| SHEET NO. | DESCRIPTION |
|---|---|
| 1 | TITLE SHEET |
| 2 | SUPPLEMENTAL INDEX |

# STATE OF TEXAS
# DEPARTMENT OF TRANSPORTATION

## PLANS OF PROPOSED
## STATE HIGHWAY ROUTINE MAINTENANCE

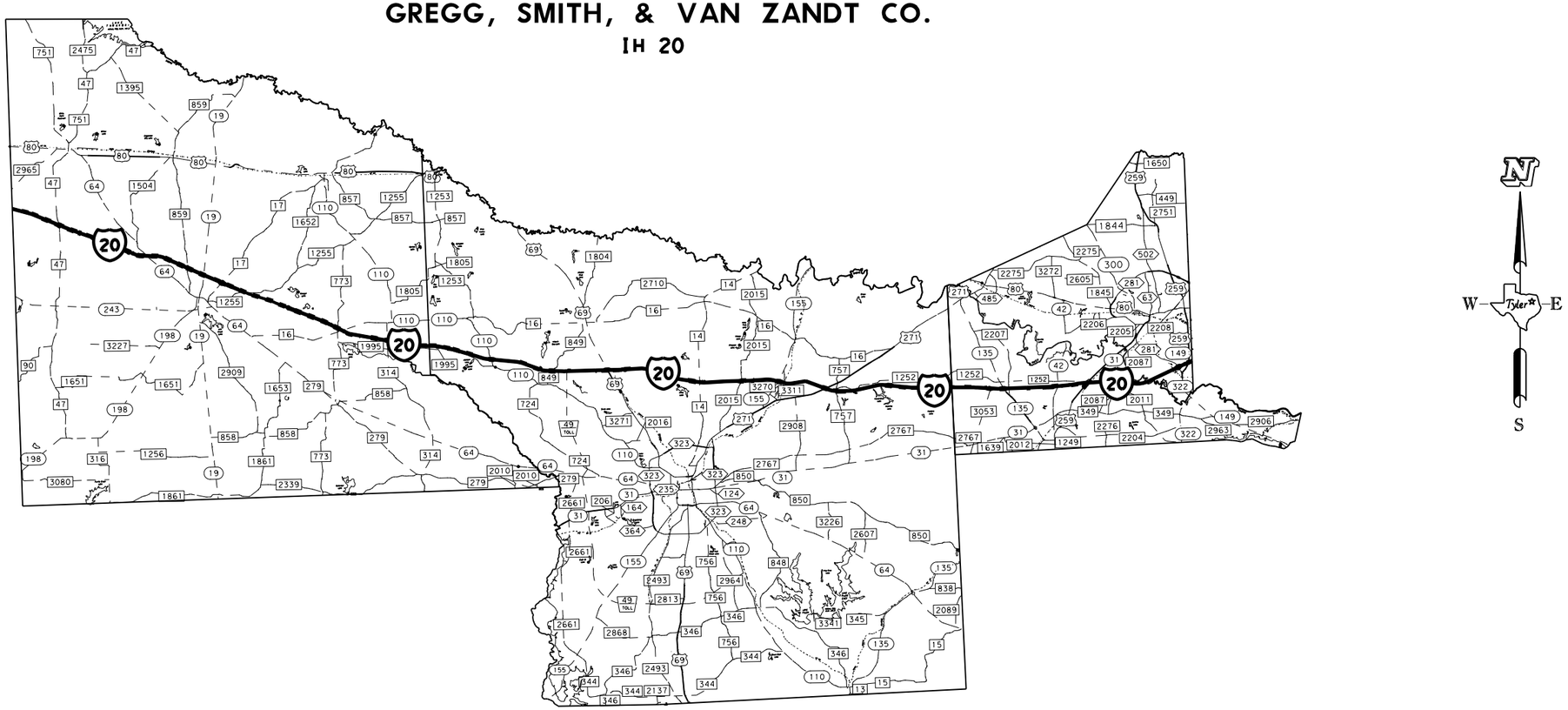
ROUTINE MAINTENANCE PROJECT NO. RMC 6367-43-001

# TOTAL MAINTENANCE

CONSISTING OF MILL AND INLAY, FULL DEPTH PAVEMENT REPAIR, GUARDRAIL REPAIR, LONG LINE AND SHORT LINE STRIPING, RAISED PAVEMENT MARKERS, SWEEPING, HERBICIDE, FULL-WIDTH MOWING, DEBRIS REMOVAL, GUIDE SIGN REPLACEMENT, ILLUMINATION, ETC...

## GREGG, SMITH, & VAN ZANDT CO.

IH 20




SIGNING IN ACCORDANCE WITH STANDARD BC SHEETS AND PART VI OF THE TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.

NO EXCEPTIONS
NO EQUATIONS
NO R.R. CROSSINGS ELIMINATED
LAYOUT SCALE: NTS



Texas Department of Transportation
© 2021

| FED.RD. DIV.NO. | MAINTENANCE CONTRACT | | SHEET NO. |
|---|---|---|---|
| 6 | RMC 6367-43-001 | | 1 |
| STATE | DIST. | COUNTY | |
| TEXAS | TYLER | SMITH, ETC. | |
| CONT. | SECT. | JOB | HIGHWAY NO. |
| 6367 | 43 | 001 | IH 20 |

TTLSHT / 100

## FINAL PLANS

DATE CONTRACT LETTING: _____
DATE CONTRACTOR BEGAN WORK: _____
DATE WORK COMPLETED & ACCEPTED: _____
CONTRACTOR: _____
USED ____ OF ____ ALLOTTED DAYS _____
FINAL CONTRACT COST : $ _____

COUNTY SMITH, ETC. CONT. NO. RMC 6367-43-001
HWY. NO. IH 20 LETTING DATE _____
DATE ACCEPTED _____

TEXAS DEPARTMENT OF TRANSPORTATION

SUBMITTED FOR LETTING: 1/28/2021 20___

DocuSigned by:
Justin G. Smith, P.E.
11C9E4B5447E4E1...
MAINTENANCE ENGINEER

RECOMMENDED & APPROVED FOR LETTING: 1/28/2021 20___

DocuSigned by:
Stuart R. Wachtstetter, P.E.
0C37DA7E3C1A4D2...
DIRECTOR OF MAINTENANCE

# SUPPLEMENTAL INDEX



STATE OF TEXAS
JUSTIN G. SMITH
107750
LICENSED
PROFESSIONAL ENGINEER

The Standard Sheets specifically identified above have been issued by me and are applicable to this project.

DocuSigned by:
Justin G. Smith, P.E. , P.E. 1/28/2021
11C9E4B5447E4E1...
JUSTIN G. SMITH Date

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

## SUPPLEMENTAL INDEX

Texas Department of Transportation



FILENAME /

| FED.RD. DIV.NO. | FEDERAL AID PROJECT NO. | | SHEET NO. |
|---|---|---|---|
| 6 | RMC 636743001 | | 2 |
| STATE | DIST. | COUNTY | |
| TEXAS | TYLER | SMITH, ETC | |
| CONT. | SECT. | JOB | HIGHWAY NO. |
| 6367 | 43 | 001 | IH 20 |

**GENERAL NOTES:**

**GENERAL.**

Contractor questions on this project are to be addressed to the following individuals:

Bradley Bassett Bradley.Bassett@txdot.gov
Justin Smith Justin.G.Smith@txdot.gov

Contractor questions will be accepted through email, phone, and in person by the above individuals.

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

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

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

TxDOT Representatives are as follows:

| | |
|---|---|
| Longview Area Engineer: Will Buskell | (903) 234-0532 |
| IH-20 Inspector: Mike Venoy | (903) 724-4167 |
| Record Keeper: Tishua Rosado | (903) 475-0525 |

**All work will be performed on a CALLOUT BASIS at locations identified by each WORK ORDER. The Department makes no guarantee for continuous work at any given time at any given location(s).**

**This is a CALLOUT CONTRACT and Plan Quantity Measurement does not apply.**

**Locations will be identified by each WORK ORDER on an as needed basis.**

**Liquidated damages in the amount according to SP000-658 per day will be charged for each day the work is not complete after the expiration of all working days calculated for each job on each work order. Working days will not be transferred from one work order to a subsequent one. Each work order is a stand-alone entity.**



**Project Number: 636743001** **Sheet 3**

**County: SMITH, ETC.** **Control:** 6367-43-001

**Highway:** IH 20

Remove all vegetation from pavement edges, intersections, and driveways prior to planing operations, seal coat, or ACP operations. This work will not be paid for directly, but will be subsidiary to the bid items of the Contract.

Restrict movement of construction equipment and haul trucks to paved surfaces. Do not cross the median with equipment and haul trucks unless specifically authorized. Use entrance and exit ramps to enter and exit the freeway mainlanes.

**ATTN: Provide a 20-ft. length per 1-in. depth temporary taper at all transverse joints in the travel lane before opening to traffic. This work will not be paid for directly, but will be subsidiary to the bid items of the Contract.**

Provide a facility at the asphalt concrete pavement plant for use by the Engineer as a laboratory. This is an existing requirement of Item 6, Article 5, "Plant Inspection and Testing," of the Standard Specifications. Provide a facility meeting the requirements of Item 504. At a minimum meet the requirements of 504.2.2.4, "Ty D Structure (Asphalt Mix Control Laboratory)" and 504.2.2.4.1, "Asphalt Content by Ignition Method." In addition, provide the following: At least one exterior door opening with a 48-in. minimum width. If steps are required to gain access to the facility's 48-in. door, provide a landing dock with minimum dimensions of 60 in. wide by 60 in. deep. The strong floor and landing of the facility should support the weight of all equipment and personnel providing a stable, essentially zero deflection during testing operations, acceptable to the Engineer. This facility will be required of all projects with plant produced asphalt concrete pavement.

No direct payment will be made for Engineer field labs. All construction, maintenance, utilities, custodial services, security, and permits necessary to establish and maintain readiness of this facility is the responsibility of the Contractor. This building/facility is required by the standard specifications and is considered a standard part of any asphalt concrete pavement plant producing materials for Department projects.

Furnish a Superpave Gyratory Compactor calibrated in accordance with Tex-241-F for molding production samples. The Superpave Gyratory Compactor will not be paid for directly, but will be subsidiary to the asphalt concrete pavement Items of work.

**ITEM 4. SCOPE OF WORK**

During final clean up, remove all foreign material that has accumulated at bridge abutments and bent caps as approved. All work and equipment involved in the removal of this material is subsidiary to the bid items of the Contract.

Preserve the integrity of all right of way monuments within project limits. Right of way monuments damaged or destroyed during construction must be replaced by a registered professional land surveyor (RPLS), at the Contractor's expense.

**ITEM 5. CONTROL OF THE WORK**

Restrict movement of construction equipment and haul trucks to paved surfaces. Do not cross the median with equipment and haul trucks unless specifically authorized. Use entrance and exit ramps to enter and exit the freeway mainlanes.

**ITEM 7. LEGAL RELATIONS AND RESPONSIBILITIES**

Do not initiate activities in a project specific location (PSL) associated with a U.S. Army Corps of Engineers (COE) permit area that has not been previously evaluated by the COE as part of the permit review of this project. Such activities include haul roads, equipment staging areas, borrow pits, and disposal sites. "Associated," defined here, means "materials are delivered to or from the PSL." The permit area includes all waters of the U.S. or associated wetlands affected by activities associated with this project. Special restrictions may be required for this work. The Contractor is responsible for all consultations with the COE regarding activities (including PSL) that have not been previously evaluated by the COE. Provide the Department with a copy of all consultations or approvals from the COE before initiating activities.

Proceed with activities in PSL that do not affect a COE permit area if Contractor determines that the PSL is non-jurisdictional or proper COE clearances have been obtained in jurisdictional areas or have been previously evaluated by the COE as part of the permit review of this project. The Contractor is responsible for documenting his determination that his activities do not affect a COE permit area. Maintain copies of determination for review by the Department or any regulatory agency.

Concrete truck drivers and concrete pump operators are required to wash out only in designated areas specifically constructed for eliminating run-off. Dispose of materials in accordance with federal, state, and local requirements.

Placement of any fill material within the channel is not allowed. A temporary crossing must clear span from channel bank to channel bank.

Maintain positive drainage for permanent and temporary work for the duration of the project. The Contractor will be responsible for any items associated with the temporary or interim drainage and all related maintenance. This work will be subsidiary to various bid items.

No significant traffic generator events identified.

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



**Project Number: 636743001** **Sheet 3**

**County: SMITH, ETC.** **Control:** 6367-43-001

**Highway:** IH 20

- Lane closures will not be permitted before 8:00 A.M. or after 5:00 P.M. unless otherwise directed.
- Lane closures will not be allowed on IH 20 on Saturday, Sunday, or after 12 P.M. on Friday.
- Unless otherwise approved, lane closures for minor or major construction operations will not be allowed on Good Friday, Easter weekend, Memorial Day, Memorial Day weekend, July 4th, Labor Day, Labor Day weekend, Thanksgiving Day thru Sunday, Christmas Eve, Christmas Day, New Year's Eve, New Year's Day, or on any other high traffic days or holidays as determined.
- Lane closures will not be allowed Friday thru Sunday of Canton's First Monday Weekend

**ITEM 8. PROSECUTION AND PROGRESS**

Working days will be computed and charged in accordance with Section 8.3.1.5., "Calendar Day."

**ITEM 9. MEASUREMENT & PAYMENT**

Notify the Engineer at least 24 hours prior to proceeding with planned work activities. Work will not be permitted if such notification has not been received. In addition, work performed without authorization will not be eligible for payment.

In accordance with Article 9.1., "Measurement of Quantities," furnish the tare and maximum gross weights as well as the volume capacity of all vehicles, trucks, truck-tractors, trailers, semi-trailers, or combination of such vehicles used to deliver materials for this Contract.
Also, furnish calculations supporting these weights and capacities. Provide all measurements required for pay a minimum of 2 days before the trucks are used.

## ROADWAY ITEMS

**ITEM 104. REMOVING CONCRETE**

Blasting will not be permitted on this project.

Before removing existing curb & gutter or laydown curb, saw cut between the gutter pan and the roadbed to eliminate the possibility of damage to the pavement structure. When the existing pavement edge has to be removed to facilitate the curb & gutter transition from existing to the proposed ramp landing, remove the old and replace the new pavement structure the same day unless otherwise directed. The use of temporary material may be allowed as approved. This work will be subsidiary to Item 104.

**ITEM 132. EMBANKMENT**

Furnish Type C embankment consisting of suitable earth material (rock, loam, clay, or other approved materials) that will form a stable embankment. The top 2 ft. of embankment material should have a plasticity index between 6 and 18.

**ITEM 134. BACKFILLING PAVEMENT EDGES**

Place mulch sod for backfilling pavement edges using an approved road widener. The use of this machine will allow mulch sod for backfilling the pavement edge to be placed from the final roadway surface. Use a self-propelled machine capable of transferring mulch sod from a dump truck located on the pavement surface to the front slope along the pavement edge. This machine may have a strike-off that will spread the mulch sod to conform to the typical section. The dump trucks and road widener should travel in the direction of the traffic unless otherwise approved. The use of this machine will be subsidiary to Item 134.

Compact the backfill adjacent to the pavement edge with a pneumatic roller or other approved equipment. This rolling will not be paid for directly, but will be subsidiary to Item 134.

**ITEM 314. EMULSIFIED ASPHALT TREATMENT**

Before application, dilute the emulsion with water up to a maximum dilution of 50% at a distribution rate of 0.30 gal. per sq. yd.

**ITEM 320. EQUIPMENT FOR ASPHALT CONCRETE PAVEMENT**

Provide either a material transfer vehicle or material transfer paver for the surface course of this project as approved.

Provide either a material transfer vehicle or material transfer paver for the surface course of this project. The material transfer vehicle must be self-propelled, wheel mounted and capable of receiving material from haul trucks separate from the paver. The 20-ton minimum capacity hopper must be equipped with a pivoting discharge conveyor and must have a means of remixing the asphaltic material before placement. The material transfer paver, if supplied, must consist of a mobile, self-propelled asphalt paver incorporating an integral mix loadout elevator (conveyor) having a minimum rated capacity of 750 ton per hour. The conveyor system must have a means of remixing the asphaltic concrete material before discharging into the paver hopper and must be equipped with either a truck dump hopper attachment or a minimum 20-ton capacity surge hopper. If a material transfer paver utilizing the truck dumper hopper attachment is used, the haul trucks must stop a minimum of 1 foot into the truck. In addition, paving will not be allowed to begin until the paver has reached its full storage capacity.



**Project Number: 636743001** **Sheet 3**

**County: SMITH, ETC.** **Control:** 6367-43-001

**Highway:** IH 20

**ITEM 342. PERMEABLE FRICTION COURSE (PFC)**

Cease production of mixture if the asphalt content from any sublot drops below 6%. Resume production following tests showing appropriate adjustments have been made to the satisfaction of the Engineer.

Provide Class A coarse aggregate for the PFC as listed in the Department’s Bituminous Rated Source Quality Catalog (BRSQC).

Warm Mix Asphalt (WMA) is not allowed.

The use of Reclaimed Asphalt Pavement (RAP) and Recycled Asphalt Shingles (RAS) is not allowed.

**ITEM 348. THIN BONDED FRICTION COURSES**

Cease production of mixture if the asphalt content from any sublot drops below 6%. Resume production following tests showing appropriate adjustments have been made to the satisfaction of the Engineer.

Provide Class A coarse aggregate for the PFC as listed in the Department’s Bituminous Rated Source Quality Catalog (BRSQC).

Warm Mix Asphalt (WMA) is not allowed.

The use of Reclaimed Asphalt Pavement (RAP) and Recycled Asphalt Shingles (RAS) is not allowed.

Provide PFC-C aggregate in accordance with Item 342.

Minimum quantity per callout will be 500 tons.

**ITEM 351. FLEXIBLE PAVEMENT STRUCTURE REPAIR**

Replace the unstable pavement structure with asphalt (Type C) unless otherwise directed. The Engineer will determine the exact locations and limits of pavement repair in the field prior to beginning this Item of work.

Apply a tack coat with a rate of 0.10 gal/sy of residual asphalt between each layer of ACP pavement unless otherwise directed.

Maximum lift thickness for asphaltic concrete repair will not exceed 3 inches.

No substitutions allowed for PG 70-22 Binder.

Furnish planing equipment to remove existing material in accordance with Item 354, as directed. The planing equipment will be subsidiary to Item 351.

Furnish an asphalt paver on full lane width pavement repair sections in accordance with Item 320 unless otherwise directed.

Minimum quantity per work order will be 800 SY with a minimum of 200 SY per lane closure.

**ITEM 354. PLANING AND TEXTURING PAVEMENT**

Use a front-end loader or other suitable equipment at the stockpile site to properly stockpile the planed material as required.

**ATTN: Vary planing locations to meet field conditions as directed. Begin and end planing at a sawed or planed vertical joint to provide a smooth transition to existing pavement. Provide a 20-ft. length per 1-in. depth temporary taper at all transverse joints in the travel lane before opening to traffic.**

Prime area where the underlying flexible base is exposed during the planing operation using an approved asphalt. The Engineer will determine the rate. Patch area as necessary with an approved ACP material. Perform this work at the end of the day's operation as directed. This work will not be paid for directly, but will be subsidiary to Item 354.

Before opening planed areas to traffic, bevel vertical or near vertical longitudinal faces in the pavement surface.

Furnish a small planing machine as approved for planing small areas and street intersections.

Overlay all planed areas by the end of each day unless otherwise approved.

If unsuitable weather or other unexpected conditions do not allow planed areas to be overlaid, provide and maintain warning signs for overnight lane closures in accordance with the traffic control plan sheets until overlay operations are complete.

Contractor will retain all RAP generated from this project.

Minimum quantity per callout will be 3500 SY.



**Project Number: 636743001** **Sheet 3**

**County: SMITH, ETC.** **Control:** 6367-43-001

**Highway:** IH 20

**ITEM 361. REPAIR OF CONCRETE PAVEMENT**

Furnish evidence of concurrence by the owner of the disposal site.

Class HES will meet a minimum compressive strength requirement of 1,800 psi within four (4) hours of closing a lane. The road will be fully opened to traffic by the end of each day.

Furnish mix designs to the Department for approval prior to placement.
Remove and replace loose sub-base material with concrete.

For full depth repair, the amount of pavement removed will be only the amount which can be replaced during the daily allowable work schedule.

Surface is 5" ACP usual but may vary. Removal and replacement of this will be subsidiary as per 361.5 of the Standard Specifications.

Provide chairs for multiple piece tiebars, threaded connectors or other adequate devices used in concrete paving, or tie them to the pavement reinforcing steel.

Minimum quantity per lane closure will be 20 SY.

**ITEM 401. FLOWABLE BACKFILL**

Use an accelerator that produces a set time in 4 hours. Provide a rheofill or equivalent air entrainment to ensure flowability. Anchor pipes to ensure no movement or displacement by the flowable fill. Furnish paper type cylinder test molds.

**ITEM 421. HYDRAULIC CEMENT CONCRETE**

The Engineer will provide strength-testing equipment.

Provide the Engineer with a mixture design report using Department-provided software in accordance with Section 421.4.1., "Classification of Concrete Mix Designs," of the standard specifications. Include in the report the producer's plant, all materials sources, and a unique identification number for the design.

Air is not required on concrete cast-in-place elements on this project. If the Contractor proposes the use of an existing concrete design containing air, the Engineer must approve the design in writing before placement. If used, air testing will be performed in accordance with the specifications.

**ITEM 533. MILLED RUMBLE STRIPS**

Provide a sweeper that meets the requirements of Section 354.2.3.

**ITEM 585. RIDE QUALITY FOR PAVEMENT SURFACES**

Use Surface Test Type B pay adjustment schedule 3 to evaluate ride quality of the travel lanes for sections 2,000' or longer in accordance with Item 585, "Ride Quality for Pavement Surfaces."

**ITEM 700. POTHOLE REPAIR STANDARD**

This item will be on an emergency callout basis as needed. The contractor shall mobilize and begin work to repair potholes within 4 hours of initial callout. If the contractor fails to begin work within 4 hours of initial callout emergency mobilization shall be forfeited for that callout.

It is expected that the materials to be utilized for filling potholes shall be a "Hot Mix Asphalt Material" or an approved cold placed asphaltic material.

Minimum quantity per callout will be 5 SY.

**ITEM 3077. SUPERPAVE MIXTURES**

When using crushed gravel as a coarse aggregate for ACP, use 1% lime as an antistripping agent.

Provide coarse aggregate for the final surface course from the same source or blended sources unless otherwise directed.

Give the State inspector at the spreading and finishing machine one weight ticket for each load of material. When directed, weigh asphaltic concrete loads on public scales to ensure the proper weight of material.

For materials paid for by the ton, provide a summary spreadsheet in accordance with Article 520.2, "Equipment."

Provide Class A coarse aggregate for the surface as listed in the Department's *Bituminous Rated Source Quality Catalog* (BRSQC).

Use an electrical impedance (non-nuclear) measurement gauge to determine mat segregation and joint density for Part V and Part VIII of test procedure Tex-207-F. Do not use nuclear density gauges or thin lift gauges for segregation or joint density determinations. Data reporting for mat segregation and joint density must be performed on Department templates.



**Project Number: 636743001** **Sheet 3**

**County: SMITH, ETC.** **Control:** 6367-43-001

**Highway:** IH 20

The use of Recycled Asphalt Shingles (RAS) is not allowed for use in the surface pavement.

All RAP used on this project must be fractionated. If an existing mix design is submitted for use as Warm Mix Asphalt (WMA), then a new trial batch with passing Hamburg Wheel test results is required.

Apply a tack coat with a rate of 0.10 gal/sy of residual asphalt between each layer of ACP pavement unless otherwise directed.

All permanent striping shall be placed within 14 day of mill & Inlay operations. Contractor shall remove all temporary tape on the same day that permanent striping is placed.

On Table 1, under 3077.2.1.3, the Sand equivalent, % Min is voided and not replaced. The minimum percent for the sand equivalent must be 45 for the combined aggregate.

## GUARDRAIL ITEMS

Repair or install necessary metal beam guard fence, end treatments, and attenuators on a call-out basis.

Work locations are non-site specific and will be determined. Accomplish work in accordance with the latest guardrail standards unless otherwise directed by the TxDOT Representative.

Guardrail repair and installation is intermittent and not continuous. Expect multiple mobilizations (call outs) for the duration of this contract. Multiple work orders may be used to accomplish the work. Once work has begun, continue until all the work on each work order is complete.

The amount of work to be performed, number of working days allowed, and the date when time charges will begin for each work order will be provided. A minimum of $500 of work per order will be scheduled for repair and/or upgrade before the Contractor is notified to begin work. Work orders may have multiple work locations.

If the remaining work to be performed to complete an order is less than the minimum call in amount, the contractor will still be required to move in and perform the remaining work on the contract if requested.

Working days for each work order will be calculated as follows. The Contractor will repair metal beam guard fence at a minimum rate of 150 feet/day/site. Any fraction of feet shall be considered as an additional working day. The Contractor will be given one day to remove and replace each damaged single guardrail terminal or crash attenuator system.

In addition, time charges for each separate site on the work order will be calculated from the next working day following the expiration of time charges on the previous job.

Liquidated damages in the amount according to SP000-658 per day will be charged for each day the work is not complete after the expiration of all working days calculated for the work order. Working days will not be transferred from one work order to a subsequent one. Each work order is a stand-alone entity. Multiple work orders may be issued within the same time duration.

If the TxDOT Representative determines that the repair or its location is a concern for public safety, the Contractor will be required to make the repair regardless of the minimum call in requirement.

In such instances, the Contractor will be required to complete repairs within forty-eight (48) hours of the notification. Column protection, SGT, and attenuator repairs are examples of safety concerns with no minimum work limits.

Verify locations of all existing utilities in the area of the work with local utility companies to avoid damage during guard fence operations.

Perform work activities between sunrise and sunset. Make all arrangements for equipment and storage areas. No storage of equipment and/or materials is permitted at Maintenance Section yards, District Office, or highway right-of-way.

Some posts have been previously set in concrete. Clear and remove all surplus and discarded materials upon completion of the work at each location. Leave the entire project in a neat condition. Assume repair expenses for any damage to any roadway or other highway appurtenance resulting from work operations.

Delineators needed for repaired or replaced rail and attenuators shall be installed at the time the guardrail or attenuator is repaired or replaced. This will be paid under Item 658, Delineators and Object Markers.

Deliver to a designated site, as determined by the TxDOT Representative, any surplus or discarded material that is deemed salvageable; it will remain the property of the Department. Determine a site and arrange for disposal of any unused material deemed not salvageable by the TxDOT Representative. Location of the site will be outside the highway right of way. Provide documents when asked to prove disposal is in accordance with state law.

Concrete truck drivers and concrete pump operators are required to wash out only in designated areas specifically constructed for eliminating run-off. Dispose of materials in accordance with federal, state, and local requirements.



**Project Number: 636743001** **Sheet 3**

**County: SMITH, ETC.** **Control:** 6367-43-001

**Highway:** IH 20

Furnish all material, labor, tools and equipment required, with the exception of channel iron bridge rail. Assure wood posts match the shape and height above ground as the existing posts. Equip all motorized vehicles with flashing strobe lights and back-up horns in working condition.

**ITEMS 429. CONCRETE STRUCTURE REPAIR**

This Item includes, but is not limited to the repair of damaged inlets, concrete curb and gutters, bridge wingwalls, bridge columns, bridge caps, sound barriers, head walls, concrete abutments, concrete approach structures, and concrete bridge barriers as specified by the TxDOT Representative. Remove down to sound material and replace with concrete to original condition.

Remove any other concrete spalls down to sound material and replaced with concrete and/or grout. Repair at Contractor’s expense the reinforcing steel if damaged during repair operations.

**ITEM 432. RIPRAP**

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

**ITEM 514. PERMANENT CONCRETE TRAFFIC BARRIER**

Provide Class C concrete for traffic barriers and footings.

Cutout and preparation for repair is subsidiary to the bid item. Leave existing rebar for tie-in during repair.

**ITEM 540. METAL BEAM GUARD FENCE**

All work involved in placement of timber posts in soil cement riprap must be included in the price bid for Item 540.

Do not paint treated timber posts.

Use round wood posts on all metal beam guard fence except where steel posts are required in accordance with “Low Fill Culvert Post Mounting” details shown on standard sheet MBGF.

Length of steel posts for low fill culvert post mounting will be determined in the field to ensure proper metal beam guard fence height.

**ITEMS 540 & 542. METAL BEAM GUARD FENCE & REMOVING METAL BEAM GUARD FENCE**

Prior to removal of existing MBGF and associated appurtenances, submit to the Engineer for approval a work plan, including a detailed timeline, outlining removal and reinstallation of safety features. It is the intent that the Contractor has the necessary materials and labor force available to reinstall the safety features prior to beginning the removal process.

Where existing MBGF is being removed and not replaced with new MBGF due to proposed roadside safety improvements, do not remove the existing MBGF prior to completion of the planned roadside safety improvements at that location unless otherwise approved in writing.

Regardless of when the Contractor installs proposed MBGF, set the rail height to account for any subsequent surfacing work in order to be in accordance with standard MBGF upon completion of the Contract.

When replacing guard rail, ensure that all segments of guard rail removed are replaced the same work day before opening to traffic.

**ITEM 542. REMOVING METAL BEAM GUARD FENCE**

The Engineer will determine the metal beam guard fence to be salvaged and location of stockpile sites.

All metal beam guard fence not designated for re-use will become the property of the Contractor. Dispose of fence as directed.

When “Removing Terminal Anchor Section,” a section consists of a terminal anchor post and one 25-ft rail element. Completely remove posts and any surrounding concrete.

**ITEM 544. GUARDRAIL END TREATMENTS**

Furnish and install new guardrail terminals under this item. New terminals shall be Type I Mash compliant as shown on the standard sheets.

Set guardrail extruder system to the height as specified in the applicable standards unless otherwise directed by the TxDOT Representative.

Install object markers Type OB-3F on the front of the impact heads of single guardrail terminals as shown on Standard Sheet D&OM (VIA).



**Project Number: 636743001** **Sheet 3**

**County: SMITH, ETC.** **Control:** 6367-43-001

**Highway:** IH 20

**ITEM 545. CRASH CUSHION ATTENUATORS**

Provide crash cushion attenuators meeting TL-3 requirements.

The six inch (6”) reinforced concrete foundation, embankment and preparation for the concrete slab are considered subsidiary to this item.

**ITEM 770. METAL BEAM GUARD FENCE REPAIR**

Furnish, repair, remove and replace or upgrade guardrail element. Supply all new materials for repairs under this item. Reuse existing materials in repairs only after the TxDOT Representative has approved it as salvageable.

The Engineer will determine whether damages guard fence will be repaired or whether to upgrade the installation to current standards using other items of work.

All single Guardrail Terminals/Single Guardrail Terminals replaced shall be Type I Mash compliant as shown on the standard sheets.

Conform to requirements for class "A" concrete as specified in item 421, "Hydraulic Cement Concrete" for terminal anchor posts or for embedment of other posts in concrete, where required. All class “A” concrete and concrete design shall be approved by the TxDOT Representative and strength testing requirement may be waived.

Repairs under "Repair of Rail Element (W-Beam)” are paid by the linear foot of rail when a terminal anchor section involves only the rail elements and not the actual anchor foundation. Provide prefabricated curved rail when needed.

Thoroughly tamp around all posts set into the soil. Backfill postholes with debris-free material, as approved by the TxDOT Representative. Remove or spread all surplus dirt to the natural grade of the surrounding area.

Repair damaged galvanized coatings in accordance with Section 445.3.D, “Repairs.”

Removal of posts that are replaced in asphalt pavement or flexible base pavement will be paid for under Item 770-6010 “REM/REPL TIM/STL POST W/O CONC FND OR 770-6012 REM/REPL TIMBER POST W/O CONC FND.”

Cap posts set in hot mix/surface treatment with four (4) inches of cold-mix. When replacing posts in riprap use grout to fill space between riprap and posts.

All bridge rail consisting of "W" rail sections connected to the top rail or concrete rail will be paid for under the bid item "Repair Rail Element (W-Beam)".

Repair of steel post with base plate also includes the repair of steel post with plate on bridge curb, on bridge deck, and/ or headwall.

Removal and replacement of blockout will be paid when existing block is broken or missing. Installation of blockout will be paid when new blocks are installed where they have never existed before.

When replacing a SGT impact head, payment will be made for replacing a new OM marker also. The OM marker is subsidiary to installation of SGT or remove/replace SGT.

Payment of the following are considered subsidiary to items used in Guardrail Replacement:

- removal of all damaged existing metal beam guard fence, anchor post, post, terminal anchor section, metal beam guard fence transitions, S.G.T.'s and any other material necessary to perform the work.

- realignment of existing rail that does not require removal.

- any work required to remove and reattach sections of rail including terminal anchor sections and S.G.T.s adjacent to the damaged rail.

- all blockouts, back-up plates and any other incidentals necessary to repair metal beam guard fence.

- drilling of new postholes and backfilling old post holes to repair metal beam guard fence.

- all required epoxy-grouted work.

- minor amounts of tree trimming and underbrush removal.

- removal and reset of SGT impact head if the rail is not extruded into the head.

- replacement of SGT cable assembly if the TxDOT Representative determines the original cable is reusable.

**ITEM 712. CLEANING AND SEALING JOINTS AND CRACKS (ASPHALT CONCRETE)**

Furnish materials in accordance with Section 300.2.8., Table 15, "Rubber-Asphalt Crack Sealer." Apply materials according to manufacturer's specifications.



**Project Number: 636743001** **Sheet 3**

**County: SMITH, ETC.** **Control:** 6367-43-001

**Highway:** IH 20

Crack sealing should be performed under existing traffic conditions with a minimum of interference to the operation of the roadway.

The sealant must be cold applied and the equipment should produce adequate pressure to dispense the sealant in a continuous flow.

All equipment will be inspected by the Engineer. The equipment must be power driven and in good operating order prior to being approved for the Contractor to begin work. Equipment must be of sufficient capacity to efficiently clean the cracks and joints before sealing, thereby providing a consistent production rate.

Any sanding required due to the tracking of material shall be performed by the Contractor and shall be considered subsidiary to the bid item. Provide the sanding materials as specified in Item 712.

Reflective cracking must be cracked sealed as directed.

**ITEM 774. ATTENUATOR REPAIR**

Repair Trinity Attenuating Crash Cushion as shown on the standard sheets. For clarification, repair includes repairing, modifying, replacement or installation of any or all parts of an existing system.

**ITEM 776 METAL RAIL REPAIR**

Rail Repair will be measured by the foot between centers of the first undamaged post on each side of the repair or to the end of the rail. Repair of metal post will be paid for under Item 770 by each post repaired.

When steel posts are damaged, new posts will be ordered and installed. The Contractor will take measurements for manufacturing the new posts. When the posts are ordered, the Contractor will instruct the manufacturer to send the TxDOT Representative a letter stating the timeframe for delivery. Time charges will be adjusted accordingly. Damaged posts may be reused or repaired for the purpose of hanging new rail section until new posts can be manufactured and delivered. If posts are repaired they will be paid under the repair item and new posts will be paid for when installed.

**GUIDESIGN REPLACEMENT**

**ITEM 416. DRILLED SHAFT FOUNDATIONS**

Collect all cuttings, spoils, and slurry resulting from drilled shaft operations and deposit material into a storage tank for disposal outside the limits of the project. Dispose of waste material in accordance with Section 416.3.7., "Additional Requirements for Slurry Displacement or Underwater Concrete Placement Methods."

Hand dressing of soil around the concrete foundations for luminaries will be required as directed. Place the level of soil at a 6:1 slope or flatter, where possible, and extend it from the top of the concrete foundation to the established grades. This work will not be paid for directly, but will be subsidiary to this Item.

Provide a low clearance drilling rig to avoid overhead transmission line.

Locate all existing utilities before drilling the foundations. Upon approval, modify operations and continue the work in a manner that will allow others to make utility adjustments if necessary.

Remove existing concrete foundations that are to be abandoned to 2 ft. below finish grade.

Backfill the remaining hole with material that is equal in composition and density to the surrounding area. Replace any surfacing with like material to equivalent condition.

Restrict movement of construction equipment and haul trucks to paved surfaces. Do not cross the median with equipment and haul trucks unless specifically authorized. Wash out concrete trucks in designated areas specifically constructed for eliminating run-off. Dispose of materials in accordance with federal, state, and local requirements.

Drill all foundation shafts to a minimum of six (6) feet in depth, leaving no loose material in the hole. Do not leave foundation holes open overnight. Finish all foundations with a trowel for a neat appearance and to the satisfaction of the TxDOT Representative. Remove all excess material from the work site.

Hand dressing of soil around the concrete foundations will be required as directed. Place the level of soil at a 6:1 slope or flatter, where possible, and extend it from the top of the concrete foundation to the established grades. This work will not be paid for directly, but will be subsidiary to this Item.

TxDOT reserves the right to test approximately 5% of the installed bases to insure proper depth and coverage of the concrete. Assume expense and replace all bases on the entire roadway if proper depth and coverage is not found, as directed by the TxDOT Representative. If proper coverage is found, TxDOT will be responsible for replacement of the pulled bases.



**Project Number: 636743001** **Sheet 3**

**County: SMITH, ETC.** **Control:** 6367-43-001

**Highway:** IH 20

Usual testing of materials placed under this Item may be waived by the TxDOT Representative, except for materials used for overhead sign bridge foundations.

**ITEM 636. SIGNS**

**TxDOT will provide all small and large roadside signs for this contract. The contractor shall provide all assemblies and hardware needed for the type of sign being replaced. Signs can be picked up at the following location:**

**Longview Maintenance Office**
**4549A W. SL 281**
**Longview, TX. 75604**

Install signs in accordance with the Department of Transportation's "Sign Crew Field Book," latest edition, or as directed.

All sign locations will be provided to the contractor with each work order. The locations may be shifted with design guidelines to secure a better location or avoid conflict with utilities and/or maintain the recommended clearance from existing signs.

Stake the foundations for any new locations, in the event that a sign needs to be relocated, as approved by the TxDOT Representative.

Large guide sign repair/replacement and installation is intermittent and not continuous. Expect multiple mobilizations (call outs) for the duration of this contract. Multiple work orders may be used to accomplish the work. Once work has begun, continue until all the work order is complete.

The amount of work to be performed, number of days allowed, and the date when time charges will begin for each work order will be provided. Work orders may have multiple work locations.

Working days for each work order will be calculated as follows. The Contractor will be given 10 days from the date of the initial work order to obtain sign supports and hardware and install the sign provided by TxDOT. Time charges for each separate site on the work order will be calculated from the next working day following the expiration of time charges on the previous job.

Install signs in accordance with the Department of Transportation's "Sign Crew Field Book," current edition, or as directed. Where applicable, install the proposed signs before removing the existing signs and prior to moving to the next location or quitting operations at the end of the work day.

Plans quantity measurement is voided for pay items considered as guide sign replacement.

**ITEM 644. SMALL ROADSIDE SIGN ASSEMBLIES**

Sign types for which details are not shown on the plans must conform to "Standard Highway Sign Designs for Texas," latest edition.

Before construction begins, locate all Texas Reference Marker (TRM) signs and Adopt-a-Highway signs using survey control methods for accuracy. Provide the survey data to the Engineer. If either type of sign is relocated during construction activities, survey the sign location and notify the Engineer before placement of the permanent sign.

Provide the survey data to the Engineer. If either type of sign is relocated during construction activities, survey the sign location and notify the Engineer before placement of the permanent sign.

Stake all sign locations for approval prior to placement.

Items under Item 644 with the description 'Install…' will cover the installation of the sign support/post only. Payment of the sign mounted on the post will be paid under item 636. The intent behind this is to clarify potential cost of work needed.

**ITEM 647. LARGE ROADSIDE SIGN SUPPORTS AND ASSEMBLIES**

Contact the TxDOT Representative at least 24 hours in advance of picking up materials at the Maintenance Section in which the replacement will occur. Sign for all materials received prior to removing them from the premises. Return all unused materials to the supplying Maintenance Section once the work order is completed.

Stake sign locations and obtain approval of the TxDOT Representative prior to placement of signs. Install all stubs so that they are level and sign posts will be plumb. Assume expense for replacement of inappropriately placed stubs. Measure and cut all sign posts, and install fuse plates in the field for proper height, in accordance with the plans and specifications. Repair any damage caused by operations at Contractor's expense and restore facilities to service in a timely manner.

Remove signs from sign posts. Separate sign posts and concrete from footings. Bundle sign posts and footings as directed by the TxDOT Representative and deliver to a location to be determined. Signs and accompanying supports that are removed under the terms of this contract are the property of the State. Return all salvaged material from existing sign assemblies to the location designated.



**Project Number: 636743001** **Sheet 3**

**County: SMITH, ETC.** **Control:** 6367-43-001

**Highway:** IH 20

Furnish the tare and maximum gross weight for all vehicles, trucks, truck-tractors, trailers, semi-trailers, or combination of such vehicles used to deliver materials for this contract in accordance with Article 9.1.B, "Volume Measurement." Furnish calculations supporting these weights. Provide all measurements required for pay a minimum of 2 days before the trucks are used.

Plans quantity measurement is voided for pay items considered as guide sign replacement.

## LONG LINE THERMO

**ITEM 662. WORK ZONE PAVEMENT MARKINGS**

Dispose of all empty paint containers and unused paint in accordance with federal, state, and local requirements.

Do not use foil backed pavement markings as removable work zone pavement markings. Removable work zone pavement markings must be pliant polymer detour grade (removable) material or other markings that can be obliterated or removed to the satisfaction of the Engineer.

**ITEM 666. RETROREFLECTORIZED PAVEMENT MARKINGS**

Use the spray method for application of the thermoplastic compound for lane lines, barrier lines, edge lines and channelizing lines.

In high traffic volume areas, do not begin work before 9 A.M. and do not continue work after 4 P.M. unless otherwise approved. In other areas, the Engineer will approve and direct the time of work.

Extrude hot to the pavement surface thermoplastic compound for arrows, stop lines, yield triangles, transverse lines, crosswalk lines, words and symbols.

For lengths greater than 300-ft, provide guide markings that will not leave a permanent mark on the roadway. Have the guide marking material and equipment used for placement approved prior to use. Provide adequate notification for approval of the guide markings prior to placement of the permanent pavement markings.

Provide a crew experienced in the work of installing pilot guideline markings and in the necessary traffic control. Supply all the equipment, personnel, traffic control, and materials necessary for the placement of pilot guideline markings as directed. All work will be in conformance with Part 6 of the TMUTCD.

The Engineer will establish beginning and ending points of no passing zones.

Furnish Type II glass beads conforming to DMS-8290, “Glass Traffic Beads,” for this project.

Begin Long Line Thermoplastic striping in mid-March (approximately).

Quantities and locations may be varied by the TxDOT Representative during actual striping operations to accommodate field conditions. Use the spray method for application of the thermoplastic compound for lane lines, barrier lines, edge lines and channelizing lines. Use Type II glass traffic beads as specified under Item 666.2.3 of the Standard Specifications.

Immediately remove and assume removal cost of any material that gets on any vehicle as a result of operations. Dispose of paint containers and unused paint in accordance with all Federal and State regulations.

Errors and existing thermos stripe deemed unfit to restripe over will be removed.

Errors in striping will be removed by water blasting only.

A sealer/paint shall be applied to concrete surface after water blast cleaning.

The contractor shall be required to meet a daily production rate of (50,000) for all Long Line Thermo Striping items.

Multiple move-ins will be required.

The contractor shall complete one full striping cycle per year on main lanes and 1 full cycle every 2 years on frontage roads. TxDOT will provide a work order by county for this work to be performed.

This Item will not be a plans quantity item.

**Pavement Sealer**

TY II markings shall be placed as pavement sealer. The beads on this project shall meet the requirements of departmental materials specification DMS-8290, Glass Traffic Beads TY II. Beads shall be embedment coated with Potters Industries AC-07 Series, Swarco/Reflex, Inc. 01227 or an equivalent adhesion insuring coating.

This Item will not be a plans quantity item.



**Project Number: 636743001** **Sheet 3**

**County: SMITH, ETC.** **Control:** 6367-43-001

**Highway:** IH 20

## SHORT LINE THERMO

### ITEM 666. RETROREFLECTORIZED PAVEMENT MARKINGS

Place Short Line Thermoplastic Striping on an “as needed” basis, as directed by the TxDOT Representative. Use personnel experienced in the type of work described in the Standard Specifications.

Obtain approval from the TxDOT Representative for material and equipment used for placement of Short Line Thermo Plastic Striping.

Place Type I Thermoplastic Markings on the sections of highway where the existing pavement markings have been obliterated or are in need of refurbishing. Layout work may be required.

Sweeping of the surface prior to the actual pavement marking application may be the only surface preparation required for most asphaltic surfaces.

Bid item 668-6084 is paid by each number placed.

Immediately remove and assume removal cost of any material that gets on any vehicle as a result of operations. Dispose of material containers and unused material in accordance with all Federal and State regulations.

Multiple move-ins will be required.

The contractor shall complete one full striping cycle per year on main lanes and 1 full cycle every 2 years on frontage roads. TxDOT will provide a work order by county for this work to be performed.

This item will not be a plans quantity item.

## PAVEMENT PREP

### ITEM 677. ELIMINATING EXISTING PAVEMENT MARKINGS AND MARKERS

Unless otherwise directed, utilize Surface Treatment Method for removal on asphaltic surfaces. The Engineer will approve materials and rates prior to use.

Furnish a high pressure water blasting system for removing paint, thermoplastic, epoxy and preformed tape material from the following surfaces without causing any grooves or trenching of the surface: asphalt, concrete, permeable friction course, grooved asphalt and grooved concrete.

Use a high pressure water blasting system that consists of a vacuum recovery system that must provide for a nearly dry surface eliminating the possibility of uncontained run-off blasting water or debris, or the need for any secondary clean-up vehicles or operations.

All components required for the complete operation of the water blasting system (ultra-high pressure pump, vacuum system, clean water supply, vacuum recovery storage, primary truck-mounted and optional secondary tractor-mounted blasting components) must be mounted and transported on a single, fully self-contained and supporting single truck chassis, thereby eliminating the need for any additional water, vacuum or other transport vehicles.

**ITEM 678. PAVEMENT SURFACE PREPARATION FOR MARKINGS**

Surface Preparation for Markings of existing TY I Thermo shall be performed by the flailing method only on asphaltic surfaces unless otherwise approved by the TxDOT Engineer.

This item will not be a plans quantity item.

## RAISED PAVEMENT MARKINGS

**ITEM 672. RAISED PAVEMENT MARKERS**

Provide dispensing equipment such that the bituminous material can be directly applied from the melting pot to the pavement surface without secondary handling. Dispensing material from the melting pot into a separate container and then to the pavement surface will not be permitted. Intermittent agitation of the bituminous material will be by a method approved by the Engineer to ensure even heat distribution and must be such that the adhesive is agitated at approved and consistent intervals.

Use equipment that is industry-standard for the type of work being performed so as to assure a minimum removal and replacement rate of 1,800 raised pavement markers per day.
Obtain approval of the TxDOT Representative for all equipment such as, linex or equivalent to be used on the project prior to beginning work.

Begin removal and replacement of raised pavement markers subsequent to placement of broken thermoplastic striping on mainlanes.

Perform an entire raised pavement marker replacement on mainlanes twice during the contract period, unless otherwise directed by the TxDOT Representative.



**Project Number: 636743001** **Sheet 3**

**County: SMITH, ETC.** **Control:** 6367-43-001

**Highway:** IH 20

Employ personnel that are experienced in removal and replacement of raised pavement markers. Place new markers within 2 inches of the original marker pad. Repair damage to asphaltic surfaces greater than ¼" in depth as a result of the removal of markers. Bituminous will be applied to all picked RPM's original pad.

Use flexible bituminous for placement of raised pavement markers on concrete sections of the roadway, being approximately 22 total lane miles for each remove and replace cycle.
Directly apply the adhesive material from dispensing equipment (melting pot) to the pavement surface without secondary handling. Insure even heat distribution of the adhesive material by intermittent agitation, with a method approved by the TxDOT Representative.

Completely remove all epoxy and bituminous residue when marker is removed from concrete pavement for replacement.

Accept ownership of unsalvageable RPM's and remove from the roadway and right of way and properly dispose of. Removal is subsidiary to Item 672. Use a method approved by the TxDOT Representative.

The contractor shall complete one full cycle of RPM'S per year on main lanes and 1 full cycle every 2 years on frontage roads. TxDOT will provide a work order by county for this work to be performed.

## DELINEATORS & OBJECT MARKERS

**ITEM 658. DELINEATOR AND OBJECT MARKER ASSEMBLIES**

Accept ownership of unsalvageable delineator and object marker assemblies and remove from the right of way.

## MOWING

**ITEM 730. MOWING**

**IH-20**

Anticipated start dates for cycles:
Cycle 1 - approximately June 1, 2021
Cycle 2 - between September 1, 2021 and October 15, 2021

Begin each mowing cycle as specified in the start to work letter. The number of acres required in the mowing cycle and days allowed for completion will be specified in the letter. If work does

not begin on the date specified, a default warning letter will be mailed stating the Contractor has 10 days to begin and work continuously.

Complete a minimum of 265 acres per working day as a basis for time charges. Complete each cycle of mowing in this contract within 10 working days.

Maintain a continuous work schedule to allow satisfactory completion of the cycle and assure all equipment is in good operating condition.

Pressure-wash all mowing equipment to prevent the spread of a parasitic plant species, which may be located on the right of way, as follows: before beginning right of way mowing operations; after completing each county of right of way mowing operations; any time the equipment enters or leaves the right of way to perform any other mowing operation at locations other than the highway right of way.

Notify the TxDOT Representative prior to any pressure washing of mowing equipment so the process may be observed. Perform the pressure washing of mowing equipment only at the location(s) approved by the TxDOT Representative.

Stop all operations when a school bus is loading or unloading within one thousand feet (1,000') of mowing operations. Resume operations when all individuals are safely out of the danger of possible injury from flying debris.

Perform Type II Full Width mowing on all cycles, including curbed grassy medians and/or islands, cattle passes, and under bridges.

Mow all acres as specified on the plans and by the TxDOT Representative to complete a cycle. Exclude those areas designated as non-mow areas by the TxDOT Representative.

Completely mow out an intersection where another contract intersects with this contract, if it has not been mowed by the other Contractor, or if it has been four days since it was first mowed.

Use a six foot wide mower when working in locations with tight or confined areas. Hand trim around all fixed objects within the mow area including trees, plants, sign posts, fence rows, cattle guard pass fences, telephone and electrical boxes, delineators, retaining walls, bridge overpasses, or other appurtenances which are a part of the facility. Perform hand trimming around all temporary signs such as construction signing.

Include suckers and sprouts up to one and one-half inches (1 1/2") around trees. Trim around all power poles and utility pedestals that are within the normal mowing areas.

Hand trim twelve feet (12') behind any guardrail and/or retaining walls where the mowers are unable to mow.



**Project Number: 636743001** **Sheet 3**

**County: SMITH, ETC.** **Control:** 6367-43-001

**Highway:** IH 20

Trim, remove debris from roadway, and move signs as the mowing progresses. Trim all mow areas by the end of each day. Mow within one foot (1') of the fence row, unless authorized by the TxDOT Representative to do otherwise.

Trim by hand areas that are too wet to mow unless they are more than four feet (4') wide and longer than one hundred feet (100'). Hand trim areas less than four feet (4') wide, regardless of the length.

Cut trees and brush up to one and one-half inches (1 1/2") in the entire right of way except in non-mow areas. Include trees and brush along creeks and drainage ditches.

Straighten all signs and/or delineators that have been knocked out of plumb by the mowing operations by the end of each working day.

Pay for all signs and/or delineators, mailboxes, guardrail, and other appurtenances damaged as a result of mowing operations. Pay replacement cost of sign foundations if they are moved as a result of mowing operations.

Payment for the cost for repairs (including labor and material) will be deducted from any due the Contractor upon completion of a partial cycle or the entire cycle of mowing.

A four wheel drive tractor will be required at various locations.

Minimum quantity per callout for "Spot Mowing" will be 2 acres.

Plans quantity measurement for full width mowing is voided.

## DEBRIS / GRAFFITI REMOVAL

### ITEM 735 DEBRIS REMOVAL

Begin spot debris removal within 24 hours of notification by the TxDOT Representative. Remove and dispose of all debris within the 1 roadbed mile limit at each call-out, as directed by the TxDOT Representative.

Payment will be based on completion of an entire cycle, which shall be completed within 3 days once begun for IH-20.

Anticipate that there will be times during the year in which two crews will work simultaneously in order to complete the cycle within the specified amount of time (3 days) for IH-20. Removal limits for IH-20 in the center median on the mainlanes extends to the concrete barrier.

Dispose of all rubber tires and rubber tire scraps collected during the performance of this contract in accordance with local, state, and federal regulations. Provide written notice to TxDOT of the disposal location of tires and tire fragments.

Perform one complete cycle of debris pickup and removal on eastbound and westbound lanes approximately once each week, unless otherwise instructed by the TxDOT Representative.

Anticipate completing two or three cycles per week during the months of June, July, and August. Perform debris removal on frontage roads and ramps as directed by the TxDOT Representative.

**ITEM 740. GRAFFITI REMOVAL AND ANTI-GRAFFITI COATING**

The 50 SF minimum requirement for a call-out is voided for this project.

Begin graffiti removal within 48 hr of each verbal notification unless otherwise directed.

Remove graffiti from the back of signs on overhead sign structures and ground mounted signs.

## SWEEPING

**ITEM 738. CLEANING AND SWEEPING HIGHWAYS**

Prosecute the work as directed by the TxDOT Representative. Work will be scheduled for non-emergencies on an “as needed” basis, with call in approximately once each quarter. An additional cycle for emergencies in each area will be scheduled as necessary. Report to work for emergencies within 48 hours of notification by the TxDOT Representative.

Work for this item includes but is not limited to all sides of raised pavement markers, barrier drain slots, slotted drains, inlet openings, attenuators, and guardrails. This item also includes the removal of all dirt and debris preventing proper drainage at the outflow side of any barrier drain slots.

Dispose of all debris collected at a state approved solid waste site. Special attention may be required for pavement that has rumble strips.

Mileage is measured by the right-of-way centerline mile, is defined as the distance measured from the beginning point to the ending point shown on the plans, and is measured once, regardless of the number of lanes or roadbeds.

Liquidated damages in the amount according to SP000-658 will be charged for each day the work is not complete after the expiration of all working days for each written notification.



**Project Number: 636743001** **Sheet 3**

**County: SMITH, ETC.** **Control:** 6367-43-001

**Highway:** IH 20

Transfer of working days from one written notification into a subsequent written notification is not allowed. Each written notification is a stand-alone entity.

For payment purposes, one cycle of Item 738-6001 consists of cleaning and sweeping of approximately 67.5 centerline miles of all center median main lane barriers in Van Zandt, Smith, and Gregg Counties.

One cycle of Item 738-6003 consists of cleaning and sweeping of approximately 8.4 centerline miles of all outside main lane barriers in Van Zandt, Smith, and Gregg Counties.

One cycle of Item 738-6174 consists of cleaning and sweeping of approximately 6.4 centerline miles of all Direct Connectors to I-20 in Van Zandt, Smith, and Gregg Counties.
Direct Connectors are defined as inside and outside barriers on all overpasses and underpasses that intersect I-20 in the Tyler District. Payment will be made only after an entire cycle has been completed.

Aggregate removal will be performed on various roadways following adverse weather as directed.

