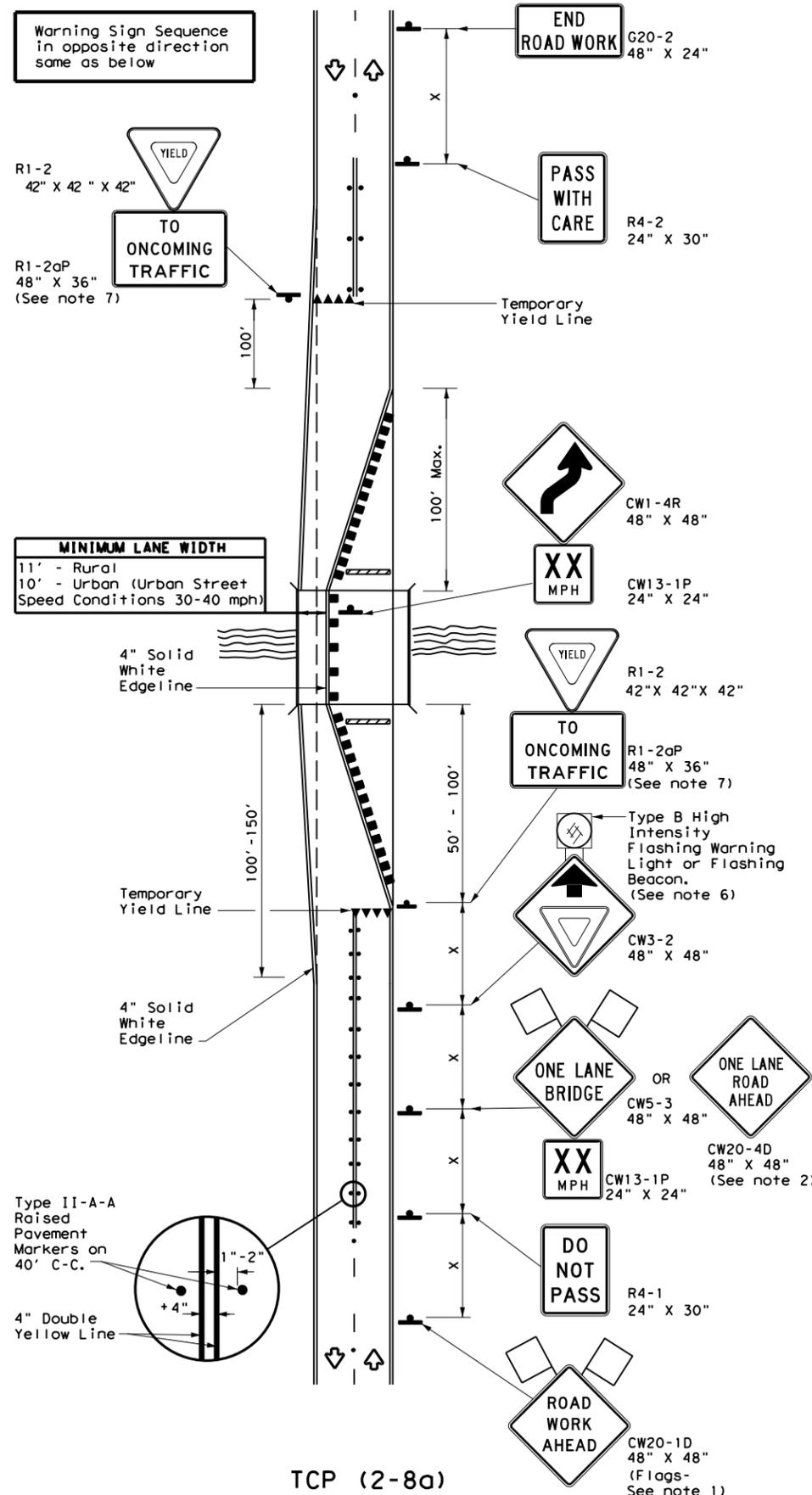
## TRAFFIC CONTROL PLAN LANE CLOSURES ON DIVIDED HIGHWAYS

### TCP (2-6) - 18

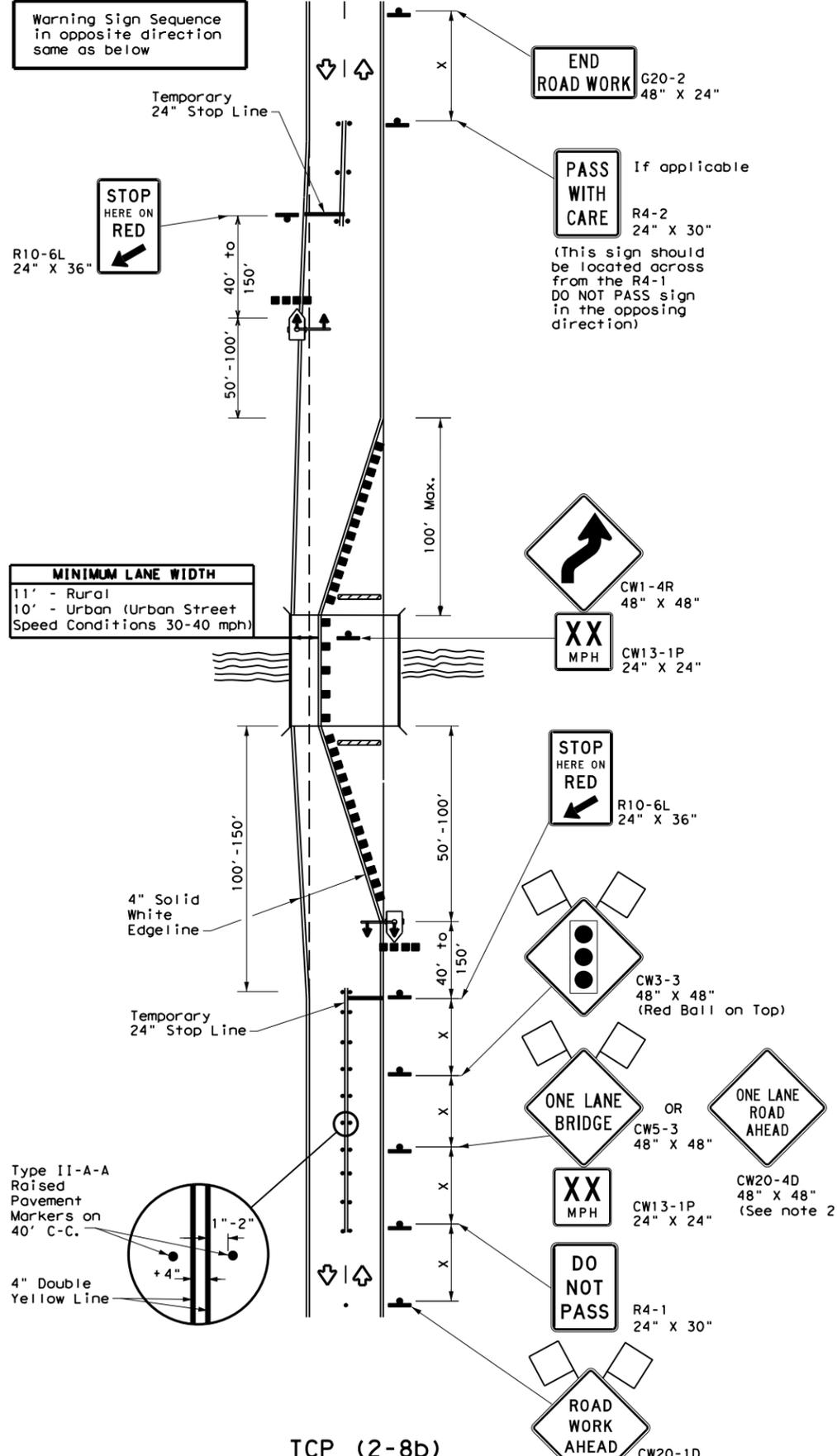
FILE: tcp2-6-18.dgn	DN:	CK:	DW:	CK:
© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS	6399	15	001	SH99
2-94 4-98	DIST	COUNTY	SHEET NO.	
8-95 2-12	BMT	LIBERTY, ETC.	26	
1-97 2-18				

166

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TCP (2-8a)  
**ONE LANE TWO-WAY**  
**TRAFFIC CONTROL WITH YIELD SIGNS**  
 (Less Than 2000 ADT-See Note 5)



TCP (2-8b)  
**ONE LANE TWO-WAY**  
**TRAFFIC CONTROL WITH TRAFFIC SIGNAL**

LEGEND			
	Type 3 Barricade		Channelizing Devices
	Sign		Traffic Flow
	Flag		Flagger
	Raised Pavement Markers Ty II-AA		Temporary or Portable Traffic Signal

Posted Speed *	Formula	Minimum Desirable Taper Lengths **			Suggested Maximum Spacing of Channelizing Devices		Minimum Sign Spacing "X" Distance	Suggested Longitudinal Buffer Space "B"	Stopping Sight Distance
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent			
30	L = WS <sup>2</sup> / 60	150'	165'	180'	30'	60'	120'	90'	200'
35		205'	225'	245'	35'	70'	160'	120'	250'
40		265'	295'	320'	40'	80'	240'	155'	305'
45	L = WS	450'	495'	540'	45'	90'	320'	195'	360'
50		500'	550'	600'	50'	100'	400'	240'	425'
55		550'	605'	660'	55'	110'	500'	295'	495'
60	L = WS	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	L = WS	750'	825'	900'	75'	150'	900'	540'	820'

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

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

**GENERAL NOTES**

- Flags attached to signs where shown are REQUIRED.
  - When this TCP is used at a location which does not involve a bridge, a 48" x 48" CW20-4D "ONE LANE ROAD AHEAD" signs should be used in lieu of the CW5-3 "ONE LANE BRIDGE" signs. The CW13-1P Advisory Speed Plaque is required with either warning sign.
  - Raised pavement markers shall be placed 40 feet c-c on centerline between DO NOT PASS signs and stop or yield lines.
  - For intermediate term situations, when it is not feasible to remove and restore pavement markings, the channelization must be made dominant by using a very close spacing. This is especially important in locations of conflicting information, such as where traffic is directed over a double yellow centerline. In such locations a maximum channelizing device spacing of 20 feet is recommended. The 20 foot channelizing device spacing recommendation is intended for the area of conflicting information and not the entire work zone.
- TCP (2-8a)**
- Traffic control by CW3-2 "YIELD AHEAD" symbol signs for one lane two-way traffic control operations should be limited to work spaces less than 400 feet long and roadways with less than 2000 ADT. Otherwise, portable traffic signals should be used.
  - If power is available, a flashing beacon should be attached to the CW3-2 "YIELD AHEAD" symbol sign for emphasis.
  - The R1-2 "YIELD" and R1-2aP "TO ONCOMING TRAFFIC" signs and other regulatory signs shall be installed at 7 foot minimum mounting height.
- TCP (2-8b)**
- A list of approved Portable Traffic Signals can be found in the "Compliant Work Zone Traffic Control Devices" list.
  - Portable traffic signals should be located to provide adequate stopping sight distance for approaching motorist (See table above).

Traffic Operations Division Standard

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

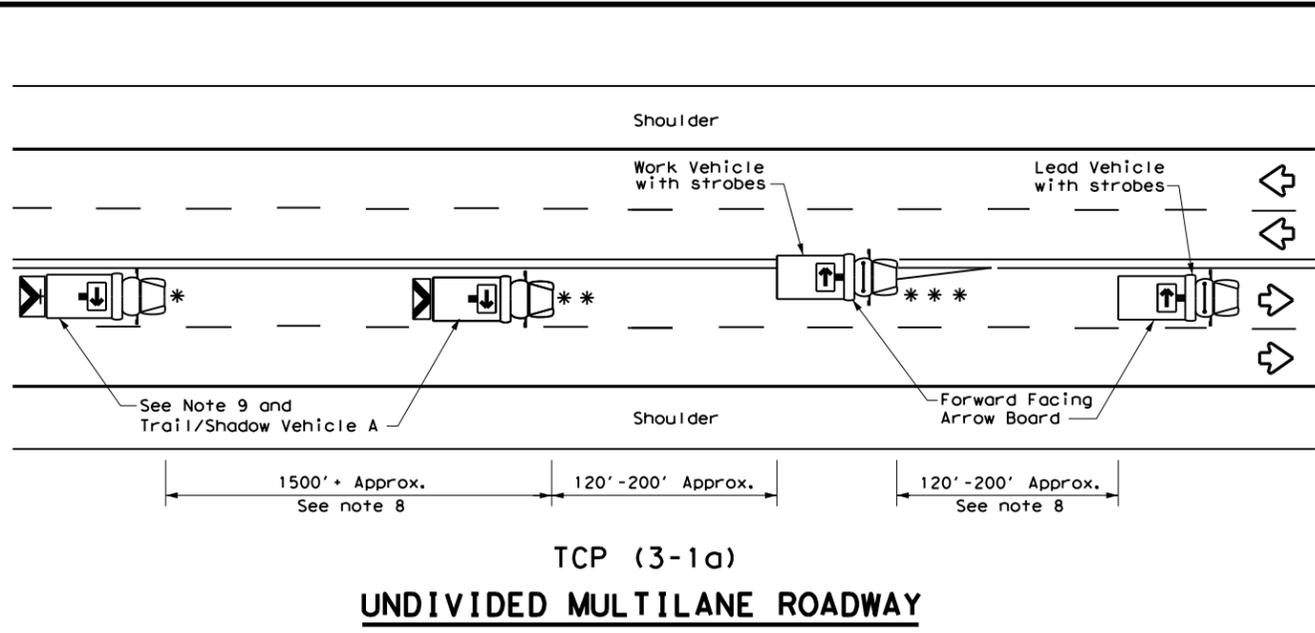
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© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
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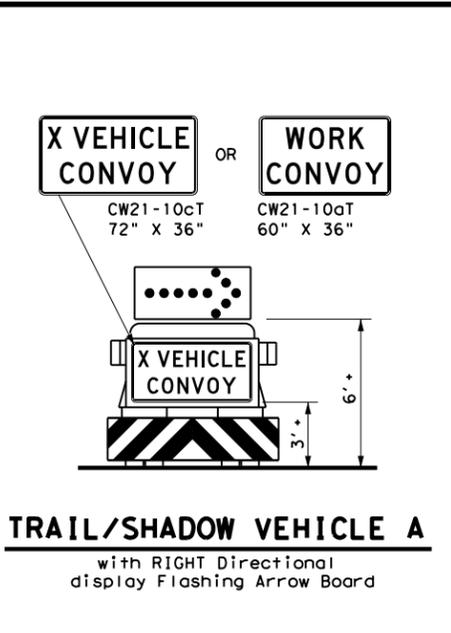
168

4:32:04 PM  
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**TCP (3-1a)**  
**UNDIVIDED MULTILANE ROADWAY**



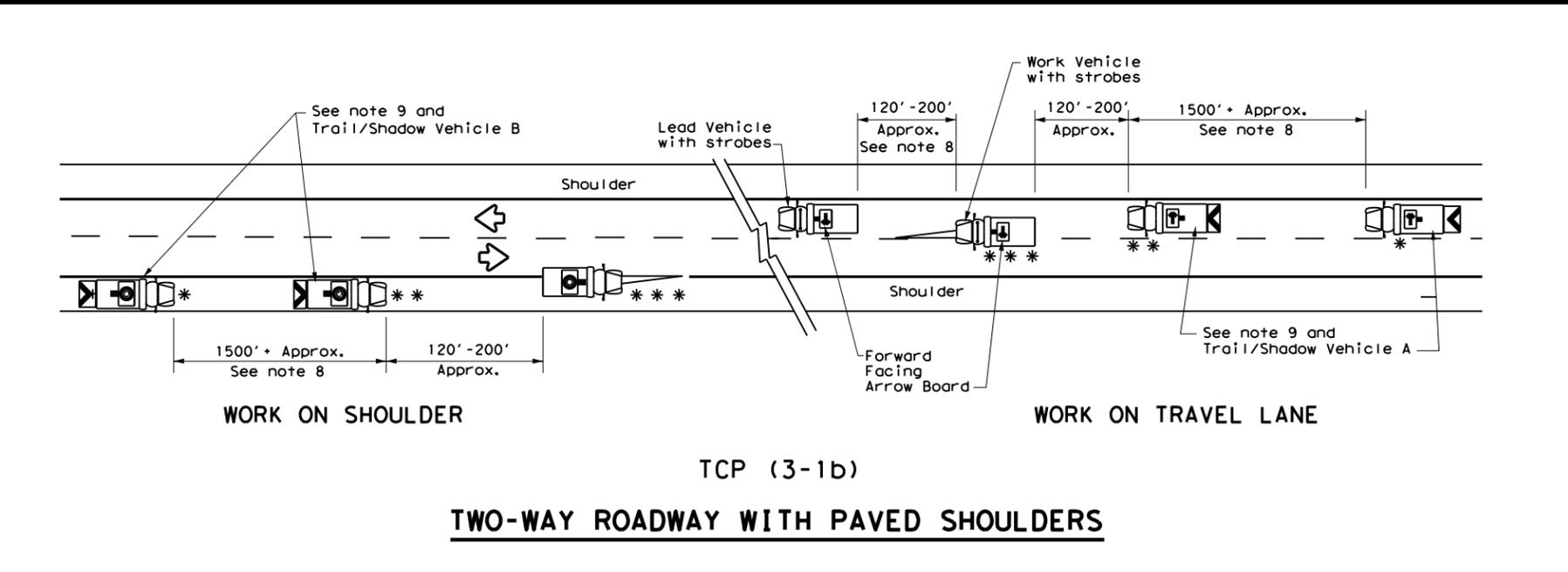
**TRAIL/SHADOW VEHICLE A**  
with RIGHT Directional display Flashing Arrow Board

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

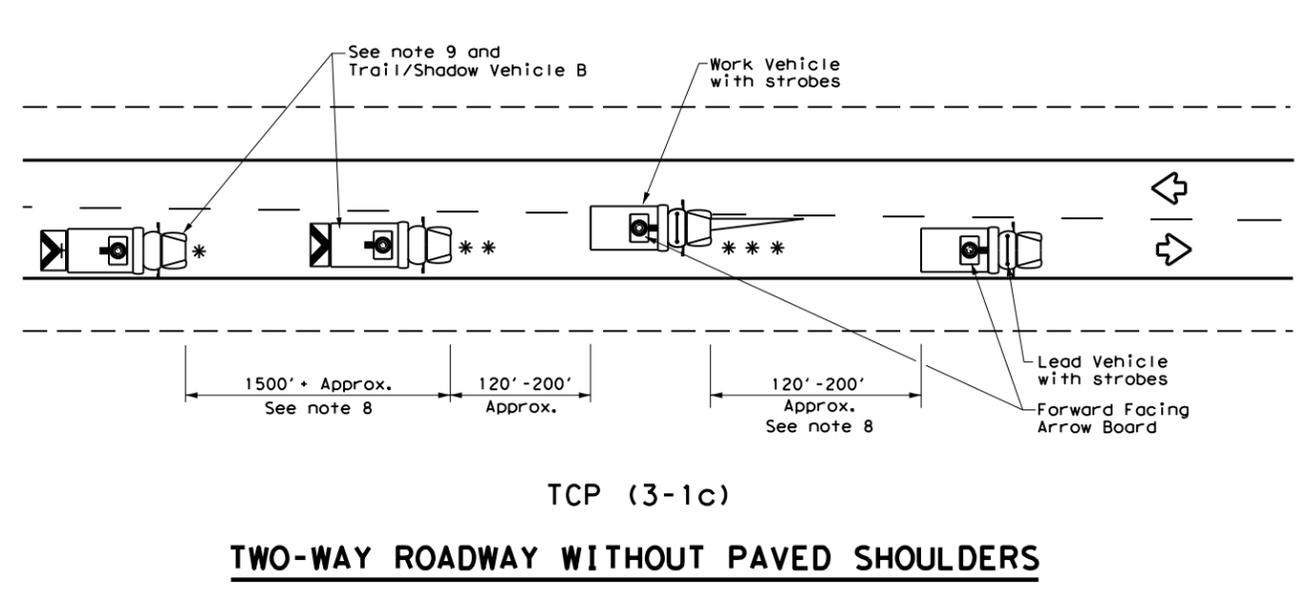
TYPICAL USAGE				
MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
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**GENERAL NOTES**

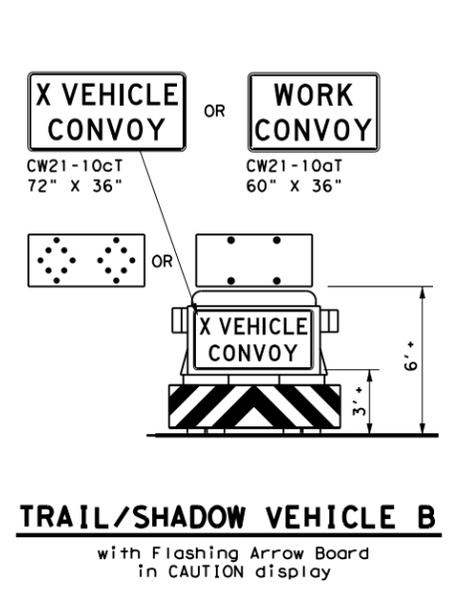
1. TRAIL, SHADOW, and LEAD vehicles shall be equipped with arrow boards as illustrated. When a LEAD vehicle is not used the WORK vehicle must be equipped with an arrow board. The Engineer will determine if the LEAD VEHICLE and/or TRAIL VEHICLE are required based on prevailing roadway conditions, traffic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



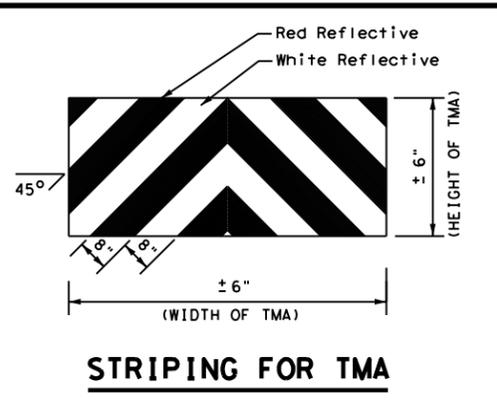
**TCP (3-1b)**  
**TWO-WAY ROADWAY WITH PAVED SHOULDERS**



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



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



**STRIPING FOR TMA**

Texas Department of Transportation

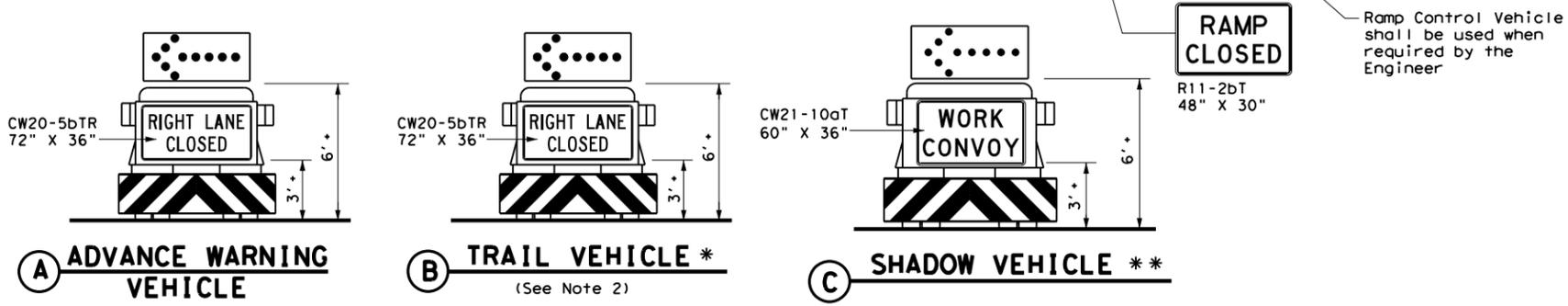
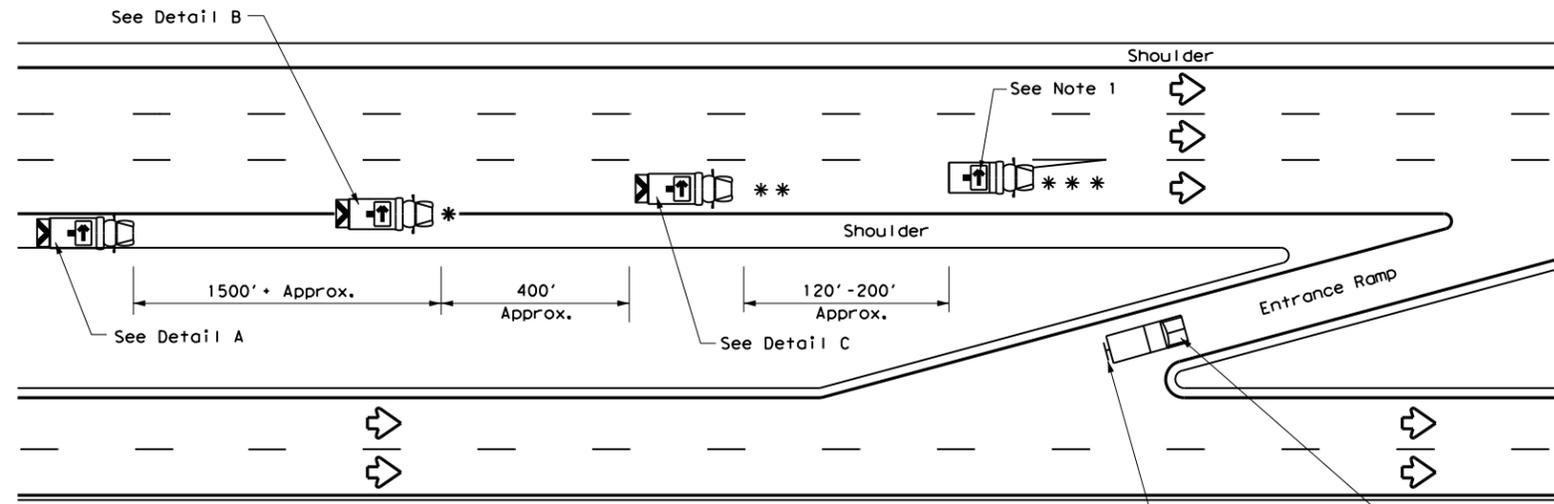
Traffic Operations Division Standard

**TRAFFIC CONTROL PLAN**  
**MOBILE OPERATIONS**  
**UNDIVIDED HIGHWAYS**

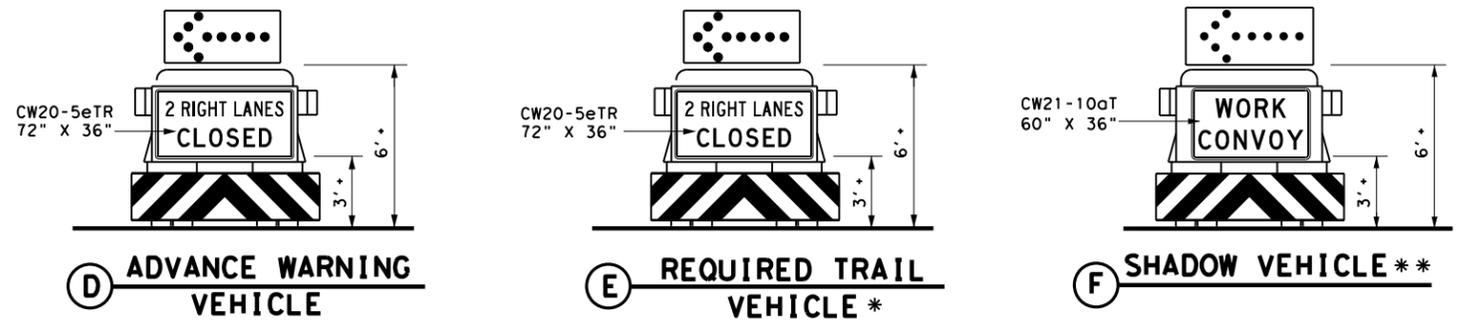
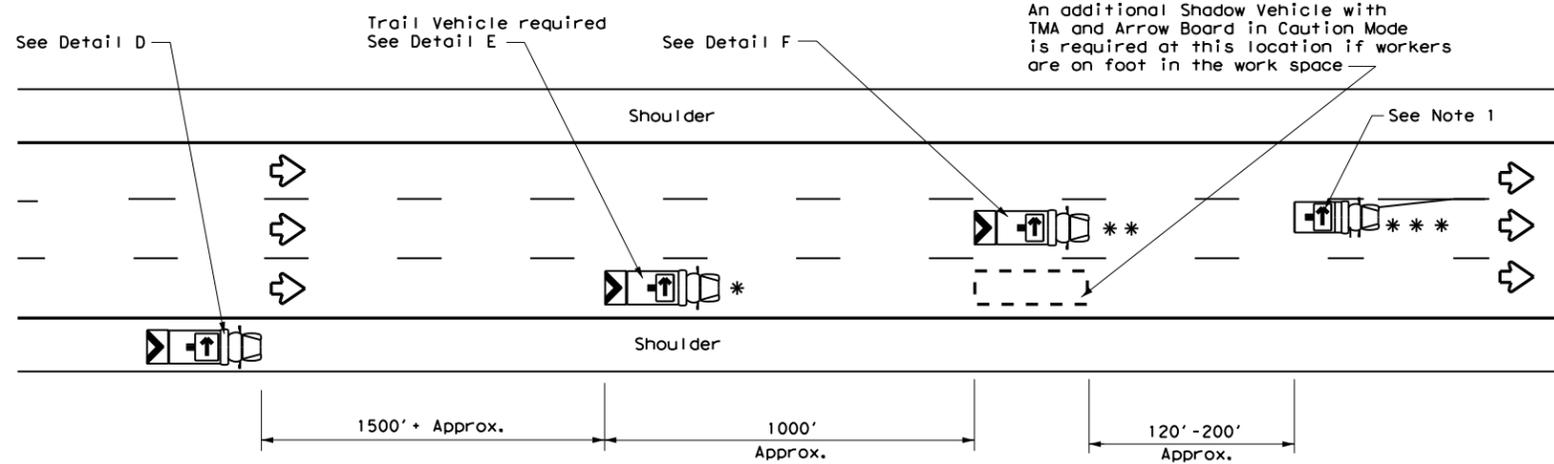
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© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
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2-94 4-98	DIST	COUNTY	SHEET NO.	
8-95 7-13	BMT	LIBERTY, ETC.	28	
1-97				

5/12/2022 4:32:09 PM  
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**RIGHT LANE CLOSURE ON DIVIDED HIGHWAY - TCP(3-2a)**



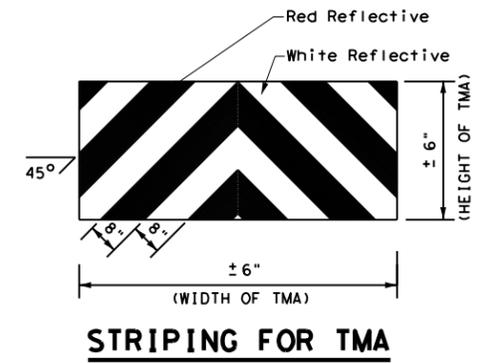
**INTERIOR LANE CLOSURE ON MULTI-LANE DIVIDED HIGHWAY - TCP(3-2b)**

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

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

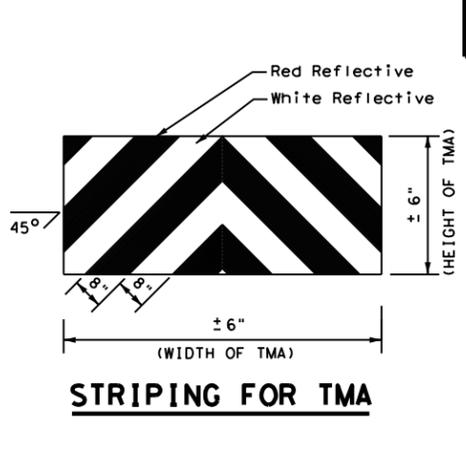
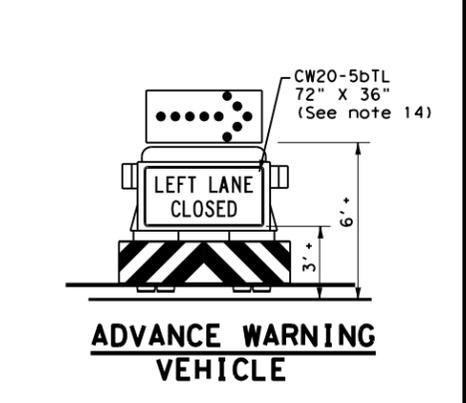
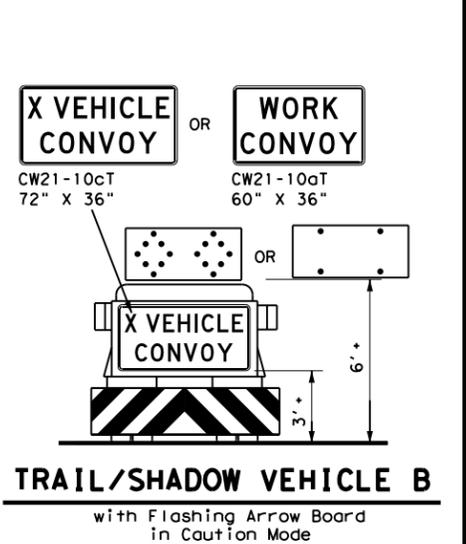
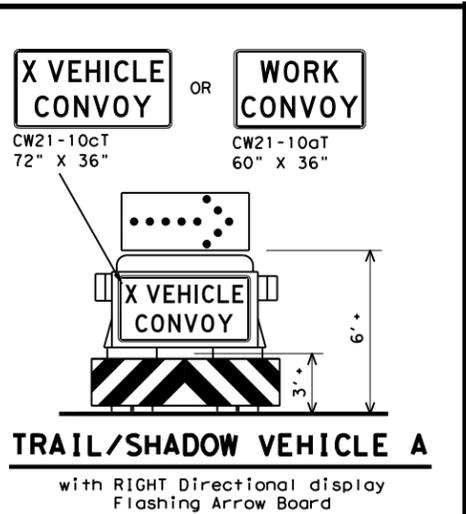
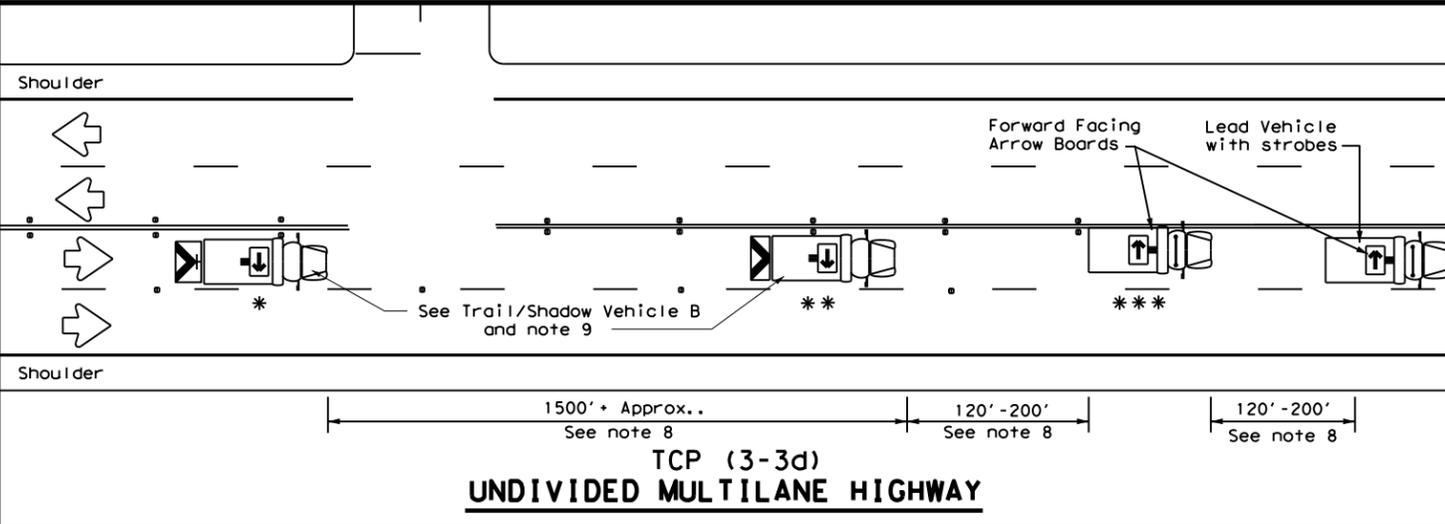
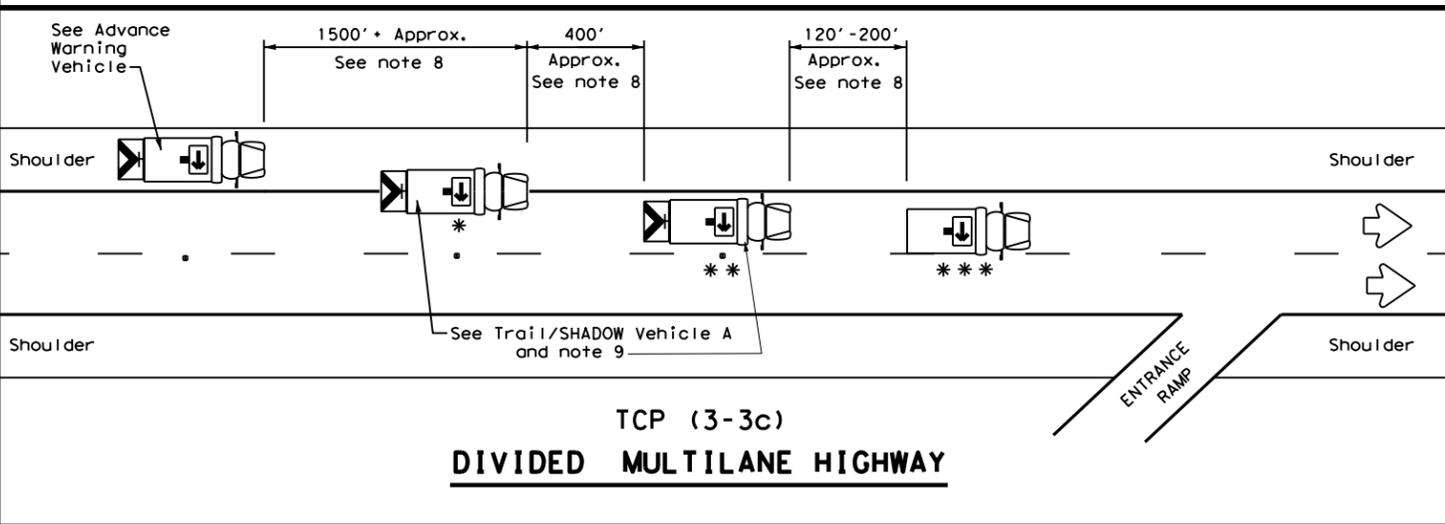
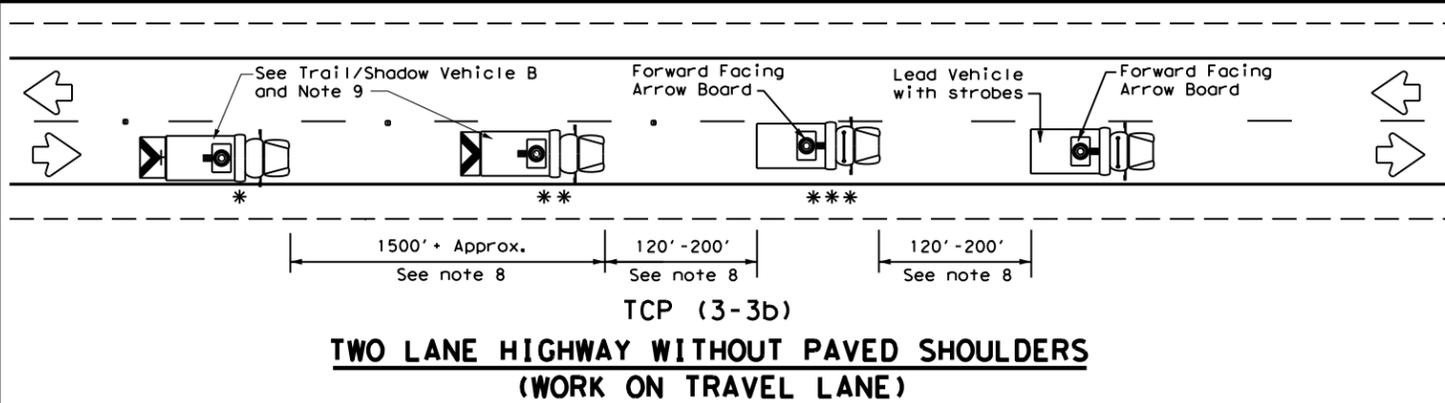
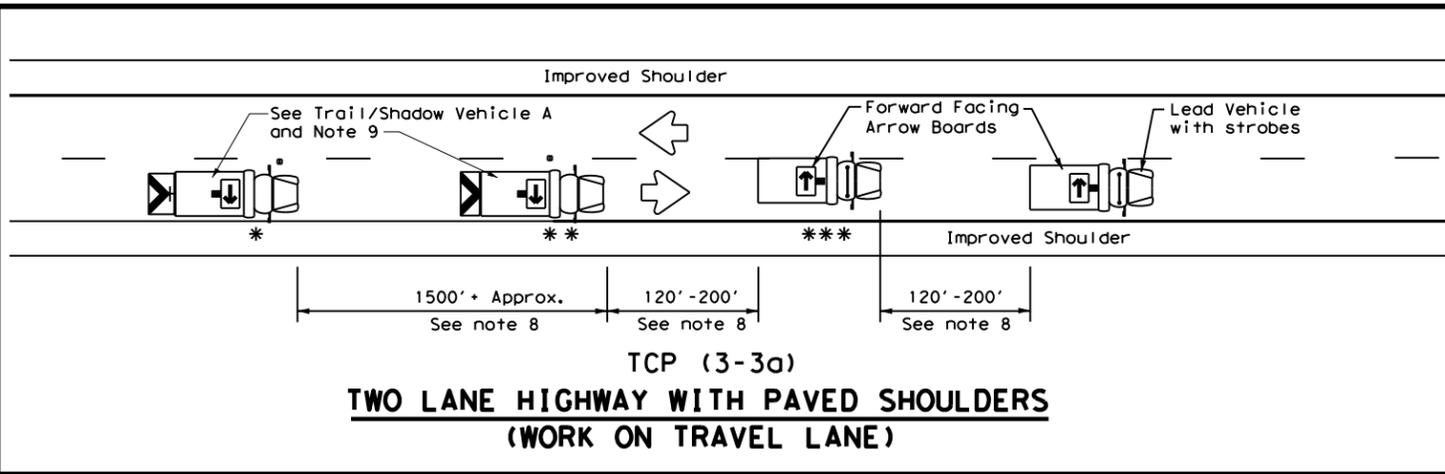
- ADVANCE WARNING, TRAIL and SHADOW vehicles shall be equipped with Type B or Type C flashing arrow boards as per the Barricade and Construction (BC) standards. Arrow boards on WORK vehicles will be optional based on the type of work being performed. The arrow boards shall be operated from inside the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



**STRIPING FOR TMA**

		<b>Traffic Operations Division Standard</b>	
<b>TRAFFIC CONTROL PLAN MOBILE OPERATIONS DIVIDED HIGHWAYS</b>			
<b>TCP(3-2)-13</b>			
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© TxDOT December 1985	CONT: 6399	SECT: 15	JOB: 001
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1-97			

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 No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to any other format.



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

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

**GENERAL NOTES**

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.

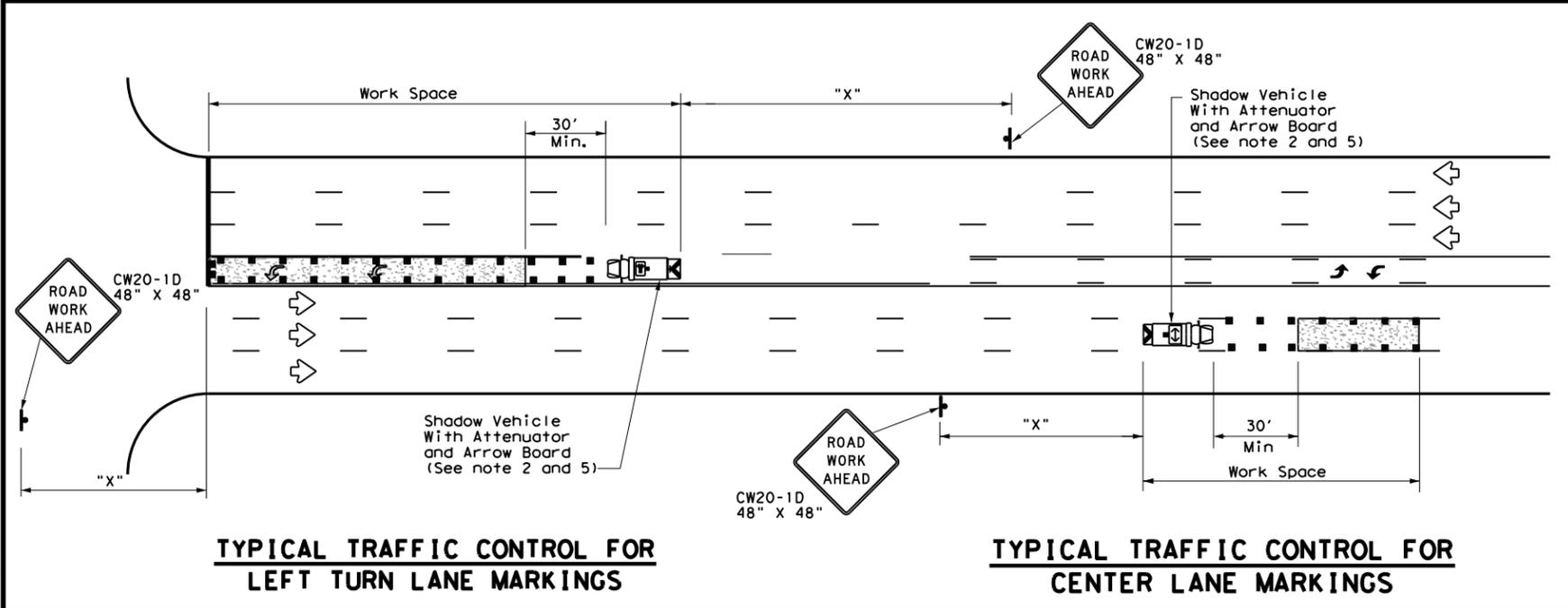
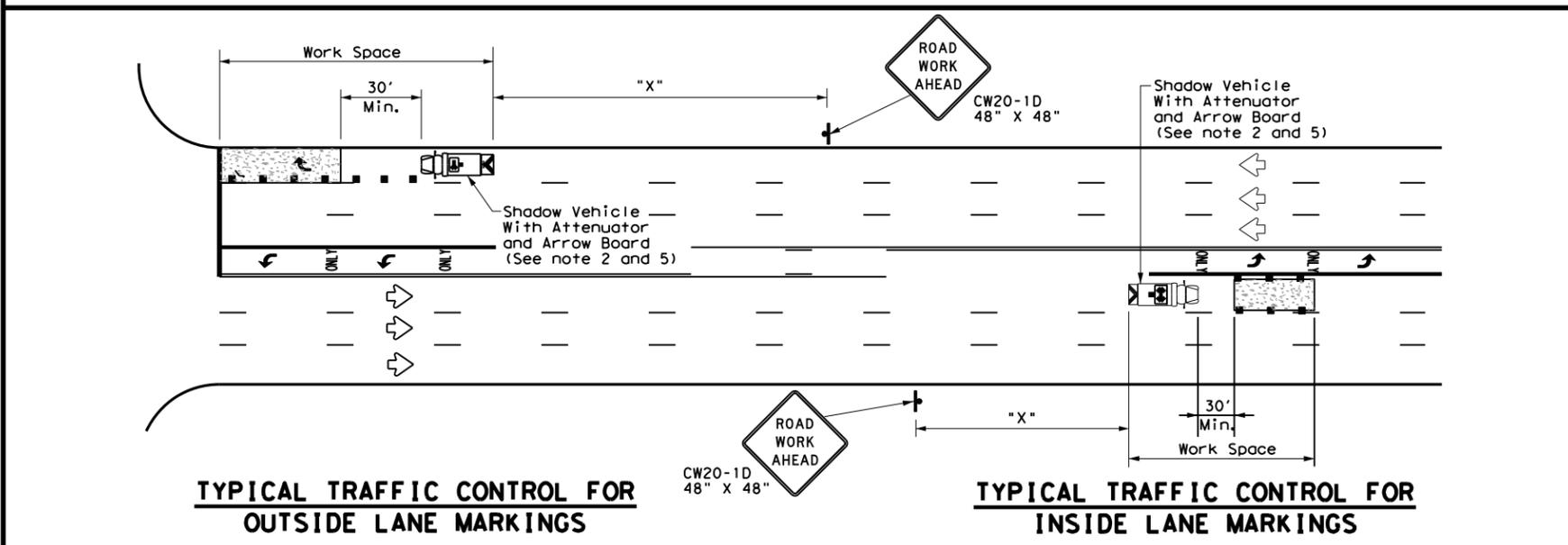
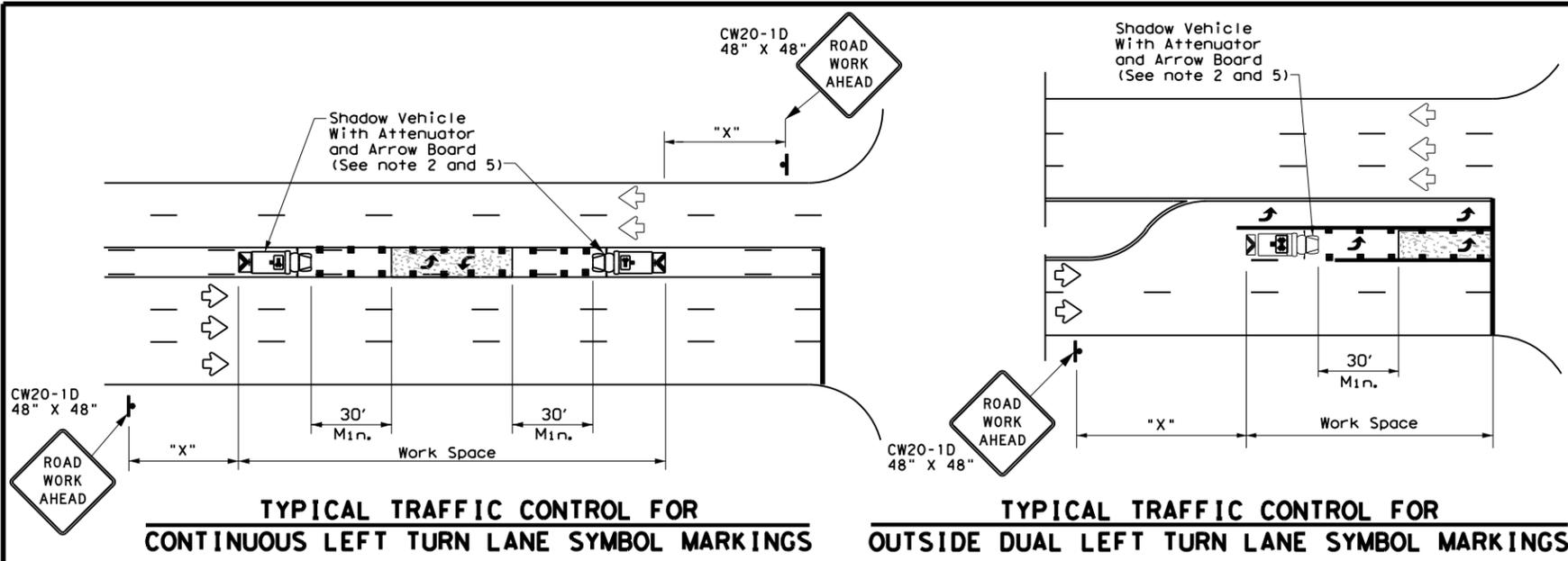
Traffic Operations Division Standard

**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
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2-94 4-98	DIST	COUNTY	SHEET NO.	
8-95 7-13	BMT	LIBERTY, ETC.	30	
1-97 7-14				

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4:32:13 PM



LEGEND		
* Trail Vehicle		ARROW BOARD DISPLAY
** Shadow Vehicle		
*** Work Vehicle		RIGHT Directional
		LEFT Directional
		Double Arrow
		Channelizing Devices

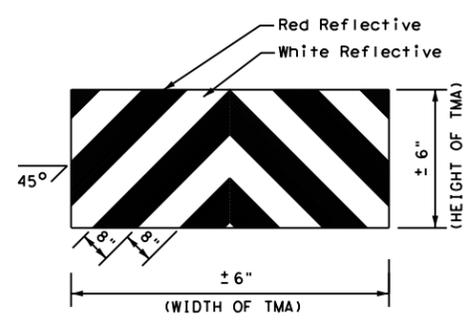
Posted Speed *	Formula	Minimum Desirable Taper Lengths **			Suggested Maximum Spacing of Channelizing Devices		Minimum Sign Spacing "X" Distance	Suggested Longitudinal Buffer Space "B"
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent		
30	L = WS <sup>2</sup> / 60	150'	165'	180'	30'	60'	120'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

\* 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. This traffic control plan is for use on conventional roads posted at 45 mph or less and is intended for mobile operations that move continuously or intermittently (stopping up to approximately 15 minutes) such as short-line striping and in-lane rumble strips. When activities are anticipated to take longer amounts of time or traffic conditions warrant, a short duration or short-term stationary traffic control plan should be used.
2. A Truck Mounted Attenuator shall be used on Shadow Vehicle. Striping on the back panel of all truck mounted attenuators shall be 8" red and white reflective sheeting placed in an inverted "V" design. Reflective sheeting shall meet or exceed the reflectivity and color requirements of departmental material specification DMS-8300, Type A.
3. All traffic control devices shall be in accordance with the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD), latest edition.
4. The use of yellow rotating beacons or strobe lights on vehicles are required. Blue high intensity rotating, flashing, oscillating or strobe lights when mounted on the drivers side of the vehicle may be operated simultaneously with the amber beacons or strobe lights.
5. Flashing arrow board shall be used on Shadow Vehicle. Flashing arrow board shall be Type B or Type C as per BC Standards. The arrow board operation shall be controlled from inside the truck.



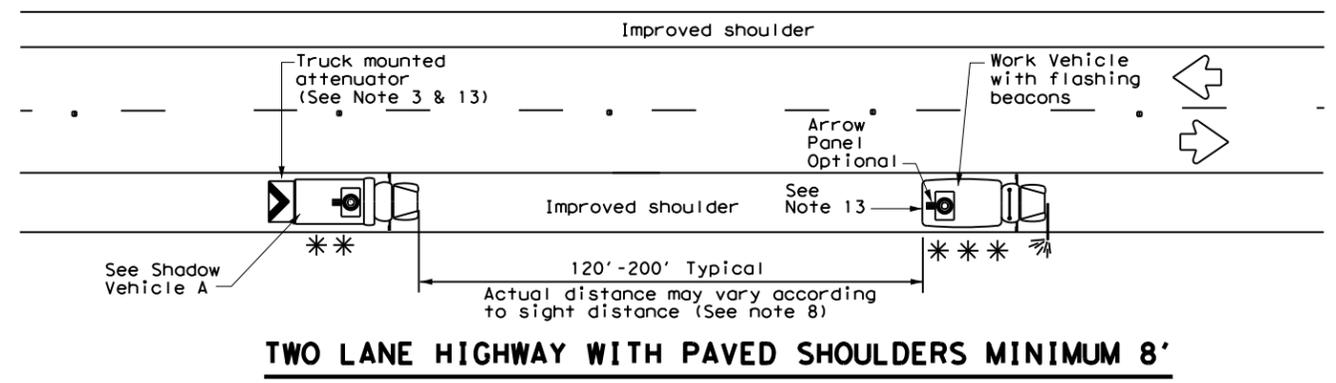
**STRIPING FOR TMA**

Texas Department of Transportation  
Traffic Operations Division Standard

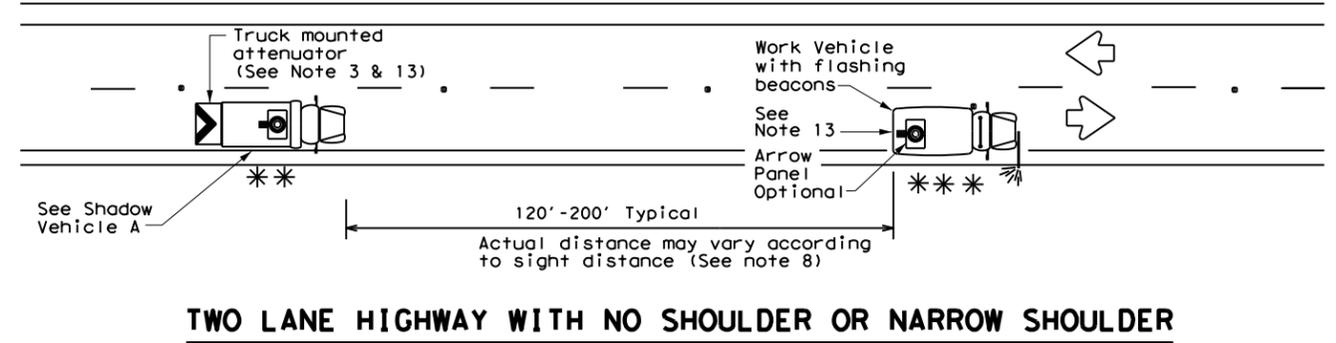
**TRAFFIC CONTROL PLAN  
MOBILE OPERATIONS FOR  
ISOLATED WORK AREAS  
UNDIVIDED HIGHWAYS  
TCP(3-4)-13**

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© TxDOT July, 2013	CONT: 6399	SECT: 15	JOB: 001	HIGHWAY: SH99
REVISIONS	DIST: BMT	COUNTY: LIBERTY, ETC.	SHEET NO.: 31	

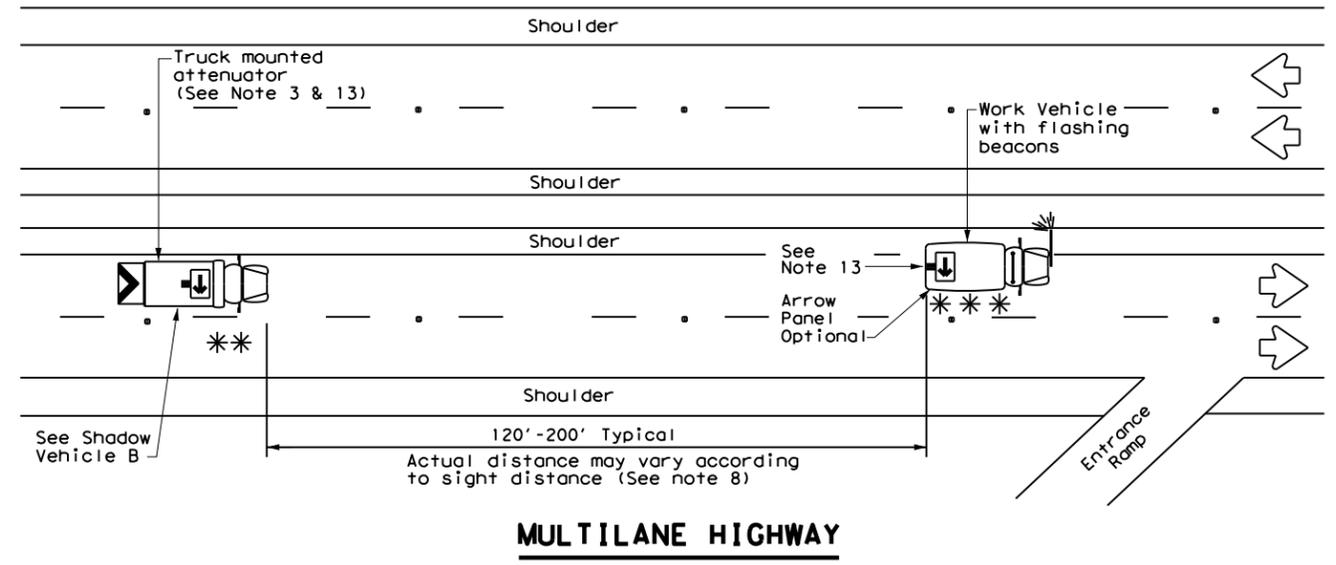
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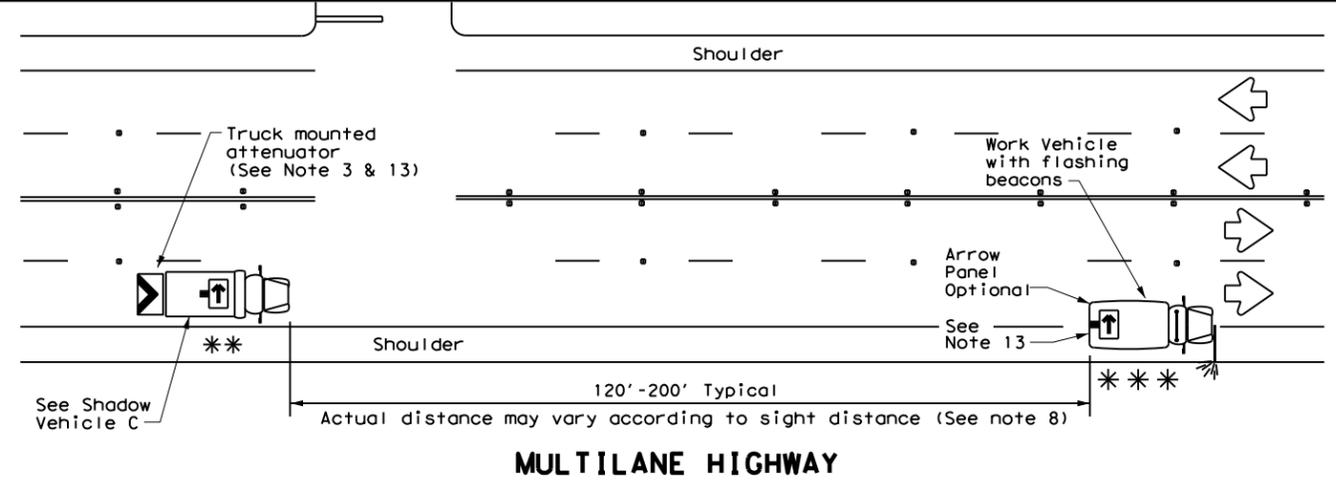
**TWO LANE HIGHWAY WITH PAVED SHOULDERS MINIMUM 8'**



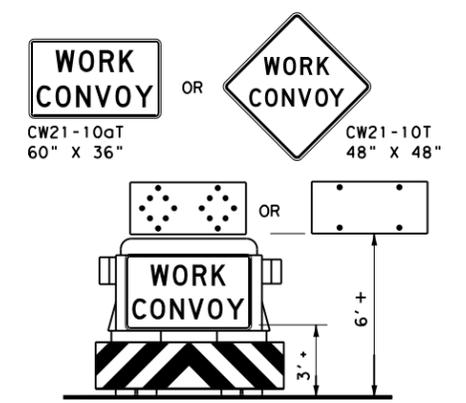
**TWO LANE HIGHWAY WITH NO SHOULDER OR NARROW SHOULDER**



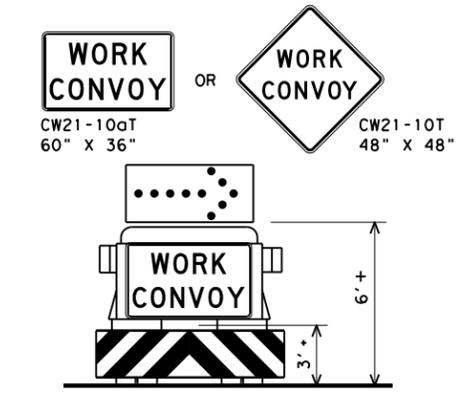
**MULTILANE HIGHWAY**



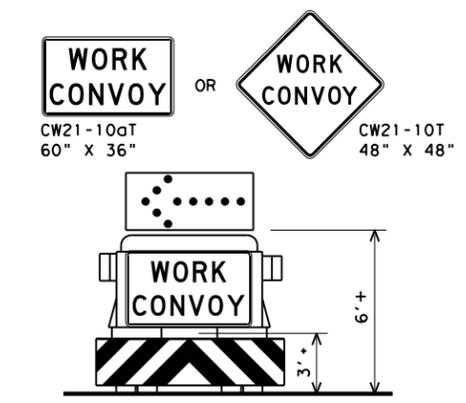
**MULTILANE HIGHWAY**



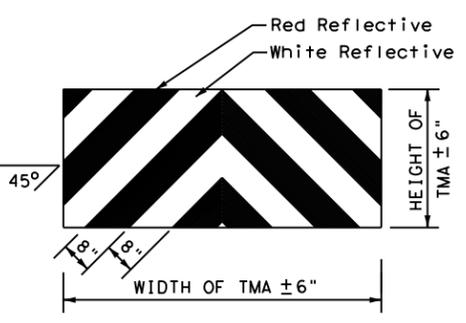
**SHADOW VEHICLE A**  
with Flashing Arrow Board in Caution Mode



**TYPICAL SHADOW VEHICLE B**  
with RIGHT Directional display Flashing Arrow Board



**TYPICAL SHADOW VEHICLE C**  
with LEFT Directional display Flashing Arrow Board



**STRIPING FOR TMA**

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

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

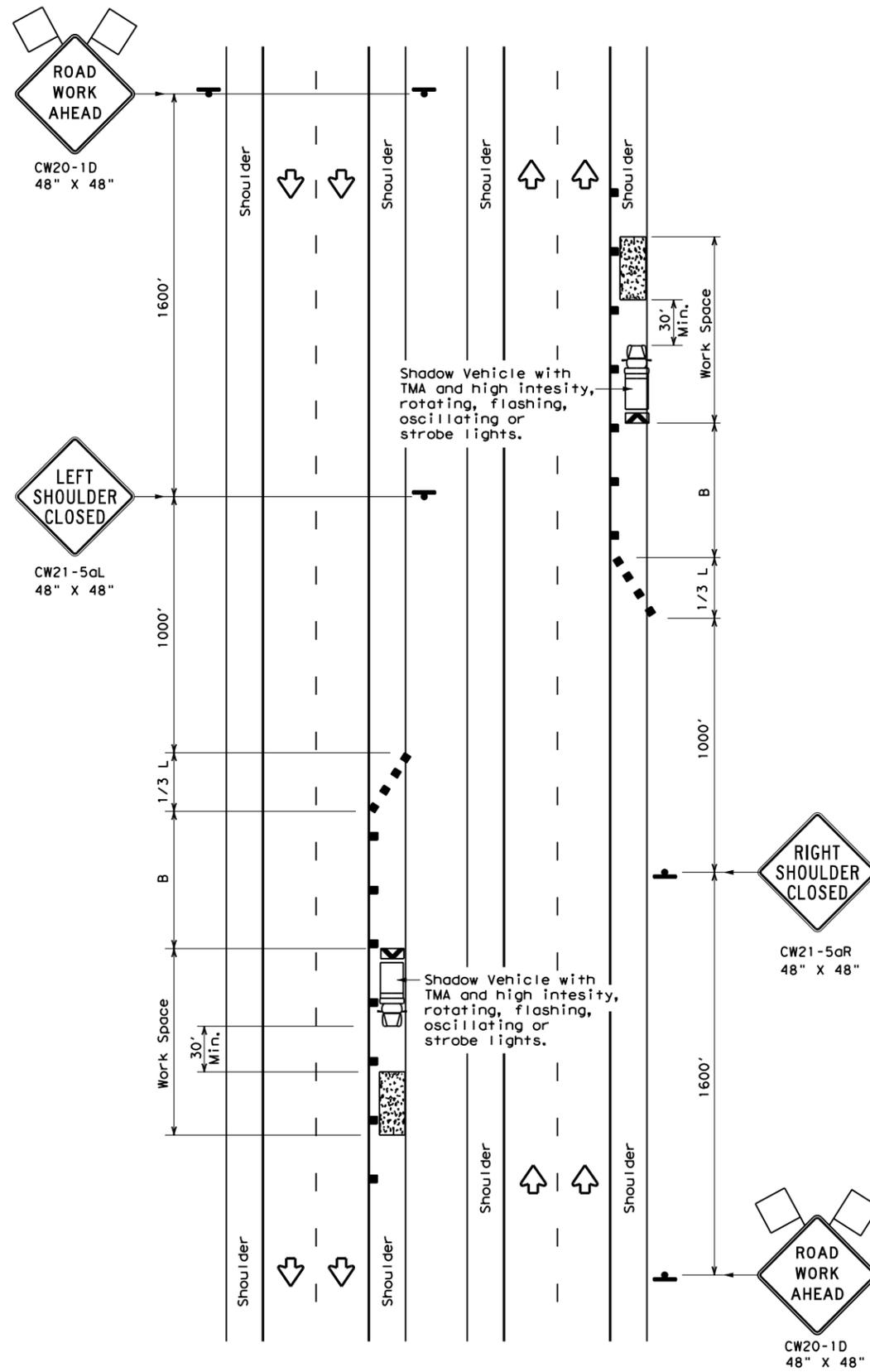
**GENERAL NOTES**

- All traffic control devices shall be in accordance with the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD), latest edition.
- The use of amber high intensity rotating, flashing, oscillating, or strobe lights on vehicles are required. Blue high intensity rotating, flashing, oscillating or strobe lights when mounted on the driver's side of the vehicle may be operated simultaneously with the amber beacons or strobe lights.
- The use of truck mounted attenuators (TMA) on the Shadow Vehicle is required.
- Striping on the back panel of all TMAs shall be 8" red reflective sheeting with white background, placed in an inverted "V" design. Reflective sheeting shall meet or exceed the reflectivity and color requirements of DEPARTMENTAL MATERIAL SPECIFICATION DMS-8300, TYPE A.
- Flashing Arrow Panels shall be Type B or Type C as per BC Standards. The panel operation shall be controlled from inside the vehicle.
- Each vehicle shall have two-way radio communication capability.
- When the work convoy must change lanes, the Shadow Vehicle should change lanes first to protect the Work Vehicle.
- Spacing between Shadow and Work Vehicle will vary depending on sight distance restrictions. Motorists approaching the work convoy should be able to see the Shadow Vehicle in time to slow down and/or change lanes as they approach the Work Convoy.
- Use of an arrow panel on the Work Vehicle is optional except as provided in note 13, but may be required by the Engineer. If an arrow panel is not used, dual flashing beacons, mounted as high and as widely separated as practicable at the rear of the Work Vehicle shall be required.
- On two-lane two-way roadways, the Work and Shadow Vehicles should pull over periodically to allow motor vehicle traffic to pass.
- Work and Shadow Vehicles should stay on the shoulder of highways having 8' or wider shoulders when possible.
- A Trail Vehicle may be added to the operation when approved by the Engineer. See TCP (3) series standards.
- The shadow vehicle may be omitted on conventional roadways when a TMA or TA and arrow panel is mounted to the herbicide vehicle. A separate shadow vehicle will be required on expressways and Freeways.

		<b>Traffic Operations Division Standard</b>	
<b>TRAFFIC CONTROL PLAN</b> <b>MOBILE OPERATIONS</b> <b>HERBICIDE TRUCK OPERATIONS</b> <b>TCP (3-5) - 18</b>			
FILE: tcp3-5.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT
© TxDOT July 2015	CONT	SECT	JOB
REVISIONS	6399	15	001
4-18	DIST	COUNTY	SHEET NO.
	BMT	LIBERTY, ETC.	32

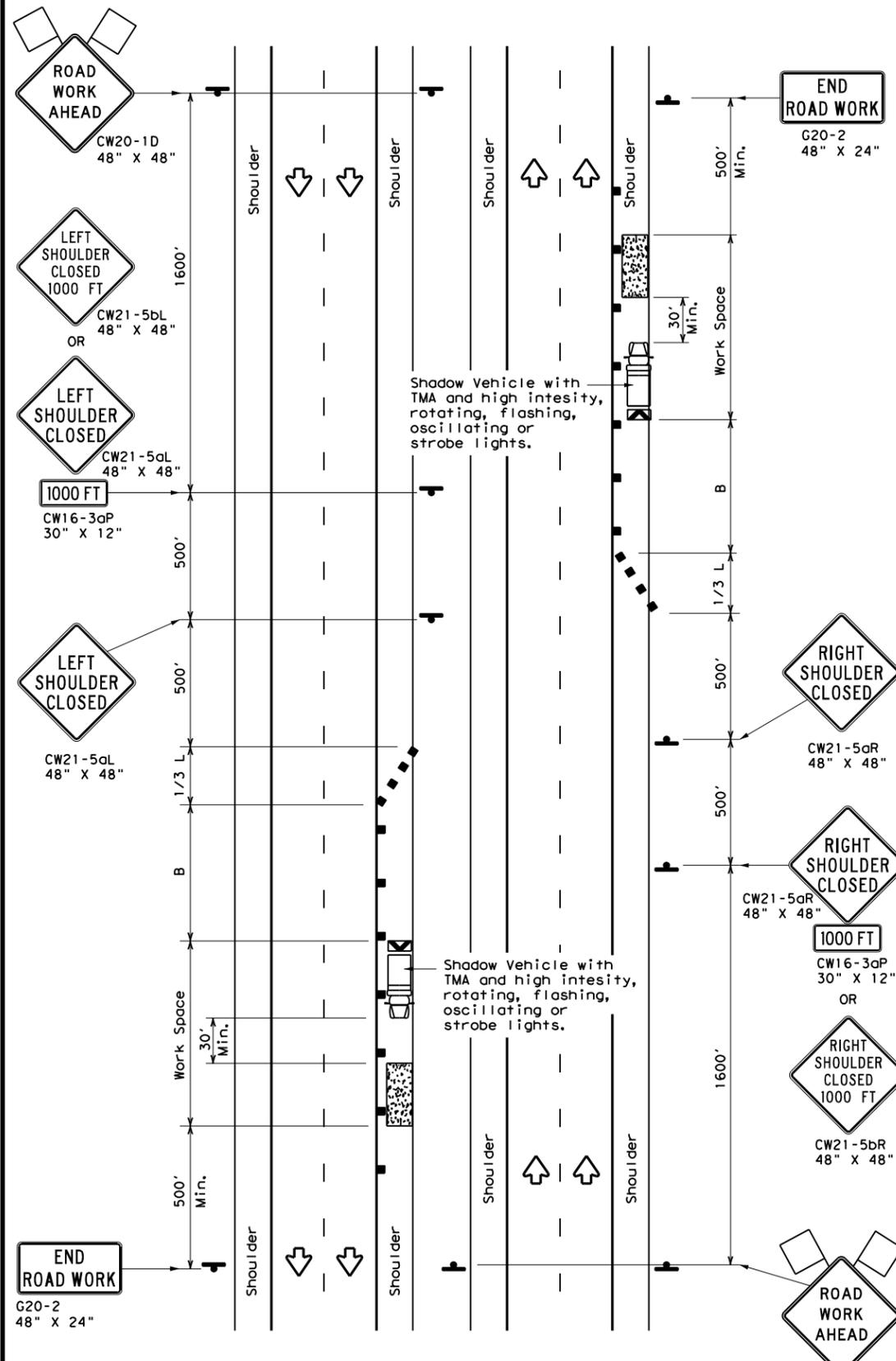
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9:01:23 AM  
DATE: 5/20/2022  
FILE:



TCP (5-1a)

**WORK AREA ON SHOULDER**



TCP (5-1b)

**WORK AREA ON SHOULDER**

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

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

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

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

**GENERAL NOTES**

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



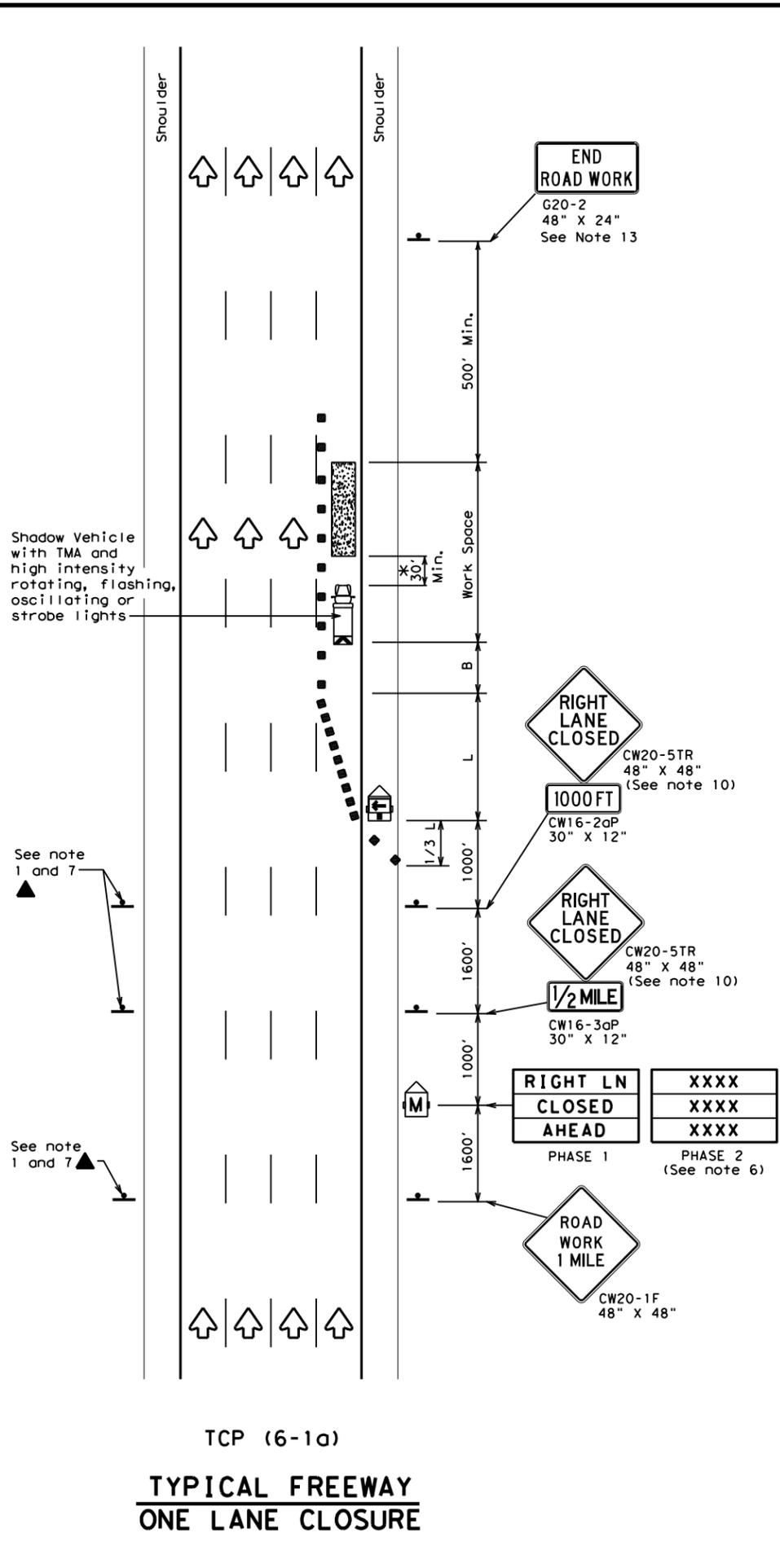
**TRAFFIC CONTROL PLAN  
SHOULDER WORK FOR  
FREEWAYS / EXPRESSWAYS**

**TCP (5-1) - 18**

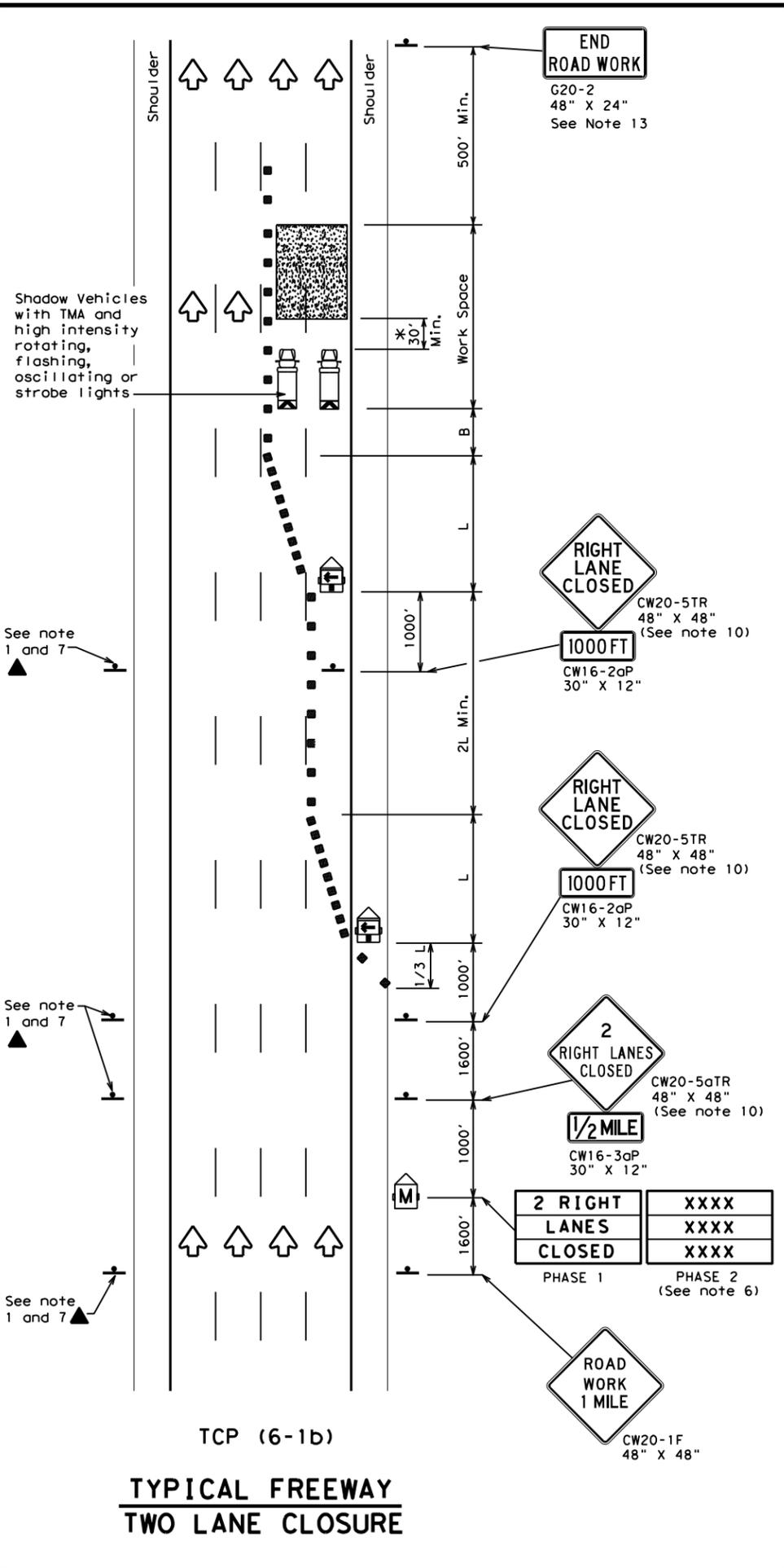
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© TxDOT February 2012	CONT	SECT	JOB	HIGHWAY
REVISIONS	6399	15	001	SH99
2-18	DIST	COUNTY	SHEET NO.	
	BMT	LIBERTY, ETC.	33	

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FILE:



TCP (6-1a)  
**TYPICAL FREEWAY ONE LANE CLOSURE**



TCP (6-1b)  
**TYPICAL FREEWAY TWO LANE CLOSURE**

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

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

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

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

**GENERAL NOTES**

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

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



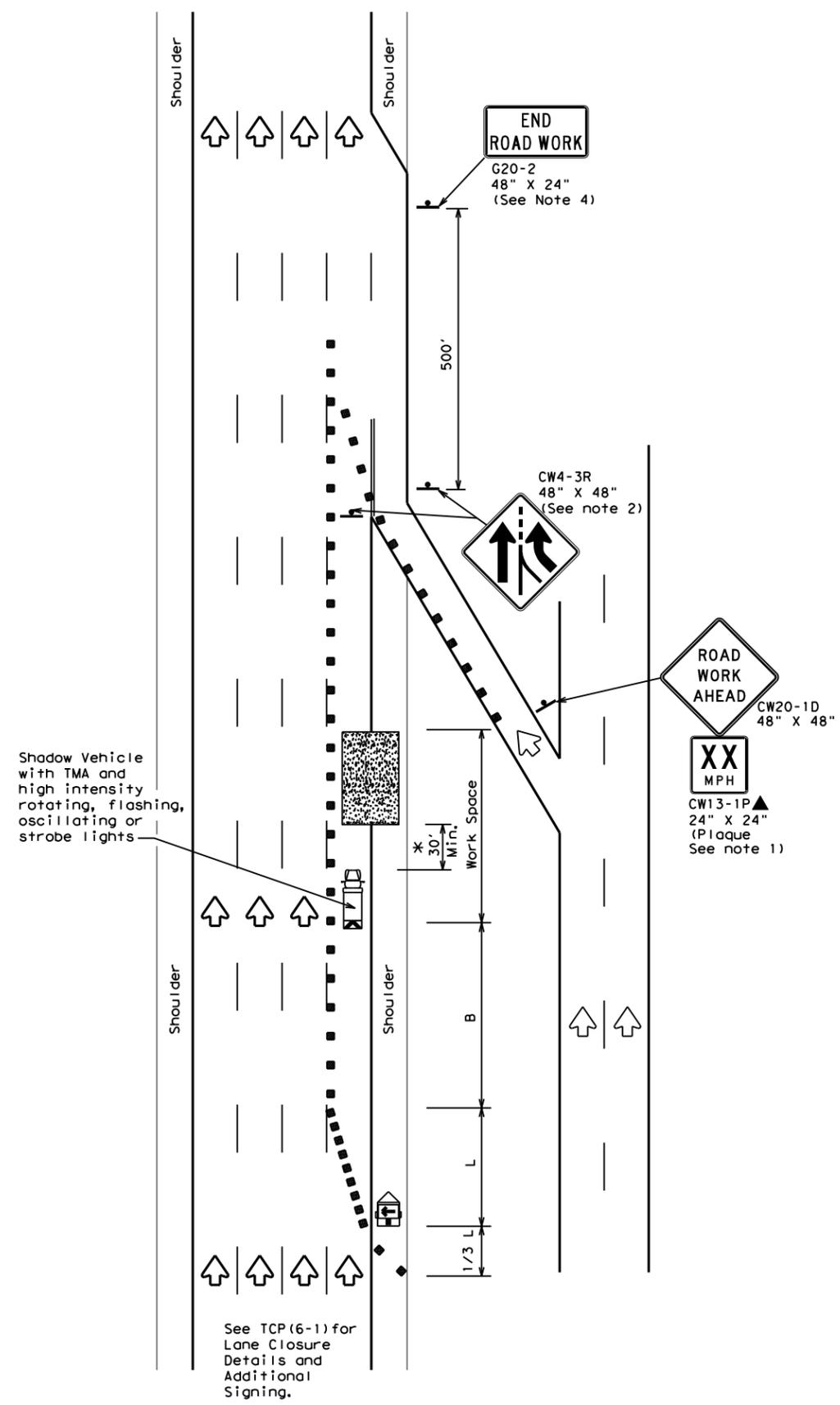
**TRAFFIC CONTROL PLAN  
FREEWAY LANE CLOSURES**

**TCP (6-1) - 12**

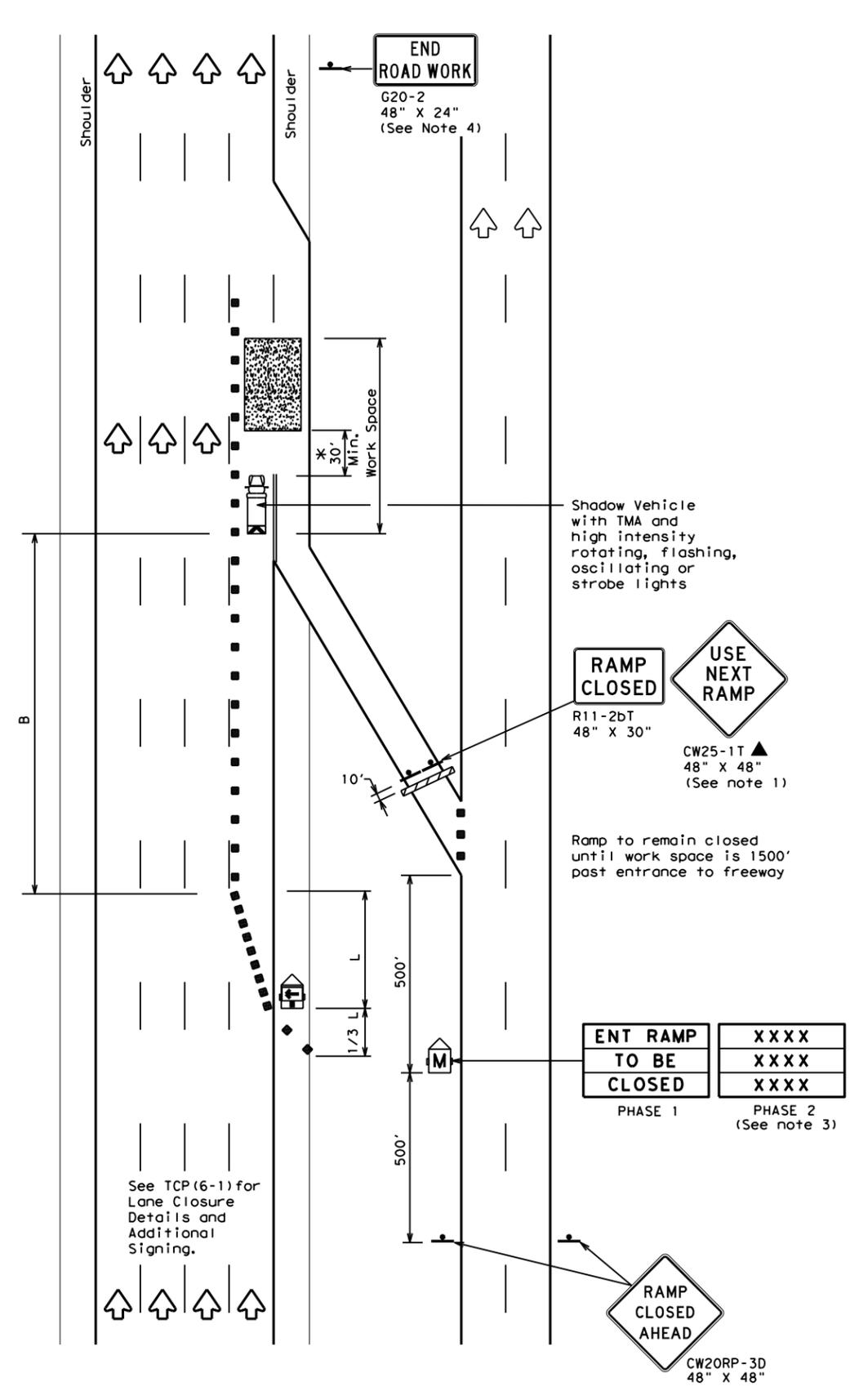
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© TxDOT	February 1998	CONT	SECT	JOB	HIGHWAY				
8-12	REVISIONS	6399	15	001	SH99				
	DIST	COUNTY	SHEET NO.						
	BMT	LIBERTY, ETC.	34						

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FILE:



TCP (6-2a)  
**ENTRANCE RAMP OPEN**  
**WORK WITHIN 500' OF RAMP**



TCP (6-2b)  
**ENTRANCE RAMP CLOSED**

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

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

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

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

**GENERAL NOTES**

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

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

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



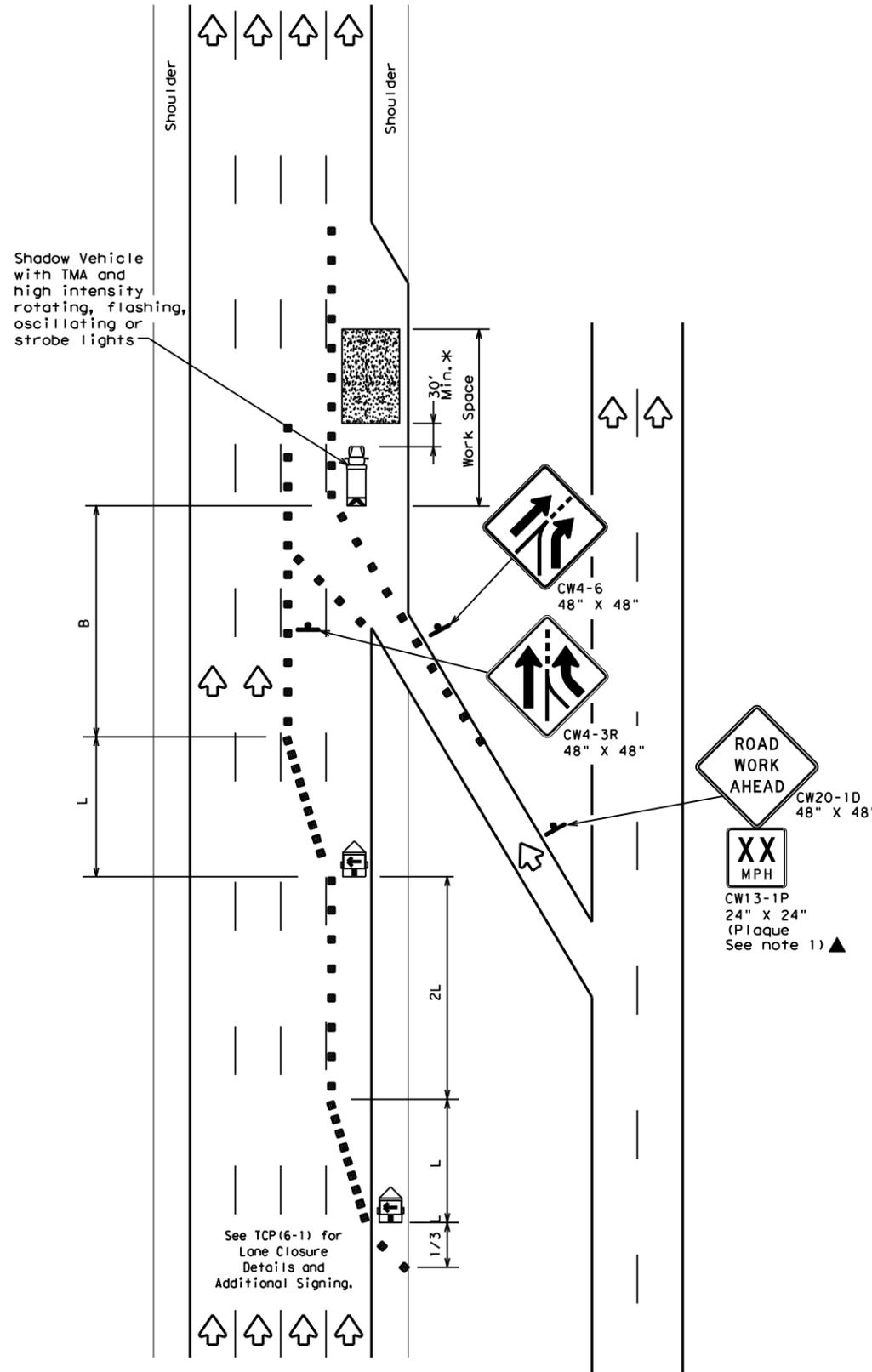
**TRAFFIC CONTROL PLAN**  
**WORK AREA NEAR RAMP**

**TCP (6-2) - 12**

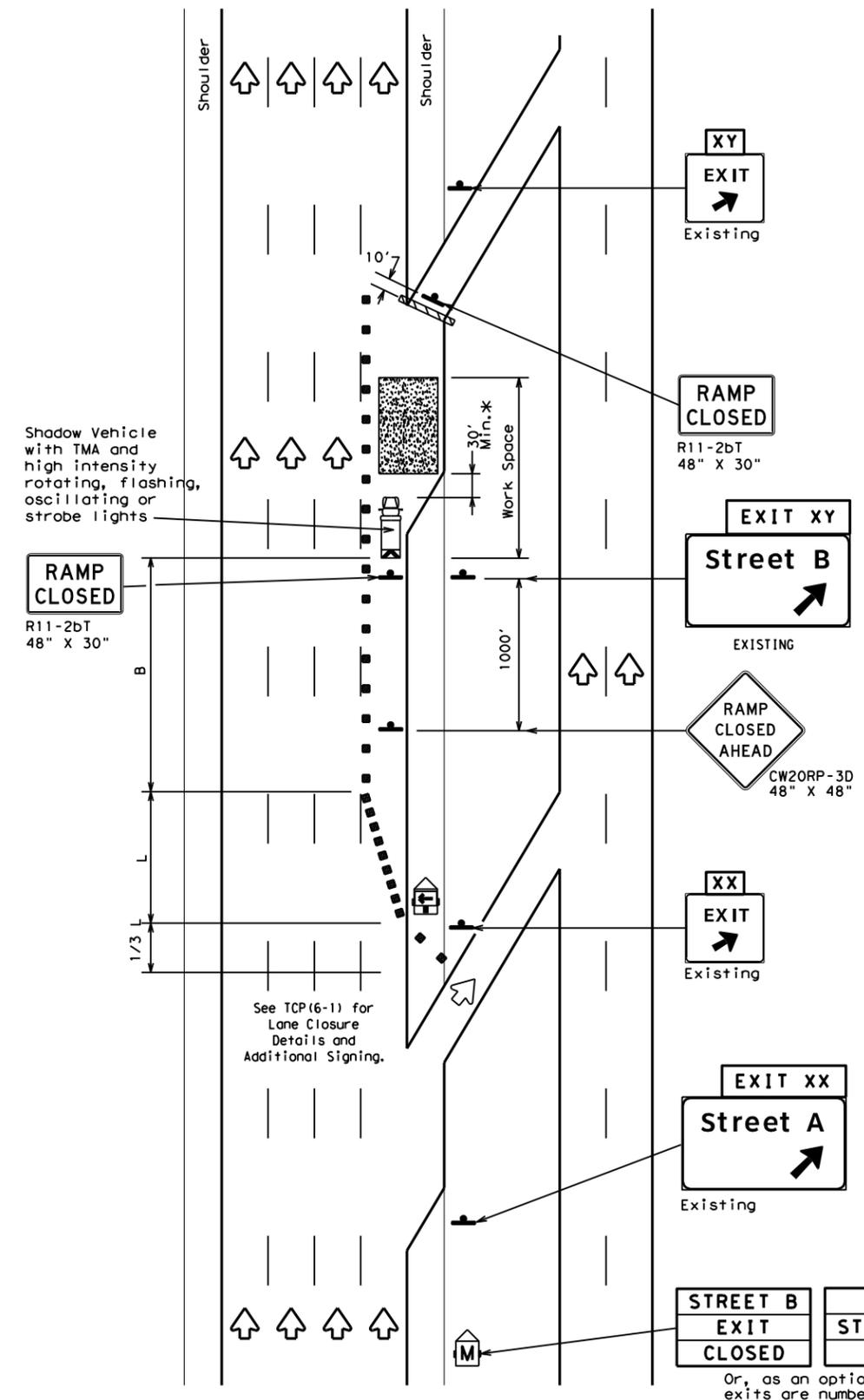
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©TxDOT February 1994	CONT	SECT	JOB	HIGHWAY
REVISIONS	6399	15	001	SH99
1-97 8-98	DIST	COUNTY	SHEET NO.	
4-98 8-12	BMT	LIBERTY, ETC.	35	

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FILE:



TCP (6-3a)  
**ENTRANCE RAMP OPEN**



TCP (6-3b)  
**EXIT RAMP CLOSED**  
**TRAFFIC EXITS PRIOR TO CLOSED RAMP**

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

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

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

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

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

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

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

STREET B EXIT CLOSED	USE STREET A EXIT
EXIT XY CLOSED	USE EXIT XX

Or, as an option when exits are numbered

Place 1 mile (approx.) in advance of Street A exit.

Texas Department of Transportation  
Traffic Operations Division Standard

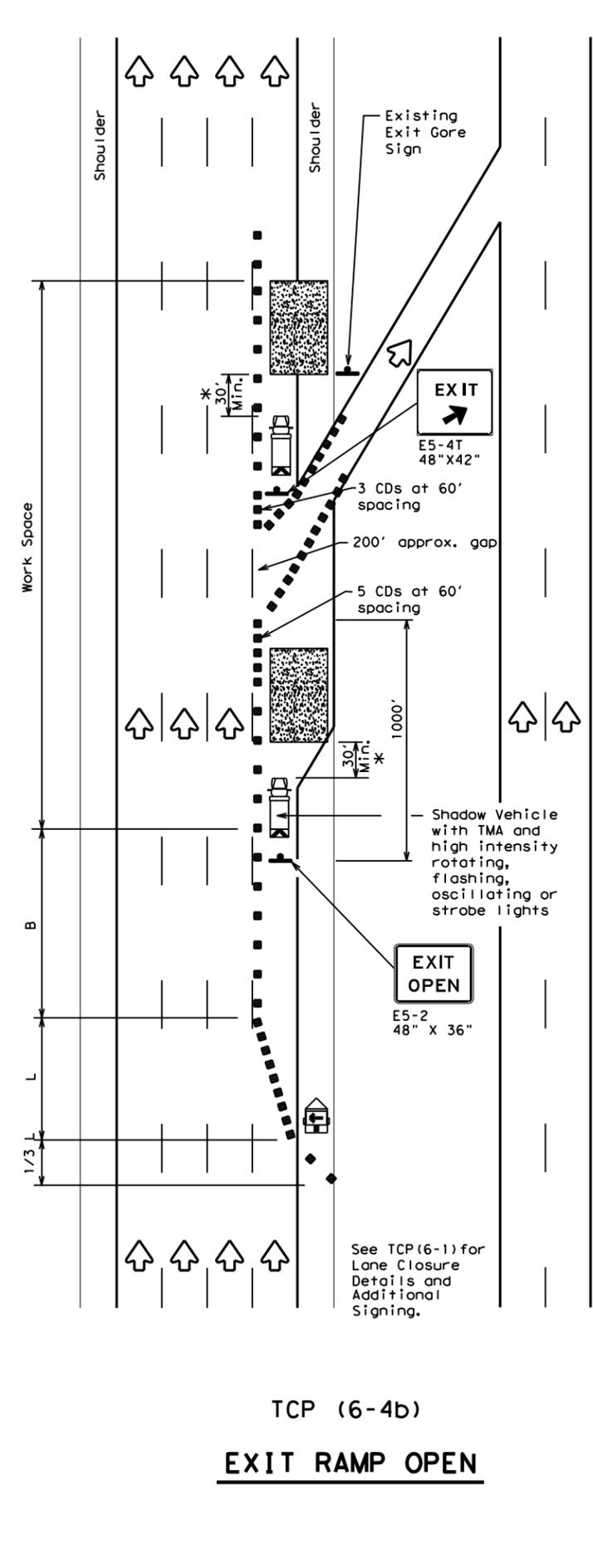
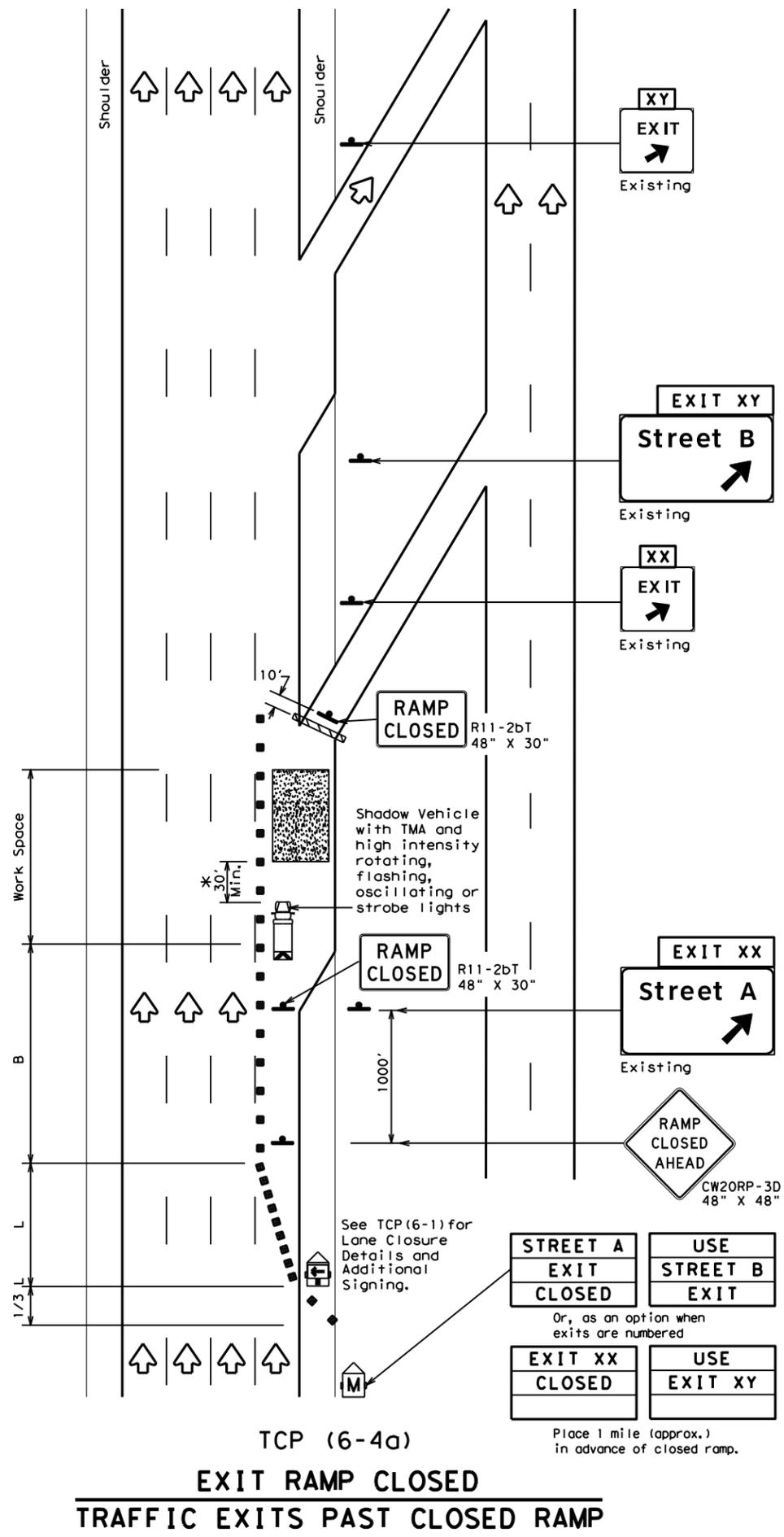
**TRAFFIC CONTROL PLAN  
WORK AREA BEYOND RAMP**

**TCP (6-3) - 12**

FILE: tcp6-3.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CR: TxDOT
©TxDOT February 1994	CONT	SECT	JOB	HIGHWAY
REVISIONS	6399	15	001	SH99
1-97 8-98	DIST	COUNTY	SHEET NO.	
4-98 8-12	BMT	LIBERTY, ETC.	36	

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FILE:



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

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

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

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

**GENERAL NOTES**

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

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

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

Texas Department of Transportation  
Traffic Operations Division Standard

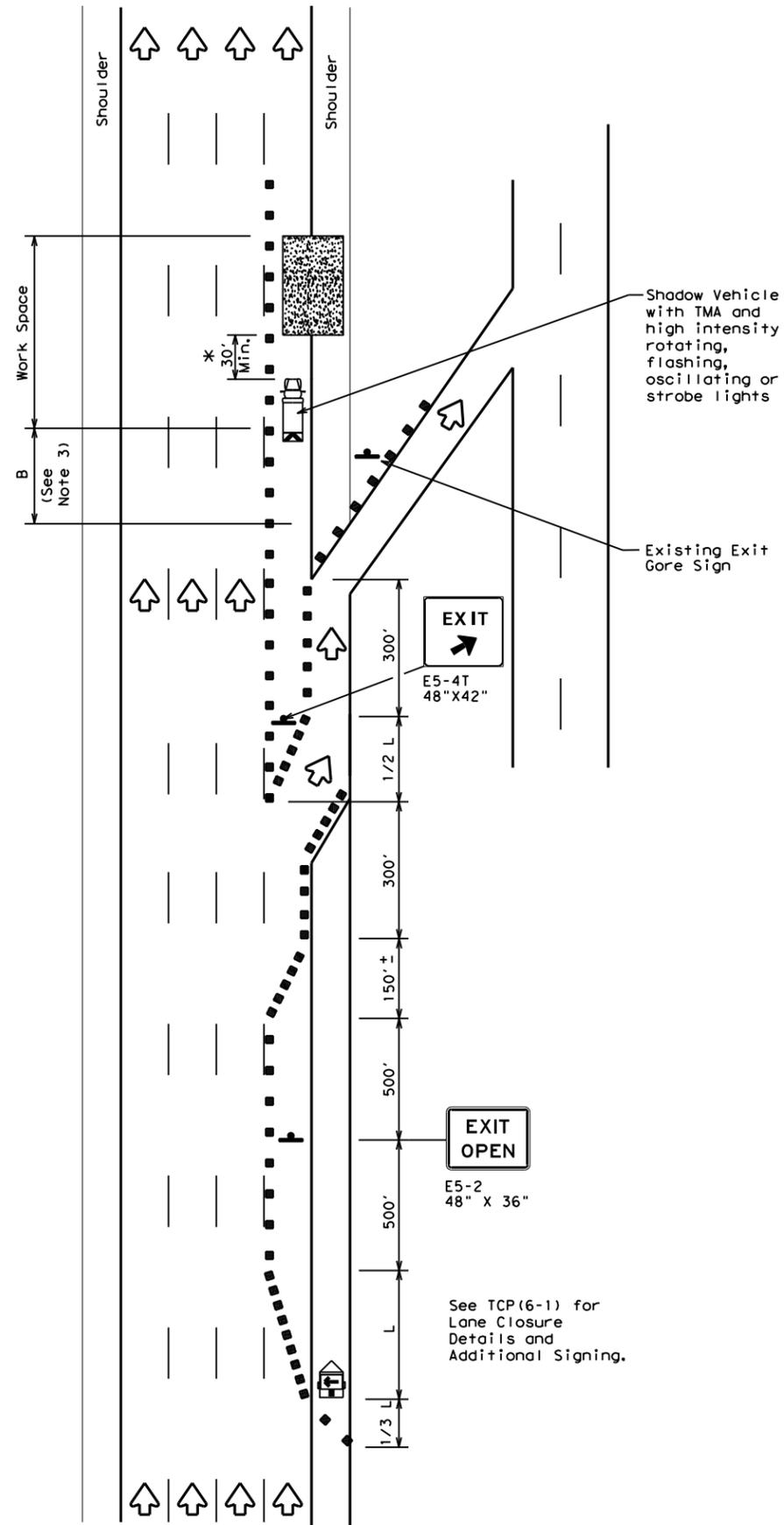
**TRAFFIC CONTROL PLAN**  
**WORK AREA AT EXIT RAMP**

**TCP (6-4) - 12**

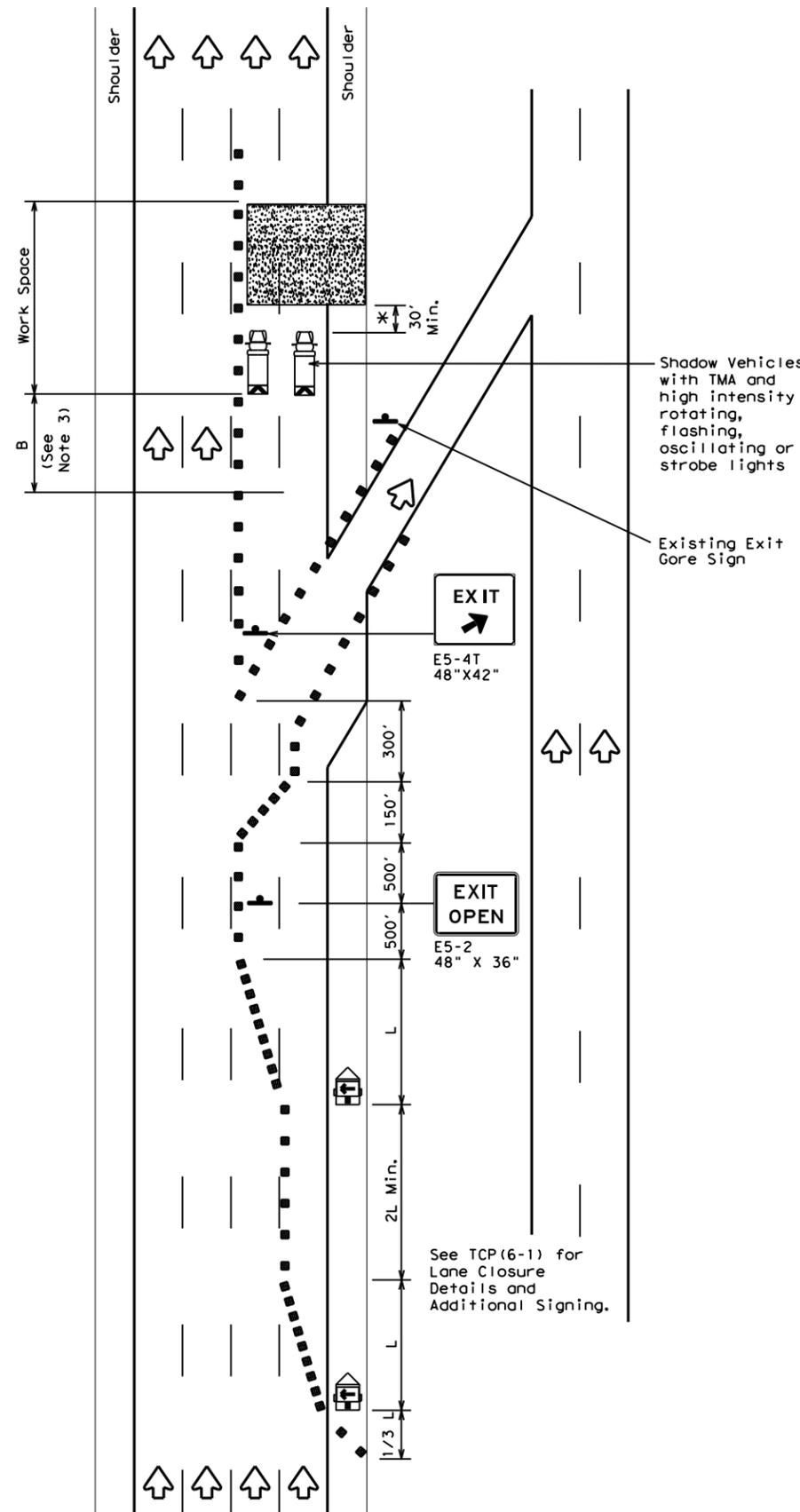
FILE: tcp6-4.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CR: TxDOT
©TxDOT February 1994	CONT	SECT	JOB	HIGHWAY
REVISIONS	6399	15	001	SH99
1-97 8-98	DIST	COUNTY	SHEET NO.	
4-98 8-12	BMT	LIBERTY, ETC.	37	

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DATE: 5/12/2022 4:32:26 PM  
FILE:



TCP (6-5a)  
**EXIT RAMP OPEN**



TCP (6-5b)  
**EXIT RAMP OPEN  
TWO LANE CLOSURE WITHIN  
1500' PAST EXIT RAMP**

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

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

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

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

**GENERAL NOTES**

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

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

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



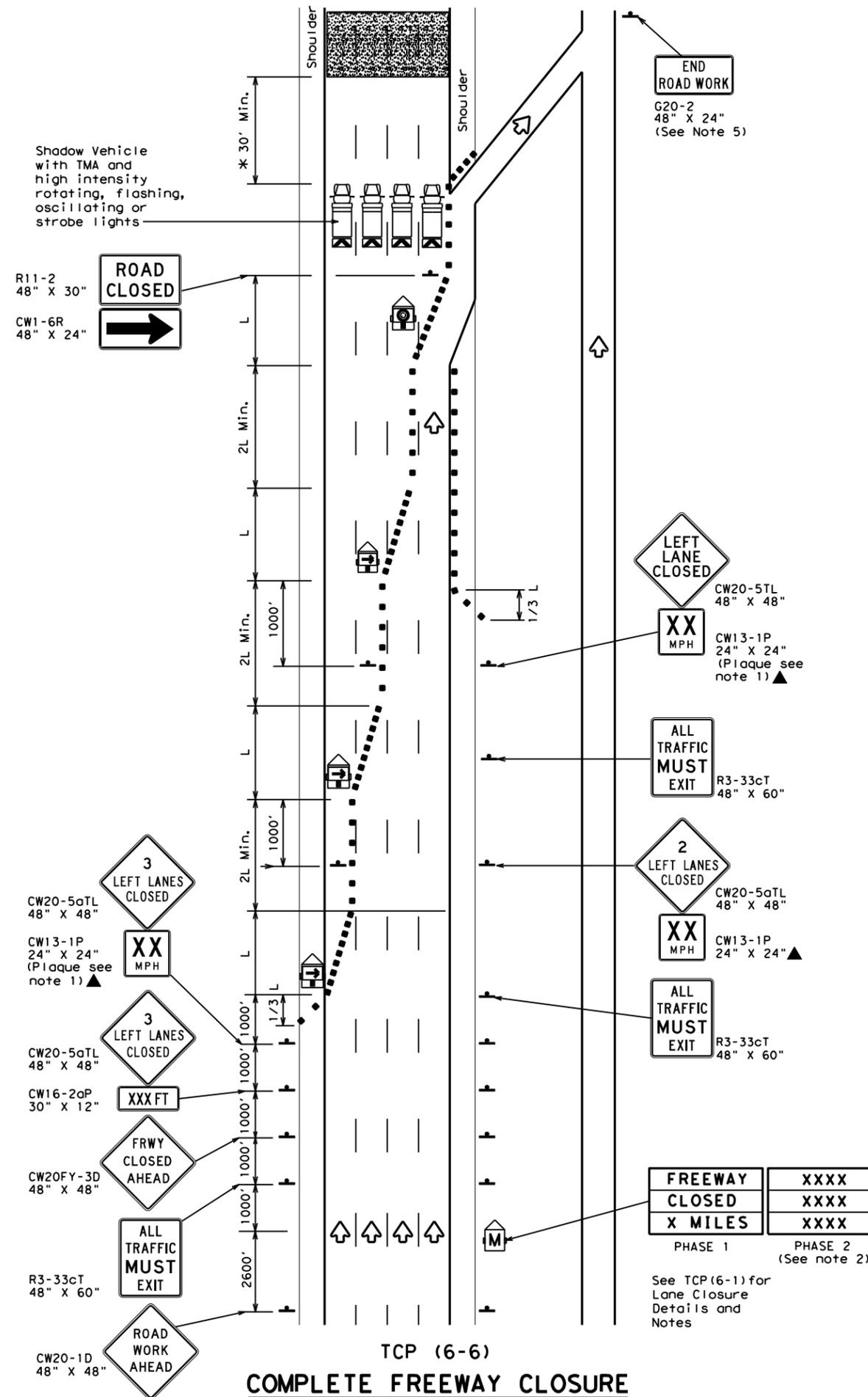
**TRAFFIC CONTROL PLAN  
WORK AREA BEYOND EXIT RAMP**

**TCP (6-5) - 12**

FILE: tcp6-5.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS	6399	15	001	SH99
1-97 8-98	DIST	COUNTY	SHEET NO.	
4-98 8-12	BMT	LIBERTY, ETC.	38	

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DATE: 5/12/2022 4:32:28 PM  
FILE:



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

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

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

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

**GENERAL NOTES**

- All traffic control devices illustrated are REQUIRED. Devices denoted with the triangle symbol may be omitted when stated elsewhere in the plans.
- Phase 2 of the PCMS message should include appropriate information formatted as shown on BC(6), such as "MERGE RIGHT," recommended speed, delay, exit information, or other specific warnings.
- Where queuing is anticipated beyond signing shown, additional PCMS signs, other warning signs, devices or Law Enforcement Officers should be available to warn approaching high speed traffic of the end of the queue, as directed by the Engineer.
- Entrance ramps located from the advance warning area to the exit ramp should be closed whenever possible.
- The END ROAD WORK (G20-2) sign may be omitted when it conflicts with G20-2 signs already in place on the project.

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

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



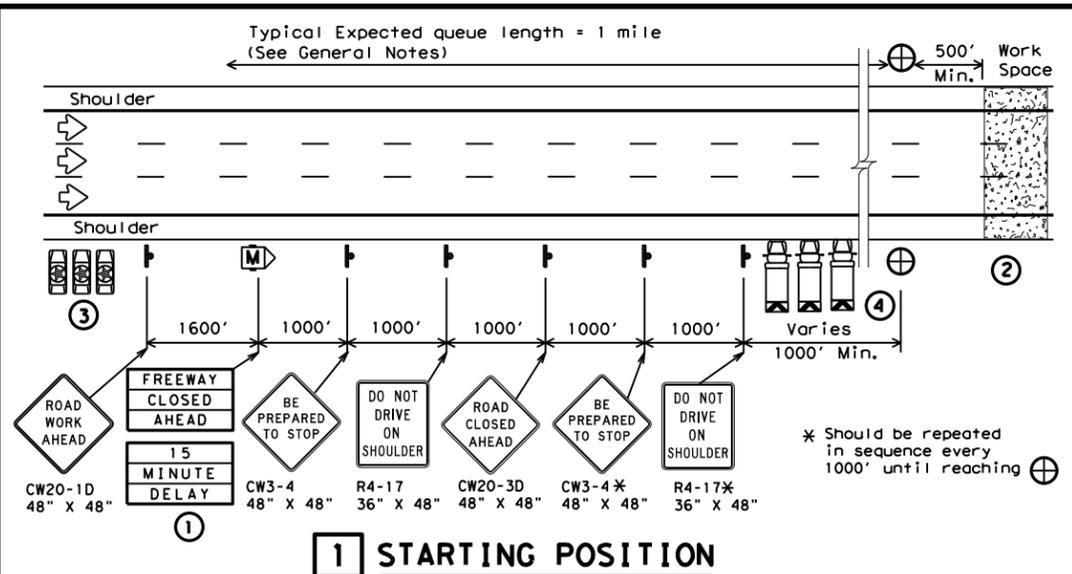
**TRAFFIC CONTROL PLAN  
FREEWAY CLOSURE**

**TCP (6-6) - 12**

FILE: tcp6-6.dgn	DN: TxDOT	CR: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 1994	CONT	SECT	JOB	HIGHWAY
REVISIONS	6399	15	001	SH99
1-97 8-98	DIST	COUNTY	SHEET NO.	
4-98 8-12	BMT	LIBERTY, ETC.	39	

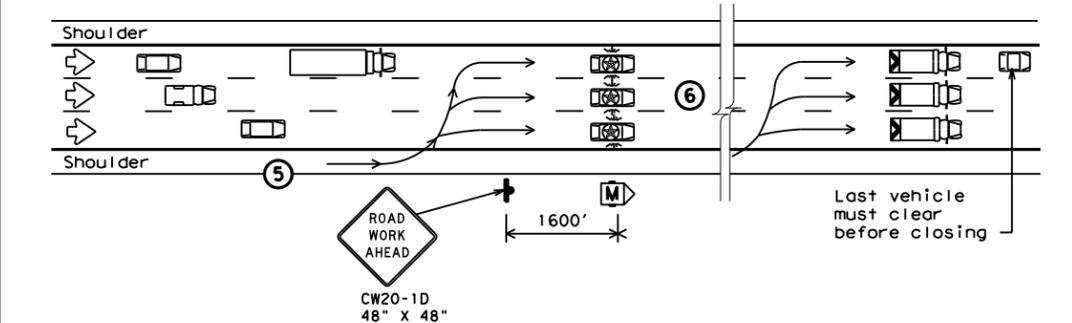
DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

DATE: 5/12/2022 4:32:31 PM  
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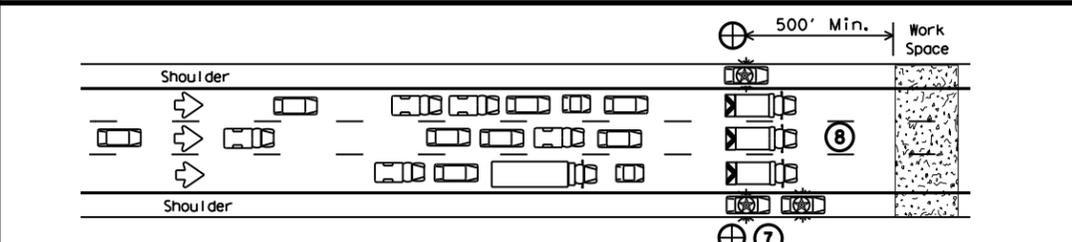
### 1 STARTING POSITION

- ① Traffic control devices should be installed or located near their intended position prior to beginning temporary roadway closure sequence. Duplicate signs should be erected on the median side of the roadway when median width permits. Warning signs should not be placed on the paved shoulders that will be used by the WARNING LEOV, or where movement of the LEOVs or barrier vehicles will be impeded.
- ② Prior to beginning the roadway closure sequence, all equipment, materials, personnel, and other items necessary to complete the work should be gathered near the work area. Entrance ramps located in the area where a queue is expected to build should be closed.
- ③ There should be one LEOV for every lane to be controlled, plus a minimum of one to warn traffic approaching a queue. An additional lead law enforcement officer is desirable to remain with the Engineer's or Contractor's point of contact (POC) during the operation in order to improve communication with all LEOVs involved.
- ④ One barrier vehicle with a Truck Mounted Attenuator and amber or blue and amber high intensity flashing/oscillating/strobe lighting shall be used for each lane to be closed.



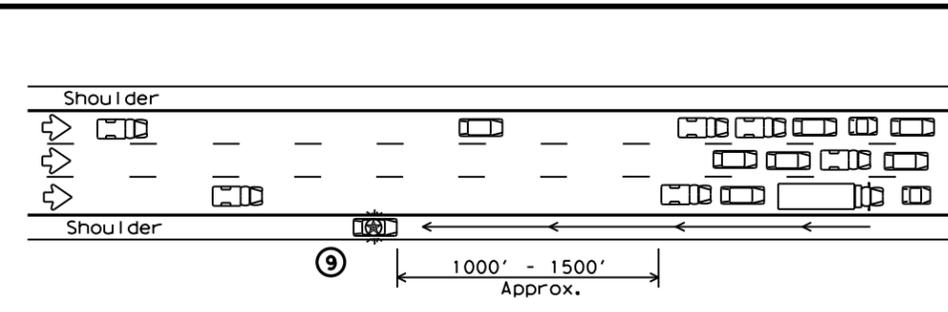
### 2 REDUCING SPEED OPERATION

- ⑤ Starting position of the LEOVs should be in advance of the most distant warning signs.
- ⑥ Once the LEOVs have achieved an abreast blocking formation while traveling toward the CP, emergency lights and headlights should be turned "ON". The LEOVs should maintain formation, not allow traffic to pass, and begin to decelerate. The LEOVs should continue to decelerate, giving the barrier vehicles opportunity to be staged upstream of the work space after traffic has cleared. The LEOVs should then continue to decelerate slowly until bringing traffic to a stop near the barrier vehicles.



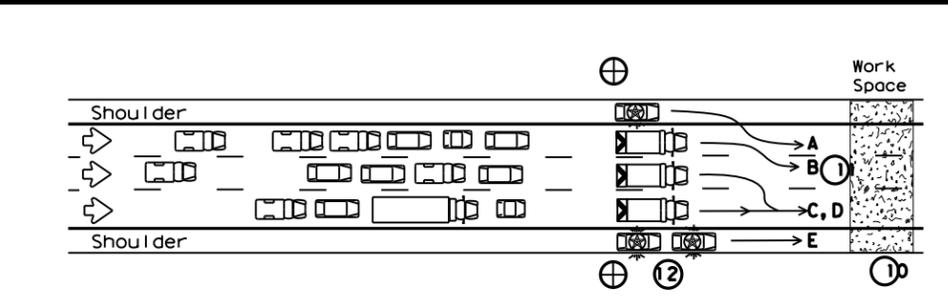
### 3 ALL TRAFFIC STOPPED AT CP

- ⑦ Once traffic is stopped the LEOVs should park on the shoulders with emergency lighting "ON" in order to provide law enforcement presence at the closure and keep shoulders blocked ahead of the work space. They should stay in radio contact with the WARNING LEOV.
- ⑧ The barrier vehicles should be parked, one in each lane, the parking brake set, with the high visibility flashing/oscillating/strobe lighting "ON," and the transmission in gear.



### 4 WARNING THE TRAFFIC QUEUE

- ⑨ The WARNING LEOV should proceed to the right shoulder of the roadway, with emergency lights on approximately 1000' in advance of the traffic queue (stopped traffic) as the queue develops. When determined that limited sight distance situations (crest of hills, sharp roadway curvature, etc.) may occur to motorists approaching the queue, the WARNING LEOV may proceed 1/4 mile or more in advance of the queue.



### 5 RELEASING STOPPED TRAFFIC

- ⑩ All equipment, materials, personnel, and other items should be removed from the roadway and maintain an adequate clear zone.
- ⑪ When the roadway is clear for traffic, the LEOV should proceed forward from the left shoulder followed by the barrier vehicles, from left to right, as shown alphabetically in the plan view.
- ⑫ The LEOV or LEOVs on the right shoulder may remain on the shoulder until satisfied that traffic is moving satisfactorily before merging or proceeding.
- ⑬ LEOVs and barrier vehicles should re-group at their respective starting positions if necessary.

LEGEND			
■	Channelizing Devices	⊕	Control Position (CP)
M	Portable Changeable Message Sign (PCMS)	⊠	Barrier Vehicle with Truck Mounted Attenuator
Ⓣ	Law Enforcement Officer's Vehicle (LEOV)	←	Traffic Flow

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

### GENERAL NOTES

1. All traffic control devices shall conform with the latest edition of the Texas Manual on Uniform Traffic Control Devices (TMUTCD). Additional guidelines for traffic control devices may be found in the TMUTCD. Signs conflicting with the roadway closure sequence should be completely removed or covered. Additional traffic control devices may be required for closure of access roads, cross streets, exit and entrance ramps as directed by the Engineer.
2. Law enforcement officers and all workers involved should review and understand all procedures before the roadway closure sequence begins. Pre-work meetings may be held for this purpose. Local emergency services and media should have advance notification of roadway closure, expected dates and approximate times of closures.
3. Law enforcement officers shall be in uniform and have jurisdiction in the locale of the work area. An additional WARNING Law Enforcement Officer's Vehicle (LEOV) may be used on the median side of the roadway where median shoulder width permits (See sequence #9).
4. The roadway closure should be during off-peak hours, as shown in the plans, or as directed by the Engineer.
5. Work should be limited to approximately 15 minutes maximum duration unless otherwise directed by the Engineer based on existing roadway conditions. If the work is not complete within 15 minutes, or if the end of the traffic queue extends past the most distant advance warning signs, the work area should be cleared of all equipment, materials, personnel, and other items, and the roadway reopened. When the queue has dissipated and the traffic flow appears normal the roadway closure sequence may be repeated.
6. For traffic volumes greater than 1000 Passenger Cars Per Hour Per Lane (PCPHPL), or for roadway closures that exceed 15 minutes, see details elsewhere in the plan.
7. If traffic queues beyond the advance warning signs during one road closure sequence, the advance warning should be extended prior to repeating the road closure sequence. When possible, PCMS signs should be located in advance of the last available exit prior to the closure to allow motorists the choice of an alternate route.

THIS PLAN IS INTENDED TO BE USED AT LOCATIONS/TIMES WHEN TRAFFIC VOLUMES ARE LESS THAN 1000 PASSENGER CARS PER HOUR PER LANE.

**Texas Department of Transportation**  
Traffic Operations Division Standard

## TRAFFIC CONTROL PLAN

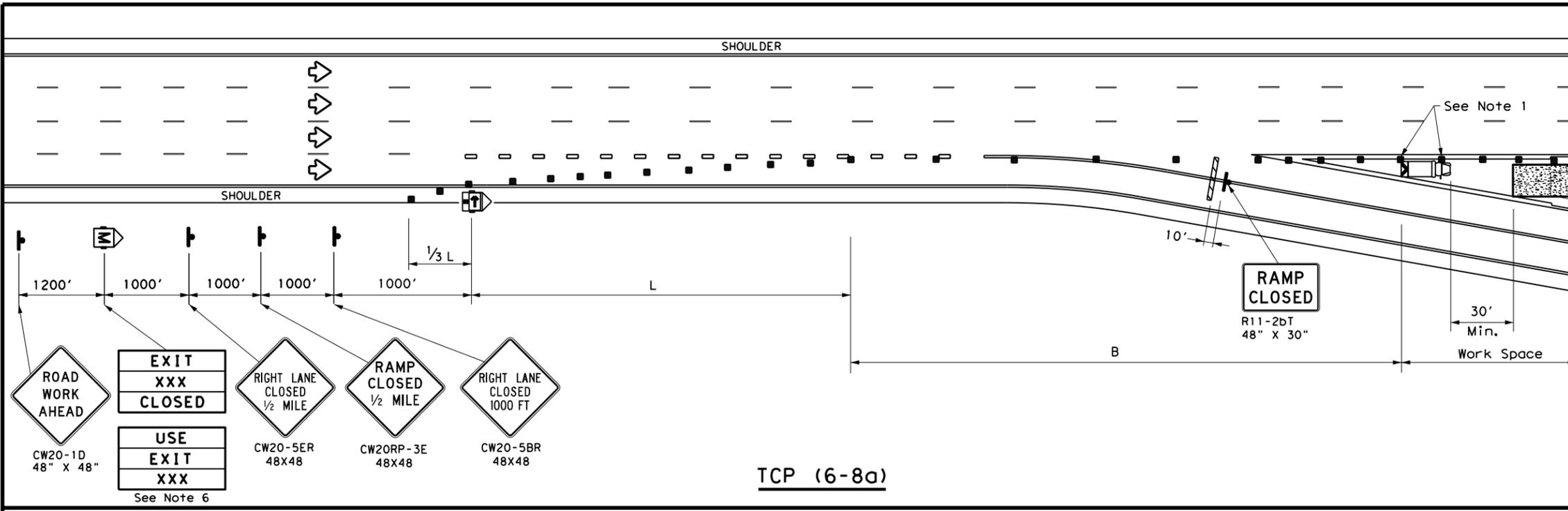
### SHORT DURATION FREEWAY CLOSURE SEQUENCE

# TCP (6-7) - 12

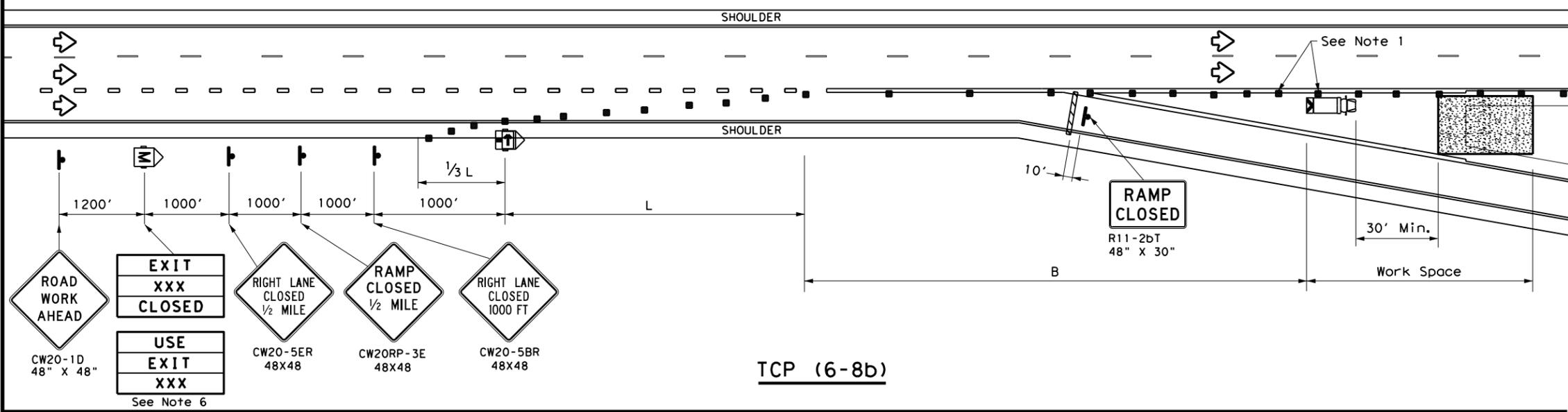
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©TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS	6399	15	001	SH99
1-97 8-12	DIST	COUNTY	SHEET NO.	
4-98	BMT	LIBERTY, ETC.	40	

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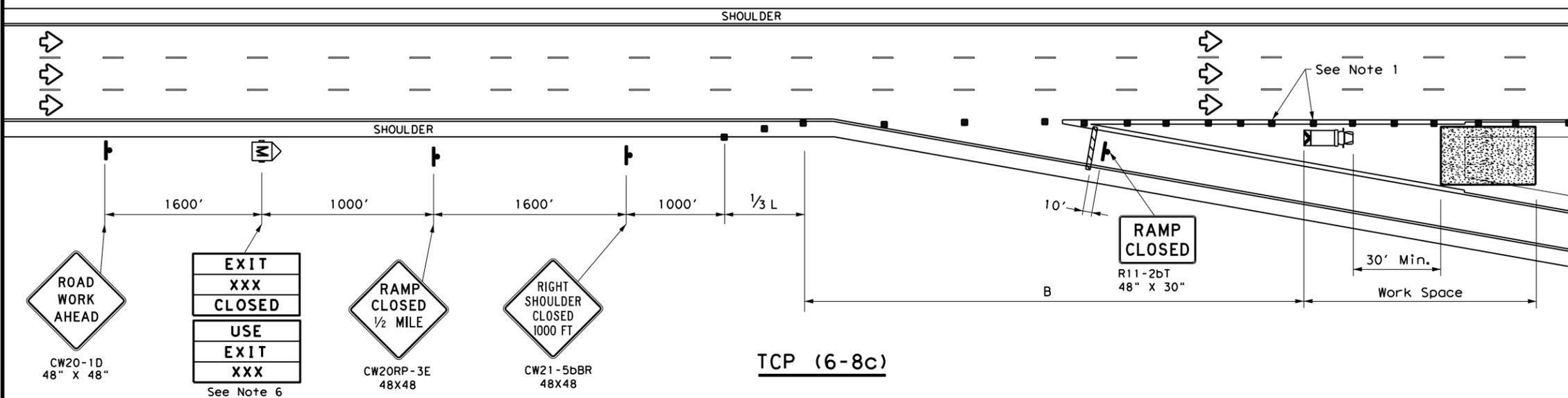
DATE: 5/12/2022 4:32:33 PM  
FILE:



TCP (6-8a)



TCP (6-8b)



TCP (6-8c)

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

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

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

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

- GENERAL NOTES**
- Place channelizing devices in the gore at 20' spacing.
  - See the Standard Highway Sign Design for Texas (SHSD) for sign details.
  - The PCMS may be omitted when a permanent DMS sign is available in an appropriate location to display a similar message as called for on the PCMS.
  - When it is determined that a through lane should be closed in addition to the exit ramp, refer to TCP(6-4) for traffic control details.
  - Truck mounted attenuator is required.
  - The PCMS may be omitted if replaced with a "RAMP CLOSED" AHEAD (CW20RP-3D) Sign.
  - Roadway ADT should be greater than 10,000.

Texas Department of Transportation  
Traffic Operations Division Standard

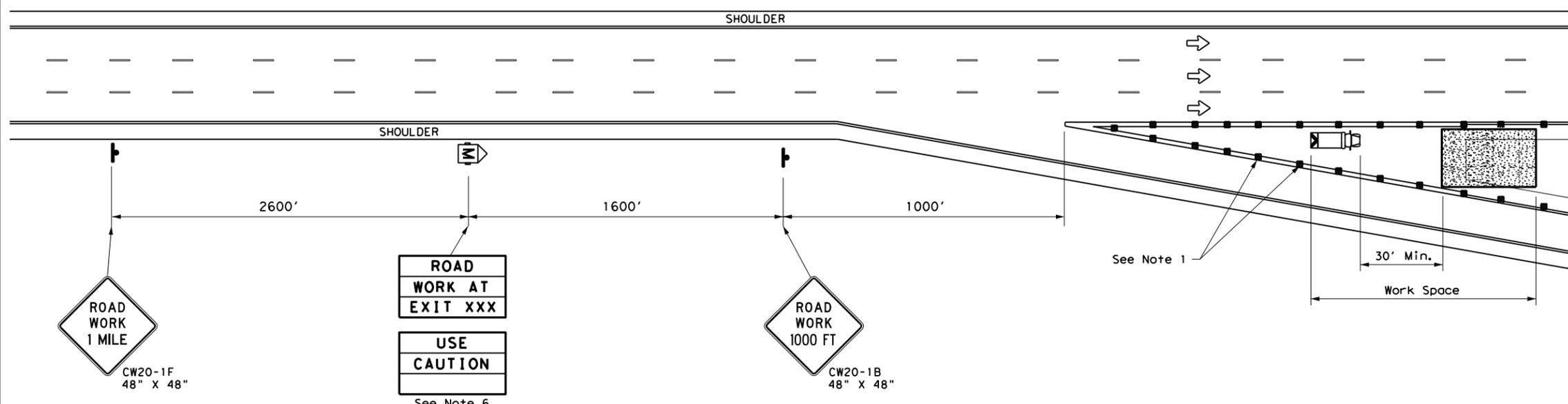
**WORK IN EXIT GORE FOR ADT GREATER THAN 10,000**

**TCP (6-8) - 14**

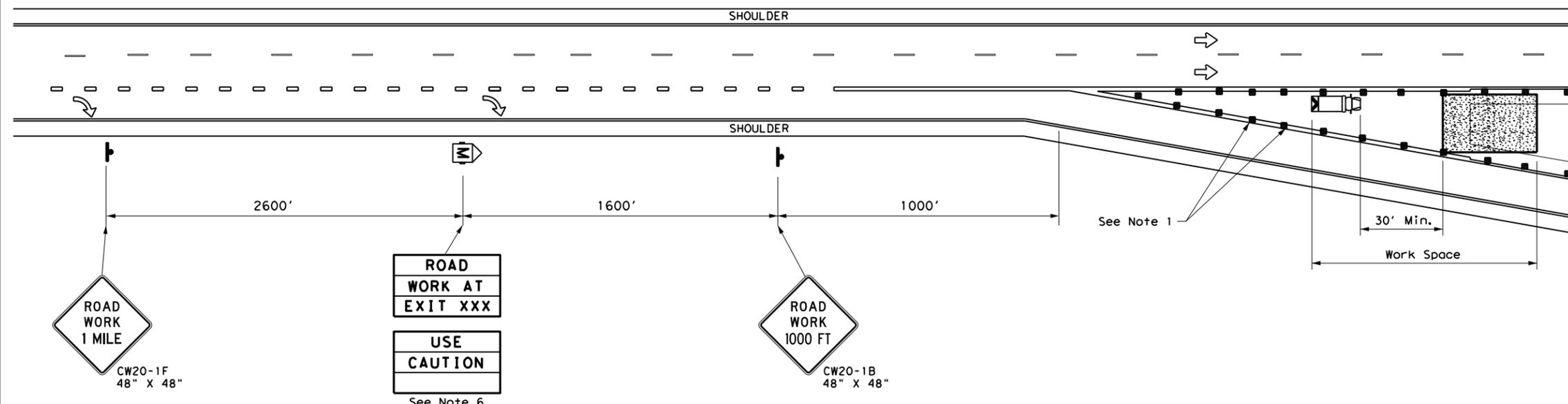
FILE: tcp6-8.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2014	CONT	SECT	JOB	HIGHWAY
REVISIONS	6399	15	001	SH99
DIST	COUNTY		SHEET NO.	
BMT	LIBERTY, ETC.		41	

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FILE:



TCP (6-9a)



TCP (6-9b)

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

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

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

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

- GENERAL NOTES**
- Place channelizing devices in the gore at 20' spacing.
  - See the Standard Highway Sign Design for Texas (SHSD) for sign details.
  - The PCMS may be omitted when a permanent DMS sign is available in an appropriate location to display a similar message as called for on the PCMS.
  - When it is determined that a through lane should be closed in addition to the exit ramp, refer to TCP (6-4) and TCP (6-8) for traffic control details.
  - Truck mounted attenuators are required.
  - The PCMS may be omitted if replaced with a "ROAD WORK 1/2 MILE" (CW20-1E).
  - Roadway ADT should be less than 10,000.



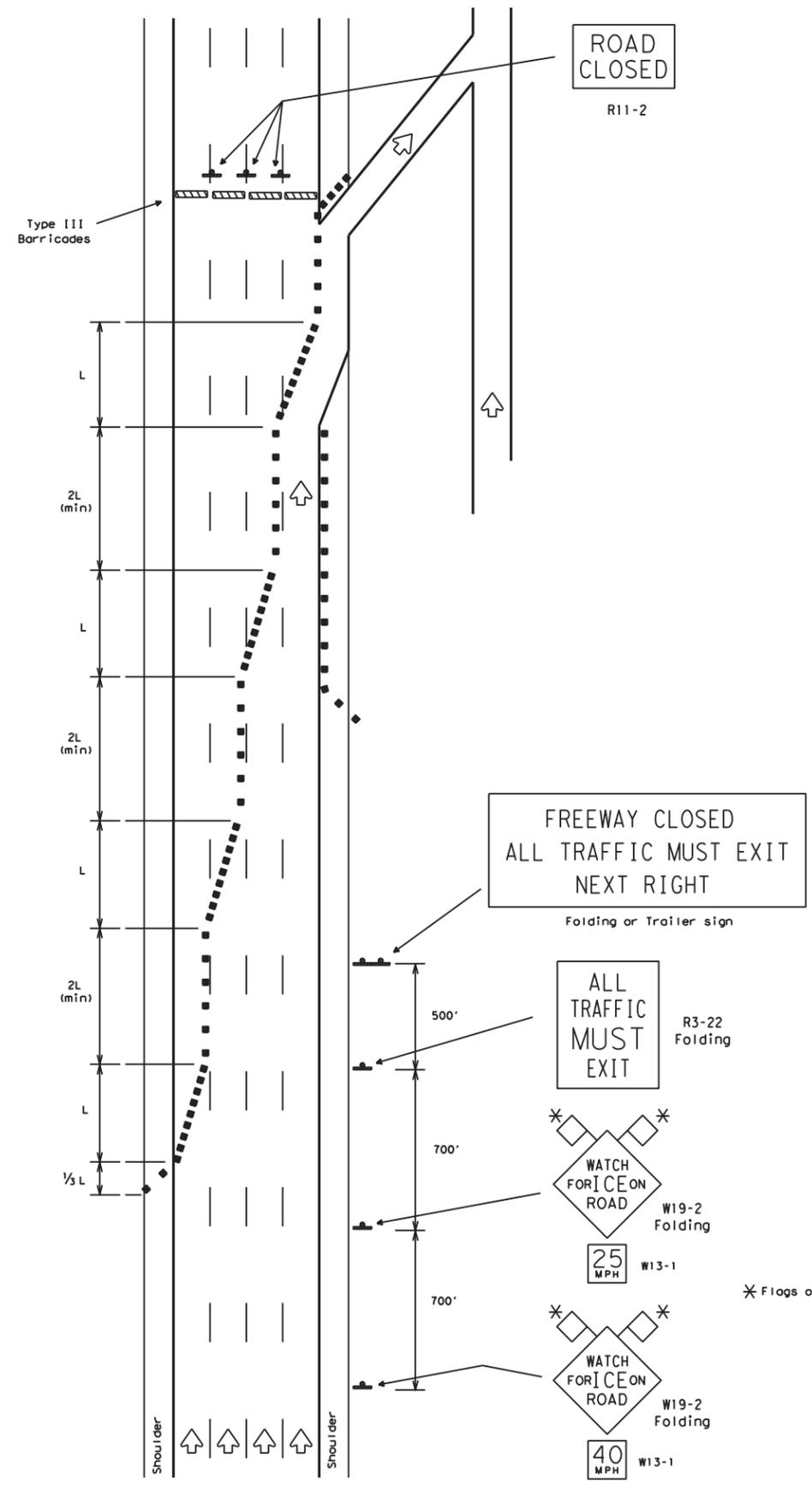
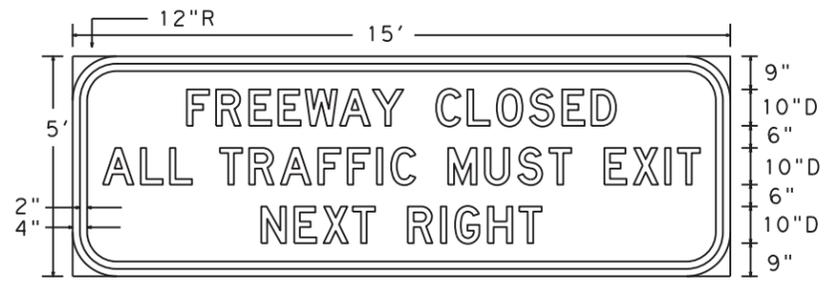
**WORK IN EXIT GORE FOR ADT LESS THAN 10,000**

**TCP (6-9) - 14**

FILE: tcp6-9.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT February 2014	CONT	SECT	JOB	HIGHWAY
REVISIONS	6399	15	001	SH99
DIST	COUNTY	SHEET NO.		
BMT	LIBERTY, ETC.	42		

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STIME:  
\$DATE:  
\$FILES:



Complete Road Closure

- LEGEND
- Type III Barricade
  - Channelizing Devices
  - Flag
  - Heavy Work Vehicle
  - Truck Mounted Attenuator
  - Trailer Mounted Flashing Arrow Panel (arrow mode)
  - Portable Changeable Message Sign
  - Trailer Mounted Flashing Arrow Panel (caution mode)
  - Flagger
  - Sign Post

Posted Speed	Formula	Minimum Desirable Taper Lengths **			Suggested Maximum Spacing of Device	
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent
30	$L = \frac{WS^2}{60}$	150'	165'	180'	30'	60' - 75'
35		205'	225'	245'	35'	70' - 90'
40		265'	295'	320'	40'	80' - 100'
45	L=WS	450'	495'	540'	45'	90' - 110'
50		500'	550'	600'	50'	100' - 125'
55		550'	605'	660'	55'	110' - 140'
60		600'	660'	720'	60'	120' - 150'
65		650'	715'	780'	65'	130' - 165'
70		700'	770'	840'	70'	140' - 175'

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

GENERAL NOTES:

- Channelizing devices may be cones, drums or combination thereof. Devices shall be reflectorized for nighttime usage.
- Emergency conditions and the necessity of the freeway's closure as quickly as possible allows the Engineer to authorize reduced length tapers and tangents of channelizing devices.