Maintain a continuous work schedule to allow satisfactory completion of one cycle each of the entire Center Median, Outside Main Lanes, and Direct Connectors from the Kaufman/Van Zandt County line to the Harrison/Gregg County line in at least 10 working days. Complete Bid Item 738-6001 within 6 working days; 738-6003 within 2 working days; 738-6174 within 2 working days. Complete all limits on each specific bid item within each area before progressing to the next item.

## TREE AND BRUSH REMOVAL

**ITEM 752 TREE AND BRUSH REMOVAL**

Use equipment that is industry-standard for the type of work being performed, specifically, loaders with sufficient capacity to remove tree trunks from the right of way; stump grinders and chippers so as to assure adequate production rates. Use aerial devices when needed.

Pick up and remove from the right of way all trees that are felled in one day, unless otherwise authorized by the TxDOT Section Representative. Obtain written consent of the property owner if a tree is not on State property prior to beginning work.

Cut, remove and grind stumps of all trees marked on one roadway before starting on another roadway unless otherwise authorized by the TxDOT Section Representative. Cut the trees down as close to the ground as possible.

Determine the diameter of the tree by measuring the circumference of the tree three feet (3') from the ground and on the uphill side, dividing it by 3.1416, then rounding to the nearest inch. Remove trees or brush less than two inches (2") in diameter which are located within four feet (4') of any tree marked for removal.

Remove stumps by grinding them to eight inches (8") below ground level. Remove and dispose of the wood chips or spread in a thin layer inside the right of way as directed by the TxDOT Section Representative.

Backfill the holes that remain after the stump is ground and then level to existing grade. Disposal of any additional stumps, logs, limbs, etc., is not allowed on private property. Disposal will be in accordance with federal, state and local laws. All removal and backfill are subsidiary to the bid item.

## TREE TRIMMING/TREE TRIMMING AND BRUSH REMOVAL

### ITEM 752 TREE TRIMMING AND BRUSH REMOVAL

Trim sides and tops of trees along highway right of way.

Use chippers, Fecon mulchers or equivalent equipment with chipper teeth or carbide teeth to dispose of tree limbs and brush removal. All chips shall be no larger than 3" x 3" x ¼" in size. The method of chipping and/or brush removal shall not damage or destroy the existing vegetation on the ROW causing erosion. Obtain the TxDOT Representative's approval prior to use. Perform smooth saw cuts to cause the least amount of damage to the trees. Use of boom axes are not permitted on this project.

Spread and/or remove excess wood chips within 24 hr. in accordance with state, federal and local environmental and waste disposal laws and regulations, as directed by the TxDOT Representative. Chips shall not be left in an area that could cause a blockage in the flow line of the ditch and/or culverts. Leave the area with a clean, neat appearance.

Trim trees and brush from right of way line to right of way line wide by 20' high unless otherwise specified on the quantity summary page in the plans. Cut limbs and brush at the state right of way or as directed by the TxDOT Representative, if the tree is not on state property.

Only power shearing equipment designed for this type of operation is acceptable. Repair deep rutting of turf caused by equipment at contractor's expense. Bucket trucks may be needed at bridges and various other locations.



**Project Number: 636743001** **Sheet 3**

**County: SMITH, ETC.** **Control:** 6367-43-001

**Highway:** IH 20

## HERBICIDE

### ITEMS 731. BROADCAST HERBICIDE

Contractor shall provide herbicide license to state representative. Document work in accordance with all federal, state, and local regulations. Submit a copy of the herbicide records on the next business day following the application. Submit a final copy of the all the herbicide application records upon completion of the Contract.

Written notification will be issued to begin each herbicide cycle.

Furnish water free of industrial wastes and other objectionable material.

The Department will evaluate each tract before herbicide application. If the entire tract does not need to be treated, acreage and or shoulder miles will be recalculated and limits of treated area on tract will be shown on the work order letter.

Required minimum acres per working day will be 80 acres for broadcast herbicide application and 20 shoulder miles for paving edge herbicide application.

**All equipment will be pressure washed prior to beginning work and before leaving the job site.**

Remove and replace guardrail, posts, bolts, nuts, etc., in those areas where entry cannot be made any other way.

Do not apply herbicide to designated non- mow areas.

Item 731-6007 Pavement Edges, Structures and Fixtures is measured and paid by the centerline mile. Centerline mile is defined as the distance measured from the beginning point to the ending point measured once regardless of the number of lanes or roadbeds.

A partial payment of 50% of the unit price bid will be paid after the initial application is performed. The final 50% of the unit price bid will be paid after the inspection and required re-treatments have been completed and accepted.

**ITEM 731:**

Unless otherwise directed, use the following rates:

| | |
|---|---|
| Gallons of Water Per Acre | As calibrated in the presence of Department's personnel |
| Ounces of Outrider Per Acre | 1.333 |
| Ounces of Roundup-Pro Per Max Acre | 8 |
| Ounces of Vista XRT Per Acre | 10 |

Target 6.6 may be considered if resistant strain of “Johnson Grass” is encountered.

**ITEM 731:**

Unless otherwise directed, use the following rates:

| | |
|---|---|
| Gallons of Water Per Acre | As calibrated in the presence of Department's personnel |
| Ounces of Esplanade Per Acre | 2 - 3 |
| Quarts of Roundup-Pro Max Per Acre | 3 |

## ILLUMINATION

**ITEM 618. CONDUIT**

Conduit placed on the underside of the bridge slab overhang must be anchored with conduit straps at 5 ft. maximum intervals as shown on standard sheets ED(1) and (2)-14. Conduit hangers will not be allowed in this location.

Furnish couplings and connections that are made wrench tight. All conduit must be brought into a ground or junction box and elbowed unless otherwise shown on the plans.

For this contract, all conduit shall be 2 inch. For road bores, all conduit shall be 2 inch PVC schedule 80, unless otherwise directed by the Engineer. For trenched, all conduit used shall be 2 inch PVC schedule 40, unless otherwise directed by the Engineer.

Place conduit in an area not exceeding 2 ft. in any direction from a straight line between terminal points. The minimum depth of the conduit should be 2 ft. except when crossing a roadway where the depth should not be more than 3 ft. nor less than 1 ft. below the bottom of the base material when placed by the jacking or boring method.



**Project Number: 636743001** **Sheet 3**

**County: SMITH, ETC.** **Control:** 6367-43-001

**Highway:** IH 20

Where conduit is to be placed under existing riprap, cut the existing riprap to neat lines as directed and replace to match original condition after conduit placement.

The Contractor may, at his option, substitute high-density polyethylene (HDPE) conduit meeting the specifications of Item 622 for all bores requiring PVC schedule 40 conduit and, when approved by the Engineer, may substitute HDPE for schedule 80 bored conduit. HDPE must be the same size as the PVC conduit shown on the plans. HDPE must be terminated with UL listed fittings. HDPE may be threaded and used with threaded PVC connectors or couplings. HDPE should be extended through the bore in one continuous piece and should be coupled to RMC elbows or to PVC conduit at the bore pits prior to entering ground boxes (if ground boxes are required by the plans). HDPE should not contain conductors during installation in this manner. No additional compensation will be paid to the Contractor when HDPE is substituted for this purpose.

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

The polymer concrete barrier box will not be paid for separately, but will be considered subsidiary to Item 618, “Conduit.”

Use materials from prequalified material producers list as shown on the Material Producer List found on the TxDOT web site. Category is “Roadway Illumination and Electrical Supplies.”

**ITEMS 618, 624, 680 & 684. CONDT, GRND BX, INSTL HWY TRF SIG & TRF SIG CBL**

The location of the controller, conductors, conduits, junction boxes and ground boxes are diagrammatic only and may be shifted by the Engineer to accommodate field conditions.

**ITEM 620. ELECTRICAL CONDUCTORS**

For both transformer and shoe-base type illumination poles, provide double-pole breakaway fuse holder as shown on the Material Producer List found on the TxDOT web site. Category is “Roadway Illumination and Electrical Supplies.”

Fuse holder is shown on list under Items 610 & 620.

Provide 10 amp time delay fuses.

## ITEM 6000. ROADWAY ILLUMINATION ASSEMBLIES

Junction boxes, connectors, flexible conduit and fused disconnects for underpass luminaires will not be paid for directly, but will be subsidiary to the various bid items.

For this project, the contractor shall supply all materials except as follows:

- Standard single mast pole
- Standard double mast pole
- Mast arms
- Transformer bases
- Luminaires and fixtures
- Luminaire Wall Packs

This material will be supplied by the department. The contractor shall contact the signal shop at (903)510-9210 at least 24 hours in advance of picking up materials. Materials will be picked up at 2709 W. Front St. in Tyler. The contractor will be required to sign for all materials received prior to removing them from the premises.

When performing work on high mast lighting, the contractor shall furnish lamps to replace the lamps that are burned out only. The department will furnish the remaining lamps. All lamps on the ring shall be replaced at the same time. Replacement of the remaining lamps is subsidiary to Item 6000-6046 Maintain High Mast Illumination.

Provide all other equipment not listed above.

Whether provided by the State or by the Contractor, install all materials in accordance with the various items.

Prior to final payment, return all unused material to the Signal Shop at the location listed above.

For this project, Replace Electrical Service shall consist of the replacement / installation of Type A Electrical Service only. The department will supply any other types of Service Assemblies that are required.

For this project, all ground boxes installed shall be TY A (122311) W / Apron.

The contractor will inspect, clean, adjust and make necessary repairs and replacement of components to illumination systems as described in special specification 6000, Illumination Maintenance.



**Project Number: 636743001** **Sheet 3**

**County: SMITH, ETC.** **Control:** 6367-43-001

**Highway:** IH 20

# TRAFFIC CONTROL

## ITEM 502. BARRICADES, SIGNS, AND TRAFFIC HANDLING

The traffic control plan for this Contract consists of: the installation and maintenance of warning signs and other traffic control devices shown on the plans; specification data, which may be included in the general notes; applicable provisions of the Texas Manual on Uniform Traffic Control Devices (TMUTCD); traffic control plan sheets included on the plans; standard BC sheets; Compliant Work Zone Traffic Control Device List, and Item 502 of the standard specifications.

Use ground-mounted sign mounts with two posts for all temporary work zone signs unless otherwise directed.

Inspect and correct deficiencies each day throughout the duration of the Contract. In accordance with Article 502.4., “Payment,” no payment will be made for the month if the Contractor fails to provide or properly maintain signs and devices in compliance with Contract requirements. Temporary warning signs that are visible when conditions do not apply will be considered improper maintenance of signs.

Provide at least one employee on call nights and weekends (or any other time that work is not in progress) for maintenance of signs and traffic control devices. This employee must have an address and telephone number near the project, as approved. Notify the Engineer in writing of the name, address, and telephone number of this employee. The Engineer will furnish this information to local law enforcement officials.

In addition to providing a Contractor’s Responsible Person and a phone number for emergency contact, have an employee available to respond on the project for emergencies and for taking corrective measures within 30 minutes.

Sign all roads intersecting the project in accordance with current BC standards.

Refer to the traffic control plan sheets for traffic handling through the work area. Contractor may vary the signing arrangement and spacing as necessary to fit field conditions; however, any proposed changes in the traffic control plan must be approved before implementation.

High-visibility safety apparel is required for workers in accordance with the General Notes on current BC standards.

Place and maintain signs, channelizing devices, and flaggers to direct and route traffic at any location and for any period of time as may be required or directed.

When operations require a lane closure, provide cones, vertical panels, drums, signs, flaggers, and flashing arrow panels as necessary to route traffic around the closed lane as shown on the plans and as directed. Lane closures will be limited to one specific lane as directed.

Maintain existing roadside signs within this project's limits during this Contract. In order to accommodate the grading or other operations, temporarily relocate these signs in accordance with the TMUTCD as directed. Use ground-mounted sign mounts with two posts for all relocated signs unless otherwise directed. This work will not be paid for directly, but will be subsidiary to Item 502.

Provide truck-mounted attenuators (TMA) as shown on the appropriate traffic control plan sheets. Provide a letter certifying that all TMA used on this project meet NCHRP 350 or AASHTO Manual for Assessing Safety Hardware (MASH) requirements.

Regulate all construction activities and equipment to minimize inconvenience to the traveling public. At points where it is necessary for trucks to stop, load, or unload, provide warning signs and flaggers to protect the traveling public.

The pavement must be entirely open to traffic each night. Remove or clearly barricade all material stockpiles, equipment left overnight, or any obstruction within 30 ft. of a travelway as approved.

The Contractor Force Account "Safety Contingency" is intended to be used for work zone enhancements that could not be foreseen in the project planning and design stage for the purpose of improving the effectiveness of the Traffic Control Plan. 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.

Provide flaggers at county roads, commercial driveways, and other intersecting roadways deemed necessary by the Engineer to maintain control of the work zone during one-lane two-way operations. Provide communication radios to each flagger in the work zone and the pilot vehicle operator.

Refer to the traffic control details for surfacing operations shown on the plans. Install signs as required by this standard or plan sheet. Keep signs in place until after completion of the surface course operation and until placement of the standard pavement markings. Place standard pavement markings within 7 days of surface treatment application. The placement of acceptable permanent pavement markings and the completion of the final cleanup will be considered a part of the surface course operation. These signs are in addition to the signs and barricades that may be required on standard BC sheets. Short-term stationary/short duration portable signs will be required during the removal of the temporary pavement markings.



**Project Number: 636743001** **Sheet 3**

**County: SMITH, ETC.** **Control:** 6367-43-001

**Highway:** IH 20

The Contractor and the Engineer should agree on the allowable length of roadway sections for scarifying and reshaping the existing base and hauling base material. Provide qualified flaggers at each end of the section being processed to instruct and direct the traveling public.

Open the repaired concrete pavement areas of 1 lane to traffic as soon as the new concrete attains the specified strength. Do not open a repaired area to traffic until all shoulder material removed for the repair has been replaced with ACP. Plan and coordinate the work in such a manner that the shoulder work will not delay opening the repaired areas to traffic.

Prior to beginning work, the Contractor and Engineer must agree on the allowable length of lane closure.

Restrict movement of construction equipment and haul trucks to all paved surfaces. Do not allow construction equipment and haul trucks to cross the median unless specifically authorized. Use entrance and exit ramps for ingress and egress to the mainlanes.

**ITEM 6001. PORTABLE CHANGEABLE MESSAGE SIGN**

Provide 3 electronic Portable Changeable Message Sign (PCMS) units adjacent to the mainlanes in advance of each lane closure. PCMS units must be in accordance with Section 6F.60 of the TMUTCD, applicable standards and special provisions. Depending on conditions, message boards may have to be relocated during daily operations. Messages will be in accordance with current BC standards. When not in use, remove PCMS units from the right of way. Measurement and payment for the PCMS noted above will be in accordance with Item 6001. The term "operational" is defined as displaying a message in direct support of current project operations as approved and directed by the Engineer.

Provide a non-erodible, stable surface to place the Portable Changeable Message Sign (PCMS) units adjacent to the roadway as directed. Payment for this surface is incidental to Item 6001.

**ITEM 6185. TRUCK MOUNTED ATTENUATOR (TMA)**

Shadow vehicles with truck mounted attenuator (TMA) are required on the traffic control plan and TCP standards for this project. The Contractor will be responsible for determining if one or more of these traffic control operations will be ongoing at the same time to determine the total number of TMAs needed for the project. Additional truck mounted attenuators (TMAs) may be required as deemed necessary by the Engineer.

In addition to the shadow vehicles with truck mounted attenuator (TMA) that are specified as being required on the traffic control plan for this project, provide 2 additional shadow vehicles

with TMA for TCP (6 - 1)-12 (MOD) thru TCP (6 - 3)-12 (MOD) as detailed on General Note 4 of this standard sheet.

Therefore, three (3) total shadow vehicles with TMA will be required for this type of work. The Contractor will be responsible for determining if one or more of these operations will be ongoing at the same time to determine the total number of TMAs needed for the project.

**TRAFFIC CONTROL - MOWING**

Refer to RS-TCP-05, which is a part of this contract. This plan does not relieve the Contractor from compliance with the Texas Manual on Uniform Traffic Control Devices (TMUTCD).

Setup a maximum of two (2) simultaneous, consecutive three (3) mile sign arrangements. Perform all work, including weed-eating, within the signed areas. Work only within the six (6) mile limit at any time.

**TRAFFIC CONTROL - THERMOPLASTIC STRIPING**

Conform to traffic control plan, pavement marking, freeway pavement marking, and barricade and construction plan sheets, which are a part of the contract.

Restrict movement of equipment and haul trucks to all paved surfaces. Do not allow and haul trucks to cross the median unless specifically authorized. Use entrance and exit ramps for ingress and egress to the main lanes.

**TRAFFIC CONTROL - DEBRIS REMOVAL**

Equip each vehicle used with one or more rotating beacon or strobe lights and a truck-mounted arrow board.

TMA’s shall be required.

**TRAFFIC CONTROL - SWEEPING**

Lane or shoulder closures will be required between TRM 593-595 at the Sabine River and in other areas where there are barriers on both sides of the travel way for a significant distance.

All work required by these general notes, except as provided for by Item 502, will not be paid for directly, but will be subsidiary to Item 502 unless otherwise shown on the plans.



**Project Number: 636743001** **Sheet 3**

**County: SMITH, ETC.** **Control:** 6367-43-001

**Highway:** IH 20

# ESTIMATE SUMMARY

PROJECT RMC 636743001
CONTROL 6367-43-001
TOTAL MAINTENANCE

| EST. | FINAL | EST. | FINAL | EST. | FINAL | EST. | FINAL | EST. | FINAL | ALT. | ITEM NO | DESC CODE | SP NO | DESCRIPTION | UNIT | TOTAL EST. | TOTAL FINAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 250.000 | | | 132 | 6021 | | EMBANKMENT (VEHICLE)(ORD COMP)(TY C) | CY | 250.000 | |
| | | | | | | | | 10000.000 | | | 134 | 6006 | | BACKFILL (TY A) | LF | 10000.000 | |
| | | | | | | | | 200.000 | | | 315 | 6002 | 001 | FOG SEAL (SS-1H) | GAL | 200.000 | |
| | | | | | | | | 73.000 | | | 342 | 6002 | 004 | PFC (ASPHALT) PG76-22 | TON | 73.000 | |
| | | | | | | | | 1136.000 | | | 342 | 6006 | 004 | PFC-C (AGGREGATE)(PG76 MIX) SAC-A | TON | 1136.000 | |
| | | | | | | | | 4833.000 | | | 348 | 6001 | 003 | TBPFC (MEMBRANE) | GAL | 4833.000 | |
| | | | | | | | | 500.000 | | | 351 | 6001 | | FLEXIBLE PAVEMENT STRUCTURE REPAIR(5") | SY | 500.000 | |
| | | | | | | | | 71978.000 | | | 354 | 6021 | | PLANE ASPH CONC PAV(0" TO 2") | SY | 71978.000 | |
| | | | | | | | | 5000.000 | | | 354 | 6025 | | PLANE ASPH CONC PAV(4" TO 6") | SY | 5000.000 | |
| | | | | | | | | 500.000 | | | 361 | 6004 | | FULL - DEPTH REPAIR CRCP (10") | SY | 500.000 | |
| | | | | | | | | 200.000 | | | 401 | 6001 | | FLOWABLE BACKFILL | CY | 200.000 | |
| | | | | | | | | 10.000 | | | 416 | 6002 | | DRILL SHAFT (24 IN) | LF | 10.000 | |
| | | | | | | | | 20.000 | | | 416 | 6016 | | DRILL SHAFT (SIGN MTS) (12 IN) | LF | 20.000 | |
| | | | | | | | | 10.000 | | | 429 | 6007 | | CONC STR REPAIR (VERTICAL & OVERHEAD) | SF | 10.000 | |
| | | | | | | | | 20.000 | | | 429 | 6009 | | CONC STR REPAIR (STANDARD) | SF | 20.000 | |
| | | | | | | | | 100.000 | | | 432 | 6026 | | RIPRAP (STONE COMMON)(DRY)(18 IN) | CY | 100.000 | |
| | | | | | | | | 100.000 | | | 432 | 6045 | | RIPRAP (MOW STRIP)(4 IN) | CY | 100.000 | |
| | | | | | | | | 1000.000 | | | 438 | 6002 | | CLEANING AND SEALING EXIST JOINTS(CL3) | LF | 1000.000 | |
| | | | | | | | | 1000.000 | | | 438 | 6004 | | CLEANING AND SEALING EXIST JOINTS(CL7) | LF | 1000.000 | |
| | | | | | | | | 1.000 | | | 500 | 6001 | | MOBILIZATION | LS | 1.000 | |
| | | | | | | | | 2.000 | | | 500 | 6001 | | MOBILIZATION (CALLOUT) | EA | 2.000 | |
| | | | | | | | | 12.000 | | | 502 | 6001 | 008 | BARRICADES, SIGNS AND TRAFFIC HANDLING | MO | 12.000 | |
| | | | | | | | | 5.000 | | | 514 | 6002 | | PERM CTB (SGL SLOPE) (TY 2) (42 ) | LF | 5.000 | |
| | | | | | | | | 50000.000 | | | 533 | 6001 | | RUMBLE STRIPS (SHOULDER) | LF | 50000.000 | |
| | | | | | | | | 25.000 | | | 540 | 6001 | 001 | MTL W-BEAM GD FEN (TIM POST) | LF | 25.000 | |
| | | | | | | | | 25.000 | | | 540 | 6003 | 001 | MTL THRIE-BEAM GD FEN (TIM POST) | LF | 25.000 | |
| | | | | | | | | 1.000 | | | 540 | 6006 | 001 | MTL BEAM GD FEN TRANS (THRIE-BEAM) | EA | 1.000 | |
| | | | | | | | | 1.000 | | | 540 | 6008 | 001 | MTL BEAM GD FEN TRANS (T101) | EA | 1.000 | |
| | | | | | | | | 25.000 | | | 540 | 6010 | 001 | MTL W-BEAM GD FEN ADJUSTMENT | LF | 25.000 | |
| | | | | | | | | 25.000 | | | 540 | 6011 | 001 | MTL THRIE-BEAM GD FEN ADJUSTMENT | LF | 25.000 | |
| | | | | | | | | 1.000 | | | 540 | 6013 | 001 | TRANSITION ADJUSTMENT | EA | 1.000 | |
| | | | | | | | | 25.000 | | | 540 | 6014 | 001 | SHORT RADIUS | LF | 25.000 | |
| | | | | | | | | 1.000 | | | 540 | 6016 | 001 | DOWNSTREAM ANCHOR TERMINAL SECTION | EA | 1.000 | |
| | | | | | | | | 25.000 | | | 542 | 6001 | | REMOVE METAL BEAM GUARD FENCE | LF | 25.000 | |
| | | | | | | | | 1.000 | | | 542 | 6002 | | REMOVE TERMINAL ANCHOR SECTION | EA | 1.000 | |
| | | | | | | | | 1.000 | | | 544 | 6004 | | GDRAIL END TRT(INST)(WOOD POST)(TY I) | EA | 1.000 | |
| | | | | | | | | 1.000 | | | 545 | 6005 | | CRASH CUSH ATTEN (REMOVE) | EA | 1.000 | |
| | | | | | | | | 600.000 | | | 636 | 6008 | 001 | REPLACE EXISTING ALUMINUM SIGNS(TY G) | SF | 600.000 | |
| | | | | | | | | 10.000 | | | 636 | 6009 | 001 | REPLACE EXISTING ALUMINUM SIGNS(TY O) | SF | 10.000 | |
| | | | | | | | | 15.000 | | | 644 | 6001 | | IN SM RD SN SUP&AM TY10BWG(1)SA(P) | EA | 15.000 | |
| | | | | | | | | 50.000 | | | 644 | 6004 | | IN SM RD SN SUP&AM TY10BWG(1)SA(T) | EA | 50.000 | |
| | | | | | | | | 10.000 | | | 644 | 6030 | | IN SM RD SN SUP&AM TYS80(1)SA(T) | EA | 10.000 | |
| | | | | | | | | 1.000 | | | 644 | 6031 | | IN SM RD SN SUP&AM TYS80(1)SA(T-2EXT) | EA | 1.000 | |
| | | | | | | | | 10.000 | | | 644 | 6033 | | IN SM RD SN SUP&AM TYS80(1)SA(U) | EA | 10.000 | |
| | | | | | | | | 2.000 | | | 644 | 6037 | | IN SM RD SN SUP&AM TYS80(1)SA(U-WC) | EA | 2.000 | |
| | | | | | | | | 15.000 | | | 644 | 6056 | | IN SM RD SN SUP&AM TYTWT(1)UA(P) | EA | 15.000 | |
| | | | | | | | | 8.000 | | | 644 | 6060 | | IN SM RD SN SUP&AM TYTWT(1)WS(P) | EA | 8.000 | |
| | | | | | | | | 1.000 | | | 644 | 6068 | | RELOCATE SM RD SN SUP&AM TY 10BWG | EA | 1.000 | |
| | | | | | | | | 1.000 | | | 644 | 6070 | | RELOCATE SM RD SN SUP&AM TY S80 | EA | 1.000 | |
| | | | | | | | | 1.000 | | | 644 | 6071 | | RELOCATE SM RD SN SUP&AM TY TWT | EA | 1.000 | |

## ESTIMATE & QUANTITY SHEET

| STATE DIST. NO. | COUNTY | PROJECT NO. | SHEET NO. |
|---|---|---|---|
| 10 | SMITH, ETC. | RMC 636743001 | 4A |

# ESTIMATE SUMMARY

PROJECT RMC 636743001
CONTROL 6367-43-001
TOTAL MAINTENANCE

| EST. | FINAL | EST. | FINAL | EST. | FINAL | EST. | FINAL | EST. | FINAL | ALT. | ITEM-CODE ITEM NO | DESC CODE | SP NO | DESCRIPTION | UNIT | TOTAL EST. | TOTAL FINAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 1.000 | | | 644 | 6076 | | REMOVE SM RD SN SUP&AM | EA | 1.000 | |
| | | | | | | | | 2000.000 | | | 647 | 6001 | 001 | INSTALL LRSS (STRUCT STEEL) | LB | 2000.000 | |
| | | | | | | | | 3.000 | | | 647 | 6003 | 001 | REMOVE LRSA | EA | 3.000 | |
| | | | | | | | | 8.000 | | | 647 | 6008 | 001 | REMOVE AND RESET LRSA | EA | 8.000 | |
| | | | | | | | | 450.000 | | | 658 | 6001 | | INSTL DEL ASSM (D-SW)SZ 1(FLX)GND | EA | 450.000 | |
| | | | | | | | | 500.000 | | | 658 | 6013 | | INSTL DEL ASSM (D-SW)SZ (BRF)CTB | EA | 500.000 | |
| | | | | | | | | 900.000 | | | 658 | 6015 | | INSTL DEL ASSM (D-SW)SZ (BRF)GF1 | EA | 900.000 | |
| | | | | | | | | 25.000 | | | 658 | 6016 | | INSTL DEL ASSM (D-SW)SZ (BRF)GF1 (BI) | EA | 25.000 | |
| | | | | | | | | 150.000 | | | 658 | 6018 | | INSTL DEL ASSM (D-SY)SZ 1(FLX)GND | EA | 150.000 | |
| | | | | | | | | 100.000 | | | 658 | 6026 | | INSTL DEL ASSM (D-SY)SZ (BRF)CTB | EA | 100.000 | |
| | | | | | | | | 300.000 | | | 658 | 6028 | | INSTL DEL ASSM (D-SY)SZ (BRF)GF1 | EA | 300.000 | |
| | | | | | | | | 75.000 | | | 658 | 6036 | | INSTL DEL ASSM (D-DW)SZ 1(FLX)GND | EA | 75.000 | |
| | | | | | | | | 25.000 | | | 658 | 6048 | | INSTL OM ASSM (OM-2Z)(FLX)GND | EA | 25.000 | |
| | | | | | | | | 25.000 | | | 658 | 6051 | | INSTL OM ASSM (OM-3L)(FLX)SRF | EA | 25.000 | |
| | | | | | | | | 25.000 | | | 658 | 6054 | | INSTL OM ASSM (OM-3R)(FLX)SRF | EA | 25.000 | |
| | | | | | | | | 350.000 | | | 658 | 6061 | | INSTL DEL ASSM (D-SW)SZ 1(BRF)GF2 | EA | 350.000 | |
| | | | | | | | | 25.000 | | | 658 | 6062 | | INSTL DEL ASSM (D-SW)SZ 1(BRF)GF2(BI) | EA | 25.000 | |
| | | | | | | | | 250.000 | | | 658 | 6064 | | INSTL DEL ASSM (D-SY)SZ 1(BRF)GF2 | EA | 250.000 | |
| | | | | | | | | 2200.000 | | | 662 | 6060 | | WK ZN PAV MRK REMOV (W)4"(BRK) | LF | 2200.000 | |
| | | | | | | | | 500.000 | | | 662 | 6064 | | WK ZN PAV MRK REMOV (W)6"(BRK) | LF | 500.000 | |
| | | | | | | | | 500.000 | | | 662 | 6093 | | WK ZN PAV MRK REMOV (Y)4"(BRK) | LF | 500.000 | |
| | | | | | | | | 40000.000 | | | 666 | 6035 | 007 | REFL PAV MRK TY I (W)8"(SLD)(090MIL) | LF | 40000.000 | |
| | | | | | | | | 500.000 | | | 666 | 6038 | 007 | REFL PAV MRK TY I (W)12"(LNDP)(090MIL) | LF | 500.000 | |
| | | | | | | | | 100.000 | | | 666 | 6158 | 007 | RE PV MRK TY I(BLACK)4"(SHADOW)(090MIL) | LF | 100.000 | |
| | | | | | | | | 5000.000 | | | 666 | 6161 | 007 | RE PV MRK TY I(BLACK)6"(SHADOW)(090MIL) | LF | 5000.000 | |
| | | | | | | | | 500.000 | | | 666 | 6167 | 007 | REFL PAV MRK TY II (W) 4" (BRK) | LF | 500.000 | |
| | | | | | | | | 7700.000 | | | 666 | 6170 | 007 | REFL PAV MRK TY II (W) 4" (SLD) | LF | 7700.000 | |
| | | | | | | | | 12500.000 | | | 666 | 6171 | 007 | REFL PAV MRK TY II (W) 6" (BRK) | LF | 12500.000 | |
| | | | | | | | | 26000.000 | | | 666 | 6174 | 007 | REFL PAV MRK TY II (W) 6" (SLD) | LF | 26000.000 | |
| | | | | | | | | 8000.000 | | | 666 | 6207 | 007 | REFL PAV MRK TY II (Y) 4" (SLD) | LF | 8000.000 | |
| | | | | | | | | 500.000 | | | 666 | 6208 | 007 | REFL PAV MRK TY II (Y) 6" (BRK) | LF | 500.000 | |
| | | | | | | | | 500.000 | | | 666 | 6210 | 007 | REFL PAV MRK TY II (Y) 6" (SLD) | LF | 500.000 | |
| | | | | | | | | 100.000 | | | 666 | 6224 | 007 | PAVEMENT SEALER 4" | LF | 100.000 | |
| | | | | | | | | 100.000 | | | 666 | 6225 | 007 | PAVEMENT SEALER 6" | LF | 100.000 | |
| | | | | | | | | 100.000 | | | 666 | 6226 | 007 | PAVEMENT SEALER 8" | LF | 100.000 | |
| | | | | | | | | 100.000 | | | 666 | 6228 | 007 | PAVEMENT SEALER 12" | LF | 100.000 | |
| | | | | | | | | 100.000 | | | 666 | 6230 | 007 | PAVEMENT SEALER 24" | LF | 100.000 | |
| | | | | | | | | 1.000 | | | 666 | 6231 | 007 | PAVEMENT SEALER (ARROW) | EA | 1.000 | |
| | | | | | | | | 1.000 | | | 666 | 6232 | 007 | PAVEMENT SEALER (WORD) | EA | 1.000 | |
| | | | | | | | | 1.000 | | | 666 | 6234 | 007 | PAVEMENT SEALER (DBL ARROW) | EA | 1.000 | |
| | | | | | | | | 10.000 | | | 666 | 6243 | 007 | PAVEMENT SEALER (YLD TRI) | EA | 10.000 | |
| | | | | | | | | 500.000 | | | 666 | 6298 | 007 | RE PM W/RET REQ TY I (W)4"(BRK)(060MIL) | LF | 500.000 | |
| | | | | | | | | 17500.000 | | | 666 | 6301 | 007 | RE PM W/RET REQ TY I (W)4"(SLD)(060MIL) | LF | 17500.000 | |
| | | | | | | | | 107000.000 | | | 666 | 6305 | 007 | RE PM W/RET REQ TY I (W)6"(BRK)(090MIL) | LF | 107000.000 | |
| | | | | | | | | 479000.000 | | | 666 | 6308 | 007 | RE PM W/RET REQ TY I (W)6"(SLD)(090MIL) | LF | 479000.000 | |
| | | | | | | | | 3400.000 | | | 666 | 6310 | 007 | RE PM W/RET REQ TY I (Y)4"(BRK)(060MIL) | LF | 3400.000 | |
| | | | | | | | | 25500.000 | | | 666 | 6313 | 007 | RE PM W/RET REQ TY I (Y)4"(SLD)(060MIL) | LF | 25500.000 | |
| | | | | | | | | 274000.000 | | | 666 | 6320 | 007 | RE PM W/RET REQ TY I (Y)6"(SLD)(090MIL) | LF | 274000.000 | |
| | | | | | | | | 20.000 | | | 668 | 6074 | | PREFAB PAV MRK TY C (W) (12") (SLD) | LF | 20.000 | |
| | | | | | | | | 1000.000 | | | 668 | 6076 | | PREFAB PAV MRK TY C (W) (24") (SLD) | LF | 1000.000 | |

## ESTIMATE & QUANTITY SHEET

| STATE DIST. NO. | COUNTY | PROJECT NO. | SHEET NO. |
|---|---|---|---|
| 10 | SMITH, ETC. | RMC 636743001 | 4B |

# ESTIMATE SUMMARY

| | | | | | | | | PROJECT RMC 636743001 | | ALT. | ITEM-CODE | | | DESCRIPTION | UNIT | TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | CONTROL 6367-43-001 | | | | | | | | | |
| | | | | | | | | TOTAL MAINTENANCE | | | | | | | | | |
| EST. | FINAL | EST. | FINAL | EST. | FINAL | EST. | FINAL | EST. | FINAL | | ITEM NO | DESC CODE | SP NO | | | EST. | FINAL |
| | | | | | | | | 5.000 | | | 668 | 6077 | | PREFAB PAV MRK TY C (W) (ARROW) | EA | 5.000 | |
| | | | | | | | | 1.000 | | | 668 | 6078 | | PREFAB PAV MRK TY C (W) (DBL ARROW) | EA | 1.000 | |
| | | | | | | | | 1.000 | | | 668 | 6084 | | PREFAB PAV MRK TY C (W) (NUMBER) | EA | 1.000 | |
| | | | | | | | | 5.000 | | | 668 | 6085 | | PREFAB PAV MRK TY C (W) (WORD) | EA | 5.000 | |
| | | | | | | | | 50.000 | | | 668 | 6092 | | PREFAB PAV MRK TY C (W) (36")(YLD TRI) | EA | 50.000 | |
| | | | | | | | | 100.000 | | | 672 | 6006 | | REFL PAV MRKR TY I-A | EA | 100.000 | |
| | | | | | | | | 700.000 | | | 672 | 6007 | | REFL PAV MRKR TY I-C | EA | 700.000 | |
| | | | | | | | | 100.000 | | | 672 | 6008 | | REFL PAV MRKR TY I-R | EA | 100.000 | |
| | | | | | | | | 3000.000 | | | 672 | 6009 | | REFL PAV MRKR TY II-A-A | EA | 3000.000 | |
| | | | | | | | | 15000.000 | | | 672 | 6010 | | REFL PAV MRKR TY II-C-R | EA | 15000.000 | |
| | | | | | | | | 23200.000 | | | 677 | 6002 | | ELIM EXT PAV MRK & MRKS (6") | LF | 23200.000 | |
| | | | | | | | | 50.000 | | | 677 | 6003 | | ELIM EXT PAV MRK & MRKS (8") | LF | 50.000 | |
| | | | | | | | | 50.000 | | | 677 | 6007 | | ELIM EXT PAV MRK & MRKS (24") | LF | 50.000 | |
| | | | | | | | | 1.000 | | | 677 | 6008 | | ELIM EXT PAV MRK & MRKS (ARROW) | EA | 1.000 | |
| | | | | | | | | 1.000 | | | 677 | 6009 | | ELIM EXT PAV MRK & MRKS (DBL ARROW) | EA | 1.000 | |
| | | | | | | | | 1.000 | | | 677 | 6012 | | ELIM EXT PAV MRK & MRKS (WORD) | EA | 1.000 | |
| | | | | | | | | 10.000 | | | 677 | 6019 | | ELIM EXT PAV MRK & MRKS (36")(YLD TRI) | EA | 10.000 | |
| | | | | | | | | 100.000 | | | 678 | 6001 | | PAV SURF PREP FOR MRK (4") | LF | 100.000 | |
| | | | | | | | | 100.000 | | | 678 | 6002 | | PAV SURF PREP FOR MRK (6") | LF | 100.000 | |
| | | | | | | | | 100.000 | | | 678 | 6004 | | PAV SURF PREP FOR MRK (8") | LF | 100.000 | |
| | | | | | | | | 100.000 | | | 678 | 6006 | | PAV SURF PREP FOR MRK (12") | LF | 100.000 | |
| | | | | | | | | 100.000 | | | 678 | 6008 | | PAV SURF PREP FOR MRK (24") | LF | 100.000 | |
| | | | | | | | | 1.000 | | | 678 | 6009 | | PAV SURF PREP FOR MRK (ARROW) | EA | 1.000 | |
| | | | | | | | | 1.000 | | | 678 | 6010 | | PAV SURF PREP FOR MRK (DBL ARROW) | EA | 1.000 | |
| | | | | | | | | 1.000 | | | 678 | 6009 | | PAV SURF PREP FOR MRK (ARROW) | EA | 1.000 | |
| | | | | | | | | 1.000 | | | 678 | 6010 | | PAV SURF PREP FOR MRK (DBL ARROW) | EA | 1.000 | |
| | | | | | | | | 1.000 | | | 678 | 6015 | | PAV SURF PREP FOR MRK (NUMBER) | EA | 1.000 | |
| | | | | | | | | 1.000 | | | 678 | 6016 | | PAV SURF PREP FOR MRK (WORD) | EA | 1.000 | |
| | | | | | | | | 10.000 | | | 678 | 6023 | | PAV SURF PREP FOR MRK (36")(YLD TRI) | EA | 10.000 | |
| | | | | | | | | 100.000 | | | 700 | 6001 | | POTHOLE REPAIR (STANDARD) | SY | 100.000 | |
| | | | | | | | | 10.000 | | | 700 | 6009 | | EMERGENCY MOBILIZATION | EA | 10.000 | |
| | | | | | | | | 20.000 | | | 712 | 6008 | | JT / CRCK SEAL (RUBBER - ASPHALT) | LMI | 20.000 | |
| | | | | | | | | 5270.000 | | | 730 | 6002 | | FULL - WIDTH MOWING | AC | 5270.000 | |
| | | | | | | | | 50.000 | | | 730 | 6003 | | SPOT MOWING | AC | 50.000 | |
| | | | | | | | | 166.000 | | | 731 | 6007 | | PAVEMENT EDGES, STRUCTURES & FIXTURES | MI | 166.000 | |
| | | | | | | | | 2650.000 | | | 731 | 6011 | | BROADCAST APPLICATION | AC | 2650.000 | |
| | | | | | | | | 100.000 | | | 735 | 6001 | | DEBRIS REMOVAL (CNTR MEDIANS/MAINLANES) | CYC | 100.000 | |
| | | | | | | | | 12.000 | | | 735 | 6003 | | DEBRIS REMOVAL (FRONTAGE ROADS) | CYC | 12.000 | |
| | | | | | | | | 12.000 | | | 735 | 6005 | | DEBRIS REMOVAL (ENTRANCE/EXIT RAMPS) | CYC | 12.000 | |
| | | | | | | | | 10.000 | | | 735 | 6007 | | DEBRIS REMOVAL (SPOT DEBRIS) | MI | 10.000 | |
| | | | | | | | | 5.000 | | | 738 | 6001 | | CLEANING / SWEEPING (CENTER MEDIAN) | CYC | 5.000 | |
| | | | | | | | | 5.000 | | | 738 | 6003 | | CLEANING / SWEEPING (OUTSIDE MAIN LANE) | CYC | 5.000 | |
| | | | | | | | | 5.000 | | | 738 | 6174 | | CLEAN/SWEEPING-DIRECT CONNECT-AREA(1) | CYC | 5.000 | |
| | | | | | | | | 10.000 | | | 740 | 6001 | | GRAFFITI REMOVAL (BLAST CLEANING) | SF | 10.000 | |
| | | | | | | | | 10.000 | | | 740 | 6002 | | GRAFFITI REMOVAL (PAINTING) | SF | 10.000 | |
| | | | | | | | | 10.000 | | | 740 | 6003 | | GRAFFITI REMOVAL (CHEMICAL CLEANING) | SF | 10.000 | |
| | | | | | | | | 15.000 | | | 752 | 6003 | | TREE TRIMMING / BRUSH REMOVAL | MI | 15.000 | |
| | | | | | | | | 50.000 | | | 752 | 6004 | | TREE TRIMMING / BRUSH REMOVAL(CHANNELS) | AC | 50.000 | |
| | | | | | | | | 3000.000 | | | 752 | 6005 | | TREE REMOVAL (4" - 12" DIA) | EA | 3000.000 | |
| | | | | | | | | 300.000 | | | 752 | 6006 | | TREE REMOVAL (12" - 18" DIA) | EA | 300.000 | |
| | | | | | | | | 150.000 | | | 752 | 6007 | | TREE REMOVAL (18" - 24" DIA) | EA | 150.000 | |
| | | | | | | | | 50.000 | | | 752 | 6008 | | TREE REMOVAL (24" - 30" DIA) | EA | 50.000 | |

ESTIMATE & QUANTITY SHEET

| STATE DIST. NO. | COUNTY | PROJECT NO. | SHEET NO. |
|---|---|---|---|
| 10 | SMITH, ETC. | RMC 636743001 | 4C |

# ESTIMATE SUMMARY

PROJECT RMC 636743001
CONTROL 6367-43-001
TOTAL MAINTENANCE

| EST. | FINAL | EST. | FINAL | EST. | FINAL | EST. | FINAL | EST. | FINAL | ALT. | ITEM-CODE ITEM NO | ITEM-CODE DESC CODE | ITEM-CODE SP NO | DESCRIPTION | UNIT | TOTAL EST. | TOTAL FINAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 20.000 | | | 752 | 6009 | | TREE REMOVAL (30" - 36" DIA) | EA | 20.000 | |
| | | | | | | | | 5.000 | | | 752 | 6010 | | TREE REMOVAL (36" - 42" DIA) | EA | 5.000 | |
| | | | | | | | | 2.000 | | | 752 | 6011 | | TREE REMOVAL (42" - 48" DIA) | EA | 2.000 | |
| | | | | | | | | 2.000 | | | 752 | 6012 | | TREE REMOVAL (48" - 60" DIA) | EA | 2.000 | |
| | | | | | | | | 1.000 | | | 752 | 6013 | | TREE REMOVAL (60" - 72" DIA) | EA | 1.000 | |
| | | | | | | | | 500.000 | | | 760 | 6001 | | DITCH CLEANING AND RESHAPING (FOOT) | LF | 500.000 | |
| | | | | | | | | 2000.000 | | | 770 | 6001 | | REPAIR RAIL ELEMENT (W - BEAM) | LF | 2000.000 | |
| | | | | | | | | 50.000 | | | 770 | 6002 | | REPAIR RAIL ELEMENT (THRIE - BEAM) | LF | 50.000 | |
| | | | | | | | | 10.000 | | | 770 | 6003 | | REP RAIL ELMNT(THRIE-BM TRANS TO W -BM) | LF | 10.000 | |
| | | | | | | | | 50.000 | | | 770 | 6010 | | REM / REPL TIMBER/STL POST W/O CONC FND | EA | 50.000 | |
| | | | | | | | | 25.000 | | | 770 | 6011 | | REM / REPL TIMBER / STL POST W/CONC FND | EA | 25.000 | |
| | | | | | | | | 100.000 | | | 770 | 6012 | | REM / REPL TIMBER POST W / O CONC FND | EA | 100.000 | |
| | | | | | | | | 1.000 | | | 770 | 6016 | | REPAIR STEEL POST WITH BASE PLATE | EA | 1.000 | |
| | | | | | | | | 125.000 | | | 770 | 6017 | | REALIGN POSTS | EA | 125.000 | |
| | | | | | | | | 40.000 | | | 770 | 6018 | | INSTALL BLOCKOUT (TYPE SPECIFIED) | EA | 40.000 | |
| | | | | | | | | 125.000 | | | 770 | 6019 | | REMOVE & REPLACE BLOCKOUT | EA | 125.000 | |
| | | | | | | | | 1500.000 | | | 770 | 6021 | | REPLACE SINGLE GDRAIL TERMINAL RAIL | LF | 1500.000 | |
| | | | | | | | | 200.000 | | | 770 | 6022 | | REPLACE SINGLE GDRAIL TERMINAL POST | EA | 200.000 | |
| | | | | | | | | 1.000 | | | 770 | 6024 | | REPLACE TERMINAL ANCHOR POSTS | EA | 1.000 | |
| | | | | | | | | 8.000 | | | 770 | 6027 | | REMOVE GDRAIL END TRT / REPL WITH SGT | EA | 8.000 | |
| | | | | | | | | 30.000 | | | 770 | 6028 | | REPL SINGLE GDRAIL TERM IMPACT HEAD | EA | 30.000 | |
| | | | | | | | | 8.000 | | | 770 | 6029 | | REM & RESET SGT IMPACT HEAD | EA | 8.000 | |
| | | | | | | | | 25.000 | | | 770 | 6030 | | REPLACE SGT CABLE ASSEMBLY | EA | 25.000 | |
| | | | | | | | | 25.000 | | | 770 | 6031 | | REPLACE SGT CABLE ANCHOR | EA | 25.000 | |
| | | | | | | | | 25.000 | | | 770 | 6032 | | REPLACE SGT STRUT | EA | 25.000 | |
| | | | | | | | | 125.000 | | | 770 | 6033 | | REPLACE SGT OBJECT MARKER | EA | 125.000 | |
| | | | | | | | | 1.000 | | | 774 | 6006 | | REPAIR (TRACC) | EA | 1.000 | |
| | | | | | | | | 1.000 | | | 774 | 6015 | | REPAIR (NARROW QUAD) | EA | 1.000 | |
| | | | | | | | | 5.000 | | | 774 | 6028 | | REPAIR (QUAD) (N) (BAY) | EA | 5.000 | |
| | | | | | | | | 1.000 | | | 774 | 6038 | | REMOVE AND REPLACE (FASTRACC) | EA | 1.000 | |
| | | | | | | | | 10.000 | | | 774 | 6052 | | REPAIR (FASTRACC) | LF | 10.000 | |
| | | | | | | | | 1.000 | | | 774 | 6055 | | REPAIR (FASTRACC) (BAY) | EA | 1.000 | |
| | | | | | | | | 15.000 | | | 776 | 6001 | | REPAIR (STEEL POST W/ W-BEAM - T101) | LF | 15.000 | |
| | | | | | | | | 15.000 | | | 776 | 6004 | | REPAIR (STL POST W/ DOUBLED W-BEAMS-T6) | LF | 15.000 | |
| | | | | | | | | 15.000 | | | 776 | 6032 | | REPAIR(STEEL POST W/ CHANNEL IRON RAIL) | LF | 15.000 | |
| | | | | | | | | 9196.000 | | | 3077 | 6022 | | SUPERPAVE MIXTURES SP-C SAC-A PG70-22 | TON | 9196.000 | |
| | | | | | | | | 8300.000 | | | 3077 | 6075 | | TACK COAT | GAL | 8300.000 | |
| | | | | | | | | 150.000 | | | 6000 | 6003 | | REPLACE ABOVE-GROUND CONDUIT | LF | 150.000 | |
| | | | | | | | | 100.000 | | | 6000 | 6006 | | REPLACE UNDERGROUND CONDUIT | LF | 100.000 | |
| | | | | | | | | 4500.000 | | | 6000 | 6009 | | REPLACE CONDUCTOR | LF | 4500.000 | |
| | | | | | | | | 10.000 | | | 6000 | 6016 | | INSTALL ELECTRICAL SPLICE | EA | 10.000 | |
| | | | | | | | | 100.000 | | | 6000 | 6020 | | ROAD BORE | LF | 100.000 | |
| | | | | | | | | 5.000 | | | 6000 | 6023 | | REPLACE ROADWAY ILLUM ASSEMBLY (HPS) | EA | 5.000 | |
| | | | | | | | | 5.000 | | | 6000 | 6026 | | REPLACE ROADWAY ILLUM ASSEMBLY (LED) | EA | 5.000 | |
| | | | | | | | | 50.000 | | | 6000 | 6042 | | REPLACE HIGH MAST LUMINAIRES | EA | 50.000 | |
| | | | | | | | | 2.000 | | | 6000 | 6043 | | REPLACE LUMINAIRE POLE | EA | 2.000 | |
| | | | | | | | | 1.000 | | | 6000 | 6044 | | REPLACE LUMINAIRE ARMS | EA | 1.000 | |
| | | | | | | | | 5.000 | | | 6000 | 6046 | | MAINTAIN HIGH MAST ILLUMINATION | EA | 5.000 | |
| | | | | | | | | 1.000 | | | 6000 | 6052 | | REPLACE ELECTRICAL SERVICE | EA | 1.000 | |
| | | | | | | | | 1.000 | | | 6000 | 6053 | | REPLACE TIMBER SERVICE POLE | EA | 1.000 | |

## ESTIMATE & QUANTITY SHEET

| STATE DIST. NO. | COUNTY | PROJECT NO. | SHEET NO. |
|---|---|---|---|
| 10 | SMITH, ETC. | RMC 636743001 | 4D |

# ESTIMATE SUMMARY

| EST. | FINAL | EST. | FINAL | EST. | FINAL | EST. | FINAL | PROJECT RMC 636743001<br>CONTROL 6367-43-001<br>TOTAL MAINTENANCE<br>EST. | FINAL | ALT. | ITEM-CODE<br>ITEM NO | DESC CODE | SP NO | DESCRIPTION | UNIT | TOTAL<br>EST. | FINAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 1.000 | | | 6000 | 6056 | | INSTALL GROUND BOX | EA | 1.000 | |
| | | | | | | | | 1.000 | | | 6000 | 6059 | | INSTALL FOUNDATION | EA | 1.000 | |
| | | | | | | | | 1.000 | | | 6000 | 6061 | | REPLACE TRANSFORMER BASE | EA | 1.000 | |
| | | | | | | | | 1.000 | | | 6000 | 6062 | | REPLACE TRANSFORMER BASE COVER | EA | 1.000 | |
| | | | | | | | | 3.000 | | | 6000 | 6072 | | REPLACE LAMP (POLE MOUNT FIXTURE) | EA | 3.000 | |
| | | | | | | | | 1.000 | | | 6000 | 6073 | | REPLACE LAMP (UNDERPASS FIXTURE) | EA | 1.000 | |
| | | | | | | | | 1.000 | | | 6000 | 6074 | | REPLACE LAMP (WALL PACK FIXTURE) | EA | 1.000 | |
| | | | | | | | | 1.000 | | | 6000 | 6076 | | REPLACE WALL PACK LUMINAIRE | EA | 1.000 | |
| | | | | | | | | 50.000 | | | 6000 | 6082 | | REPLACE FUSE | EA | 50.000 | |
| | | | | | | | | 15.000 | | | 6000 | 6084 | | REPLACE BREAKAWAY FUSE HOLDER | EA | 15.000 | |
| | | | | | | | | 1.000 | | | 6000 | 6093 | | REPLACE HAND-OFF-AUTO SWITCH | EA | 1.000 | |
| | | | | | | | | 1.000 | | | 6000 | 6094 | | REPLACE CONTACTOR | EA | 1.000 | |
| | | | | | | | | 1.000 | | | 6000 | 6097 | | REPLACE BREAKER PANEL | EA | 1.000 | |
| | | | | | | | | 1.000 | | | 6000 | 6099 | | REPLACE CIRCUIT BREAKER | EA | 1.000 | |
| | | | | | | | | 25.000 | | | 6000 | 6108 | | REPLACE LUMINAIRES | EA | 25.000 | |
| | | | | | | | | 10.000 | | | 6000 | 6109 | | REPLACE PHOTOCELL | EA | 10.000 | |
| | | | | | | | | 50.000 | | | 6001 | 6001 | | PORTABLE CHANGEABLE MESSAGE SIGN | DAY | 50.000 | |
| | | | | | | | | 1.000 | | | 6119 | 6023 | | REPLACE OF SIGNAL HEAD ASSM | EA | 1.000 | |
| | | | | | | | | 900.000 | | | 6185 | 6002 | 002 | TMA (STATIONARY) | DAY | 900.000 | |

ESTIMATE & QUANTITY SHEET

| STATE DIST. NO. | COUNTY | PROJECT NO. | SHEET NO. |
|---|---|---|---|
| 10 | SMITH, ETC. | RMC 636743001 | 4E |

## BASIS OF ESTIMATE

| | ITEM | DESCRIPTION | RATE | UNITS | UNIT | QUANTITY | UNIT |
|---|---|---|---|---|---|---|---|
| ① | 315 | FOG SEAL (SS-1H) | 0.09 GAL/SY | 2,222 | SY | 200 | GAL |
| ① | 342 | PFC (ASPHALT) PG76-22 | 9 LBS./SY | 16,109 | SY | 73 | TON |
| | | PFC-C (AGGREGATE) (PG76-MIX) SAC-A | 141 LBS./SY | 16,109 | SY | 1,136 | TON |
| ① | 344 | SUPERPAVE MIXTURES SP-C SAC-A PG76-22 (2") | 220 LBS./SY | 83,601 | SY | 9,196 | TON |
| ① | 348 | THPFC (MEMBRANE) | .3 GAL/SY | 16,109 | SY | 4,833 | GAL |
| ① | 500 | MOBILIZATION | | | | 1 | LS |
| | 502 | BARRICADES, SIGNS AND TRAFFIC HANDLING (IH-20) | | | | 12 | MO |
| | 6001 | PORTABLE CHANGEABLE MESSAGE SIGN | | | | 50 | DAY |
| | 6185 | TMA (STATIONARY) | | | | 900 | DAY |

① FOR CONTRACTOR INFORMATION ONLY.

## ② ROADWAY SUMMARY

| | ITEM | DESCRIPTION | UNIT | QUANTITY |
|---|---|---|---|---|
| | 132 | EMBANKMENT TY B (VEHICLE) (ORD COMP) | CY | 250 |
| ④ | 134 | BACKFILL (TY A) | LF | 10,000 |
| ③ | 315 | FOG SEAL (SS-IH) | GAL | 200 |
| | 342 | PFC (ASPHALT) PG76-22 | TON | 73 |
| | 342 | PFC-C (AGGREGATE) (PG76 MIX) SAC-A | TON | 1,136 |
| | 348 | THPFC (MEMBRANE) | GAL | 4,833 |
| | 351 | FLEXIBLE PAVEMENT STRUCTURE REPAIR (5") | SY | 500 |
| | 354 | PLANE ASPH CONC PAV (0" TO 2") | SY | 71,978 |
| | 354 | PLANE ASPH CONC PAV (4" TO 6") | SY | 5,000 |
| | 361 | FULL-DEPTH REPAIR CRCP (10") | SY | 500 |
| | 401 | FLOWABLE BACKFILL | CY | 200 |
| | 432 | RIPRAP (STONE COMMON) (DRY) (18 IN) | CY | 100 |
| | 438 | CLEAN AND SEAL EXISTING JOINTS (CL-3) | LF | 1,000 |
| | 438 | CLEAN AND SEAL EXISTING JOINTS (CL-7) | LF | 1,000 |
| | 500 | MOBILIZATION (CALLOUT) | EA | 2 |
| ⑤ | 533 | RUMBLE STRIPS (SHOULDER) | LF | 50,000 |
| | 700 | POTHOLE REPAIR STANDARD | SY | 100 |
| | 700 | EMERGENCY MOBILIZATION | EA | 10 |
| ⑥ | 712 | JT/CRCK SEAL (RUBBER-ASPHALT) | LMI | 20 |
| | 760 | DITCH CLEANING AND RESHAPING (FOOT) | LF | 500 |
| | 3077 | SUPERPAVE MIXTURE SP-C SAC-A PG70-22 | TON | 9,196 |
| | 3077 | TACK COAT | GAL | 8,300 |

② TxDOT RESERVES THE RIGHT TO OVER/UNDERRUN THESE QUANTITIES.

③ APPLY EMULSION TO BACKFILL AREAS, THIS WILL BE SUBSIDIARY TO ITEM 134 BACKFILL.

④ TxDOT WILL PROVIDE MATERIAL TO BE USED FOR ITEM 134 BACKFILL PAVEMENT EDGES.

⑤ ITEM 500 "MOBILIZATION (CALLOUT)" IS TO BE USED FOR THE VARIOUS CALLOUT LOCATIONS.

⑥ ITEM 700 "EMERGENCY MOBILIZATION" IS TO BE USED FOR POTHOLE REPAIR CALLOUTS.

# QUANTITY SUMMARIES



Texas Department of Transportation



FILENAME /

| FED.RD. DIV.NO. | PROJECT NO. | | SHEET NO. |
|---|---|---|---|
| 6 | RMC 6367-43-001 | | 5A |
| STATE | DIST. | COUNTY | |
| TEXAS | TYLER | SMITH, ETC | |
| CONT. | SECT. | JOB | HIGHWAY NO. |
| 6367 | 43 | 001 | IH-20 |

## GUARD RAIL SUMMARY

| ITEM | DESCRIPTION | UNIT | QUNTITY |
|---|---|---|---|
| 429 | CONC STR REPAIR (VERTICAL & OVERHEAD) | SF | 10 |
| 429 | CONC STR REPAIR (STANDARD) | SF | 20 |
| 432 | RIPRAP (MOW STRIP) (4IN) | CY | 100 |
| 514 | PERM CTB (SGL SLOPE) (TY 2) (42) | LF | 5 |
| 540 | MTL W-BEAM GD FEN (TIM POST) | LF | 25 |
| 540 | MTL THRIE-BEAM GD FEN (TIM POST) | LF | 25 |
| 540 | MTL BEAM GD FEN TRANS (THRIE-BEAM) | EA | 1 |
| 540 | MTL BEAM GD FEN TRANS (T101) | EA | 1 |
| 540 | MTL W-BEAM GD FEN ADJUSTMENT | LF | 25 |
| 540 | MTL THRIE-BEAM GD FEN ADJUSTMENT | LF | 25 |
| 540 | TRANSITION ADJUSTMENT | EA | 1 |
| 540 | SHORT RADIOUS | LF | 25 |
| 540 | DOWNSTREAM ANCHOR TERMINAL SECTION | EA | 1 |
| 542 | REMOVING METAL BEAM GUARD FENCE | LF | 25 |
| 542 | REMOVING TERMINAL ANCHOR SECTION | EA | 1 |
| 544 | GDRAIL END TRT(INST)(WOOD POST)(TY I) | EA | 1 |
| 545 | CRASH CUSH ATTEN (REMOVE) | EA | 1 |
| 770 | REPAIR RAIL ELEMENT (W-BEAM) | LF | 2,000 |
| 770 | REPAIR RAIL ELEMENT (THRIE-BEAM) | LF | 50 |
| 770 | REP RAIL ELMNT(THRIE-BM TRANS TO W-BM) | LF | 10 |
| 770 | REM/REPL TIMBER/STL POST W/O CONC FND | EA | 50 |
| 770 | REM/REPL TIMBER/STL POST W/ CONC FND | EA | 25 |
| 770 | REM/REPL TIMBER POST W/O CONC FND | EA | 100 |
| 770 | REPAIR STEEL POST WITH BASE PLATE | EA | 1 |
| 770 | REALIGN POSTS | EA | 125 |
| 770 | INSTALL BLOCKOUT | EA | 40 |
| 770 | REMOVE & REPLACE BLOCKOUT | EA | 125 |
| 770 | REPLACE SINGLE GDRAIL TERMINAL RAIL | LF | 1,500 |
| 770 | REPLACE SINGLE GDRAIL TERMINAL POST | EA | 200 |
| 770 | REPLACE TERMINAL ANCHOR POSTS | EA | 1 |
| 770 | REMOVE GDRAIL END TRT/ REPL WITH SGT | EA | 8 |
| 770 | REPL SINGLE GDRAIL TERM IMPACT HEAD | EA | 30 |
| 770 | REM & RESET SGT IMPACT HEAD | EA | 8 |
| 770 | REPLACE SGT CABLE ASSEMBLY | EA | 25 |
| 770 | REPLACE SGT CABLE ANCHOR | EA | 25 |
| 770 | REPLACE SGT STRUT | EA | 25 |
| 770 | REPLACE SGT OBJECT MARKER | EA | 125 |
| 774 | REPAIR (TRACC) | EA | 1 |
| 774 | REPAIR (NARROW QUAD) | EA | 1 |
| 774 | REPAIR (QUAD)(N)(BAY) | EA | 5 |
| 774 | REMOVE AND REPLACE (FASTRACC) | EA | 1 |
| 774 | REPAIR (FASTRACC) | EA | 10 |
| 774 | REPAIR (FASTRACC)(BAY) | EA | 1 |
| 776 | REPAIR (STEEL POST W/ W-BEAM-T101) | LF | 15 |
| 776 | REPAIR(STL POST W/DOUBLED W-BEAMS-T6) | LF | 15 |
| 776 | REPAIR (STEEL POST W/CHANNEL IRON RAIL) | LF | 15 |

## ⑧ GUIDE SIGNS

| ITEM | DESCRIPTION | UNIT | QUANTITY |
|---|---|---|---|
| 416 | DRILL SHAFT (24 IN) | LF | 10 |
| 416 | DRILL SHAFT (SIGN MTS)(12 IN) | LF | 20 |
| 636 | REPLACE EXISTING ALUMINUM SIGNS (TY G) | SF | 600 |
| 636 | REPLACE EXISTING ALUMINUM SIGNS (TY O) | SF | 10 |
| 644 | IN SM RD SN SUP&AM TY10BWG(1)SA(P) | EA | 15 |
| 644 | INS SM RD SN SUP&AM TY 10BWG(1) SA(T) | EA | 50 |
| 644 | INS SM RD SN SUP&AM TY S80(1) SA(T) | EA | 10 |
| 644 | IN SM RD SN SUP&AM TYS80(1)SA(T-2EXT) | EA | 1 |
| 644 | IN SM RD SN SUP&AM TYS80(1)SA(U) | EA | 10 |
| 644 | IN SM RD SN SUP&AM TYS80(1)SA(U-WC) | EA | 2 |
| 644 | IN SM RD SN SUP&AM TYTWT(1)UA(P) | EA | 15 |
| 664 | IN SM RD SN SUP&AM TYTWT(1)WS(P) | EA | 8 |
| 644 | RELOCATE SM RD SN SUP & AM TY 10BWG | EA | 1 |
| 644 | RELOCATE SM RD SN SUP & AM TY S80 | EA | 1 |
| 644 | RELOCATE SM RD SN SUP & AM TY TWT | EA | 1 |
| 644 | REMOVE SM RD SN SUP & AM | EA | 1 |
| 647 | INSTALL LRSS (STRUCT STEEL) | LB | 2,000 |
| 647 | REMOVE LRSA | EA | 3 |
| 647 | REMOVE AND RESET LSRA | EA | 8 |

⑧ TxDOT WILL PROVIDE ALL ALUMINUM SIGNS FOR THIS PROJECT.

# QUANTITY SUMMARIES



Texas Department of Transportation



FILENAME /

| FED.RD. DIV.NO. | PROJECT NO. | | SHEET NO. |
|---|---|---|---|
| 6 | RMC 6367-43-001 | | 5B |
| STATE | DIST. | COUNTY | |
| TEXAS | TYLER | SMITH, ETC | |
| CONT. | SECT. | JOB | HIGHWAY NO. |
| 6367 | 43 | 001 | IH-20 |

## LONG LINE

| | ITEM | DESCRIPTION | UNIT | QUANTITY |
|---|---|---|---|---|
| | 662 | WK ZN PAV MRK REMOV (W) 4" (BRK) | LF | 2,200 |
| | 662 | WK ZN PAV MRK REMOV (W) 6" (BRK) | LF | 500 |
| | 662 | WK ZN PAV MRK REMOV (Y) 4" (BRK) | LF | 500 |
| | 666 | REFL PAV MRK TY I (W) 8" (SLD)(090MIL) | LF | 40,000 |
| | 666 | REFL PAV MRK TY I (W) 12"(LNDP)(090MIL | LF | 500 |
| | 666 | REF PAV MRK TY II (W) 4" (BRK) | LF | 500 |
| | 666 | REF PAV MRK TY II (W) 4" (SLD) | LF | 7,700 |
| | 666 | REF PAV MRK TY II (W) 6" (BRK) | LF | 12,500 |
| | 666 | REF PAV MRK TY II (W) 6" (SLD) | LF | 26,000 |
| | 666 | REF PAV MRK TY II (Y) 4" (SLD) | LF | 8,000 |
| | 666 | REF PAV MRK TY II (Y) 6" (BRK) | LF | 500 |
| | 666 | REF PAV MRK TY II (Y) 6" (SLD) | LF | 500 |
| | 666 | RE PM W/RET REQ TY I (W) 4" (BRK)(060MIL) | LF | 500 |
| | 666 | RE PM W/RET REQ TY I (W) 4" (SLD)(060MIL) | LF | 17,500 |
| | 666 | RE PM W/RET REQ TY I (W) 6" (BRK)(090MIL) | LF | 107,000 |
| | 666 | RE PM W/RET REQ TY I (W) 6" (SLD)(090MIL) | LF | 479,000 |
| | 666 | RE PM W/RET REQ TY I (Y) 4" (BRK)(060MIL) | LF | 3,400 |
| | 666 | RE PM W/RET REQ TY I (Y) 4" (SLD)(060MIL) | LF | 25,500 |
| | 666 | RE PM W/RET REQ TY I (Y) 4" (SLD)(090MIL) | LF | 274,000 |
| ⑨ | 677 | ELIM EXT PAV MRK & MRKS ( 6") | LF | 23,200 |
| ⑨ | 677 | ELIM EXT PAV MRK & MRKS ( 8") | LF | 50 |

⑨ WILL BE ELIMINATING PROFILE ON CONCRETE WITH WATER BLAST METHOD

## PAVEMENT PREP SUMMARY

| ITEM | DESCRIPTION | UNIT | QUANTITY |
|---|---|---|---|
| 666 | RE PV MRK TY I (BLACK) 4" (SHADOW) (090MIL) | LF | 100 |
| 666 | RE PV MRK TY I (BLACK) 6" (SHADOW) (090MIL) | LF | 5,000 |
| 666 | PAVEMENT SEALER 4" | LF | 100 |
| 666 | PAVEMENT SEALER 6" | LF | 100 |
| 666 | PAVEMENT SEALER 8" | LF | 100 |
| 666 | PAVEMENT SEALER 12" | LF | 100 |
| 666 | PAVEMENT SEALER 24" | LF | 100 |
| 666 | PAVEMENT SEALER (ARROW) | EA | 1 |
| 666 | PAVEMENT SEALER (WORD) | EA | 1 |
| 666 | PAVEMENT SEALER (DBL ARROW) | EA | 1 |
| 666 | PAVEMENT SEALER (YLD TRI) | EA | 10 |
| 678 | PAV SURF PREP FOR MRK ( 4") | LF | 100 |
| 678 | PAV SURF PREP FOR MRK ( 6") | LF | 100 |
| 678 | PAV SURF PREP FOR MRK ( 8") | LF | 100 |
| 678 | PAV SURF PREP FOR MRK (12") | LF | 100 |
| 678 | PAV SURF PREP FOR MRK (24") | LF | 100 |
| 678 | PAV SURF PREP FOR MRK (ARROW) | EA | 1 |
| 678 | PAV SURF PREP FOR MRK (DBL ARROW) | EA | 1 |
| 678 | PAV SURF PREP FOR MRK (NUMBER) | EA | 1 |
| 678 | PAV SURF PREP FOR MRK (WORD) | EA | 1 |
| 678 | PAV SURF PREP FOR MRK (36") (YLD TRI) | EA | 10 |

## SHORT LINE

| | ITEM | DESCRIPTION | UNIT | QUANTITY |
|---|---|---|---|---|
| | 666 | PREFAB PAV MRK TY C (W) (12") (SLD) | LF | 20 |
| | 666 | PREFAB PAV MRK TY C (W) (24") (SLD) | LF | 1,000 |
| | 666 | PREFAB PAV MRK TY C (W) (ARROW) | EA | 5 |
| | 666 | PREFAB PAV MRK TY C (W) (DBL ARROW) | EA | 1 |
| | 666 | PREFAB PAV MRK TY C (W) (NUMBER) | EA | 1 |
| | 668 | PREFAB PAV MRK TY C (W) (WORD) | EA | 5 |
| | 668 | PREFAB PAV MRK TY C (W) (36")(YLD TRI) | EA | 50 |
| ⑨ | 677 | ELIM EXT PAV MRK & MRKS (24") | LF | 50 |
| ⑨ | 677 | ELIM EXT PAV MRK & MRKS (ARROW) | EA | 1 |
| ⑨ | 677 | ELIM EXT PAV MRK & MRKS (DBL ARROW) | EA | 1 |
| ⑨ | 677 | ELIM EXT PAV MRK & MRKS (WORD) | EA | 1 |
| ⑨ | 677 | ELIM EXT PAV MRK & MRKS (36")(YLD TRI) | EA | 10 |

⑨ WILL BE ELIMINATING PROFILE ON CONCRETE WITH WATER BLAST METHOD

## RAISED PAVEMENT MARKER

| ITEM | DESCRIPTION | UNIT | QUANTITY |
|---|---|---|---|
| 672 | REFL PAV MRKR TY I-A | EA | 100 |
| 672 | REFL PAV MRKR TY I-C | EA | 700 |
| 672 | REFL PAV MRKR TY I-R | EA | 100 |
| 672 | REFL PAV MRKR TY II-A-A | EA | 3,000 |
| 672 | REFL PAV MRKR TY II-C-R | EA | 15,000 |





FILENAME /

| FED.RD. DIV.NO. | PROJECT NO. | | SHEET NO. |
|---|---|---|---|
| 6 | RMC 6367-43-001 | | 5C |
| STATE | DIST. | COUNTY | |
| TEXAS | TYLER | SMITH, ETC | |
| CONT. | SECT. | JOB | HIGHWAY NO. |
| 6367 | 43 | 001 | IH-20 |

# QUANTITY SUMMARIES

## DELINEATOR & OBJECT MARKER SUMMARY

| ITEM | DESCRIPTION | UNIT | QUANTITY |
|---|---|---|---|
| 658 | INSTL DEL ASSM (D-SW)SZ 1(FLX)GND | EA | 450 |
| 658 | INSTL DEL ASSM (D-SW)SZ 1(BRF)CTB | EA | 500 |
| 658 | INSTL DEL ASSM (D-SW)SZ (BRF)GF1 | EA | 900 |
| 658 | INSTL DEL ASSM (D-SW)SZ (BRF)GF1(BI) | EA | 25 |
| 658 | INSTL DEL ASSM (D-SY)SZ 1(FLX)GND | EA | 150 |
| 658 | INSTL DEL ASSM (D-SY)SZ (BRF)CTB | EA | 100 |
| 658 | INSTL DEL ASSM (D-SY)SZ (BRF)GF1 | EA | 300 |
| 658 | INSTL DEL ASSM (D-DW)SZ 1(FLX)GND | EA | 75 |
| 658 | INSTL OM ASSM (OM-2Z)(FLX)GND | EA | 25 |
| 658 | INSTL OM ASSM (OM-3L)(FLX)SRF | EA | 25 |
| 658 | INSTL OM ASSM (OM-3R)(FLX)SRF | EA | 25 |
| 658 | INSTL DEL ASSM (D-SW)SZ 1(BRF)GF2 | EA | 350 |
| 658 | INSTL DEL ASSM (D-SW)SZ (BRF)GF2(BI) | EA | 25 |
| 658 | INSTL DEL ASSM (D-SY)SZ 1(BRF)GF2 | EA | 250 |

## MOWING

| ITEM | DESCRIPTION | UNIT | QUANTITY |
|---|---|---|---|
| 730 | FULL-WIDTH MOWING | AC | 5,270 |
| 730 | SPOT MOWING | AC | 50 |

## HERBICIDE SUMMARY

| | ITEM | DESCRIPTION | UNIT | QUANTITY |
|---|---|---|---|---|
| | 731 | PAVEMENT EDGES, STRUCTURES & FIXTURES | MI | 166 |
| (10) | 731 | BROADCAST APPLICATION | AC | 2,650 |

(10) THE METHOD OF MEASURE FOR THIS ITEM WILL BE BY THE CENTERLINE MILE.

## DEBRIS REMOVAL

| ITEM | DESCRIPTION | UNIT | QUANTITY |
|---|---|---|---|
| 735 | DEBRIS REMOVAL (CNTR MEDIANS/MAINLANES) | CYC | 100 |
| 735 | DEBRIS REMOVAL (FRONTAGE ROADS) | CYC | 12 |
| 735 | DEBRIS REMOVAL (ENTRANCE/EXIT RAMPS) | CYC | 12 |
| 735 | DEBRIS REMOVAL (SPOT DEBRIS) | MI | 10 |

## SWEEPING

| ITEM | DESCRIPTION | UNIT | QUANTITY |
|---|---|---|---|
| 738 | CLEANING/SWEEPING (CENTER MEDIAN) | CYC | 5 |
| 738 | CLEANING/SWEEPING (OUTSIDE MAIN LANE) | CYC | 5 |
| 738 | CLEANING / SWEEPING (DIRECT CONNECTOR) | CYC | 5 |

## GRAFFITI REMOVAL

| ITEM | DESCRIPTION | UNIT | QUANTITY |
|---|---|---|---|
| 740 | GRAFFITI REMOVAL (BLAST CLEANING) | SF | 10 |
| 740 | GRAFFITI REMOVAL (PAINTING) | SF | 10 |
| 740 | GRAFFITI REMOVAL (CHEMICAL CLEANING) | SF | 10 |

## TREE TRIMMING & REMOVAL SUMMARY

| ITEM | DESCRIPTION | UNIT | QUANTITY |
|---|---|---|---|
| 752 | TREE TRIMMING/BRUSH REMOVAL | MI | 15 |
| 752 | TREE TRIMMING/BRUSH REMOVAL (CHANNEL) | AC | 50 |
| 752 | TREE REMOVAL (4"-12" DIA) | EA | 3000 |
| 752 | TREE REMOVAL (12"-18" DIA) | EA | 300 |
| 752 | TREE REMOVAL (18"-24" DIA) | EA | 150 |
| 752 | TREE REMOVAL (24"-30" DIA) | EA | 50 |
| 752 | TREE REMOVAL (30"-36" DIA) | EA | 20 |
| 752 | TREE REMOVAL (36"-42" DIA) | EA | 5 |
| 752 | TREE REMOVAL (42"-48" DIA) | EA | 2 |
| 752 | TREE REMOVAL (48"-60" DIA) | EA | 2 |
| 752 | TREE REMOVAL (60"-72" DIA) | EA | 1 |



Texas Department of Transportation



FILENAME /

| FED.RD. DIV.NO. | PROJECT NO. | | SHEET NO. |
|---|---|---|---|
| 6 | RMC 6367-43-001 | | 5D |
| STATE | DIST. | COUNTY | |
| TEXAS | TYLER | SMITH, ETC | |
| CONT. | SECT. | JOB | HIGHWAY NO. |
| 6367 | 43 | 001 | IH-20 |

# QUANTITY SUMMARIES

## ILLUMINATION SUMMARY

| ITEM | DESCRIPTION | UNIT | QUANTITY |
|---|---|---|---|
| 6000 | REPLACE ABOVE - GROUND CONDUIT | LF | 150 |
| 6000 | REPLACE UNDERGROUND CONDUIT | LF | 100 |
| 6000 | REPLACE CONDUCTOR | LF | 4,500 |
| 6000 | INSTALL ELECTRICAL SPICE | EA | 10 |
| 6000 | ROAD BORE | LF | 100 |
| 6000 | REPLACE ROADWAY ILLUM ASSEMBLY (HPS) | EA | 5 |
| 6000 | REPLACE ROADWAY ILLUM ASSEMBLY (LED) | EA | 5 |
| 6000 | REPLACE HIGH MAST LUMINAIRES | EA | 50 |
| 6000 | REPLACE LUMINAIRE POLE | EA | 2 |
| 6000 | REPLACE LUMINAIRE ARMS | EA | 1 |
| 6000 | MAINTAIN HIGH MAST ILLUMINATION | EA | 5 |
| 6000 | REPLACE ELECTRICAL SERVICE | EA | 1 |
| 6000 | REPLACE TIMBER SERVICE POLE | EA | 1 |
| 6000 | INSTALL GROUND BOX | EA | 1 |
| 6000 | INSTALL FOUNDATION | EA | 1 |
| 6000 | REPLACE TRANSFORMER BASE | EA | 1 |
| 6000 | REPLACE TRANSFORMER BASE COVER | EA | 1 |
| 6000 | REPLACE LAMP (POLE MOUNT FIXTURE) | EA | 3 |
| 6000 | REPLACE LAMP (UNDERPASS FIXTURE) | EA | 1 |
| 6000 | REPLACE LAMP (WALL PACK FIXTURE) | EA | 1 |
| 6000 | REPLACE WALL PACK LUMINAIRE | EA | 1 |
| 6000 | REPLACE FUSE | EA | 50 |
| 6000 | REPLACE BREAKAWAY FUSE HOLDER | EA | 15 |
| 6000 | REPLACE HAND - OFF - AUTO SWITCH | EA | 1 |
| 6000 | REPLACE CONTACTOR | EA | 1 |
| 6000 | REPLACE BREAKER PANEL | EA | 1 |
| 6000 | REPLACE CIRCUIT BREAKER | EA | 1 |
| 6000 | REPLACE LUMINAIRES | EA | 25 |
| 6000 | REPLACE PHOTO CELL | EA | 10 |
| 6119 | REPLACE OF SIGNAL HEAD ASSM | EA | 1 |

# QUANTITY SUMMARIES





FILENAME /

| FED.RD. DIV.NO. | PROJECT NO. | | SHEET NO. |
|---|---|---|---|
| 6 | RMC 6367-43-001 | | 5E |
| STATE | DIST. | COUNTY | |
| TEXAS | TYLER | SMITH, ETC | |
| CONT. | SECT. | JOB | HIGHWAY NO. |
| 6367 | 43 | 001 | IH-20 |

## ⑦ MILL AND INLAY LOCATION SUMMARY

| DESCRIPTION | LENGTH | WIDTH | SQUARE YARDS | COMMENTS |
|---|---|---|---|---|
| | | | | |
| GREGG COUNTY | | | | |
| E. SERVICE RD. FROM FM 2087 TO END OF STATE MAINT. | 7,320 | 11 | 8,947 | 2" SUPERPAVE - OVERLAY ONLY |
| W. SERVICE RD. FROM FM 2087 TO END OF STATE MAINT. | 5,000 | 11 | 6,111 | 2" SUPERPAVE - OVERLAY ONLY |
| E. SERVICE RD. FROM SH 31 TO END OF STATE MAINT. | 4,000 | 11 | 4,889 | 2" SUPERPAVE - OVERLAY ONLY |
| E. SERVICE RD. FROM SH 31 TO END OF STATE MAINT. | 6,370 | 11 | 7,786 | 2" SUPERPAVE - OVERLAY ONLY |
| WEST OF SH 135 BRIDGE TO END OF ON RAMP SH 135 | 1,500 | 12 | 2,000 | 1.5" PFC AND OR 4-6" SUPERPAVE |
| OFF RAMP FM 3053 TO END OF ON RAMP FM 3053 | 1,300 | 12 | 1,733 | 1.5" PFC AND OR 4-6" SUPERPAVE |
| WEST OF SH 135 BRIDGE TO END OF ON RAMP SH 135 | 1,500 | 12 | 2,000 | 1.5" PFC AND OR 4-6" SUPERPAVE |
| OFF RAMP FM 3053 TO END OF ON RAMP FM 3053 | 1,300 | 12 | 1,733 | 1.5" PFC AND OR 4-6" SUPERPAVE |
| GREGG COUNTY LINE TO END OF ON RAMP JOY WRIGHT | 1,000 | 12 | 1,333 | 1.5" PFC AND OR 4-6" SUPERPAVE |
| MT PISGAH BRIDGE TO 581 MILE MARKER | 800 | 12 | 1,067 | 1.5" PFC AND OR 4-6" SUPERPAVE |
| GREEN 1 MILE TO LIBERTY CITY EXIT TO BLUE SIGN | 1,330 | 12 | 1,773 | 1.5" PFC AND OR 4-6" SUPERPAVE |
| JUST AFTER OFF RAMP FM 3053 TO END OF ON RAMP | 1,815 | 12 | 2,420 | 1.5" PFC AND OR 4-6" SUPERPAVE |
| JUST AFTER OFF RAMP FM 3053 TO END OF ON RAMP | 1,815 | 12 | 2,420 | 1.5" PFC AND OR 4-6" SUPERPAVE |
| SMITH COUNTY | | | | |
| 330' W. OF THE SCALES EXIT RAMP (WB RIGHT LANE) | 225 | 14 | 350 | 2" OR 6" SUPERPAVE (PARTIALLY COMPLETE) |
| 1,000' E. PF WILLOW BRANCH EXIT (WB RIGHT LANE LANE) | 400 | 14 | 600 | 2" OR 6" SUPERPAVE |
| CHANGED TO EXIT RAMP ONLY (SP EB EXIT ONLY) | 686 | 14 | 1,067 | 2" OR 6" SUPERPAVE |
| HARVEY RD. EXIT 554 | 1,400 | 24 | 3,733 | 2" SUPERPAVE |
| WILLOW BRANCH EXIT 554 (SP RAMPS EAST AND WEST) | 5,620 | 24 | 14,987 | 2" SUPERPAVE |
| JOY WRIGHT MNT RD. EXIT 577 (EB EXIT RAMP ONLY) | 877 | 24 | 2,339 | 2" SUPERPAVE |
| DERRICK PARK RAMPS AND PARKING AREA EAST AND WEST | | | 14,821 | 2" SUPERPAVE |
| FM 2015 EXIT 565 (WB RAMPS ONLY) | 1,500 | 24 | 4,000 | 2" SUPERPAVE |
| 500' EAST OF JIM HOG EB ON RAMP | 1,000 | 14 | 1,556 | 2" SUPERPAVE |
| 580' EAST OF MILE MARKER 560 | 1,800 | 14 | 2,800 | 2" OR 6" SUPERPAVE |
| EB EXIT RAMP AT LAVENDER RD. | 500 | 14 | 778 | 2" SUPERPAVE |
| EB SERVICE RD AND ON RAMP | 1,800 | 28 | 5,600 | 2" SUPERPAVE |
| FM 849 WB ON RAMP OUTSIDE LANE | 3,550 | 12 | 4,733 | 2" SUPERPAVE |
| FM 849 WB ON RAMP | 720 | 14 | 1,120 | 2" SUPERPAVE |
| STARTING AT THE 551 WB OUT LANE | 5,590 | 12 | 7,453 | 2" SUPERPAVE |
| STARTING AT THE US 271 WB BRIDGE JOINT ON WEST SIDE OF BRIDGE | 5,640 | 12 | 7,520 | 2" SUPERPAVE (PARTIALLY COMPLETED) |
| 440' W. OF THE BARBER RD. EXIT (RIGHT LANE ONLY) | 320 | 12 | 427 | 1.5" PFC - RIGHT LANE |
| STARTING 440' FROM BARBER RD. EXIT FOR 12,082' (RIGHT LANE ONLY) | 12,082 | 12 | 16,109 | 1.5" PFC - IH 20 RIGHT LANE |
| END OF OF GORE AT BARBER RD. EXIT (RIGHT LANE ONLY) | 265 | 12 | 353 | 1.5" PFC - RIGHT LANE |
| STARTING AT BARBER RD. EXIT (RIGHT LANE ONLY) | 4,053 | 12 | 5,404 | 1.5" PFC - RIGHT LANE |
| AT NEXT GUARDRAIL (RIGHT LANE ONLY) | 2,000 | 12 | 2,667 | 1.5" PFC - RIGHT LANE |
| | | | | |

⑦ THIS SUMMARY TABLE IS TO PROVIDE AN IDEA OF THE TYPICAL LOCATIONS AND QUANTITIES FOR PAVEMENT WORK. TXDOT RESERVES THE RIGHT TO CHANGE THESE QUANTITIES AND LOCATIONS ACCORDING TO BUSSINESS NEEDS.

STATE OF TEXAS
JUSTIN G. SMITH
107750
LICENSED
PROFESSIONAL ENGINEER
DocuSigned by:
Justin G. Smith, P.E.
11C9E4B5447E4E1...

SHEET 6 OF 7

Texas Department of Transportation



FILENAME /

| FED. RD. DIV. NO. | PROJECT NO. | | SHEET NO. |
|---|---|---|---|
| 6 | RMC 6367-43-001 | | 5F |
| STATE | DIST. | COUNTY | |
| TEXAS | TYLER | SMITH, ETC. | |
| CONT. | SECT. | JOB | HIGHWAY NO. |
| 6367 | 43 | 001 | IH 20 |

# QUANTITY SUMMARIES

## ⑦ MILL AND INLAY LOCATION SUMMARY

| DESCRIPTION | LENGTH | WIDTH | SQUARE YARDS | COMMENTS |
|---|---|---|---|---|
| VAN ZANDT COUNTY | | | | |
| OAKLAND/COLFAX ON RAMP (STOP SIGN TO ON RAMP) | 700 | 26 | 2,022 | 2" SUPERPAVE |
| FM 314 EB OFF RAMPS | 1,370 | 13 | 1,979 | 2" SUPERPAVE |
| FM 314 WB ON RAMPS | 850 | 13 | 1,228 | 2" SUPERPAVE |
| SH 64 WB OFF RAMP | 1,900 | 13 | 2,744 | 2" SUPERPAVE |
| SH 64 EB ON RAMP | 960 | 13 | 1,387 | 2" SUPERPAVE |
| FM 314 EB ON RAMP | 400 | 13 | 578 | 2" SUPERPAVE |
| | | | | |

⑦ THIS SUMMARY TABLE IS TO PROVIDE AN IDEA OF THE TYPICAL LOCATIONS AND QUANTITIES FOR PAVEMENT WORK. TXDOT RESERVES THE RIGHT TO CHANGE THESE QUANTITIES AND LOCATIONS ACCORDING TO BUSSINESS NEEDS.
CALLOUT WORK WILL ALSO INCLUDE A SINGLE UNIT OF ITEM 500-6033 "MOBILIZATION (CALLOUT)"FOR EACH WORK ORDER.

STATE OF TEXAS
JUSTIN G. SMITH
107750
LICENSED PROFESSIONAL ENGINEER

DocuSigned by:
Justin G. Smith, P.E.
11C9E4B5447E4E1...

SHEET 7 OF 7

Texas Department of Transportation



FILENAME /

| FED.RD. DIV.NO. | PROJECT NO. | | SHEET NO. |
|---|---|---|---|
| 6 | RMC 6367-43-001 | | 5G |
| STATE | DIST. | COUNTY | |
| TEXAS | TYLER | SMITH, ETC. | |
| CONT. | SECT. | JOB | HIGHWAY NO. |
| 6367 | 43 | 001 | IH 20 |

# QUANTITY SUMMARIES

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:
FILE:

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

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

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

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

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

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

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

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

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

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

10. As shown on BC(2), the OBEY WARNING SIGNS STATE LAW sign, STAY ALERT TALK OR TEXT LATER (see Sign Detail G20-10T) and the WORK ZONE TRAFFIC FINES DOUBLE sign with plaque shall be erected in advance of the CSJ limits. However, the TRAFFIC FINES DOUBLE sign will not be required on projects consisting solely of mobile operation work, such as striping or milling edgeline rumble strips. The BEGIN ROAD WORK NEXT X MILES, CONTRACTOR and END ROAD WORK signs shall be erected at or near the CSJ limits.

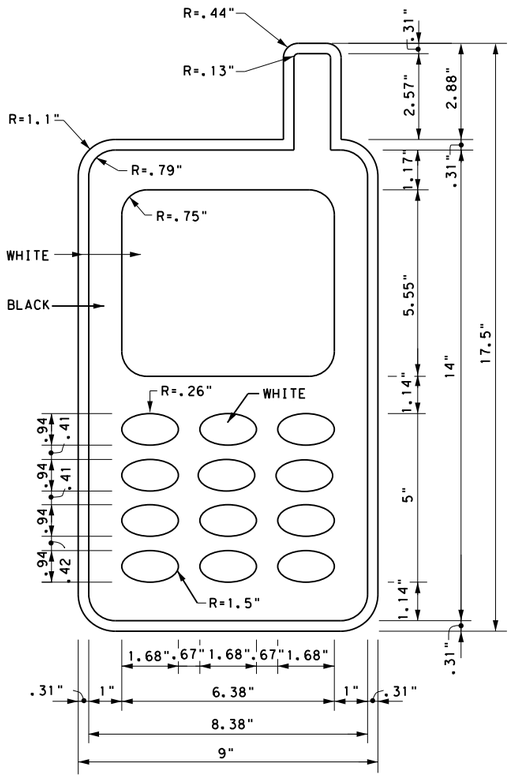
11. Except for devices required by Note 10, traffic control devices should be in place only while work is actually in progress or a definite need exists.

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

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

## WORKER SAFETY APPAREL NOTES:

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





3.0" Radius, 1.25" Border, 0.75" Indent, Black on Yellow;
[STAY ALERT] Font: D
3.0" Radius, 1.25" Border, 0.75" Indent, Black on Orange;
[TALK OR TEXT LATER] Font: C specified length;

## SIGN DETAIL (G20-10T)

Only pre-qualified products shall be used. The "Compliant Work Zone Traffic Control Devices List" (CWZTCD) describes pre-qualified products and their sources and may be found on-line at the web address given below or by contacting:

Texas Department of Transportation
Traffic Operations Division - TE
Phone (512) 416-3118

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



Texas Department of Transportation | Traffic Operations Division Standard

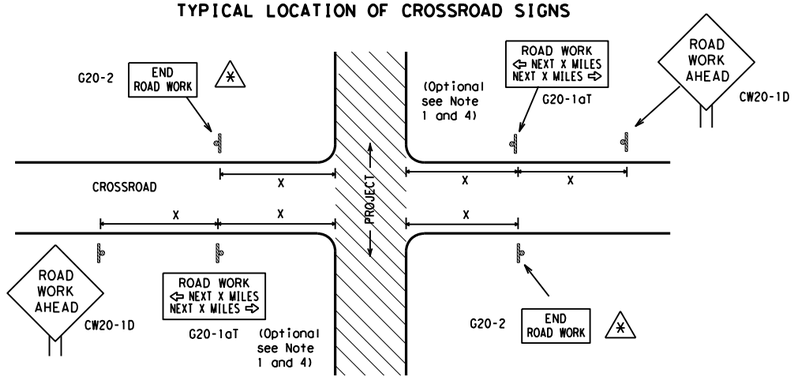
# BARRICADE AND CONSTRUCTION GENERAL NOTES AND REQUIREMENTS

# BC(1)-14

| FILE: bc-14.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT November 2002 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 4-03 5-10 8-14 | DIST | COUNTY | | SHEET NO. |
| 9-07 7-13 | 10 | SMITH, ETC. | | 6 |

DATE:
FILE:

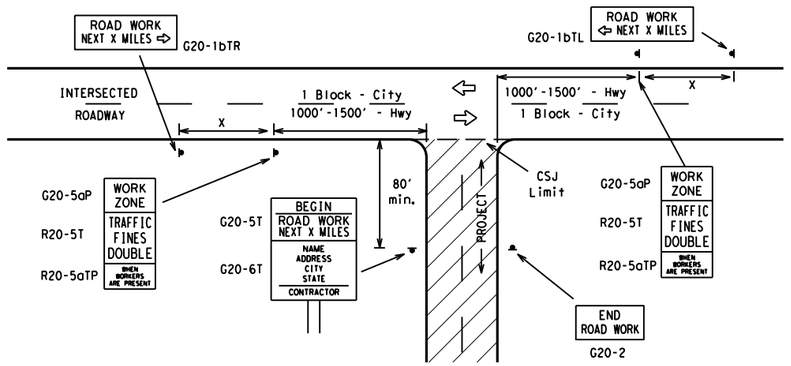
## TYPICAL LOCATION OF CROSSROAD SIGNS




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

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

## T-INTERSECTION




## CSJ LIMITS AT T-INTERSECTION

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

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

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

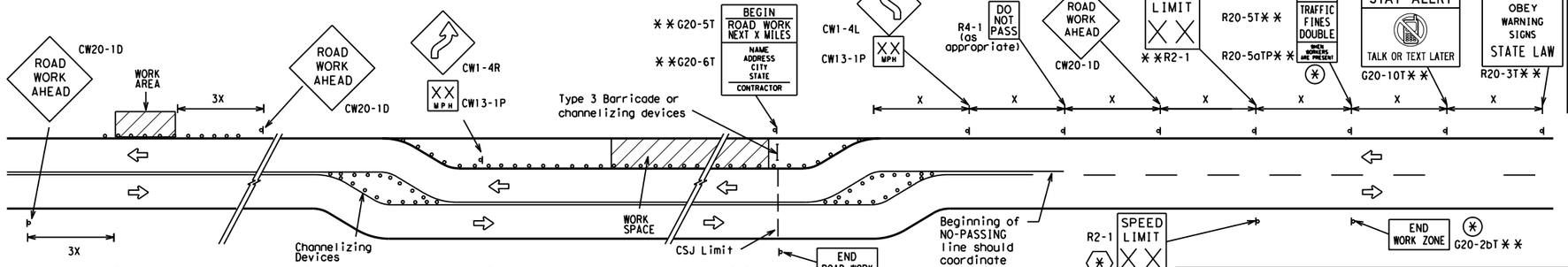
✱ For typical sign spacings on divided highways, expressways and freeways, see Part 6 of the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD) typical application diagrams or TCP Standard Sheets.

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

## GENERAL NOTES

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

## WORK AREAS IN MULTIPLE LOCATIONS WITHIN CSJ LIMITS

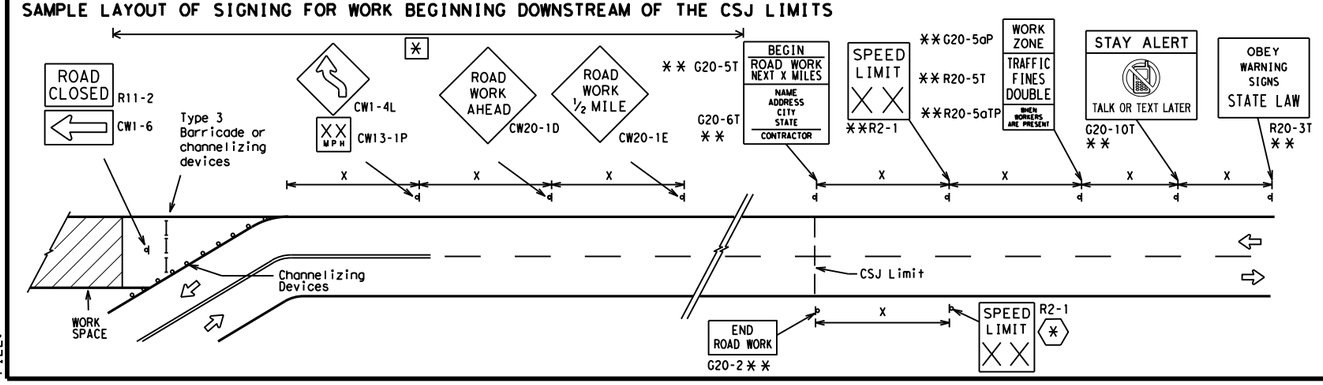



When extended distances occur between minimal work spaces, the Engineer/Inspector should ensure additional "ROAD WORK AHEAD"(CW20-1D)signs are placed in advance of these work areas to remind drivers they are still within the project limits. See the applicable TCP sheets for exact location and spacing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

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




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




## NOTES

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

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

✱✱ Required CSJ Limit signing. See Note 10 on BC(1). TRAFFIC FINES DOUBLE signs will not be required on projects consisting solely of mobile operations work.

[✱] 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

Texas Department of Transportation

Traffic Operations Division Standard

# BARRICADE AND CONSTRUCTION PROJECT LIMIT

# BC(2)-14

| FILE: bc-14.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT November 2002 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 9-07 8-14 | DIST | COUNTY | | SHEET NO. |
| 7-13 | 10 | SMITH, ETC. | | 7 |

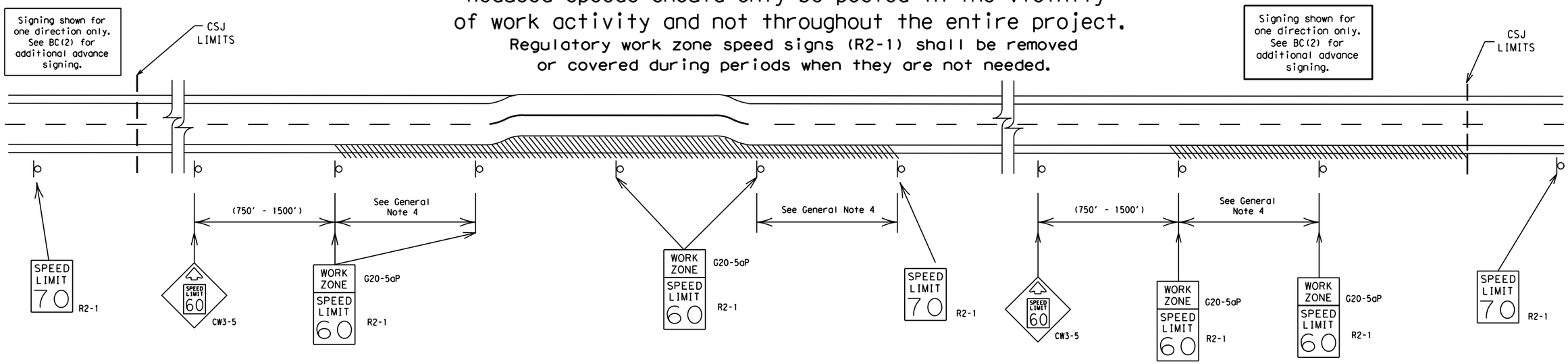
DATE:
FILE:

# TYPICAL APPLICATION OF WORK ZONE SPEED LIMIT SIGNS

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

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

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




## GUIDANCE FOR USE:

### LONG/INTERMEDIATE TERM WORK ZONE SPEED LIMITS

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

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

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

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

### SHORT TERM WORK ZONE SPEED LIMITS

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

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

### GENERAL NOTES

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



Texas Department of Transportation

Traffic Operations Division Standard

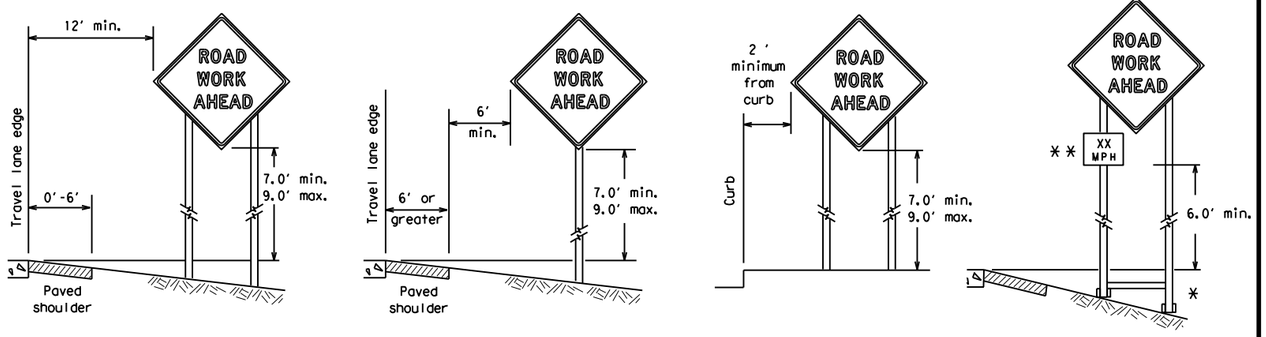
## BARRICADE AND CONSTRUCTION WORK ZONE SPEED LIMIT

## BC(3)-14

| FILE: bc-14.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT November 2002 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS 9-07 8-14 7-13 | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 8 |

DATE:
FILE:

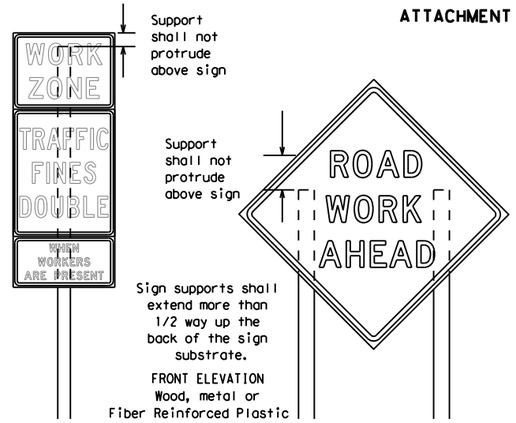
## TYPICAL MINIMUM CLEARANCES FOR LONG TERM AND INTERMEDIATE TERM SIGNS



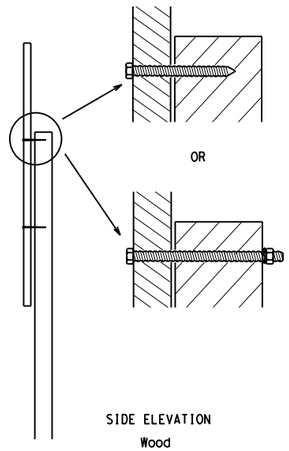

* When placing skid supports on unlevel ground, the leg post lengths must be adjusted so the sign appears straight and plumb. Objects shall NOT be placed under skids as a means of leveling.

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

## ATTACHMENT FOR SIGN SUPPORTS




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

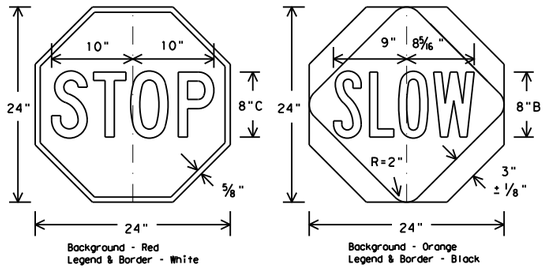



Attachment to wooden supports will be by bolts and nuts or screws. Use TxDOT's or manufacturer's recommended procedures for attaching sign substrates to other types of sign supports

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

## STOP/SLOW PADDLES

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




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

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

## GENERAL NOTES FOR WORK ZONE SIGNS

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

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

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

## SIGN MOUNTING HEIGHT

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

## SIZE OF SIGNS

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

## SIGN SUBSTRATES

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

## REFLECTIVE SHEETING

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

## SIGN LETTERS

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

## REMOVING OR COVERING

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

## SIGN SUPPORT WEIGHTS

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

## FLAGS ON SIGNS

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



Texas Department of Transportation

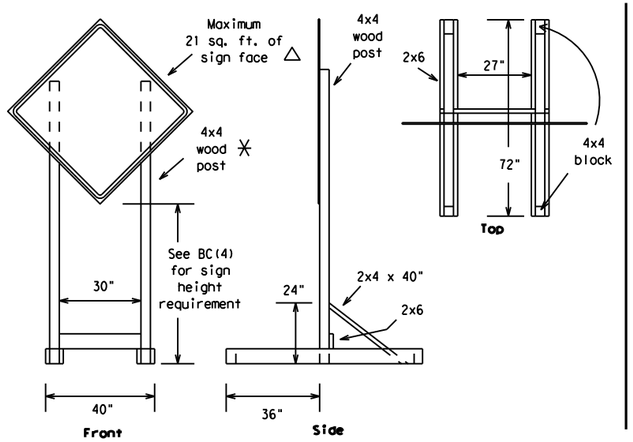
Traffic Operations Division Standard

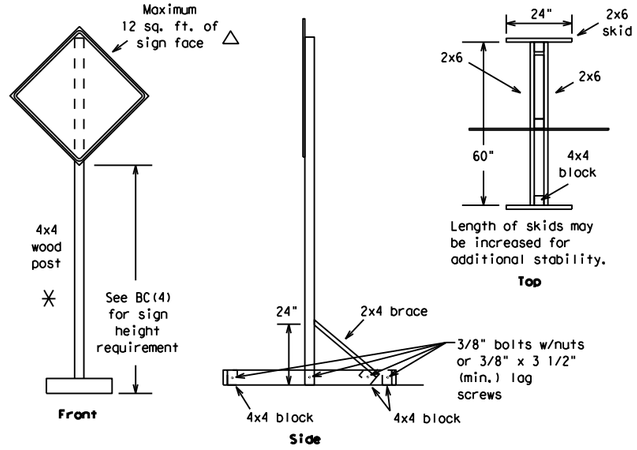
# BARRICADE AND CONSTRUCTION TEMPORARY SIGN NOTES

# BC(4)-14

| FILE: bc-14.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| © TxDOT November 2002 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 9-07 8-14 | DIST | COUNTY | | SHEET NO. |
| 7-13 | 10 | SMITH, ETC. | | 9 |

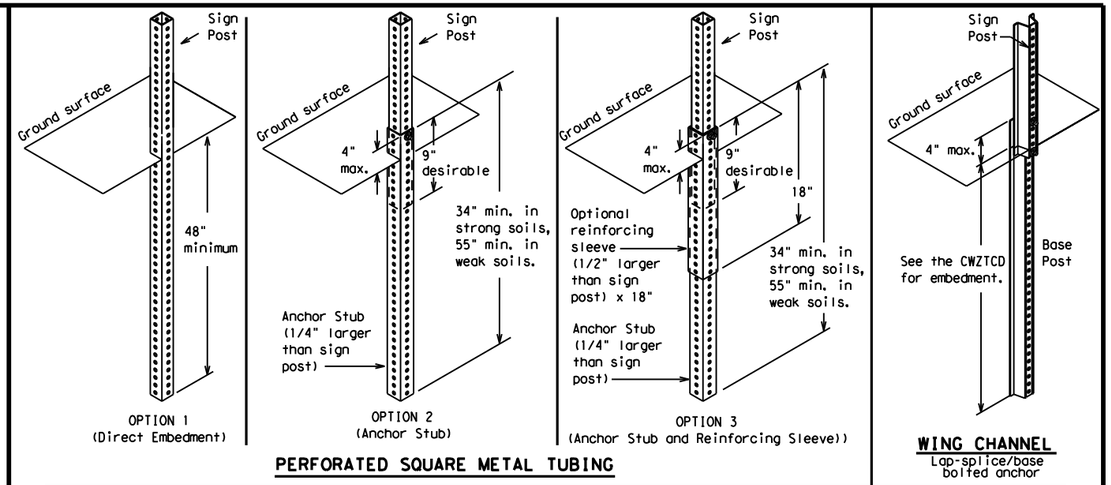
DISCLAIMER:
The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.



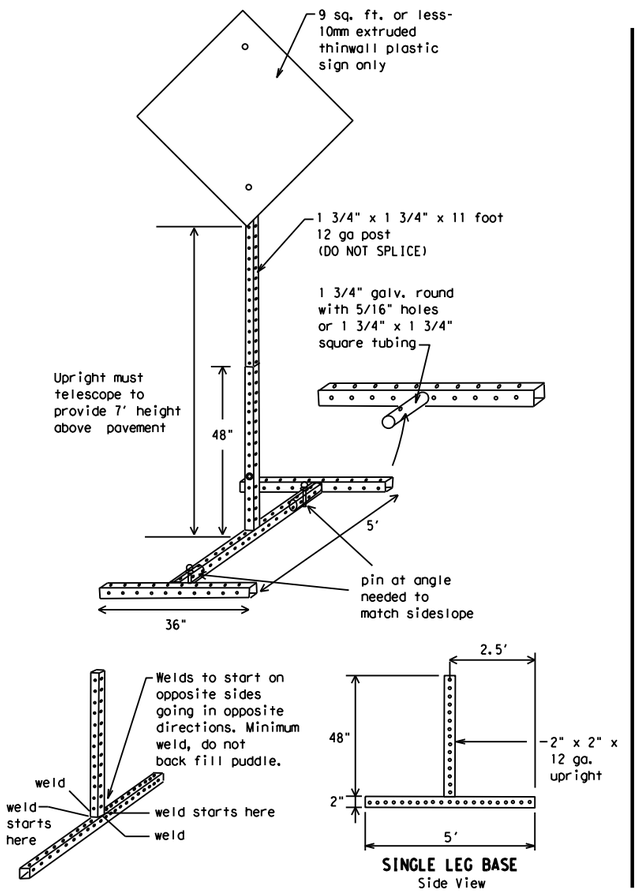

# SKID MOUNTED WOOD SIGN SUPPORTS

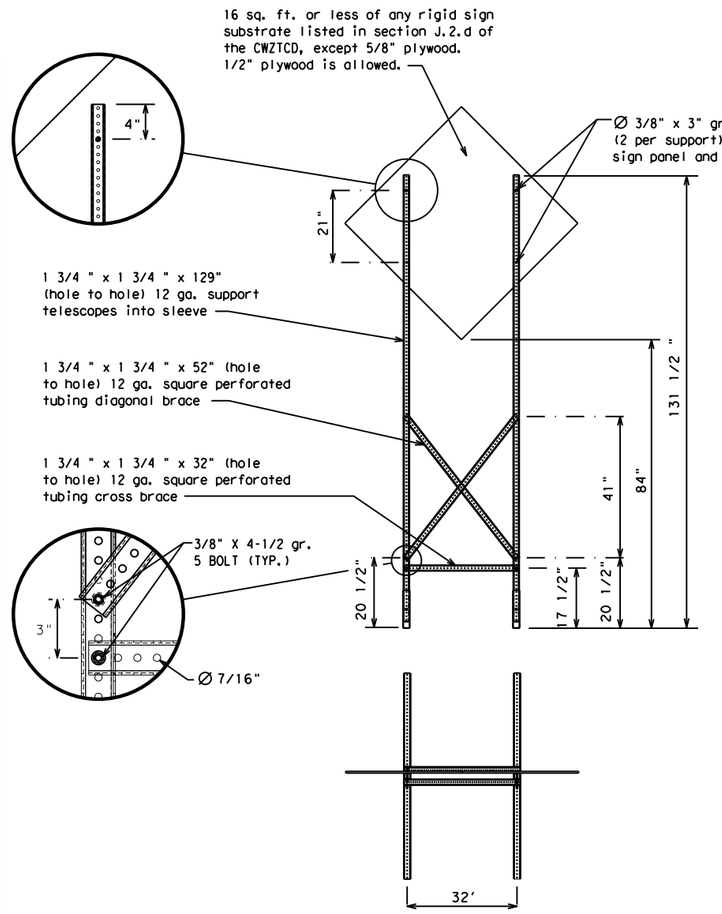
LONG/INTERMEDIATE TERM STATIONARY - PORTABLE SKID MOUNTED SIGN SUPPORTS □

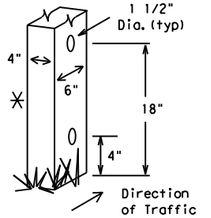



# GROUND MOUNTED SIGN SUPPORTS

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.