ENGINEER SEAL

Sign: \_\_\_\_\_

Date: 07-12-2022

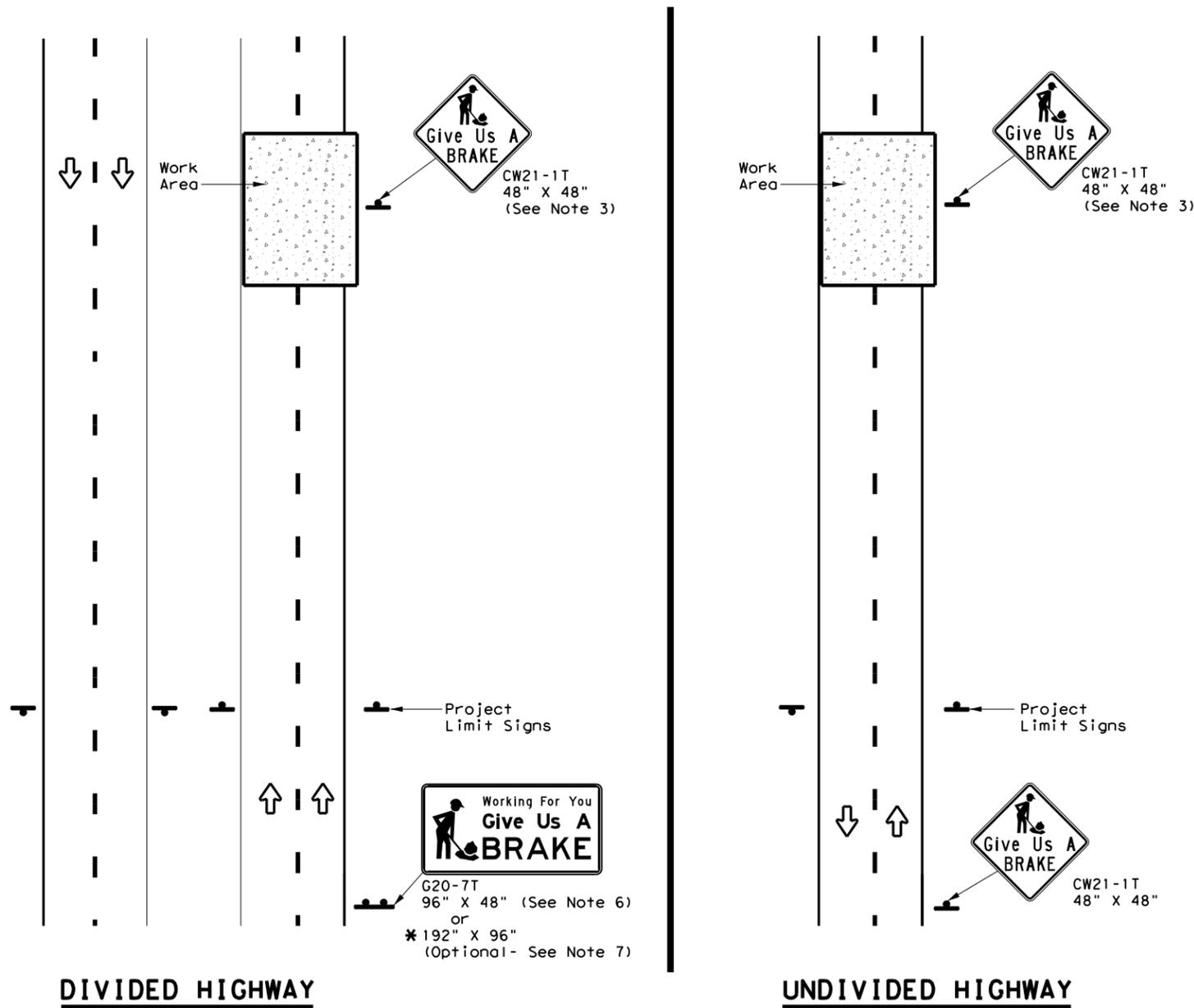
**Texas Department of Transportation**  
Traffic Operations Division

**TRAFFIC CONTROL PLAN  
EMERGENCY ROAD CLOSURE  
(ICE CONDITIONS)**

© TxDOT October 1997		DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
REVISIONS					
CONT	SECT	JOB	HIGHWAY		
6399	15	001	SH99		
DIST		COUNTY	SHEET NO.		
BMT		LIBERTY, ETC.	43		

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SIGNS ARE SHOWN FOR ONE DIRECTION OF TRAVEL

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

SUMMARY OF LARGE SIGNS

BACKGROUND COLOR	SIGN DESIGNATION	SIGN	SIGN DIMENSIONS	REFLECTIVE SHEETING	SQ FT	GALVANIZED STRUCTURAL STEEL		DRILLED SHAFT
						Size	(LF)	
						①	②	24" DIA. (LF)
Orange	G20-7T		96" X 48"	Type B <sub>FL</sub> or C <sub>FL</sub>	32	▲	▲	▲
Orange	G20-7T		192" X 96"	Type B <sub>FL</sub> or C <sub>FL</sub>	128	W8x18	16 17	12

▲ See Note 6 Below

LEGEND	
	Sign
	Large Sign
	Traffic Flow

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

COLOR	USAGE	SHEETING MATERIAL
ORANGE	BACKGROUND	TYPE B <sub>FL</sub> OR TYPE C <sub>FL</sub>
BLACK	LEGEND & BORDERS	NON-REFLECTIVE ACRYLIC FILM

GENERAL NOTES

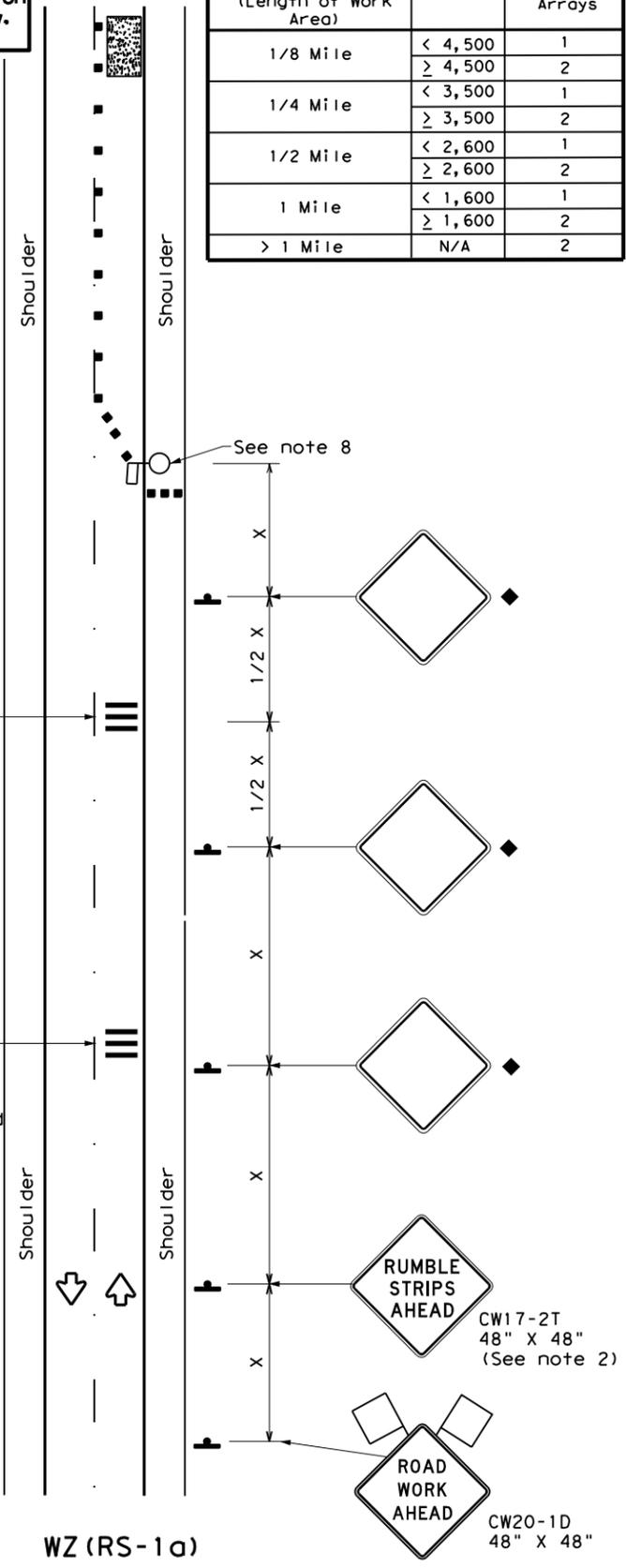
- See BC and SMD sheets for additional sign support details.
- Sign locations shall be approved by the Engineer.
- For projects more than two miles in length, Give Us a BRAKE signs should be repeated halfway through the project. The Give Us a Brake (CW21-1T) may be used for this purpose.
- Work zone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

				Traffic Operations Division Standard	
<b>WORK ZONE "GIVE US A BRAKE" SIGNS</b>					
<b>WZ (BRK) - 13</b>					
FILE:	wzbrk-13.dgn	DN:	TxDOT	CK:	TxDOT
©TxDOT	August 1995	CONT	SECT	JOB	HIGHWAY
REVISIONS		6399	15	001	SH99
6-96	5-98	7-13	DIST	COUNTY	SHEET NO.
8-96	3-03		BMT	LIBERTY, ETC.	44

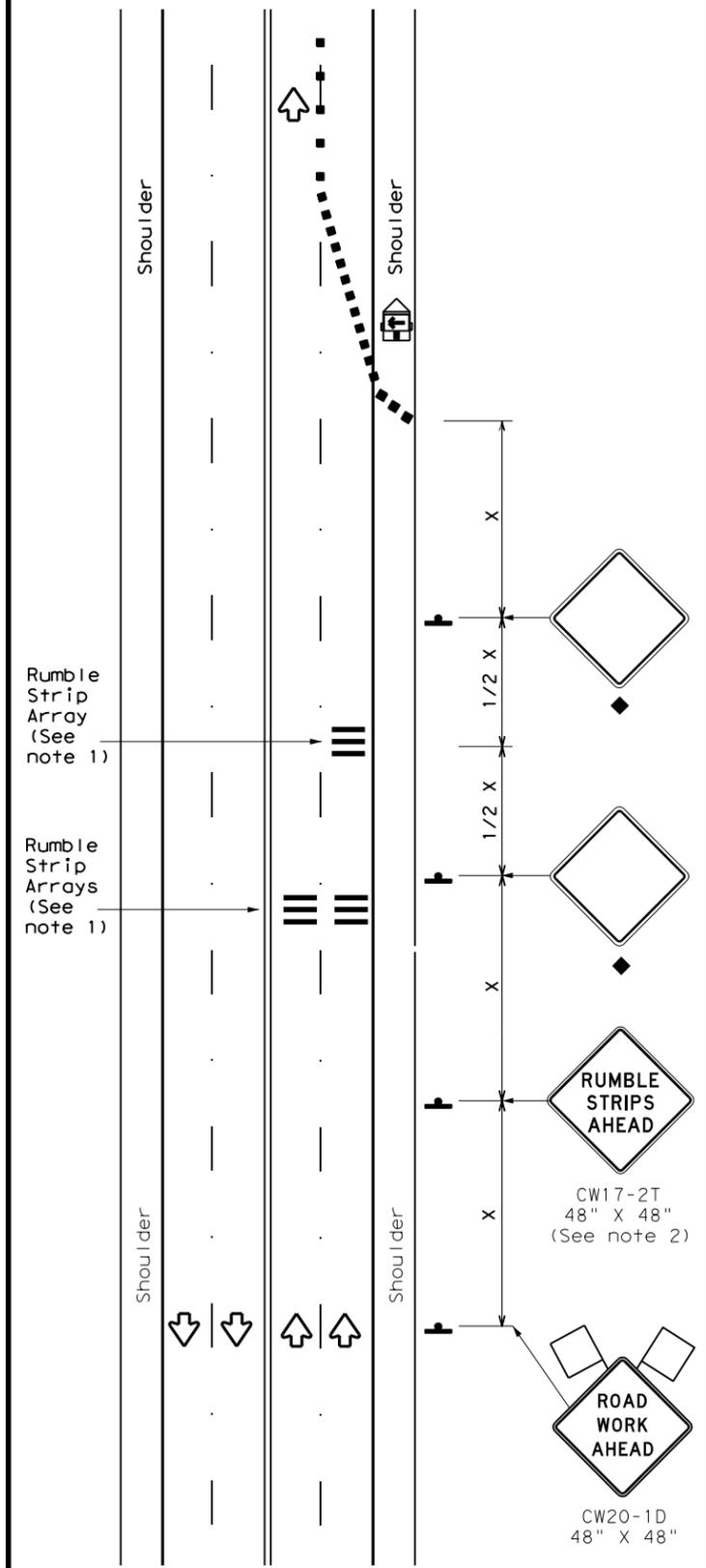
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Warning sign and rumble strip sequence in opposite direction is same as below.

Flagger to Flagger (Length of Work Area)	ADT	# of Rumble Strip Arrays
1/8 Mile	< 4,500	1
	≥ 4,500	2
1/4 Mile	< 3,500	1
	≥ 3,500	2
1/2 Mile	< 2,600	1
	≥ 2,600	2
1 Mile	< 1,600	1
	≥ 1,600	2
> 1 Mile	N/A	2



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



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

**GENERAL NOTES**

- Each Rumble Strip Array should consist of three rumble strips spaced center to center at the spacing shown in Table 2, placed transverse across the lane at locations shown.
- The CW17-2T "RUMBLE STRIPS AHEAD" sign should be located after the CW20-1D "ROAD WORK AHEAD" sign and spaced as shown. If traffic is observed to be queuing, or is expected to queue beyond the Rumble Strips, the CW17-2T sign and the first Rumble Strip Array may be located upstream of the CW20-1D sign as necessary to provide needed warning.
- Temporary Rumble Strips will be considered subsidiary to Item 502, and shall be a product listed on the Compliant Work Zone Traffic Control Devices.
- Remove Temporary Rumble Strips before removing the advanced warning signs.
- Temporary Rumble Strips should not be used on horizontal curves, loose gravel, soft or bleeding asphalt, heavily rutted pavements or unpaved surfaces.
- Temporary Rumble Strips shall be installed and maintained as per manufacturer's recommendations.
- This standard sheet shall be used in conjunction with other appropriate TCP standard, TMUTCD typical application or project specific detail for the project.
- The one-lane two-way application may utilize a flagger, an Automated Flagger Assistance Device (AFAD) or a Portable Traffic Signal (PTS).
- Replace defective Temporary Rumble Strips as directed by the Engineer.
- Temporary Rumble Strips may be used on freeways or expressways based on engineering judgment and written direction from the Engineer.

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

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

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

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

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

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

Texas Department of Transportation  
 Traffic Safety Division Standard

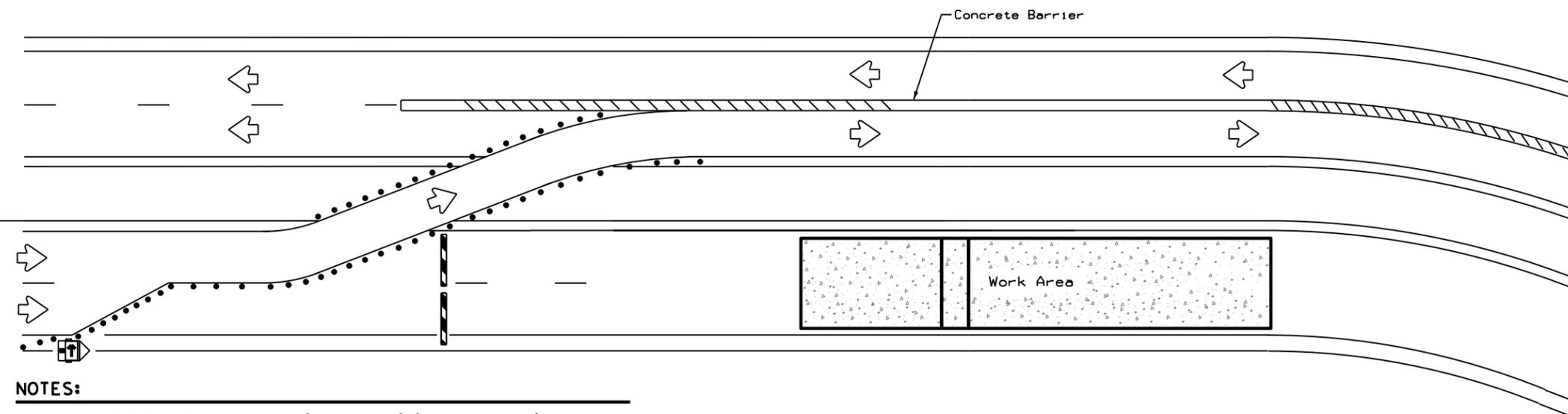
## TEMPORARY RUMBLE STRIPS

### WZ (RS) - 22

FILE: wzrs22.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT November 2012	CONT	SECT	JOB	HIGHWAY
REVISIONS	6399	15	001	SH99
2-14 1-22	DIST	COUNTY	SHEET NO.	
4-16	BMT	LIBERTY, ETC.	45	

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DATE: 5/12/2022 4:33:09 PM  
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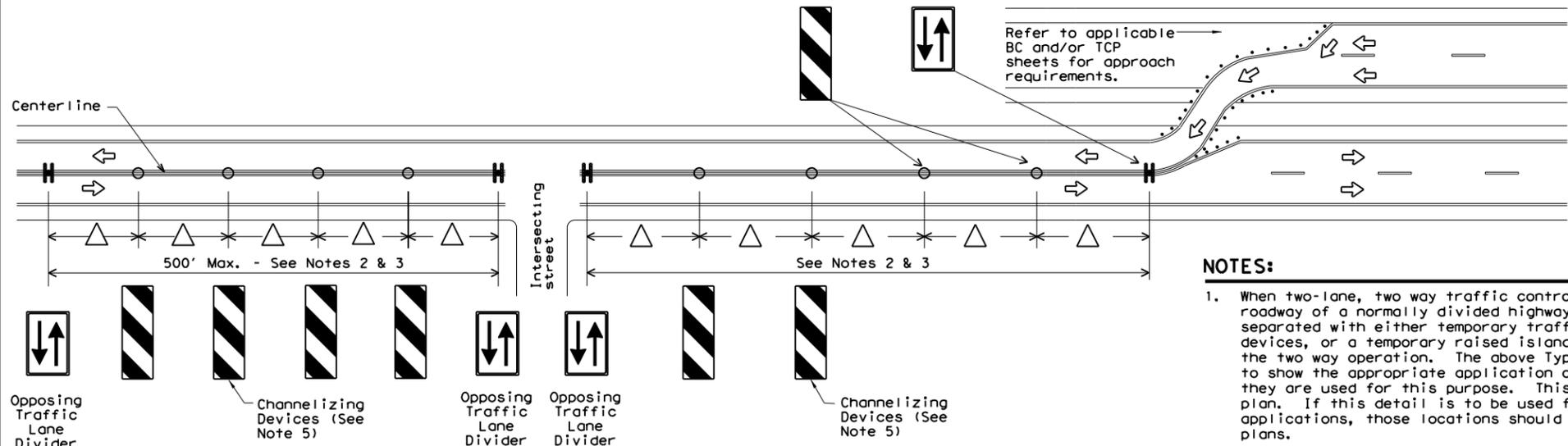
LEGEND	
	Type 3 Barricade
	Channelizing Devices
	Trailer Mounted Flashing Arrow Board
	Sign
	Safety glare screen

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

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

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

### BARRIER DELINEATION WITH MODULAR GLARE SCREENS



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

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

		Traffic Operations Division Standard	
<b>TRAFFIC CONTROL PLAN TYPICAL DETAILS</b>			
<b>WZ(TD) - 17</b>			
FILE:	wz1d-17.dgn	DN:	TxDOT
© TxDOT	February 1998	CK:	TxDOT
REVISIONS		OW:	TxDOT
4-98	2-17	CONT	SECT
3-03		6399	15
7-13		JOB	001
		DIST	COUNTY
		BMT	LIBERTY, ETC.
		SHEET NO.	46

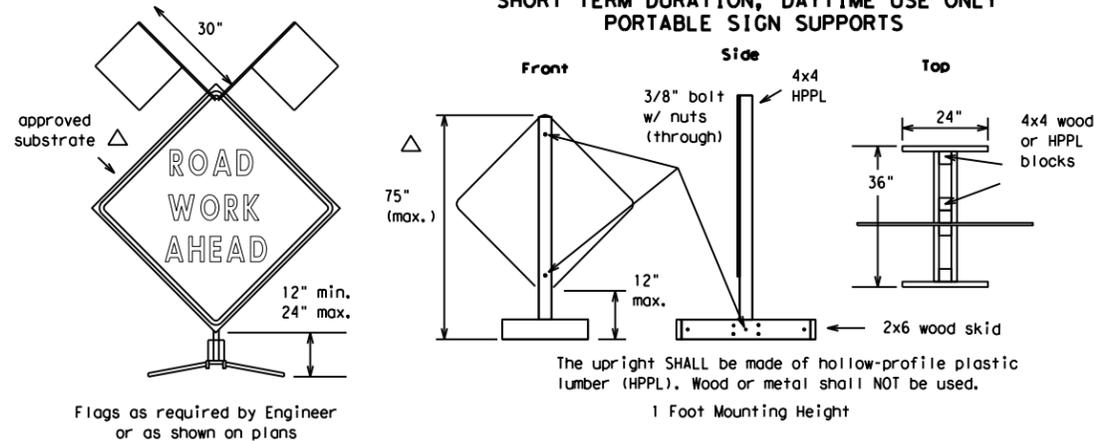


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△ See the CWZTCD for the type of sign substrate that can be used for each approved sign support.

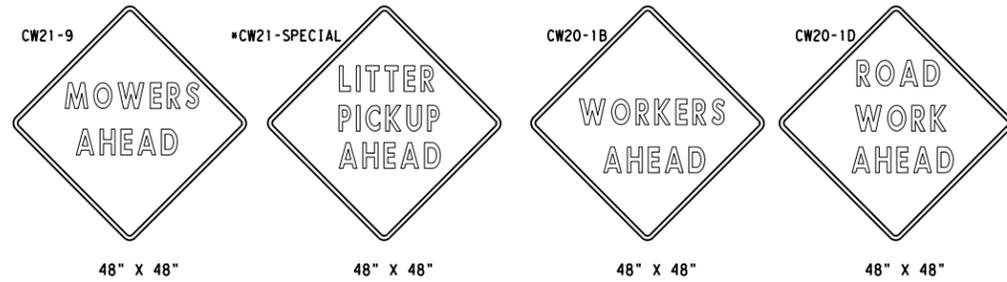
## EXAMPLES OF SIGN SUPPORTS

### SHORT TERM DURATION, DAYTIME USE ONLY PORTABLE SIGN SUPPORTS



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

**Nails will NOT be allowed.**



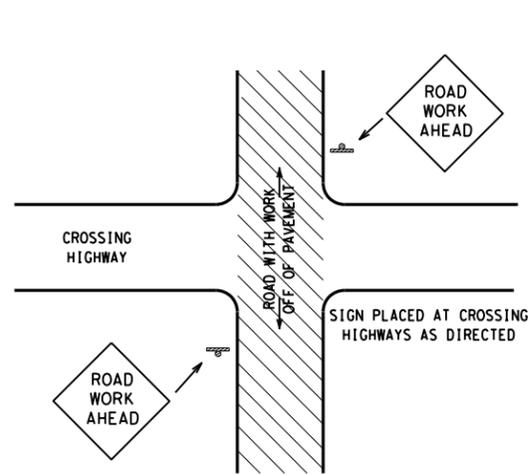
**SIGN IN ACCORDANCE WITH THE TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS**

**MOWERS AHEAD SIGNS ARE USED FOR MOWING OPERATIONS.**

**LITTER PICKUP AHEAD, ROAD WORK AHEAD AND WORKER AHEAD SIGNS ARE USED AS DIRECTED FOR OTHER MAINTENANCE OPERATIONS WHEN ALL WORK OCCURS OFF OF THE PAVED HIGHWAY SURFACE.**

### ROLL-UP SIGNS CONFORMING TO DMS-8310 AND THE CWZTCD ALLOWED

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



### TYPICAL LOCATION OF SIGNS AT HIGHWAY CROSSING

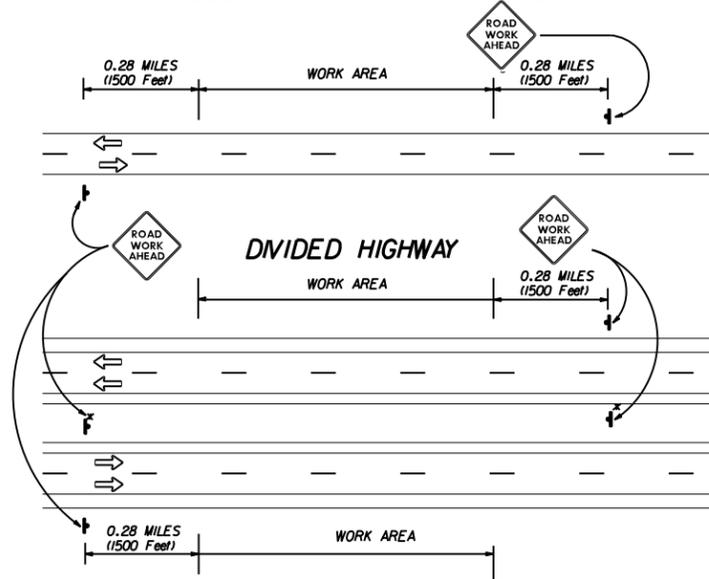
WORK AREA IS A MAXIMUM OF 2.0 MILES UNLESS OTHERWISE DIRECTED. SIGNS MAY REMAIN IN PLACE ONLY DURING DAYLIGHT HOURS.

SIGNS ARE TO BE PLACED 6' TO 12' OFF OF THE PAVED SURFACE UNLESS OTHERWISE DIRECTED.

ROAD WORK AHEAD SIGNS SHOWN AS EXAMPLES, ONE OF THE FOUR TYPE SIGNS WILL BE USED AS DIRECTED.

\* SIGNS IN THE MEDIAN ARE REQUIRED WHEN WORK OCCURS IN MEDIAN

### UNDIVIDED HIGHWAY OR FRONTAGE ROAD



### TRAFFIC CONTROL PLAN FOR WORK OFF OF THE PAVED SURFACE.

### GENERAL NOTES FOR WORK ZONE SIGNS

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

### Duration of Work (as defined by the "Texas Manual on Uniform Traffic Control Devices" Part VII)

- The Contractor is responsible for ensuring the sign support and substrate meets crashworthiness. For mowing operation all signs and supports are Short-term Duration for daytime work.
- The Contractor shall furnish the sign sizes shown on this sheet or as directed by the Engineer.

### SIGN SUBSTRATES

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

### REFLECTIVE SHEETING

- Reflectorized signs shall be constructed of sheeting meeting the color and retro-reflectivity requirements of DMS-8300 or DMS-8310. The DMS specifications can be accessed from the following web address:  
[http://manuals.dot.state.tx.us:80/dynaweb/colmates/@Generic\\_CollectionView;cs=default;ts=default](http://manuals.dot.state.tx.us:80/dynaweb/colmates/@Generic_CollectionView;cs=default;ts=default)
- White sheeting, meeting the requirements of DMS-8300 Type C (High Specific Intensity), shall be used for signs with white background and channelizing devices.
- Orange sheeting, meeting the requirements of DMS-8300 Type E (Fluorescent Prismatic), shall be used for signs with orange backgrounds.

### SIGN LETTERS

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

### REMOVING OR COVERING

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

### SIGN SUPPORT WEIGHTS

- Where sign supports require the use of weights to keep from turning over, the use of sandbags with dry cohesionless sand is recommended.
- The sandbags will be tied shut to keep the sand from spilling and to maintain a constant weight.
- Rock, concrete, iron, steel or other solid objects will not be permitted for use as sign support weights.
- Sandbags should weigh a minimum of 35 lbs and a maximum of 50 lbs.
- Sandbags shall be made of a durable material that tears upon vehicular impact.
- Rubber (such as tire inner tubes) shall NOT be used for sandbags.
- Rubber ballasts (such as those used with cones or edgeline channelizers) shall NOT be used as sign support weights.
- Sandbags shall only be placed along or laid over the base supports of the traffic control device and shall not be suspended above ground level or hung with rope, wire, chains or other fasteners. Sandbags shall be placed along the length of the skids to weigh down the sign supports.
- Sandbags shall NOT be placed under the skid and shall not be used to level sign supports placed on slopes.

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

Any sign, sign support or traffic control device that is struck or damaged by the Contractor or his/her construction equipment shall be replaced or repaired as soon as possible by the Contractor at the Contractor's expense.

Only pre-qualified products shall be used. A copy of the "Compliant Work Zone Traffic Control Devices List" (CWZTCD) describes pre-qualified products and their sources and may be obtained by contacting:

Standards Engineer  
Traffic Operations Division - TE  
Texas Department of Transportation  
125 East 11th Street  
Austin, Texas 78701-2483  
Phone (512) 416-3120  
Fax (512) 416-3299

Instructions to locate the "CWZTCD" on TxDOT website are:

Start at website - [www.dot.state.tx.us](http://www.dot.state.tx.us)  
Click on "About TxDOT",  
Click on "Organizational Chart",  
Click on Traffic Operations Box,  
Click on "Compliant Work Zone Traffic Control Devices",  
Click on "View PDF".  
This site is printable.

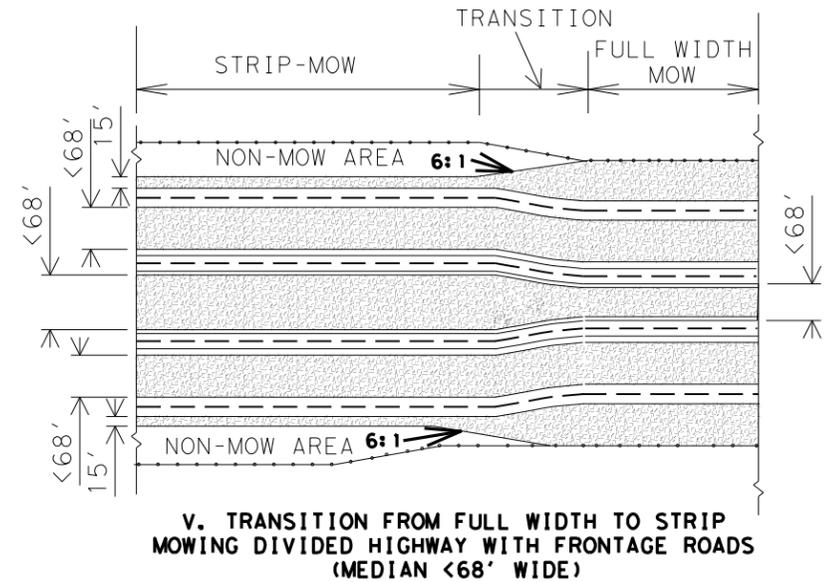
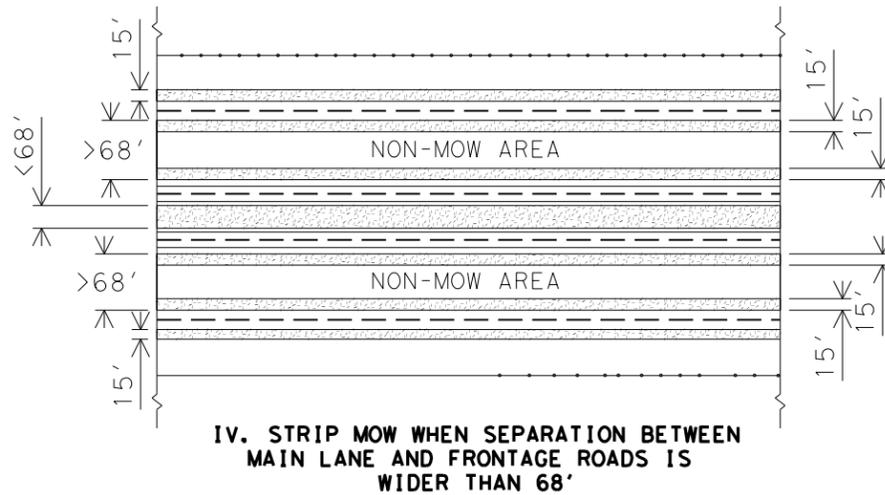
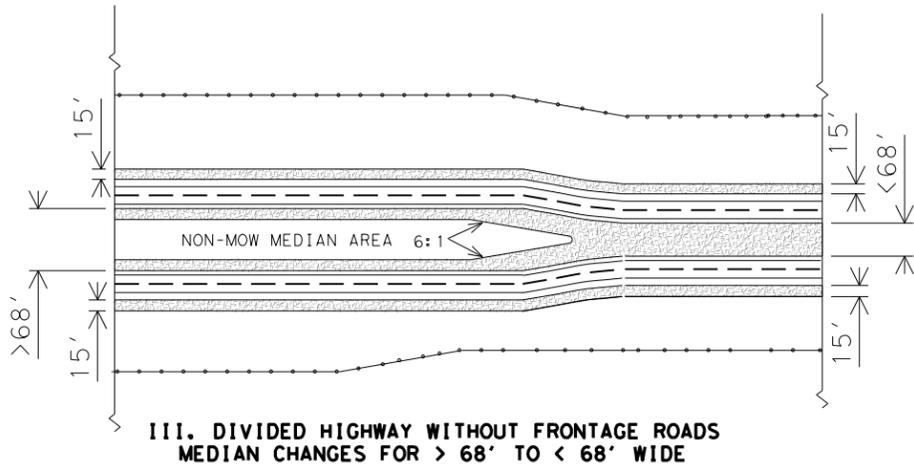
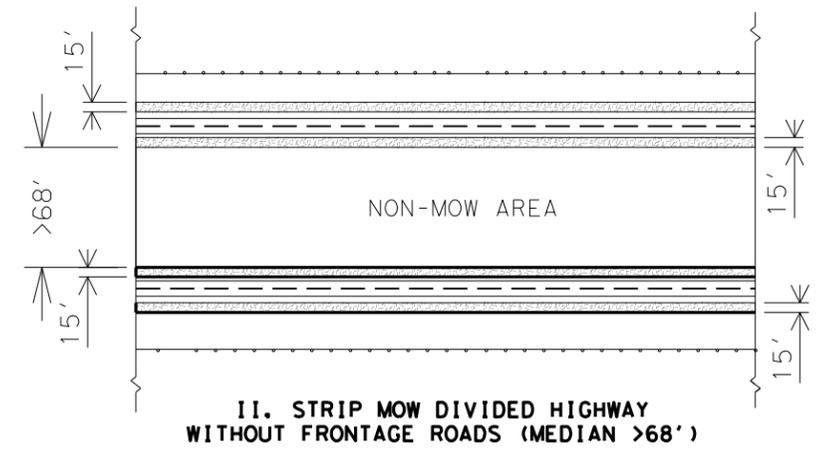
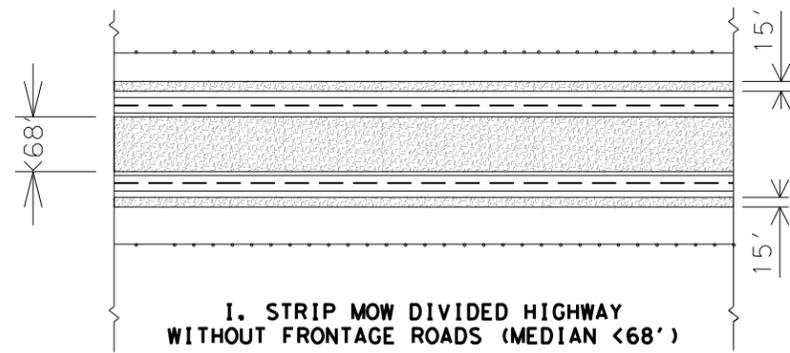
Texas Department of Transportation  
Maintenance Division  
Standard Plans

## ROADSIDE TRAFFIC CONTROL PLAN

SHEET 1 OF 1 RS-TCP-05 NOT TO SCALE

FILE: RSTCP05.DGN	DN: LJB	CK: JG	DR: -	CR: -	NEG NO.:
© TxDOT FEBRUARY 2005		STATE DISTRICT	FEDERAL REGION	MAINTENANCE PROJECT	SHEET
REVISED: September 17, 2004	12	06	RMC6399-15-001	48	
REVISED: FEBRUARY 2, 2005 Sign placement in TCP	COUNTY	CONTROL	SECTION	JOB	HIGHWAY
REVISED:	LIBERTY, ETC.	6399	15	001	SH99

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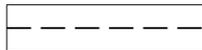


**GENERAL NOTES:**

1. MOW THE ENTIRE WIDTH OF MEDIANS AND OUTER SEPARATIONS (AREAS BETWEEN MAIN LANES, RAMPS, AND FRONTAGE ROAD) EXCEPT FOR NON-MOW AREAS.
2. MOW FULL-WIDTH ALL MEDIANS AND OUTER SEPARATIONS 68' OR LESS FROM PAVEMENT EDGE TO PAVEMENT EDGE.
3. FOR MEDIANS AND OUTER SEPARATIONS GREATER THAN 68' MOW A 15' ALONG EACH PAVEMENT EDGE.
4. NON-MOW AREAS IN MEDIANS & OUTER SEPARATIONS WILL BE CONSIDERED THE AREA IN MEDIANS AND OUTER SEPARATIONS GREATER THAN 68' BETWEEN THE 15' STRIP MOW AREAS.
5. OTHER NON-MOW AREA'S WILL BE SHOWN ELSEWHERE ON PLANS OR MARKED ON THE RIGHT OF WAY.

**KEY**

MOW AREA 

PAVED ROADWAY 

RIGHT-OF-WAY LINE 

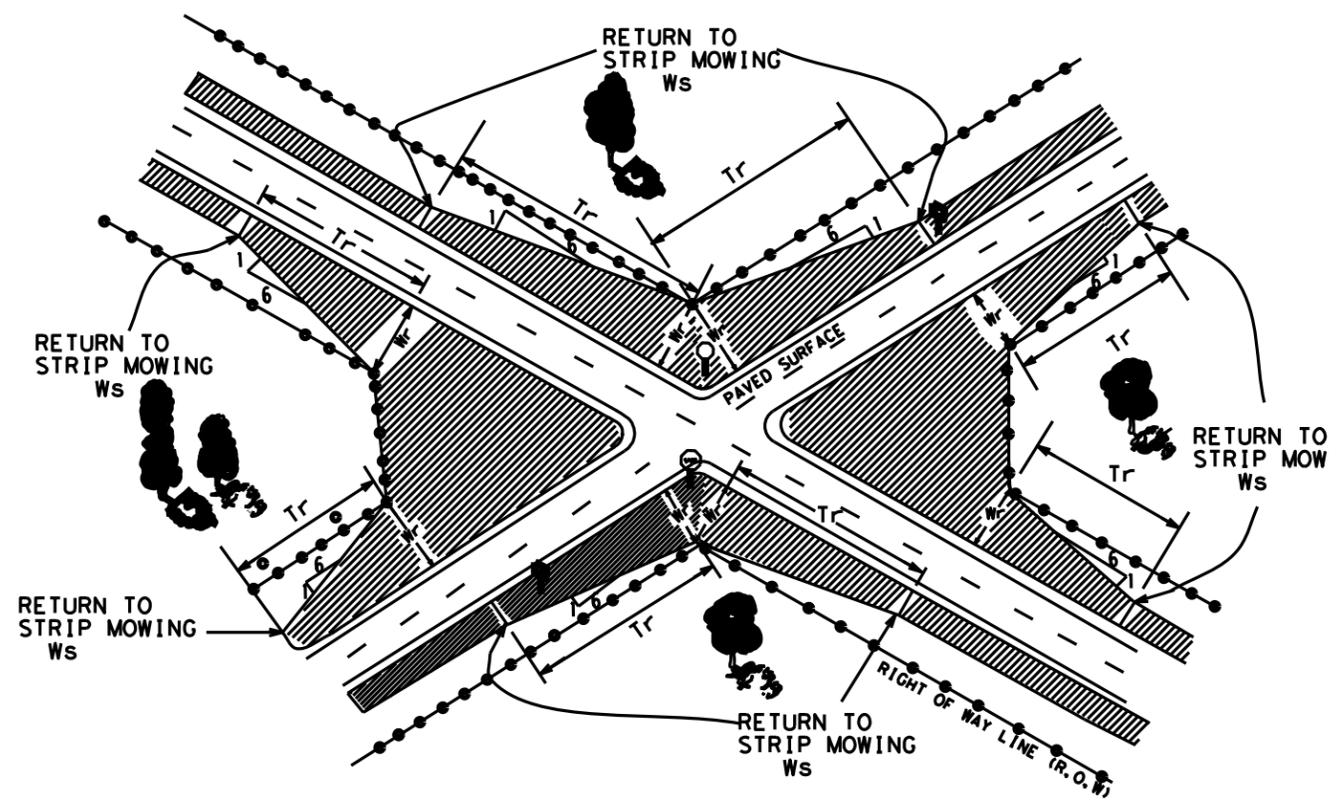


STRIP MOWING  
 (DIVIDED HIGHWAYS)  
 STRIP-MOW-D-04

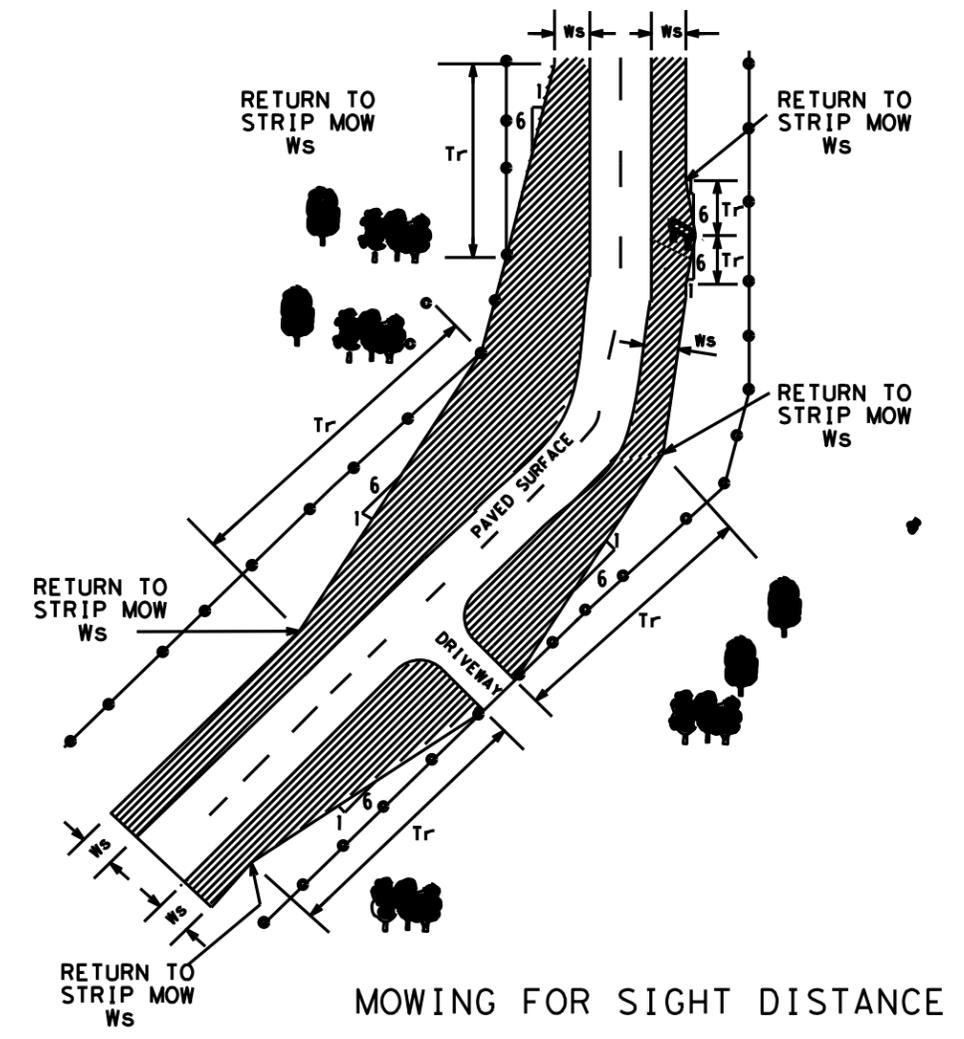
SHEET 1 OF 1 NOT TO SCALE

FILE:	SMOWD04.DGN	DN:	LJB	CK:	JG	DW:	-	CK:	-	NEG NO.:	
© TxDOT JUNE 2004		STATE DISTRICT	FEDERAL REGION	PROJECT				SHEET			
REVISED:	6/03/2004	BMT		RMC6399-15-001				49			
REVISED:		COUNTY			CONTROL	SECTION	JOB	HIGHWAY			
REVISED:		LIBERTY, ETC.			6399	15	001	SH99			

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MOWING FOR SIGHT DISTANCE  
 WITH TRANSITION FROM INTERSECTION  
 BACK TO STRIP MOWING



MOWING FOR SIGHT DISTANCE  
 TRANSITIONS AT DRIVEWAYS,  
 SIGNS, AND CURVES

**GENERAL NOTES:**

1. THE NORMAL WIDTH FOR STRIP MOWING IS 15' UNLESS OTHERWISE SHOWN ON THE PLANS.
2. MOW TO THE R.O.W. LINE IN FRONT OF BUSINESSES, RESIDENCES, CHURCHES, OR CULTIVATED FIELDS UNLESS OTHERWISE SHOWN ON THE PLANS.
3. TRANSITION FOR SIGHT DISTANCE TO R.O.W LINE OR AROUND SIGNS AS SHOWN ON THIS SHEET UNLESS OTHERWISE SHOWN ON THE PLANS.

	RIGHT OF WAY LINE
	MOWING LOCATION
$W_r$	R.O.W. WIDTH (AT START OF TRANSITION)
$W_s$	STRIP MOWING WIDTH
$T_r$	TRANSITION



Texas Department of Transportation  
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 Standard Plans

STRIP MOWING NON-DIVIDED HIGHWAYS

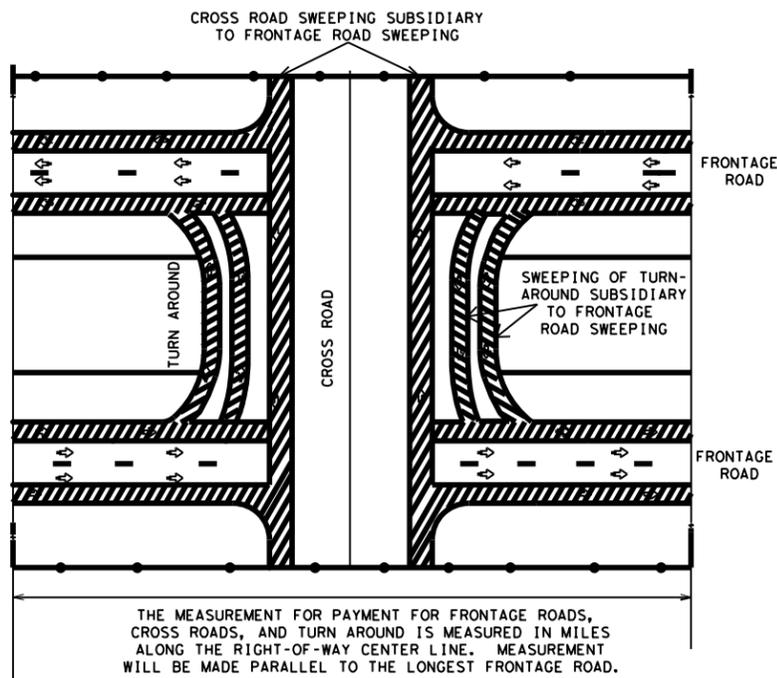
STRIP-MOW-ND-04

SHEET 1 OF 1 NOT TO SCALE

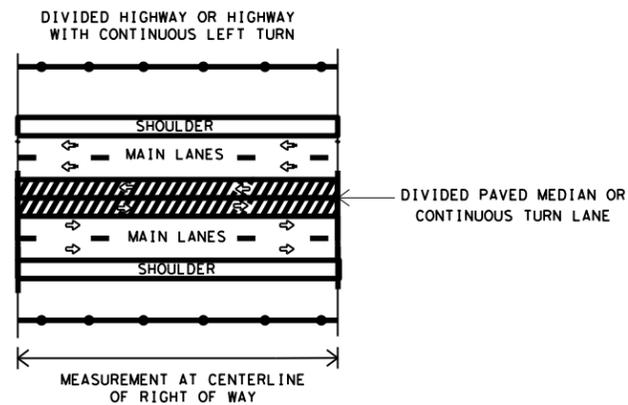
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REVISED:	5/18/2004	LJB	\$DIST\$		RMC6399-15-001					50	
REVISED:				COUNTY		CONTROL	SECTION	JOB		HIGHWAY	
REVISED:				LIBERTY, ETC.		6399	15	001		SH99	

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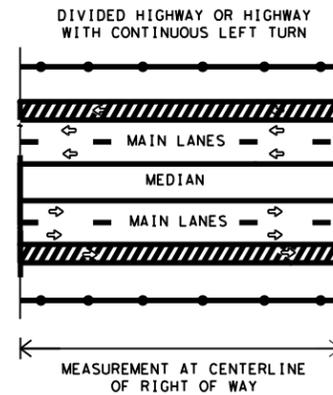
### FRONTAGE ROAD SWEEPING



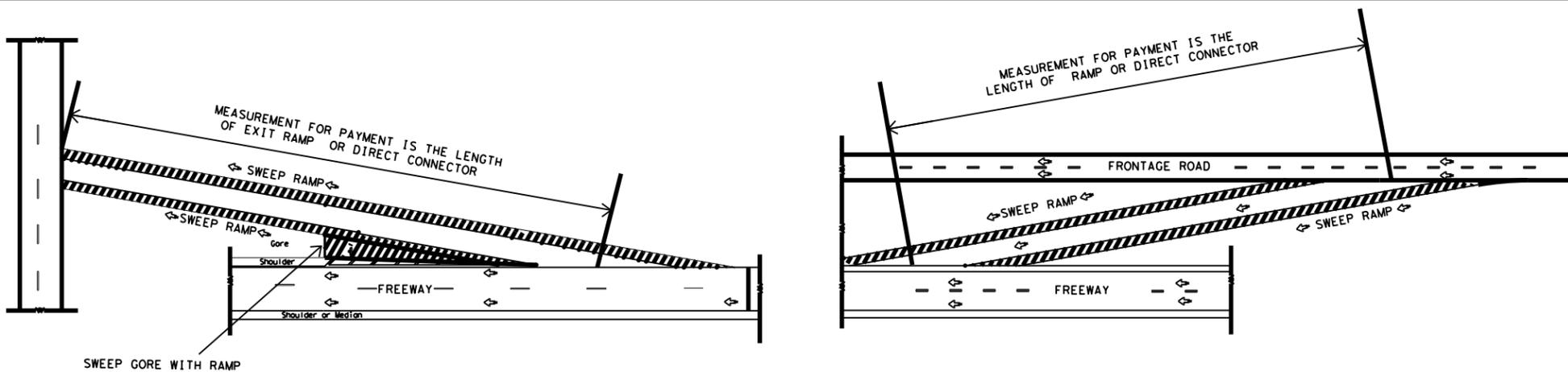
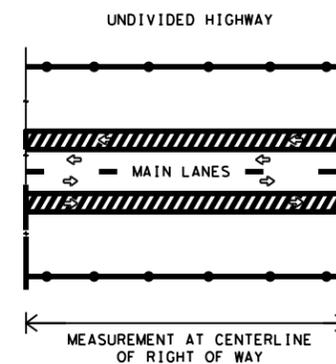
### CENTER MEDIAN SWEEPING



### OUTSIDE MAIN LANE SWEEPING

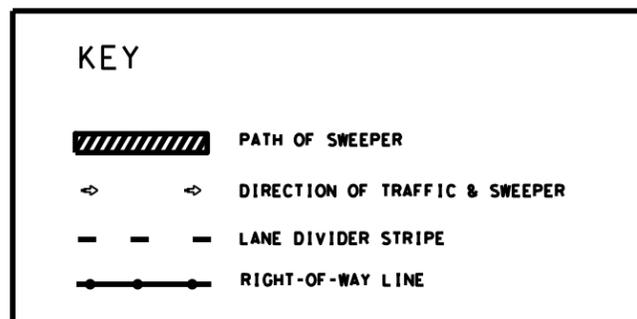


### OUTSIDE MAIN LANE SWEEPING



### RAMPS OR DIRECT CONNECTORS

PAYMENT ITEM	NORMAL NUMBER OF PASSES OF THE SWEEPER	MEASUREMENT OF CENTER LINE MILES	OTHER AREAS SUBSIDIARY TO PAYMENT ITEM
SWEEPING (CENTER MEDIAN)	2	OF RIGHT OF WAY	NONE
SWEEPING (OUTSIDE MAIN LANE)	2	OF RIGHT OF WAY	NONE
SWEEPING (ONE FRONTAGE ROAD)	2	OF RIGHT OF WAY	CROSS ROADS & TURN AROUNDS
SWEEPING (TWO FRONTAGE ROADS)	4	OF RIGHT OF WAY	CROSS ROADS & TURN AROUNDS
SWEEPING (RAMP)	2	OF RAMP	GORE AREA
SWEEPING (DIRECT CONNECTOR)	2	OF CONNECTOR	GORE AREA



Texas Department of Transportation  
 Maintenance Division  
 Standard Plans

## SWEEPING HIGHWAYS

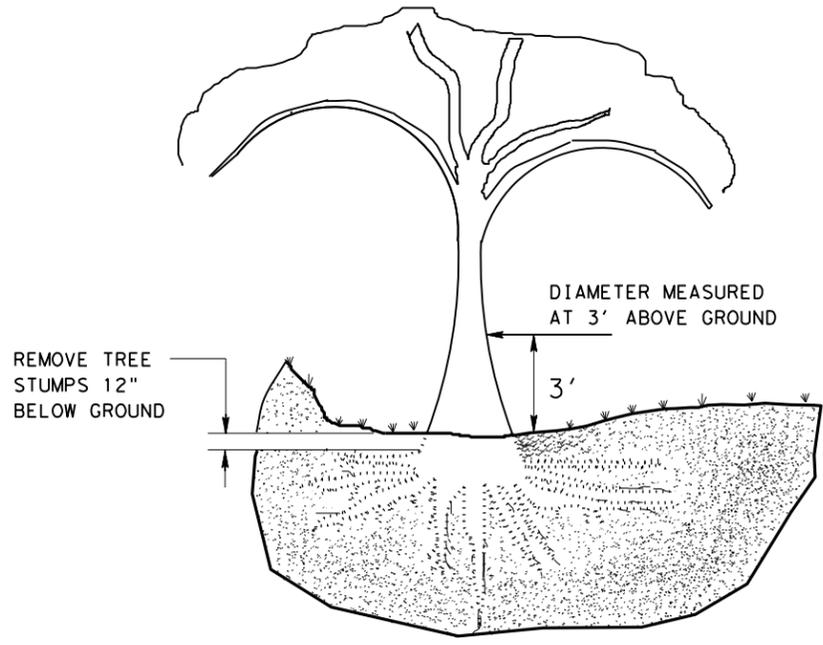
SWEEP - 04

SHEET 1 OF 1 NOT TO SCALE

FILE: SWEEP04.DGN	DN: LJB	CK: JG	DW: -	CK: -	NEG NO.:
©TxDOT MAY 2004		STATE DISTRICT	FEDERAL REGION	MAINTENANCE PROJECT NO.	⊕ SHEET
REVISED:	BMT	RMC6399-15-001		51	
REVISED:	COUNTY	CONTROL	SECTION	JOB	HIGHWAY
REVISED:	LIBERTY, ETC.	6399	15	001	SH99

LEVELS DISPLAYED  
 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16  
 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32  
 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48  
 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63

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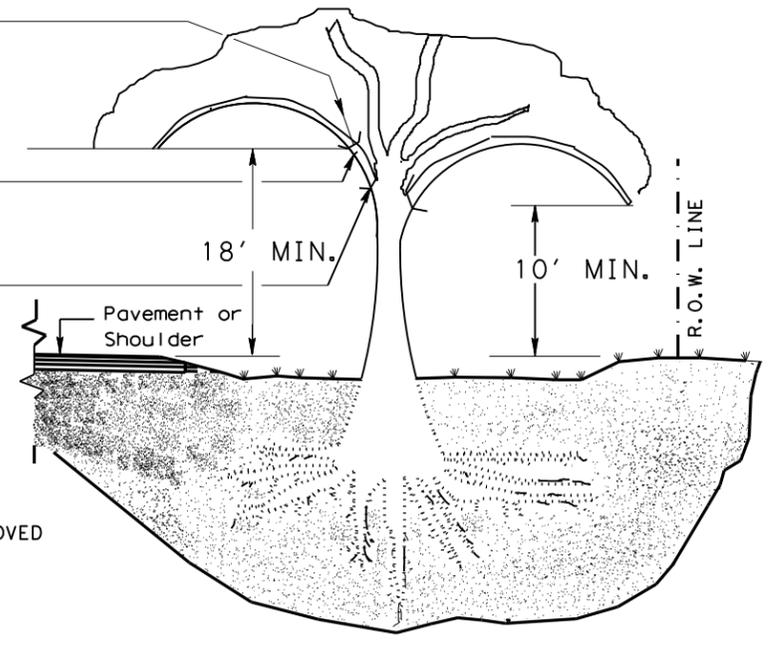
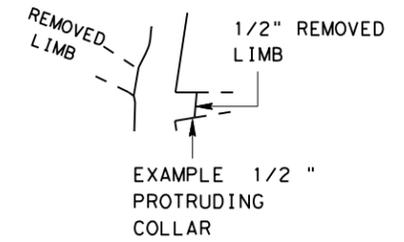


TREE REMOVAL

STEP 1:  
CUT 1/3 WAY THROUGH BOTTOM OF LIMB 8" TO 12" ABOVE MAIN STEM (OR TRUNK).

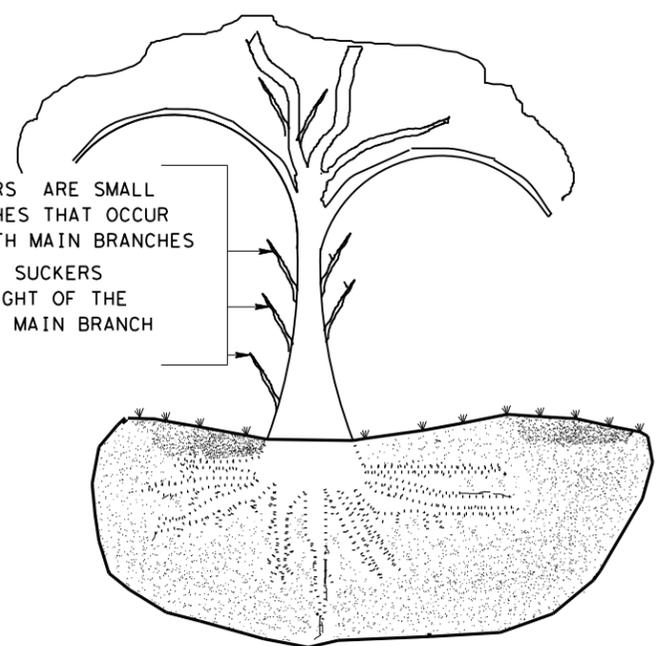
STEP 2:  
REMOVE LIMB 4" TO 6" BEYOND THE FIRST CUT

STEP 3:  
REMOVE STUB WITH A SMOOTH CUT SO THAT TRACE COLLAR OF THE REMOVED LIMB PROTRUDES APPROXIMATELY 1/2" FROM THE MAIN STEM

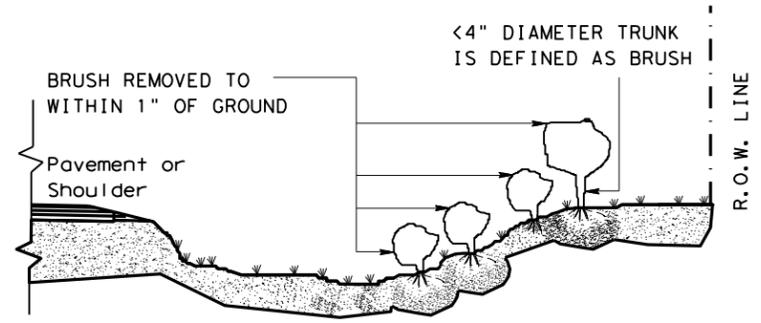


TREE TRIMMING

SUCKERS ARE SMALL BRANCHES THAT OCCUR BENEATH MAIN BRANCHES. REMOVE SUCKERS TO HEIGHT OF THE LOWEST MAIN BRANCH



STEPS 1, 2 AND 3 APPLY WHEN REMOVING LIMBS 2" IN DIAMETER OR LARGER.



BRUSH REMOVAL

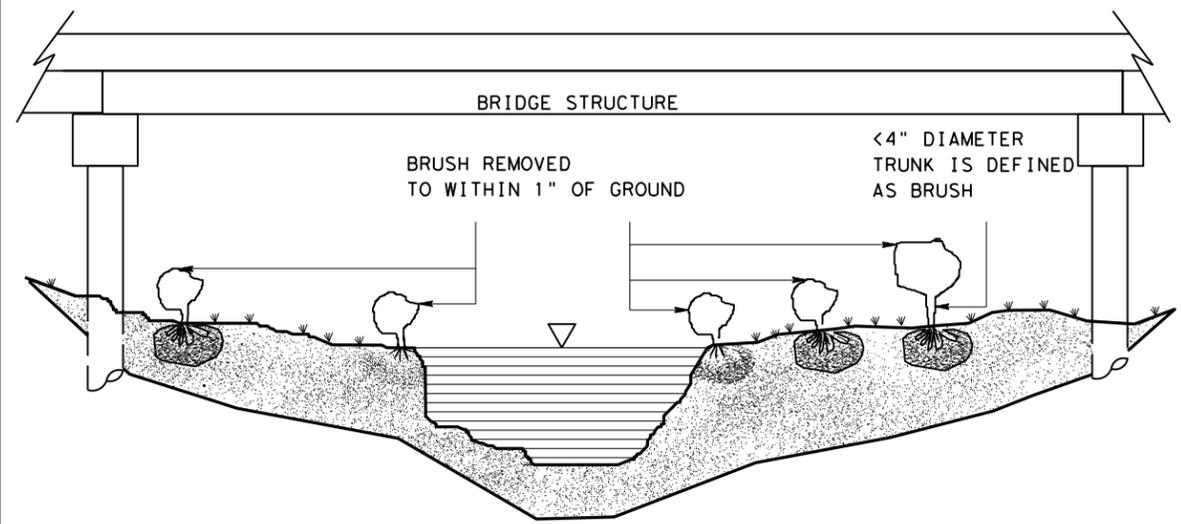
GENERAL NOTES:

TREE TRIMMING

1. TRIM AND REMOVE ALL TREE LIMBS ON THE PAVEMENT SIDE OF THE TRUNK 18' ABOVE THE PAVEMENT OR BRIDGE DECK ELEVATION, UNLESS OTHERWISE SHOWN ON THE PLANS.
2. TRIM AND REMOVE ALL TREE LIMBS BETWEEN THE TRUNK AND R.O.W. LINE 10' ABOVE NATURAL GROUND, TERRAIN OR OTHER STRUCTURE ELEVATION, UNLESS OTHERWISE SHOWN ON THE PLANS.

TREE REMOVAL

3. FOR TREES MARKED FOR REMOVAL, THE DIAMETER OF TREES ARE DETERMINED BY MEASUREMENT OF THE TRUNK CIRCUMFERENCE 3' ABOVE THE GROUND. TREES WITH TRUNKS OF LESS THAN 4" DIAMETER ARE CONSIDERED TO BE BRUSH. TREES WITH MULTIPLE TRUNKS AT THE POINT OF MEASUREMENT ARE MEASURED AND PAID FOR SEPARATELY.
4. MEASUREMENTS FOR PAYMENT OF TREE DIAMETERS ARE DIVIDED INTO THE RANGES SHOWN IN TABLE 1.



BRUSH REMOVAL UNDER BRIDGE AND IN CHANNEL

PAY ITEM	RANGE FOR PAY ITEMS			
	TRUNK DIAMETER *		TRUNK CIRCUMFERENCE	
	LOWER LIMIT IS GREATER THAN	UPPER LIMIT IS LESS THAN OR EQUAL TO	LOWER LIMIT IS GREATER THAN	UPPER LIMIT IS LESS THAN OR EQUAL TO
752 6005	4	12	12 1/2	37 1/2
752 6006	12	18	37 1/2	56 1/2
752 6007	18	24	56 1/2	75 1/2
752 6008	24	30	75 1/2	94
752 6009	30	36	94	113
752 6010	36	42	113	132
752 6011	42	48	132	151
752 6012	48	60	151	188 1/2
752 6013	60	72	188 1/2	226
752 6019	72	84	226	264
	84	GREATER THAN 84	264	NOT APPLICABLE

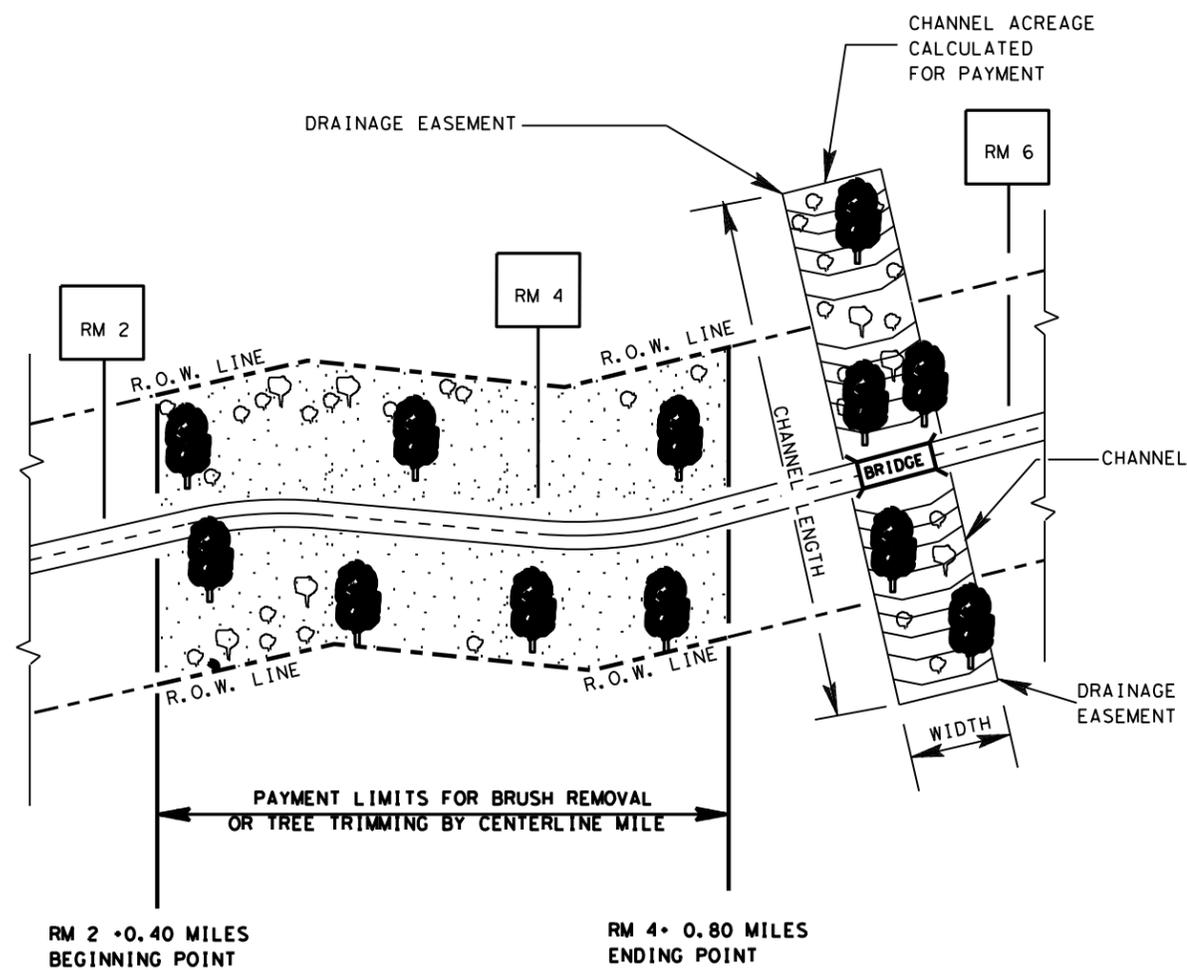
\*SEE GENERAL NOTE #3.



TREE AND BRUSH REMOVAL  
TRB-15(1)

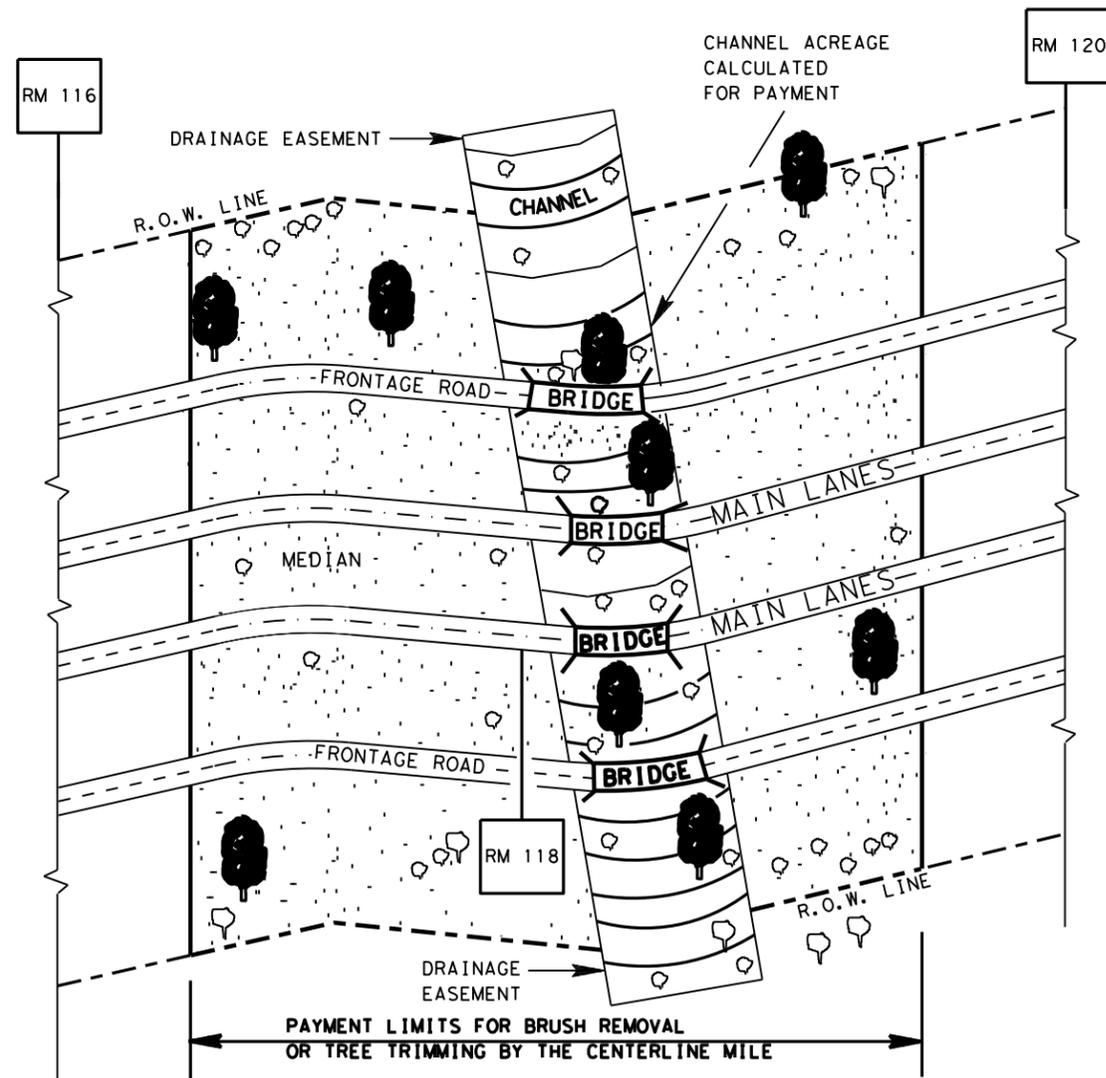
FILE:	DW: JEO	CK: LJB	DW: JEO	CK:
© TxDOT MARCH 2015	CONT	6399	15	001
REVISIONS				SH99
Revised table 1 to 2014 Specification	DIST		COUNTY	SHEET NO.
	BMT		LIBERTY, ETC.	52

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BRUSH REMOVED TO WITHIN 1" OF GROUND <4" DIAMETER TRUNK IS DEFINED AS BRUSH UNLESS OTHERWISE DIRECTED

EXAMPLE: UNDIVIDED HIGHWAY



BRUSH REMOVED TO WITHIN 1" OF GROUND <4" DIAMETER TRUNK IS DEFINED AS BRUSH UNLESS OTHERWISE DIRECTED

EXAMPLE: DIVIDED HIGHWAY WITH FRONTAGE ROADS

GENERAL NOTES:

TREE TRIMMING AND BRUSH REMOVAL

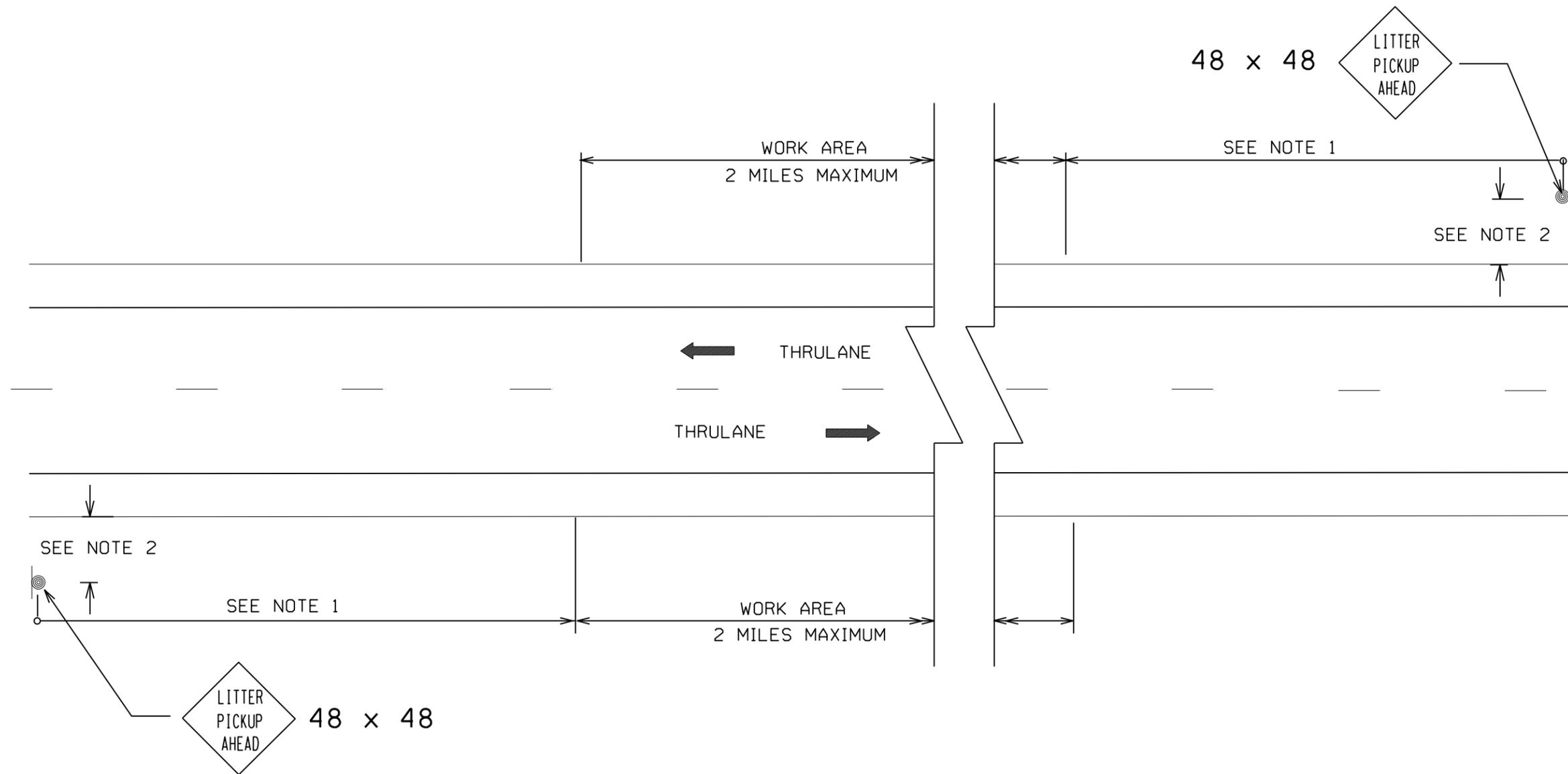
1. PAYMENT BY THE CENTERLINE MILE IS MADE TO THE NEAREST 1/100 (0.01) MILE.
2. LIMITS OF WORK ARE SHOWN AS DISTANCES FROM REFERENCE MARKERS (RM).
3. PAY ITEMS BY THE CENTERLINE MILE INCLUDE ALL TREE TRIMMING OR BRUSH REMOVAL IN THE RIGHT OF WAY ON BOTH SIDES OF THE HIGHWAY. FOR DIVIDED HIGHWAYS, THE MEDIAN IS INCLUDED. FOR HIGHWAYS WITH FRONTAGE ROADS, THE AREAS BETWEEN THE FRONTAGE ROADS AND MAIN LANES, AND THE AREAS OUTSIDE OF THE FRONTAGE ROADS ARE INCLUDED.
4. BRUSH REMOVAL AND TREE TRIMMING UNDER BRIDGES, IN AND ALONG CHANNELS AND EASEMENTS ARE PAID FOR BY THE ACRE FOR AREAS DESIGNATED ON THE PLANS.

 **Texas Department of Transportation**  
 Maintenance Division  
 Standard Plans

**TREE AND BRUSH REMOVAL**  
**TRB-15 (2)**

NOT TO SCALE		SHEET 2 OF 2					
FILE: TRB-15 (2).DGN	DRAWN: JEO	MODIFIED:	CHECKED: DM/LJB	DW: -	CK: -	NEG NO.:	
© TxDOT APRIL 2015	STATE DISTRICT	FEDERAL REGION	PROJECT		SHEET		
REVISED: 5/13/2004	LJB	12	6	RMC6399-15-001		53	
REVISED: 9/24/2004	LJB	COUNTY		CONTROL SECTION	JOB	HIGHWAY	
REVISED: APRIL 2015	JEO	LIBERTY, ETC.		6399001	001	SH99	

11:15:25 AM  
 6/30/2022  
 C:\IN\_PROGRESS\RM\6399-15-001-SH99-Liberty-2-DCN\Standards\3-HOUSTON DIST STDS\8-HOU-TC (LP) (1).dgn



**NOTES:**

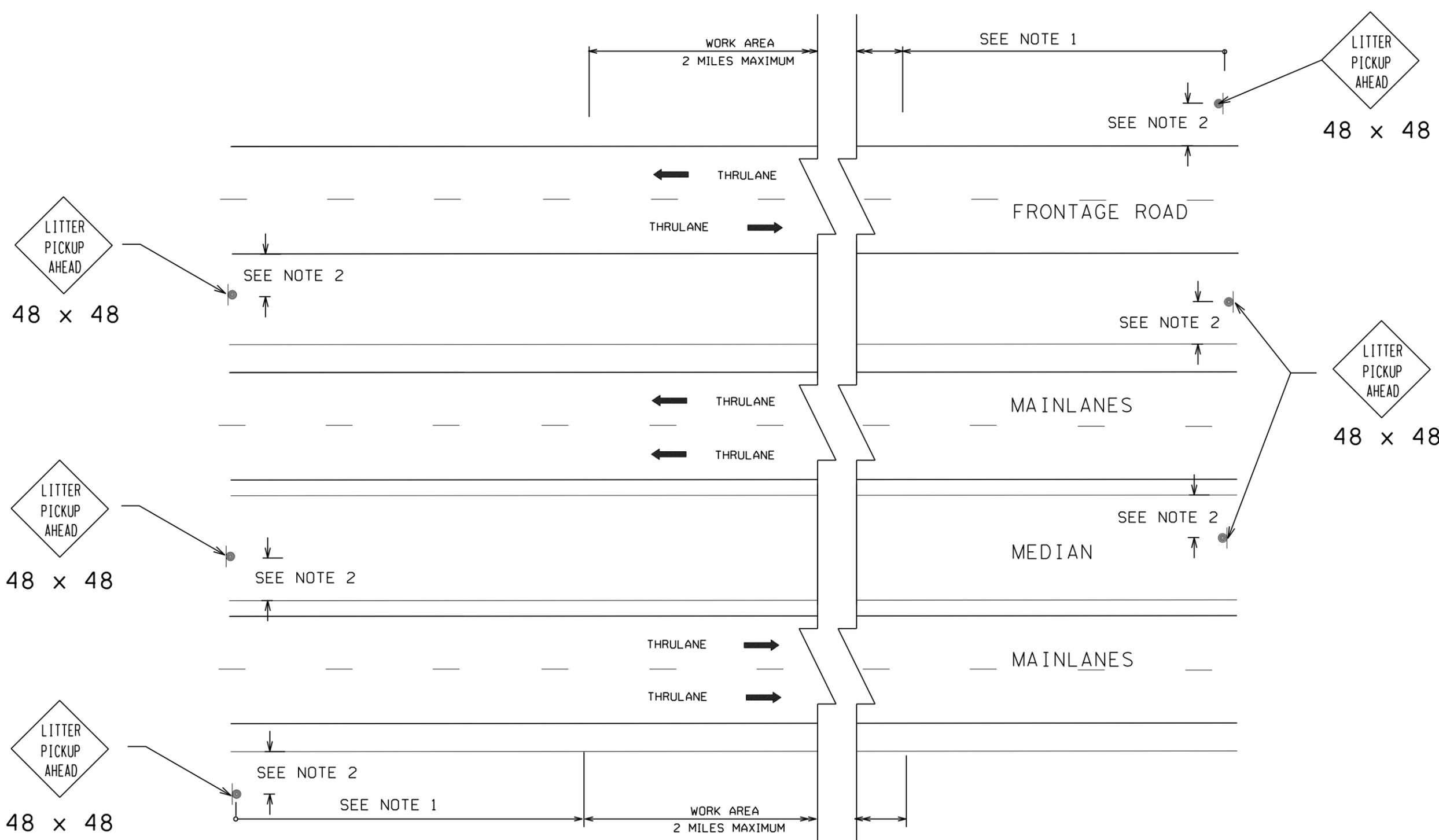
- 1) SEE BC(2), PROJECT LIMIT "TYPICAL CONSTRUCTION WARNING SIGN SIZE AND SPACING", FOR SIGN SPACING.
- 2) SEE BC(4), TEMPORARY SIGN NOTES, FOR MINIMUM CLEARANCES.

N.T.S.

SHEET 1 OF 2

<b>TRAFFIC CONTROL PLAN          SIGNING ARRANGEMENT          LITTER PICKUP          (TWO-LANE HIGHWAY)</b>				
<b>(TC)LP (1)</b>				
FILE#	DN#	CK#	DW#	CK#
© TxDOT 2014	DISTRICT	FED REG	PROJECT NO.	SHEET
REVISIONS	HOUSTON	6	RM6399-15-001	54
	COUNTY	CONTROL SECT	JOB	HIGHWAY
	LIBERTY, ETC	6399	15 001	SH99

STD H-31A



**NOTES:**

- 1) SEE BC(2), PROJECT LIMIT "TYPICAL CONSTRUCTION WARNING SIGN SIZE AND SPACING", FOR SIGN SPACING.
- 2) SEE BC(4), TEMPORARY SIGN NOTES, FOR MINIMUM CLEARANCES.

N.T.S.

SHEET 2 OF 2

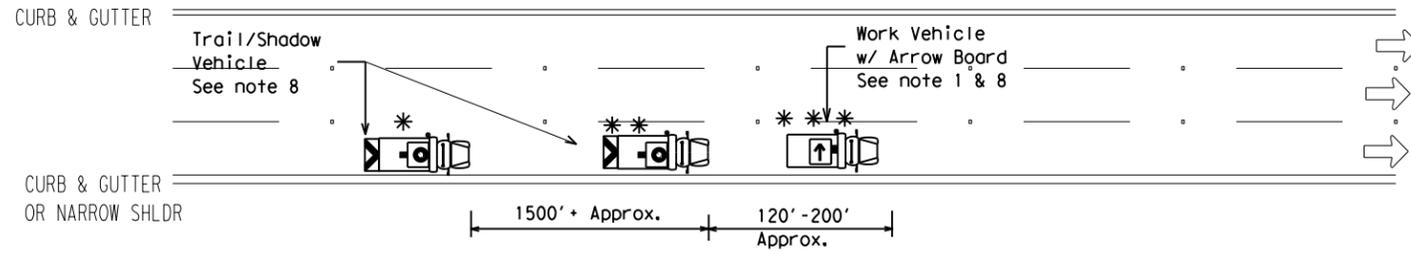
**TRAFFIC CONTROL PLAN**  
**SIGNING ARRANGEMENT**  
**LITTER PICKUP**

**(TC)LP (2)**

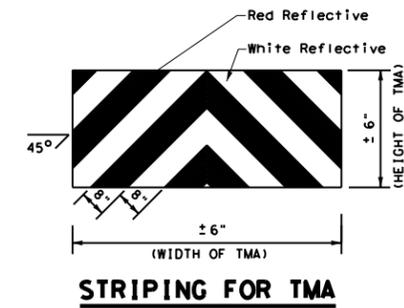
FILE#	DN#	CK#	DW#	CK#
© TxDOT 2014	DISTRICT	FED REG	PROJECT NO.	SHEET
REVISIONS	HOUSTON	6	RMC6399-15-00	55
	COUNTY	CONTROL SECT	JOB	HIGHWAY
	LIBERTY, ETC.	6399	15 001	SH99

STD H-31B

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**OUTSIDE LANE DEBRIS PICKUP AT Frontage Road or other roadways with narrow shoulders**

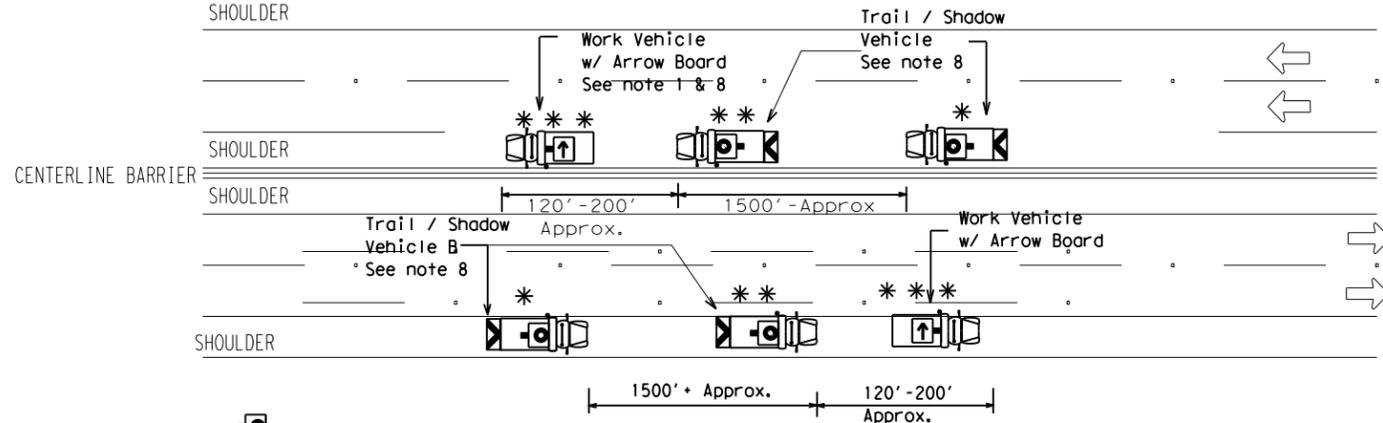


LEGEND			
*	Trail Vehicle	ARROW BOARD DISPLAY	
**	Shadow Vehicle		
** *	Work Vehicle		RIGHT Directional
	Heavy Work Vehicle		LEFT Directional
	Truck Mounted Attenuator (TMA)		Double Arrow
	Traffic Flow		CAUTION (Alternating Diamond or 4 Corner Flash)

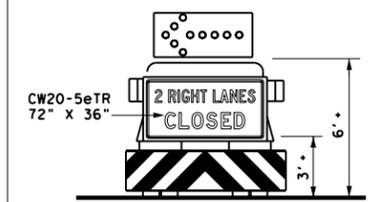
TYPICAL USAGE				
MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
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**GENERAL NOTES**

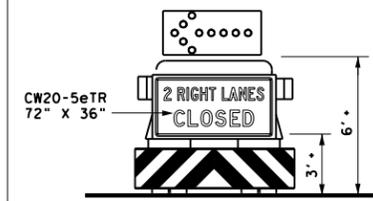
- ADVANCE WARNING, TRAIL and SHADOW vehicles shall be equipped with Type B or Type C flashing arrow boards as per the Barricade and Construction (BC) standards. Arrow boards on WORK vehicles will be optional based on the type of work being performed. The arrow boards shall be operated from inside the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



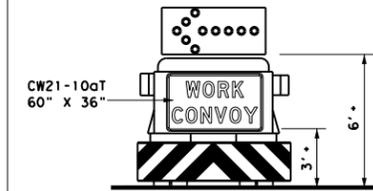
**CENTERLINE & OUTSIDE SHOULDER DEBRIS PICKUP AT Divided Multilane Roadway with full shoulder**



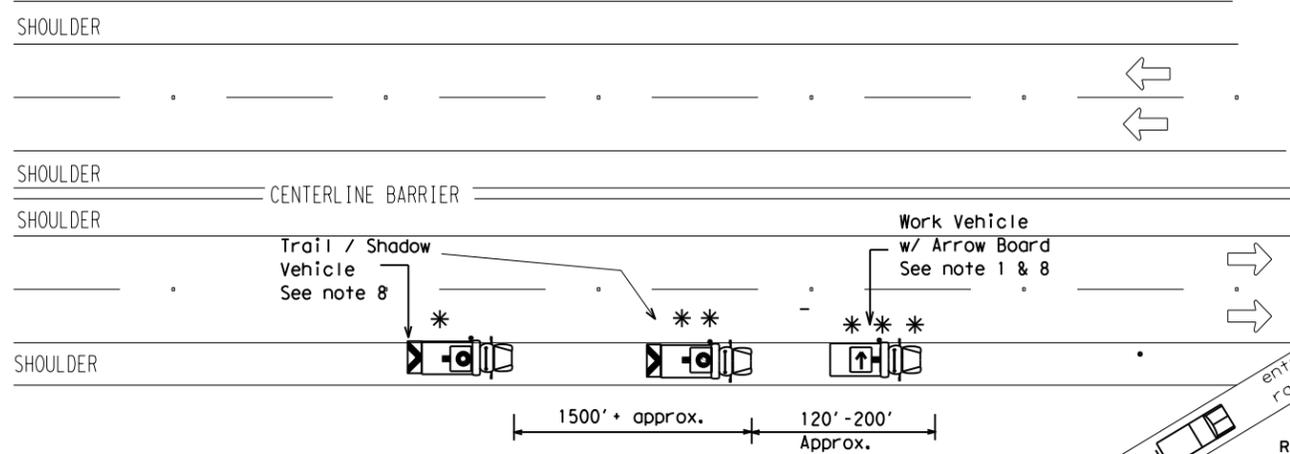
**(D) ADVANCE WARNING VEHICLE**



**(E) REQUIRED TRAIL VEHICLE \***



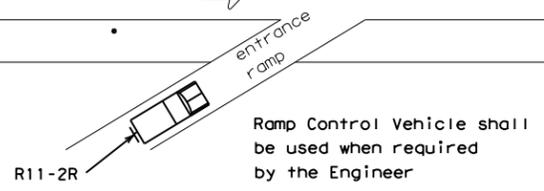
**(F) SHADOW VEHICLE \*\***



**OUTSIDE SHOULDER DEBRIS/DRAIN SLOTS AT Divided Multilane Roadway with full shoulder**



R11-2R



*Signature*, P.E.

6/30/2022

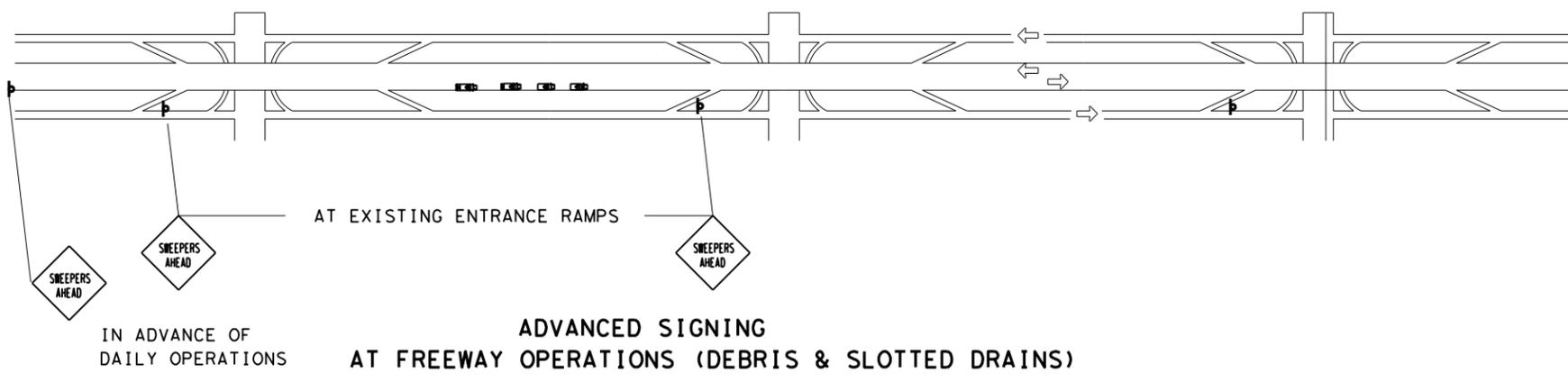
Texas Department of Transportation

**TRAFFIC CONTROL PLAN  
DEBRIS & DRAIN SLOTS  
OPERATIONS**

1 OF 2

© TxDOT	DN: TxDOT	CK: TxDOT	DR: TxDOT	CK: TxDOT
REVISIONS	CONT	SECT	JOB	HIGHWAY
	6399	15	001	SH99
	DIST	COUNTY		SHEET NO.
	BMT	LIBERTY, ETC.		56

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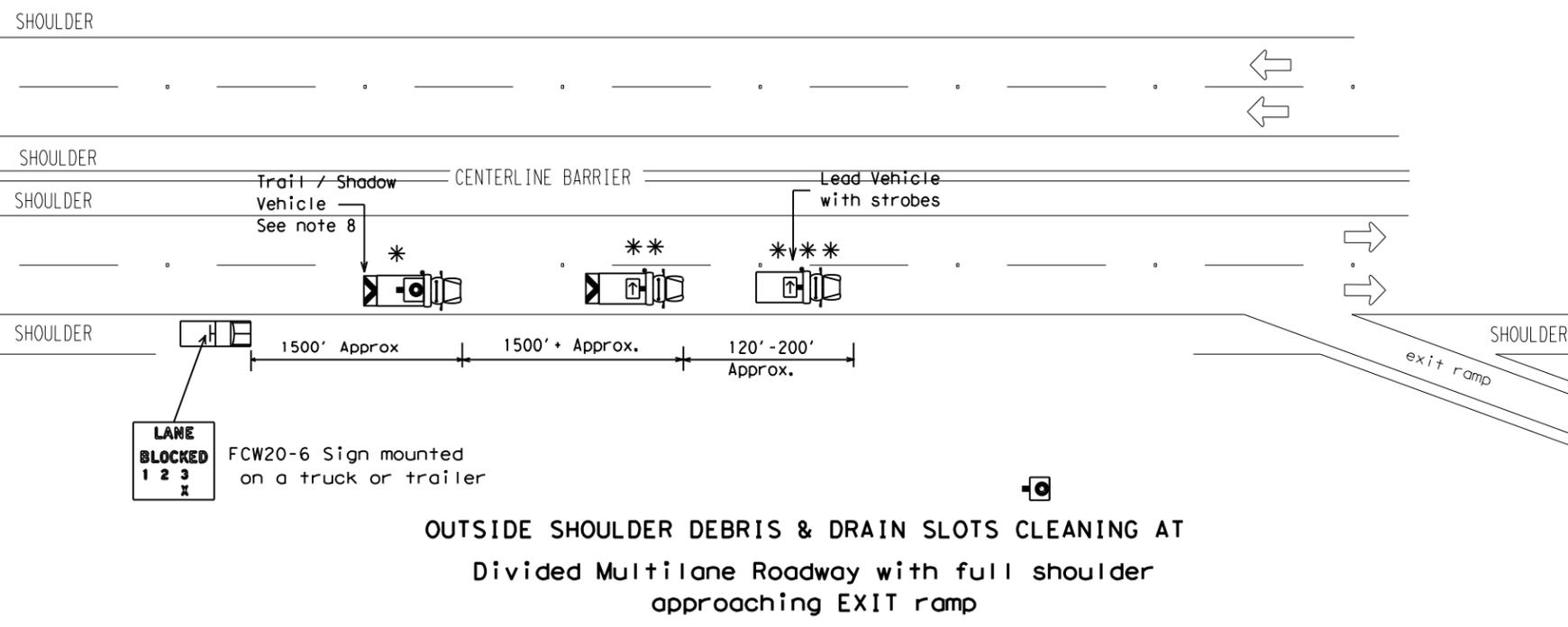


LEGEND			
*	Trail Vehicle	ARROW BOARD DISPLAY	
**	Shadow Vehicle		
***	Work Vehicle		RIGHT Directional
	Heavy Work Vehicle		LEFT Directional
	Truck Mounted Attenuator (TMA)		Double Arrow
	Traffic Flow		CAUTION (Alternating Diamond or 4 Corner Flash)

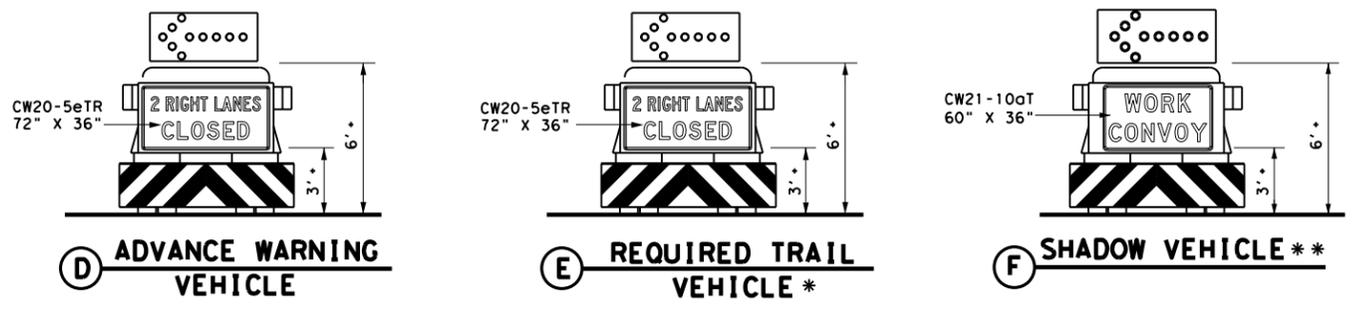
TYPICAL USAGE				
MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
✓				

**GENERAL NOTES**

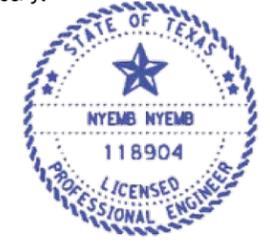
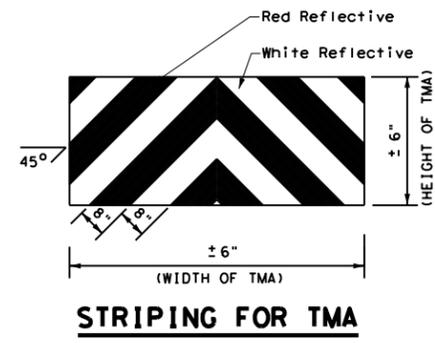
- ADVANCE WARNING, TRAIL and SHADOW vehicles shall be equipped with Type B or Type C flashing arrow boards as per the Barricade and Construction (BC) standards. Arrow boards on WORK vehicles will be optional based on the type of work being performed. The arrow boards shall be operated from inside the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



**OUTSIDE SHOULDER DEBRIS & DRAIN SLOTS CLEANING AT Divided Multilane Roadway with full shoulder approaching EXIT ramp**



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



*Signature*, P.E.

DATE: \$DATE\$

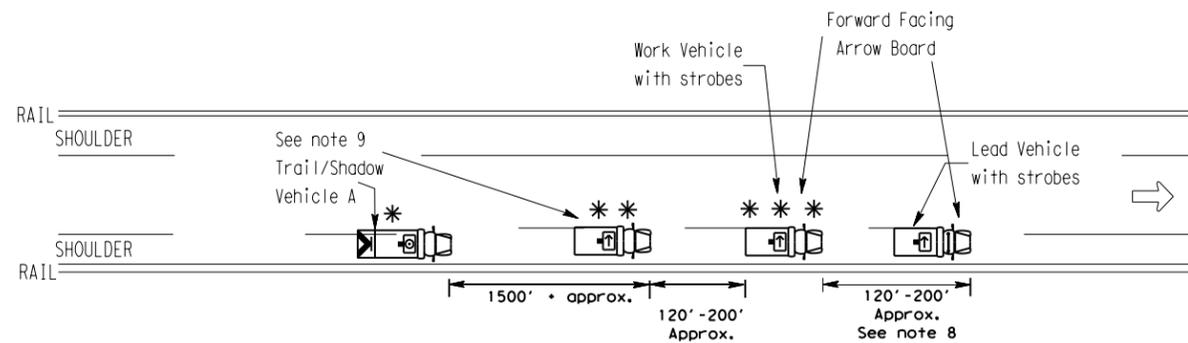
**Texas Department of Transportation**  
Traffic Operations Division

**TRAFFIC CONTROL PLAN  
DEBRIS & DRAIN SLOTS  
OPERATIONS**

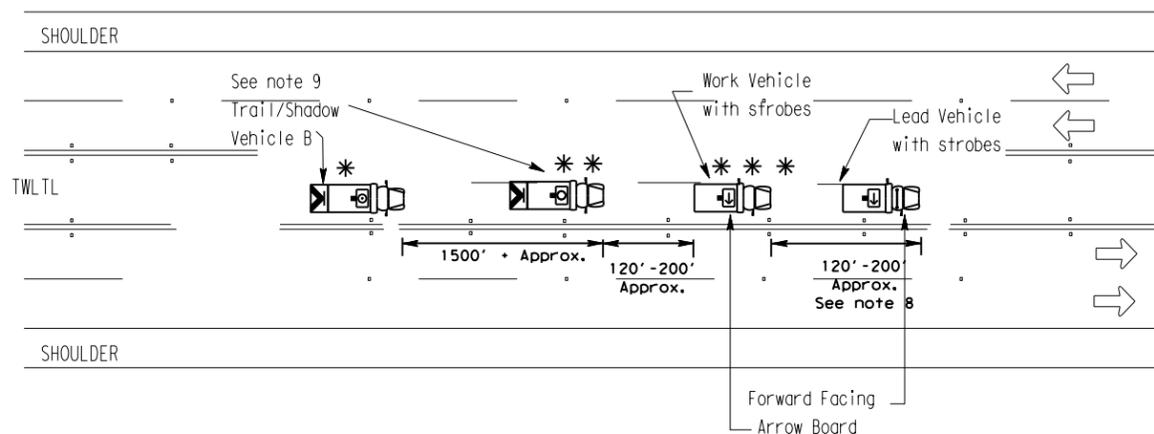
2 OF 2					
© TxDOT		DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
REVISIONS	CONT	SECT	JOB	HIGHWAY	
	6399	15	001	SH99	
	DIST	COUNTY		SHEET NO.	
	BMT	LIBERTY, ETC.		57	

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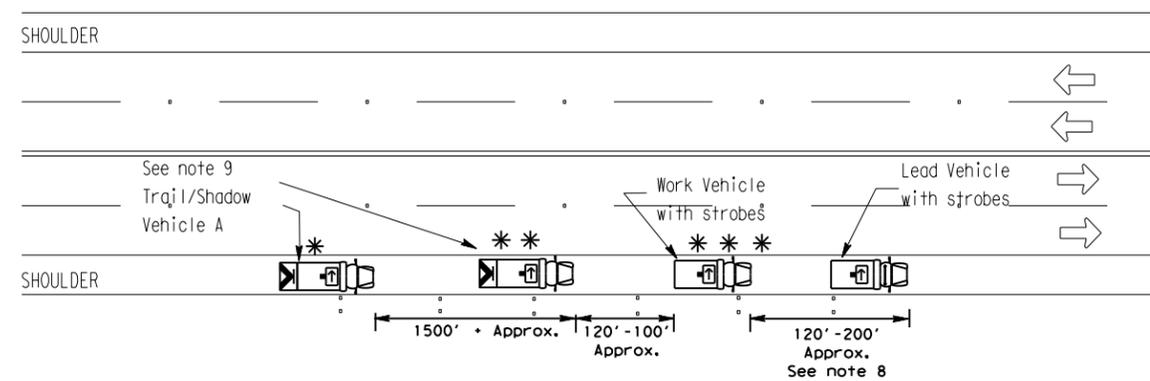
6/30/2022 11:32:22 AM SF:LEL



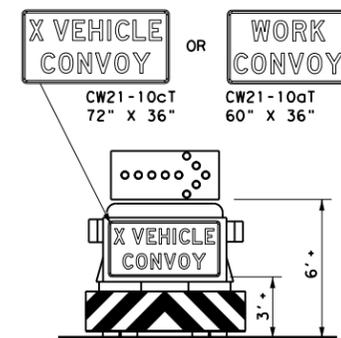
**SWEEPING FOR Direct Connector**



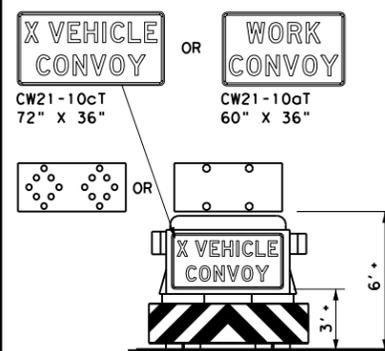
**CENTERLINE SWEEPING FOR Roadway with Two Way Left Turn Lane (TWLTL)**



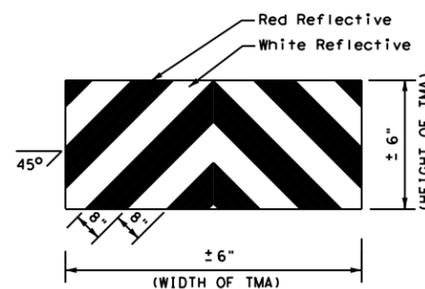
**OUTSIDE SHOULDER SWEEPING FOR Undivided Multilane Roadway with full shoulder**



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



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



**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 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.



*Signature*, P.E.

DATE: \$DATE\$

Texas Department of Transportation

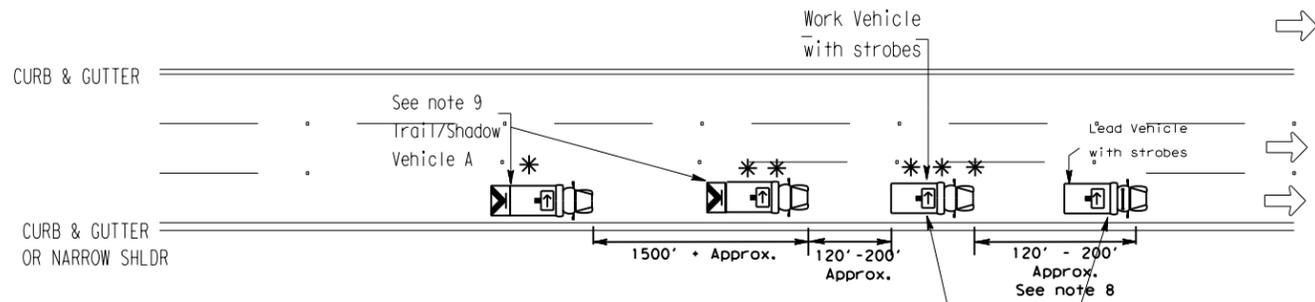
**TRAFFIC CONTROL PLAN SWEEPING OPERATIONS**

1 OF 3

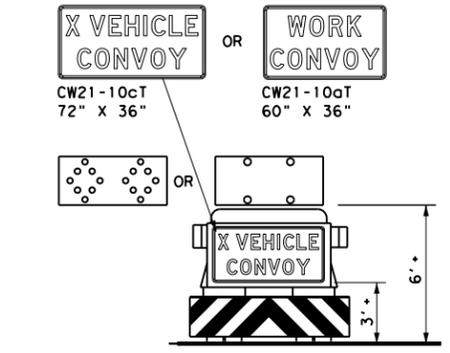
REVISIONS	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
	CONT	SECT	JOB	HIGHWAY
	6399	15	001	SH99
	DIST	COUNTY		SHEET NO.
	BMT	LIBERTY, ETC.		58

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6/30/2022 11:32:25 AM SFLEL\$



**OUTSIDE LANE SWEEPING FOR Frontage Road or other roadways with narrow shoulders**



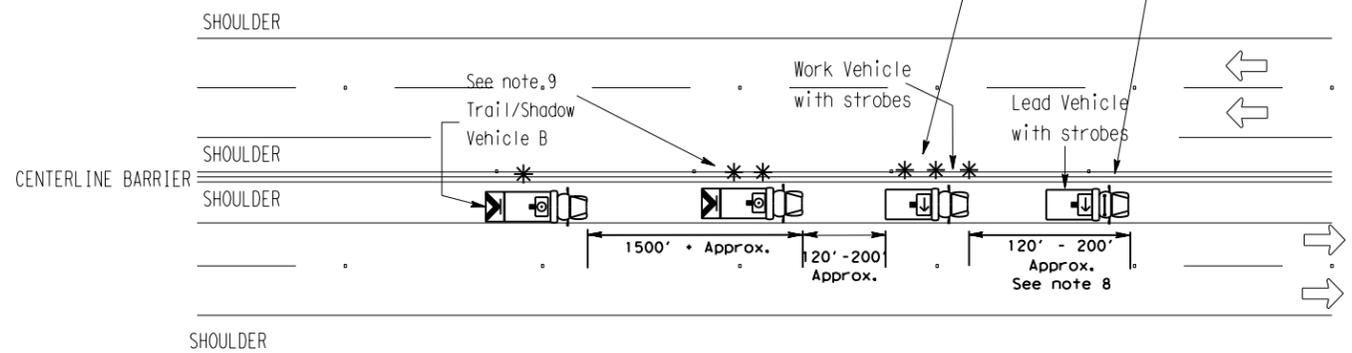
**TRAIL/SHADOW VEHICLE B**  
with Flashing Arrow Board in CAUTION display

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)

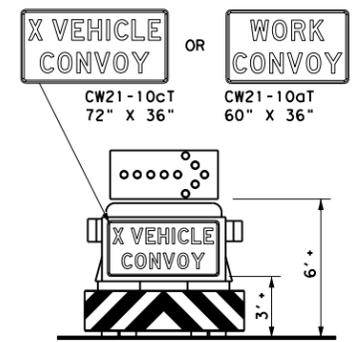
TYPICAL USAGE			
MOBILE	SHORT DURATION	SHORT TERM STATIONARY	LONG TERM STATIONARY
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**GENERAL NOTES**

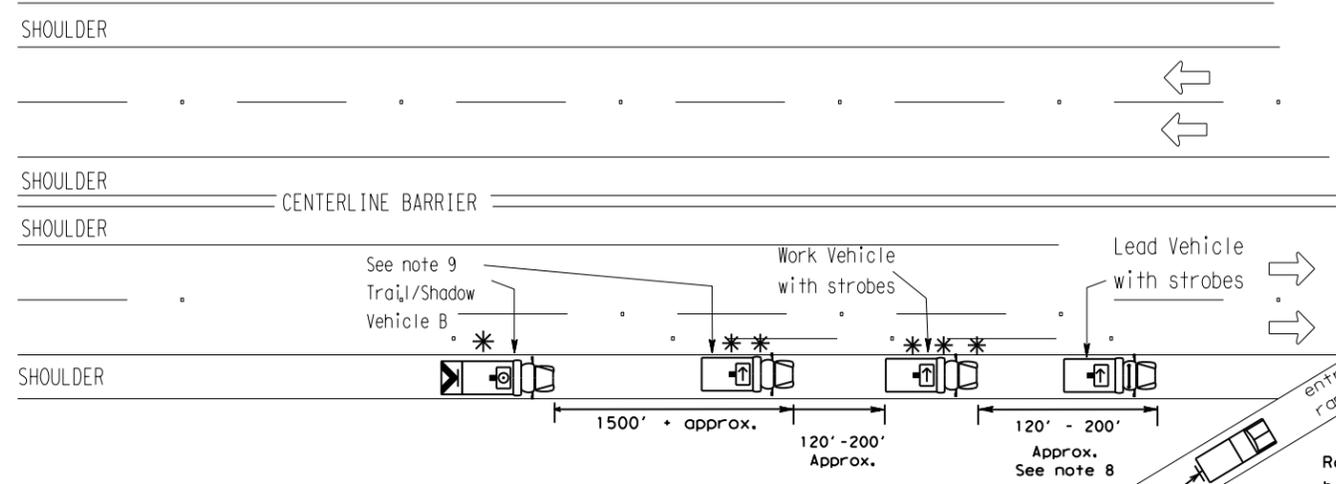
1. TRAIL, SHADOW, and LEAD vehicles shall be equipped with arrow boards as illustrated. When a LEAD vehicle is not used the WORK vehicle must be equipped with an arrow board. The Engineer will determine if the LEAD VEHICLE and/or TRAIL VEHICLE are required based on prevailing roadway conditions, traffic 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.



**CENTERLINE SHOULDER SWEEPING FOR Divided Multilane Roadway with full shoulder**



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

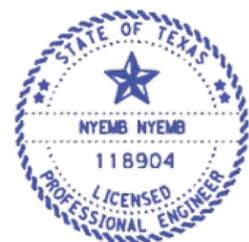


**OUTSIDE SHOULDER SWEEPING FOR Divided Multilane Roadway with full shoulder**



R11-2R

Ramp Control Vehicle shall be used when required by the Engineer



*Engumb, P.E.*

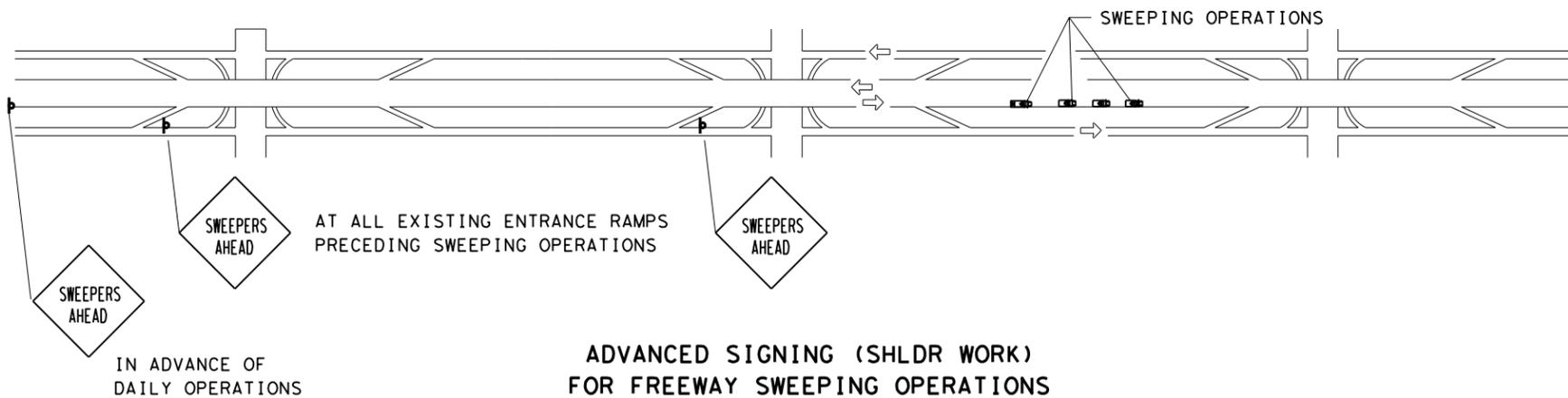
6/30/2022



**TRAFFIC CONTROL PLAN SWEEPING OPERATIONS**

© TxDOT	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
REVISIONS	CONT	SECT	JOB	HIGHWAY
	6399	15	001	SH99
	DIST	COUNTY	SHEET NO.	
	BMT	LIBERTY, ETC.	59	

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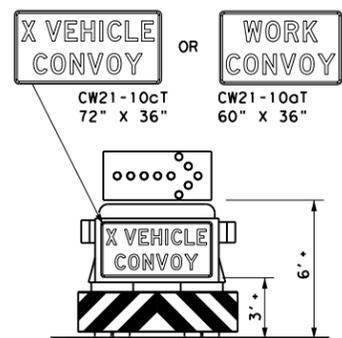
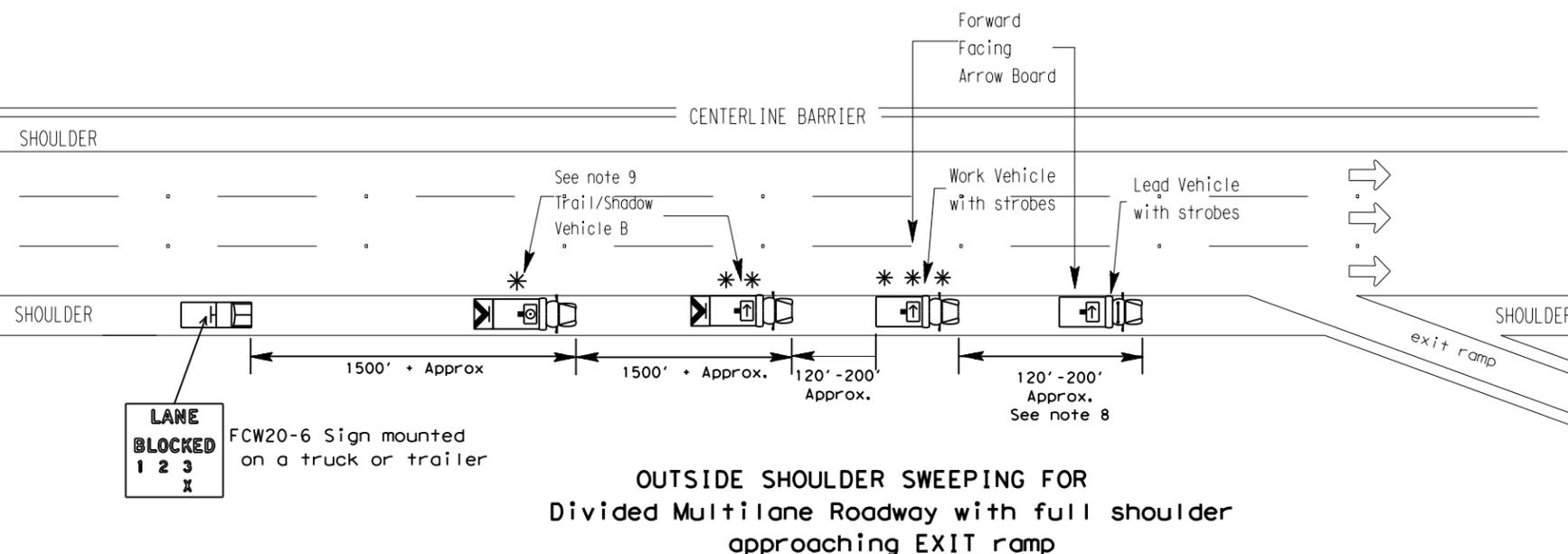


LEGEND			
*	Trail Vehicle	ARROW BOARD DISPLAY	
**	Shadow Vehicle		
***	Work Vehicle		RIGHT Directional
	Heavy Work Vehicle		LEFT Directional
	Truck Mounted Attenuator (TMA)		Double Arrow
	Traffic Flow		CAUTION (Alternating Diamond or 4 Corner Flash)

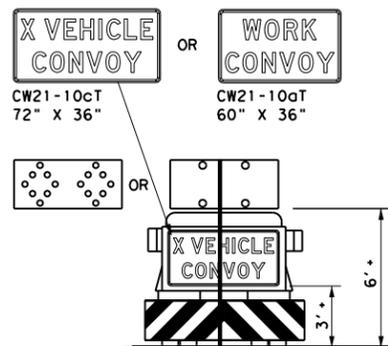
TYPICAL USAGE				
MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**GENERAL NOTES**

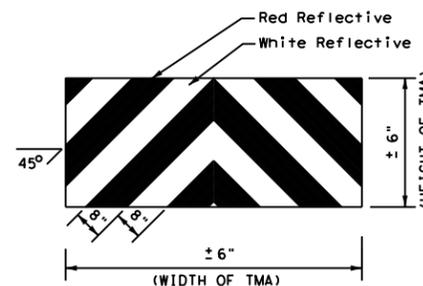
1. TRAIL, SHADOW, and LEAD vehicles shall be equipped with arrow boards as illustrated. When a LEAD vehicle is not used the WORK vehicle must be equipped with an arrow board. The Engineer will determine if the LEAD VEHICLE and/or TRAIL VEHICLE are required based on prevailing roadway conditions, traffic 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.



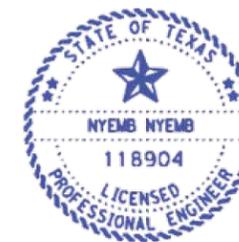
**TRAIL/SHADOW VEHICLE A**  
with RIGHT Directional display Flashing Arrow Board



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



**STRIPING FOR TMA**



*Engelb, P.E.*

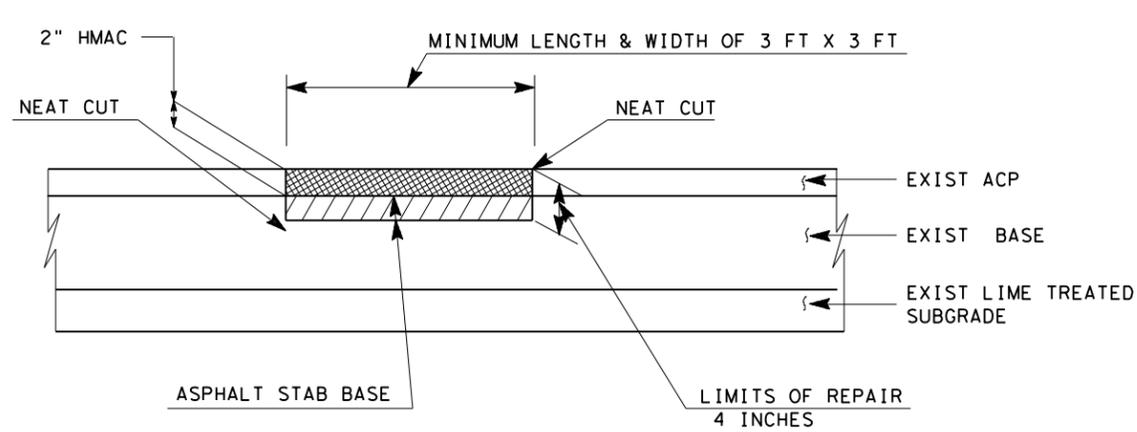
6/30/2022

Texas Department of Transportation  
Traffic Operations Division

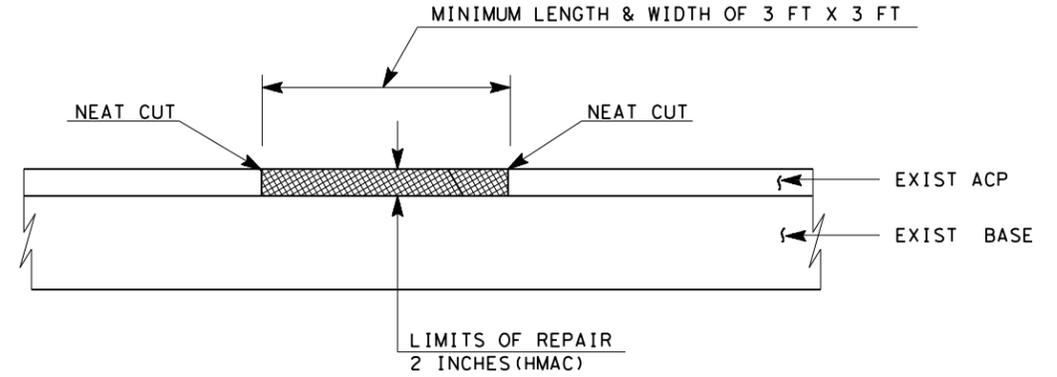
**TRAFFIC CONTROL PLAN  
SWEEPING OPERATIONS**

© TxDOT		DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
REVISIONS		CONT	SECT	JOB	HIGHWAY
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		DIST	COUNTY	SHEET NO.	
		BMT	LIBERTY, ETC.	60	

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PARTIAL SECTION ①  
 FULL DEPTH REPAIR  
 (ITEM 351)



PARTIAL SECTION ②  
 ASPHALTIC PAVEMENT REPAIR  
 (ITEM 351)

NOTES:

1. FULL DEPTH REPAIR WILL BE PAID FOR UNDER ITEM 351, "FLEXIBLE PAVEMENT STRUCTURE REPAIR (6")" AND SHALL CONFORM TO THE REQUIREMENTS OF ITEM 340, "DENSE-GRADED HOT-MIX ASPHALT (SMALL QTY) TY D" AND ITEM 292, "ASPHALT TREATMENT (PLANT-MIXED)".
2. ALL SURFACE MATERIALS SHALL CONSIST OF TWO (2) INCHES OF (TYPE D) (SAC A OR B) (PG 64-22).
3. THE ENGINEER SHALL DETERMINE THE DEPTH OF REPAIR REQUIRED AFTER THE REMOVAL OF THE ACP OVERLAY. IF A FULL DEPTH REPAIR IS REQUIRED AND THE MATERIAL EXCAVATED IS GREATER THAN THOSE SPECIFIED ON THE PLANS, A DEPTH OF FOUR (4) INCHES SHALL BE CONSIDERED THE PLAN DEPTH.



*Engemb, P.E.*

6/29/2022

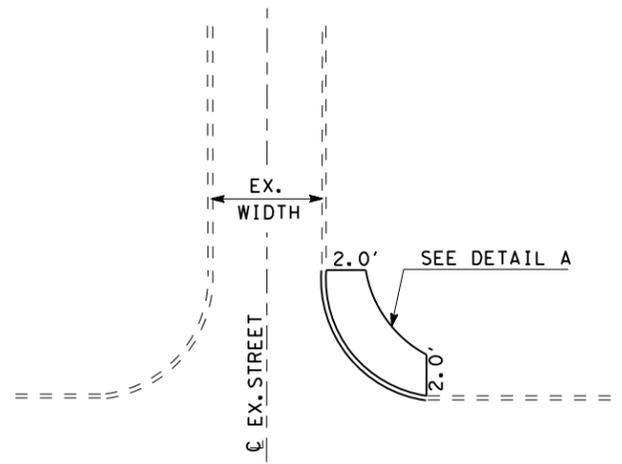
ASPHALTIC PAVEMENT DETAILS

N. T. S.

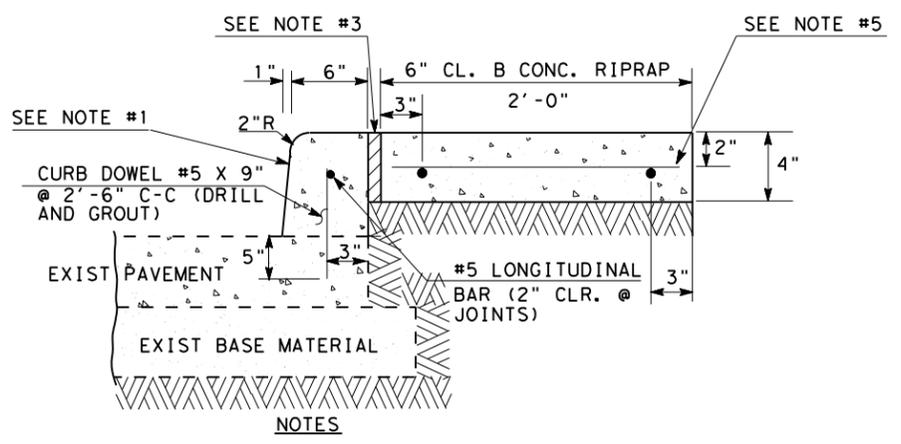
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TEXAS	BMT	LIBERTY, ETC.
CONT.	SECT.	JOB SHEET NO.
6399	15	001 61

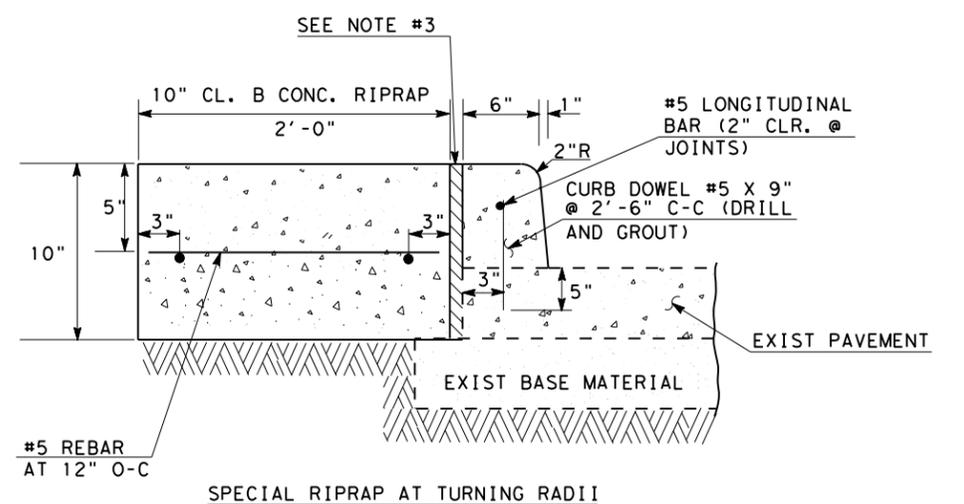
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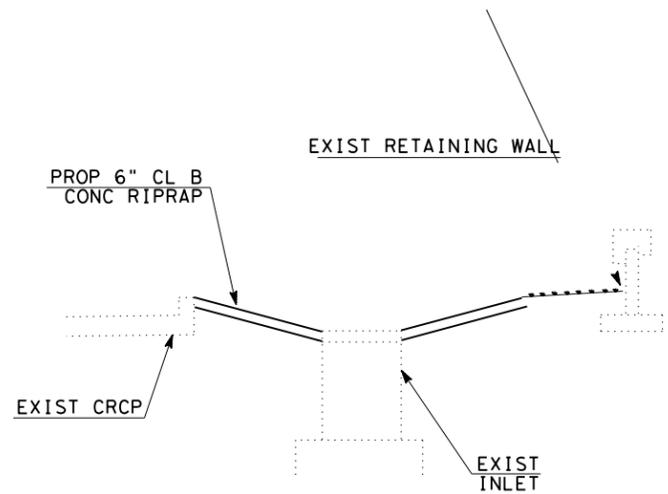
TYPICAL CURB REPAIR  
(AT TURNING RADII)



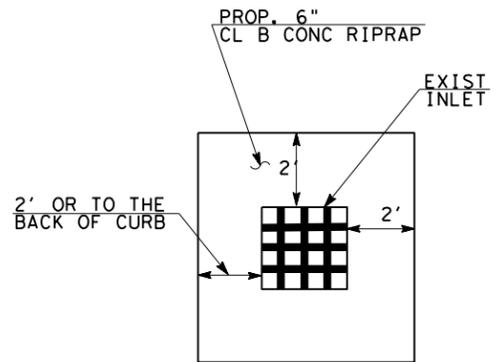
DETAIL A  
(RIPRAP AT TURNING RADII)



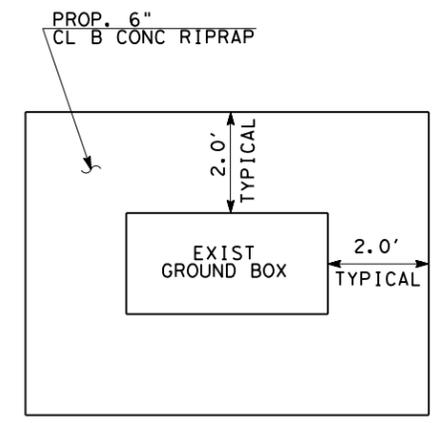
SPECIAL RIPRAP AT TURNING RADII



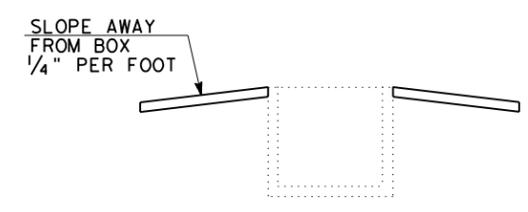
DETAILS OF INLET RIPRAP  
BEHIND CURB  
SEE NOTE #2



DETAILS OF INLET RIPRAP  
SEE NOTE #2



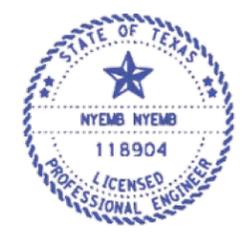
TYPE 1 OR TYPE 2 GROUND BOX  
SEE NOTE #2



DETAILS OF GROUND BOX  
RIPRAP  
SEE NOTE #2

**NOTES**

1. REMOVAL AND REPLACEMENT OF DAMAGED CONCRETE CURB SHALL BE PAID FOR UNDER THE APPROPRIATE BID ITEMS.
2. THE ESTIMATED QUANTITY OF CONCRETE RIPRAP PER GROUND BOX IS 0.41 CY FOR TYPE 1 BOXES AND 0.51 CY FOR TYPE 2 BOXES. FOR INLETS VARIES FROM 0.58 TO 0.83 CY OF RIPRAP. A ONE INCH (1") REDWOOD OR CYPRESS BOARD JT. OR 1/2" NON-EXTRUDING PREFORMED BITUMINOUS JOINT MATERIAL SHALL BE REQUIRED BETWEEN THE WALLS OF THE BOX OR INLET AND THE CL. B CONCRETE.
3. WHERE SIDEWALKS AND RIPRAP ARE PLACED ADJACENT TO THE BACK OF CURB OR OTHER CONCRETE SURFACES, A 1" REDWOOD OR CYPRESS BOARD JT. OR 1/2" NON-EXTRUDING PREFORMED BITUMINOUS JOINT MATERIAL SHALL BE REQUIRED BETWEEN THE TWO SURFACES AND AT 36' (MAX) INTERVALS FOR THE ENTIRE LENGTH OF SIDEWALK.
4. EXCAVATION AND BACKFILL FOR SIDEWALKS AND RIPRAP WILL NOT BE PAID FOR DIRECTLY, BUT SHALL BE CONSIDERED INCIDENTAL TO THE BID ITEM. EXCESS MATERIAL SHALL BE GRADED TO DRAIN AS DIRECTED BY THE ENGINEER.
5. #3 AND #4 BARS REINFORCING SHALL BE AT 18" MAXIMUM C-C SPACING IN BOTH DIRECTIONS.



*Signature*, P.E.

6/29/2022

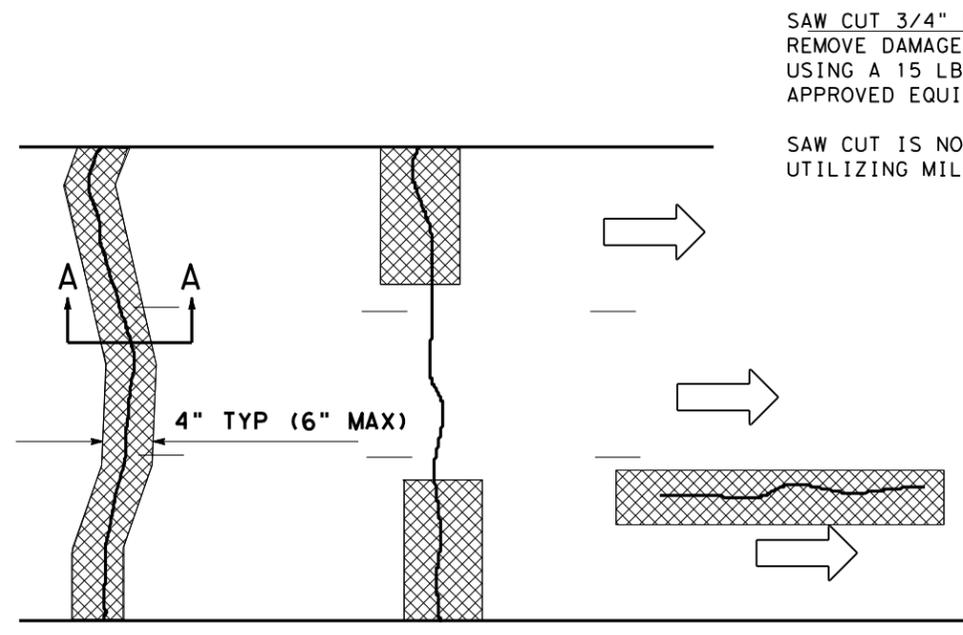
MISCELLANEOUS  
DETAILS SHEET

© 2022		Texas Department of Transportation	
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STATE	DIST.	LIBERTY, ETC.	
TEXAS	BMT	HARRIS	
CONT.	SECT.	JOB	SHEET NO.
6399	15	001	62

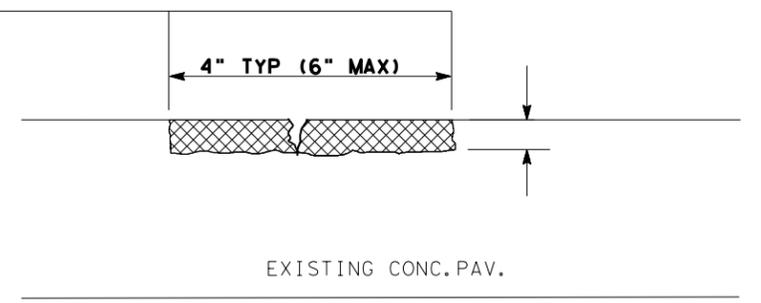
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**NOTES:**

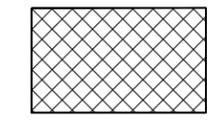
1. ACTUAL REPAIR AREAS WILL BE MARKED IN THE FIELD BY THE ENGINEER.
2. THE NUMBER OF LANES MAY VARY FROM THAT SHOWN ON THIS DETAIL.
3. REPAIR AREAS MAY BE LONGITUDINAL OR TRANSVERSE AND MAY COVER ONE OR MORE LANES. OTHER CONFIGURATIONS SHOULD BE EXPECTED, AS DIRECTED BY THE ENGINEER.
4. FOR ITEM 721, STRICTLY FOLLOW THE SPECIFICATIONS REQUIREMENT FOR ADDING BULKING AGGREGATES (721.4) . RESIN AND BULKING STONE SHALL NOT BE MIXED PRIOR TO PLACING MATERIAL IN THE SPALL AREA.



SAW CUT 3/4" MINIMUM DEPTH. REMOVE DAMAGED CONCRETE USING A 15 LBS. HAMMER OR APPROVED EQUIPMENT.  
SAW CUT IS NOT REQUIRED IF UTILIZING MILLING EQUIPMENT.



**SECTION A-A**



REPAIR AREA. USE ITEM 721 AS DIRECTED BY THE ENGINEER

**DETAIL "A"**  
**REPAIRS AT TRANSVERSE OR LONGITUDINAL CRACKING**

1. USE CONCRETE REPAIR MANUAL CHAPTER 2 SECTION 1 TO DETERMINE TYPE OF REPAIR. THE FINAL DETERMINATION OF THE TYPE OF REPAIR (MINOR VS INTERMEDIATE) AND TYPE OF REPAIR MATERIAL WILL BE AS DIRECTED BY THE ENGINEER. AS A RULE, SPALLS WHICH REVEAL MORE THAN 1/2 EXISTING REINFORCEMENT WILL BE INTERMEDIATE REPAIRS.

- FOR MINOR REPAIRS AS DEFINED BY CONCRETE REPAIR MANUAL:

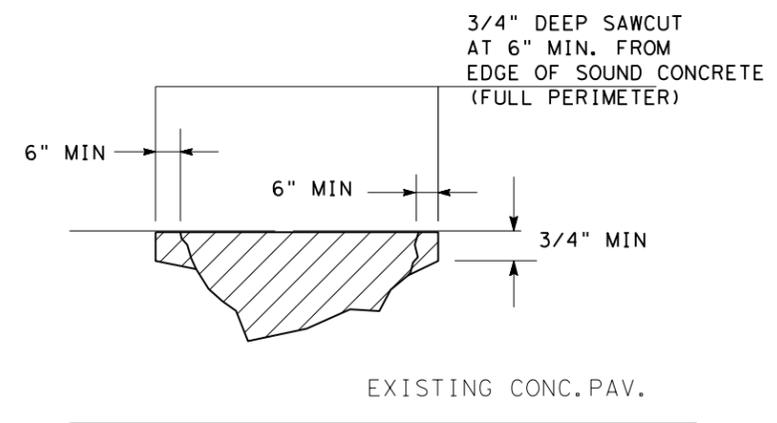
THE GOVERNING ITEM WILL BE EITHER USE ITEM 720 AS DIRECTED BY ENGINEER. FOLLOW REPAIR PROCEDURES IN CHAPTER 3 SECTION 1 OF CONCRETE REPAIR MANUAL.

-FOR INTERMEDIATE OR MAJOR REPAIRS AS DEFINED BY CONCRETE REPAIR MANUAL:

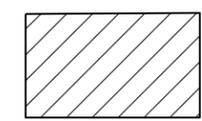
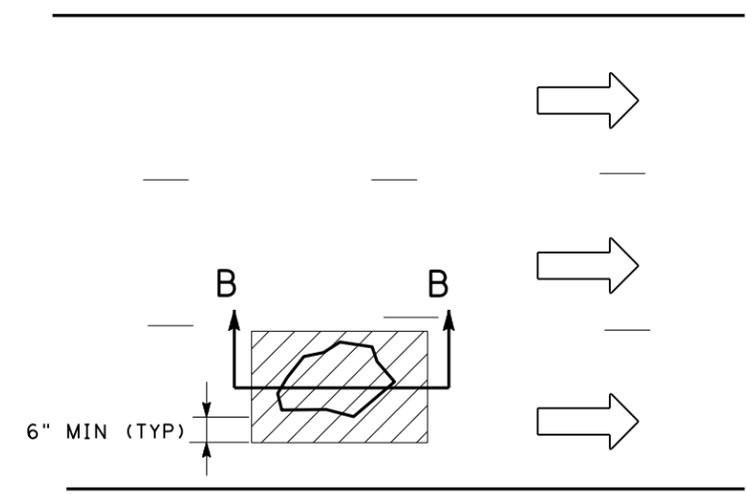
THE GOVERNING ITEM WILL BE EITHER ITEM 361 OR ITEM 4003 AS DIRECTED BY THE ENGINEER. FOLLOW REPAIR PROCEDURES AND USE MATERIALS ACCORDING TO RESPECTIVE ITEM (361 OR 4003).

2. ACTUAL REPAIR AREAS WILL BE MARKED IN THE FIELD BY THE ENGINEER.

3. FOR ITEM 721, STRICTLY FOLLOW THE SPECIFICATIONS REQUIREMENT FOR ADDING BULKING AGGREGATES (721.4) . RESIN AND BULKING STONE SHALL NOT BE MIXED PRIOR TO PLACING MATERIAL IN THE SPALL AREA.



**SECTION B-B**



REPAIR AREA FOR GOVERNING ITEM AND TYPE OF MATERIAL SEE NOTE 1.

**DETAIL "B"**  
**SPALL REPAIRS**

DO NOT REMOVE MORE CONCRETE THAN CAN BE REPAIRED IN THE SAME WORK PERIOD. IF, THE CONTRACTOR CANNOT COMPLETE A SECTION BEFORE THE END OF THE WORKDAY, APPLY ACP MATERIAL TO FILL VOID. LABOR AND MATERIALS FOR INSTALLATION AND REMOVAL WILL BE AT CONTRACTORS EXPENSE.



*Engumb, P.E.*

6/29/2022

NOT TO SCALE

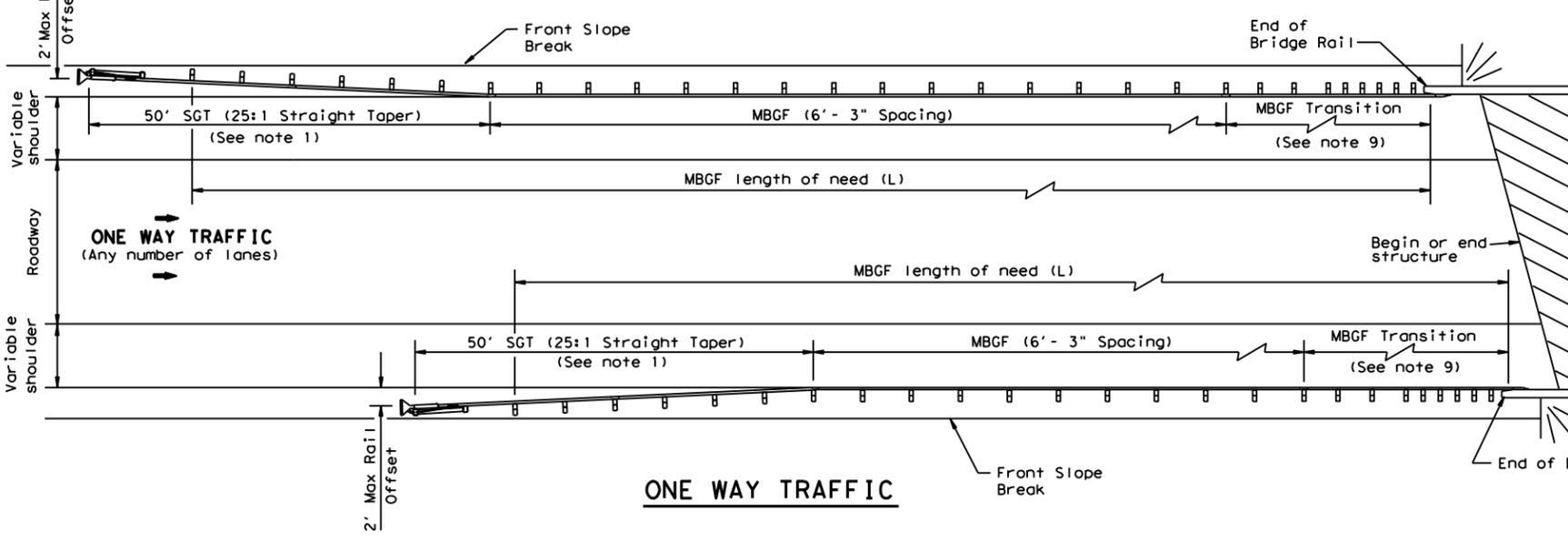
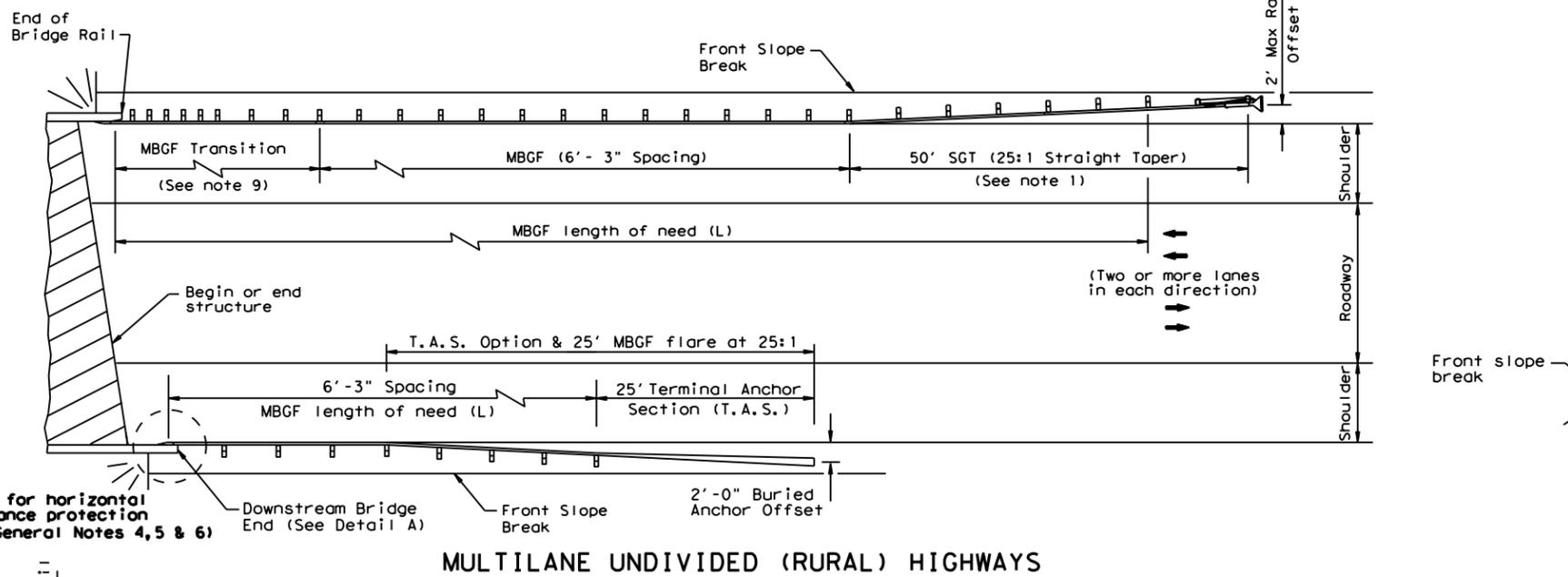
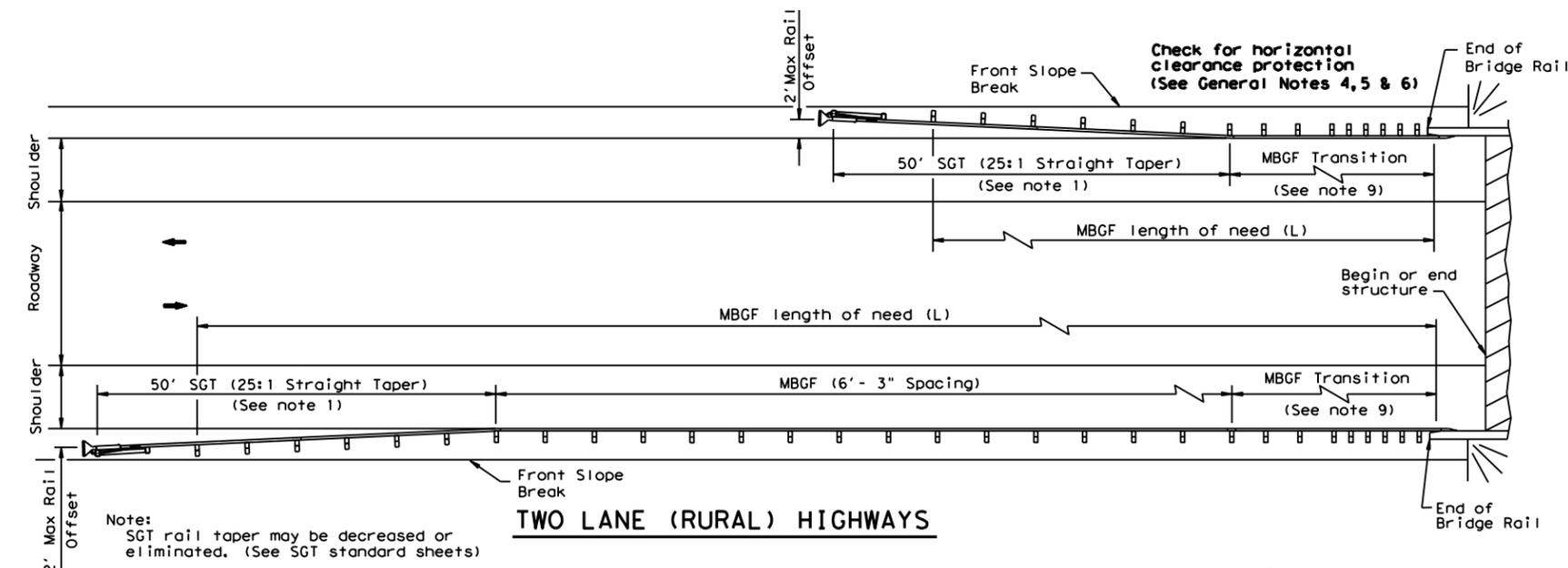


**RDWY CRACK & SPALL REPAIR DETAILS**

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STATE	STATE DIST. NO.	COUNTY	
TEXAS	BMT	LIBERTY, ETC.	
CONT.	SECT.	JOB	HIGHWAY NO.
6399	15	001	SH99

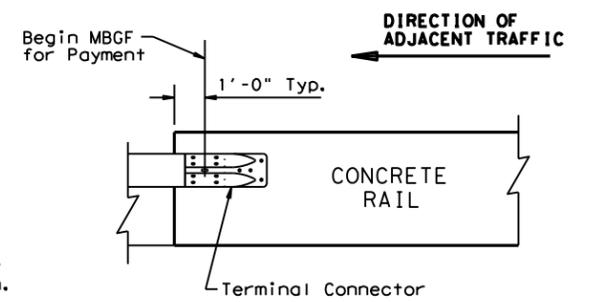
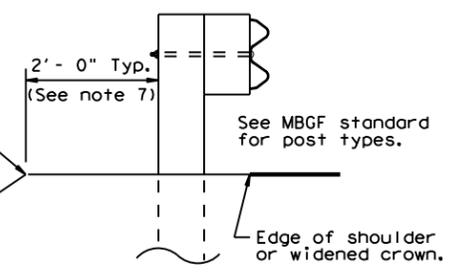
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DATE:  
FILE:



**GENERAL NOTES**

1. For more detail: See MBGF, SGT, and MBGF Transition standard sheets.
2. Quantities of metal beam guard fence (MBGF) at individual bridge ends are shown elsewhere in plans.
3. Use average daily traffic (ADT) for the current year to determine MBGF length of need in accordance with the Roadway Design Manual unless otherwise specified. Where significant traffic volume growth is anticipated on low volume (0-750 ADT) highways, use length determinations for the higher volume category.
4. MBGF may not be required to shield departure end of bridge unless other obstacles within the horizontal clearance limits or opposing traffic indicate a MBGF consideration.
5. Terminal anchor sections (TAS) are only for downstream end anchorage use, outside the horizontal clearance area of opposing traffic.
6. Direct connection of MBGF (at 6'-3" post spacing without transition) to concrete rail are only for downstream rail connections outside the horizontal clearance area of opposing traffic. (See Detail A)
7. The crown shall be widened to accommodate MBGF. Typically the "front slope" break should be 2'-0" from the back of the MBGF post. This applies to new construction on new alignment or where existing roadway cross section is to be widened to increase roadway width. This does not apply to rehabilitation work where existing roadway crown width is to be retained (See Typical Cross Section at MBGF).
8. For restrictive bridge widths: The MBGF should be properly transitioned from the existing bridge rail to the adjoining MBGF (See MBGF Transition Standards). Metal beam guard fence at these bridge location(s) shall be flared at the rate of 25:1 or flatter, and be of the length necessary to locate the terminal end at the 2 ft. "maximum" offset from the shoulder edge.
9. Transition length and post spacing will vary depending on the transition type. Transition type will be shown elsewhere in the plans.