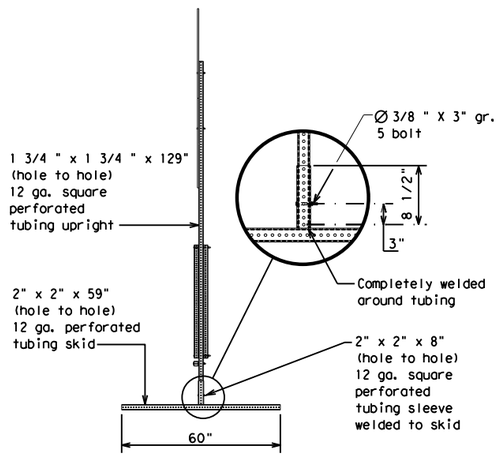



| Nominal Post Size | Number of Posts | Maximum Sq. feet of Sign Face | Minimum Soil Embedment | Drilled Hole(s) Required |
|---|---|---|---|---|
| 4 x 4 | 1 | 12 | 36" | NO |
| 4 x 4 | 2 | 21 | 36" | NO |
| 4 x 6 | 1 | 21 | 36" | YES |
| 4 x 6 | 2 | 36 | 36" | YES |

WOOD POST SYSTEM FOR GROUND MOUNTED SIGN SUPPORTS




## WEDGE ANCHORS

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

## OTHER DESIGNS

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

## GENERAL NOTES

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

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

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

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



# SKID MOUNTED PERFORATED SQUARE STEEL TUBING SIGN SUPPORTS

DATE:
FILE:

Texas Department of Transportation — Traffic Operations Division Standard

# BARRICADE AND CONSTRUCTION TYPICAL SIGN SUPPORT

## BC(5)-14

| FILE: bc-14.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| © TxDOT November 2002 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 9-07 8-14 | DIST | COUNTY | | SHEET NO. |
| 7-13 | 10 | SMITH, ETC. | | 10 |

DATE:
FILE:

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

## PORTABLE CHANGEABLE MESSAGE SIGNS

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

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

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

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

# RECOMMENDED PHASES AND FORMATS FOR PCMS MESSAGES DURING ROADWORK ACTIVITIES

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

## Phase 1: Condition Lists

### Road/Lane/Ramp Closure List

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

### Other Condition List

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

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

## Phase 2: Possible Component Lists

### Action to Take/Effect on Travel List

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

### Location List

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

### Warning List

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

### ** Advance Notice List

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

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

** See Application Guidelines Note 6.

### APPLICATION GUIDELINES

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

### WORDING ALTERNATIVES

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

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

### FULL MATRIX PCMS SIGNS

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



Texas Department of Transportation

Traffic Operations Division Standard

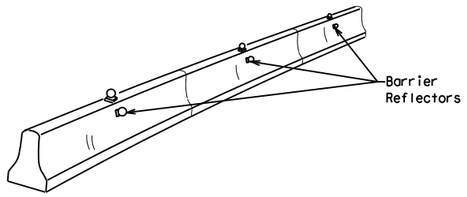
# BARRICADE AND CONSTRUCTION PORTABLE CHANGEABLE MESSAGE SIGN (PCMS)

# BC(6)-14

| FILE: bc-14.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT November 2002 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 9-07 8-14 | DIST | COUNTY | | SHEET NO. |
| 7-13 | 10 | SMITH, ETC. | | 11 |

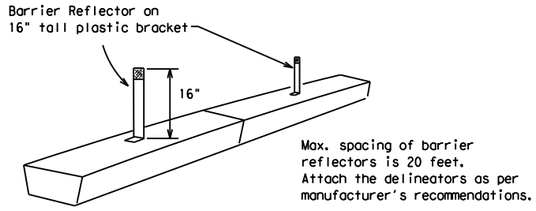
DATE:
FILE:

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

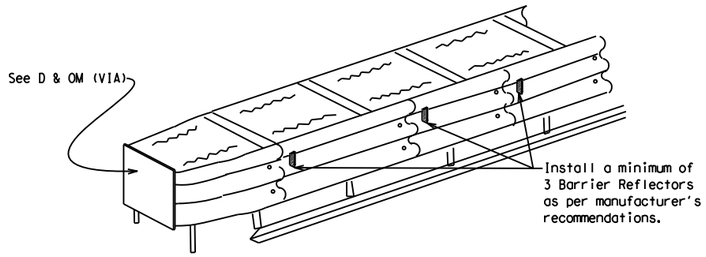



## CONCRETE TRAFFIC BARRIER (CTB)

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




## LOW PROFILE CONCRETE BARRIER (LPCB)

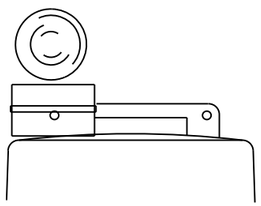



## DELINEATION OF END TREATMENTS

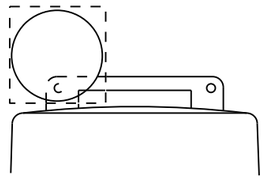
**END TREATMENTS FOR CTB'S USED IN WORK ZONES**

End treatments used on CTB's in work zones shall meet crashworthy standards as defined in the National Cooperative Highway Research Report 350. Refer to the CWZTCD List for approved end treatments and manufacturers.

# BARRIER REFLECTORS FOR CONCRETE TRAFFIC BARRIER AND ATTENUATORS



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



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

## WARNING LIGHTS

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

## WARNING LIGHTS MOUNTED ON PLASTIC DRUMS

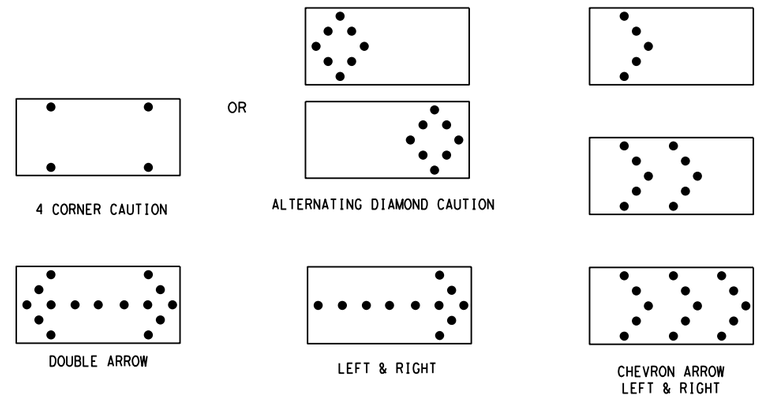
1. Type A flashing warning lights are intended to warn drivers that they are approaching or are in a potentially hazardous area.
2. Type A random flashing warning lights are not intended for delineation and shall not be used in a series.
3. A series of sequential flashing warning lights placed on channelizing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

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

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

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

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




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

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

**ATTENTION**

Flashing Arrow Boards shall be equipped with automatic dimming devices.

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

# FLASHING ARROW BOARDS



## TRUCK-MOUNTED ATTENUATORS

1. Truck-mounted attenuators (TMA) used on TxDOT facilities must meet the requirements outlined in the National Cooperative Highway Research Report No. 350 (NCHRP 350) or the Manual for Assessing Safety Hardware (MASH).
2. Refer to the CWZTCD for the requirements of Level 2 or Level 3 TMAs.
3. Refer to the CWZTCD for a list of approved TMAs.
4. TMAs are required on freeways unless otherwise noted in the plans.
5. A TMA should be used anytime that it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the work performance.
6. The only reason a TMA should not be required is when a work area is spread down the roadway and the work crew is an extended distance from the TMA.

Texas Department of Transportation

*Traffic Operations Division Standard*

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

# BC(7)-14

| FILE: bc-14.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| © TxDOT November 2002 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 9-07 8-14 | DIST | COUNTY | | SHEET NO. |
| 7-13 | 10 | SMITH, ETC. | | 12 |

101

DATE:
FILE:

## GENERAL NOTES

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

## GENERAL DESIGN REQUIREMENTS

Pre-qualified plastic drums shall meet the following requirements:

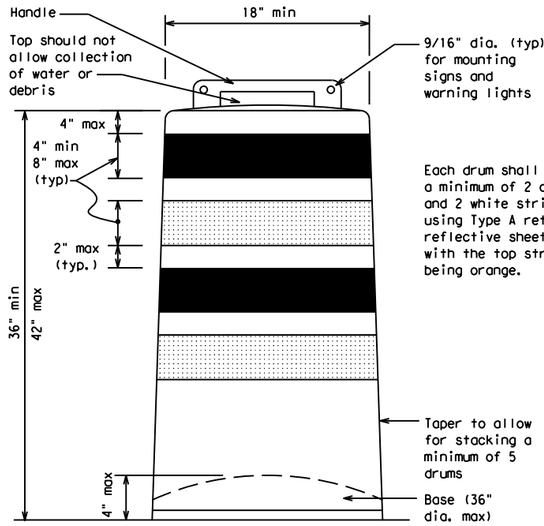
1. Plastic drums shall be a two-piece design; the "body" of the drum shall be the top portion and the "base" shall be the bottom.
2. The body and base shall lock together in such a manner that the body separates from the base when impacted by a vehicle traveling at a speed of 20 MPH or greater but prevents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

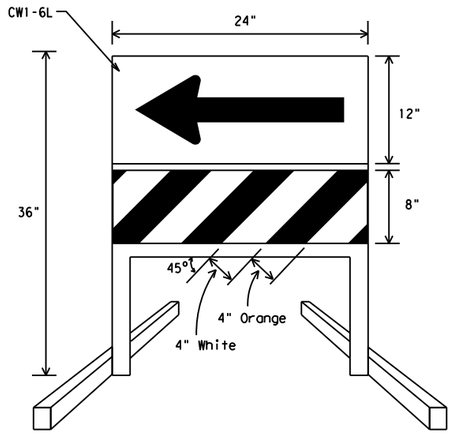
## RETROREFLECTIVE SHEETING

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

## BALLAST

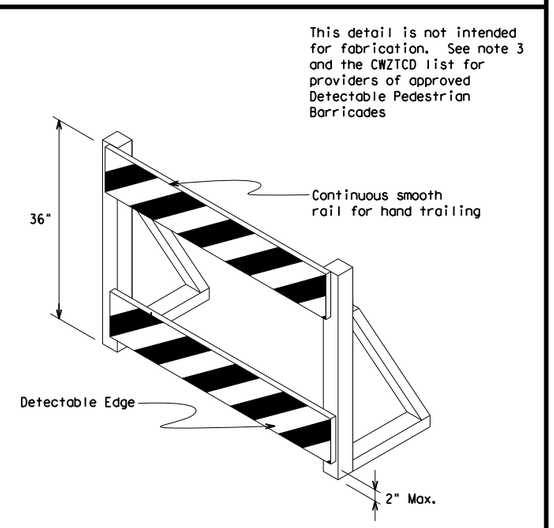
1. Unballasted bases shall be large enough to hold up to 50 lbs. of sand. This base, when filled with the ballast material, should weigh between 35 lbs (minimum) and 50 lbs (maximum). The ballast may be sand in one to three sandbags separate from the base, sand in a sand-filled plastic base, or other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



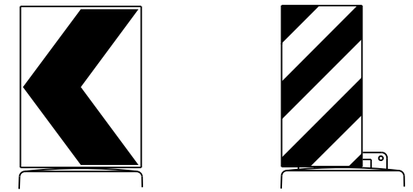

## DIRECTION INDICATOR BARRICADE

1. The Direction Indicator Barricade may be used in tapers, transitions, and other areas where specific directional guidance to drivers is necessary.
2. If used, the Direction Indicator Barricade should be used in series to direct the driver through the transition and into the intended travel lane.
3. The Direction Indicator Barricade shall consist of One-Direction Large Arrow (CW1-6) sign in the size shown with a black arrow on a background of Type $B_{FL}$ or Type $C_{FL}$ Orange retroreflective sheeting above a rail with Type A retroreflective sheeting in alternating 4" white and orange stripes sloping downward at an angle of 45 degrees in the direction road users are to pass. Sheeting types shall be as per DMS 8300.
4. Double arrows on the Direction Indicator Barricade will not be allowed.
5. Approved manufacturers are shown on the CWZTCD List. Ballast shall be as approved by the manufacturers instructions.




## DETECTABLE PEDESTRIAN BARRICADES

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



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

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

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

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

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



Texas Department of Transportation

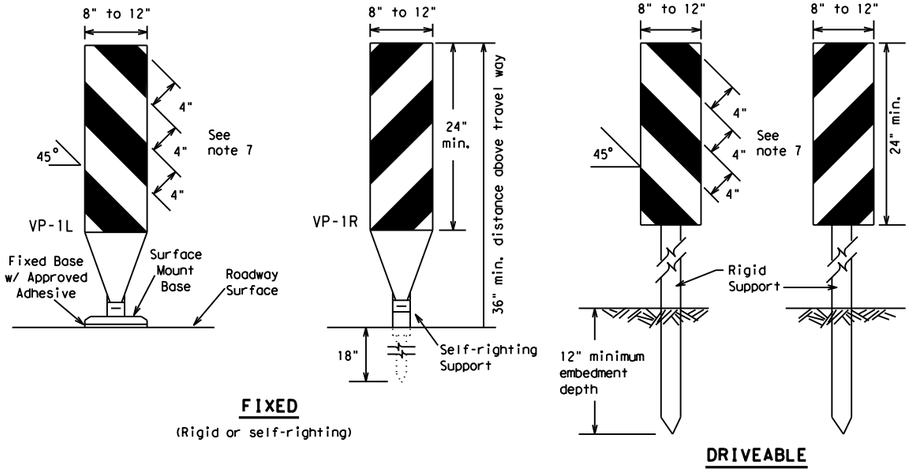
Traffic Operations Division Standard

# BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

# BC(8)-14

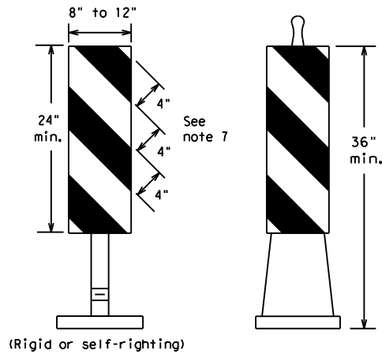
| FILE: bc-14.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT November 2002 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 4-03 7-13 | DIST | COUNTY | | SHEET NO. |
| 9-07 8-14 | 10 | SMITH, ETC. | | 13 |

DATE:
FILE:




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

**DRIVEABLE**

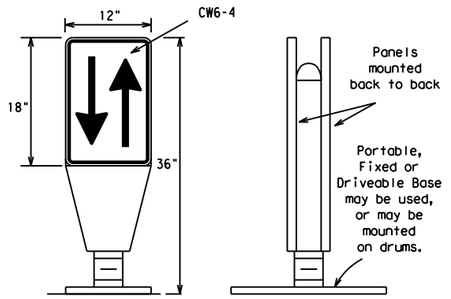



(Rigid or self-righting)

**PORTABLE**

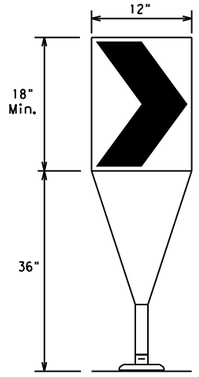
1. Vertical Panels (VP's) are normally used to channelize traffic or divide opposing lanes of traffic.
2. VP's may be used in daytime or nighttime situations. They may be used at the edge of shoulder drop-offs and other areas such as lane transitions where positive daytime and nighttime delineation is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

## VERTICAL PANELS (VPs)




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

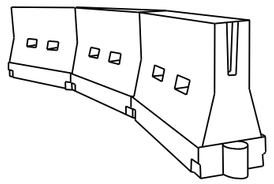
## OPPOSING TRAFFIC LANE DIVIDERS (OTLD)




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

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

## CHEVRONS



## LONGITUDINAL CHANNELIZING DEVICES (LCD)

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

## WATER BALLASTED SYSTEMS USED AS BARRIERS

1. Water ballasted systems used as barriers shall not be used solely to channelize road users, but also to protect the work space per the appropriate NCHRP 350 crashworthiness requirements based on roadway speed and barrier application.
2. Water ballasted systems used to channelize vehicular traffic shall be supplemented with retroreflective delineation or channelizing devices to improve daytime/nighttime visibility. They may also be supplemented with pavement markings.
3. Water ballasted systems used as barriers shall be placed in accordance to application and installation requirements specific to the device, and used only when shown on the CWZTCD list.
4. Water ballasted systems used as barriers should not be used for a merging taper except in low speed (less than 45 MPH) urban areas. When used on a taper in a low speed urban area, the taper shall be delineated and the taper length should be designed to optimize road user operations considering the available geometric conditions.
5. When water ballasted systems used as barriers have blunt ends exposed to traffic, they should be attenuated as per manufacturer recommendations or flared to a point outside the clear zone.

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

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

## GENERAL NOTES

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

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

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

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

SHEET 9 OF 12

Texas Department of Transportation | Traffic Operations Division Standard

# BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

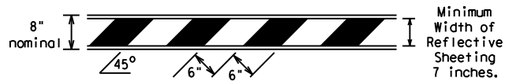
# BC(9)-14

| FILE: bc-14.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| © TxDOT November 2002 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 9-07 8-14 | DIST | COUNTY | | SHEET NO. |
| 7-13 | 10 | SMITH, ETC. | | 14 |

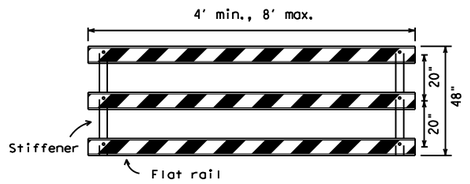
## TYPE 3 BARRICADES

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 conforming to Departmental Material Specification DMS-8300 unless otherwise noted.

Barricades shall NOT be used as a sign support.



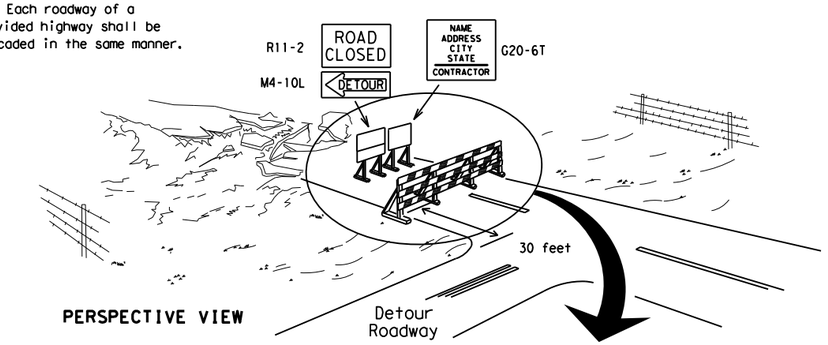

### TYPICAL STRIPING DETAIL FOR BARRICADE RAIL




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

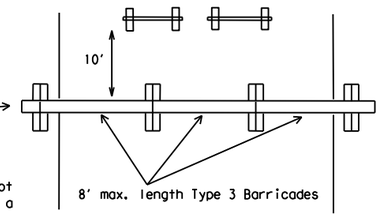
### TYPICAL PANEL DETAIL FOR SKID OR POST TYPE BARRICADES

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




PERSPECTIVE VIEW

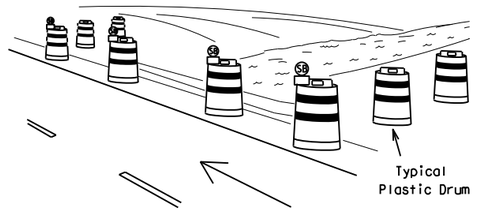
The three rails on Type 3 barricades shall be reflectorized orange and reflective white stripes on one side facing one-way traffic and both sides for two-way traffic.
Barricade striping should slant downward in the direction of detour.




PLAN VIEW

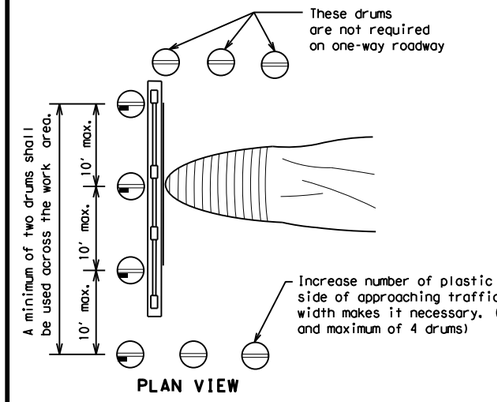
1. Signs should be mounted on independent supports at a 7 foot mounting height in center of roadway. The signs should be a minimum of 10 feet behind Type 3 Barricades.
2. Advance signing shall be as specified elsewhere in the plans.

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




PERSPECTIVE VIEW

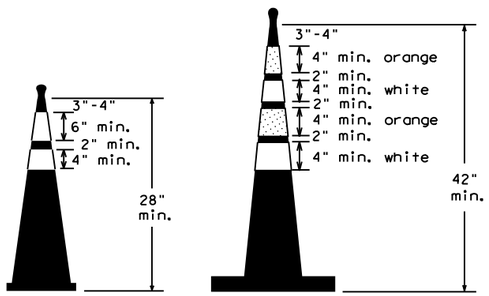
1. Where positive redirectional capability is provided, drums may be omitted.
2. Plastic construction fencing may be used with drums for safety as required in the plans.
3. Vertical Panels on flexible support may be substituted for drums when the shoulder width is less than 4 feet.
4. When the shoulder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




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

PLAN VIEW

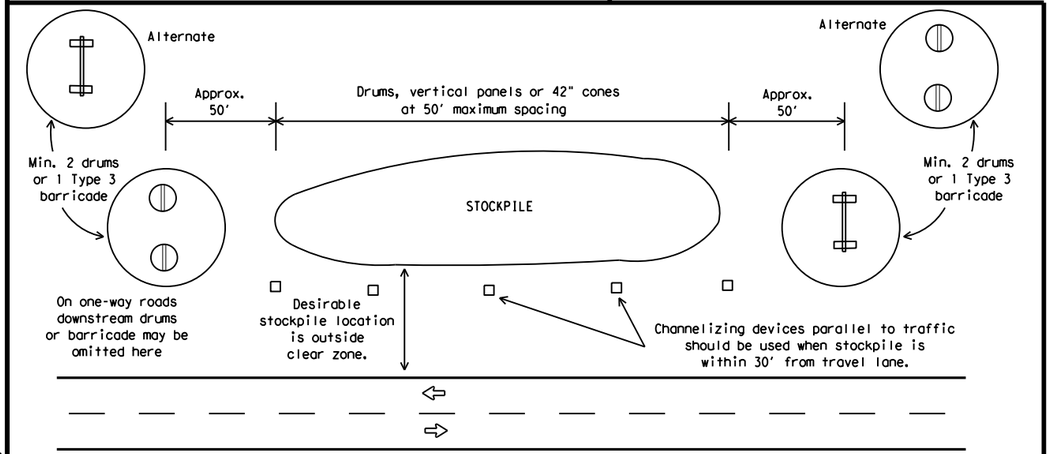
### CULVERT WIDENING OR OTHER ISOLATED WORK WITHIN THE PROJECT LIMITS




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

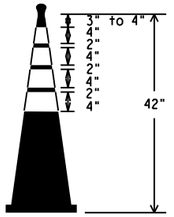
42" 2-piece cones shall have a minimum weight of 30 lbs. including base.

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

THIS DEVICE SHALL NOT BE USED ON PROJECTS LET AFTER MARCH 2014.




EDGELINE CHANNELIZER

1. This device is intended only for use in place of a vertical panel to channelize traffic by indicating the edge of the travel lane. It is not intended to be used in transitions or tapers.
2. This device shall not be used to separate lanes of traffic (opposing or otherwise) or warn of objects.
3. This device is based on a 42 inch, two-piece cone with an alternate striping pattern: four 4 inch retroreflective bands, with an approximate 2 inch gap between bands. The color of the band should correspond to the color of the edgeline (yellow for left edgeline, white for right edgeline) for which the device is substituted or for which it supplements. The reflectorized bands shall be retroreflective Type A conforming to Departmental Material Specification DMS-8300, unless otherwise noted.
4. The base must weigh a minimum of 30 lbs.



Texas Department of Transportation

Traffic Operations Division Standard

# BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

# BC(10)-14

| FILE: bc-14.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| © TxDOT November 2002 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS 9-07 8-14 7-13 | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 15 |

104

DATE:
FILE:

DATE:
FILE:

# WORK ZONE PAVEMENT MARKINGS

## GENERAL

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

## RAISED PAVEMENT MARKERS

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

## PREFABRICATED PAVEMENT MARKINGS

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

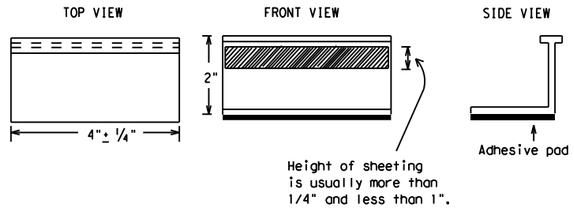
## MAINTAINING WORK ZONE PAVEMENT MARKINGS

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

## REMOVAL OF PAVEMENT MARKINGS

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

# Temporary Flexible-Reflective Roadway Marker Tabs




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

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

## RAISED PAVEMENT MARKERS USED AS GUIDEMARKS

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

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

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

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



Texas Department of Transportation

Traffic Operations Division Standard

# BARRICADE AND CONSTRUCTION PAVEMENT MARKINGS

## BC(11)-14

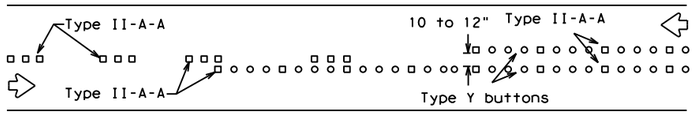
| FILE: bc-14.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT February 1998 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 2-98 9-07 | DIST | COUNTY | | SHEET NO. |
| 1-02 7-13 | 10 | SMITH, ETC. | | 16 |
| 11-02 8-14 | | | | |

105

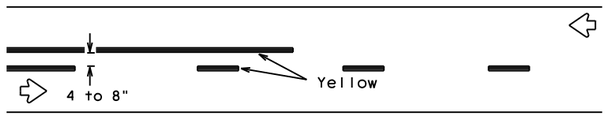
DATE:
FILE:

# PAVEMENT MARKING PATTERNS

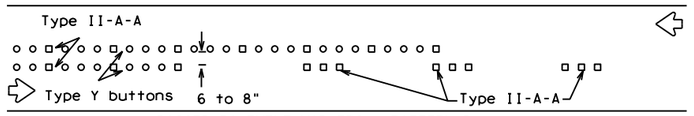

REFLECTORIZED PAVEMENT MARKINGS - PATTERN A




RAISED PAVEMENT MARKERS - PATTERN A



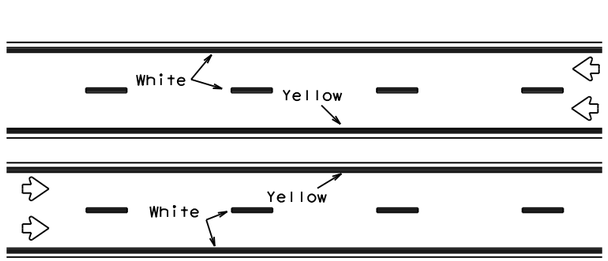

REFLECTORIZED PAVEMENT MARKINGS - PATTERN B



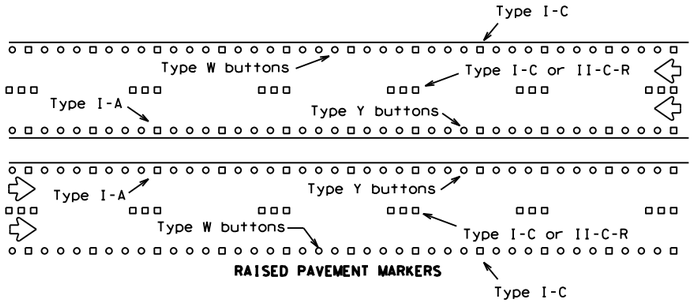

RAISED PAVEMENT MARKERS - PATTERN B

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

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



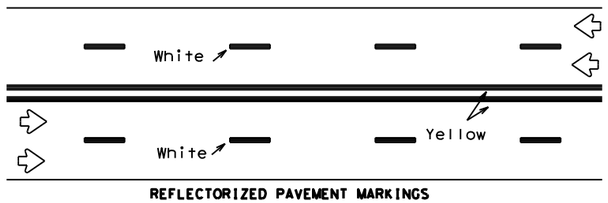

REFLECTORIZED PAVEMENT MARKINGS



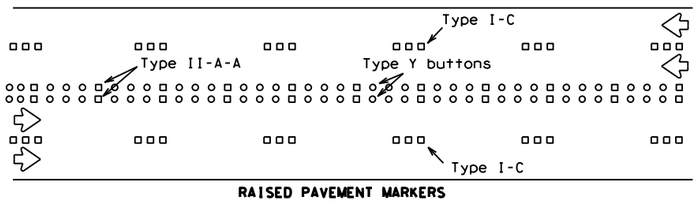

RAISED PAVEMENT MARKERS

Prefabricated markings may be substituted for reflectorized pavement markings.

## EDGE & LANE LINES FOR DIVIDED HIGHWAY



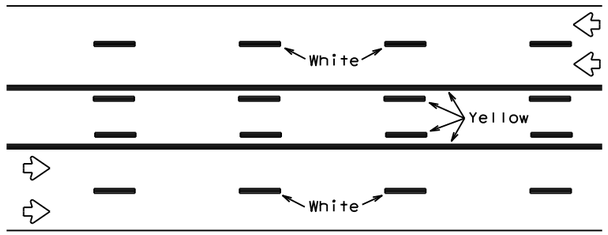

REFLECTORIZED PAVEMENT MARKINGS



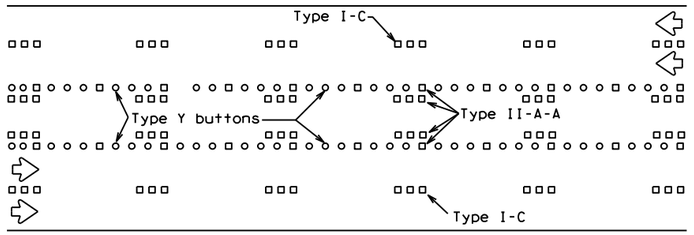

RAISED PAVEMENT MARKERS

Prefabricated markings may be substituted for reflectorized pavement markings.

## LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS




REFLECTORIZED PAVEMENT MARKINGS




RAISED PAVEMENT MARKERS

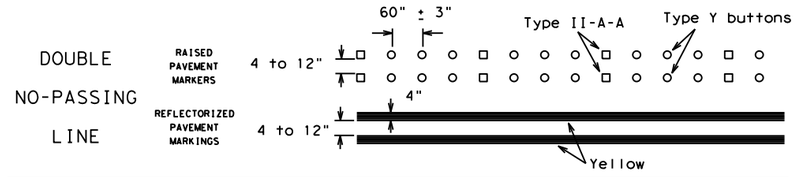
Prefabricated markings may be substituted for reflectorized pavement markings.

## TWO-WAY LEFT TURN LANE

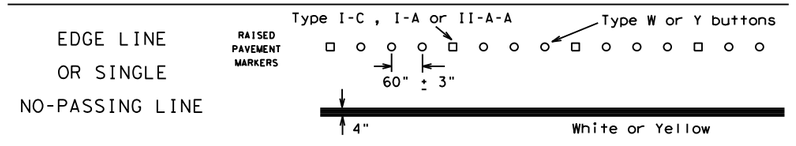
# STANDARD WORK ZONE PAVEMENT MARKINGS DETAILS

## SOLID LINES

### DOUBLE NO-PASSING LINE

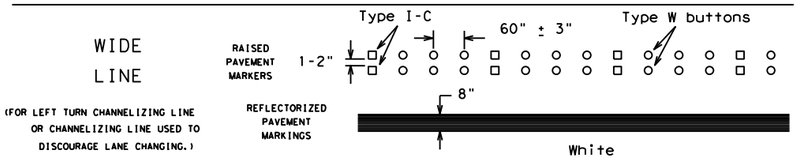



### EDGE LINE OR SINGLE NO-PASSING LINE



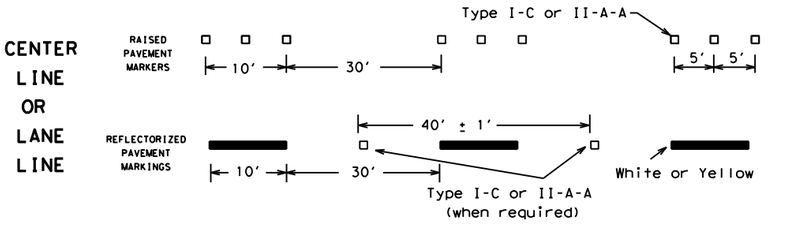

### WIDE LINE

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

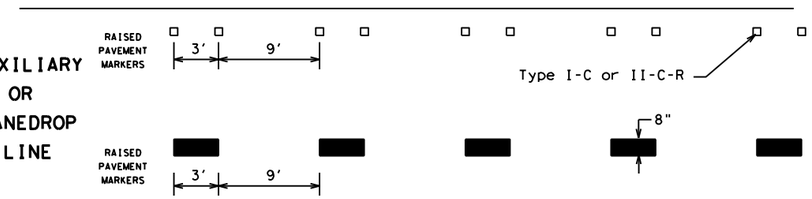



## BROKEN LINES

### CENTER LINE OR LANE LINE

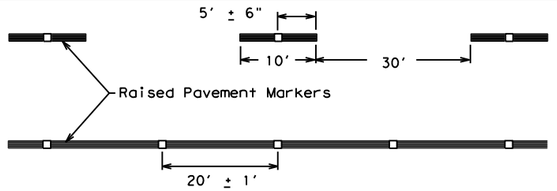



### AUXILIARY OR LANEDROP LINE




### REMOVABLE MARKINGS WITH RAISED PAVEMENT MARKERS

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




Centerline only - not to be used on edge lines

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



Texas Department of Transportation

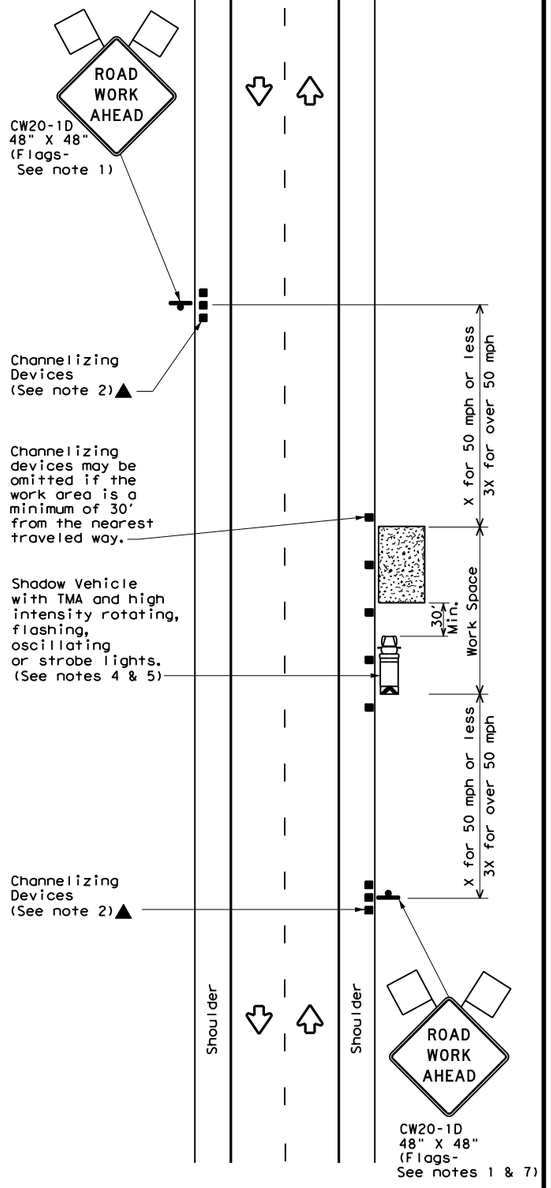
Traffic Operations Division Standard

# BARRICADE AND CONSTRUCTION PAVEMENT MARKING PATTERNS

## BC(12)-14

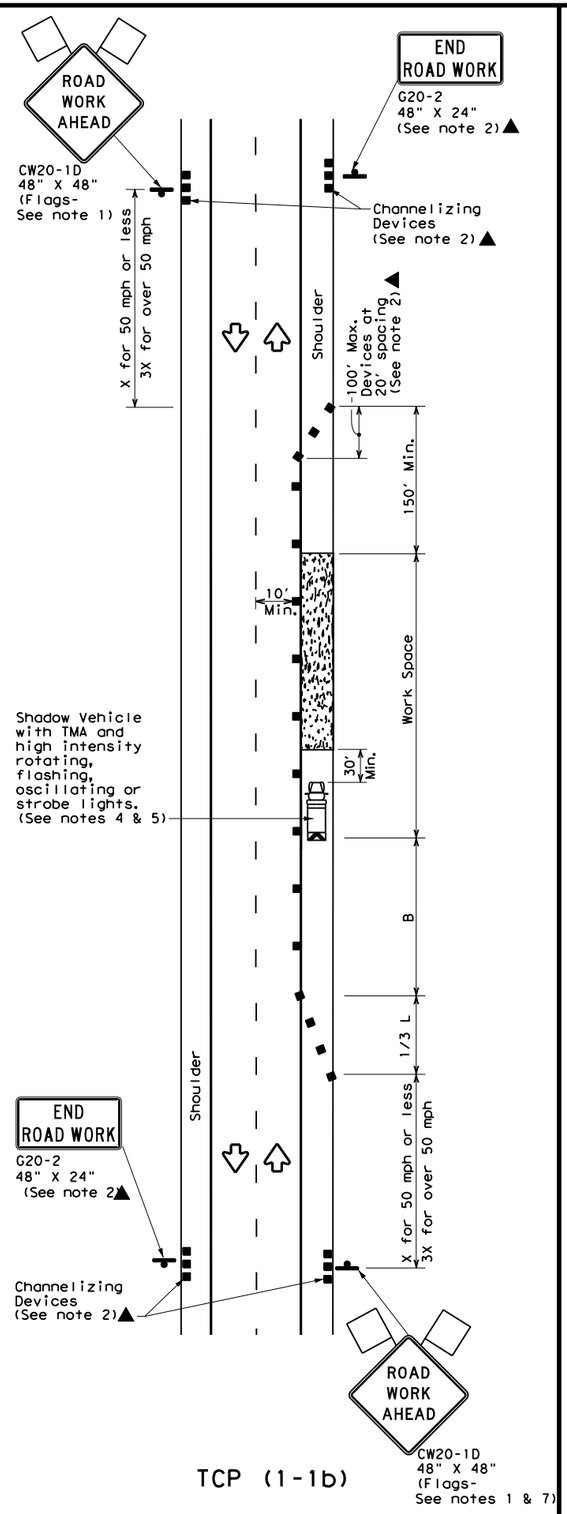
| FILE: bc-14.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| © TxDOT February 1998 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 1-97 9-07 | DIST | COUNTY | | SHEET NO. |
| 2-98 7-13 | 10 | SMITH, ETC. | | 17 |
| 11-02 8-14 | | | | |

DATE:
FILE:



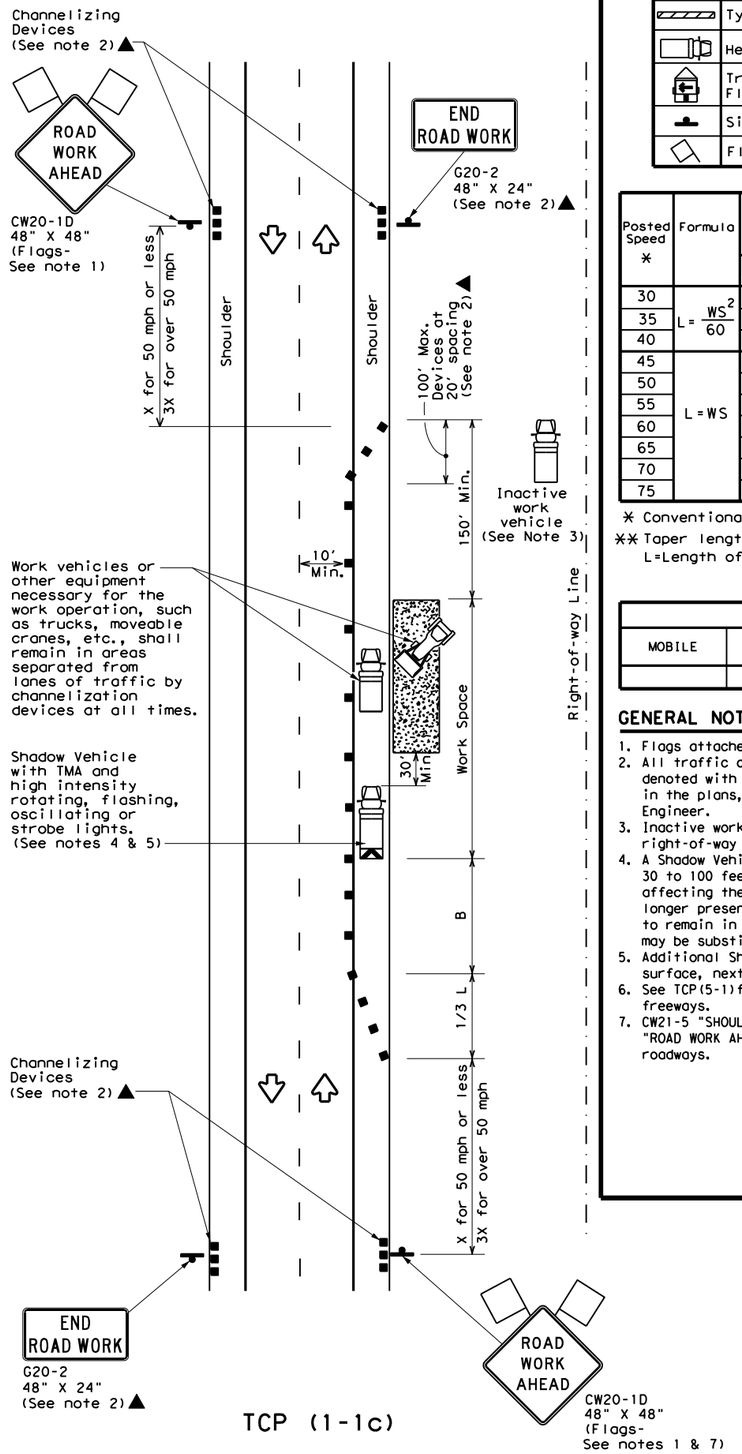

TCP (1-1a)

## WORK SPACE NEAR SHOULDER
Conventional Roads




TCP (1-1b)

## WORK SPACE ON SHOULDER
Conventional Roads




TCP (1-1c)

## WORK VEHICLES ON SHOULDER
Conventional Roads

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

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

* Conventional Roads Only

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

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

## GENERAL NOTES

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

Texas Department of Transportation

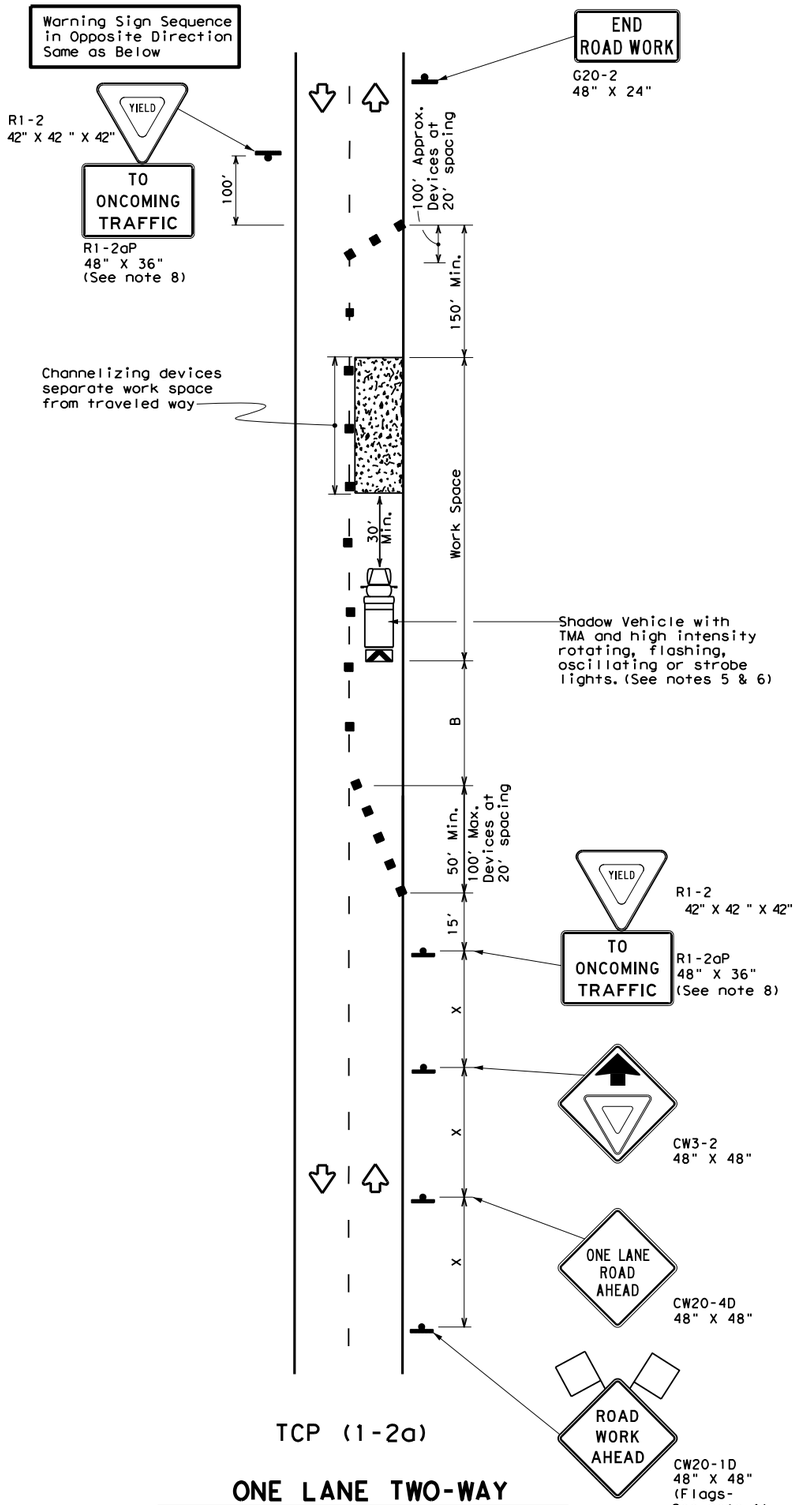
Traffic Operations Division Standard

# TRAFFIC CONTROL PLAN CONVENTIONAL ROAD SHOULDER WORK

# TCP(1-1)-18

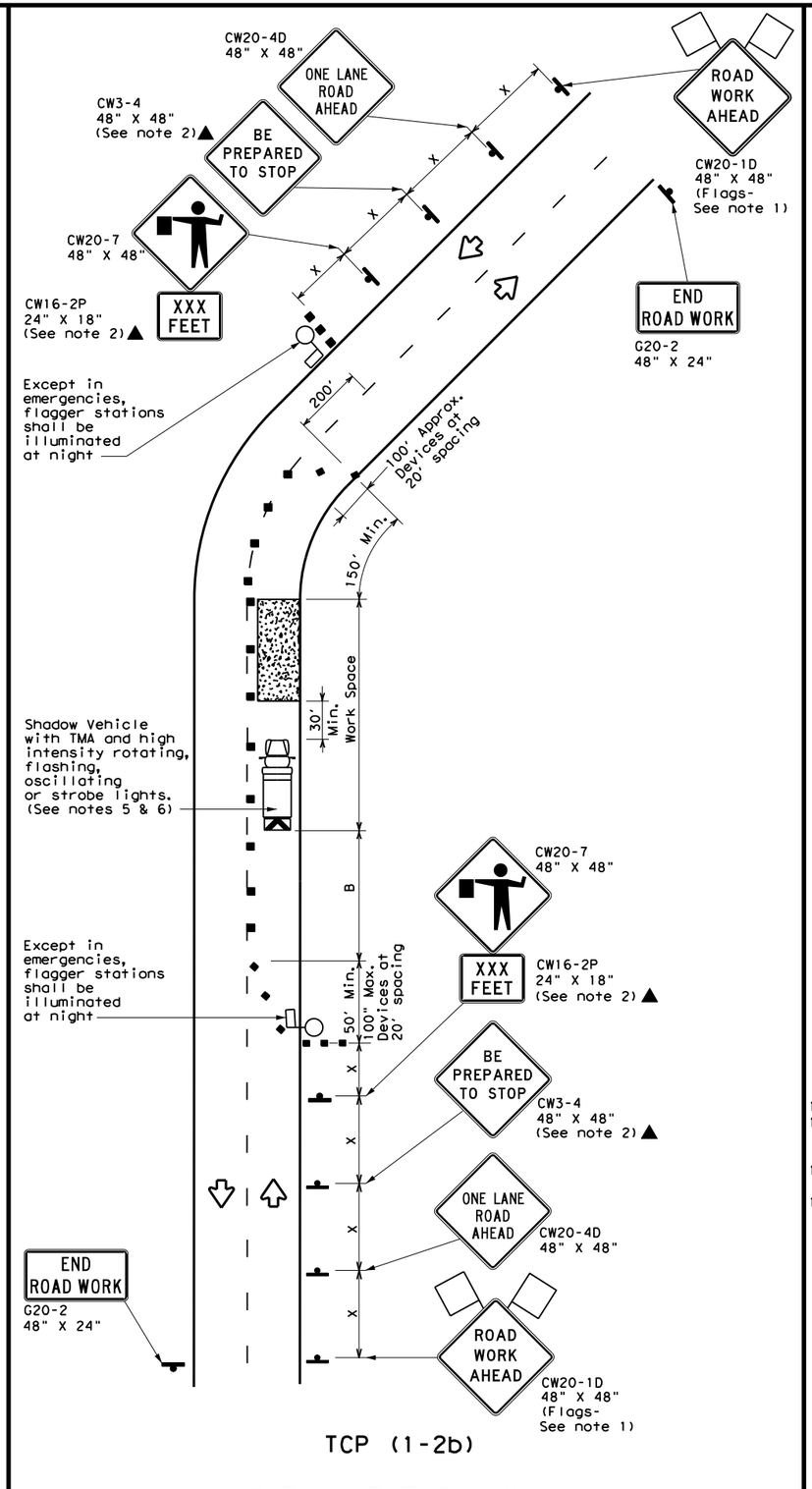
| FILE: tcp1-1-18.dgn | DN: | CK: | DW: | CK: |
|---|---|---|---|---|
| © TxDOT December 1985 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS 2-94 4-98 | 6367 | 43 | 001 | IH-20 |
| 8-95 2-12 | DIST | COUNTY | | SHEET NO. |
| 1-97 2-18 | 10 | SMITH, ETC. | | 18 |

DATE:
FILE:




TCP (1-2a)

## ONE LANE TWO-WAY
## CONTROL WITH YIELD SIGNS
(Less than 2000 ADT - See note 7)




TCP (1-2b)

## ONE LANE TWO-WAY
## CONTROL WITH FLAGGERS

### LEGEND

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

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

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

### TYPICAL USAGE

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

### GENERAL NOTES

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

### TCP (1-2a)

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

### TCP (1-2b)

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

Texas Department of Transportation

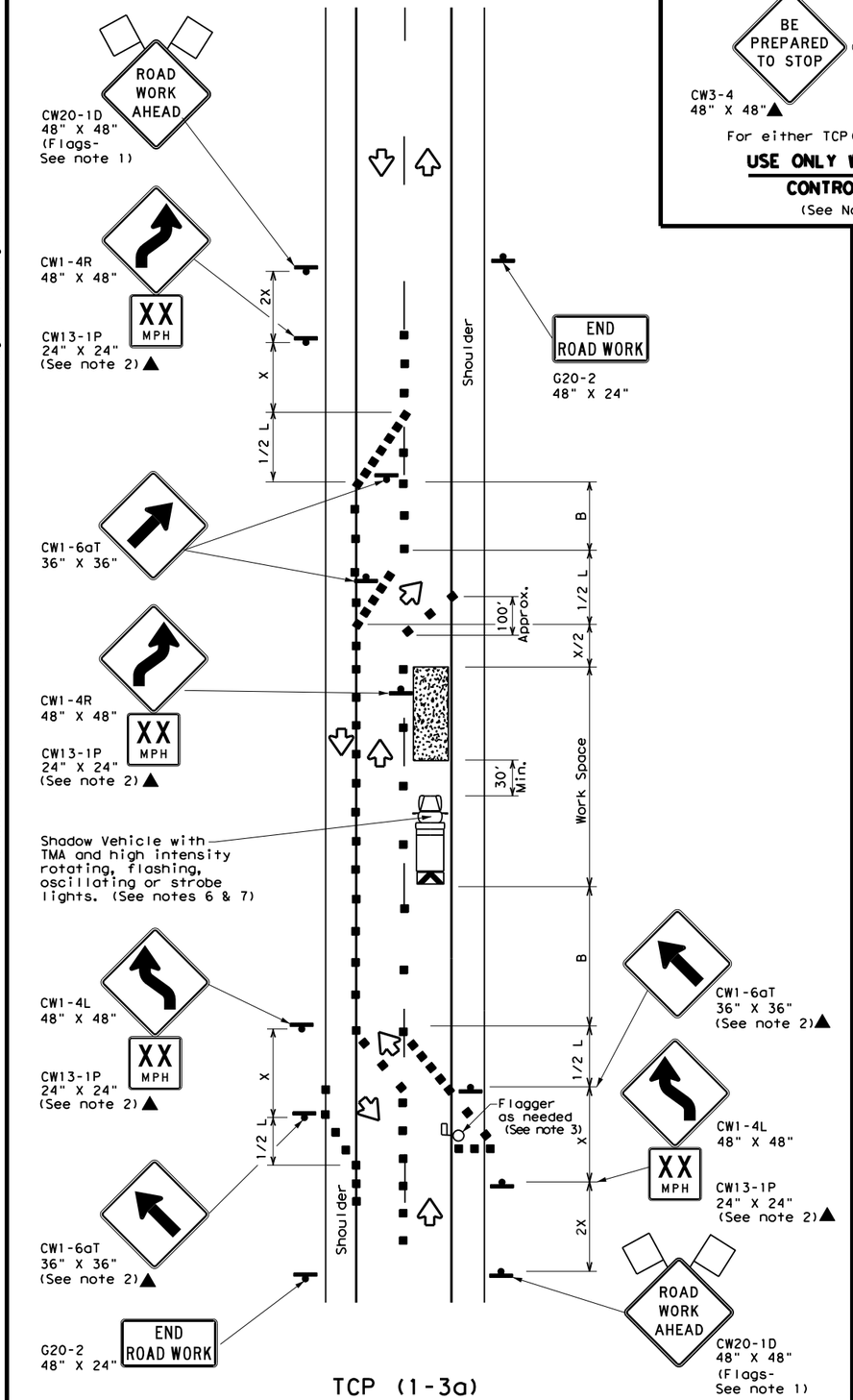
Traffic Operations Division Standard

# TRAFFIC CONTROL PLAN
# ONE-LANE TWO-WAY
# TRAFFIC CONTROL

## TCP(1-2)-18

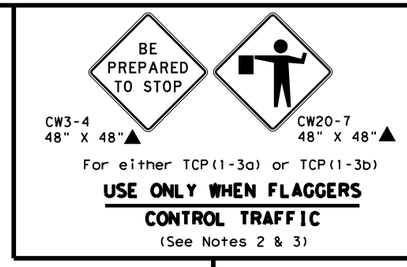
| FILE: tcp1-2-18.dgn | DN: | CK: | DW: | CK: |
|---|---|---|---|---|
| © TxDOT December 1985 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS 4-90 4-98 2-94 2-12 1-97 2-18 | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 19 |