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

**ONLY FOR USE IN MAINTENANCE REPAIRS.**

Texas Department of Transportation Design Division Standard

**BRIDGE END DETAILS  
(28" METAL BEAM GUARD FENCE  
APPLICATIONS TO RIGID RAILS)  
BED (28) - 19**

FILE: bed2819.dgn	DN: TxDOT	CK: KM	DW: BD	CK: VP
© TxDOT NOVEMBER 2019	CONT	SECT	JOB	HIGHWAY
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	DIST	COUNTY	SHEET NO.	
	BMT	LIBERTY, ETC.	64	



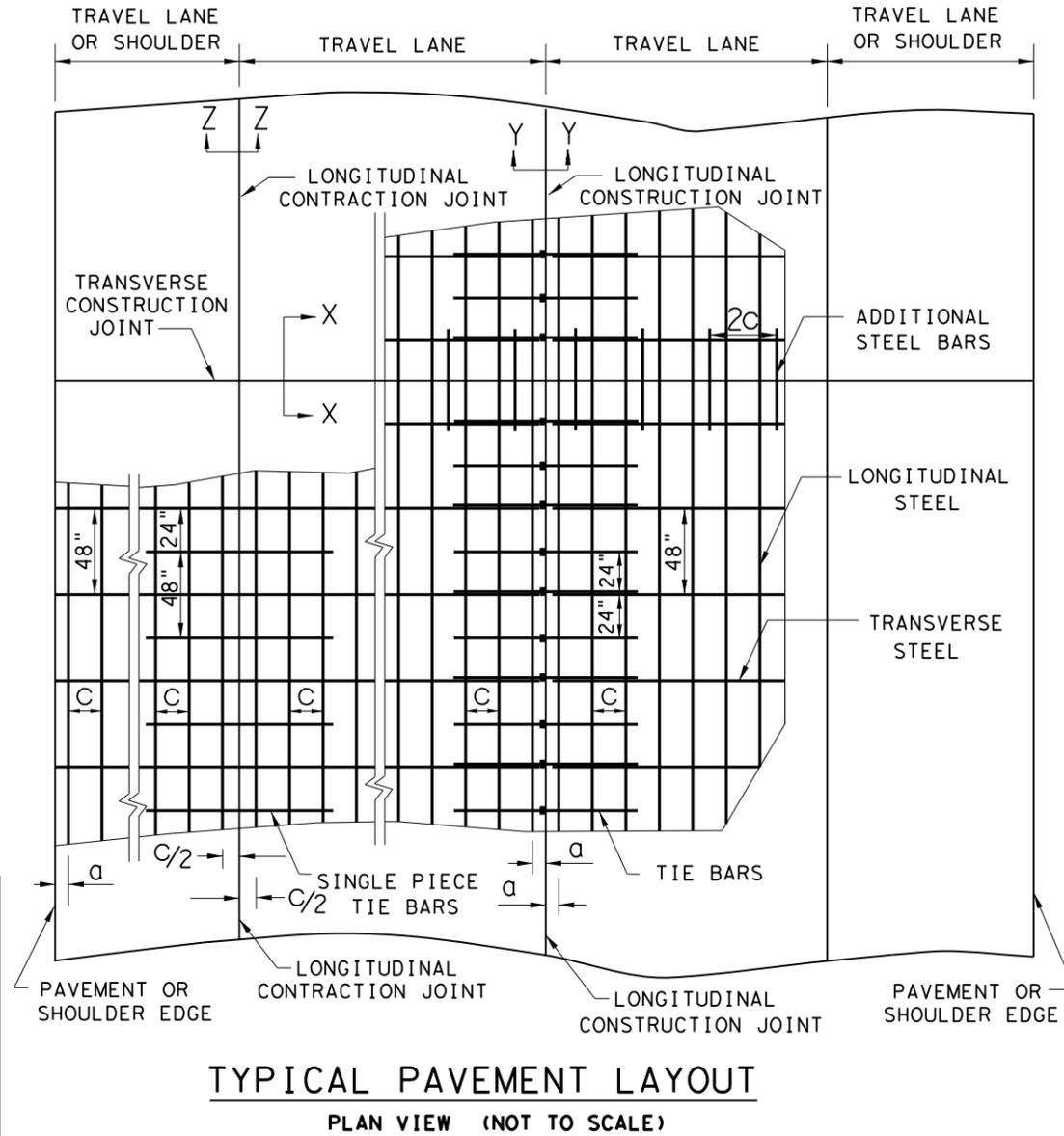


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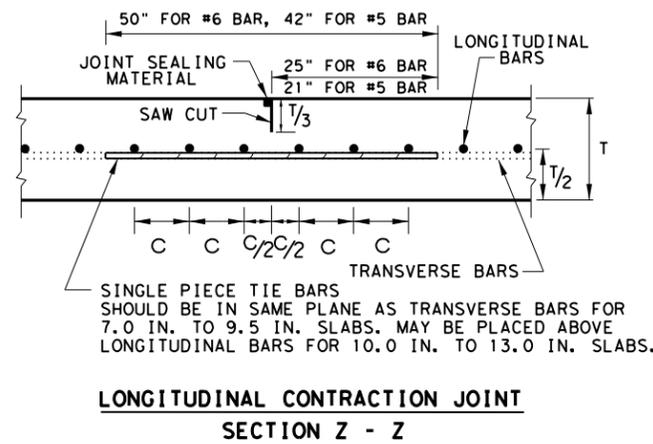
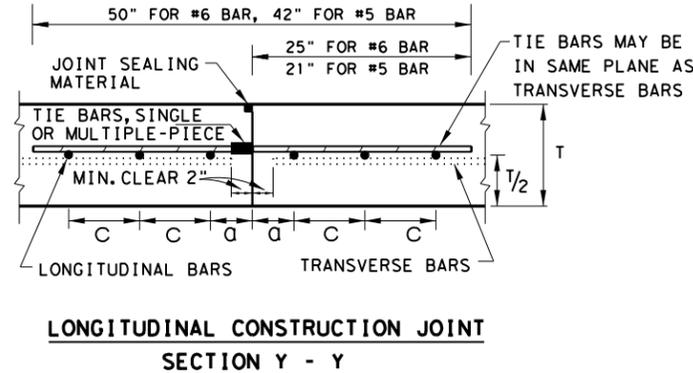
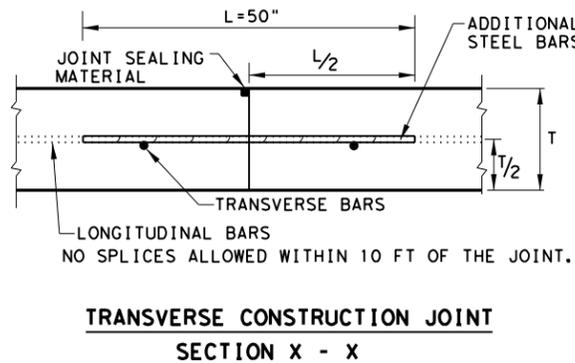
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SLAB THICKNESS AND BAR SIZE		REGULAR STEEL BARS	FIRST SPACING AT EDGE OR JOINT	ADDITIONAL STEEL BARS AT TRANSVERSE CONSTRUCTION JOINT (SECTION X-X)	
T (IN.)	BAR SIZE	SPACING C (IN.)	SPACING a (IN.)	SPACING 2 x C (IN.)	LENGTH L (IN.)
7.0	#5	6.5	3 TO 4	13	50
7.5	#5	6.0	3 TO 4	12	50
8.0	#6	9.0	3 TO 4	18	50
8.5	#6	8.5	3 TO 4	17	50
9.0	#6	8.0	3 TO 4	16	50
9.5	#6	7.5	3 TO 4	15	50
10.0	#6	7.0	3 TO 4	14	50
10.5	#6	6.75	3 TO 4	13.5	50
11.0	#6	6.5	3 TO 4	13	50
11.5	#6	6.25	3 TO 4	12.5	50
12.0	#6	6.0	3 TO 4	12	50
12.5	#6	5.75	3 TO 4	11.5	50
13.0	#6	5.5	3 TO 4	11	50

SLAB THICKNESS (IN.)	TRANSVERSE STEEL		TIE BARS AT LONGITUDINAL CONSTRUCTION JOINT (SECTION Z-Z)		TIE BARS AT LONGITUDINAL CONSTRUCTION JOINT (SECTION Y-Y)	
	BAR SIZE	SPACING (IN.)	BAR SIZE	SPACING (IN.)	BAR SIZE	SPACING (IN.)
7.0 - 7.5	#5	48	#5	48	#5	24
8.0 - 13.0	#5	48	#6	48	#6	24



1. DETAILS FOR PAVEMENT WIDTH, PAVEMENT THICKNESS AND THE CROWN CROSS-SLOPE SHALL BE SHOWN ELSEWHERE IN THE PLANS. PAVEMENTS WIDER THAN 100 FT. WITHOUT A FREE LONGITUDINAL JOINT ARE NOT COVERED BY THIS STANDARD.
2. USE COARSE AGGREGATES WITH A RATED COEFFICIENT OF THERMAL EXPANSION (COTE) OF NOT MORE THAN  $5.5 \times 10^{-6}$  IN/IN/°F AS LISTED IN THE CONCRETE RATED SOURCE QUALITY CATALOG (CRSQC).
3. ALL THE REINFORCING STEEL AND TIE BARS SHALL BE DEFORMED STEEL BARS CONFORMING TO ASTM A 615 (GRADE 60) OR ASTM A 996 (GRADE 60) OR ABOVE. STEEL BAR SIZES AND SPACINGS SHALL CONFORM TO TABLE NO.1 AND TABLE NO.2.
4. STEEL BAR PLACEMENT TOLERANCE SHALL BE +/- 1 IN. HORIZONTALLY AND +/- 0.5 IN. VERTICALLY. CALCULATED AVERAGE BAR SPACING (CONCRETE PLACEMENT WIDTH / NUMBER OF LONGITUDINAL BARS) SHALL CONFORM TO TABLE NO.1
5. PAVEMENT WIDTHS OF MORE THAN 15 FT. SHALL HAVE A LONGITUDINAL JOINT (SECTION Z-Z OR SECTION Y-Y). THESE JOINTS SHALL BE LOCATED WITHIN 6 IN. OF THE LANE LINE UNLESS THE JOINT LOCATION IS SHOWN ELSEWHERE ON THE PLANS.
6. THE SAW CUT DEPTH FOR THE LONGITUDINAL CONTRACTION JOINT (SECTION Z-Z) SHALL BE ONE THIRD OF THE SLAB THICKNESS (T/3).
7. WHEN TYING CONCRETE GUTTER AT A LONGITUDINAL JOINT, THE TIE BAR LENGTH OR POSITION MAY BE ADJUSTED. PROVIDE 3 IN. OF CONCRETE COVER FROM THE BACK OF GUTTER TO THE END OF TIE BAR.
8. REPLACE MISSING OR DAMAGED TIE BARS WITHOUT ADDITIONAL COMPENSATION BY DRILLING MIN.10 IN. DEEP AND GROUTING TIE BARS WITH TYPE III, CLASS C EPOXY. MEET THE PULL-OUT TEST REQUIREMENTS IN ITEM 361.
9. OMIT TIE BARS LOCATED WITHIN 18-IN. OF THE TRANSVERSE CONSTRUCTION JOINTS (SECTION X-X). USE HAND-OPERATED IMMERSION VIBRATORS TO CONSOLIDATE THE CONCRETE ADJACENT TO ALL FORMED JOINTS.
10. LONGITUDINAL REINFORCING STEEL SPLICES SHALL BE A MINIMUM OF 25 IN. STAGGER THE LAP LOCATIONS SO THAT NO MORE THAN 1/3 OF THE LONGITUDINAL STEEL IS SPLICED IN ANY GIVEN 12-FT. WIDTH AND 2-FT. LENGTH OF THE PAVEMENT.
11. THE DETAIL FOR THE JOINT SEALANT AND RESERVOIR IS SHOWN ON STANDARD SHEET "CONCRETE PAVING DETAILS, JOINT SEALS."

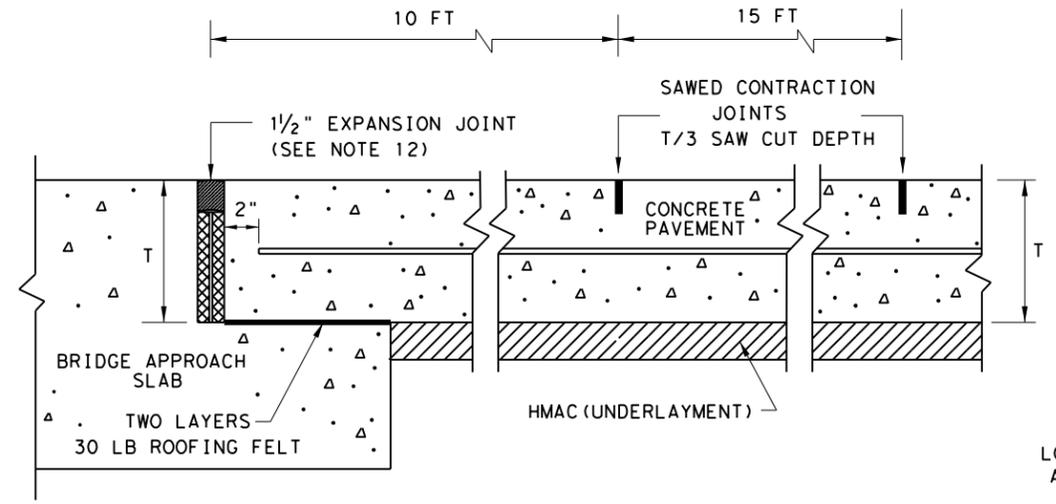


SHEET 1 OF 2

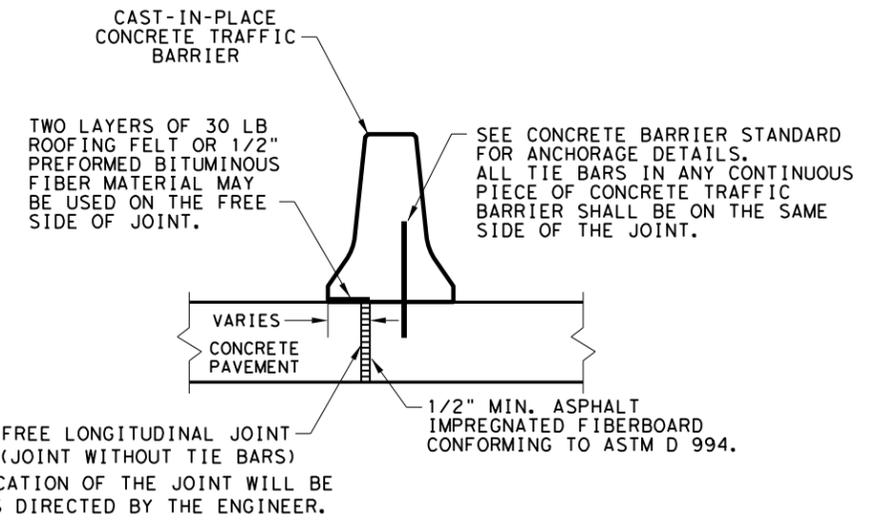
		Design Division Standard	
<b>CONTINUOUSLY REINFORCED CONCRETE PAVEMENT</b> <b>ONE LAYER STEEL BAR PLACEMENT</b> <b>T - 7 to 13 INCHES</b> <b>CRCP (1) - 20</b>			
FILE: crcp120.dgn	DN: TxDOT	CK: KM	DW: AN
© TxDOT: APRIL 2020	CONT: 6399	SECT: 15	JOB: 001
10/10/2011 ADD GN #12	REVISIONS	6399	SH99
04/09/2013 REMOVE 6" AND 6.5" ADD CTE REQUIREMENTS	DIST: BMT	COUNTY: LIBERTY, ETC.	SHEET NO.: 67
05/05/2017 COTE AS RATED 4.3			

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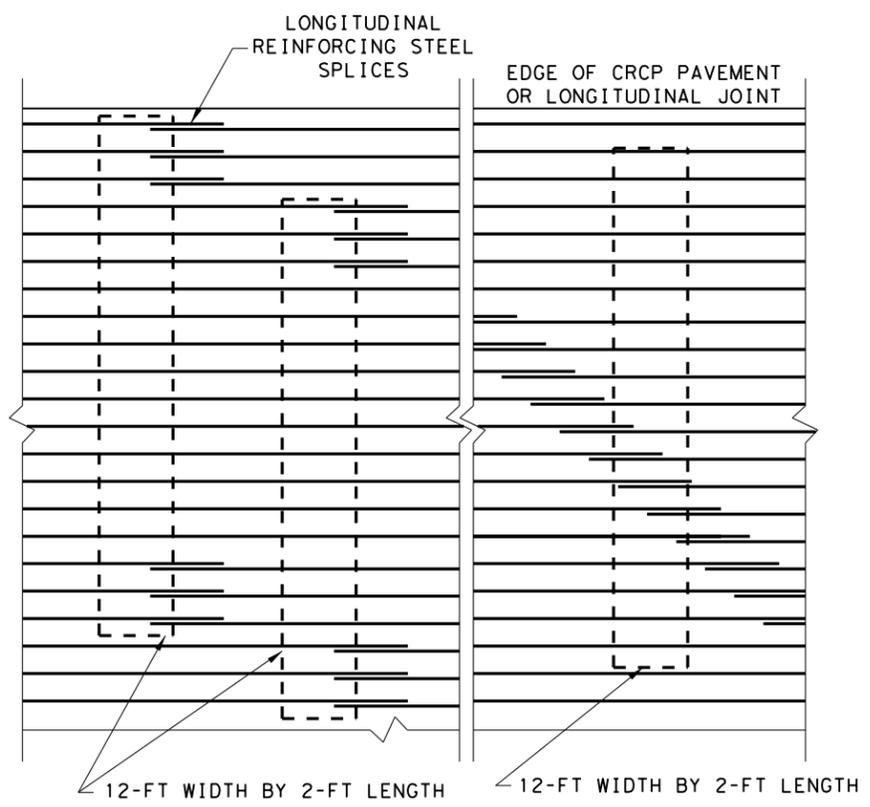
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**TRANSVERSE EXPANSION JOINT DETAIL  
AT BRIDGE APPROACH**

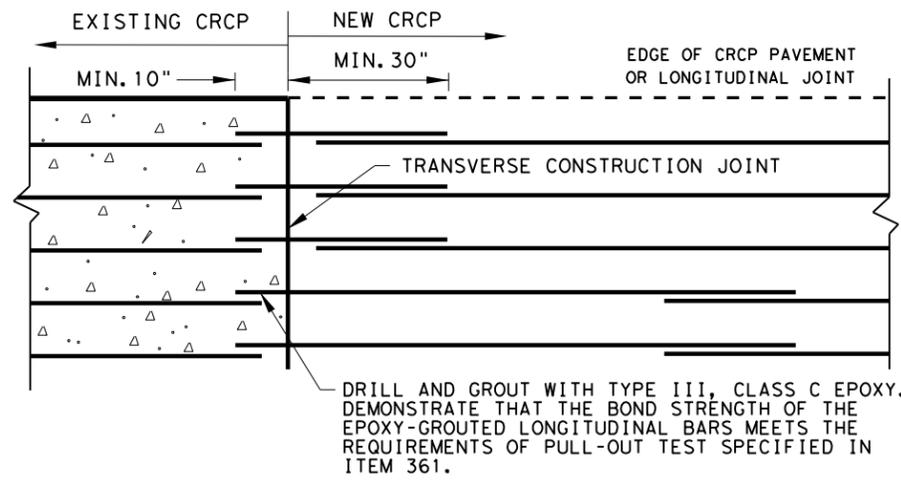


**FREE LONGITUDINAL JOINT DETAIL**

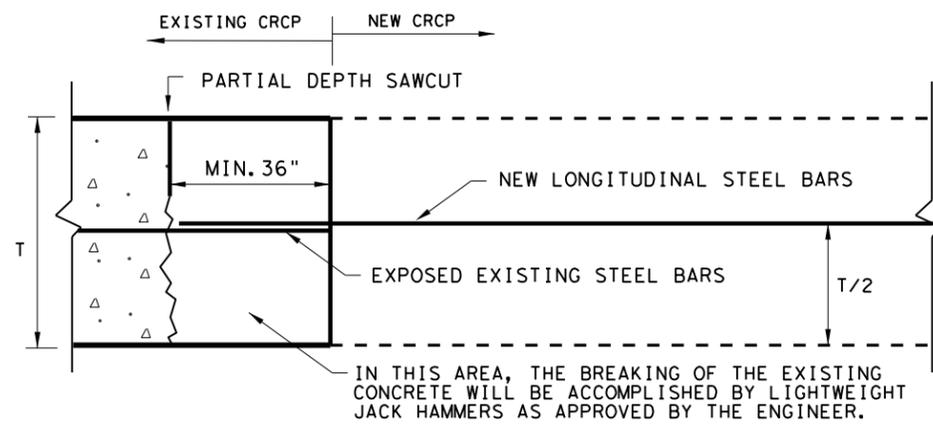


STAGGER THE LAP LOCATIONS SO THAT NO MORE THAN 1/3 OF THE LONGITUDINAL STEEL IS SPLICED IN ANY GIVEN 12-FT. WIDTH AND 2-FT. LENGTH OF THE PAVEMENT. ANY OTHER LAP CONFIGURATION MEETING THIS REQUIREMENT WILL BE ALLOWED.

**EXAMPLES OF LAP CONFIGURATION  
PLAN VIEW (NOT TO SCALE)**

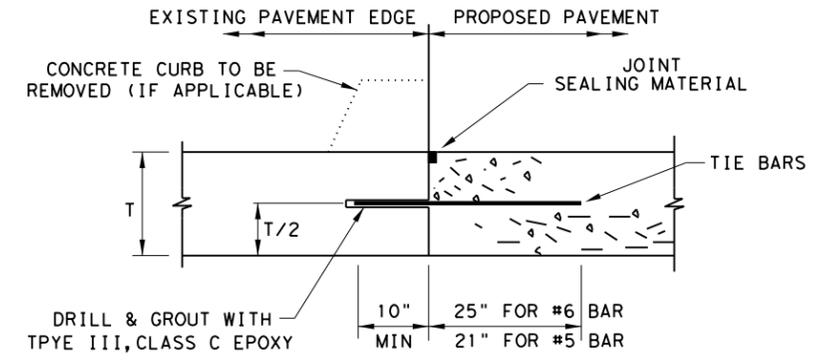


**OPTION A: DRILL AND EPOXY  
PLAN VIEW (NOT TO SCALE)**



**OPTION B: BREAKBACK AND LAP**

**TRANSVERSE TIE JOINT DETAIL  
EXISTING CRCP TO NEW CRCP**



1. BEFORE WIDENING WORK, DEMONSTRATE THAT THE BOND STRENGTH OF THE EPOXY-GROUTED TIE BARS MEETS THE REQUIREMENTS OF PULL-OUT TEST SPECIFIED IN ITEM 361.
2. SPACE TIE BARS AT 24" SPACING. USE #6 TIE BARS FOR 8" AND THICKER SLABS, USE #5 TIE BARS FOR LESS THAN 8" THICK SLABS.

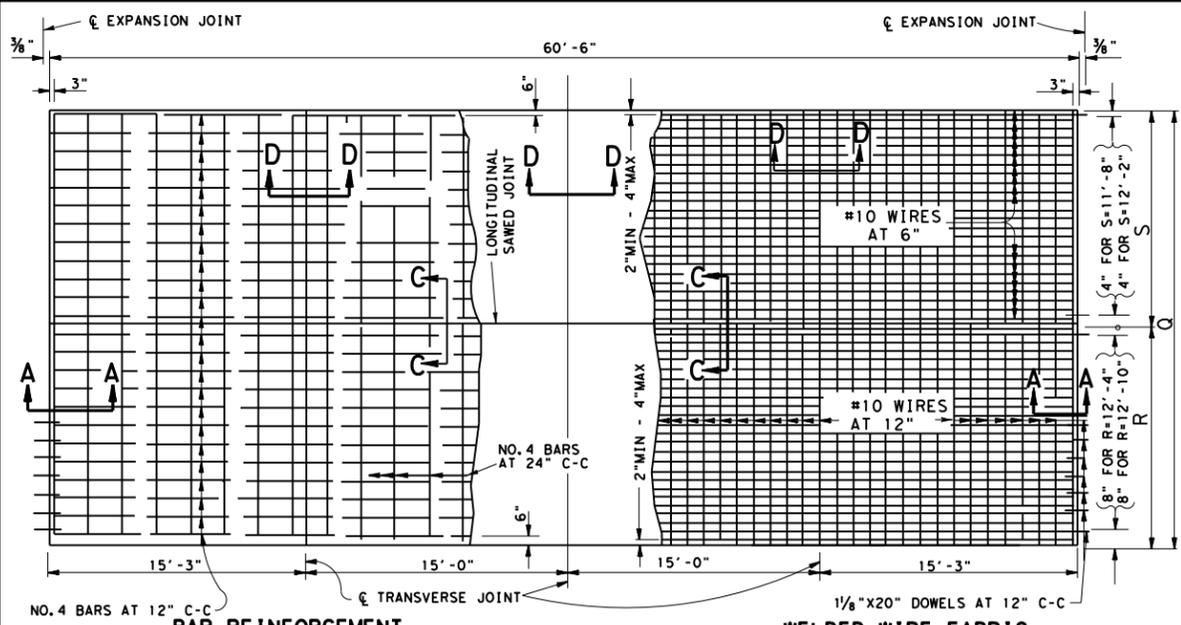
**LONGITUDINAL WIDENING JOINT DETAIL**

SHEET 2 OF 2



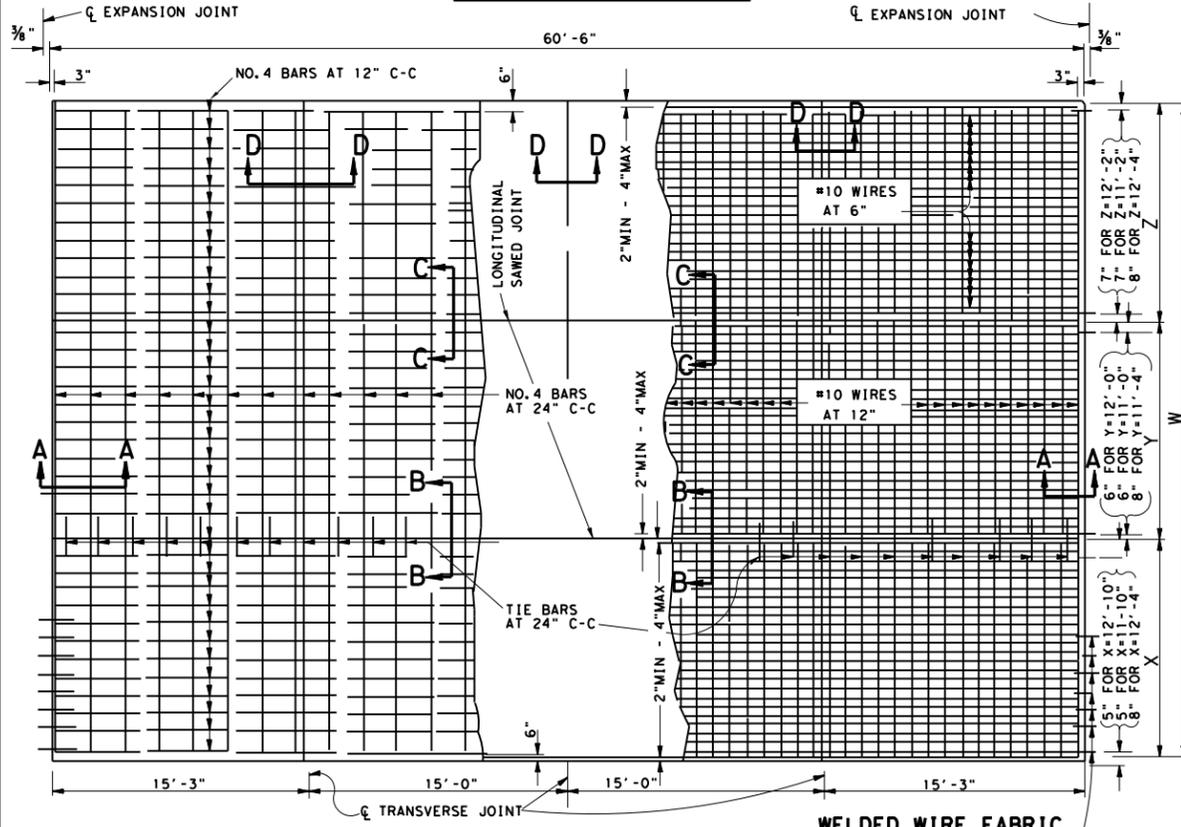
**CONTINUOUSLY REINFORCED  
CONCRETE PAVEMENT  
ONE LAYER STEEL BAR PLACEMENT  
T - 7 to 13 INCHES  
CRCP(1)-20**

FILE: crcp120.dgn	DN: TxDOT	CK: KM	DW: AN	CK: VP
© TxDOT: APRIL 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	6399	15	001	SH99
03/16/2020 REMOVED TABLE 1A	DIST	COUNTY	SHEET NO.	
	BMT	LIBERTY, ETC.	68	



**TWO LANE PAVEMENT PLAN**

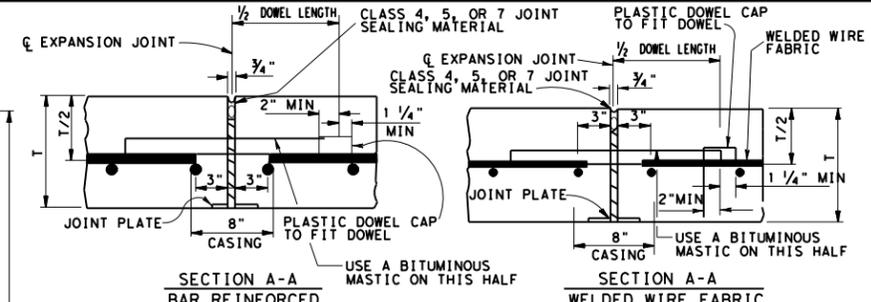
	WIDTH - Q		
	24'-0"	24'-6"	25'-0"
R	12'-4"	12'-4"	12'-10"
S	11'-8"	12'-2"	12'-2"



**THREE LANE PAVEMENT PLAN**

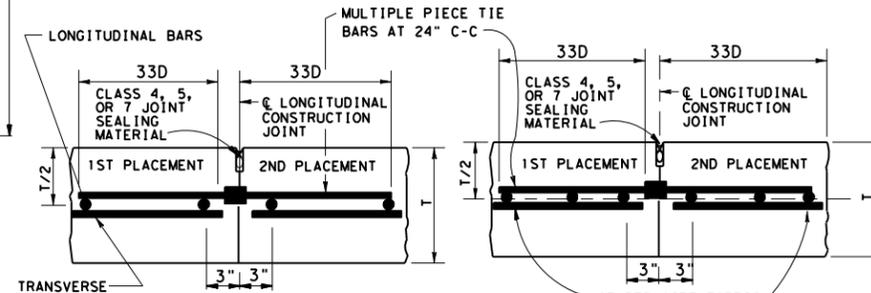
	WIDTH - W		
	37'-0"	36'-0"	34'-0"
X	12'-10"	12'-4"	11'-10"
Y	12'-0"	11'-4"	11'-0"
Z	12'-2"	12'-4"	11'-2"

D = DIAMETER  
R = RADIUS  
T = THICKNESS

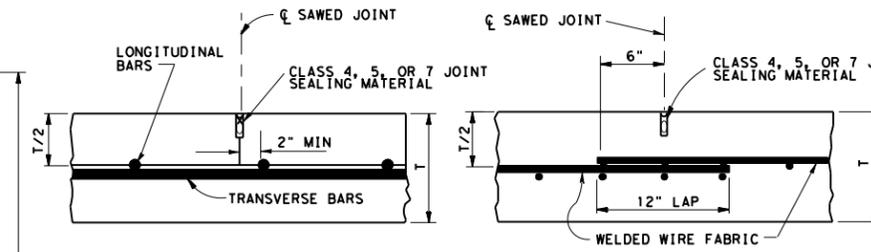


**TRANSVERSE EXPANSION JOINTS**

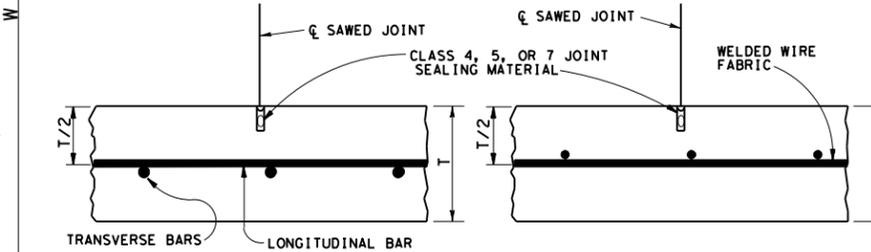
NOTE: DOWEL BARS CONFORMING TO ASTM A615 OR A616 GRADE 60 ARE ACCEPTABLE



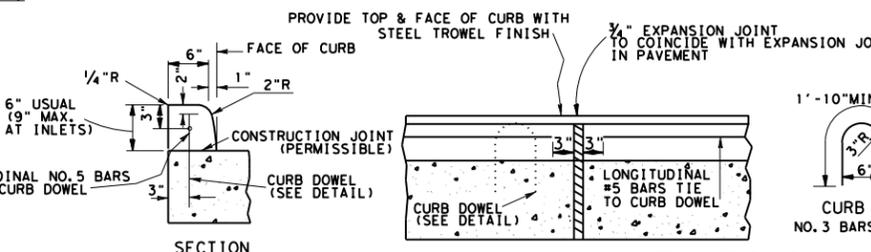
**LONGITUDINAL CONSTRUCTION JOINTS**



**LONGITUDINAL SAWED JOINTS**



**TRANSVERSE SAWED JOINTS**



**TYPICAL 6" CURB (DETAIL)**

- GENERAL NOTES**
- MULTIPLE PIECE TIE BARS ARE REQUIRED AT LONGITUDINAL CONSTRUCTION JOINTS. USE MULTIPLE PIECE TIE BAR ASSEMBLIES WITH STOP TYPE COUPLINGS AND WITH THREADS ON THE BARS. ENSURE THE MULTIPLE PIECE TIE BAR ASSEMBLIES DEVELOP A MINIMUM ULTIMATE TENSILE STRENGTH EQUAL TO 1.25 TIMES THE YIELD STRENGTH OF THE TRANSVERSE BARS BEING JOINED. USE DEFORMED REINFORCING BARS FOR TIE BARS. TIE BAR ASSEMBLIES MADE FROM STEELS OTHER THAN ASTM GRADE 60 AND WITH DEFORMATIONS OTHER THAN ASTM STANDARD MAY BE USED IF IT CAN BE PROVEN TO THE ENGINEER THAT THEY ARE IN EVERY RESPECT THE EQUAL OF THE ASSEMBLIES SPECIFIED. LABORATORY TESTING OF THE PROPOSED ASSEMBLIES, AT THE CONTRACTOR'S EXPENSE, MAY BE REQUIRED.
  - FORM CONSTRUCTION JOINTS WITH METAL OR WOOD FORMS EQUAL IN DEPTH TO THE NOMINAL DEPTH OF THE PAVEMENT OR BY OTHER MEANS APPROVED PRIOR TO THEIR USE.
  - SAW LONGITUDINAL AND TRANSVERSE JOINTS AS SOON AS SAWING CAN BE ACCOMPLISHED WITHOUT DAMAGE TO THE PAVEMENT AND BEFORE 24 HOURS AFTER PLACING THE CONCRETE, THE EXACT TIME WILL BE APPROVED BY THE ENGINEER. PREFORMED JOINT WITH ASPHALT STRIP IS NOT ACCEPTABLE.
  - LONGITUDINAL JOINTS ARE SHOWN OFFSET FOUR INCHES FROM THE THEORETICAL LANE LINE AND MAY BE OFFSET TO EITHER SIDE IF THE WIDTH OF THE WIRE FABRIC IS PROPERLY ADJUSTED.
  - ONE OF THE LONGITUDINAL JOINTS OF PAVEMENT SLABS WIDER THAN TWO LANES MAY BE A CONSTRUCTION JOINT. FOR PAVEMENT SLABS WIDER THAN 15 FT. PROVIDE A LOGITUDINAL SAWED JOINT UNLESS OTHERWISE DIRECTED.
  - FORM THE JOINT SEAL SPACE AT TRANSVERSE EXPANSION JOINTS BY USING A STRAIGHT FORM PLACED BEHIND THE LONGITUDINAL FLOAT. LOOSEN THE FORM AS SOON AS THE CONCRETE WILL RETAIN ITS SHAPE AND EDGE WITH AN APPROVED EDGING TOOL. TOOL BOTH EDGES OF LONGITUDINAL CONSTRUCTION JOINTS TO A 1/8 IN. RADIUS AT THE PAVEMENT SURFACE.
  - DO NOT DISCHARGE CONCRETE FROM THE MIXER DIRECTLY ON TOP OF OR ON THE SIDES OF THE EXPANSION JOINT ASSEMBLIES.
  - LAP TRANSVERSE EDGES OF SHEETS OF WELDED WIRE FABRIC 12 INCHES EXCEPT AT TRANSVERSE EXPANSION JOINTS. LAP LONGITUDINAL EDGES 6 INCHES EXCEPT AT LONGITUDINAL CONSTRUCTION JOINTS.
  - DOWEL BARS MAY BE COATED WITH STAINLESS STEEL, MONEL METAL, OR IN ACCORDANCE WITH THE ITEM "REINFORCING STEEL" SECTION ON EPOXY COATING; WITH A WELDED DOWEL ASSEMBLY SUPPORT, AS APPROVED. ENSURE THE CASING CONFORMS TO THE REQUIREMENTS OF ONE OF THE GRADES OF ASTM A167-70 OR A176-71 AND IS NOT LESS THAN 0.010 INCH THICK. PROVIDE A CASING AT LEAST 8 INCHES LONG AND THAT COVERS THE MIDDLE 8 INCHES OF THE DOWEL.
  - SECURE DOWELS PARALLEL TO THE PAVEMENT SURFACE AND PERPENDICULAR TO THE JOINT WITH THE AID OF APPROVED WELDED WIRE BASKET ARRANGEMENTS. ENSURE WELDED WIRE BASKET ARRANGEMENTS DO NOT CROSS THE EXPANSION JOINT. UNIFORMLY COAT DOWELS WITH A BITUMINOUS MASTIC ON THE END WITH THE DOWEL CAP.
  - DO NOT BEND TIE BARS AND DOWEL BARS. TO PREVENT DISPLACEMENT OF WIRE FABRIC BY CONCRETE PLACEMENT, TIE THE FABRIC PANEL TOGETHER AND TIE THE INITIAL FABRIC PANELS OF EACH SLAB TO THE DOWEL BASKET OR AS DIRECTED.
  - TOOL PAVEMENT EDGES TO A RADIUS OF 1/8 IN. WITH AN APPROVED EDGING TOOL.
  - DETAILS FOR PAVEMENT WIDTH, PAVEMENT THICKNESS, AND CROWN-SLOPE ARE ELSEWHERE SHOWN ON THE PLANS.
  - THE CONTRACTOR HAS THE OPTION OF USING WELDED WIRE FABRIC OR BAR REINFORCEMENT. LOCATE THE LONGITUDINAL STEEL AT THE CENTER OF THE SLAB. TAKE NECESSARY PRECAUTIONS TO INSURE THAT THE FINAL POSITION OF STEEL IS WITHIN 1/2 IN. OF THE SLAB CENTER. ENSURE THE LONGITUDINAL AND TRANSVERSE STEEL SPACING DOES NOT VARY MORE THAN ONE-TWELFTH OF SPACING SHOWN.
  - LONGITUDINAL STEEL MAY BE SPLICED WITH 33 TIMES BAR DIAMETER LAPS.
  - FOR LANE WIDTHS NOT SHOWN OR FOR VARIABLE PANEL LENGTHS AND WIDTHS, SPACE REINFORCING STEEL AND DOWELS AS DIRECTED.
  - USE APPROVED BAR MAT CHAIRS. DO NOT EXCEED CHAIR SPACING OF 30 IN. C-C (TRANSVERSE) AND 48 IN. C-C (LONGITUDINAL). GALVANIZING THE CHAIRS IS NOT REQUIRED.
  - OBTAIN BOARDS FOR EXPANSION JOINT FILLER FROM REDWOOD TIMBER.
  - PROVIDE AND CONSTRUCT THE JOINT PLATE AS APPROVED.
  - WHEN CURB IS PLACED SEPARATELY FROM THE CONCRETE PAVEMENT, PROVIDE THE REINFORCING STEEL AS SHOWN IN THE CURB DETAIL. THE CURB REINFORCING STEEL MAY BE OMITTED WHEN THE CURB IS PLACED MONOLITHICALLY.

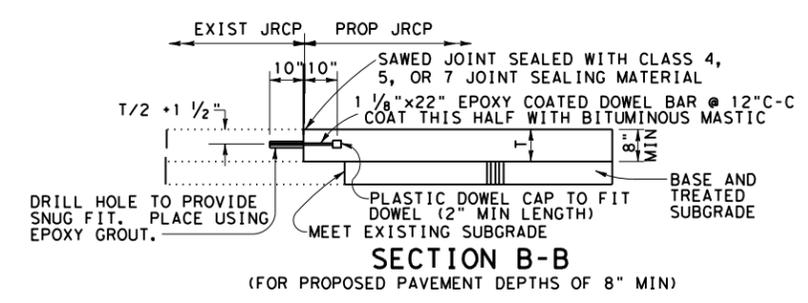
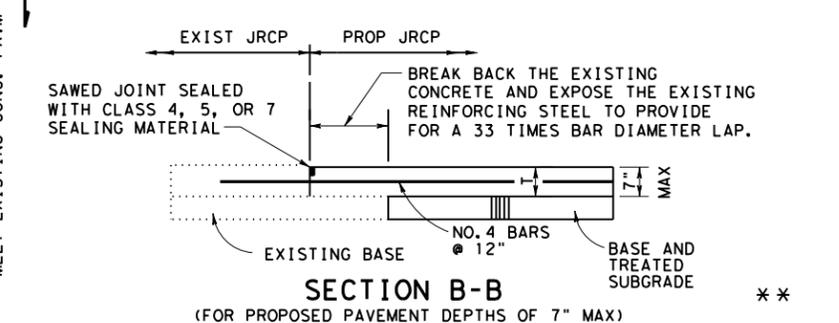
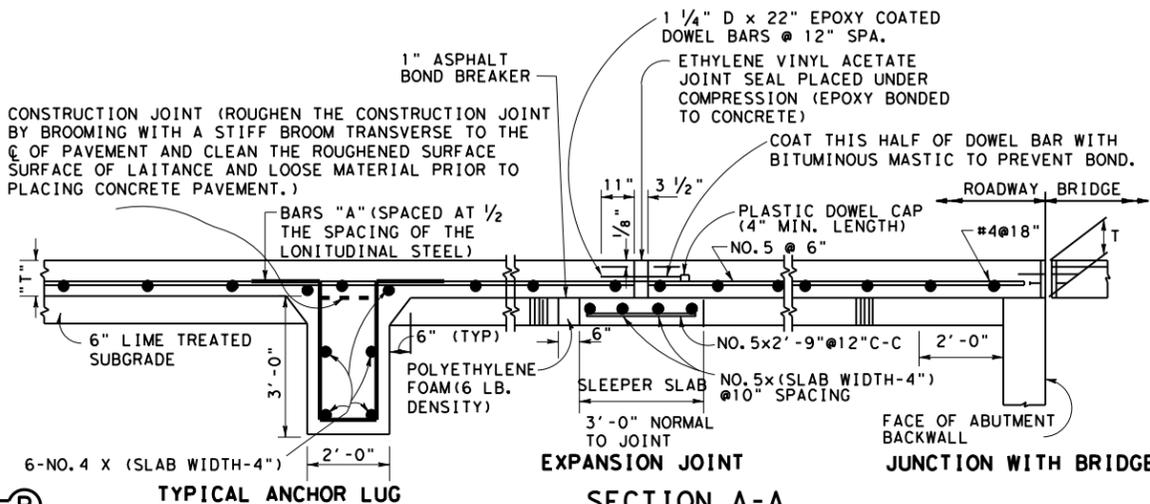
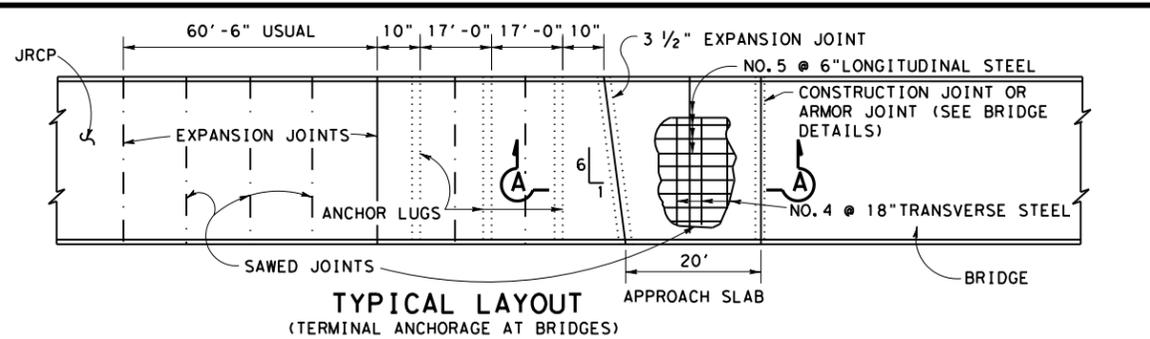
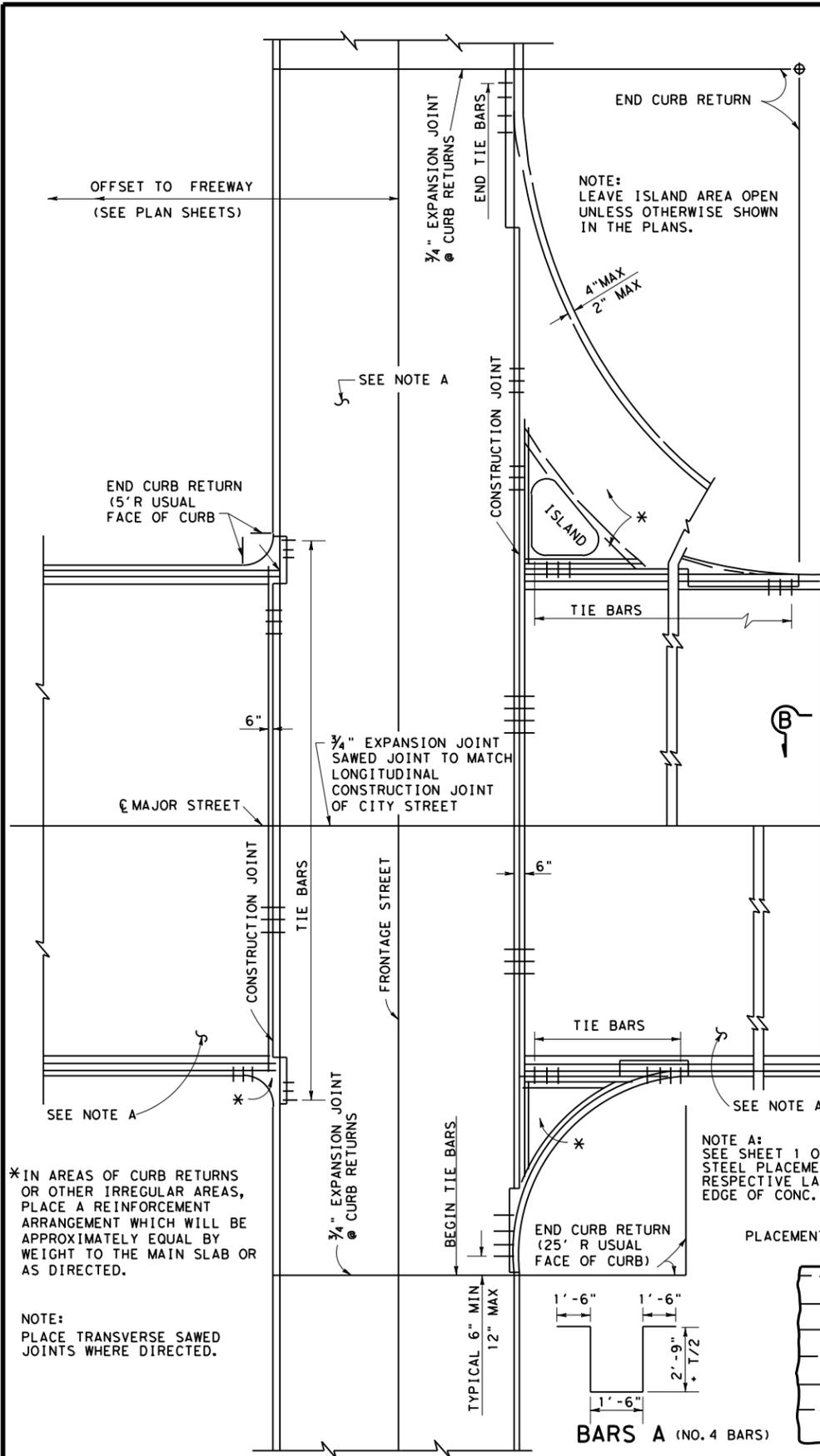
(GENERAL NOTES CONTINUED ON SHEET 2 OF 2)

**Texas Department of Transportation**  
Houston District

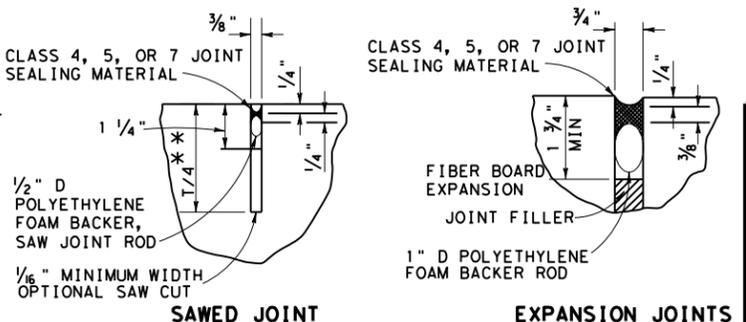
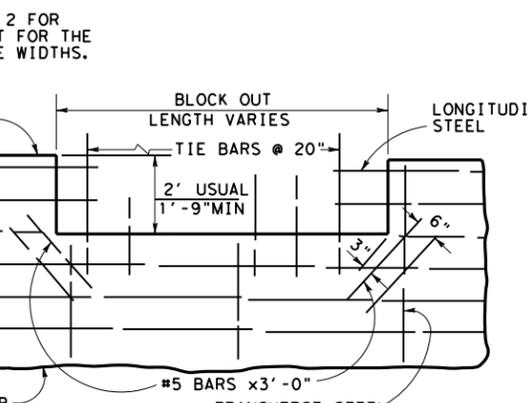
**JOINTED REINFORCED CONCRETE PAVEMENT DETAILS**  
(FOR PAVEMENT THICKNESS 10 INCHES OR LESS)

**JRPC** SHEET 1 OF 2

FILE: STDB-2.dgn	DN:	CK:	DW:	CK:
© TxDOT MAR. 2004	DIST	FED REG	PROJECT NO.	SHEET
REVISIONS	BMT	6	RMC6399-15-001	69
5/05 2004 SPECS	COUNTY	CONTROL	SECT	JOB
7/2010 ADDED NOTE	LIBERTY, ETC.	6399	15	001
8/2015 MODIFIED NOTES				SH99



REPLACE ANY BENT LONGITUDINAL REINFORCING. IF THERE IS NOT SUFFICIENT EXPOSED REINFORCING TO PROVIDE A MINIMUM OF A 33 TIMES BAR DIAMETER LAP, REMOVE THE EXISTING PAVEMENT AND SUFFICIENTLY EXPOSE THE EXISTING REINFORCING TO PROVIDE A 33 TIMES BAR DIAMETER LAP. REPLACE ANY SHEAR BARS THAT ARE DISTURBED, BY DRILLING AND GROUTING AS REQUIRED BY NOTE #29. PERFORM THIS CORRECTIVE ACTION AT NO EXPENSE TO THE DEPARTMENT.



INTERSECTION OF MAJOR STREET WITH FRONTAGE STREET  
TYPICAL REINFORCING PLAN

DETAIL OF BLOCKOUT  
\*OMIT TIE BARS  
\* INLET BLOCK-OUT

JOINT SEALING DETAILS

- GENERAL NOTES (CONTINUED FROM SHEET 1 OF 2)
- CONSTRUCT ANCHOR LUGS, EXPANSION JOINTS, AND SLEEPER SLABS AS DETAILED IN SECTION A-A. THESE WILL BE PAID FOR IN ACCORDANCE WITH ITEM, "CONCRETE PAVEMENT TERMINALS."
  - REINFORCING STEEL FOR TERMINAL ANCHOR SYSTEMS MAY BE GRADE 40 OR GRADE 60.
  - PLACE CONCRETE FOR ANCHOR LUGS AS SOON AS POSSIBLE AFTER COMPLETING EXCAVATION, TO PRESERVE THE INHERENT SOIL CHARACTERISTICS. EXCAVATING FOR AND PLACING CONCRETE FOR ANCHOR SYSTEM MAY BE IN PREFORMED SECTIONS CORRESPONDING TO THE WIDTH OF PAVING PLACEMENT.
  - APPLY A STEEL TROWEL FINISH TO SLEEPER SLABS AND COAT WITH AN ASPHALT BOND BREAKER.
  - THE DETAILS FOR ANCHORS, LUGS, EXPANSION JOINTS, AND SLEEPER SLABS ARE NOT APPLICABLE UNLESS SHOWN ELSEWHERE IN THE PLANS.
  - APPROACH SLAB WILL BE PAID FOR IN ACCORDANCE WITH THE ITEM "CONCRETE STRUCTURES."
  - WITHIN 5 MINUTES OF SAWING, COMPLETELY REMOVE THE RESULTING SLURRY FROM THE JOINT BY FLUSHING WITH HIGH PRESSURE WATER. THEN ALLOW THE JOINT TO DRY FOR A MINIMUM OF 48 HOURS BEFORE SANDBLASTING THE JOINT.
  - DO NOT SHEAR CUT DOWEL BARS.
  - SIZE ADDITIONAL SHEAR BARS AS LONGITUDINAL BARS AND SPACE THEM MIDWAY BETWEEN ALTERNATE LONGITUDINAL BARS ALONG THE TRANSVERSE CONSTRUCTION JOINT FORMED AT THE LEAVE-OUT.
  - IF THE CONCRETE DESIGN REQUIRES GREATER THAN 5.5 SACKS OF CEMENTITIOUS MATERIAL PER CUBIC YARD, WRITTEN APPROVAL BY THE AREA ENGINEER WILL BE REQUIRED. ENSURE CONCRETE MIXES PLACED FROM APRIL 1 TO OCTOBER 31 CONTAIN A MINIMUM OF 25 PERCENT BY WEIGHT OF CLASS "F" FLY ASH.
  - IN LOCATIONS WHERE THE PLANS CALL FOR FAST TRACK CONCRETE PAVEMENT IN LIEU OF JRCP (LAID ON COMPACTED OR STABILIZED SUBGRADE), USE DETAILS IN THIS STANDARD IN CONJUNCTION WITH THE APPROPRIATE FAST TRACK CONCRETE SPECIFICATION. IF THE JRCP IS LAID UPON A BASE STRUCTURE, ADD 3" TO THE FAST TRACK PAVEMENT THICKNESS TO COMPENSATE FOR THE BASE.

**Texas Department of Transportation**  
Houston District

**JOINED REINFORCED CONCRETE PAVEMENT DETAILS**  
EXPANSION JOINT DESIGN  
(FOR PAVEMENT THICKNESS 10 INCHES OR LESS)

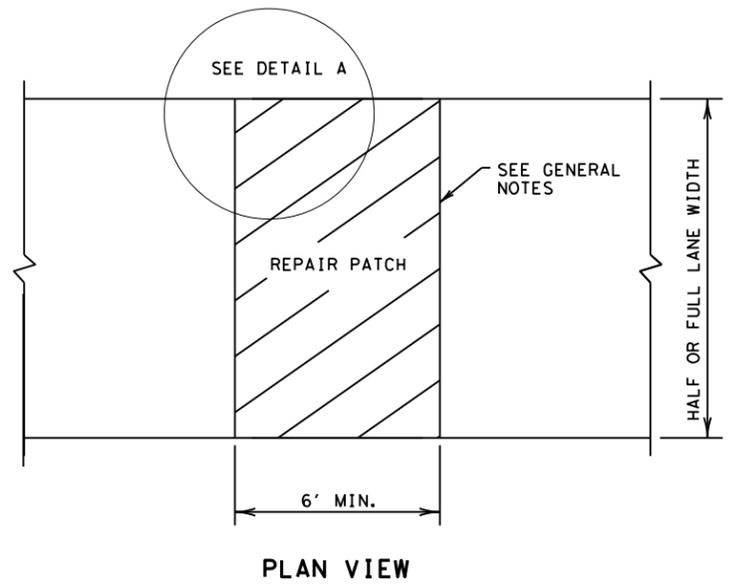
JRCP SHEET 2 OF 2

FILE: STDB-2.dgn	DN:	CK:	DW:	CK:
© TxDOT MAR. 2004	DIST	FED REG	PROJECT NO.	SHEET
REVISIONS	BMT	6	RMC6399-15-001	70
5/05 2004 SPECS	COUNTY	CONTROL	SECT	JOB
7/2010 ADDED NOTE	LIBERTY, ETC.	6399	15	001
9/2013 ADDED NOTE				SH99
8/2015 MODIFIED NOTES				

DATE: 5/12/2022  
 FILE: D:\NNYEMB Docs\_Extension\NHAO FOLDERS\MAINTENANCE\RM\RM IN PROGRESS\RM\_6399-15-001-SH99-Liberty\2-DGN\Standards\6-Roadway\2-Roadway Standards\1-PAVEMENT\5-repcp14(1).dgn  
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TABLE NO.1 STEEL BAR SIZE AND SPACING						
TYPE PAVEMENT	SLAB THICKNESS AND BAR SIZE		LONGITUDINAL*		TRANSVERSE*	
	T (IN.)	BAR SIZE	REGULAR BARS	TIEBARS	BARS	TIEBARS
			SPACING (IN.)	SPACING (IN.)	SPACING (IN.)	SPACING (IN.)
CRCP	6.0	#5	7.5	7.5	24	24
	6.5		7.0	7.0		
	7.0		6.5	6.5		
	7.5		6.0	6.0		
	8.0	#6	9.0	9.0	24	24
	8.5		8.5	8.5		
	9.0		8.0	8.0		
	9.5		7.5	7.5		
	10.0		7.0	7.0		
	10.5		6.75	6.75		
11.0	6.5	6.5				
11.5	6.25	6.25				
≥12.0	6.0	6.0				
JRCP	<8.0	#5	24.0	12.0	24	24
	≥8.0	#6	24.0	12.0	24	24
CPCD	<8.0	#5	NONE	12.0	NONE	24
	≥8.0	#6	NONE	12.0	NONE	24

\* USE 12" SPACING AS FIRST AND LAST SPACING AT END OR SIDE FOR ALL BARS.

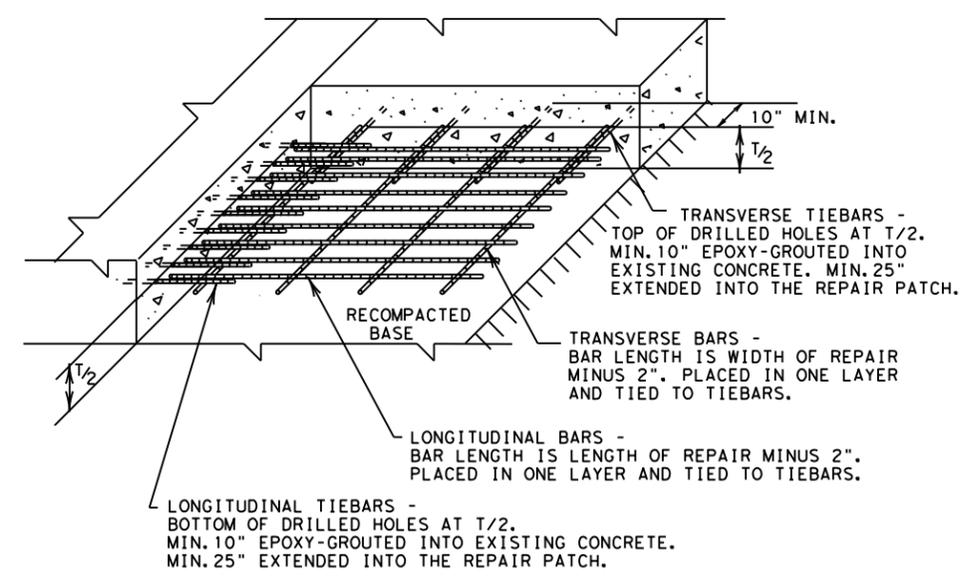


PLAN VIEW

**FULL-DEPTH REPAIR OF CRCP, JRCP, AND CPCD**

**GENERAL NOTES**

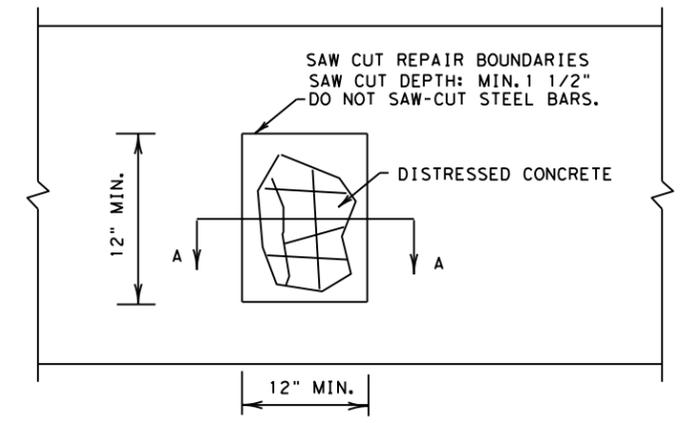
- ITEM 361, "REPAIR OF CONCRETE PAVEMENT" SHALL GOVERN FOR THIS WORK.
- MULTIPLE PIECE TIEBARS SHALL BE USED WHEN THE REPAIR AREA MUST BE PLACED IN TWO STAGES DUE TO SEQUENCE OF CONSTRUCTION.
- FULL DEPTH SAW CUTS SHALL BE MADE AROUND THE PERIMETER OF THE AREA TO BE REPAIRED. THE CUT SHALL BE MADE AT A RIGHT ANGLE TO THE PAVEMENT EDGE AND TO THE CENTER LINE OF THE PAVEMENT.
- AT LEAST ONE LONGITUDINAL FULL DEPTH SAW CUT SHALL BE AT AN EXISTING LONGITUDINAL JOINT.
- ADDITIONAL SAW CUTS MAY BE REQUIRED WITHIN THE AREA OF THE REPAIR TO FACILITATE REMOVAL OF THE CONCRETE OR TO ALLEVIATE BINDING OF THE FULL DEPTH SAW CUT AT THE REPAIR EDGE.
- THE SAW CUTS WHICH EXTEND OUTSIDE THE AREA OF THE REPAIR WILL BE CLEANED AND FILLED WITH A CEMENTITIOUS GROUT APPROVED BY THE ENGINEER.
- EXISTING LONGITUDINAL AND TRANSVERSE JOINTS REMOVED DUE TO REPAIR OPERATION SHOULD BE RESTORED IN ACCORDANCE WITH STANDARD SHEET "CONCRETE PAVING DETAILS, JOINT SEALS."



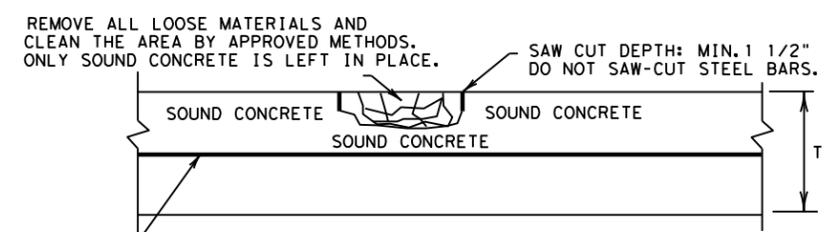
DETAIL A  
GROUTED TIEBARS & REINFORCEMENT

**GENERAL NOTES**

- ITEM 361, "REPAIR OF CONCRETE PAVEMENT" SHALL GOVERN FOR THIS WORK.
- THE SAW CUTS WHICH EXTEND OUTSIDE THE AREA OF THE REPAIR WILL BE CLEANED AND FILLED WITH A CEMENTITIOUS GROUT APPROVED BY THE ENGINEER.
- EXISTING LONGITUDINAL AND TRANSVERSE JOINTS REMOVED DUE TO REPAIR OPERATION SHOULD BE RESTORED IN ACCORDANCE WITH STANDARD SHEET "CONCRETE PAVING DETAILS, JOINT SEALS."



PLAN VIEW



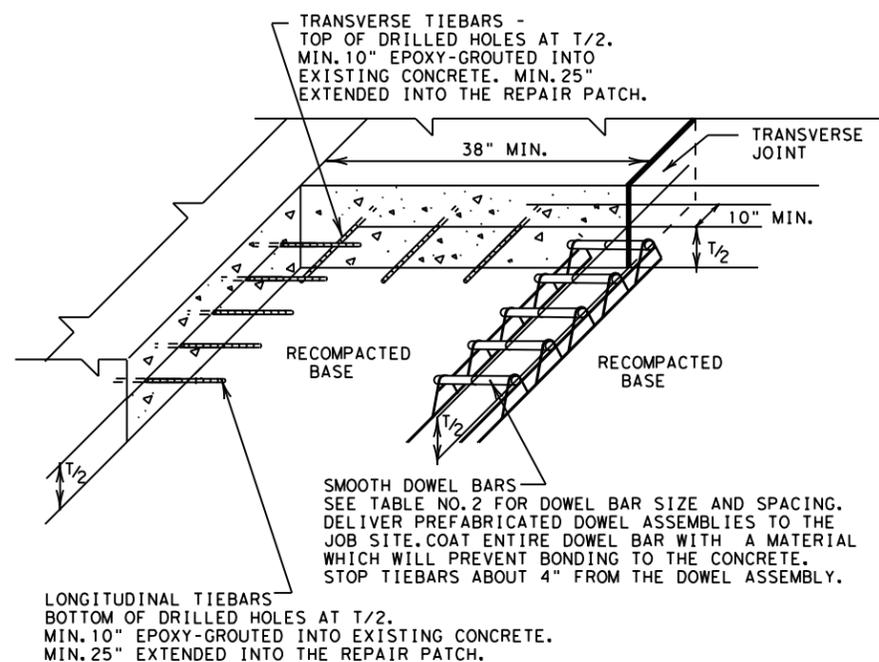
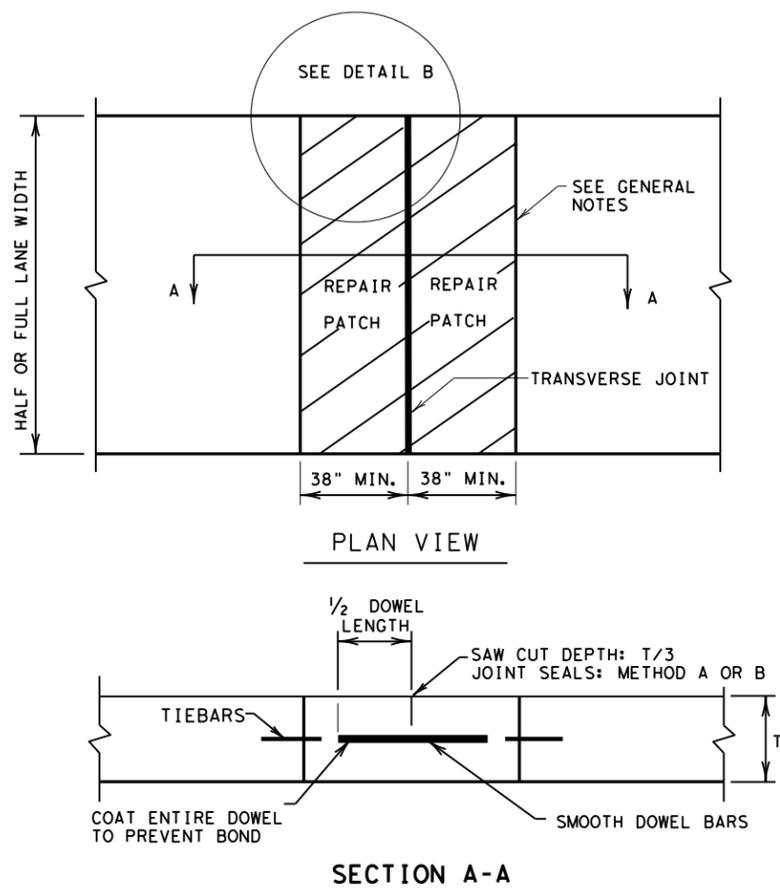
- LONGITUDINAL STEEL BARS:
- \*REPAIR AREAS MAY BE ADJUSTED AFTER REMOVING DISTRESSED CONCRETE. SWITCH THE HALF-DEPTH REPAIR TO FULL-DEPTH REPAIR IF EXPOSED EXISTING LONGITUDINAL BARS ARE DEFICIENT, AS APPROVED. COMPENSATION WILL BE MADE FOR UNEXPECTED VOLUMES OF REPAIR AREAS OR CHANGES IN SCOPE OF WORK.
  - \*INCREASE THE REPAIR AREA AND PERFORM A FULL-DEPTH REPAIR AS DIRECTED IF LONGITUDINAL STEEL BARS WERE DAMAGED BY THE REMOVAL OPERATIONS. NO ADDITIONAL COMPENSATION WILL BE MADE.

SECTION A-A  
HALF-DEPTH REPAIR

SHEET 1 OF 2

				Design Division Standard	
<b>REPAIR OF CONCRETE PAVEMENT</b>					
<b>REPCP-14</b>					
FILE: repcp14.dgn	DN: TxDOT	DN: HC	DW: HC	CK: AN	
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**DETAIL B**  
**GROUTED TIEBARS & DOWELS**

**REPAIR OF TRANSVERSE JOINT OF CPCD**

**GENERAL NOTES**

- ITEM 361, "REPAIR OF CONCRETE PAVEMENT" SHALL GOVERN FOR THIS WORK.
- MULTIPLE PIECE TIEBARS SHALL BE USED WHEN THE REPAIR AREA MUST BE PLACED IN TWO STAGES DUE TO SEQUENCE OF CONSTRUCTION.
- FULL DEPTH SAW CUTS SHALL BE MADE AROUND THE PERIMETER OF THE AREA TO BE REPAIRED. THE CUT SHALL BE MADE AT A RIGHT ANGLE TO THE PAVEMENT EDGE AND TO THE CENTER LINE OF THE PAVEMENT.
- AT LEAST ONE LONGITUDINAL FULL DEPTH SAW CUT SHALL BE AT AN EXISTING LONGITUDINAL JOINT.
- ADDITIONAL SAW CUTS MAY BE REQUIRED WITHIN THE AREA OF THE REPAIR TO FACILITATE REMOVAL OF THE CONCRETE OR TO ALLEVIATE BINDING OF THE FULL DEPTH SAW CUT AT THE REPAIR EDGE.
- THE SAW CUTS WHICH EXTEND OUTSIDE THE AREA OF THE REPAIR WILL BE CLEANED AND FILLED WITH A CEMENTITIOUS GROUT APPROVED BY THE ENGINEER.
- EXISTING LONGITUDINAL AND TRANSVERSE JOINTS REMOVED DUE TO REPAIR OPERATION SHOULD BE RESTORED IN ACCORDANCE WITH STANDARD SHEET "CONCRETE PAVING DETAILS, JOINT SEALS."
- DOWEL BAR PLACEMENT TOLERANCE SHALL BE +/- 1/4 IN. HORIZONTALLY AND VERTICALLY UNLESS OTHERWISE SPECIFIED. WHERE DOWEL BAR BASKETS ARE USED, REMOVE THE SHIPPING WIRES.

PAVEMENT THICKNESS (INCHES)	SIZE AND DIA.	LENGTH (IN.)	SPACING (IN.)
<10	#8 (1 IN.)	18.0	12.0
≥10	#10 (1 1/4 IN.)		

SHEET 2 OF 2



**REPAIR OF CONCRETE PAVEMENT**

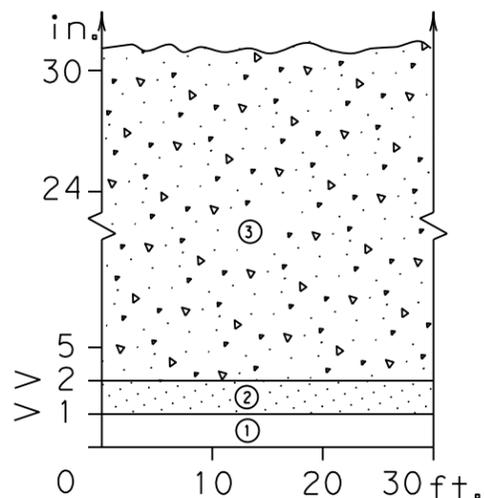
**REPCP-14**

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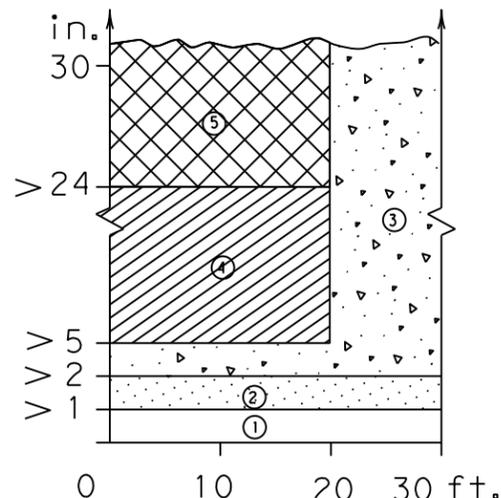
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### DEFINITION OF TREATMENT ZONES FOR VARIOUS EDGE CONDITIONS

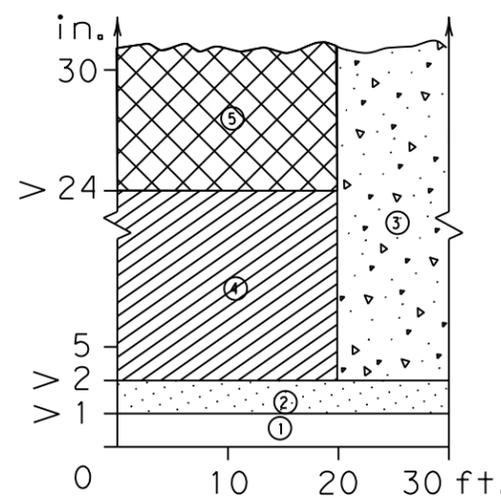
Edge Height (D) in Inches versus Lateral Clearance (Y) in Feet



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



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



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

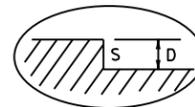
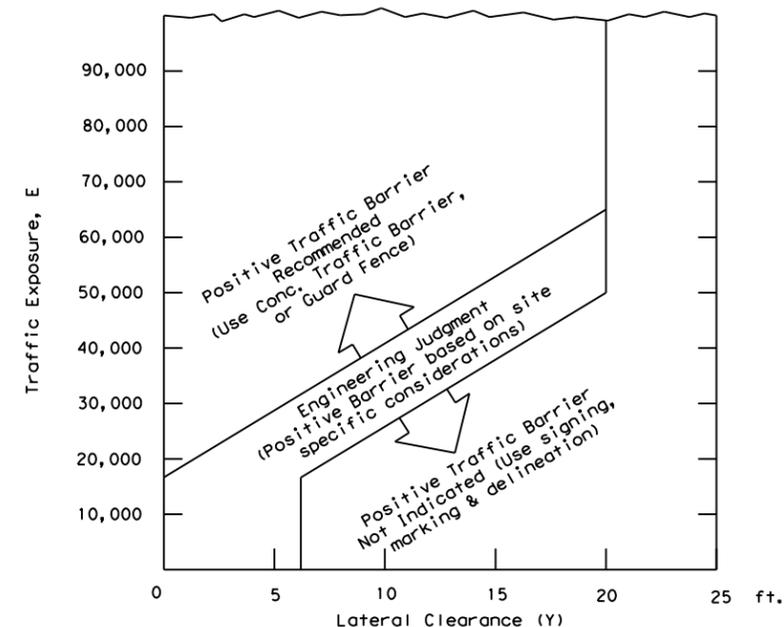


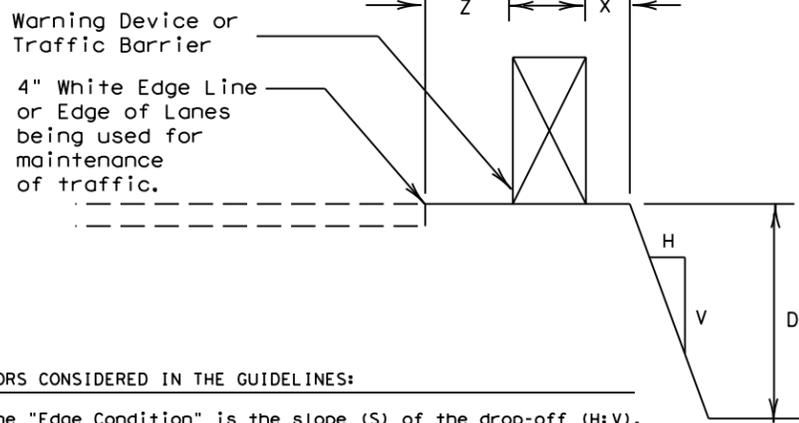
FIGURE-1: CONDITIONS INDICATING USE OF POSITIVE BARRIER FOR ZONE 5 ( [Cross-hatched box] )



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

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

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

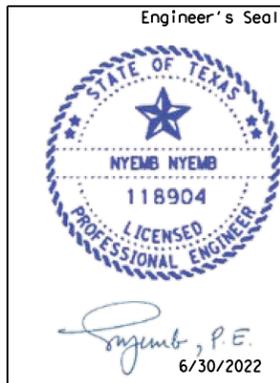


**FACTORS CONSIDERED IN THE GUIDELINES:**

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

**Edge Condition Notes:**

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



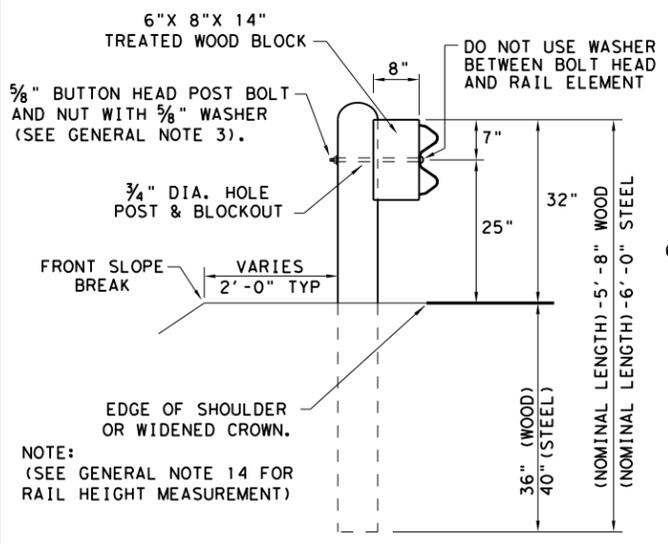
## TREATMENT FOR VARIOUS EDGE CONDITIONS

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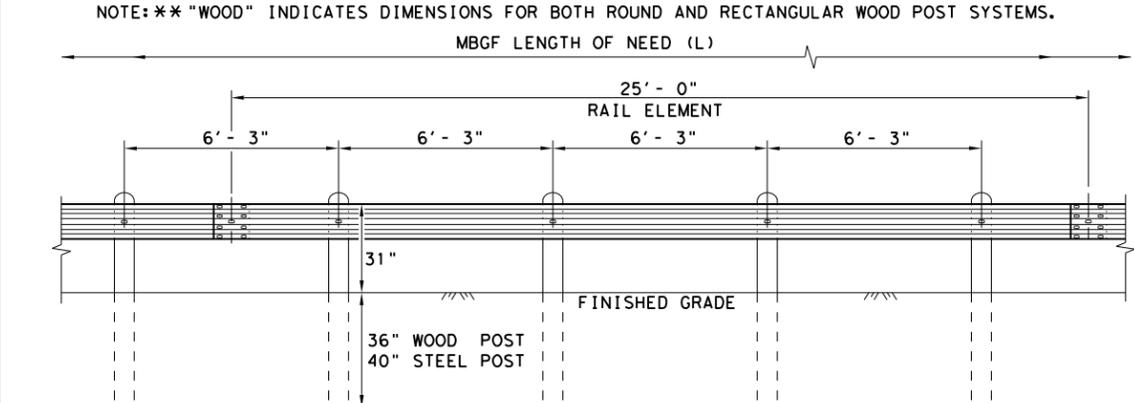
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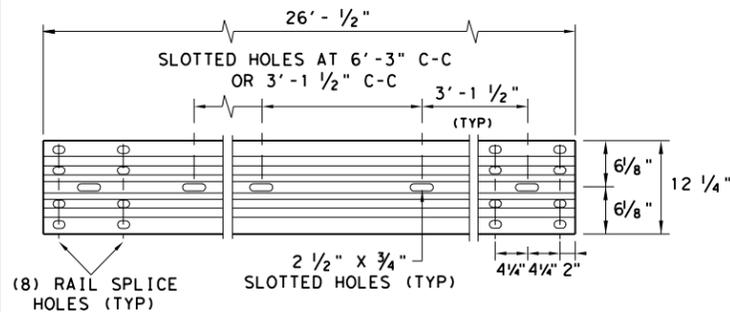


**TYPICAL POST PLACEMENT**



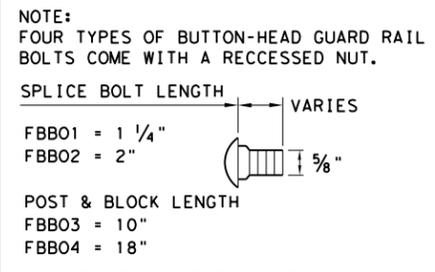
**ELEVATION MID-SPAN RAIL SPLICE**

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



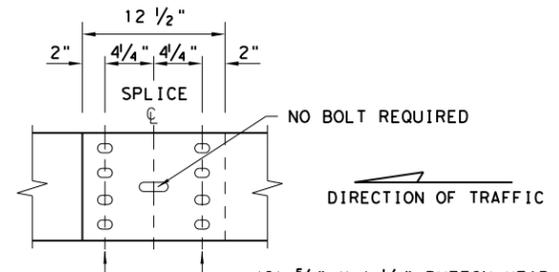
**ELEVATION 25' - 0" (NOM.) W-BEAM SECTION**

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



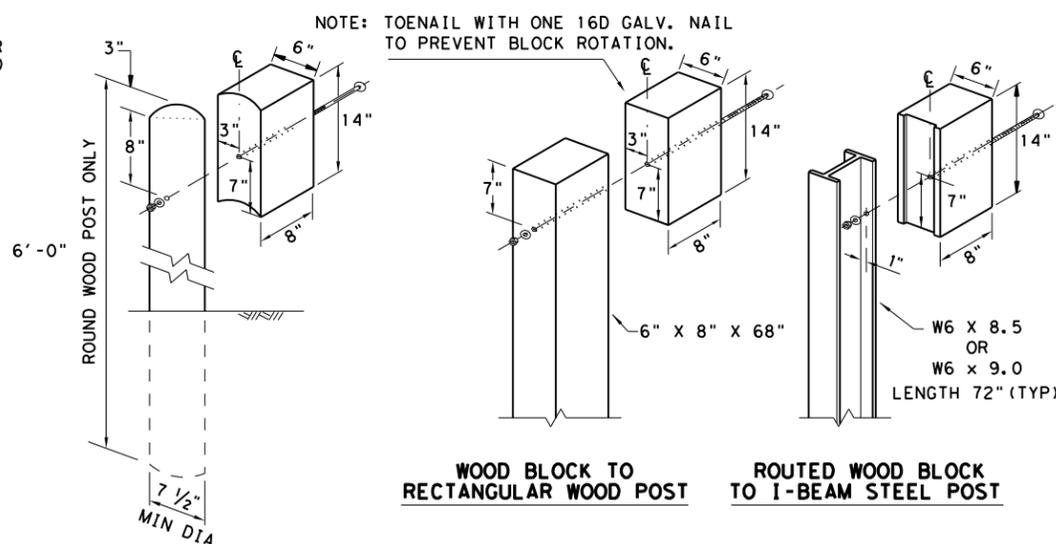
**BUTTON HEAD BOLT**

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



**MID-SPAN RAIL SPLICE DETAIL**

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

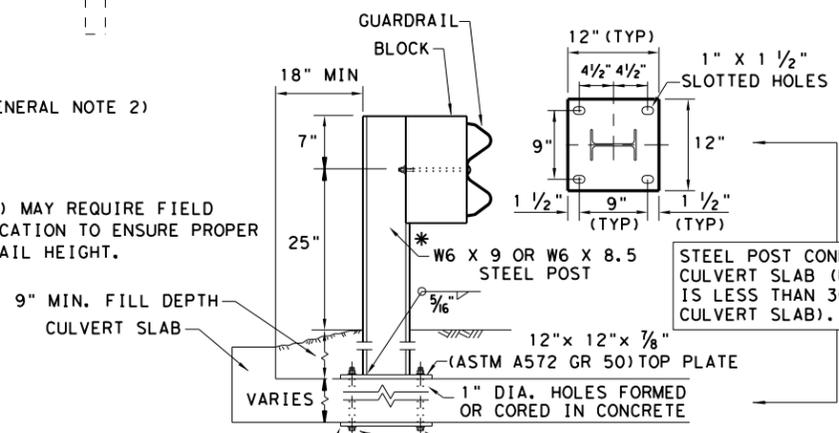


**WOOD BLOCK TO ROUND WOOD POST**      **ROUTED WOOD BLOCK TO I-BEAM STEEL POST**

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

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

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



**LOW FILL CULVERT POST**

12" x 12" x 1/4" (ASTM A36) STEEL BOTTOM PLATE WITH 1" DIA. HOLES REQUIRED WITH BOLT-THROUGH INSTALLATION.

NOTE: TWO INSTALLATION OPTIONS.

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

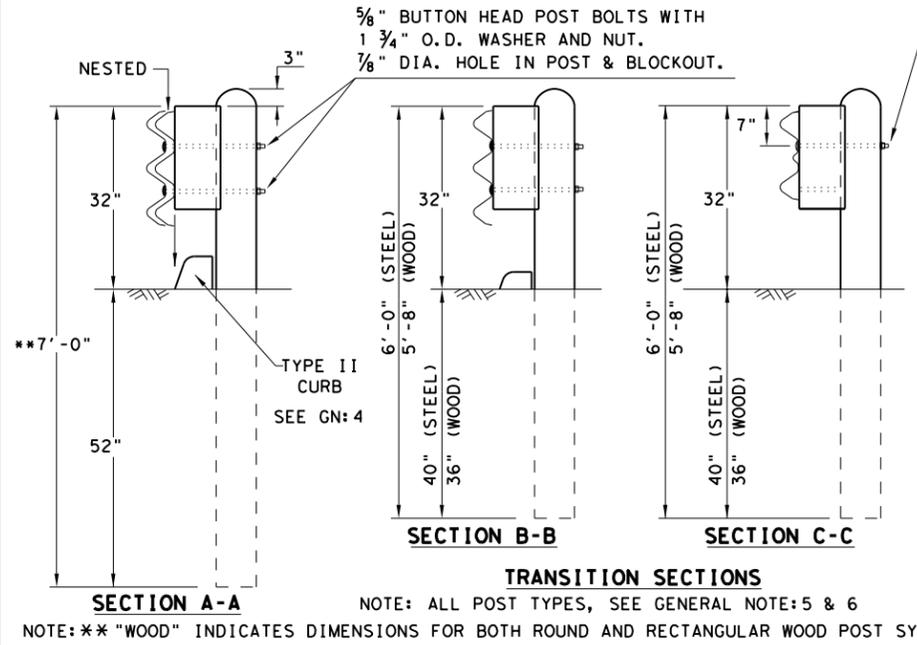
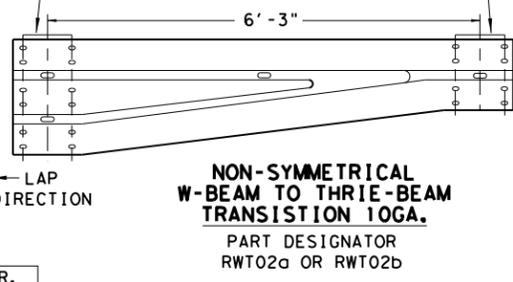
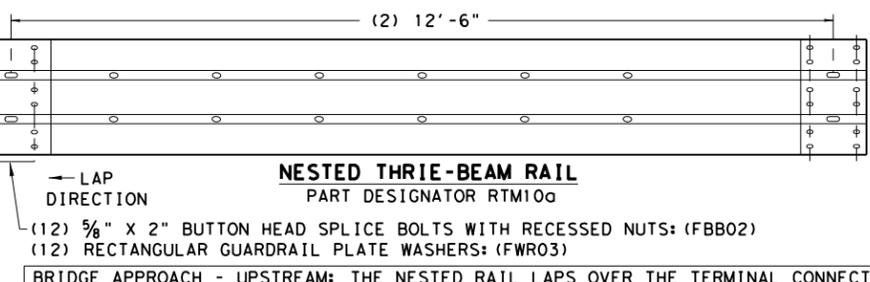
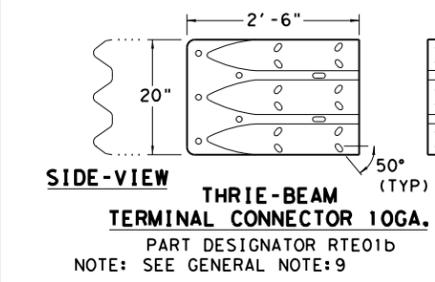
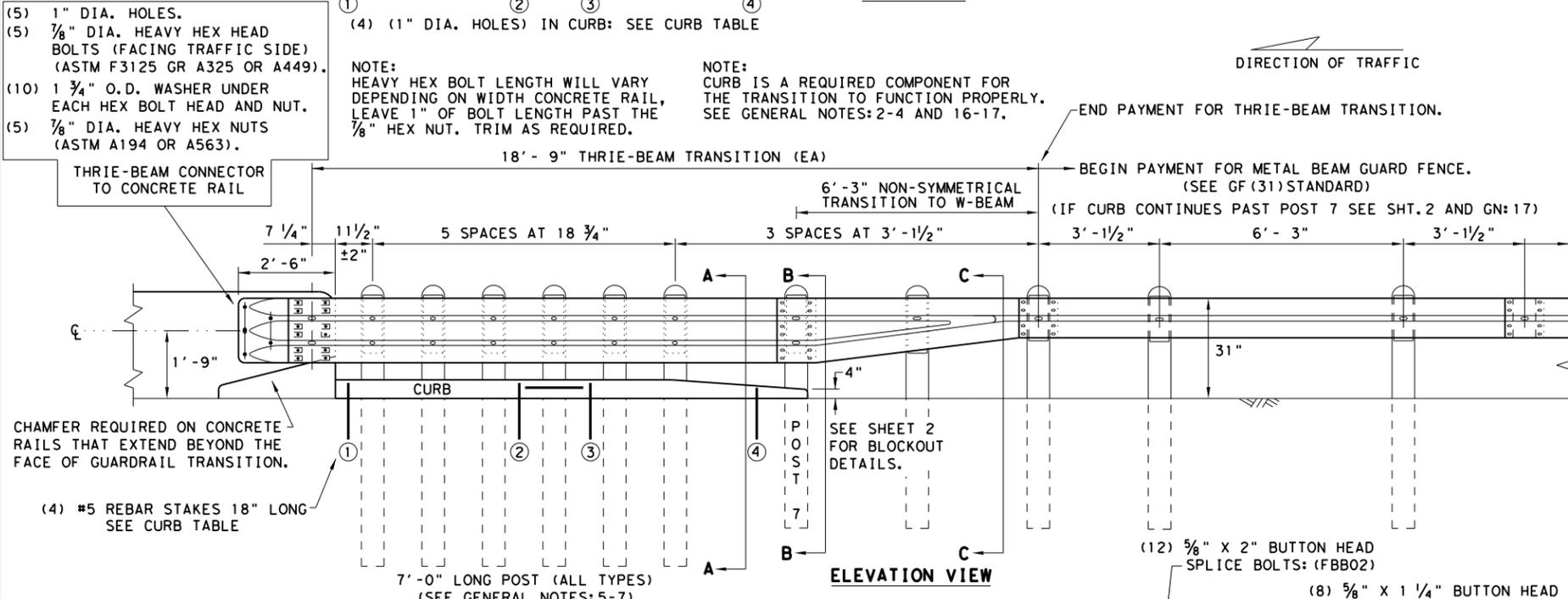
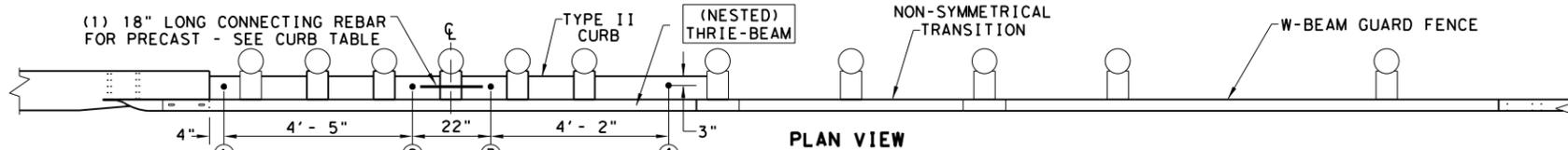
NOTE: CULVERTS OF 25 FT. OR LESS, SEE GF(31)LS STANDARD FOR "LONG SPAN" OPTION.

NOTE: TRANSITIONS 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.

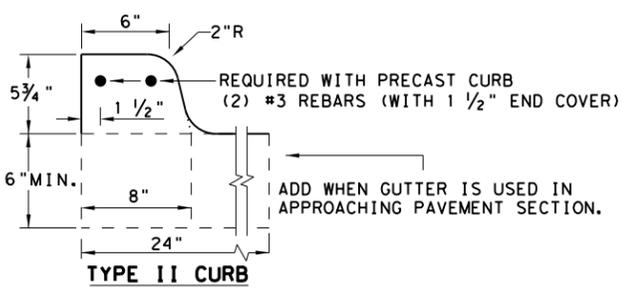
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<b>METAL BEAM GUARD FENCE</b> <b>TL-3 MASH COMPLIANT</b> <b>GF(31)-19</b>				
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THRIE-BEAM TERMINAL - CURB TABLE	
PRECAST CURB FULL LENGTH EQUALS 12'-2"	
THE PRECAST CURB MAY BE FORMED INTO TWO SECTIONS.	
CURB (1)	LENGTH 5'-8"
CURB (2)	LENGTH 6'-6"
TAPER CURB (2) TO A HEIGHT OF 4" AT POST 7	
CONNECTING PRECAST CURB SECTIONS (1) & (2):	
FORM OR CORE 1" DIA. HOLE 9" LONG INTO EACH CURB END.	
USE (1) #5 GR.60 REBAR 18" LONG TO CONNECT BOTH CURBS.	
SECURING PRECAST OR CAST-IN-PLACE TO FINISHED GRADE *:	
FORM OR CORE (4) 1" DIA. HOLES, SEE PLAN AND ELEVATION VIEWS FOR HOLE LOCATIONS. DRIVE (4) #5 GR.60 REBAR STAKES 18" LONG INTO THE GROUND AND 1/2" BELOW TOP OF CURB.	
FILL HOLES WITH APPROVED GROUT MIXTURE.	



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

**GENERAL NOTES**

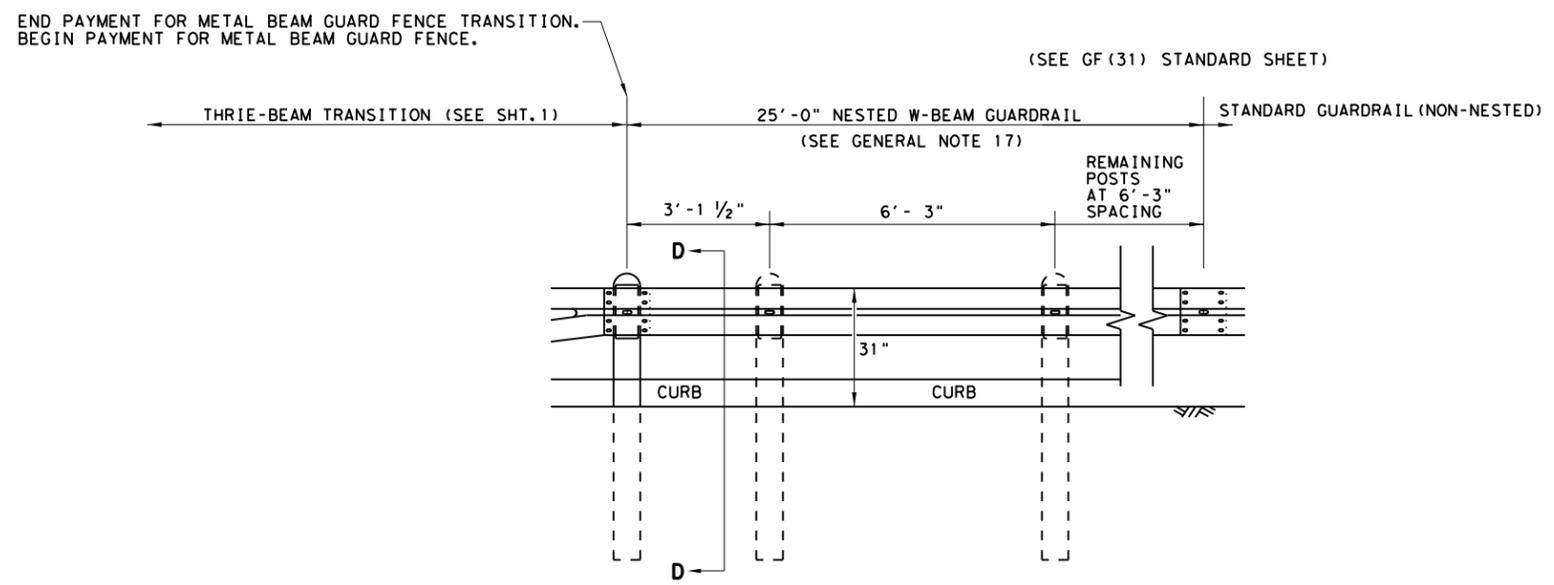
- CONTACT THE DESIGN DIVISION FOR DRAINAGE CUT OUT OPTIONS NEEDED WITHIN THE CURB SECTION OF THE THRIE-BEAM TRANSITION. (512) 416-2678
- CONCRETE CURB MAY BE CAST-IN-PLACE OR PRECAST AS SHOWN ON THIS SHEET. WHEN USED IN CONJUNCTION WITH THE THRIE-BEAM TRANSITIONS, CURB SHALL BE TYPE II (5-3/4" HEIGHT); SEE CURRENT CCG 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.
- 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.
- 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.
- FOR ROUND WOOD POST SYSTEMS, ALL ROUND WOOD POSTS SHALL BE 7 1/2" DIA. MINIMUM THROUGHOUT THE THRIE-BEAM TRANSITION.
- 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.
- THE POST LENGTH SHALL BE MARKED ON ALL 7'-0" LONG POSTS BY THE MANUFACTURER. THE MARK SHALL BE LOCATED WITHIN THE TOP 1 FT. REGION OF THE POST, AT LEAST 5/8" IN HEIGHT, AND VISIBLE AFTER INSTALLATION. WOODEN POSTS SHALL BE MARKED WITH A BRAND, AND STEEL POSTS WITH A STENCIL BEFORE GALVANIZING.
- POSTS SHALL NOT BE SET IN CONCRETE, OF ANY DEPTH.
- 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.
- BUTTON HEAD "POST BOLTS & NUTS" SHALL MEET THE REQUIREMENTS OF (ASTM A307), AND SHALL BE OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT AND 5/8" WASHER (FWC16G) AND NOT MORE THAN 1" BEYOND IT. TRIM REMAINING BOLT LENGTH TO MEET REQUIRED LENGTH.
- FITTINGS (BOLTS, NUTS, AND WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING". FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
- CROWN SHALL BE WIDENED TO ACCOMMODATE TRANSITIONS.
- WHERE SOLID ROCK IS ENCOUNTERED, CONTACT THE DESIGN DIVISION FOR ADDITIONAL GUIDANCE. (512) 416-2678
- 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.
- REFER TO GF (31) STANDARD SHEET & BRIDGE RAILING DETAILS FOR ADDITIONAL DETAILS.
- 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.
- IF CURB EXTENDS BEYOND POST 7, 25' OF NESTED W-BEAM GUARDRAIL SHALL BE INSTALLED BEYOND THE PAY LIMITS OF THRIE-BEAM TRANSITION SECTION, (SEE SHT.2). PAYMENT FOR THIS 25' SECTION WILL BE BY LINEAR FOOT, PAY ITEM "0540 6XXX MTL W-BEAM GD FEN (NESTED) (TIM POST)" OR "540 6XXX MTL W-BEAM GD FEN (NESTED) (STEEL POST)" AS APPLICABLE FOR POST TYPE. SEE SHT.2 FOR ADDITIONAL INFORMATION.

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

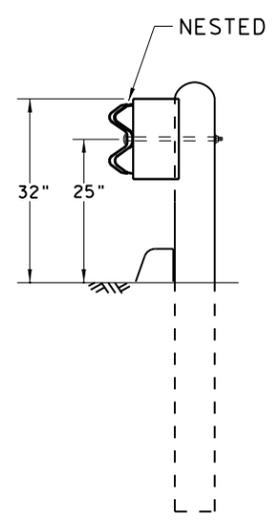
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<b>METAL BEAM GUARD FENCE</b> <b>THRIE-BEAM TRANSITION</b> <b>TL-3 MASH COMPLIANT</b> <b>GF (31) TR TL3-20</b>			
FILE: gf31tr+1320.dgn	DN: TxDOT	CK: KM	DW: VP
© TxDOT: NOVEMBER 2020	CONT	SECT	JOB
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DIST	COUNTY	SHEET NO.	
BMT	LIBERTY, ETC.	76	

DATE: 5/12/2022  
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 DISCLAIMER: 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.

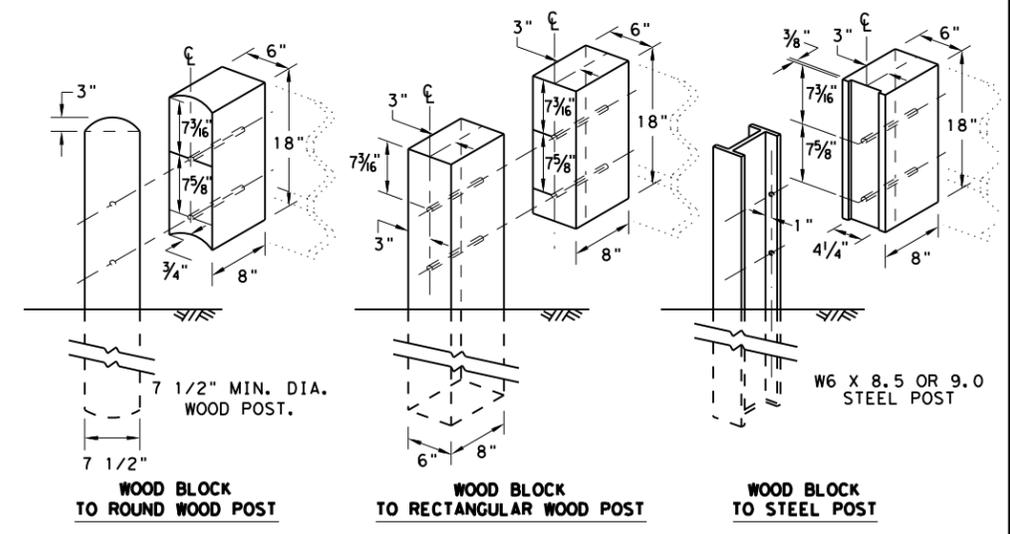
REQUIRED ALTERNATIVE FOR CONTINUOUS CURB EXTENDING PAST POST 7 (SEE SHT. 1 GENERAL NOTE 17)



ELEVATION VIEW



SECTION D-D



THRIE BEAM TRANSITION BLOCKOUT DETAILS

HIGH-SPEED TRANSITION

SHEET 2 OF 2

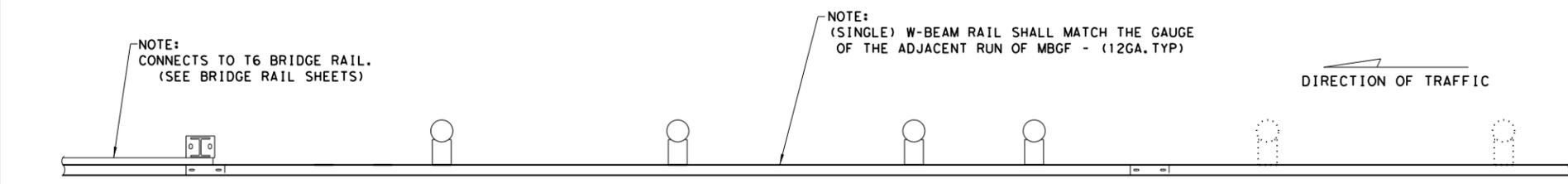
	Design Division Standard
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**METAL BEAM GUARD FENCE**  
**THRIE-BEAM TRANSITION**  
**TL-3 MASH COMPLIANT**  
**GF (31) TR TL3-20**

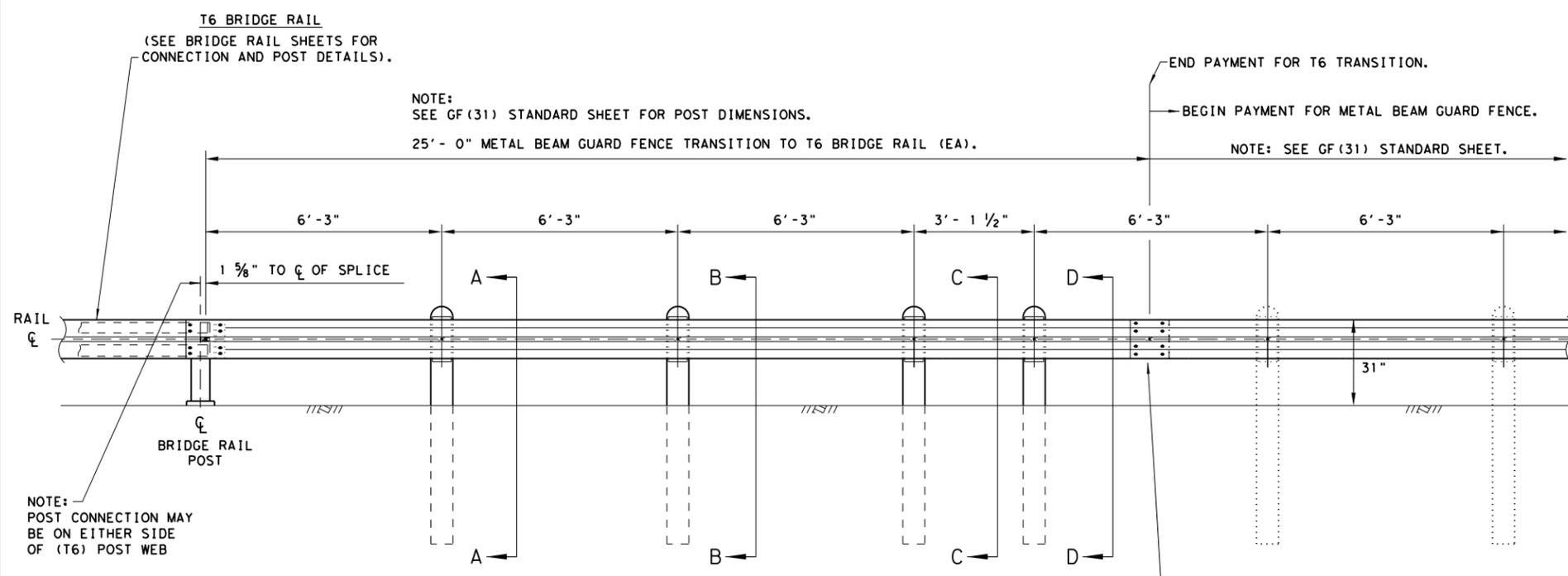
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©TXDOT: NOVEMBER 2020	CONT	SECT	JOB	HIGHWAY
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DIST	COUNTY		SHEET NO.	
BMT	LIBERTY, ETC.		77	



DATE: 5/12/2022  
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 DISCLAIMER: THE USE OF THIS STANDARD IS GOVERNED BY THE "TEXAS ENGINEERING PRACTICE ACT". NO WARRANTY OF ANY KIND IS MADE BY TXDOT FOR ANY PURPOSE WHATSOEVER. TXDOT ASSUMES NO RESPONSIBILITY FOR THE CONVERSION OF THIS STANDARD TO OTHER FORMATS OR FOR INCORRECT RESULTS OR DAMAGES RESULTING FROM ITS USE.



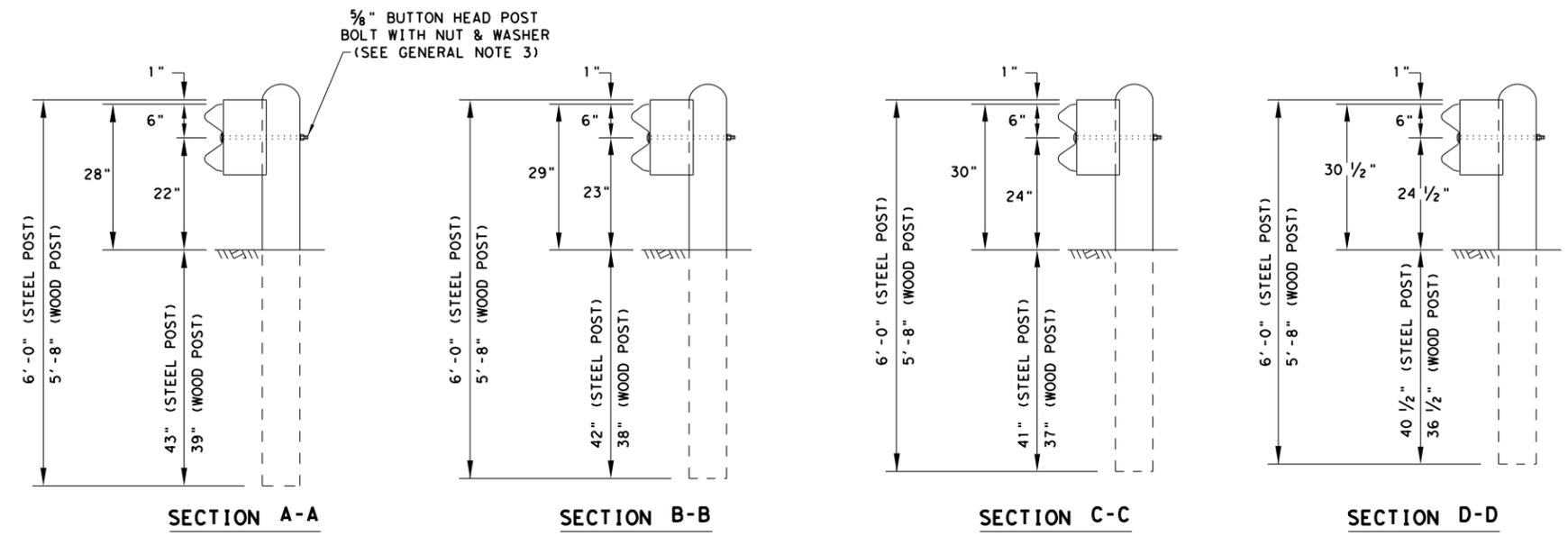
**PLAN VIEW**



**ELEVATION VIEW**

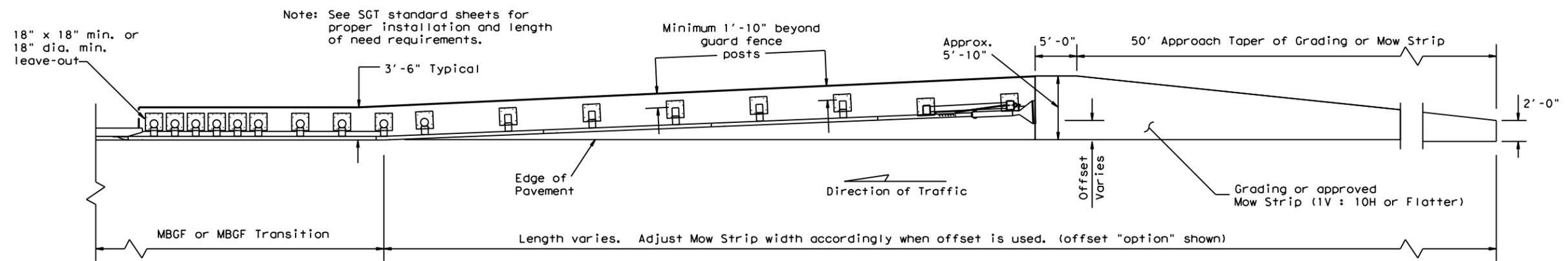
- GENERAL NOTES**
1. THE TYPE OF POST (ROUND WOOD POST, RECTANGULAR WOOD POST, OR STEEL POST) WILL BE AS SHOWN IN THE PLANS. THE EXACT POSITION OF MBGF SHALL BE SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER. STEEL POSTS TO BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING."
  2. RAIL ELEMENT SHALL MEET THE REQUIREMENTS OF ITEM 540, "METAL BEAM GUARD FENCE" EXCEPT AS MODIFIED IN THE PLANS. THE CONTRACTOR MAY FURNISH RAIL ELEMENTS OF 25'-0", OR 12'-6" (NOM.) LENGTHS. RAIL ELEMENTS MAY HAVE SLOTTED HOLES AT 3'-1 1/2" C-C OR 6'-3" C-C. A SPECIAL LENGTH OF RAIL MAY BE MANUFACTURED TO ACCOMMODATE THE TRANSITION SECTIONS OF GUARDRAIL.
  3. BUTTON HEAD "POST" BOLTS (ASTM A307 GR.A) SHALL BE OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT (ASTM A563) AND 5/8" ROUND WASHER (ASTM F436) AND NOT MORE THAN 1" BEYOND IT. BUTTON HEAD "SPlice" BOLTS (ASTM A307) ARE 5/8" X 1-1/4" WITH 5/8" NUTS (ASTM A563).
  4. FITTINGS (BOLTS, NUTS, AND WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING." FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM REQUIRING CONSTRUCTION OF THE TRANSITION.
  5. CROWN SHALL BE WIDENED TO ACCOMMODATE THE METAL BEAM GUARD FENCE.
  6. WHERE SOLID ROCK IS ENCOUNTERED. CONTACT THE DESIGN DIVISION FOR ADDITIONAL GUIDANCE. (512) 416-2678
  7. POSTS SHALL NOT BE SET IN CONCRETE.
  8. UNLESS OTHERWISE SHOWN IN THE PLANS, A COMPOSITE MATERIAL BLOCK THAT MEETS THE REQUIREMENTS OF DMS-7210, "COMPOSITE MATERIAL POSTS AND BLOCKS FOR METAL BEAM GUARD FENCE" MAY BE SUBSTITUTED FOR BLOCKS OF SIMILAR DIMENSIONS. THE CONSTRUCTION DIVISION, TXDOT MAINTAINS A MATERIAL PRODUCER LIST (MPL) FOR PRODUCERS OF MATERIALS CONFORMING TO DMS-7210. ONLY PRODUCERS ON THE MPL MAY FURNISH COMPOSITE MATERIAL BLOCKS.
  9. REFER TO STANDARD GF(31) & APPLICABLE BRIDGE RAILING STANDARD FOR ADDITIONAL DETAILS.

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



				Design Division Standard
<b>METAL BEAM GUARD FENCE          TRANSITION          (T6)          GF (31) T6-19</b>				
FILE: gf31t619.dgn	DN: TXDOT	CK: KM	DW: VP	CK: CGL/AG
© TXDOT: NOVEMBER 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	6399	15	001	SH99
	DIST	COUNTY		SHEET NO.
	BMT	LIBERTY, ETC.		79

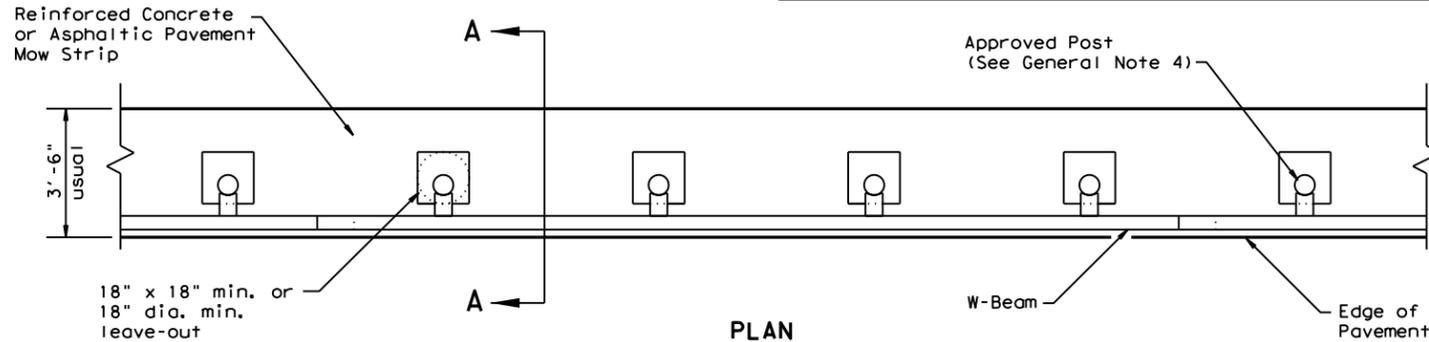
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Note: See SGT standard sheets for proper installation and length of need requirements.

**GRADING AND MOW STRIP AT GUARDRAIL END TREATMENTS**

Note: Site Condition(s)  
 Site conditions may exist where grading is required for the proper installation of metal guard fence and end treatments.  
 Approach grading or mow strip may be decreased or eliminated, as directed by the Engineer.

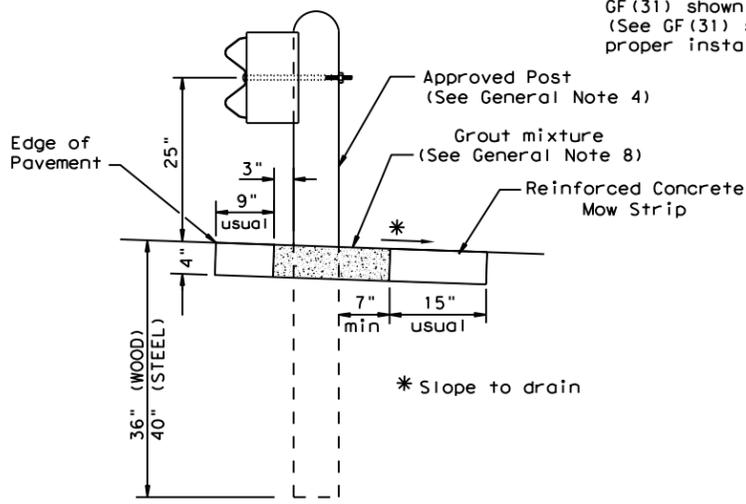


**PLAN**

GF(31) shown with Mow Strip  
 (See GF(31) standard sheet for proper installation)

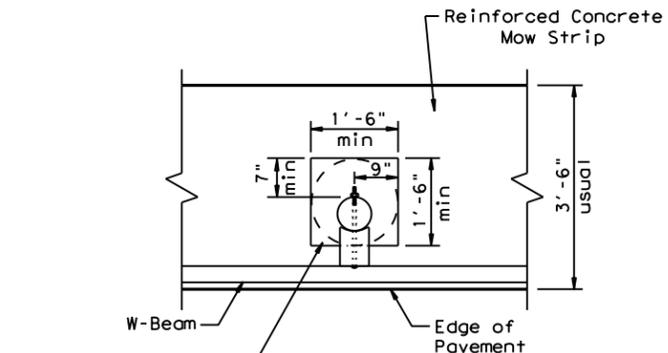
**GENERAL NOTES**

1. This mow strip design is for use with metal beam guard fence, guard fence transitions, and guard fence end treatments. See applicable GF(31) MBGF or GF(31) Transition Standard sheet for additional information.
2. Mow strips shall be reinforced concrete with (wire mesh or synthetic fiber), as shown on the plans and will be paid for under the pertinent bid item. Reinforced concrete shall be placed in accordance with Item 432, "Riprap." The use of the synthetic fiber in lieu of steel reinforcing is acceptable, provided the fiber producer is on the Department Material Producer List (MPL), maintained by TxDOT, Construction Division.
3. The leave-out behind the post shall be a minimum of 7".
4. Only steel (W6 x 8.5 or W6 x 9.0), or 7 1/2" Dia. round wood posts are acceptable for use in the mow strip. See GF(31) Standard for additional details.
5. Other curb placement options may be used. Curbs are not considered part of the mow strip and will be paid for under other pertinent bid item.
6. Thickness of the mow strip will be 4".
7. The limits of payment for reinforced concrete will include leave-outs for the posts.
8. The leave-outs shall be filled with a Grout mixture consisting of: 2719 pounds sand, 188 pounds Type I or II cement, and 550 pounds of water per cubic yard, with a 28-day compressive strength of approximately 230 psi or less. Provide grout with a consistency that will flow into and completely fill all voids. Due to auger size, larger leave-out dimensions are acceptable from both an impact performance and maintenance repair standpoint (Suggested Maximum leave-out of 20"). Payment for furnishing and placing the grout mixture will be subsidiary to the pay item of riprap mow strip.



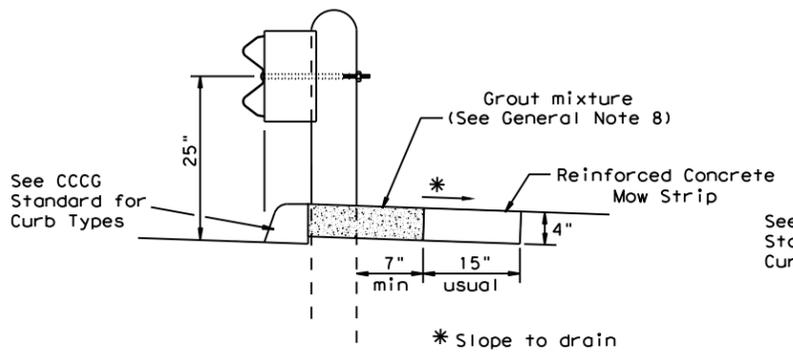
**SECTION A-A**

Typical



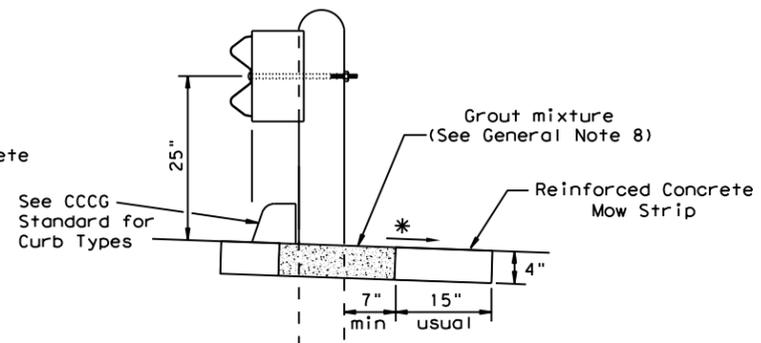
**MOW STRIP DETAIL**

Reinforced Concrete Mow Strip with 18" x 18" Square or 18" Dia. minimum leave-out.



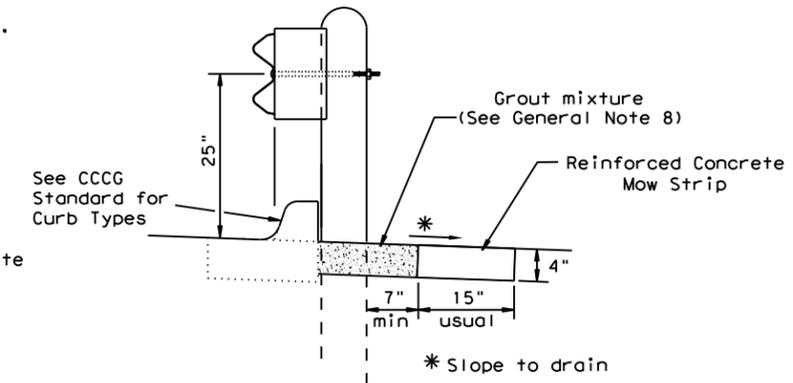
**CURB OPTION (1)**

This option will increase the post embedment throughout the system.



**CURB OPTION (2)**

Curb shown on top of mow strip



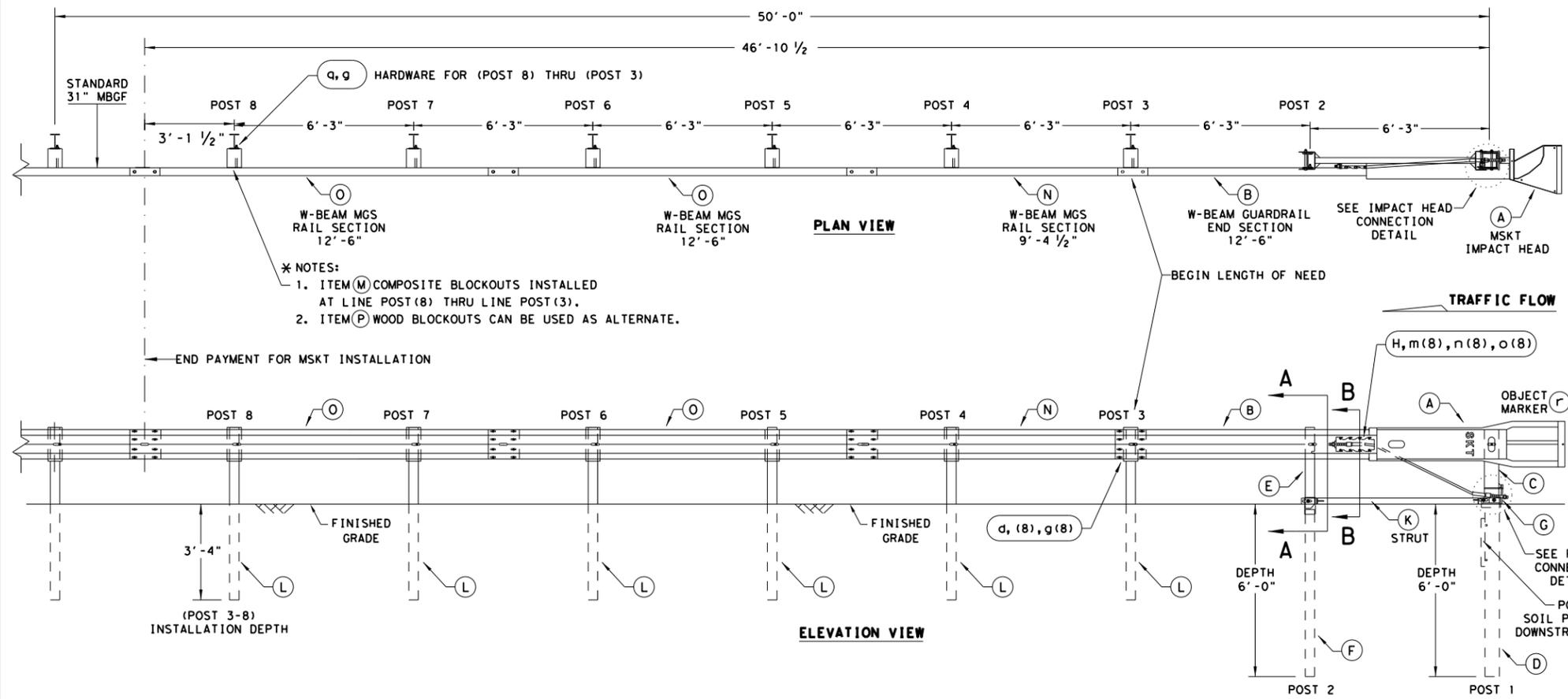
**CURB OPTION (3)**

		Design Division Standard	
<b>METAL BEAM GUARD FENCE (MOW STRIP)</b> <b>TL-3 MASH COMPLIANT</b> <b>GF(31)MS-19</b>			
FILE: gf31ms19.dgn	DN: TxDOT	CK: KM	DW: VP
©TxDOT: NOVEMBER 2019	CONT	SECT	JOB
REVISIONS	6399 15	001	SH99
DIST	COUNTY	SHEET NO.	
BMT	LIBERTY, ETC.	80	



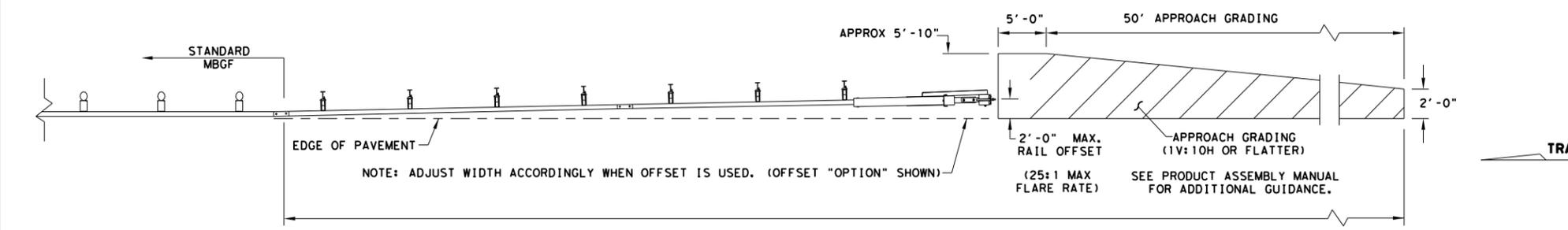
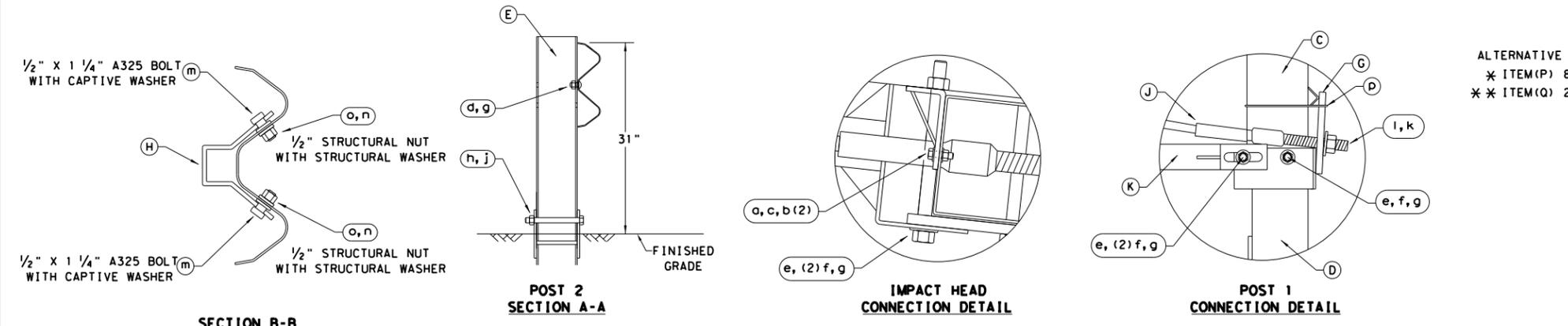
DISCLAIMER: THIS STANDARD IS GOVERNED BY THE "TEXAS ENGINEERING PRACTICE ACT". NO WARRANTY OF ANY KIND IS MADE BY TxDOT FOR ANY PURPOSE WHATSOEVER. THE USE OF THIS STANDARD ASSUMES NO RESPONSIBILITY FOR THE CONVERSION OF THIS STANDARD TO OTHER FORMATS OR FOR INCORRECT RESULTS OR DAMAGES RESULTING FROM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

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 FILE: D:\NNYEMB Docs\_Extension\NHAO FOLDERS\MAINTENANCE\RMV\RMV IN PROGRESS\RMV\_6399-15-001-SH99-Liberty\2-Roadway Standards\2-BARRIER AND GUARDRAIL END



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

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



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

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

**Design Division Standard**

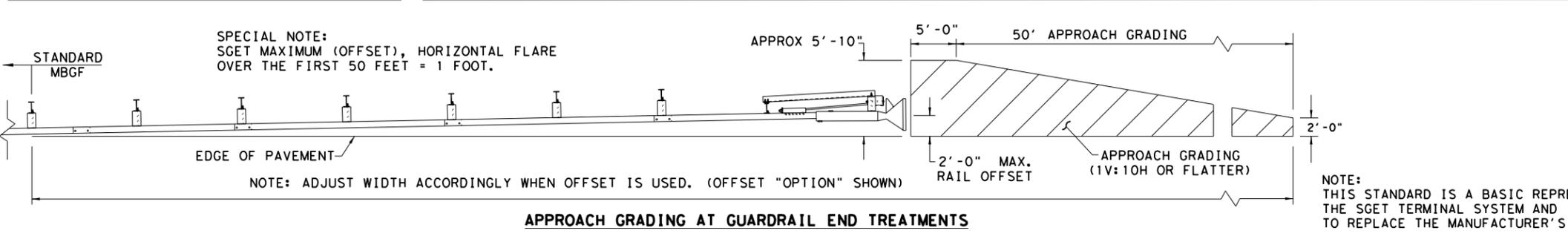
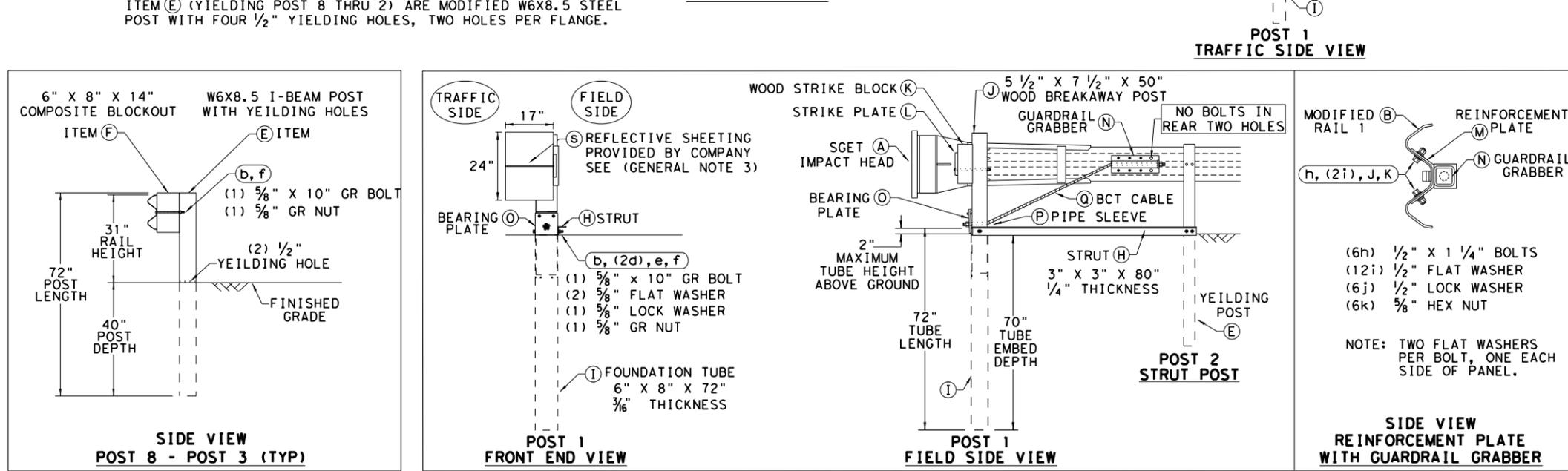
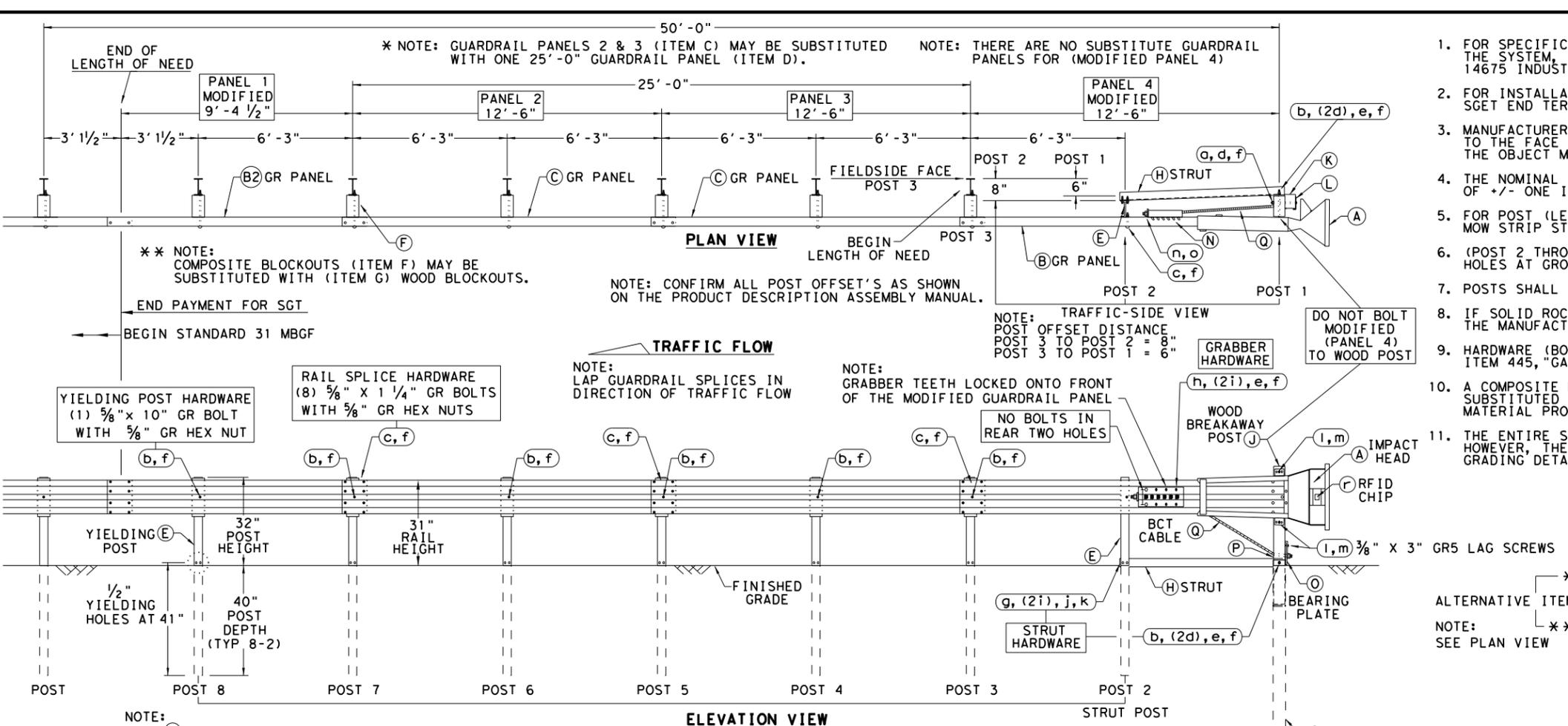
## SINGLE GUARDRAIL TERMINAL

### MSKT-MASH-TL-3

### SGT (12S) 31-18

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© TxDOT: APRIL 2018	CONT	SECT	JOB	HIGHWAY
REVISIONS	6399	15	001	SH99
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BMT	LIBERTY, ETC.		82	

DATE: 5/12/2022  
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- ### GENERAL NOTES
- FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: SPIG INDUSTRY, INC. AT 1(267) 644-9510. 14675 INDUSTRIAL PARK RD; BRISTOL, VA 24202
  - FOR INSTALLATION, REPAIR AND MAINTENANCE REFER TO THE MANUFACTURER'S; SGET END TERMINAL, PRODUCT DESCRIPTION ASSEMBLY MANUAL.
  - MANUFACTURER WILL APPLY HIGH INTENSITY REFLECTIVE SHEETING, "OBJECT MARKER" TO THE FACE PLATE OF THE DEVICE PER MANUFACTURER'S RECOMMENDATIONS. THE OBJECT MARKER SHALL CONFORM TO THE STANDARDS REQUIRED IN TEXAS MUTCD.
  - THE NOMINAL HEIGHT OF THE GUARDRAIL BEAM IS 31 INCHES WITH A TOLERANCE OF +/- ONE INCH.
  - FOR POST (LEAVE-OUT) INSTALLATION AND GUIDANCE SEE TXDOT'S LATEST ROADWAY MOW STRIP STANDARD.
  - (POST 2 THROUGH POST 8) ARE MODIFIED STEEL-YIELDING POSTS WITH YIELDING HOLES AT GROUND LEVEL. THERE ARE NO SUBSTITUTE POSTS.
  - POSTS SHALL NOT BE SET IN CONCRETE.
  - IF SOLID ROCK IS ENCOUNTERED FOR ANY OF THE POSTS IN THE SYSTEM, CONTACT THE MANUFACTURER FOR SPECIFIC INSTALLATION GUIDANCE.
  - HARDWARE (BOLTS, NUTS, & WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING". FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
  - A COMPOSITE MATERIAL BLOCKOUT THAT MEETS DMS-7210 REQUIREMENTS MAY BE SUBSTITUTED FOR AN APPROVED WOOD BLOCKOUT. SEE CONSTRUCTION DIVISION MATERIAL PRODUCER LIST (MPL) FOR CERTIFIED PRODUCERS.
  - THE ENTIRE SYSTEM MUST BE INSTALLED IN A STRAIGHT LINE WITHOUT ANY CURVE. HOWEVER, THE SYSTEM CAN BE OFFSET BY TWO FEET AS SHOWN ON THE APPROACH GRADING DETAIL TO HELP OFF-SET THE IMPACT HEAD FROM SHOULDER OF THE ROAD.

ITEM	QTY	MAIN SYSTEM COMPONENTS	ITEM #
A	1	SGET IMPACT HEAD	SIH1A
B	1	MODIFIED GUARDRAIL PANEL 12'-6" 12GA	126SPZGP
B2	1	MODIFIED GUARDRAIL PANEL 9'-4 1/2" 12GA	GP94
C	2	STANDARD GUARDRAIL PANEL 12'-6" 12GA	GP126
D	1	STANDARD GUARDRAIL PANEL 25'-0" 12GA	GP25
E	7	MODIFIED YIELDING I-BEAM POST W6x8.5	YP6MOD
F	6	COMPOSITE BLOCKOUT 6" X 8" X 14"	CBO8
G	6	WOOD BLOCKOUT 6" X 8" X 14"	WBO8
H	1	STRUT 3" X 3" X 80" X 1/4" A36 ANGLE	STR80
I	1	FOUNDATION TUBE 6" X 8" X 72" X 3/8"	FNDT6
J	1	WOOD BREAKAWAY POST 5 1/2" X 7 1/2" X 50"	WBRK50
K	1	WOOD STRIKE BLOCK	WSBK14
L	1	STRIKE PLATE 1/4" A36 BENT PLATE	SPLT8
M	1	REINFORCEMENT PLATE 12 GA. GR55	REPLT17
N	1	GUARDRAIL GRABBER 2 1/2" X 2 1/2" X 16 1/2"	GGR17
O	1	BEARING PLATE 8" X 8 5/8" X 5/8" A36	BPLT8
P	1	PIPE SLEEVE 4 1/4" X 2 3/8" O.D. (2 1/8" I.D.)	PSLV4
Q	1	BCT CABLE 3/4" X 81" LENGTH	CBL81

ITEM	QTY	SMALL HARDWARE	ITEM #
a	1	5/8" X 12" GUARDRAIL BOLT 307A HDG	12GRBLT
b	7	5/8" X 10" GUARDRAIL BOLT 307A HDG	10GRBLT
c	33	5/8" X 1 1/4" GR SPlice BOLTS 307A HDG	1GRBLT
d	3	5/8" FLAT WASHER F436 A325 HDG	58FW436
e	1	5/8" LOCK WASHER HDG	58LW
f	39	5/8" GUARDRAIL HEX NUT HDG	58HN563
g	2	1/2" X 2" STRUT BOLT A325 HDG	2BLT
h	6	1/2" X 1 1/4" PLATE BOLT A325 HDG	125BLT
i	16	1/2" FLAT WASHER F436 A325 HDG	12FWF436
j	8	1/2" LOCK WASHER HDG	12LW
k	8	1/2" HEX NUT A563 HDG	12HN563
l	4	3/8" X 3" HEX LAG SCREW GR5 HDG	38LS
m	4	3/8" FLAT WASHER F436 A325 HDG	38FW844
n	2	1" FLAT WASHER F436 A325 HDG	1FWF436
o	2	1" HEX NUT A563DH HDG	1HN563
p	1	18" TO 24" LONG ZIP TIE RATED 175-200LB	ZPT18
q	1	1 1/2" X 4" SCH-40 PVC PIPE	PSPCR4
r	1	RFID CHIP RATED MIL-STD-810F	RFID810F
s	1	IMPACT HEAD REFLECTIVE SHEETING	RS30M

Design Division Standard

## SPIG INDUSTRY, LLC

### SINGLE GUARDRAIL TERMINAL

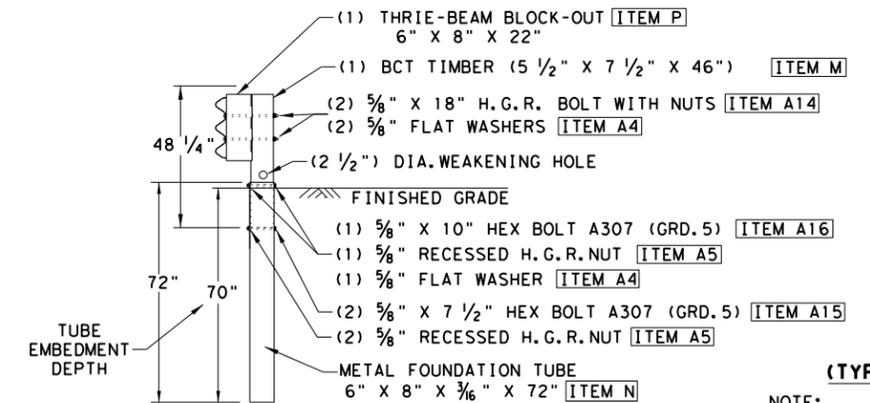
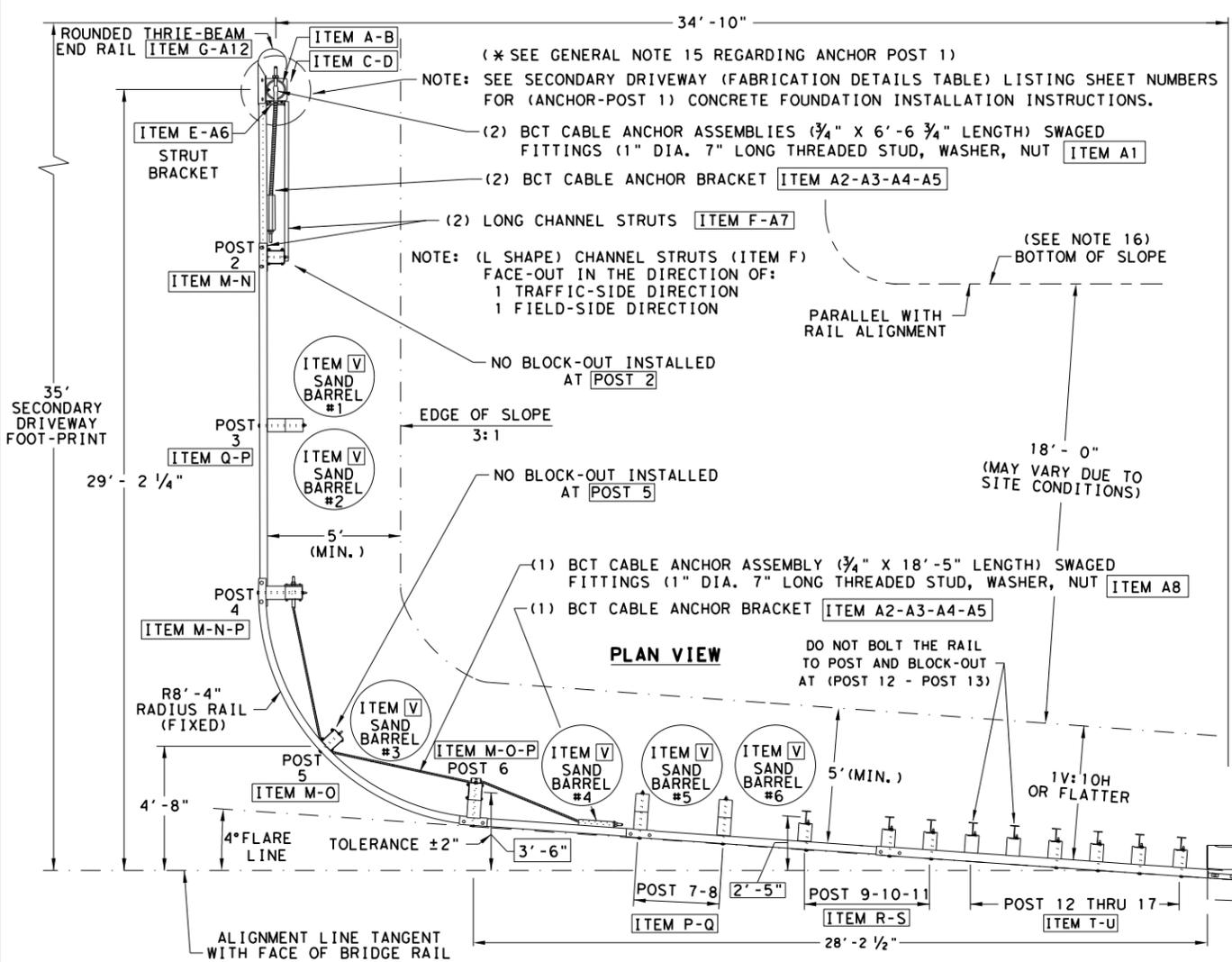
### SGET - TL-3 - MASH

### SGT (15) 31-20

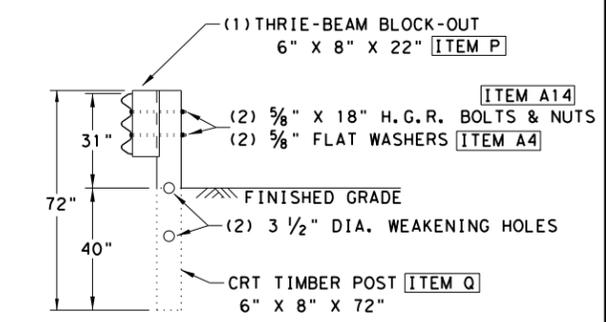
FILE: sg153120.dgn	DN: TXDOT	CK: KM	DW: VP	CK: VP
© TXDOT: APRIL 2020	CONT: 6399	SECT: 15	JOB: 001	HIGHWAY: SH99
REVISIONS	6399	15	001	SH99
DIST: BMT	COUNTY: LIBERTY, ETC.	SHEET NO. 83		

NOTE: THIS STANDARD IS A BASIC REPRESENTATION OF THE SGET TERMINAL SYSTEM AND IS NOT INTENDED TO REPLACE THE MANUFACTURER'S ASSEMBLY MANUAL.

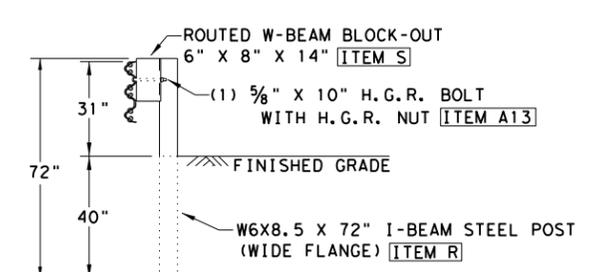
DISCLAIMER: THE USE OF THIS STANDARD IS GOVERNED BY THE "TEXAS ENGINEERING PRACTICE ACT". NO WARRANTY OF ANY KIND IS MADE BY TxDOT FOR ANY PURPOSE WHATSOEVER. TxDOT ASSUMES NO RESPONSIBILITY FOR THE CONVERSION OF THIS STANDARD TO OTHER FORMATS OR FOR INCORRECT RESULTS OR DAMAGES RESULTING FROM ITS USE. FILE: D:\NHYEMB Docs Extension\NHHAO FOLDERS\MAINTENANCE\RMVC IN PROGRESS\RMVC\_6399-15-001-SH99-L1ber12-DCN\Standard\16-Roadway Standard\2-Roadway Standard\2-BARRIER AND GUARDRAIL END



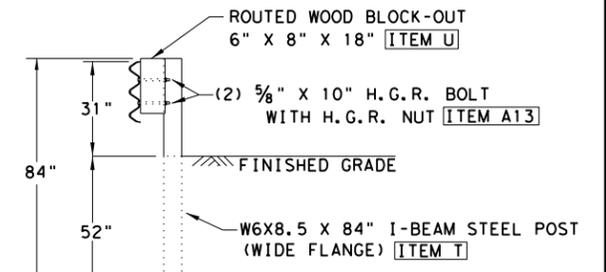
**SECTION VIEW (A-A)  
TIMBER POST WITH  
METAL FOUNDATION TUBE  
(TYP) BCT POSTS 2-4-5-6**



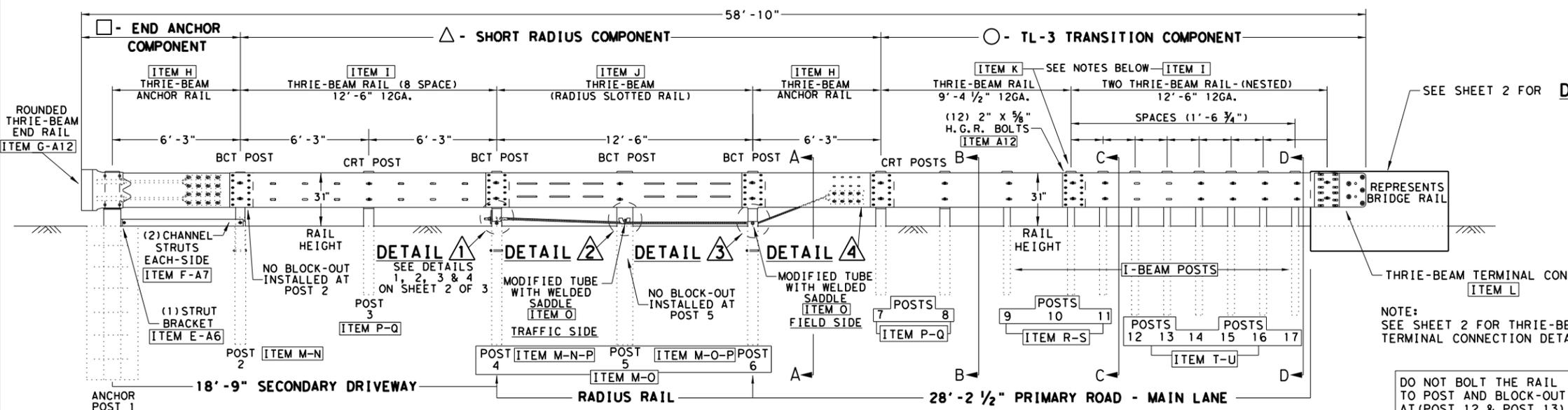
**SECTION VIEW (B-B)  
(TYP) CRT TIMBER POSTS 3-7-8**



**SECTION VIEW C-C  
(TYP) AT POSTS 9-10-11**



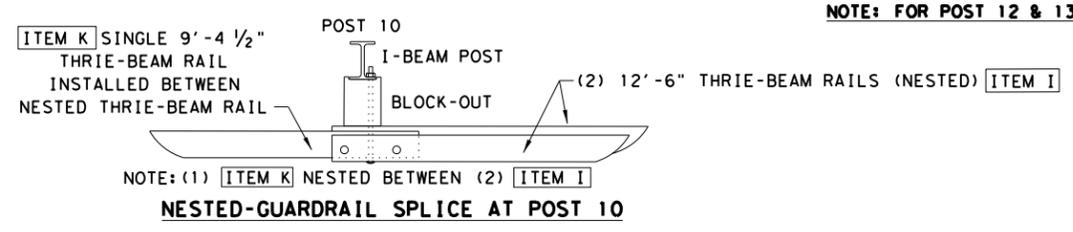
**\* SECTION VIEW D-D  
(TYP) AT POSTS 12-13-14-15-16-17**



ANCHOR POST 1 FABRICATION DETAILS	
SHEET DESCRIPTION	SHEET NUMBER
ANCHOR POST	SHEET 1 OF 8
ANCHOR SLEEVE	SHEET 2 OF 8
RADIUS RAIL	SHEET 3 OF 8
THRIE-BEAM RAILS	SHEET 4 OF 8
BCT TIMBER POST	SHEET 5 OF 8
STRUT RADIUS ANCHOR	SHEET 6 OF 8
FOUNDATION TUBE	SHEET 7 OF 8
ANCHOR CABLE	SHEET 8 OF 8

**NOTE: ALL CABLE BRACKET ASSEMBLIES ARE LOCATED ON THE FIELD-SIDE. SHOWN HERE FOR CLARITY.**

**NOTE: FOR BCT POSTS 2-4-5-6 INSTALL (1) OR (2) ITEM A15-A4-A5 BOLT ASSEMBLIES TO PREVENT TIMBER POST SLIDING DOWN FOUNDATION TUBE.**



**NESTED-GUARDRAIL SPLICE AT POST 10**

SEE SHEET 2 FOR **DETAIL 5** (PRIMARY BRIDGE RAIL CONNECTION)

**(MASH TL-3 COMPLIANT)  
TESTED TO MASH TL-3 WITH A 3:1 SLOPE**

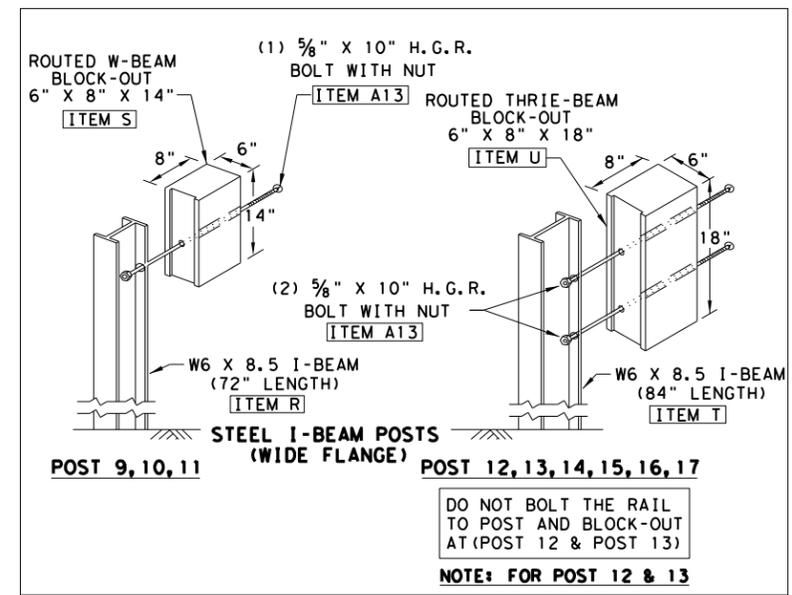
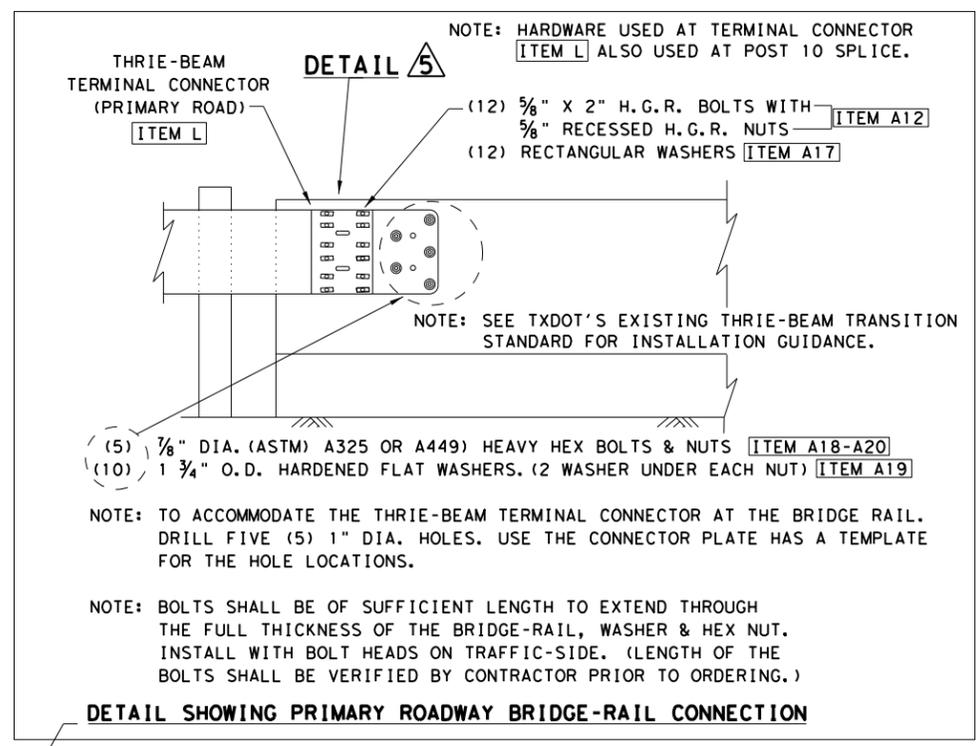
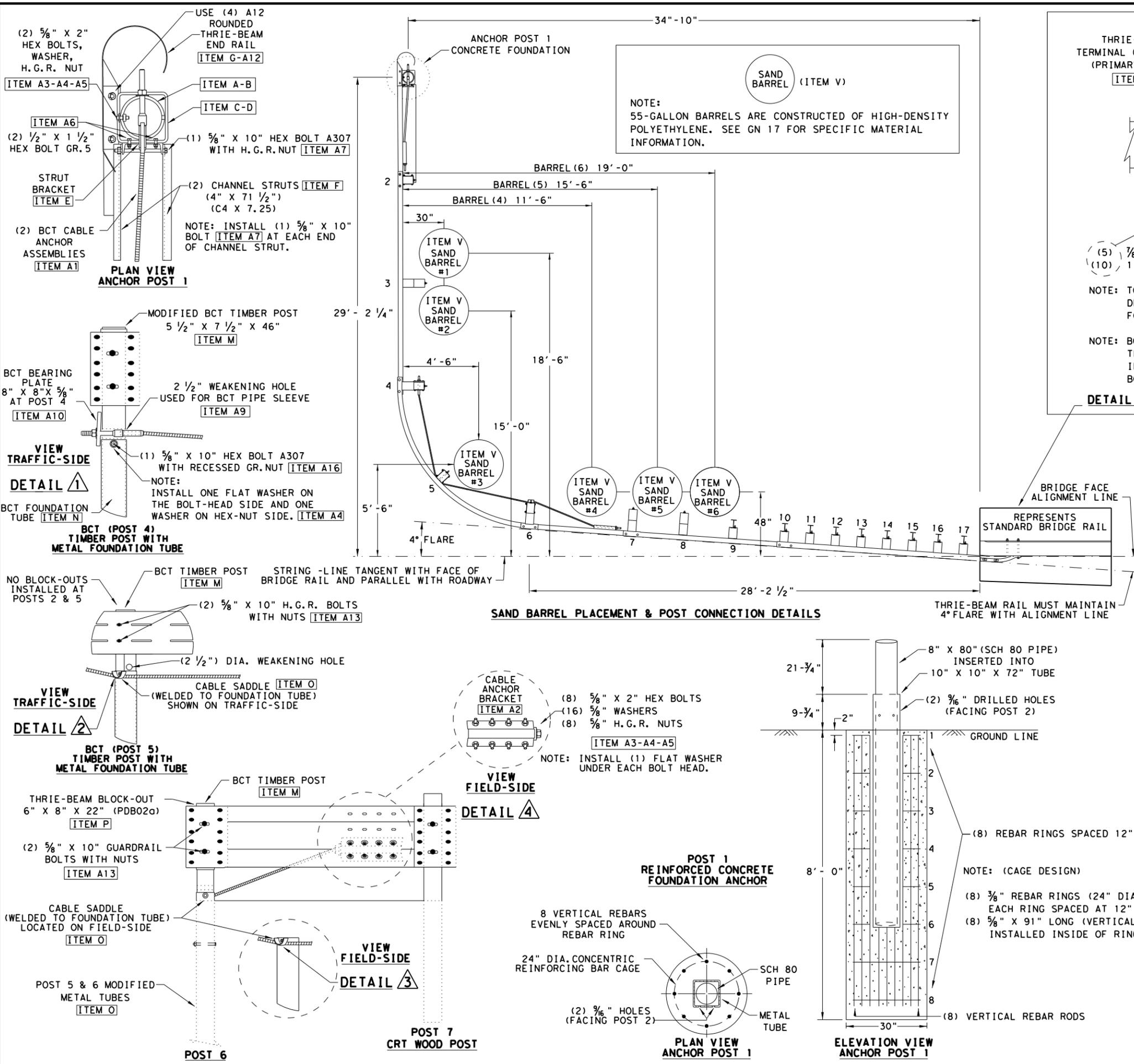
SHEET 1 OF 3

		Design Division Standard	
<b>TL-3 SHORT RADIUS GUARDRAIL MASH COMPLIANT SRG (TL-3) - 21</b>			
FILE: srg1321	TxDOT	CK:KM	DN:VP
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REVISIONS	6399	15	001
DIST	COUNTY	SHEET NO.	
BMT	LIBERTY, ETC.	84	

**NOTE: SEE SHEET 2 FOR THRIE-BEAM TERMINAL CONNECTION DETAILS.**

**DO NOT BOLT THE RAIL TO POST AND BLOCK-OUT AT (POST 12 & POST 13)  
NOTE: FOR POST 12 & 13**

DATE: 5/12/2022  
 FILE: D:\NNYEMB Docs Extension\NHAO FOLDERS\MAINTENANCE\RM\_C\_6399-15-001-SH99-15-001-ROADWAY 2-BARRIER AND GUARDRAIL END  
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(MASH TL-3 COMPLIANT)  
TESTED TO MASH TL-3 WITH A 3:1 SLOPE

SHEET 2 OF 3

		Design Division Standard	
<b>TL-3</b> <b>SHORT RADIUS GUARDRAIL</b> <b>MASH COMPLIANT</b> <b>SRG (TL-3) -21</b>			
FILE: srg1321	TxDOT	CK:KM	DN:VP
© TxDOT: FEBRUARY 2021 REVISIONS	CONT	SECT	JOB
	6399	15	001
	DIST	COUNTY	SHEET NO.
	BMT	LIBERTY, ETC.	85

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ITEM	ALL LARGE & SMALL COMPONENT DESCRIPTIONS
A	POST 1 TOP (SCH.80 PIPE) (8" X 80" LENGTH)
B	POST 1 TOP (WELDED SUPPORT COLLAR 10" X 10" X 1/2" ASTM A36)
C	POST 1 TUBE (HSS 10" X 10" X 1/2" X 72" LENGTH) A500 GR.B
D	POST 1 (WELDED PLATE 9 1/4" X 9 1/4" X 1/8") A36
E	POST 1 STRUT BRACKET (C8 X 11.50 A36)
F	(POST 1 & 2) CHANNEL STRUTS (4" X 71 1/2") (C4 X 7.25)A36
G	THRIE-BEAM RAIL (END ANCHOR - ROUNDED TYPE) 12GA. (RTE02a)
H	THRIE-BEAM RAIL (ANCHOR) (6'-3" LENGTH) 12GA. (RWM14a)
I	THRIE-BEAM RAIL (8 SPACE) (12'-6" LENGTH) 12GA. (RTM08)
J	THRIE-BEAM RAIL (RADIUS 8'-4 1/2") (SLOTTED) 12GA.
K	THRIE-BEAM RAIL (3 SPACE) (9'-4 1/2" LENGTH) 12GA.
L	THRIE BEAM RAIL (TERMINAL CONNECTOR) (BRIDGE-RAIL) (RTE01b)
M	POST 2,4,5,6 BCT TIMBER (5 1/2" X 7 1/2" X 46") (PDF04)
N	POST 2,4, BCT TUBE (6" X 8" X 3/16" X 72" LENGTH) (PTE05)
O	POST 5,6 MODIFIED BCT TUBES (FOR WELDED CABLE SADDLES)
P	POST 3,4,6,7,8 THRIE-BEAM BLOCK-OUT (6" X 8" X 22") (PDB02a)
Q	POST 3,7,8 CRT TIMBER POSTS (6" X 8" X 72" LENGTH) (PDE09)
R	POST 9,10,11 I-BEAM POSTS (W6X8.5 X 72" LENGTH) (PWE01)
S	POST 9,10,11 ROUTED W-BEAM BLOCK-OUT (6" X 8" X 14") (PDB01b)
T	POST 12 THRU 17 I-BEAM POSTS (W6X8.5 X 84" LENGTH) (PWE07)
U	POST 12 THRU 17 ROUTED BLOCK-OUT (6" X 8" X 18") (PDB??)
V	SAND BARRELS 700-715 LBS
A1	BCT CABLE ANCHOR ASSEMBLIES (3/4" X 6'-6 3/4" LENGTH) (FCA01)
A2	BCT CABLE ANCHOR BRACKET (FPA01)
A3	5/8" X 2" HEX BOLT A307 GRD.5 (FOR CABLE BRACKETS)
A4	5/8" FLAT WASHER A307 GRD.5 (1 WASHER UNDER BOLT HEAD & 1 NUT)
A5	5/8" RECESSED H.G.R NUT (NUTS FOR HEX BOLTS)
A6	STRUT BRACKET HARDWARE (1/2" X 1 1/2") HEX BOLT A307 GRD.5
A7	CHANNEL STRUT HARDWARE (5/8" X 10") HEX BOLT A307 GRD.5
A8	BCT CABLE ANCHOR ASSEMBLY (FCA02) (3/4" X 18'-5" LENGTH)
A9	BCT POST SLEEVE (FMM02a) (POST 4 ONLY)
A10	BCT CABLE BEARING PLATE (5/8" X 8" X 8" (FPB01) (POST 4 ONLY)
A11	5/8" X 1 1/4" H.G.R. BOLTS (FBB01) (SPLICES AT POST 2,4,6,7)
A12	5/8" X 2" H.G.R. BOLTS (FBB02) (ROUND TERM-POST 10-END SPLICE)
A13	5/8" X 10" H.G.R. BOLTS (FBB03) (I-BEAM POSTS RAIL & BLOCKOUT)
A14	5/8" X 18" H.G.R. BOLTS (FBB04) (POSTS 3,4,6,7,8)
A15	5/8" X 7 1/2" HEX BOLTS A307 GRD.5 (BCT POSTS 2,4,5,6)
A16	5/8" X 10" HEX BOLTS A307 GRD.5 (BCT POSTS 2,4,5,6)
A17	RECTANGULAR WASHERS (FWR03) (FOR TERMINAL CONNECTOR RTE01b)
A18	7/8" X (LENGTH VARIES) HEX BOLTS A325 OR A449 GR.5
A19	1 3/4" O.D. HARDENED FLAT WASHER A325
A20	7/8" HEX NUT GR.5 A325

END ANCHOR (POST 1 & POST 2)	
ITEM	QTY
A	1
B	1
C	1
D	1
E	1
F	2
G	1
H	1
A1	2
A2	2
A3	18
A4	36
A5	22
A6	2
A7	2
A12	4

TL-3 SHORT RADIUS (POST 2 TO POST 7)	
ITEM	QTY
H	1
I	1
J	1
M	4
N	2
O	2
P	4
Q	2
A8	1
A9	1
A10	1
A11	48
A14	8
A15	8
A16	4

TL-3 TRANSITION (POST 7 TO POST 17)	
ITEM	QTY
I	2
K	1
L	1
P	1
Q	1
R	3
S	3
T	6
U	6
A12	24
A13	18
A14	2
A17	12
A18	5
A19	10
A20	5

TL-3 SHORT RADIUS GUARDRAIL COMPLETE SYSTEM	
ITEM	TOTAL QTY
A	1
B	1
C	1
D	1
E	1
F	2
G	1
H	2
I	3
J	1
K	1
L	1
M	4
N	2
O	2
P	5
Q	3
R	3
S	3
T	6
U	6
V	6
A1	2
A2	3
A3	26
A4	76
A5	42
A6	2
A7	2
A8	1
A9	1
A10	1
A11	48
A12	28
A13	18
A14	10
A15	8
A16	4
A17	12
A18	5
A19	10
A20	5

- GENERAL NOTES**
- FOR ADDITIONAL INSTALLATION INFORMATION AND GUIDANCE CONTACT: TEXAS DEPARTMENT OF TRANSPORTATION, (TXDOT'S DESIGN DIVISION). (512) 416-2678. THE EXACT POSITION OF MBGF SHALL BE SHOWN ELSEWHERE IN THE PLANS OR AS DIRECTED BY THE ENGINEER. THE SIGHT DISTANCE OF THE INSTALLATION WILL NEED TO BE VERIFIED WITH RESPECT TO THE SPECIFIC SITE PLACEMENT.
  - STEEL POSTS ARE NOT PERMITTED AT CRT OR BCT POST POSITIONS.
  - RAIL ELEMENT SHALL MEET THE REQUIREMENTS OF ITEM 540, "METAL BEAM GUARD FENCE" EXCEPT AS MODIFIED ON THE PLANS. THE CONTRACTOR MAY FURNISH RAIL ELEMENTS OF 12 1/2" OR 25 FOOT NOMINAL LENGTHS.
  - BUTTON HEAD "POST BOLTS & NUTS" SHALL MEET THE REQUIREMENTS OF (ASTM A307), AND SHALL BE OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT AND 5/8" WASHER (FWC16a) AND NOT MORE THAN 1" BEYOND IT. TRIM REMAINING BOLT LENGTH TO MEET REQUIRED LENGTH.
  - FITTINGS (BOLTS, NUTS, AND WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING." FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
  - CROWN SHALL BE WIDENED TO ACCOMMODATE THE METAL BEAM GUARD FENCE.
  - THE LATERAL APPROACH TO THE GUARD FENCE, SHALL HAVE A SLOPE RATE OF NOT MORE THAN 1V:10H.
  - IT IS NOT RECOMMENDED THAT GUARD FENCE BE PLACED IN THE VICINITY OF CURBS.
  - GUARDRAIL POSTS SHALL NOT BE SET IN CONCRETE, OF ANY DEPTH.
  - SPECIAL FABRICATION WILL BE REQUIRED FOR THRIE BEAM RAIL RADIUS (ITEM J).
  - ALL MATERIAL AND WORK INVOLVED IS SUBSIDIARY TO SHORT RADIUS BID ITEM, INCLUDING, BUT NOT LIMITED TO FOUNDATIONS, GRADING, THRIE BEAM RAIL, SAND BARRELS, AND OTHER PARTS.
  - ALL CABLE ASSEMBLIES SHOULD BE TAUT AFTER INSTALLATION. WHEN CABLES ARE MANIPULATED BY HAND THE CABLES SHOULD NOT MOVE MORE THAN 1" IN ANY DIRECTION PERPENDICULAR TO THE CABLE.
  - THE BCT BEARING PLATE INSTALLED AT POST 4 SHOULD BE ORIENTED SUCH THAT THE 3" DIMENSION FROM PLATE EDGE TO CENTER OF BOLT HOLE IS ON THE BOTTOM AND 5" DIMENSION FROM PLATE EDGE TO CENTER OF BOLT HOLE IS ON THE TOP.
  - FOUNDATION AT POST 1 SHALL BE CLASS C CONCRETE.
  - POST (1) IS NOT A CRASHWORTHY TERMINAL. THE DESIGN AND PLACEMENT OF POST (1) MUST BE OUTSIDE OF THE CLEAR ZONE OF THE SECONDARY ROADWAY USING THE RESPECTIVE CLEAR ZONE CRITERIA. PLEASE CONTACT THE DESIGN DIVISION (512) 416-2678 FOR ASSISTANCE IN DETERMINING THE APPROPRIATE USE AND/OR PLACEMENT OF THE SYSTEM IN CONSTRAINED LOCATIONS. THE PAYMENT OF THE COMPLETE SYSTEM WILL BE WITH BID ITEMS: 540 XXXX TL-3 31" SHORT RADIUS (COMPLETE).
  - TESTED TO MASH WITH A 3:1 SLOPE OR SHALLOWER IS PREFERABLE IN THE LIMITS OF THE TOP AND BOTTOM OF THE SLOPE AS SHOWN IN THE PLAN VIEW. IF FIELD CONDITIONS REQUIRE A STEEPER SLOPE, THIS MAY BE ALLOWABLE UP TO A 2:1 SLOPE. CONTACT THE DESIGN DIVISION FOR ADDITIONAL GUIDANCE.
  - THE BARRELS ARE ENERGY ABSORPTION ENERGITE III, MODEL 640 FILLED WITH 715 LB (+/-15) SAND; OR AN APPROVED EQUIVALENT. THE APPROXIMATE HEIGHT OF THE BARREL IS 41" (+/-).
  - ALTERNATE METHODS TO TERMINATE THE SRG ALONG THE PRIMARY ROADWAY ARE AVAILABLE WHEN SITE CONDITIONS DICTATE. CONTACT DESIGN DIVISION FOR DETAILS: 512 416-2678
- NOTE: SEE SHEET 1 OF 3.

**SPECIAL APPLICATION NOTES.**

- THIS IS A MASH COMPLIANT TL-3 SHORT RADIUS GUARDRAIL SYSTEM WITH A TOP RAIL HEIGHT OF 31". AVAILABLE FOR USE ON ANY SPEED ROADWAY. THE SYSTEM REQUIRES A MINIMUM PLACEMENT FOOTPRINT OF 34'-10" ALONG THE PRIMARY ROAD AND A 35'-0" ALONG SECONDARY DRIVEWAY.
- IT IS CRITICAL THAT THE PRIMARY GUARDRAIL MAINTAIN A (4 DEGREE FLARE) WITH THE SECONDARY DRIVEWAY.
- THE SYSTEM REQUIRES A MINIMUM 5' WIDE (WORK ZONE) DIRECTLY BEHIND THE GUARDRAIL SYSTEM WITH A SLOPE AT 1V:10H OR FLATTER FROM THERE A MAXIMUM 3:1 SLOPE IS RECOMMENDED. SEE SHEET 1 OF 3 FOR FLARE AND SLOPE DETAILS.
- NOTE FOR INSTALLER: THE THREE (3) CRT POSTS ITEM (Q), AT POST LOCATIONS, 3, 7, & 8.), REQUIRE THE FOLLOWING FIELD ADJUSTMENT. USING A 3/4" X 10" LONG SPADE BIT DRILL ONE (1) ADDITIONAL HOLE 7-7/8" DIRECTLY BELOW THE EXISTING TOP HOLE TO ACCOMMODATE THE HARDWARE FOR THE 22" LONG BLOCKOUT.

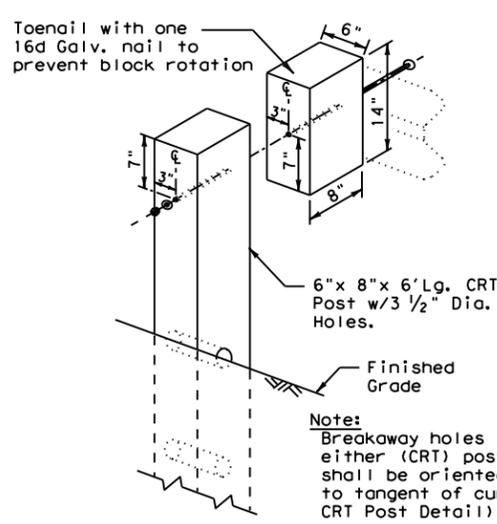
OPTION FOR ADDITIONAL 3/4" HOLE. THE 22" LONG BLOCKOUT (PDB01a) IS MANUFACTURED WITH TWO 3/4" DRILLED HOLES FOR THE POST HARDWARE, THEREFORE THE BLOCKOUT CAN BE USED AS A TEMPLATE GUIDE FOR THE BOTTOM 3/4" HOLE. AFTER INSTALLING THE CRT POST USE THE TOP HOLE TO MOUNT THE 22" LONG BLOCKOUT TO POST, USE THE BLOCKOUT'S PRE-DRILLED HOLE AS A GUIDE FOR THE BOTTOM 3/4" HOLE.

(MASH TL-3 COMPLIANT)  
TESTED TO MASH TL-3 WITH A 3:1 SLOPE

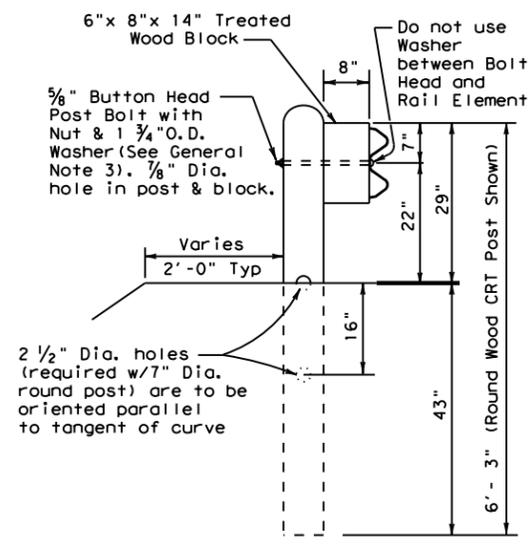
SHEET 3 OF 3

		Design Division Standard
<h2 style="margin: 0;">TL-3</h2> <h3 style="margin: 0;">SHORT RADIUS GUARDRAIL</h3> <h3 style="margin: 0;">MASH COMPLIANT</h3> <h2 style="margin: 0;">SRG (TL-3) -21</h2>		
FILE: srg+1321	TxDOT	CK:KM DN:VP CK:CGL
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REVISIONS	6399 15	001 SH99
DIST	COUNTY SHEET NO.	
BMT	LIBERTY, ETC. 86	

DATE: 5/12/2022  
 FILE: D:\N\N\EMB Docs\Extension\N\HAO FOLDERS\MAINTENANCE\RM\RM IN PROGRESS\RM\_6399-15-001-SH99-Liberty\2-Roadway Standards\2-BARRIER AND GUARDRAIL END  
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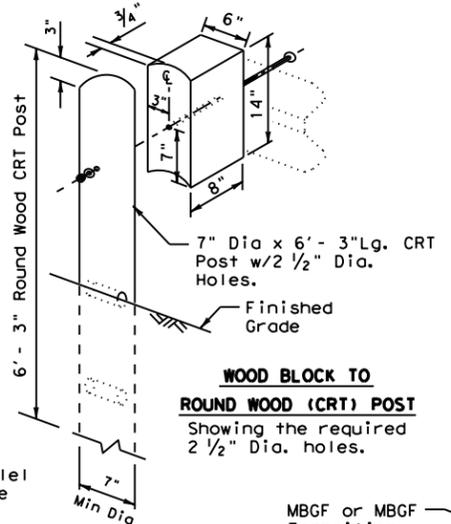


**WOOD BLOCK TO RECTANGULAR WOOD (CRT) POST**  
Showing the required 3 1/2" Dia. holes.

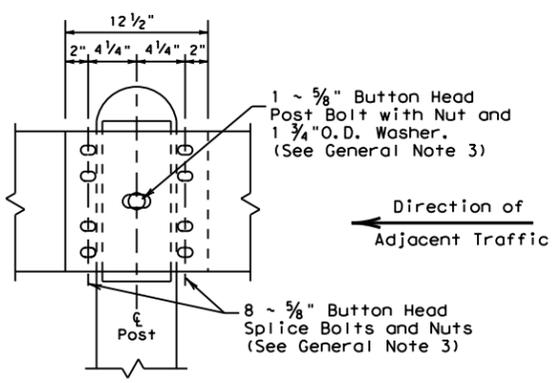


**(CRT) POST DETAIL CONTROLLED RELEASE TERMINAL POST**

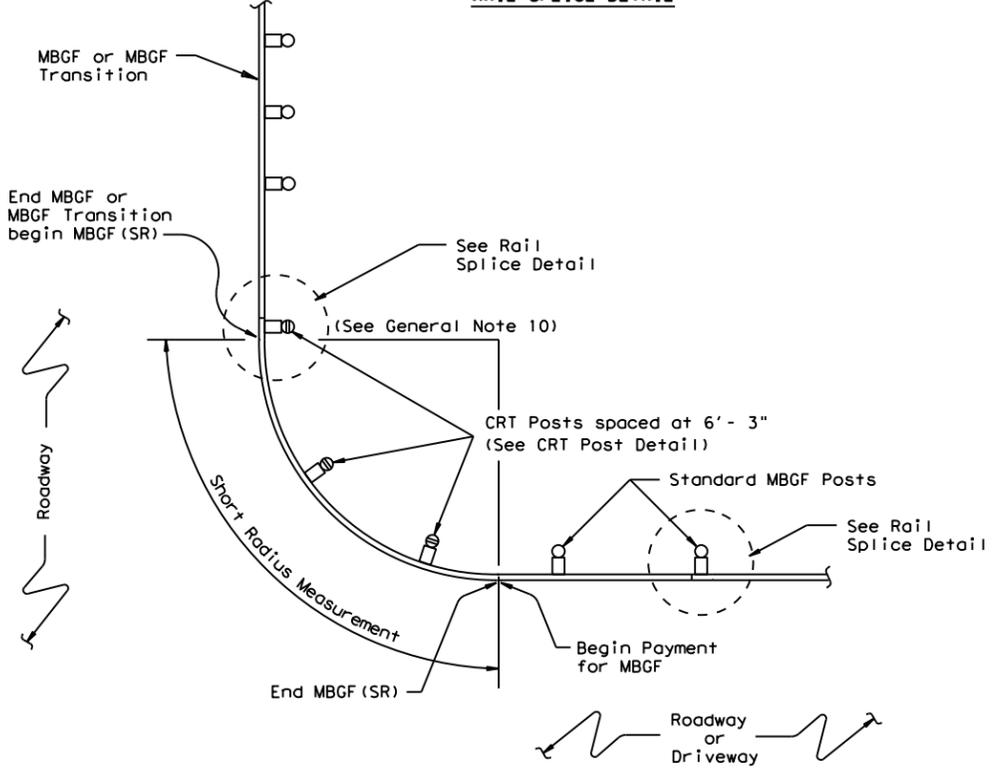
Two or more wood CRT post(s) are required at any radius installation located at intersecting roadways or driveways.



**WOOD BLOCK TO ROUND WOOD (CRT) POST**  
Showing the required 2 1/2" Dia. holes.



**RAIL SPLICE DETAIL**



**PLAN VIEW SHOWING TYPICAL RADIUS**

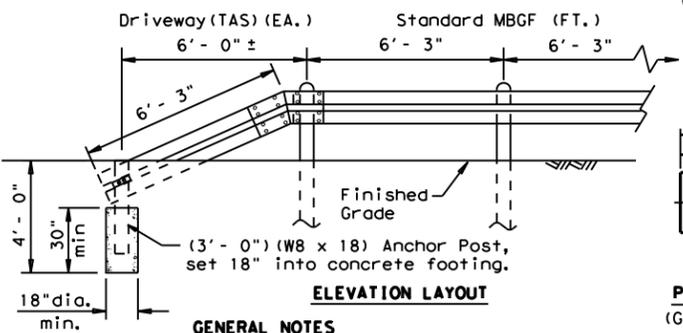
The required radius is shown elsewhere on the plans.

**GENERAL NOTES**

- The type of (CRT) post (round wood post, or rectangular wood post) will be shown elsewhere in the plans. The exact position of MBGF shall be shown elsewhere in the plans or as directed by the Engineer.
- Steel posts are not permitted at CRT post positions.
- Rail element shall meet the requirements of Item 540, "Metal Beam Guard Fence" except as modified on the plans. The Contractor may furnish rail elements of 12 1/2 or 25 foot nominal lengths.
- Button head "post" bolts (ASTM A307) shall be of sufficient length to extend through the full thickness of the nut (ASTM A563) and Type A (1 3/4" O.D.) washer and not more than 1" beyond it. Button head "splice" bolts (ASTM A307) are 5/8" x 1 1/4" (or 2" long at triple rail splices) with a 3/8" double recessed nut (ASTM A563).
- Fittings (bolts, nuts, and washers) shall be galvanized in accordance with Item 445, "Galvanizing." Fittings shall be subsidiary to the bid item.
- Crown shall be widened to accommodate the Metal Beam Guard Fence.
- The lateral approach to the guard fence, shall have a slope rate of not more than 1V:10H.
- Unless otherwise shown in the plans, guard fence placed in the vicinity of curbs shall be positioned so that the face of curb is located directly below or behind the face of the block. Rail placed over curbs shall be installed so that the post bolt is located approximately 21 inches above the gutter pan or roadway surface.
- If solid rock is encountered within 0 to 18" of the finished grade, drill a 22" dia. hole, 24" into the rock, or drill two 12" dia. front to back overlapping holes, 24" into the rock. If solid rock is encountered below 18", drill a 12" dia. hole, 12" into the rock or to the standard embedment depth, whichever is less. Any excess post length, after meeting these depths, may be field cut to ensure proper guardrail mounting height. Backfill with a cohesionless material.
- Guardrail posts shall not be set in concrete, of any depth.
- Special rail fabrication will be required at installations having a curvature of less than 150 ft. radius. The required radius shall be shown on the plans.
- The terminal anchor section (TAS) post shall be set in Class A concrete (unless otherwise shown in the plans) in accordance with Item 421, "Hydraulic Cement Concrete." Concrete shall be subsidiary to the bid item requiring construction of the terminal anchor section (TAS). Terminal anchor post to be galvanized in accordance with Item 445, "Galvanizing."
- Unless otherwise shown in the plans, a composite material post and/or block that meets the requirements of DMS-7210, "Composite Material Posts and Blocks for Metal Beam Guard Fence" may be substituted for posts and/or blocks of similar dimensions. The Construction Division, TxDOT maintains a Material Producer List (MPL) for producers of materials conforming to DMS-7210. Only producers on the MPL can furnish composite material posts and/or blocks.

**"DRIVEWAY" TERMINAL ANCHOR SECTION**

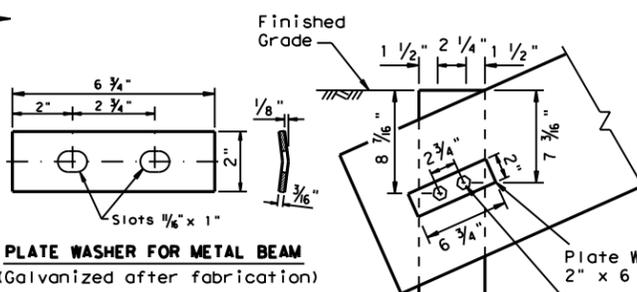
Only for use within driveway locations, where a standard (TAS) Terminal Anchor Section can not be installed.



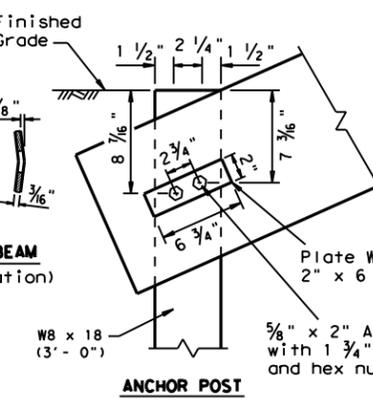
**ELEVATION LAYOUT**

**GENERAL NOTES**

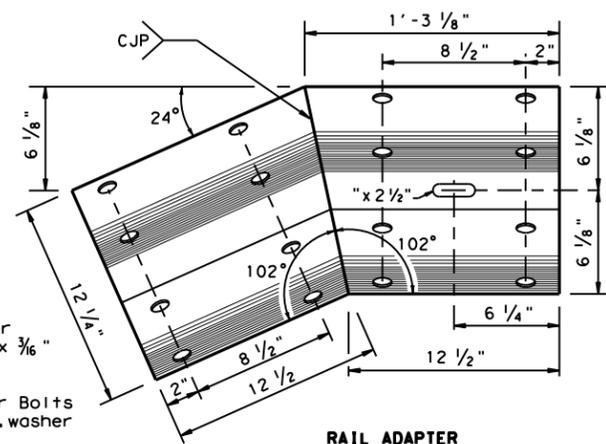
- The "Driveway" Terminal Anchor Section is ONLY to be used within driveway locations, where the ROW is limited and a standard 25 ft. (TAS) Terminal Anchor Section, is too long.
- Terminal anchor post shall be set in Class A concrete.
- All steel shall be galvanized after fabrication in accordance with Item 445, "Galvanizing."



**PLATE WASHER FOR METAL BEAM**  
(Galvanized after fabrication)



**ANCHOR POST**

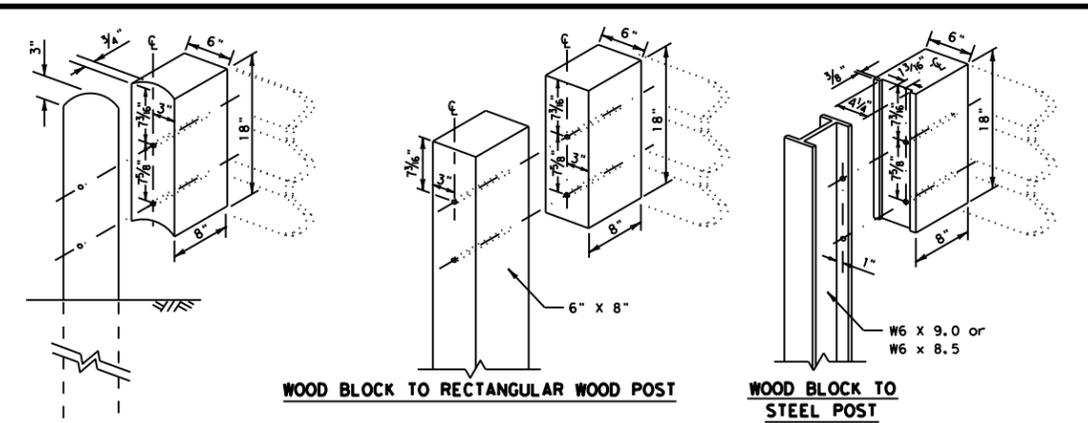
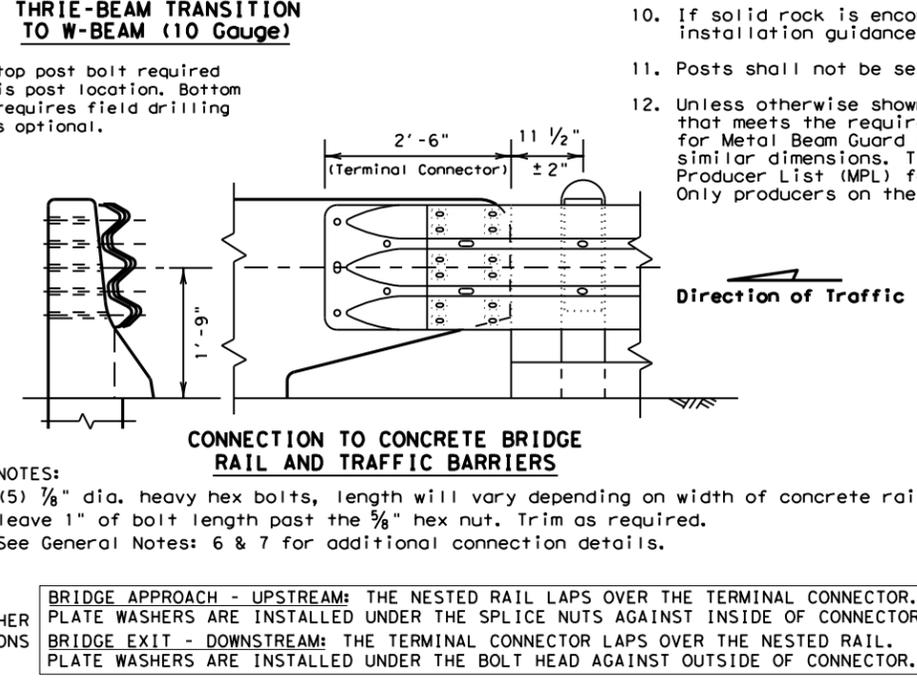
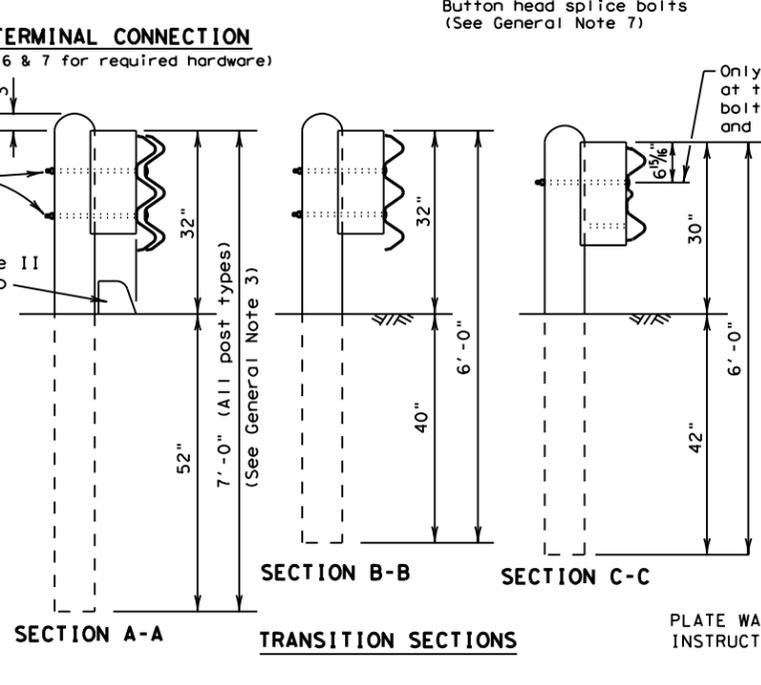
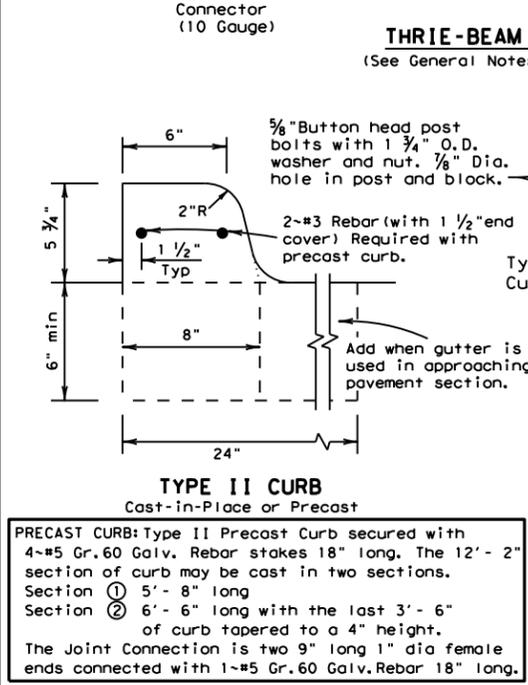
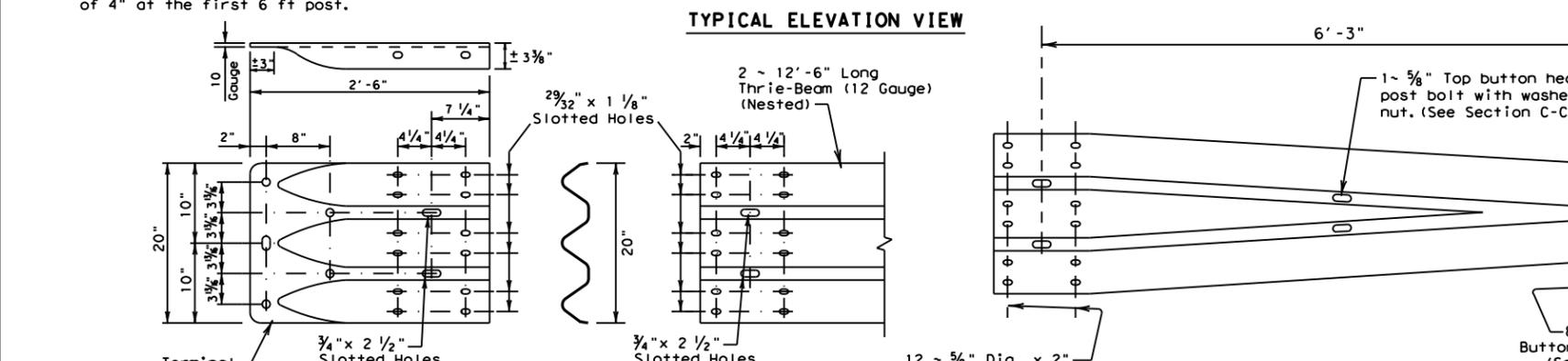
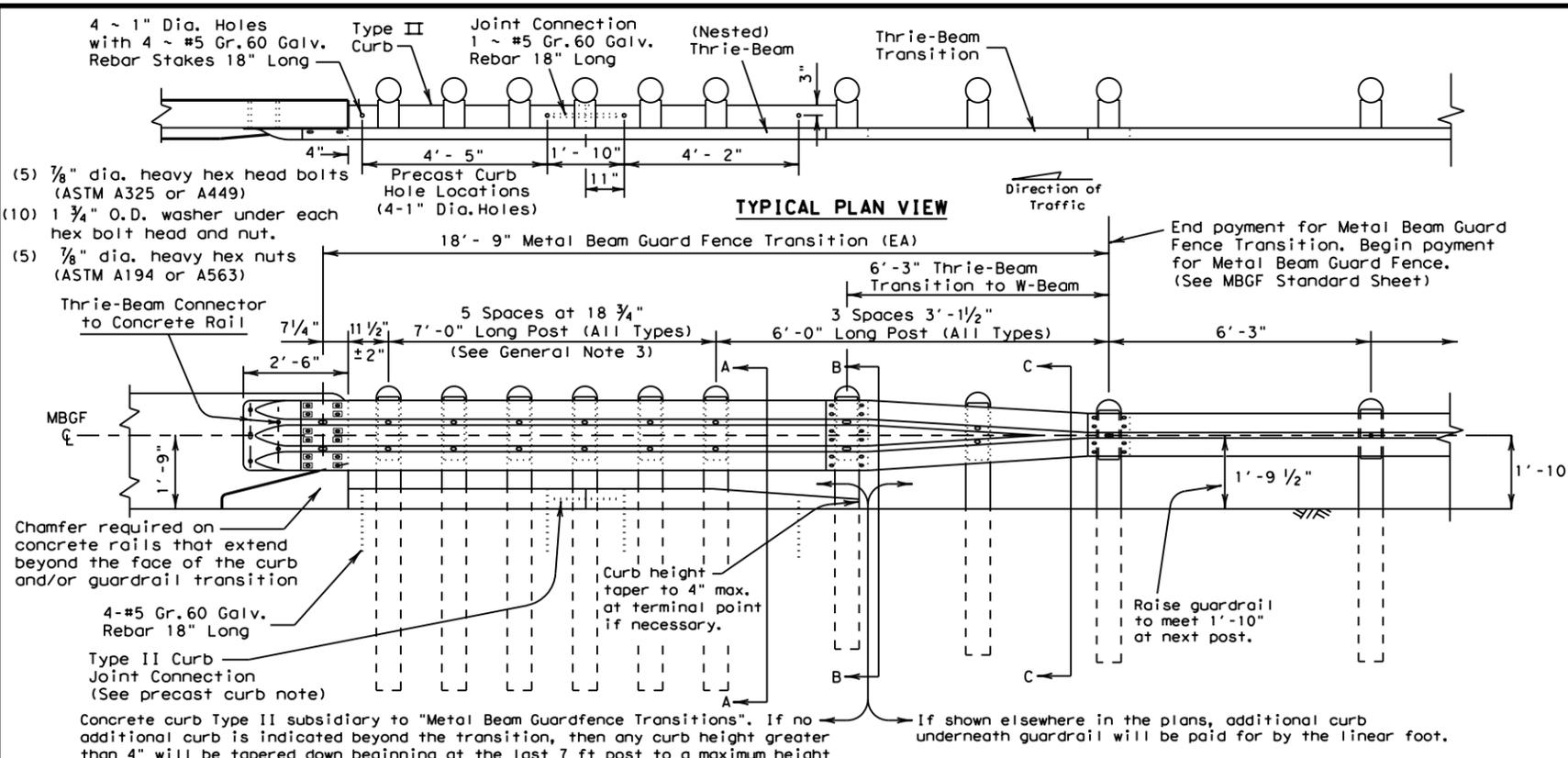


**RAIL ADAPTER**  
Rail - 10 gauge  
(Galvanized after fabrication)

**ONLY FOR USE IN MAINTENANCE REPAIRS OR HIGHLY CONSTRAINED SITE CONDITIONS.**

		Design Division Standard	
<b>METAL BEAM GUARD FENCE (SHORT RADIUS) MBGF (SR) - 19</b>			
FILE: mbgfsr19.dgn © TxDOT NOVEMBER 2019 REVISIONS	DN: TxDOT CONT: 6399 SECT: 15 DIST: BMT	CK: KM JOB: 001 COUNTY: LIBERTY, ETC.	DW: BD HIGHWAY: SH99 SHEET NO.: 87

DATE: 5/12/2022  
 FILE: D:\NNYEMB Docs\Extension\NHAO FOLDERS\MAINTENANCE\RM\RM IN PROGRESS\RM\_6399-15-001-SH99-Liberty\2-Roadway Standards\2-BARRIER AND GUARDRAIL END  
 DISCLAIMER: THE USE OF THIS STANDARD IS COVERED 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.



- GENERAL NOTES**
- Concrete curb may be cast-in-place or precast as shown on this sheet. When used in conjunction with thrie-beam guard fence transitions, curb shall be Type II (Typically 5 3/4" height above surface; See CCCC standard sheet) unless otherwise shown in the plans. 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.
  - Contact the Design Division for drainage cut options needed within the curb section of the transition.
  - The type of post (round wood, rectangular wood or steel) will be shown elsewhere in the plans.
  - 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 3/8" in height, and visible after installation. Wooden posts shall be marked with a brand, and steel posts with a stencil before galvanizing.
  - Rail element 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.
  - Unless otherwise shown in the plans, transitions shall be placed with the block face in front of or directly above the curb face.
  - Install terminal connector with (12) rectangular guardrail plate washers: (FWR03) and (12) 5/8" x 2" button head splice bolts with recessed nuts.
  - Button head "post bolts & nuts" shall meet the requirements of (ASTM A307), and shall be of sufficient length to extend through the full thickness of the nut and 5/8" washer (FWC16a) and not more than 1" beyond it. Trim remaining bolt length to meet required length.
  - Fittings (bolts, nuts, and washers) shall be galvanized in accordance with Item 445, "Galvanizing". Fittings shall be subsidiary to the bid item.
  - Crown shall be widened to accommodate transitions.
  - If solid rock is encountered. See the MBGF standard sheet for the proper installation guidance.
  - Posts shall not be set in concrete.
  - Unless otherwise shown in the plans, a composite material post and/or block that meets the requirements of DMS-7210, "Composite Material Posts and Blocks for Metal Beam Guard Fence" may be substituted for posts and/or blocks of similar dimensions. The Construction Division, TxDOT, maintains a Material Producer List (MPL) for producers of materials conforming to DMS-7210. Only producers on the MPL can furnish composite material posts and/or blocks.

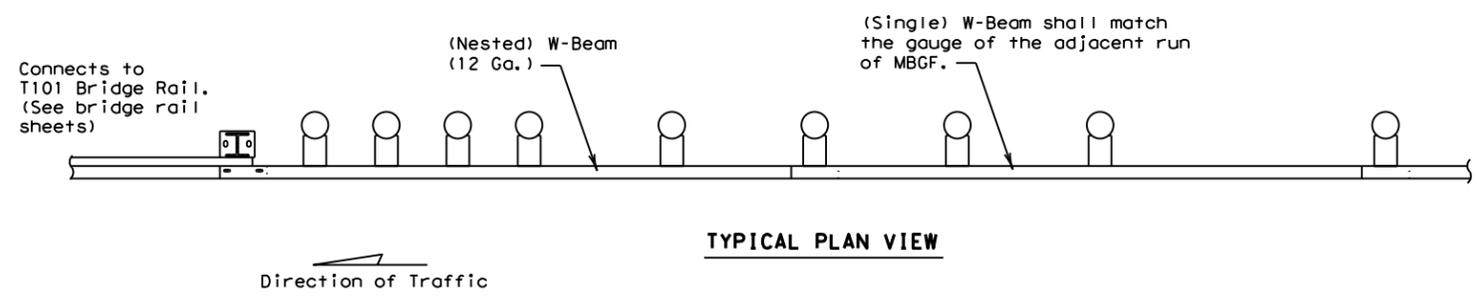
**ONLY FOR USE IN MAINTENANCE REPAIRS.**

Texas Department of Transportation  
 Design Division Standard

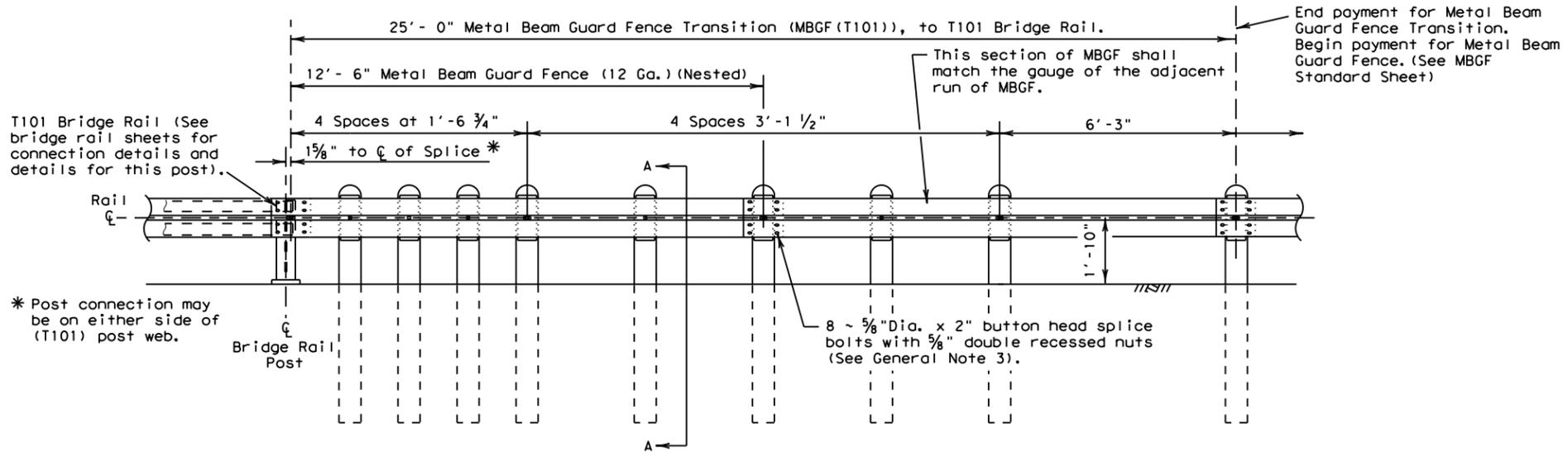
**METAL BEAM GUARD FENCE TRANSITION (THRIE-BEAM TRANSITION) MBGF (TR) - 19**

FILE: mbgfr19.dgn	DN: TxDOT	CK: KM	DW: BD	CK: VP
© TxDOT NOVEMBER 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	6399	15	001	SH99
DIST	COUNTY	SHEET NO.		
BMT	LIBERTY, ETC.			88

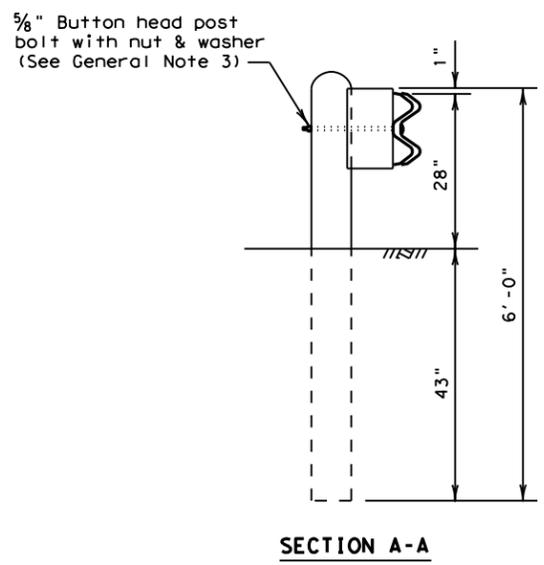
DATE: 5/12/2022  
 FILE: D:\NNYEMB Docs\_Extension\NHAO\_FOLDERS\MAINTENANCE\RMV IN PROGRESS\RMV\_6399-15-001-SH99-15-001-Roadway\_Standards\2-BARRIER AND GUARDRAIL END  
 DISCLAIMER: THIS STANDARD IS GOVERNED BY THE "TEXAS ENGINEERING PRACTICE ACT". NO WARRANTY OF ANY KIND IS MADE BY TxDOT FOR ANY PURPOSE WHATSOEVER. TxDOT ASSUMES NO RESPONSIBILITY FOR THE CONVERSION OF THIS STANDARD TO OTHER FORMATS OR FOR INCORRECT RESULTS OR DAMAGES RESULTING FROM ITS USE.



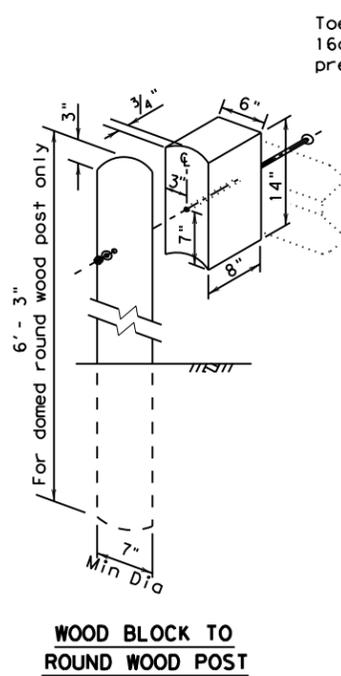
**TYPICAL PLAN VIEW**



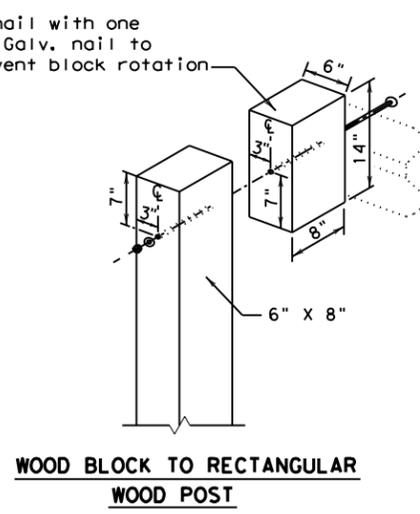
**TYPICAL ELEVATION VIEW**



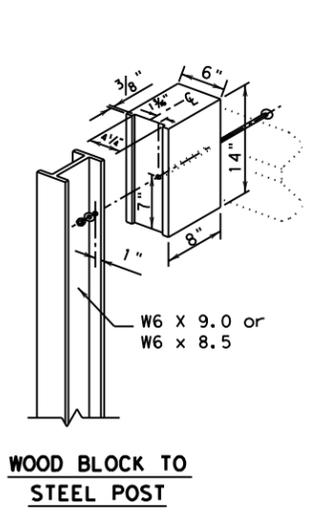
**SECTION A-A**



**WOOD BLOCK TO ROUND WOOD POST**



**WOOD BLOCK TO RECTANGULAR WOOD POST**



**WOOD BLOCK TO STEEL POST**

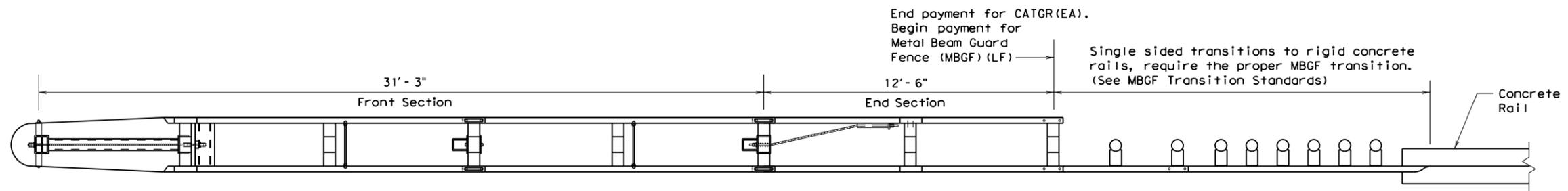
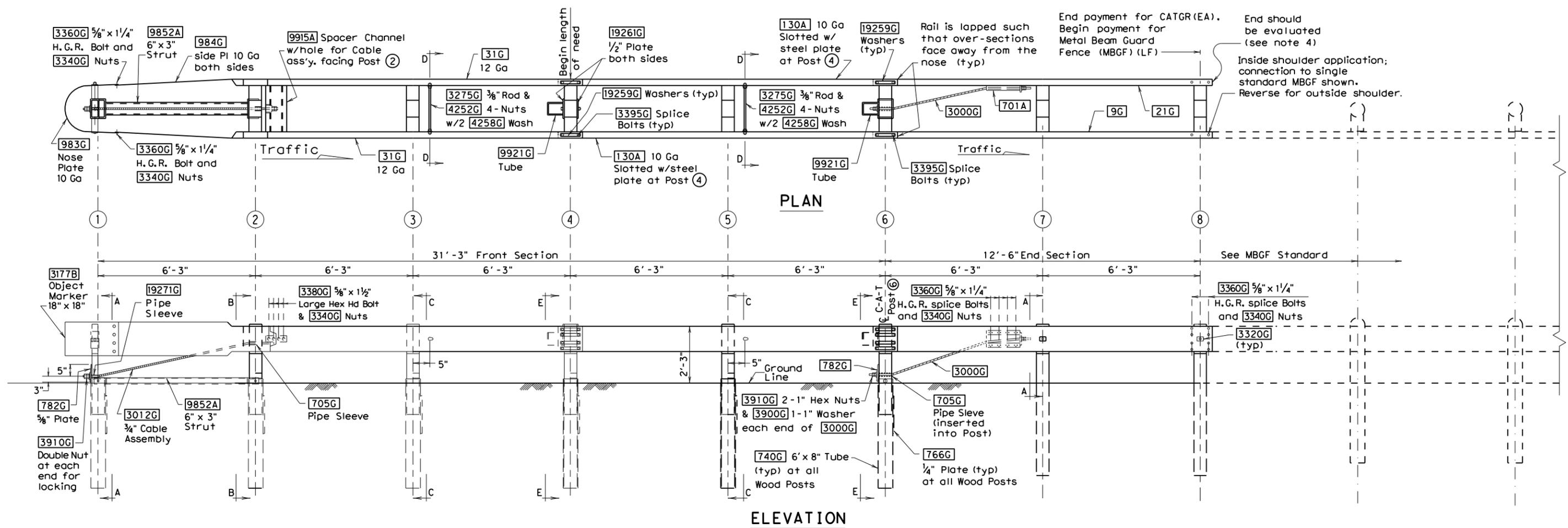
**GENERAL NOTES**

1. The type of post (round wood post, rectangular wood post, or steel post) will be shown elsewhere in the plans. The exact position of transitions shall be shown elsewhere in the plans or as directed by the Engineer.
2. Rail element shall meet the requirements of Item 540, "Metal Beam Guard Fence" except as modified on the plans.
3. Button head "post" bolts (ASTM A307) shall be of sufficient length to extend through the full thickness of the nut (ASTM A563) and the Type A 1 3/4" O.D. washer and not more than 1" beyond it. Button head "splice" bolts (ASTM A307) are 5/8" x 2" (at triple rail splices) with a 5/8" double recessed nuts (ASTM A563).
4. Fittings (bolts, nuts, and washers) shall be galvanized in accordance with Item 445, "Galvanizing." Fittings shall be subsidiary to the bid item requiring construction of the transition.
5. Crown will be widened to accommodate transitions.
6. If solid rock is encountered. See the MBGF standard sheet for proper installation guidance.
7. Posts shall not be set in concrete.
8. Unless otherwise shown in the plans, a composite material post and/or block that meets the requirements of DMS-7210, "Composite Material Posts and Blocks for Metal Beam Guard Fence" may be substituted for posts and/or blocks of similar dimensions. The Construction Division, TxDOT, maintains a Material Producer List (MPL) for producers of materials conforming to DMS-7210. Only producers on the MPL can furnish composite material posts and/or blocks.
8. Refer to MBGF Standard Sheet for additional details.

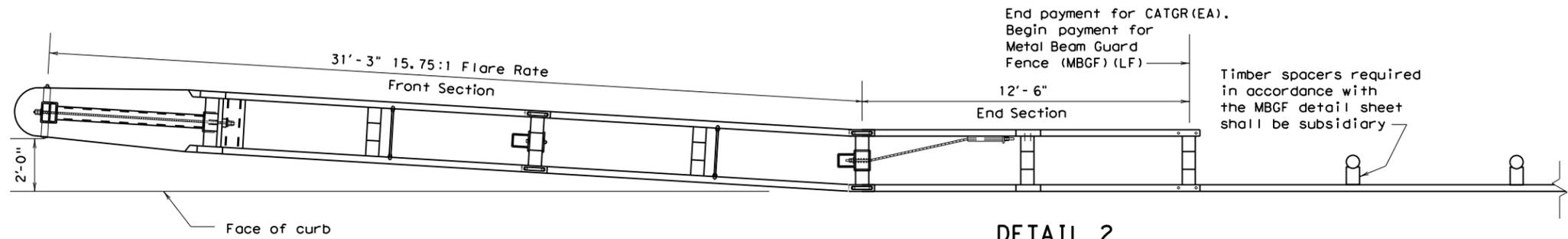
**ONLY FOR USE IN MAINTENANCE REPAIRS.**

		Design Division Standard	
<b>METAL BEAM GUARD FENCE TRANSITION (T101)</b> <b>(T101 BRIDGE RAIL)</b> <b>MBGF (T101) - 19</b>			
FILE: mbgft10119.dgn	DN: TxDOT	CK: KM	DW: BD
© TxDOT NOVEMBER 2019	CONT: 6399	SECT: 15	JOB: 001
REVISIONS		HIGHWAY: SH99	
DIST: BMT	COUNTY: LIBERTY, ETC.	SHEET NO.: 89	

DATE: 5/12/2022  
 FILE: D:\NNYEMB Docs\_Extension\NHAO FOLDERS\MAINTENANCE\RMC IN PROGRESS\RMC\_6399-15-001-SH99-Liberty\2-Roadway Standards\2-BARRIER AND GUARDRAIL END  
 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.



**DETAIL 3**  
Usual minimum placement to protect concrete rails



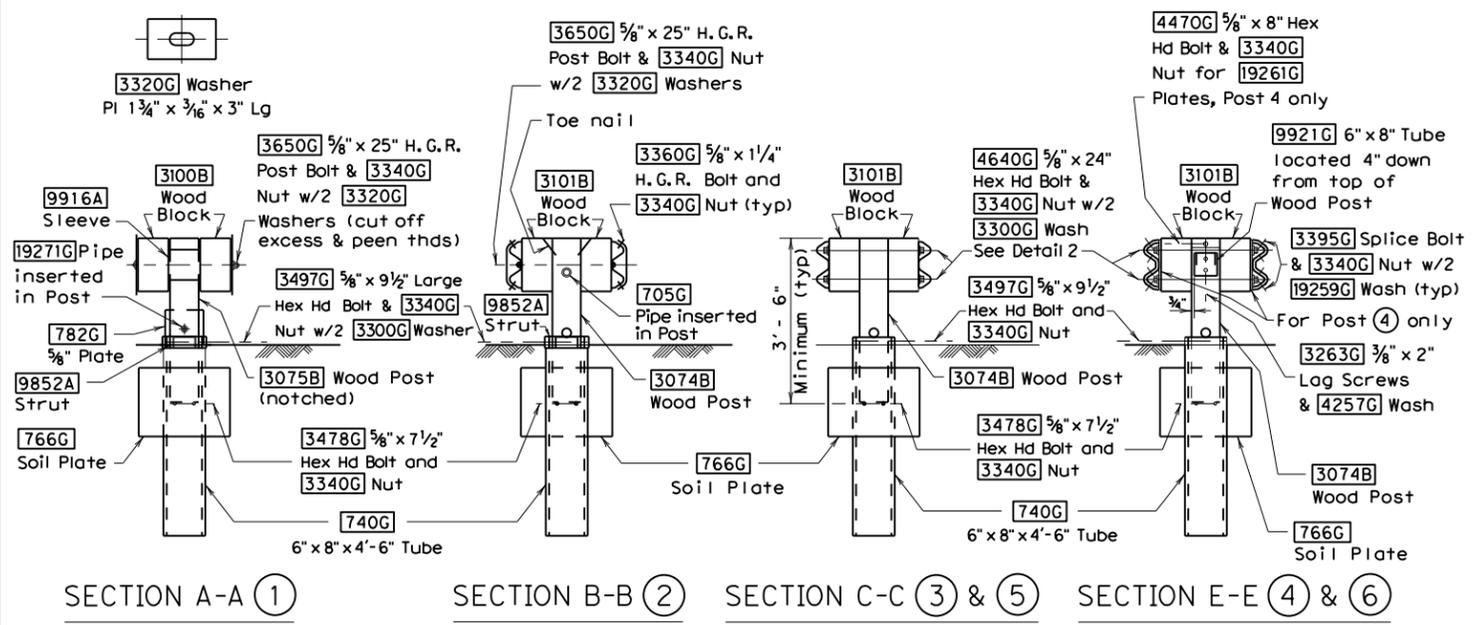
**DETAIL 2**  
Placement at curbed locations

SHEET 1 OF 2

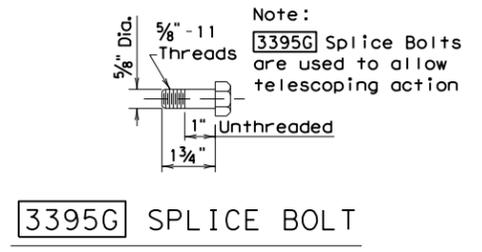
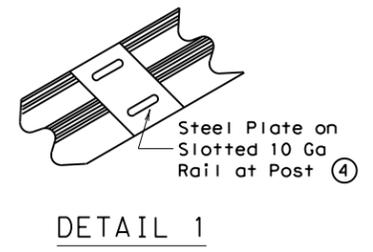
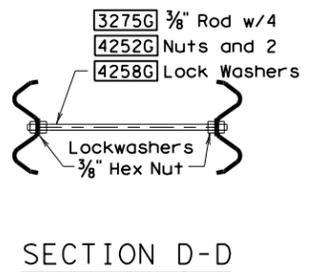
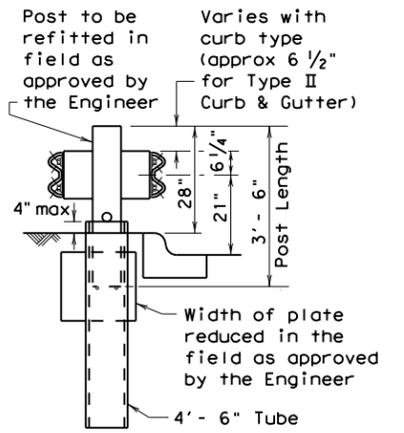
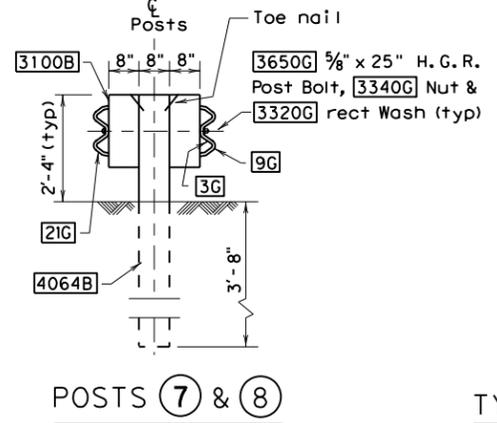
		<i>Design Division Standard</i>	
<b>TRINITY HIGHWAY ENERGY ABSORPTION CRASH CUSHION (GUARDRAIL) CATGR (2) - 17</b>			
FILE: catgr17.dgn	DN: TxDOT	CK: KM	DW: BD
© TxDOT: 1997	CONT: 6399	SECT: 15	JOB: 001
REVISIONS	REVISED 03, 2016 VP		HIGHWAY: SH99
	REVISED 03, 2017 KM		
DIST: BMT	COUNTY: LIBERTY, ETC.	SHEET NO.: 90	

**SACRIFICIAL**

DATE: 5/12/2022  
 FILE: D:\NNYEMB Docs\_Extension\NHAO FOLDERS\MAINTENANCE\RM\ IN PROGRESS\RM\_6399-15-001-SH99-Liberty-2-Roadway Standards\2-BARRIER AND GUARDRAIL END  
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Note:  
There are no Rail to Post attachments for Posts (3), (5), & (6)



CATGR GUARDRAIL TERMINAL (POSTS 1-6) BILL OF MATERIALS

Mfr Code #	QTY	DESCRIPTION
983G	1	Nose Plate x 10 GA
984G	2	Side Plate x 10 GA
31G	2	"W" Beam 12 GA x 13'-6 1/2"
130A	2	"W" Beam 10 GA x 13'-6 1/2"
9852A	1	Channel Strut x 6'-6"
740G	6	Steel Foundation Tube
766G	6	Soil Plate 18" x 24"
3075B	1	Wood Post 5 1/2" x 7 1/2" (Notched) (Post 1)
3074B	5	Wood Post 5 1/2" x 7 1/2" (Post 2 - 6)
3100B	2	Wood Block 5 1/2" x 7 1/2" (Post 1)
3101B	10	Wood Block 5 1/2" x 7 1/2" (Post 2 - 6)
9916A	1	Sleeve (Post 1)
9915A	1	Spacer Channel (Post 2)
9921G	2	Steel Tube (Post 4 & 6)
19271G	1	Pipe Sleeve (Post 1)
705G	1	Pipe Sleeve (Post 2)
19261G	2	Post Plate (Post 4)
782G	1	Bearing Plate (Post 1)
3012G	1	Cable Assembly (from Post 1 to 2)
3275G	2	3/8" Restraint Rod (Post 3 & 5)
19259G	32	Plate Washer (Post 4 & 6)

HARDWARE		
3263G	4	3/8" x 2" Lg Lag Screw
4252G	8	3/8" Hex Nut
4258G	4	3/8" Lock Washer
4257G	4	3/8" Flat Washer
3320G	4	Rectangular Washer
3395G	32	5/8" x 1 3/4" H.H. Splice Bolt
3650G	2	5/8" x 25" Lg H.G.R. Bolt
4640G	8	5/8" x 24" Lg H.H. Bolt
3478G	13	5/8" x 7 1/2" Lg H.H. Bolt
3380G	8	5/8" x 1 1/2" Lg H.H. Bolt
3360G	16	5/8" x 1 1/4" Lg H.G.R. Bolt
3340G	85	5/8" H.G.R. Nut
3300G	8	5/8" Flat Washer
3497G	6	5/8" x 9 1/2" Lg H.H. Bolt
3910G	4	1" Hex Nut
3900G	2	1" Flat Washer

DELINEATOR		
3177B	1	Object Marker (18" x 18") (Cut to fit)

CATGR GUARDRAIL TERMINAL (POSTS 7-8) BILL OF MATERIALS

Mfr Code #	QTY	DESCRIPTION
4064B	2	Wood Post 5 1/2" x 7 1/2" x 6'
3101B	4	Wood Block 5 1/2" x 7 1/2"
21G	1	"W" Beam Guard Rail (12 Ga)
9G	1	"W" Beam Guard Rail (12 Ga)
701A	1	Bracket
782G	1	Bearing Plate (Post 6)
705G	1	Pipe Sleeve (Post 6)
3000G	1	Cable Assembly (from Post 6 to Rail)
3320G	2	Rectangular Washer

HARDWARE		
3360G	24	5/8" x 1 1/4" H.G.R. Splice Bolt
3400G	4	5/8" x 25" H.G.R. Post Bolt
3380G	8	5/8" x 1 1/2" Hex Hd Bolt
3340G	28	5/8" H.G.R. Nut
3300G	8	5/8" Washer
3910G	4	1" Hex Nut
3900G	2	1" Washer

GENERAL NOTES

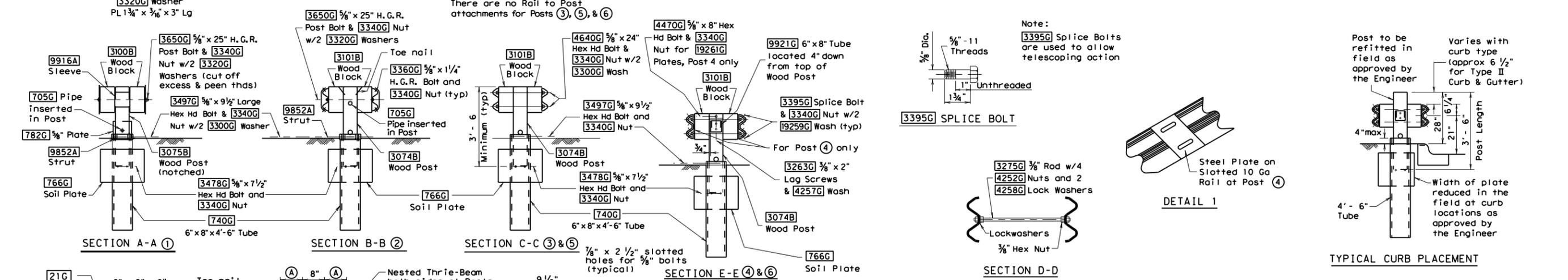
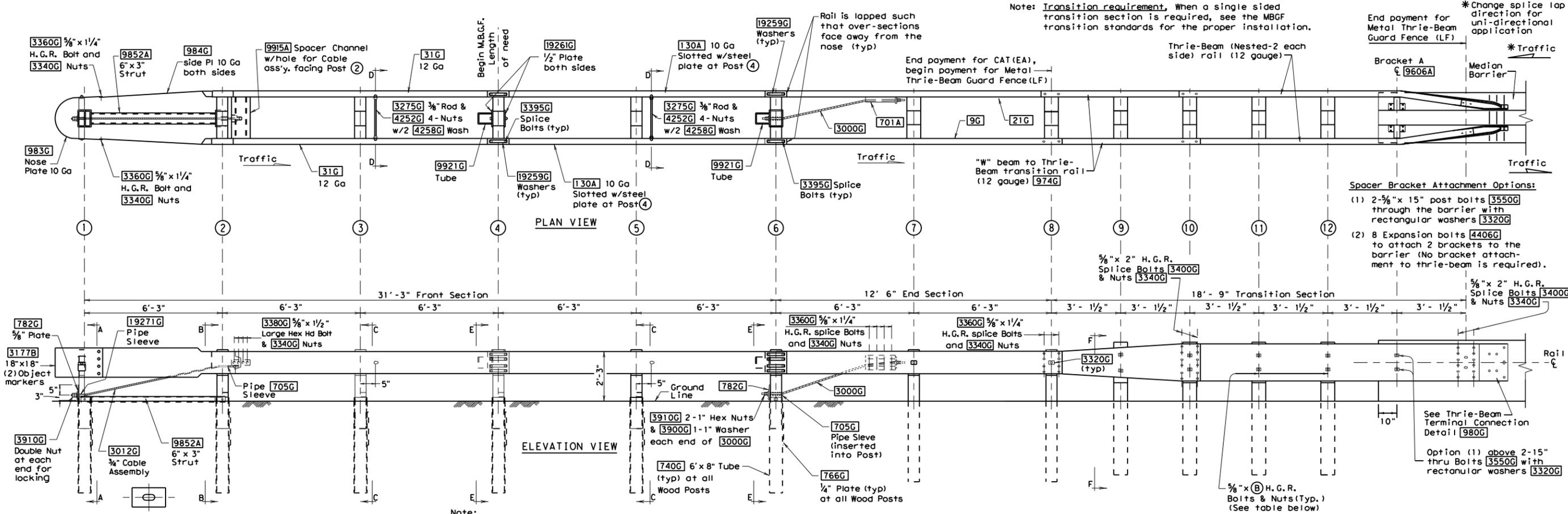
- For specific information regarding installation and technical guidance of the system, contact: Trinity Highway at 1(888)323-6374. 70 W. Madison St. Suite 2350. Chicago, IL 60602
- Crown will be widened to accommodate the CAT system. The crown should extend at least 3 feet beyond the inside face of rail. The ground line at posts should be an extension of the roadway surface crown.
- All bolts, nuts, washers, cable assemblies, cable anchors, post tubes, backup plates, and soil plates shall be galvanized.
- The exposed end segment of an "End Section" should be evaluated as a potential obstacle in the determination of the need of MGBF for the opposing direction of traffic.
- If a "single sided" transition is required, (as shown in Detail 3) the proper MGBF transition standards are required.
- For placement at curb sections, the height from gutter pan to post bolt will be 21", and the front section shall be flared (See Detail 2).
- The wood blockouts shall be "toe nailed" to the rectangular wood posts to prevent them from turning when the wood shrinks.
- Either 6" x 8" or 5 1/2" x 7 1/2" wood blocks may be used at posts 1 through 8 as supplied by the manufacturer.
- An object marker shall be installed on the front of the terminal as detailed on the D&M(VIA).

		Design Division Standard	
<b>TRINITY HIGHWAY ENERGY ABSORPTION CRASH CUSHION (GUARDRAIL)</b>			
<b>CATGR (2) - 17</b>			
FILE: catgr17.dgn	DN: TxDOT	CK: KM	DW: KM
© TxDOT: 1997	CONT	SECT	JOB
REVISED 03, 2016 VP	6399	15	001
REVISED 03, 2017 KM	DIST	COUNTY	SHEET NO.
	BMT	LIBERTY, ETC.	91

SACRIFICIAL

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DATE: 5/12/2022 4:38:54 PM  
 FILE: D:\NNYEMB Docs\_Extensions\NHAO FOLDERS\MAINTENANCE\RMV IN PROGRESS\RMV\_6399-15-001-SH99-Liberty2-DGN\Standards\2-Roadway\_Standards\2-BARRIER AND GUARDRAIL END



Post	(A) Block Width	Product Code	(B) Post Bolt Length	Product Code
9	6 1/2"	3409B	24"	3640G
10	5 1/2"	3408B	22"	3620G
11	4 1/2"	3407B	20"	3600G
12	3 1/2"	3406B	18"	3580G

**BRACKET "A" DETAILS**  
 AT C.T.B. (1" ACP Key-in)  
 1/4" steel plate or section of rectangular tubing with flanges welded on to the satisfaction of the Engineer

\*\* Modifications (as approved by the Engineer) in bracket design will be required for other barrier configurations.

SHEET 1 OF 2

**TRINITY HIGHWAY ENERGY ABSORPTION CRASH CUSHION (CONCRETE BARRIER) CATCB(1)-17**

FILE: catcb17.dgn		DN: TxDOT	CK: KM	DW: BD	CK: VP
© TxDOT: 1997		CONT	SECT	JOB	HIGHWAY
REVISED 03, 2016 VP		6399	15	001	SH99
REVISED 03, 2017 KM		DIST	COUNTY	SHEET NO.	
		BMT	LIBERTY, ETC.	92	

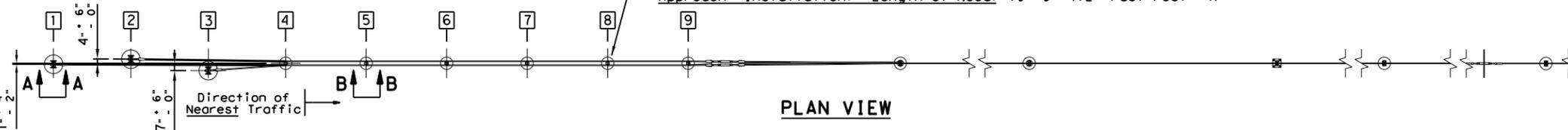
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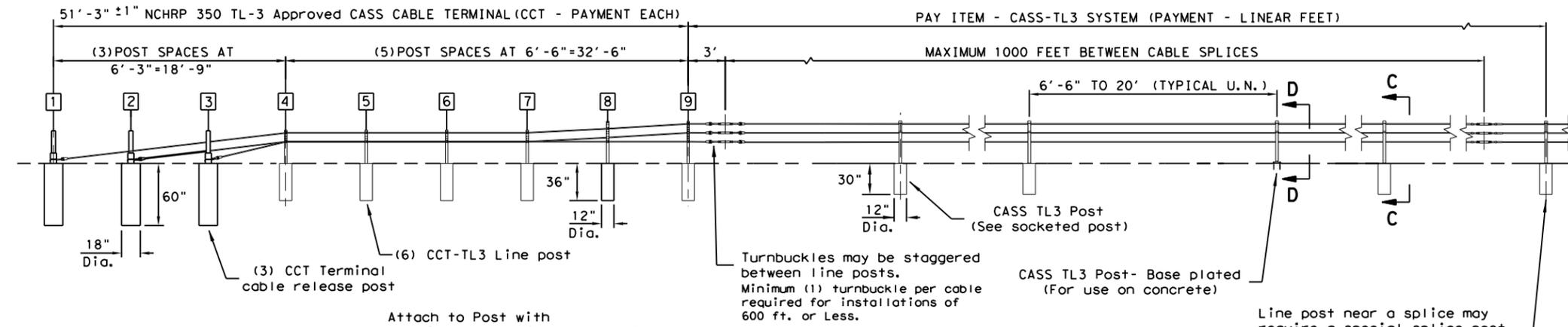
DATE: 5/12/2022 4:38:58 PM  
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**Preferred Installation:** Locate post #2 away from nearest traffic. System has been successfully tested with opposite installation.

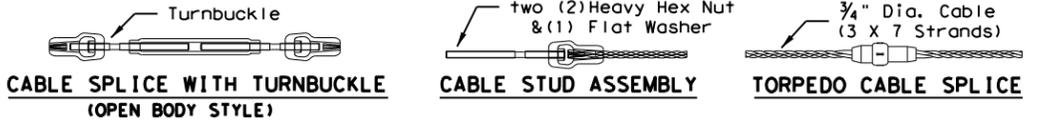
**Length-of-Need Cass Cable Terminal (CCT):**  
**Departure Installation:** Length-of-Need: 44'-9" (At Post #8)  
**Approach Installation:** Length-of-Need: 19'-9" (12" Past Post #4)



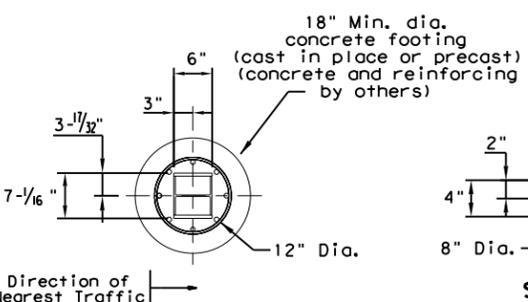
**PLAN VIEW**



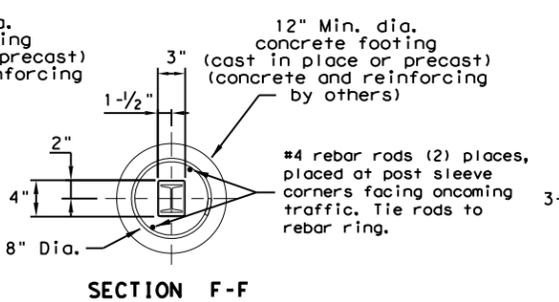
**ELEVATION VIEW (TYPICAL LAY-OUT)**



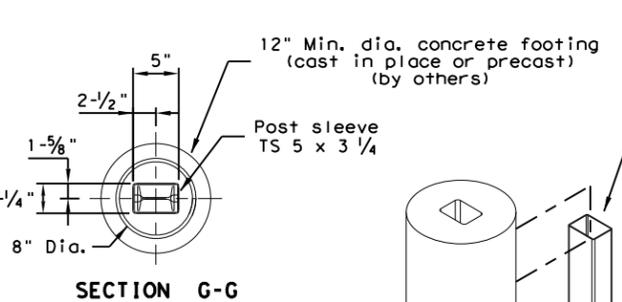
**CABLE SPLICE WITH TURNBUCKLE (OPEN BODY STYLE)**  
**CABLE STUD ASSEMBLY**  
**TORPEDO CABLE SPLICE**



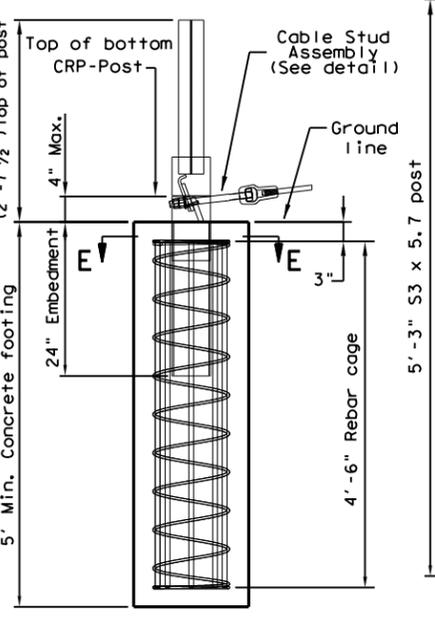
**SECTION E-E**



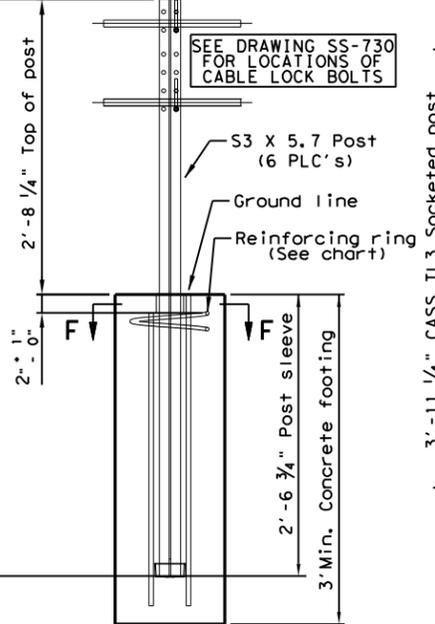
**SECTION F-F**



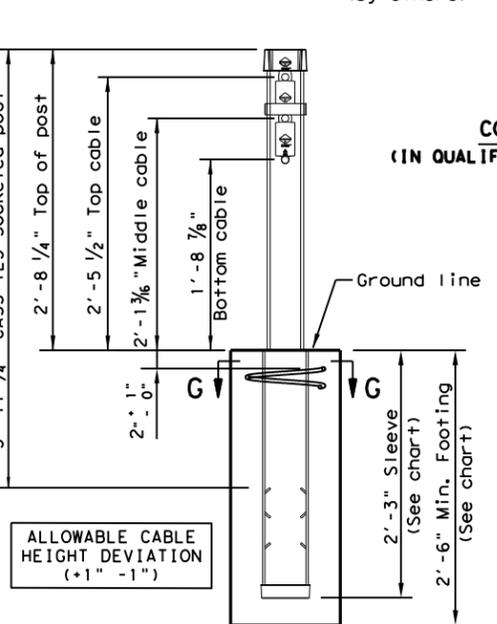
**SECTION G-G**



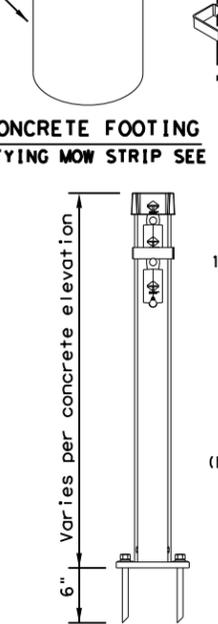
**VIEW A-A (CABLE RELEASE POST 1-3)**



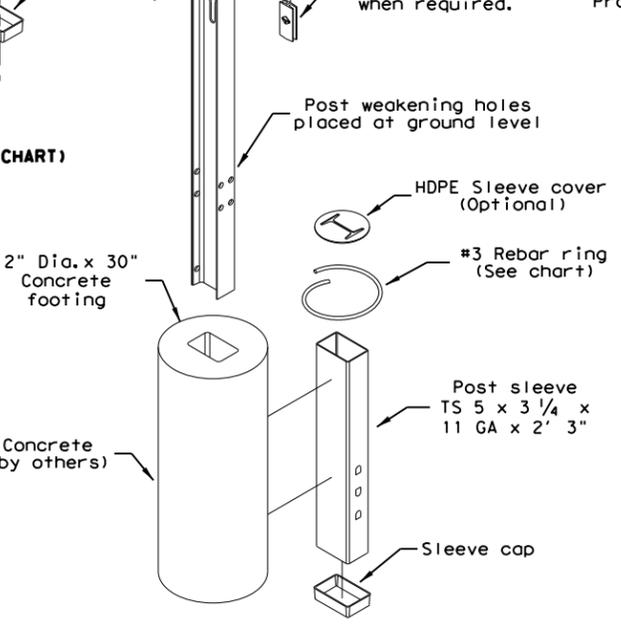
**VIEW B-B (TERMINAL LINE POST 4-7)**



**SECTION C-C (SOCKETED POST)**



**SECTION D-D (BASE PLATED POST)**



**STANDARD POST & CONCRETE FOOTING (SOCKETED POST)**

- GENERAL NOTES**
- This drawing is a general overview of CASS TL-3 Barrier System. See SS-730 (latest version) for specific details of CASS cable terminal (CCT) and cable safety system (CASS) requirements, proper installation, options and specification.
  - CASS is designed for bi-directional traffic flows and can be installed on either side of the median. Contact Trinity (800-527-6050) or consult the design, installation, or repair manual(s) for additional information.
  - All concrete for CASS footings shall be TxDOT class A. If class A or stronger concrete is utilized for the mowstrip, please see chart below for allowable footing depth and sleeve deviations.
  - All posts shall be socketed unless otherwise specified. All cables shall be pre-stretched unless otherwise specified.
  - For payment see Special Specification "Cable Barrier System".
  - CASS TL-3 shall be installed on shoulders or medians with slopes of 6:1 or flatter without obstructions, depressions, etc. That may significantly affect the stability of an errant vehicle. Grading of site and/or appropriate fill materials may be required. The designer/installer shall "Flatten" or "Round" various topographical inconsistencies that could interfere with the ability of the installer to consistently maintain the design height (in relation to the terrain) of the cables. Please consult manual(s) and/or TxDOT Memo(s) for installations in "Ditch Sections".
  - CASS TL-3 post spacing may be modified to avoid obstacles that conflict with the installation of CASS TL-3 line posts or to reduce deflection on radiuses. No post space can exceed the maximum post TxDOT space limit of 20'. Reducing or increasing post spacing affects deflection. CASS TL-3 may be laterally transferred at a rate not to exceed 30:1.
  - Post foundations may be drilled through existing pavement. Please see line post foundation chart for minimum footing requirements in various applications.
  - For aesthetic purposes Trinity recommends all sleeves, driven posts, and lower cable release posts to be installed reasonably plumb (approximately 1/8" per foot).
  - CASS TL-3 shall be installed in well-drained, compacted, NCHRP Report 350 Standard soil. If soil does not meet this classification, if solid rock/concrete is encountered below grade or if soil is susceptible to severe freeze/thaw cycles, please contact Trinity about alternate footing design(s). Trinity suggests the use of "Mow strips" for erosion prevention and ease of maintenance / installation.
  - See the Texas MUTCD for proper "Barrier" Delineation.

MOW STRIP DETAIL*			CONCRETE FOOTING CHART		
MOW STRIP	DEPTH	WIDTH	FOOTING	TUBE SLEEVE	REBAR RING
NONE			30" Min.	27" Min.	YES
HMA	6" Min.	3' Min.	27" Min.	15" Min.	NO
HMA	8" Min.	3' Min.	24" Min.	15" Min.	NO
RC	3" Min.	3' Min.	24" Min.	15" Min.	NO

Chart does not apply to Terminal Posts 1 thru 9.  
 \* Mow strip or pavement.  
 HMA = Hot Mix Asphalt (Not Recycled Asphalt Pavement).  
 RC = Reinforced Concrete (TxDOT Class A Minimum).

Trinity Highway Products, LLC.  
 2525 Stemmons Freeway  
 Dallas, TX 75207  
 Phone: (800) 644-7976  
 Product: INFO@TRIN.NET

**CABLE TENSION CHART**

FAHRENHEIT DEGREES	PRE-STRETCHED LB / FORCE
-10	7300
0	7000
10	6600
20	6300
30	6000
40	5600
50	5300
60	5000
70	4600
80	4300
90	4000
100	3600
110	3300
120	3000
130	2700
140	2500
150	2300

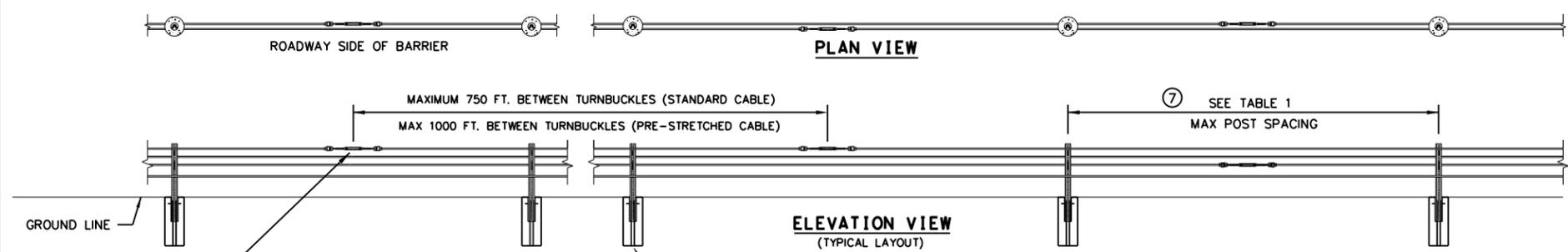
Allowable deviation from chart in tangent sections: +800, -200 pounds/force. Cable tension readings are typically higher in curved cable sections.

**TRINITY**  
**CABLE SAFETY SYSTEM**  
**(TL-3)**  
**CASS (TL3) - 14**

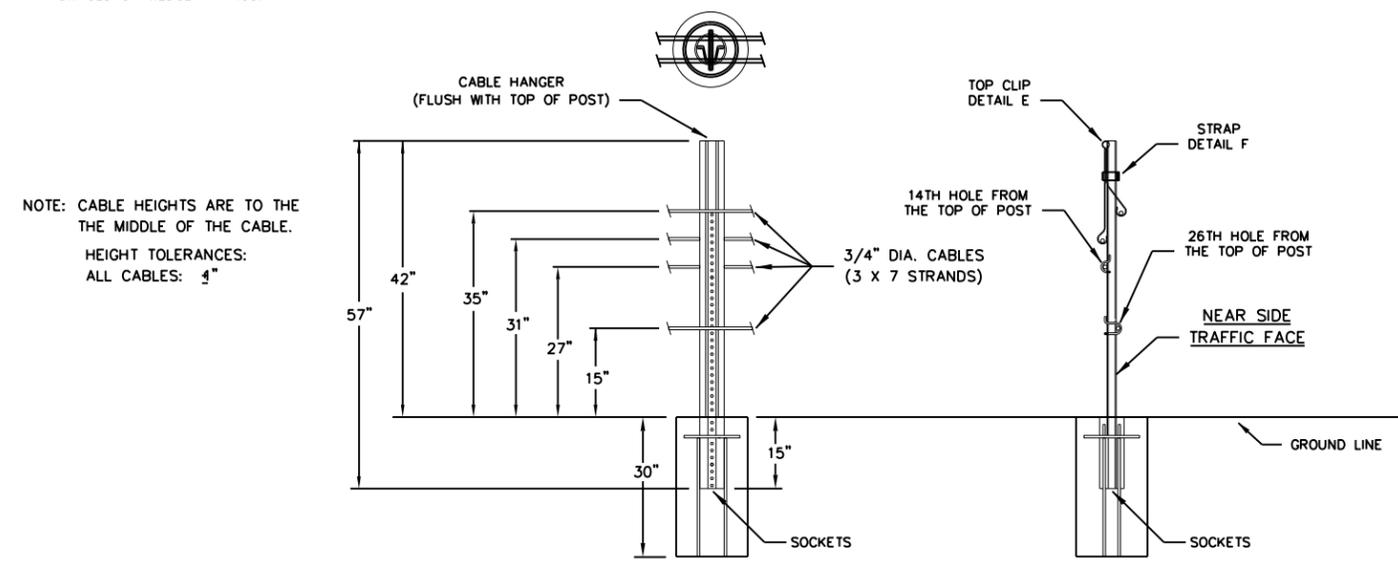
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REVISIONS:	BMT	COUNTY: LIBERTY, ETC.	SHEET NO. 94	

Design Division Standard

DATE: 5/12/2022  
 FILE: D:\NNYEMB Docs\_Extension\NHAO FOLDERS\MAINTENANCE\RMC\_IN\_PROGRESS\RMC\_6399-15-001-SH99-Liberty\2-Roadway Standards\2-BARRIER AND GUARDRAIL END  
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- GENERAL NOTES**
- FOR ADDITIONAL INFORMATION CONTACT YOUR DISTRIBUTOR OR NUCOR STEEL MARION, INC. AT (740) 383-4011.
  - FOR PAYMENT SEE SPECIAL SPECIFICATION "CABLE BARRIER SYSTEM".
  - FOR ADDITIONAL INFORMATION SEE THE MANUFACTURER'S PRODUCT MANUAL.
  - THE NU-CABLE SYSTEM IS DESIGNED FOR BI-DIRECTIONAL TRAFFIC FLOWS. SEE THE MANUFACTURER'S PRODUCT MANUAL FOR PLACEMENT ADJACENT TO GUARDRAIL END TREATMENTS.
  - THE NU-CABLE SYSTEM SHALL BE INSTALLED ON MEDIANS WITH SLOPES OF 6:1 OR FLATTER WITHOUT OBSTRUCTIONS, DEPRESSIONS, ETC; THAT MAY SIGNIFICANTLY AFFECT THE STABILITY OF AN ERRANT VEHICLE.
  - THE NU-CABLE SYSTEM MAY BE INSTALLED ON EITHER SIDE OF THE ROADWAY. Rib-Bak™ CABLE LINE POSTS MAY BE SOCKETED OR DRIVEN DESIGN.
  - THE TL-4 FOR 6:1 SLOPES CAN USE 4# / LF POST. SEE TABLE #1 FOR POST SIZE PER SPACING.
  - SEE (TABLE 2) FOR TENSION AMOUNT AT SPECIFIC CABLE TEMPERATURE FOR INITIAL INSTALLATION.
  - SEE (TABLE 3) FOR TENSION AMOUNT AT SPECIFIC CABLE TEMPERATURE FOR MAINTENANCE.
  - FOURTH (LOWEST) CABLE IS NOT OPTIONAL ON THE TL-4 SYSTEM.
  - CONSULT YOUR PROJECT PLAN SHEETS AND CABLE BARRIER SPECIFICATIONS FOR DESIRED SOCKET MATERIAL.
  - ALL FOUNDATION DESIGNS ARE BASED ON NCHRP 350 STRONG (S1) SOIL. CONSULT THE MANUFACTURER FOR SPECIFIC FOUNDATION DESIGN IF SOIL TYPES DIFFER.



⑦ **TABLE 1**

**POST SIZE TABLE**

POST SPACING	POST SIZE
0' - 17'-6"	4# / LF X 4' OR 6' POST
17'-6" - 20'	5# / LF X 4' POST

POST SPACING IS PER 8 FOOT DEFLECTION REQUIREMENTS. CONSULT PRODUCT MANUAL IF GREATER DEFLECTION IS PERMISSIBLE.

⑧ **TABLE 2**

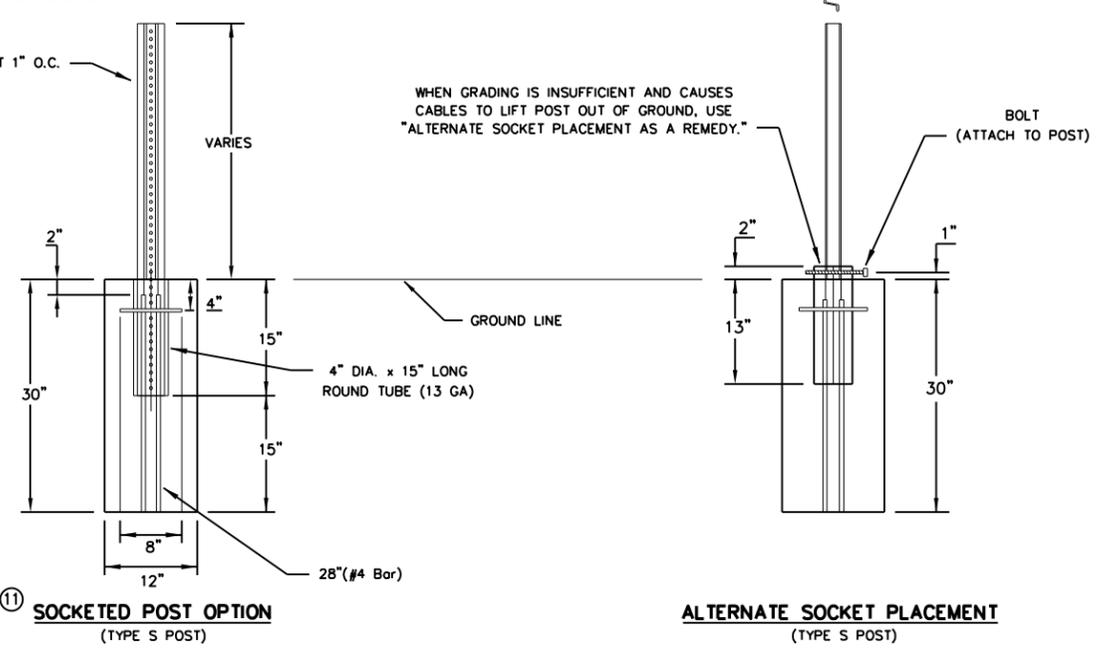
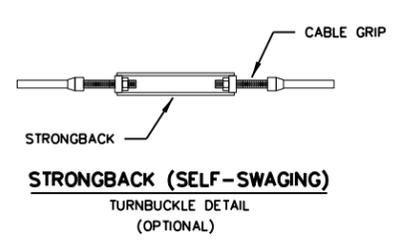
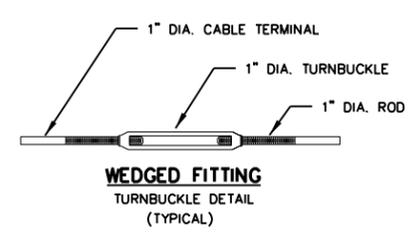
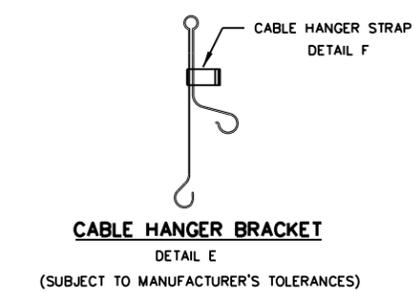
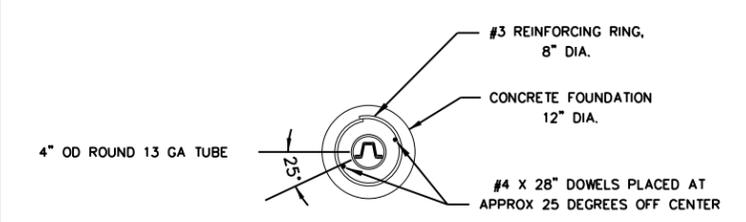
**CABLE TENSION CHART**

INITIAL INSTALL	
F	LBF
120	4624
110	4986
100	5350
90	5713
80	6077
70	6440
60	7167
50	7894
40	8619
30	9346
20	10073
10	10800
0	11525
-10	12252
-20	12979
-30	13706

⑨ **TABLE 3**

**CABLE TENSION CHART**

MAINTENANCE	
F	LBF
120	4021
110	4336
100	4652
90	4968
80	5284
70	5600
60	6232
50	6864
40	7495
30	8127
20	8759
10	9391
0	10022
-10	10654
-20	11286
-30	11918



SHEET 1 OF 2

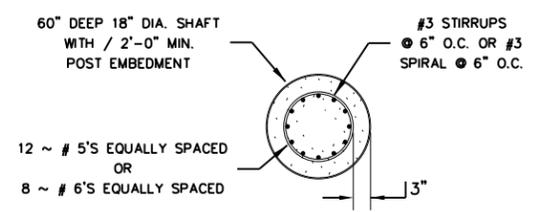
Texas Department of Transportation  
 Design Division Standard

**NU-CABLE BARRIER SYSTEM (TL-4) (4 CABLE)**

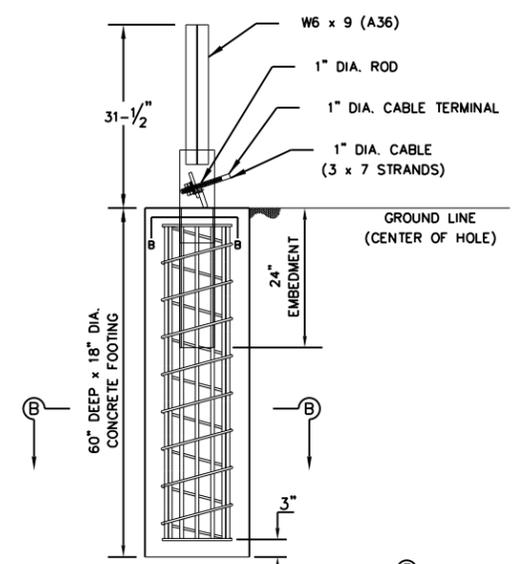
**NU-CABLE (TL4) - 14**

FILE:	DN:	CK:	DW:	CK:
© TxDOT:	CONT	SECT	JOB	HIGHWAY
REVISIONS	6399	15	001	SH99
	DIST	COUNTY	SHEET NO.	
	BMT	LIBERTY, ETC.	95	

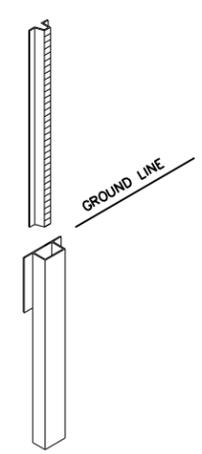
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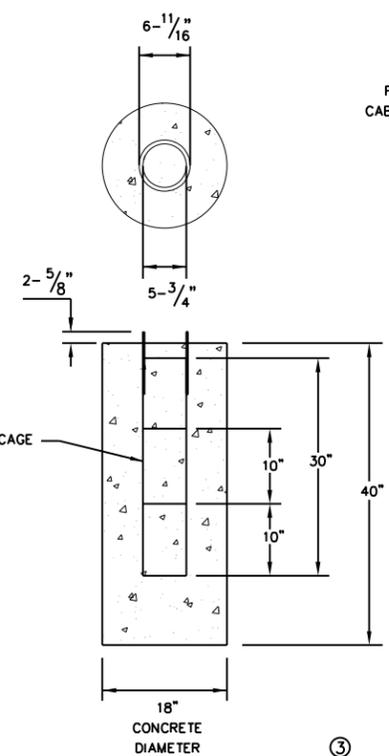
**SECTION B-B**  
(CABLE RELEASE POST)



**DETAIL A - CRP IN CONCRETE FOOTING**  
(3000 PSI MIN CONCRETE)



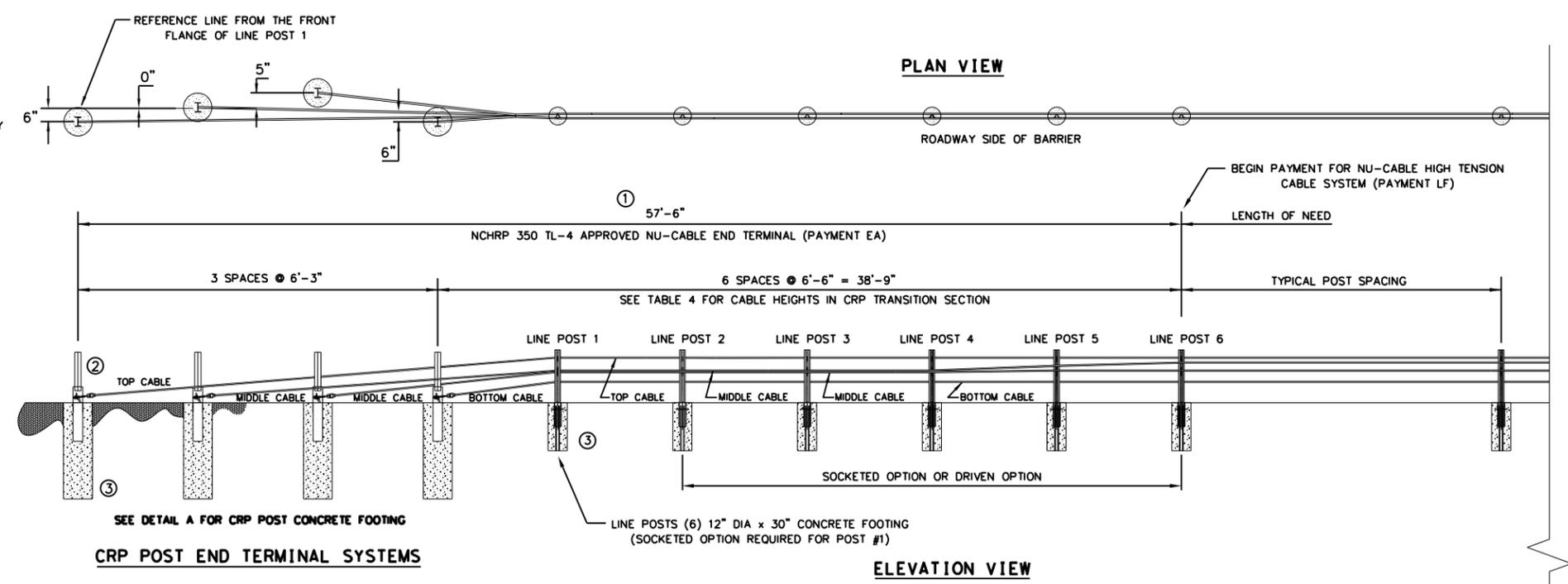
**DRIVEN SOCKET OPTION**



**NU-TEN CONCRETE FOOTING DETAIL**

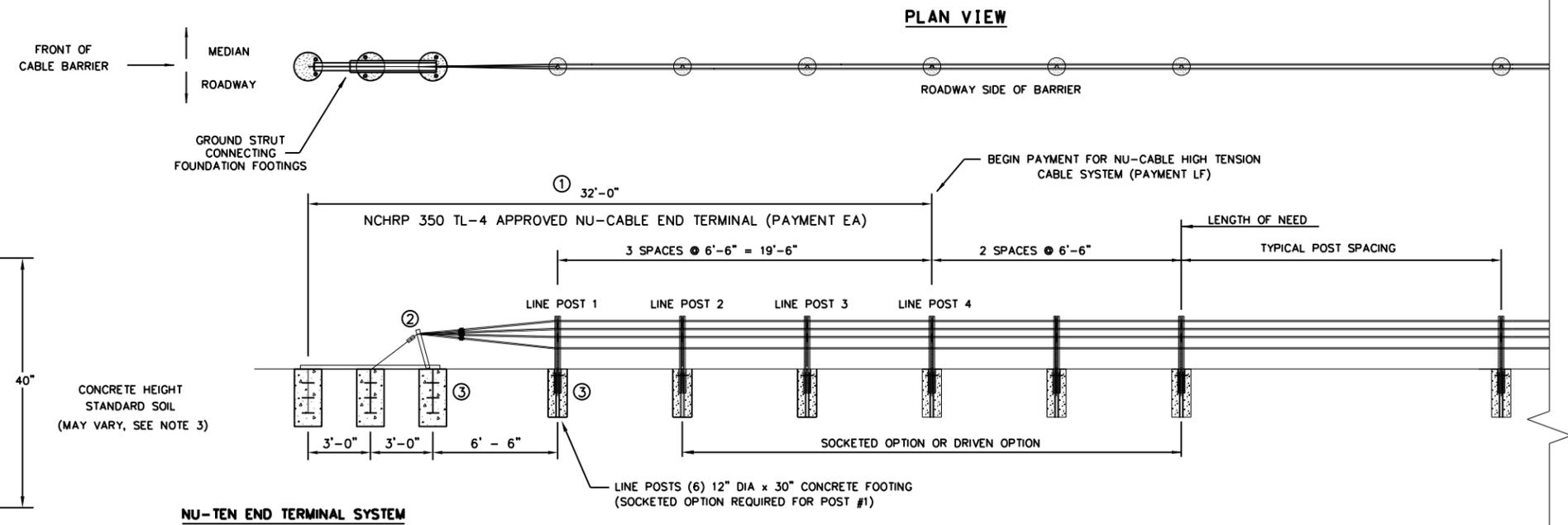
**TABLE 4**

CRP END TERMINAL CABLE HEIGHTS - TL-4						
	LP 1	LP 2	LP 3	LP 4	LP 5	LP 6
TOP CABLE	34"	34"	34"	34"	34"	34"
UPPER-MIDDLE CABLE	27"	27"	27"	27"	28"	31"
BOTTOM-MIDDLE CABLE	24"	24"	24"	24"	24"	24"
BOTTOM CABLE	15"	15"	15"	15"	15"	15"



**CRP POST END TERMINAL SYSTEMS**

① THE OPPOSING END TREATMENTS ON A PARTICULAR RUN ARE MIRRORED IN THEIR LAYOUT.



**NU-TEN END TERMINAL SYSTEM**

**NOTES**

1. THE OPPOSING END TREATMENTS ON A PARTICULAR RUN ARE MIRRORED IN THEIR LAYOUT. SYSTEM PAYMENT IS PER EACH (EA). REFER TO PROJECT SPECIFICATIONS FOR ADDITIONAL PAYMENT INFORMATION
2. REFER TO INSTALLATION MANUAL FOR CABLE END ASSEMBLY DETAIL.
3. ALL FOUNDATION DESIGNS ARE BASED ON NCHRP 350 STRONG (S1) SOIL. CONSULT THE MANUFACTURER FOR SPECIFIC FOUNDATION DESIGNS IF SOIL TYPES DIFFER.
4. SEE TABLE 4 CABLE HEIGHTS IN CRP TRANSITION SECTION.

SHEET 2 OF 2

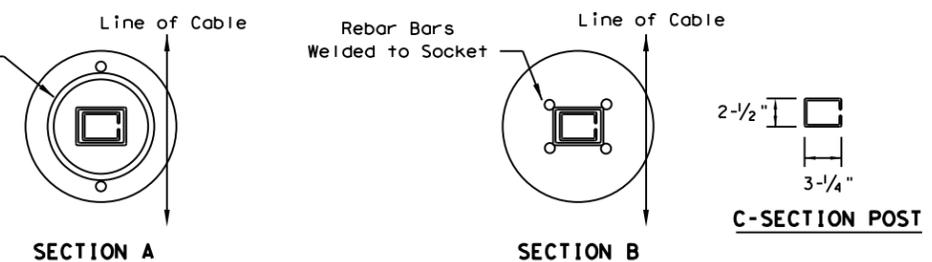
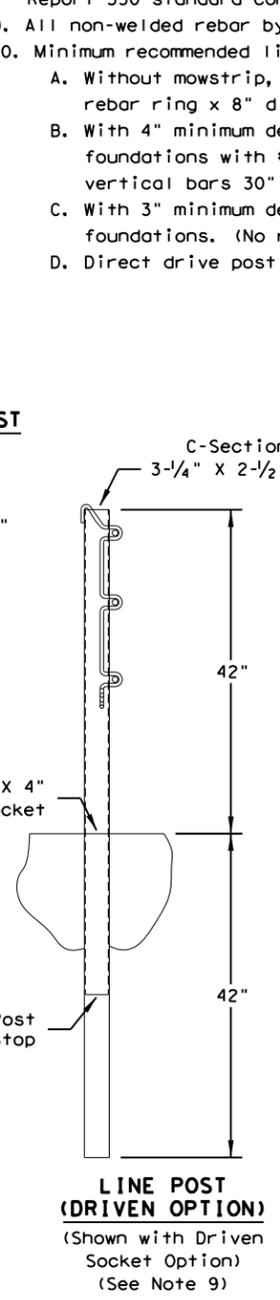
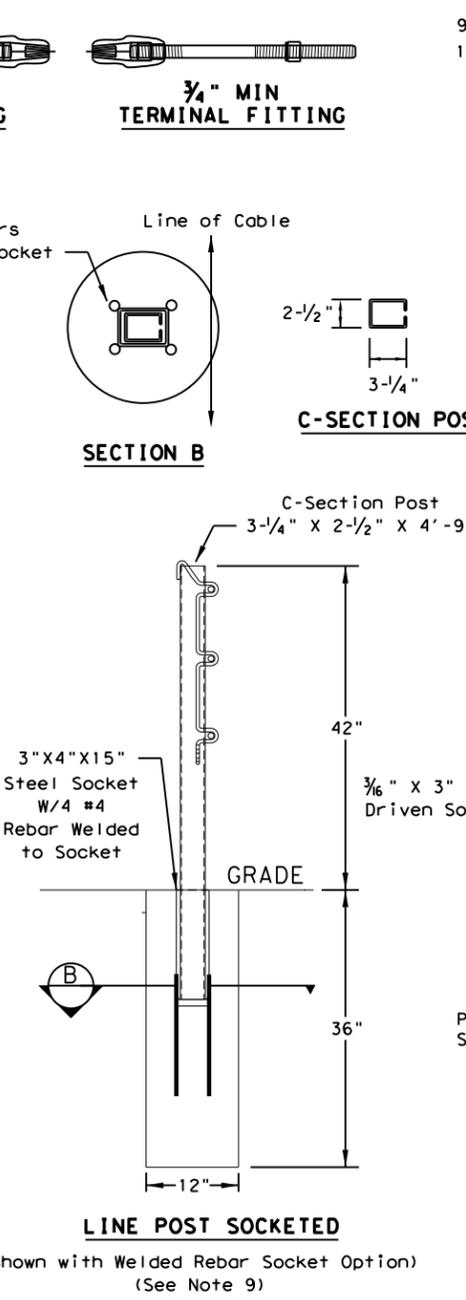
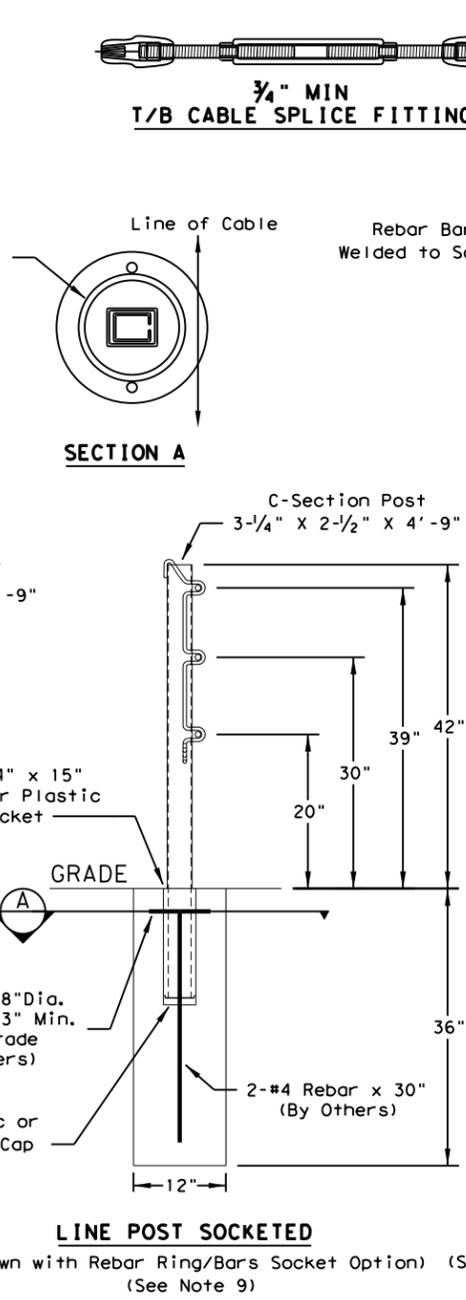
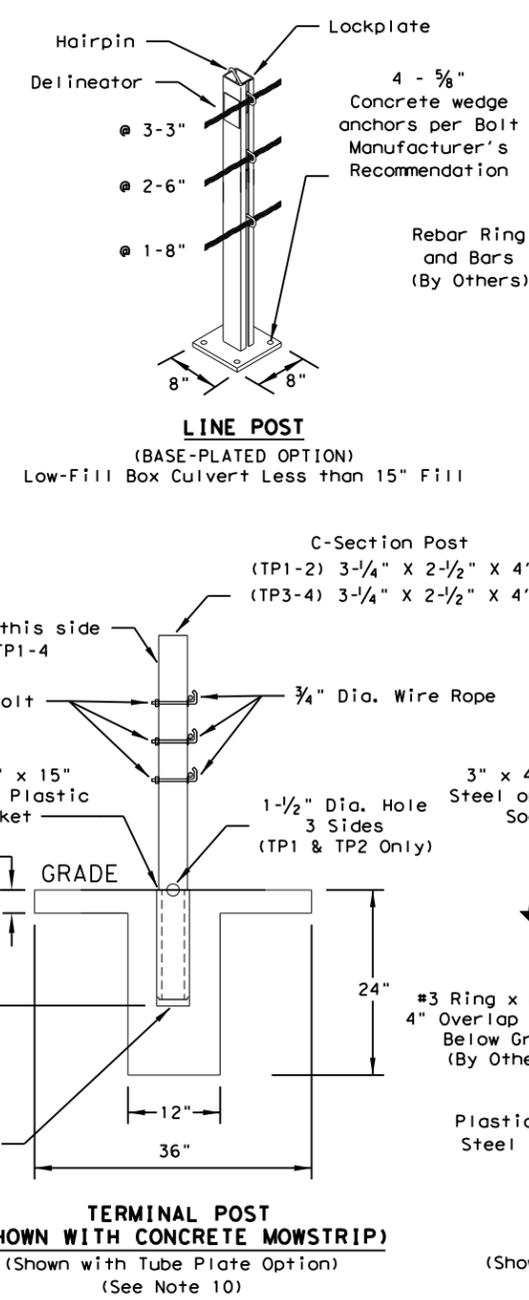
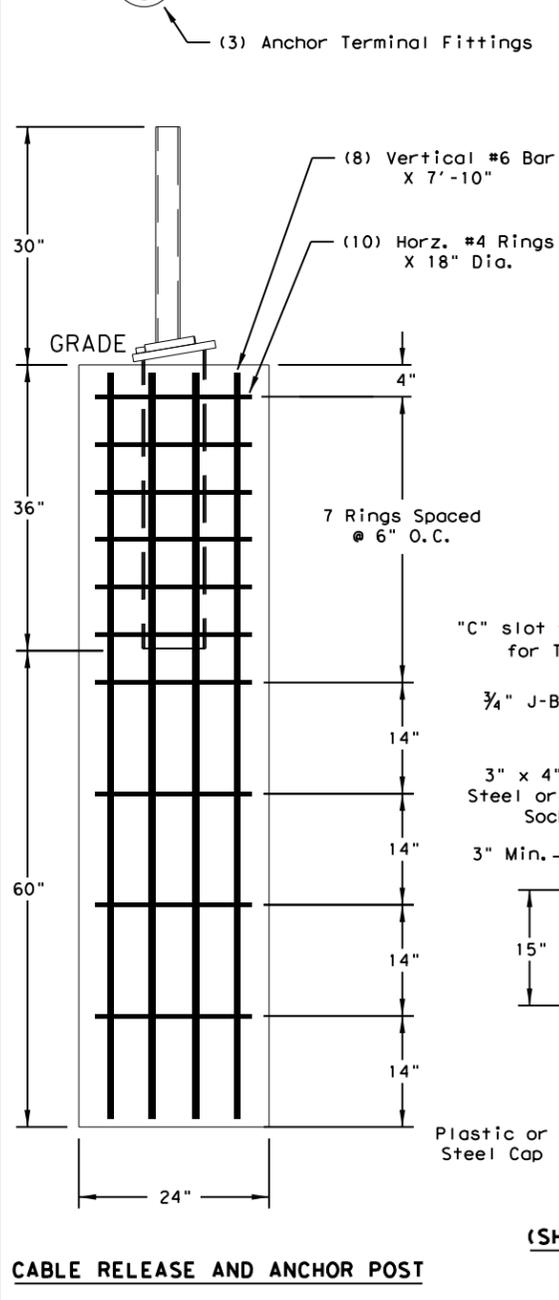
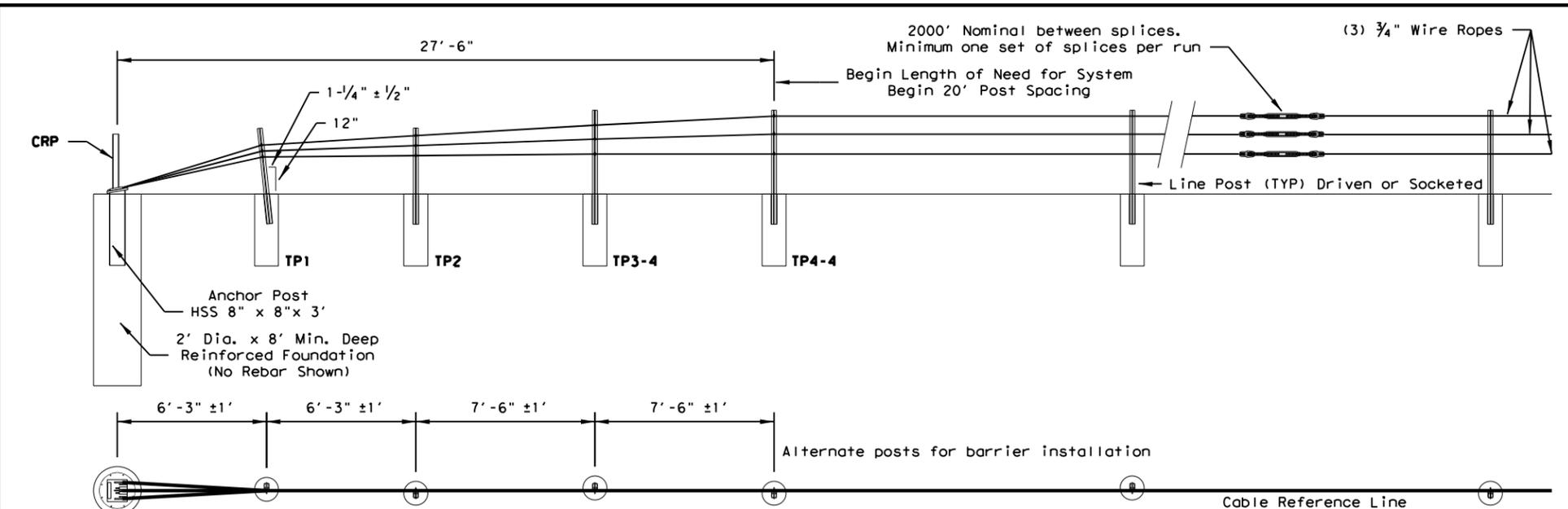
Design Division Standard

**NU-CABLE BARRIER SYSTEM (TL-4)**  
**(4 CABLE)**  
**NU-CABLE (TL4) - 14**

FILE:	DN:	CK:	DW:	CK:
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- ### GENERAL NOTES
- For additional information contact Gibraltar, Inc. at 1-800-495-8957, 830-798-5444, or see the manufacturer's product manual.
  - All concrete shall be CLASS A.
  - The Cable Barrier System shall be installed on shoulders or on medians with slopes of 6:1 or flatter. If installed on slopes steeper than 6:1 up to 4:1 the TL-4 system performs as a TL-3 and Gibraltar must be contacted for various guidelines related to placement.
  - The Cable Barrier System is accepted by the FHWA Test Level - 4.
  - See the Texas MUTCD for proper "Barrier" delineation.
  - Rock Clause: Where solid rock is encountered:
    - For socketed post, continue digging 12" diameter, 15" deep into rock or the required plan depth, whichever comes first.
    - For driven post, core drill a 4" diameter hole 18" deep into rock or the required plan depth, whichever comes first.
    - For Anchor post, continue digging 24" diameter, 30" deep into rock or the required plan depth, whichever comes first.
  - Tolerances:
    - \* LP = 3" out of plumb, at top
    - \* Cable height = 1"
    - \* Anchor Post = 5" off of Cable Reference Line
  - The Gibraltar cable barrier system shall be installed in NCHRP Report 350 standard compacted soil. Soil must be well drained.
  - All non-welded rebar by others.
  - Minimum recommended line post foundation.
    - Without mowstrip, 36" Deep x 12" diameter foundations with #3 rebar ring x 8" diameter with two #4 rebar vertical bars 30" long
    - With 4" minimum depth hot mix asphalt, 30" deep x 12" diameter foundations with #3 rebar ring x 8" diameter with two #4 rebar vertical bars 30" long.
    - With 3" minimum depth concrete mowstrip, 24" deep x 12" diameter foundations. (No rebar required)
    - Direct drive post 42" deep.

Temperature (°F)	Tension
-10 °F	8000
0 °F	7600
10 °F	7200
20 °F	6800
30 °F	6400
40 °F	6000
50 °F	5600
60 °F	5200
70 °F	4800
80 °F	4400
90 °F	4000
100 °F	3600
110 °F	3200

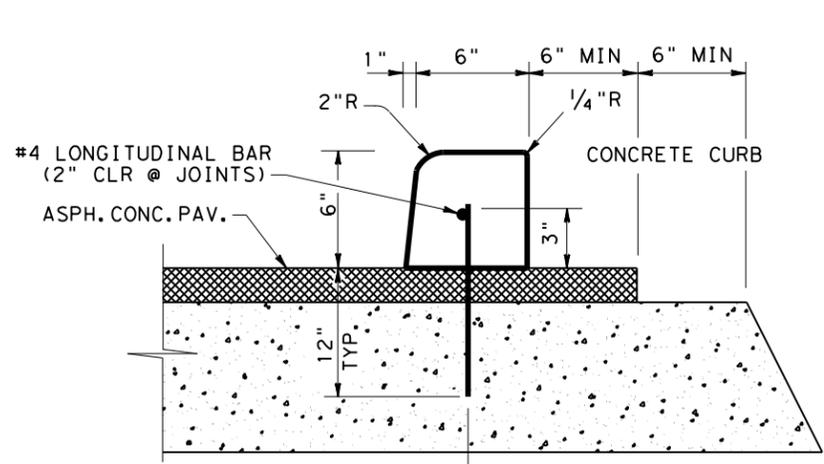
Deflection	Post Spacing
8'-0"	20 FT
7'-0"	12 FT
6'-8"	10 FT

\* Allowable Deviation from Chart +/- 10%

**GIBRALTAR CABLE BARRIER SYSTEM (TL-4)**
  
**GBRL TR (TL4) - 14**

FILE: gbrl tr t1414.dgn	DN: TxDOT	CK: RM	DW: VP	CK:
© TxDOT: March 2014	CONT: 6399	SECT: 15	JOB: 001	HIGHWAY: SH99
REVISIONS:	DIST: BMT	COUNTY: LIBERTY, ETC.	SHEET NO. 97	

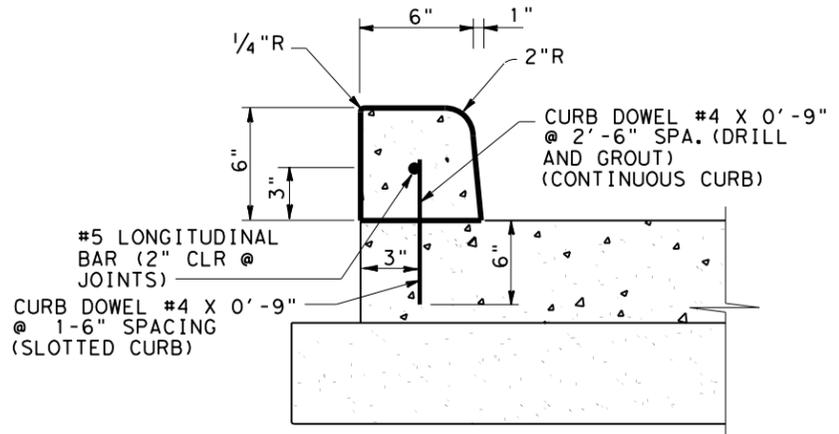
Design Division Standard



CONTINUOUS CURB; DOWEL #5 X 1'-3"  
@ 2'-6" SPA. (DRILL & GROUT)  
SLOTTED CURB; DOWEL #5 X 1'-3"  
@ 1'-6" SPA. (DRILL & GROUT)

**SHOWN ON EXISTING OR PROPOSED ACP PAVEMENT**  
(PAY ITEM 529-6011) - FOR CONTINUOUS

**CONCRETE CURB (DOWEL) (6 IN.)**

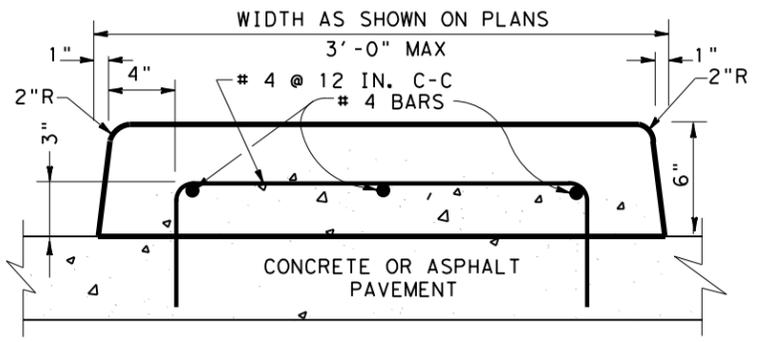


**SHOWN ON EXISTING OR PROPOSED CONCRETE PAVEMENT**  
(PAY ITEM 529-6011) - FOR CONTINUOUS

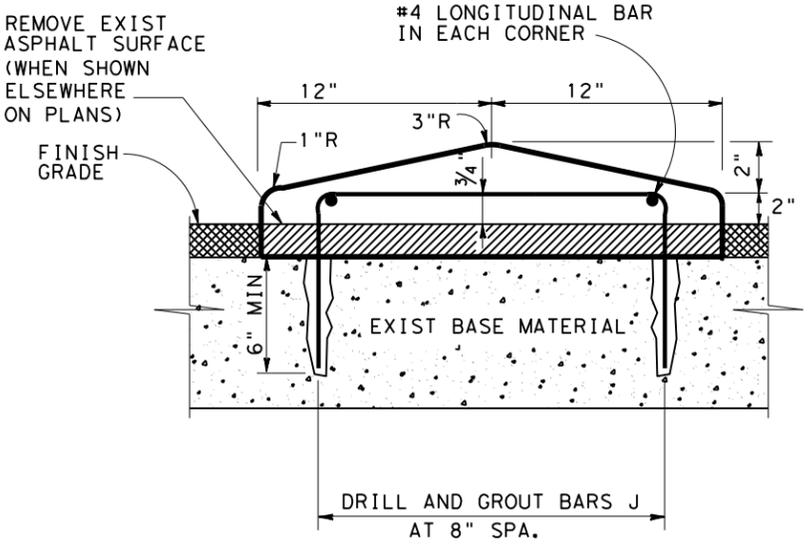


**BAR K**  
#4

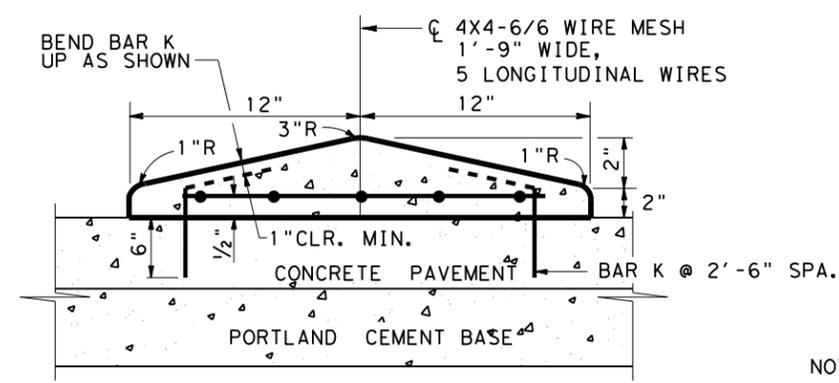
**BAR J**  
#4



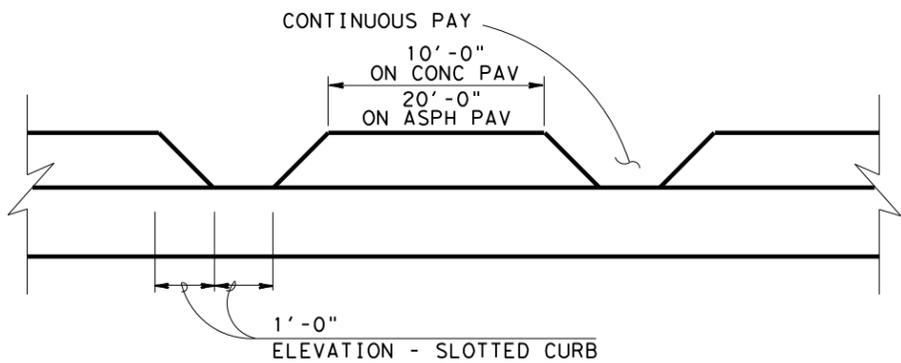
ITEM 536-6001 CONCRETE MEDIAN  
SEE NOTE 2



**SHOWN ON EXISTING ACP PAVEMENT**  
SEE NOTE 2 - ITEM 536-6003 CONC DIRECTIONAL ISLAND



**SHOWN ON EXISTING OR PROPOSED CONCRETE PAVEMENT**  
SEE NOTE 2 - ITEM 536-6003 CONC DIRECTIONAL ISLAND



ITEM 529-6012 CONCRETE CURB (SLOTTED) - ON CONC.  
ITEM 529-6009 CONC CURB (DOWEL) (SLOTTED) - ON ASPH.

- NOTES:
1. DRILL AND GROUT BARS SHOWN AS PER ITEM 420.4.7.10, 6" EMBEDMENT, MINIMUM ON CONC.
  2. INSTALL A 2 INCH DRAINAGE OPENING AT 10 FT C-C WHEN CURB/ISLAND IS NOT ON TOP OF CROSS SECTION. (LOCATED ON A 2 OR 3 PERCENT TRANSVERSE GRADE, OR SUPERELEVATION.)

**CONCRETE DIRECTIONAL ISLAND**

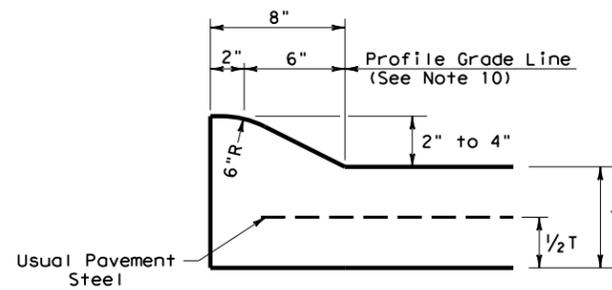
**Texas Department of Transportation**  
Houston District

**CONCRETE CURB AND DIRECTIONAL ISLAND DETAILS**  
CC & DID

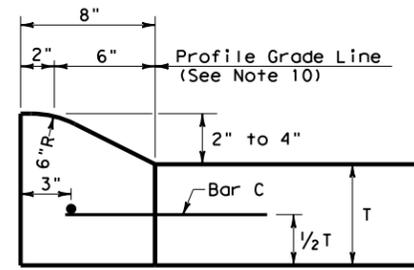
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	BMT	6399	15	001
				HIGHWAY
				SH99

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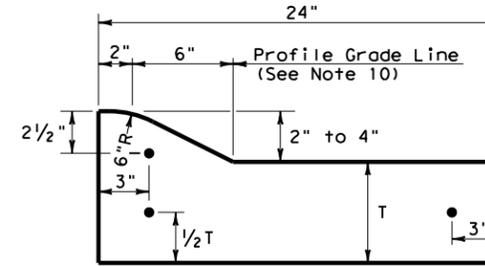
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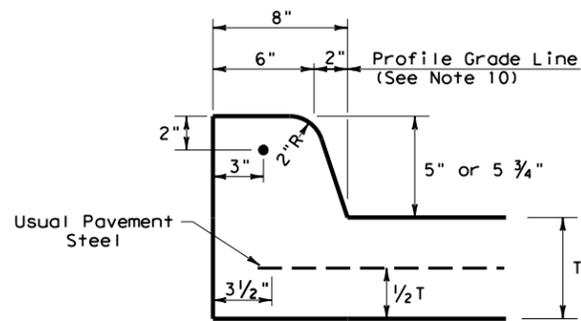
**TYPE I CURB (MONOLITHIC)**  
2" - 4" HEIGHT



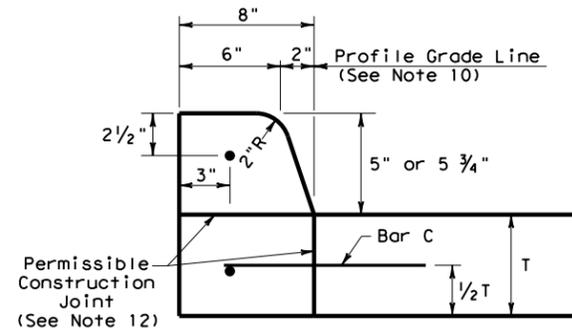
**TYPE I CURB**  
2" - 4" HEIGHT



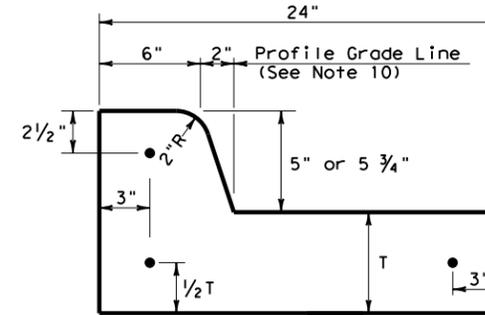
**TYPE I CURB AND GUTTER**  
2" - 4" HEIGHT



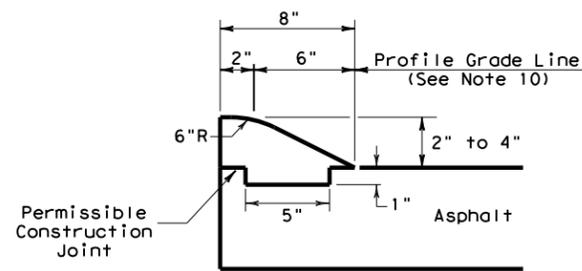
**TYPE II CURB (MONOLITHIC)**  
5" - 5 3/4" HEIGHT



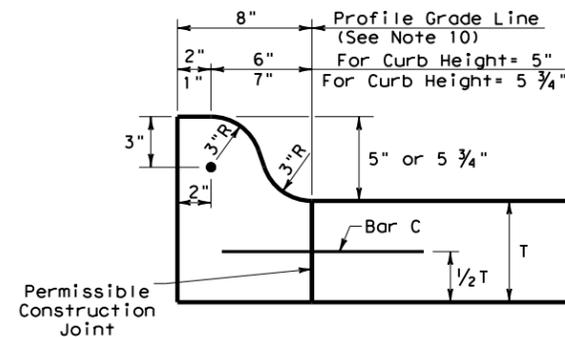
**TYPE II CURB**  
5" - 5 3/4" HEIGHT



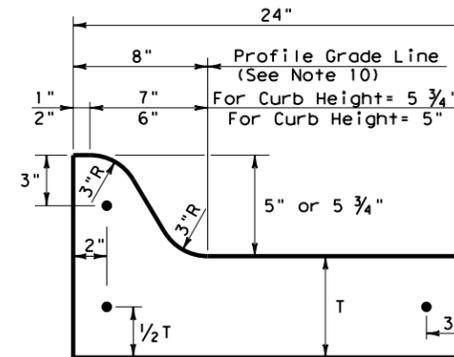
**TYPE II CURB AND GUTTER**  
5" - 5 3/4" HEIGHT



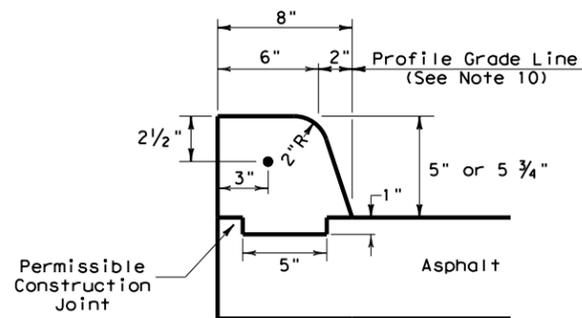
**TYPE III CURB (KEYED)**  
2" - 4" HEIGHT



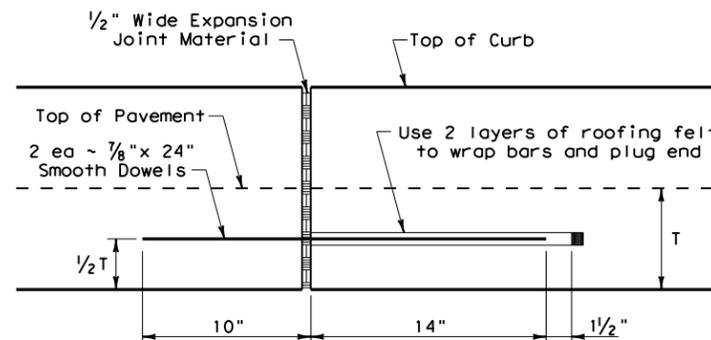
**TYPE IIa CURB**  
5" - 5 3/4" HEIGHT



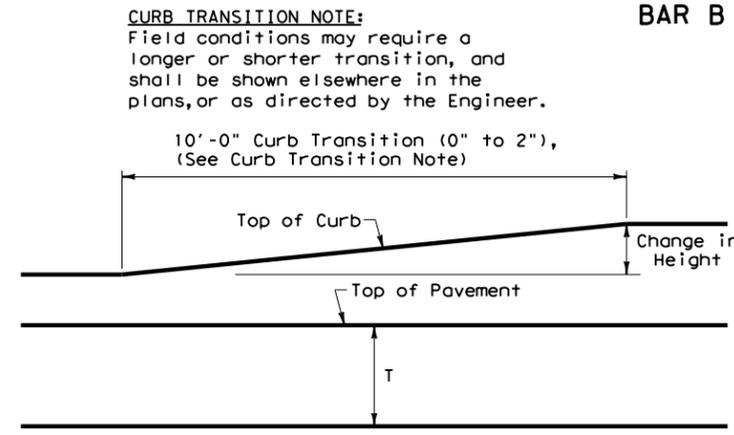
**TYPE IIa CURB AND GUTTER**  
5" - 5 3/4" HEIGHT



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



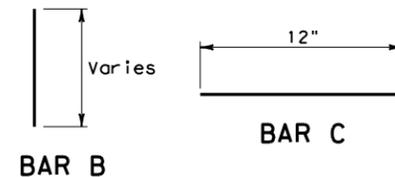
**EXPANSION JOINT DETAIL**



**CURB TRANSITION**  
Note: To be paid for as Highest Curb

**GENERAL NOTES**

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



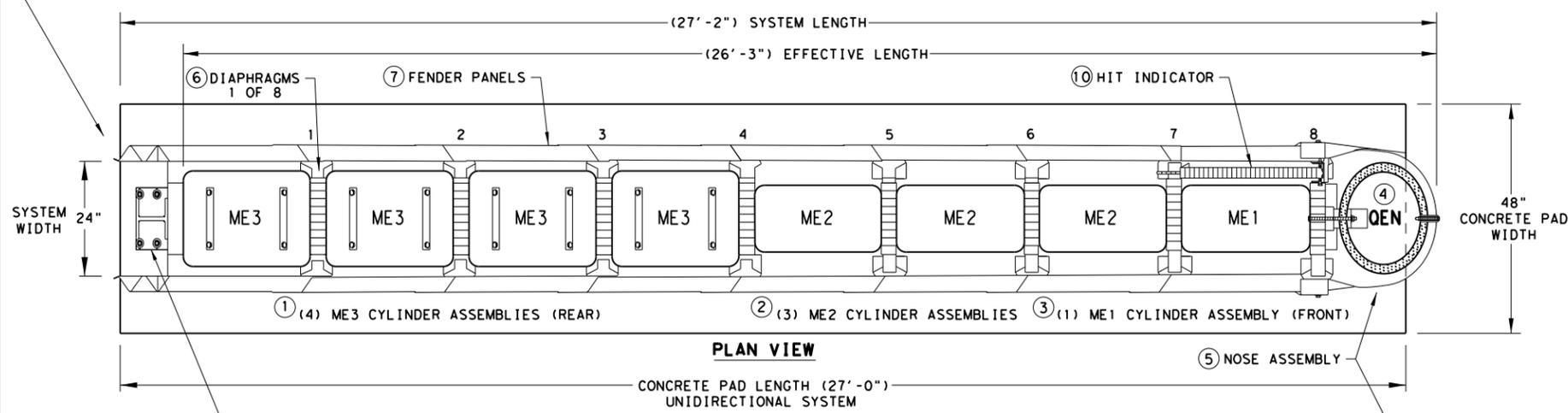
**CURB TRANSITION NOTE:**  
Field conditions may require a longer or shorter transition, and shall be shown elsewhere in the plans, or as directed by the Engineer.