DATE:
FILE:




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

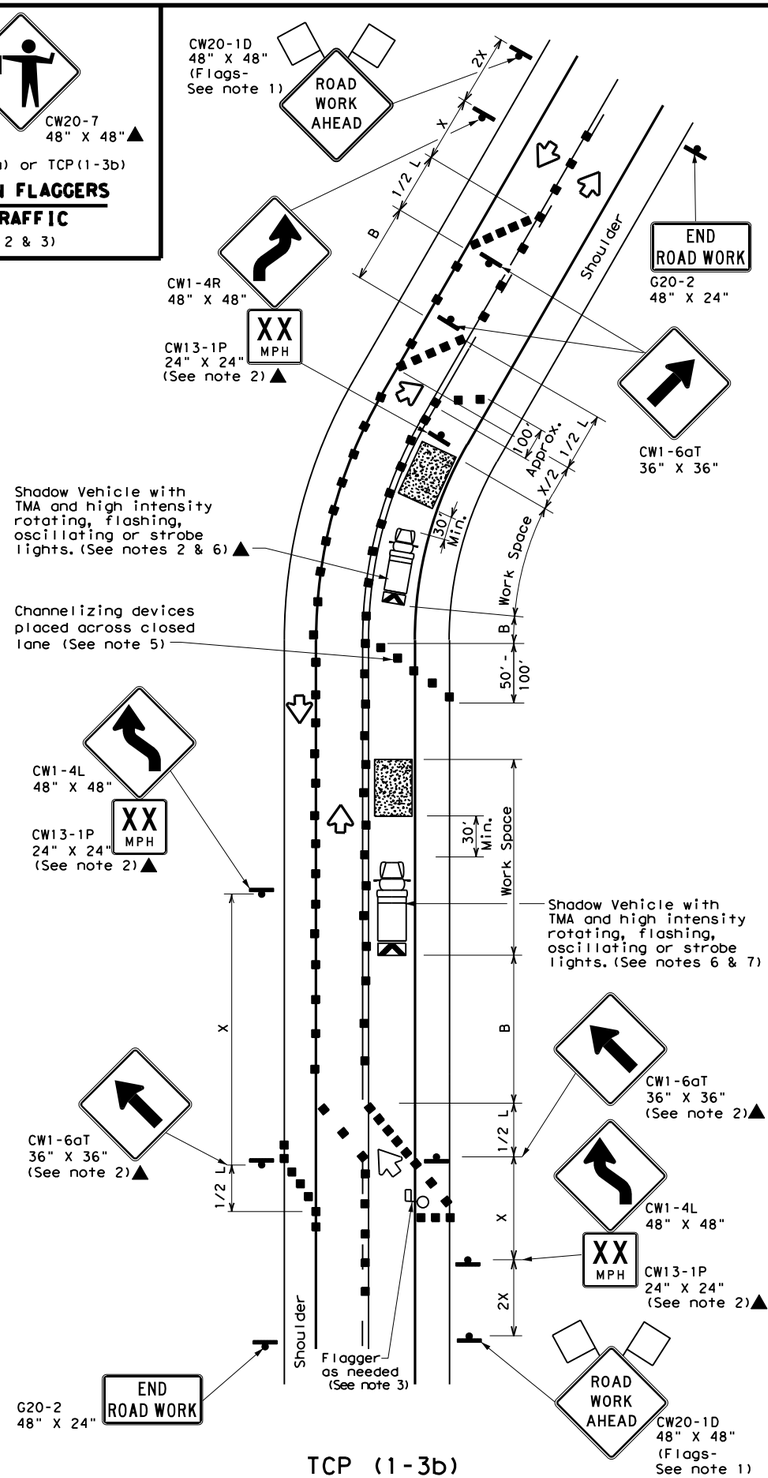
**ONE LANE CLOSED**
**ADEQUATE FIELD OF VIEW**




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

**USE ONLY WHEN FLAGGERS CONTROL TRAFFIC**

(See Notes 2 & 3)




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

**ONE LANE CLOSED**
**INADEQUATE FIELD OF VIEW**

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

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

* Conventional Roads Only

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

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

## GENERAL NOTES

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

Texas Department of Transportation

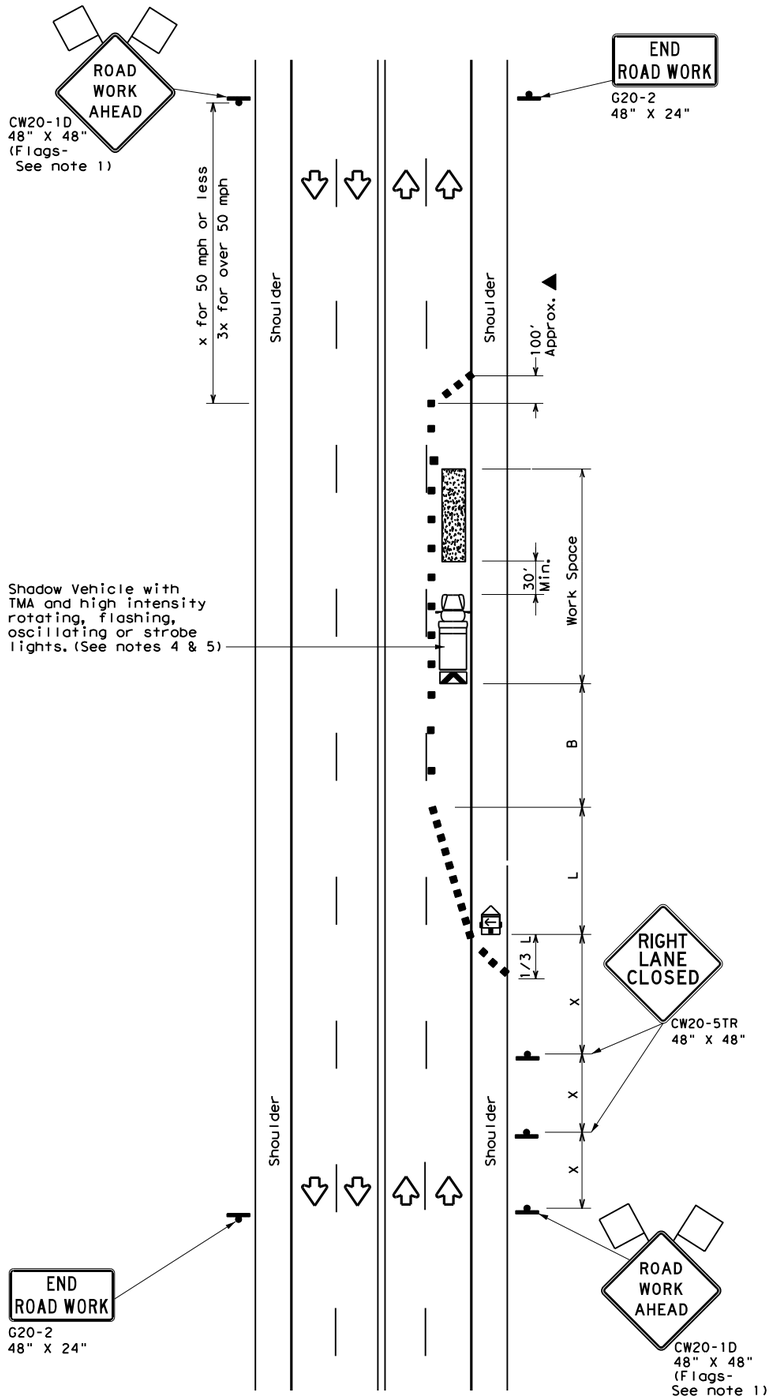
*Traffic Operations Division Standard*

# TRAFFIC CONTROL PLAN
# TRAFFIC SHIFTS ON TWO LANE ROADS

## TCP(1-3)-18

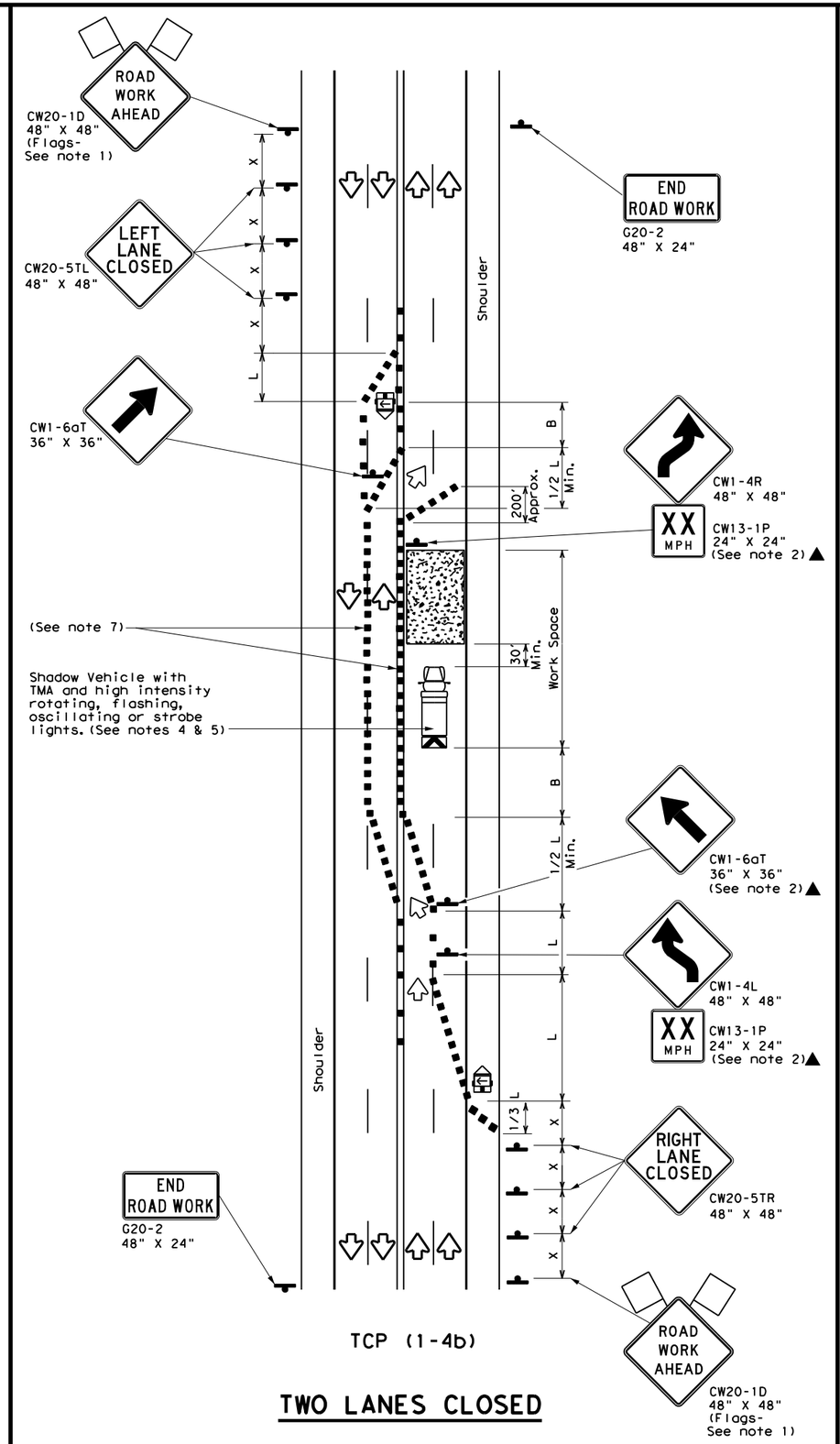
| FILE: tcp1-3-18.dgn | DN: | CK: | DW: | CK: |
|---|---|---|---|---|
| © TxDOT December 1985 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 2-94 4-98 | DIST | COUNTY | | SHEET NO. |
| 8-95 2-12 | 10 | SMITH, ETC. | | 20 |
| 1-97 2-18 | | | | |

DATE:
FILE:




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

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

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

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

## GENERAL NOTES

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

### TCP (1-4a)

6. 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)

7. 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.

Texas Department of Transportation

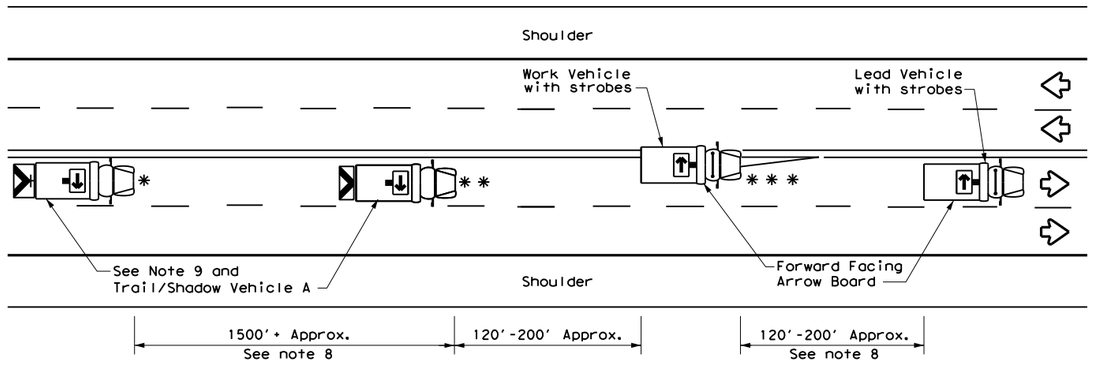
Traffic Operations Division Standard

# TRAFFIC CONTROL PLAN LANE CLOSURES ON MULTILANE CONVENTIONAL ROADS

# TCP(1-4)-18

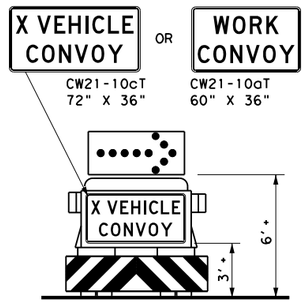
| FILE: tcp1-4-18.dgn | DN: | CK: | DW: | CK: |
|---|---|---|---|---|
| © TxDOT December 1985 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 2-94 4-98 | DIST | COUNTY | | SHEET NO. |
| 8-95 2-12 | 10 | SMITH, ETC. | | 21 |
| 1-97 2-18 | | | | |

DATE:
FILE:



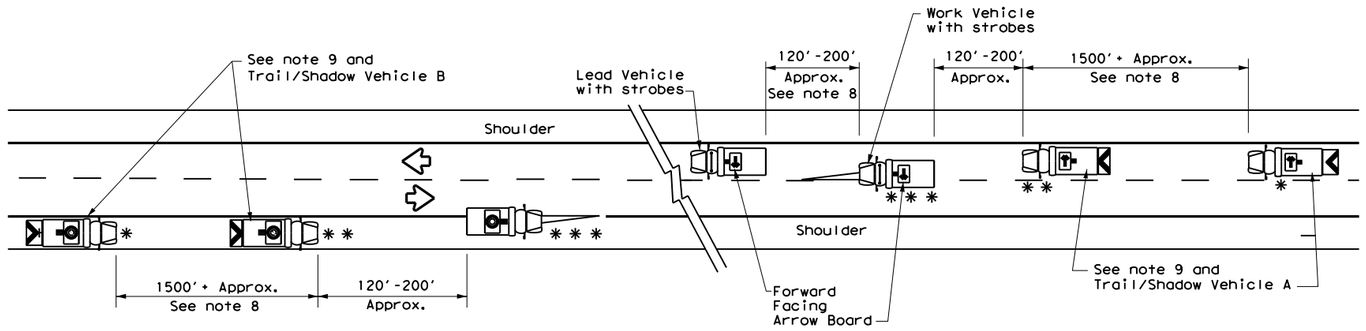

TCP (3-1a)

## UNDIVIDED MULTILANE ROADWAY



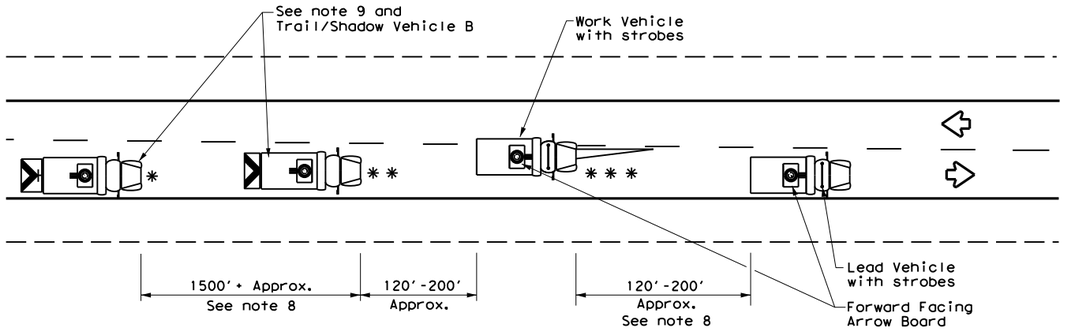

## TRAIL/SHADOW VEHICLE A

with RIGHT Directional display Flashing Arrow Board



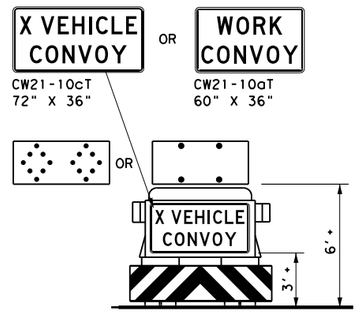

TCP (3-1b)

## TWO-WAY ROADWAY WITH PAVED SHOULDERS




TCP (3-1c)

## TWO-WAY ROADWAY WITHOUT PAVED SHOULDERS




## TRAIL/SHADOW VEHICLE B

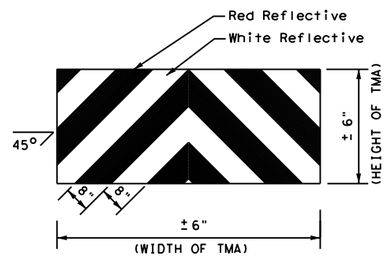
with Flashing Arrow Board in CAUTION display

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

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

## GENERAL NOTES

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




## STRIPING FOR TMA

Texas Department of Transportation

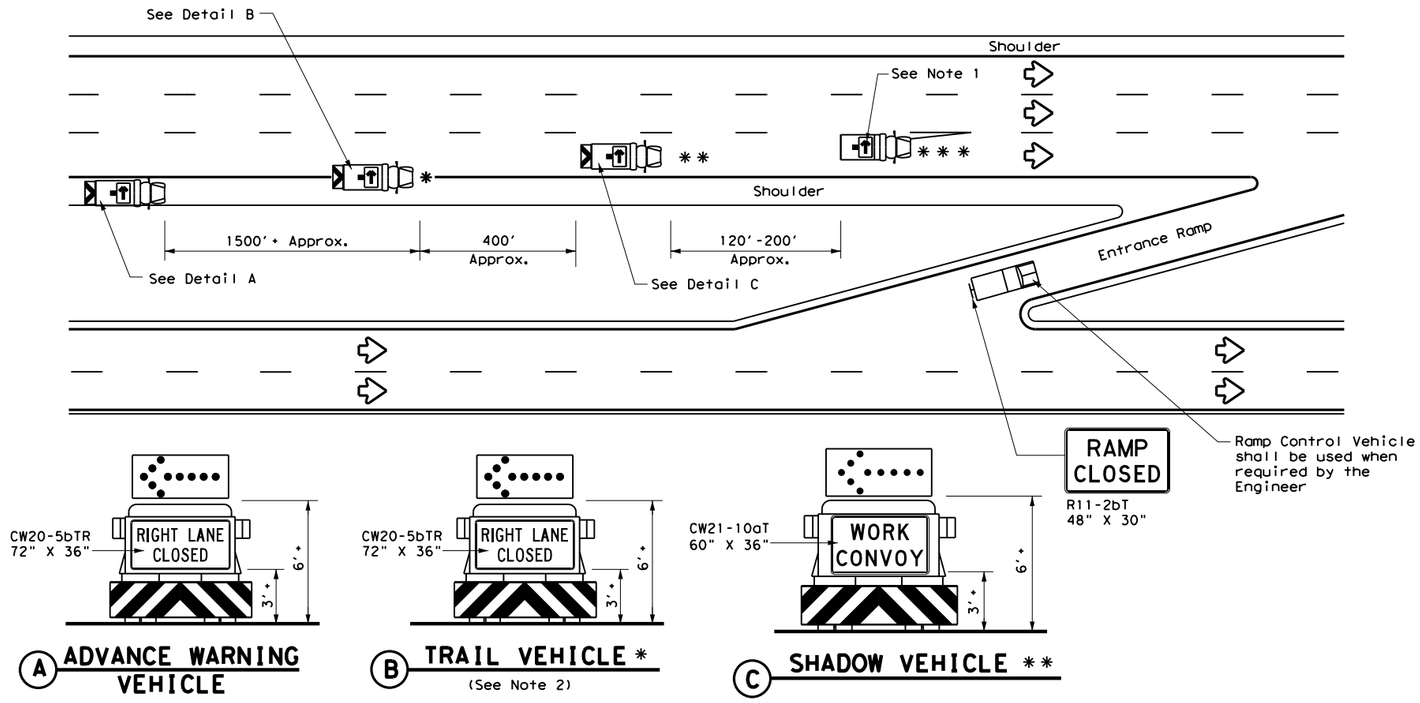
Traffic Operations Division Standard

# TRAFFIC CONTROL PLAN MOBILE OPERATIONS UNDIVIDED HIGHWAYS

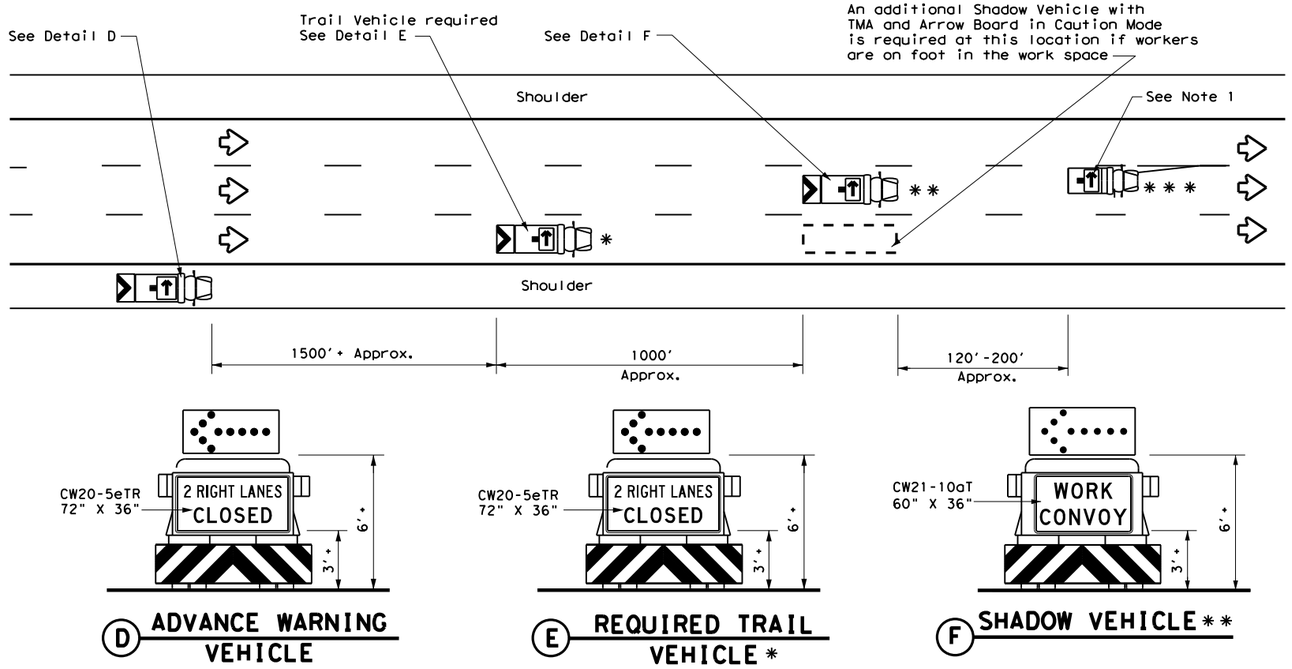
# TCP(3-1)-13

| FILE: tcp3-1.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| © TxDOT December 1985 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS 2-94 4-98 8-95 7-13 1-97 | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC | | 22 |

DATE:
FILE:




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



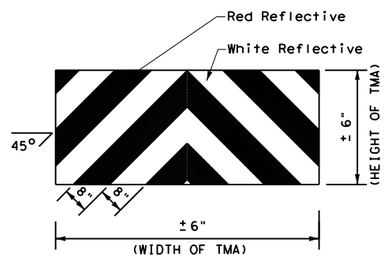

## INTERIOR LANE CLOSURE ON MULTI-LANE DIVIDED HIGHWAY - TCP(3-2b)

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

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

## GENERAL NOTES

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




STRIPING FOR TMA

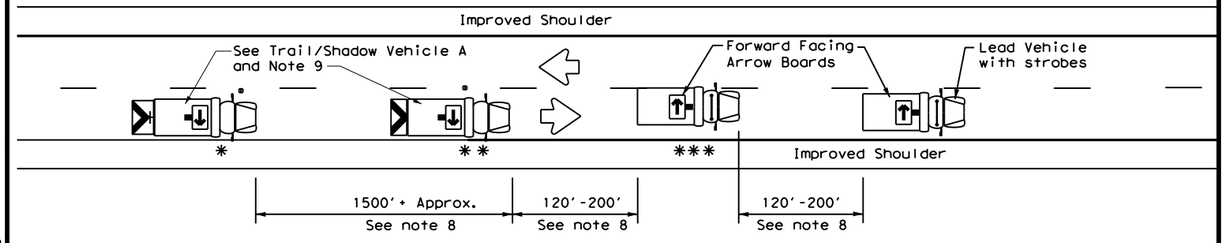
Texas Department of Transportation

Traffic Operations Division Standard

# TRAFFIC CONTROL PLAN MOBILE OPERATIONS DIVIDED HIGHWAYS

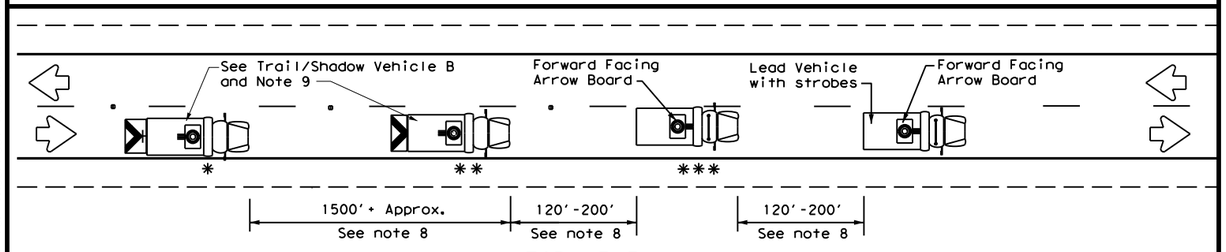
# TCP(3-2)-13

| FILE: tcp3-2.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| © TxDOT December 1985 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS 2-94 4-98 8-95 7-13 1-97 | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC | | 23 |



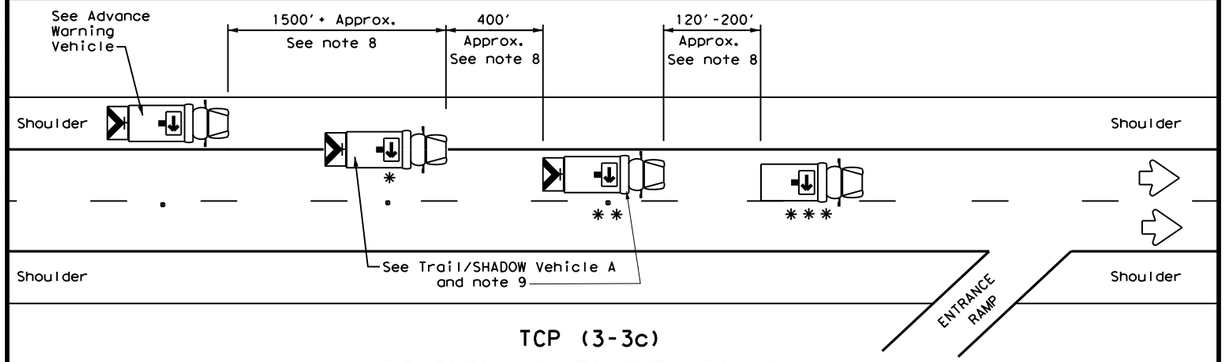

TCP (3-3a)

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



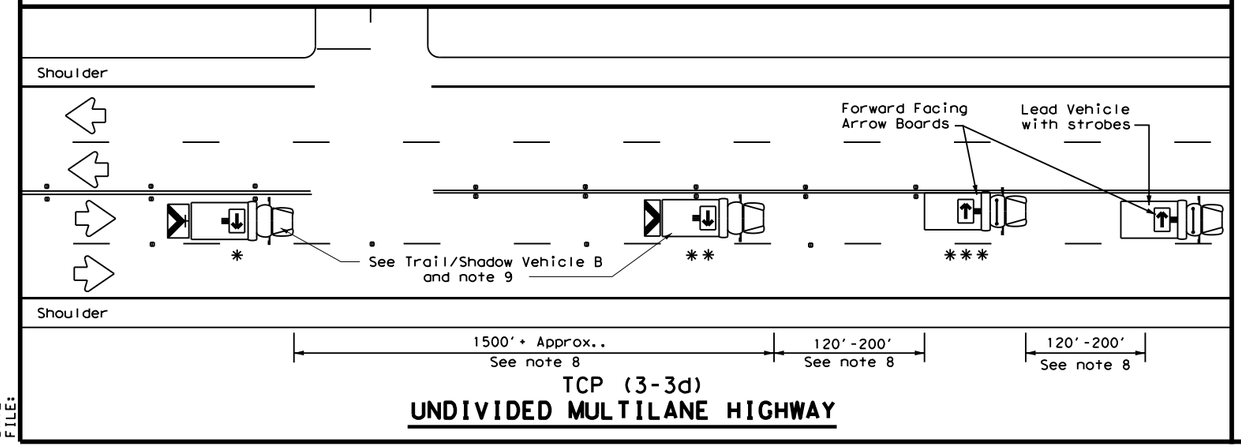

TCP (3-3b)

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




TCP (3-3c)

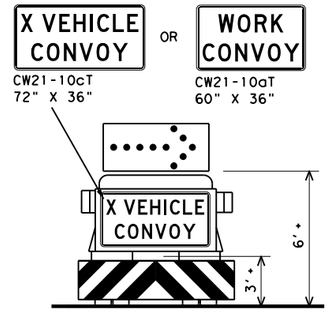
## DIVIDED MULTILANE HIGHWAY




TCP (3-3d)

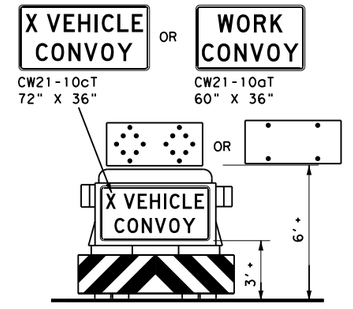
## UNDIVIDED MULTILANE HIGHWAY

DATE:
FILE:



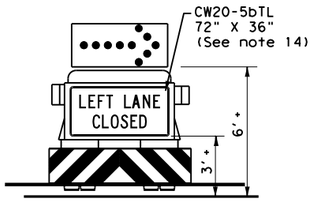

## TRAIL/SHADOW VEHICLE A

with RIGHT Directional display
Flashing Arrow Board

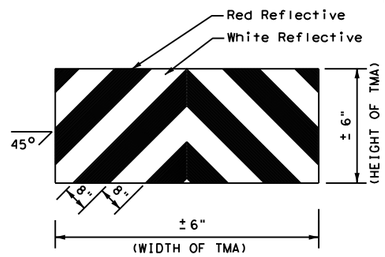



## TRAIL/SHADOW VEHICLE B

with Flashing Arrow Board
in Caution Mode




## ADVANCE WARNING VEHICLE




## STRIPING FOR TMA

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

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

## GENERAL NOTES

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

Texas Department of Transportation

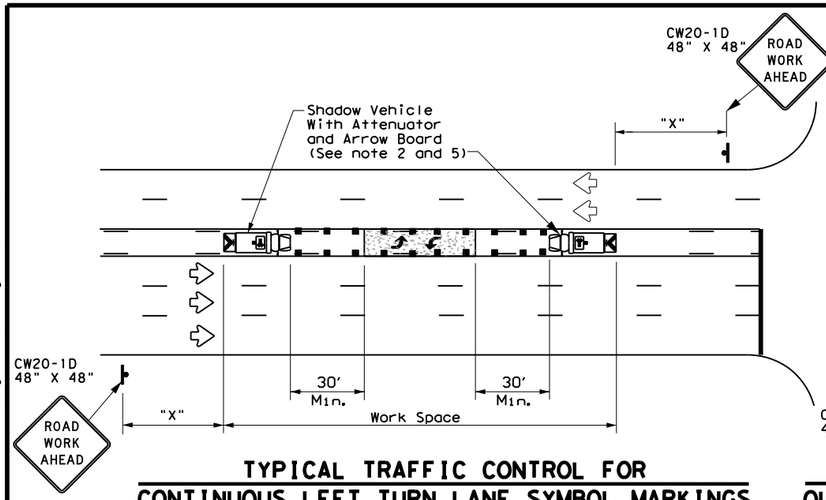
Traffic Operations Division Standard

# TRAFFIC CONTROL PLAN MOBILE OPERATIONS RAISED PAVEMENT MARKER INSTALLATION/ REMOVAL

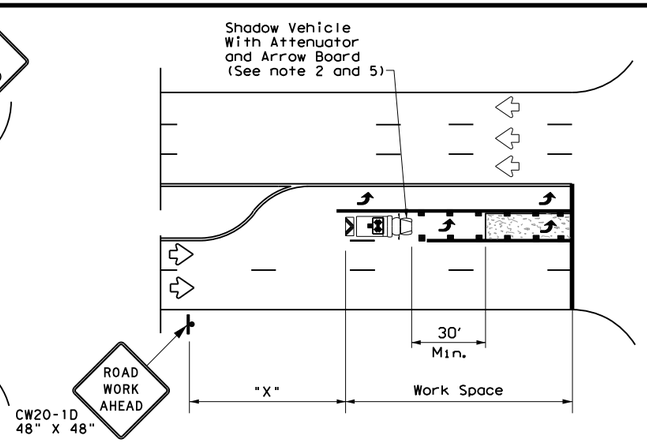
# TCP(3-3)-14

| FILE: tcp3-3.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT September 1987 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 2-94 4-98 | DIST | COUNTY | | SHEET NO. |
| 8-95 7-13 | 10 | SMITH, ETC. | | 24 |
| 1-97 7-14 | | | | |

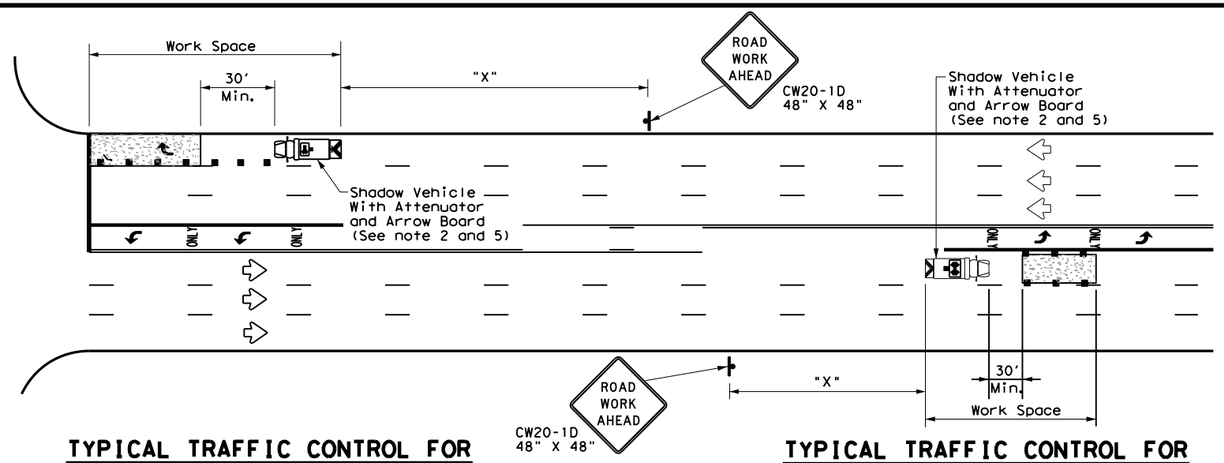
DATE:
FILE:




**TYPICAL TRAFFIC CONTROL FOR CONTINUOUS LEFT TURN LANE SYMBOL MARKINGS**

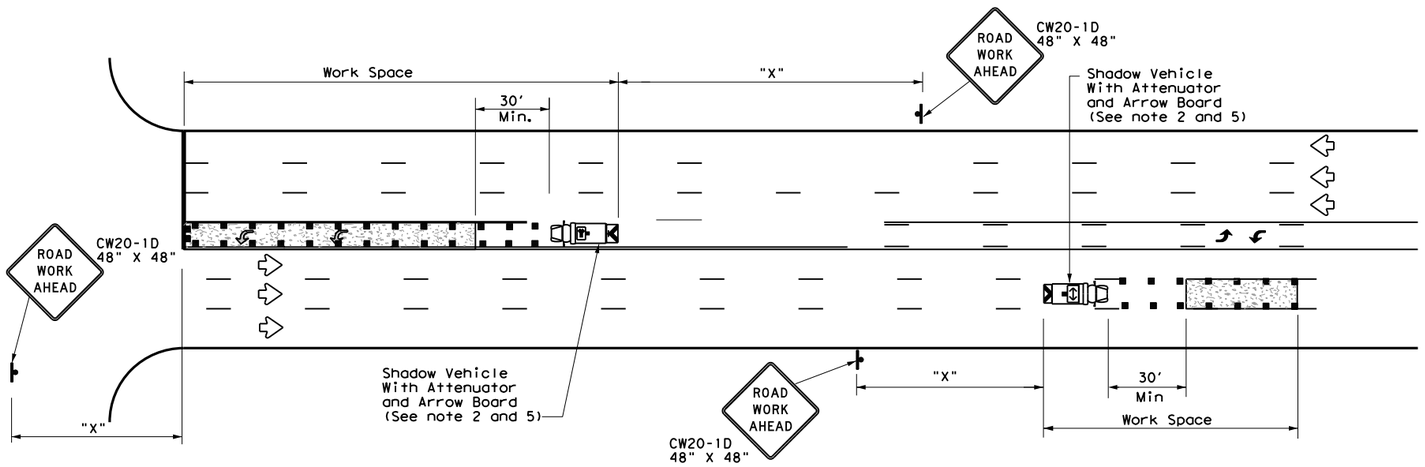



**TYPICAL TRAFFIC CONTROL FOR OUTSIDE DUAL LEFT TURN LANE SYMBOL MARKINGS**




**TYPICAL TRAFFIC CONTROL FOR OUTSIDE LANE MARKINGS**

**TYPICAL TRAFFIC CONTROL FOR INSIDE LANE MARKINGS**




**TYPICAL TRAFFIC CONTROL FOR LEFT TURN LANE MARKINGS**

**TYPICAL TRAFFIC CONTROL FOR CENTER LANE MARKINGS**

| 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 | | Channelizing Devices |

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

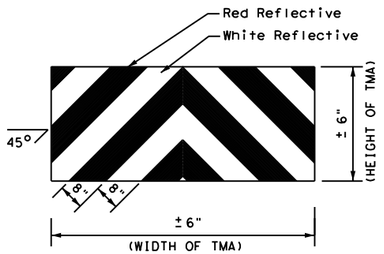
* Conventional Roads Only

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

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

## GENERAL NOTES

1. 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

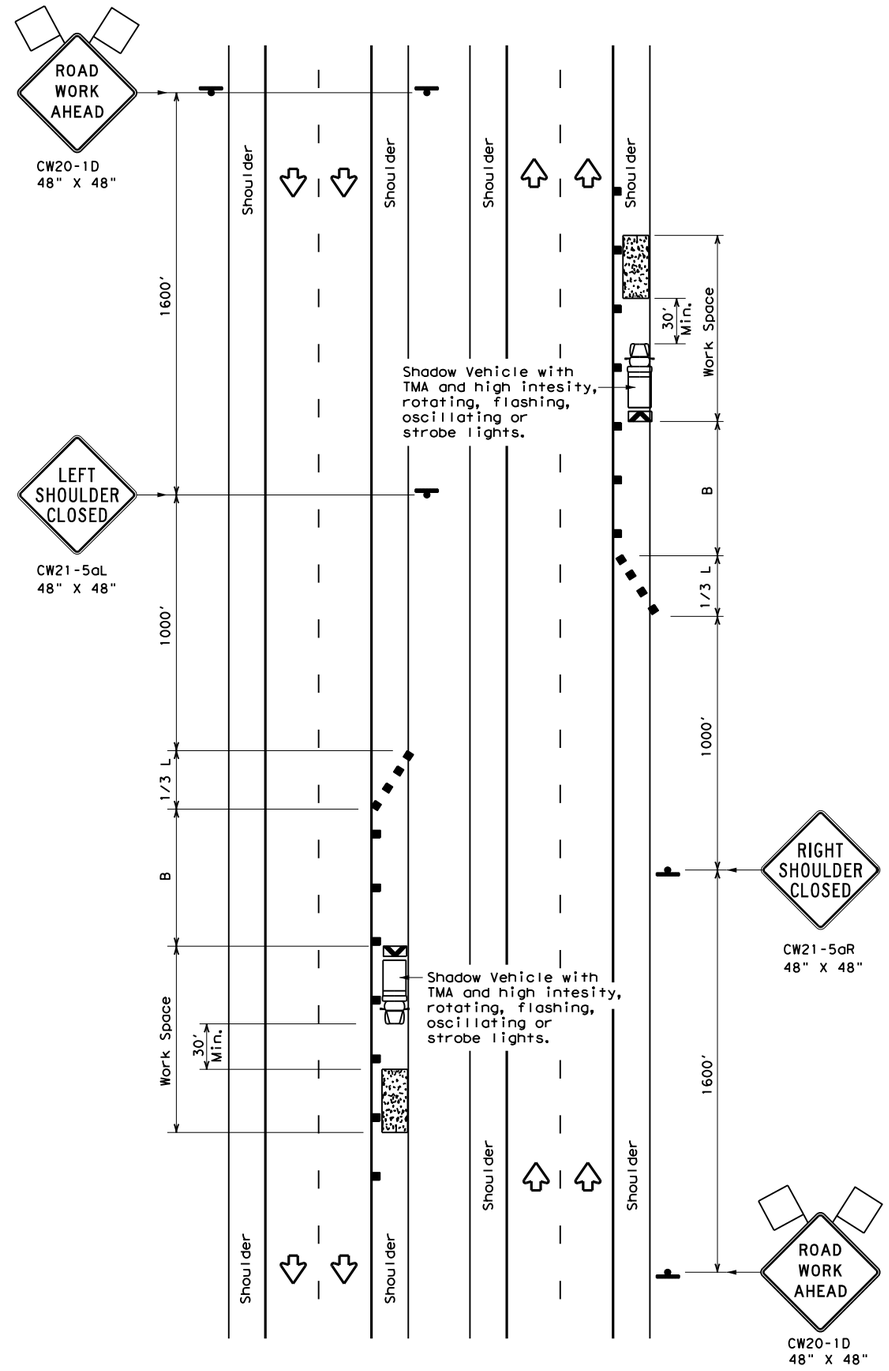
*Traffic Operations Division Standard*

# TRAFFIC CONTROL PLAN MOBILE OPERATIONS FOR ISOLATED WORK AREAS UNDIVIDED HIGHWAYS

# TCP(3-4)-13

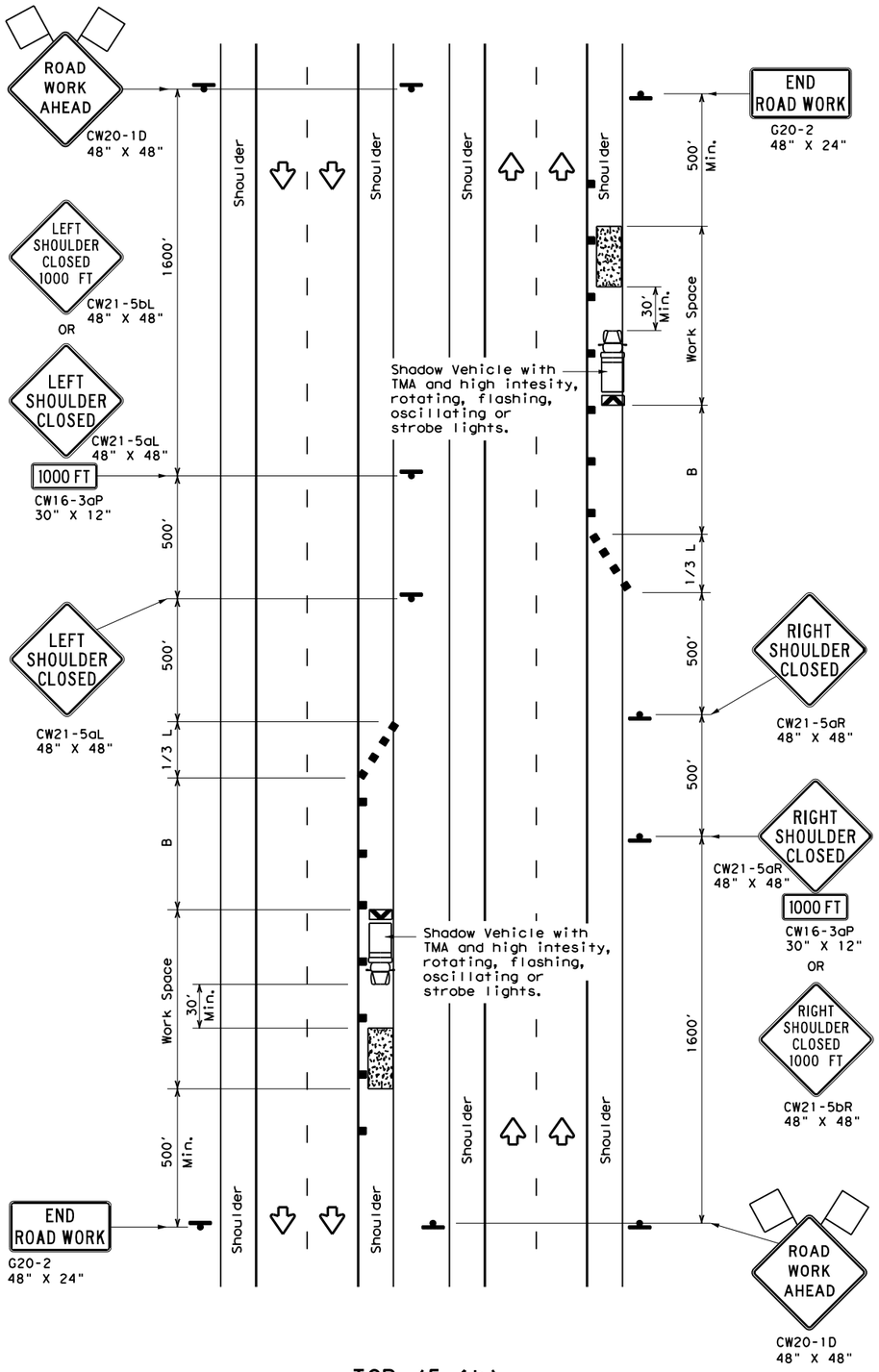
| FILE: tcp3-4.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| © TxDOT July, 2013 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC | | 25 |

DATE:
FILE:




TCP (5-1a)

## WORK AREA ON SHOULDER




TCP (5-1b)

## WORK AREA ON SHOULDER

### LEGEND

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

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

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

### TYPICAL USAGE

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

### GENERAL NOTES

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

Texas Department of Transportation

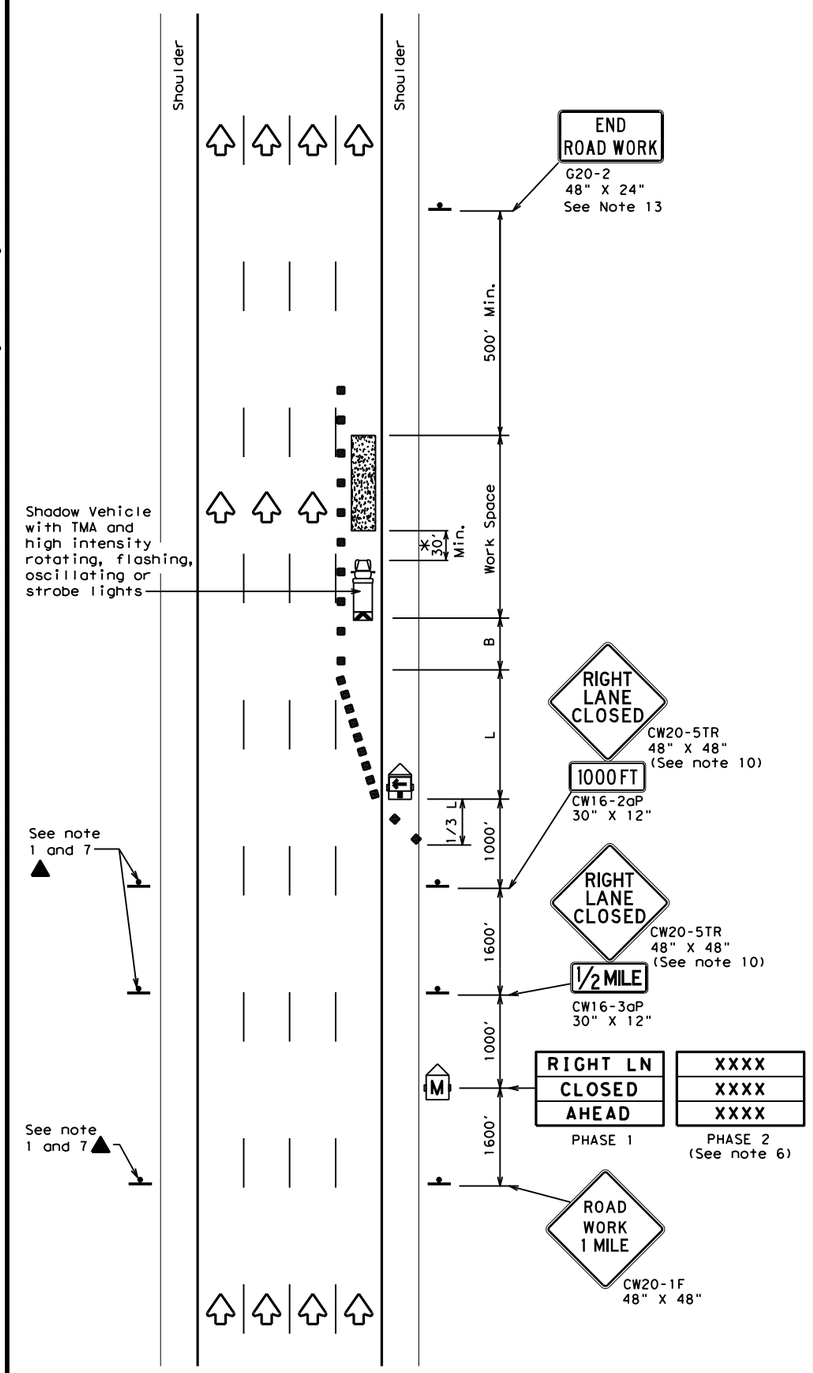
*Traffic Operations Division Standard*

# TRAFFIC CONTROL PLAN SHOULDER WORK FOR FREEWAYS / EXPRESSWAYS

# TCP(5-1)-18

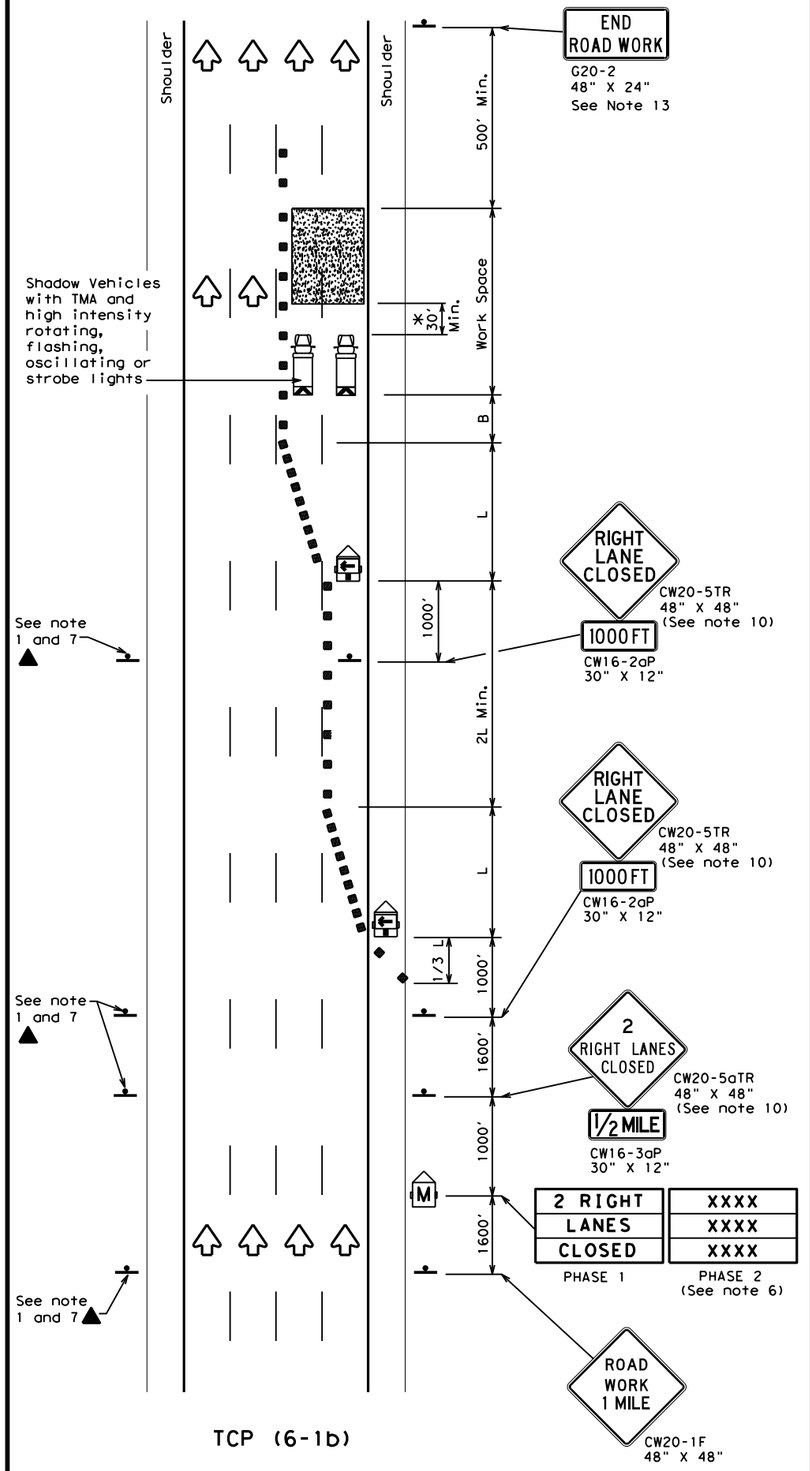
| FILE: tcp5-1-18.dgn | DN: | CK: | DW: | CK: |
|---|---|---|---|---|
| ©TxDOT February 2012 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS 2-18 | 6367 | 43 | 001 | IH 20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 26 |