		<b>Design Division Standard</b>	
<h2>CONCRETE CURB AND GUTTER</h2>			
<h3>CCCG-21</h3>			
FILE: cccg21.dgn	DN: TxDOT	CK: AN	DW: SS
© TxDOT: FEBRUARY 2021	CONT: 6399 15	SECT: 001	HIGHWAY: SH99
REVISIONS:	BMT	COUNTY: LIBERTY, ETC.	SHEET NO.: 99

DATE: 6/29/2022  
 FILE: D:\NRYEMB Docs\Extension\NHAO FOLDERS\MAINTENANCE\RMC IN PROGRESS\RMC\_6399-15-001-SH99-Liberty-2-Roadway Standards\2-Roadway Standards\2-BARRIER AND GUARDRAIL END

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

**QUADGUARD ELITE M10 24" WIDE (8 BAY) SYSTEM**



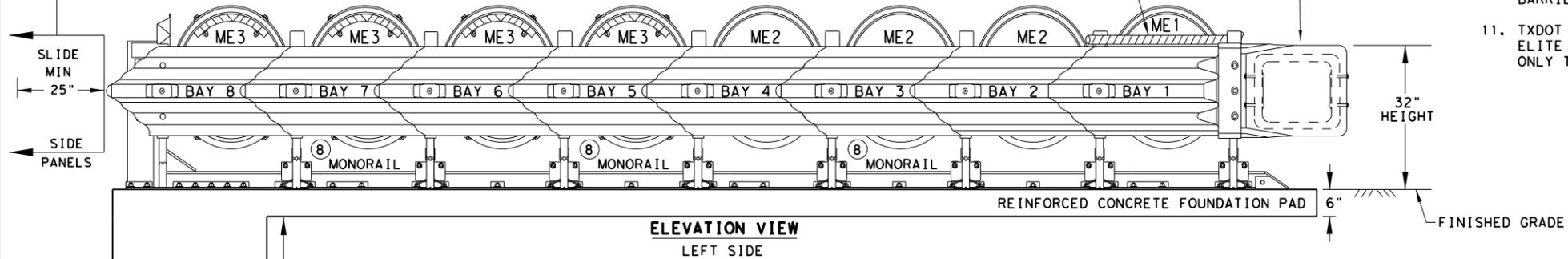
KEY	KEY
① ME3 CYLINDER ASSEMBLIES	⑥ DIAPHRAGMS
② ME2 CYLINDER ASSEMBLIES	⑦ FENDER PANELS
③ ME1 CYLINDER ASSEMBLY	⑧ MONORAILS
④ QEN CYLINDER	⑨ TYPE OF BACKUP
⑤ NOSE BELT ASSEMBLY	⑩ HIT INDICATOR

⑨ SHOWN WITH TENSION STRUT BACKUP ASSEMBLY

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

NOTE: HIT INDICATOR WILL RAISE UPON IMPACT.

④ QEN CYLINDER INSTALLED INSIDE OF NOSE BELT ASSEMBLY ⑤



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

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

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

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

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

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

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

**BACKUP ASSEMBLY TYPES FOR SYSTEM TRANSITIONS**

SEE GENERAL NOTE 10 FOR CLEARANCE LIMITATIONS

⑨ TENSION STRUT BACKUP

⑨ CONCRETE BACKUP

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

NOTE:  
TRANSITION ASSEMBLIES FOR THE QUADGUARD ELITE M10 TO THRIE-BEAM OR W-BEAM FENCE REQUIRES I-BEAM POSTS:  
ALL POSTS W6X8.5/9 I-BEAMS (78" LONG).

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

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

**GENERAL NOTES**

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

FOUNDATION & ANCHORING REQUIREMENTS	
FOUNDATION TYPES: A, B, C, & D	
FOUNDATION TYPE: A	REINFORCED CONCRETE PAD OR ROADWAY
FOUNDATION:	6" MINIMUM DEPTH (P.C.C.)
ANCHORAGE:	7" STUDS EMBEDDED 5 1/2" - APPROVED ADHESIVE
FOUNDATION TYPE: B	ASPHALT OVER P.C.C.
FOUNDATION:	3" MIN. (A.C.) OVER 3" MIN. (P.C.C.)
ANCHORAGE:	18" THREADED ROD EMBEDDED 16 1/2" - APPROVED ADHESIVE
FOUNDATION TYPE: C	ASPHALT OVER SUBBASE
FOUNDATION:	6" MIN. (A.C.) OVER 6" MIN. (C.S.)
ANCHORAGE:	18" THREADED ROD EMBEDDED 16 1/2" - APPROVED ADHESIVE
FOUNDATION TYPE: D	ASPHALT ONLY
FOUNDATION:	8" MIN. (A.C.)
ANCHORAGE:	18" THREADED ROD EMBEDDED 16 1/2" - APPROVED ADHESIVE

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

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

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

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

Design Division Standard

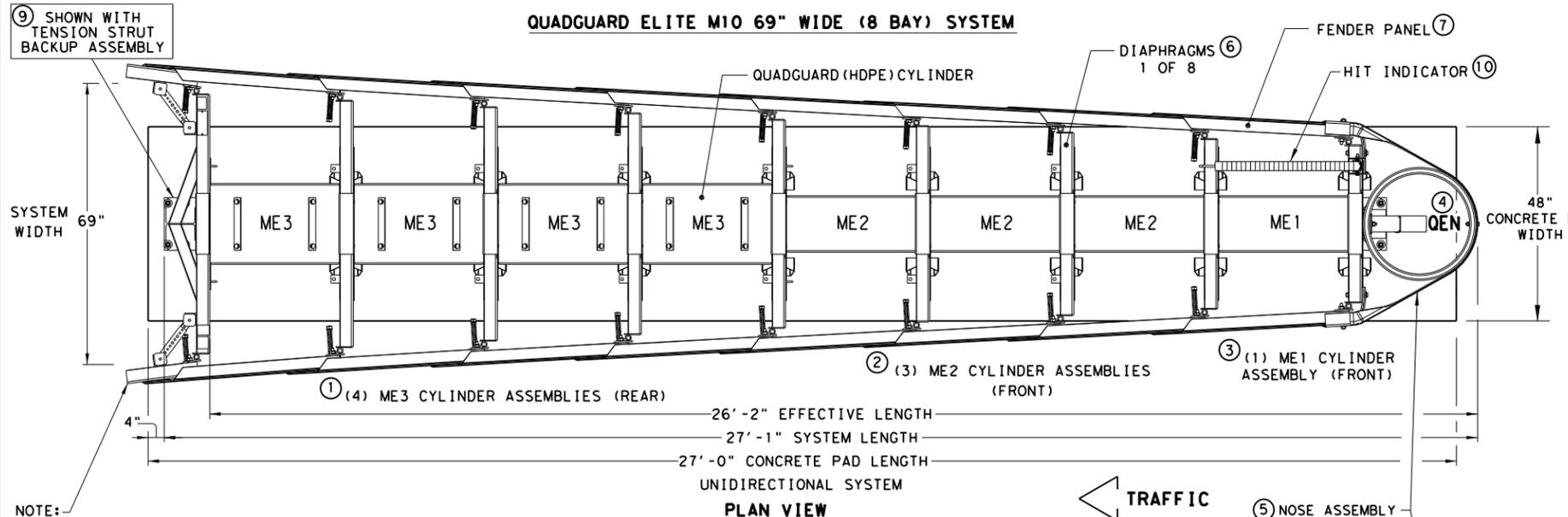
**TRINITY HIGHWAY  
ENERGY ABSORPTION  
QUADGUARD ELITE M10  
(MASH TL-3)  
QGUARD ELITE (M10) (N) -20**

FILE: qgel1+em10n20.dgn	DN: TXDOT	CK: KM	DW: VP	CK: AG
© TXDOT: NOVEMBER 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	6399 15	001	SH99	
	DIST	COUNTY	SHEET NO.	
	BMT	LIBERTY, ETC.	100	

**LOW MAINTENANCE**

DATE: 5/12/2022  
 FILE: D:\N\YEMB Docs\Extension\N\HAO FOLDERS\MAINTENANCE\N\MC\N\MC\_6399-15-001-SH99-Liberty2-Roadway Standards\2-BARRIER AND GUARDRAIL END  
 DISCLAIMER: THIS STANDARD IS COVERED 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.

**QUADGUARD ELITE M10 69" WIDE (8 BAY) SYSTEM**

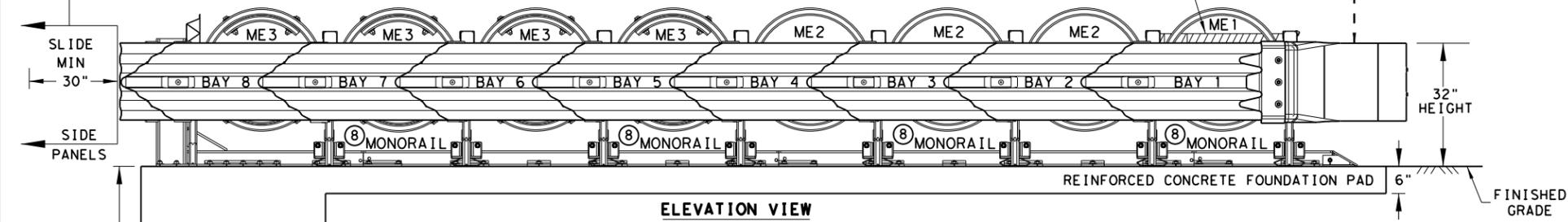


NOTE:  
A TRANSITION MAY BE REQUIRED TO INSTALL THE QUADGUARD ELITE M10 TO THE OBJECT BEING SHIELDED.

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

NOTE:  
HIT INDICATOR WILL RAISE UPON IMPACT.

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



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

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

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

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

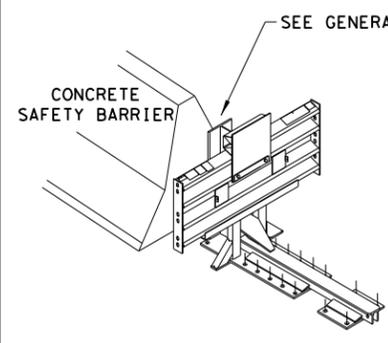
CONCRETE PAD AND ANCHOR BLOCK COMBINATIONS SHALL BE CONFIRMED WITH THE MANUFACTURER BASED UPON SITE SPECIFIC DATA (SSD).

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

TL-3 MODEL #	QM10069E	CYLINDER TYPES IN BAYS			
BAYS	8	TYPE-ME3	TYPE-ME2	TYPE-ME1	TYPE-QEN
DIAPHRAGMS	8	4	3	1	1
WIDTH	69"	REAR	FRONT	NOSE	

**ELEVATION VIEW LEFT SIDE**

**BACKUP ASSEMBLY TYPES FOR SYSTEM TRANSITIONS**



**⑨ TENSION STRUT BACKUP**

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

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

NOTE:  
TRANSITION ASSEMBLIES FOR THE QUADGUARD ELITE M10 TO THRIE-BEAM OR W-BEAM FENCE REQUIRES I-BEAM POSTS:  
ALL POSTS W6X8.5/9 I-BEAMS (78" LONG).

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

**GENERAL NOTES**

- FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: TRINITY HIGHWAY - ENERGY ABSORPTION INC. AT 1(888)323-6374.
- SEE THE RECENT QUADGUARD ELITE M10 WIDE PRODUCT DESCRIPTION ASSEMBLY MANUAL FOR IMPACT PERFORMANCE CHARACTERISTICS AND DESIGN LIMITATIONS AND THE DRAWING PACKAGE FOR THE WIDE 69" SYSTEM BEFORE INSTALLING THE QUADGUARD ELITE M10 AT ANY GIVEN LOCATION.
- FOR BI-DIRECTIONAL TRAFFIC: THE LOCATION AND OR WIDTH OF THE QUADGUARD ELITE M10 WIDE 69" IS RESTRICTED. AS BI-DIRECTIONAL TRAFFIC APPROACHES THE REAR OF THE QUADGUARD ELITE M10 WIDE 69", THE QUADGUARD ELITE M10 SHOULD NOT EXTEND FURTHER INTO THE TRAFFIC-SIDE OF THE BARRIER THAN THE OBSTACLE. ANY TRANSITION INSTALLED MUST EITHER BE TANGENT TO BOTH QUADGUARD ELITE M10 AND OBSTACLE OR MUST ANGLE TOWARD FIELD SIDE OF THE BARRIER.
- SYSTEM TRANSITION: APPROPRIATE TRANSITION PANELS OR SIDE PANELS WILL BE REQUIRED FOR PROPER IMPACT PERFORMANCE. THE CORRECT PANEL(S) TO USE WILL DEPEND ON THE DIRECTION OF TRAFFIC FLOW AND WHAT TYPE OF BARRIER OR ROAD FEATURE THE QUADGUARD ELITE M10 SYSTEM IS SHIELDING. SEE THE QUADGUARD ELITE M10 WIDE [69"] PRODUCT DESCRIPTION & ASSEMBLY MANUAL FOR FURTHER DETAILS.
- COMPONENTS FOR THE QUADGUARD ELITE (M10) BACKUP AND REINFORCING DETAILS ARE SHOWN ON THE QUADGUARD ELITE M10 WIDE PRODUCT DESCRIPTION & ASSEMBLY MANUAL.
- CONCRETE PAD SHALL BE 6" MIN. REINFORCED 28MPa [4,000 PSI] (P.C.) OR 8" MIN. NON-REINFORCED 28MPa [4,000 PSI] CONCRETE ROADWAY MEASURING AT LEAST 12'-0" WIDE BY 50'-0" LONG. ANCHOR BLOCK IS NOT REQUIRED WHEN USING 8" CONCRETE PAD INSTALLED AGAINST AN IMMOVABLE STRUCTURE, E.G. CONCRETE WALL.
- IF THE CROSS-SLOPE VARIES MORE THAN 2% OVER THE LENGTH OF THE SYSTEM, THE CONCRETE PAD WILL REQUIRE LEVELING. MAXIMUM PERMISSIBLE CROSS-SLOPE IS 8%.
- THE INSTALLATION AREA SHOULD BE FREE OF CURBS, ELEVATED OBJECTS, OR DEPRESSIONS.
- THE QUADGUARD ELITE M10 SYSTEM SHOULD BE INSTALLED APPROXIMATELY PARALLEL WITH THE BARRIER.
- FOR THE TENSION STRUT BACKUP, THE DISTANCE BETWEEN THE BACK OF BACKUP AND THE BARRIER WALL SHOULD NOT EXCEED 7" IN ANY CASE.
- THE WIDE QUADGUARD ELITE M10 SYSTEM IS ONLY AVAILABLE IN A 69" WIDTH.

**FOUNDATION & ANCHORING REQUIREMENTS FOUNDATION TYPES: A, B, C, & D**

FOUNDATION TYPE:A	REINFORCED CONCRETE PAD OR ROADWAY
FOUNDATION:	6" MINIMUM DEPTH (P.C.C.)
ANCHORAGE:	7" STUDS EMBEDDED 5 1/2" - APPROVED ADHESIVE
FOUNDATION TYPE:B	ASPHALT OVER P.C.C.
FOUNDATION:	3" MIN. (A.C.) OVER 3" MIN. (P.C.C.)
ANCHORAGE:	18" THREADED ROD EMBEDDED 16 1/2" - APPROVED ADHESIVE
FOUNDATION TYPE:C	ASPHALT OVER SUBBASE
FOUNDATION:	6" MIN. (A.C.) OVER 6" MIN. (C.S.)
ANCHORAGE:	18" THREADED ROD EMBEDDED 16 1/2" - APPROVED ADHESIVE
FOUNDATION TYPE:D	ASPHALT ONLY
FOUNDATION:	8" MIN. (A.C.)
ANCHORAGE:	18" THREADED ROD EMBEDDED 16 1/2" - APPROVED ADHESIVE

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

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

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

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

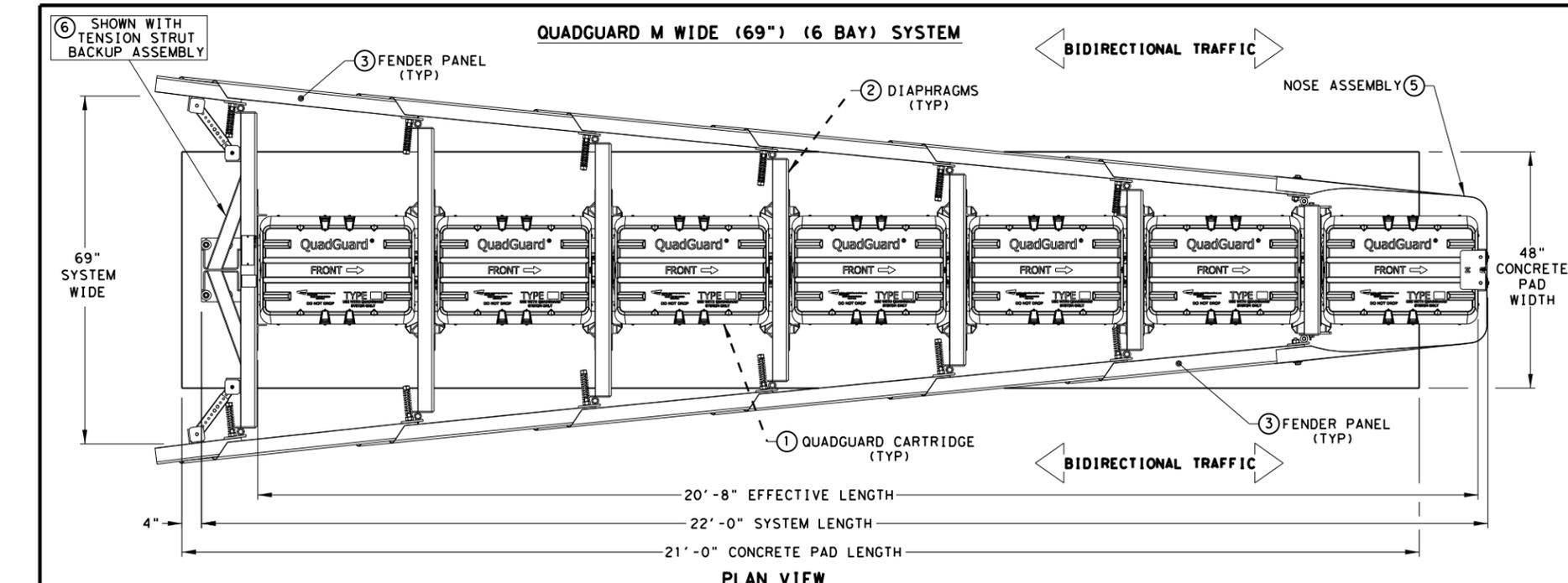
Design Division Standard

TRINITY HIGHWAY  
 ENERGY ABSORPTION  
 QUADGUARD ELITE M10 WIDE  
 (MASH TL-3)  
 QGELITE (M10) (W) -20

FILE: qgel1tem10w20.dgn	DN:TxDOT	CK:KM	DW:SS	CK:AG
©TxDOT: NOVEMBER 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	6399 15	001	SH99	
	DIST	COUNTY	SHEET NO.	
	BMT	LIBERTY, ETC.	101	

**LOW MAINTENANCE**

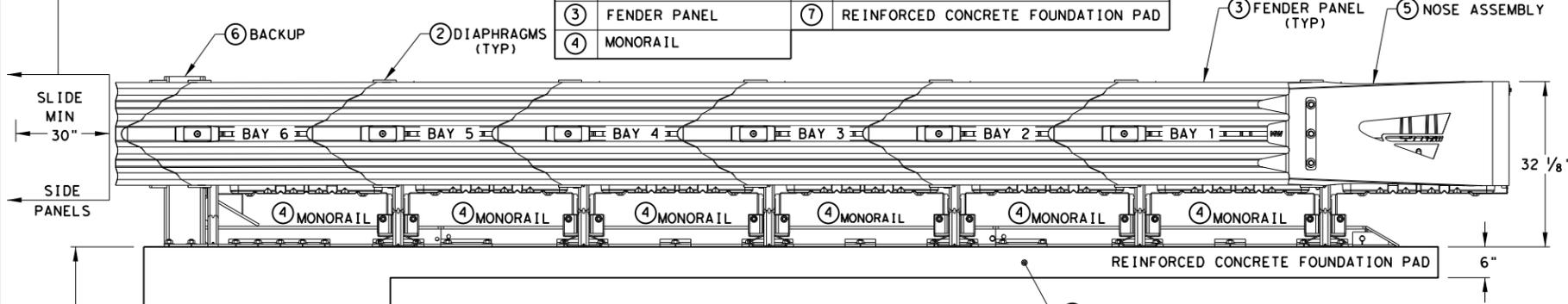
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PLAN VIEW

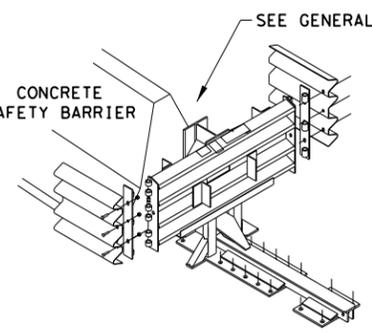
KEY	DESCRIPTION	KEY	DESCRIPTION
①	QUADGUARD CARTRIDGE	⑤	NOSE ASSEMBLY
②	DIAPHRAGM	⑥	TYPE OF BACKUP
③	FENDER PANEL	⑦	REINFORCED CONCRETE FOUNDATION PAD
④	MONORAIL		

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



ELEVATION VIEW  
LEFT SIDE

**BACKUP ASSEMBLY TYPES FOR SYSTEM TRANSITIONS**



⑥ TENSION STRUT BACKUP

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

NOTE: TRANSITION ASSEMBLIES FOR THE QUADGUARD M WIDE TO THRIE-BEAM OR W-BEAM FENCE REQUIRES I-BEAM POSTS: ALL POSTS W6X8.5/9 I-BEAMS (78" LONG).

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

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

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

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

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

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

NOTE: THE QUADGUARD M WIDE 6-BAY SYSTEM TESTED TO MASH TL-3.

TL-3 MODEL #	QM10069 (627515)	CARTRIDGE TYPES IN BAYS	
BAYS	6	TYPE I	TYPE II
DIAPHRAGMS	6	4	3
WIDTH	69"	REAR	FRONT

**GENERAL NOTES**

- FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: TRINITY HIGHWAY - ENERGY ABSORPTION INC. AT 1(888)323-6374 OR WEBSITE www.trinityhighway.com.
- SEE THE RECENT QUADGUARD M WIDE PRODUCT DESCRIPTION ASSEMBLY MANUAL FOR IMPACT PERFORMANCE CHARACTERISTICS AND DESIGN LIMITATIONS AND THE DRAWING PACKAGE FOR THE SIX (6) BAY WIDE [69"] SYSTEM BEFORE INSTALLING THE QUADGUARD M WIDE AT ANY GIVEN LOCATION.
- COMPONENTS FOR THE QUADGUARD M WIDE BACKUP AND REINFORCING DETAILS ARE SHOWN ON THE QUADGUARD M WIDE PRODUCT DESCRIPTION & ASSEMBLY MANUAL.
- THE INSTALLATION AREA SHOULD BE FREE OF CURBS, ELEVATED OBJECTS, OR DEPRESSIONS.
- FOR PERMANENT APPLICATIONS, QUADGUARD M WIDE SHOULD BE ASSEMBLED ON AN EXISTING OR FRESHLY PLACED AND CURED CONCRETE BASE 28MPa [4,000 PSI] MINIMUM. QUADGUARD M WIDE SYSTEM MAY ALSO BE ASSEMBLED ON REINFORCED OR NON-REINFORCED CONCRETE ROADWAY (MINIMUM 8" THICK).
- CONCRETE PAD SHALL BE 6" MIN. REINFORCED 28MPa [4,000 PSI] (P.C.) OR 8" MIN. NON-REINFORCED 28MPa [4,000 PSI] CONCRETE ROADWAY MEASURING AT LEAST 12'-0" WIDE BY 50'-0" LONG. ANCHOR BLOCK IS NOT REQUIRED WHEN USING 8" CONCRETE PAD INSTALLED AGAINST AN IMMOVABLE STRUCTURE, E.G. CONCRETE WALL.
- IF THE CROSS-SLOPE VARIES MORE THAN 2% OVER THE LENGTH OF THE SYSTEM, THE CONCRETE PAD WILL REQUIRE LEVELING. MAXIMUM PERMISSIBLE CROSS-SLOPE IS 8%.
- FOR BI-DIRECTIONAL TRAFFIC: THE LOCATION AND OR WIDTH OF THE QUADGUARD M WIDE IS RESTRICTED. AS BI-DIRECTIONAL TRAFFIC APPROACHES THE REAR OF THE QUADGUARD M WIDE, THE QUADGUARD M WIDE SHOULD NOT EXTEND FURTHER INTO THE TRAFFIC-SIDE OF THE BARRIER THAN THE OBSTACLE. ANY TRANSITION INSTALLED MUST EITHER BE TANGENT TO BOTH QUADGUARD M WIDE AND OBSTACLE OR MUST ANGLE TOWARD FIELD SIDE OF THE BARRIER.
- SYSTEM TRANSITION: APPROPRIATE TRANSITION PANELS OR SIDE PANELS WILL BE REQUIRED FOR PROPER IMPACT PERFORMANCE. THE CORRECT PANEL(S) TO USE WILL DEPEND ON THE DIRECTION OF TRAFFIC FLOW AND WHAT TYPE OF BARRIER OR ROAD FEATURE THE QUADGUARD M WIDE SYSTEM IS SHIELDING. SEE THE QUADGUARD M WIDE PRODUCT DESCRIPTION & ASSEMBLY MANUAL FOR FURTHER DETAILS.
- THE QUADGUARD M WIDE SYSTEM SHOULD BE INSTALLED APPROXIMATELY PARALLEL WITH THE BARRIER.
- FOR THE TENSION STRUT BACKUP, THE DISTANCE BETWEEN THE BACK OF BACKUP AND THE BARRIER WALL SHOULD NOT EXCEED 7" IN ANY CASE.
- THE WIDE QUADGUARD M WIDE SYSTEM IS ONLY AVAILABLE IN A 69" WIDTH AND HAS A 6-BAY SYSTEM THAT HAS BEEN TESTED TO MASH TEST LEVEL 3.
- IF THE OUTSIDE WIDTH OF OBSTACLE(S) BEING SHIELDED IS 53" OR GREATER, THE OUTSIDE OF OBSTACLE(S) MUST BE CHAMFERED. SEE THE QUADGUARD M WIDE PRODUCT DESCRIPTION & ASSEMBLY MANUAL FOR FURTHER DETAILS.
- SEE THE "QUADGUARD M WIDE SYSTEM PRODUCT MANUAL" FOR A DESCRIPTION OF ITS IMPACT PERFORMANCE CHARACTERISTICS AND DESIGN LIMITATIONS BEFORE PLACING A SYSTEM AT A GIVEN SITE. INFORMATION AND COPIES OF ABOVE MANUAL ARE AVAILABLE BY CALLING CUSTOMER SERVICE DEPARTMENT AT (888) 323-6374.

**FOUNDATION & ANCHORING REQUIREMENTS  
FOUNDATION TYPES: A & B**

FOUNDATION TYPE: A	REINFORCED CONCRETE PAD OR ROADWAY
FOUNDATION:	6" MINIMUM DEPTH WITH ANCHOR BLOCK (P.C.C.)
ANCHORAGE:	7" STUDS EMBEDDED 5 1/2" - APPROVED ADHESIVE
FOUNDATION TYPE: B	REINFORCED OR NON-REINFORCED CONCRETE PAD OR ROADWAY
FOUNDATION:	8" MINIMUM DEPTH (P.C.C.)
ANCHORAGE:	7" STUDS EMBEDDED 5 1/2" - APPROVED ADHESIVE

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

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

TENSION STRUT BACKUP MAY NOT BE USED IN ASPHALT CONCRETE (A.C.). SEE TRINITY'S PRODUCT DESCRIPTION ASSEMBLY MANUAL FOR MORE INFORMATION.

Texas Department of Transportation  
**TRINITY HIGHWAY ENERGY ABSORPTION QUADGUARD M WIDE (MASH TL-3)**  
**QG (M) (W) -21**

FILE:	qgmw21.dgn	DN:	TxDOT	CK:	KM	DW:	SS	CK:	CL
© TxDOT:	JULY 2021	CONT:	6399	SECT:	15	JOB:	001	HIGHWAY:	SH99
REVISIONS:		DIST:		COUNTY:		SHEET NO.:			
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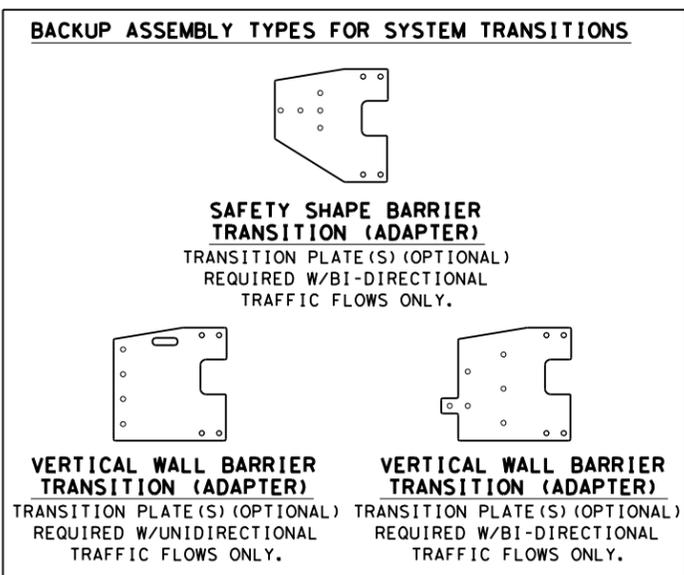
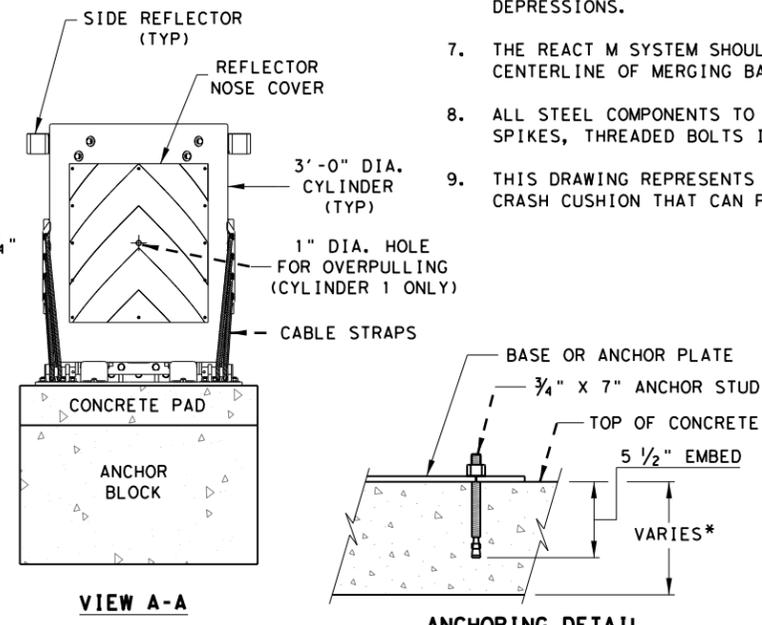
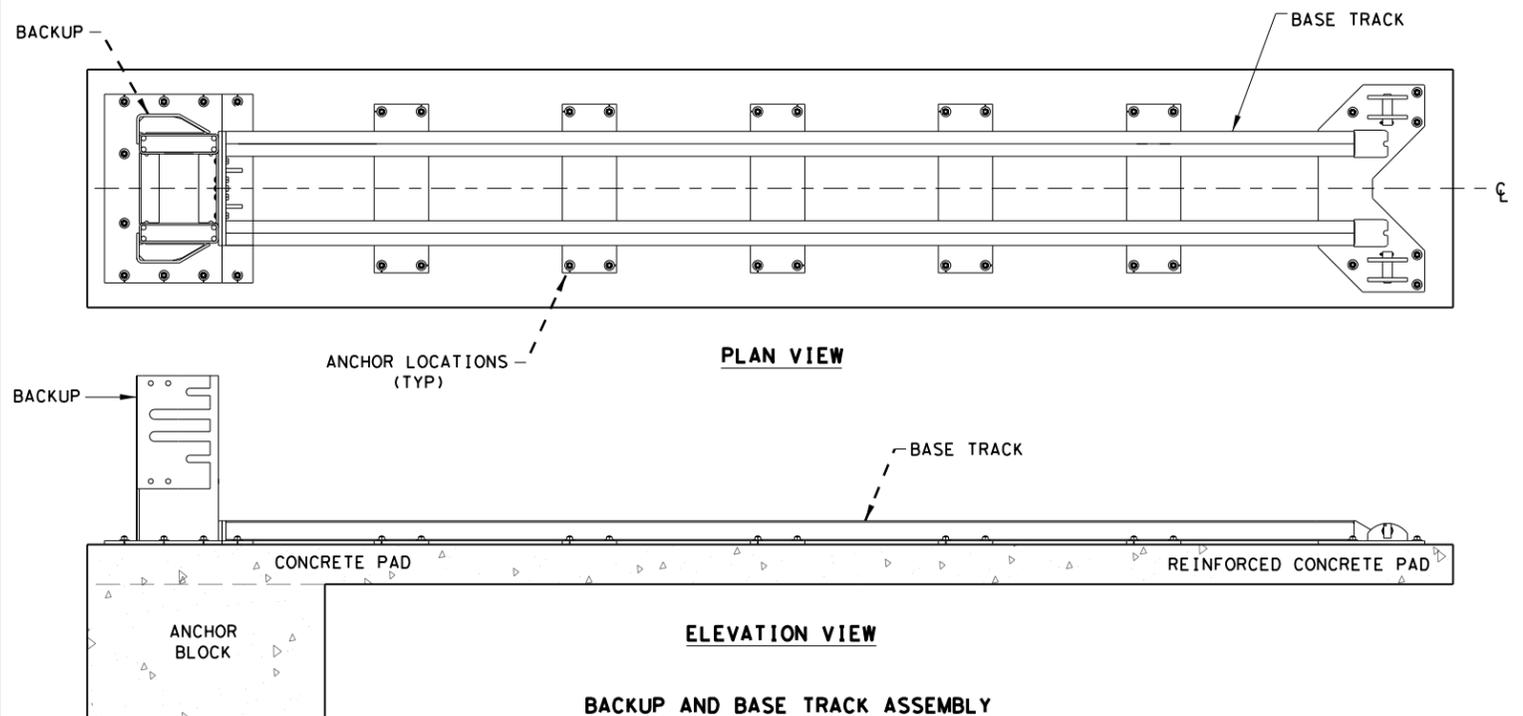
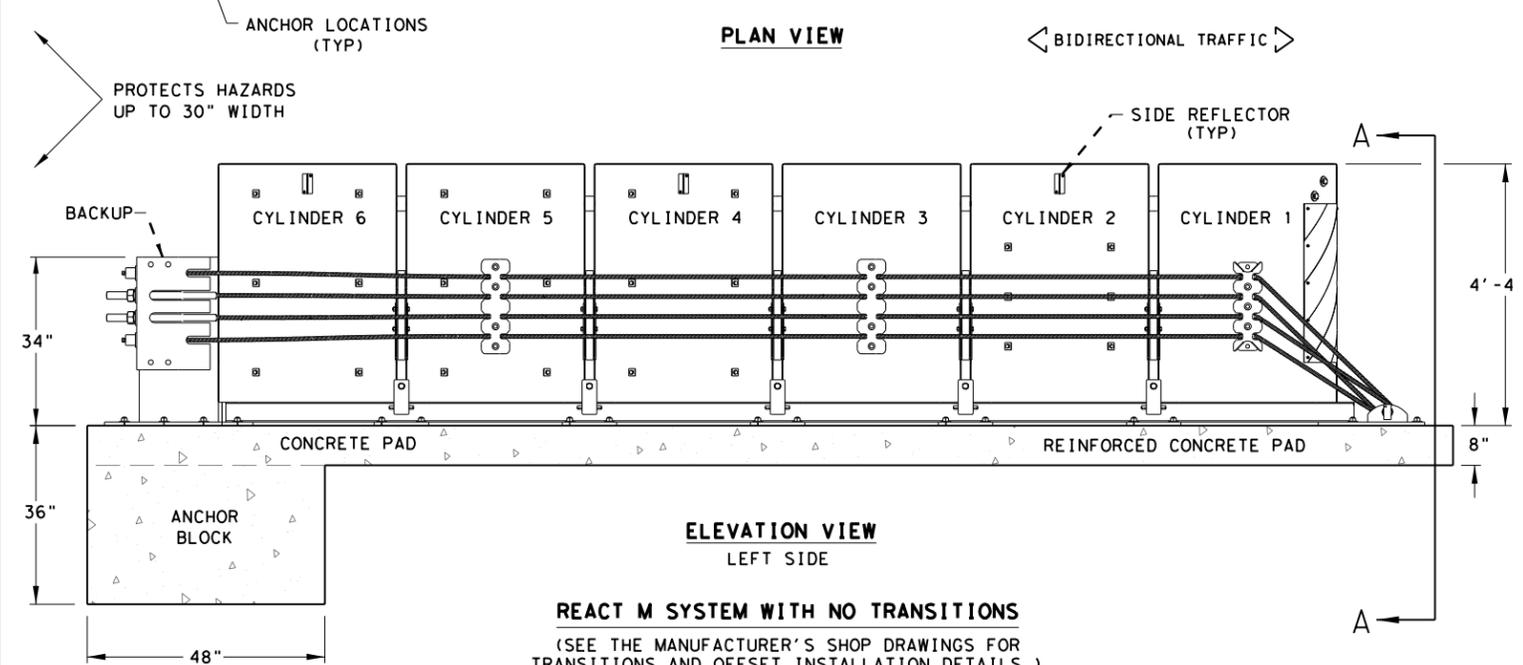
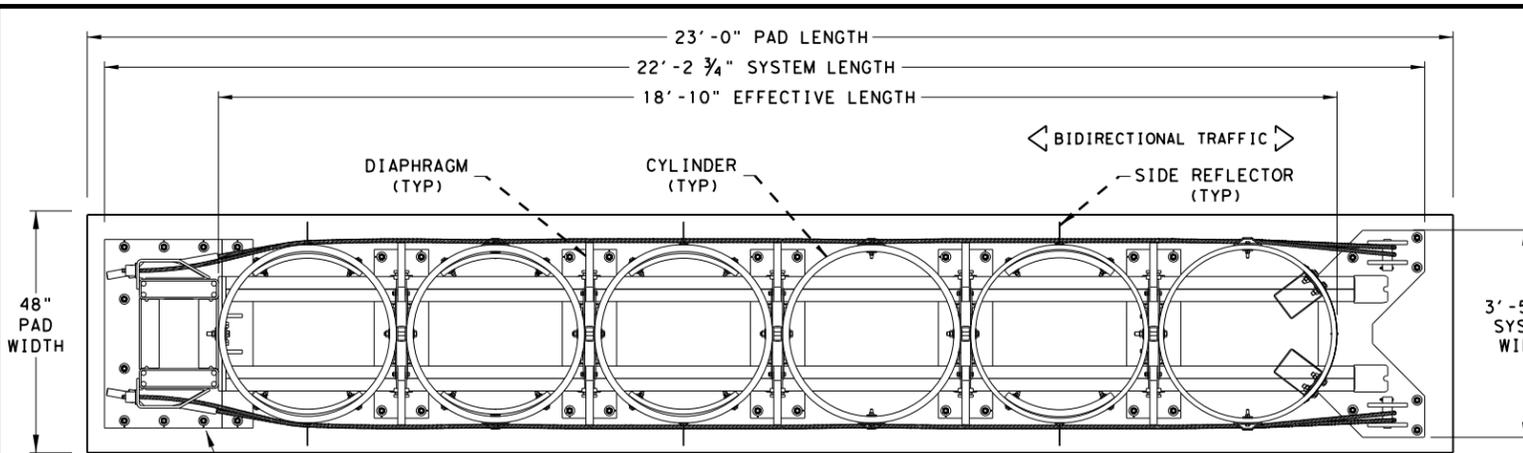
REUSABLE

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

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

- GENERAL NOTES**
- FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: TRINITY HIGHWAY - ENERGY ABSORPTION AT 1(888)323-6374 OR WEBSITE: [www.trinityhighway.com](http://www.trinityhighway.com).
  - THE NOSE OF THE REACT M SHALL BE CLAD WITH A PLASTIC WRAP WITH STANDARD DELINEATION ADHERED TO THE WRAP AND SHALL HAVE A SERIES OF SIDE MARKER REFLECTORS ON BOTH SIDES OF THE UNIT. SEE SITE PLAN VIEWS FOR MARKER AND PLASTIC WRAP COLOR ORIENTATION.
  - FOR BI-DIRECTIONAL TRAFFIC, APPROPRIATE TRANSITION DETAILS WILL BE AS SHOWN ON THE MANUFACTURER'S SHOP DRAWINGS.
  - DETAILS OF COMPONENTS FOR THE REACT M, BACKUPS AND REINFORCING DETAILS WILL BE SHOWN ON THE MANUFACTURER'S SHOP DRAWINGS FURNISHED TO THE ENGINEER.
  - IF THE CROSS-SLOPE VARIES MORE THAN 2% OVER THE LENGTH OF THE SYSTEM, THE CONCRETE PAD WILL REQUIRE LEVELING. MAXIMUM PERMISSIBLE CROSS-SLOPE IS 8%.
  - THE INSTALLATION AREA SHOULD BE FREE FROM CURBS, ELEVATED OBJECTS, OR DEPRESSIONS.
  - THE REACT M SYSTEM SHOULD BE APPROXIMATELY PARALLEL WITH THE BARRIER OR CENTERLINE OF MERGING BARRIERS.
  - ALL STEEL COMPONENTS TO BE HOT DIPPED GALVANIZED EXCEPT STAKES, DRIVE SPIKES, THREADED BOLTS IN BACKUP UNIT, AND WEDGE FITTINGS ON CABLES.
  - THIS DRAWING REPRESENTS THE REACT M TL-3 SYSTEM, RE-DIRECTIVE, NON-GATING CRASH CUSHION THAT CAN PROTECT HAZARDS UP TO 30-INCHES IN WIDTH.

**DESIGN DATA TABLE FOR REACT M**

TEST NUMBER	TEST LEVEL	OVERALL LENGTH	TRANSITION LENGTH	SYSTEM WIDTH
3-30 to 3-36	TL-3	22'-2 3/4"	-	3'-5 3/4"
3-37A	TL-3	22'-2 3/4"	9'-10 3/4"	3'-5 3/4"
3-38	TL-3	22'-2 3/4"	-	3'-5 3/4"

**ANCHOR SYSTEM TYPE**

APPROVED ADHESIVE, 7" STUDS, 5.5" EMBEDMENT

**FOUNDATION TYPES**

MINIMUM 8" REINFORCED PORTLAND CEMENT CONCRETE PAD (REQUIRED REINFORCING STEEL FOR CONCRETE PAD SHALL BE SHOWN ON THE MANUFACTURER'S SHOP DRAWINGS.)

MINIMUM 8" NON-REINFORCED PORTLAND CEMENT CONCRETE ROADWAY MEASURING AT LEAST 12' WIDE BY 50' LONG)

MINIMUM 7" CONCRETE DECK STRUCTURE, OR MINIMUM 6" REINFORCED CONCRETE ROADWAY

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

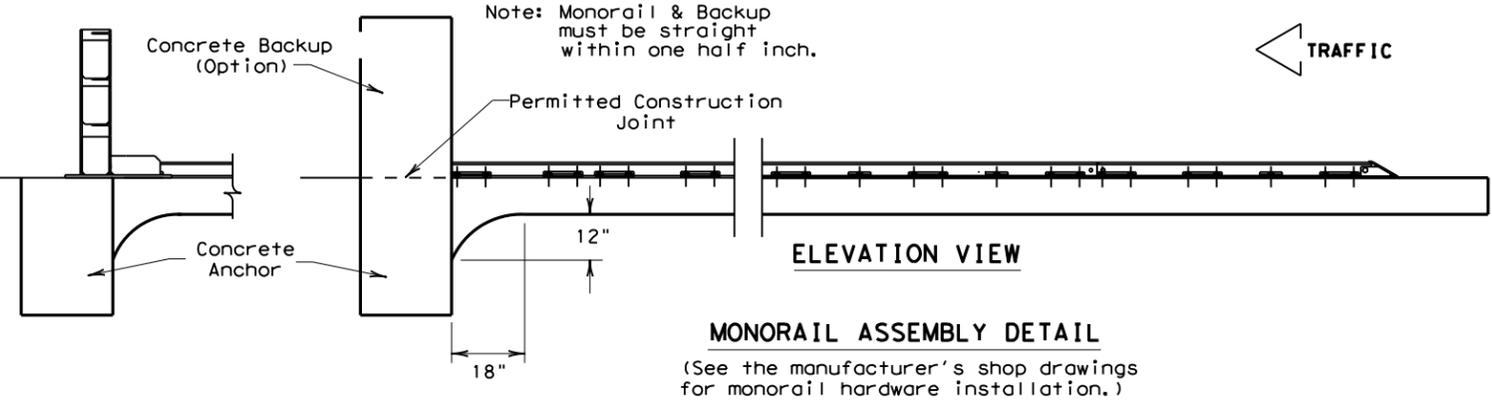
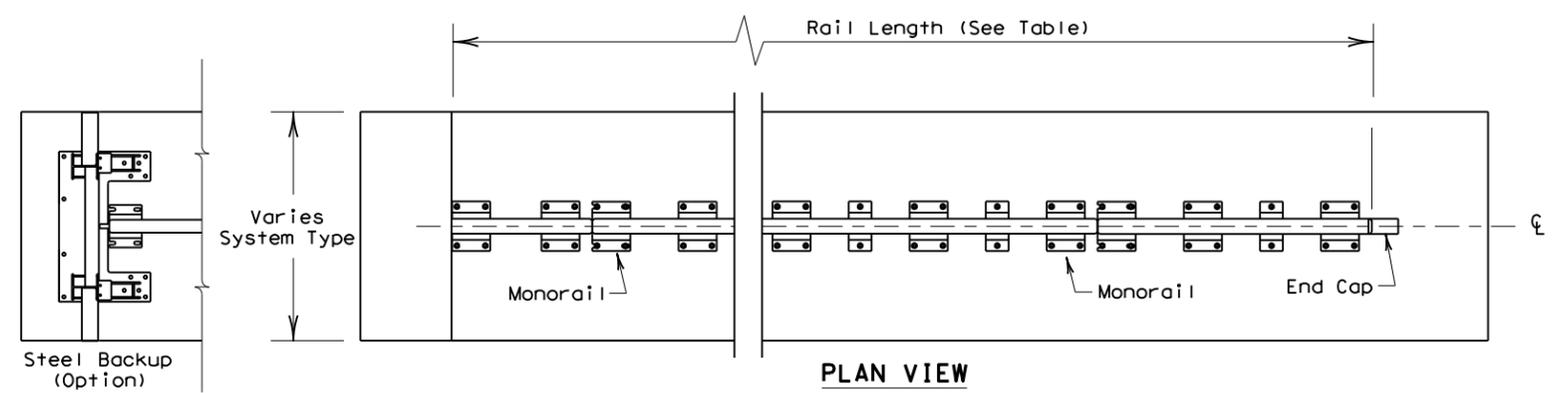
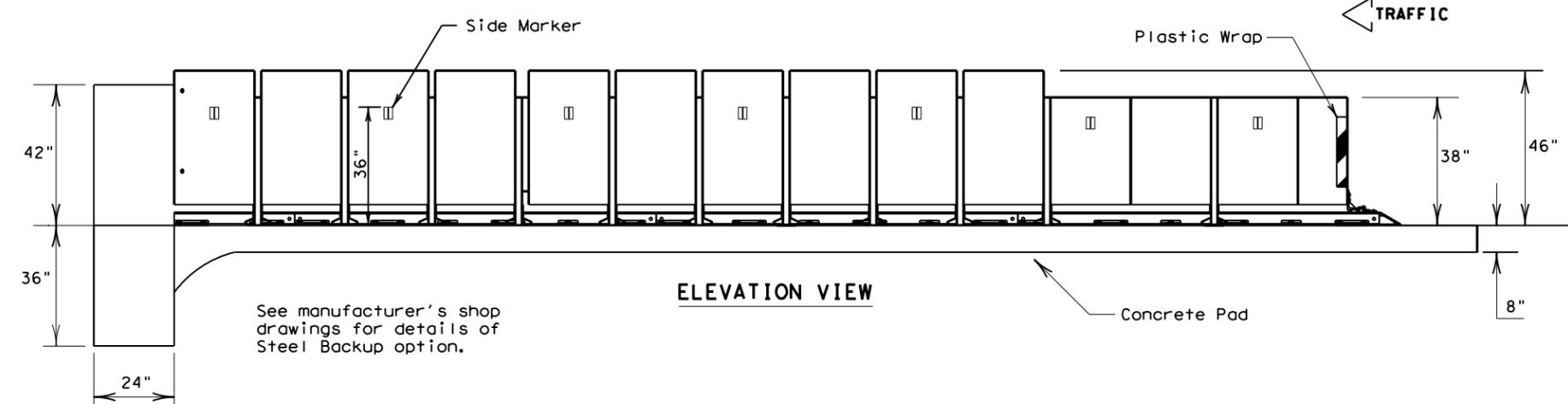
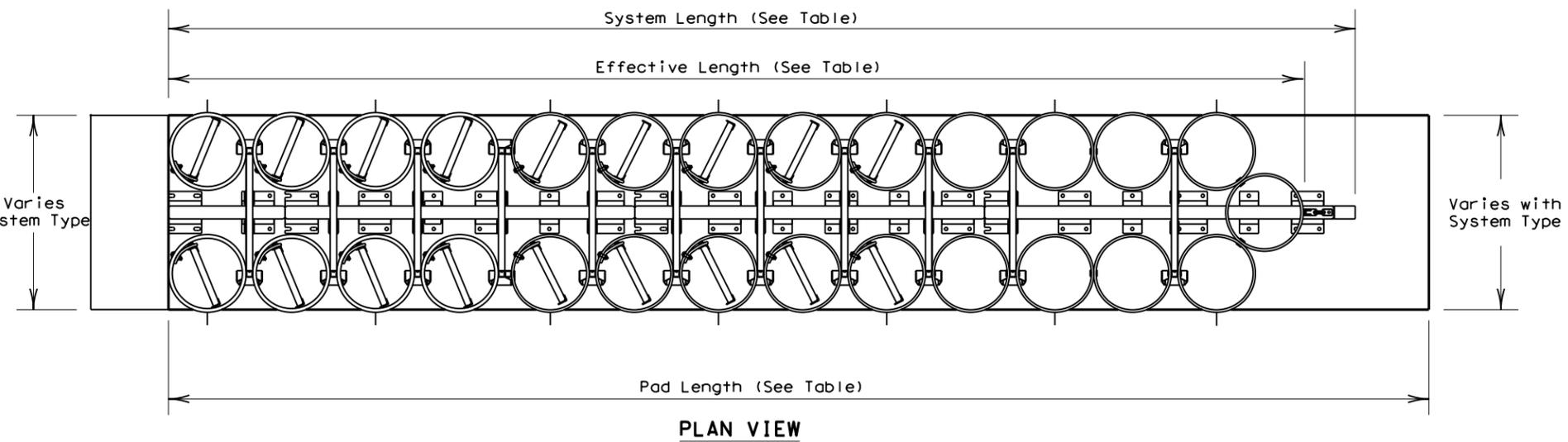
Texas Department of Transportation  
Design Division Standard

**TRINITY HIGHWAY ENERGY ABSORPTION CRASH CUSHION REACT M (NARROW) (MASH TL-3) REACT (M) -21**

FILE: reactm21.dgn	DN: TxDOT	CK: KM	DW: SS	CK: CL
© TxDOT: JULY 2021	CONT: 6399	SECT: 15	JOB: 001	HIGHWAY: SH99
REVISIONS	DIST: BMT	COUNTY: LIBERTY, ETC.	SHEET NO. 103	

**LOW MAINTENANCE**

DATE: 5/12/2022  
 FILE: D:\N\YEMB Docs\_Extension\NHAO FOLDERS\MAINTENANCE\RMC IN PROGRESS\RMC\_6399-15-001-SH99-1 Liberty\2-Roadway Standards\2-BARRIER AND GUARDRAIL END  
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**MONORAIL ASSEMBLY DETAIL**  
 (See the manufacturer's shop drawings for monorail hardware installation.)

**GENERAL NOTES**

1. For specific information regarding installation and technical guidance of the system, contact: Trinity Highway - Energy Absorption at 1(888)323-6374, 70 W. Madison St. Suite 2350, Chicago, IL 60602
2. The nose of the REACT 350 shall be clad with a plastic wrap with standard delineation adhered to the wrap and shall have a series of side marker reflectors on both sides of the unit. See site plan views for marker and plastic wrap color orientation.
3. For bi-directional traffic, appropriate transition details will be as shown on the manufacturer's shop drawings.
4. Details of components for the REACT(W) and backups and reinforcing details will be shown on the manufacturer's shop drawings furnished to the Engineer.
5. If the cross-slope varies more than 2% over the length of the system, the concrete pad will require leveling. Maximum permissible cross-slope is 8%.
6. The installation area should be free from curbs, elevated objects, or depressions.
7. The REACT(W) system should be approximately parallel with the barrier or centerline of merging barriers.
8. All steel components to be hot dipped galvanized except stakes, drive spikes, threaded bolts in backup unit, and wedge fittings on cables.

WIDE REACT SYSTEMS					
SYSTEM TYPE	BACKUP WIDTH	TEST LEVEL	SYSTEM LENGTH	EFFECTIVE LENGTH	PAD LENGTH
W60	60"	TL-2	18'-10"	16'-3"	19'-6"
		TL-3	30'-10"	29'-3"	32'-6"
W96	96"	TL-2	18'-10"	17'-6"	19'-7"
		TL-3	34'-9"	32'-10"	35'-6"
W120	120"	TL-3	33'-10"	32'-2"	35'-6"

(See the manufacturer's shop drawings for additional details.)

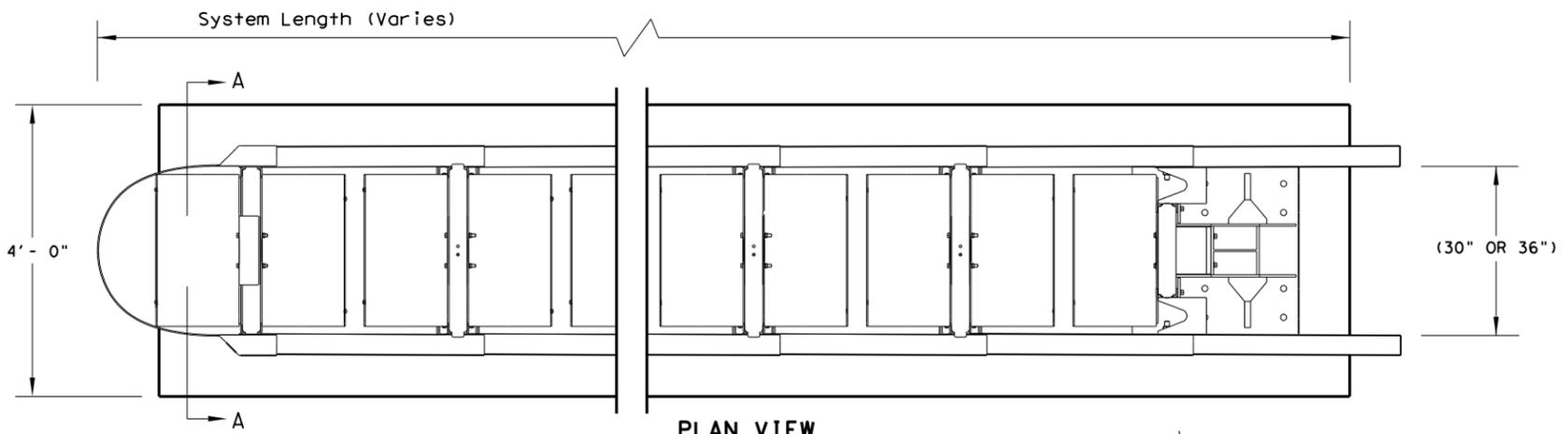
ANCHOR SYSTEM TYPE
MP-3 <sup>®</sup> polyester anchoring system with 7.5" studs, 5.5" embedment
FOUNDATION TYPES
Minimum 8" Reinforced concrete pad (Required reinforcing steel for concrete pad shall be shown on the manufacturer's shop drawings.)
Minimum 8" Non-reinforced concrete roadway (Measuring at least 12' wide by 50' long)
Minimum 7" Concrete deck structure, or Minimum 6" Reinforced concrete roadway

				Design Division Standard	
<b>TRINITY HIGHWAY ENERGY ABSORPTION CRASH CUSHION (REACT 350 WIDE) REACT (W) - 16</b>					
FILE: reactw16.dgn	DN: TxDOT	CK: KM	DW: VP	CK: VP	
© TxDOT: October 2001	CONT	SECT	JOB	HIGHWAY	
REVISIONS	6399	15	001	SH99	
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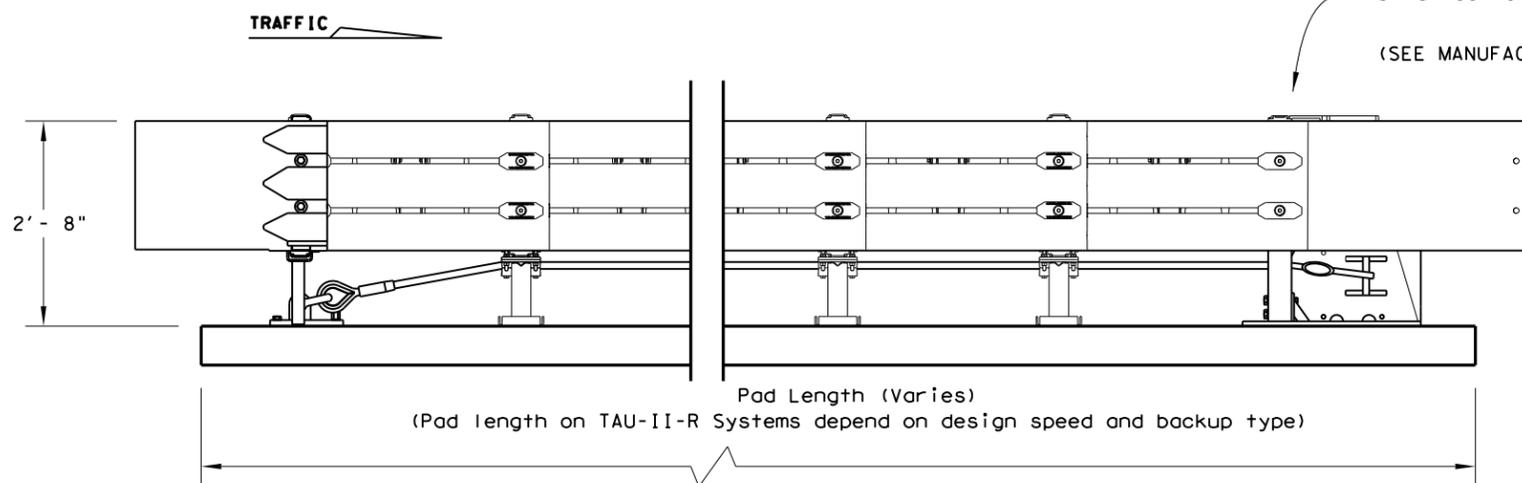
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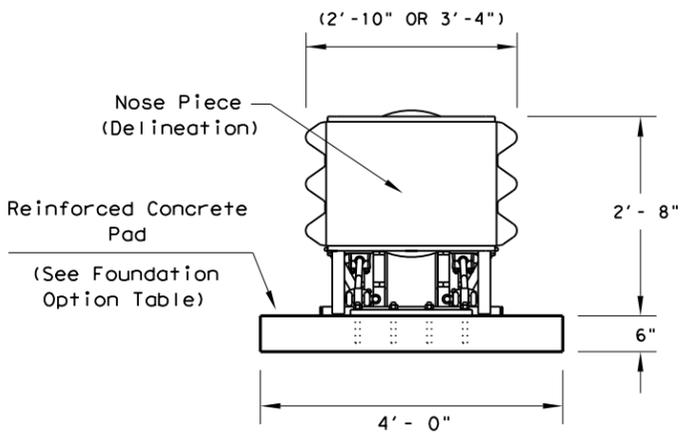


**PLAN VIEW**



**ELEVATION VIEW**

Attachments and transitions to various barrier shapes, barrier railings and bi-directional traffic flows are available.  
 (SEE MANUFACTURER'S PRODUCT MANUAL)



**SECTION A-A**

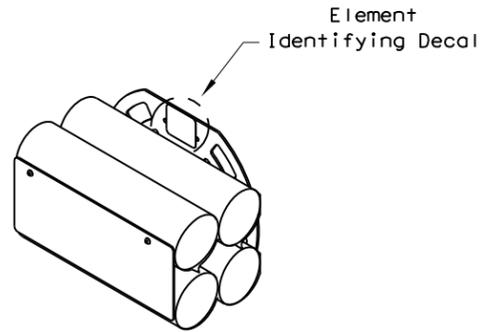
Nose Piece delineation orientation, is shown elsewhere on the plans.

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

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

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

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



**ENERGY ABSORBING ELEMENTS (EAE)**

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

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

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

Note: System lengths are ± 2"

**GENERAL NOTES**

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

**BILL OF MATERIAL**

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

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

(See manufacturer's product manual for details)

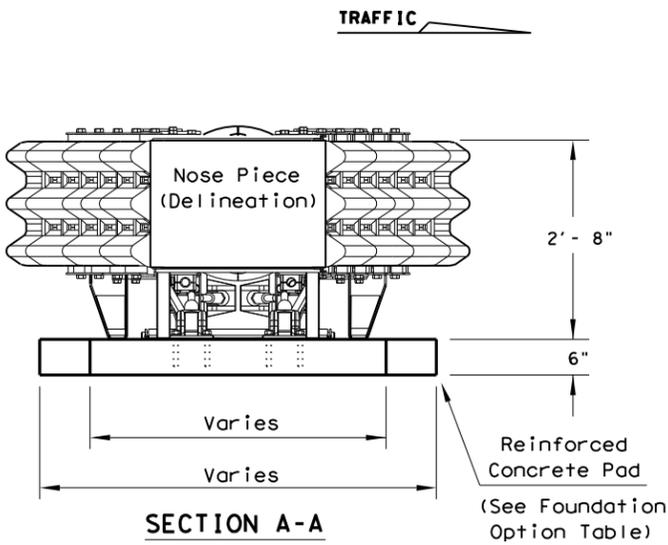
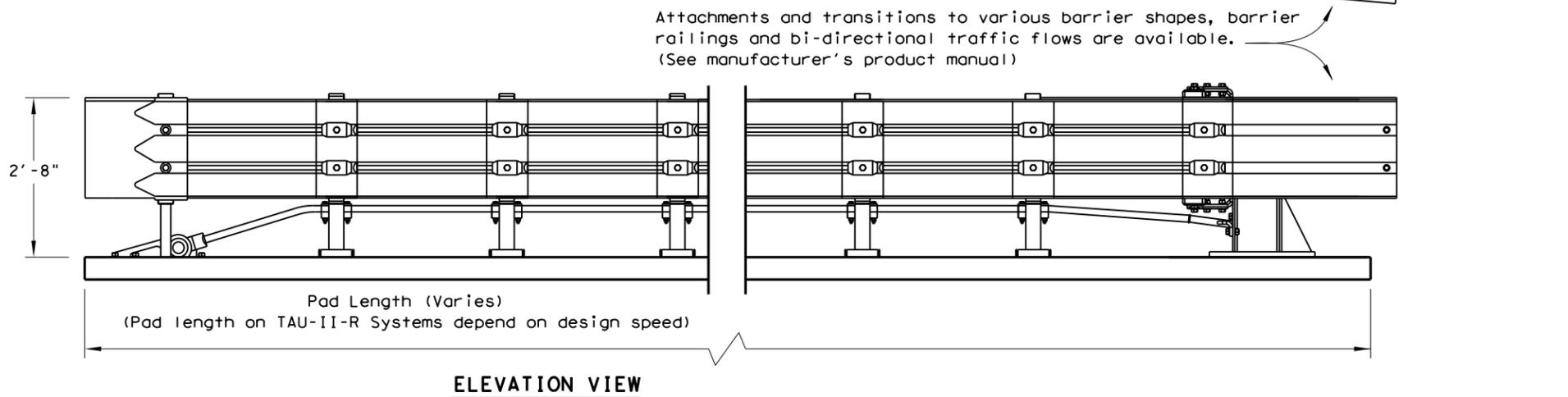
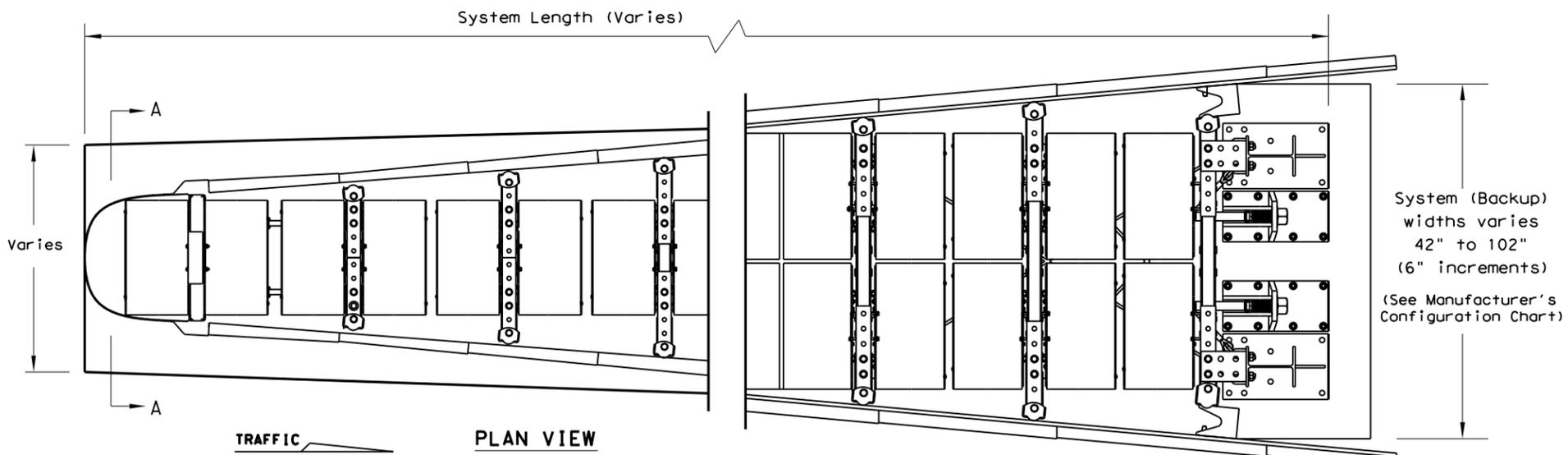


**LTS-BARRIER SYSTEMS**  
**CRASH CUSHION**  
**(R-NARROW)**  
**TAU-II-R(N)-16**

FILE: tauirr16.dgn	DW: TxDOT	CK: KM	DW: VP	CK: CGL
©TxDOT: January 2013	CONT	SECT	JOB	HIGHWAY
REVISIONS	6399	15	001	SH99
REVISED 06, 2013 (VP)	DIST	COUNTY	SHEET NO.	
REVISED 03, 2016 (VP)	BMT	LIBERTY, ETC.	105	

**LOW MAINTENANCE**

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

**BACKUP SUPPORT OPTIONS**

Wide Flange (Stand alone)

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

Attachments and transitions to various barrier shapes, barrier railings and bi-directional traffic flows are available. (See manufacturer's product manual)

TAU-II-R (WIDE) SYSTEM LENGTHS				
SYSTEM WIDTH	TL-2	TL-3	70 mph	
42"	15'-4"	29'-5"	32'-3"	
48"	15'-4"	29'-5"	32'-3"	
54"	15'-4"	29'-5"	32'-3"	
60"	12'-5"	29'-5"	32'-3"	
66"	12'-5"	26'-7"	29'-5"	
72"	12'-5"	26'-7"	26'-7"	
78"	12'-5"	26'-7"	26'-7"	
84"	12'-5"	26'-7"	26'-7"	
90"	12'-5"	26'-7"	26'-7"	
96"	12'-5"	26'-7"	26'-7"	
102"			26'-7"	

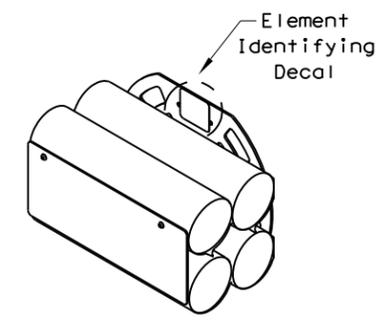
Note: System Lengths are +/-2"

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

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

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

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



ENERGY ABSORBING ELEMENTS (EAE)

**GENERAL NOTES**

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

**BILL OF MATERIAL**

PRODUCT CODE	QTY	DESCRIPTION
B030704	1	Front Support
B030703	TBD	Mid Support
TBD	TBD	XL Bulkhead
TBD	TBD	XXL Bulkhead
TBD	TBD	XXXL Bulkhead
TBD	1	Backstop Assembly (See Table)
TBD	2	Front Cable Anchor
TBD	1	Nose Assembly
B010202	TBD	Sliding Panel
B010659	2	End Panel
K001003	1	Slider Assembly Kit
BSI-1202006-KT	TBD	TAU-II-R Slider Kit
BSI-1107131-KT	TBD	TAU-II-R EAE Mounting Hw Kit
BSI-1012069-00	TBD	Energy Absorbing Element, Type 1
BSI-1012070-00	TBD	Energy Absorbing Element, Type 2
BSI-1012071-00	TBD	Energy Absorbing Element, Type 3
BSI-1109042-00	TBD	Energy Absorbing Element, Type 1S
BSI-1107116-00	TBD	Energy Absorbing Element, Type 2S
BSI-1110009-00	TBD	Energy Absorbing Element, Type 3N
TBD	TBD	Cable Assembly
K001031	TBD	Lateral Support Kit
K001004	TBD	Cable Guide Kit
K001005	2	Front Support Leg Kit
TBD	1	Anchoring Package

(TBD) = To Be Determined, depending on Backup Type and System Length. (See manufacturer's product manual for details)



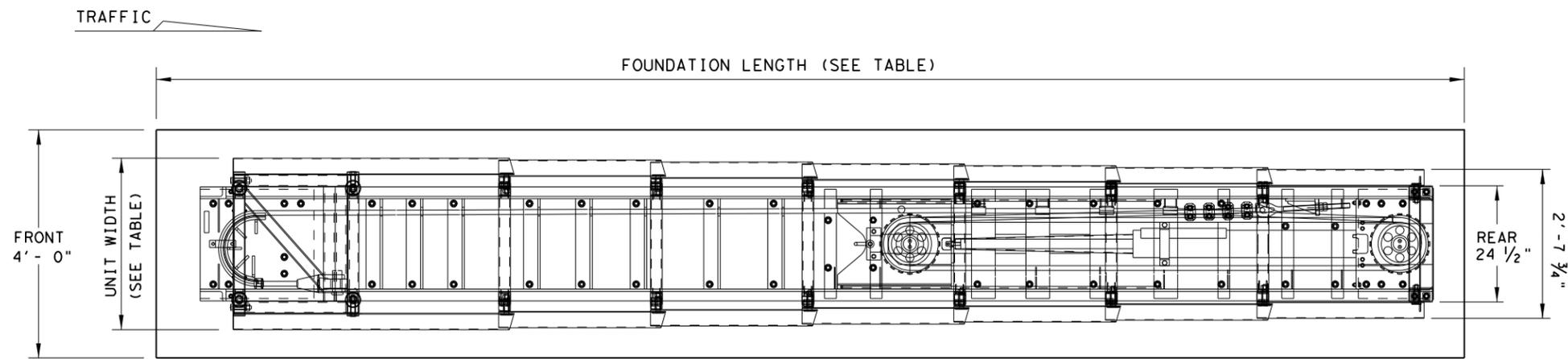
**LTS-BARRIER SYSTEMS  
CRASH CUSHION  
(R-WIDE)  
TAU-II-R(W)-16**

**LOW MAINTENANCE**

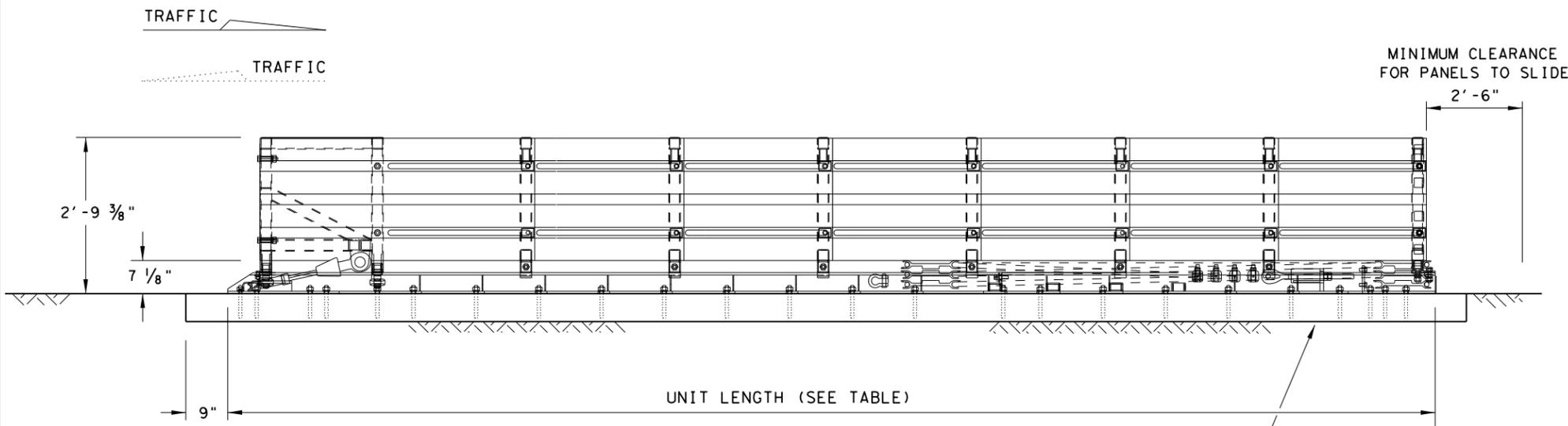
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REVISED 06, 2013 (VP)	DIST	COUNTY	SHEET NO.	
REVISED 02, 2016 (VP)	BMT	LIBERTY, ETC.	106	

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PLAN VIEW



ELEVATION VIEW

6" REINFORCED PAD SHOWN  
(SEE FOUNDATION OPTIONS)

MODEL	TEST LEVEL	UNIT LENGTH (approx.)	UNIT WIDTH	FOUNDATION LENGTH	OBSTACLE WIDTH
SCI70GM	TL-2	13'-6"	2'-10 5/8"	15'-6 1/4"	24" to 36"
SCI100GM	TL-3	21'-6"	3'-1 1/2"	23'-0"	24" to 36"

SYSTEM AND PAD LENGTHS VARY DEPENDING ON BACKUP TYPE.

**FOUNDATION OPTIONS**

6" REINFORCED CONCRETE (5 1/2" ANCHOR EMBEDMENT)
8" UNREINFORCED CONCRETE (5 1/2" ANCHOR EMBEDMENT)
3" MIN. ASPHALT OVER 3" MIN. CONCRETE (16 1/2" ANCHOR EMBED.)
6" ASPHALT OVER 6" COMPACT SUBBASE (16 1/2" ANCHOR EMBED.)
8" MINIMUM ASPHALT (16 1/2" ANCHOR EMBEDMENT)

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

**TRANSITION OPTIONS**

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

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

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

**GENERAL NOTES**

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

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

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



**WORK AREA PROTECTION  
CORP  
(SMART-NARROW)**

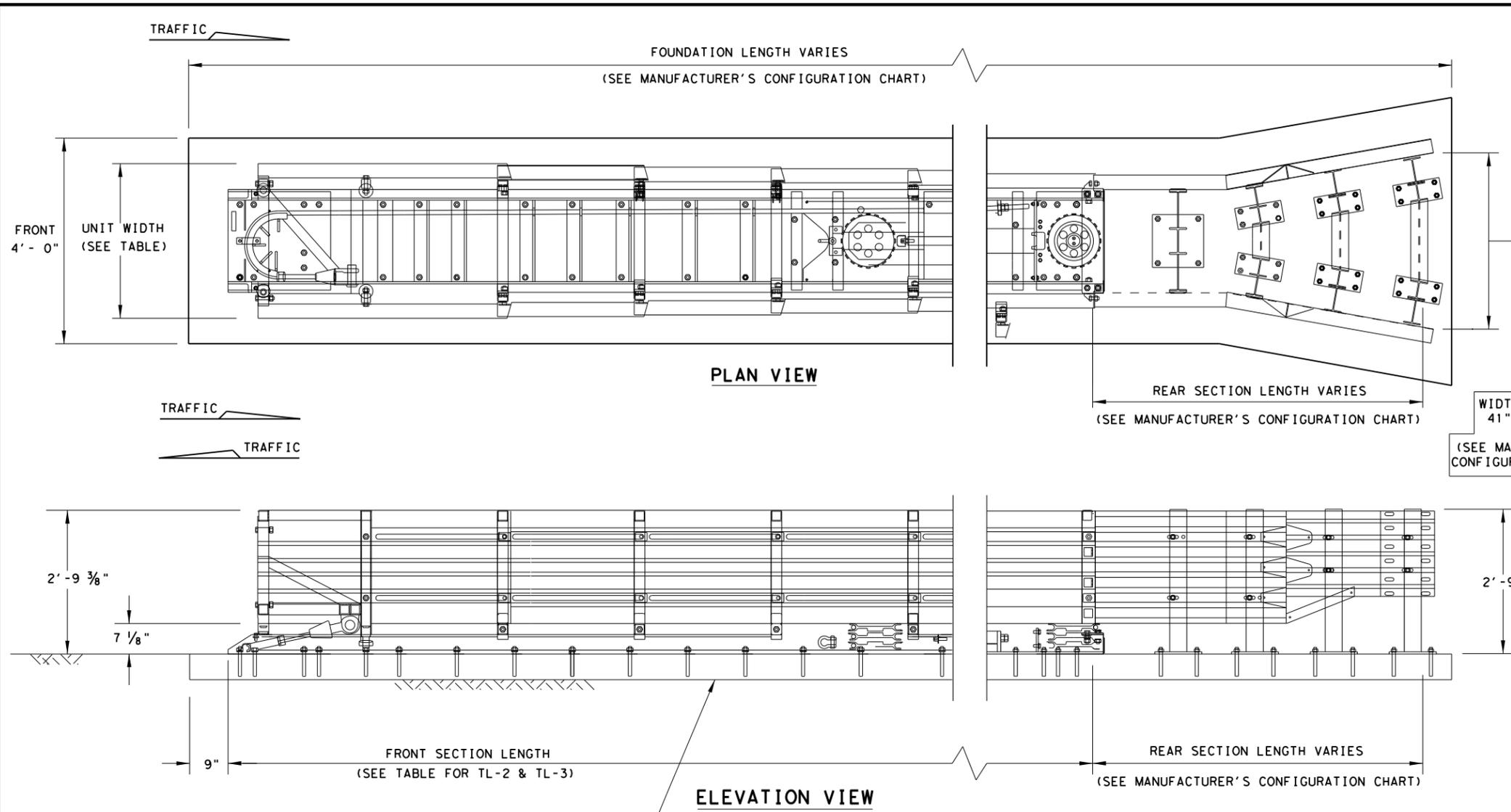
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©TxDOT: February 2006	CONT	SECT	JOB	HIGHWAY
REVISIONS	6399	15	001	SH99
REVISED 06, 2013 (VP)	DIST	COUNTY	SHEET NO.	
REVISED 03, 2016 (VP)	BMT	LIBERTY, ETC.	107	

**LOW MAINTENANCE**

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### GENERAL NOTES

- FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: WORK AREA PROTECTION, CORP. AT (800) 327-4417, OR (630) 377-9100.
- FOR BI-DIRECTIONAL TRAFFIC, APPROPRIATE TRANSITION PANELS WILL BE REQUIRED.
- ADDITIONAL DETAILS FOR THE TRANSITION OPTIONS AND FOUNDATION OPTIONS WILL BE SHOWN ON THE MANUFACTURER'S SHOP DRAWINGS FURNISHED TO THE ENGINEER.
- CONCRETE SHALL BE CLASS "S" WITH A MINIMUM COMPRESSIVE STRENGTH OF 4,000 PSI.
- MAXIMUM PERMISSIBLE CROSS-SLOPE IS 8%.
- THE INSTALLATION AREA SHOULD BE FREE FROM CURBS, ELEVATED OBJECTS, OR DEPRESSIONS.
- THE SCI100GM & SC170GM SYSTEMS SHOULD BE APPROXIMATELY PARALLEL WITH THE BARRIER OR  $\phi$  OF MERGING BARRIERS.

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

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

WIDE TRANSITION LENGTHS		
GORE WIDTH	TL-2 OVERALL SYSTEM LENGTH	TL-3 OVERALL SYSTEM LENGTH
41"	20'-1"	28'-1"
48"	21'-10"	29'-10"
55"	23'-5"	31'-5"
60"	24'-7"	32'-7"
68"	26'-6"	34'-6"
69"	26'-8"	34'-8"
81"	29'-7"	37'-7"
88"	31'-2"	39'-2"
94"	32'-7"	40'-7"
100"	34'-1"	42'-1"
107"	35'-8"	43'-8"
112"	36'-11"	44'-11"
120"	38'-10"	46'-10"
126"	40'-2"	48'-2"
133"	41'-11"	49'-11"

FOUNDATION OPTIONS
6" Reinforced Concrete (5 1/2" Anchor Embedment)
8" Unreinforced Concrete (5 1/2" Anchor Embedment)
3" Min. Asphalt over 3" Min. Concrete (16 1/2" Anchor Embed.)
6" Asphalt over 6" Compact Subbase (16 1/2" Anchor Embed.)
8" Minimum Asphalt (16 1/2" Anchor Embedment)

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

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

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

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

MODEL (WIDE)	TEST LEVEL	FRONT SECTION LENGTH	UNIT WIDTH	FOUNDATION LENGTH	GORE WIDTH
SC170GM	TL-2	13'-6"	2'-10 5/8"	OVERALL LENGTH PLUS 1'-6"	41" TO 133"
SCI100GM	TL-3	21'-6"	3'-1 1/2"	OVERALL LENGTH PLUS 1'-6"	41" TO 133"

SYSTEM AND PAD LENGTHS VARY DEPENDING ON BACKUP TYPE.

LOW MAINTENANCE

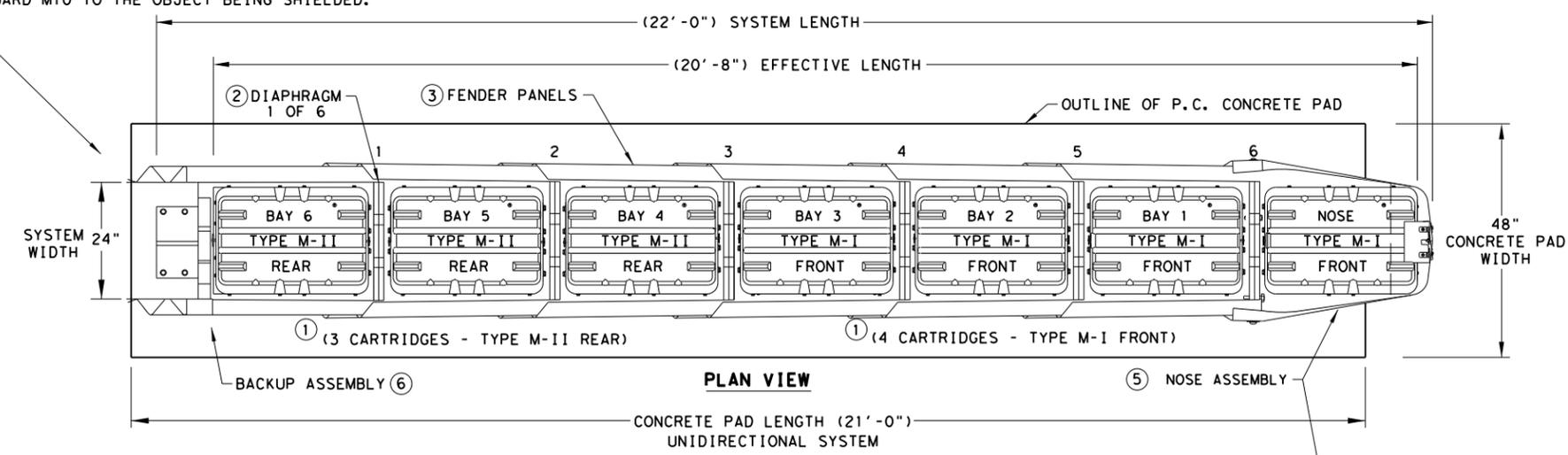
				Design Division Standard	
<b>WORK AREA PROTECTION CORP (SMART-WIDE)</b>					
<b>SMTC (W) - 16</b>					
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© TxDOT: FEBRUARY 2006	CONT	SECT	JOB	HIGHWAY	
	6399	15	001	SH99	
REVISIONS					
REVISED 06, 2013 VP					
REVISED 03, 2016 VP					
REVISED 04, 2018 VP					
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BMT	LIBERTY, ETC.		108		

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 FILE: D:\NNYEMB Docs\Extension\NHAO FOLDERS\MAINTENANCE\RMV\RMV IN PROGRESS\RMV\_6399-15-001-SH99-Liberty\2-Roadway Standards\2-BARRIER AND GUARDRAIL END

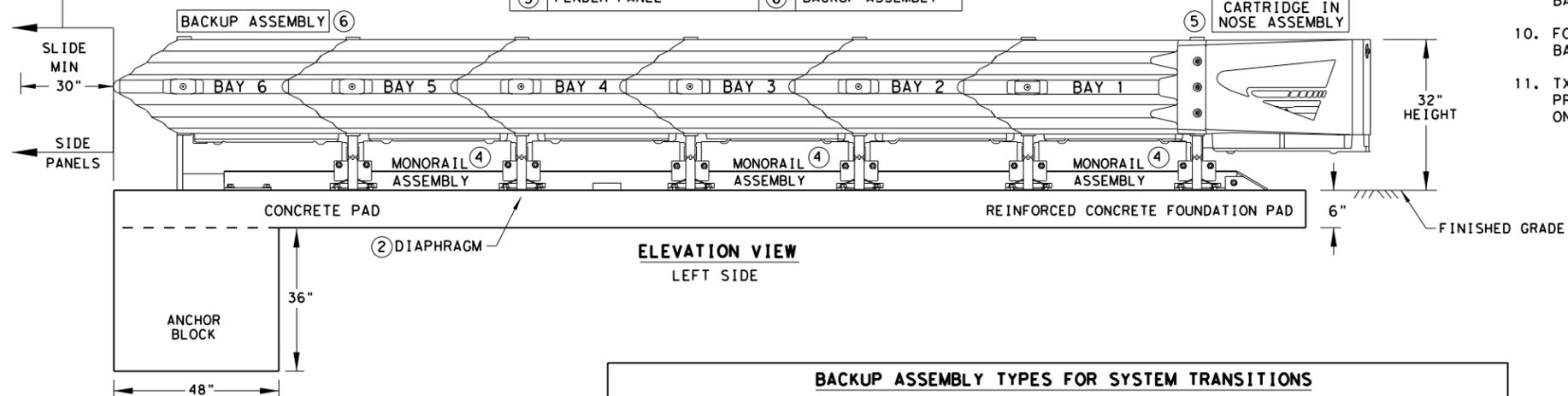
NOTE:  
 A TRANSITION MAY BE REQUIRED TO INSTALL THE QUADGUARD M10 TO THE OBJECT BEING SHIELDED.

**QUADGUARD M10 24" WIDE 6-BAY SYSTEM**



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

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



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

FOUNDATION & ANCHORING REQUIREMENTS	
FOUNDATION TYPES: A, B, C, & D	
FOUNDATION TYPE: A	REINFORCED CONCRETE PAD OR ROADWAY
FOUNDATION:	6" MINIMUM DEPTH (P.C.C.)
ANCHORAGE:	7" STUDS EMBEDDED 5 1/2" - APPROVED ADHESIVE
FOUNDATION TYPE: B	ASPHALT OVER P.C.C.
FOUNDATION:	3" MIN. (A.C.) OVER 3" MIN. (P.C.C.)
ANCHORAGE:	18" THREADED ROD EMBEDDED 16 1/2" - APPROVED ADHESIVE
FOUNDATION TYPE: C	ASPHALT OVER SUBBASE
FOUNDATION:	6" MIN. (A.C.) OVER 6" MIN. (C.S.)
ANCHORAGE:	18" THREADED ROD EMBEDDED 16 1/2" - APPROVED ADHESIVE
FOUNDATION TYPE: D	ASPHALT ONLY
FOUNDATION:	8" MIN. (A.C.)
ANCHORAGE:	18" THREADED ROD EMBEDDED 16 1/2" - APPROVED ADHESIVE

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

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

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

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

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

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

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

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

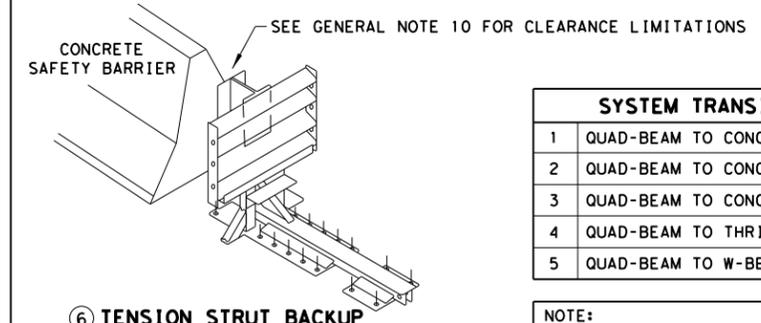
CONCRETE PAD AND ANCHOR BLOCK COMBINATIONS SHALL BE CONFIRMED WITH THE MANUFACTURER BASED UPON SITE SPECIFIC DATA (SSD).

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

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

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

**BACKUP ASSEMBLY TYPES FOR SYSTEM TRANSITIONS**



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

NOTE:  
 TRANSITION ASSEMBLIES FOR THE QUADGUARD M10 TO THRIE-BEAM OR W-BEAM FENCE REQUIRES I-BEAM POSTS:  
 ALL POSTS W6x8.5/9 I-BEAMS (78" LONG).

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

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

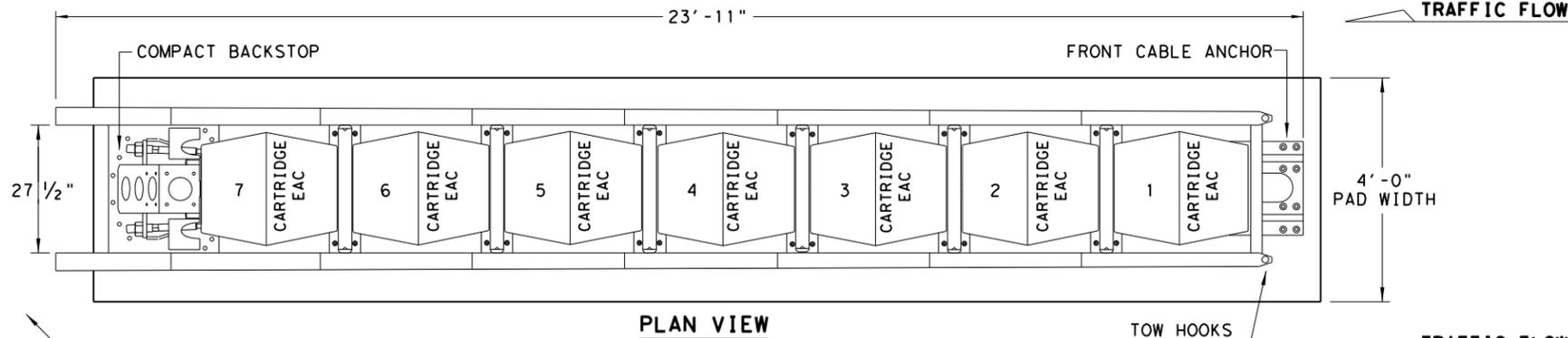
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		<b>Design Division Standard</b>		
<b>TRINITY HIGHWAY          ENERGY ABSORPTION          QUADGUARD M10          (MASH TL-3 &amp; TL-2 NARROW-24" ONLY)          QUADGUARD (M10) (N) - 20</b>				
FILE: qguardm10n20.dgn	DN: TXDOT	CK: KM	DW: VP	CK: AG
© TXDOT: NOVEMBER 2020	CONT SECT	JOB	HIGHWAY	
REVISIONS	6399 15	001	SH99	
	DIST	COUNTY	SHEET NO.	
	BMT	LIBERTY, ETC.	109	

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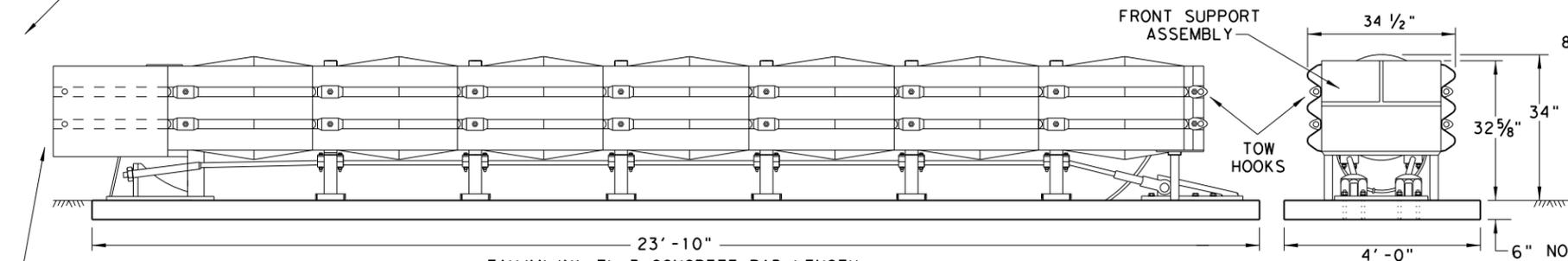
TAU(M) (N) TL-3 SYSTEM LENGTH VARIES WITH TRANSITION TYPE



PLAN VIEW

NOTE:  
 TAU(M) (N) TL-2 SYSTEM CONTAINS (4) TYPE B (EAC) CARTRIDGES.  
 INSTALLED ON ROADWAYS WITH MAXIMUM SPEEDS OF 45 MPH.

PROTECTS HAZARDS  
 UP TO 30" WIDTH



ELEVATION VIEW

NOTES:  
 TRANSITIONS AND ATTACHMENTS TO VARIOUS BARRIER SHAPES,  
 RAILINGS AND BI-DIRECTIONAL TRAFFIC FLOWS ARE AVAILABLE.  
 SEE MANUFACTURER'S INSTALLATION INSTRUCTIONS MANUAL FOR  
 ADDITIONAL TRANSITION DETAILS.

NOTE:  
 CONCRETE FOUNDATION PAD LENGTH VARIES WITH TL-3 AND  
 TL-2 SYSTEMS, SEE SYSTEM & FOUNDATION LENGTH TABLE.

FOUNDATION OPTIONS
6" REINFORCED CONCRETE
8" UNREINFORCED CONCRETE
ASPHALT OVER CONCRETE WITH MINIMUM 6" EMBEDMENT IN CONCRETE
* 6" ASPHALT OVER 6" COMPACT SUBBASE
* 8" MINIMUM ASPHALT

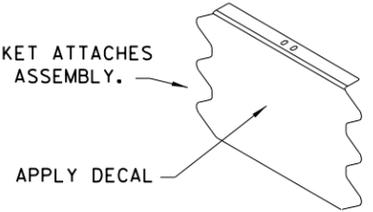
SYSTEM & FOUNDATION LENGTH TABLE	
SYSTEM LENGTH	FOUNDATION LENGTH
TL-2 = 15'-5"	TL-2 = 15'-4"
TL-3 = 23'-11"	TL-3 = 23'-10"

\* NOTE:  
 REQUIRES AN ASPHALT ANCHORAGE PACKAGE: INCLUDES ADDITIONAL BRACES  
 FOR THE FRONT CABLE ANCHOR AND THE COMPACT BACKSTOP, AND ASPHALT  
 HARDWARE KIT. THE TL-3 ASPHALT CONFIGURATION ALSO REQUIRES NESTED  
 SLIDER PANELS AND SHIMS AT THE LAST TWO BAYS. SEE MANUFACTURER'S  
 INSTALLATION INSTRUCTION MANUAL FOR DETAILS.

NOTE:  
 SEE MANUFACTURER'S INSTALLATION INSTRUCTION MANUAL FOR FOUNDATION  
 SPECIFICATIONS THAT INCLUDE, STONE AGGREGATE MIX, COMPRESSION  
 STRENGTH, STEEL SIZE, ANCHOR SIZE, AND EMBEDMENT DEPTH.

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

NOTE:  
 DELINEATION BRACKET ATTACHES  
 TO FRONT SUPPORT ASSEMBLY.



DELINEATION BRACKET

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

TRANSITION OPTIONS	
USE THE COMPACT BACKSTOP	VERTICAL WALL
	CONCRETE TRAFFIC BARRIERS
	W-BEAM GUARDRAIL
	THRIE BEAM GUARDRAIL

NOTE:  
 FOR BI-DIRECTIONAL TRANSITION PANELS AND BRIDGE RAIL END SHOE  
 DETAILS. SEE MANUFACTURER'S INSTALLATION INSTRUCTIONS MANUAL.

**GENERAL NOTES**

- FOR SPECIFIC INFORMATION REGARDING THE INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: LINDSAY TRANSPORTATION SOLUTIONS (LTS) - BARRIER SYSTEMS, INC. AT (707) 374-6800. 180 RIVER ROAD, RIO VISTA, CA 94571
- REFER TO THE LATEST (LTS) INSTALLATION INSTRUCTION MANUAL FOR IMPORANT SAFETY MESSAGES, COMPLETE SYSTEM ASSEMBLY, AND ANCHOR INSTALLATION REQUIREMENTS FOR THE NINE (9) DIFFERENT SITE TRANSITIONS.
- INSTALLATION DETAILS FOR THE COMPACT BACKSTOP, FRONT CABLE ANCHOR AND FOUNDATION OPTIONS ARE SHOWN ON THE INSTALLATION INSTRUCTION MANUAL FURNISHED TO THE ENGINEER.
- CONCRETE SHALL BE CLASS "S" WITH A MINIMUM COMPRESSIVE STRENGTH OF 4,000 P.S.I.
- IF THE CROSS-SLOPES VARIES MORE THAN 2% OVER THE LENGTH OF THE SYSTEM, THE CONCRETE PAD WILL REQUIRE LEVELING. MAXIMUM PERMISSIBLE CROSS-SLOPE IS 8%
- THE INSTALLATION AREA SHOULD BE FREE FROM CURBS, ELEVATED OBJECTS, OR DEPRESSIONS.
- THE TAU(M) (N) SYSTEM SHOULD BE APPROXIMATELY PARALLEL WITH THE BARRIER OR CENTER LINE OF MERGING BARRIERS.
- THIS DRAWING REPRESENTS THE UNIVERSAL TAU(M) (N) TL-3 SYSTEM, A RE-DIRECTIVE NON-GATING CRASH CUSHION THAT CAN PROTECT HAZARDS UP TO 30-INCHES IN WIDTH. ALSO AVAILABLE IN TL-2 CONFIGURATION.

NOTE:  
 PAD THICKNESS VARIES - SEE FOUNDATION OPTIONS

BILL OF MATERIALS FOR TAU(M) (N) TL-3 & TL-2 SYSTEMS		QUANTITIES	
PART NUMBER	PART DESCRIPTION	TL-3 SYSTEM	TL-2 SYSTEM
BSI-1708019-00	SLIDING PANEL GALVANIZED TAU(M) (N)	14	8
BSI-1708030-00	END PANEL, THRIE BEAM, GALV, TAU(M) (N)	2	2
BSI-1706001-00	CABLE ASSEMBLY, 7 BAY, TAU(M) (N)	2	-
BSI-1805036-00	CABLE ASSEMBLY, 4 BAY, TAU(M) (N)	-	2
BSI-1708018-00	FRONT CABLE ANCHOR	1	1
BSI-1707034-00	COMPACT BACKSTOP	1	1
B030703	MIDDLE SUPPORT ASSEMBLY	6	3
B030704	FRONT SUPPORT	1	1
B010722	ENERGY ABSORBING CARTRIDGE, TYPE B	7	4
K001005	TAU-II FRONT SUPPORT LEG KIT	1	1
BSI-1709083-KT	TETHER KIT (INCLUDES ALL HARDWARE)	1	1
BSI-1809041-KT	SLIDER KIT (INCLUDES ALL HARDWARE)	7	4
BSI-1808033-KT	CABLE GUIDE KIT (INCLUDES ALL HARDWARE)	6	3
BSI-1809040-KT	TOW HOOK KIT (INCLUDES ALL HARDWARE)	1	1
BSI-1808034-KT	DELINEATION BRACKET KIT (INCLUDES ALL HARDWARE)	1	1
BSI-1808035-KT	END PANEL MOUNT KIT (INCLUDES ALL HARDWARE)	1	1
BSI-1808036-KT	CONCRETE ANCHORING KIT	1	1
* * SEE NOTE	HIGH REFLECTIVE DECAL	1	1
ECN 3883	INSTALLATION AND INSTRUCTIONS MANUAL	1	1

NOTES:  
 UPGRADE KITS ARE AVAILABLE TO RETROFIT EXISTING  
 NCHRP 350 TAU-II SYSTEMS TO MASH COMPLIANT SYSTEMS.  
 SEE MANUFACTURER'S PRODUCT INFORMATION.

THE TAU(M) (N) UNIDIRECTIONAL SYSTEM IS FREE STANDING  
 AND IS NOT REQUIRED TO BE CONNECTED TO THE HAZARD.

TRANSITIONS TO GUARD FENCE, BRIDGE RAILS AND ROADSIDE  
 BARRIERS SHALL BE IN ACCORDANCE WITH TxDOT'S POLICY.

NOTE:  
 THIS STANDARD IS A BASIC REPRESENTATION OF THE  
 UNIVERSAL TAU(M) (N) SYSTEM, IT IS NOT INTENDED TO  
 REPLACE THE INSTALLATION INSTRUCTION MANUAL.

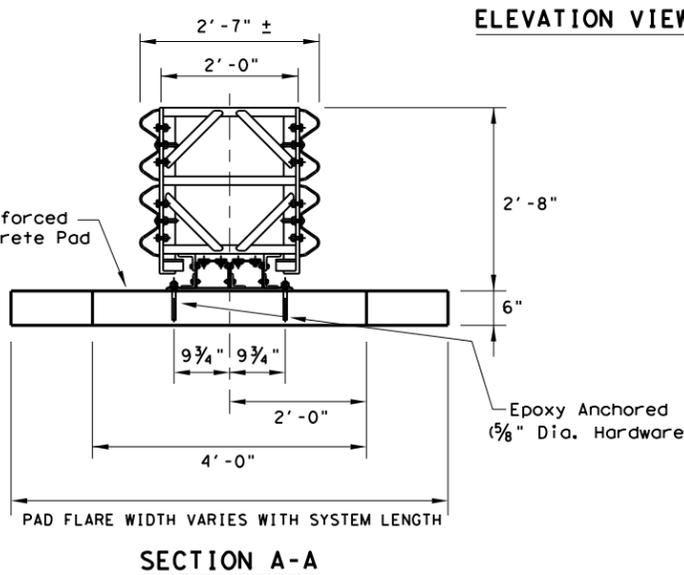
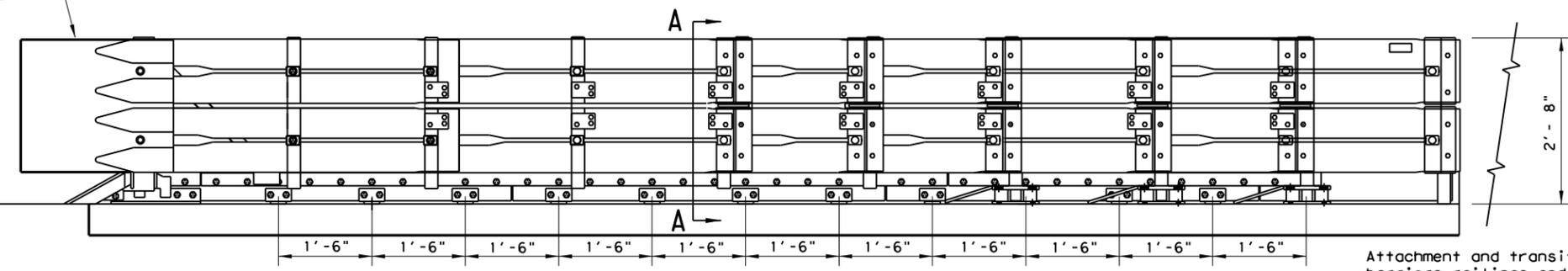
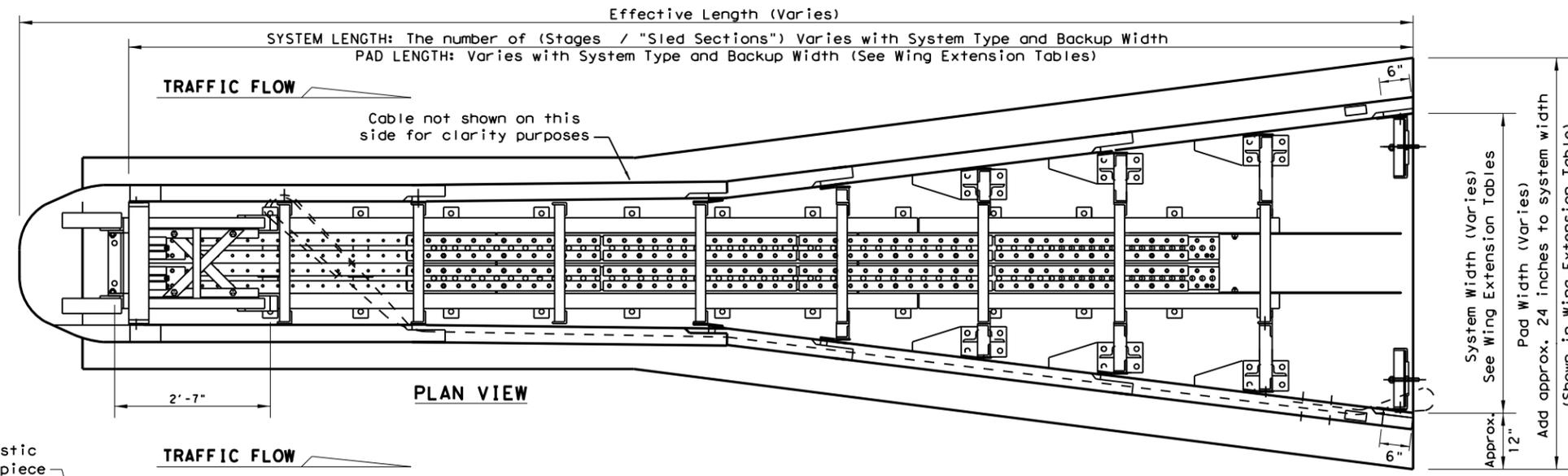
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Design Division Standard

LINDSAY TRANSPORTATION SOLUTIONS  
 UNIVERSAL  
 CRASH CUSHION  
 (MASH TL-3 & TL-2)  
 TAU(M) (N) - 19

FILE: tau19.dgn	DW: TxDOT	CK: KM	DW: VP	CK:
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TYPE (WIDE)	TEST LEVEL
FASTRACC (4 Stage System)	70
TRACC (3 Stage System)	TL-3
SHORTTRACC (2 Stage System)	TL-2

NOTE: The Stage System refers to number of replaceable "sled sections" that could be replaced independently.

Wide-FASTRACC WING EXTENSIONS				
NUMBER OF WING EXTENSIONS	WIDTH	SYSTEM LENGTH	EFFECTIVE LENGTH	Wide-FASTRACC EXTENSION PART NUMBER (LEFT# / RIGHT#)
0 (BASE UNIT)	71"	25'-11"	27'-11"	
1	78"	28'-3"	30'-3"	33940
2	85"	30'-7"	32'-7"	33941 / 33942
3	92"	32'-11"	34'-11"	33943 / 33944
4	99"	35'-2"	37'-2"	33945 / 33946
5	106"	37'-6"	39'-6"	33947 / 33948
6	113"	39'-10"	41'-10"	33949 / 33950
7	120"	42'-2"	44'-2"	33951 / 33952
8	127"	44'-5"	46'-5"	33953 / 33954
9	134"	46'-9"	48'-9"	33955 / 33956
10	141"	49'-1"	51'-1"	33957 / 33958
10+				CONSULT TRINITY SALES PERSON

Wide-TRACC WING EXTENSIONS				
NUMBER OF WING EXTENSIONS	WIDTH	SYSTEM LENGTH	EFFECTIVE LENGTH	Wide-TRACC EXTENSION PART NUMBER (LEFT# / RIGHT#)
0 (BASE UNIT)	58"	21'	23'	
1	65"	23'-4"	25'-4"	33940
2	72"	25'-8"	27'-8"	33941 / 33942
3	79"	28'	30'	33943 / 33944
4	86"	30'-4"	32'-4"	33945 / 33946
5	92"	32'-8"	34'-8"	33947 / 33948
6	99"	35'	37'	33949 / 33950
7	106"	37'-4"	39'-4"	33951 / 33952
8	113"	39'-8"	41'-8"	33953 / 33954
9	120"	42'	44'	33955 / 33956
10	127"	44'-4"	46'-4"	33957 / 33958
10+				CONSULT TRINITY SALES PERSON

Wide-SHORTTRACC WING EXTENSIONS				
NUMBER OF WING EXTENSIONS	WIDTH	SYSTEM LENGTH	EFFECTIVE LENGTH	Wide-SHORTTRACC EXTENSION PART NUMBER (LEFT# / RIGHT#)
0 (BASE UNIT)	39"	15'	17'	
1	46"	17'-4"	19'-4"	33940
2	53"	18'-9"	20'-9"	33941 / 33942
3	60"	21'-1"	23'-1"	33943 / 33944
4	66"	23'-5"	25'-5"	33945 / 33946
5	73"	25'-8"	27'-8"	33947 / 33948
6	80"	28'-1"	30'-1"	33949 / 33950
7	87"	30'-4"	32'-4"	33951 / 33952
8	94"	32'-7"	34'-7"	33953 / 33954
9	101"	34'-11"	36'-11"	33955 / 33956
10	108"	37'-3"	39'-3"	33957 / 33958
10+				CONSULT TRINITY SALES PERSON

Attachment and transitions to other shapes, barriers railings and bi-directional traffic flows are available. (See manufacturer's product manual).

BACKUP SUPPORT OPTIONS	
SQUARE CONCRETE BACKUP	
CONCRETE BARRIER (CTB) BACKUP	
SINGLE SLOPE CONCRETE BARRIER (SSCB)	
GUARDRAIL BACKUP (BASE-PLATED POST)	
GUARDRAIL BACKUP (DRIVEN POST)	
TRANSITION OPTIONS	
VERTICAL WALL	
MODIFIED (CTB) TO VERTICAL WALL	
CONCRETE BARRIER (CTB)	
GUARDRAIL (W-BEAM)	
GUARDRAIL (THRIE-BEAM)	

FOR BI-DIRECTIONAL TRANSITION PANEL DETAILS (SEE MANUFACTURER'S PRODUCT MANUAL).

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

FOUNDATION OPTIONS	
6" REINFORCED CONCRETE	
8" UNREINFORCED CONCRETE	
3" MIN. ASPHALT OVER 3" MIN. CONCRETE	
6" ASPHALT OVER 6" COMPACT SUBBASE	
8" MINIMUM ASPHALT	

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

**GENERAL NOTES**

- 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
- Contact the company for: Custom widths from 31" up to 57" wide, and transition panels for bi-directional traffic applications.
- Details of components for the WideTRACC, Backups and re-inforcing details will be shown on the manufacturer's shop drawings furnished to the Engineer.
- Concrete shall be class "S" with a min. compressive strength 4,000 p.s.i.
- If the cross-slope varies more than 2% over the length of the system, the concrete pad will require leveling. Maximum permissible cross-slope 8%.
- The installation area should be free from curbs, elevated objects, or depressions.
- The WideTRACC system should be approximately parallel with the barrier or  $\phi$  of merging barriers.
- The Unit shown is flared on both sides, but can be flared on a single side either left or right. The flares will effect the length and width of the system. (See Wing Extension Tables)

Wide-TRACC - BILL OF MATERIAL				
PART #	FAST TRACC QTY	TRACC QTY	SHORT TRACC QTY	DESCRIPTION
25937A	1			WIDEFASTRACC UNIT ASSEMBLY
25939A		1		WIDETRACC UNIT ASSEMBLY
25997A			1	WIDESHORTTRACC UNIT ASSEMBLY
3310G	4	4	4	5/8" LOCKWASHER
4372G	4	4	4	5/8" FLATWASHER
4451G	4	4	4	5/8" DIA X 6" EXP. WEDGE ANCHOR
6531B	1	1	1	PLASTIC NOSEPIECE
6668B	4	4	4	REFLECTIVE SHEETING

ANCHOR HARDWARE (CONCRETE BASE)				
5204B	72	50	18	5/8" DIA X 7-1/16" THD ANCHOR STUD
4372G	72	50	18	5/8" FLATWASHER
3310G	72	50	18	5/8" LOCKWASHER
3361G	72	50	18	5/8" HEX NUT
5206B	6	4	2	Adhesive, Hilti Hit HY-150

ANCHOR HARDWARE (ASPHALT BASE)				
6380G	72	50	18	5/8" Dia x 18" Thd Anchor Stud
4372G	72	50	18	5/8" Flatwasher
3310G	72	50	18	5/8" Lockwasher
3361G	72	50	18	5/8" HEX NUT
5206B	15	11	4	ADHESIVE, HILTI HIT HY-150

ANCHOR HARDWARE (OPTIONAL ITEMS, AS NEEDED)				
5207B	A/R	A/R	A/R	NOZZLE, MIXER, HILTI HIT HY-150
5208B	A/R	A/R	A/R	EXT. TUBE, MIXER, HILTI HIT HY-150
5205B	A/R	A/R	A/R	DISPENSER GUN, HILTI HIT HY-150
5209B	A/R	A/R	A/R	DRILL BIT, 1/16", HILTI SDS

Design Division Standard

**TRINITY HIGHWAY**  
**CRASH CUSHION**  
**(WIDE UNIT)**  
**TRACC (W) - 16**

FILE: tracw16.dgn	DW: TxDOT	CK: KM	DW: VP	CK: VP
© TxDOT February 2006	CONT	SECT	JOB	HIGHWAY
REVISIONS	6399	15	001	SH99
REVISED 06, 2013 (VP)	DIST	COUNTY	SHEET NO.	
REVISED 03, 2016 (VP)	BMT	LIBERTY, ETC.	111	

**REUSABLE**

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REFLECTOR UNIT SIZES FOR DELINEATORS AND OBJECT MARKERS				
DEVICE	SIZE 1	SIZE 2	SIZE 3	SIZE 4
SHEETING	Yellow, White or Red Type B or C reflective sheeting			
NOTE	1. Size 1 and 4 - Direct applied reflective sheeting for use on flexible post (fix). 2. Size 2 and 3 - For use on wing channel (wc) post only. Use approved metal, plastic or fiberglass backplate with 17/64" mounting holes.			

DELINEATORS				
DEVICE	SINGLE		DOUBLE	
SHEETING	Yellow, White or Red Type B or C Reflective Sheeting			
POST TYPE	WC	YFLX, WFLX	WC	YFLX, WFLX
MOUNT TYPE	GND	GND, SRF	GND	GND, SRF

D & OM DESCRIPTIVE CODES	
INSTL DEL ASSM	(D-XX)SZ X (XXXX)XXX (XX)
NUMBER OF REFLECTORS	S = Single D = Double
COLOR OF REFLECTORS	W = White Y = Yellow R = Red
REFLECTOR UNIT SIZE	1 or 2
TYPE OF POST OR DELINEATOR	WC = Wing Channel Post YFLX = Yellow Flexible Post WFLX = White Flexible Post BRF = Barrier Reflector
TYPE OF MOUNT	GND = Embedded (drivable or set in concrete) CTB = Concrete Barrier Mount GF1 or GF2 = Guard Fence Attachment SRF = Surface Mount
DIRECTION	If Required BI = Bi-Directional BR = Bi-Directional with red on back
INSTL OM ASSM	(OM-XX) (XXXX)XXX (XX)
TYPE OF OBJECT MARKER	1, 2, 3, or 4
NUMBER OF REFLECTORS OR DIRECTION	X = 3-Size 2 reflector units (Type 2 only) Y = 1-Size 3 reflector unit (Type 2 only) Z = 3-Size 1 or 1-Size 4 reflector unit(s) (Type 2 only) L = Left Side (Type 3 Object Marker only) R = Right Side (Type 3 Object Marker only) C = Center (Type 3 Object Marker only)
TYPE OF POST	WC = Wing Channel Post WFLX = White Flexible Post TWT = Thin Walled Tubing
TYPE OF MOUNT	GND = Embedded (drivable) SRF = Surface Mount WAS = Wedge Anchor Steel WAP = Wedge Anchor Plastic
DIRECTION	If Required BI = Bi-Directional

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

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

BARRIER REFLECTORS (BRF)			
DEVICE			
SHEETING	Yellow, White, Red		
NOTE	1. Barrier reflectors shall meet the requirements of DMS 8600. 2. Approved Barrier Reflectors are listed on the "Barrier Reflectors" Material Producer List at: www.txdot.gov.		

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"		
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.

**DELINATOR & OBJECT MARKER MATERIAL DESCRIPTION**  
**D & OM(1)-20**

FILE: dom1-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CR: TXDOT
© TXDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	6399	15	001	SH99
10-09 3-15	DIST	COUNTY	SHEET NO.	
4-10 7-20	BMT	LIBERTY, ETC.	112	

20A

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POST TYPE AND SUPPORT FOUNDATION DETAILS				TYPE OF BARRIER MOUNTS	
WING CHANNEL (WC)	FLEXIBLE POSTS (YFLX, WFLX)		WEDGE ANCHOR SYSTEMS		GUARD FENCE ATTACHMENT
GND	GND	SRF	WAS	WAP	GF 1
<p>Ground Line</p> <p>2'-0" Usual</p>	<p>Reflective material</p> <p>Post</p> <p>Stub</p>	<p>Reflective material</p> <p>Post</p> <p>Base</p>	<p>12" Dia.</p> <p>27" 30"</p>	<p>3" (Approx.)</p> <p>15"</p> <p>17" 20"</p> <p>12" Dia.</p> <p>3.5"</p> <p>17"</p> <p>30°</p> <p>2"</p> <p>1"</p>	<p>Centerline of MBCF rail element</p>
	EMBEDDED		SURFACE MOUNT	STEEL	PLASTIC
<b>NOTES</b> 1. Embedded Wing Channel (WC) post option may be used for Type 2 Object Markers and Delineators only. 2. 1.12 lbs/ft steel per ASTM A 1011 SS Gr. 50, or ASTM A499.	<b>NOTES</b> 1. See "Flexible Delineator and Object Marker Posts" Material Producer List for approved devices. 2. Install per manufacturer's recommendations. 3. Post length may vary to meet field conditions. 4. When using yellow delineators with flexible posts to separate opposing direction of travel, such as centerline or median use, the flexible posts shall be yellow.		<b>NOTE</b> 1. Install per manufacturer's recommendations.		

TYPE OF BARRIER MOUNTS	
GUARD FENCE ATTACHMENT	
GF 1	GF 2
	<p>Attached to post or block</p> <p>2'-6" Min.</p> <p>4" Min.</p> <p>4'-0"</p>

CONCRETE TRAFFIC BARRIER (CTB)	
<p>Place Barrier Reflector on top or on side(s) of CTB.</p>	

- GENERAL NOTES**
- Place delineators on a section of roadway at a consistent distance from the edge of pavement.
  - Where a restriction prevents consistent placement from the pavement edge, place the affected object markers in line with the innermost edge of the obstruction.
  - 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.
  - Install all delineators, object markers and barrier reflectors in accordance with the manufacturer's recommendation.
  - Barrier reflectors should be installed a minimum of 18 inches above the edge of the pavement surface.
  - Diagonal stripes on Type 3 object markers shall slope down toward the intended travel lane.

TYPES 1,3, AND 4 OBJECT MARKERS AND CHEVRONS
<p>4'-0"</p> <p>Pavement surface</p> <p>Ground Line</p>
<b>NOTE</b> Mounting at 4 feet to the bottom of the chevron is permitted for chevrons that will not exceed a height of 6'-6" to the top of the chevron (sizes 24" x 30" and smaller)

CHEVRONS AND ONE DIRECTION LARGE ARROW SIGN
<p>7'-0"</p> <p>Pavement surface</p> <p>Ground Line</p>
<b>NOTE</b> Chevrons 30" x 36" and larger shall be mounted at a height of 7' to the bottom of the chevron. Chevron sign and ONE DIRECTION LARGE ARROW sign (W1-9T) shall be installed per SMD standard sheets and paid under item 644.

DELINEATORS AND TYPE 2 OBJECT MARKERS
<p>Approximately 4'-0"</p> <p>Pavement surface</p> <p>Ground Line</p> <p>2'-0" to 8'-0" or in front of object being marked</p>
<b>NOTE</b> See general notes 1, 2 and 3.

		<b>Traffic Safety Division Standard</b>	
<h2>DELINEATOR &amp; OBJECT MARKER INSTALLATION</h2> <h3>D &amp; OM(2)-20</h3>			
FILE: dom2-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT
© TxDOT August 2004	CONT	SECT	JOB
REVISIONS	6399	15	001
10-09 3-15	DIST	COUNTY	SHEET NO.
4-10 7-20	BMT	LIBERTY, ETC.	113



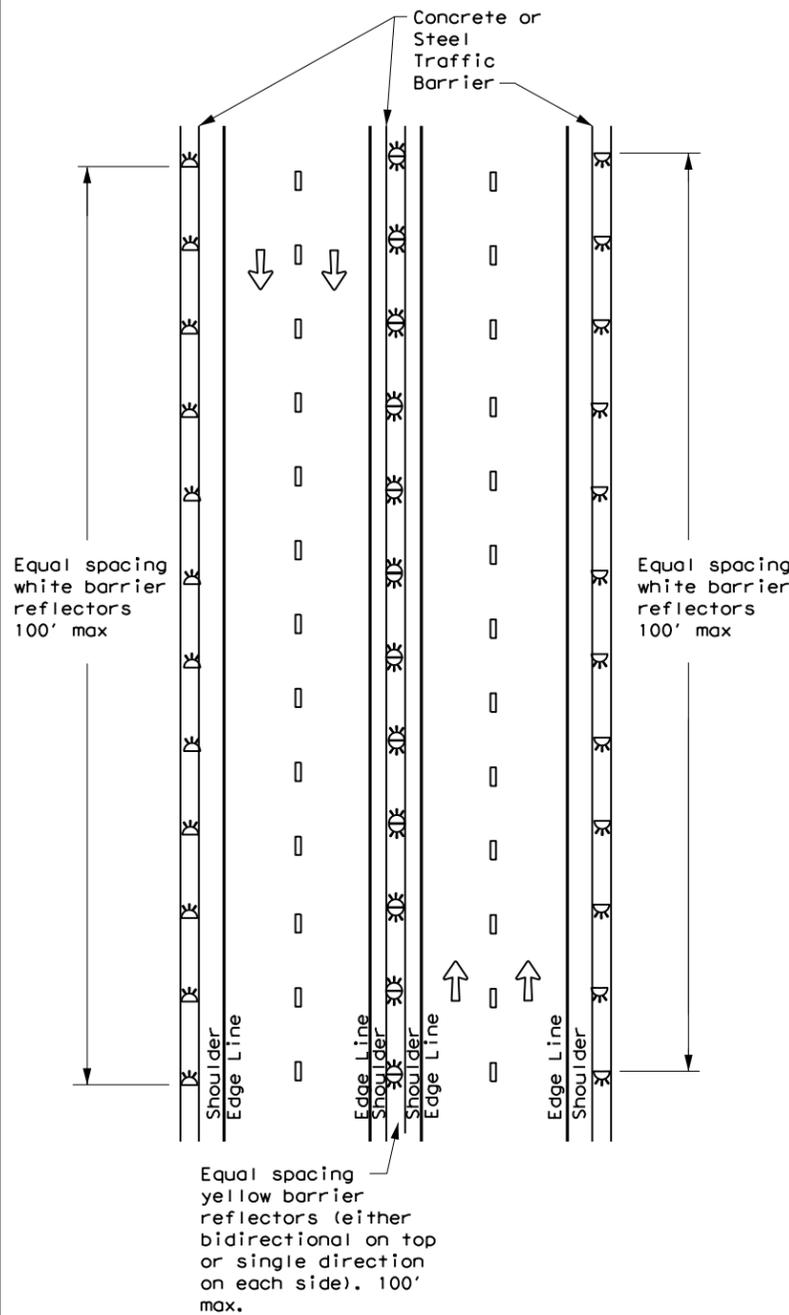




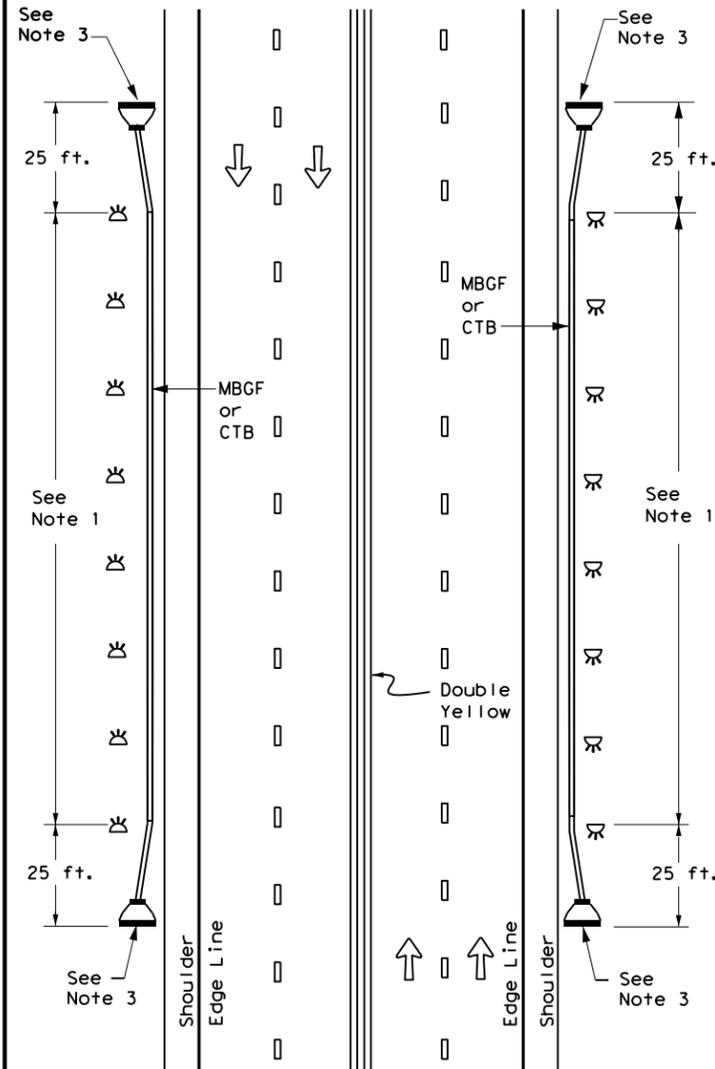
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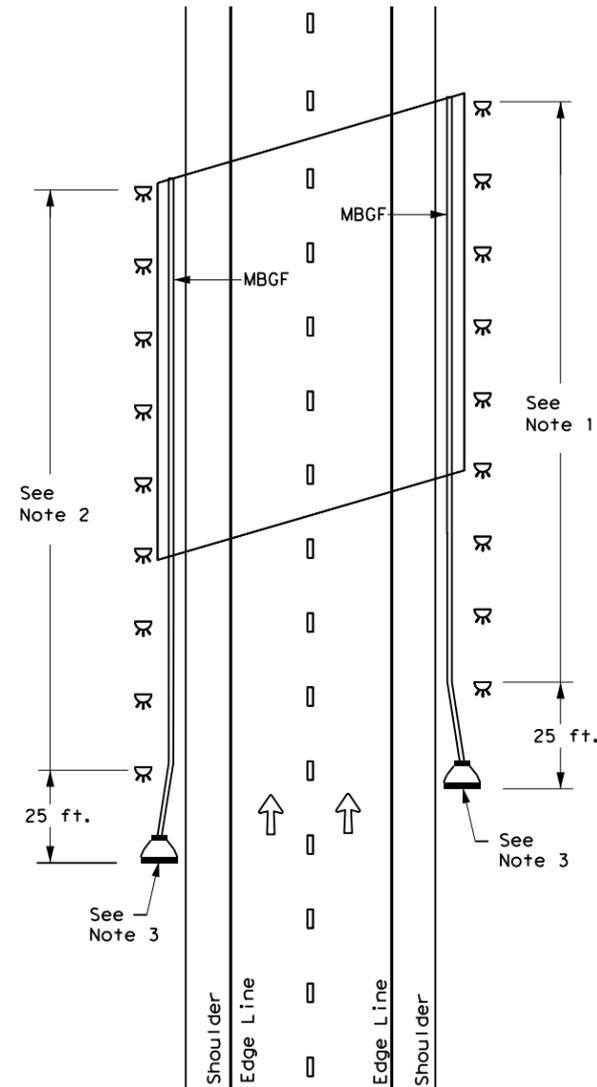
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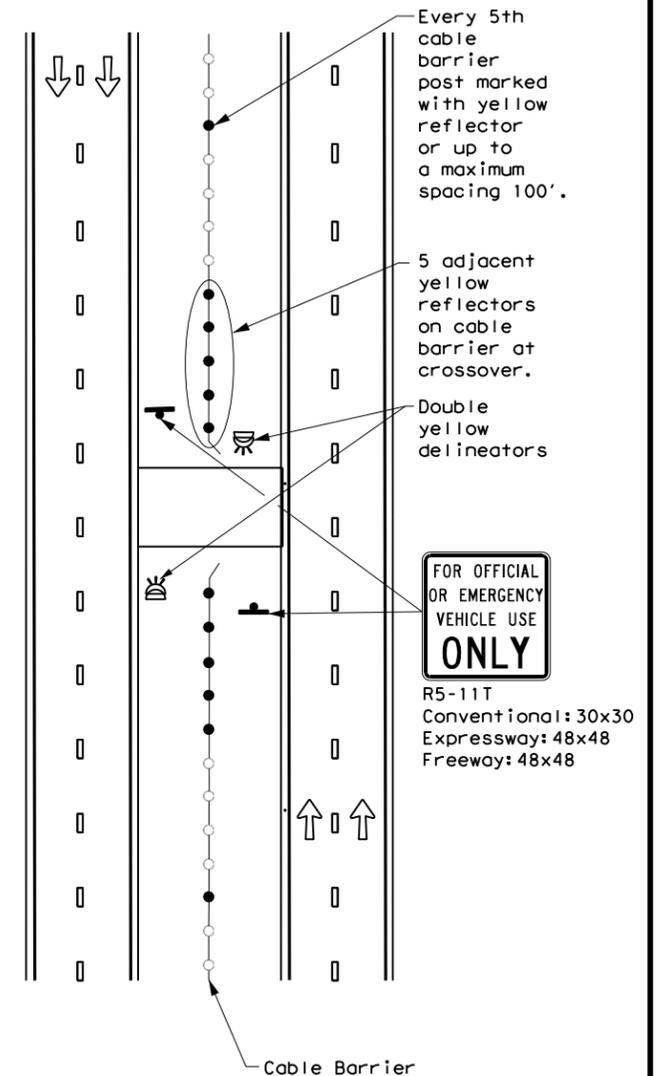
### MULTI-LANE UNDIVIDED, TWO-WAY ROADWAY WITH METAL BEAM GUARD FENCE (MBGF)



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



### EMERGENCY CROSSOVER



#### NOTES

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

#### LEGEND

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

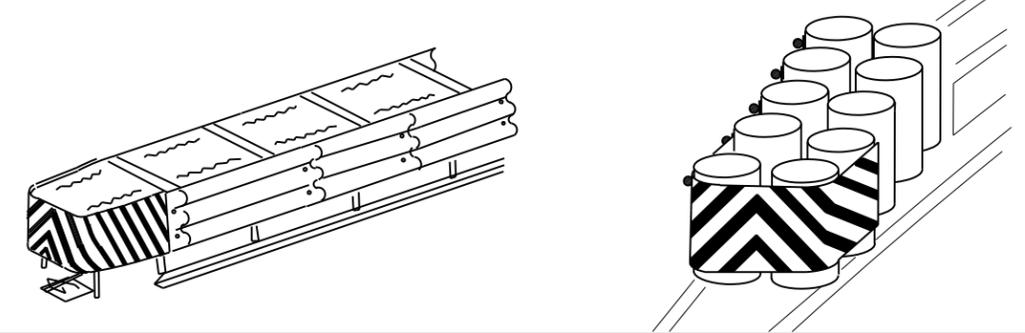
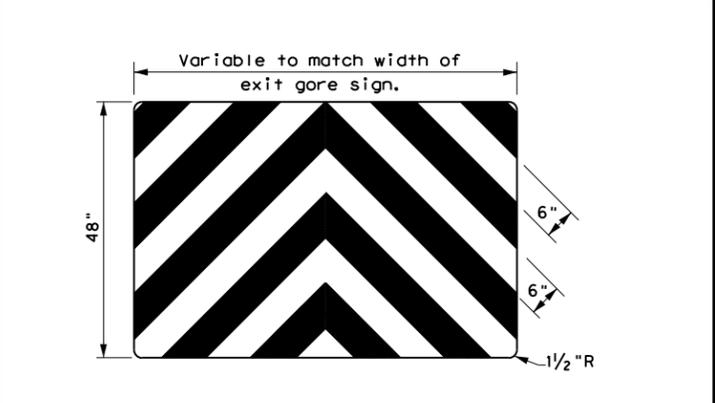
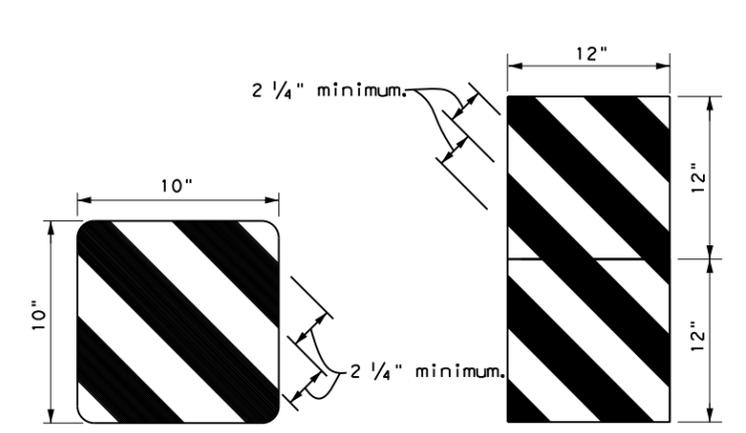
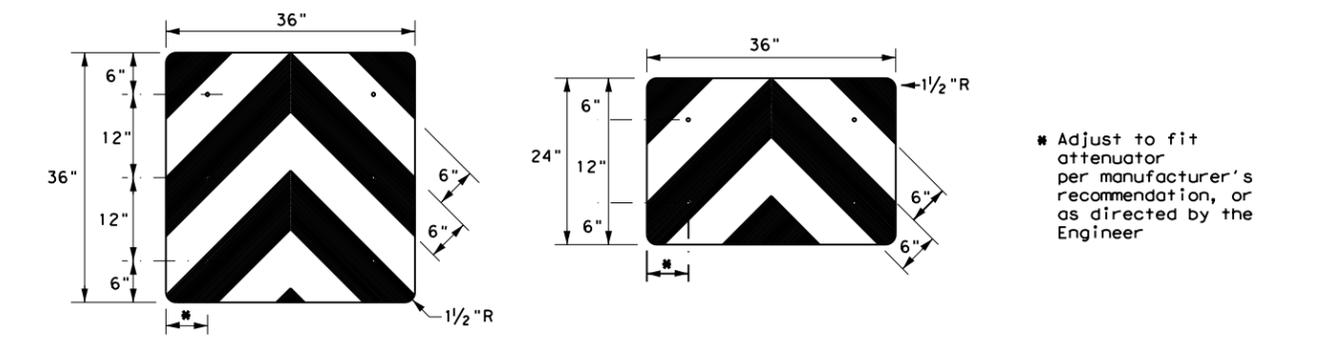
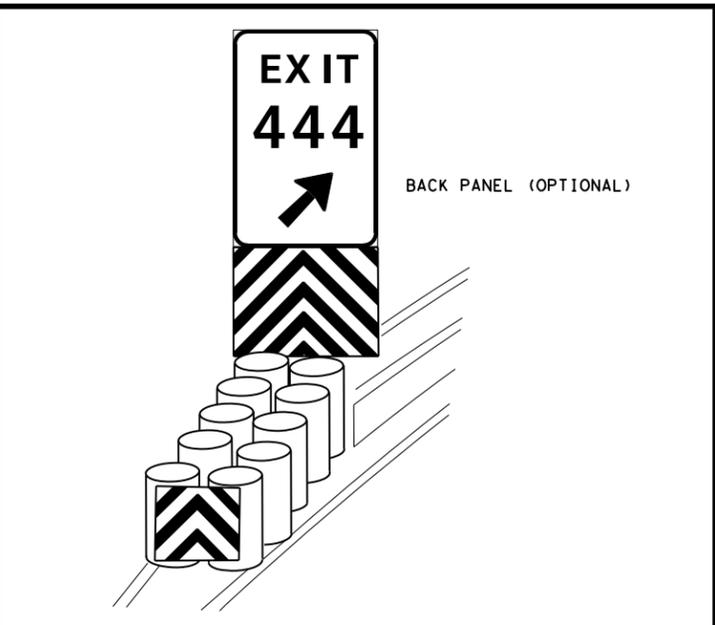
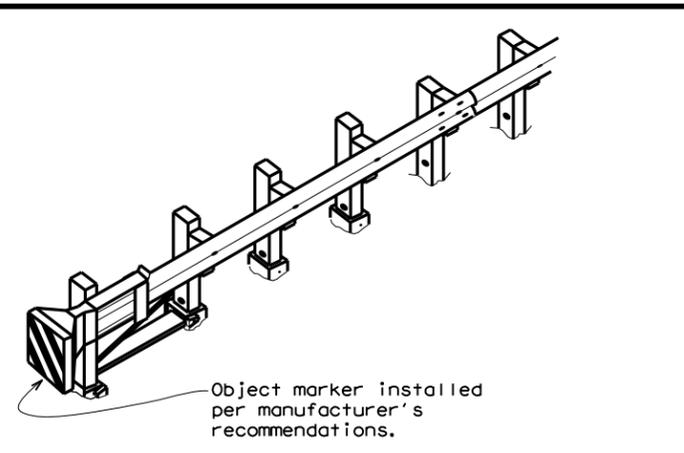
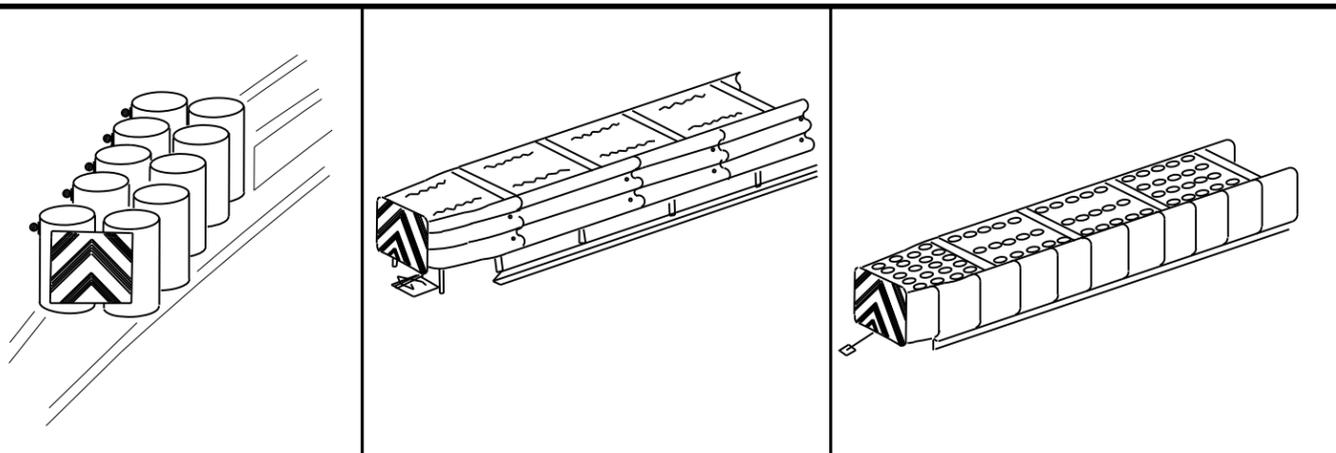


## DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

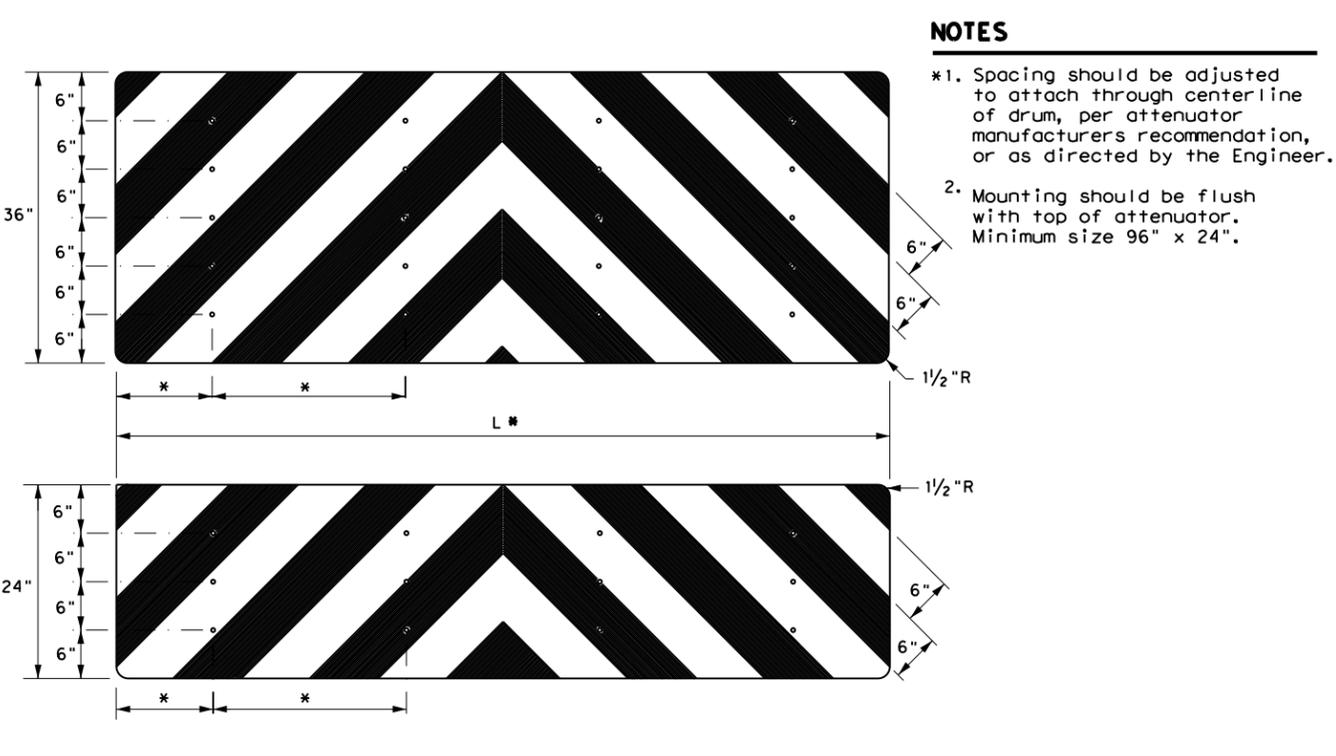
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© TxDOT August 2015	CONT	SECT	JOB	HIGHWAY
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7-20	DIST	COUNTY	SHEET NO.	
	BMT	LIBERTY, ETC.	117	

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



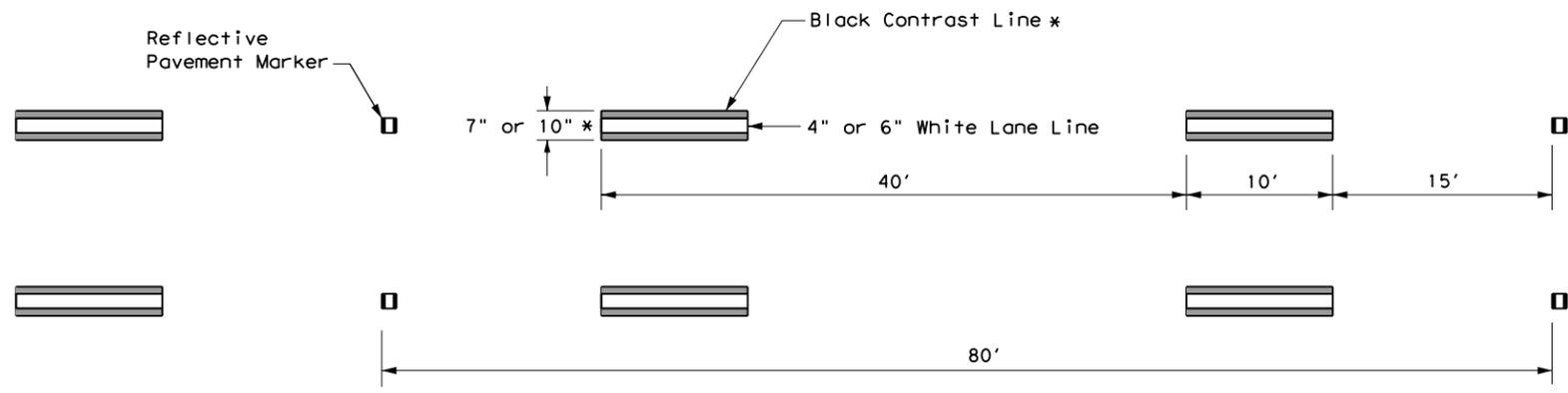
- NOTES**
- Spacing should be adjusted to attach through centerline of drum, per attenuator manufacturer's recommendation, or as directed by the Engineer.
  - Mounting should be flush with top of attenuator. Minimum size 96" x 24".