DATE:
FILE:




TCP (6-1a)

## TYPICAL FREEWAY ONE LANE CLOSURE




TCP (6-1b)

## TYPICAL FREEWAY TWO LANE CLOSURE

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

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

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

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

## GENERAL NOTES

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

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

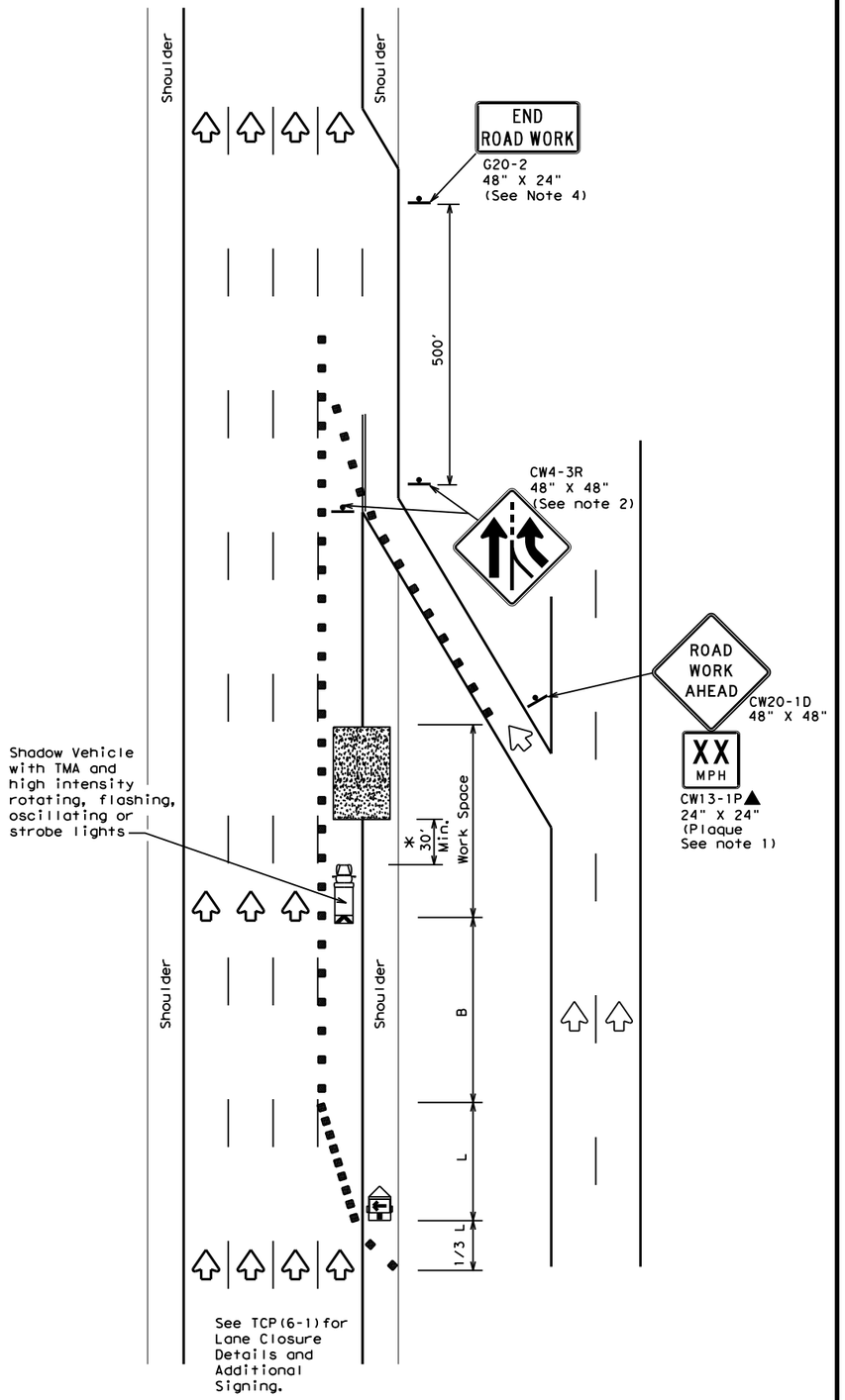
*Texas Department of Transportation*
*Traffic Operations Division Standard*

# TRAFFIC CONTROL PLAN FREEWAY LANE CLOSURES

## TCP(6-1)-12

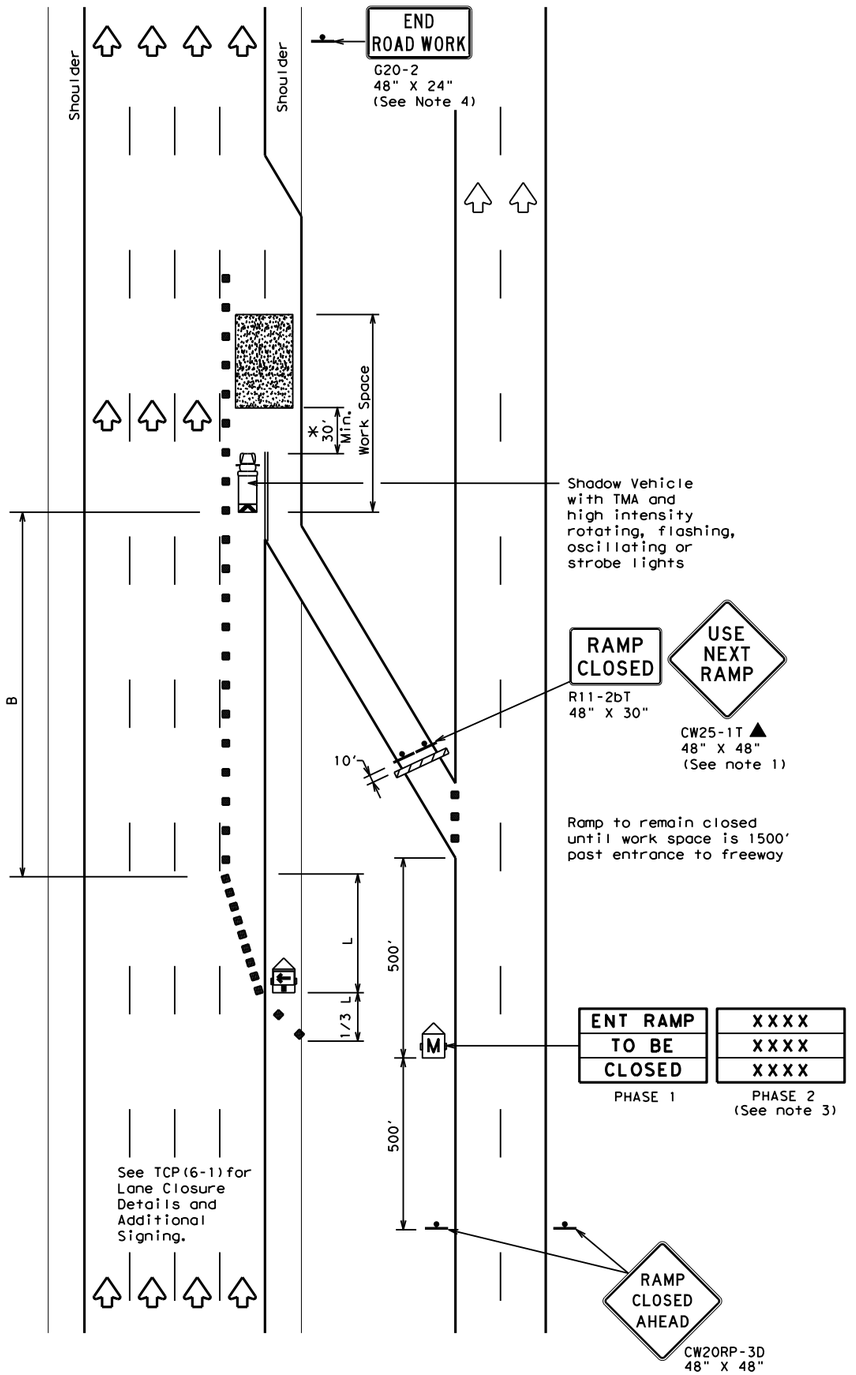
| FILE: tcp6-1.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT February 1998 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 8-12 | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC | | 27 |

DATE:
FILE:




TCP (6-2a)

## ENTRANCE RAMP OPEN
## WORK WITHIN 500' OF RAMP




TCP (6-2b)

## ENTRANCE RAMP CLOSED

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

| Posted Speed | Formula | Minimum Desirable Taper Lengths "L" ** | | | 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.
2. ADDED LANE Symbol (CW4-3) sign may be omitted when sign between ramp and mainlane can be seen from both roadways.
3. See "Advance Notice List" on BC(6) for recommended date and time formatting options for PCMS Phase 2 message.
4. The END ROAD WORK (G20-2) sign may be omitted when it conflicts with G20-2 signs already in place on the project.

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

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

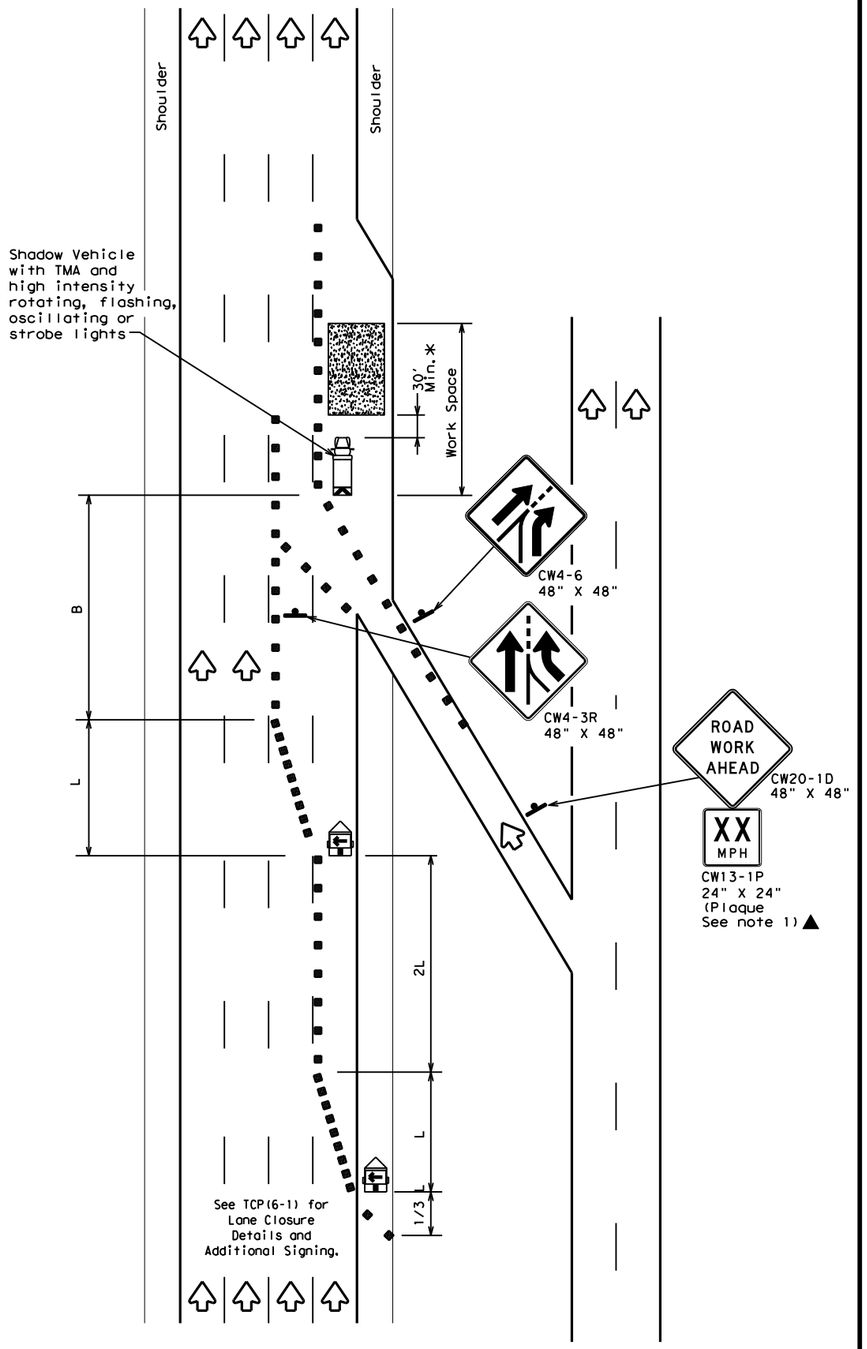
*Texas Department of Transportation*
*Traffic Operations Division Standard*

# TRAFFIC CONTROL PLAN
# WORK AREA NEAR RAMP

## TCP(6-2)-12

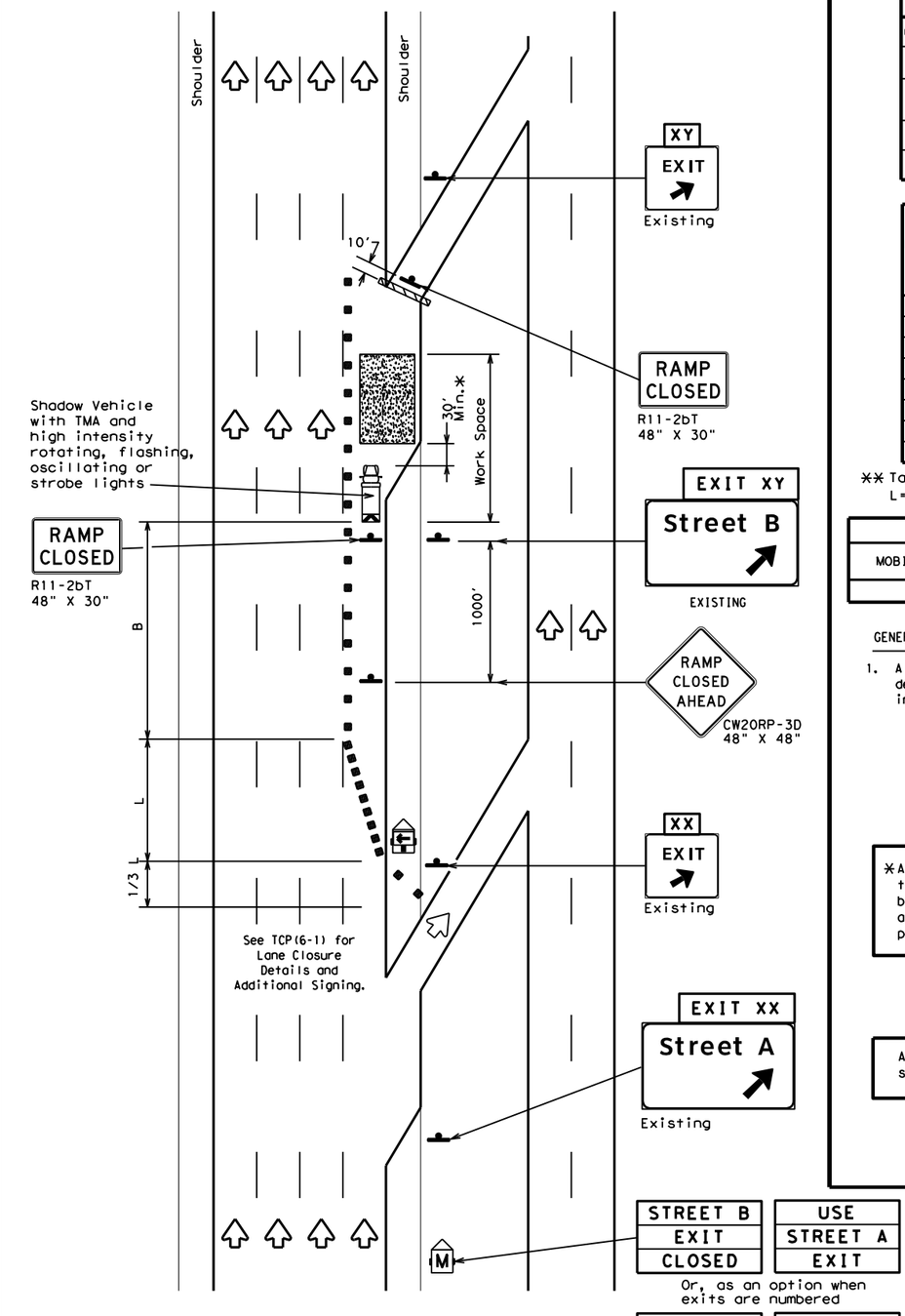
| FILE: tcp6-2.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT February 1994 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 1-97 8-98 | DIST | COUNTY | | SHEET NO. |
| 4-98 8-12 | 10 | SMITH, ETC. | | 28 |

DATE:
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 | M | Portable Changeable Message Sign (PCMS) |
| | Sign | | Traffic Flow |
| | Flag | | Flagger |

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

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

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

GENERAL NOTES:

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

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

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

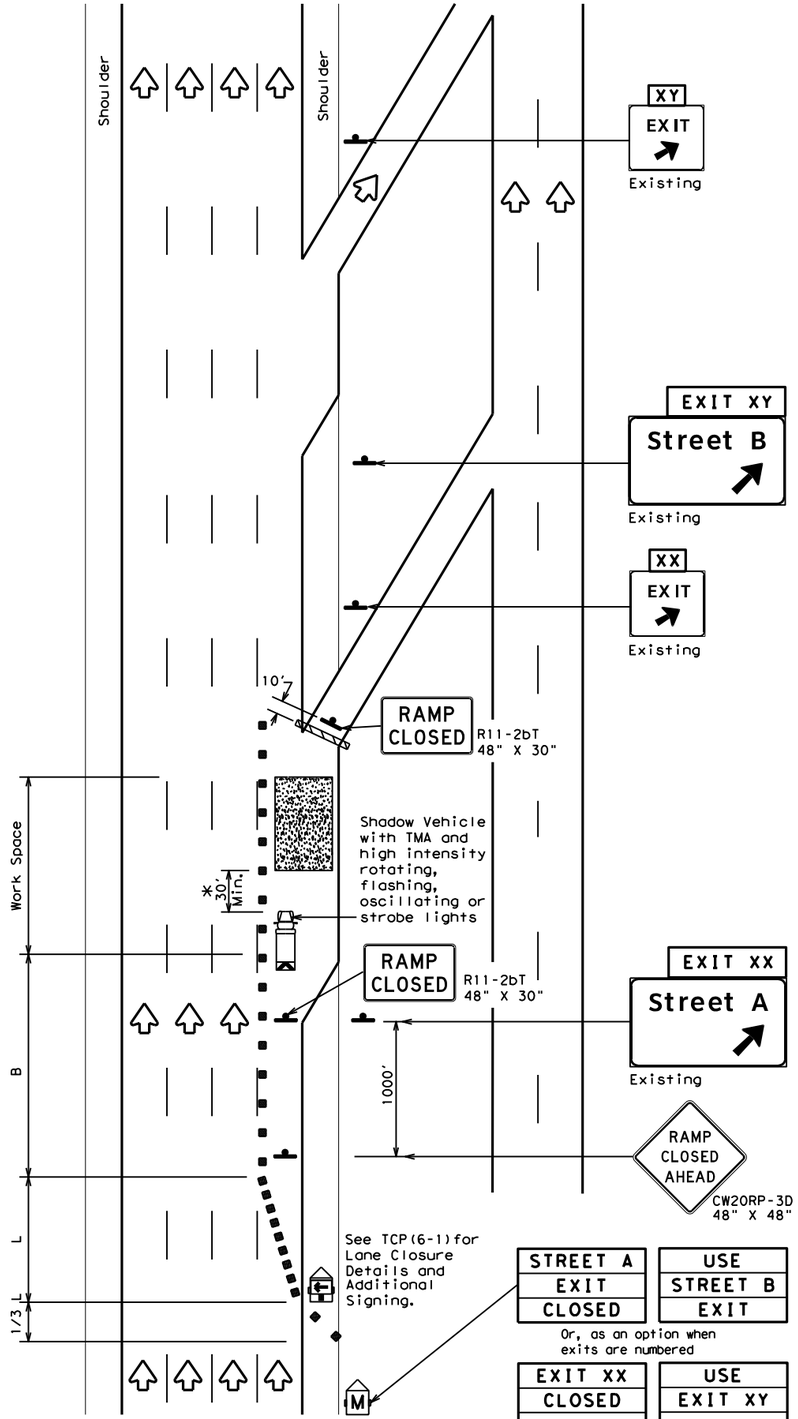
*Texas Department of Transportation*
*Traffic Operations Division Standard*

# TRAFFIC CONTROL PLAN
# WORK AREA BEYOND RAMP

## TCP(6-3)-12

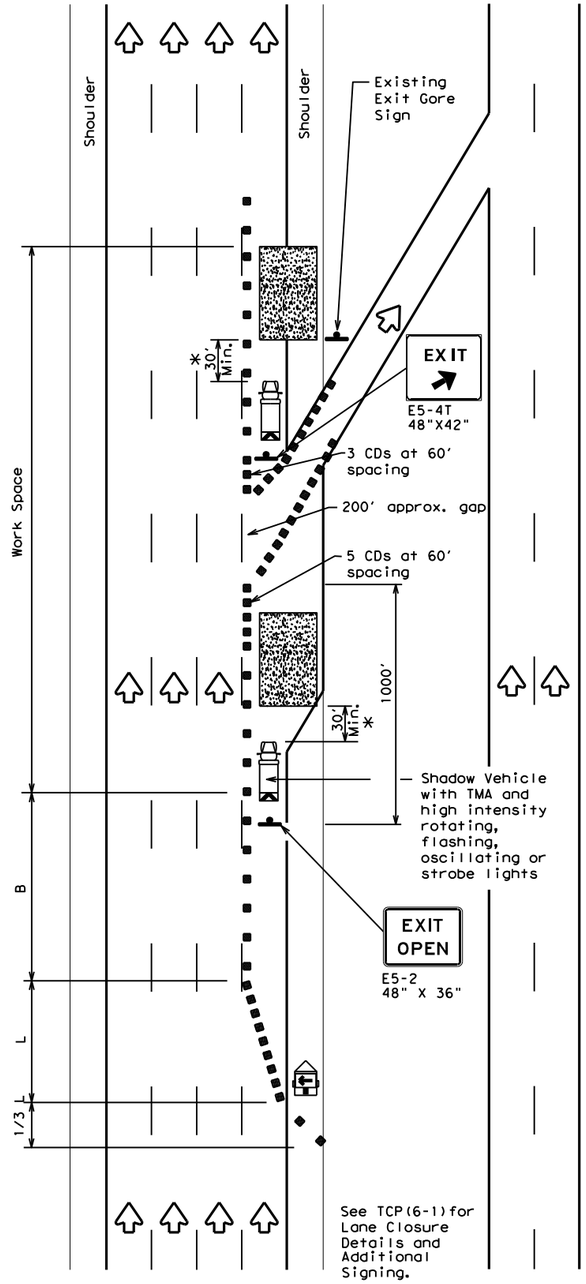
| FILE: tcp6-3.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT February 1994 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 1-97 8-98 | DIST | COUNTY | | SHEET NO. |
| 4-98 8-12 | 10 | SMITH, ETC. | | 29 |

DATE:
FILE:




TCP (6-4a)

## EXIT RAMP CLOSED
## TRAFFIC EXITS PAST CLOSED RAMP




TCP (6-4b)

## EXIT RAMP OPEN

### LEGEND

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

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

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

### TYPICAL USAGE

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

### GENERAL NOTES

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

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

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

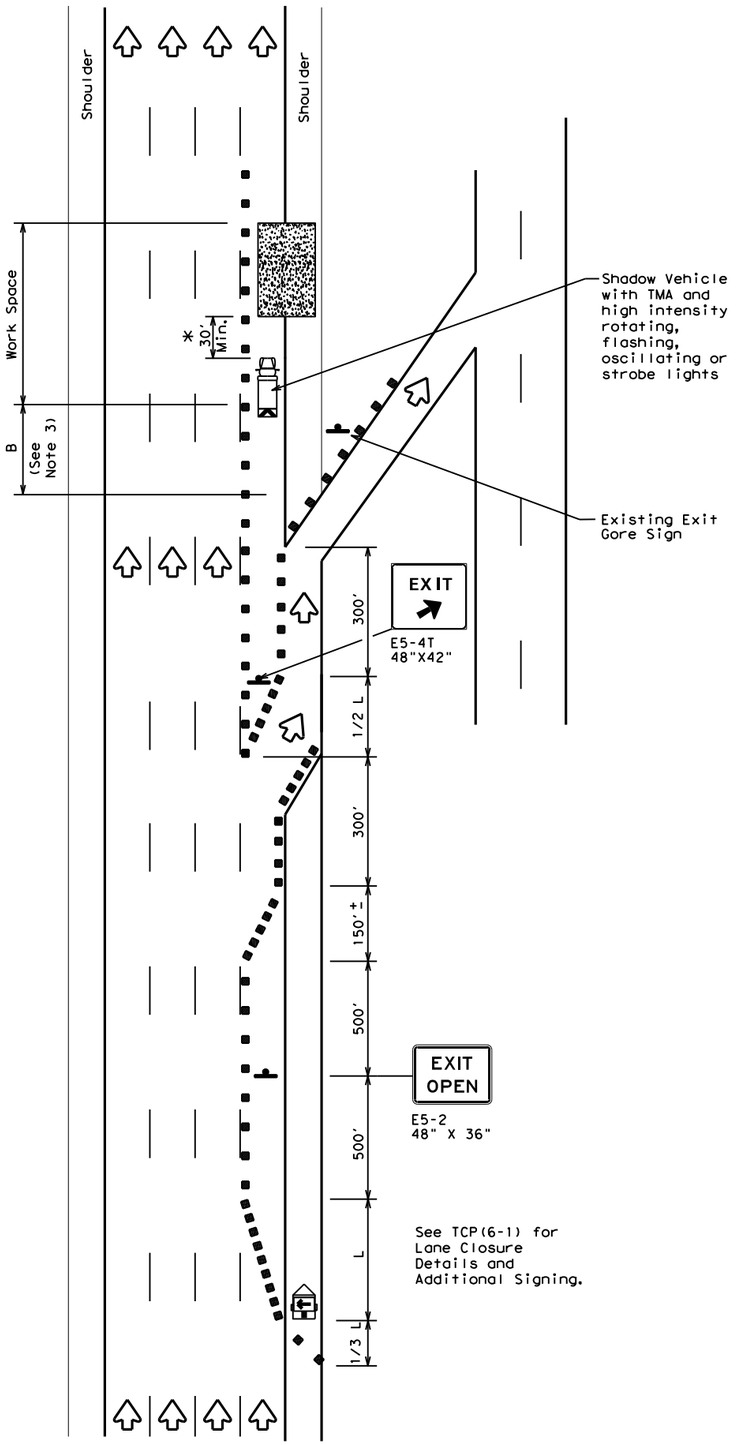
*Texas Department of Transportation*
*Traffic Operations Division Standard*

# TRAFFIC CONTROL PLAN
# WORK AREA AT EXIT RAMP

## TCP(6-4)-12

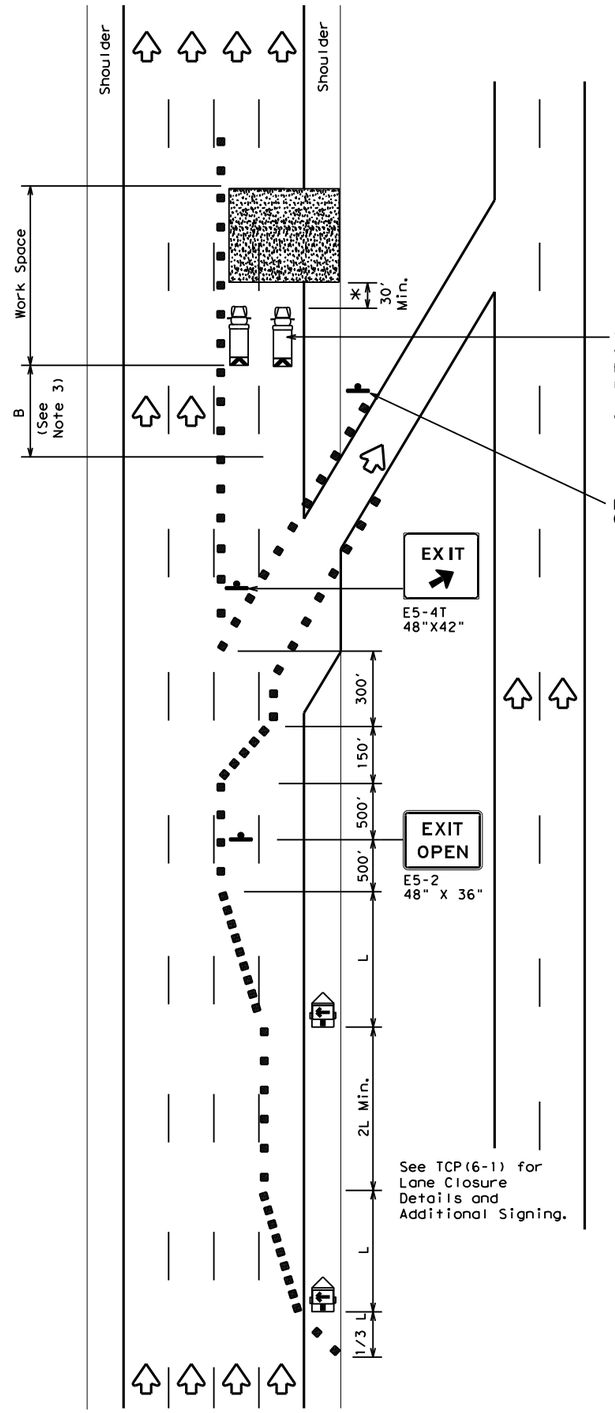
| FILE: tcp6-4.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT Feburary 1994 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 1-97 8-98 | DIST | COUNTY | | SHEET NO. |
| 4-98 8-12 | 10 | SMITH, ETC. | | 30 |

DATE:
FILE:




TCP (6-5a)

## EXIT RAMP OPEN




TCP (6-5b)

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

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

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

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

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

## GENERAL NOTES

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

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

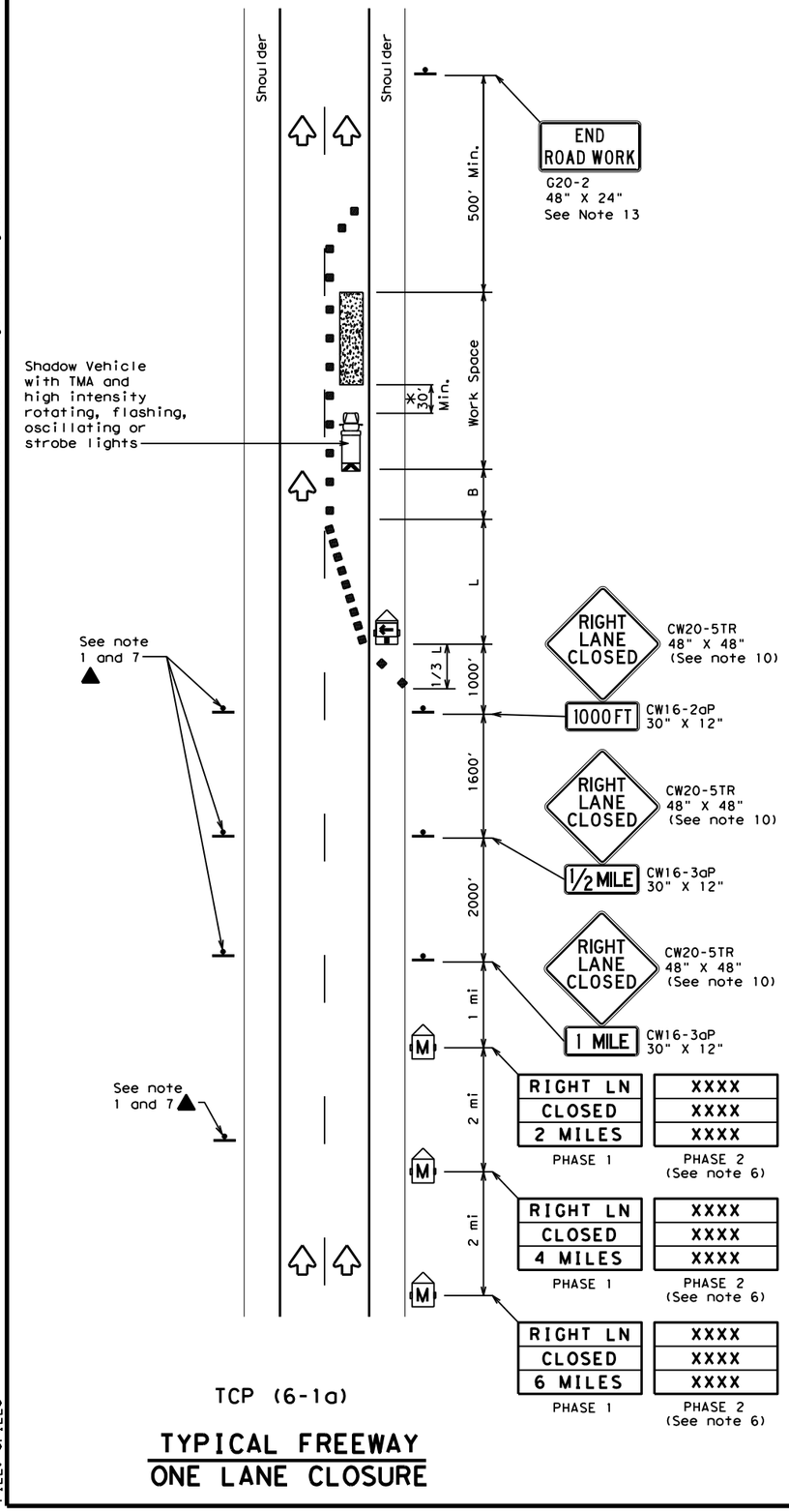
Additional requirements for lane closures and advance signing shall be as shown on TCP (6-1) or as directed by the Engineer.

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

# TRAFFIC CONTROL PLAN
# WORK AREA BEYOND EXIT RAMP

## TCP(6-5)-12

| FILE: tcp6-5.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT Feburary 1998 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 1-97 8-98 | DIST | COUNTY | | SHEET NO. |
| 4-98 8-12 | 10 | SMITH, ETC. | | 31 |




TCP (6-1a)

## TYPICAL FREEWAY ONE LANE CLOSURE

## GENERAL NOTES

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

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

| Posted Speed | Formula | Minimum Desirable Taper Lengths "L" ** | | | 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 |
| | ✓ | ✓ | ✓ | |

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

Texas Department of Transportation
Traffic Operations Division Standard

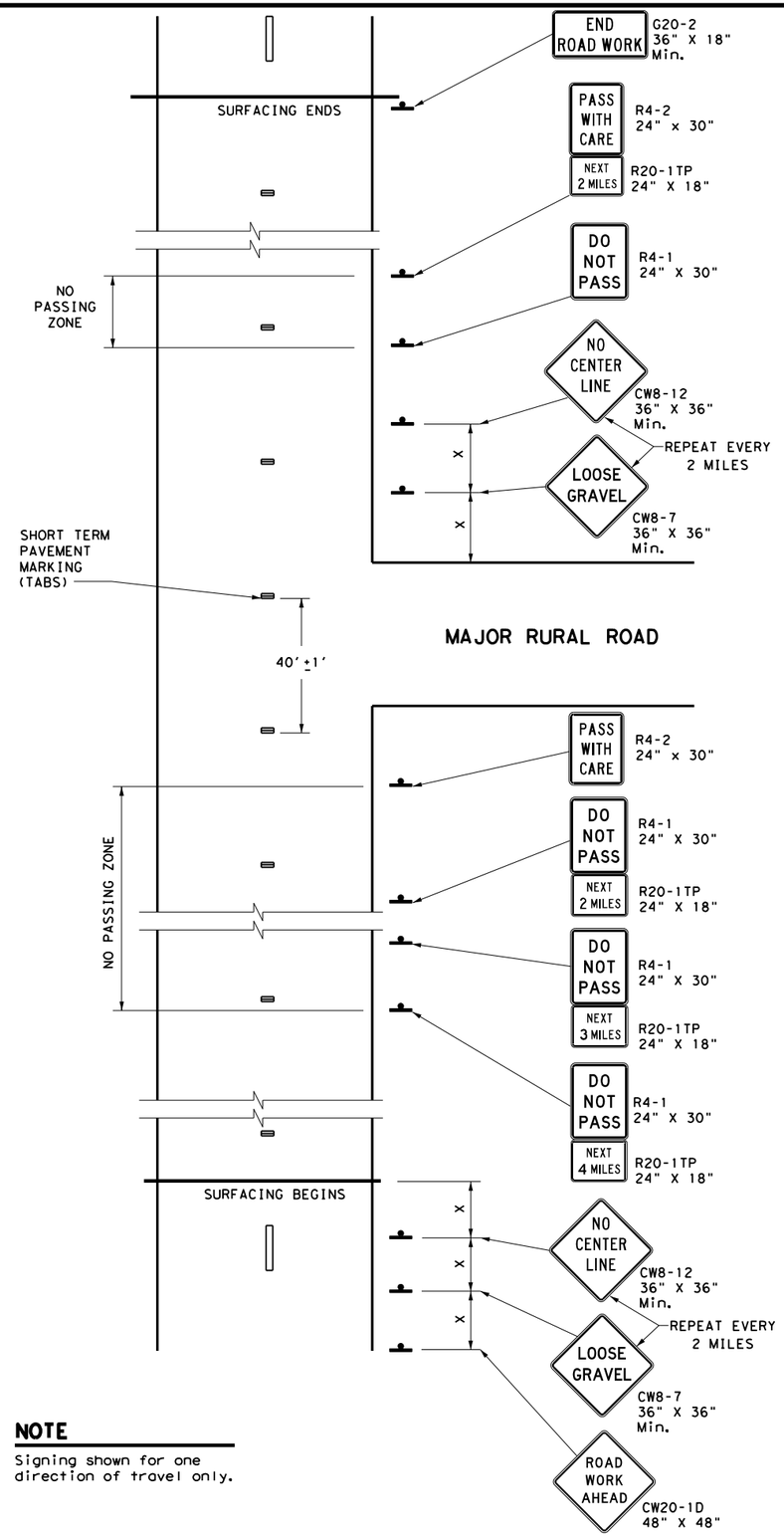
# TRAFFIC CONTROL PLAN FREEWAY LANE CLOSURES

# TCP(6-1)-12(MOD)

| FILE: tcp6-1.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT February 1998 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 8-12 | DIST | COUNTY | | SHEET NO. |
| 9-16-16 | 10 | SMITH, ETC. | | 32 |

DATE: $DATE$ $TIME$
FILE: $FILE$

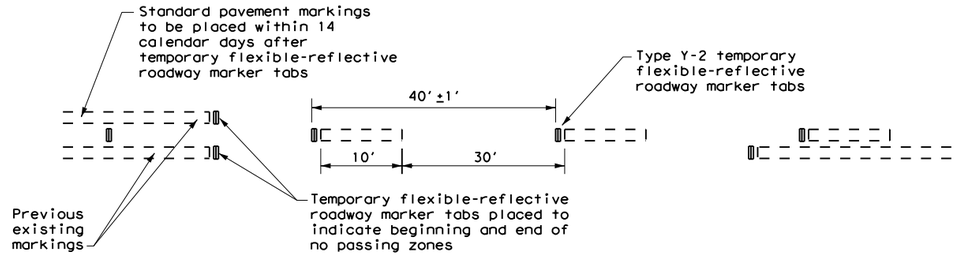
DATE:
FILE:




**NOTE**

Signing shown for one direction of travel only.

# NO PASSING ZONES ON TWO-LANE TWO-WAY ROADS




# TABS ON CENTERLINES OF TWO-LANE TWO-WAY ROADS

For seal coat, micro-surface or similar operations

## "DO NOT PASS" SIGN (R4-1) and NO-PASSING ZONES

A. Prior to the beginning of construction, all currently striped no-passing zones shall be signed with the DO NOT PASS (R4-1) signs and PASS WITH CARE (R4-2) signs placed at the beginning and end of each zone for each direction of travel except as otherwise provided herein. Signs marking these individual no-passing zones need not be covered prior to construction if the signs supplement the existing pavement markings.

B. At the discretion of the Engineer, in areas of numerous no-passing zones, several zones may be combined as a single zone. If passing is to be prohibited over one or more lengthy sections, a DO NOT PASS sign and a NEXT XX MILES (R20-1TP) plaque may be used at the beginning of such zones. The DO NOT PASS sign and the NEXT XX MILES plaque should be repeated every mile to the end of the no-passing zone. In areas where there is considerable distance between no-passing zones, the end of the no-passing zone may be signed with a PASS WITH CARE sign and a NEXT XX MILES plaque.

C. Depending on traffic volumes and length of sections, it may be desirable to prohibit passing throughout the project to prevent damage to windshield and lights. The DO NOT PASS sign and NEXT XX MILES plaque should be used and repeated as often as necessary for this purpose. Where several existing zones are to be combined into one individual no-passing zone, the sign at the beginning of the zone should be covered until the surfacing operation has passed this location so as not to have the DO NOT PASS sign conflict with the existing pavement markings. Also, unless one days operation completes the entire length of such combined zones, appropriate DO NOT PASS and PASS WITH CARE signs should be placed at the beginning and end of the no-passing zones where the surfacing operation has stopped for the day.

D. R4-1 and R4-2 are to remain in place until standard pavement markings are installed.

## "NO CENTER LINE" SIGN (CW8-12)

A. Center line markings are yellow pavement markings that delineate the separation of travel lanes that have opposite directions of travel on a roadway. Divided highways do not typically have center line markings.

B. At the time construction activity obliterates the existing center line markings(low volume roads may not have an existing centerline), a NO CENTER LINE (CW8-12) sign should be erected at the beginning of the work area, at approximately 2 mile intervals within the work area, beyond major intersections and other locations deemed necessary by the Engineer.

C. The NO CENTER LINE signs are to remain in place until standard pavement markings are installed.

## "LOOSE GRAVEL" SIGN (CW8-7)

A. When construction begins, a LOOSE GRAVEL (CW8-7) sign should be erected at each end of the work area and repeated at intervals of approximately 2 miles in rural areas and closer in urban areas.

B. The LOOSE GRAVEL signs are to remain in place until the condition no longer exists.

## PAVEMENT MARKINGS

A. Temporary markings for surfacing projects shall be Temporary Flexible-reflective Roadway Marker Tabs unless otherwise approved by the Engineer. Tabs are to be installed to provide true alignment for striping crews or as directed by the Engineer. Tabs will be placed at the spacing indicated. Tabs should be applied to the pavement
no more than two (2) days before the surfacing is applied. After the surfacing is rolled and swept, the cover over the reflective strip shall be removed.

B. Tabs shall not be used to simulate edge lines.

C. Tab placement for overlay/inlay operations shall be as shown on the WZ(STPM) standard sheet.

## COORDINATION OF SIGN LOCATIONS

A. The location of warning signs at the beginning and end of a work area are to be coordinated with other signing typically shown on the Barricade and Construction Standards for project limits to ensure adequate sign spacing.

B. Where possible the ROAD WORK AHEAD (CW20-1D), LOOSE GRAVEL (CW8-7), and NO CENTER LINE (CW8-12) signs should be placed in the sequence shown following the OBEY WARNING SIGNS STATE LAW (R20-3T) and the TRAFFIC FINES DOUBLE (R20-5T) sign, and one "X" sign spacing prior to the CONTRACTOR (G20-6T)sign typically located at or near the limits of surfacing. LOOSE GRAVEL and NO CENTER LINE signs will then be repeated as described above.

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

* Conventional Roads Only

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

## GENERAL NOTES

1. The traffic control devices detailed on this sheet will be furnished and erected as directed by the Engineer on sections of roadway where tabs must be placed prior to the surfacing operation which will cover or obliterate the existing pavement markings.
2. The devices shown on this sheet are to be used to supplement those required by the BC Standards or others required elsewhere in the plans.
3. Signs shall be erected as detailed on the BC Standards or the Compliant Work Zone Traffic Control Devices List (CWZTCD) on supports approved for Long-Term / Intermediate-Term Work Zone Sign Supports.
4. When surfacing operations take place on divided highways, freeways or expressways, the size of diamond shaped construction warning signs shall be 48" x 48".
5. Signs on divided highways, freeways and expressways will be placed on both right and left sides of the roadway based on roadway conditions as directed by the Engineer.

Texas Department of Transportation

*Traffic Operations Division Standard*

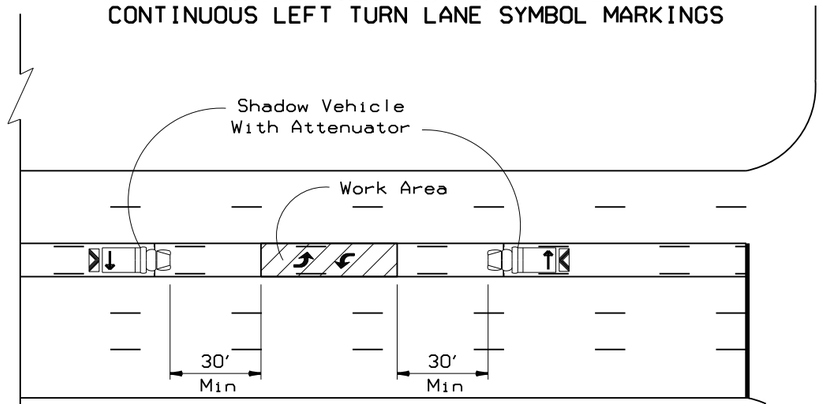
# TRAFFIC CONTROL DETAILS FOR SURFACING OPERATIONS

# TCP(7-1)-13

| FILE: tcp7-1.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT March 1991 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 4-92 4-98 | DIST | COUNTY | | SHEET NO. |
| 1-97 7-13 | 10 | SMITH, ETC. | | 33 |

210

## TYPICAL TRAFFIC CONTROL FOR CONTINUOUS LEFT TURN LANE SYMBOL MARKINGS

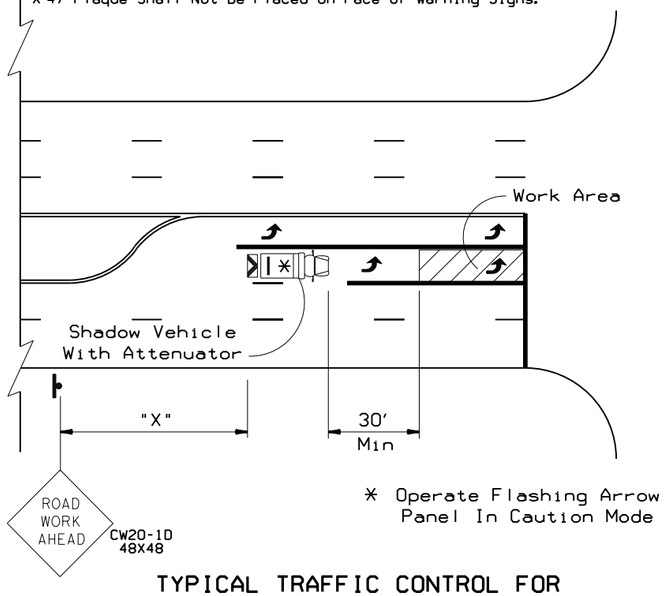



**NOTES:**

1) This Traffic Control Plan Shall Be Used For Placement Of All Stop Lines, Words And Symbol Markings Or Any Other Operation As Directed By The Engineer.
2) Only One Lane ( Including Left Turn Lane) Closure Permitted Per Direction Of Travel.
3) A Truck Mounted Attenuator Shall Be Used On Shadow Vehicle. Truck Mounted Attenuator Shall Be From An Approved Source As Shown In The General Notes.

* 4) Plaque Shall Not Be Placed On Face Of Warning Signs.

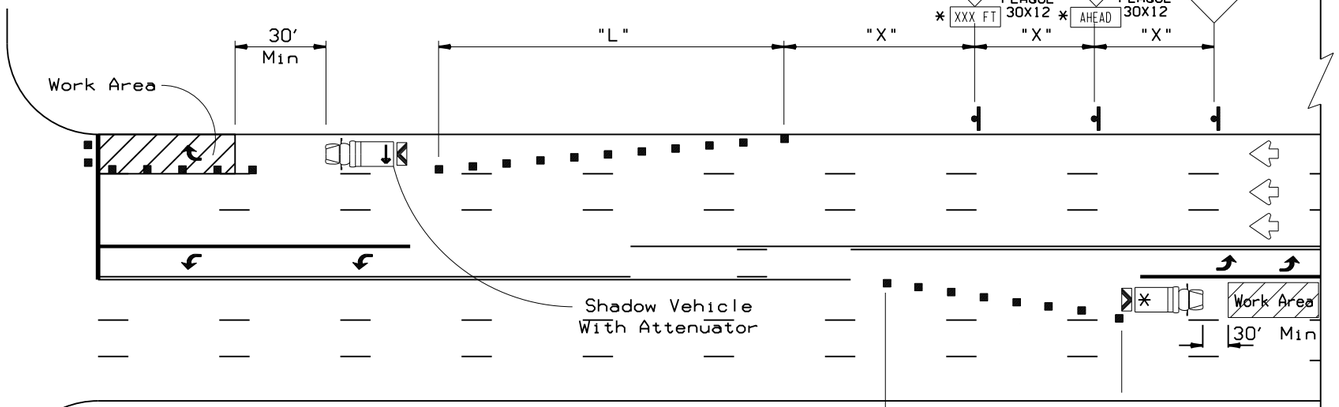
## TYPICAL TRAFFIC CONTROL FOR OUTSIDE DUAL LEFT TURN LANE MARKINGS



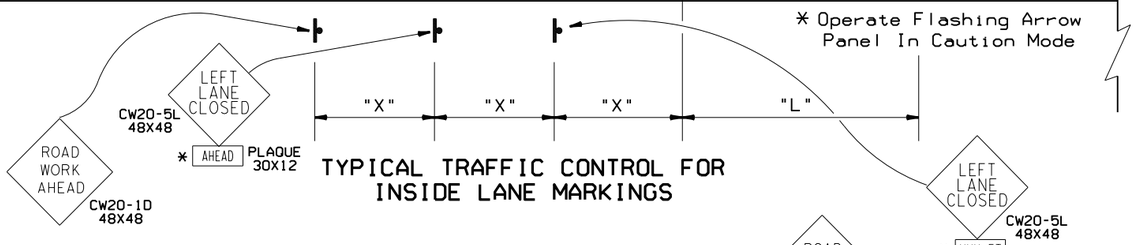

LEGEND

Type III Barricade ■ ■ Channelizing Devices Flag
Heavy Work Vehicle Truck Mounted Attenuator
Trailer Mounted Flashing Arrow Panel (M) Portable Changeable Message Sign
Flagger Sign Post

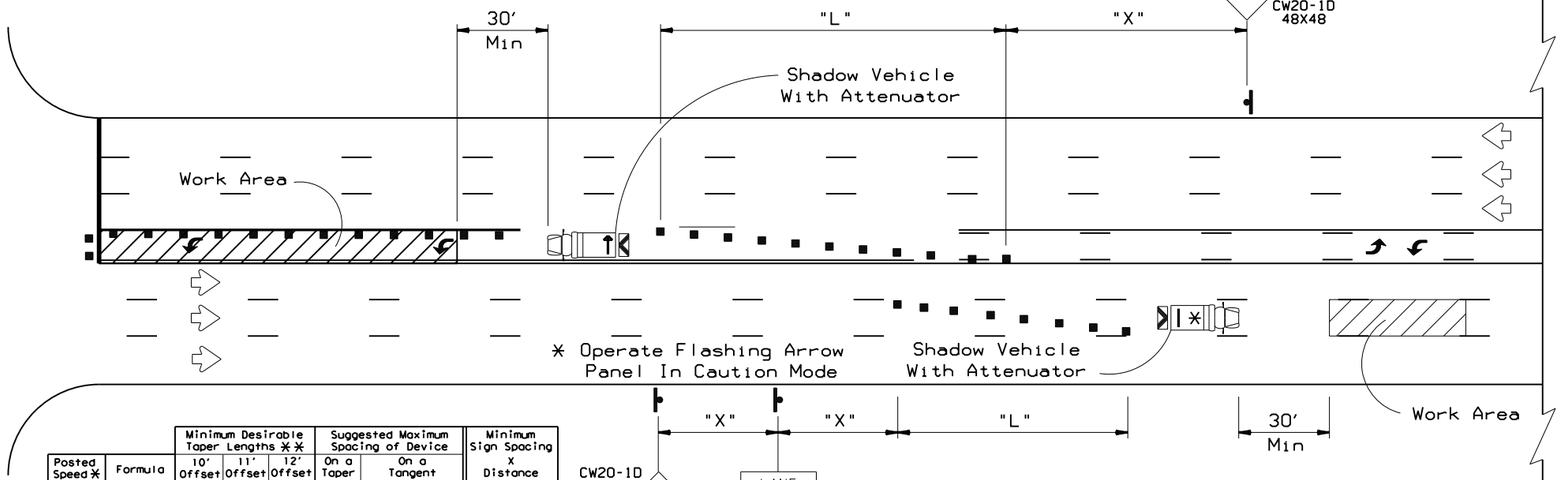
## TYPICAL TRAFFIC CONTROL FOR OUTSIDE LANE MARKINGS




## TYPICAL TRAFFIC CONTROL FOR INSIDE LANE MARKINGS




## TYPICAL TRAFFIC CONTROL FOR LEFT TURN LANE MARKINGS




## TYPICAL TRAFFIC CONTROL FOR CENTER LANE MARKINGS

| Posted Speed * | Formula | Minimum Desirable Taper Lengths ** 10' Offset | 11' Offset | 12' Offset | Suggested Maximum Spacing of Device On a Taper | On a Tangent | Minimum Sign Spacing x Distance |
|---|---|---|---|---|---|---|---|
| 30 | $L=\frac{WS^2}{60}$ | 150' | 165' | 180' | 30' | 60'-75' | 120' |
| 35 | | 205' | 225' | 245' | 35' | 70'-90' | 160' |
| 40 | | 265' | 295' | 320' | 40' | 80'-100' | 240' |
| 45 | L=WS | 450' | 495' | 540' | 45' | 90'-110' | 320' |
| 50 | | 500' | 550' | 600' | 50' | 100'-125' | 400' |
| 55 | | 550' | 605' | 660' | 55' | 110'-140' | 500' |
| 60 | | 600' | 660' | 720' | 60' | 120'-150' | *600' |
| 65 | | 650' | 715' | 780' | 65' | 130'-165' | *700' |
| 70 | | 700' | 770' | 840' | 70' | 140'-175' | *800' |

* Conventional Roads Only

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

# TCP FOR STATIONARY STRIPING OPERATIONS ON MULTILANE HIGHWAYS


TYLER DISTRICT STANDARD
Texas Department of Transportation
tcp21.dgn
/

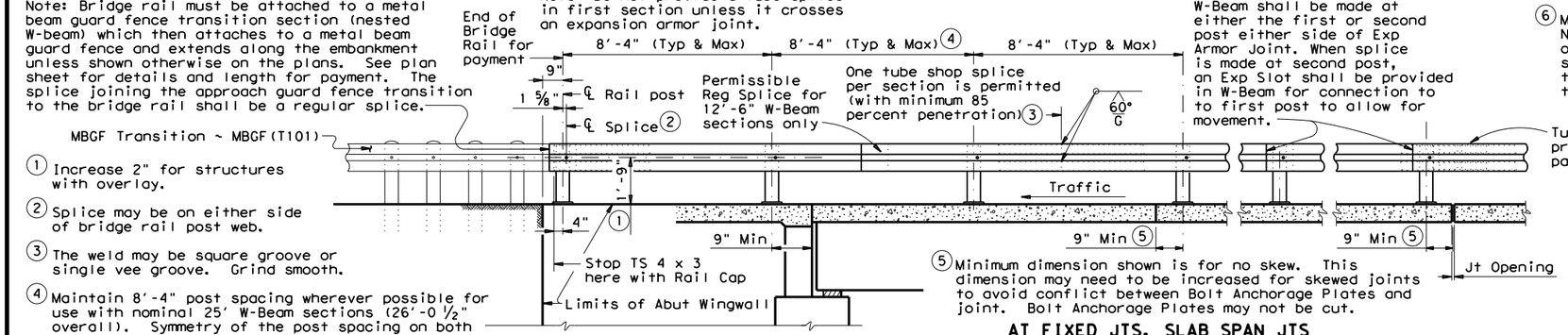
| REVISIONS: |
|---|
| 5-97 |
| 3-99 |
| 4-99 |

| FED.RD. DIV.NO. | AID PROJECT NO. | | SHEET NO. |
|---|---|---|---|
| 6 | RMC 636743001 | | 34 |
| STATE | DIST. | COUNTY | |
| TEXAS | TYLER | SMITH, ETC | |
| CONT. | SECT. | JOB | HIGHWAY NO. |
| 6367 | 43 | 001 | IH-20 |

Note: Bridge rail must be attached to a metal beam guard fence transition section (nested W-beam) which then attaches to a metal beam guard fence and extends along the embankment unless shown otherwise on the plans. See plan sheet for details and length for payment. The splice joining the approach guard fence transition to the bridge rail shall be a regular splice.