**NOTES**

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

		Traffic Safety Division Standard	
<b>DELINEATOR &amp; OBJECT MARKER FOR VEHICLE IMPACT ATTENUATORS</b> <b>D &amp; OM(VIA) -20</b>			
FILE: domvia20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT
© TXDOT December 1989	CONT	SECT	JOB
REVISIONS		6399 15	001
4-92 8-04	DIST	COUNTY	SHEET NO.
8-95 3-15	BMT	LIBERTY, ETC.	118
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20G			

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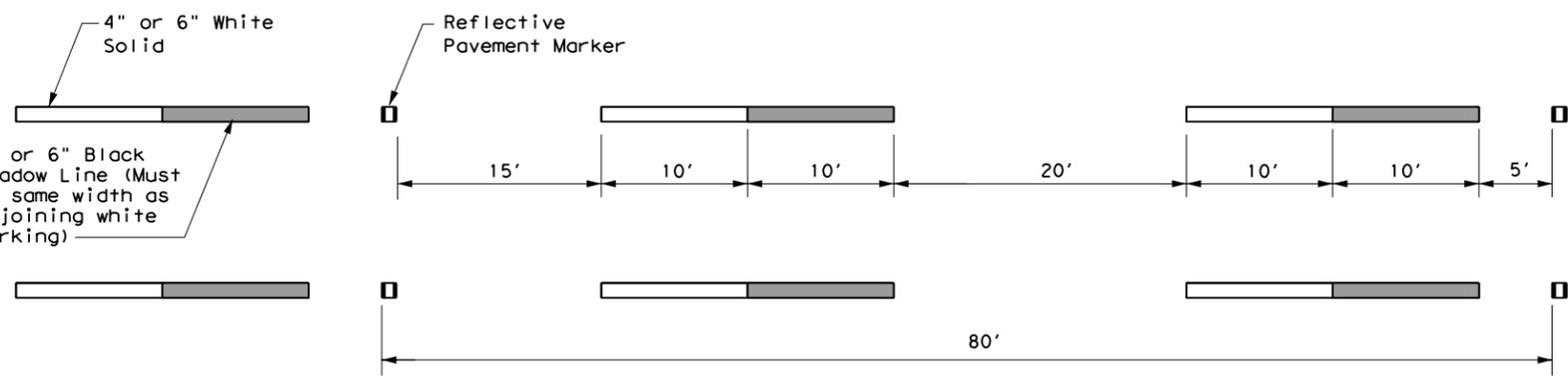
**CONTRAST LANE LINE DESIGN**

\* See contrast line dimensions table for width of black line.

CONTRAST LINE DIMENSIONS		
White	Black (per side)	Total Width
4"	1.5"	7"
6"	2"	10"

**GENERAL NOTES**

1. Contrast and Shadow markings may only be used on concrete pavements.
2. Contrast and Shadow markings shall not be used on edge lines.
3. Contrast lane lines shall be permanent prefabricated pavement markings meeting DMS 8240.
4. Shadow lane line designs shall be a liquid markings system approved by TxDOT.
5. All raised reflective pavement markers placed in broken lines shall be placed in line with and midway between the white stripes.
6. See PM(2) for raised reflective pavement markings installation details.



**SHADOW LANE LINE DESIGN**

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.



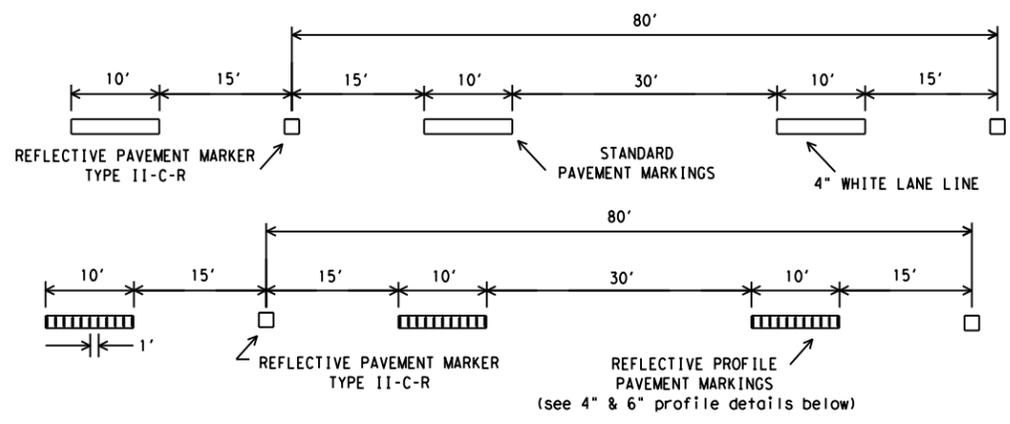
**CONTRAST AND SHADOW PAVEMENT MARKINGS**

**CPM(1) - 14**

FILE: CPM(1)14.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CR: TxDOT
© TxDOT May 2014	CONT	SECT	JOB	HIGHWAY
REVISIONS	6399	15	001	SH99
DIST	COUNTY		SHEET NO.	
BMT	LIBERTY, ETC.		119	

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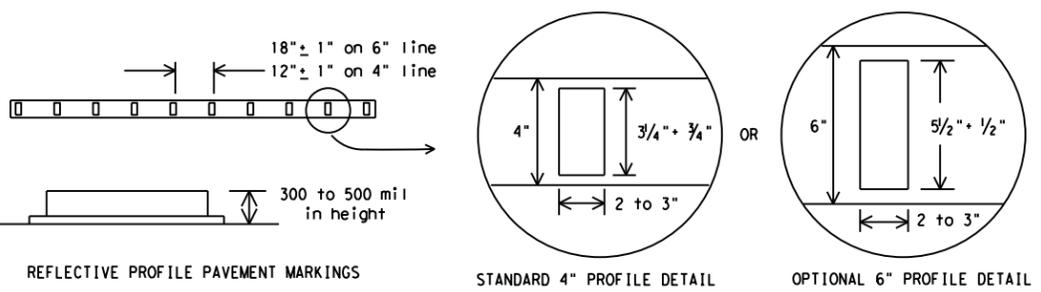
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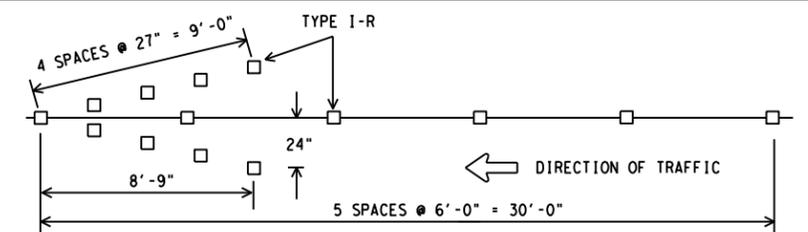
PAVEMENT MARKERS (REFL) TYPE II-C-R SHALL BE SPACED ON 80' CENTERS WITH THE CLEAR FACE TOWARD NORMAL TRAFFIC AND THE RED FACE TOWARD WRONG WAY TRAFFIC.

### TRAFFIC LANE LINES PAVEMENT MARKING DETAILS

EDGE LINES SHOULD TYPICALLY BE 4" WIDE AND THE MATERIALS SHALL BE AS SPECIFIED IN THE PLANS. IF RAISED PROFILE PAVEMENT MARKINGS ARE USED SEE DETAILS BELOW.

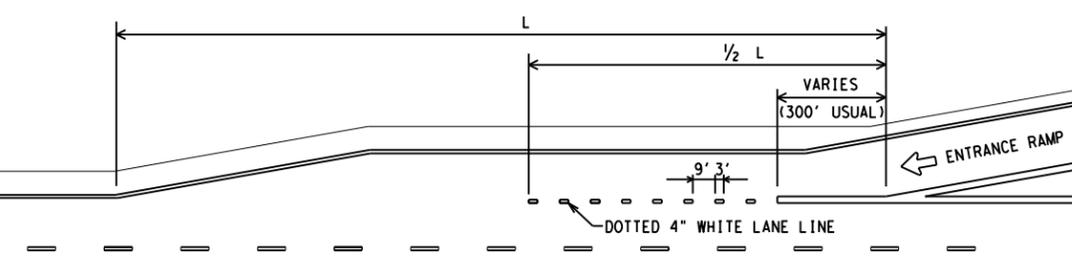


### EDGE LINE PAVEMENT MARKINGS

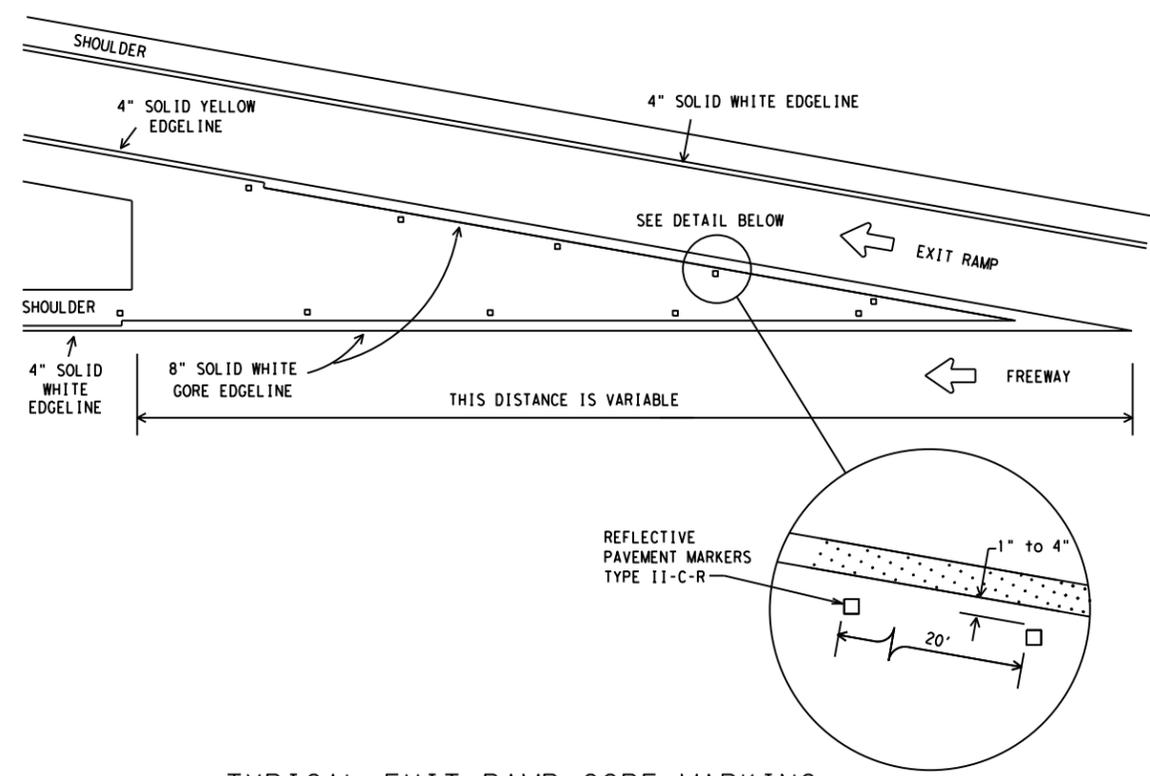


ALL RAISED MARKERS IN THE WRONG WAY ARROW SHALL BE TYPE I-R REFLECTORIZED PAVEMENT MARKERS WITH THE REFLECTORIZED SURFACE FACING THE WRONG WAY TRAFFIC. TYPE II-C-R SHALL NOT BE USED. REFLECTORIZED WRONG WAY ARROWS, NOT TO EXCEED TWO, MAY BE PLACED ON EXIT RAMP. LOCATION OF THE ARROWS SHALL BE AS SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER.

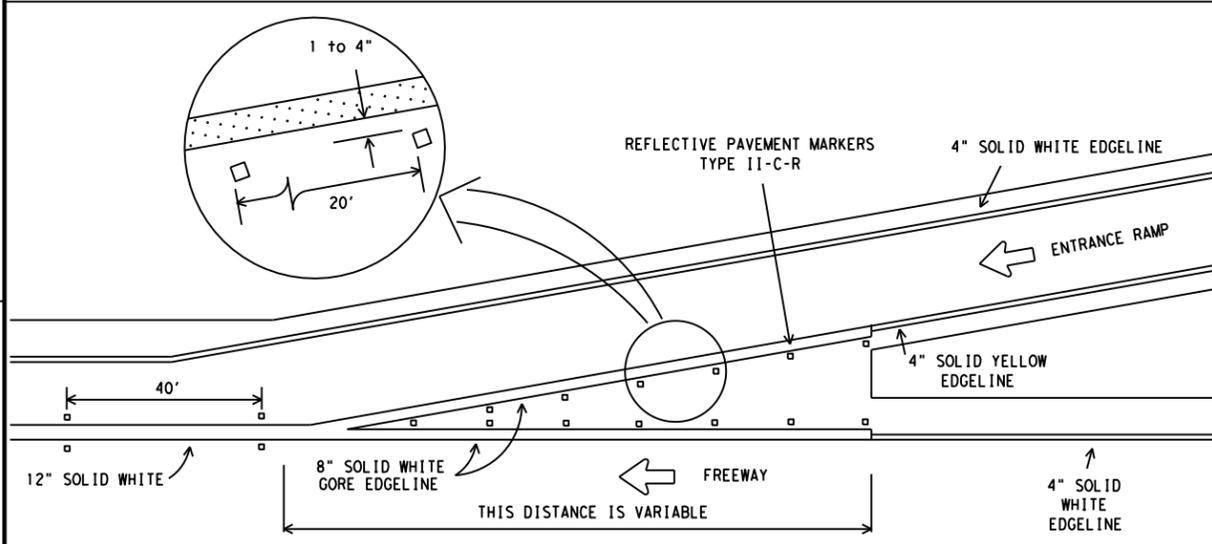
### WRONG WAY ARROW DETAIL



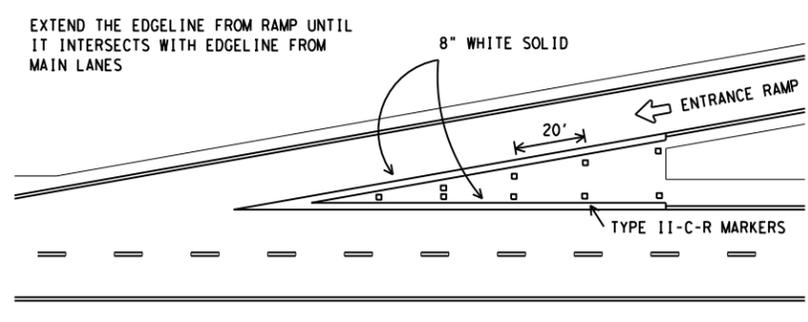
### PARALLEL ACCELERATION LANE



### TYPICAL EXIT RAMP GORE MARKING



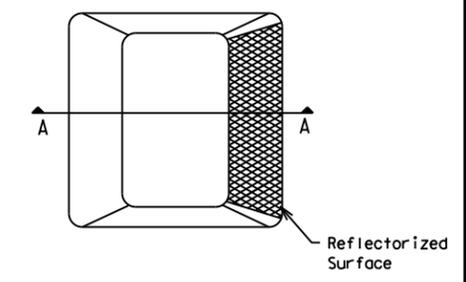
### TYPICAL ENTRANCE RAMP GORE MARKING



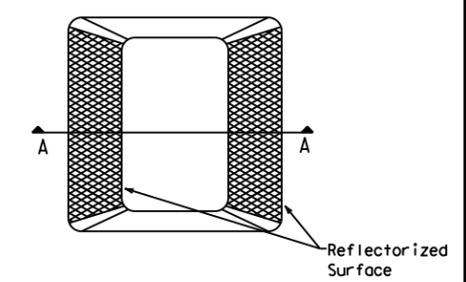
### TAPERED ACCELERATION LANE

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

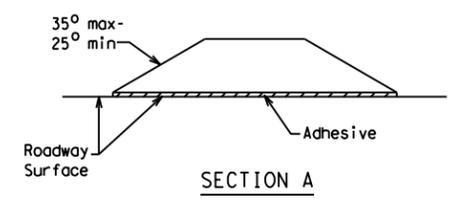
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



Type I (Top View)



Type II (Top View)



SECTION A

### RAISED PAVEMENT MARKERS

Texas Department of Transportation  
Traffic Operations Division

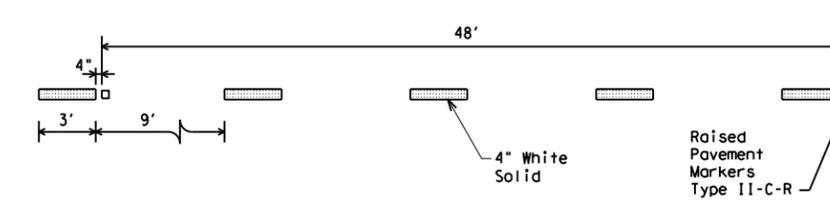
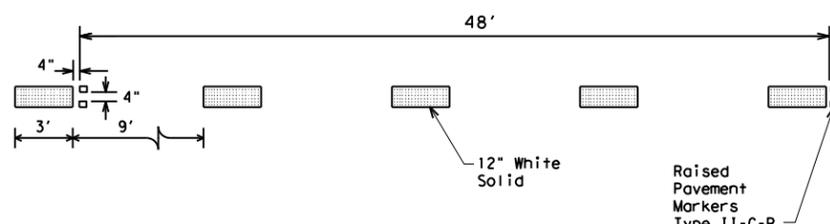
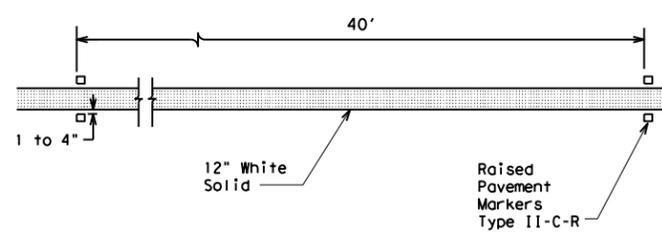
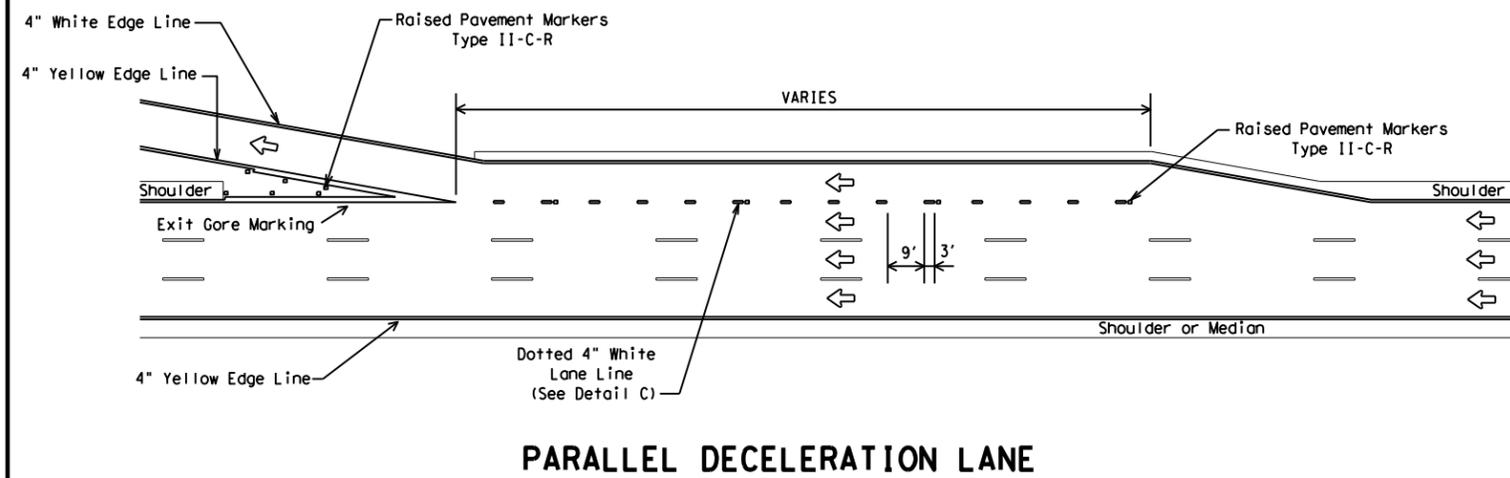
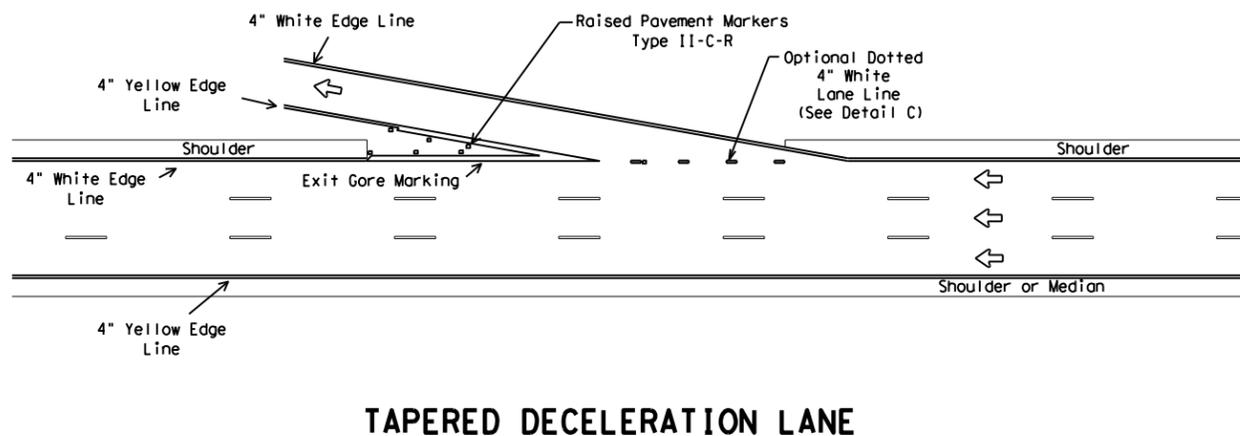
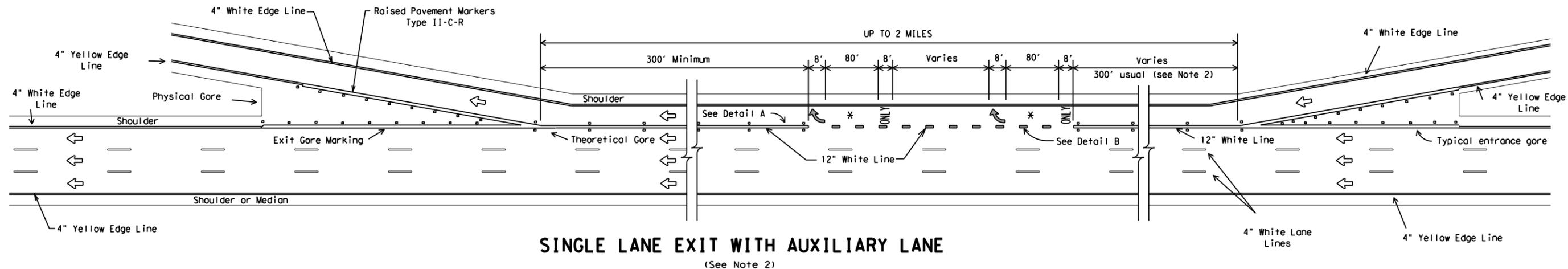
## TYPICAL STANDARD FREEWAY PAVEMENT MARKINGS WITH RAISED PAVEMENT MARKERS

FPM(1)-12

© TxDOT May 1974		DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
REVISIONS		CONT	SECT	JOB	HIGHWAY
4-92	2-10	6399	15	001	SH99
5-00	2-12	DIST		COUNTY	SHEET NO.
8-00		BMT		LIBERTY, ETC.	120
2-08					

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DATE: 5/12/2022 4:40:37 PM  
 FILE: D:\N\YEMB Docs\_Extensions\N\HAO FOLDERS\MAINTENANCE\RM\RM IN PROGRESS\RM\6399-15-001-SH99-Liberty\2-DGN\Standards\9-Pavement Markings & Delineator Standards\10-fpm2-12 (1).



**GENERAL NOTES**

1. Pavement markings shall be white except as otherwise noted.
2. Length of 12" white line may vary depending on location.
3. Wide (12") Dotted Lane Line (See Detail B) is used to separate a through lane from a lane drop at normal exit ramp and from an auxiliary lane between an entrance and exit ramp.
4. Normal (4") Dotted Lane Line (See Detail C) is used at parallel acceleration and deceleration lanes.

LEGEND	
←	Denotes direction of traffic.
↪	Pavement marking arrows (white)
*	Arrow markings are optional, however "ONLY" is required if arrow is used

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

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

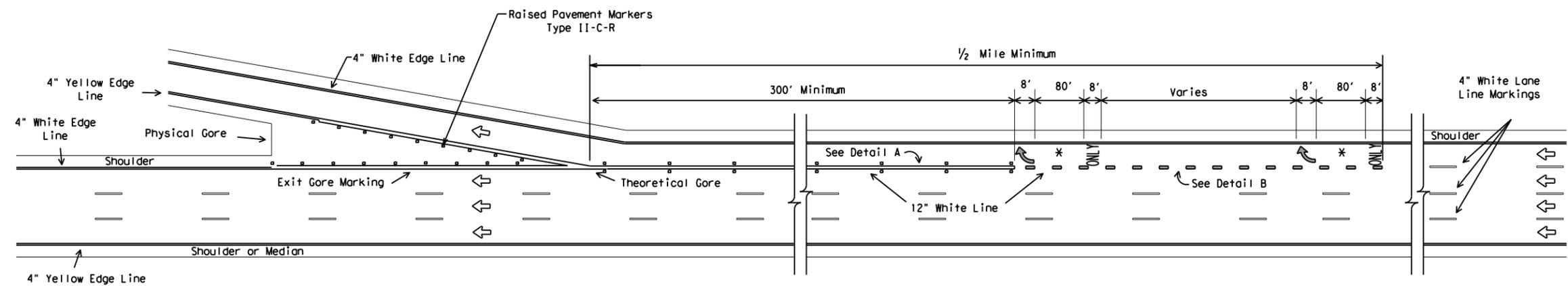


**TYPICAL STANDARD  
FREEWAY PAVEMENT MARKINGS  
ENTRANCE AND EXIT RAMP**  
**FPM(2)-12**

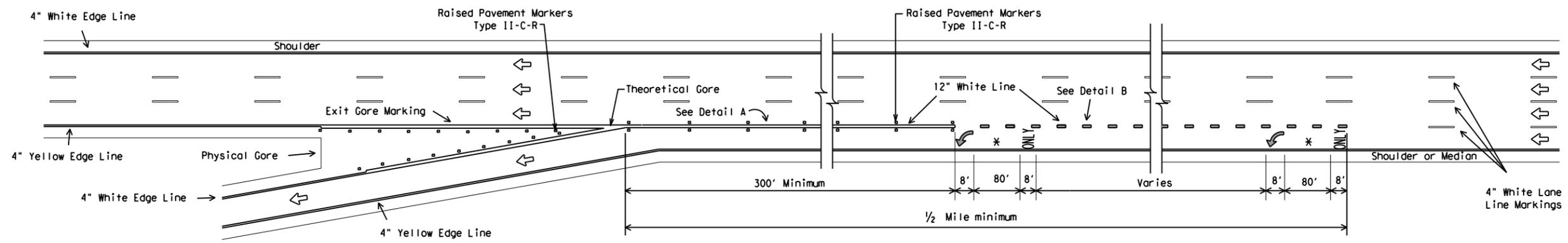
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8-95	2-12				
5-00					
8-00					
		DIST	COUNTY	SHEET NO.	
		BMT	LIBERTY, ETC.	121	

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**SINGLE LANE EXIT - LANE DROP OR EXIT ONLY**

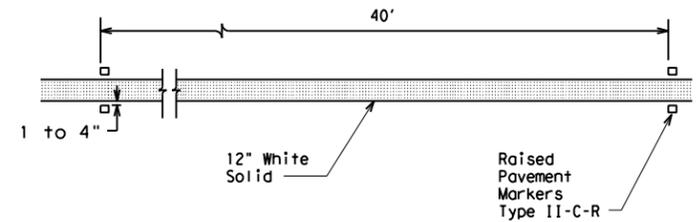


**SINGLE LANE EXIT - LANE DROP OR EXIT ONLY (LEFTHAND)**

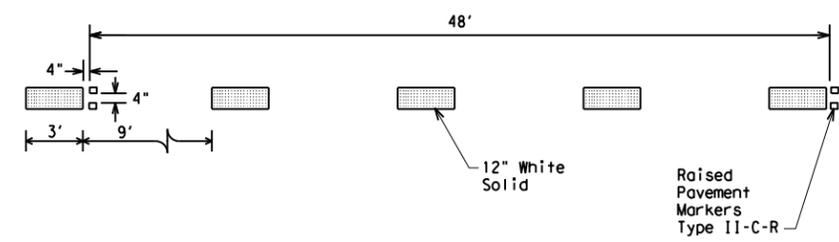
LEGEND	
←	Denotes direction of traffic.
↪	Pavement marking arrows (white)
✱	Arrow markings are optional, however "ONLY" is required if arrow is used

**GENERAL NOTES**

1. Pavement markings shall be white except as otherwise noted.
2. Length of 12" white line may vary depending on location.
3. Wide (12") Dotted Lane Line (See Detail B) is used to separate a through lane from a lane drop at normal exit ramp and from an auxiliary lane between an entrance and exit ramp.



**DETAIL A**



**DETAIL B**

Wide (12") Dotted Lane Line (See Note 3)

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

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

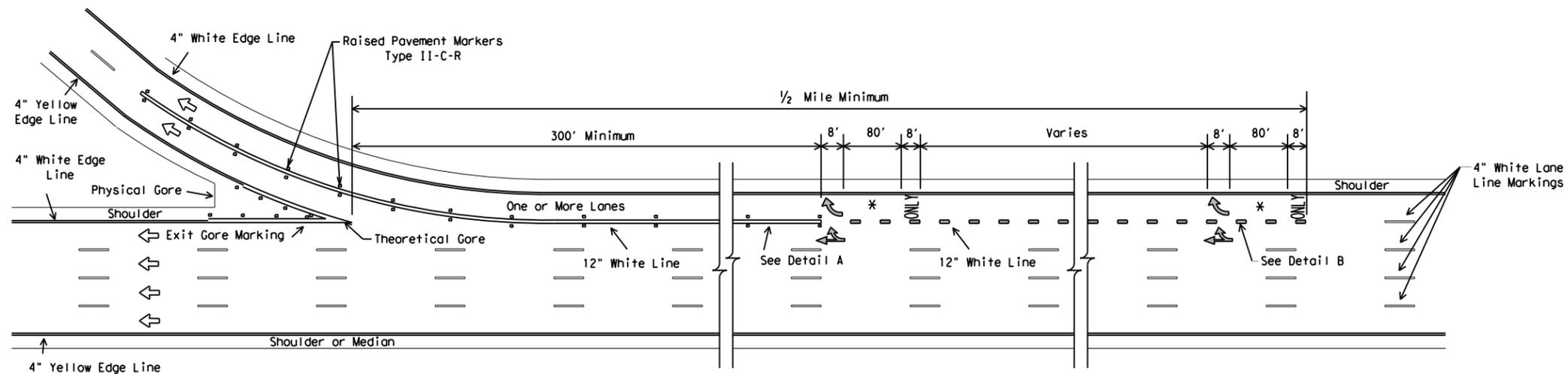


**TYPICAL STANDARD  
FREEWAY PAVEMENT MARKINGS  
LANE DROP (EXIT ONLY) EXIT RAMPS  
FPM(3) - 12**

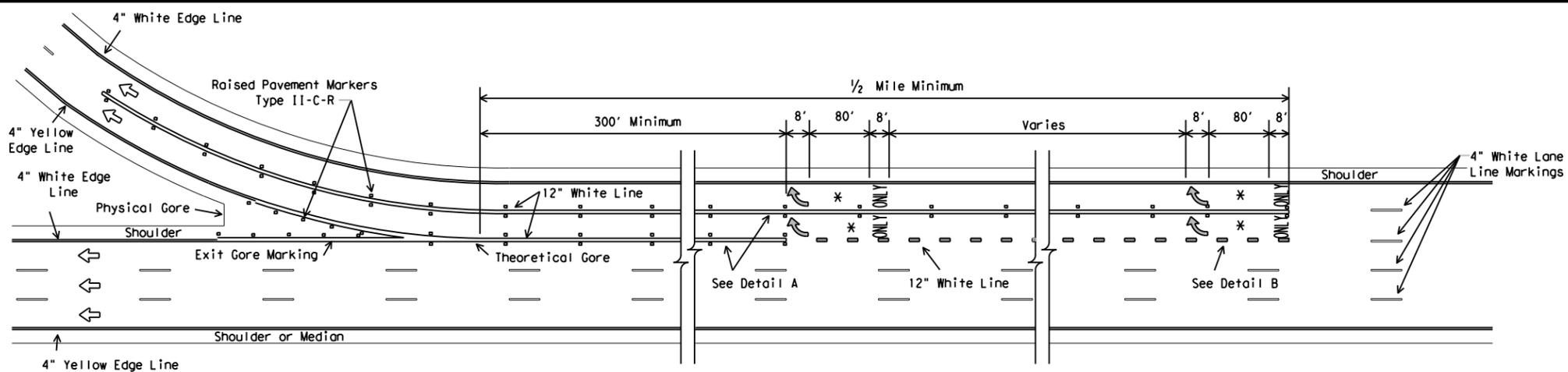
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8-00		6399	15	001	SH99
2-10		DIST		COUNTY	SHEET NO.
2-12		BMT		LIBERTY, ETC.	122

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DATE: 5/12/2022 4:40:41 PM  
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**MULTIPLE LANE EXIT - EXIT ONLY WITH OPTION LANE**

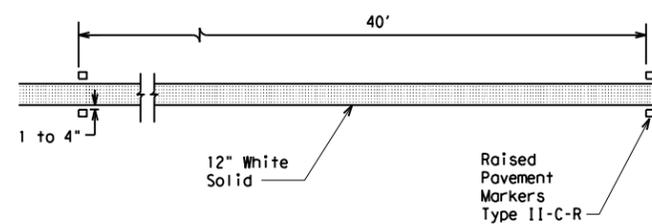


**MULTIPLE LANE EXIT ONLY**

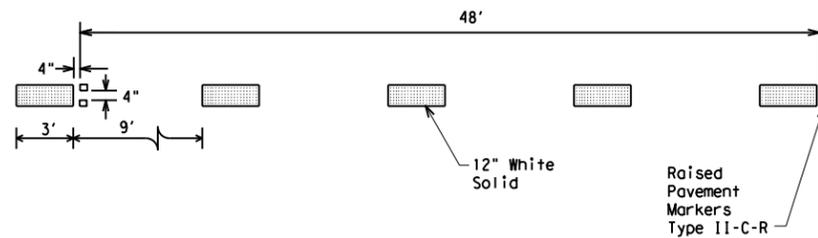
LEGEND	
	Denotes direction of traffic
	Pavement marking arrow (white)
	Optional Pavement Marking Arrows (white)
	Arrow markings are optional, however "ONLY" is required if arrow is used

**GENERAL NOTES**

1. Pavement markings shall be white except as otherwise noted.
2. Length of 12" white line may vary depending on location.
3. Wide (12") Dotted Lane Line (See Detail B) is used to separate a through lane from a lane drop at normal exit ramp and from an auxiliary lane between an entrance and exit ramp.



**DETAIL A**



**DETAIL B**

Wide (12") Dotted Lane Line (See Note 3)

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

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



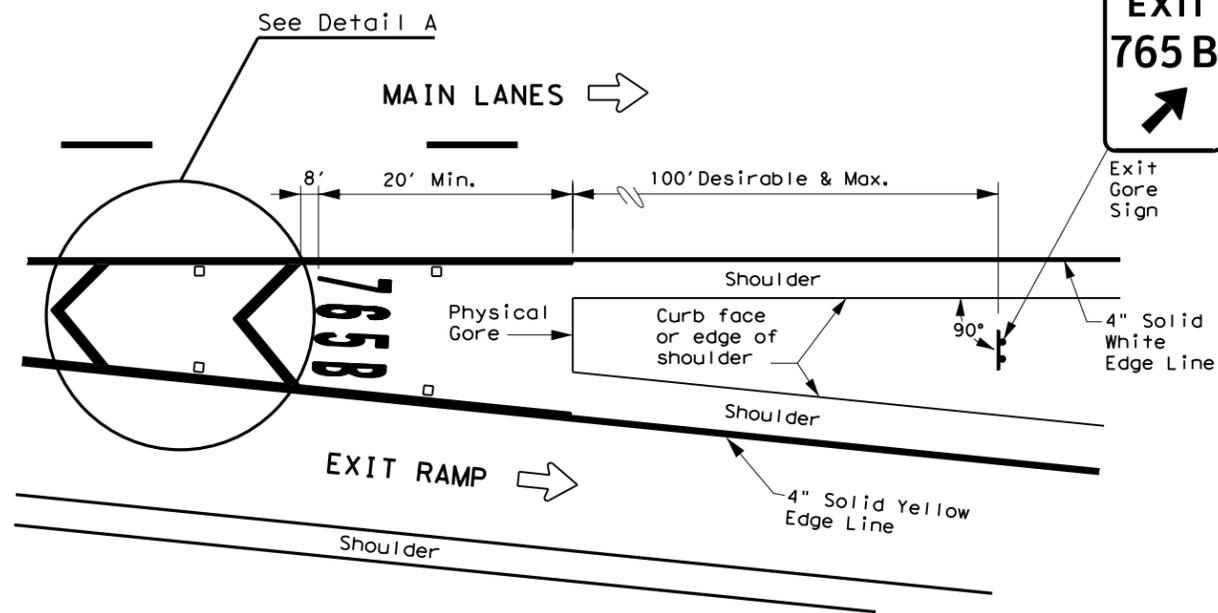
**TYPICAL STANDARD  
FREEWAY PAVEMENT MARKINGS  
LANE DROP (EXIT ONLY) DETAILS  
FPM(4) - 12**

© TxDOT April 1992		DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
REVISIONS					
CONT	SECT	JOB		HIGHWAY	
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8-00	DIST		COUNTY	SHEET NO.	
2-10	BMT		LIBERTY, ETC.	123	
2-12					

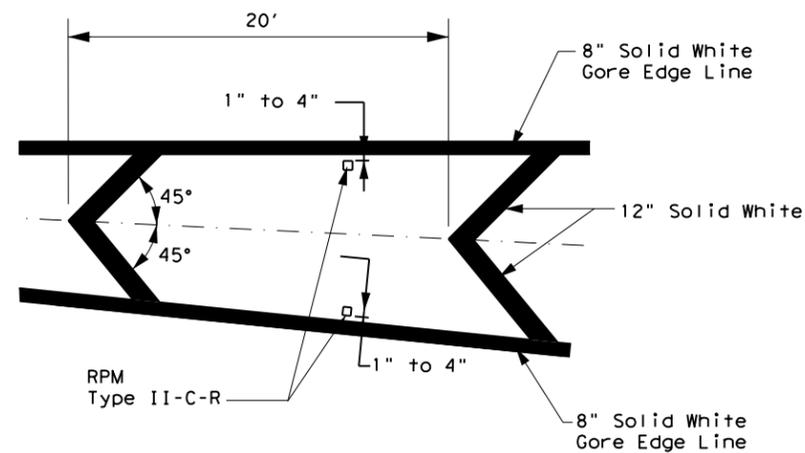
DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of units. The use of this standard is governed by the "Texas Engineering Practice Act". No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

**EXIT NUMBER PAVEMENT MARKING NOTES**

1. Minimum 8 foot white markings should be used, unless otherwise noted.
2. Spacing between letters and numbers should be approximately 4 inches.
3. Pavement markings are to be located as specified elsewhere in the plans.
4. All pavement marking materials shall meet the required Departmental Material Specifications or as specified in these plans.
5. Numbers and Letters details can be found in the Standard Highway Design for Texas (SHSD) Chapter 12 at <http://www.txdot.gov>



**MARKINGS WITH EXIT NUMBER**



**NOTES**

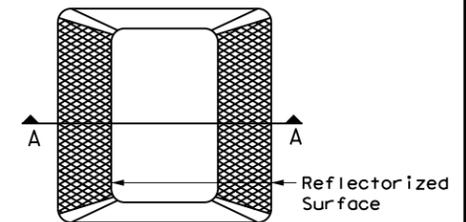
1. Raised pavement markers shall be centered between chevron or gore lines.
2. For more information, see ReflectORIZED Raised Pavement Marker Detail.

**DETAIL A**

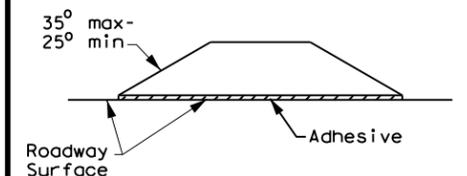
MATERIAL SPECIFICATIONS	
PAVEMENT MARKERS (REFLECTORIZED)	DMS-4200
EPOXY AND ADHESIVES	DMS-6100
BITUMINOUS ADHESIVE FOR PAVEMENT MARKERS	DMS-6130
TRAFFIC PAINT	DMS-8200
HOT APPLIED THERMOPLASTIC	DMS-8220
PERMANENT PREFABRICATED PAVEMENT MARKINGS	DMS-8240

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

LEGEND	
←	Traffic flow
□	ReflectORIZED Raised Markers (RPM) Type II-C-R

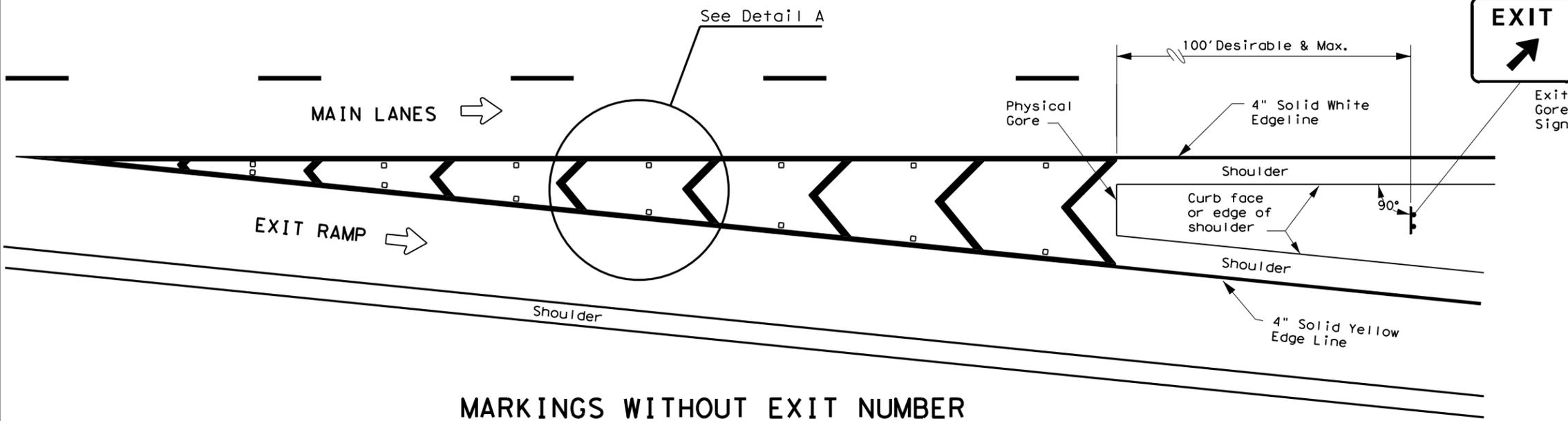


**Type II (Top View)**



**SECTION A**

**REFLECTORIZED RAISED PAVEMENT MARKER (RPM)**



**MARKINGS WITHOUT EXIT NUMBER**

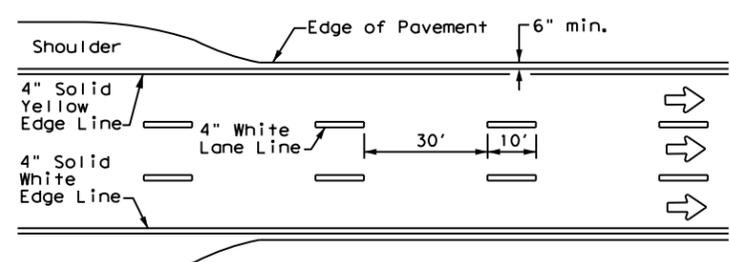


**EXIT GORE PAVEMENT MARKINGS**

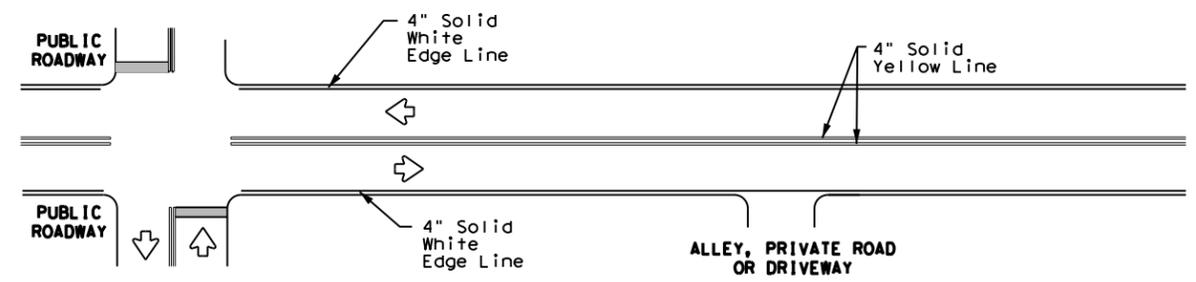
**FPM(5) - 19**

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© TxDOT September 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	6399	15	001	SH99
DIST	COUNTY	SHEET NO.		
BMT	LIBERTY, ETC.	124		

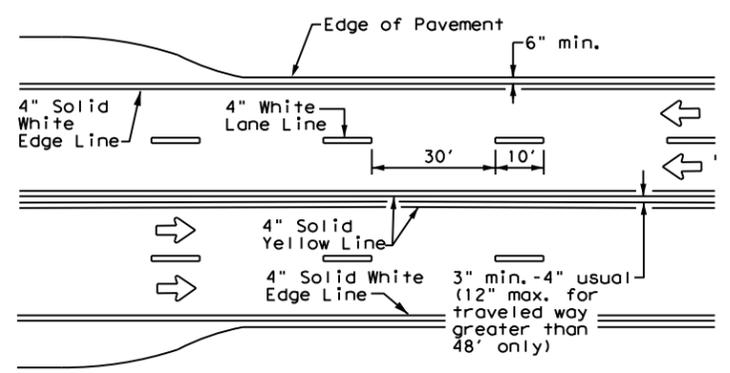
DATE: 5/12/2022 4:40:45 PM  
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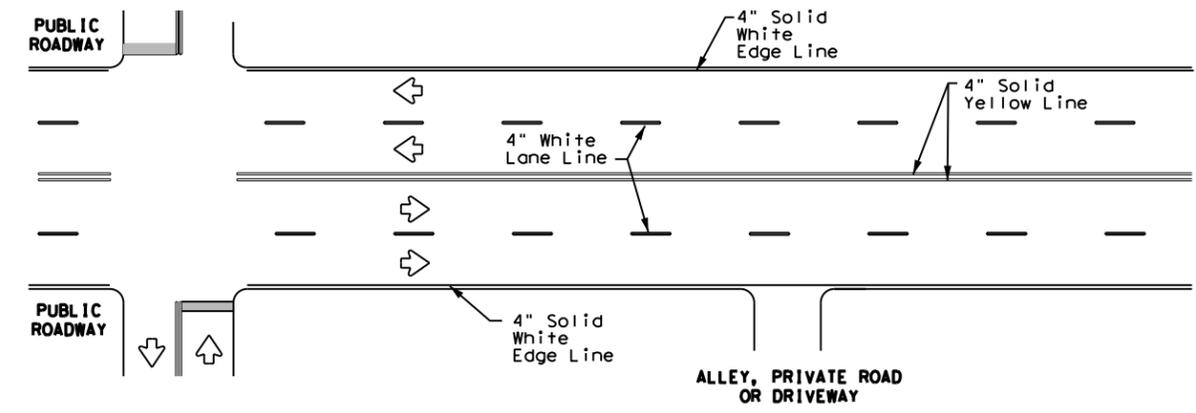
**EDGE LINE AND LANE LINES  
ONE-WAY ROADWAY  
WITH OR WITHOUT SHOULDERS**



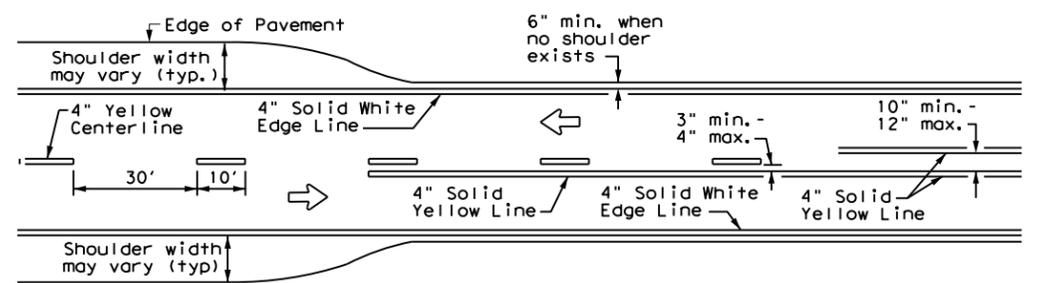
**TYPICAL TWO-LANE, TWO-WAY PAVEMENT  
MARKINGS THROUGH INTERSECTIONS**



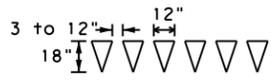
**CENTERLINE AND LANE LINES  
FOUR LANE TWO-WAY ROADWAY  
WITH OR WITHOUT SHOULDERS**



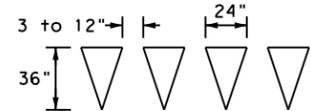
**TYPICAL MULTI-LANE, TWO-WAY PAVEMENT  
MARKINGS THROUGH INTERSECTIONS**



**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.

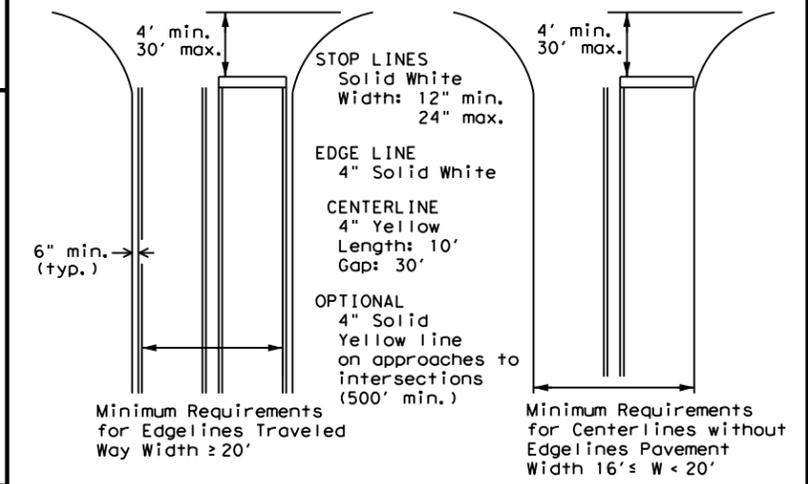
**YIELD LINES**

**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 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.

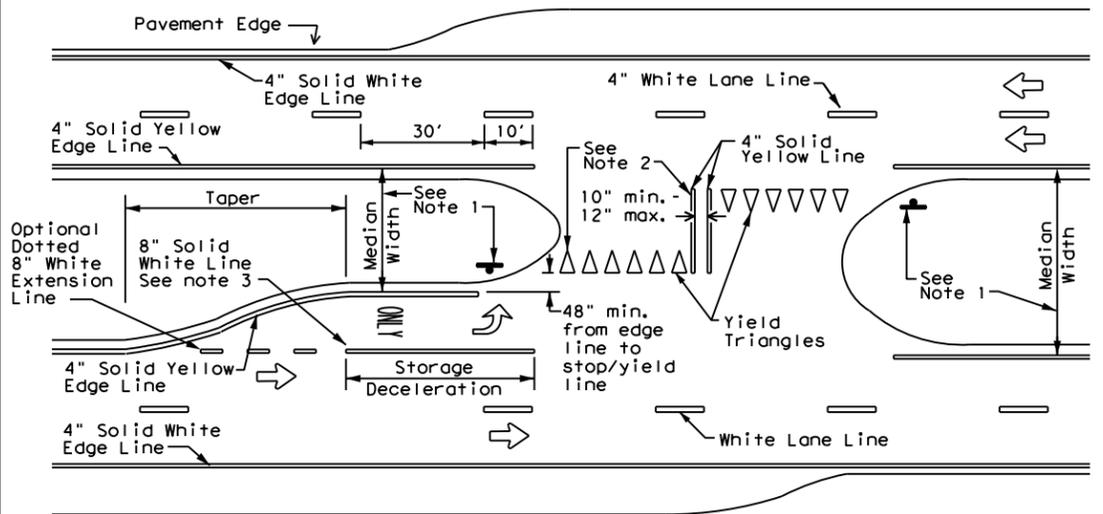


**GUIDE FOR PLACEMENT OF STOP LINES,  
EDGE LINE & CENTERLINE**

Based on Traveled Way and Pavement Widths for Undivided Highways

**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 triangles 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.



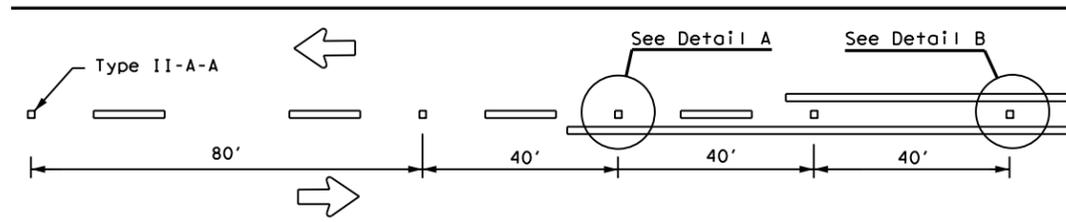
**FOUR LANE DIVIDED ROADWAY CROSSOVERS**

**TYPICAL STANDARD  
PAVEMENT MARKINGS**

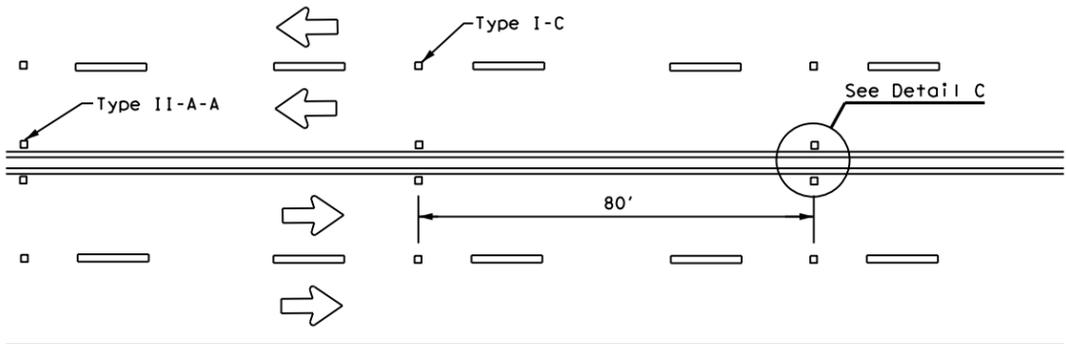
**PM(1)-20**

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© TxDOT November 1978	CONT	SECT	JOB	HIGHWAY
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5-00 2-12	DIST	COUNTY	SHEET NO.	
8-00 6-20	BMT	LIBERTY, ETC.	125	

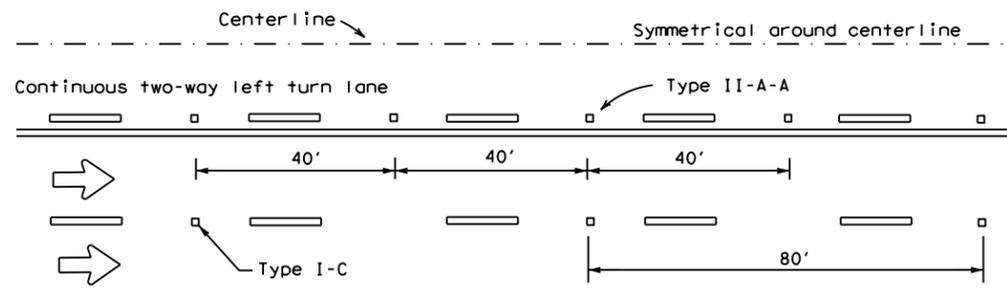
# REFLECTIVE RAISED PAVEMENT MARKERS FOR VEHICLE POSITIONING GUIDANCE



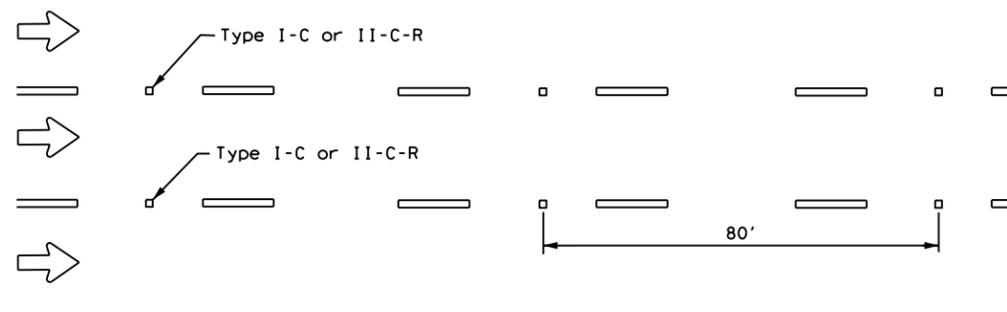
**CENTERLINE FOR ALL TWO LANE ROADWAYS**



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

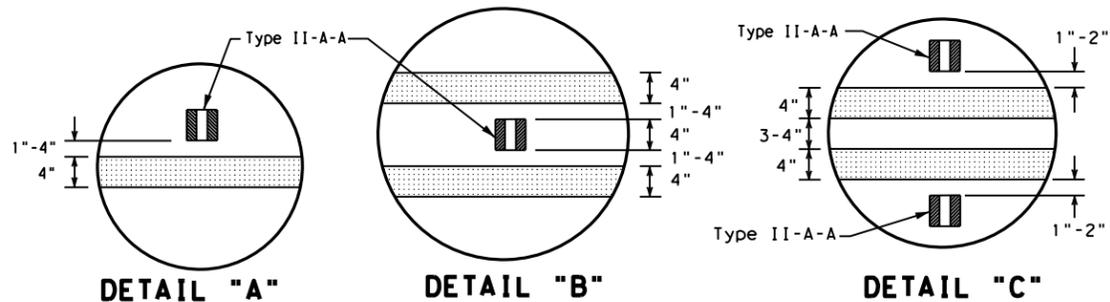


**CENTERLINE AND LANE LINES FOR TWO-WAY LEFT TURN LANE**



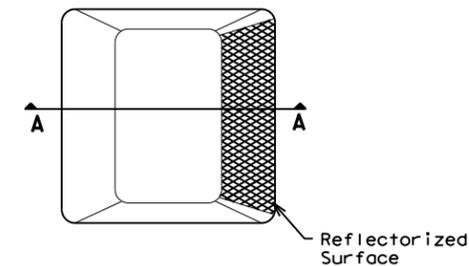
**LANE LINES FOR ONE-WAY ROADWAY (NON-FREEWAY FACILITIES)**

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

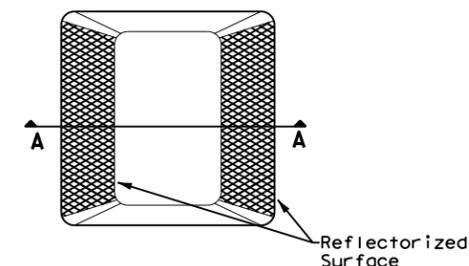


MATERIAL SPECIFICATIONS	
PAVEMENT MARKERS (REFLECTORIZED)	DMS-4200
EPOXY AND ADHESIVES	DMS-6100
BITUMINOUS ADHESIVE FOR PAVEMENT MARKERS	DMS-6130
TRAFFIC PAINT	DMS-8200
HOT APPLIED THERMOPLASTIC	DMS-8220
PERMANENT PREFABRICATED PAVEMENT MARKINGS	DMS-8240

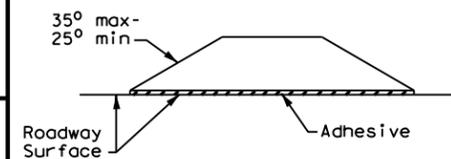
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



**Type I (Top View)**



**Type II (Top View)**

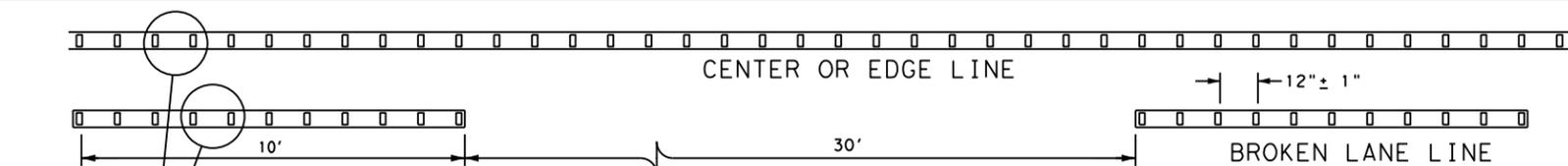


**SECTION A**

**RAISED PAVEMENT MARKERS**

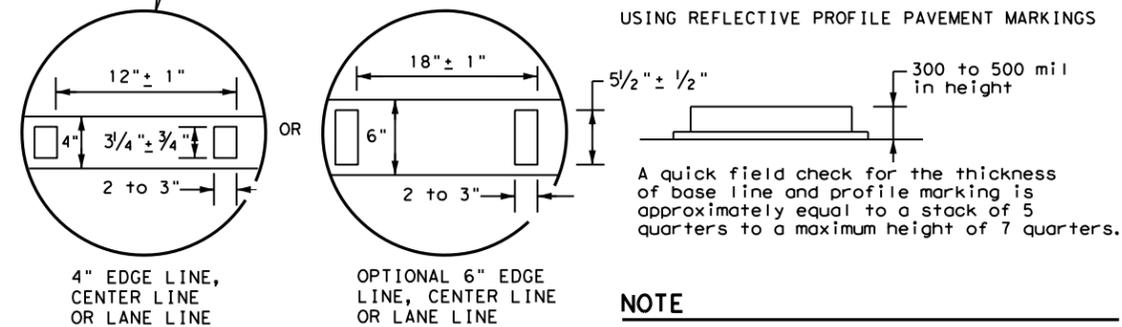
**GENERAL NOTES**

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



**REFLECTORIZED PROFILE  
PATTERN DETAIL**

USING REFLECTIVE PROFILE PAVEMENT MARKINGS



**NOTE**

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



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

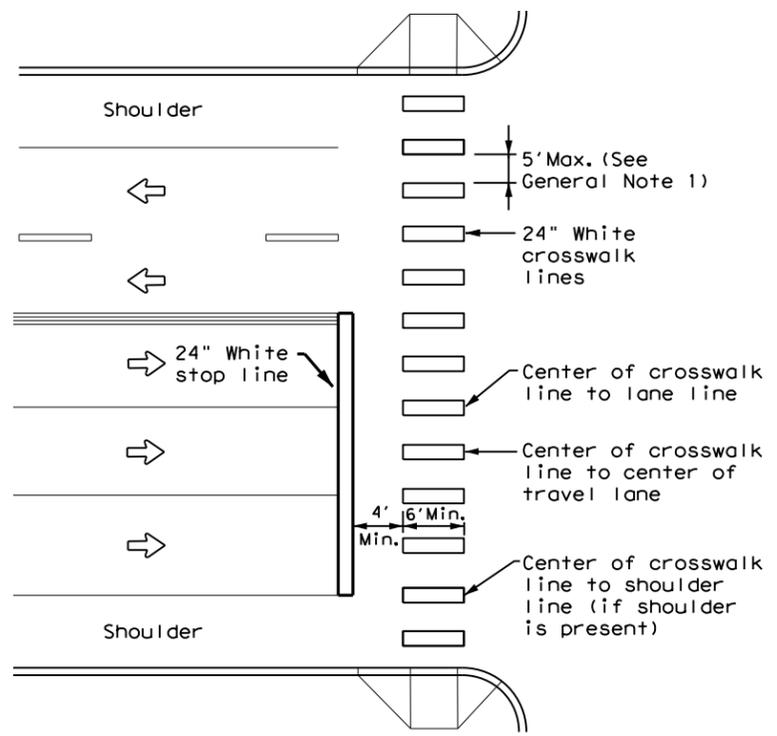
FILE: pm2-20.dgn	DN:	CK:	DW:	CK:
© TxDOT April 1977	CONT	SECT	JOB	HIGHWAY
4-92 2-10 REVISIONS	6399	15	001	SH99
5-00 2-12	DIST	COUNTY	SHEET NO.	
8-00 6-20	BMT	LIBERTY, ETC.	126	

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DATE: 5/12/2022 4:40:52 PM  
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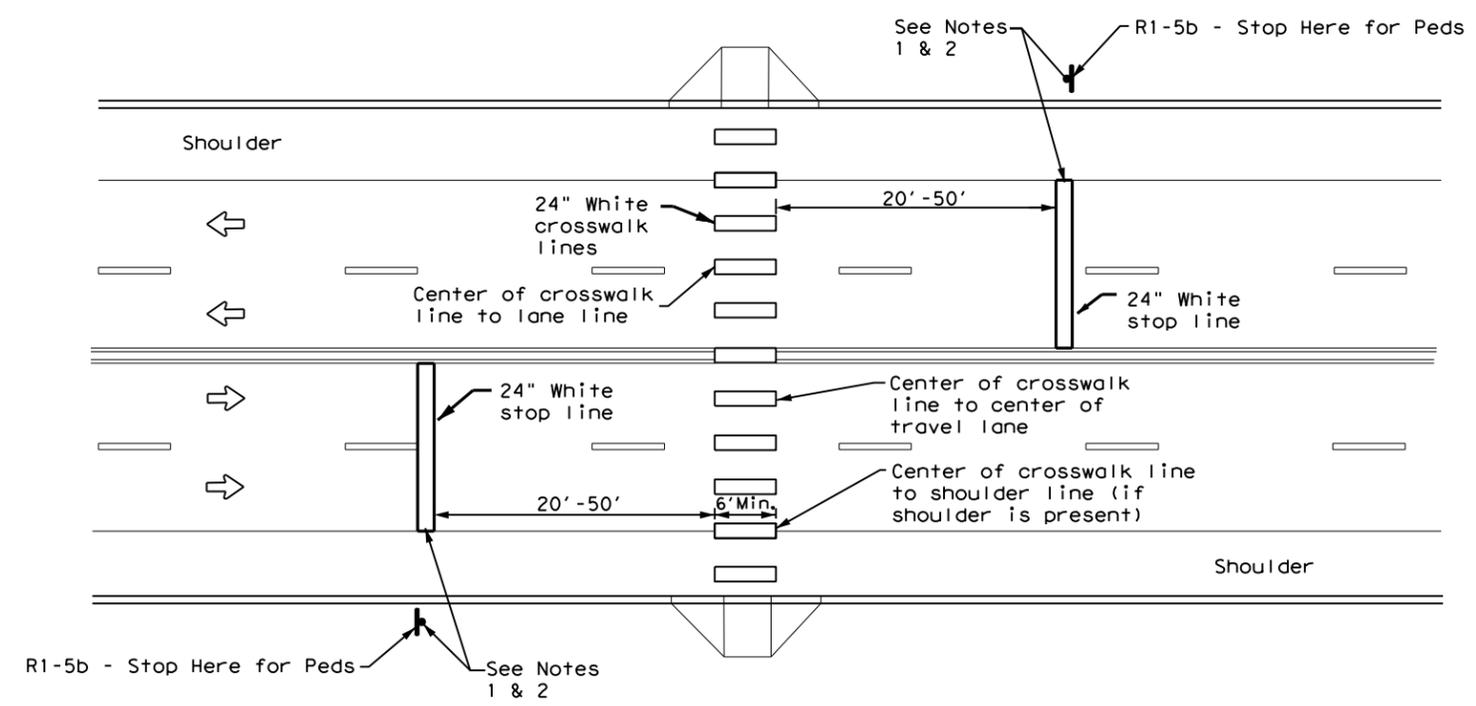
**HIGH-VISIBILITY LONGITUDINAL CROSSWALK AT CONTROLLED APPROACH**

**GENERAL NOTES**

1. Longitudinal crosswalk lines should not be placed in the wheel path of vehicles. Center the crosswalk lines on travel lanes, lane lines, and shoulder lines (if present).
2. A minimum 6" clear distance shall be provided to the curb face. If the last crosswalk line falls into this distance it must be omitted.
3. For divided roadways, adjustments in spacing of the crosswalk lines should be made in the median so that the crosswalk lines are maintained in their proper location across the travel portion of the roadway.
4. At skewed crosswalks, the crosswalk lines are to remain parallel to the lane lines.
5. Each crosswalk shall be a minimum of 6' wide.
6. The High-Visibility Longitudinal Crosswalk is the preferred crosswalk pattern on State Highways. Other crosswalk patterns as shown in the "Texas Manual on Uniform Traffic Control Devices" may be used. All crosswalk designs and dimension shall comply with the "Texas Manual on Uniform Traffic Control Devices."
7. Final placement of Stop Bar and Crosswalk shall be approved by the Engineer in the field.

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.

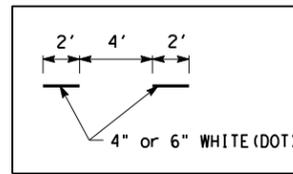


**UNSIGNALIZED MID BLOCK HIGH-VISIBILITY LONGITUDINAL CROSSWALK**

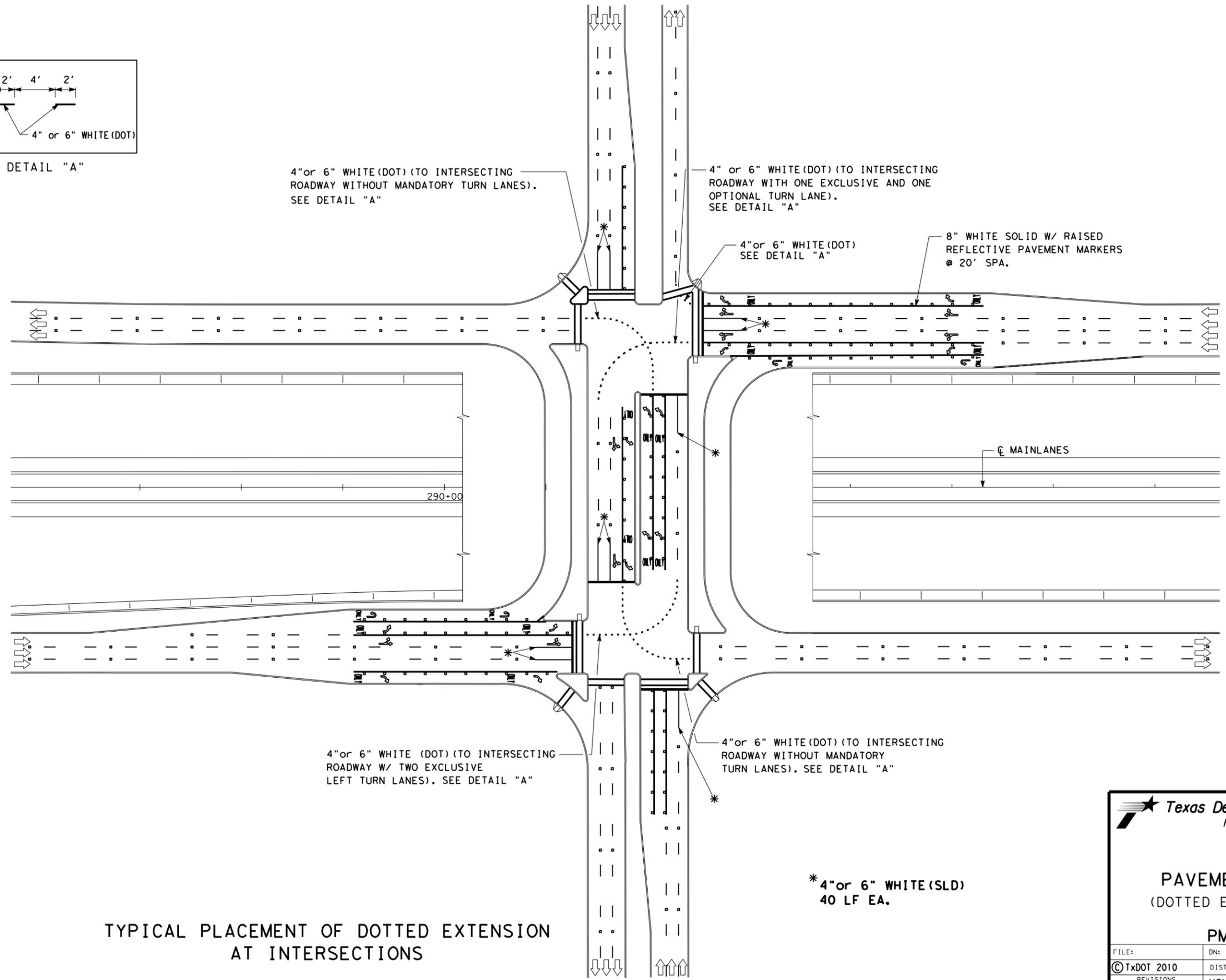
**NOTES:**

1. Use stop bars with "Stop Here for Pedestrians" signs at unsignalized mid block crosswalks.
2. Use stop bars with "Stop Here on Red" signs at mid block crosswalks controlled by traffic signals or pedestrian hybrid beacons.

		<b>Texas Department of Transportation</b>		<i>Traffic Safety Division Standard</i>	
<h2>CROSSWALK PAVEMENT MARKINGS</h2> <h3>PM(4) - 22</h3>					
FILE:	pm4-22.dgn	DN:	CK:	DW:	CK:
© TxDOT	June 2020	CONT	SECT	JOB	HIGHWAY
3-22	REVISIONS	6399	15	001	SH99
		DIST	COUNTY	SHEET NO.	
		BMT	LIBERTY, ETC.	128	



DETAIL "A"



TYPICAL PLACEMENT OF DOTTED EXTENSION AT INTERSECTIONS

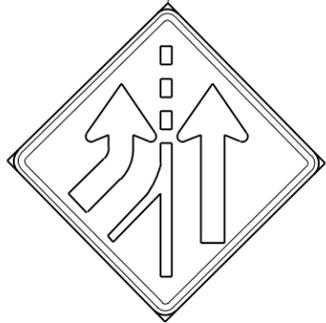
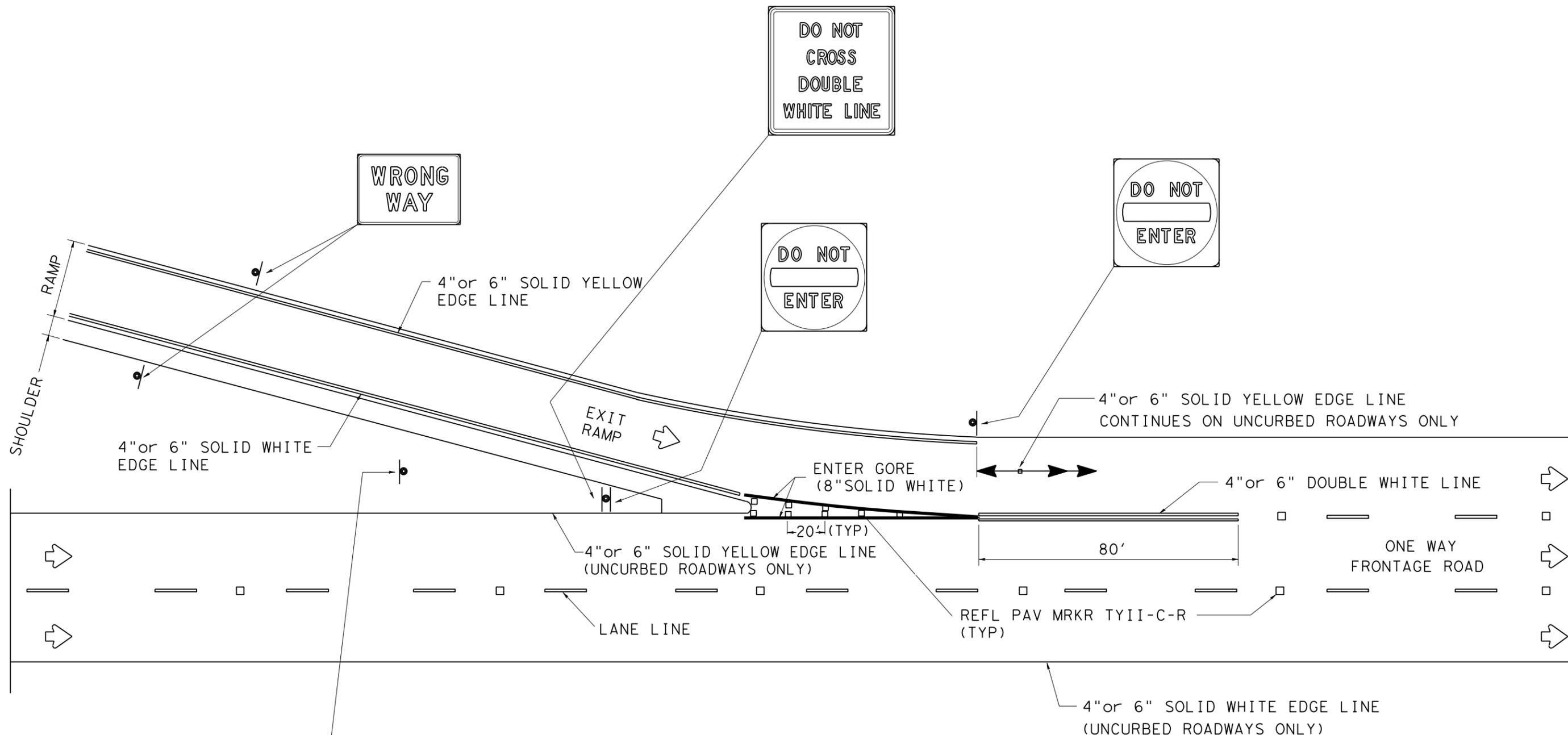


PAVEMENT MARKINGS  
(DOTTED EXTENSION DETAILS)

PM(DOT) - 11

FILE:	DN:	CK:	DW:	CK:
© TxDOT 2010	DIST	FED REG	PROJECT NO.	SHEET
4/2010	HOU	6	RMC6399-15-001	129
4/2011	COUNTY	CONTROL	SECT	JOB
	LIBERTY, ETC.	6399	15	001
				SH99

\* 4" or 6" WHITE (SLD)  
40 LF EA.



DRAWING SCALE: NONE

Texas Department of Transportation  
Houston District

SIGNING AND PAVEMENT MARKING DETAILS  
EXIT RAMPS-FRONTAGE ROAD

ER-FR(1)-09

FILE:	DN:	CK:	DW:	CK:
© TxDOT 1998	DIST	FED REG	PROJECT NO.	SHEET
REVISIONS FEB., 2008 DEC., 2009	HOU	6	RMC6399-15-001	130
COUNTY	CONTROL	SECT	JOB	HIGHWAY
LIBERTY, ETC.	15	001	001	SH99

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## SIGN SUPPORT DESCRIPTIVE CODES

(Descriptive Codes correspond to project estimate and quantities sheets)

SM RD SGN ASSM TY XXXXX(X)XX(X-XXXX)

**Post Type**

FRP = Fiberglass Reinforced Plastic Pipe (see SMD(FRP))  
 TWT = Thin-Walled Tubing (see SMD(TWT))  
 10BWG = 10 BWG Tubing (see SMD(SLIP-1) to (SLIP-3))  
 S80 = Schedule 80 Pipe (see SMD(SLIP-1) to (SLIP-3))

**Number of Posts (1 or 2)**

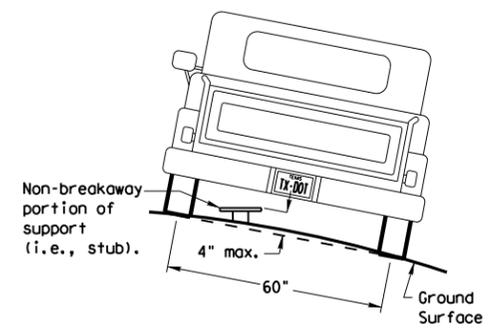
**Anchor Type**

UA = Universal Anchor - Concreted (see SMD(FRP) and (TWT))  
 UB = Universal Anchor - Bolted down (see SMD(FRP) and (TWT))  
 WS = Wedge Anchor Steel - (see SMD(TWT))  
 WP = Wedge Anchor Plastic (see SMD(TWT))  
 SA = Slipbase - Concreted (see SMD(SLIP-1) to (SLIP-3))  
 SB = Slipbase - Bolted Down (see SMD(SLIP-1) to (SLIP-3))

**Sign Mounting Designation**

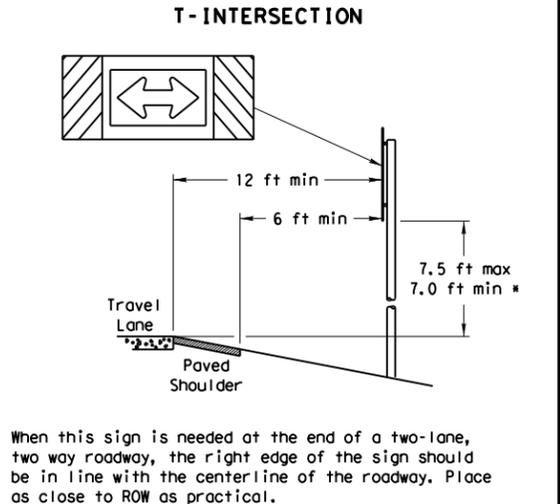
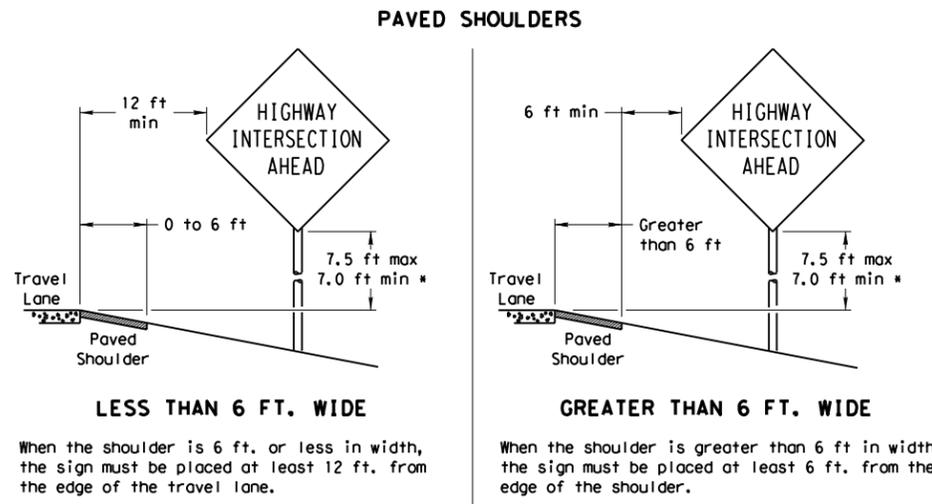
P = Prefab. "Plain" (see SMD(SLIP-1) to (SLIP-3), (TWT), (FRP))  
 T = Prefab. "T" (see SMD(SLIP-1) to (SLIP-3), (TWT))  
 U = Prefab. "U" (see SMD(SLIP-1) to (SLIP-3))  
 IF REQUIRED  
 1EXT or 2EXT = Number of Extensions (see SMD(SLIP-1) to (SLIP-3), (TWT))  
 BM = Extruded Wind Beam (see SMD(SLIP-1) to (SLIP-3))  
 WC = 1.12 #/ft Wing Channel (see SMD(SLIP-1) to (SLIP-3))  
 EXAL = Extruded Aluminum Sign Panels (see SMD(SLIP-3))

## REQUIRED CLEARANCE FOR BREAKAWAY SUPPORT

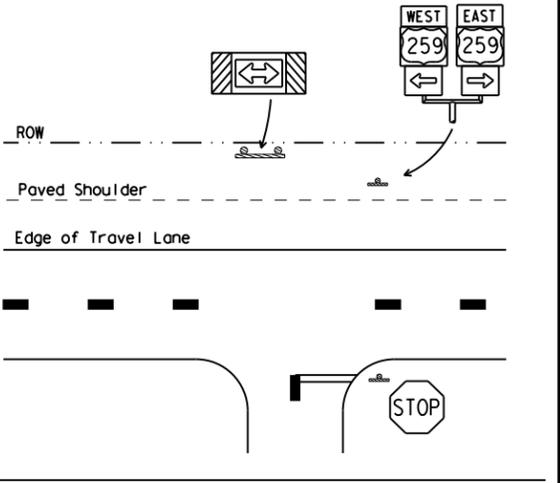
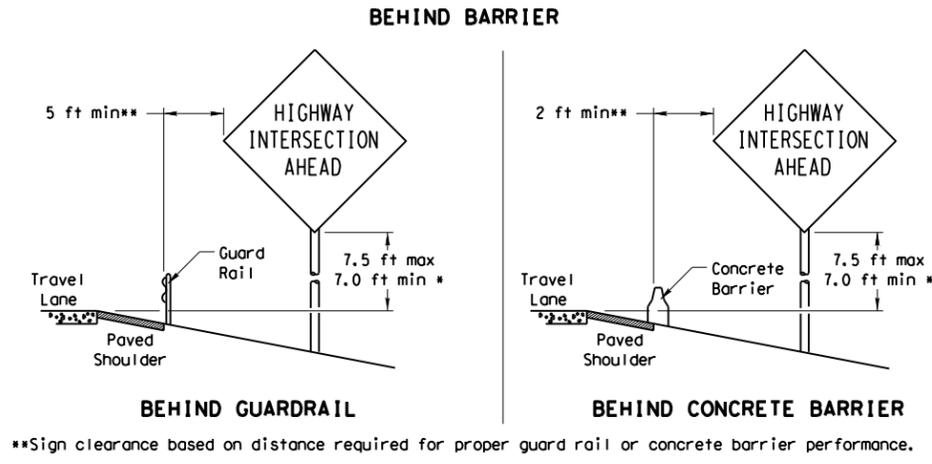
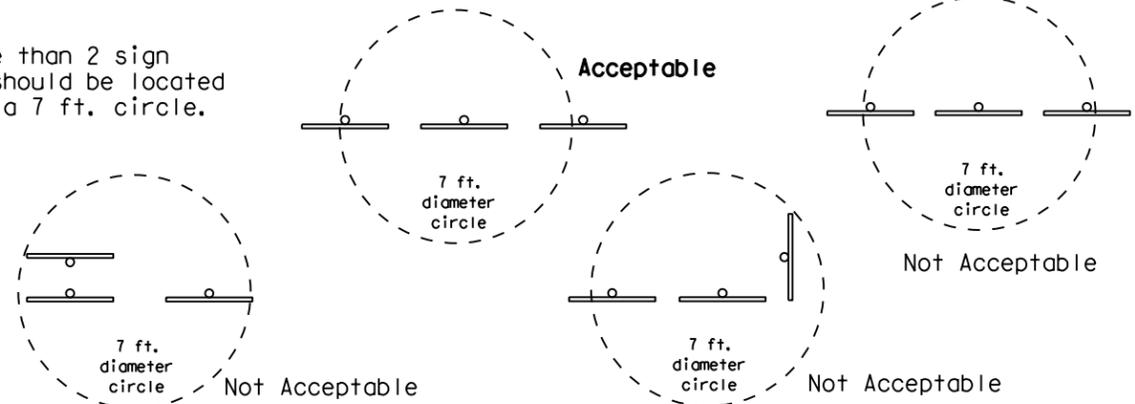


To avoid vehicle undercarriage snagging, any substantial remains of a breakaway support, when it is broken away, should not project more than 4 inches above a 60-inch chord (i.e., typical space between wheel paths).

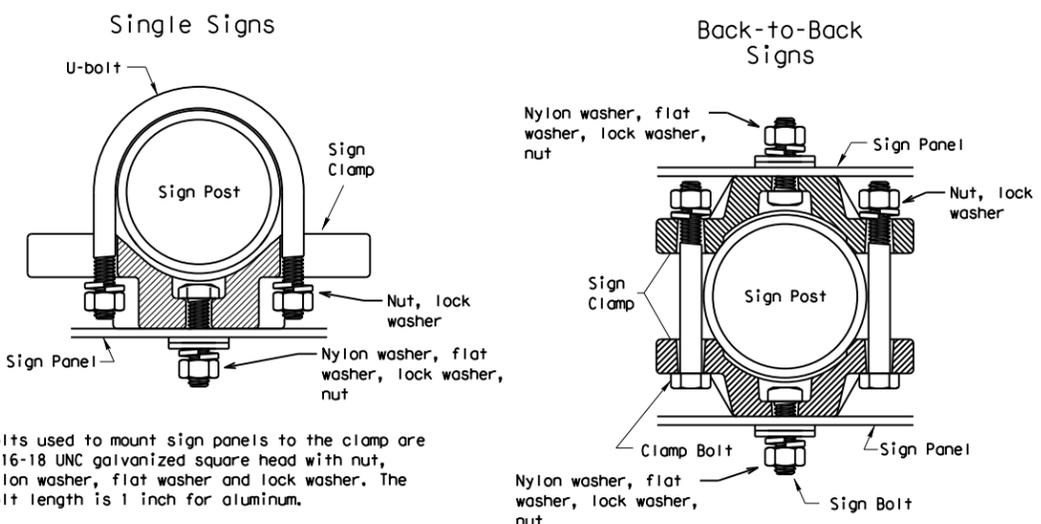
## SIGN LOCATION



No more than 2 sign posts should be located within a 7 ft. circle.



## TYPICAL SIGN ATTACHMENT DETAIL



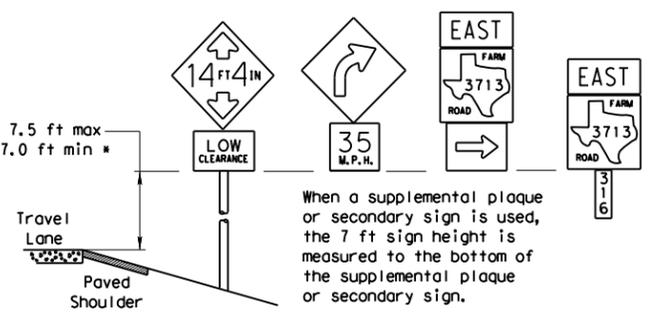
Bolts used to mount sign panels to the clamp are 5/16-18 UNC galvanized square head with nut, nylon washer, flat washer and lock washer. The bolt length is 1 inch for aluminum.

When two sign clamps are used to mount signs back-to-back, use a 5/16-18 UNC galvanized hex head per ASTM A307 with nut and helical-spring lock washer. The approximate bolt lengths for various post sizes and sign clamp types are given in the table at right. The bolt length may need to be adjusted depending upon field conditions.

Sign clamps may be either the specific size clamp or the universal clamp.

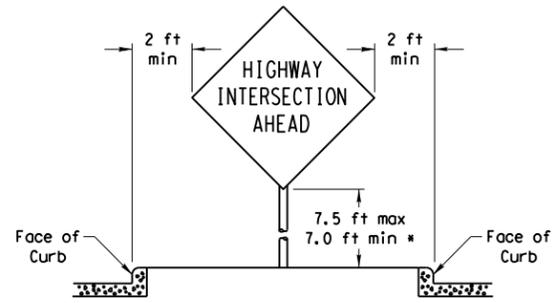
Pipe Diameter	Approximate Bolt Length	
	Specific Clamp	Universal Clamp
2" nominal	3"	3 or 3 1/2"
2 1/2" nominal	3 or 3 1/2"	3 1/2 or 4"
3" nominal	3 1/2 or 4"	4 1/2"

## SIGNS WITH PLAQUES

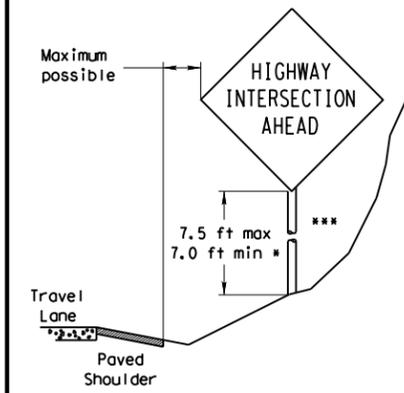


When a supplemental plaque or secondary sign is used, the 7 ft sign height is measured to the bottom of the supplemental plaque or secondary sign.

## CURB & GUTTER OR RAISED ISLAND



## RESTRICTED RIGHT-OF-WAY (When 6 ft min. is not possible.)



Right-of-way restrictions may be created by rocks, water, vegetation, forest, buildings, a narrow island, or other factors.

In situations where a lateral restriction prevents the minimum horizontal clearance from the edge of the travel lane, signs should be placed as far from the travel lane as practical.

\*\*\* Post may be shorter if protected by guardrail or if Engineer determines the post could not be hit due to extreme slope.

- \* 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>

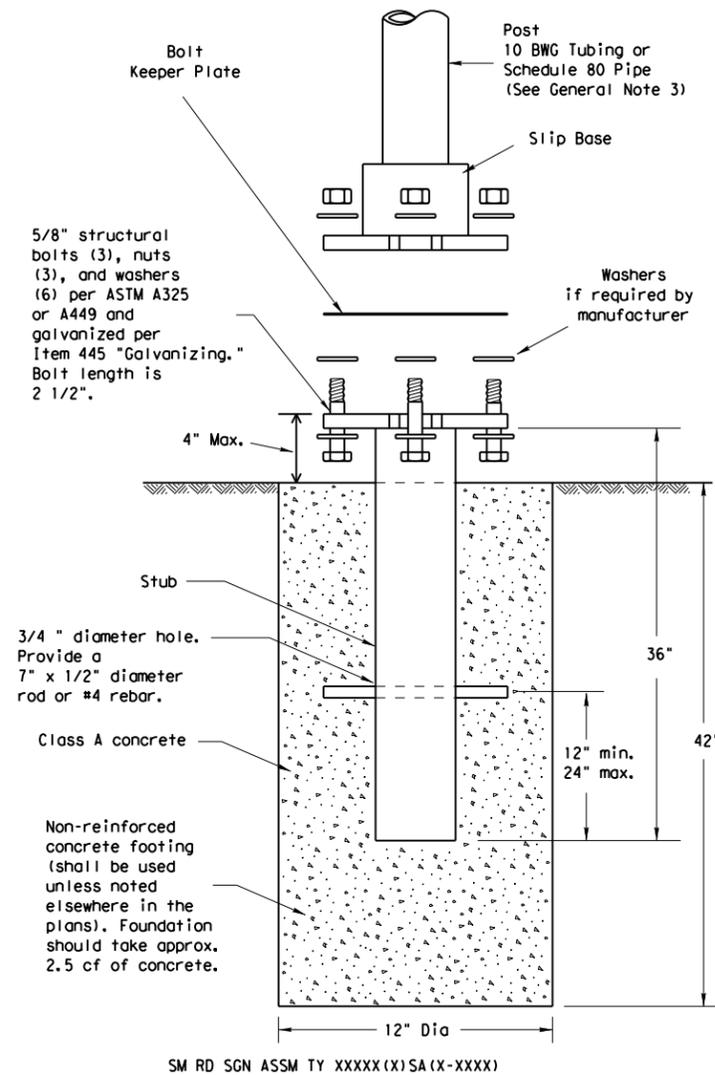


## SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS GENERAL NOTES & DETAILS

SMD(GEN)-08

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9-08	REVISIONS	CONT	SECT	JOB	HIGHWAY
		6399	15	001	SH99
		DIST	COUNTY		SHEET NO.
		BMT	LIBERTY, ETC.		131

# TRIANGULAR SLIPBASE INSTALLATION GENERAL REQUIREMENTS



## NOTE

There are various devices approved for the Triangular Slipbase System. Please reference the Material Producer List for approved slip base systems. [http://www.txdot.gov/business/producer\\_list.htm](http://www.txdot.gov/business/producer_list.htm) The devices shall be installed per manufacturers' recommendations. Installation procedures shall be provided to the Engineer by Contractor.

## GENERAL NOTES:

- Slip base shall be permanently marked to indicate manufacturer. Method, design, and location of marking are subject to approval of the TxDOT Traffic Standards Engineer.
- Material used as post with this system shall conform to the following specifications:
  - 10 BWG Tubing (2.875" outside diameter)
    - 0.134" nominal wall thickness
    - Seamless or electric-resistance welded steel tubing or pipe
    - Steel shall be HSLAS Gr 55 per ASTM A1011 or ASTM A1008
    - Other steels may be used if they meet the following:
      - 55,000 PSI minimum yield strength
      - 70,000 PSI minimum tensile strength
      - 20% minimum elongation in 2"
    - Wall thickness (uncoated) shall be within the range of 0.122" to 0.138"
    - Outside diameter (uncoated) shall be within the range of 2.867" to 2.883"
    - Galvanization per ASTM A123 or ASTM A653 G210. For precoated steel tubing (ASTM A653), recoat tube outside diameter weld seam by metallizing with zinc wire per ASTM B833.
  - Schedule 80 Pipe (2.875" outside diameter)
    - 0.276" nominal wall thickness
    - Steel tubing per ASTM A500 Gr C
    - Other seamless or electric-resistance welded steel tubing or pipe with equivalent outside diameter and wall thickness may be used if they meet the following:
      - 46,000 PSI minimum yield strength
      - 62,000 PSI minimum tensile strength
      - 21% minimum elongation in 2"
    - Wall thickness (uncoated) shall be within the range of 0.248" to 0.304"
    - Outside diameter (uncoated) shall be within the range of 2.855" to 2.895"
    - Galvanization per ASTM A123
- See the Traffic Operations Division website for detailed drawings of sign clamps and Texas Universal Triangular Slipbase System components. The website address is: <http://www.txdot.gov/publications/traffic.htm>
- Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.

## ASSEMBLY PROCEDURE

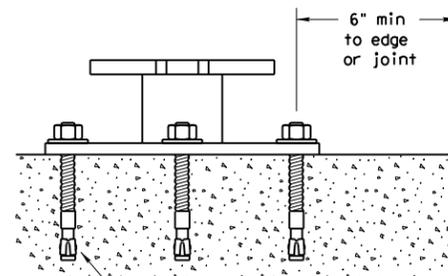
### Foundation

- Prepare 12-inch diameter by 42-inch deep hole. If solid rock is encountered, the depth of the foundation may be reduced such that it is embedded a minimum of 18 inches into the solid rock.
- The Engineer may permit batches of concrete less than 2 cubic yards to be mixed with a portable, motor-driven concrete mixer. For small placements less than 0.5 cubic yards, hand mixing in a suitable container may be allowed by Engineer. Concrete shall be Class A.
- Push the pipe end of the slip base stub into the center of the concrete. Rotate the stub back and forth while pushing it down into the concrete to assure good contact between the concrete and stub. Continue to work the stub into the concrete until it is between 2 to 4 inches above the ground.
- Plumb the stub. Allow a minimum of 4 days to set, unless otherwise directed by the Engineer.
- The triangular slipbase system is multidirectional and is designed to release when struck from any direction.

### Support

- Cut support so that the bottom of the sign will be 7 to 7.5 feet above the edge of the travelway (i.e., edge of the closest lane) when slip plate is below the edge of pavement or 7 to 7.5 feet above slip plate when the slip plate is above the edge of the travelway. The cut shall be plumb and straight.
- Attach sign to support using connections shown. When multiple signs are installed on the same support, ensure the minimum clearance between each sign is maintained. See SMD(SLIP-2) for clearances based on sign types.

## CONCRETE ANCHOR



5/8" diameter Concrete Anchor - 8 places (embed a minimum of 5 1/2" and torque to min. of 50 ft-lbs). Anchor may be expansion or adhesive type.

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, "Epoxyes and Adhesives." Adhesive anchors may be loaded after adequate epoxy cure time per the manufacturer's recommendations. Top of bolt shall extend at least flush with top of the nut when installed. The anchor, when installed in 4000 psi normal-weight concrete with a 5 1/2" minimum embedment, shall have a minimum allowable tension and shear of 3900 and 3100 psi, respectively.

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Texas Department of Transportation  
Traffic Operations Division

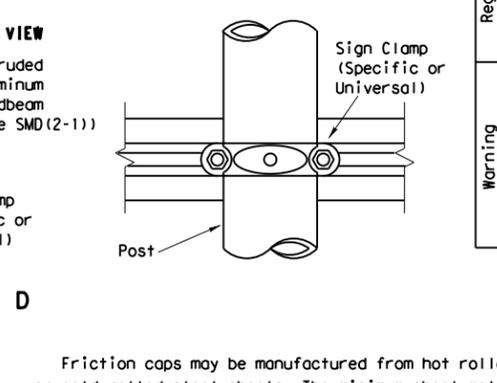
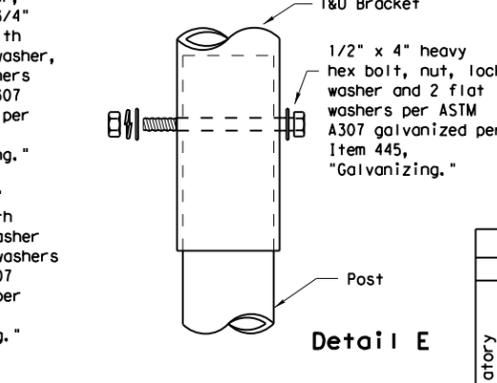
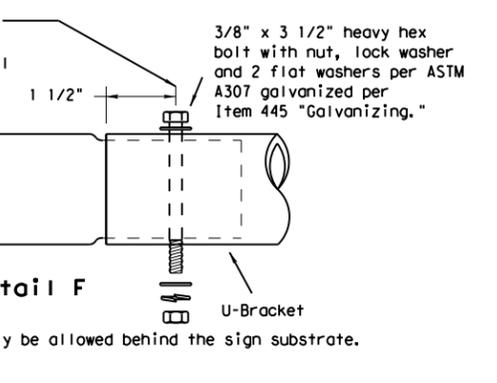
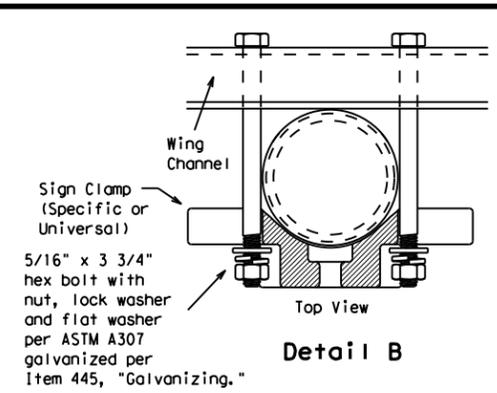
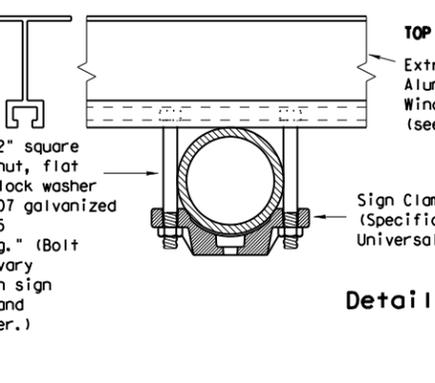
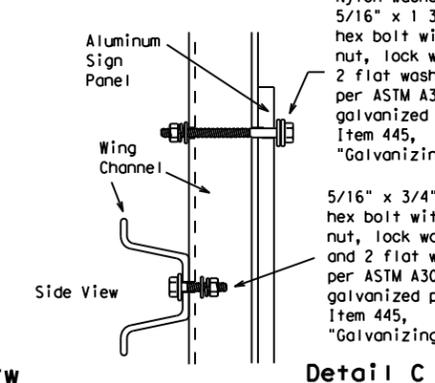
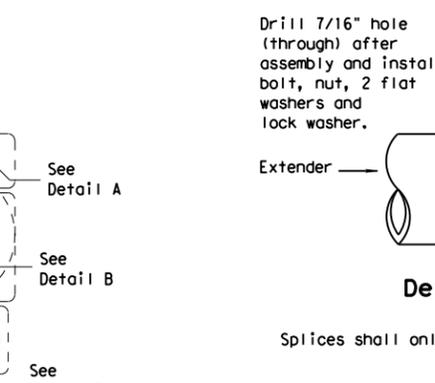
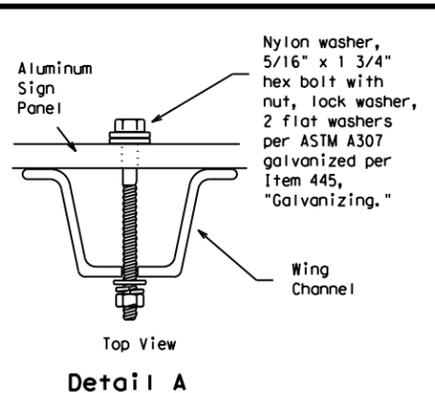
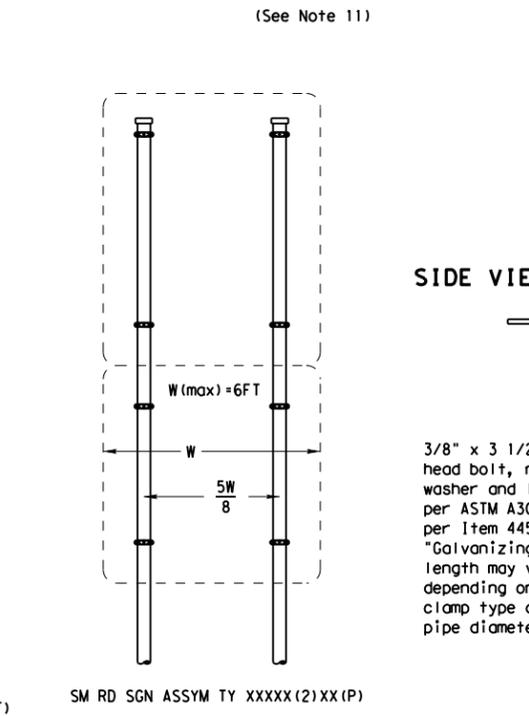
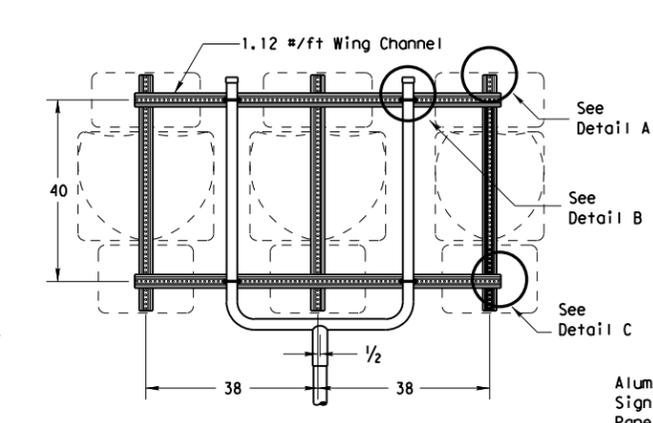
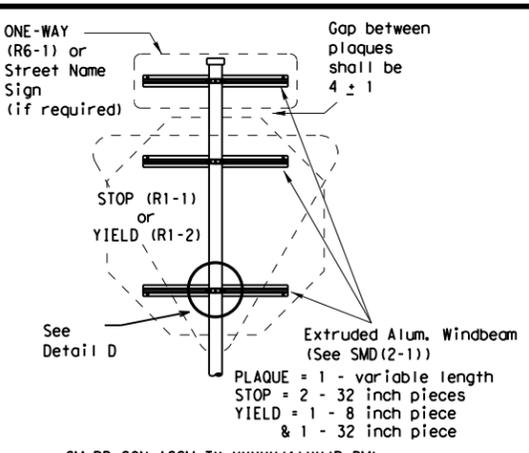
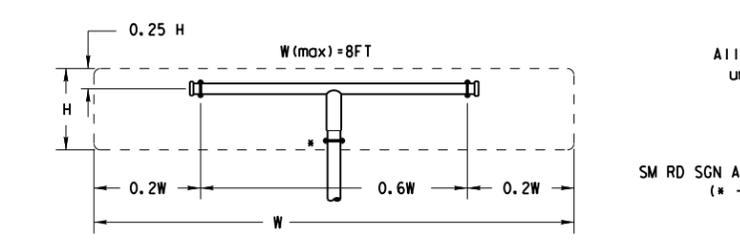
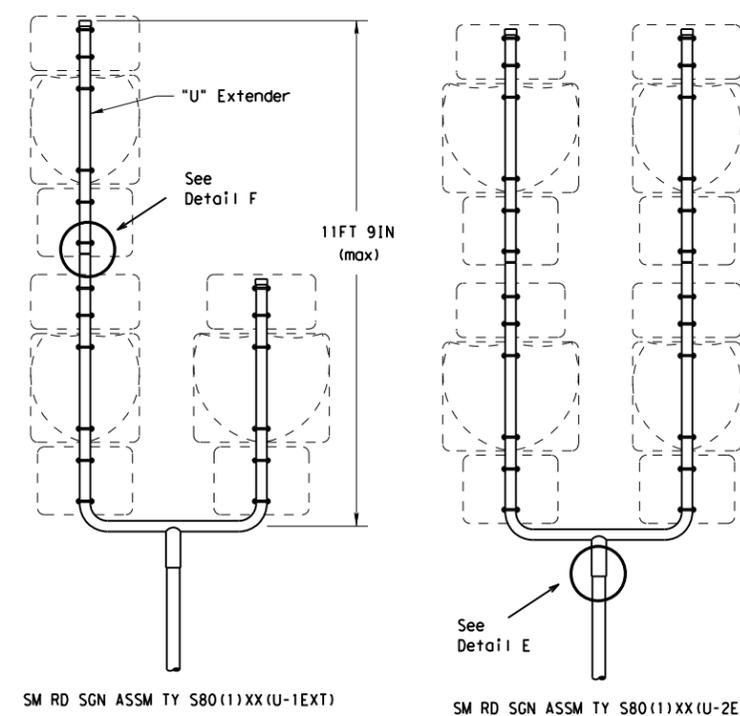
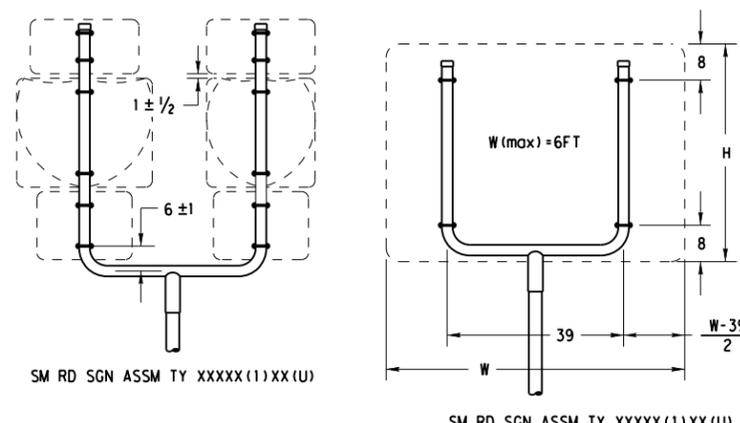
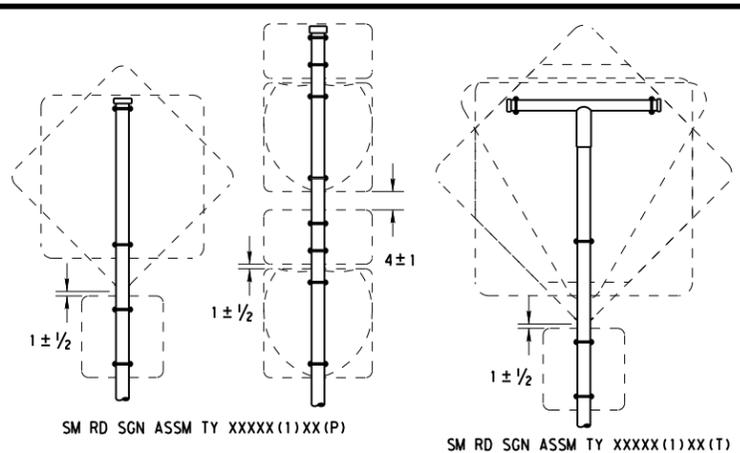
SIGN MOUNTING DETAILS  
SMALL ROADSIDE SIGNS  
TRIANGULAR SLIPBASE SYSTEM

SMD(SLIP-1)-08

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		DIST	COUNTY	SHEET NO.	
		BMT	LIBERTY, ETC.	132	

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**GENERAL NOTES:**

SIGN SUPPORT	# OF POSTS	MAX. SIGN AREA
10 BWG	1	16 SF
10 BWG	2	32 SF
Sch 80	1	32 SF
Sch 80	2	64 SF

- The Engineer may require that a Schedule 80 post be used in place of a 10 BWG where a sign height is abnormally high due to a fill slope.
- Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.
- Aluminum sign blanks shall conform to Departmental Material Specifications DMS-7110 and shall have the following minimum thicknesses: 0.080 for signs less than 7.5 sq. ft., 0.100 for signs 7.5 to 15 sq. ft., and 0.125 for signs greater than 15 sq. ft.
- Signs that require specific supports due to reasons in addition to windloading are indicated on the "REQUIRED SUPPORT" table on this sheet.
- For horizontal rectangular signs fabricated from flat aluminum, T-brackets are used for signs 24 inches or less in height. U-brackets are used for signs of greater height.
- When two triangular slipbase supports are used to support a single sign, they shall not be "rigidly" connected to each other except through the sign panel. This will allow each support to act independently when impacted by an errant vehicle.
- Wing channel shall meet ASTM A 1011 SS Gr 50 and be galvanized per ASTM A 123.
- Excess pipe, wing channel, or windbeam shall be cut off so that it does not extend beyond the sign panel (i.e., excess support shall not be visible when the sign is viewed from the front.) Repair galvanized coating at cut support ends per Item 445, "Galvanizing."
- Additional route markers may be added vertically, provided the total sign area does not exceed the maximum allowable amount per Note 1.
- 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.
- Post open ends shall be fitted with Friction Caps.
- 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)
Warning	48x60-inch signs	TY S80(1)XX(T)
	48x48-inch signs (diamond or square)	TY 10BWG(1)XX(T)
	48x60-inch signs	TY S80(1)XX(T)
	48-inch Advance School X-ing sign (S1-1)	TY 10BWG(1)XX(T)
	48-inch School X-ing sign (S2-1)	TY 10BWG(1)XX(T)
	Large Arrow sign (W1-6 & W1-7)	TY 10BWG(1)XX(T)

Friction caps may be manufactured from hot rolled or cold rolled steel sheets. The minimum sheet metal thickness shall be 24 gauge for all cap sizes. The rim edges shall be reasonably straight and smooth. Caps shall be sized and formed in such a manner as to produce a drive-on friction fit and have no tendency to rock when seated on the pipe. The depth shall be sufficient to give positive protection against entrance of rainwater. They shall be free of sharp creases or indentations and show no evidence of metal fracture. Caps shall have an electrodeposited coating of zinc in accordance with the requirements of ASTM B633 Class FE/ZN 8.

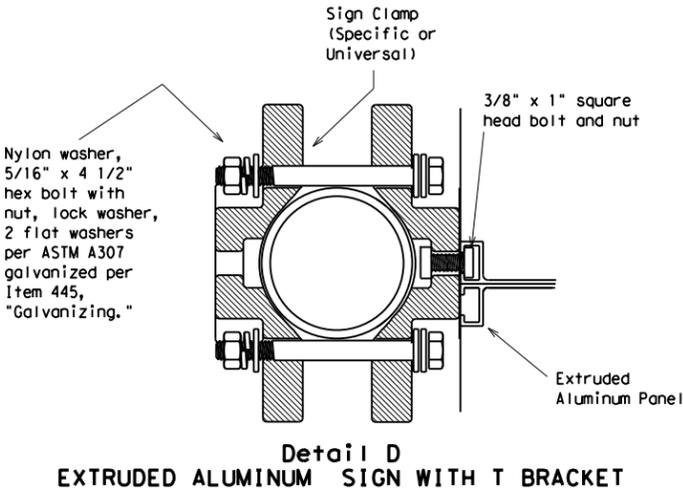
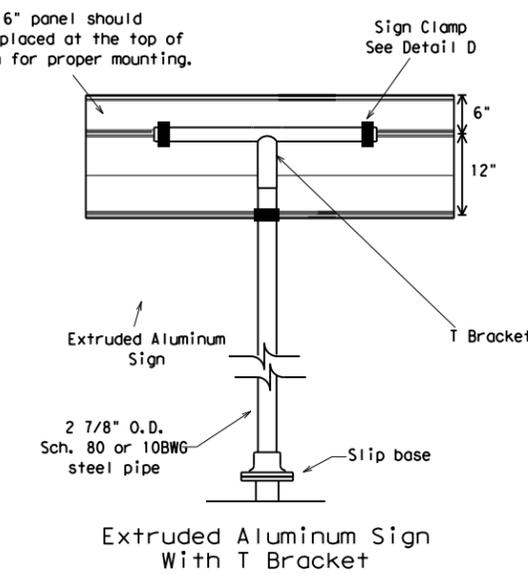
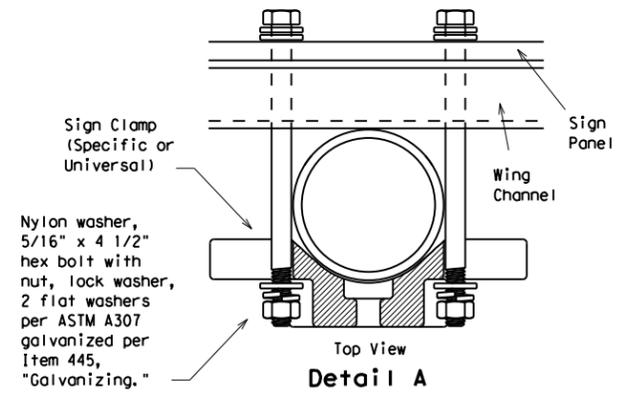
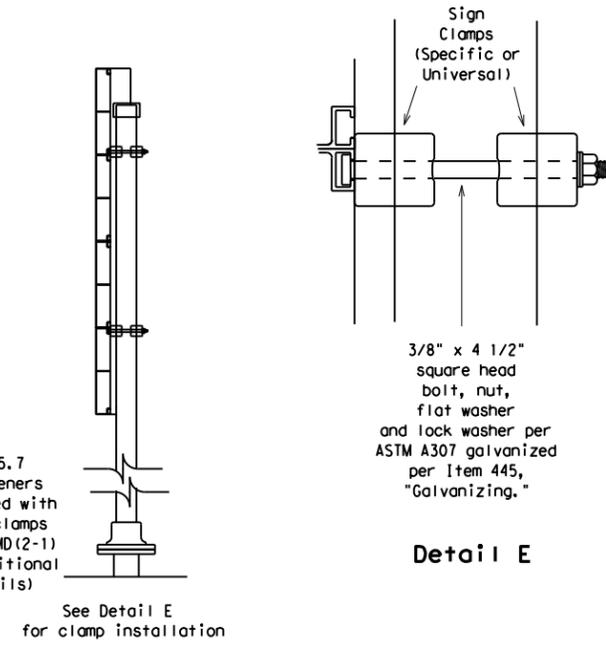
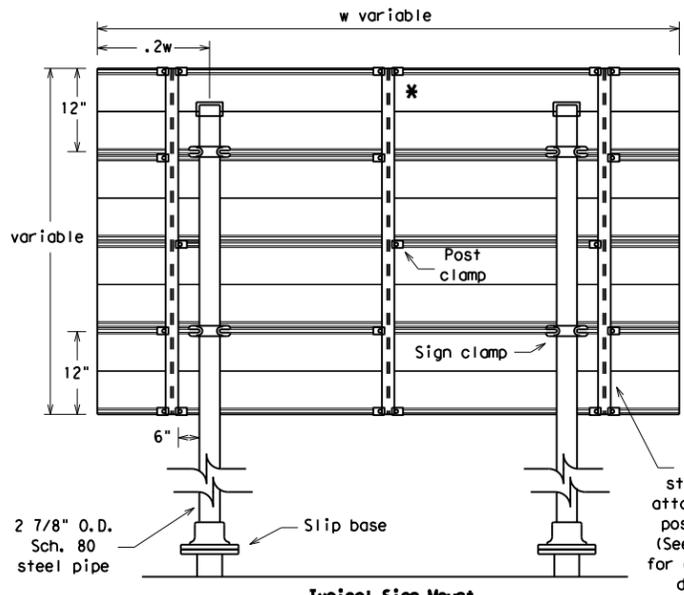
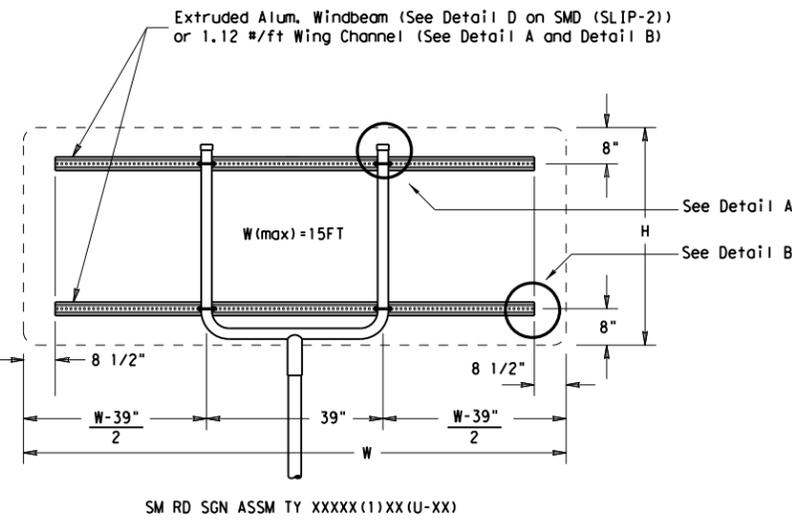
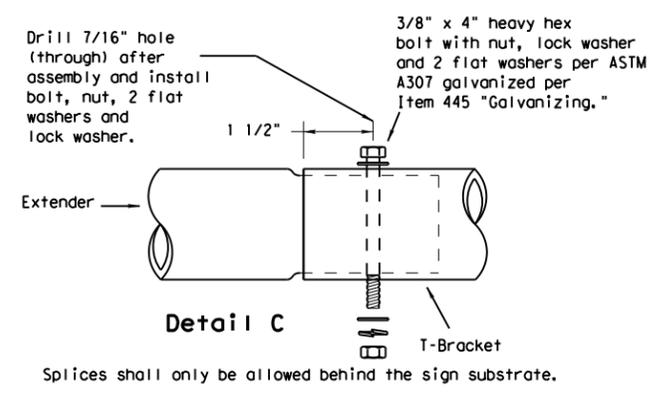
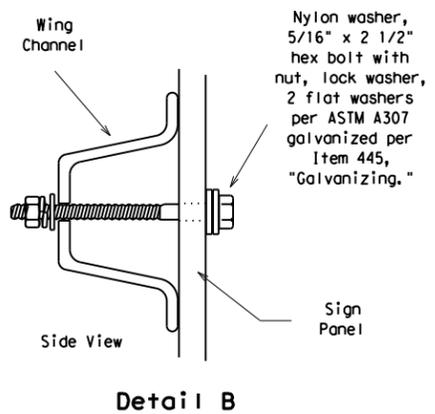
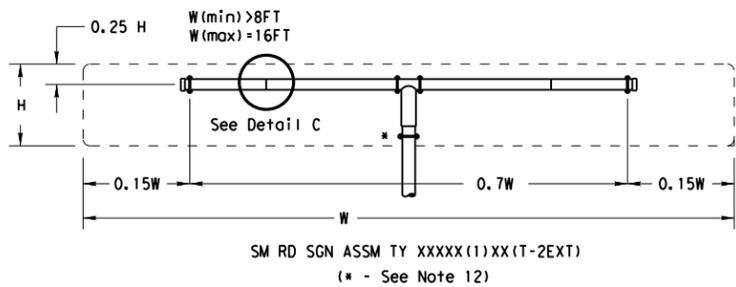
**Texas Department of Transportation**  
 Traffic Operations Division

**SIGN MOUNTING DETAILS**  
**SMALL ROADSIDE SIGNS**  
**TRIANGULAR SLIPBASE SYSTEM**  
**SMD(SLIP-2)-08**

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9-08	REVISIONS	CON: 6399	SECT: 15	JOB: 001	HIGHWAY: SH99
		DIST: BMT	COUNTY: LIBERTY, ETC.	SHEET NO. 133	

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GENERAL NOTES:

- | SIGN SUPPORT | # OF POSTS | MAX. SIGN AREA |
|--------------|------------|----------------|
| 10 BWG       | 1          | 16 SF          |
| 10 BWG       | 2          | 32 SF          |
| Sch 80       | 1          | 32 SF          |
| Sch 80       | 2          | 64 SF          |
- The Engineer may require that a Schedule 80 post be used in place of a 10 BWG where a sign height is abnormally high due to a fill slope.
- Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.
- Aluminum sign blanks shall conform to Departmental Material Specifications DMS-7110 and shall have the following minimum thicknesses: 0.080 for signs less than 7.5 sq. ft., 0.100 for signs 7.5 to 15 sq. ft., and 0.125 for signs greater than 15 sq. ft.
- Signs that require specific supports due to reasons in addition to windloading are indicated on the "REQUIRED SUPPORT" table on this sheet.
- For horizontal rectangular signs fabricated from flat aluminum, T-brackets are used for signs 24 inches or less in height. U-brackets are used for signs of greater height.
- When two triangular slipbase supports are used to support a single sign, they shall not be "rigidly" connected to each other except through the sign panel. This will allow each support to act independently when impacted by an errant vehicle.
- Wing channel shall meet ASTM A 1011 SS Gr 50 and be galvanized per ASTM A 123.
- Excess pipe, wing channel, or windbeam shall be cut off so that it does not extend beyond the sign panel (i.e., excess support shall not be visible when the sign is viewed from the front.) Repair galvanized coating at cut support ends per Item 445, "Galvanizing."
- Sign blanks shall be the sizes and shapes shown on the plans.
- Additional sign clamp required on the "T-bracket" post for 24 inch high signs. Place the clamp 3 inches above bottom of sign when possible.
- Post open ends shall be fitted with Friction Caps.

REQUIRED SUPPORT		
	SIGN DESCRIPTION	SUPPORT
Regulatory	48-inch STOP sign (R1-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	60-inch YIELD sign (R1-2)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	48x16-inch ONE-WAY sign (R6-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	36x48, 48x36, and 48x48-inch signs	TY 10BWG(1)XX(T)
Warning	48x60-inch signs	TY S80(1)XX(T)
	48x48-inch signs (diamond or square)	TY 10BWG(1)XX(T)
	48x60-inch signs	TY S80(1)XX(T)
	48-inch Advance School X-ing sign (S1-1)	TY 10BWG(1)XX(T)
	48-inch School X-ing sign (S2-1)	TY 10BWG(1)XX(T)
	Large Arrow sign (W1-6 & W1-7)	TY 10BWG(1)XX(T)



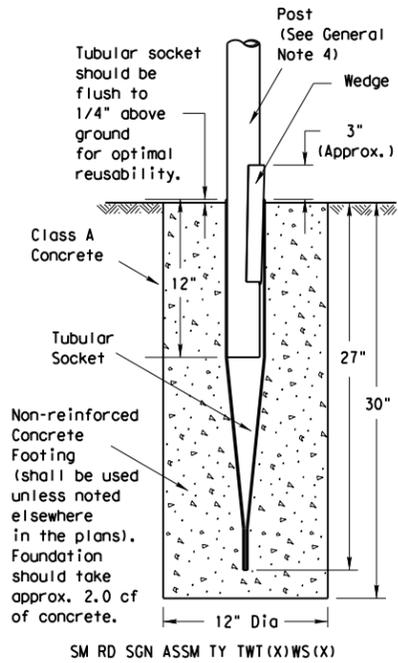
**SIGN MOUNTING DETAILS  
 SMALL ROADSIDE SIGNS  
 TRIANGULAR SLIPBASE SYSTEM  
 SMD (SLIP-3) -08**

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9-08	REVISIONS	CONT	SECT	JOB	HIGHWAY
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		DIST	COUNTY	SHEET NO.	
		BMT	LIBERTY, ETC.	134	

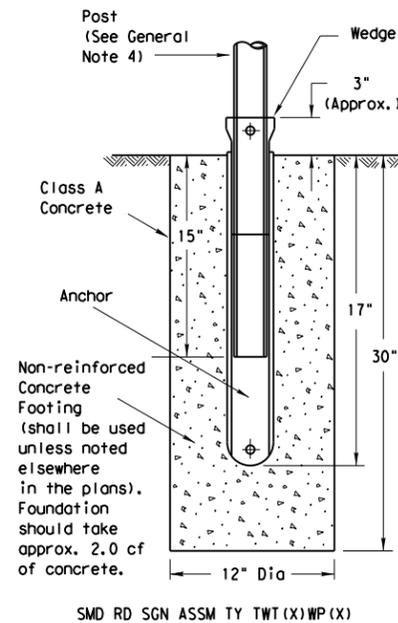
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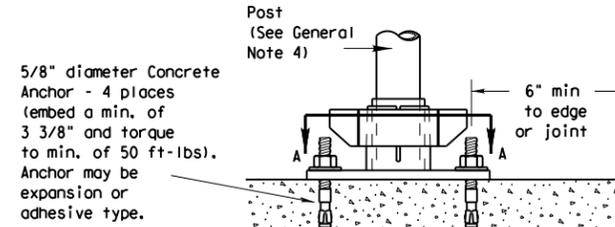
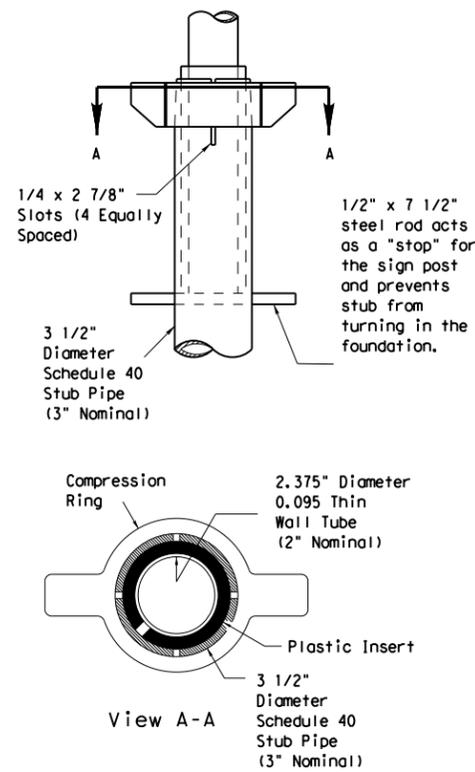
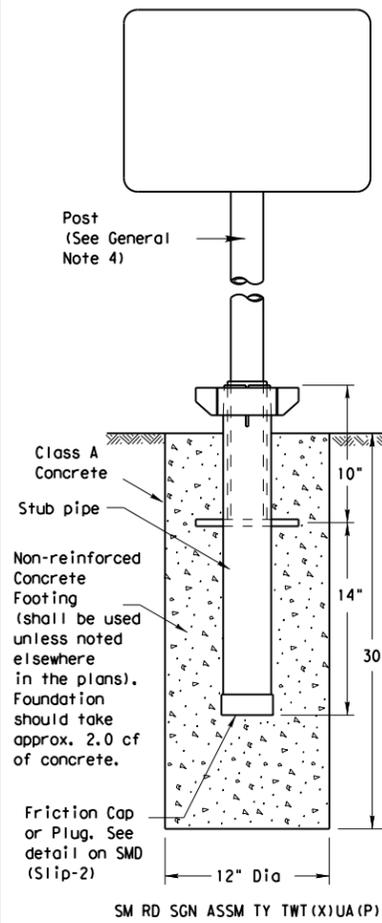
### Wedge Anchor Steel System



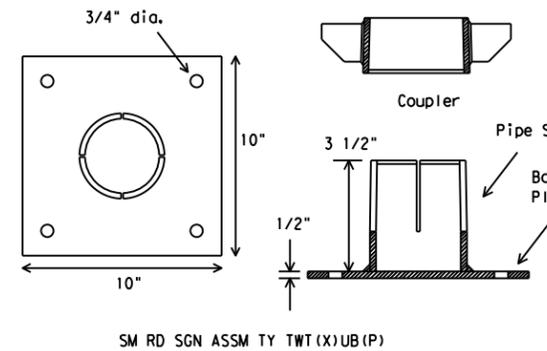
### Wedge Anchor High Density Polyethylene (HDPE) System



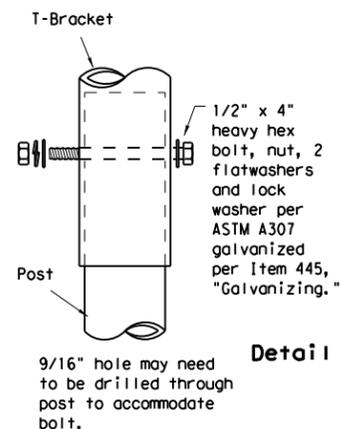
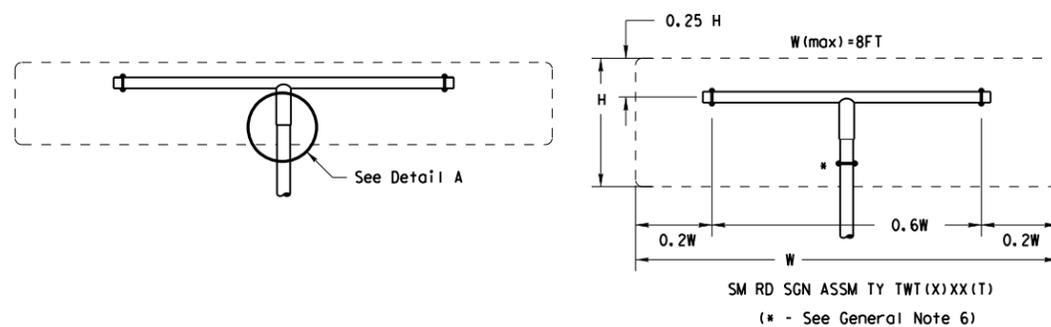
### Universal Anchor System with Thin-Walled Tubing Post



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, "Epoxy and Adhesives." Adhesive anchors may be loaded after adequate epoxy cure time per the manufacturer's recommendations.



### Sign Installation Using a Prefabricated T-Bracket for Thin-Wall Tubing Post



NOTE  
 The devices shall be installed per manufacturer's recommendations. Installation procedures shall be provided to the Engineer by Contractor.

### GENERAL NOTES:

- The Wedge Anchor System and the Universal Anchor System with thin wall tubing post may be used to support up to 10 square feet of sign area.
- The tubular socket, wedge and prefabricated T-bracket shall be permanently marked to indicate manufacturer. Method, design, and location of marking are subject to the approval of the TxDOT Traffic Standards Engineer.
- Except for posts (13 BWG Tubing), clamps, nuts and bolts, all components shall be prequalified. A list of prequalified vendors may be obtained from the Material Producer List web page. The website address is: [http://www.txdot.gov/business/producer\\_list.htm](http://www.txdot.gov/business/producer_list.htm)
- Material used as post with this system shall conform to the following specifications:  
 13 BWG Tubing (2.375" outside diameter) (TWT)  
 0.095" nominal wall thickness  
 Seamless or electric-resistance welded steel tubing  
 Steel shall be HSLA 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  
 18% minimum elongation in 2"  
 Wall thickness (uncoated) shall be within the range of .083" to .099"  
 Outside diameter (uncoated) shall be within the range of 2.369" to 2.381"  
 Galvanization per ASTM 123 or ASTM A653 G210. For precoated steel tubing (ASTM A653), recoat tube outside diameter weld seam by metallizing with zinc wire per ASTM B833.
- Sign blanks shall be the sizes and shapes shown on the plans.
- Additional sign clamp required on the "T-bracket" post for 24" high signs. Place clamp at least 3" above bottom of sign when possible.
- Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.
- See the Traffic Operations Division website for detailed drawings of sign clamps and Wedge Anchor System components. The website address is: <http://www.txdot.gov/publications/traffic.htm>

### WEDGE ANCHOR SYSTEM INSTALLATION PROCEDURE

- 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.
- 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. Place concrete into hole until it is approximately flush with the ground. Concrete shall be Class A.
- Insert tubular socket into concrete until top of socket is approximately 1/4" above the concrete footing.
- Plumb the socket. Allow a minimum 4 days for concrete to set, unless otherwise directed by Engineer.
- Attach the sign to the sign post.
- Insert the sign post into socket and align sign face with roadway.
- Drive the wedge into the socket to secure post. This will leave approximately 3 inches of the wedge exposed.

### UNIVERSAL ANCHOR SYSTEM INSTALLATION PROCEDURE

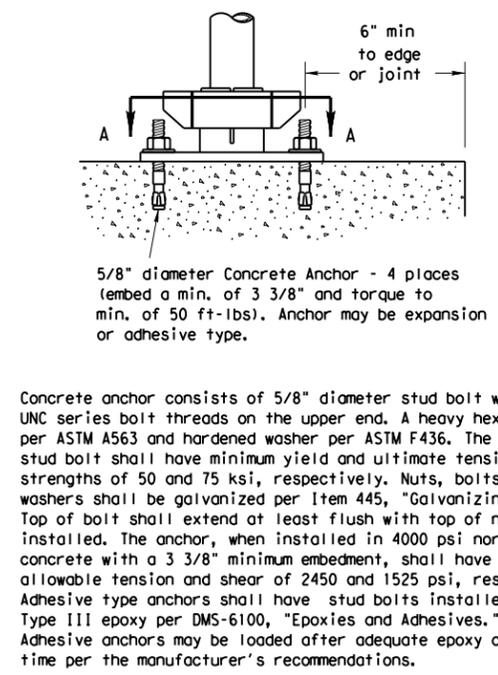
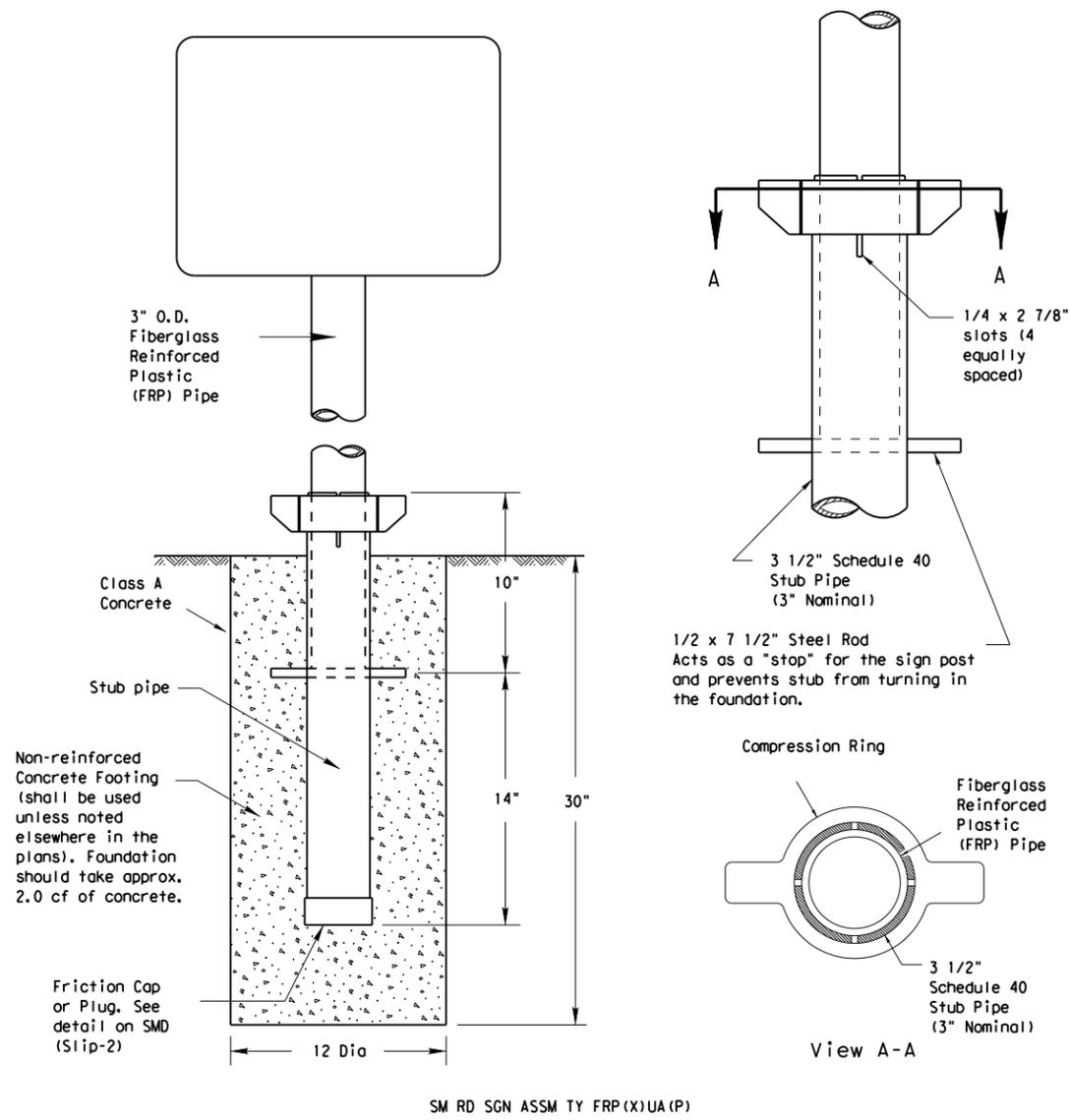
- Dig foundation hole. Where solid rock is encountered at ground level, the foundation shall be a minimum depth of 18". When solid rock is encountered below ground level, the foundation shall extend in the solid rock a minimum depth of 18" or provide a minimum foundation depth of 30". If solid rock is 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.
- Insert base post in hole to depths shown and backfill hole with concrete.
- Level and plumb the base post using a torpedo level and allow concrete adequate time to set. The bottom of the slots provided in the stub pipe shall remain above the top of the concrete foundation.
- Attach the sign to the sign post.
- Install plastic insert around bottom of post.
- Insert sign post into base post. Lower until the post comes to rest on steel rod.
- Seat compression ring using a hammer. Typically, the top of compression ring will be approximately level with top of stub post when optimally installed.
- Check sign post by hand to ensure it is unable to turn. If loose, increase the tightening of the compression ring.

Texas Department of Transportation  
 Traffic Operations Division

## SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS WEDGE & UNIVERSAL ANCHOR WITH THIN WALL TUBING POST SMD (TWT) -08

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9-08	REVISIONS	CONTRACT	SECTION	JOB	HIGHWAY
		6399	15	001	SH99
		DIST	COUNTY	SHEET NO.	
		BMT	LIBERTY, ETC.	135	

## Universal Anchor System with Fiberglass Reinforced Plastic (FRP) Post



**GENERAL NOTES:**

- 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.
- All nuts, bolts and washers shall be galvanized per Item 445, "Galvanizing."
- 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**

- 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.
- Thickness of FRP sign support is 0.125" + 0.031", - 0.0".
- 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

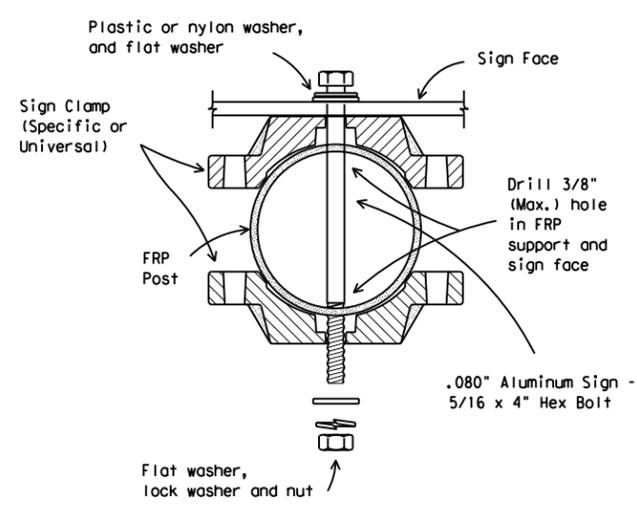
**UNIVERSAL ANCHOR SYSTEM INSTALLATION PROCEDURES**

- 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.
- 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.
- 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.
- 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.
- Attach sign to FRP post.
- Insert sign post into base post. Lower until the post comes to rest on the steel rod.
- Use hammer to ensure the coupler is firmly seated. Top of coupler should be level with top of base post in most instances.
- Check sign to ensure there is no twist. If loose, increase the tightening of coupler.

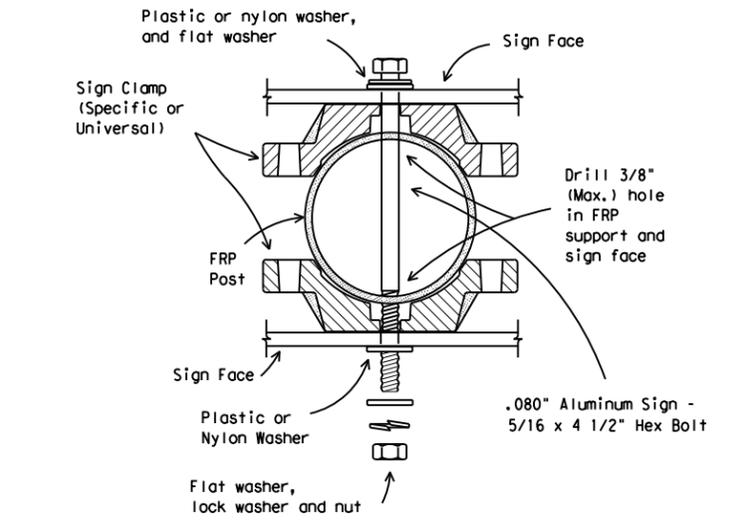
**BOLT DOWN SIGN SUPPORT**

- Position base plate with coupler on existing concrete.
- Drill holes into concrete and insert the 5/8" diameter bolts with wedge anchors, and tighten nuts.
- Attach sign to FRP post.
- Insert bottom of sign post into pipe stub.
- Use hammer to ensure the coupler is firmly seated. Top of coupler should be level with top of base post in most instances.
- 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**

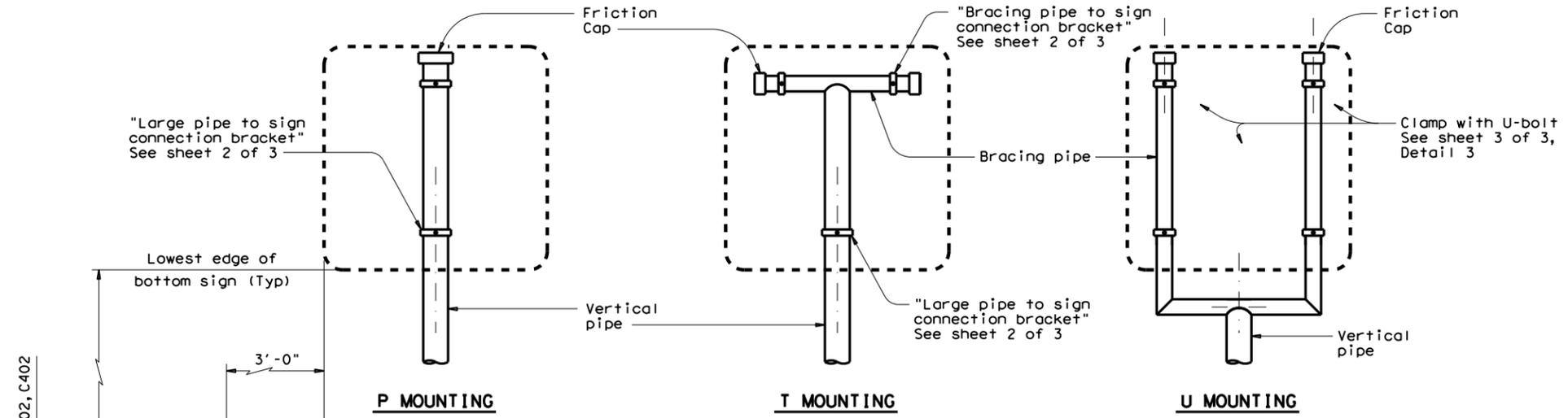
**SMD (FRP) -08**

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		DIST	COUNTY		SHEET NO.
		BMT	LIBERTY, ETC.		136

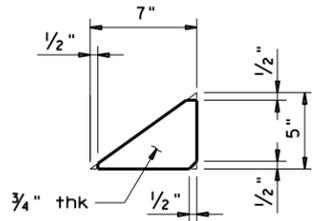
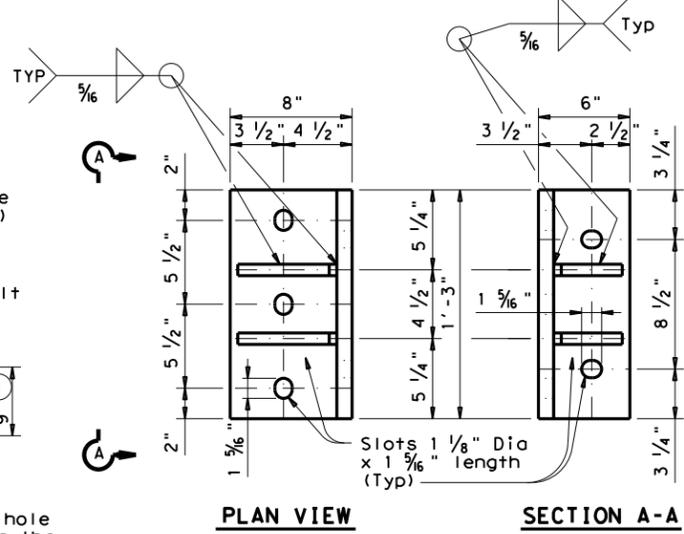
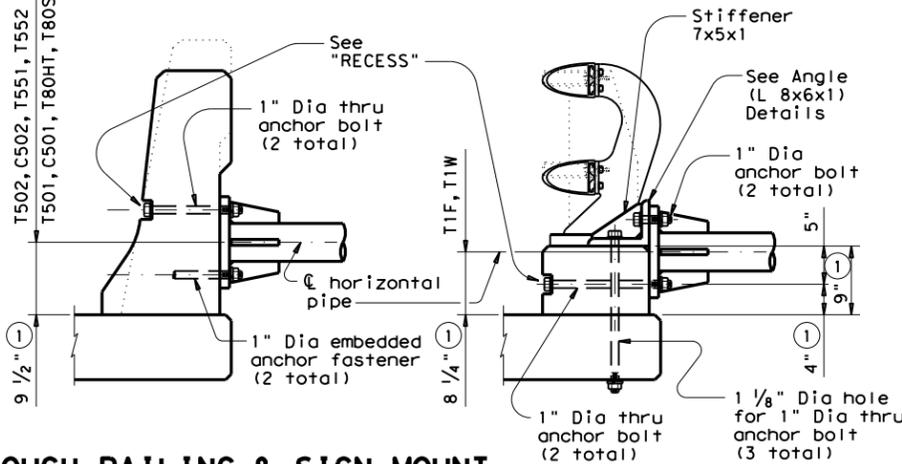
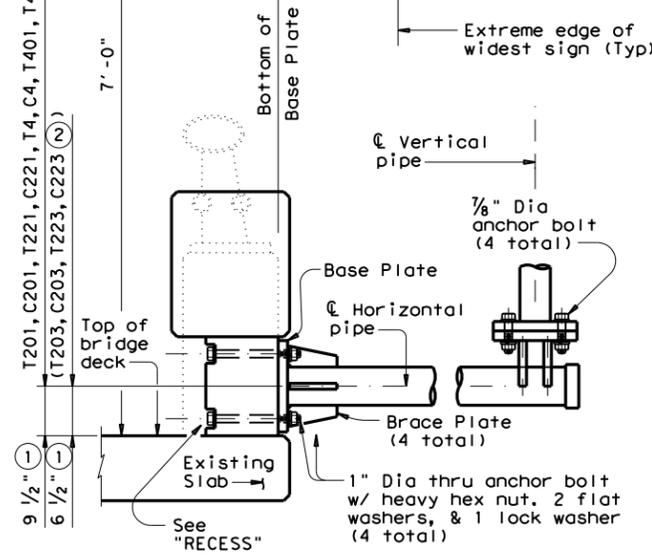
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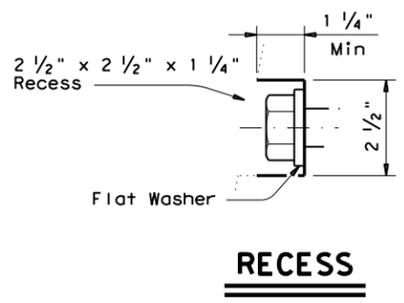


**VARIOUS SIGN ATTACHMENTS**  
 (Mounting NOT deviated from SHSD)



**ANGLE (L 8x6x1) DETAILS**

- ① Increase 2" for structure with overlay.
- ② Attached at center post.



PIPE SIZE AND THICKNESS			
Pipe Placement Design Wind Speed	Horizontal	Vertical	Bracing
90 mph	5" X-Strong (.375")	4" X-Strong (.337")	2 1/2" Standard (.203")
130 mph	6" X-Strong (.432")	5" X-Strong (.375")	3" X-Strong (.300")

**GENERAL NOTES:**  
 Design conforms to 2013 AASHTO Standard Specifications for Highway Signs, Luminaires, and Traffic Signals and Interim Specifications thereto. Design 3-second gust wind speeds of 90 mph and 130 mph with a 1.14 gust factor, and a wind importance factor of 1.0 (50-year mean recurrence interval) for the supporting structures. For mounting connection between sign panel and pipe, wind importance factors of 0.71 and 0.54, for 90 mph and 130 mph winds, respectively, are applied to adjust the wind speeds to a 10-year mean recurrence interval.