Note: Do not provide a tube splice in first section unless it crosses an expansion armor joint.

Note: Expansion splice in W-Beam shall be made at either the first or second post either side of Exp Armor Joint. When splice is made at second post, an Exp Slot shall be provided in W-Beam for connection to to first post to allow for movement.




AT ABUTMENT BENTS

AT FIXED JTS, SLAB SPAN JTS AND CG (PAN FORM) JTS

AT EXPANSION JOINTS

(1) Increase 2" for structures with overlay.

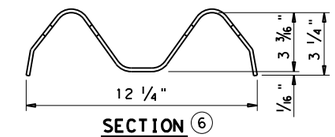
(2) Splice may be on either side of bridge rail post web.

(3) The weld may be square groove or single vee groove. Grind smooth.

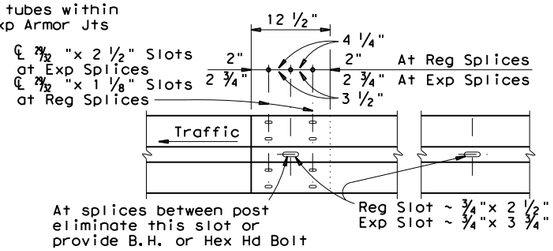
(4) Maintain 8'-4" post spacing wherever possible for use with nominal 25' W-Beam sections (26'-0 ½" overall). Symmetry of the post spacing on both sides and along the structure is not necessary. The nominal 25' sections may also be maintained by introducing four post spaces at 6'-3" at areas of conflict. Two adjacent spaces of 8'-8" and 8'-0" each are also permissible.

(5) Minimum dimension shown is for no skew. This dimension may need to be increased for skewed joints to avoid conflict between Bolt Anchorage Plates and joint. Bolt Anchorage Plates may not be cut.

(6) Member shall be 12 Gage Steel Nom thickness = 0.1046" exclusive of protective coating. Actual section may vary slightly with the manufacturer and conforms to AASHTO M-180.




SECTION (6)




Note: Provide ⅝" Dia Button Head Shoulder Bolts or Hex Head Bolts with Hex Nuts at all splice slots

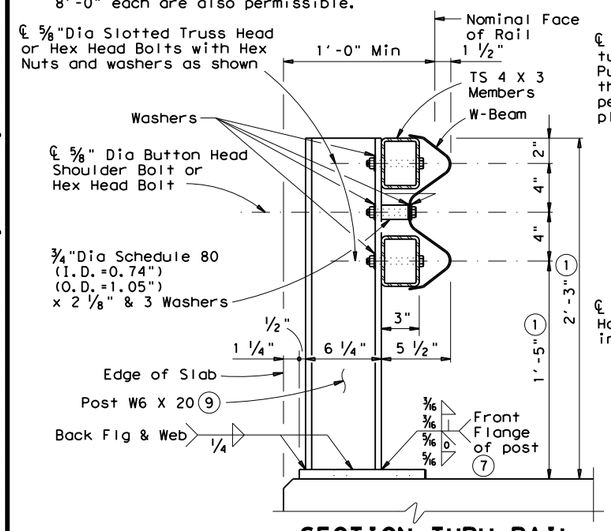
SPLICE POST CONN

## INSIDE ELEVATION OF RAIL

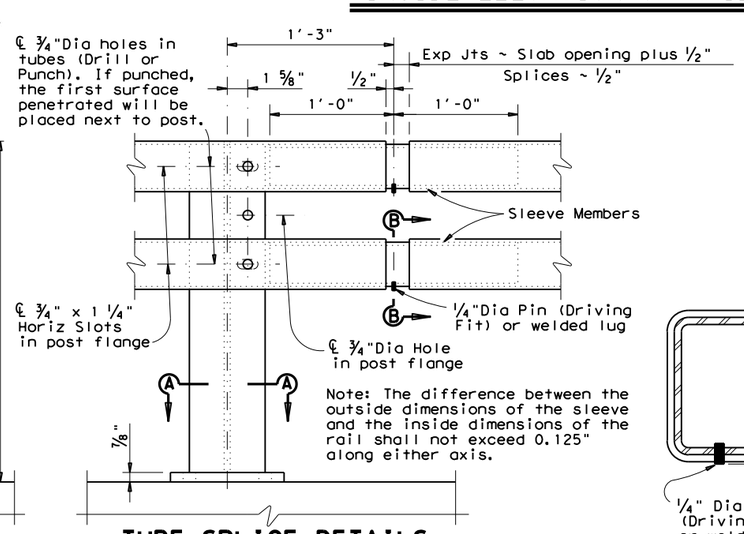
## W-BEAM DETAILS

| TUBE & SLEEVE MEMBERS | | |
|---|---|---|
| Rail Member | | Sleeve Thickness |
| Material | Thickness | Material ~ A36 |
| A 500 Grade C | 0.188" | 0.188" |
| A 500 Grade B | 0.250" | 0.250" |
| A 500 Grade A or A 501 | 0.313" | 0.250" |

Note: Other sections of equal or greater strength are acceptable for sleeves.



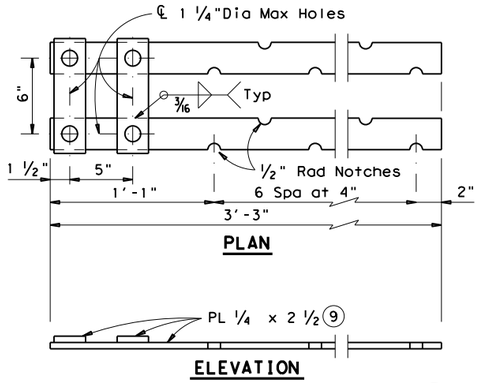

SECTION THRU RAIL




TUBE SPLICE DETAILS




SECTION B-B SLEEVE FABRICATION OPTION RAIL CAP




BOLT ANCHORAGE PLATES (11)

GENERAL NOTES:

This rail was evaluated based on the results of previous crash tests and approved for a NCHRP Report 350 TL-3 rating and can be used for design speeds of 50 mph and greater.

Section lengths of TS 4 x 3 members shall be attached continuously to a minimum of three posts (except at abutments with expansion joints).

Face of rail and posts shall be vertical transversely unless otherwise approved by the Engineer. Posts shall be perpendicular to adjacent roadway grade. Grout may be used under base plates if necessary.

All W-beam, tubing, posts, bolts, nuts, washers, anchorage plates and bottom plates are considered as parts of the rail for payment.

All steel components shall be galvanized unless otherwise shown in plans.

At expansion slots in W-beam rail, tighten bolts snugly.

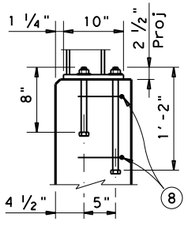
Anchor bolts shall be ¾" Dia ASTM A325 bolts (or A321 threaded rods with one tack welded hex nut each) with one hex nut and one 2" O.D. washer (0.153" Min thick) plus one 1 ½" O.D. hardened washer (0.122" Min thick) at each bolt. Optionally use rectangular ⅜ x 2 x 0'-3" A36 plate with 1⅛ "Dia hole. Threaded rods may be 0.670" minimum diameter with rolled threads. Nuts shall conform to A563 requirements. The untapped blanks shall be galvanized prior to cutting the threads. Threads for bolts and nuts shall have Class 2A and 2B fit tolerances in accordance with ANSI B1.1.

Shop drawings to be submitted to the Bridge Engineer for approval will be required only for rails on horizontal curves as follows, in which case the rail members shall be fabricated to the required radius: Deep Beam ~ 150' or less; Tubes ~ 600' or less. For rails not requiring shop drawings, erection drawings showing section lengths, splice locations, rail post spacing and anchor bolt setting shall be submitted to the Area Engineer for approval.

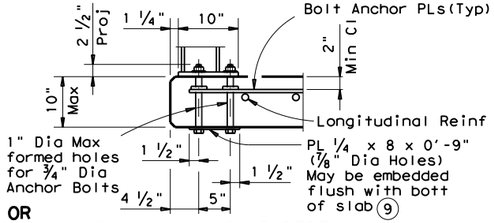
Shop drawings may be submitted as 11"x 17" prints provided they are clearly legible.

This rail requires a min slab thickness of 8" and is not recommended for use with Box Beam or Double-T Structures with asphalt overlay.

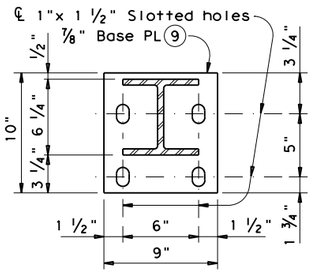
Average weight of railing with no overlay and with 0.25" tubes is 39 plf.



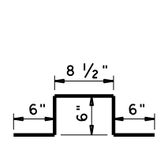

ON ABUT WINGWALL OR CIP RETAINING WALL

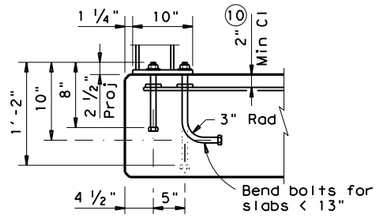



ON 10" MAX SLAB DEPTH




SECTION A-A




ON SLAB DEPTH GREATER THAN 10"

POST MOUNTING DETAILS

(7) In lieu of front Flg weld shown, a ⅜" fillet weld all around including edges of flange may be used.

(8) Adjust horizontal reinforcing as necessary and place two #4 bars around anchor bolts. These bars are to be considered subsidiary to Rail.

(9) All steel posts and plates shall be ASTM A36.

(10) Set plates under longitudinal reinforcing if necessary.

(11) Install one anchorage plate assembly in slab at each rail post. Do not galvanize or oil this assembly. Bolt Anchorage Plates may not be cut.



LEVELS DISPLAYED ACC:

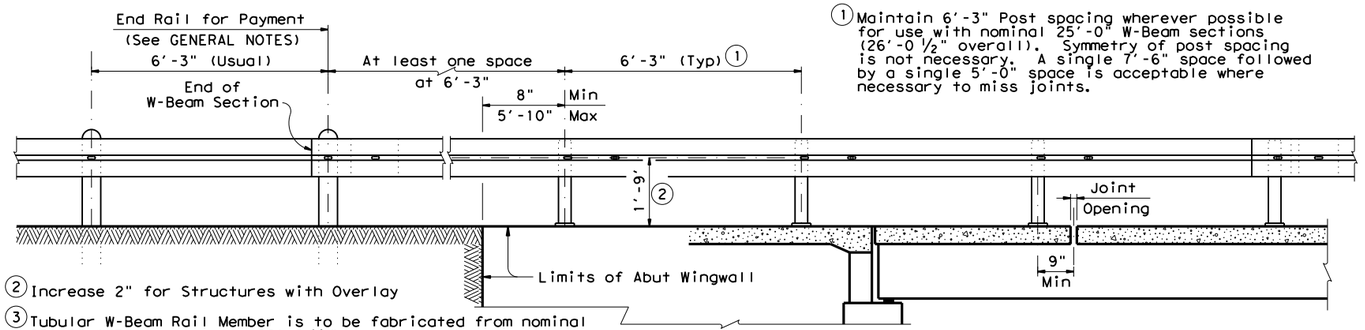
Texas Department of Transportation
Bridge Division

# TRAFFIC RAIL

## TYPE T101

| FILE: rlstde03.dgn | DN: JJP | CK: TxDOT | DW: JTR | CK: DWM |
|---|---|---|---|---|
| ©TxDOT February 2003 | DISTRICT | FEDERAL AID PROJECT | | SHEET |
| REVISIONS | 10 | RMC 6367-43-001 | | 35 |
| | COUNTY | CONTROL | SECT | JOB | HIGHWAY |
| | SMITH, ETC. | 6367 | 43 | 001 | IH-20 |

LEVELS DISPLAYED | ACC:



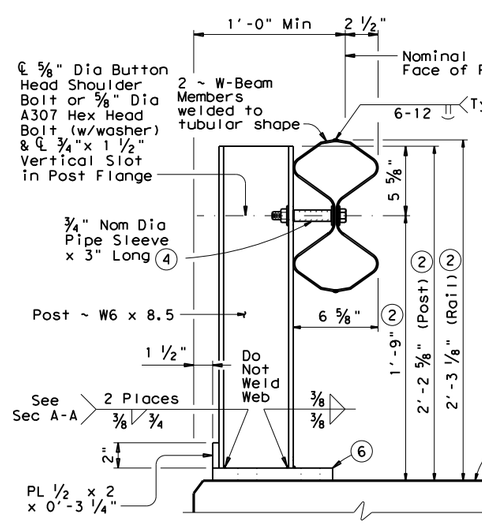

(1) Maintain 6'-3" Post spacing wherever possible for use with nominal 25'-0" W-Beam sections (26'-0 ½" overall). Symmetry of post spacing is not necessary. A single 7'-6" space followed by a single 5'-0" space is acceptable where necessary to miss joints.

(2) Increase 2" for Structures with Overlay

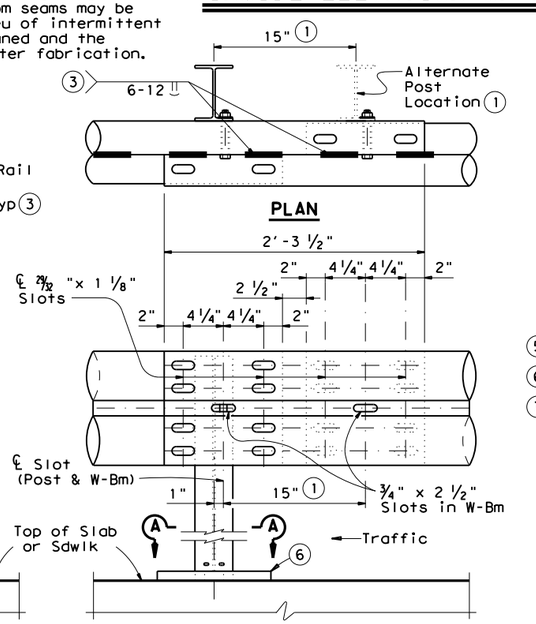
(3) Tubular W-Beam Rail Member is to be fabricated from nominal 25'-0" W-Beam sections (26'-0 ½" overall). Additional post mounting slots are to be made in each member 15" from the standard slots at 6'-3" centers. Top and bottom seams may be continuously welded with 80% penetration in lieu of intermittent welding shown. Welds shall be chipped and cleaned and the complete 27'-3 ½" tubular member galvanized after fabrication.

(4) See Section Thru Splice for Washers

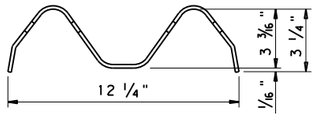
## INSIDE ELEVATION OF RAIL




## SECTION THRU RAIL




## TUBULAR W-BEAM SPLICE DETAILS



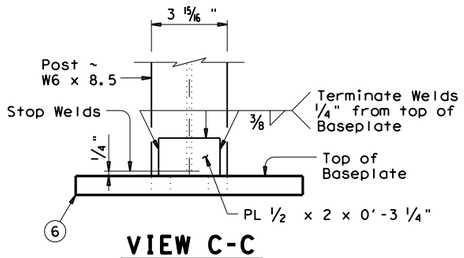

Member shall be 12 Gage Steel ~ Nom thickness = 0.1046" exclusive of protective coating. Actual section may vary slightly with the manufacturer.

## W-BEAM SECTION

(5) PL ¼ x 6 x 0'-8" ( ⅝" Dia Holes)

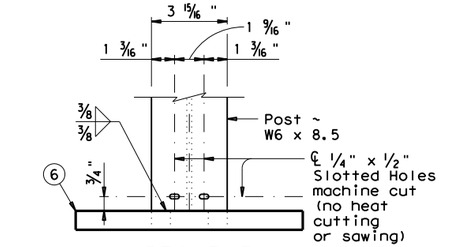
(6) PL ¾ x 9 ½ x 1'-0"

(7) 8 ~ ⅝" Splice nuts shall be tacked to bent sheet metal postioners as shown. Other suitable positioning methods or devices may be substituted. The complete splice shall have 16 bolts. Each bolt will include a 1 ¾" x 3" x ⅜" plate washer or a 1 ¾"O.D. washer.



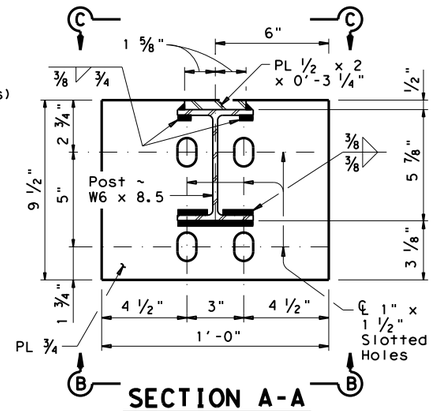

## VIEW C-C

Showing Back of Post

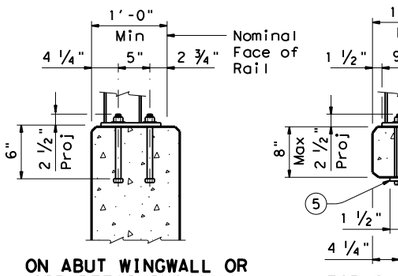



## VIEW B-B

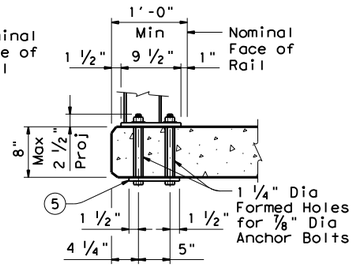
Showing Front of Post



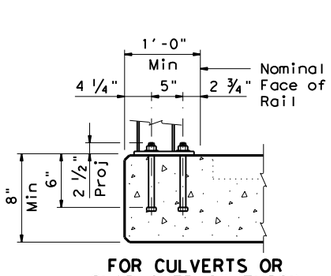

## SECTION A-A




ON ABUT WINGWALL OR CIP RETAINING WALL

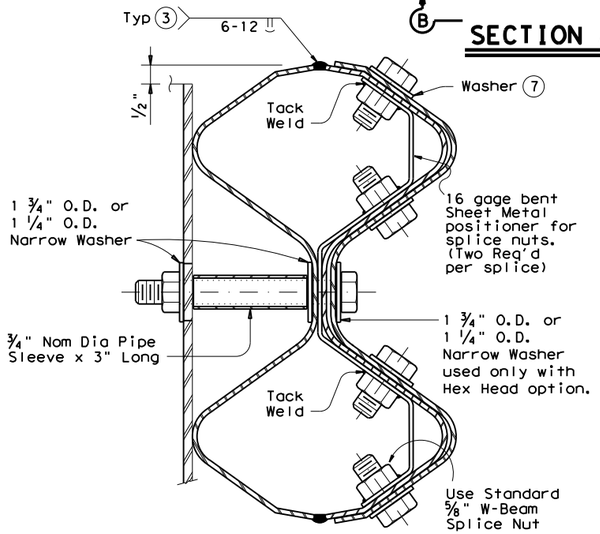



FOR 8" MAX CONC DEPTH




FOR CULVERTS OR SLAB OVER 8" THICK

## POST MOUNTING DETAILS




## SECTION THRU SPLICE

## GENERAL NOTES:

This rail was evaluated based on the results of previous crash tests and approved for a NCHRP Report 350 TL-2 rating. The T6 rail is only approved for low speed use, design speeds of 45 mph and less.

Tubular Rail Member shall be extended and connected to at least the first soil embedded post at each end of the structure. More such posts shall be used to utilize 25' standard sections. Approach guard fence posts shall be spaced at 6'-3" adjacent to the Tubular Rail since its flexibility is similar to standard metal beam guard fence. Do not install additional posts at 3'-1 ½" centers. Payment for this rail shall be in increments of 25'.

Face of rail and posts shall be vertical transversely unless otherwise approved by the Engineer. Posts shall be perpendicular to adjacent roadway grade. Grout may be used under base plates if necessary.

All posts, w-beam, pipe, sheet metal, bolts, nuts, washers, and bottom plates are considered as parts of the rail for payment.

All steel components except reinforcing shall be galvanized unless otherwise shown in plans.

Rail shall be extended across all fixed armor joints, slab span joints, or pan form joints with no change in post spacing or continuity. At expansion armor joints of 1 ¼" or less, the splice bolts nearest the joint and post mounting bolts at intervening post shall be snugly tightened to allow for rail expansion. At expansion armor joints over 1 ¼", suitably longer splice holes shall be provided.

Anchor bolts shall be ⅞" Dia ASTM A307 Grade A bolts (or A36 threaded rods with one tack welded hex nut each) with one hex nut and one hardened steel washer at each bolt (1 ¾" O.D. or 2" O.D. as directed by the Engineer). Clipped washers may be used as necessary. Threaded rods may be 0.781" minimum diameter with rolled threads. Nuts shall conform to A563 requirements. The untapped blanks shall be galvanized prior to cutting the threads. Threads for bolts and nuts shall have Class 2A and 2B fit tolerances in accordance with ANSI B1.1.

Shop drawings to be submitted to the Bridge Engineer for approval are required only for the proposed rail splices at armor expansion joints greater than 1 ¼" and for rails on horizontal curves in which case the Tubular Rail member shall be fabricated to the required radius if the radius is 600 feet or less. For rails not requiring shop drawings, erection drawings showing splice locations shall be submitted to the Area Engineer for approval. Shop or Erection Drawings may be 11" x 17" or larger.

Average weight of railing (6'-3" Post spa and no Overlay) = 23 plf.

DESIGN/REPAIR CRITERIA

The posts of this rail are designed to break away on impact from an errant vehicle. The rail is designed to deflect approx. two to three feet as it contains and redirects the errant vehicle. This rail may not be installed on top of or behind curbs that project above finished grade.

Fully anchored guardfence must be attached to each end of rail.

Repairs to impact-damaged post/baseplate units are not permitted. All impact-damaged posts must be replaced with a new post/baseplate unit.

This railing is especially suitable for use on bridge width box culverts. The detail sheet titled "Culvert Mounting For T6 Traffic Rail, Type T6-CM" is then required, showing culvert curbs and wingwall modifications and additional reinforcing steel to be included as part of the railing for payment.

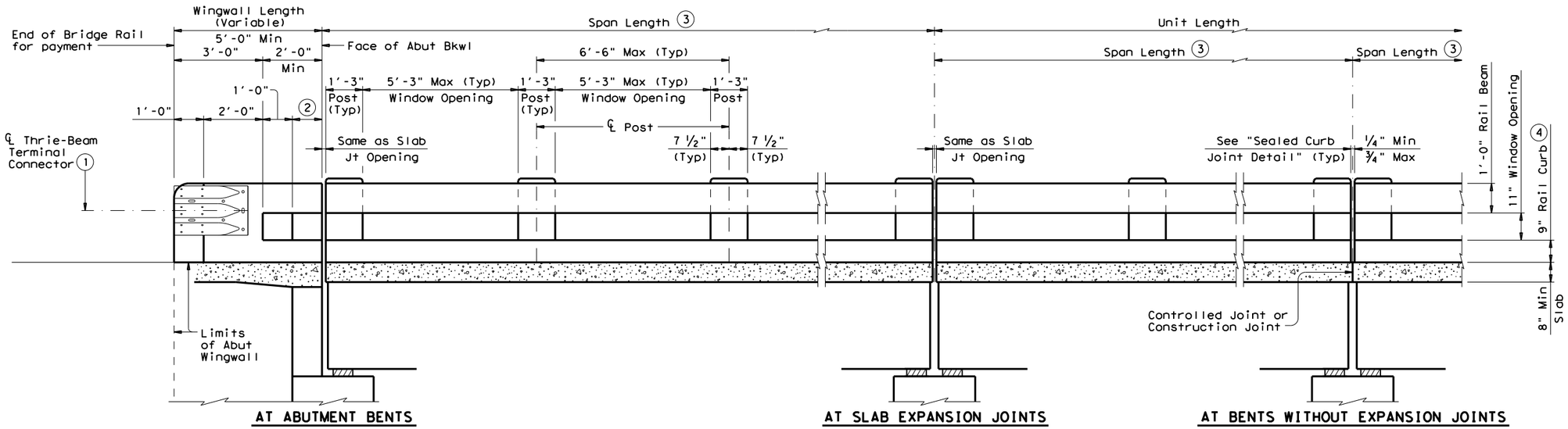
**The use of this railing is restricted to design speeds of 45 mph or less.**

Texas Department of Transportation
Bridge Division

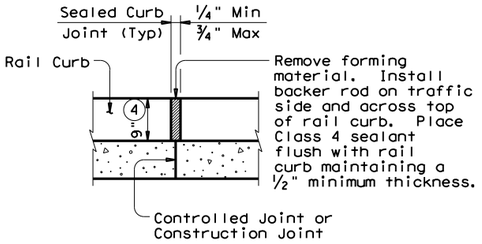
# TRAFFIC RAIL

# TYPE T6

| FILE: rlste20.dgn | DN: JJP | CK: TxDOT | DW: JTR | CK: DWM |
|---|---|---|---|---|
| ©TxDOT February 2003 | DISTRICT | FEDERAL AID PROJECT | | SHEET |
| REVISIONS | 10 | RMC 6367-43-001 | | 36 |
| | COUNTY | CONTROL | SECT | JOB | HIGHWAY |
| | SMITH, ETC. | 6367 | 43 | 001 | IH-20 |

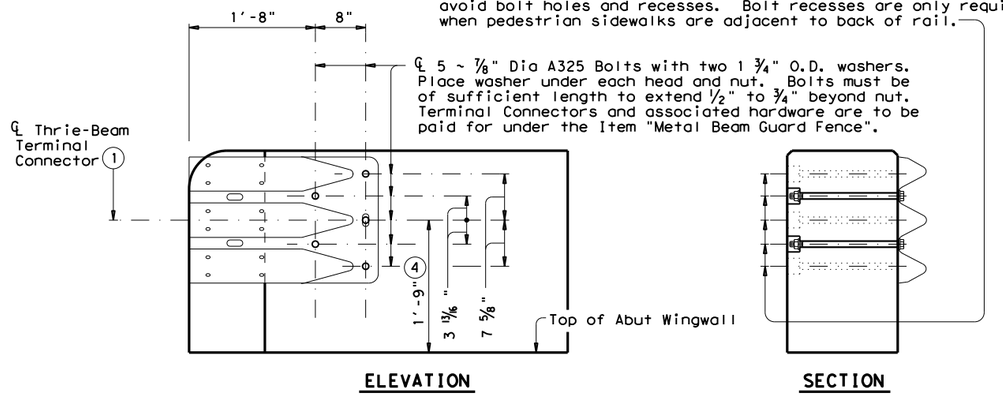



## ROADWAY ELEVATION OF RAIL




## SEALED CURB JOINT DETAIL

Provide at all interior bents without slab expansion joints.




## TERMINAL CONNECTION DETAILS

(Special forming details on parapet not shown for clarity. See "Elevation Showing Typical Reinforcing Placement".)

(1) Terminal Connectors and associated hardware are to be paid for under the Item "Metal Beam Guard Fence". Metal Beam Guard Fence Transitions must be attached to the bridge rail and extended along the embankment unless otherwise shown in the plans.

(2) Wingwall length minus 4'-0" (Variable) 1'-0" Min.

(3) Span length of rail must always have a minimum of three posts. Spans always have a post located at each end of span. Space posts equally within a span unless directed otherwise by the Engineer.

(4) Increase 2" for structures with 2" Max overlay.



Texas Department of Transportation
Bridge Division

# TRAFFIC RAIL

## TYPE T66

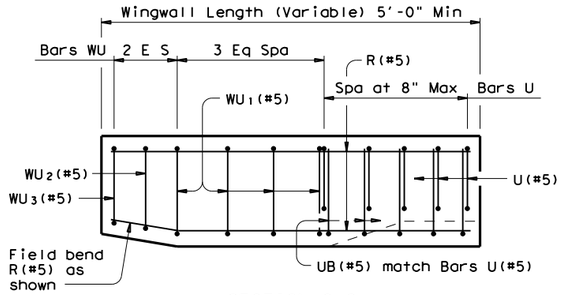
| FILE: rlstd012.dgn | DN: TxDOT | CK: TxDOT | DW: JTR | CK: JMH | |
|---|---|---|---|---|---|
| ©TxDOT April 2009 | DISTRICT | FEDERAL AID PROJECT | | | SHEET |
| REVISIONS | 10 | RMC 6367-43-001 | | | 37 |
| 05-11: Bars VC, Curb Joint Note. 07-12: Guardrail Transition. | COUNTY | | CONTROL | SECT | JOB | HIGHWAY |
| | SMITH, ETC | | 6367 | 43 | 001 | IH-20 |

PATH:
LEVELS DISPLAYED
1

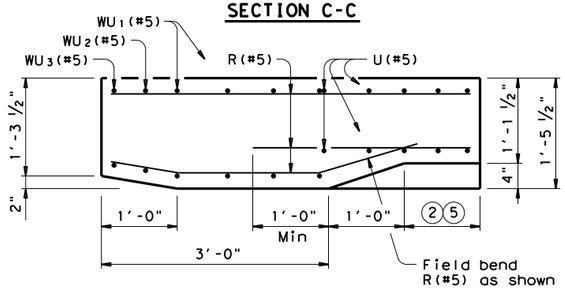
LEVELS DISPLAYED

PATH:

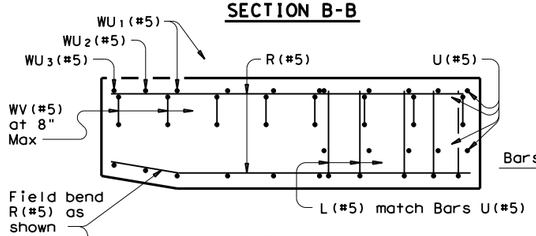
1



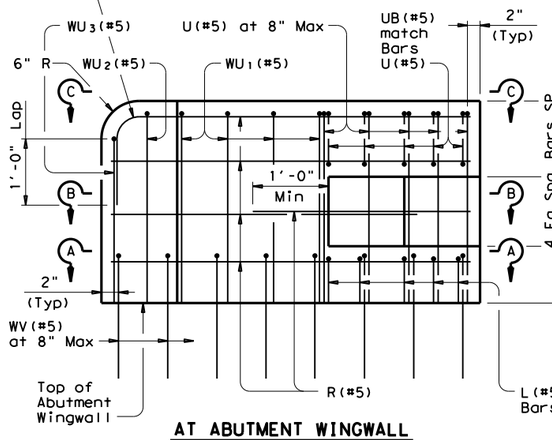

## SECTION C-C




## SECTION B-B




## SECTION A-A




## AT ABUTMENT WINGWALL

(2) Wingwall length minus 4'-0" (Variable) 1'-0" Min.

(3) Span length of rail must always have a minimum of three posts. Spans always have a post located at each end of span. Space post equally within a span unless directed otherwise by the Engineer.

(4) Increase 2" for structures with 2" Max overlay.

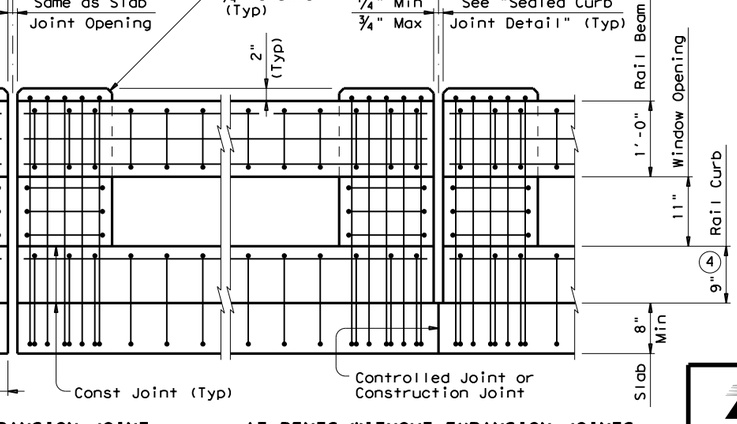
(5) Bars L, U and UB are spaced at 8" Max.

(6) Side Slot Drains must be centered between rail post.

(7) Side Slot Drains must be centered between rail posts within the limits shown. Side Slot Drains may be used where shown elsewhere on the plans or as directed by the Engineer. Drains should not be placed over railroad tracks, lower roadways, or sidewalks. When this rail is used as a separator between a roadway surface and a sidewalk surface, side drain slots are not permitted.

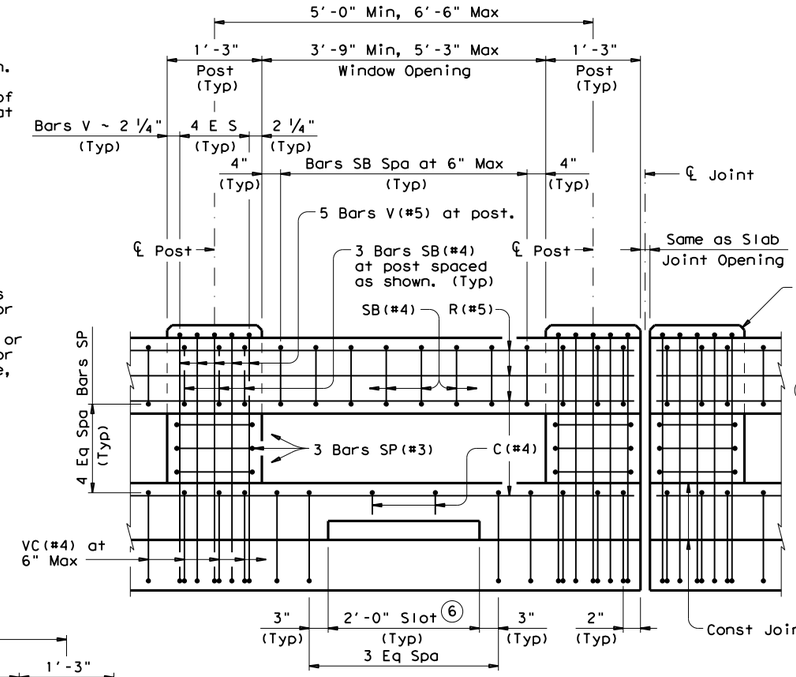



## AT SLAB EXPANSION JOINT

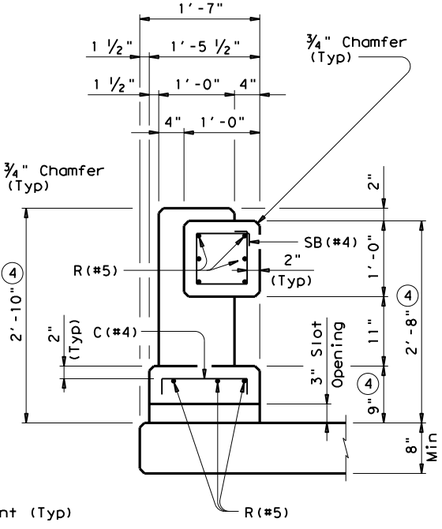



## AT BENTS WITHOUT EXPANSION JOINTS

## ELEVATION SHOWING TYPICAL REINFORCING PLACEMENT




## OPTIONAL SIDE SLOT DRAIN DETAIL (7)




## SECTION THRU OPTIONAL SIDE SLOT DRAIN

SHEET 2 OF 3

Texas Department of Transportation
Bridge Division

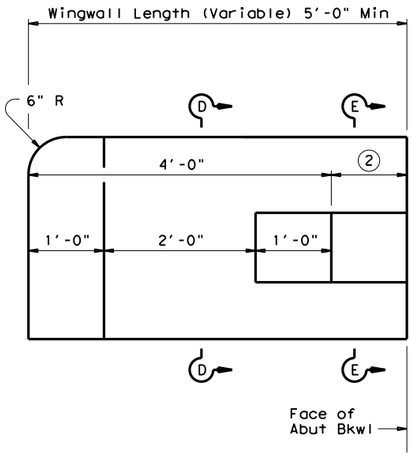
# TRAFFIC RAIL

# TYPE T66

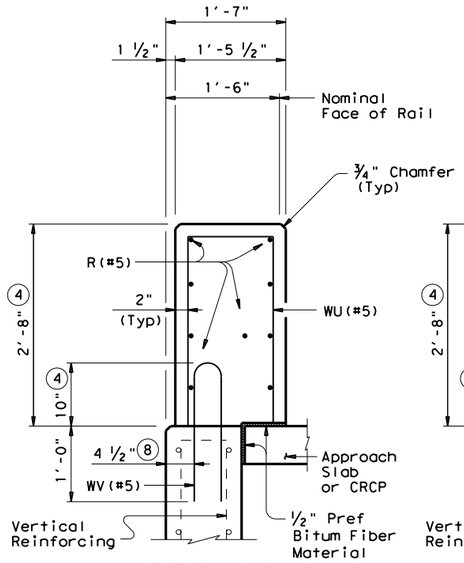
| | | | | | | |
|---|---|---|---|---|---|---|
| FILE: rlstd012.dgn | DN: TxDOT | CK: TxDOT | DW: JTR | | CK: JMH | |
| © TxDOT April 2009 | DISTRICT | FEDERAL AID PROJECT | | | | SHEET |
| REVISIONS | 10 | RMC 6367-43-001 | | | | 38 |
| 05-11: Bars VC, Curb Joint Note.<br>07-12: Guardrail Transition. | COUNTY | | CONTROL | SECT | JOB | HIGHWAY |
| | SMITH, ETC | | 6367 | 43 | 001 | IH-20 |

LEVELS DISPLAYED

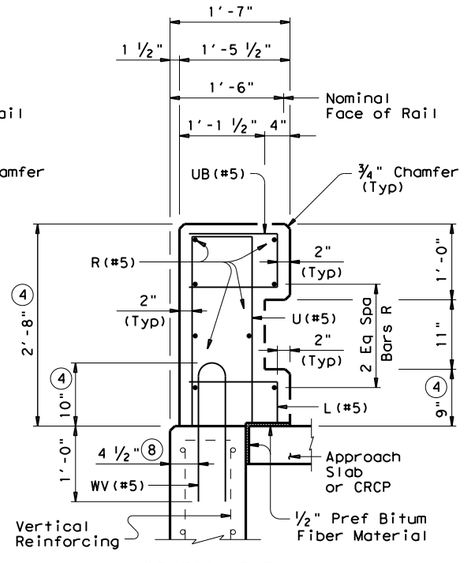
PATH:




## ELEVATION AT ABUTMENT WINGWALL

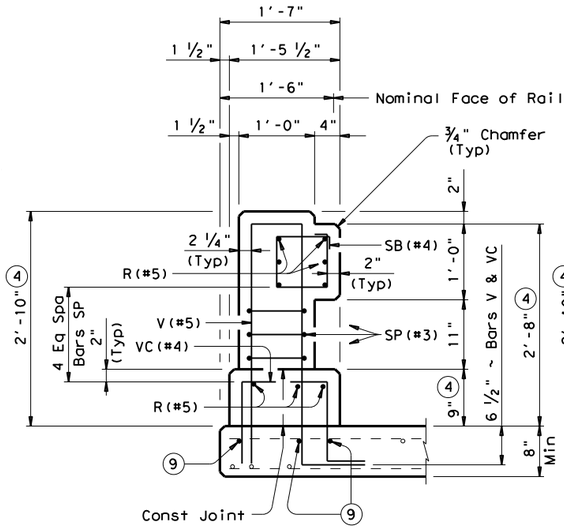



SECTION D-D
ON ABUTMENT WINGWALLS
OR CIP RETAINING WALLS

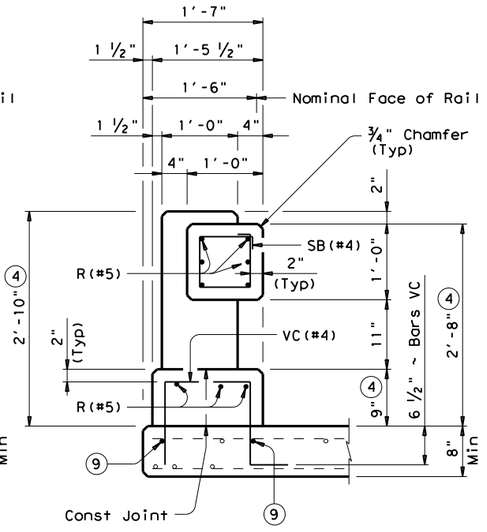



SECTION E-E
ON ABUTMENT WINGWALLS
OR CIP RETAINING WALLS

## SECTIONS THRU RAIL




ON BRIDGE SLAB AT POST




ON BRIDGE SLAB AT WINDOW

(2) Wingwall length minus 4'-0" (Variable) 1'-0" Min.

(4) Increase 2" for structures with 2" Max overlay.

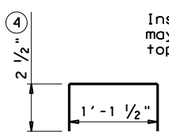
(8) 5 ½" when vertical reinforcing has closer clear cover over horizontal reinforcing in abutment wingwalls or retaining walls on traffic side of wall.

(9) Top longitudinal slab bar may be adjusted laterally 3" plus or minus to tie reinforcing.

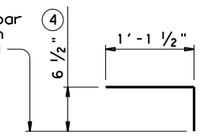
**CONSTRUCTION NOTES:**
The back of railing must be vertical unless otherwise shown on the plans or approved by the Engineer.

**MATERIAL NOTES:**
All steel components except reinforcing must be galvanized unless otherwise shown on plans.
Use Class "C" concrete. Use Class "C" (HPC) if required elsewhere.
All reinforcing steel must be Grade 60.
Epoxy coat all rail reinforcing if slab bars are epoxy coated.

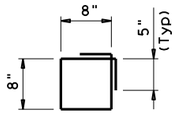
**GENERAL NOTES:**
This rail has been evaluated and accepted to be of equal strength to railings with like geometry, which have been crash tested to meet NCHRP Report 350 TL-3 criteria. This rail can be used for design speeds of 50 mph and greater when a TL-3 rated guard fence transition is used. When a TL-2 rated guard fence transition is used, this rail can only be used for design speeds of 45 mph and less.
This railing cannot be used on bridges with expansion joints providing more than 5" movement.
Rail anchorage details shown on this standard may require modification for select structure types. See appropriate details elsewhere in plans for these modifications.
Shop drawings are not required for this rail.
Average weight of railing with no overlay is 355 plf.



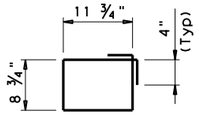

BARS C (#4)



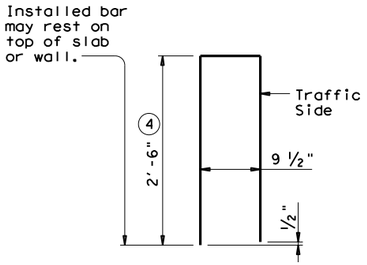

BARS L (#5)



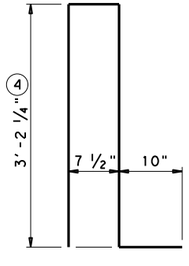

BARS SB (#4)



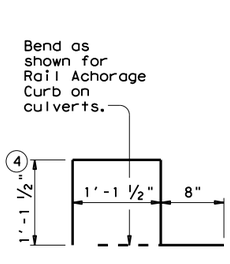

BARS SP (#3)



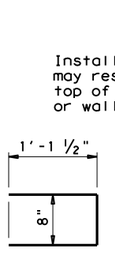

BARS U (#5)



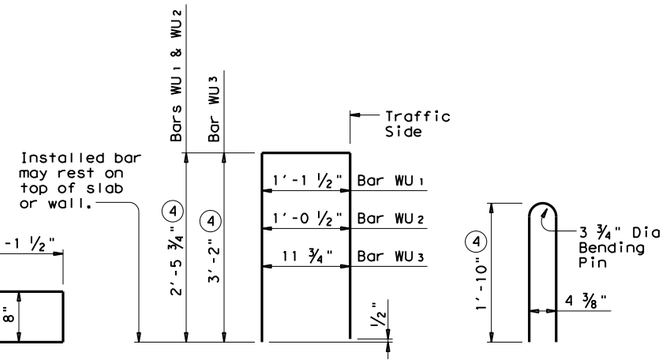

BARS V (#5)




BARS VC (#4)




BARS UB (#5)




BARS WU (#5)




BARS WV (#5)

SHEET 3 OF 3

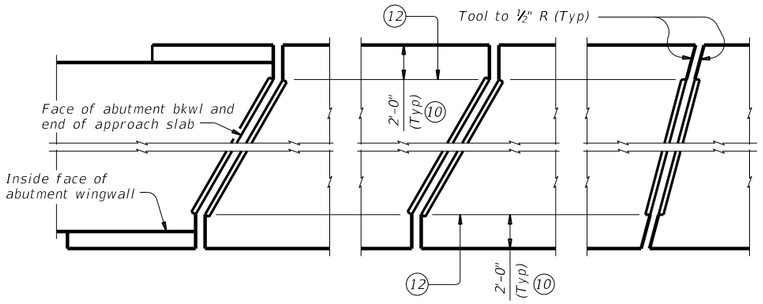
*Texas Department of Transportation*
*Bridge Division*

# TRAFFIC RAIL

# TYPE T66

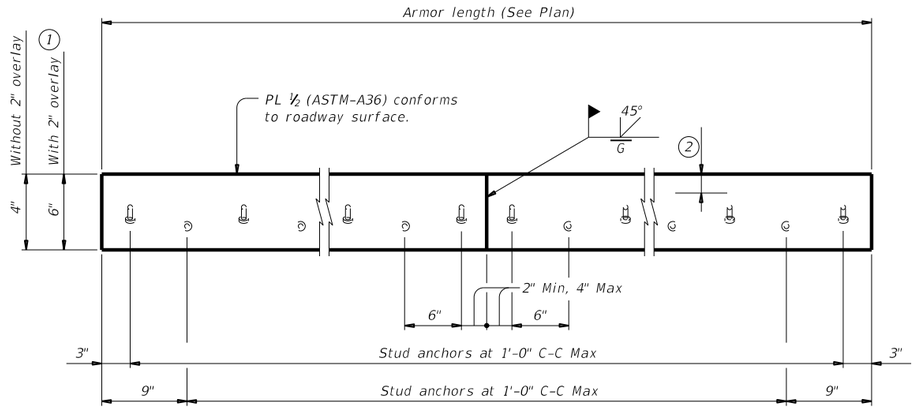
| FILE: rlstd012.dgn | DN: TxDOT | CK: TxDOT | DW: JTR | CK: JMH |
|---|---|---|---|---|
| ©TxDOT April 2009 | DISTRICT | FEDERAL AID PROJECT | | SHEET |
| REVISIONS | 10 | RMC 6367-43-001 | | 39 |
| 05-11: Bars VC, Curb Joint Note. 07-12: Guardrail Transition. | COUNTY | CONTROL | SECT | JOB | HIGHWAY |
| | SMITH, ETC | 6367 | 43 | 001 | IH-20 |

DATE:
FILE:



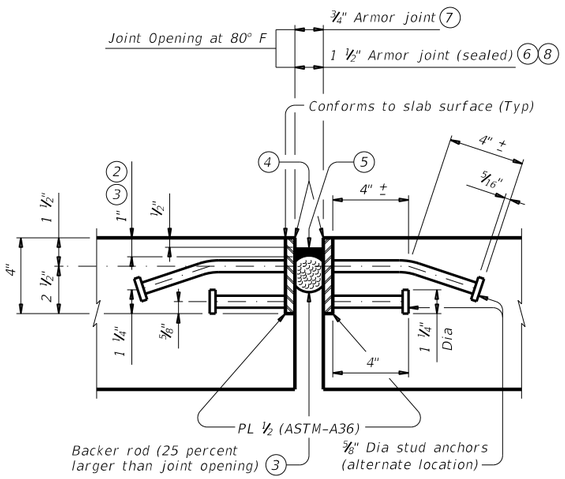

JOINTS AT ABUTMENTS | SKEWS OVER 15° | SKEWS THRU 15°

## PLANS OF ARMOR PLATES

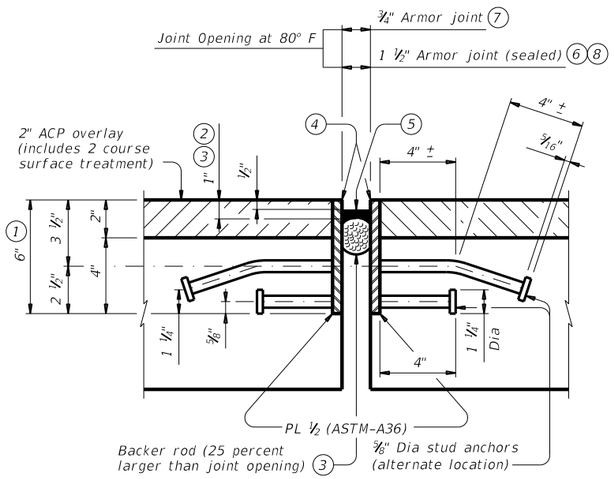



## ELEVATION OF BASIC ARMOR PLATE

1. Adjust 6" plate height for overlay thicknesses other than the 2" shown. Adjust weight by 1.70 plf for each ½" variation in thickness.
2. Do not paint top 1 ½" of plate if using sealed armor joint.
3. Set top of backer rod 1" below top of armor plate. Backer rod must be compatible with joint sealant. Use of multiple pieces to create a backer rod cross section is not permitted. Top of backer rod must be convex as shown.
4. Blast clean entire contact area between sealant and plate (SSPC-SP10) before installing sealant. Light brush blast and thoroughly clean all dust and debris from concrete surfaces in contact with joint sealant before application of silicone seal.
5. Use Class 7 joint sealant that conforms to DMS-6310.
6. Place sealant while ambient temperature is between 55°F and 80°F and is rising.
7. Armor joint does not include joint sealant or backer rod.
8. Armor joint (sealed) includes Class 7 joint sealant and backer rod.
9. Form vertical leg of seal as per the Manufacturer's recommendations. Use Class 4 joint sealant if Class 7 cannot be installed correctly. Install according to Manufacturer's recommendations.
10. Unless shown otherwise, terminate armor plate at slab break point if break is more than 2'-0" from slab edge.
11. See "Plans of Armor Plates".
12. At Fabricator's option, armor plate may extend up to 6" beyond this point for skews through 15°.
13. Align shipping angle perpendicular to joint.



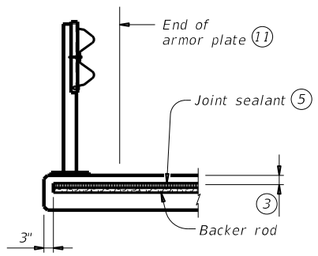

SHOWN WITHOUT 2" OVERLAY AT JOINT LOCATION



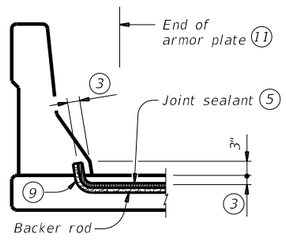

SHOWN WITH 2" OVERLAY AT JOINT LOCATION 1

## ARMOR JOINT SECTIONS

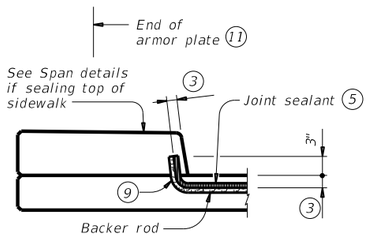
Showing Armor Joint (Sealed)




AT STEEL POST BRIDGE RAIL




AT CONCRETE BRIDGE RAIL




AT SIDEWALK

## JOINT SEALANT TERMINATION DETAILS

Armor joint (sealed) only. Armor plate is not shown for clarity.

### FABRICATION NOTES:

Match mark corresponding plate sections and secure together for shipment with shipping angle. Do not use erection bolts.

Ship armor joints in convenient lengths of 10'-0" Min and 24'-0" Max unless necessary for stage construction or widenings. One shop splice is permitted in each shipping length provided no piece is less than 2'-0" long and sufficient studs are added to limit the stud to shop splice distance to 2" Min and 4" Max.

Weld studs in accordance with AWS D1.1.

Use groove welds for all shop and field butt splices. Grind smooth areas in contact with seal. Make all necessary field splice joint preparations in the shop.

Paint the entire steel section, except as stated in Note 2, with System II or IV primer in accordance with Item 446 "Field Cleaning and Painting Steel." Provide paints in accordance with Item 446.2. Prepare steel and apply paint in accordance with Items 446.4.7.3 and 446.4.7.4.

Shop drawings for the fabrication of armor joints will not require the Engineer's approval if fabrication is in accordance with the details shown on this standard.

### CONSTRUCTION NOTES:

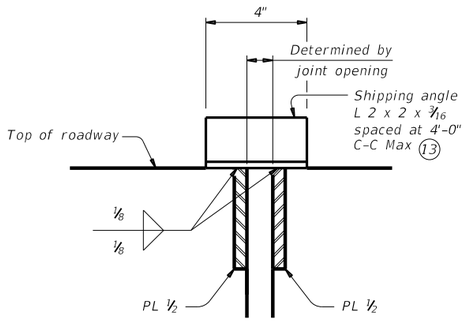
Secure armor joints in position and place to proper grade and alignment by welding braces to adjacent reinforcing steel, to prestressed beam stirrups, or to anchors cast in concrete diaphragms. Include cost of temporary bracing in the price bid for Armor Joint.

Remove shipping angle immediately after each joint half is secured in place. Grind smooth, and touch up with organic zinc-rich paint.

### GENERAL NOTES:

Provide armor joints at locations shown on the plans. Provide the seal when "Armor Joint (Sealed)" is noted on the plans. These joint details accommodate a joint movement range of 1 ⅜" ( ¾" opening movement and ⅜" closure movement).

Payment for armor joint, with or without seal, is based on length of armor plate.