See standard sheet WV & IZ(LTS2013) for the boundaries of each design wind zone. All mounting shall be based on 130 mph wind speed design except when located in 90 mph wind zone. Maximum panel area is 30 sq. ft. Maximum design height is 50 ft, with design height defined as the distance between natural ground (average elevation of surrounding terrain) and the center of sign(s) at the mounting location.

Material for pipe shall be ASTM A53 Grade B, or A501. Structural steel plates shall be ASTM A36, A572 Grade 50, or A588. Bolts used to connect pipe and mounting bracket, and wind beam to sign panel shall be ASTM A307. Anchor bolts shall be ASTM A325 or A193 B7. Each anchor bolt shall be provided with 2 flat washers, 1 lock washer, and 1 heavy hex nut. All parts shall be galvanized in accordance with Standard Specifications Item 445, "Galvanizing".

Attach horizontal pipe at least 2'-0" from the edge of any nearby drain slot.

Contractor shall verify applicable field dimensions before fabrication. Holes drilled through the railing parapet wall shall be drilled with rotary (coring or masonry drill) type equipment. Percussion (star) drilling shall not be allowed. Anchorage for pipe attached to rail shall be placed using an anchoring system approved by the engineer. Installation of anchor fasteners including hole depth, diameter and material shall be in accordance with the manufacturers' recommendation.

Each embedded anchor fastener shall resist an allowable design loading (after applying the reduction factors of bolt spacing and bolt edge distance) of:

	130 mph	90 mph
Tension	12.5 kips	7.5 kips
Shear	9.0 kips	5.0 kips

Each anchoring system shall provide a capacity to resist the required tension and shear acting simultaneously.

For sign connection to mounting, shop drill holes on sign blank in accordance with the current Standard Highway Sign Designs for Texas (SHSD). Additional hole(s) needed to meet a stipulated-type mounting may be field drilled. For multi-sign or back-to-back signs mounting, the engineer shall determine the proper type which ensures each individual mounting meets requirements.

Refer to Standard sheets SMD(GEN), SMD(SLIP-2) and SMD(2-1) for details not covered here.

SHEET 1 OF 3

Texas Department of Transportation  
 Traffic Operations Division Standard

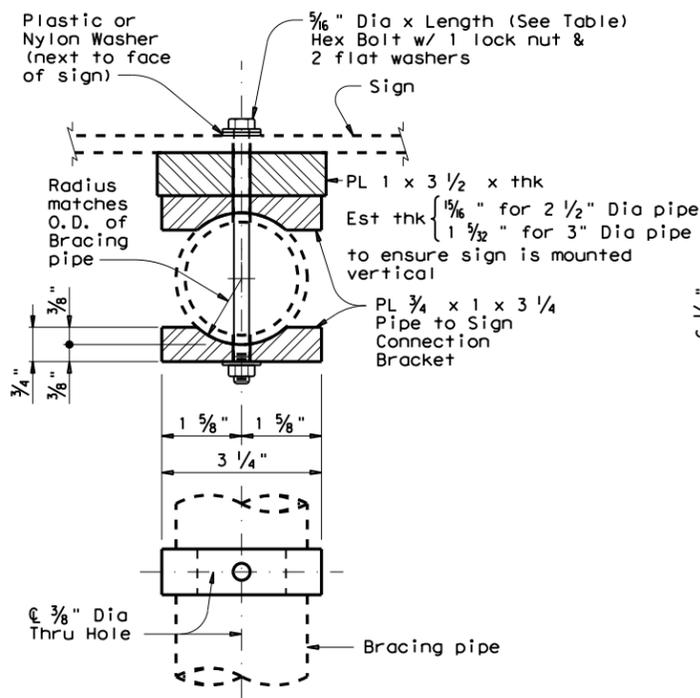
**BRIDGE RAILING SIGN MOUNT DETAILS**

**SMD (BR-1) - 14**

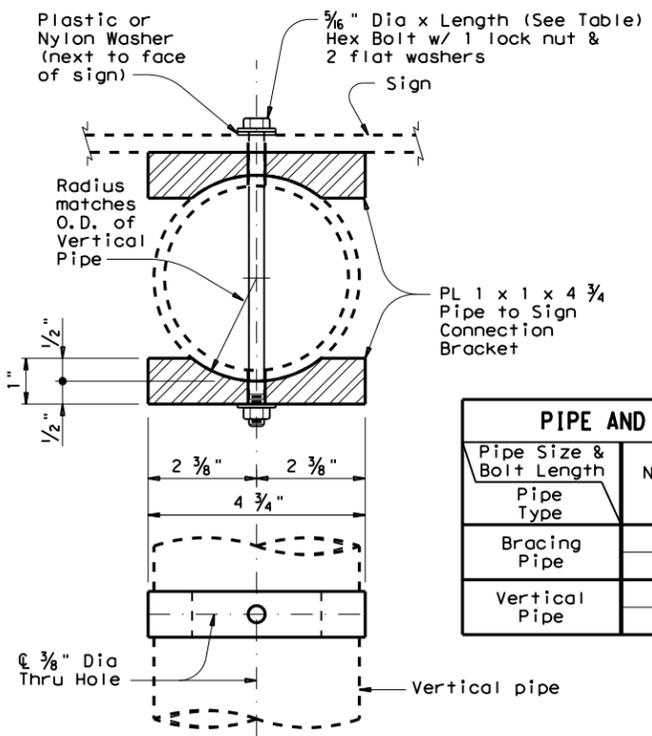
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BMT	LIBERTY, ETC.	137		

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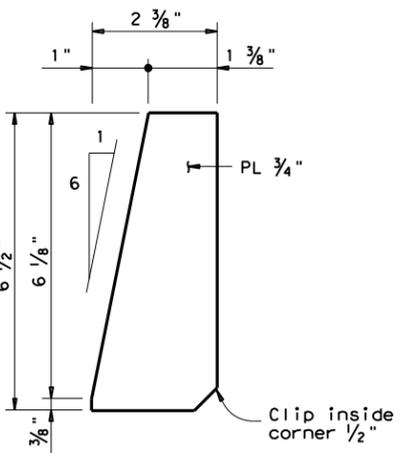
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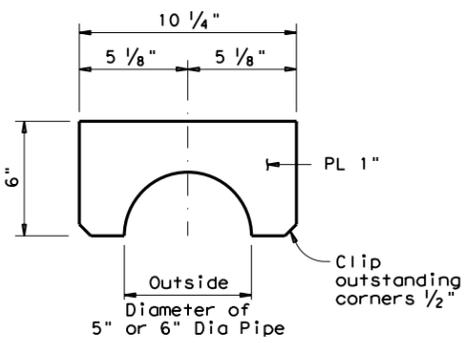
**BRACING PIPE TO SIGN CONNECTION BRACKET DETAILS**  
 (Showing T Mounting)



**LARGE PIPE TO SIGN CONNECTION BRACKET DETAILS**  
 (Showing P or T Mounting)

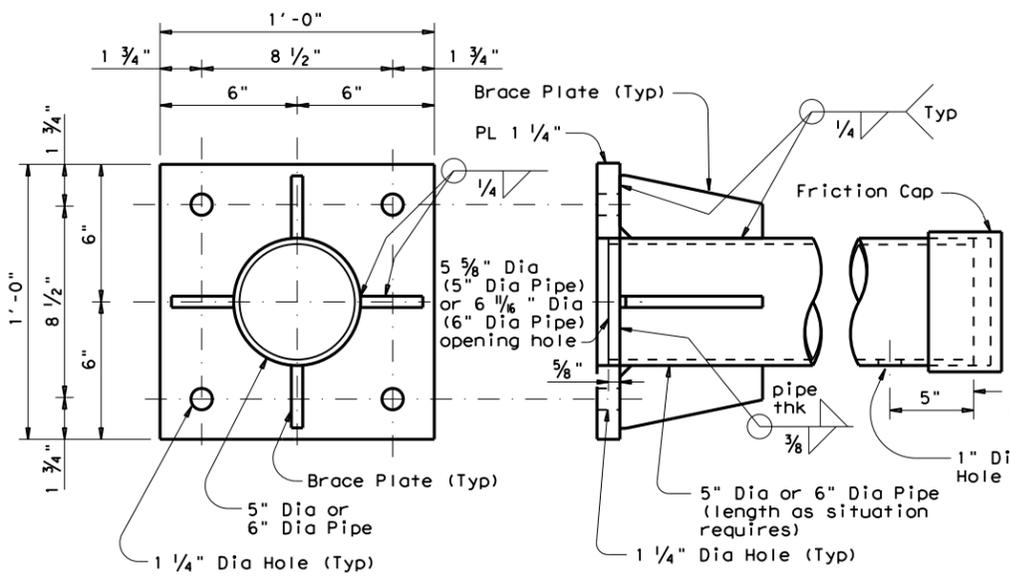


**BRACE PLATE DETAILS**

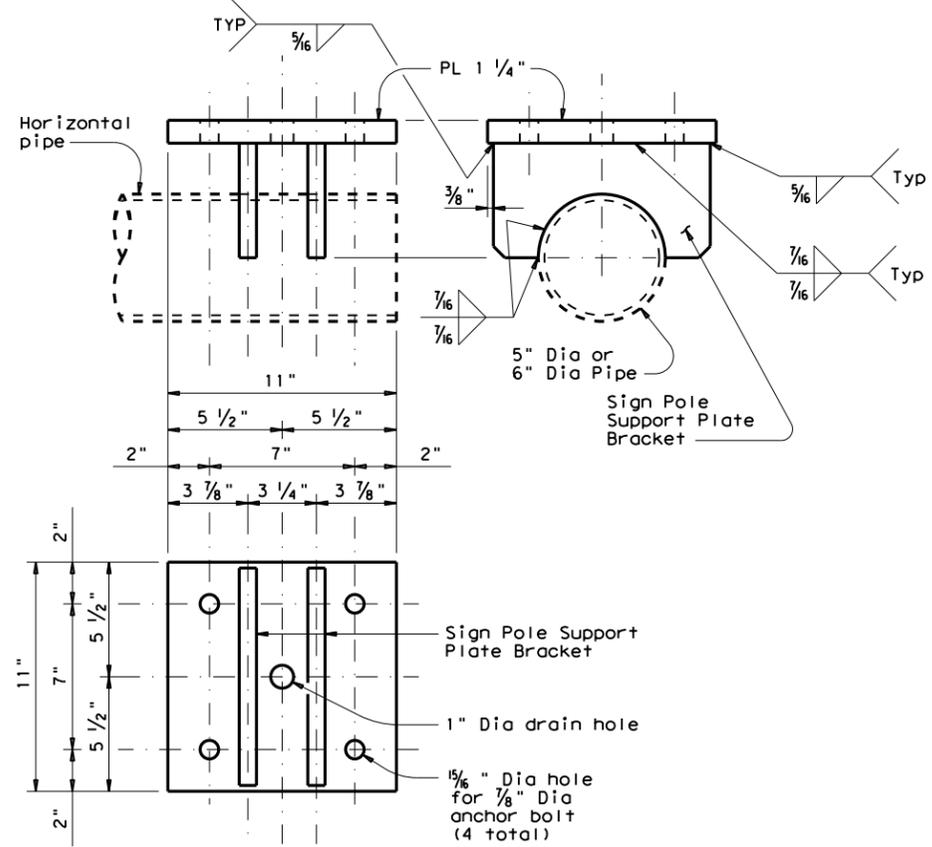


**SIGN POLE SUPPORT PLATE BRACKET DETAILS**

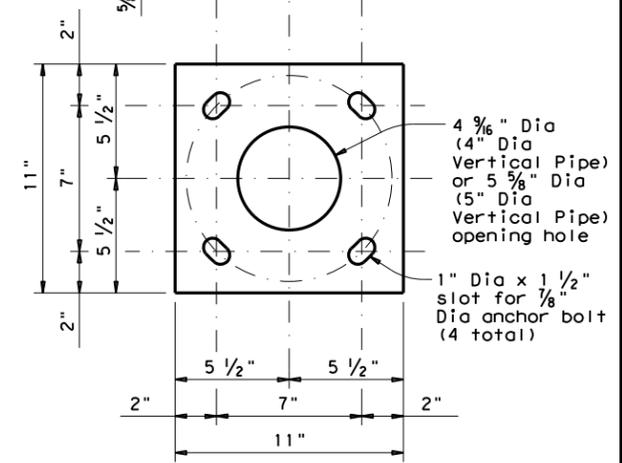
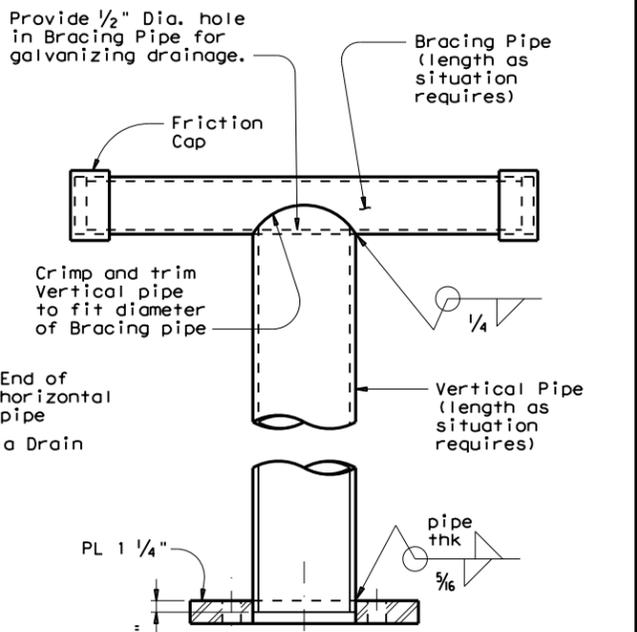
PIPE AND BOLT SPECIFICATIONS		
Pipe Size & Bolt Length	Nominal Pipe Dia (in.)	Bolt Length (in.)
Bracing Pipe	2 1/2	6
Vertical Pipe	3	7
Vertical Pipe	4	7
Vertical Pipe	5	8



**BASE PLATE DETAILS**



**SIGN POLE SUPPORT PLATE DETAILS**



**SIGN POLE & POLE BASE PLATE DETAILS**  
 (Showing only T Mounting)

SHEET 2 OF 3



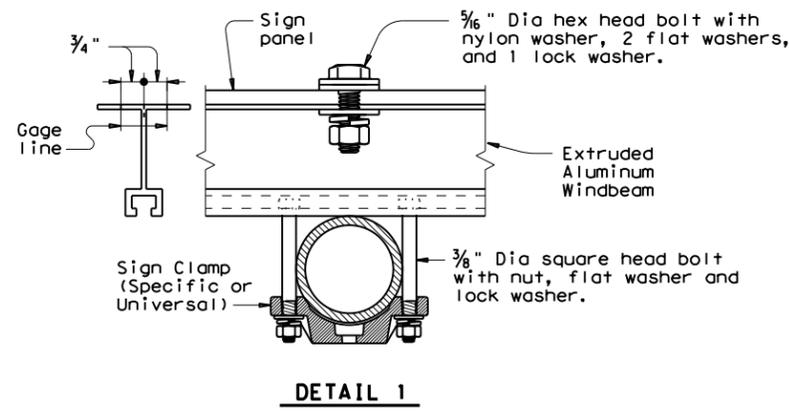
**BRIDGE RAILING SIGN MOUNT DETAILS**

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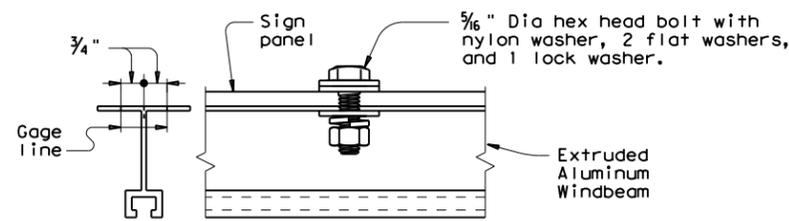
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REVISIONS	6399	15	001	SH99
DIST	COUNTY	SHEET NO.		
BMT	LIBERTY, ETC.	138		

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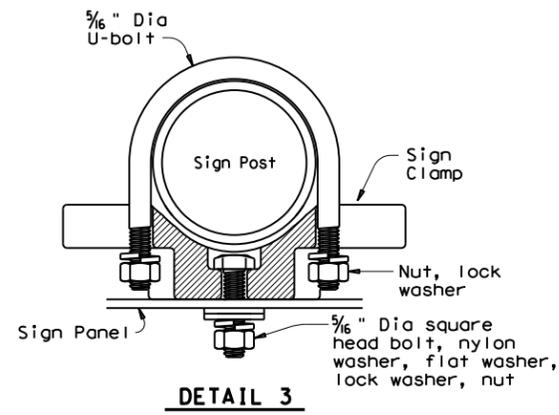
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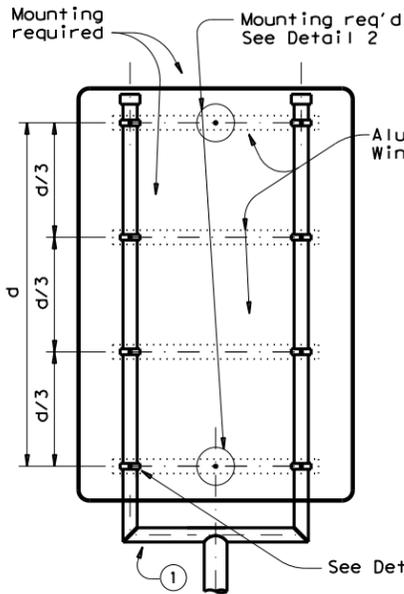
DETAIL 1



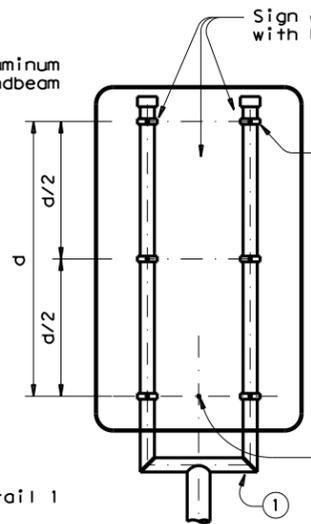
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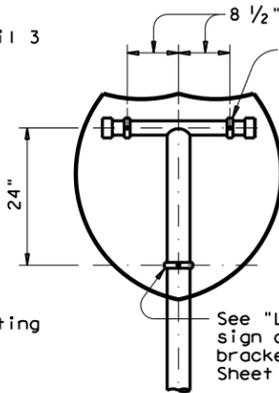
DETAIL 3



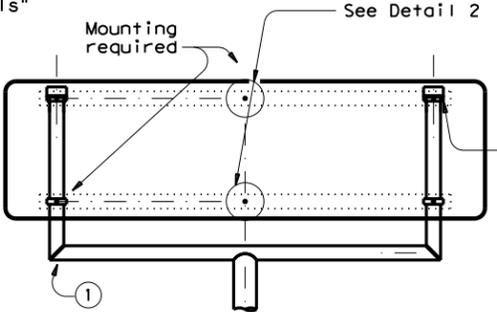
TYPE 4



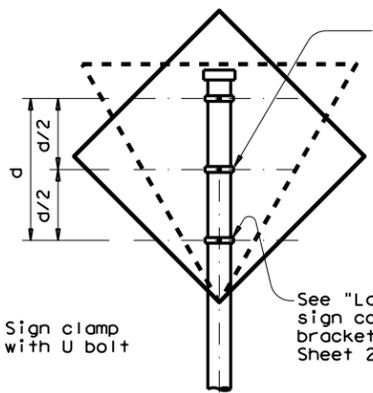
TYPE 32



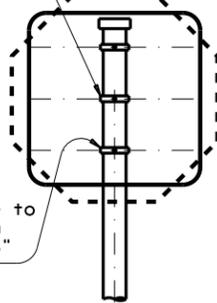
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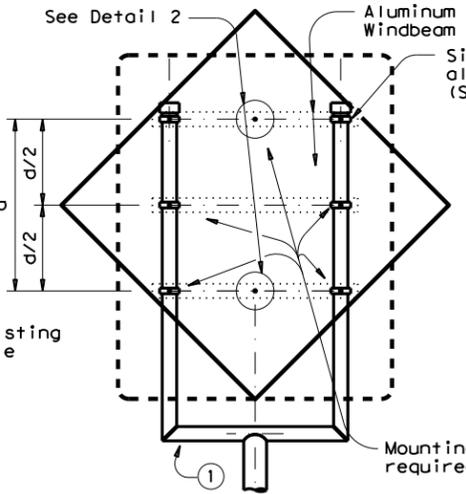
TYPE 23



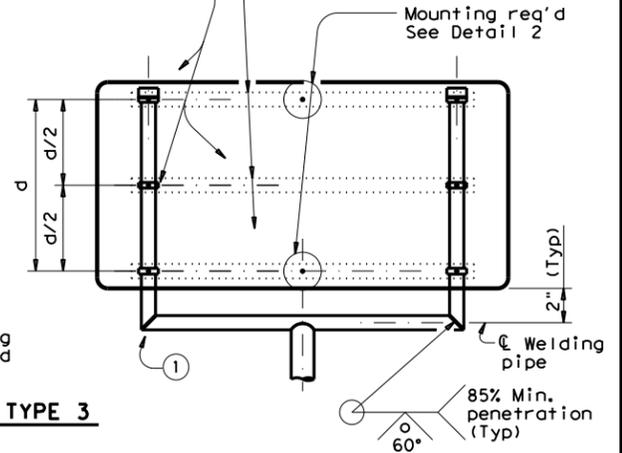
TYPE 1



TYPE 2



TYPE 3



SIGN SHAPE	SQUARE			HORIZONTAL RECTANGLE			VERTICAL RECTANGLE			DIAMOND			OCTAGON			EQUILATERAL TRIANGLE			INTERSTATE SHIELD	PENTAGON (SCHOOL)					
	P	T	U	P	T	U	P	T	U	P	T	U	P	T	U	P	T	U	P	P	T				
Type of Sign Mounting on SHSD																									
Design Wind Speed																									
90 mph					(Type 23) 60"x48"			(Type 3) 72"x36" 78"x36"			(Type 2) 36"x48" (Type 32) 36"x60" 36"x72" 42"x60" 48"x54" 48"x60" 48"x72"									(Type 3) 60"x60"			(Type Special) 45"x36"		
130 mph	(Type 1) 30"x30" 36"x36"	(Type 3) 48"x48"		(Type 1) 36"x24" 36"x30"	(Type 23) 48"x42" 54"x42" 60"x30" 66"x36" 84"x24"			(Type 3) 72"x36" 78"x36"	(Type 1) 30"x36" 30"x42"		(Type 3) 36"x48" 36"x60" 36"x72" 42"x60" 48"x54" 48"x60"	(Type 3) 48"x60"	(Type 1) 36"x36"	(Type 3) 48"x48" 60"x60"				(Type 1) 48"x48"			(Type Special) 36"x36" 45"x36"				

Notes: 1. Drill holes in addition to the hole pattern of the Standard Highway Sign Designs for Texas (SHSD) at specified locations to meet a stipulated-type mounting indicated in the parenthesis ( ).  
 2. "Blank" in the above table indicates all other signs excluded from stipulated mounting shall be mounted in accordance with SHSD.  
 3. In lieu of welding, the Fabricator may bend bracing pipe elbows if the following conditions are met:  
 a. Spacing between vertical bracing pipes is equal to or greater than 2'-6".  
 b. Bending radius is 12".  
 c. The distance between the lowest clamp and centerline of horizontal bent pipe is 13" max.

SHEET 3 OF 3

Texas Department of Transportation  
 Traffic Operations Division Standard

## BRIDGE RAILING SIGN MOUNT DETAILS

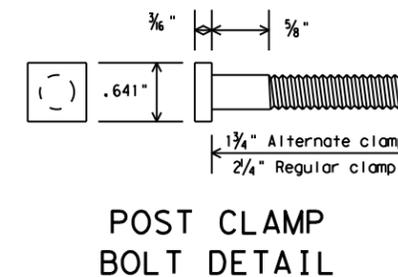
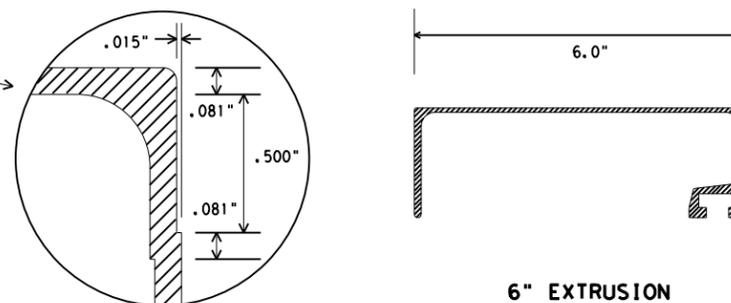
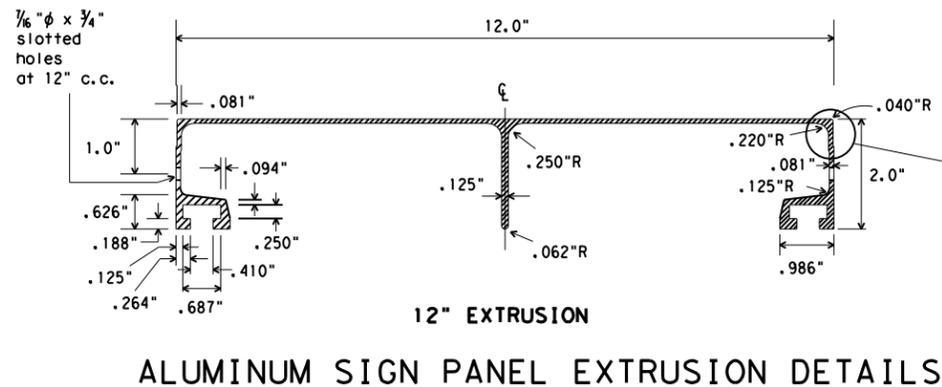
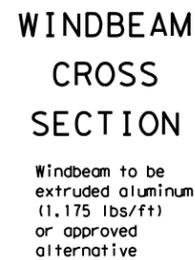
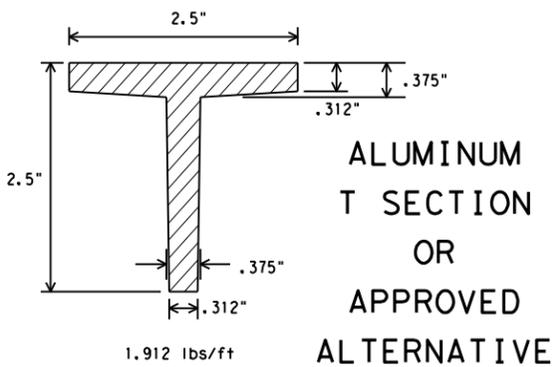
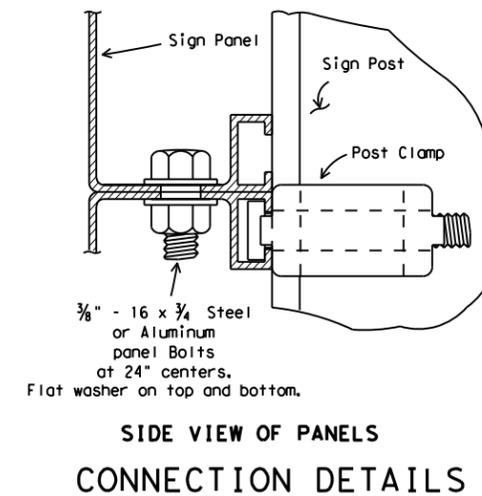
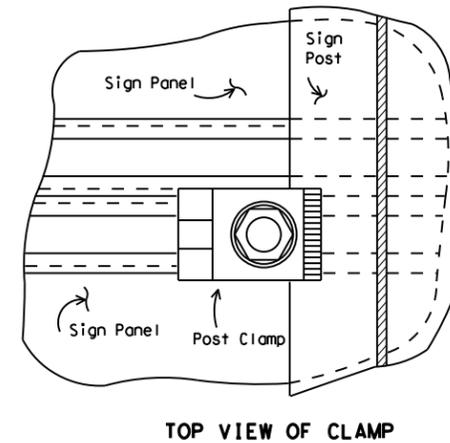
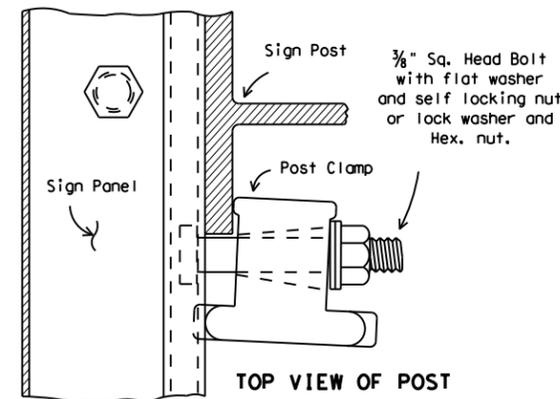
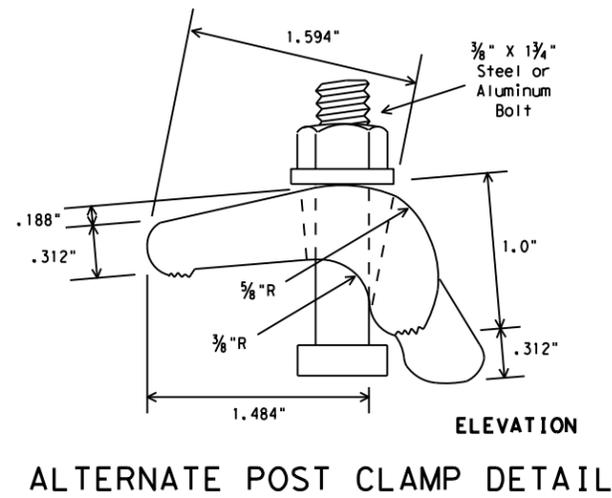
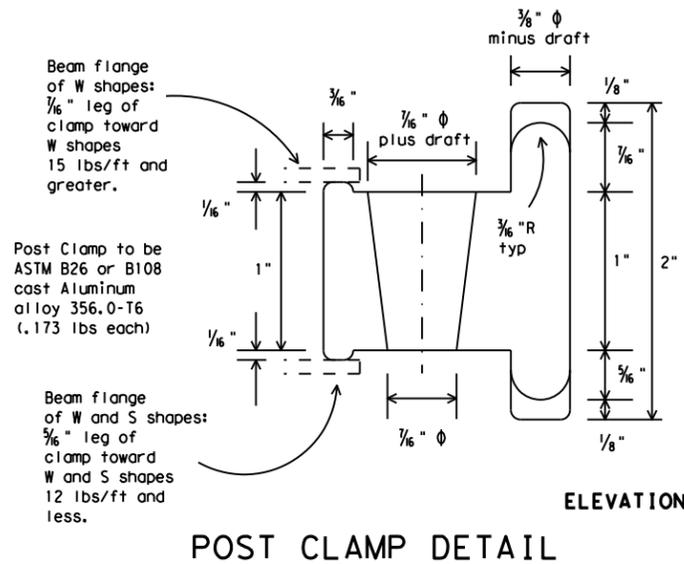
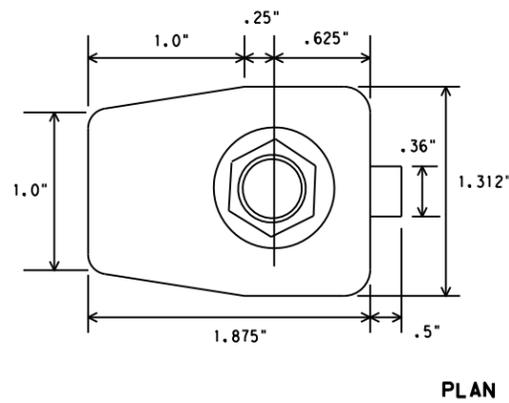
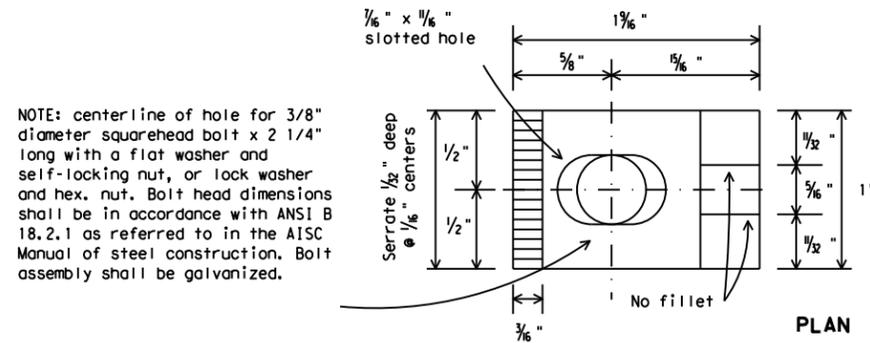
### SMD (BR-3) - 14

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DEPARTMENTAL MATERIAL SPECIFICATIONS	
SIGN HARDWARE	DMS-7120

- GENERAL NOTES:
- Design conforms with AASHTO Specifications for the design and construction of structural supports for highway signs.
  - Materials and fabrication shall conform to the requirements of the Department material specifications.
  - Structural steel shall be "low-alloy steel" for non-bridge structures per Item 442, "Metal For Structures."
  - For fiberglass substrate connection details, see manufacturer's recommendations.

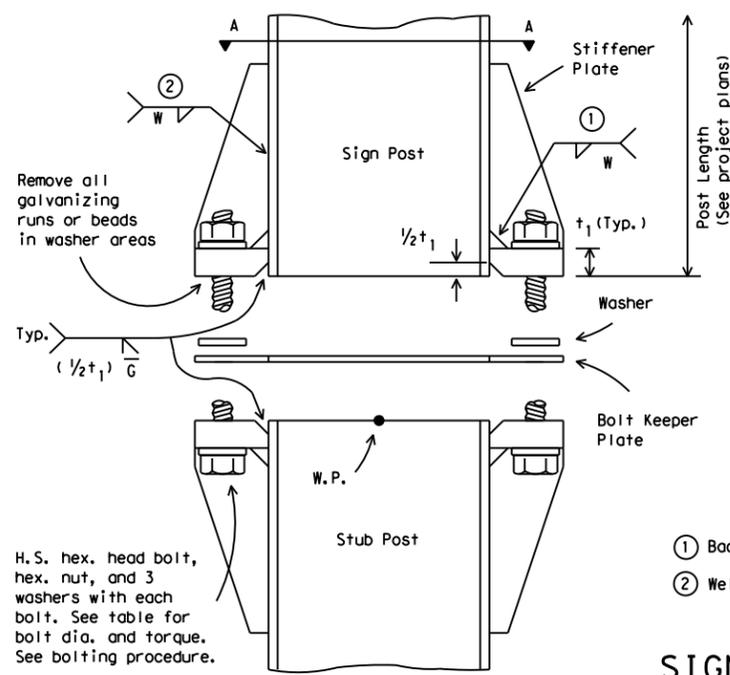
Texas Department of Transportation
   
 Traffic Operations Division

**SIGN MOUNTING DETAILS-  
 EXTRUDED ALUMINUM  
 SIGN PANELS & HARDWARE**
  
**SMD(2-1)-08**

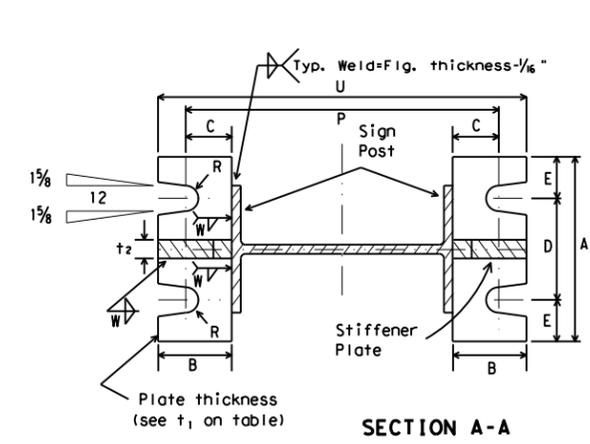
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		BMT	LIBERTY, ETC.		140

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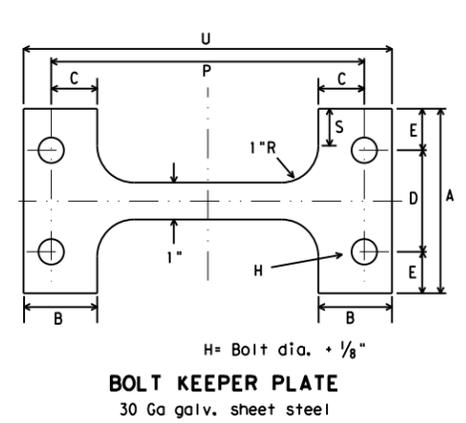
**ELEVATION**



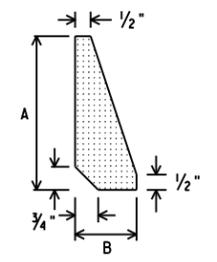
**SECTION A-A**

- ① Back up weld to be made before installing stiffener plate
- ② Weld W may be continued across clips to seal joint

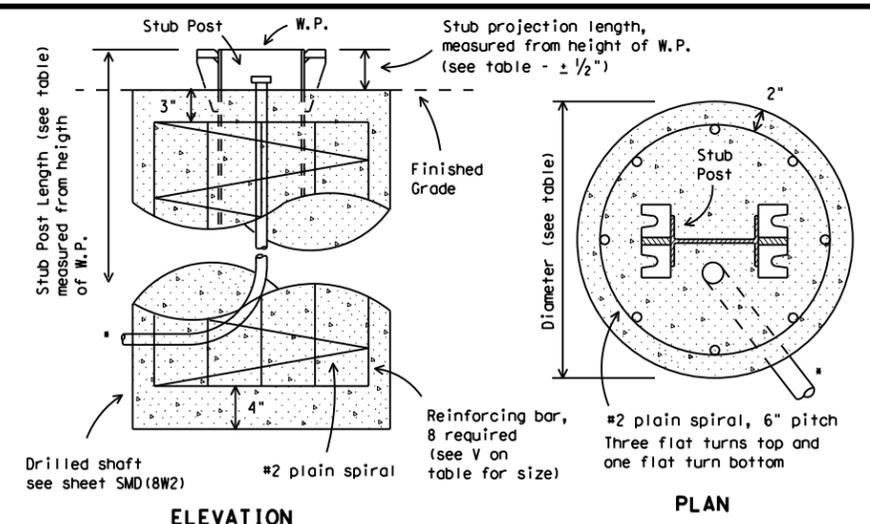
**SIGN POST AND STUB POST**  
(For W Shapes)



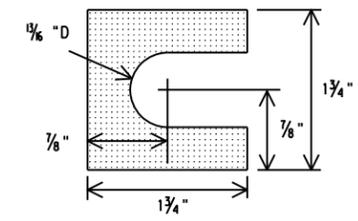
**BOLT KEEPER PLATE**  
30 Ga galv. sheet steel



**STIFFENER PLATE DETAIL**  
Steel Plate (thickness = t<sub>2</sub>)  
(See table for dimensions)



**FOUNDATION DETAIL**  
\*Note: For signs with electrical apparatus, see ED(10) for conduit required in foundation.

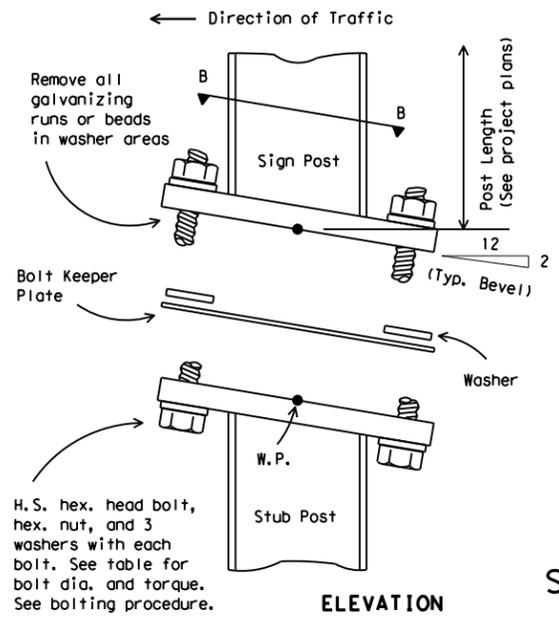


**SHIM DETAIL**  
Furnish two .012\"+ thick and two .032\"+ thick shims per post. Shims shall be fabricated from brass shim stock or strip conforming to ASTM B36.

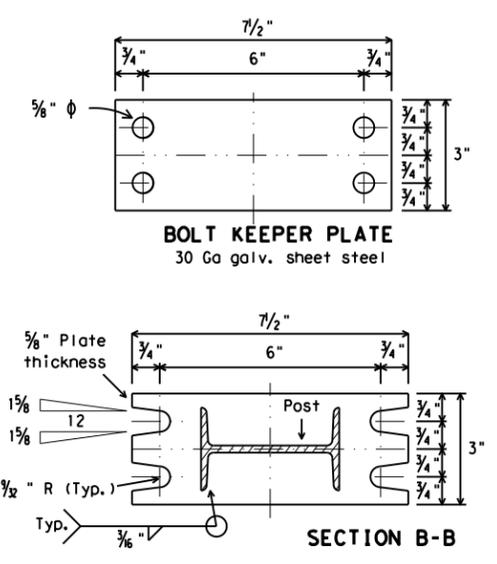
- BOLTING PROCEDURE FOR ASSEMBLY OF BASE CONNECTION:**
- Assemble sign post, BOLT KEEPER PLATE and stub post with bolts and three flat washers per bolt as shown.
  - Shim as required to plumb post.
  - Tighten all bolts the maximum possible with a 12 to 15 inch wrench to clean bolt threads and to bed washers and shims.
  - Loosen each bolt in sequence and retighten bolts in a systematic order to the prescribed torque. Do not over-tighten.
  - To prevent nut loosening, burr threads of bolt at junction with nut using a center punch.

Dimensions Post Size	Base Connection Data Table										Perforated Fuse Plate Data Table							Bolt Keeper Data			Foundation Data								
	Bolt Size & Torque	A	B	C	D	E	t <sub>1</sub>	t <sub>2</sub>	W	R	F	G	J	K	M	d <sub>1</sub>	d <sub>2</sub>	t <sub>3</sub>	Bolt Dia.	Wt. (ea.) (lbs.)	Bolt length	P	S	U	Stub length	Stub projection	Dr. Shaft diameter	Bar V Size	
W6x9	5/8" φ × 2 3/4"										4 1/4"	2"	4"	2 1/4"	1"	9/16"	3/4"	1/4"	1/2"	1.01	1 1/2"	8 3/8"		9 7/8"	2'-0"	3"		#5	
W6x12	440-450 inch pounds	5"	2"	1 1/4"	2 3/4"	1 1/8"	3/4"	1/2"	1/4"	1/32"	5"	2 1/2"	6"	3 1/2"	1 1/2"	1/16"	1/4"	3/8"	5/8"	2.51	2 1/4"	8 1/2"	1"	10"	2'-0"	3"		#5	
W6x15	36-38 foot pounds										5"	2 1/2"	5 1/4"	2 3/4"	1 1/4"	1/16"	1/16"	3/8"	5/8"	2.26	2 1/4"	10 5/8"		10"	2'-6"	3"		#6	
W8x18											5 1/2"	2 1/2"	5 1/4"	2 3/4"	1 1/4"	13/16"	1"	1/2"	3/4"	3.35	2 1/4"	11"		12 3/8"	2'-6"	3"		#7	
W8x21	3/4" φ × 3 1/2"										5 1/2"	2 1/2"	5 1/4"	2 3/4"	1 1/4"	13/16"	1"	1/2"	3/4"	3.35	2 1/4"	11"		12 3/8"	3'-0"	2 1/2"		#8	
W10x22	740-750 inch pounds	6"	2 1/4"	1 3/8"	3 1/2"	1 1/4"	1"	3/4"	5/16"	13/32"	6"	3"	5 3/4"	2 3/4"	1 3/8"	13/16"	1 1/8"	1/2"	3/4"	4.03	2 1/4"	12 7/8"	1 1/2"	14 5/8"	3'-0"	2 1/2"		#9	
W10x26	62-63 foot pounds										6"	3"	6 1/2"	3 1/2"	1 5/8"	13/16"	1 5/16"	1/2"	3/4"	4.47	2 1/4"	13 3/8"	1 1/2"	14 7/8"	3'-0"	2 1/2"		#10	
W12x26											6"	3"	6 1/2"	3 1/2"	1 5/8"	13/16"	1 5/16"	1/2"	3/4"	4.47	2 1/4"	15"		16 3/4"	3'-0"	2 1/2"		#11	
S3x5.7	1/2" φ × 2 1/2"	See Detail Below										3 3/4"	1 1/2"	2 5/8"	1 1/2"	5/8"	9/16"	3/8"	1/4"	1/2"	0.60	1 1/2"	See Detail Below			3'-3 1/2"	3 1/2"	12"	Non-reinforced
S4x7.7	440-450 inch pounds	See Detail Below										3 3/4"	1 1/2"	2 5/8"	1 1/2"	5/8"	9/16"	3/8"	1/4"	1/2"	0.60	1 1/2"	See Detail Below			3'-3 1/2"	3 1/2"	12"	Non-reinforced

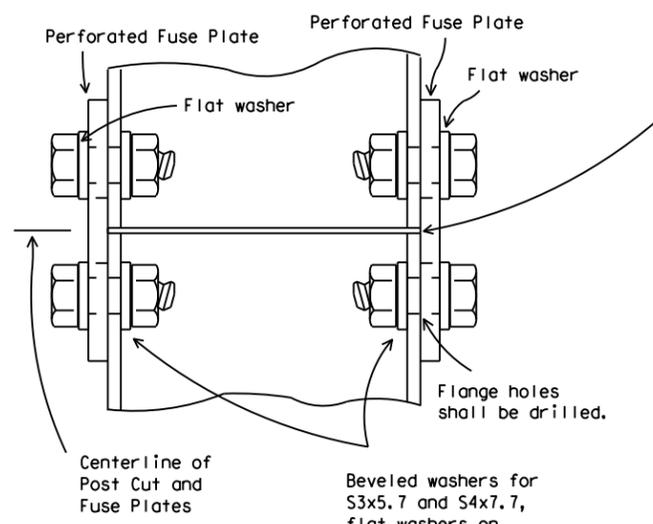
③ Foundation design shall be Type G Mount, see SMD (TY G).



**ELEVATION**



**SECTION B-B**  
**SIGN POST AND STUB POST**  
(For S4x7.7 and S3x5.7)



**DETAIL "A"**

**PERFORATED FUSE PLATE DETAIL**

Use H.S. hex head bolts, hex head nut and bevel or flat washer (where req'd) under nut. All holes shall be drilled, sub-punched and reamed. All plate cuts shall preferably be saw cuts. However, flame cutting will be permitted provided all edges are ground. Metal projecting beyond the plane of the plate face will not be permitted. Steel fuse plates shall conform to the requirements of ASTM A36. ASTM A572 Grade 50 or ASTM A588 may be substituted for A36 at the option of the fabricator. Mill test reports shall be submitted for Fuse Plates. Steel used shall have an ultimate tensile strength not to exceed 80 KSI. For alternative Fuse Plate contact Traffic Operations Division.

**Texas Department of Transportation**  
 Traffic Operations Division

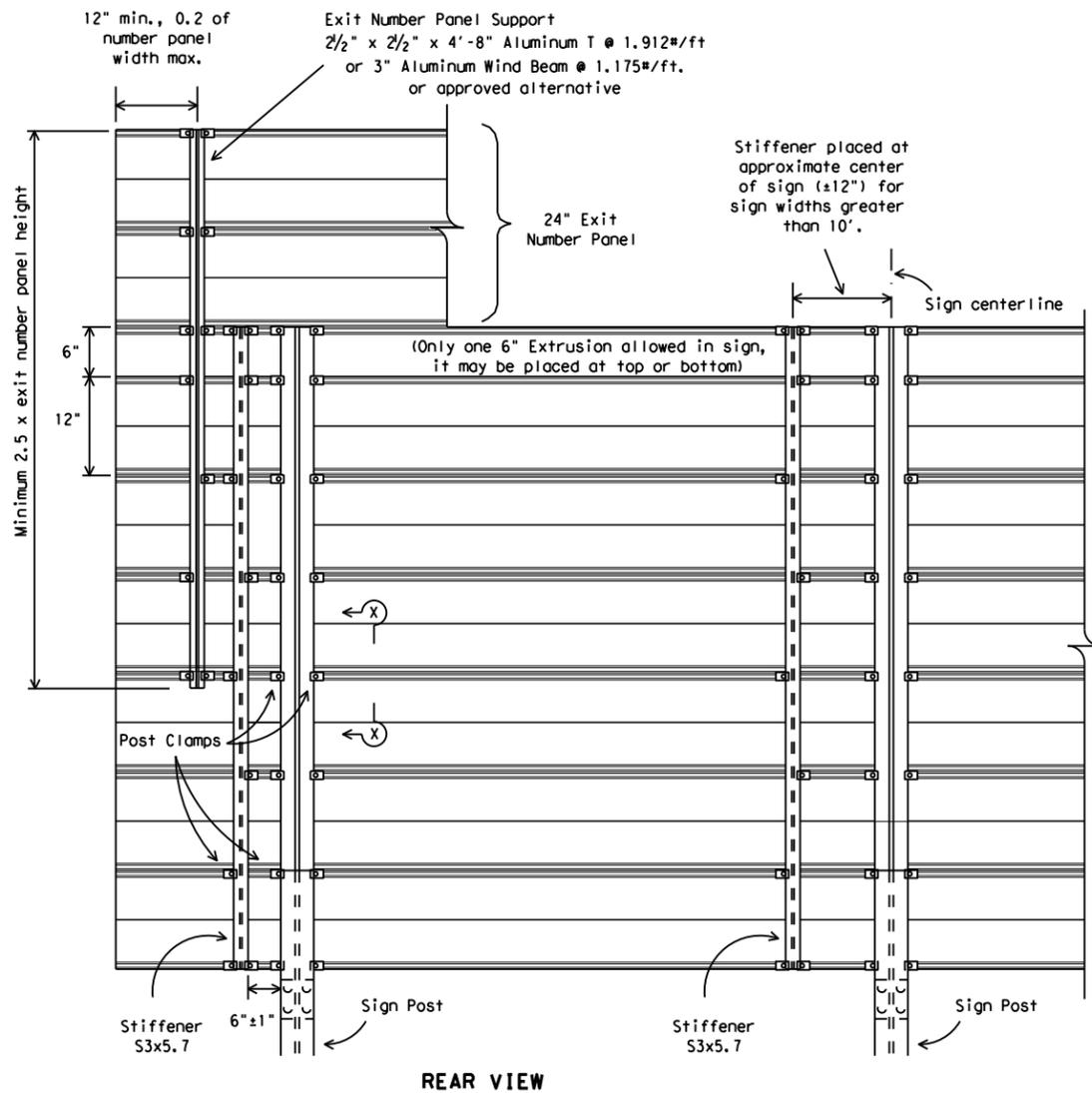
**SIGN MOUNTING DETAILS-  
 LARGE ROADSIDE SIGNS  
 FOUNDATION & STUB**

**SMD(2-2)-08**

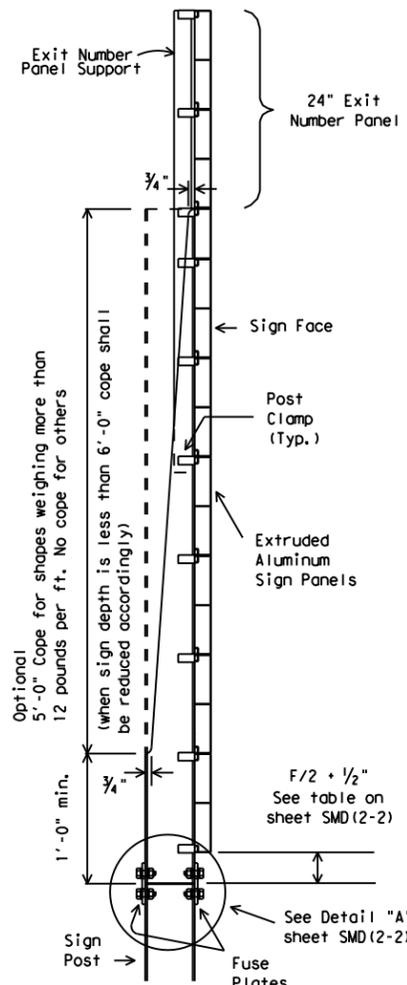
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9-08		6399	15	001	SH99
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		BMT	LIBERTY, ETC.		141

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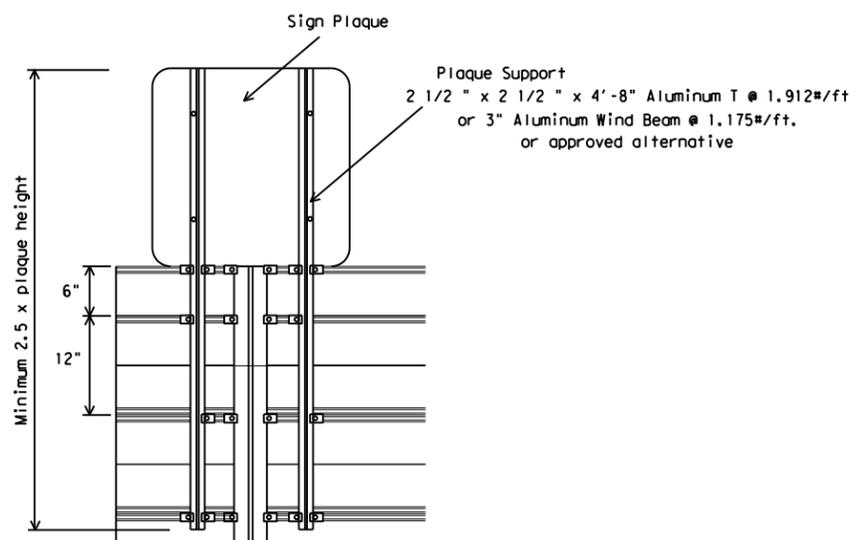


REAR VIEW

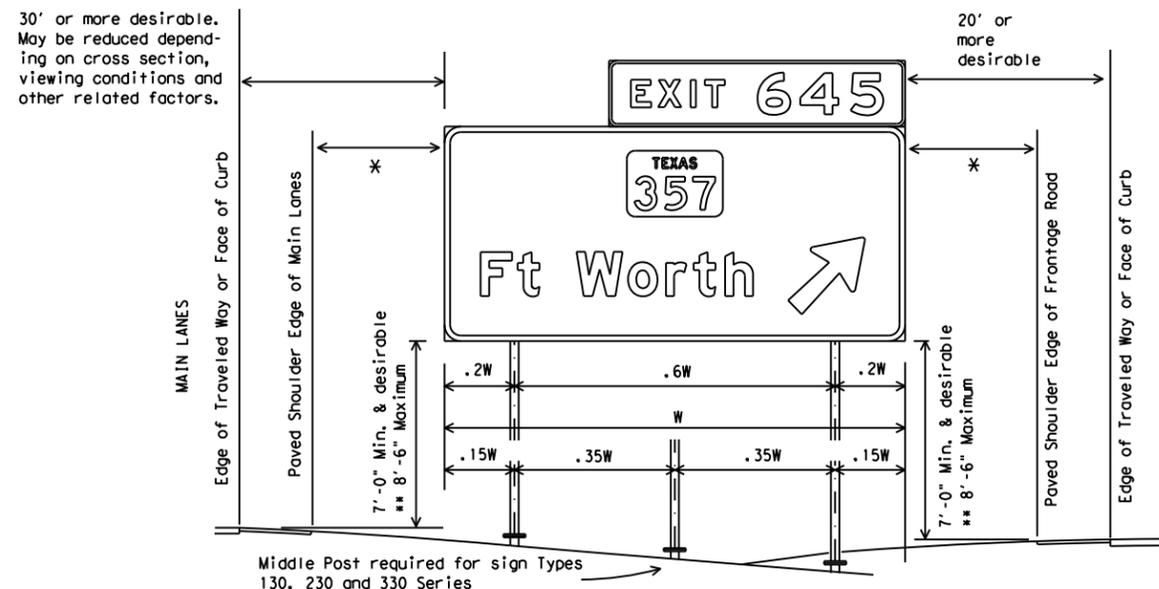


SIDE VIEW

ALUMINUM PARENT SIGN & EXIT NUMBER PANEL MOUNTING DETAILS



SIGN PLAQUE MOUNTING DETAIL TO ALUMINUM PARENT SIGN



TYPICAL SIGN INSTALLATION AND LOCATION

LATERAL CLEARANCE NOTES:

Lateral clearances of signs mounted on median side of main lanes are the same as shown above where space will permit.

Where a sign is to be located behind guardrail, an allowable minimum clearance of five feet may be used, measured from the face of the guardrail to the near edge of sign.

\* - 6' minimum and desirable may be used only in areas of limited lateral clearance and when approved by the Engineer.

POST SPACING NOTES:

Post spacing on a two post sign may vary a maximum of plus or minus 10% of total sign width to fit field conditions.

Post spacing on a three post sign may vary a maximum of plus or minus 5% of total sign width to fit field conditions.

SIGN HEIGHT NOTES:

\*\* The 8' 6" maximum may be exceeded when placing signs on extreme slopes. In these conditions, a 7' minimum from natural ground to bottom of sign must be maintained.

DEPARTMENTAL MATERIAL SPECIFICATIONS

ALUMINUM SIGN BLANKS	DMS-7110
SIGN HARDWARE	DMS-7120

GENERAL NOTES:

- Exit number panel shall be mounted to the right hand side of the parent sign for right exits and to the left hand side for left exits. The number panel shall be mounted with two uprights so its right edge is even with the right edge of the parent sign or vice-versa for left hand exits.
- Exit number panel support shall be symmetrical about number panel centerline.
- Exit number panel support shall be ASTM A36 structural steel galvanized after fabrication, or ASTM B221 aluminum alloy 6061-T6 or approved alternative.
- All bolts, nuts and washers shall be galvanized per ASTM Designation: B695 Class 50, or A153 Class C or D.
- Posts, parent sign panels, and exit number panels shall comply with notes on sheets SMD(2-1) and SMD(2-2).
- Signs (such as exit number panels) attached above a parent sign shall be made of the same type material as the parent sign. General Service and Routing signs may be fabricated from flat sheet aluminum.
- Exit number panel support and other connection hardware required to fasten exit number panel to parent sign shall be subsidiary to "Aluminum Signs" or "Fiberglass Signs."
- For fiberglass sign installation details, see manufacturer's recommendations.



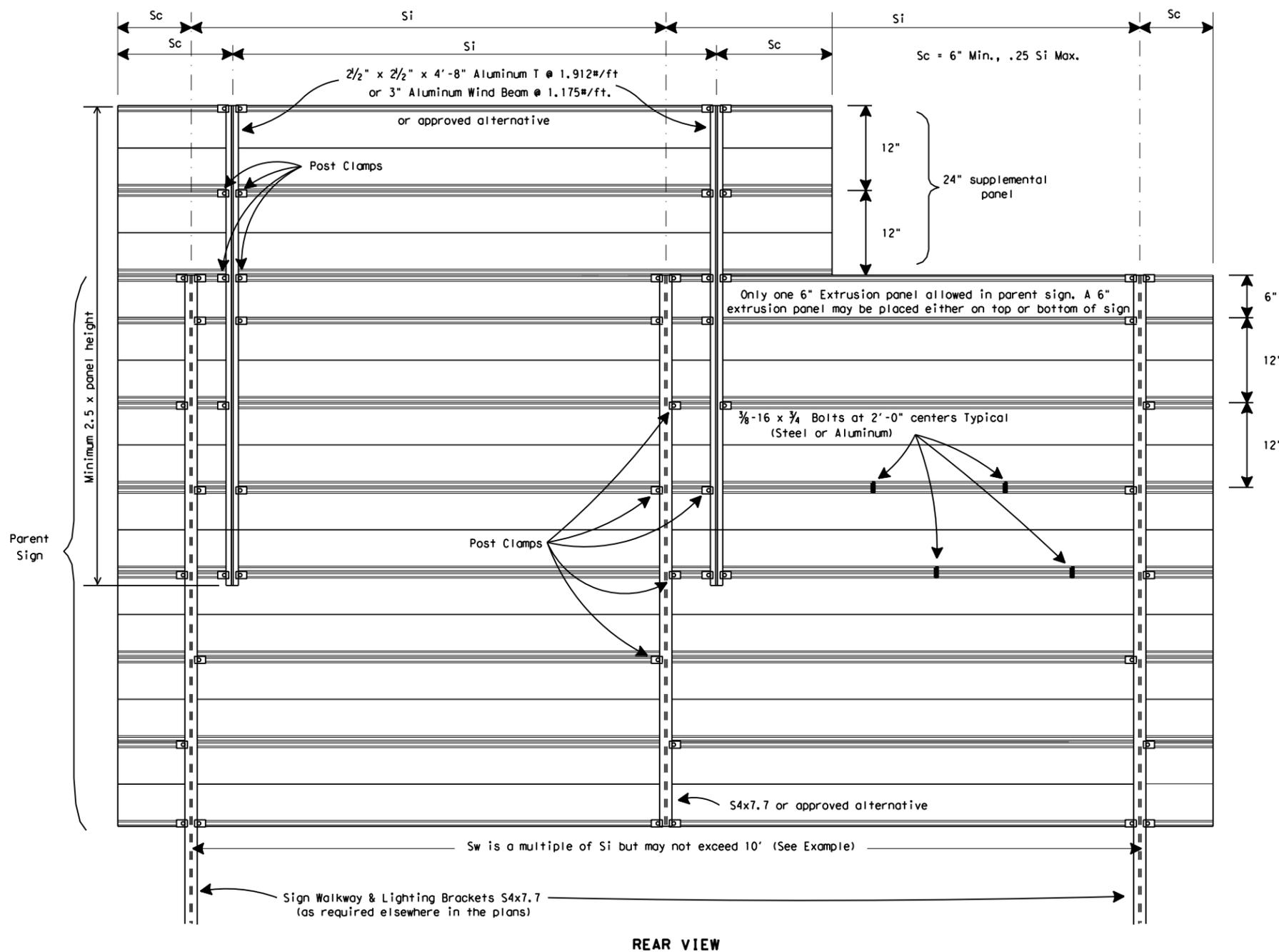
SIGN MOUNTING DETAILS-  
LARGE ROADSIDE SIGNS

SMD(2-3)-08

© TxDOT August 1995	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
9-08	CONTRACT NO. 6399	SECTION 15	JOB NO. 001	HIGHWAY SH99
	DIST. BMT	COUNTY. LIBERTY, ETC.	SHEET NO. 142	

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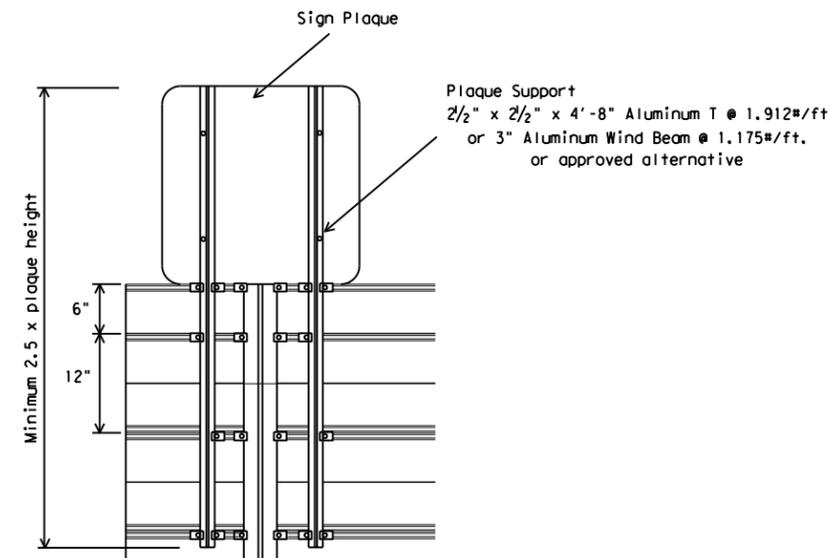
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EXAMPLES (FOR DETERMINING Si and Sw)

NO.	ZONE	"d"	EXIT PANEL	WALKWAY	Si	Sw	COMMENT
1	1	15.0	YES	YES	4.5	9.0	Sw=2x(Si)
2	2	14.0	YES	NO	7.5	7.5	Sw = Si
3	1	15.0	NO	NO	8.5	8.5	Sw = Si
4	3	14.0	NO	YES	10.0	10.0	Sw = Si

Values shown for Si are maximum values. Si may be varied for different sign lengths and Truss mounting conditions. Sw should not exceed two times Si (Max.) or 10 feet.



SIGN PLAQUE MOUNTING DETAIL

"d" Deepest Sign in Group (Ft.)	MAXIMUM SIGN SUPPORT SPACING "Si" (FEET)																			
	EXTRUDED ALUMINUM SIGN PANELS																			
	WITH EXIT NUMBER PANELS								WITHOUT EXIT NUMBER PANELS											
	WITH WALKWAYS				WITHOUT WALKWAYS				WITH WALKWAYS				WITHOUT WALKWAYS							
WIND ZONE	WIND ZONE	WIND ZONE	WIND ZONE	WIND ZONE	WIND ZONE	WIND ZONE	WIND ZONE	WIND ZONE	WIND ZONE	WIND ZONE	WIND ZONE	WIND ZONE	WIND ZONE	WIND ZONE	WIND ZONE	WIND ZONE				
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
15	4.5	7	8	10	5	7	8	10	7	8	9	10	8.5	10	10	10				
14	6	7.5	9.5	10	6	7.5	9.5	10	8	9	10	10	10	10	10					
13	7.5	9	10	10	7.5	9	10	10	9	10	10	10	10	10	10					
12	8.5	10	10	10	8.5	10	10	10	10	10	10	10	10	10	10					
11 or less	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10					

For fiberglass sign installations, see manufacturer's recommendations.

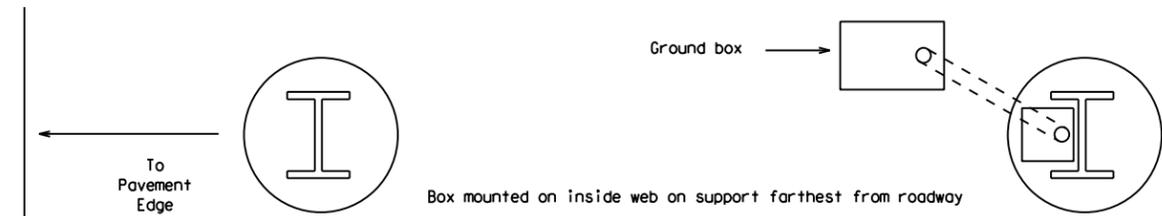


**SIGN MOUNTING DETAILS-  
 OVERHEAD SIGNS  
 EXTRUDED ALUMINUM  
 SMD (2-4) -08**

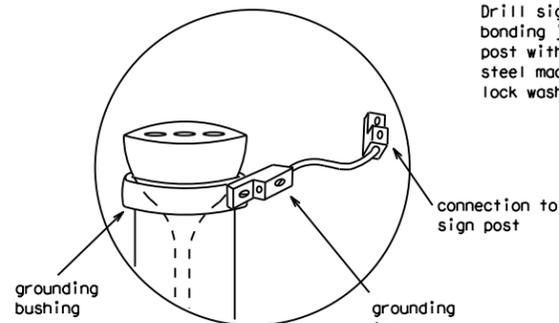
© TxDOT December 1995		DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
9-08	REVISIONS	CONT	SECT	JOB	HIGHWAY
		6399	15	001	SH99
		DIST	COUNTY	SHEET NO.	
		BMT	LIBERTY, ETC.	143	

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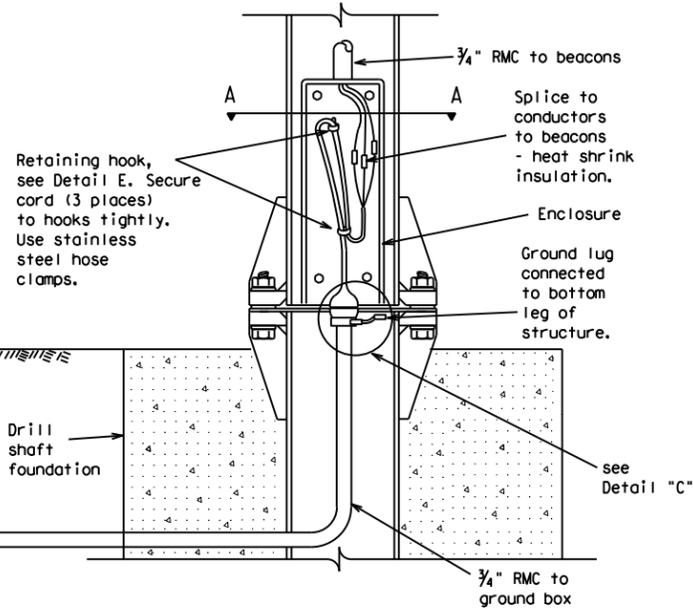
PLAN VIEW



DETAIL C

Pull connector down tight against conduit then clamp in ground box. See Detail "D"

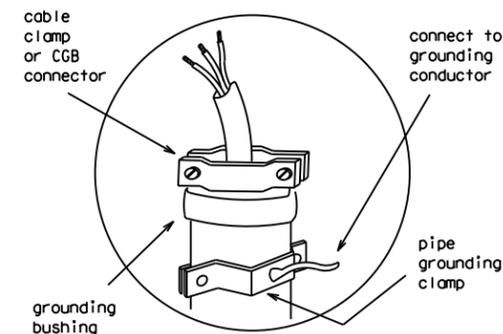
Drill sign post - structure leg, terminate bonding jumper with listed connector to post with a 10-24 (3/16") min. stainless steel machine screw, nut, flat washer and lock washer made wrench tight.



ELECTRICAL CONNECTION DETAIL

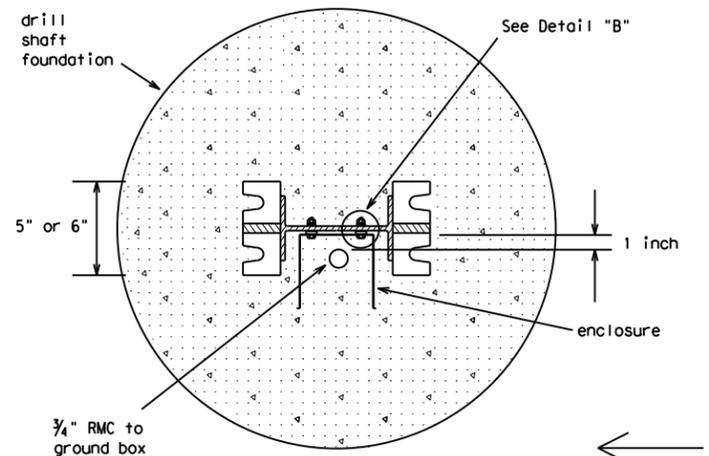
Enclosure cover not shown for clarity  
 Detail shows channel greater than 4 inches.  
 Less than 4 inches similar, see Detail A.

Use RMC E11s, provide grounding bushings. Terminate bonding jumper to ground rod and equipment grounding conductors.



DETAIL D

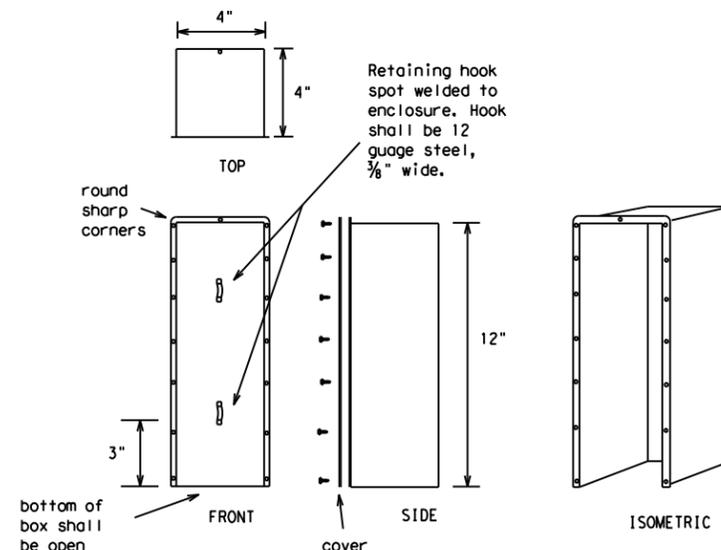
Pull cable so opposite end connector is tight against conduit end, clamp cable at top of conduit as shown.



SECTION A-A

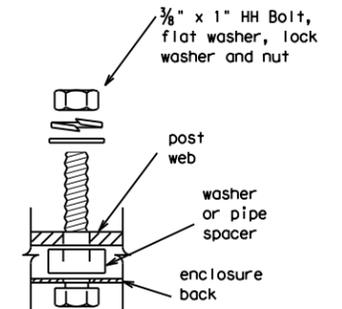
Stub-post connection  
 conduit, bolts and enclosure  
 (cover not shown)

direction of traffic



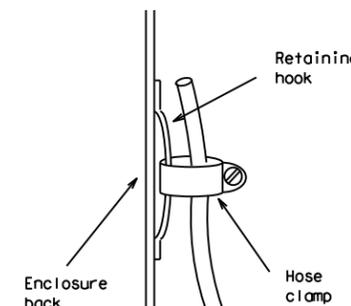
ENCLOSURE

make from 12 gauge galvanized sheet metal



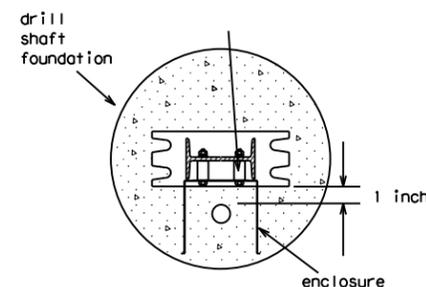
DETAIL B

enclosure connection  
 (4 places)  
 (use 2 inch bolt for 3 and 4 inch channels)



DETAIL E

steel pipe spacer  
 (1" for 3" channel,  
 1 1/4" for 4" channel)  
 See detail B



DETAIL A

Stub-post connection  
 conduit, bolts and enclosure  
 for 3 and 4 inch channel  
 (cover not shown)

direction of traffic

NOTES:

- Breakaway connector shall be rated for 300 VAC, 30 amps and shall be waterproof. Connector shall be a three pole (two line conductors and neutral) polarized elastomer connector made from thermosetting synthetic polymer which remains flexible over the temperature range of -40 degrees C to 90 degrees C. The pins on the connector shall be overmolded 1/4" from the face of the connector toward the tips of the pins with the same material used in the construction of the connector body. This overmolding of the pins shall provide a non-conductive double taper which prevents the intrusion of water into the connection when the connectors are fully engaged. The pin receptors shall have current carrying barrels recessed 1/2" from the face of the connector and surrounded by beryllium copper spring sleeves. The plug/receptacle combination shall be listed by an approved testing facility (UL or Factory Mutual) as suitable for outdoor use and shall have passed a rain test and a watertight (immersion) test as approved by the Engineer.
- The female connector shall be integrally molded to a 13' length of type 50 cord containing three number 10 or number 8 AWG conductors. The male connector shall be integrally molded to a 20' length of Type 50 cord containing three number 10 or number 8 AWG conductors. Cord conductors shall have colored insulation, two black and one white, or shall be taped or painted to be two black and one white. Tape or paint marking shall cover entire exposed length. The contractor shall make a brochure submittal on cord connectors. Breakaway connector and cord shall not be paid for separately, but shall be subsidiary to the various items.
- The contractor shall install in-line waterproof fuseholders for each line conductor in the ground box. Fuses shall be fast-acting 5 amp (Bussman KTK5, Gould ATM5, Littelfuse KLK5 or equal).
- Conduit shall convert to 3/4" liquidtight flexible metallic conduit below the fuse plate or knee joint and shall revert to 3/4" RMC above the fuse plate or knee joint. The length of liquidtight flexible metal conduit shall not exceed 6".
- Ground rod clamp shall be Blackburn GG 5/8H, Weaver W5.8 or equal.
- Ground rod to be driven to a depth to leave between 2 to 4 inches of rod above the gravel placed under the ground box. See ED(2) standard sheet for ground box details.

11-01 Revision  
 Liquidtight conduit size corrected.  
 Editing of minor notes.

Texas Department of Transportation  
 Traffic Operations Division

**SIGN MOUNTING DETAILS-  
 LARGE ROADSIDE SIGNS  
 ELECTRICAL CONNECTION**

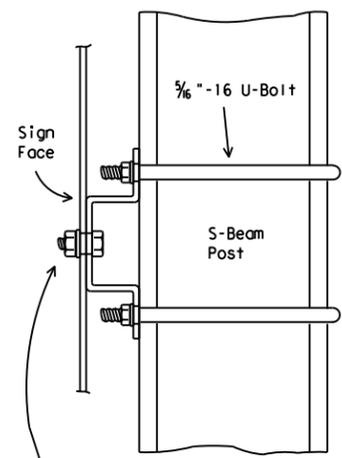
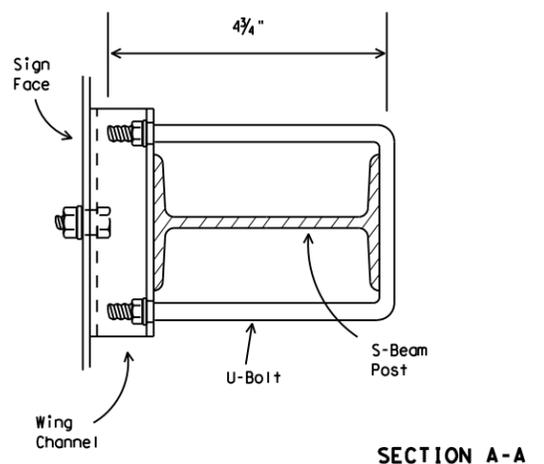
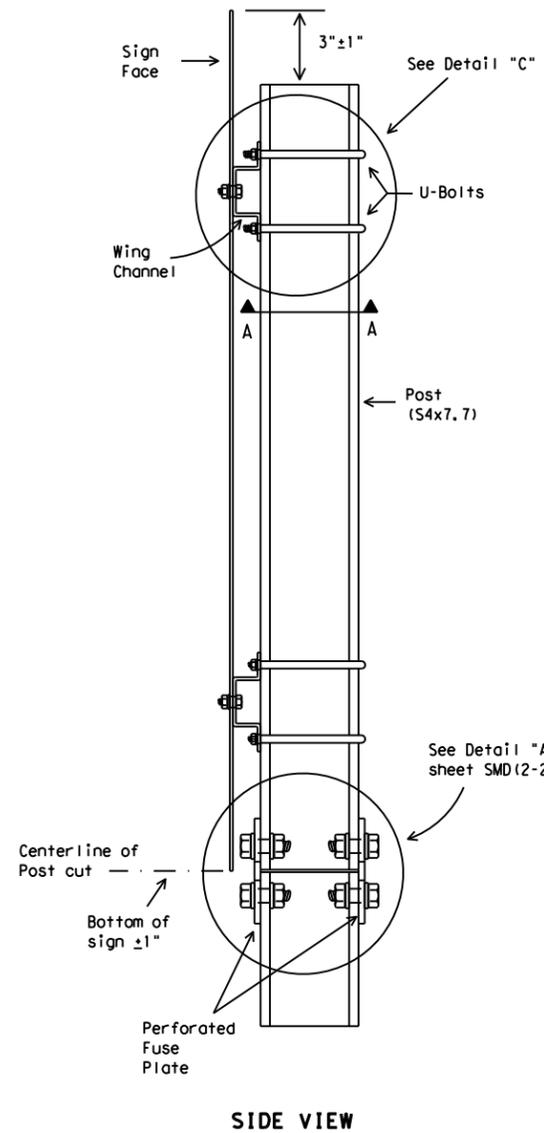
**SMD(2-6)-01**

© TxDOT April 1998		DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
11-98	REVISIONS	CONT	SECT	JOB	HIGHWAY
11-01		6399	15	001	SH99
		DIST	COUNTY	SHEET NO.	
		BMT	LIBERTY, ETC.	144	

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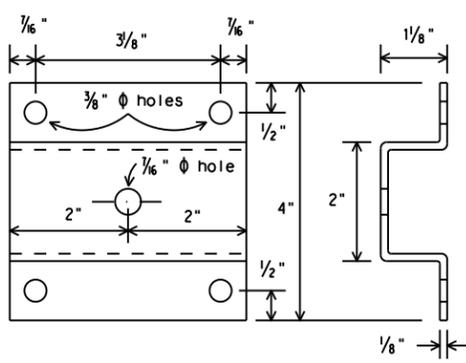
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# WING CHANNEL CLAMP DETAIL FOR TYPE G MOUNT



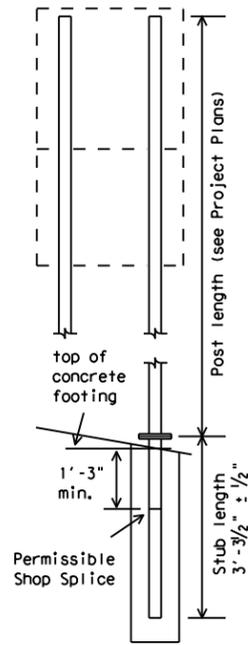
Galvanized steel or aluminum self-locking hex. head nut. 3/8" - 16 x 3/4" hex. head bolt for sheet metal. 3/8" - 16 x 1 1/4" hex. head bolt for plywood. 3/8" galvanized medium washer.

DETAIL "C"



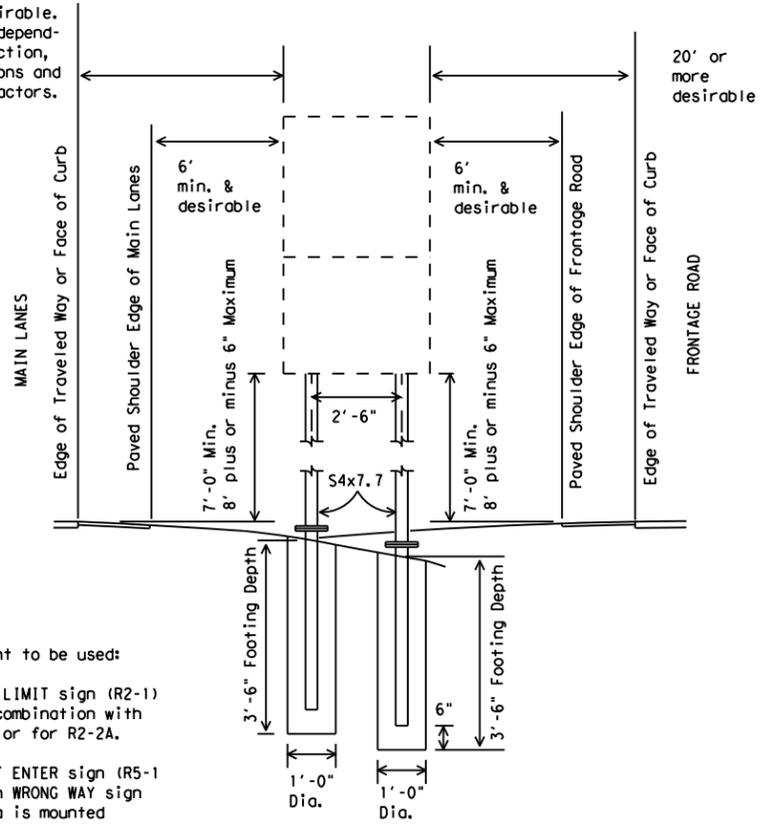
WING CHANNEL

Wing channel, 4" width x 1/8" depth x 1/8" thickness, shall be aluminum (ASTM B221 6061-T6 or B308 6061-T6), galvanized steel (ASTM A36) or stainless steel (ASTM A167 type 304, No. 2B finish).



The weight of one S4x7.7 post is equal to 112.2 lbs. plus 7.7 lbs./ft x (post length in feet minus 10 ft). The weight of 112.2 lbs. includes 10 feet of post length, post foundation stub, related connection plates, friction fuse plate, and all high strength bolts, nuts and washers.

30' or more desirable. May be reduced depending on cross section, viewing conditions and other related factors.



This type mount to be used:  
 (1) For SPEED LIMIT sign (R2-1) when used in combination with R2-2 and R2-4 or for R2-2A.  
 (2) For DO NOT ENTER sign (R5-1) when used with WRONG WAY sign (R5-1a). R5-1a is mounted above R5-1.

DEPARTMENTAL MATERIAL SPECIFICATIONS  
 SIGN HARDWARE  
 DMS-7120

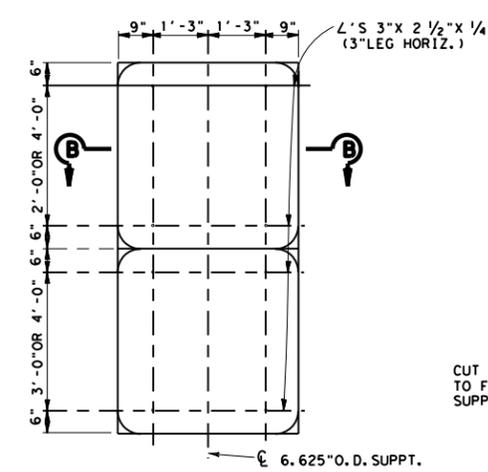
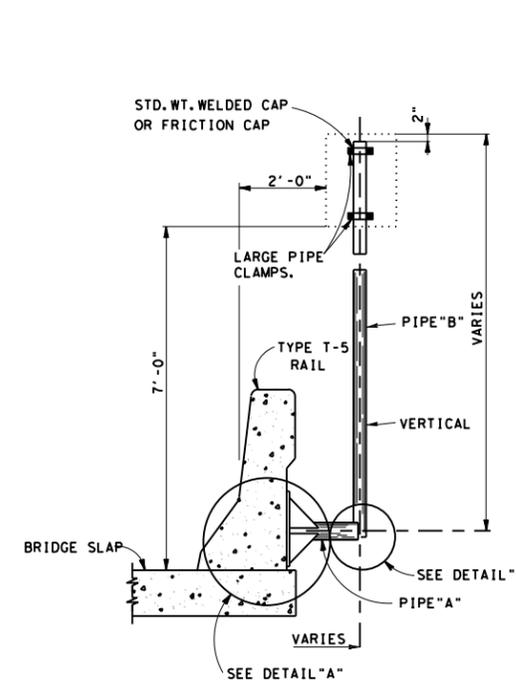
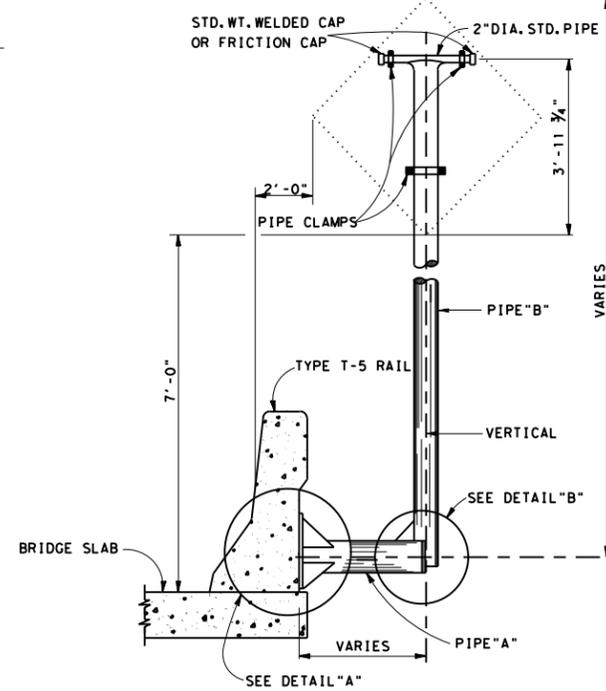
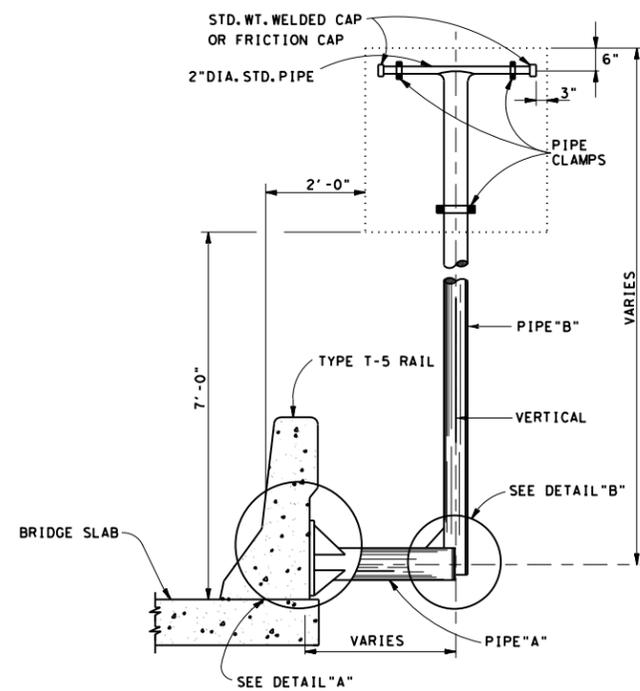
- GENERAL NOTES:
- Design conforms with AASHTO Specifications for the design and construction of structural supports for highway signs.
  - Materials and fabrication shall conform to the requirements of the Department material specifications.
  - Structural steel shall be "Low-Alloy Steel" for non-bridge structures per Item 442, "Metal For Structures."
  - Parts shall be saw cut either before galvanizing and the galvanized cut cleaned of zinc build-up, or saw cut after galvanizing and the cut surface repaired per Item 445, "Galvanizing." (Cut surface will not be treated until plate is installed and all bolts fully tightened.)



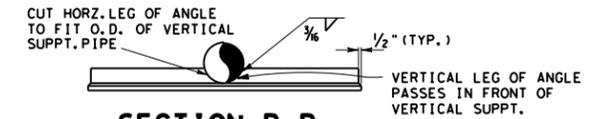
## SIGN MOUNTING DETAILS, TYPE G SUPPORT

SMD(TY G)-08

© TxDOT August 1995		DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
REVISIONS					
1-97	CON	SECT	JOB	HIGHWAY	
9-08	6399	15	001	SH99	
DIST		COUNTY		SHEET NO.	
BMT		LIBERTY, ETC.		145	

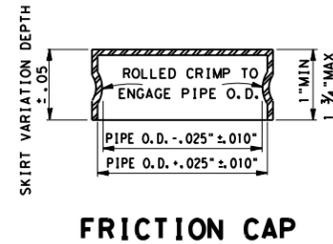


SIGN AREA S.F.	PIPE A SIZE	PIPE B SIZE	CORRESPONDING TYPE GROUND MOUNT
1-10	4.500" O.D. X 0.337" W.T.	3.500" O.D. X 0.300" W.T.	10 BWG (1) SA (P)
10-16	8.625" O.D. X 0.332" W.T.	4.500" O.D. X 0.337" W.T.	10 BWG (1) SA (T)
16-32	8.625" O.D. X 0.332" W.T.	6.625" O.D. X 0.280" W.T.	S80 (1) SA (T) S80 (1) SA (U) S80 (1) SA (U-1EXT)
32-40	8.625" O.D. X 0.332" W.T.	6.625" O.D. X 0.432" W.T.	S80 (2) SA (P) S80 (1) SA (U-2EXT)



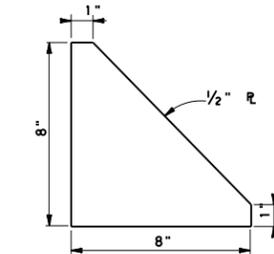
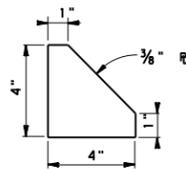
R2-1 (48x60) & R2-4 (48x60)  
R5-1a (48x36) & R5-1 (48x48)

**BRIDGE MOUNTED SIGNS**

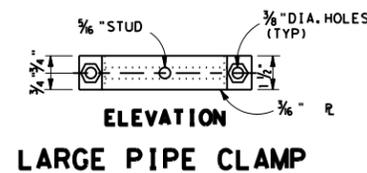
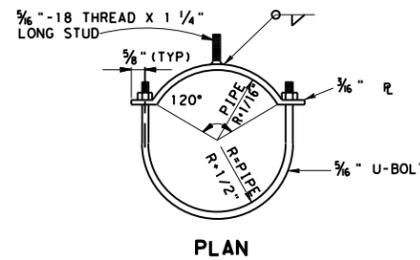


**NOTES:**  
FRICION CAPS-MANUFACTURED FROM HOT OR COLD ROLLED STEEL SHEETS, SIZED FOR DRIVE FRICTION FIT, AND SO FORMED AS TO HAVE NO TENDENCY TO ROCK WHEN SEATED. THEY SHALL BE FREE OF SHARP INDENTATIONS AND EVIDENCE OF METAL FRACTURE, WITH RIMS REASONABLY STRAIGHT AND SMOOTH.

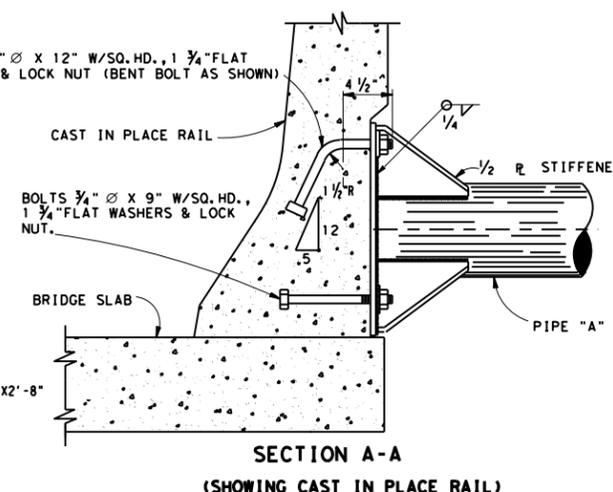
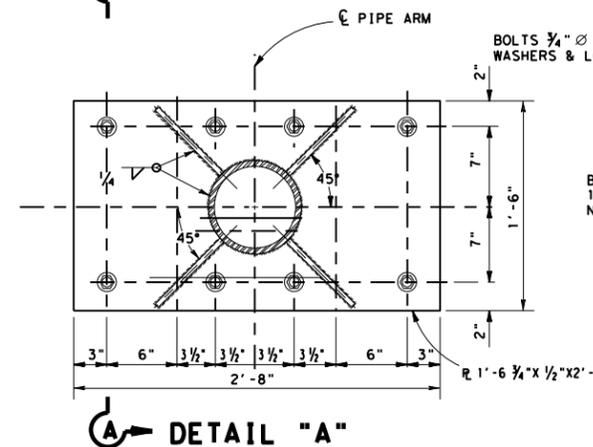
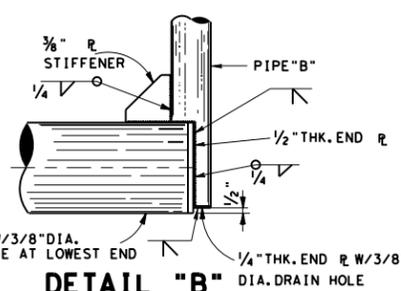
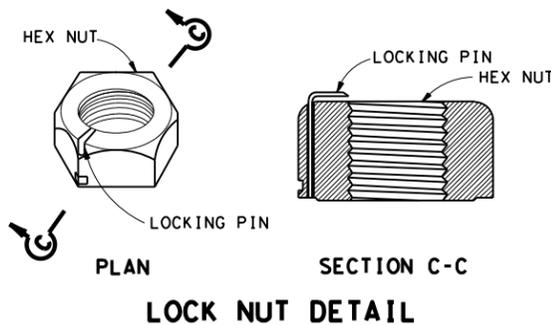
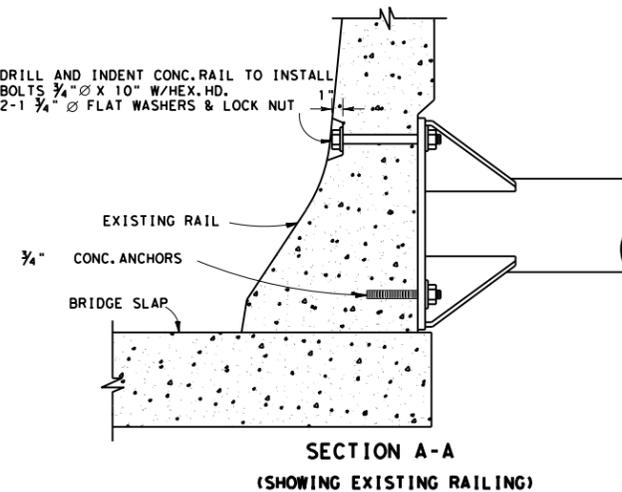
**3/8" R STIFFENER**



**1/2" R STIFFENER**



DRILL AND INDENT CONC. RAIL TO INSTALL BOLTS 3/4" X 10" W/HEX. HD. 2-1 3/4" FLAT WASHERS & LOCK NUT



**NOTES:**

CONTRACTOR SHALL CHECK CROSS SLOPE ON BRIDGES AND THEN FABRICATE SIGN MOUNTS SO SIGN SUPPORT PIPE IS VERTICAL. ADDITIONAL "U" OR "T" EXTENSION PIPE OF THE SIZE AND LENGTHS SHOWN ON STANDARD PLAN SHEETS SHALL BE PROVIDED AND ATTACHED (WELDED OR AS DIRECTED BY THE ENGINEER) TO PIPE "B" AS REQUIRED. SIGN PANELS SHALL BE ATTACHED TO THE 3" DIA. OR SMALLER PIPE ARMS AS SHOWN IN THE STANDARD PLAN SHEETS. ATTACHMENT TO 4" OR 6" PIPES SHALL BE AS SHOWN ON THIS SHEET OR AS SHOWN IN STANDARD PLAN SHEETS EXCEPT FOR R2-1 AND R2-4 OR R5-1A AND R5-1 SIGN COMBINATIONS WHICH SHALL BE MOUNTED AS SHOWN ON THIS SHEET. LOCK NUTS WITH NONREVERSIBLE HIGH TENSILE STRENGTH STAINLESS STEEL LOCKING PINS SHALL BE USED ON BOLTS. CONCRETE ANCHORS SHALL BE STANDARD 3 UNIT CONCRETE ANCHORS. RAWL, PARABOLT, KWIKBOLT OR EQUAL, WITH LOCK NUT, FLAT WASHER & LOCK WASHER. ANCHORS SHALL NOT BE LESS THAN 4 1/2" IN LENGTH. SIGN SUPPORTS SHALL BE GALVANIZED AFTER FABRICATION. SIGN SUPPORT BRACKETS AS DETAILED ON THIS SHEET ARE FOR SIGNS MOUNTED ON RIGHT SIDE OF ROADWAY. LEFT HAND BRACKETS SHALL BE OPPOSITE TO THOSE SHOWN. SEE SIGN LAYOUT SHEETS TO DETERMINE WHETHER RIGHT OR LEFT HAND BRACKET IS REQUIRED. ANY CHIPPING, GOUGING, OR OTHER WORK, TOOLS OR ANY OTHER INCIDENTALS NECESSARY TO EFFECT THE INSTALLATION OF BRIDGE MOUNTED SIGN BRACKETS ON CURBS, PARAPET WALLS, COPINGS OR OTHER LOCATIONS AS CALLED FOR IN PLANS WILL NOT BE PAID FOR DIRECTLY BUT SHALL BE CONSIDERED SUBSIDIARY TO THE ITEM "SMALL ROADSIDE SIGN SUPPORTS AND ASSEMBLIES".

Texas Department of Transportation  
Houston District

**BRIDGE MOUNTING DETAILS**  
(FOR SMALL ROADSIDE SIGNS)

SMD (BM-1) -04

FILE:	DN:	CK:	DW:	CK:
© TxDOT 1998	DIST	FED REG	PROJECT NO.	SHEET
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	COUNTY	CONTROL	SECT	JOB
	LIBERTY, ETC.	6399	15	001
				SH99

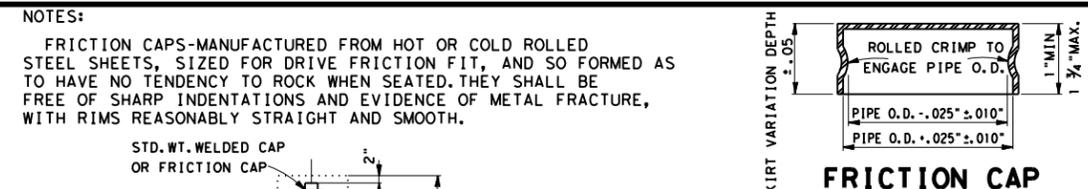
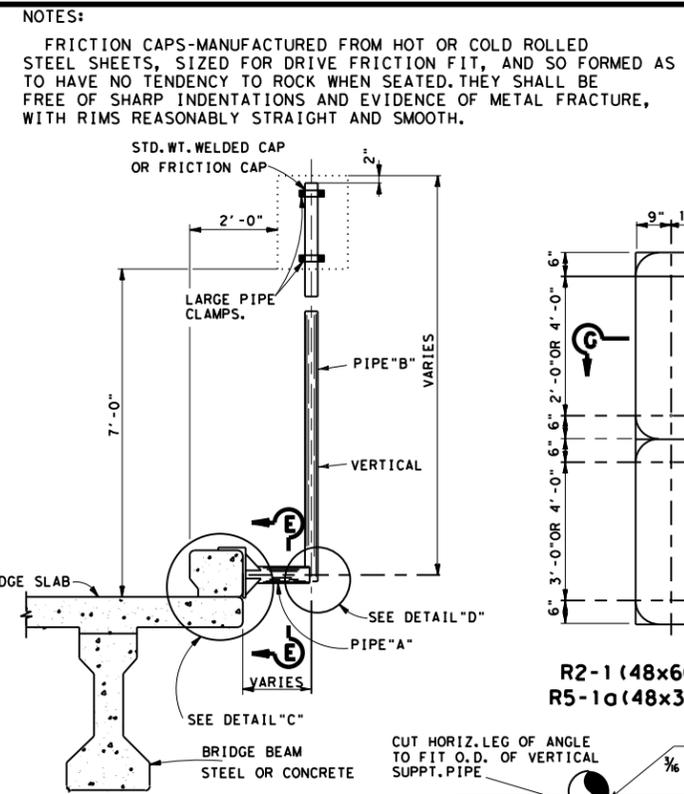
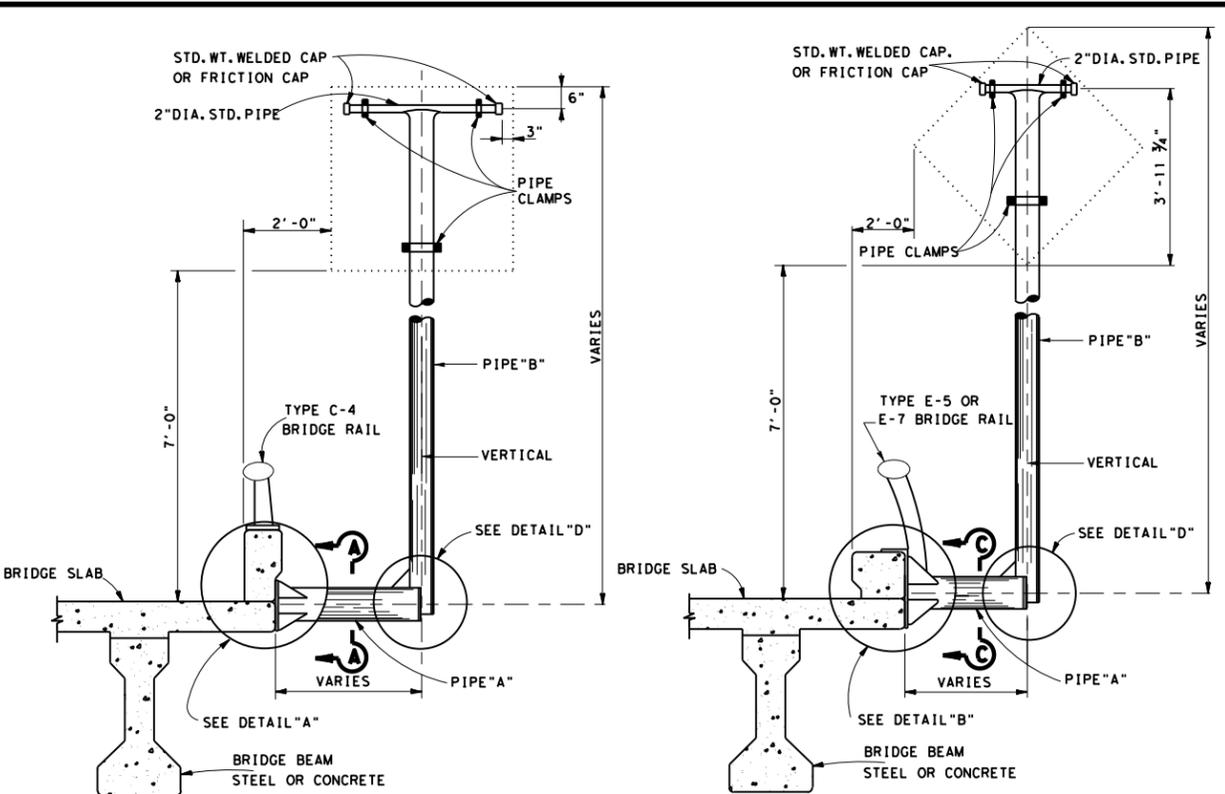
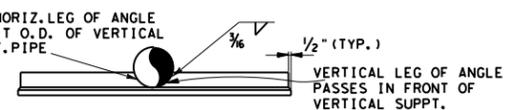
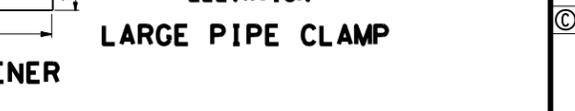
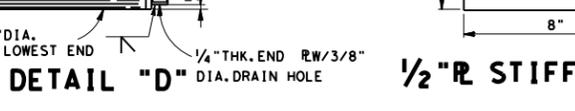
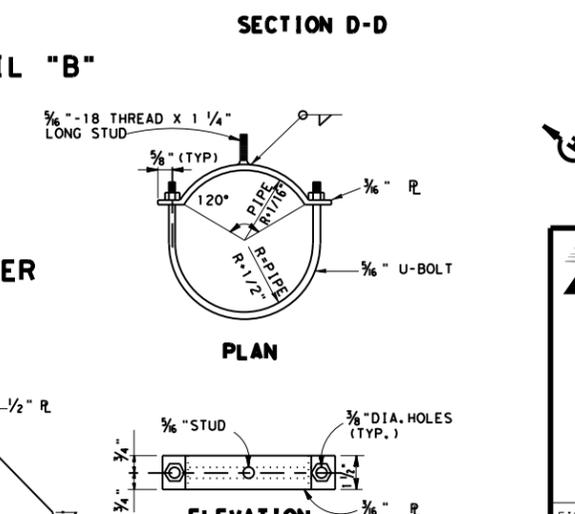
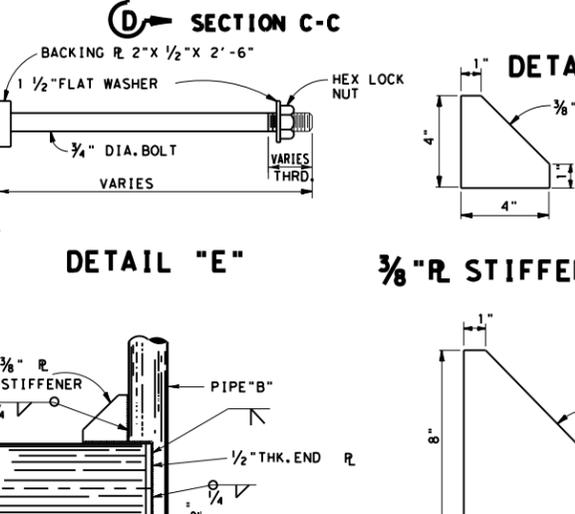
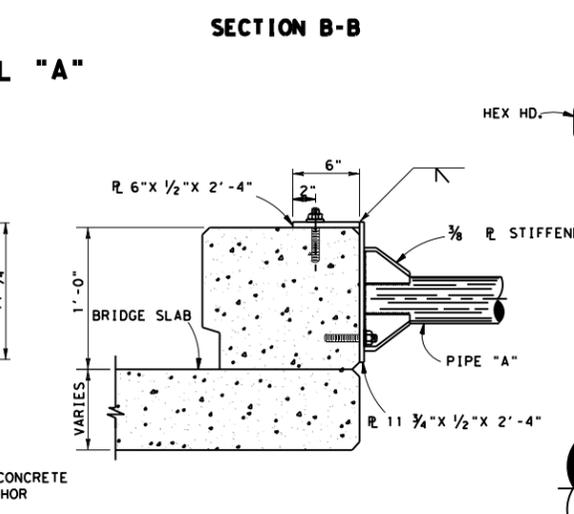
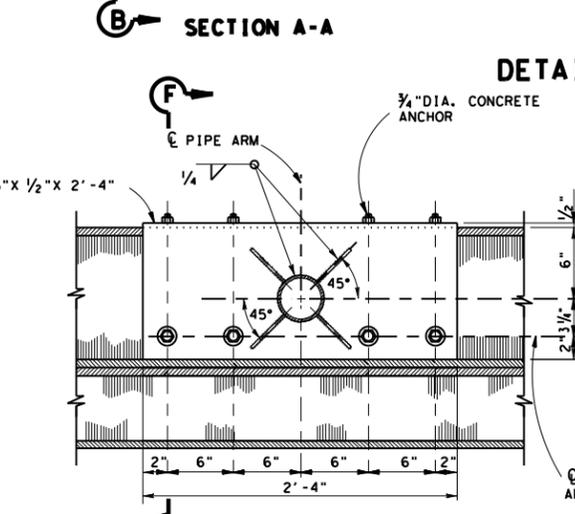
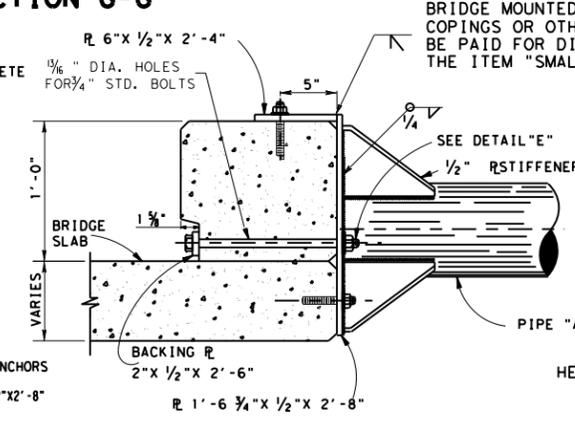
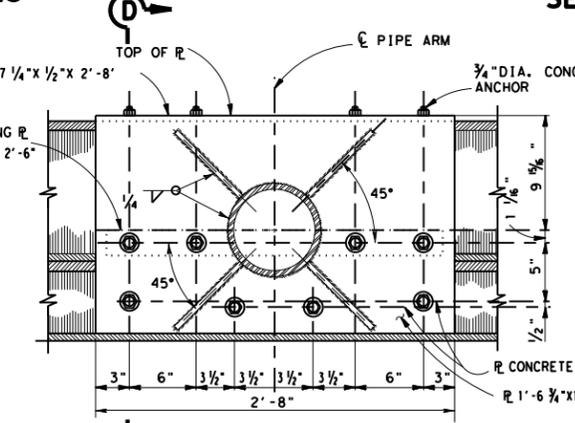
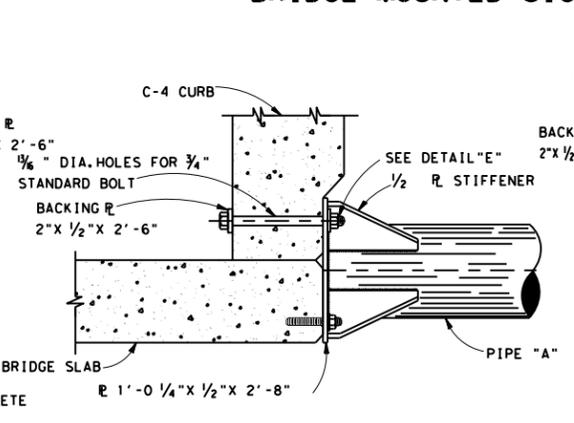
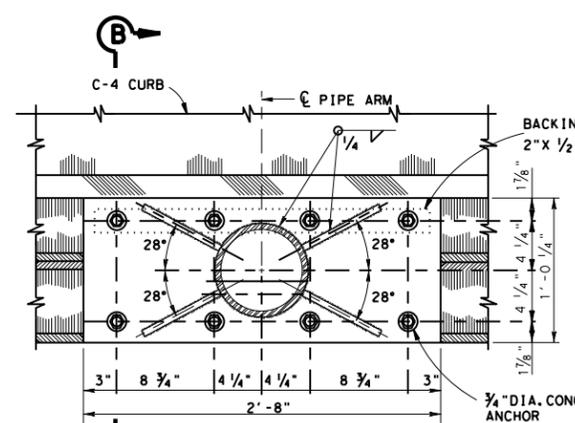


TABLE OF PIPE SIZES			
SIGN AREA S.F.	PIPE A SIZE	PIPE B SIZE	CORRESPONDING TYPE GROUND MOUNT
1-10	4.500" O.D. X 0.337" W.T.	3.500" O.D. X 0.300" W.T.	10 BWG (1) SA (P)
10-16	8.625" O.D. X 0.332" W.T.	4.500" O.D. X 0.337" W.T.	10 BWG (1) SA (T)
16-32	8.625" O.D. X 0.332" W.T.	6.625" O.D. X 0.280" W.T.	S80 (1) SA (T) S80 (1) SA (U) S80 (1) SA (U-1EXT)
32-40	8.625" O.D. X 0.332" W.T.	6.625" O.D. X 0.432" W.T.	S80 (2) SA (P) S80 (1) SA (U-2EXT)

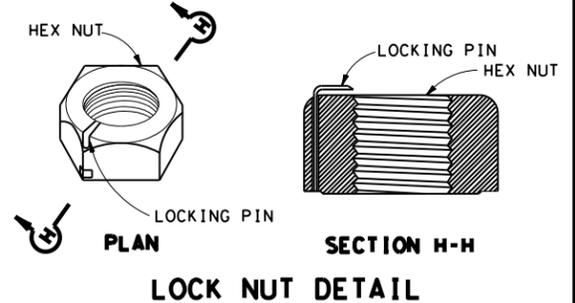
**NOTES:**

CONTRACTOR SHALL CHECK CROSS SLOPE ON BRIDGES AND THEN FABRICATE SIGN MOUNTS SO SIGN SUPPORT PIPE IS VERTICAL. ADDITIONAL "U" OR "T" EXTENSION PIPE OF THE SIZE AND LENGTHS SHOWN ON STANDARD PLAN SHEETS SHALL BE PROVIDED AND ATTACHED (WELDED OR AS DIRECTED BY THE ENGINEER) TO PIPE "B" AS REQUIRED. SIGN PANELS SHALL BE ATTACHED TO THE 3" DIA. OR SMALLER PIPE ARMS AS SHOWN IN THE STANDARD PLAN SHEETS. ATTACHMENT TO 4" OR 6" PIPES SHALL BE AS SHOWN ON THIS SHEET OR AS SHOWN IN STANDARD PLAN SHEETS EXCEPT FOR R2-1 AND R2-4 OR R5-1A AND R5-1 SIGN COMBINATIONS WHICH SHALL BE MOUNTED AS SHOWN ON THIS SHEET. LOCK NUTS WITH NONREVERSIBLE HIGH TENSILE STRENGTH STAINLESS STEEL LOCKING PINS SHALL BE USED ON BOLTS. CONCRETE ANCHORS SHALL BE STANDARD 3 UNIT CONCRETE ANCHORS. RAWL, PARABOLT, KWIKBOLT OR EQUAL, WITH LOCK NUT, FLAT WASHER & LOCK WASHER. ANCHORS SHALL NOT BE LESS THAN 4 1/2" IN LENGTH. SIGN SUPPORTS SHALL BE GALVANIZED AFTER FABRICATION. SIGN SUPPORT BRACKETS AS DETAILED ON THIS SHEET ARE FOR SIGNS MOUNTED ON RIGHT SIDE OF ROADWAY. LEFT HAND BRACKETS SHALL BE OPPOSITE TO THOSE SHOWN. SEE SIGN LAYOUT SHEETS TO DETERMINE WHETHER RIGHT OR LEFT HAND BRACKET IS REQUIRED. ANY CHIPPING, GOUGING, OR OTHER WORK, TOOLS OR ANY OTHER INCIDENTALS NECESSARY TO EFFECT THE INSTALLATION OF BRIDGE MOUNTED SIGN BRACKETS ON CURBS, PARAPET WALLS, COPINGS OR OTHER LOCATIONS AS CALLED FOR IN PLANS WILL NOT BE PAID FOR DIRECTLY BUT SHALL BE CONSIDERED SUBSIDIARY TO THE ITEM "SMALL ROADSIDE SIGN SUPPORTS AND ASSEMBLIES".

**BRIDGE MOUNTED SIGNS**



R2-1 (48x60) & R2-4 (48x60)  
R5-1a (48x36) & R5-1 (48x48)



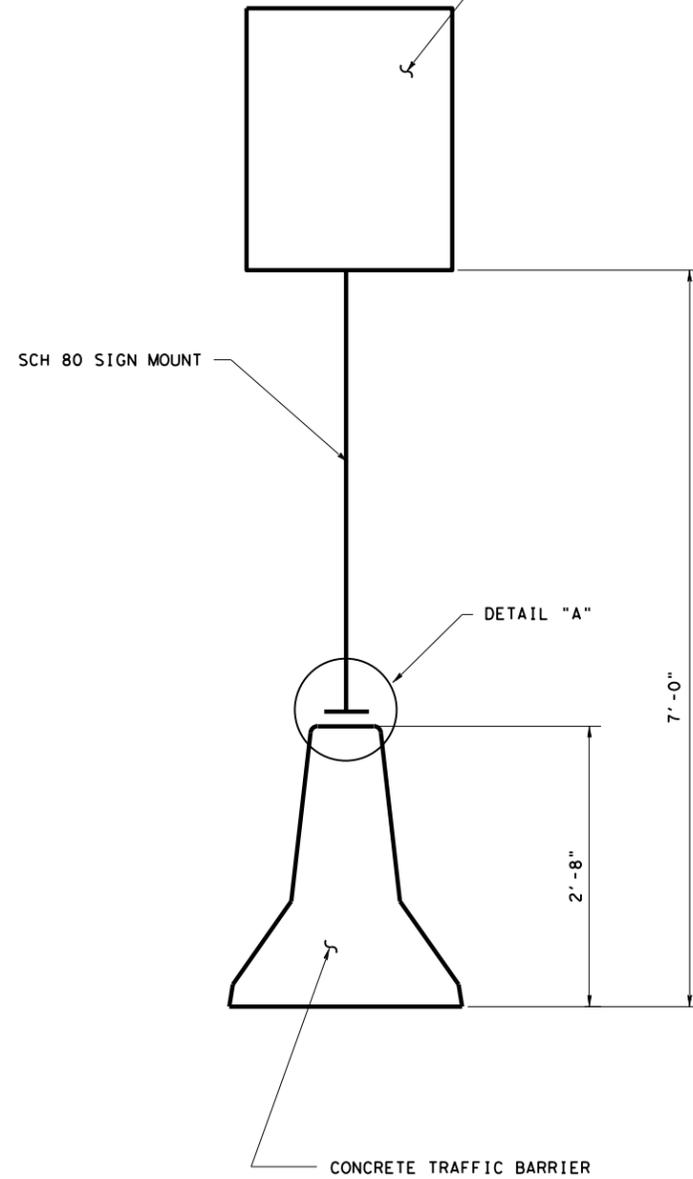
Texas Department of Transportation  
Houston District

**BRIDGE MOUNTING DETAILS**  
(FOR SMALL ROADSIDE SIGNS)

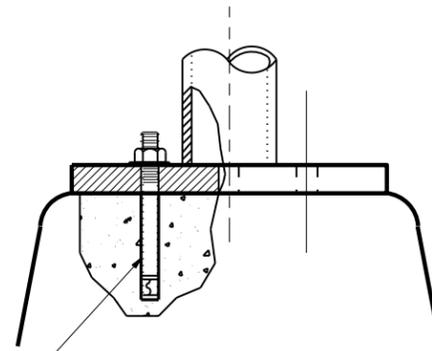
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	COUNTY	CONTROL	SECT	JOB
	LIBERTY, ETC.	6399	15	001
				SH99

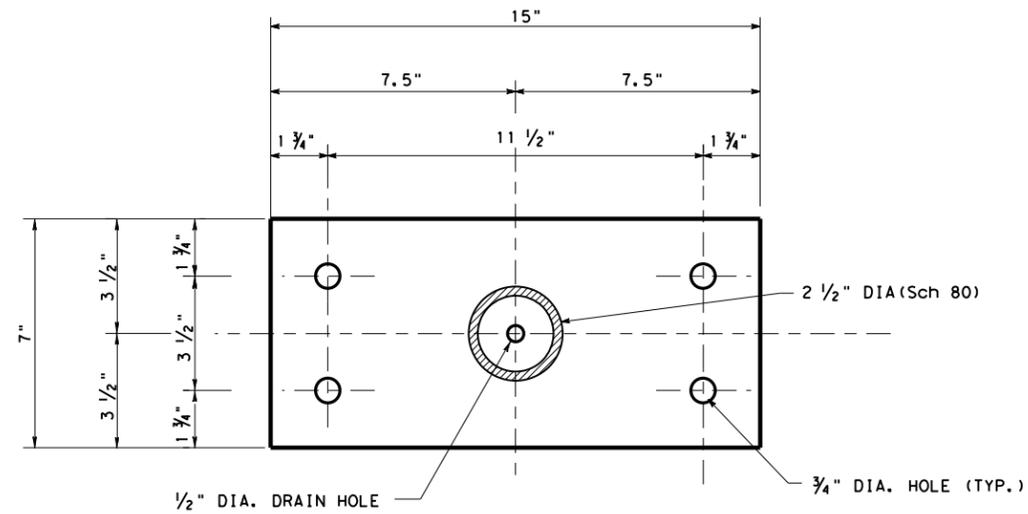
MAX. SIGN AREA = 16.0 SF



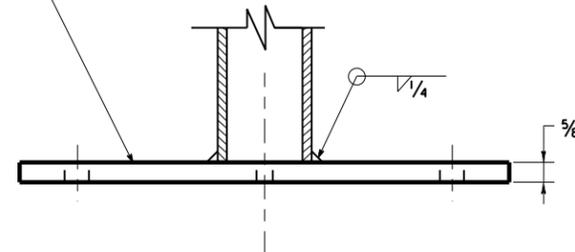
5/8" DIA. CONCRETE ANCHOR  
4 PLACES (EMBED A MINIMUM OF  
5 1/2" AND TORQUE TO MIN. OF  
50 FT-LBS). ANCHOR MAY BE  
EXPANSION OR ADHESIVE TYPE.



DETAIL "A"



5/8"x7"x15"  
Bolt-Down Plate  
(Galv. A36)



NOTES:  
THE CONCRETE TRAFFIC BARRIER SIGN MOUNT SHALL BE PAID FOR UNDER  
THE ITEM, "INS SM RD SN SUP & AM TYPE S80(1)SB(X-XXXX)".

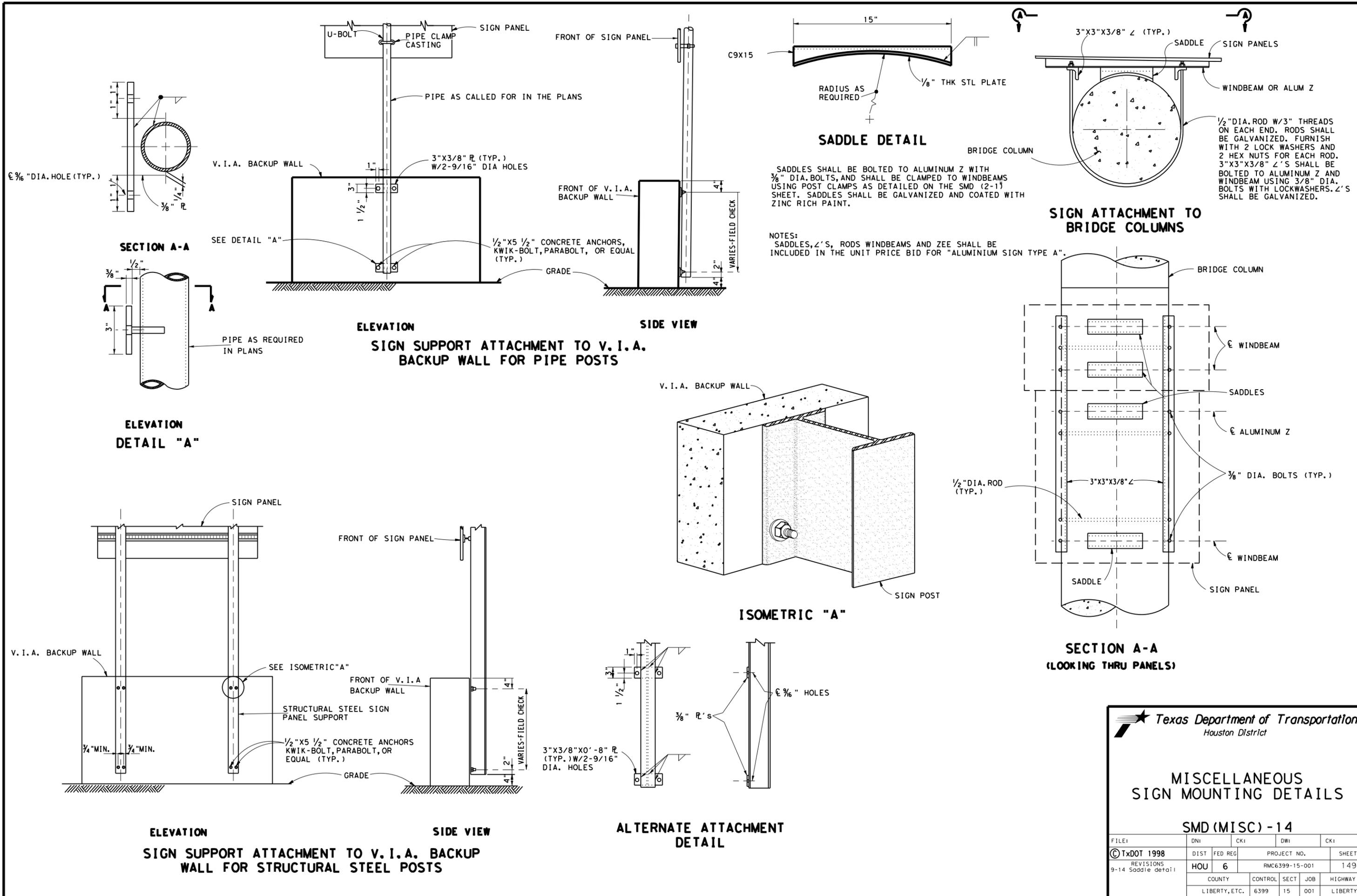
For General Notes, see "SMD Series" Standard  
sheets for Small Roadside Signs.

Texas Department of Transportation  
Houston District

CONCRETE TRAFFIC BARRIER  
SIGN MOUNT

SMD (CTB) -04

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© TxDOT 1998	DIST	FED REG	PROJECT NO.	SHEET
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	COUNTY	CONTROL	SECT	JOB
	LIBERTY, ETC.	6399	15	001
				HIGHWAY
				SH99



Texas Department of Transportation  
 Houston District

**MISCELLANEOUS  
 SIGN MOUNTING DETAILS**

**SMD (MISC) - 14**

FILE:	DN:	CK:	DW:	CK:
© TxDOT 1998	DIST	FED REG	PROJECT NO.	SHEET
REVISIONS 9-14 Saddle detail	HOU	6	RMC6399-15-001	149
COUNTY	CONTROL	SECT	JOB	HIGHWAY
LIBERTY, ETC.	6399	15	001	LIBERTY, ETC.

# ROADWAY ILLUMINATION ASSEMBLY NOTES

DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of units. The use of this standard is not intended to constitute a contract. The user is responsible for the conversion of units. The use of this standard is not intended to constitute a contract. The user is responsible for the conversion of units.

1. Details apply to roadway lighting installations bid or referenced under Item 610, "Roadway Illumination Assemblies." Provide, furnish, and install all other materials not shown on the plans which may be necessary for complete and proper construction. Where manufacturers provide warranties or guarantees as a customary trade practice, furnish to the State such warranties or guarantees.
2. The locations of poles and fixtures may be shifted by the Engineer to accommodate local conditions. Install or remove poles and luminaires located near overhead electrical lines using established industry and utility safety practices and in accordance with laws governing such work. Consult with the appropriate utility company prior to beginning such work.
3. 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, Intertek Testing Services NA Inc., or FM Approvals LLC can be considered equivalent to UL. Faulty fabrication or poor workmanship in any material, equipment, or installation is justification for rejection.
4. Provide Roadway Illumination Light Fixtures as per TxDOT Departmental Material Specification (DMS) 11010, Item 610, and as shown on the Material Producers List (MPL) for Roadway Illumination and Electrical Supplies.
5. Fabricate steel roadway illumination poles in accordance with Roadway Illumination Poles (RIP) standards and Item 610. Poles fabricated according to RIP standards do not require shop drawing submittals.
  - a. Alternate designs to RIP standards or the use of aluminum to fabricate poles will require the submission of shop drawings electronically. For instructions on submitting shop drawings electronically see "Guide to Electronic Shop Drawing Submittal" on the TxDOT web site.
  - b. Limitations on use of the RIP standard: The RIP standard details were developed for installations in locations where the 3-second gust basic maximum wind speed is 110 mph, and where the elevation of the base of the pole is less than (i.e. not more than) 25' above the elevation of the surrounding terrain, in accordance with the "AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals," 6th Edition (2013) of the AASHTO Design Specifications. For poles to be installed in regions where the maximum basic wind speed exceeds 110 mph or to be mounted more than 25' above the surrounding terrain, provide poles meeting the following requirements:
    - i. Submittals. Following the electronic shop drawing submittal process (see Guide to Electronic Shop Drawing Submittal on the TxDOT web site), submit to the Engineer for approval fabrication drawings and calculations for the poles, sealed by a Texas licensed professional engineer (P.E.).
    - ii. Luminaire Structural Support Requirements. Provide light poles, arms, and anchor bolt assemblies with a 25 year design life to safely resist dead loads, ice loads and the required basic wind speeds at the location of installation in accordance with the 6th edition (2013) of the AASHTO Design Specifications. For transformer base poles, include transformer base and connecting hardware in calculations and shop drawing submittals. Structurally test all transformer bases to resist the theoretical plastic moment capacity of the pole. Submit certification of the plastic moment load test and FHWA breakaway requirement test of the model of base being furnished with the shop drawings. Show breakaway base model number, manufacturer's name, and logo on shop drawings. Include on manufacturer's shop drawings the ASTM designations for all materials to be used.
6. For both transformer and shoe-base type illumination poles, provide and install double-pole breakaway fuse holders as specified by DMS-11040. Breakaway fuse holders are listed on the MPL for Roadway Illumination and Electrical Supplies under Items 610 & 620. Provide 10 amp time delay fuses for breakaway connectors in light poles, or inside the light fixture for underpass luminaires. In each pole, connect luminaires to the breakaway connector with continuous stranded 12 AWG copper conductors as listed on the MPL. Bond all equipment grounding conductors together and to the ground lug in the transformer base or hand hole.
7. Tighten anchor bolts for shoe base, concrete traffic barrier base, and bridge mount roadway illumination poles, in accordance with Item 449.
8. Install T-Base with following procedure:
  - a. Anchor Bolt Tightening.
    - i. Coat the threads of the anchor bolts with electrically conductive lubricant.
    - ii. Place the T-base over the anchor bolts. Foundation must be level and flat. The maximum permissible gap under any one corner of the t-base is 1/8" before nuts are tightened.
    - iii. Coat the bearing surfaces of the nuts and washers with electrically conductive lubricant. Install (1) 1/2" hold down washer, (1) lock washer, and (1) nut on each anchor bolt. Turn the nuts onto the bolts so that each is hand-tight against the washer.
    - iv. Using a torque wrench, tighten each nut to 150 ft-lb. Uniform contact is required between the foundation and the T-base in the corner regions of the T-base, and all corner gaps must be closed after applying torque. If a gap still exists after torquing to 150 ft-lbs, continue torquing each bolt incrementally until gap is closed or maximum allowable torque of 250 ft. pound is reached, whichever comes first. If 250 ft-lbs is not enough to close the gap the foundation must be leveled. Gaps along the straight sides of the T-bases and the foundation are permissible. Ensure that no high point of contact occurs between the straight sides of the T-base and the foundation.
    - v. Check top of T-base for level. If not level then foundation must be leveled.
  - b. Top Bolt Procedure
    - i. Erect pole over T-base with crane. Coat bolts, nuts, washers, and lock washers with electrically conductive lubricant.

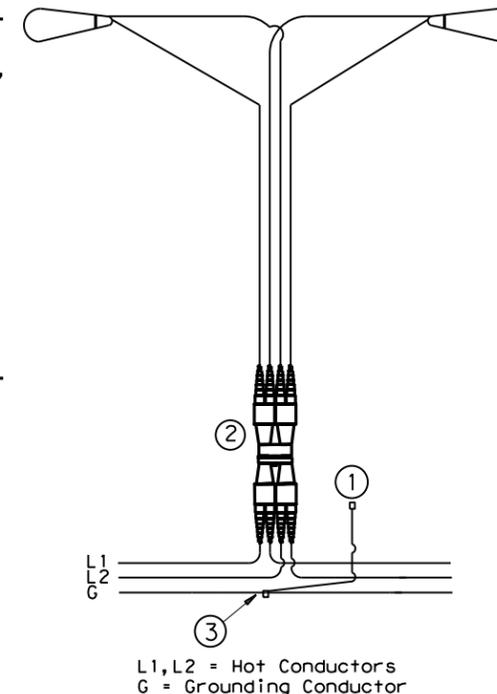
- ii. Install bolts and 1/2" connecting washers from the inside of the T-base, thread up through the pole base. Install flat washers, lock washers and nuts snug tight according to Item 447, "Structural Bolting."
  - iii. Tighten each nut to 150 ft-lb. using a torque wrench.
- c. Level and Plumb
- i. Ensure pole is plumb and mast arm is perpendicular to the roadway according to plans to within 5 degrees.
9. Construct luminaire pole foundations in accordance with Item 416, "Drilled Shaft Foundations," and TxDOT standard sheet RID(2).
  10. Provide and install underpass luminaires in accordance with Item 610, DMS-11010, and TxDOT standard sheet RID(3). Typical luminaire size for underpass luminaires is 150W HPS or 150W EQ LED.
  11. Mount luminaires on arms level as shown by the luminaire level indicator.
  12. Orient luminaires perpendicular to the roadway intended to be lit unless otherwise shown on the plans.

## Wiring Diagram Notes:

- ① Use 1/2 in. -13 UNC threaded, copper or tin-plated copper, pole bonding connector, sized appropriately for conductors, bonded to T-base, or use ground lug in handhole as available.
- ② Use pre-qualified two-pole breakaway connectors for all luminaire pole installations. For luminaires fed by a circuit with a neutral conductor, use double pole breakaway connectors with the neutral side unfused and marked white.
- ③ Split Bolt or other connector.

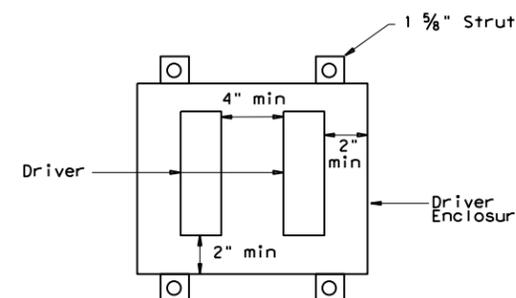
## Decorative LED Lighting Notes:

1. LED Drivers in Remote Outdoor enclosures (for drivers that do not include an enclosure as part of a factory assembly):
  - a. Provide NEMA 3R outdoor enclosure or as approved.
  - b. Install enclosure at least 12" above ground or other horizontal surface. Mount vertically or on ceiling, and avoid direct sun where possible.
  - c. Install drivers with at least 2 inches of space from enclosure walls.
  - d. For multiple drivers in an enclosure, provide at least 4 inches side to side and 1 inch end to end from other drivers or electronic equipment
  - e. For drivers mounted on back wall of enclosure, mount enclosure on 1 5/8" strut or other standoff to dissipate heat, or mount driver to side of the enclosure or to the metal cover.
  - f. Provide remote drivers with a maximum of 100 watts
  - g. Provide drivers with documentation of 100,000 hr lifetime at Tcase of 65C or higher.



## TYPICAL WIRING DIAGRAM

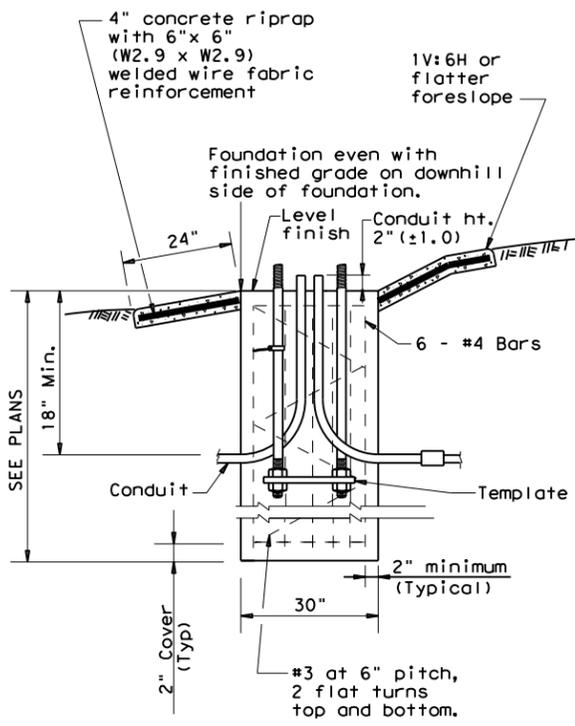
LUMINAIRES SERVED AT 480V ON 240/480 VOLT SERVICE OR LUMINAIRES SERVED AT 240V FOR 120/240 VOLT SERVICE.



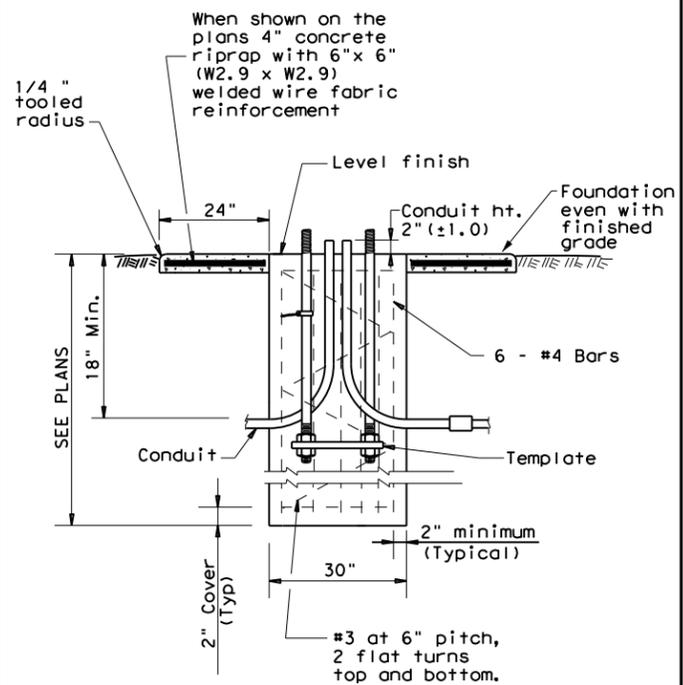
Driver Spacing In Remote Enclosure

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© TxDOT January 2007	CONT	SECT	JOB
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12-20	BMT	LIBERTY, ETC.	150

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 The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of units or the accuracy of the information contained herein.



**SECTION A-A**  
SHOWING SLOPED GRADE



**SECTION A-A**  
SHOWING CONSTANT GRADE

**TABLE 1**

**ANCHOR BOLTS**

POLE MOUNTING HEIGHT	BOLT CIRCLE		ANCHOR BOLT SIZE
	Shoe Base	T-Base	
<40 ft.	13 in.	14 in.	1 in. x 30 in.
40-50 ft.	15 in.	17 1/4 in.	1 1/4 in. x 30 in.

**TABLE 2**

**RECOMMENDED FOUNDATION LENGTHS**  
(See note 1)

MOUNTING HEIGHT	TEXAS CONE PENETROMETER N Blows/ft		
	10	15	40
<20 ft.	6'	6'	6'
>20 ft. to 30 ft.	8'	6'	6'
>30 ft. to 40 ft.	8'	8'	6'
>40 ft. to 50 ft.	10'	8'	6'

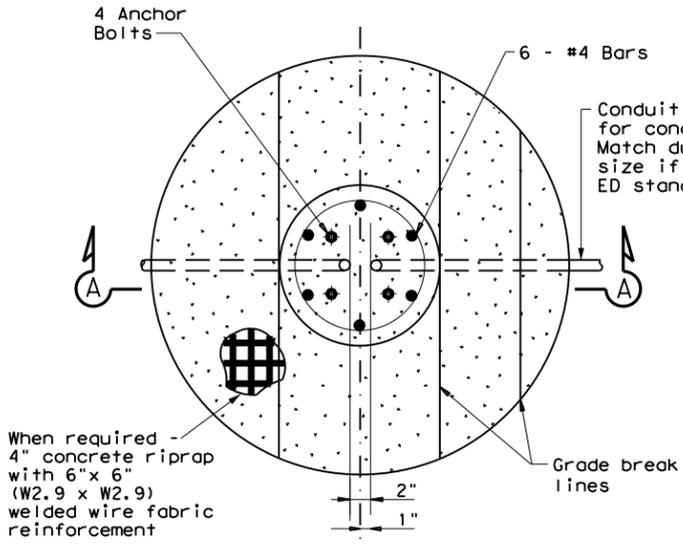
**TABLE 3**

**PAY QUANTITY OF RIPRAP PER FOUNDATION**  
(Install only when shown on the plans)

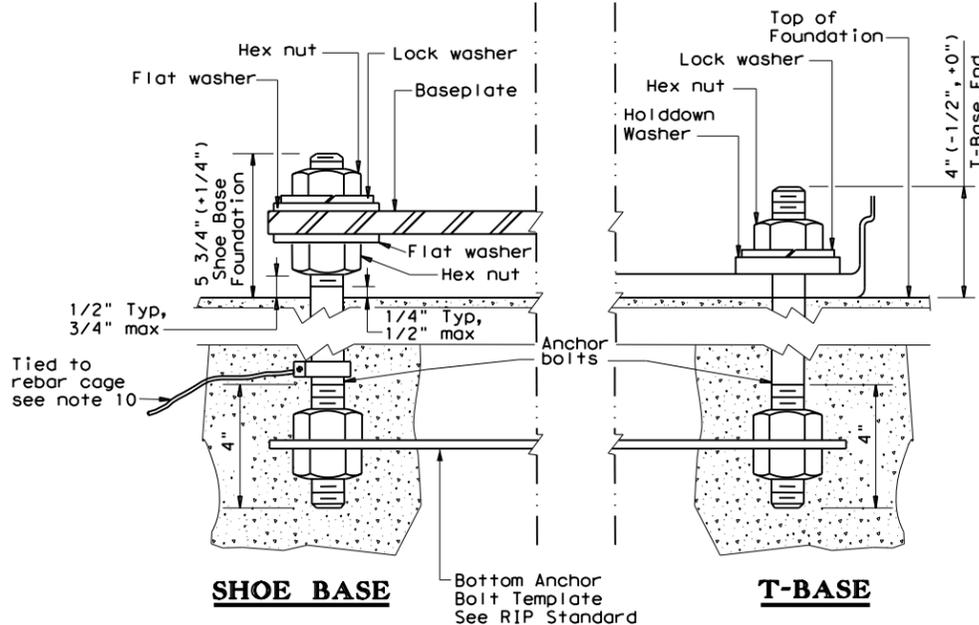
Foundation Diameter	RIPRAP DIAMETER	RIPRAP (CONC) (CL B)
30 in.	78 in.	0.35 CY

**GENERAL NOTES:**

- "Recommended Foundation Lengths" table is for information purposes only. Foundation lengths shall be as shown on the plans, or as directed by the Engineer. Foundations will be paid for under Item 416, "Drilled Shaft Foundations," unless otherwise shown on the plans.
- Erect roadway illumination assembly poles plumb and true. Form and level the top 6" of the foundation so the pole will be plumb. Use leveling nuts to plumb shoe base poles. Do not use shims or leveling nuts under transformer bases. Do not grout between baseplate and the foundation.
- Ensure Class 2A and 2B fit for anchor bolts and nuts. Tap and chase nuts after galvanizing. Anchor bolt body with rolled threads need not be full size.
- Use appropriate class of concrete as specified in Items 416 and 432. Concrete for riprap may be upgraded to Class C at no extra cost to the Department.
- Place riprap around the foundation when called for elsewhere in the plans. Riprap will be paid for under Item 432.
- Locate breakaway roadway illumination assemblies as shown in the placement table, unless otherwise dimensioned on the plans. Protect non-breakaway illumination assemblies from vehicular impact (i.e. 2.5 ft. behind guard rail or mounted on traffic barrier), or located outside the clear zone, except that 2.5 ft. from curb face is minimum desired for light poles on city streets, 45 mph or less. See Roadway Design Manual for further information.
- Use 4 hold down and 4 connecting washers on transformer base poles as recommended by the manufacturer and supplied with base.
- Install a minimum of 2 conduits in each foundation. See lighting layout sheets for locations of foundations with more than 2 conduits. Cap unused conduits in foundations on both ends.
- Conduit location in foundations is critical for breakaway devices. Place conduits 2 in. apart on centerline as shown.
- Bond anchor bolt to rebar cage with #6 bare stranded copper conductor. Use listed mechanical connectors rated for embedment in concrete. The bonded steel in the foundation creates a concrete encased grounding electrode which replaces the ground rod.
- Grade earthwork around T-base foundations even with the finished grade as shown in Section A-A to ensure proper function of the breakaway device. Use riprap on T-base foundations that are located on sloped grades, and as shown on the plans for level grades.



**FOUNDATION DETAIL**



**ANCHOR BOLT DETAIL**

**TABLE 4**

**BREAKAWAY POLE PLACEMENT (See note 6)**

ROADWAY FUNCTIONAL CLASSIFICATION	** POLE OFFSET (DISTANCE TO FACE OF TRANSFORMER BASE)
Freeway Mainlanes (roadway with full control of access)	15 ft. (minimum and typical) from lane edge
All curbed, 45 mph or less design speed	2.5 ft. minimum (15 ft. desirable) from curb face
All others	10 ft. minimum*(15 ft. desirable) from lane edge

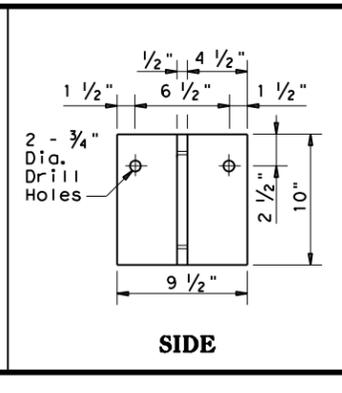
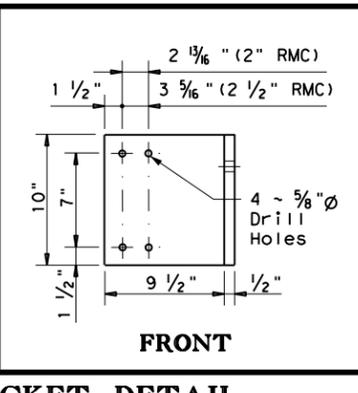
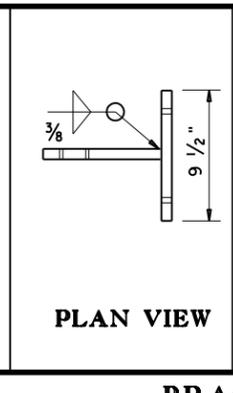
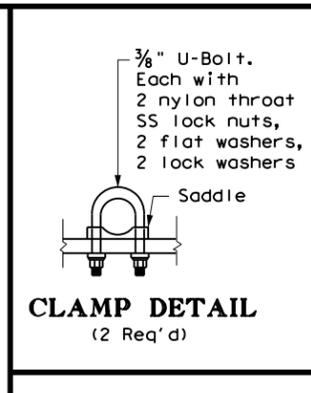
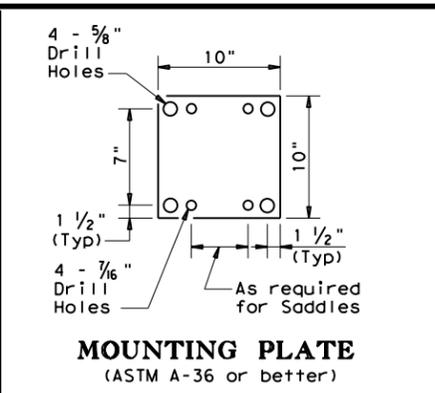
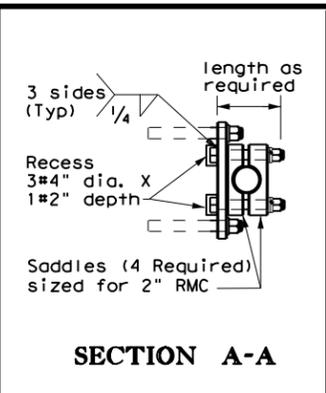
\* or as close to ROW line as is practical

\*\* provide 2/5 of the luminaire mounting height behind the pole for "falling area" to prevent encroachment on the other travel lanes. See design guidelines.

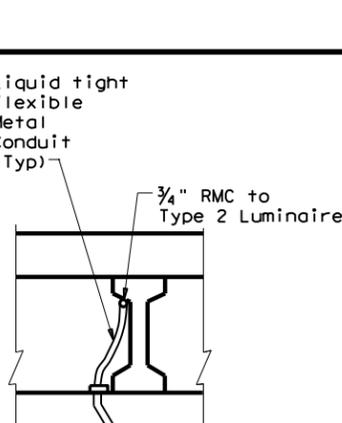
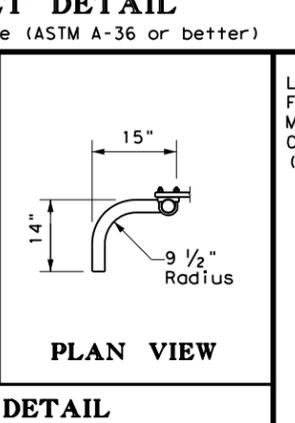
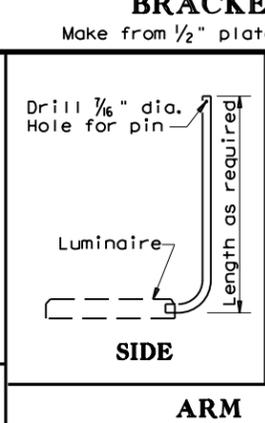
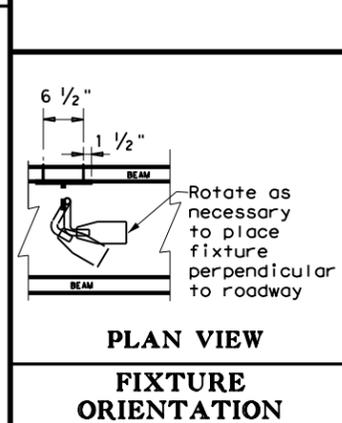
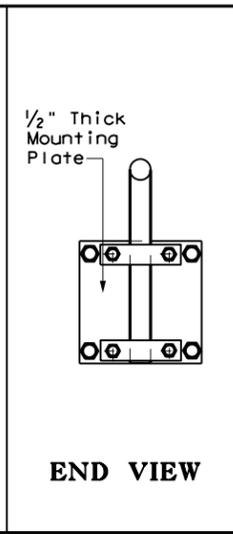
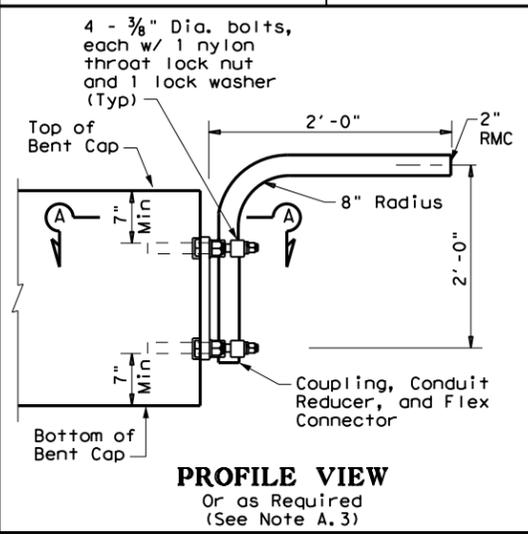
Texas Department of Transportation  
**ROADWAY ILLUMINATION DETAILS**  
 (RDWY ILLUM FOUNDATIONS)  
**RID(2)-20**

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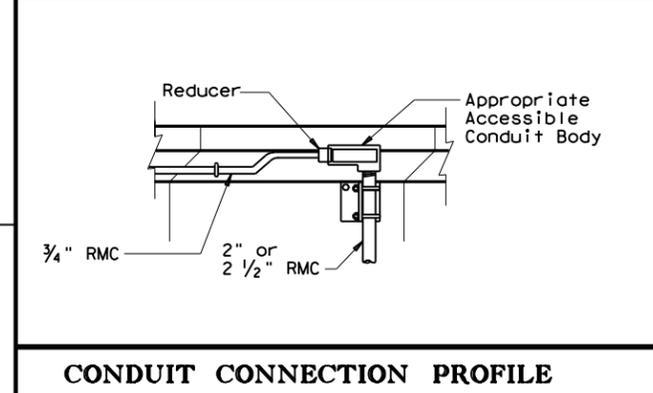
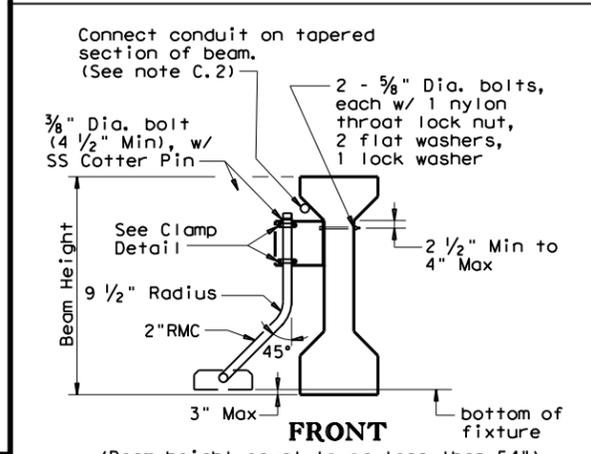
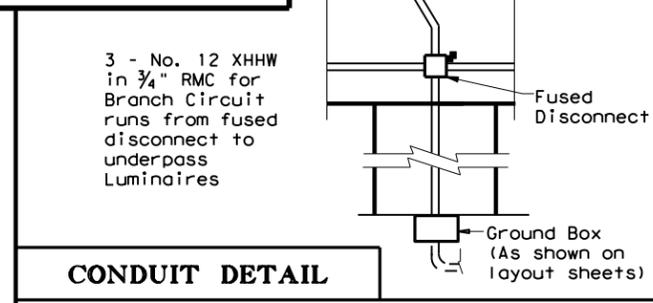
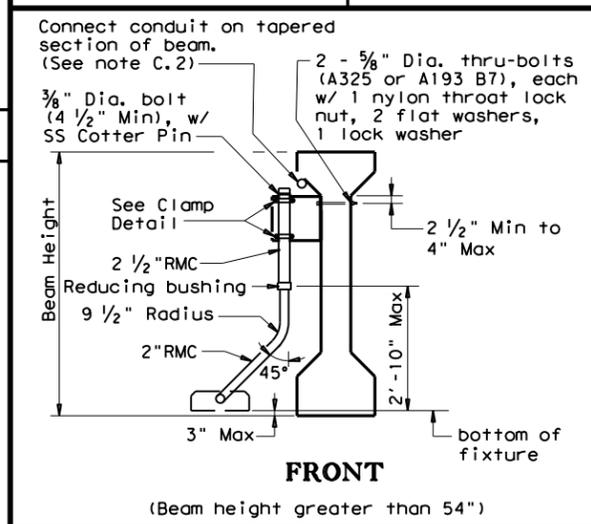
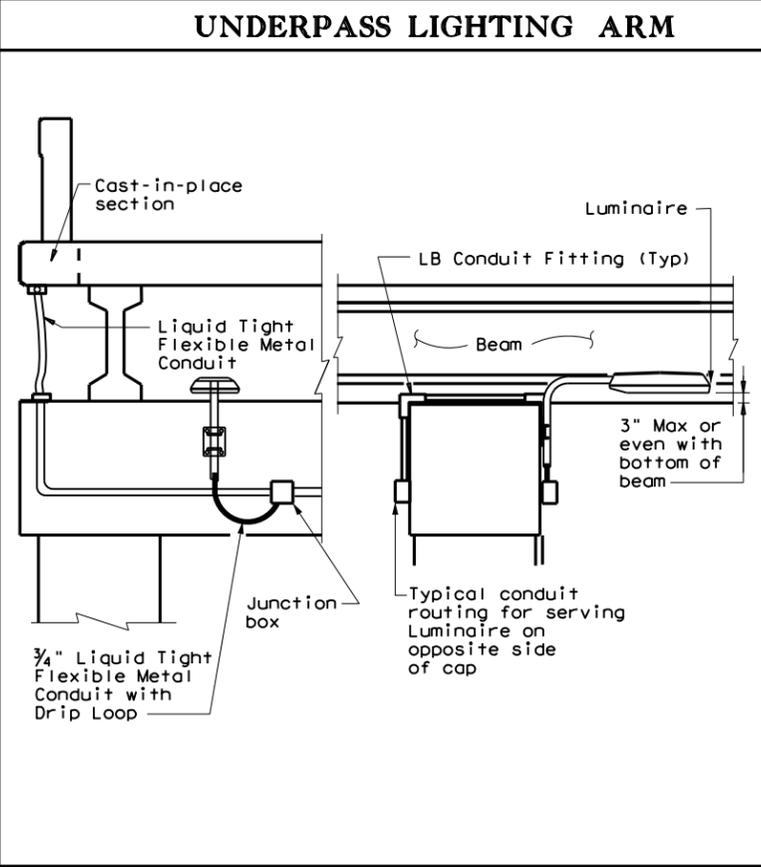
DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of units.



- GENERAL NOTES:**
- A. ALL 150 watt HPS and 150 watt equivalent LED Luminaires**
- Luminaire locations, conduit and conductor sizes and routing are typical and diagrammatic only. See project layout sheets for specific details.
  - Conduit will be paid for under Item 618, "Conduit" and conductors will be paid for under Item 620, "Electrical Conductors," unless otherwise shown on the plans.
  - Adjust conduit in saddles to place fixture height and orientation as required. See fixture orientation detail and plans. Where practicable, place luminaires so the bottom of luminaire is above the bottom of the beam, maximum of 3 in. (See detail UNDERPASS LIGHTING ARM TYPE 2)
  - Except as noted, galvanize all structural steel and exposed bolts, nuts, and washers in accordance with Item 445 "Galvanizing".
  - Fabrication of brackets and support arms will not be paid for directly but is subsidiary to Item 610, "Roadway Illumination Assemblies."
  - Install a heavy duty NEMA 3R fused disconnect or breaker enclosure rated at 30 amps and 480 volts to switch underpass luminaires as shown on plans, with at least one per bridge circuit. Install 20 amp time-delay fuses or inverse-time circuit breakers. Mount disconnect or breaker enclosure 10 ft. (min) above grade on columns or bent caps as approved by the Department. Modify disconnect to allow padlocking in the "ON" and "OFF" positions. Padlocks and disconnect switches or circuit breakers for underpass fixtures will not be paid for directly but are subsidiary to the various bid items of the contract.
  - Conduit on columns, caps, and slab is shown surface mounted. For new columns and caps, embed PVC conduit in concrete. Bond and ground metal junction boxes and conduit.



- B. TYPE 1**
- Provide 2 in. rigid metal conduit (2.375" O.D., 0.146" wall) for Type 1 arm shaft.
  - Use 3/8 in. stainless steel bolt or stud non-epoxy type expansion anchors for concrete for Type 1 mounting. Except as noted, provide an allowable 2650 lbs minimum pull-out force (after consideration of adjustment factors for edge distance and bolt spacing) for each anchor. Install each anchor to the embedment depth recommended by the manufacturer.
  - Attach conduit to plate with 4 saddles, four - 3/8 in. diameter bolts, nylon throat lock nuts, and lock washers.
- C. TYPE 2**
- Provide 2 in. rigid metal conduit (2.375" O.D., 0.146" wall) or provide a combination of 2 1/2 in. (2.875" O.D., 0.193" wall) and 2 in. (2.375" O.D., 0.146" wall) rigid metal conduits with a reducing bushing as beam height stipulated for Type 2 arm shaft. Field cutting and threading will be permitted. Paint cut and threaded areas with zinc rich paint after conduit is connected to adjacent fitting.
  - Connecting conduit may be strapped to tapered section only of precast beams as shown. Anchor as approved by the Engineer. Maximum anchor depth is 1 in.
  - Indiscriminate drilling into precast concrete beams may result in reduced beam strength. Use drilling location and method as directed by the Engineer. See Location of Underpass Lighting Mounting Bracket detail. The locations shown in the table are such that reinforcing strands will not be damaged.

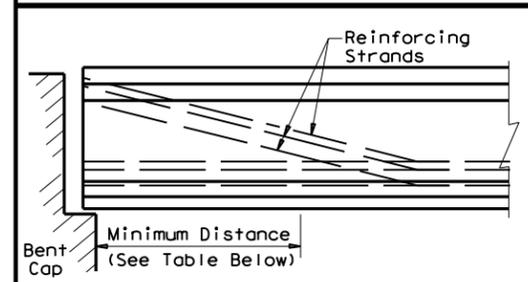


**IN RD IL AM (U/P) (TY 1)**  
 If bridge has pre-cast panels under deck, run circuit under deck edge.

**UNDERPASS LIGHTING TYPE 1**

**IN RD IL AM (U/P) (TY 2)**

**UNDERPASS LIGHTING TYPE 2**



SPAN LENGTH	MINIMUM DISTANCE
≤ 50'	10'-0"
50' - 70'	15'-0"
70' - 90'	20'-0"
> 90'	25'-0"

Texas Department of Transportation  
 Traffic Safety Division Standard

**ROADWAY ILLUMINATION DETAILS (UNDERPASS LIGHT FIXTURES)**

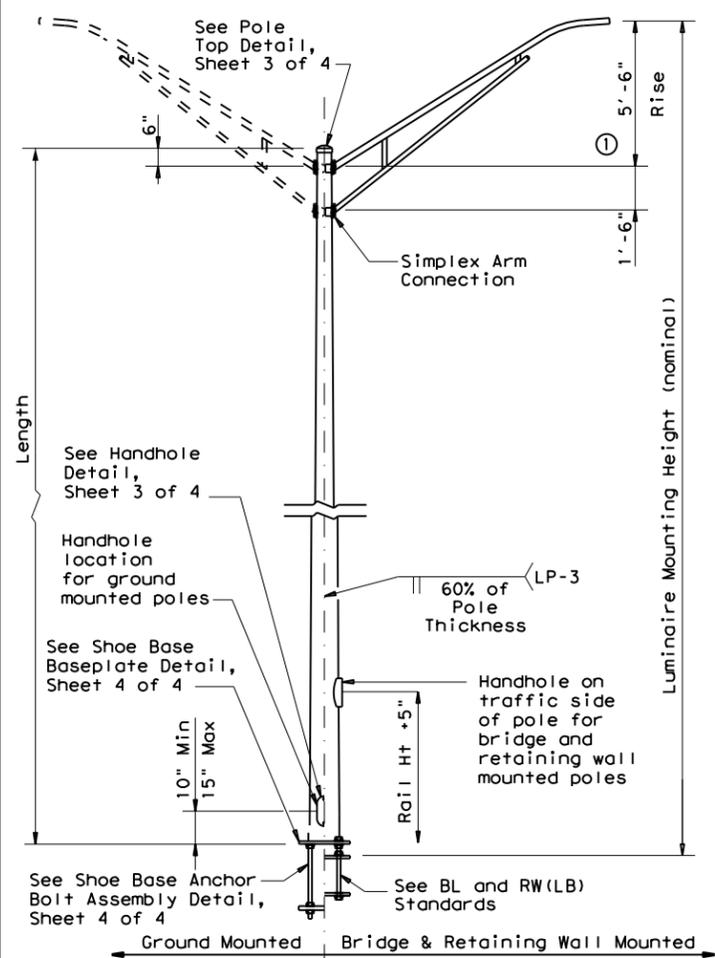
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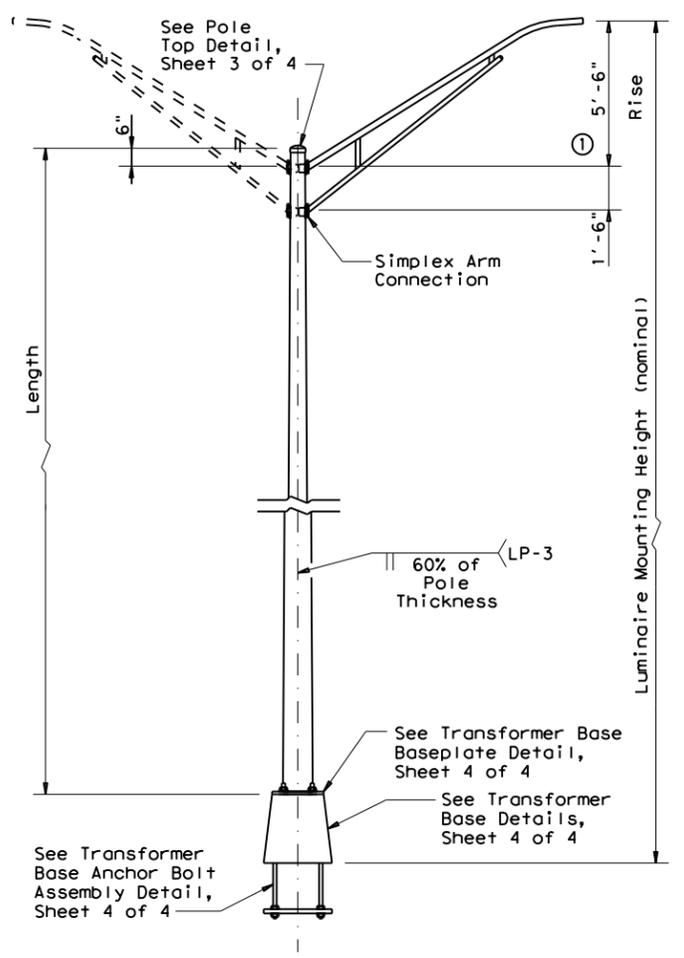


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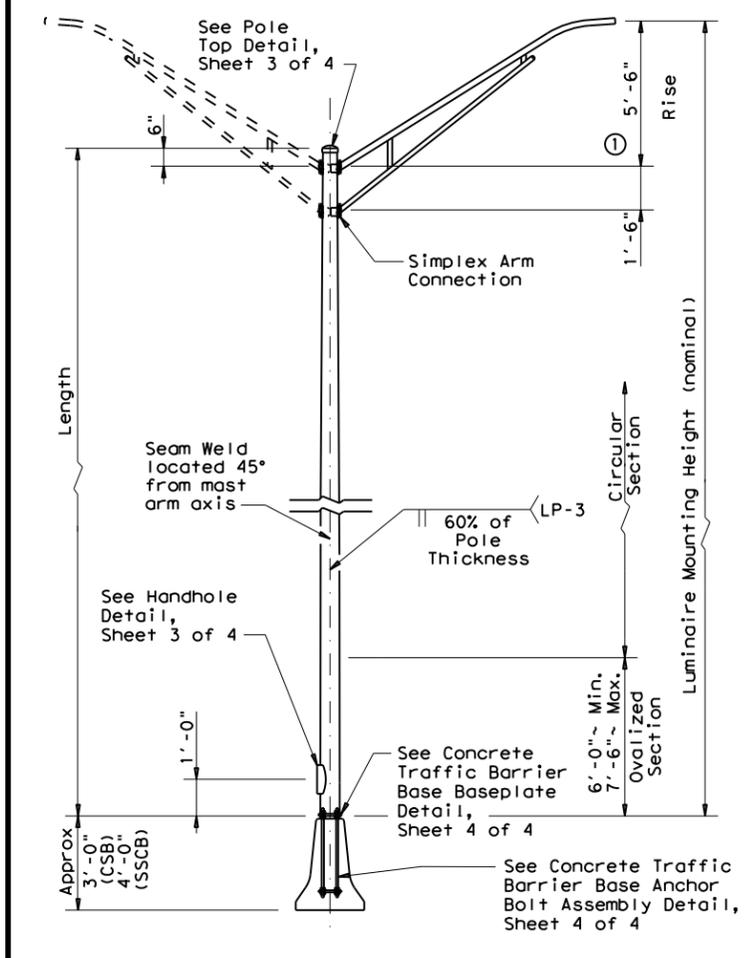
**SHOE BASE POLE**

Luminaire Mounting Height (Nominal) (ft)	Base Diameter (in)	Top Diameter (in)	Length (ft)	Pole Thickness (in)	Design Moment (K-ft)
20.00	7.00	4.90	15.00	0.1196	7.1
30.00	7.50	4.00	25.00	0.1196	13.2
31.00-39.00	8.00	4.36-3.24	26.00-34.00	0.1196	20.7
40.00	8.50	3.60	35.00	0.1196	20.7
50.00	10.50	4.20	45.00	0.1196	30.3



**TRANSFORMER BASE POLE**

Luminaire Mounting Height (Nominal) (ft)	Base Diameter (in)	Top Diameter (in)	Length (ft)	Pole Thickness (in)	Design Moment (K-ft)
20.00	7.00	5.11	13.50	0.1196	7.1
30.00	7.50	4.21	23.50	0.1196	13.2
31.00-39.00	8.00	4.57-3.45	24.50-32.50	0.1196	20.7
40.00	8.50	3.81	33.50	0.1196	20.7
50.00	10.00	3.91	43.50	0.1196	30.3



**CONCRETE TRAFFIC BARRIER BASE POLE**

CONCRETE TRAFFIC BARRIER BASE POLE (CSB/SSCB)						
Luminaire Mounting Height (Nominal) (ft)	Base Diameter (in)	Top Diameter (in)	Length (ft)	Pole Thickness (in)	Design Moment (K-ft)	
					About C of Rail	Perp. to Rail
28.00	9.00	5.78	23.00	0.1196	10.3	13.2
38.00	9.00	4.38	33.00	0.1196	16.6	20.8
48.00	10.50	4.48	43.00	0.1345	25.1	30.5

**GENERAL NOTES:**

- Designs conform to AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, 6th Edition (2013) and Interim Revisions thereto. Design 3-Second Gust Wind Speed equals 110 mph with a 1.14 gust factor. A wind importance factor of 0.80 is applied to adjust the wind speed to a 25 year recurrence interval. Design moments listed in tables assume base of pole is 25' above natural ground level.
- Structures are designed to support two 12' luminaire mast arms and luminaires. Mast arms are designed to support a 60-pound luminaire having an effective projected area of 1.6 square feet.
- Fabrication shall be in accordance with the Specifications and with the details, dimensions, and weld procedures shown herein. Do not submit shop drawings for roadway illumination pole assemblies fabricated in accordance with the details, dimensions, and weld procedures shown herein. Weld references call for preapproved weld procedures which the Fabricator must obtain prior to fabrication. Materials, fabrication tolerances, and shipping practices shall meet the requirements of these sheets and the Specifications. In the absence of specified fabrication tolerances, dimensions shall be within the tolerances generally obtainable in normal fabrication practice.
- For mounting heights between values shown in the tables, use base diameter and thickness values for the larger height.
- Unless otherwise noted, all steel parts shall be galvanized in accordance with Item 445, "Galvanizing."
- Steel poles shall be fabricated in accordance with Item 441, "Steel Structures." Longitudinal seam welds for pole sections shall have 60% minimum penetration. All welding shall be in accordance with AWS D1.1, Structural Welding Code-Steel.
- Two-section poles joined by circumferential welds will not be permitted, unless otherwise shown on the plans. Poles may be fabricated in two sections and field-assembled by the lap-joint method. The two sections shall telescope together with a lap length of not less than 1-1/2 times the shaft diameter at the lap joint.
- Alternate material equal to or better than material specified may be substituted with the approval of the Engineer.
- Lubricate and tighten anchor bolts, when erecting shoe base poles and concrete traffic barrier base poles, in accordance with Item 449, "Anchor Bolts."
- All poles, except Transformer Base Poles, shall have hand holes with reinforcing frames and covers. For ground mounted shoe base poles, hand holes shall be placed 90 degrees to mast arm unless otherwise noted on the plans. For poles mounted on a concrete traffic barrier with one luminaire arm, hand holes shall be located 180 degrees from luminaire arm. For poles mounted on a concrete traffic barrier with two luminaire arms, all hand holes shall be on the same side of the barrier. For poles mounted on a bridge lighting bracket or a retaining wall lighting bracket, hand hole shall be on traffic side of the pole, at a height that will clear the barrier.
- The finished pole shall have a smooth, uniform finish free of pits, blisters, or other defects. Scratched, chipped, and other damaged galvanized areas on poles and mast arms shall be repaired in accordance with Item 445, "Galvanizing."
- Pole length is based on a 5'-6" luminaire arm rise. 4 ft. luminaire arms have a 2'-6" rise. A pole with 4 ft. luminaire arms will have an actual mounting height 3'-0" less than the nominal mounting height. Increasing the pole length to meet the nominal mounting height is allowed, but unnecessary unless otherwise directed by the engineer.
- Erect transformer base poles in accordance with sheet RID(1).

**MATERIAL DATA**

COMPONENT	ASTM DESIGNATION	MIN. YIELD (ksi)
Pole Shaft (0.14"/ft. Taper)	A572 Gr 50, A595 Gr A, A1011 HSLAS Gr 50 Cl 2 ③, or A1008 HSLAS Gr 50 Cl 2	50
Base Plate and Handhole Frame	A572 Gr.50, or A36	36
T-Base Connecting Bolts	F3125 Gr A325	92
Anchor Bolts	F1554 Gr 55, A193-B7 or A321	55 105
Anchor Bolt Templates	A36	36
Heavy Hex (H.H.) Nuts	A194 Gr 2H, or A563 Gr DH	
Flat Washers	F436	

**NOTES:**

- 2'-6" rise for 4 ft. luminaire arms.
- Before ovalized as shown on Concrete Traffic Barrier Base Baseplate details, Sheet 4 of 4.
- A1011 SS Gr 50 may be used instead of HSLAS, provided the material meets the elongation requirements for HSLAS.

**POLE ASSEMBLY FABRICATION TOLERANCES TABLE**

DIMENSION	TOLERANCE
Shaft length	+1"
I.D. of outside piece of slip fitting pieces	+1/8", -1/16"
O.D. of inside piece of slip fitting pieces	+1/32", -1/8"
Shaft diameter: other	+3/16"
Out of "round"	1/4"
Straightness of shaft	±1/4" in 10 ft
Twist in multi-sided shaft	4° in 50 ft
Perpendicular to baseplate	1/8" in 24"
Pole centered on baseplate	±1/4"
Location of Attachments	±1/4"
Bolt hole spacing	±1/16"

SHEET 2 OF 4

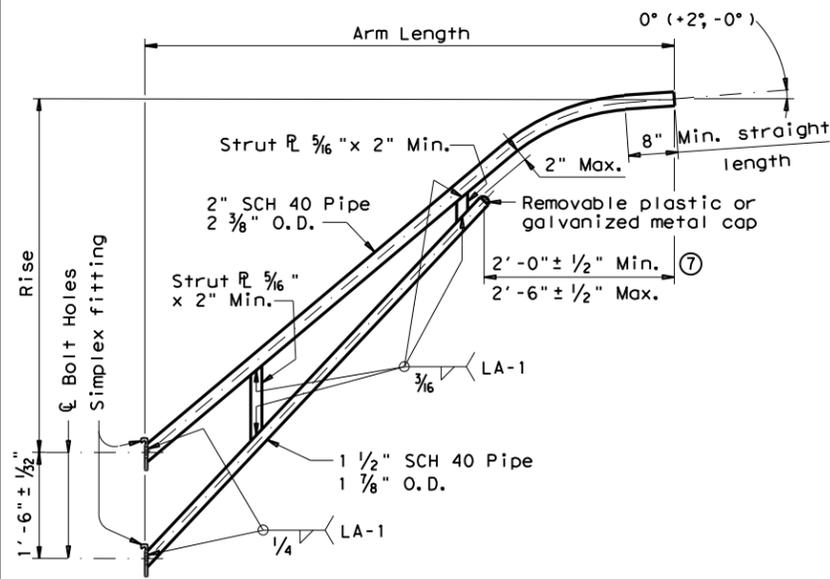
Traffic Safety Division Standard

ROADWAY ILLUMINATION POLES

RIP(2) - 19

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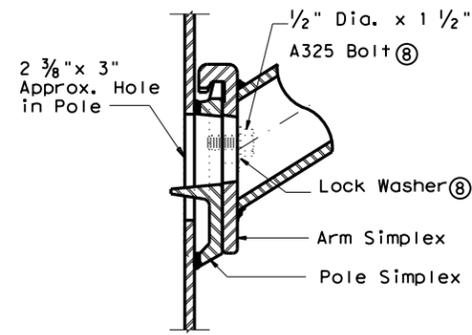
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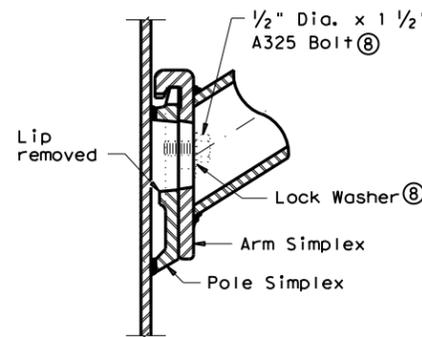
**LUMINAIRE ARM**

LUMINAIRE ARM DIMENSIONS		
Nominal Arm Length	Arm Length	Rise
4'-0"	3'-6"	2'-6"
6'-0"	5'-6"	5'-6"
8'-0"	7'-6"	5'-6"
10'-0"	9'-6"	5'-6"
12'-0"	11'-6"	5'-6"

ARM ASSEMBLY FABRICATION TOLERANCES TABLE	
DIMENSION	TOLERANCE
Arm Length	±1"
Arm Rise	±1"
Deviation from flat	1/8" in 12"
Spacing between holes	±1/32"

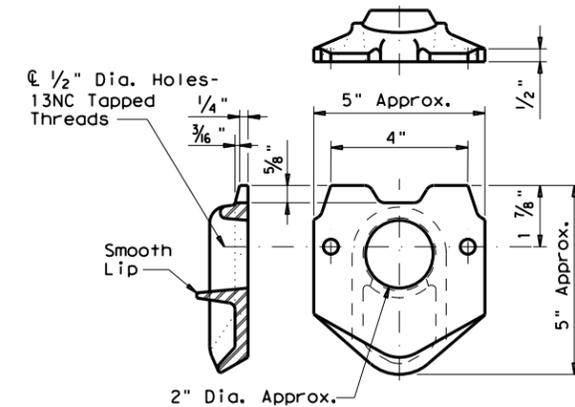


**UPPER SIMPLEX FITTING**  
(Gusset not shown for clarity)

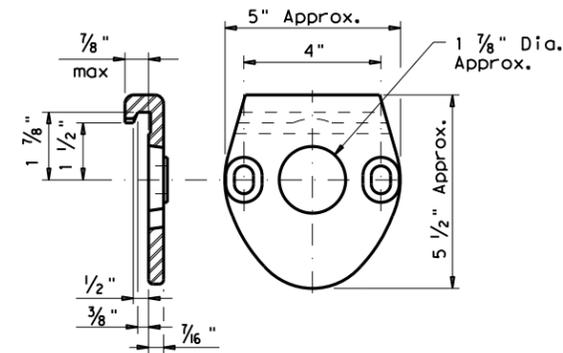


**LOWER SIMPLEX FITTING**  
(Gusset not shown for clarity)

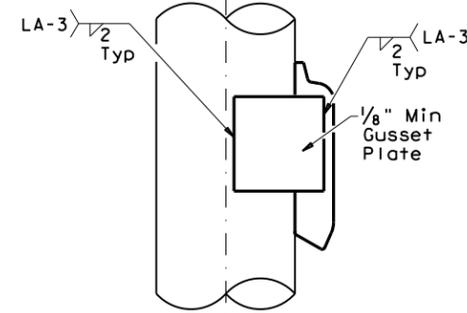
**SECTION B-B**



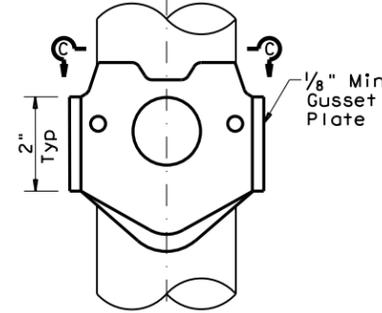
**POLE SIMPLEX DETAIL**



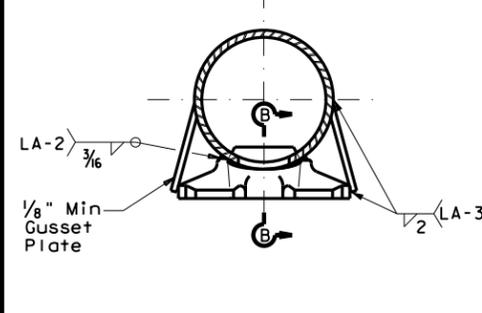
**ARM SIMPLEX DETAIL**



**SIDE**

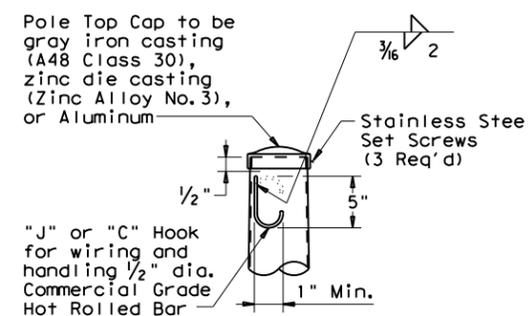


**ELEVATION**

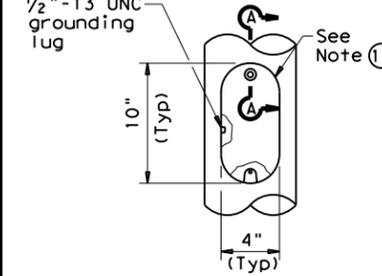


**SECTION C-C**

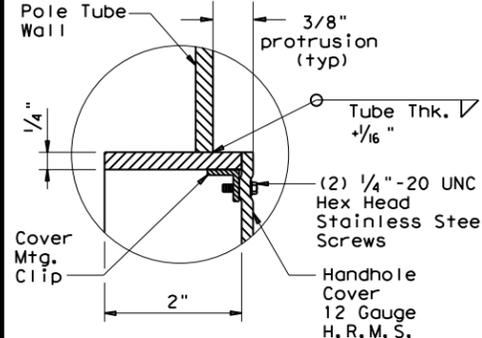
**SIMPLEX ATTACHMENT DETAIL**



**POLE TOP**



**ELEVATION**



**SECTION A-A**

**HANDHOLE**

**NOTES:**

- Any of the materials listed for plates may be used where the drawings do not specify a particular ASTM designation.
- 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.
- A572, A1008 HSLAS-F, and A1011 HSLAS-F materials may have higher yield strengths but shall not have less elongation than the grade indicated.
- 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.
- Each pole simplex fitting shall be supplied with 2 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.
- Proposed deviations in arm simplex dimensions or materials must be submitted to the Department for approval.
- A welded handhole frame is permissible. Maximum of two (2) CJP weld splices is allowed.

**MATERIALS**

Pole or Arm Simplex	ASTM A27 Gr 65-35 or Gr 70-36, A148 Gr 80-50, A576 Gr 1021, or A36 (Arm only)
Arm Pipes	ASTM A53 Gr A or B, A500 Gr B, A501, A 1008 HSLAS-F Gr 50, or A1011 HSLAS-F Gr 50
Arm Struts and Gusset Plates	ASTM A36, A572 Gr 50, or A588
Misc.	ASTM designations as noted

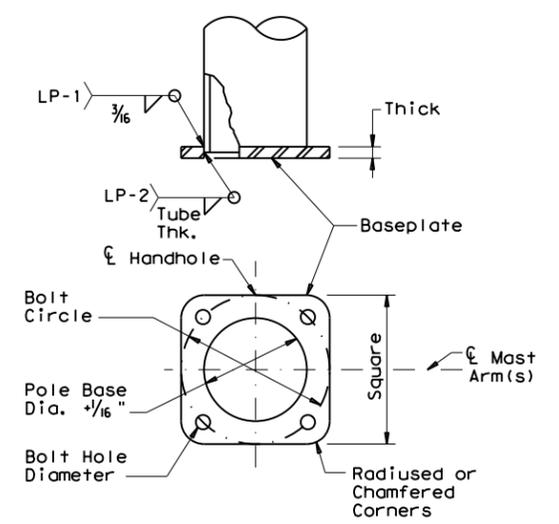
SHEET 3 OF 4



**ROADWAY ILLUMINATION POLES**  
**RIP(3) - 19**

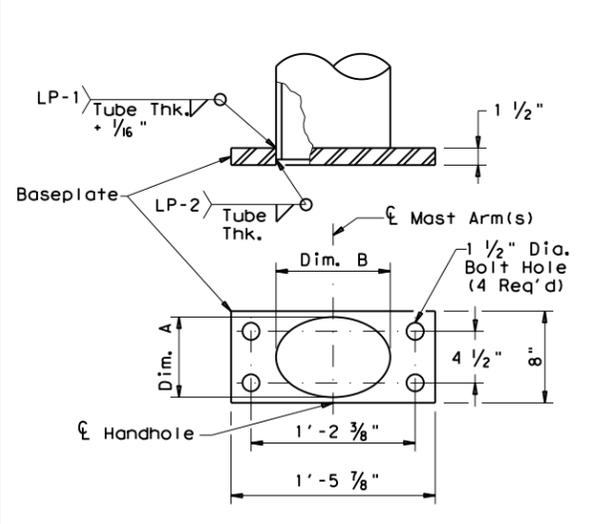
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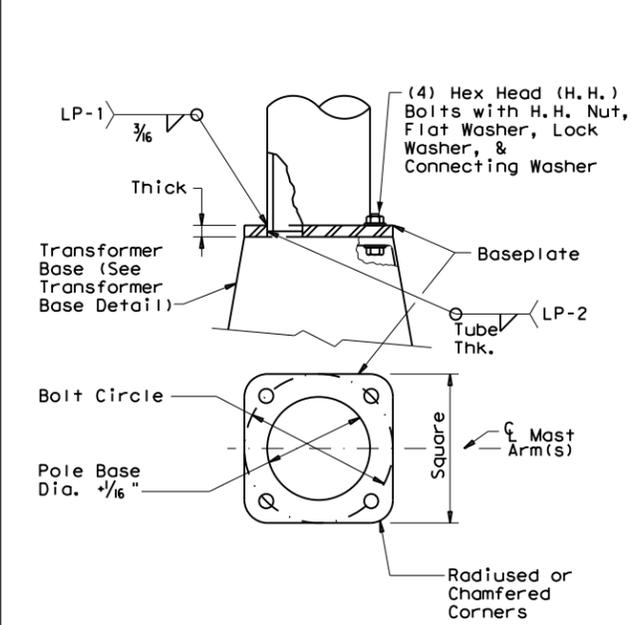
**SHOE BASE BASEPLATE**

SHOE BASE BASEPLATE TABLE				
MOUNTING HEIGHTS (nominal)	BOLT CIRCLE	SQUARE	THICK	BOLT HOLE DIAMETER
20' - 39'	13"	13"	1 1/4"	1 1/4"
40'	15"	15"	1 1/4"	1 1/2"
50'	15"	15"	1 1/2"	1 1/2"



**CONCRETE TRAFFIC BARRIER BASE BASEPLATE**

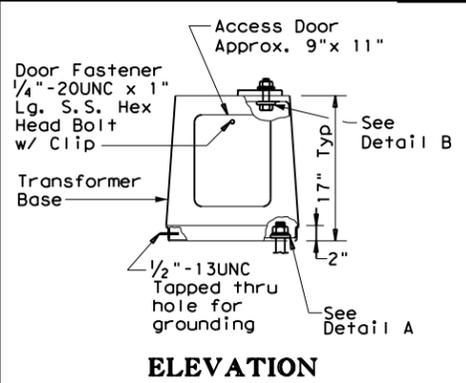
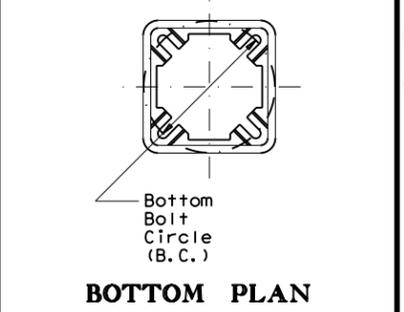
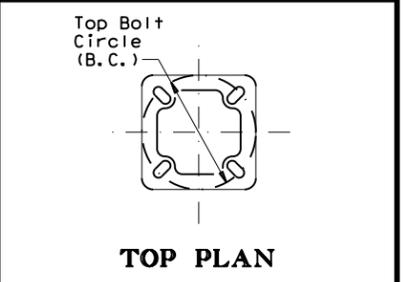
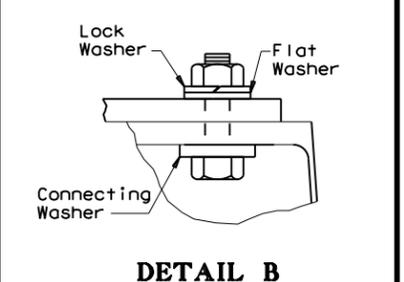
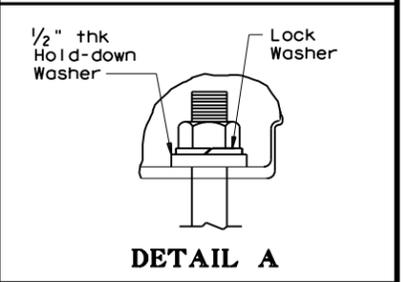
CONCRETE TRAFFIC BARRIER BASE BASEPLATE TABLE			
MOUNTING HEIGHTS (nominal)	POLE DIA. (12)	DIM. A	DIM. B
28' - 38'	9"	7" ± 1/4"	10" ± 1/4"
48'	10 1/2"	7" ± 1/4"	13" ± 1/4"



**TRANSFORMER BASE BASEPLATE**

TRANSFORMER BASE BASEPLATE TABLE						
MOUNTING HEIGHTS (nominal)	BOLT CIRCLE	SQUARE	THICK	CONNECTING BOLT DIA.	BOLT HOLE DIAMETER	TRANSFORMER BASE TYPE
20' - 39'	13"	13"	1 1/4"	1"	1 1/4"	A
40'	15"	15"	1 1/4"	1 1/4"	1 1/2"	B
50'	15"	15"	1 1/2"	1 1/4"	1 1/2"	B

TRANSFORMER BASE TABLE		
TYPE	TOP B.C.	BTM. B.C.
A	13"	14"
B	15"	17 1/4"



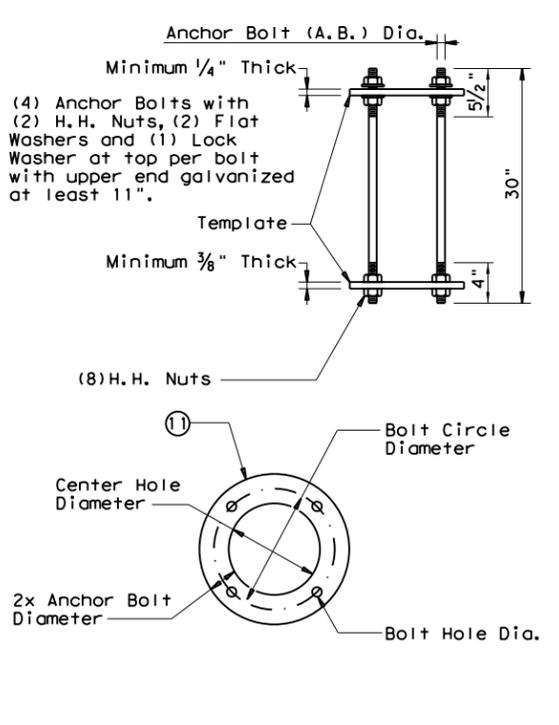
**TRANSFORMER BASE DETAILS**

- GENERAL NOTES:**
- For mounting heights between those shown in the table, use the values in the table for the larger mounting height.
  - All breakaway bases shall meet the breakaway requirements of the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, 6th Edition (2013) and Interim Revisions thereto, and shall have been tested by FHWA-approved methods. All bases shall have been structurally tested to resist 150% of the design moment.
  - Transformer bases shall be cast from aluminum, ASTM B108 or B26 Alloy 356.0-T6, or other material approved by the Engineer. Four Hex Head (H.H.) bolts with four H.H. nuts, four lock washers, four flat washers, and connecting and hold-down washers as recommended by the manufacturer, galvanized to ASTM A153 Class C or D, or B695 Class 50, shall be provided with each transformer base for connecting the pole. Bolts shall be ASTM A325 or approved equal. Nuts shall be ASTM A563 grade DH galvanized.
  - Bases shall be stamped, incised or by other approved permanent means, marked to show fabricator's name or logo, and model number. Such information shall be placed in a readily seen location, inside or outside the base, but shall not be placed on the door.
  - Doors for transformer bases shall be made of plastic, fiberglass or other non-metallic material approved by the Engineer and shall be attached with stainless steel screws or bolts. Transformer bases shall be cleaned by grit blast cleaning after heat treatment. Certification by the manufacturer of heat treatment shall be furnished with transformer bases. The certification shall show the metal alloy and temper and that the base meets those requirements, chemical and physical. The certification shall also show the material ASTM specification. Transformer bases shall be cast with a removable tab bar for material testing. Some bars may have been removed by the manufacturer for testing.

**NOTES:**

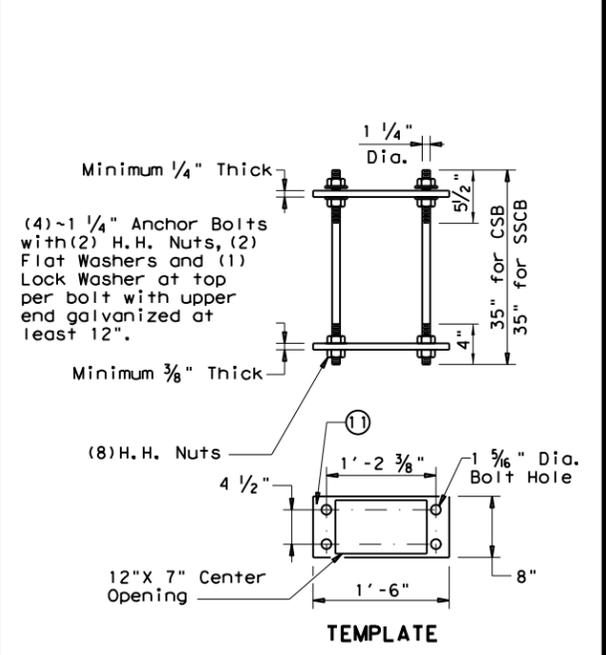
- Anchor Bolt Templates do not need to be galvanized.
- Pole diameter before ovalized.

ANCHOR BOLT FABRICATION TOLERANCES TABLE	
DIMENSION	TOLERANCE
Length	± 1/2"
Threaded length	± 1/2"
Galvanized length (if required)	- 1/4"



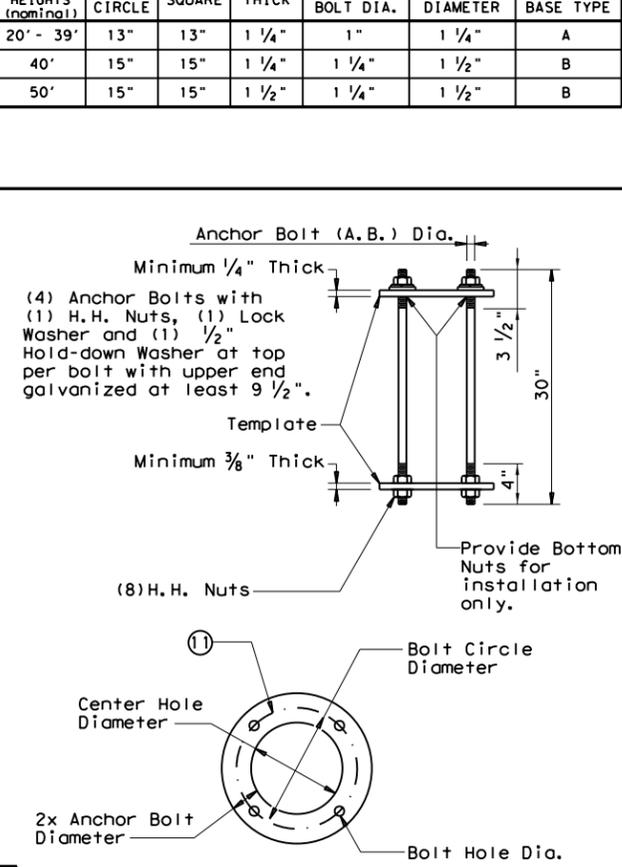
**SHOE BASE ANCHOR BOLT ASSEMBLY**

SHOE BASE ANCHOR BOLT ASSEMBLY TABLE				
MOUNTING HEIGHTS (nominal)	A.B. Dia.	BOLT CIRCLE DIAMETER	CTR. HOLE DIAMETER	BOLT HOLE DIAMETER
20' - 39'	1"	13"	11"	1 1/16"
40' - 50'	1 1/4"	15"	12 1/2"	1 5/16"



**CONCRETE TRAFFIC BARRIER BASE ANCHOR BOLT ASSEMBLY**

CONCRETE TRAFFIC BARRIER BASE ANCHOR BOLT ASSEMBLY TABLE				
MOUNTING HEIGHTS (nominal)	A.B. Dia.	BOLT CIRCLE DIAMETER	CTR. HOLE DIAMETER	BOLT HOLE DIAMETER
20' - 39'	1"	14"	12"	1 1/16"
40' - 50'	1 1/4"	17 1/4"	14 3/4"	1 5/16"



**TRANSFORMER BASE ANCHOR BOLT ASSEMBLY**

SHEET 4 OF 4

Texas Department of Transportation

Traffic Safety Division Standard

## ROADWAY ILLUMINATION POLES

### RIP(4) - 19

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REVISIONS	6399	15	001	SH99
7-17	DIST	COUNTY	SHEET NO.	
12-19	BMT	LIBERTY, ETC.	156	

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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 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 1/2 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.

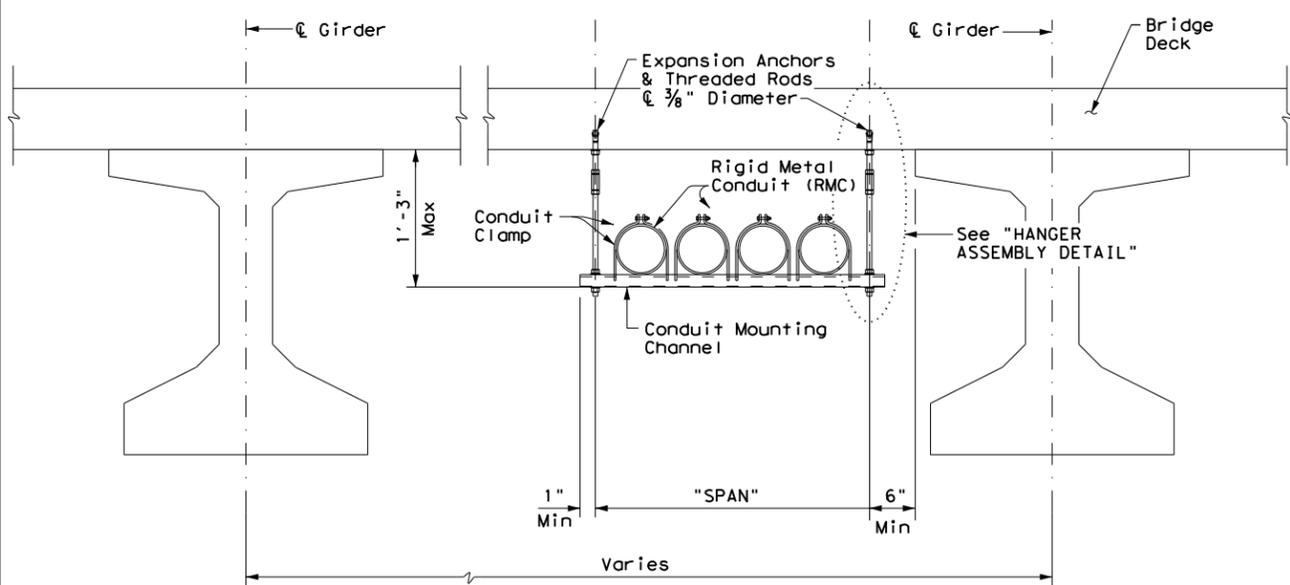
8. Provide PVC elbows in PVC conduit systems, unless otherwise shown on the plans. Use only a flat, high tensile strength polyester fiber pull tape for pulling conductors through the PVC conduit system. When galvanized steel RMC elbows are specifically called for in the plans and any portion of the RMC 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	
<h1>ELECTRICAL DETAILS CONDUITS &amp; NOTES</h1>			
<h2>ED(1) - 14</h2>			
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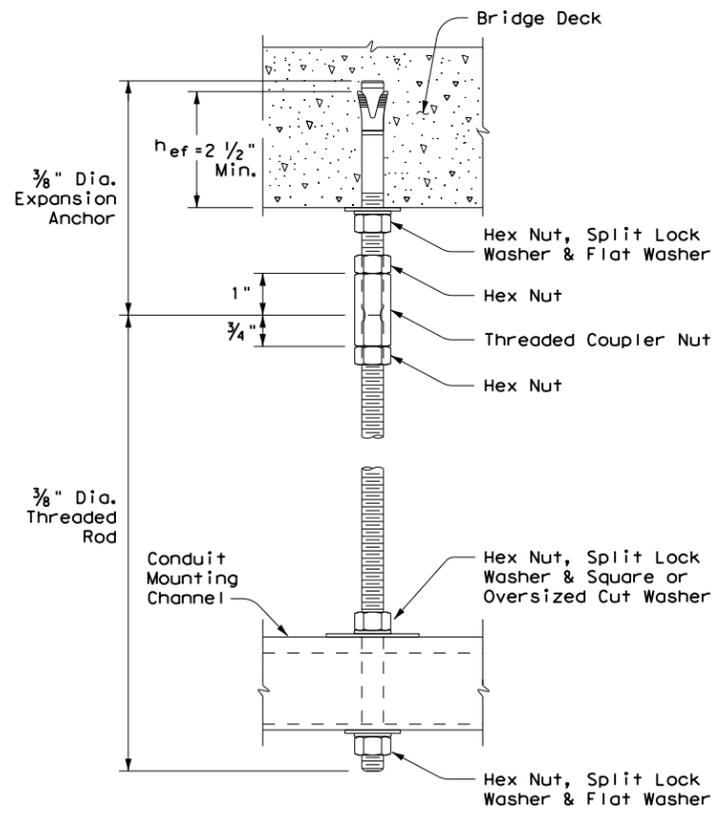
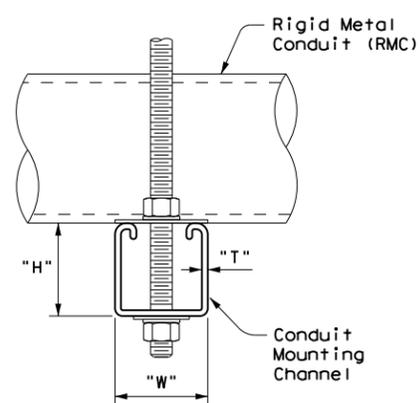
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CONDUIT HANGING DETAIL

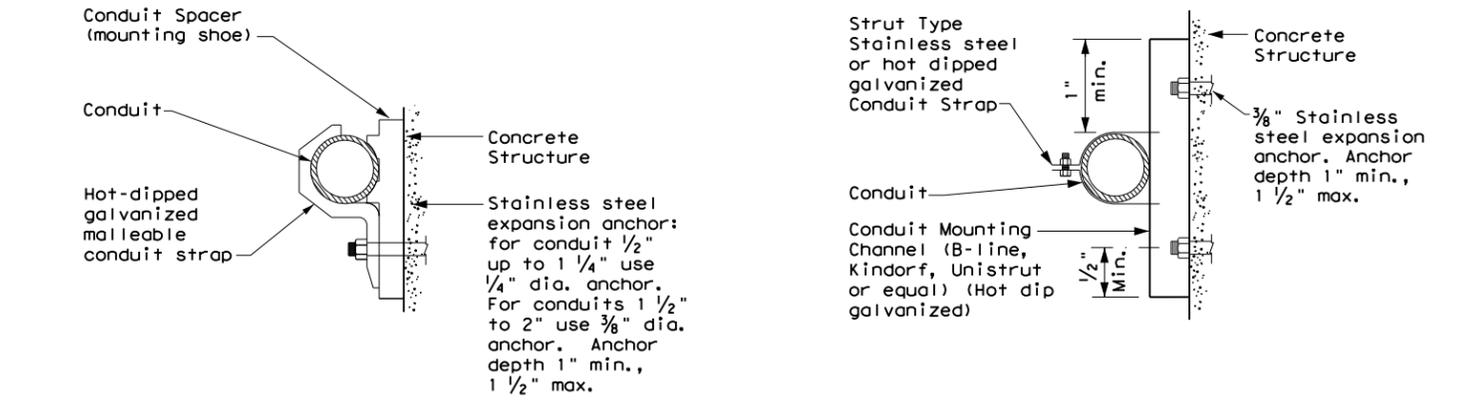
CONDUIT MOUNTING CHANNEL		
"SPAN"	"W" x "H"	"T"
less than 2'	1 5/8" x 1 3/8"	12 Ga.
2'-0" to 2'-6"	1 5/8" x 1 5/8"	12 Ga.
>2'-6" to 3'-0"	1 5/8" x 2 1/16"	12 Ga.

Channels with round or short slotted hole patterns are allowed, if the load carrying capacity is not reduced by more than 15%.



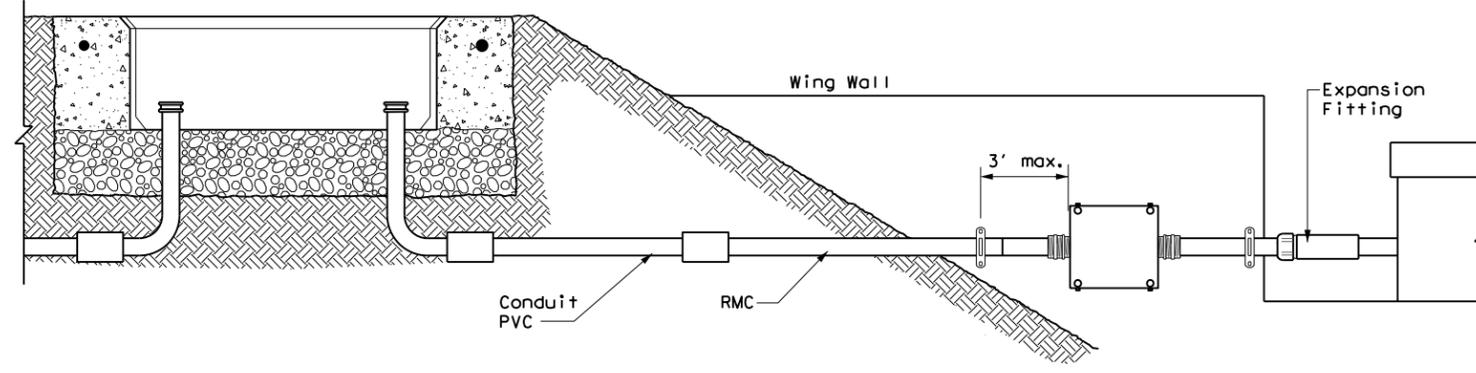
HANGER ASSEMBLY DETAIL

ELECTRIC CONDUIT TO BRIDGE DECK ATTACHMENT



CONDUIT MOUNTING OPTIONS

Attachment to concrete surfaces  
See ED(1)B.2



TYPICAL CONDUIT ENTRY TO BRIDGE STRUCTURE DETAIL

EXPANSION ANCHOR NOTES FOR BRIDGE DECK ATTACHMENT

1. Use torque controlled mechanical expansion anchors that are approved for use in cracked concrete by the International Code Council, Evaluation Service (ICC-ES). The chosen anchor product shall have a designated ICC-ES Evaluation Report number, and its approval status shall be maintained on the ICC-ES website under Division 031600 for Concrete Anchors.
2. Unless otherwise approved by the Engineer: do not use adhesive anchors; do not use expansion anchors that are not included in the ICC-ES approval list; and do not use expansion anchors that are only approved for use in uncracked concrete.
3. Use anchors manufactured with stainless steel expansion wedges. Anchors manufactured with carbon steel expansion wedges are not allowed. Anchor bodies can be either zinc-plated carbon steel or stainless steel. For application in marine environment, both the anchor body and expansion wedge shall be stainless steel.
4. Install anchors as shown on the plans and in accordance with the anchor manufacturer's published installation instructions. Arrange a field demonstration test to evaluate the procedures and tools. The test shall be witnessed and approved by the Engineer prior to furnishing anchors on the structure.
5. Prior to hole drilling, use rebar locator to ensure clearing of existing deck strands or reinforcement. Install anchors to ensure a minimum effective embedment depth, (h<sub>ef</sub>), as shown. Increase (h<sub>ef</sub>) as needed to ensure sufficient thread length for proper torquing and tightening of anchors.
6. Use anchors of minimum 1600 Lbs tensile capacity (minimum of steel, concrete breakout, and concrete pullout strengths as determined by ACI 318 Appendix D) at the required minimum embedment depth (h<sub>ef</sub>). No lateral loads shall be introduced after conduit installation.

		Traffic Operations Division Standard	
<h2>ELECTRICAL DETAILS CONDUIT SUPPORTS</h2>			
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# ELECTRICAL CONDUCTORS

## A. MATERIAL INFORMATION

1. Provide Type XHHW insulated conductors in accordance with Departmental Material Specification (DMS) 11040 "Conductors" and Item 620 "Electrical Conductors." Provide conductors as listed on the Material Producers List (MPL) on the Department web site under "Roadway Illumination and Electrical Supplies" Item 620. Color code insulated conductors in conformance with the NEC. Identify grounded (neutral) conductors with white insulation. Identify grounding conductors (ground wires) with green insulation or bare conductors. Identify ungrounded (hot) conductors with any color insulation except green, white, or gray. Keep color scheme consistent throughout the wiring system. Identify conductors 6 American Wire Gauge (AWG) and smaller by continuous color jacket. Identify electrical conductors 4 AWG and larger by continuous color jacket or by colored tape. When identifying conductors with colored tape, mark at least 6 in. of the conductor's insulation with half laps of tape.
2. Provide a solid copper 6 AWG grounding electrode conductor to bond the electrical service equipment to the concrete encased grounding electrode or the ground rod at the service location. Connect the grounding electrode conductor to the ground rod with a UL listed connector in accordance with DMS 11040. Connect the grounding electrode conductor to the concrete encased grounding electrode as shown in the plans.
3. Where two or more circuits are present in one conduit or enclosure, permanently identify the conductors of each branch circuit by attaching a non-metallic tag around both circuit conductors at each accessible location. Provide tags with two straps, large enough to indicate circuit number, letter, or other identification as shown in the plans. Print circuit identification on the tag with a permanent marker.
4. Use listed compression or screw type pressure connectors, terminal blocks, or split bolt connectors for splicing as specified in DMS 11040. Use hot melt adhesive tape to fill the gap and seal the ends of heat shrink tubing. Provide UL listed gel-filled insulating splice covers. Splicing materials, insulating materials, breakaway disconnects, splice covers, and fuse holders are subsidiary to various bid items.

## B. CONSTRUCTION METHODS

1. Use only a flat, high tensile strength polyester fiber pull tape for pulling conductors through the conduit system. After installing conductors in conduit, perform conductor pull test. If a conductor cannot be freely pulled, make any needed alterations or repairs at no additional cost to the department. Perform insulation resistance tests in accordance with Item 620. Coordinate with the Engineer to witness the tests.
2. Leave 2 ft. minimum, 3 ft. maximum length for each conductor up to the splice in ground boxes. Leave 3 ft. minimum, 4 ft. maximum length of conductor in ground boxes when pulled through with no splice. Leave 1 ft. minimum, 1.5 ft. maximum length of conductor at enclosures, weatherheads and pole bases.
3. Make splices only in junction boxes, ground boxes, pole bases, or electrical enclosures and use only listed compression or screw type pressure connectors, terminal blocks, or split bolt connectors. Insulate splices with heavy wall heat shrink tubing or gel-filled insulating splice covers to provide a watertight seal. 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.

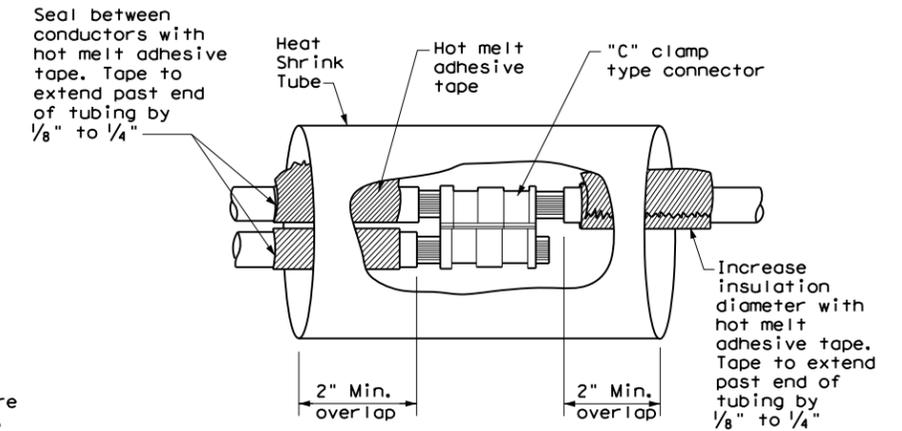
## GROUND RODS & GROUNDING ELECTRODES

### A. MATERIAL INFORMATION

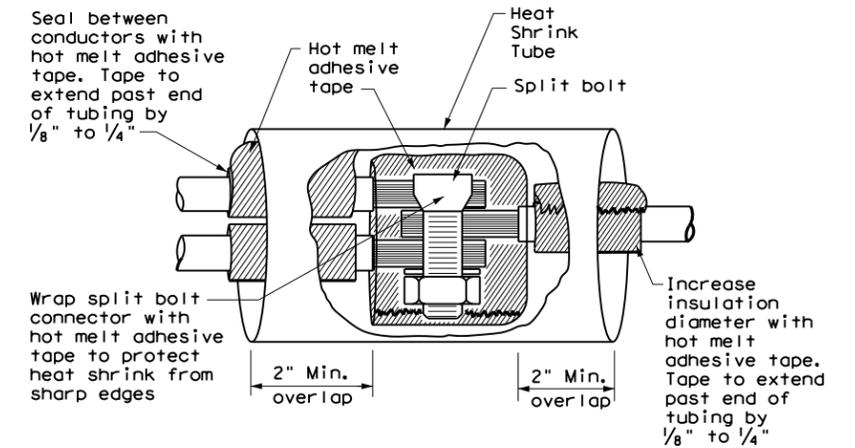
1. Provide and install a grounding electrode at electrical services. Provide ground rods according to DMS 11040 and the plans. Larger diameter or longer length rods may be called for in some specific locations, see the individual plans sheets. Concrete encased grounding electrodes may be called for in specific locations including electrical service, see individual plan sheets.

### B. CONSTRUCTION METHODS

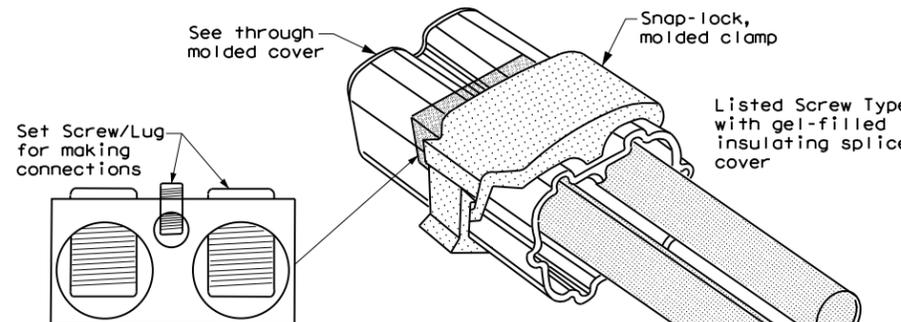
1. Furnish auxiliary ground rods for lightning protection and install in soil, concrete, or both, as called for in the plans. For ground rods installed in concrete, ensure the connection of the conductor to the ground rod is readily accessible for inspection or repairs. For ground rods installed in soil, 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**



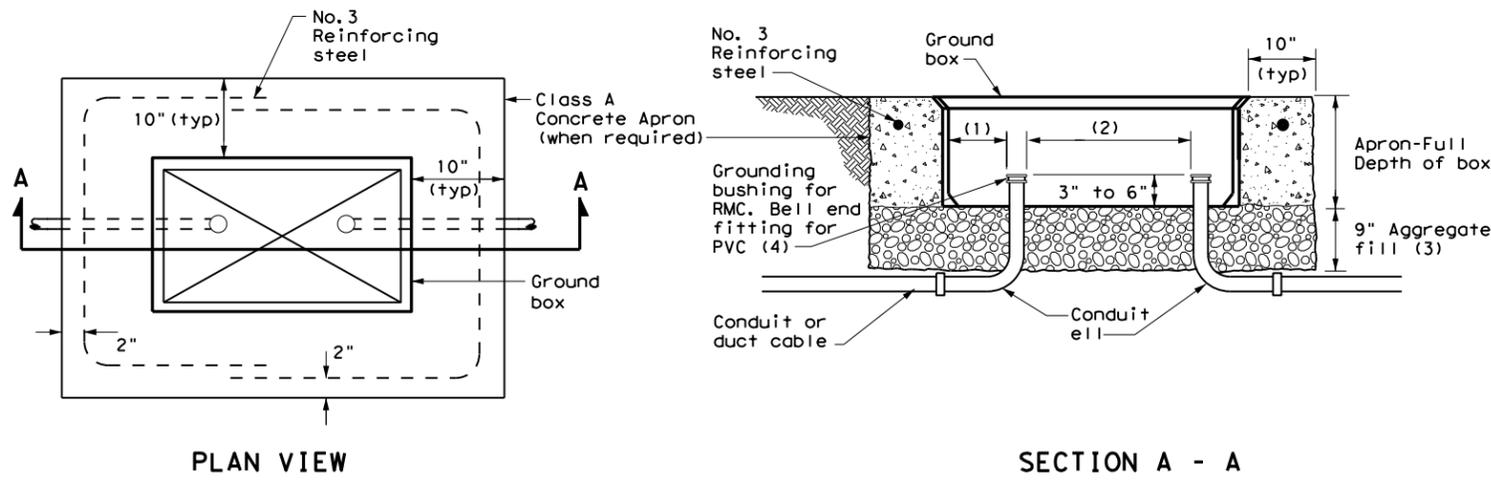
**SPLICE OPTION 3  
Listed Screw Type**

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		Traffic Operations Division Standard	
<h2>ELECTRICAL DETAILS CONDUCTORS</h2>			
<h3>ED(3) - 14</h3>			
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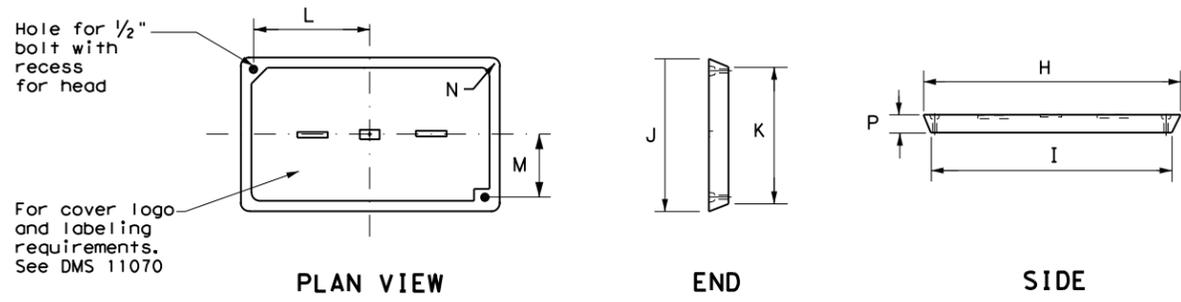


**APRON FOR GROUND BOX**

- (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



**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**

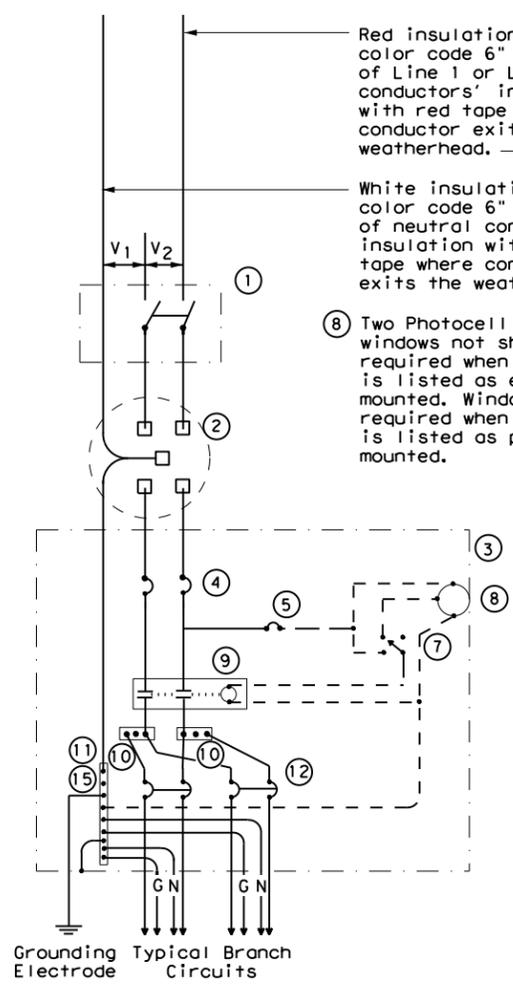
1. Remove all gravel and dirt from conduit. Cap all conduits prior to placing aggregate and setting ground box. Provide Grade 3 or 4 coarse aggregate as shown on Table 2 of Item 302 "Aggregates for Surface Treatments." Ensure aggregate bed is in place and at least 9 inches deep, prior to setting the 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.

				Traffic Operations Division Standard	
<h2>ELECTRICAL DETAILS</h2> <h3>GROUND BOXES</h3> <h4>ED(4) - 14</h4>					
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DIST:	BMT	COUNTY:	LIBERTY, ETC.	SHEET NO.:	160

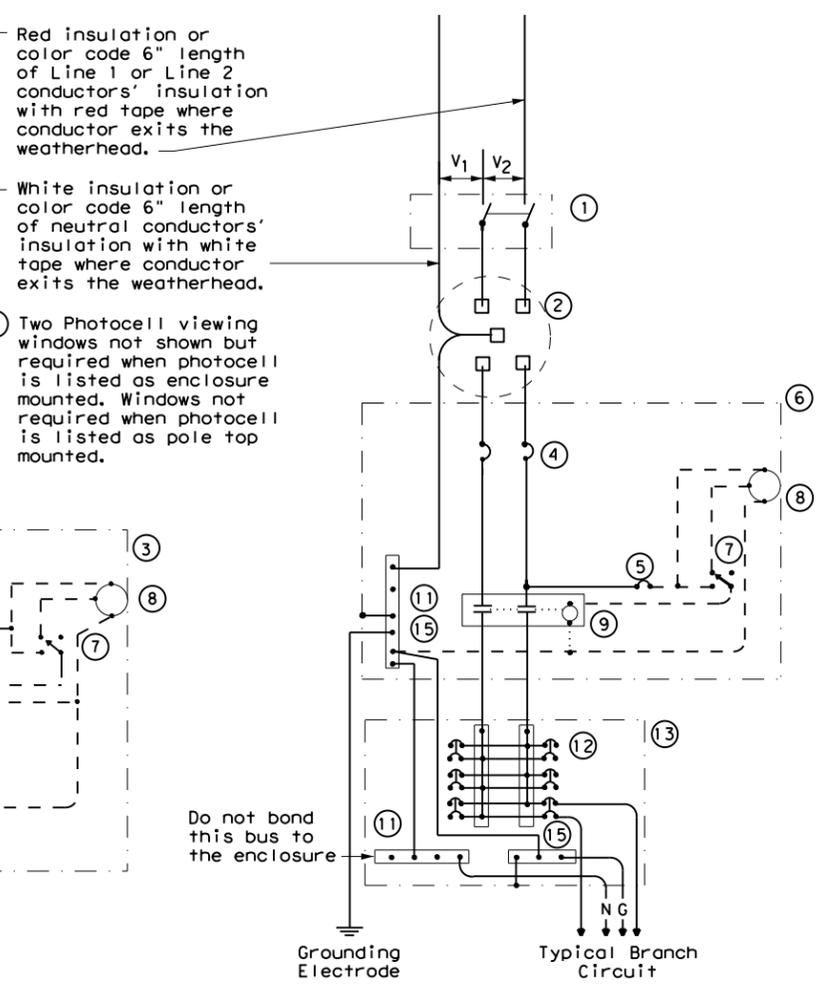


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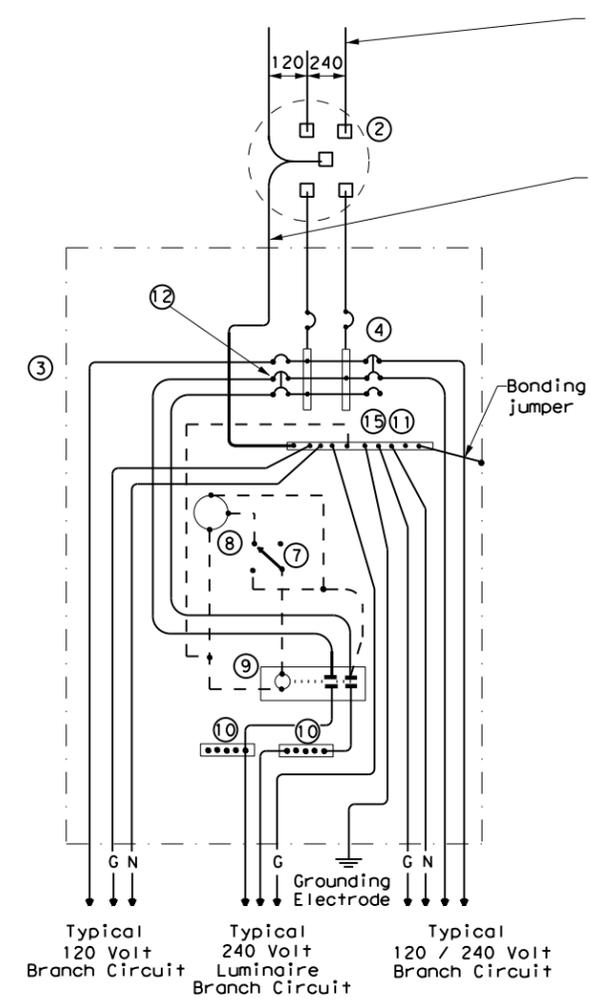
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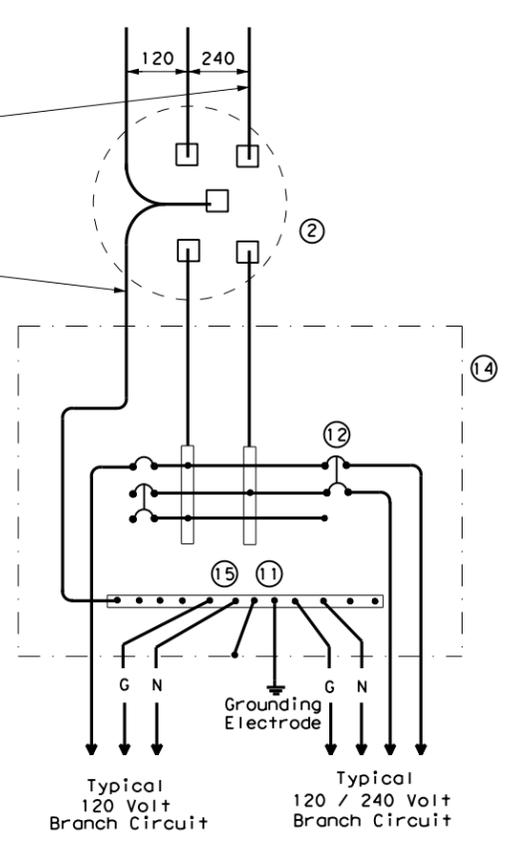
**SCHEMATIC TYPE A  
THREE WIRE**



**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

				Traffic Operations Division Standard	
<b>ELECTRICAL DETAILS SERVICE ENCLOSURE AND NOTES</b>					
<b>ED(6) - 14</b>					
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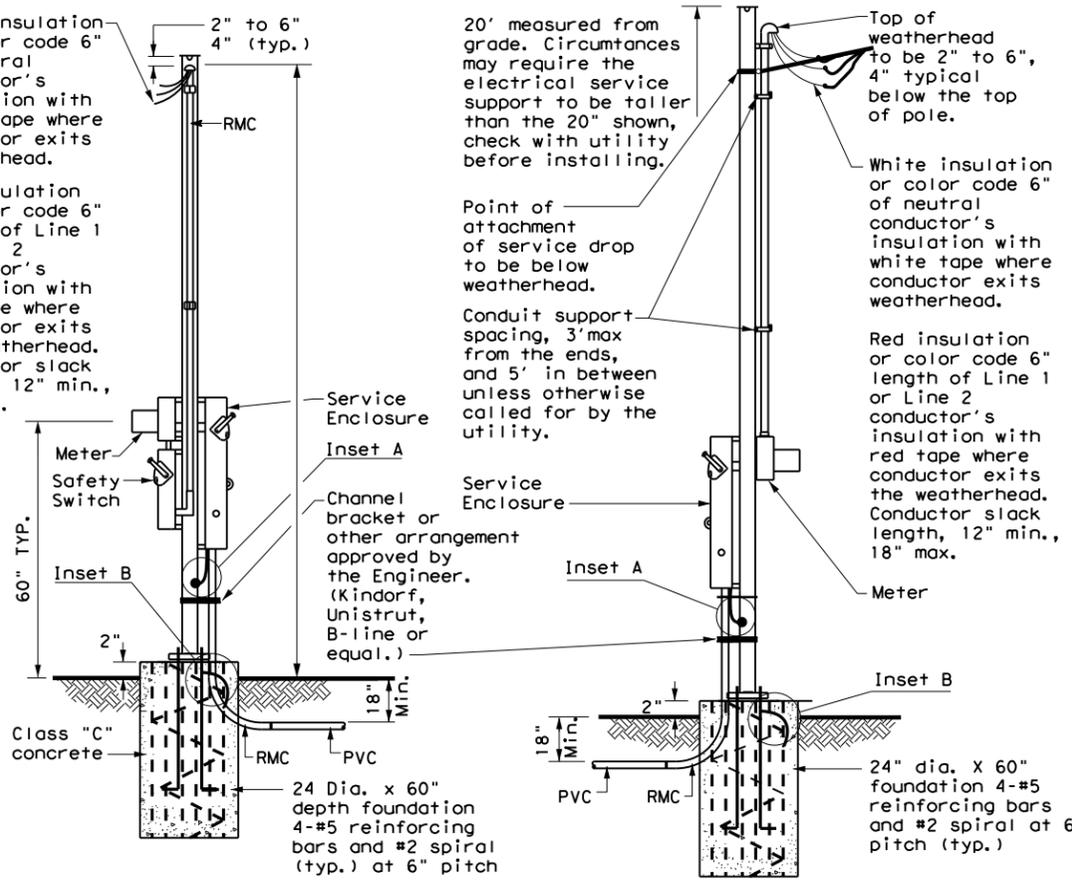
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**SUPPORT TYPE STEEL POLE (SP) AND STEEL FRAME (SF)**

1. Provide steel pole and steel frame supports as per TxDOT Departmental Material Specification (DMS)11080 "Electrical Services." Mount all equipment and conduit on 12 gauge galvanized steel or stainless steel channel strut, 1 1/2 in. or 1 3/8 in. wide by 1 in. up to 3 3/4 in. deep Unistrut, Kindorf, B-line or equal. Bolt or weld all channel and hardware to vertical members as approved. Do not stack channel. File smooth and paint field cut ends of all channel with zinc-rich paint before installing.
2. Provide poles for overhead service with an eyebolt or similar fitting for attachment of the service drop to the pole in conformance with the electric utility provider's specifications.
3. Provide and install galvanized 3/4 in. x 18 in. x 4 in. (dia. x length x hook length) anchor bolts for underground service supports. Provide and install galvanized 3/4 in. x 56 in. x 4 in. anchor bolts for overhead service supports. Ensure anchor bolts have 3 in. of thread, with 3 1/4 in. to 3 1/2 in. of the exposed anchor bolt projecting above finished foundation. Provide and install leveling nuts for all anchor bolts.
4. Bond one of the anchor bolts to the rebar cage with 6 AWG bare stranded copper conductor. Use listed mechanical connectors rated for embedment in concrete. See Inset B.
5. Furnish and install rigid metallic ellis in all steel pole and steel frame foundations for all conduits entering the service from underground.
6. Use class C concrete for foundations. Ensure reinforcing steel is Grade 60 with 3" of unobstructed concrete cover.
7. Drill and tap steel poles and frames for 1/2 in. X 13 UNC tank ground fitting. For steel pole service supports, provide and install tank ground fitting 4 in. to 6 in. below electrical service enclosure. Provide properly sized hole through the bottom of the enclosure for the service grounding electrode conductor. Ensure electrical service grounding electrode conductor is as short and straight as possible from the enclosure to the tank ground fitting. For steel frame service supports, provide and install tank ground fitting on steel frame post. Install service grounding electrode conductor in a non-metallic conduit or tubing from the enclosure to the steel frame post. Connect electrical service grounding electrode conductor to the tank ground fitting. See steel frame and steel pole details and Inset A for more information. Size service entrance conduit and branch circuit conduit as shown in the plans. For underground conduit runs from the electrical service, extend RMC from the service enclosure to an RMC elbow, and then connect the schedule type and size of conduit shown in the plans. Provide and install grounding bushings where RMC terminates in the enclosure. Grounding bushings are not required when RMC is fitted into a sealing hub or threaded boss.
8. If Steel pole or frame is painted, bond each separate painted piece with a bonding jumper attached to a tapped hole.
9. Provide 1/4" - 20 machine screws for bonding. Do not use sheet metal screws. Remove all non-conductive material at contact points. Terminate bonding jumpers with listed devices. Install minimum size 6 AWG stranded copper bonding jumpers. Make up all threaded bonding connections wrench tight.
10. Avoid contact of the service drop and service entrance conductors with the metal pole to prevent abrasion of the insulated conductors.
11. Shop drawings are not required for service support structure unless specifically stated elsewhere or directed by the Engineer.

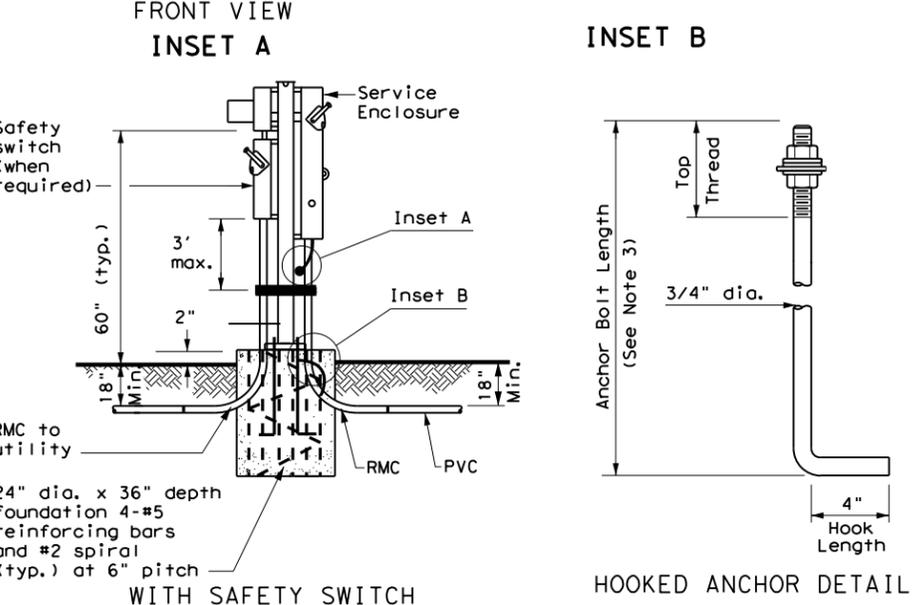
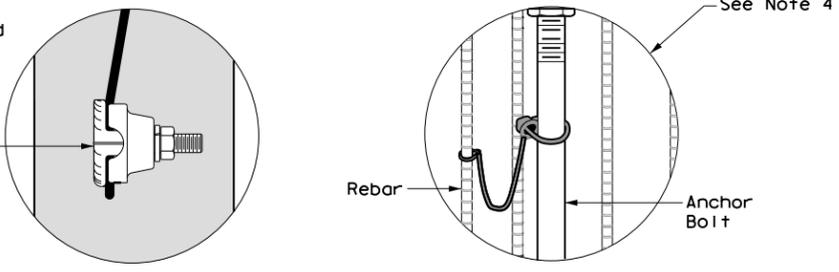
White insulation or color code 6" of neutral conductor's insulation with white tape where conductor exits weatherhead.

Red insulation or color code 6" length of Line 1 or Line 2 conductor's insulation with red tape where conductor exits the weatherhead. Conductor slack length, 12" min., 18" max.

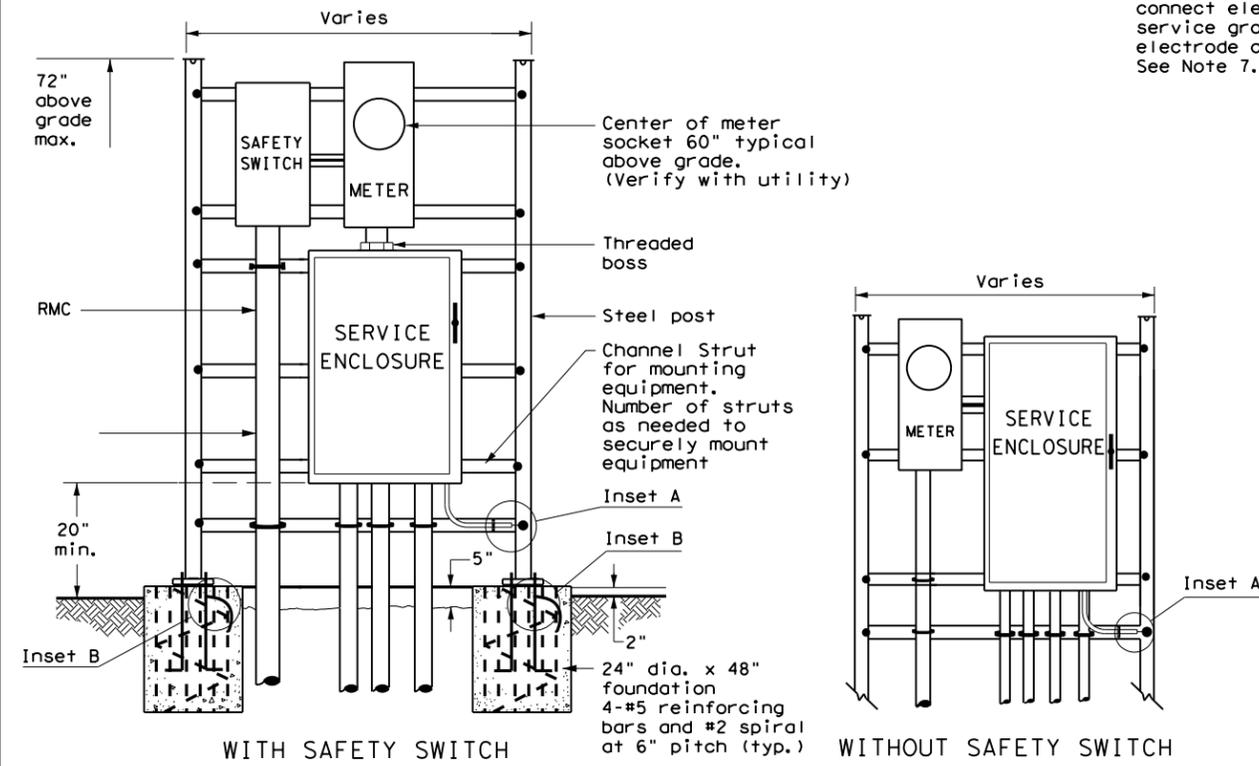


WITH SAFETY SWITCH      WITHOUT SAFETY SWITCH  
**SERVICE SUPPORT TYPE SP (O) - OVERHEAD SERVICE**

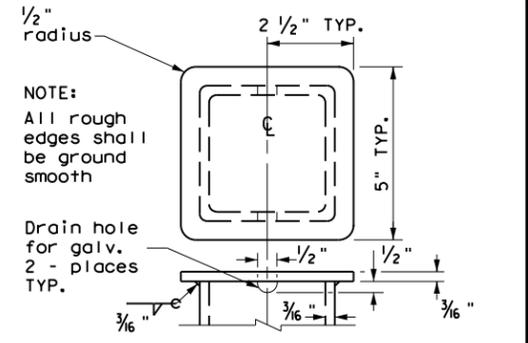
Drill, tap, and thread 1/2" X 13 UNC. Install tank ground fitting, connect electrical service grounding electrode conductor. See Note 7.



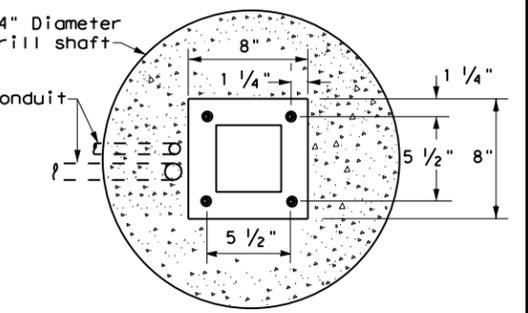
WITH SAFETY SWITCH      HOOKED ANCHOR DETAIL  
**SERVICE SUPPORT TYPE SP (U) - UNDERGROUND SERVICE**



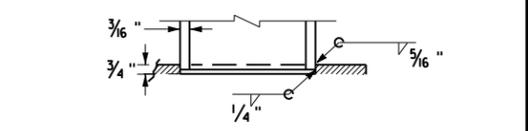
WITH SAFETY SWITCH      WITHOUT SAFETY SWITCH  
**SERVICE SUPPORT TYPE SF (U) - UNDERGROUND SERVICE**



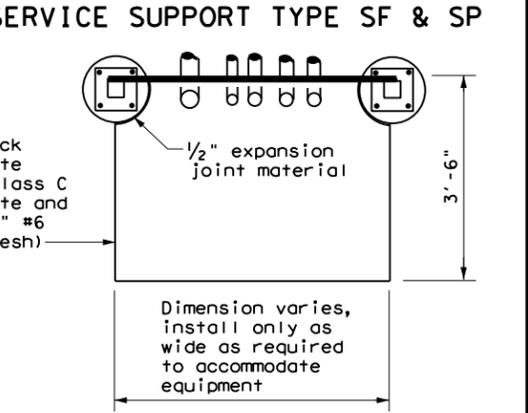
**POLE TOP PLATE**



**BASE PLATE DETAIL**



**BOTTOM OF POLE**



**TOP VIEW**

**SERVICE SUPPORT TY SF (O) & SF (U)**

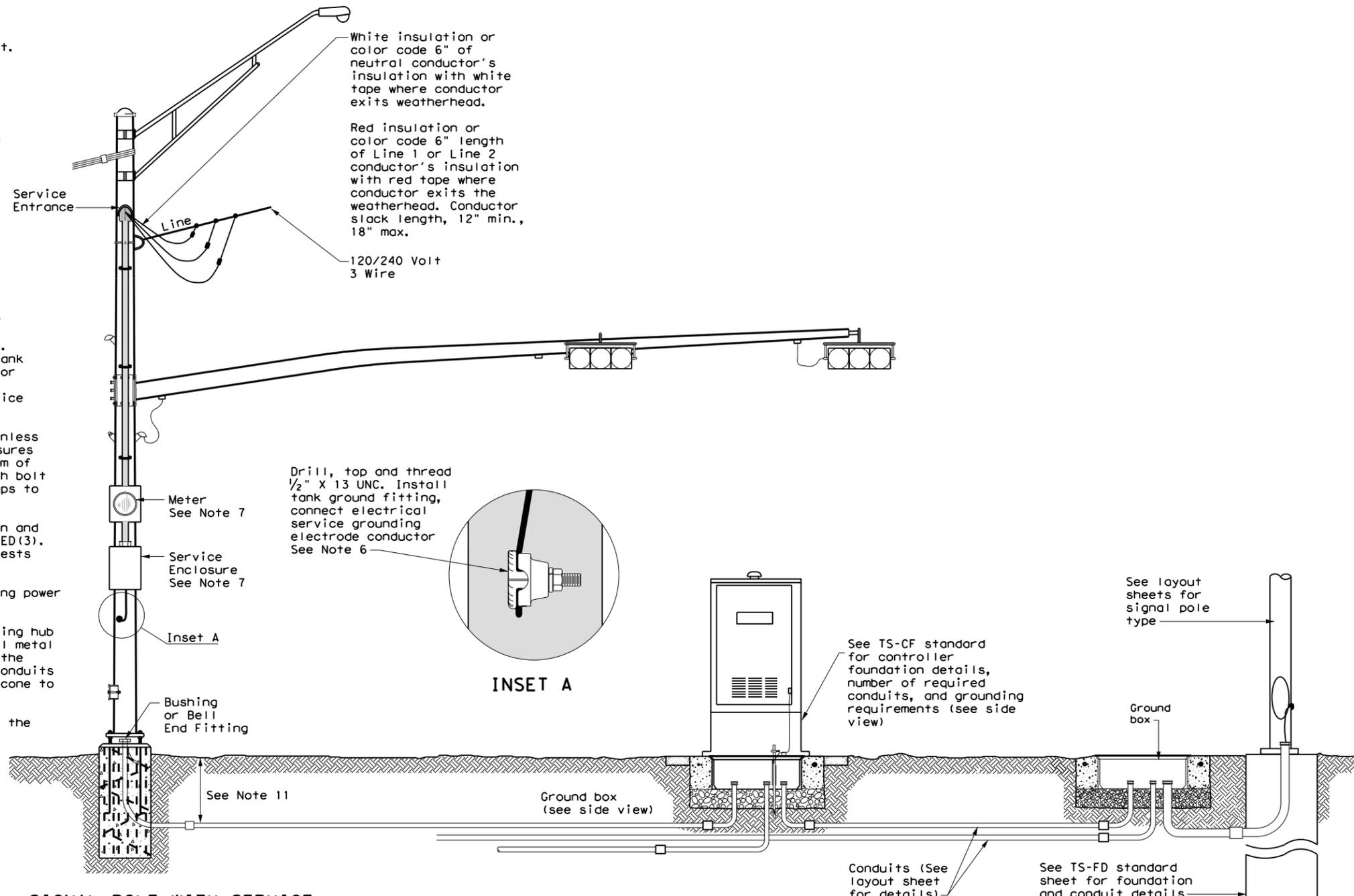
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**TRAFFIC SIGNAL NOTES**

1. Do not pass luminaire conductors through the signal controller cabinet.
2. Include an equipment grounding conductor in all conduits throughout the electrical system. Bond all exposed metal parts to the grounding conductor.
3. Provide roadway luminaires, when required, in accordance with the material and construction sections of Item 610, "Roadway Illumination Assemblies," except for performance testing of luminaires. Test installed roadway luminaires for proper operation as a part of the associated traffic signal system test.
4. If internally illuminated street name signs are approved for use, ground the fixture to the pole with a 12 AWG green XHHW conductor.
5. Bond anchor bolts to rebar cage in two locations using #3 bars or 6 AWG stranded copper conductors. Use listed mechanical connectors rated for embedment in concrete. See TxDOT standard TS-FD for further details.
6. Drill and tap signal poles for 1/2 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 3/4 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".

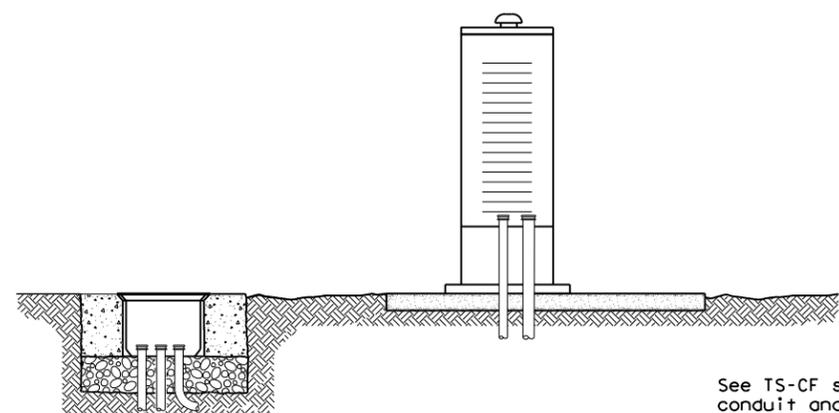


**SIGNAL POLE WITH SERVICE**

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.

**SIGNAL CONTROLLER FRONT VIEW**

**SIGNAL POLE**



**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.

**ELECTRICAL DETAILS TYPICAL TRAFFIC SIGNAL SYSTEM DETAILS ED(8) - 14**

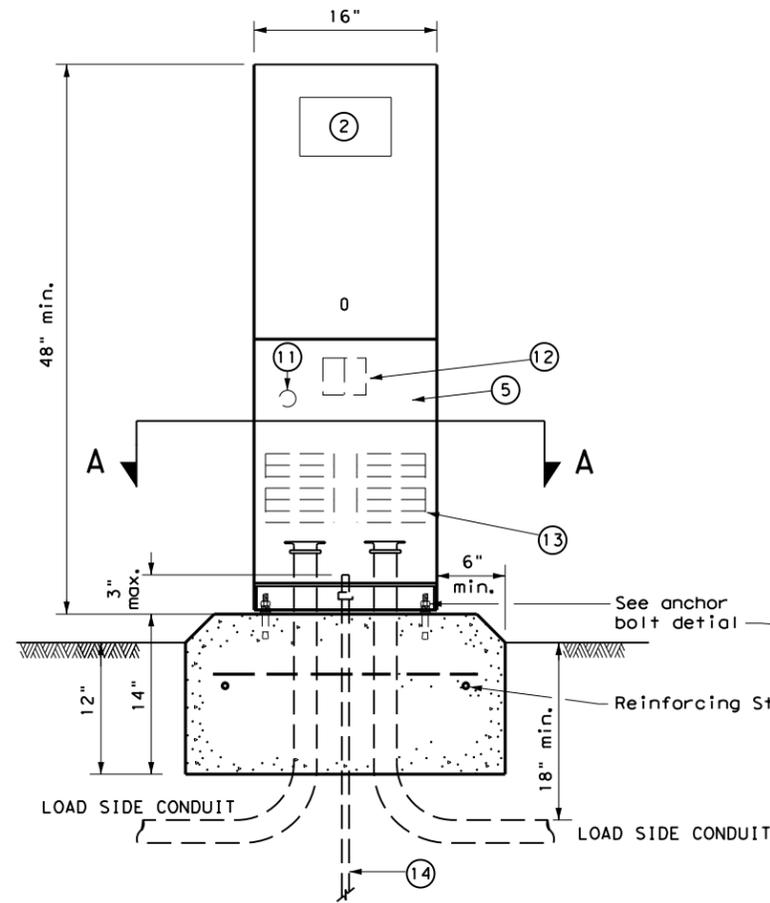
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© TxDOT October 2014	CONT	SECT	JOB	HIGHWAY
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BMT	LIBERTY, ETC.		164	

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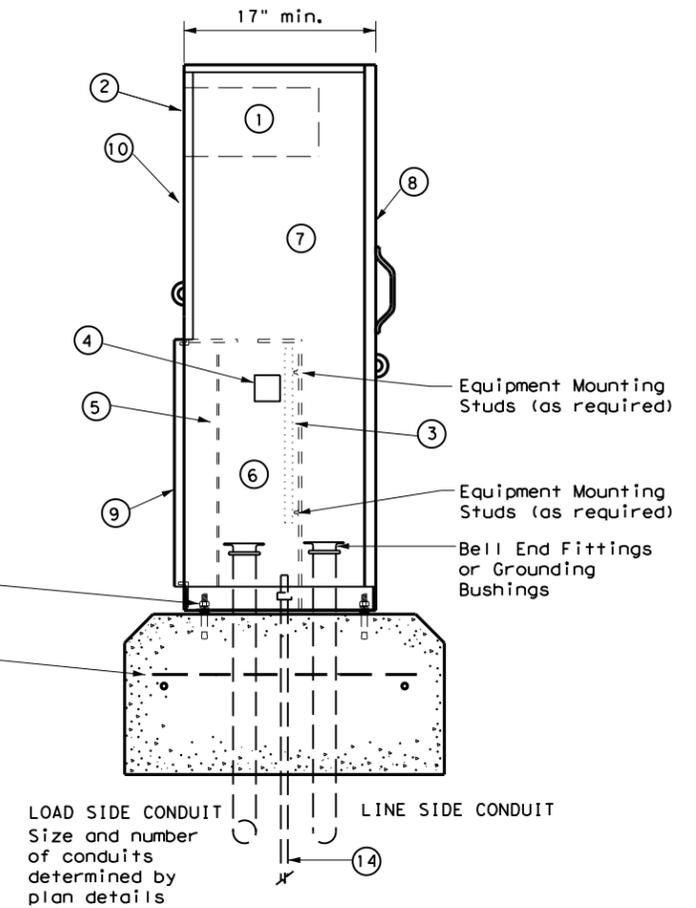
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**PEDESTAL SERVICE NOTES**

1. Manufacture pedestal electrical services in accordance with Departmental Material Specifications (DMS) 11080 "Electrical Services", 11085 "Electrical Services-Pedestal (PS)" and Item 628 "Electrical Services." Provide pedestal electrical services as listed on the Material Producers List (MPL) on the Department's web site under "Roadway Illumination and Electrical Supplies," Item 628. Ensure all mounting hardware and installation details of services meet utility company specifications. Contact the local utility company for approval of pedestal details prior to installing the electrical pedestal service. Submit any changes required by the utility company prior to manufacturing the pedestal enclosure.
2. When a meter socket is required, provide a socket with a minimum 100 amp rating that complies with local utility requirements.
3. Provide Class A or C concrete for pedestal service foundations in accordance with Item 420, "Concrete Substructures," except that concrete will not be paid for directly but is considered subsidiary to Item 628.
4. Provide #4 reinforcing steel for foundations in accordance with Item 440, "Reinforcement for Concrete."
5. Install 1/2 in. X 2 1/16 in. minimum length concrete single expansion type anchors for mounting pedestal enclosure to foundation. Anchor location to match mounting holes in each corner of enclosure. Secure each of the four corners of the pedestal enclosure to the anchors in the foundation with a 1/2 in. galvanized or stainless steel machine thread bolt, a properly sized locknut and a flat washer.
6. Finish top of concrete foundation in a neat and workmanlike manner. If leveling washers are used, ensure no more than 1/8 in. gap at any corner. Do not exceed a maximum dip or rise in the foundation of 1/8 in. per foot. When properly installed, ensure the top of the service enclosure is level front to back and side to side within 1/4 in. Repair rocking or movement of the service enclosure at no additional cost to the department.
7. Do not use liquidtight flexible metal conduit (LFMC) on pedestal type services.
8. Ensure all elbows in the foundation are sized as per utility provider's conduit requirements for underground conduit and feeders. PVC extensions may be installed provided the ends of the rigid metal conduits are more than 2 in. below the top of the concrete foundation. Where extension conduits are metal, grounding bushings must be installed with a bonding jumper properly terminated.

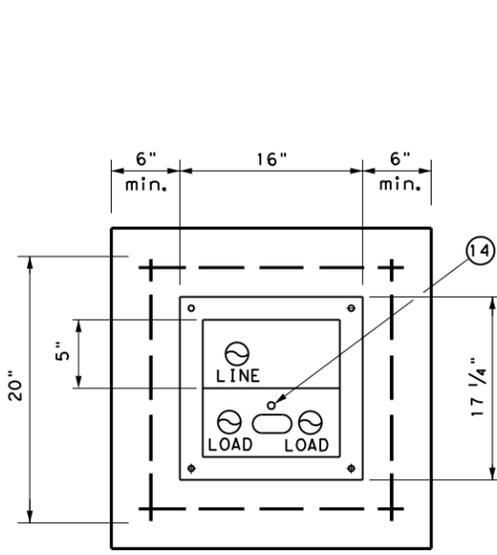


**FRONT VIEW**

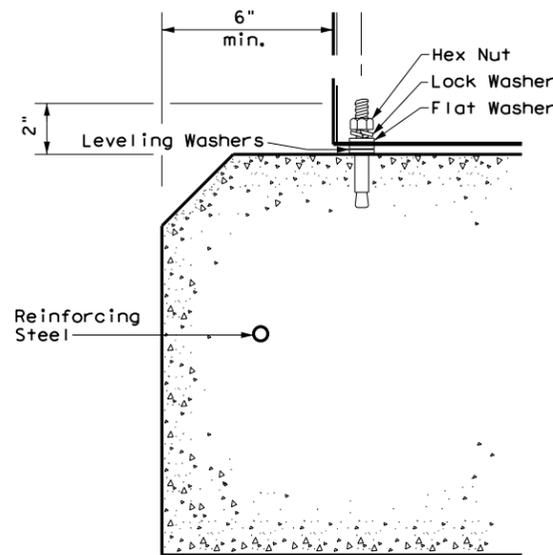


**SIDE VIEW**

TYPE C shown, TYPE A similar except that TYPE A shall have individual circuit breakers (CB) mounted on an equipment mounting panel. CB Handles shall protrude through hinged deadfront trim.



**SECTION A-A**



**ANCHOR BOLT DETAIL**

**LEGEND**

1	Meter Socket, (when required)
2	Meter Socket Window, (when required)
3	Equipment Mounting Panel
4	Photo Electric Control Window, (When required)
5	Hinged Deadfront Trim
6	Load Side Conduit Trim
7	Line Side Conduit Area
8	Utility Access Door, with handle
9	Pedestal Door
10	Hinged Meter Access
11	Control Station (H-O-A Switch)
12	Main Disconnect
13	Branch Circuit Breakers
14	Copper Clad Ground Rod - 5/8" X 10'

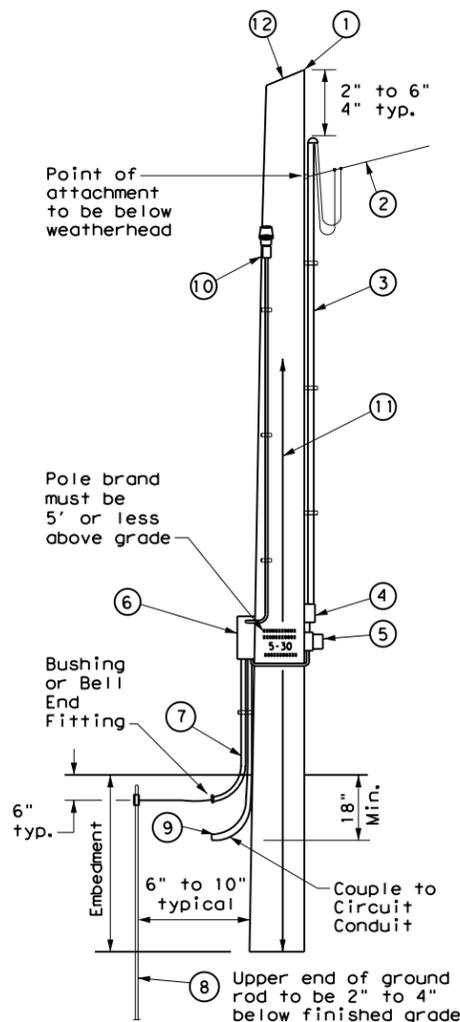
		<b>Traffic Operations Division Standard</b>	
<b>ELECTRICAL DETAILS ELECTRICAL SERVICE SUPPORT PEDESTAL SERVICE TYPE PS</b>			
<b>ED(9) - 14</b>			
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### TIMBER POLE (TP) SERVICE SUPPORT NOTES

1. Ensure electrical service support is a class 5 treated timber pole as per Item 627 "Treated Timber Poles." Embed timber pole to depth required in Item 627.
2. Conduit and electrical conductors attached to the electrical service pole and underground within 12 in. of service pole are not paid for directly but are subsidiary to the electrical service.
3. Install pole-top mounted photocell (T) on north side of pole, or in service enclosure (E) as required. See Electrical Service Data chart in plan set.
4. Gain pole as required to provide flat surface for each channel. Gain timber pole to  $\frac{3}{8}$  in. max. depth and  $1\frac{1}{8}$  in. max. height. Gain pole in a neat and workmanlike manner.
5. Mount meter and service equipment on stainless steel or galvanized channel (Unistrut, Kindorf, or equal). Provide channel sized 1 in. to  $3\frac{3}{4}$  in. maximum depth, and  $1\frac{1}{2}$  in. to  $1\frac{5}{8}$  in. maximum width. File smooth the cut ends of galvanized channel and paint with zinc rich paint before installing on pole. Secure each channel section to timber pole with two galvanized or SS lag bolts,  $\frac{1}{4}$  in. minimum diameter by  $1\frac{1}{2}$  in. minimum length. Use a galvanized or SS flat washer on each lag bolt. Do not stack channel.
6. When excess length must be trimmed from poles, trim from the top end only.

- ① Class 5 pole, height as required
- ② Service drop from utility company (attached below weatherhead)
- ③ Service conduit (RMC) and service entrance conductors - One Red, One Black, One White (See Electrical Service Data)
- ④ Safety switch (when required)
- ⑤ Meter (when required)
- ⑥ Service enclosure
- ⑦ 6 AWG bare grounding electrode conductor in  $\frac{1}{2}$  in. PVC to ground rod - extend  $\frac{1}{2}$  in. PVC 6 in. underground.
- ⑧  $\frac{5}{8}$  in. x 8 ft. Copper clad ground rod - drive ground rod to a depth of 2 in. to 4 in. below grade.
- ⑨ RMC same size as branch circuit conduit.
- ⑩ See pole-top mounted photocell detail on ED(5).
- ⑪ When required by the serving utility provide bare 6 AWG copper conductor. Run wire from pole top to butt wrap or copper butt plate. Protect conductor with non-conductive material to a height of 8 ft. above finished grade.
- ⑫ When required by utility, cut top of pole at an angle to enhance rain run off.

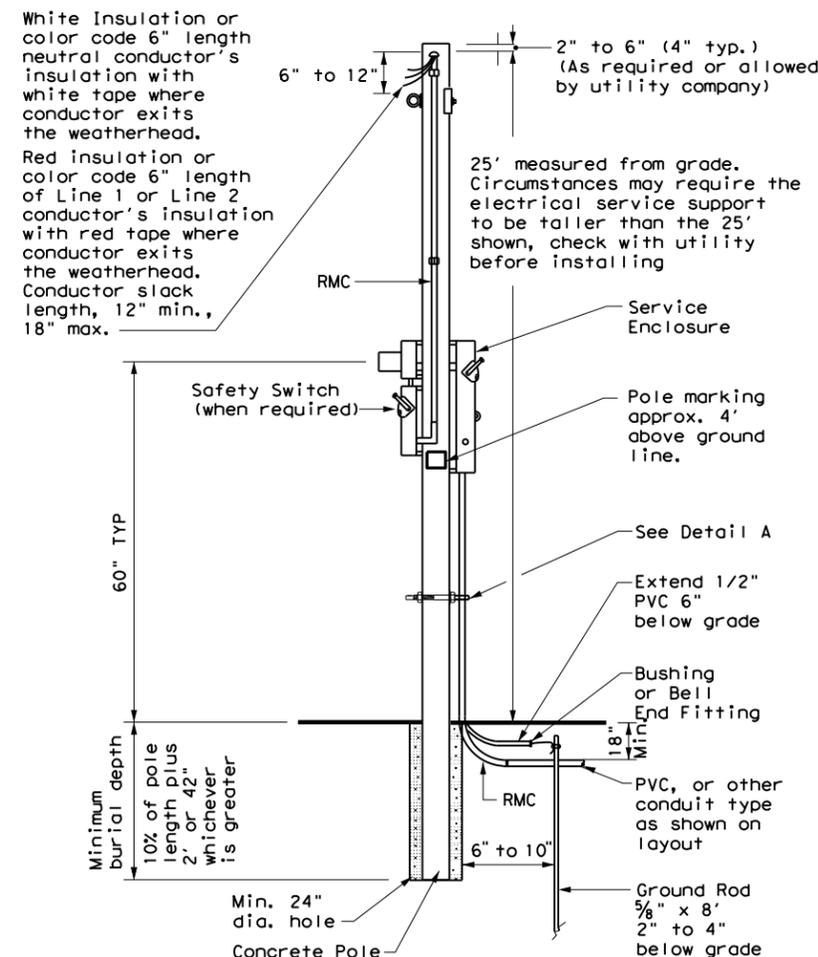


SERVICE SUPPORT TYPE TP (O)

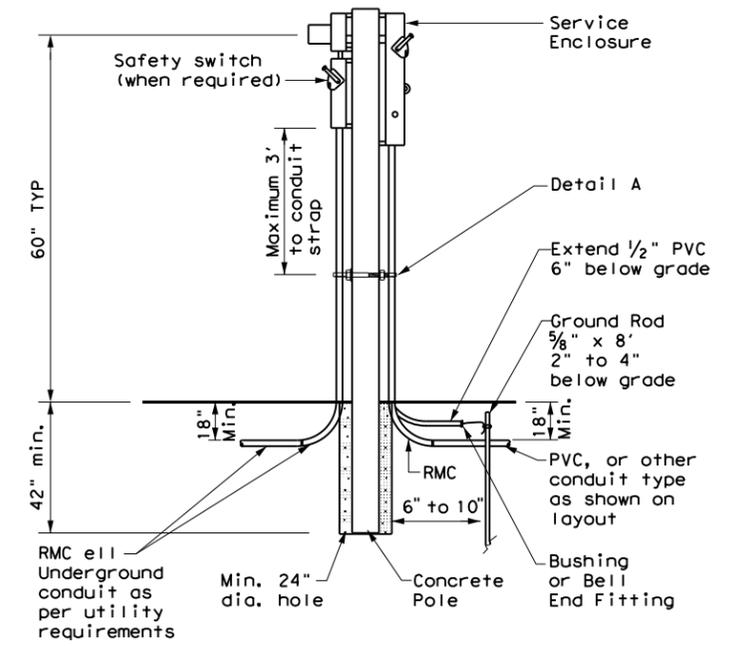
### GRANITE CONCRETE (GC) & OTHER CONCRETE (OC) NOTES

Ensure electrical service support structures bid as type Granite Concrete (GC) or Other Concrete (OC) meet the following requirements.

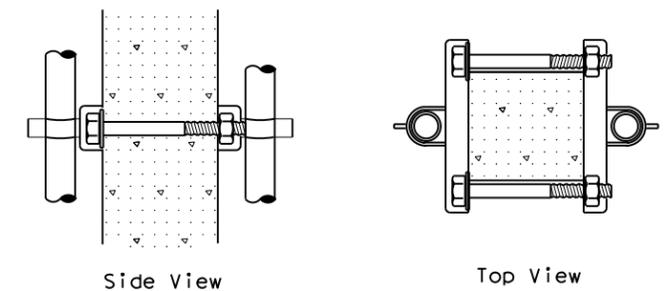
1. Provide GC and OC poles that meet the requirements of DMS 11080 "Electrical Services."
2. Provide prestressed concrete poles suitable for direct embedment into the ground without special foundations.
3. Verify poles are marked as required on DMS 11080. Location of marking should be approximately 4' above final grade. Use the two-point pickup locations when handling pole in horizontal position, and one-point pickup location for use in raising the pole to a vertical position. These marks are small but conspicuous.
4. Embed poles 42 in. or 10% of the length plus 2 ft., whichever is greater.
5. Ensure all installation details of services are in accordance with utility company specifications.
6. Install a one point rack or eye bolt bracket 6 inches to 12 inches below the weatherhead as an overhead service drop anchoring point for the electric utility.
7. Furnish and install galvanized or stainless steel channel strut  $1\frac{1}{2}$  in. or  $1\frac{5}{8}$  in. wide by 1 in. up to  $3\frac{3}{4}$  in. deep (Unistrut, Kindorf, B-line or equal). Attach channel strut with stainless steel concrete anchors (max. 1" depth), square U-bolts or back to back channel strut with long bolts, or other secure mounting as approved by the Engineer. Ensure bolts are galvanized in accordance with ASTM A153. Do not stack channel struts.
8. Backfill the holes thoroughly by tamping in 6 in. lifts. After tamping to grade, place additional backfill material in a 6 inch high cone around the pole to allow for settling. Use material equal in composition and density to the surrounding area. Backfilling will not be paid for directly but is subsidiary to various bid items.



CONCRETE SERVICE SUPPORT Overhead (O)



CONCRETE SERVICE SUPPORT Underground (U)



#### DETAIL A

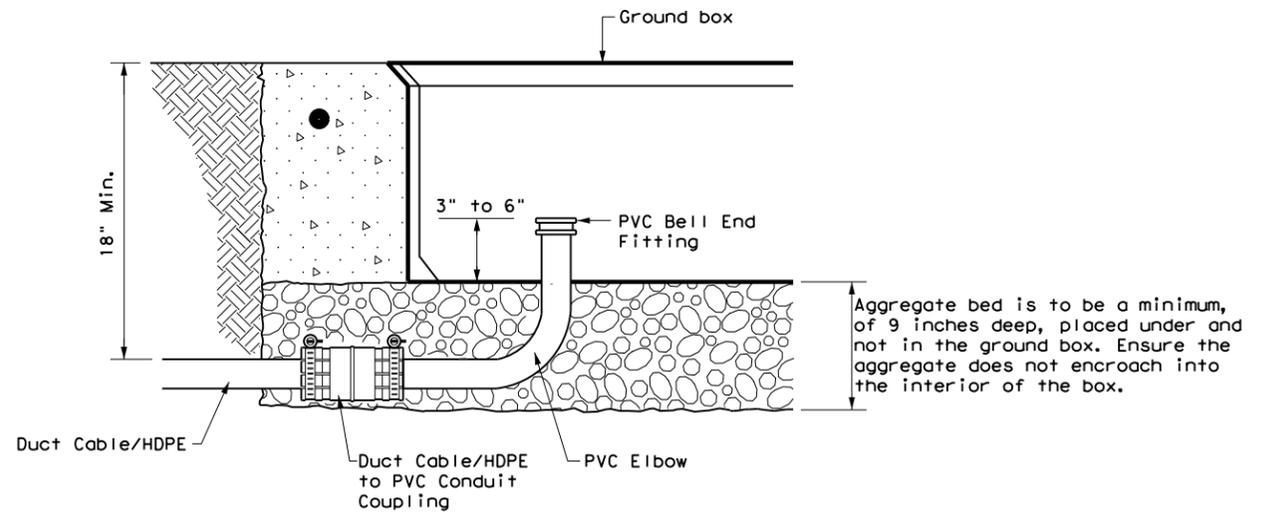
See Note 7. Before installing channel that has been cut, file sharp edges and paint with zinc-rich paint. Ensure there is no paint splatter on the pole.

		Traffic Operations Division Standard	
<b>ELECTRICAL DETAILS SERVICE SUPPORT TYPES GC, OC, &amp; TP</b>			
<b>ED(10)-14</b>			
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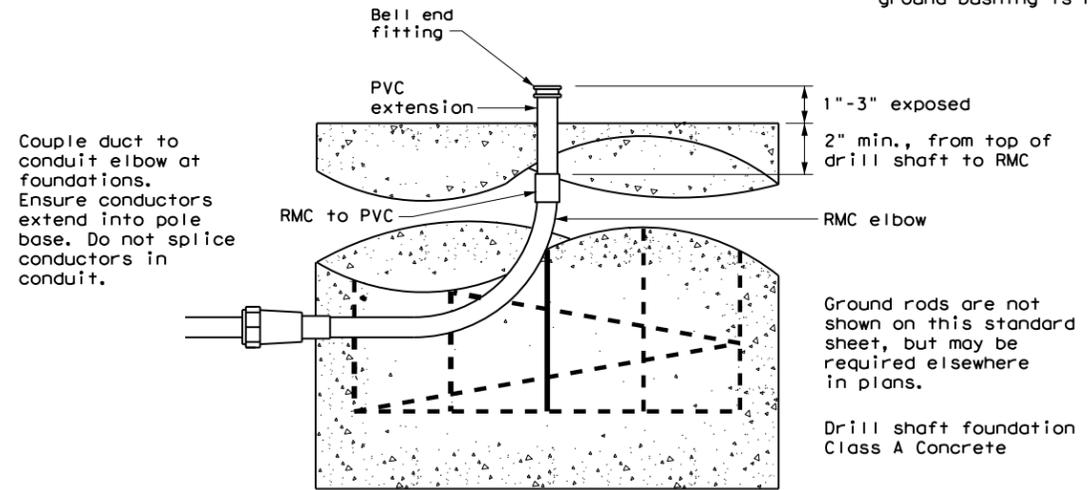
### DUCT CABLE & HDPE CONDUIT NOTES

1. Provide duct cable in accordance with Departmental Material Specification (DMS) 11060 "Duct Cable" and Item 622 "Duct Cable." Provide duct cable as listed on the Material Producer List (MPL) on the Department web site under "Roadway Illumination and Electrical Supplies" Item 622.
2. Provide High-Density Polyethylene (HDPE) conduit in accordance with DMS 11060 and Item 618, "Conduit." Provide HDPE as listed on the MPL on the Department web site under "Roadway Illumination and Electrical Supplies," Item 618.
3. Supply duct cable with a minimum 2 in. diameter, unless otherwise shown in the plans. Provide duct cable and HDPE conduit as shown by descriptive code or on the plans. Bend duct cable and HDPE conduit as recommended by the manufacturer, with a minimum bending radius of 26 in. for 2 in. duct. Follow manufacturers' recommendations when handling duct cable and HDPE conduit reels and during installation of duct cable and HDPE conduit.
4. Do not splice conductors within duct cable or HDPE conduit. Couple duct cable and HDPE entering a ground box or foundation to a PVC elbow. When galvanized steel RMC elbows are called for in the plans and any portion of the RMC elbow is buried less than 18" from possible contact, ground the RMC elbow.
5. Furnish and install duct cable with factory installed conductors, sized as shown in the plans and as required by the National Electrical Code (NEC). The NEC contains specific requirements for duct cable in Article, "Nonmetallic Underground Conduit with Conductors: Type NUCC."
6. When conduit casing is called for in the plans, extend duct cable or HDPE conduit through the conduit casing in one continuous length without connection to the casing.
7. Seal the ends of duct cable or HDPE conduit with duct seal, expandable foam, or other approved method after completing the pull tests required by Item 622.
8. Provide minimum cover of 24 in. under roadways, 18 in. in other locations, or as shown on the plans.
9. Furnish and install listed fittings to couple duct cable or HDPE conduit to other types of conduit. Duct cable and HDPE conduit may be field-threaded and spliced with PVC or RMC threaded couplings; connected with listed tie-wrap fittings; connected using listed coupling made of HDPE with stainless steel external banding clamps and locking rings; connected with approved electrofusion conduit couplings; or connected using an approved chemical fusion method using an epoxy or adhesive specifically designed for HDPE couplings and connectors all installed in accordance with their manufacturer's instructions. Do not use PVC glue on HDPE. Do not use water pipe fittings, or connect conduit with heat shrink tubing.

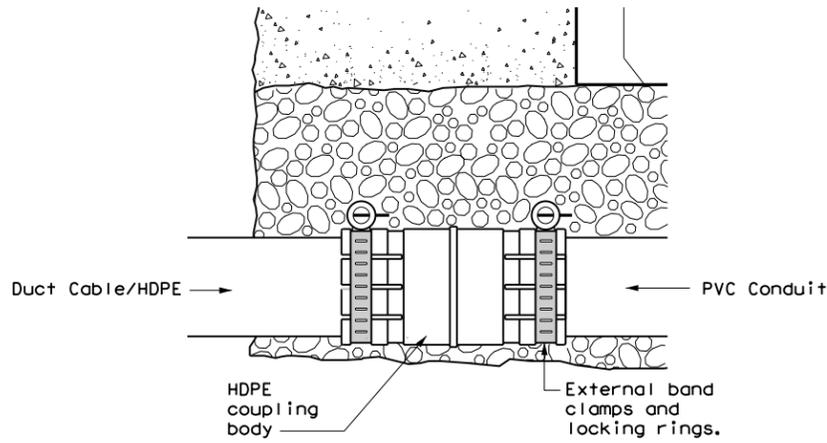


**DUCT CABLE/HDPE AT GROUND BOX**

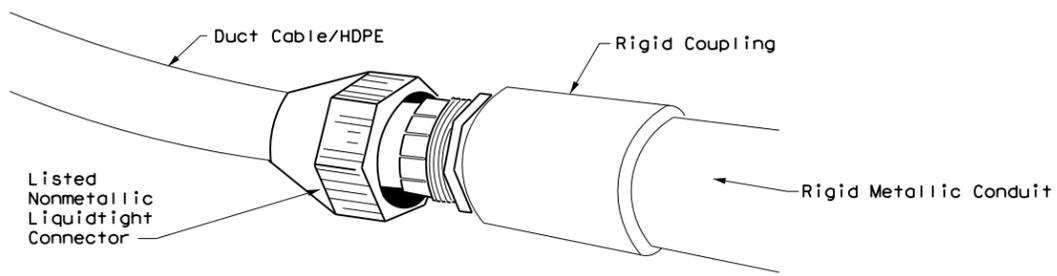
When the upper end of an RMC Ell does not enter the ground box, it may be extended with a SCH-40 PVC conduit nipple and bell end, provided there is a minimum of 18" of cover over all parts of the elbow. If not, a rigid extension and ground bushing is required.



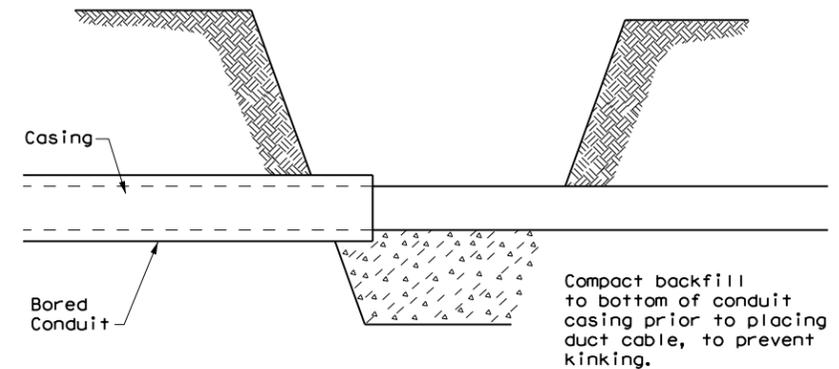
**DUCT CABLE / HDPE AT FOUNDATION**



**DUCT CABLE/HDPE TO PVC**



**DUCT CABLE/HDPE TO RMC**

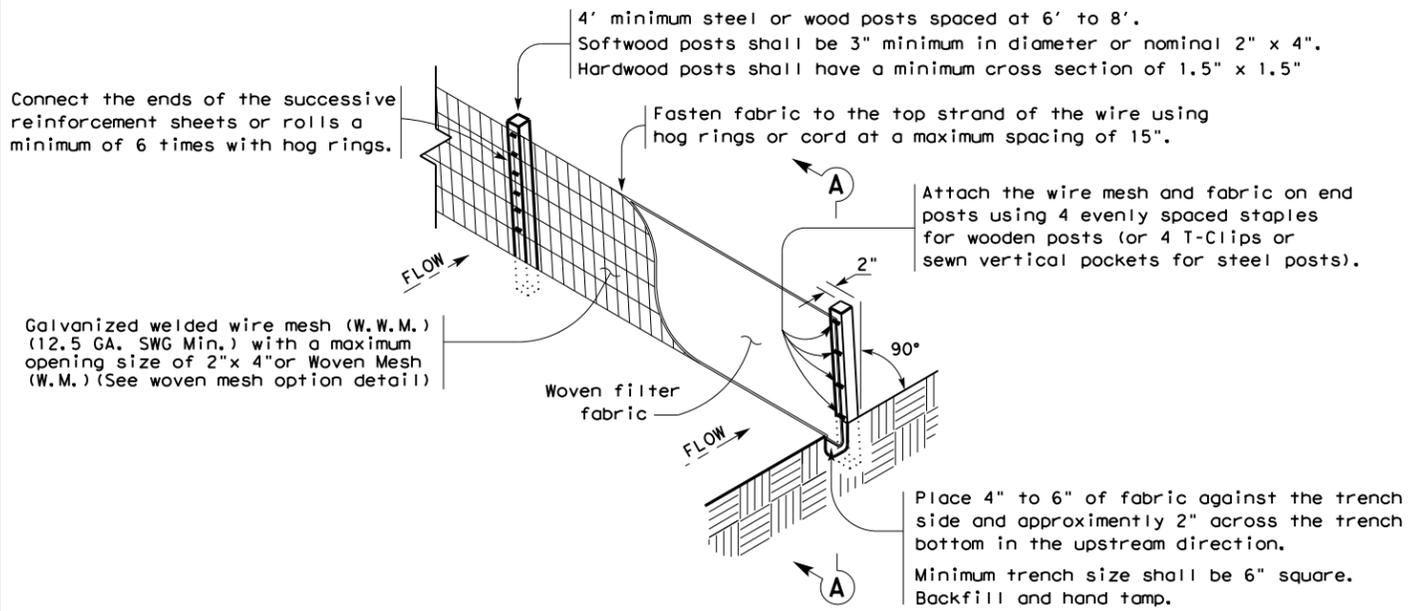


**BORE PIT DETAIL**

		Traffic Operations Division Standard	
<h2>ELECTRICAL DETAILS</h2> <h3>DUCT CABLE / HDPE CONDUIT</h3> <h4>ED(11)-14</h4>			
FILE: ed11-14.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT
© TxDOT October 2014	CONT: 6399	SECT: 15	JOB: 001
REVISIONS	COUNTY: LIBERTY, ETC.		SHEET NO.: 167

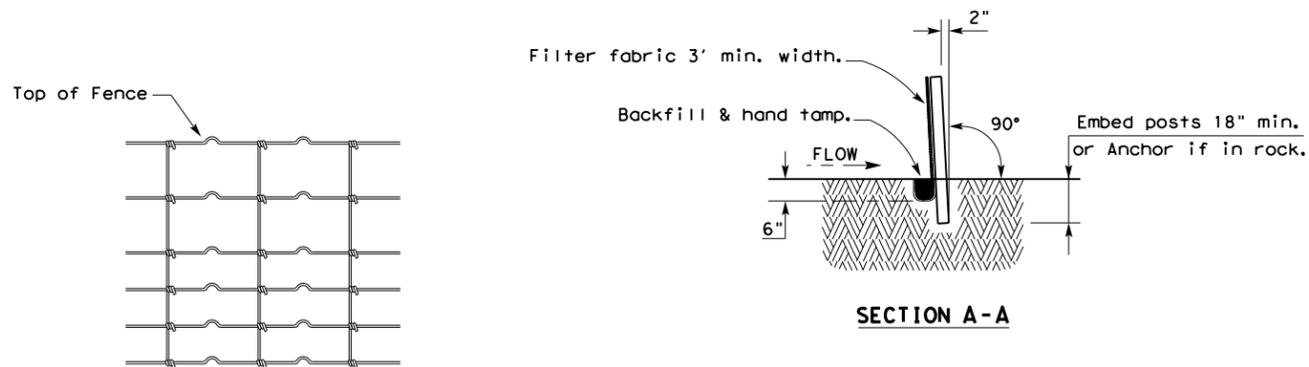
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DATE  
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**TEMPORARY SEDIMENT CONTROL FENCE**

SCF



**HINGE JOINT KNOT WOVEN MESH (OPTION) DETAIL**

Galvanized hinge joint knot woven mesh (12.5 GA. SWG Min.) requires a minimum of five horizontal wires spaced at a maximum of 12 inches apart and all vertical wires spaced at a maximum of 12 inches apart.

**SEDIMENT CONTROL FENCE USAGE GUIDELINES**

A sediment control fence may be constructed near the downstream perimeter of a disturbed area along a contour to intercept sediment from overland runoff. A 2 year storm frequency may be used to calculate the flow rate to be filtered.

Sediment control fence should be sized to filter a maximum flow through rate of 100 GPM/FT<sup>2</sup>. Sediment control fence is not recommended to control erosion from a drainage area larger than 2 acres.

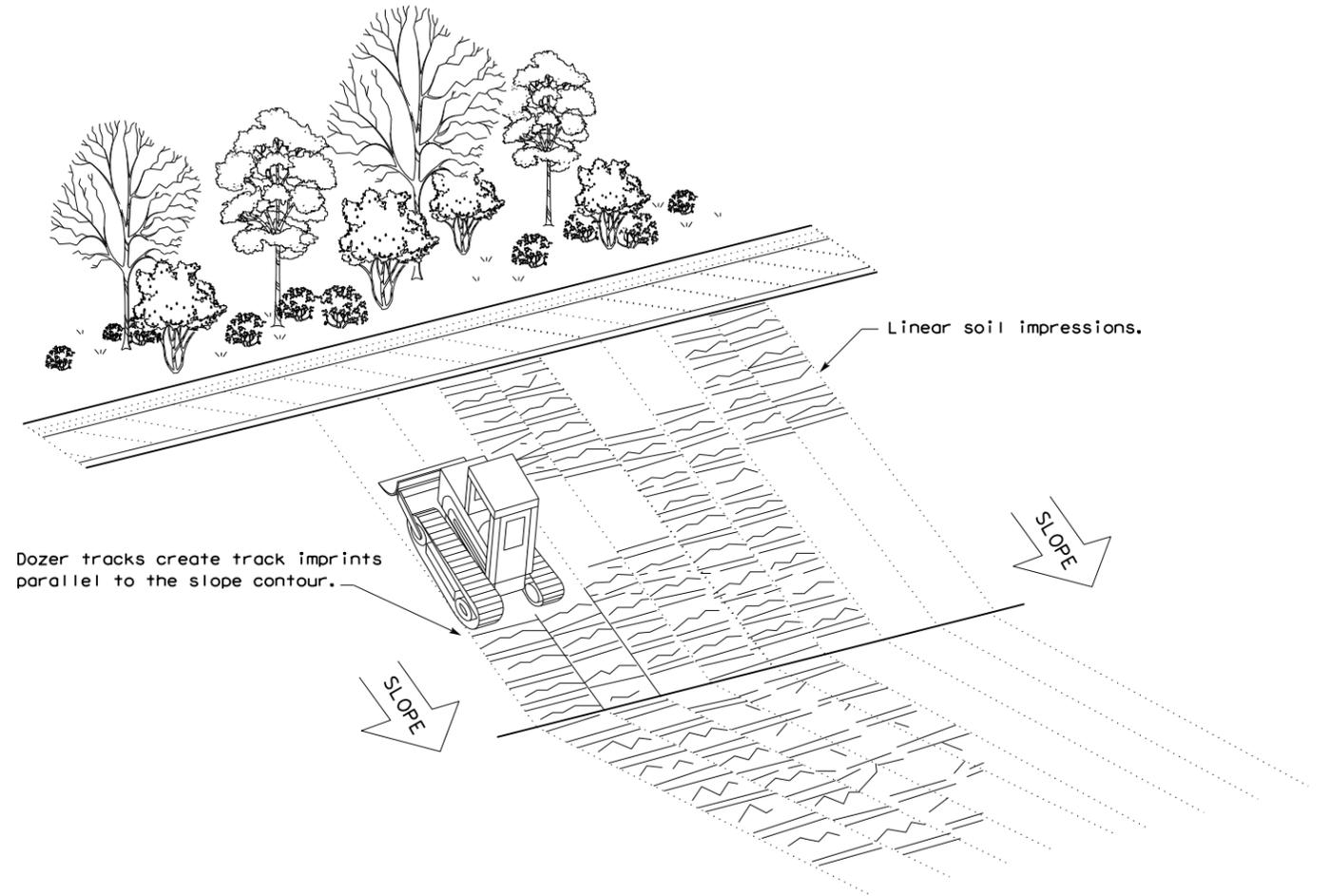
**LEGEND**

Sediment Control Fence

SCF

**GENERAL NOTES**

1. Vertical tracking is required on projects where soil distributing activities have occurred unless otherwise approved.
2. Perform vertical tracking on slopes to temporarily stabilize soil.
3. Provide equipment with a track undercarriage capable of producing linear soil impressions measuring a minimum of 12" in length by 2" to 4" in width by 1/2" to 2" in depth.
4. Do not exceed 12" between track impressions.
5. Install continuous linear track impressions where the minimum 12" length impressions are perpendicular to the slope or direction of water flow.

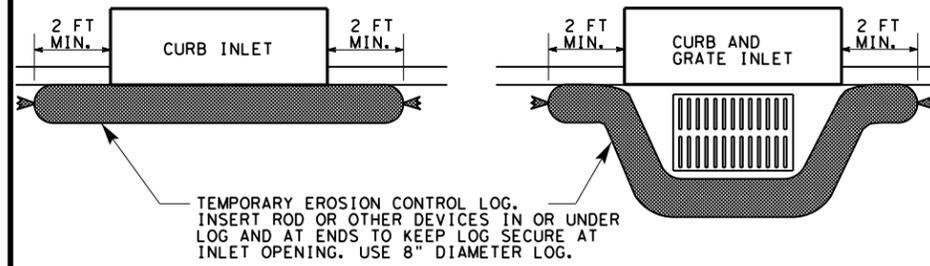


**VERTICAL TRACKING**

				Design Division Standard	
<b>TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES FENCE &amp; VERTICAL TRACKING</b> <b>EC(1)-16</b>					
FILE: ec116	DN: TxDOT	CK: KM	DW: VP	DN/CK: LS	
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY	
REVISIONS	639915	001	SH99		
	DIST	COUNTY	SHEET NO.		
	BMT	LIBERTY, ETC.	168		

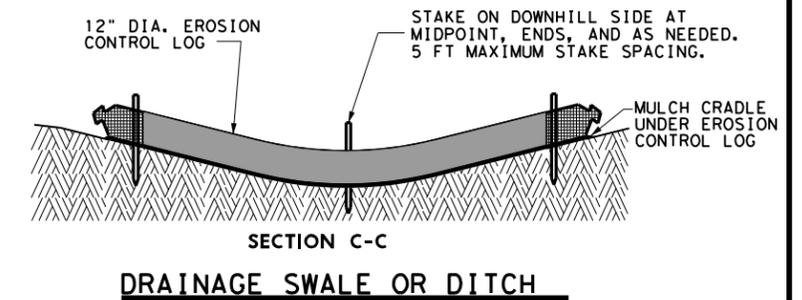
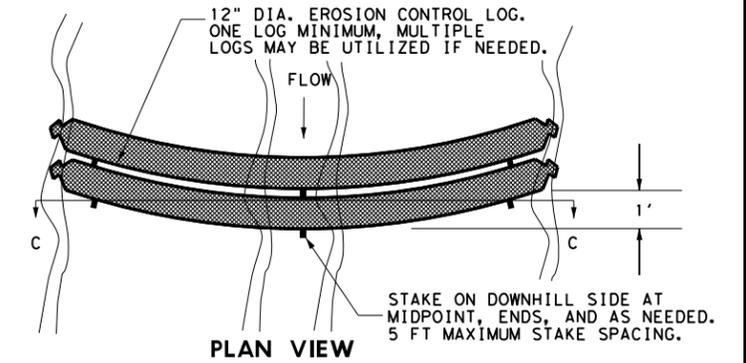
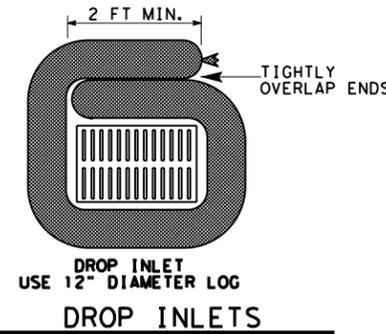
# CURB INLETS 8" DIAMETER LOGS

ITEM 506-6040 BIODEG EROSN CONT LOGS (INSTL) (8")



# DROP INLETS AND OTHER LOCATIONS 12" DIAMETER LOGS

ITEM 506-6041 BIODEG EROSN CONT LOGS (INSTL) (12")



## 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).

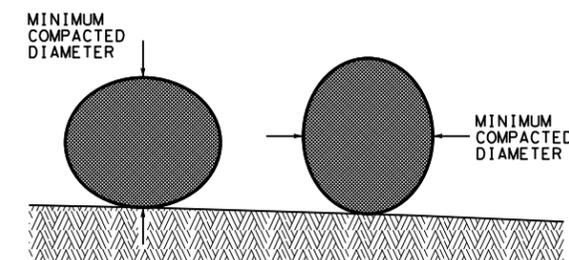
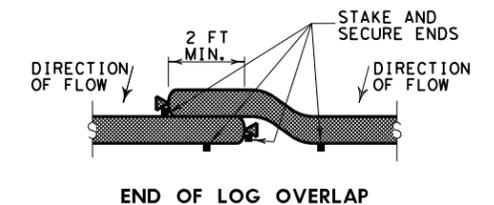
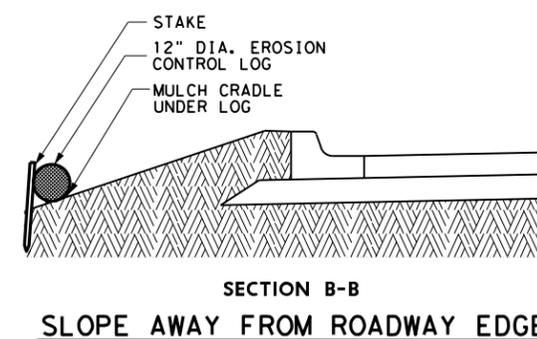
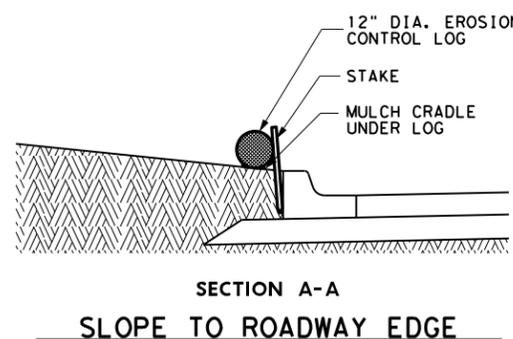
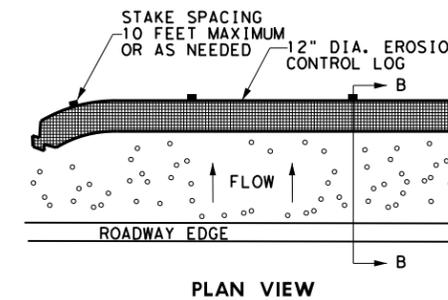
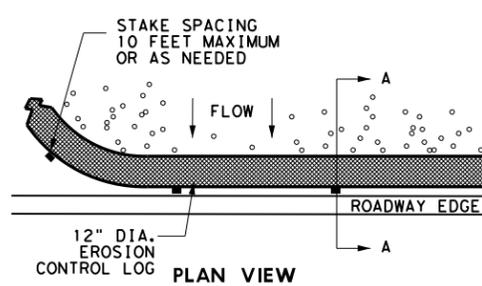
Sediment traps should be placed in the following locations:

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



## 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	OW: TxDot	CR: TxDot
© TXDOT 2014	DISTRICT: 6	FED REG: BMT	PROJECT NUMBER: RMC6399-15-001	HIGHWAY: 169
REVISIONS				
3/15 MINOR CORRECTIONS				
COUNTY: LIBERTY, ETC.	CONTROL SECT: 6399	JOB: 15	SHEET: 001	169

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DATE: 5/20/2022 9:33:19 AM  
 FILE:

**I. STORMWATER POLLUTION PREVENTION-CLEAN WATER ACT SECTION 402**

TPDES TXR 150000: Stormwater Discharge Permit or Construction General Permit required for projects with 1 or more acres disturbed soil. Projects with any disturbed soil must protect for erosion and sedimentation in accordance with Item 506.

List MS4 Operator(s) that may receive discharges from this project. They may need to be notified prior to construction activities.

- 1. TxDOT - Beaumont District

- 2. No non-TxDOT

No Action Required     Required Action

Action No.

- 1. Prevent stormwater pollution by controlling erosion and sedimentation in accordance with TPDES Permit TXR 150000
- 2. Comply with the SW3P and revise when necessary to control pollution or required by the Engineer. Stabilize the project site per SW3P.
- 3. See EPIC Notes

**II. WORK IN OR NEAR STREAMS, WATERBODIES AND WETLANDS CLEAN WATER ACT SECTIONS 401 AND 404**

USACE Permit required for filling, dredging, excavating or other work in any water bodies, rivers, creeks, streams, wetlands or wet areas.

The Contractor must adhere to all of the terms and conditions, including Regional conditions for the State of Texas, associated with the following permit(s):

- No Permit Required
- Nationwide Permit 14 - PCN not Required (less than 1/10th acre waters or wetlands affected)
- Nationwide Permit 14 - PCN Required (1/10 to <1/2 acre, 1/3 in tidal waters)
- Individual 404 Permit Required: Permit # \_\_\_\_\_
- Other Nationwide Permit Required: NWP# \_\_\_\_\_

Required Actions: List waters of the US permit applies to, location in project and check Best Management Practices planned to control erosion, sedimentation and post-project TSS.

- 1. Maintain a neat and clean worksite next to the water and do not allow any debris to fall in the water.
- 2.
- 3.
- 4.

The elevation of the ordinary high water marks of any areas requiring work to be performed in the waters of the US requiring the use of a nationwide permit can be found on the Bridge Layouts.

**Best Management Practices:**

<b>Erosion</b>	<b>Sedimentation</b>	<b>Post-Construction TSS</b>
<input type="checkbox"/> Temporary Vegetation	<input type="checkbox"/> Silt Fence	<input type="checkbox"/> Vegetative Filter Strips
<input type="checkbox"/> Blankets/Matting	<input type="checkbox"/> Rock Berm	<input type="checkbox"/> Retention/Irrigation Systems
<input type="checkbox"/> Mulch	<input type="checkbox"/> Triangular Filter Dike	<input type="checkbox"/> Extended Detention Basin
<input type="checkbox"/> Sodding	<input type="checkbox"/> Sand Bag Berm	<input type="checkbox"/> Constructed Wetlands
<input type="checkbox"/> Interceptor Swale	<input type="checkbox"/> Straw Bale Dike	<input type="checkbox"/> Wet Basin
<input type="checkbox"/> Diversion Dike	<input type="checkbox"/> Brush Berms	<input type="checkbox"/> Erosion Control Compost
<input type="checkbox"/> Erosion Control Compost	<input type="checkbox"/> Erosion Control Compost	<input type="checkbox"/> Mulch Filter Berm and Socks
<input type="checkbox"/> Mulch Filter Berm and Socks	<input type="checkbox"/> Mulch Filter Berm and Socks	<input type="checkbox"/> Compost Filter Berm and Socks
<input type="checkbox"/> Compost Filter Berm and Socks	<input type="checkbox"/> Compost Filter Berm and Socks	<input type="checkbox"/> Vegetation Lined Ditches
	<input type="checkbox"/> Stone Outlet Sediment Traps	<input type="checkbox"/> Sand Filter Systems
	<input type="checkbox"/> Sediment Basins	

**III. CULTURAL RESOURCES**

No Action Required     Required Action

Action No.

- 1. Refer to TxDOT Standard Specifications in the event historical issues or archeological artifacts are found during construction. Upon discovery of archeological artifacts (bones, burnt rock, flint, pottery, etc.) cease work in the immediate area and contact the Engineer immediately.
- 2.

**IV. VEGETATION RESOURCES**

No Action Required     Required Action

Action No.

- 1. Preserve native vegetation to the extent practical. Contractor must adhere to Construction Specification Requirements Specs 162, 164, 192, 193, 506, 730, 751, 752 in order to comply with requirements for invasive species, beneficial landscaping, and tree/brush removal commitments.
- 2.

**V. FEDERAL LISTED, PROPOSED THREATENED, ENDANGERED SPECIES, CRITICAL HABITAT, STATE LISTED SPECIES, CANDIDATE SPECIES AND MIGRATORY BIRDS.**

No Action Required     Required Action

Action No.

- 1. See EPIC Notes
- 2.
- 3.
- 4.

If any of the listed species are observed, cease work in the immediate area, do not disturb species or habitat and contact the Engineer immediately. The work may not remove active nests from bridges and other structures during nesting season of the birds associated with the nests. If caves or sinkholes are discovered, cease work in the immediate area, and contact the Engineer immediately.

**LIST OF ABBREVIATIONS**

BMP: Best Management Practice	SPCC: Spill Prevention Control and Countermeasure
CGP: Construction General Permit	SW3P: Storm Water Pollution Prevention Plan
DSHS: Texas Department of State Health Services	PCN: Pre-Construction Notification
FHWA: Federal Highway Administration	PSL: Project Specific Location
MOA: Memorandum of Agreement	TCEQ: Texas Commission on Environmental Quality
MOU: Memorandum of Understanding	TPDES: Texas Pollutant Discharge Elimination System
MS4: Municipal Separate Stormwater Sewer System	TPWD: Texas Parks and Wildlife Department
MBTA: Migratory Bird Treaty Act	TxDOT: Texas Department of Transportation
NOT: Notice of Termination	T&E: Threatened and Endangered Species
NWP: Nationwide Permit	USACE: U.S. Army Corps of Engineers
NOI: Notice of Intent	USFWS: U.S. Fish and Wildlife Service

**VI. HAZARDOUS MATERIALS OR CONTAMINATION ISSUES**

General (applies to all projects):

Comply with the Hazard Communication Act (the Act) for personnel who will be working with hazardous materials by conducting safety meetings prior to beginning construction and making workers aware of potential hazards in the workplace. Ensure that all workers are provided with personal protective equipment appropriate for any hazardous materials used. Obtain and keep on-site Material Safety Data Sheets (MSDS) for all hazardous products used on the project, which may include, but are not limited to the following categories: Paints, acids, solvents, asphalt products, chemical additives, fuels and concrete curing compounds or additives. Provide protected storage, off bare ground and covered, for products which may be hazardous. Maintain product labelling as required by the Act. Maintain an adequate supply of on-site spill response materials, as indicated in the MSDS. In the event of a spill, take actions to mitigate the spill as indicated in the MSDS, in accordance with safe work practices, and contact the District Spill Coordinator immediately. The Contractor shall be responsible for the proper containment and cleanup of all product spills.

Contact the Engineer if any of the following are detected:

- \* Dead or distressed vegetation (not identified as normal)
- \* Trash piles, drums, canister, barrels, etc.
- \* Undesirable smells or odors
- \* Evidence of leaching or seepage of substances

List below any bridge class structure(s), not including box culverts, being replaced, rehabilitated, removed, extended or modified as part of this project, or state "None", if applicable.

If "None", then no further action is required. Otherwise TxDOT is responsible for completing asbestos assessment/inspection and evaluation for presence of lead. Provide results below:

Structure Location	PSN	Element	Lead	Asbestos
"NONE"				(NOT) PRESENT

If Asbestos is present, then TxDOT must retain a DSHS licensed asbestos consultant to assist with the notification, develop abatement/mitigation procedures, and perform management activities as necessary. The notification form to DSHS must be postmarked at least 15 working days prior to scheduled demolition.

If Asbestos is not present, then TxDOT is still required to notify DSHS 15 working days prior to any scheduled demolition.

In either case, the Contractor is responsible for providing the date(s) for abatement activities and/or demolition with careful coordination between the Engineer and asbestos consultant in order to minimize construction delays and subsequent claims.

Any other evidence indicating possible hazardous materials or contamination discovered on site. Hazardous Materials or Contamination Issues Specific to this Project:

No Action Required     Required Action

Action No.

**VII. OTHER ENVIRONMENTAL ISSUES**

(includes regional issues such as Edwards Aquifer District, etc.)

No Action Required     Required Action

Action No.

- 1. See EPIC Notes
- 2.
- 3.

			<b>Beaumont District Standard</b>	
<b>ENVIRONMENTAL PERMITS, ISSUES AND COMMITMENTS</b> <b>EPIC</b>				
FILE: epic.dgn	DN: TxDOT	CK: AM	DW: VP	CK: AR
© TxDOT January 2012	CONT	SECT	JOB	HIGHWAY
REVISIONS	6399	15	001	SH99
12-12-2011 (DS)	DIST	COUNTY	SHEET NO.	
05-07-14 ADDED CONTRACTOR NOTE TO SECTION IV.	BMT	LIBERTY, ETC.	170	