SHOWN WITHOUT 2" OVERLAY AT JOINT LOCATION

With overlay similar

## SHIPPING ANGLE

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

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

Texas Department of Transportation

Bridge Division Standard

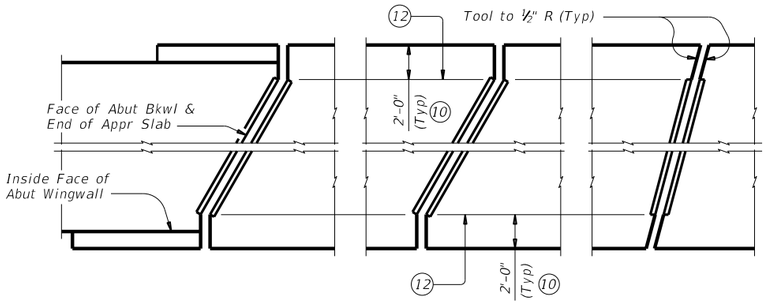
# ARMOR JOINT DETAILS

AJ

| FILE: ajstde01-19.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT April 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 40 |

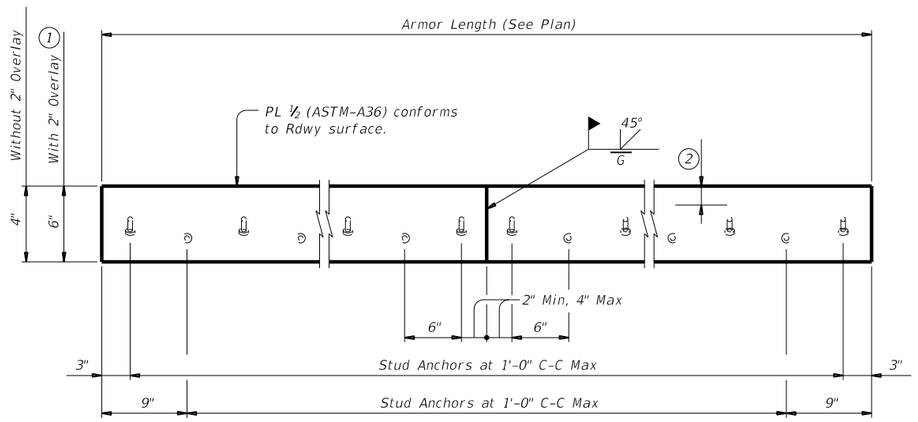
DISCLAIMER:
The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

DATE:
FILE:



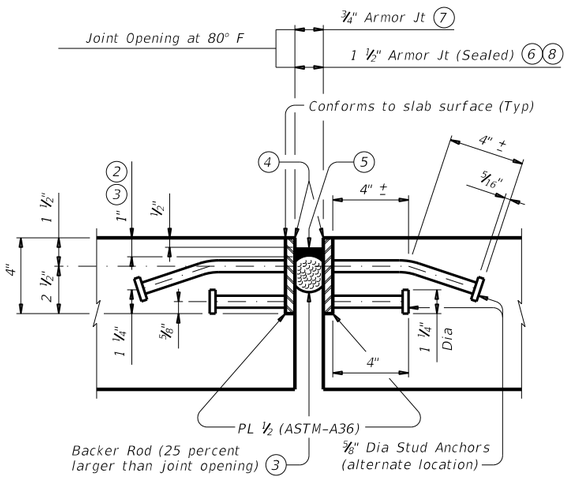

JOINTS AT ABUTMENTS | SKEWS OVER 15° | SKEWS THRU 15°

## PLANS OF ARMOR PLATES

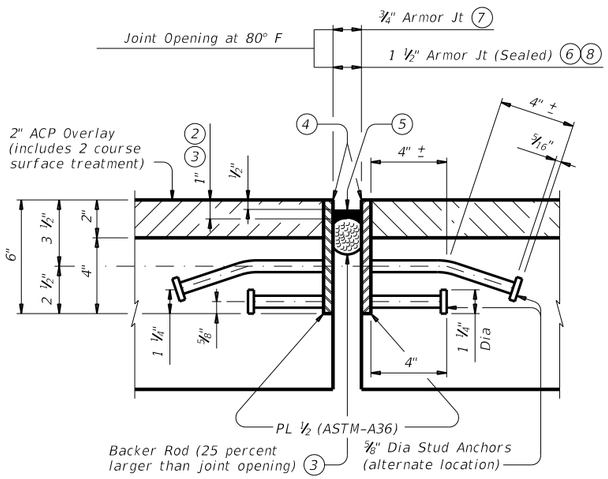



## ELEVATION OF BASIC ARMOR PLATE

1. Adjust 6" plate height for overlay thicknesses other than the 2" shown. Adjust values by 1.70 Lbs for each ½" variation in thickness.
2. Do not paint top 1 ½" of plate if using sealed armor joint.
3. Set top of backer rod 1" below top of armor plate. Backer rod must be compatible with joint sealant. Use of multiple pieces to create a backer rod cross section is not permitted. Top of backer rod must be convex as shown.
4. Blast clean entire contact area between sealant and plate (SSPC-SP10) before installing sealant. Light brush blast and thoroughly clean all dust and debris from concrete surfaces in contact with joint sealant before application of silicone seal.
5. Use Class 7 joint sealant that conforms to DMS-6310.
6. Place sealant while ambient temperature is between 55°F and 80°F and is rising.
7. Armor Joint does not include joint sealant or backer rod.
8. Armor Joint (Sealed) includes Class 7 joint sealant and backer rod.
9. Form vertical leg of seal as per the Manufacturer's recommendations. Use Class 4 joint sealant if Class 7 cannot be installed correctly. Install according to Manufacturer's recommendations.
10. Unless shown otherwise, terminate armor plate at slab break point if break is more than 2'-0" from slab edge.
11. See "Plans of Armor Plates".
12. At Fabricator's option, armor plate may extend up to 6" beyond this point for skews through 15°.
13. Align shipping angle perpendicular to joint.



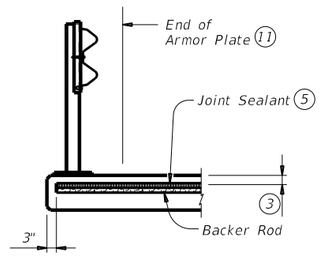

SHOWN WITHOUT 2" OVERLAY AT JOINT LOCATION



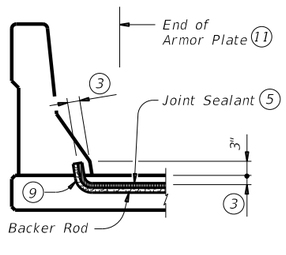

SHOWN WITH 2" OVERLAY AT JOINT LOCATION 1

## ARMOR JOINT SECTIONS

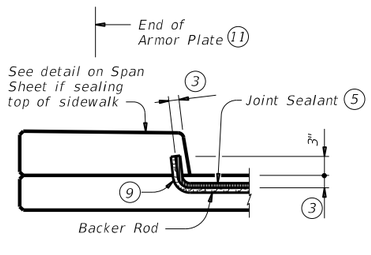
Showing Armor Joint (Sealed)




AT STEEL POST BRIDGE RAIL




AT CONCRETE BRIDGE RAIL




AT SIDEWALK

## JOINT SEALANT TERMINATION DETAILS

Armor Joint (Sealed) only. Armor Plate is not shown for clarity.

### FABRICATION NOTES:

Match mark corresponding plate sections and secure together for shipment with shipping angle. Do not use erection bolts.

Ship armor joints in convenient lengths of 10'-0" Min and 24'-0" Max unless necessary for stage construction or widenings. One shop splice is permitted in each shipping length provided no piece is less than 2'-0" long and sufficient studs are added to limit the stud to shop splice distance to 2" Min and 4" Max.

Weld studs in accordance with AWS D1.1.

Use groove welds for all shop and field butt splices. Grind smooth areas in contact with seal. Make all necessary field splice joint preparations in the shop.

Paint portions of plate not in contact with concrete with the primer specified for System II paint.

Shop drawings for the fabrication of armor joints will not require the Engineer's approval if fabrication is in accordance with the details shown on this standard.

### CONSTRUCTION NOTES:

Secure armor joints in position and place to proper grade and alignment by welding braces to adjacent reinforcing steel, to prestressed beam stirrups, or to anchors cast in concrete diaphragms. Include cost of temporary bracing in the price bid for Armor Joint.

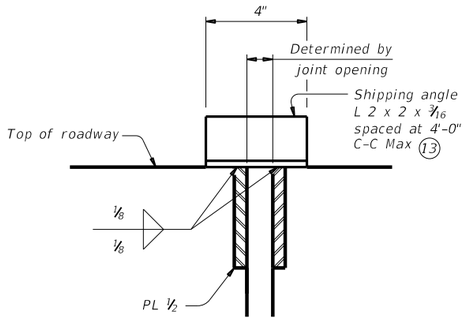
Remove shipping angle immediately after each joint half is secured in place. Grind smooth, and touch up with organic zinc-rich paint.

### GENERAL NOTES:

Provide armor joints at locations shown on the plans. Provide the seal when "Armor Joint (Sealed)" is noted on the plans.

These joint details accommodate a joint movement range of 1 ⅜" ( ¾" opening movement and ⅝" closure movement).

Payment for armor joint, with or wthout seal, is based on length of armor plate.




SHOWN WITHOUT 2" OVERLAY AT JOINT LOCATION

With overlay similar

## SHIPPING ANGLE

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

| WEIGHTS P.L.F. FOR ONE ARMOR JOINT (2 PLATES) | |
|---|---|
| WITHOUT OVERLAY | 16.10 Lb |
| WITH 2" OVERLAY 1 | 22.90 Lb |

Texas Department of Transportation

Bridge Division Standard

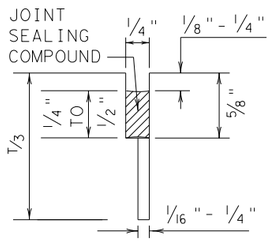
# ARMOR JOINT DETAILS

AJ

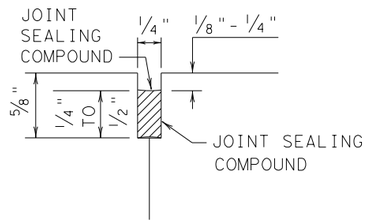
| FILE: ajstde01.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT January 2015 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 41 |

DATE:
FILE:

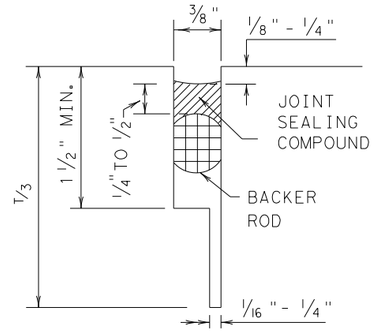
## METHOD B: JOINT SEALING COMPOUND



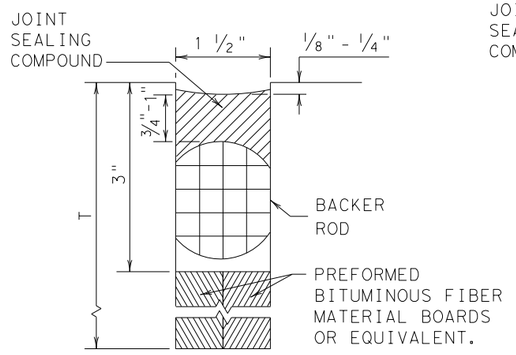

LONGITUDINAL SAWED CONTRACTION JOINT



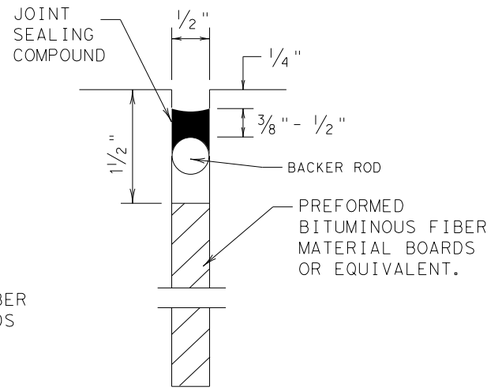

LONGITUDINAL OR TRANSVERSE CONSTRUCTION JOINT




TRANSVERSE SAWED CONTRACTION JOINT

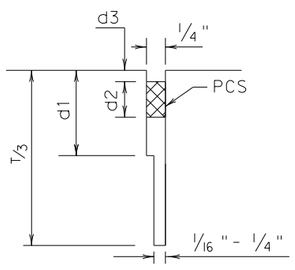



TRANSVERSE FORMED EXPANSION JOINT

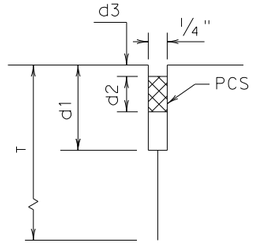



FORMED ISOLATION JOINT

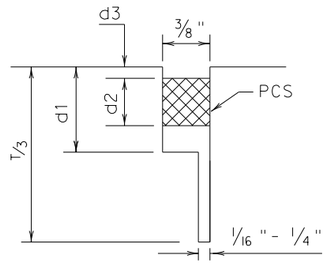
## METHOD A: PREFORMED COMPRESSION SEALS (PCS)(DMS-6310 CLASS 6)



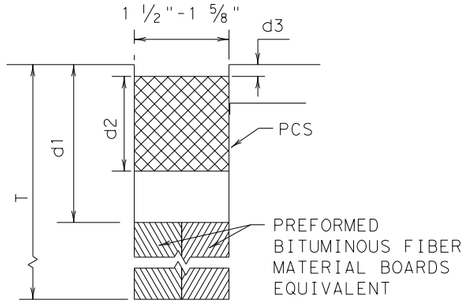

LONGITUDINAL SAWED CONTRACTION JOINT




LONGITUDINAL CONSTRUCTION JOINT




TRANSVERSE SAWED CONTRACTION JOINT




TRANSVERSE FORMED EXPANSION JOINT

## GENERAL NOTES

1. UNLESS OTHERWISE SHOWN IN THE PLANS, EITHER METHOD "A" OR METHOD "B" MAY BE USED.
2. THE LOCATION OF JOINTS SHALL BE AS SHOWN ELSEWHERE IN THE PLANS.
3. THE JOINT RESERVOIR FOR SEALANT OR PCS SHALL BE SAWED UNLESS OTHERWISE SHOWN ON THE PLANS FOR THE LONGITUDINAL AND TRANSVERSE CONSTRUCTION JOINTS AND THE SAWED JOINTS.
4. DIMENSIONS d1, d2, AND d3 SHOWN IN METHOD A SHALL BE IN ACCORDANCE WITH THE PREFORMED COMPRESSION SEAL MANUFACTURER'S RECOMMENDATION.
5. REFER TO DMS-6310 "JOINT SEALANTS AND FILLERS" FOR THE CLASSIFICATIONS.
6. FOR SAWED LONGITUDINAL JOINT, LONGITUDINAL OR TRANSVERSE CONSTRUCTION JOINT, USE JOINT SEALANT CLASS 5 OR 8 UNLESS OTHERWISE SHOWN ON THE PLAN OR APPROVED.
7. FOR TRANSVERSE SAWED CONTRACTION, TRANSVERSE FORMED EXPANSION JOINT, AND ISOLATION JOINT USE JOINT SEALANT CLASS 5 OR 8 AT NEW JOINTS. USE JOINT SEALANT CLASS 4,5,7,OR 8 FOR MAINTAINING EXISTING JOINTS.
8. THE JOINTS SHALL BE CLEANED IN ACCORDANCE WITH THE ITEM 438 "CLEANING AND SEALING JOINTS" OR ITEM 713 "CLEANING AND SEALING JOINTS AND CRACKS (CONCRETE PAVEMENT)".
9. ISOLATION JOINTS ACCOMMODATE HORIZONTAL AND VERTICAL MOVEMENTS THAT OCCUR BETWEEN A PAVEMENT AND A STRUCTURE. ISOLATION JOINTS MAY BE USED FOR BRIDGE ABUTMENTS, INTERSECTIONS, CURB AND GUTTER, OLD AND NEW PAVEMENTS, OR AROUND DRAINAGE INLETS, MANHOLES, FOOTINGS AND LIGHTING STRUCTURES.

Texas Department of Transportation

Design Division Standard

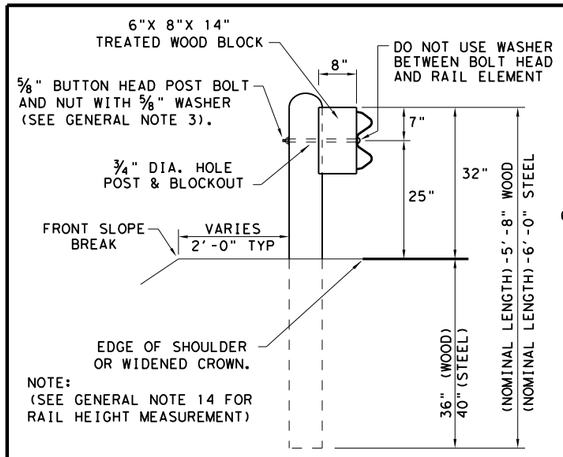
# CONCRETE PAVING DETAILS

# JOINT SEALS

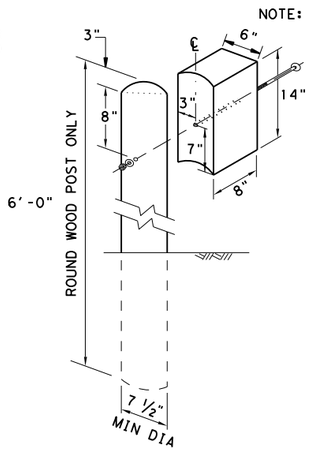
# JS-14

| FILE: js14.dgn | DN: TxDOT | DN: HC | DW: HC | CK: AN |
|---|---|---|---|---|
| ©TxDOT: DECEMBER 2014 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 42 |

DATE:
FILE:

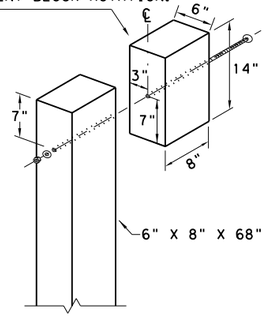



**TYPICAL POST PLACEMENT**

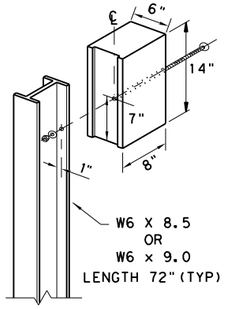



**WOOD BLOCK TO ROUND WOOD POST**

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

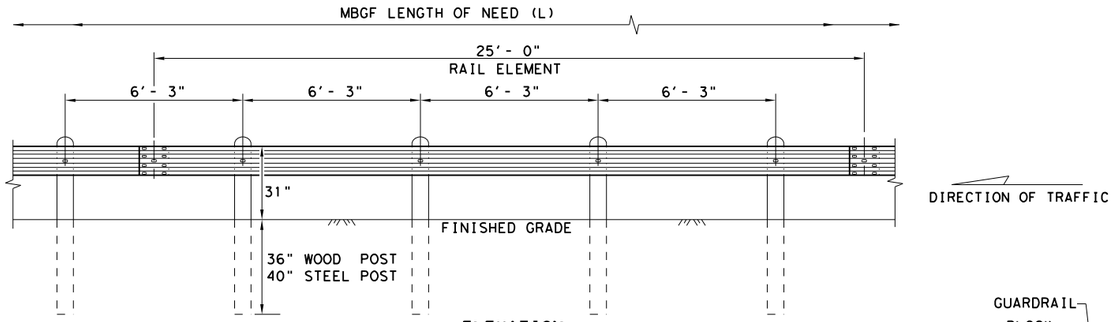



**WOOD BLOCK TO RECTANGULAR WOOD POST**



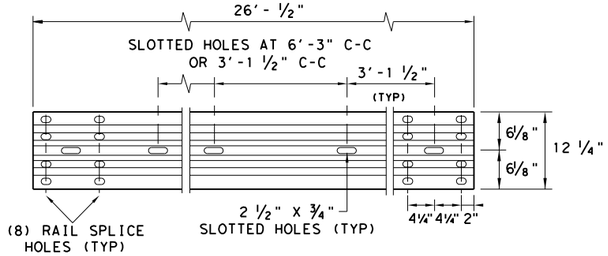

**ROUTED WOOD BLOCK TO I-BEAM STEEL POST**

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



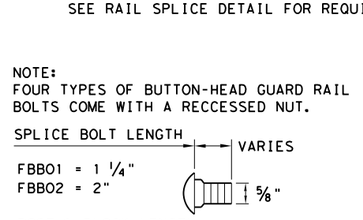

**ELEVATION**
**MID-SPAN RAIL SPLICE**

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



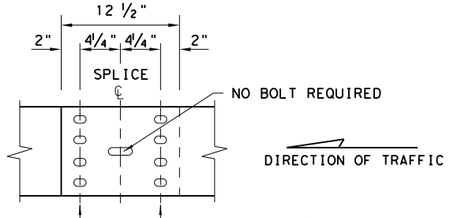

**ELEVATION 25'- 0" (NOM.) W-BEAM SECTION**

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



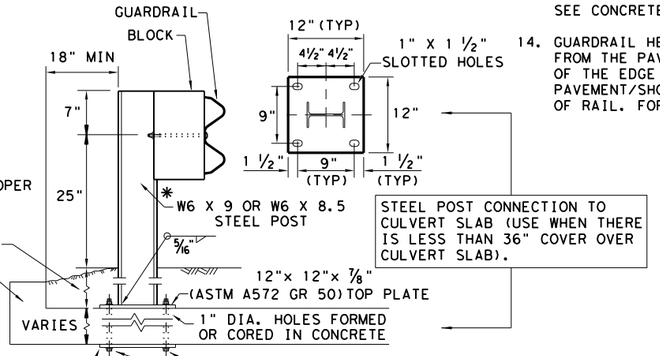

**BUTTON HEAD BOLT**

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




**MID-SPAN RAIL SPLICE DETAIL**

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




**LOW FILL CULVERT POST**

NOTE: TWO INSTALLATION OPTIONS.

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

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

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

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

## GENERAL NOTES

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

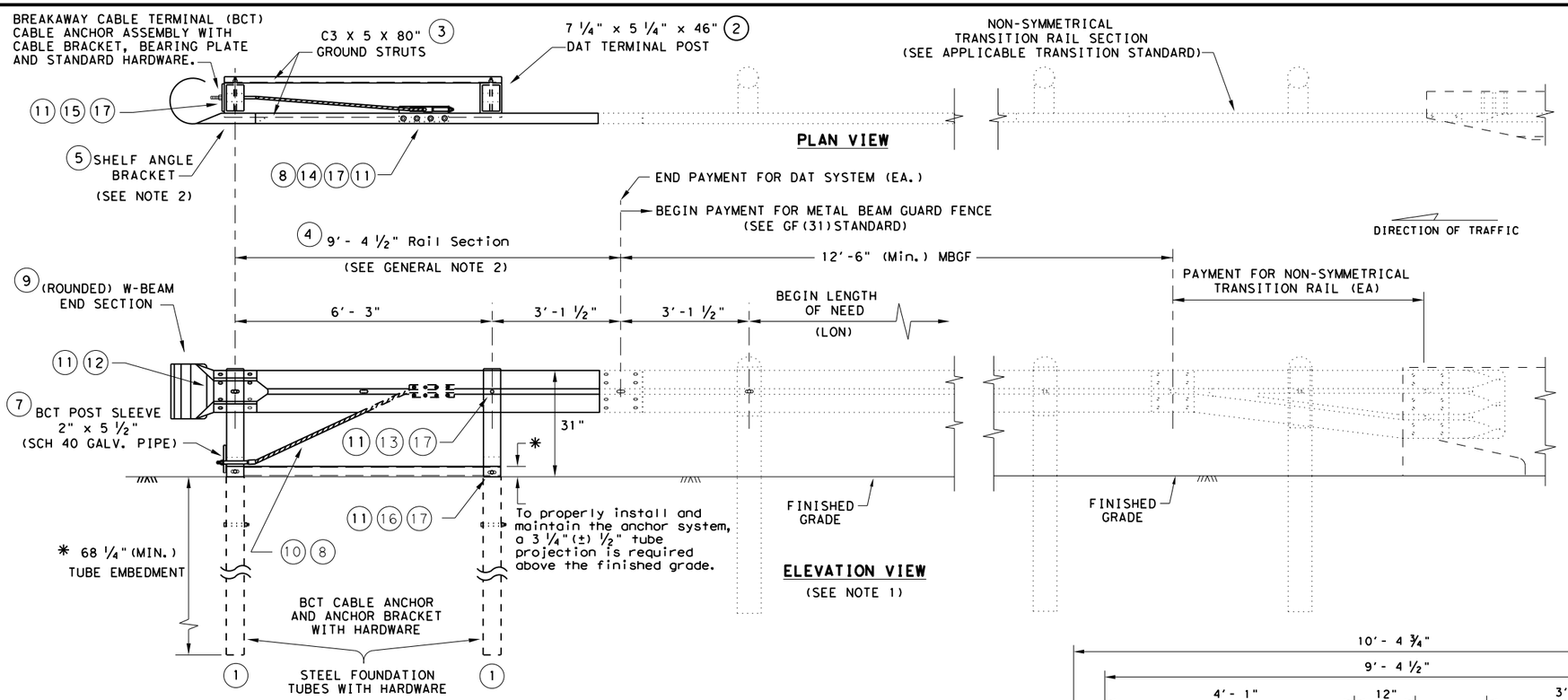
Texas Department of Transportation

Design Division Standard

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

| FILE: gf3119.dgn | DN: TxDOT | CK: KM | DW: VP | CK: CGL/AG |
|---|---|---|---|---|
| ©TxDOT: NOVEMBER 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 43 |

DATE:
FILE:




## DOWNSTREAM ANCHOR TERMINAL (DAT)

NOTE: ONLY FOR DOWNSTREAM USE, WHEN LOCATED OUTSIDE THE HORIZONTAL CLEARANCE AREA OF OPPOSING TRAFFIC.

## GENERAL NOTES

1. THE DETAIL SHOWN IS THE MINIMUM LENGTH OF NEED (LON) FOR A DOWNSTREAM ANCHOR TERMINAL (DAT) CONNECTED TO A CONCRETE RAIL.
2. THE RAIL SECTION AT THE END POST IS SUPPORTED BY THE SHELF ANGLE BRACKET. THE RAIL ELEMENT IS NOT ATTACHED TO THE END POST.
3. THE FOUNDATION TUBES SHALL NOT PROJECT MORE THAN 3 3/4" ABOVE THE FINISHED GRADE.
4. ALL HARDWARE FOR DAT SHALL BE ASTM A307 UNLESS OTHERWISE SHOWN.
5. REFER TO GF(31) SHEET FOR TERMINAL CONNECTION DETAILS.

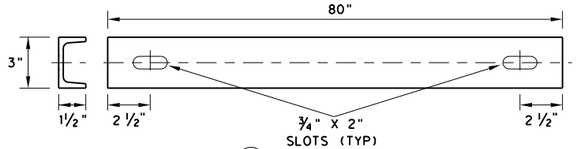
## MOW STRIP INSTALLATION

IF A MOW STRIP IS REQUIRED WITH THE DAT INSTALLATION THE LEAVE-OUT AREA AROUND THE STEEL FOUNDATION TUBES AND THE TWO CHANNEL STRUTS MAY BE OMITTED. THIS WILL REQUIRE A FULL POUR AT THE FOUNDATION TUBES.

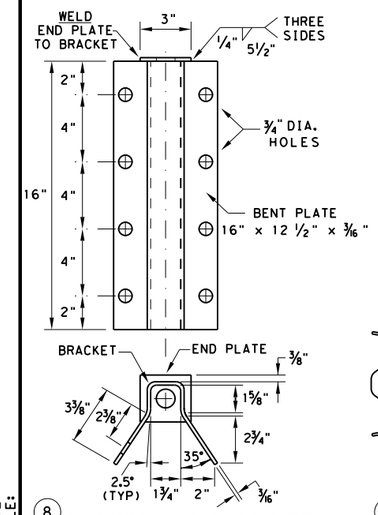
| # | (DAT) PARTS LIST | QTY |
|---|---|---|
| (1) | STEEL FOUNDATION TUBE | 2 |
| (2) | DAT TERMINAL POST | 2 |
| (3) | CHANNEL STRUT | 2 |
| (4) | TERMINAL RAIL ELEMENT | 1 |
| (5) | SHELF ANGLE BRACKET | 1 |
| (6) | BCT BEARING PLATE | 1 |
| (7) | BCT POST SLEEVE | 1 |
| (8) | GUARDRAIL ANCHOR BRACKET | 1 |
| (9) | (ROUNDED) W-BEAM END SECTION | 1 |
| (10) | BCT CABLE ANCHOR | 1 |
| (11) | RECESSED NUT, GUARDRAIL | 20 |
| (12) | 1 1/4" BUTTON HEAD BOLT | 4 |
| (13) | 10" BUTTON HEAD BOLT | 2 |
| (14) | 5/8" X 2" HEX HEAD BOLT | 8 |
| (15) | 5/8" X 8" HEX HEAD BOLT | 4 |
| (16) | 5/8" X 10" HEX HEAD BOLT | 2 |
| (17) | 5/8" FLAT WASHER | 18 |



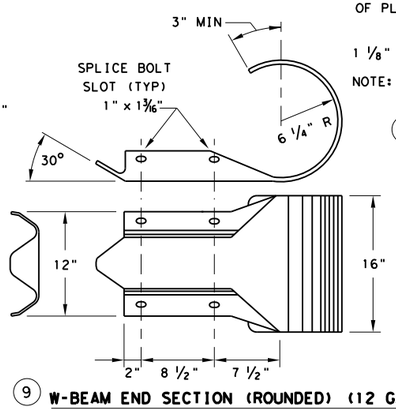

(4) TERMINAL RAIL ELEMENT FOR DAT



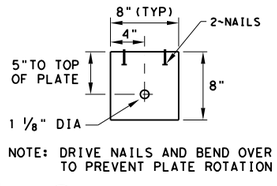

(3) CHANNEL STRUT
C3 X 5 X 80", GRADE A36




(8) GUARDRAIL ANCHOR BRACKET

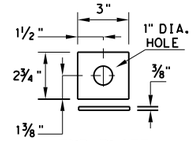



(9) W-BEAM END SECTION (ROUNDED) (12 GA.)

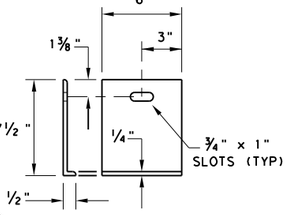



NOTE: DRIVE NAILS AND BEND OVER TO PREVENT PLATE ROTATION

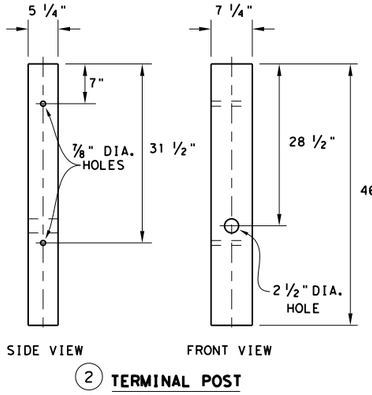
(6) BEARING PLATE
8"x 8"x 5/8" R



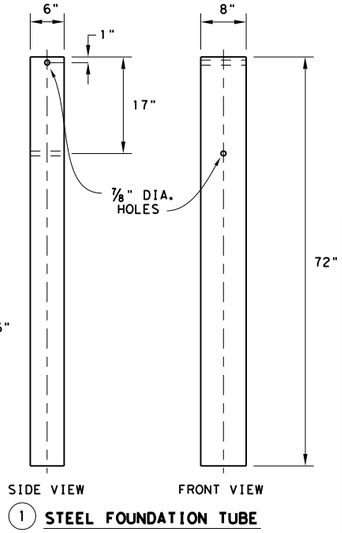

END PLATE




(5) SHELF ANGLE BRACKET




(2) TERMINAL POST
7 1/4"x 5 1/4"x 46" WOOD POST




(1) STEEL FOUNDATION TUBE
6"x 8"x 1/8" x 72" STEEL TUBE

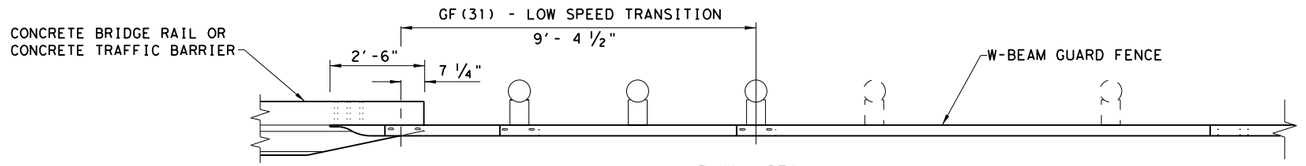
Texas Department of Transportation — Design Division Standard

# METAL BEAM GUARD FENCE
## (DOWNSTREAM ANCHOR TERMINAL)
## TL-3 MASH COMPLIANT

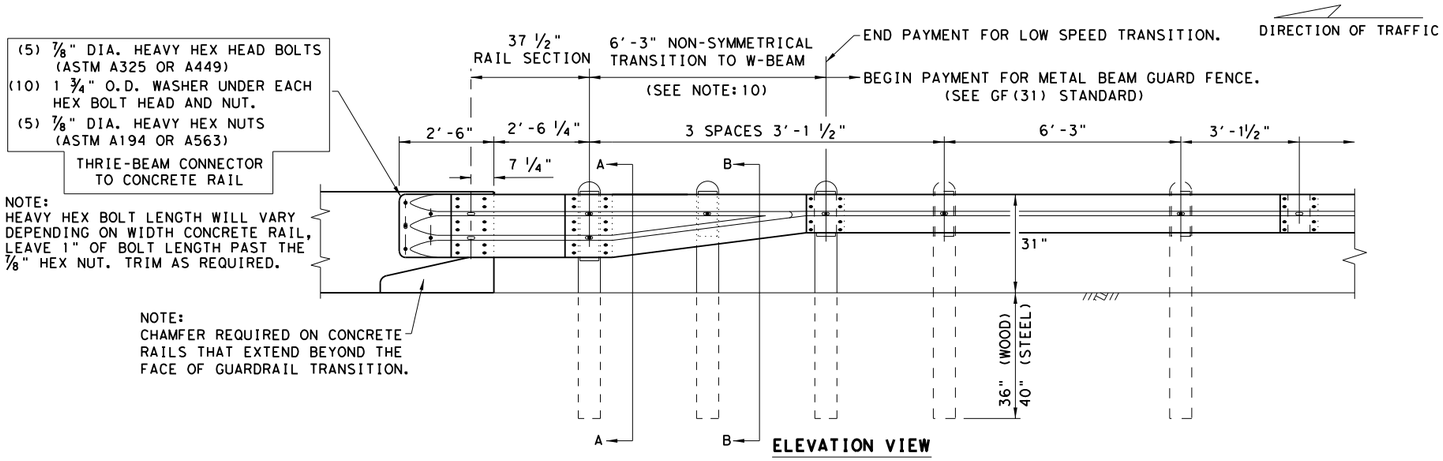
# GF(31)DAT-19

| FILE: gf31dat19.dgn | DN: TxDOT | CK: KM | DW: VP | CK: CGL/AG |
|---|---|---|---|---|
| ©TxDOT: NOVEMBER 2019 REVISIONS | CONT | SECT | JOB | HIGHWAY |
| | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 44 |

DATE:
FILE:



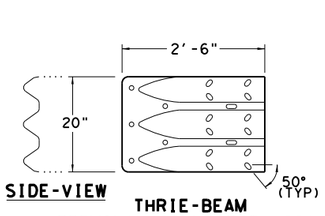

PLAN VIEW




ELEVATION VIEW

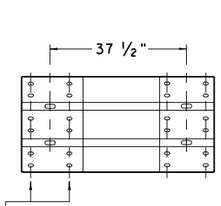
## GENERAL NOTES

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 TRANSITIONS SHALL BE AS SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER. REFER TO GF(31)STANDARD SHEET.
2. RAIL ELEMENT SHALL MEET THE REQUIREMENTS OF ITEM 540, "METAL BEAM GUARD FENCE" EXCEPT AS MODIFIED IN THE PLANS.
3. 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.
4. BUTTON HEAD "POST BOLTS & NUTS" SHALL MEET THE REQUIREMENTS OF (ASTM A307), AND SHALL BE OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT AND ⅝" WASHER (FWC16a)AND NOT MORE THAN 1" BEYOND IT. TRIM BOLT LENGTH TO MEET REQUIRED LENGTH.
5. POSTS SHALL NOT BE SET IN CONCRETE, OF ANY DEPTH.
6. CROWN SHALL BE WIDENED TO ACCOMMODATE TRANSITIONS.
7. WHERE SOLID ROCK IS ENCOUNTERED, CONTACT THE DESIGN DIVISION FOR ADDITIONAL GUIDANCE. (512) 416-2678
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 CAN FURNISH COMPOSITE MATERIAL BLOCKS.
9. REFER TO GF(31)STANDARD SHEET & BRIDGE RAILING DETAILS FOR ADDITIONAL DETAILS.
10. FOR ROUND WOOD POSTS SYSTEMS, ALL ROUND WOOD POSTS SHALL BE 7 ½" DIA. MINIMUM THROUGHOUT THE TRANSITION.

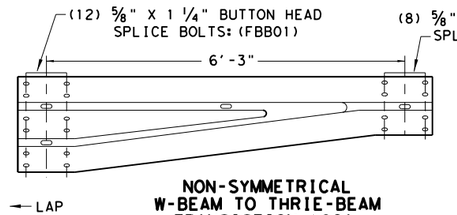



SIDE-VIEW

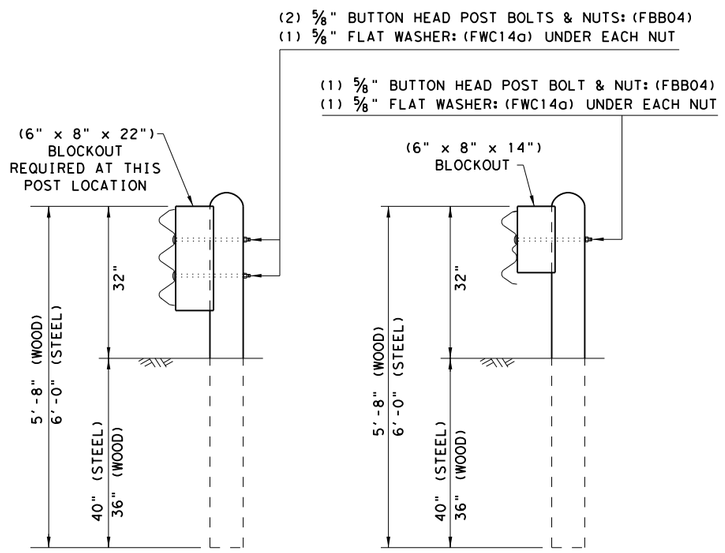
THRIE-BEAM TERMINAL CONNECTOR 10GA.
PART DESIGNATOR RTE01b




THRIE-BEAM RAIL SHORT SECTION 10GA.
PART DESIGNATOR RTM01a




NON-SYMMETRICAL W-BEAM TO THRIE-BEAM TRANSISTION 10GA.
PART DESIGNATOR RWT02a OR RWT02b



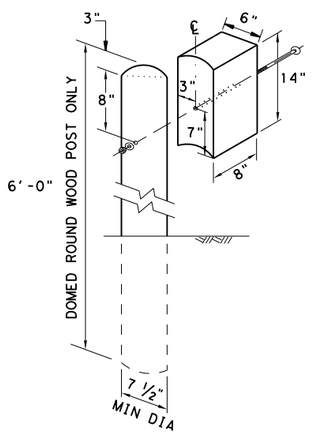

SECTION A-A

SECTION B-B

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

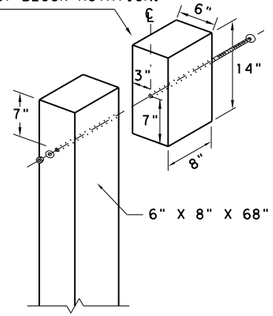
PLATE WASHER INSTRUCTIONS

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

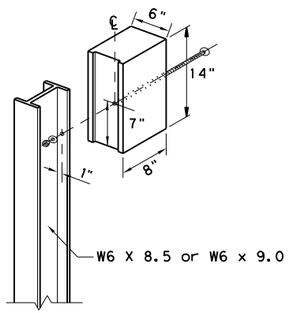



WOOD BLOCK TO ROUND WOOD POST

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




WOOD BLOCK TO RECTANGULAR WOOD POST




ROUTED WOOD BLOCK TO I-BEAM STEEL POST

LOW-SPEED TRANSITION

Texas Department of Transportation

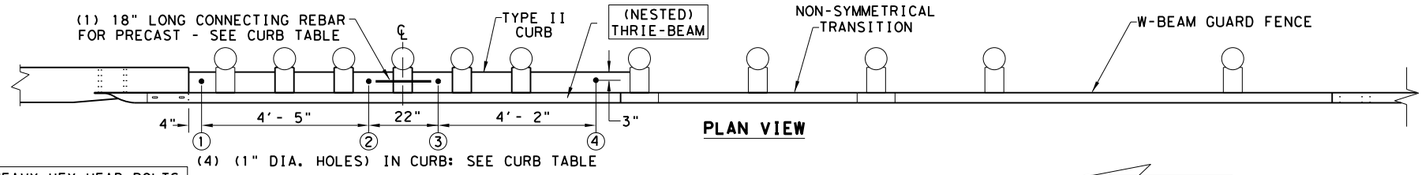
Design Division Standard

# METAL BEAM GUARD FENCE THRIE-BEAM TRANSITION TL-2 MASH COMPLIANT

# GF(31)TR TL2-19

| | | | | |
|---|---|---|---|---|
| FILE: gf31tr-tl219.dgn | DN: TxDOT | CK: KM | DW: VP | CK: CGL/AG |
| ©TxDOT: NOVEMBER 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 45 |

DATE:
FILE:




PLAN VIEW

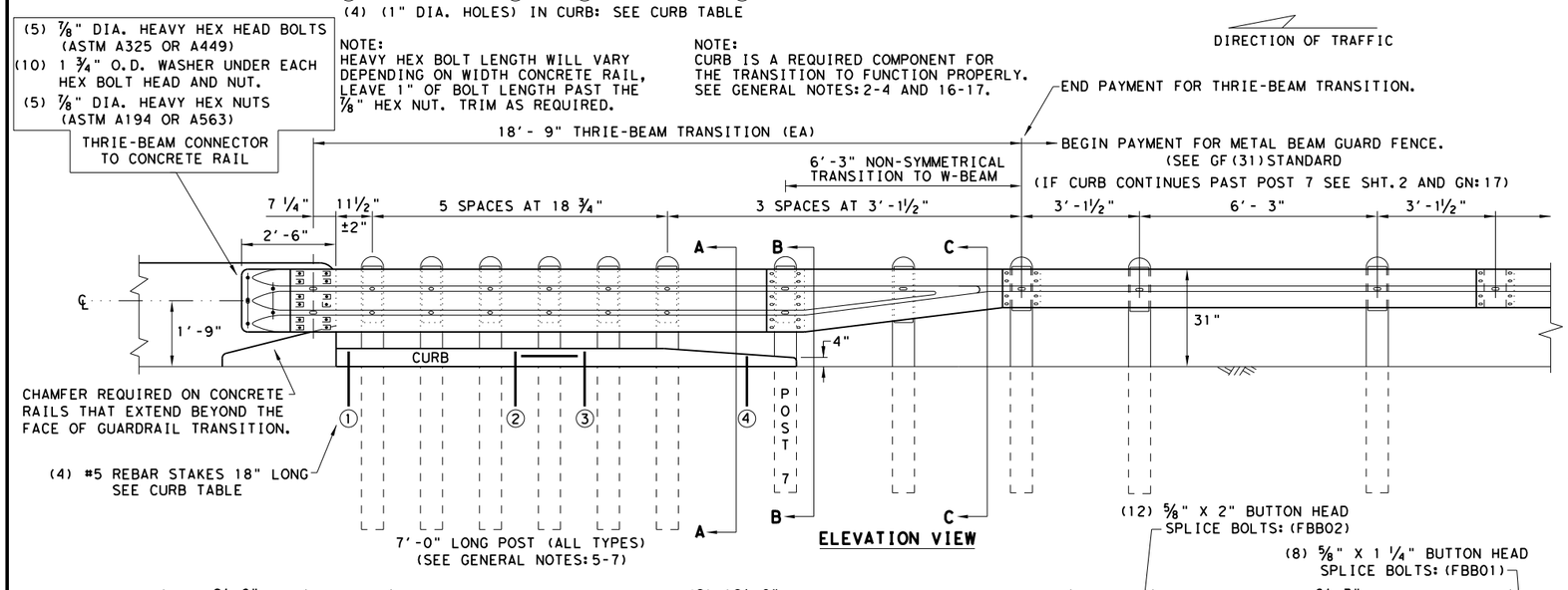
DIRECTION OF TRAFFIC

(5) ⅞" DIA. HEAVY HEX HEAD BOLTS (ASTM A325 OR A449)
(10) 1 ¾" O.D. WASHER UNDER EACH HEX BOLT HEAD AND NUT.
(5) ⅞" DIA. HEAVY HEX NUTS (ASTM A194 OR A563)

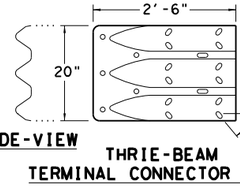
THRIE-BEAM CONNECTOR TO CONCRETE RAIL

NOTE:
HEAVY HEX BOLT LENGTH WILL VARY DEPENDING ON WIDTH CONCRETE RAIL, LEAVE 1" OF BOLT LENGTH PAST THE ⅞" HEX NUT. TRIM AS REQUIRED.

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

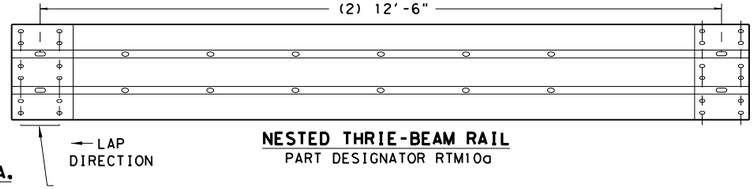



ELEVATION VIEW

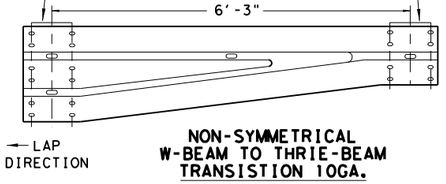



SIDE-VIEW

THRIE-BEAM TERMINAL CONNECTOR 10GA.
PART DESIGNATOR RTE01b
NOTE: SEE GENERAL NOTE: 9



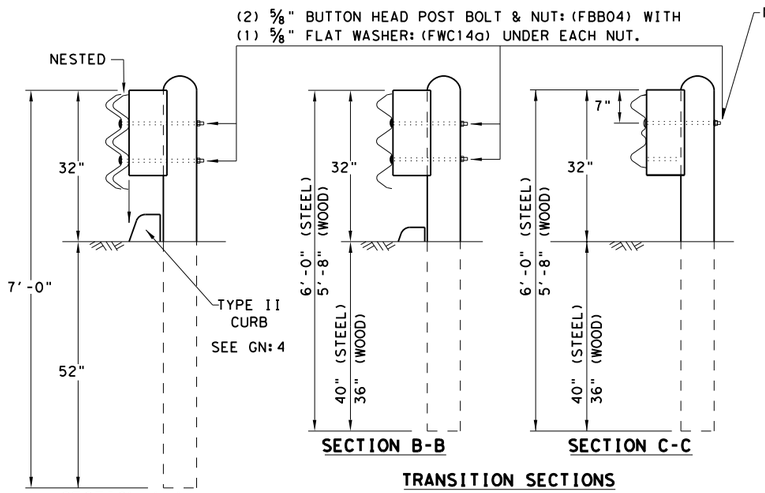

NESTED THRIE-BEAM RAIL
PART DESIGNATOR RTM10a




NON-SYMMETRICAL W-BEAM TO THRIE-BEAM TRANSITION 10GA.
PART DESIGNATOR RWT02a OR RWT02b

PLATE WASHER INSTRUCTIONS

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




SECTION A-A

SECTION B-B

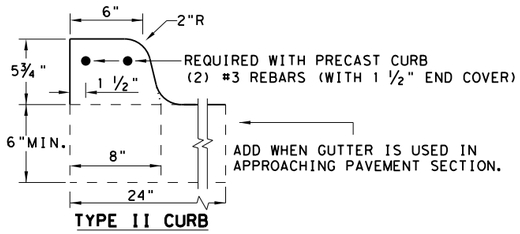
SECTION C-C

TRANSITION SECTIONS

NOTE: ALL POST TYPES, SEE GENERAL NOTE: 5 & 6

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

| THRIE-BEAM TERMINAL - CURB TABLE |
|---|
| PRECAST CURB FULL LENGTH EQUALS 12'- 2" THE PRECAST CURB MAY BE FORMED INTO TWO SECTIONS. |
| CURB (1) LENGTH 5'- 8" |
| CURB (2) LENGTH 6'- 6" |
| TAPER CURB (2) TO A HEIGHT OF 4" AT POST 7 |
| CONNECTING PRECAST CURB SECTIONS (1) & (2): |
| FORM OR CORE (1" DIA. HOLE 9" LONG) INTO EACH CURB END. USE (1) #5 GR.60 REBAR 18" LONG TO CONNECT BOTH CURBS. |
| SECURING PRECAST OR CAST-IN-PLACE TO FINISHED GRADE: |
| FORM OR CORE FOUR (1" DIA. HOLES), SEE BOTH VIEWS FOR HOLE LOCATIONS. DRIVE (4) #5 GR.60 REBAR STAKES 18" LONG INTO THE GROUND AND ½" BELOW TOP OF CURB. FILL HOLES WITH APPROVED GROUT MIXTURE. |




TYPE II CURB

NOTE: OPTIONS FOR TYPE II CURB:
1. PRECAST
2. CAST-IN-PLACE

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

TYPE II CURB DETAILS

## GENERAL NOTES

1. CONTACT THE DESIGN DIVISION FOR DRAINAGE CUT OUT OPTIONS NEEDED WITHIN THE CURB SECTION OF THE THRIE-BEAM TRANSITION. (512) 416-2678
2. CONCRETE CURB MAY BE CAST-IN-PLACE OR PRECAST AS SHOWN ON THIS SHEET. WHEN USED IN CONJUNCTION WITH THE THRIE-BEAM TRANSITIONS, CURB SHALL BE TYPE II (5- ¾") HEIGHT; SEE CURRENT CCCG STANDARD SHEET FOR FURTHER DETAILS. IF OTHER CURB HEIGHTS ARE SHOWN IN THE PLANS IN CONJUNCTION WITH THE TRANSITION, THE CURB HEIGHT MAY BE FROM 4" TO 8" WITH A RELATIVELY VERTICAL FACE. CONCRETE CURB SHALL BE CONTINUOUS TO THE SEVENTH POST UNLESS OTHERWISE SHOWN IN THE PLANS. SEE GENERAL NOTE: 17 FOR CIRCUMSTANCES WHERE CURB CONTINUES PAST POST 7.
3. CONCRETE CURB TYPE II SUBSIDIARY TO "METAL BEAM GUARD FENCE TRANSITION". IF NO ADDITIONAL CURB IS INDICATED BEYOND THE TRANSITION, THEN ANY CURB HEIGHT GREATER THAN 4" WILL BE TAPERED DOWN BEGINNING AT THE LAST 7 FT. POST TO A MAXIMUM HEIGHT OF 4" AT POST 7. IF SHOWN ELSEWHERE IN THE PLANS, ADDITIONAL CURB UNDERNEATH GUARDRAIL WILL BE PAID FOR BY THE LINEAR FOOT.
4. UNLESS OTHERWISE SHOWN IN THE PLANS, TRANSITIONS SHALL BE PLACED WITH THE BLOCKOUT FACE IN FRONT OF OR DIRECTLY ABOVE THE CURB FACE. SEE SECTION A-A.
5. FOR ROUND WOOD POST SYSTEMS, ALL ROUND WOOD POSTS SHALL BE 7 ½" DIA. MINIMUM THROUGHOUT THE THRIE-BEAM TRANSITION.
6. THE TYPE OF POST (ROUND WOOD POST, RECTANGULAR WOOD POST OR STEEL POST) WILL BE AS SHOWN IN THE PLANS. REFER TO GF(31) STANDARD SHEET.
7. THE POST LENGTH SHALL BE MARKED ON ALL 7'- 0" LONG POSTS BY THE MANUFACTURER. THE MARK SHALL BE LOCATED WITHIN THE TOP 1 FT. REGION OF THE POST, AT LEAST ⅝" IN HEIGHT, AND VISIBLE AFTER INSTALLATION. WOODEN POSTS SHALL BE MARKED WITH A BRAND, AND STEEL POSTS WITH A STENCIL BEFORE GALVANIZING.
8. POSTS SHALL NOT BE SET IN CONCRETE, OF ANY DEPTH.
9. RAIL ELEMENTS SHALL MEET THE REQUIREMENTS OF ITEM 540, "METAL BEAM GUARD FENCE" EXCEPT AS MODIFIED ON THE PLANS. THE THRIE-BEAM TERMINAL CONNECTOR AND THE THRIE-BEAM TRANSITION TO W-BEAM SHALL BE OF THE SAME MATERIAL, BUT SHALL NOT BE LESS THAN 10 GAUGE. CONTRACTOR SHALL VERIFY THAT THE LOCATIONS OF BOLT HOLES MATCH THOSE IN THE THRIE-BEAM TERMINAL CONNECTOR PRIOR TO ORDERING MATERIALS.
10. BUTTON HEAD "POST BOLTS & NUTS" SHALL MEET THE REQUIREMENTS OF (ASTM A307), AND SHALL BE OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT AND ⅝" WASHER (FWC16a) AND NOT MORE THAN 1" BEYOND IT. TRIM REMAINING BOLT LENGTH TO MEET REQUIRED LENGTH.
11. FITTINGS (BOLTS, NUTS, AND WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING". FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
12. CROWN SHALL BE WIDENED TO ACCOMMODATE TRANSITIONS.
13. WHERE SOLID ROCK IS ENCOUNTERED, CONTACT THE DESIGN DIVISION FOR ADDITIONAL GUIDANCE. (512) 416-2678
14. UNLESS OTHERWISE SHOWN IN THE PLANS, A COMPOSITE MATERIAL BLOCK THAT MEETS THE REQUIREMENTS OF DMS-7210, "COMPOSITE MATERIAL POSTS AND BLOCKS FOR METAL BEAM GUARD FENCE" MAY BE SUBSTITUTED FOR BLOCKS OF SIMILAR DIMENSIONS. TXDOT'S CONSTRUCTION DIVISION MAINTAINS A MATERIAL PRODUCER LIST (MPL) FOR PRODUCERS OF MATERIALS CONFORMING TO DMS-7210. ONLY PRODUCERS ON THE MPL CAN FURNISH COMPOSITE MATERIAL BLOCKS.
15. REFER TO GF(31) STANDARD SHEET & BRIDGE RAILING DETAILS FOR ADDITIONAL DETAILS.
16. THE INSTALLATION OF THE TYPE II CURB IS CRITICAL FOR THE PERFORMANCE OF THE THRIE-BEAM TRANSITION SYSTEM. THE CURB PREVENTS (VEHICLE WHEEL SNAGGING) AT THE CONCRETE RAIL AND IS REQUIRED TO MEET MASH CRASH TEST CRITERIA.
17. IF CURB EXTENDS BEYOND POST 7, 25' OF NESTED W-BEAM GUARDRAIL SHALL BE INSTALLED BEYOND THE PAY LIMITS OF THRIE-BEAM TRANSITION SECTION, (SEE SHT.2). PAYMENT FOR THIS 25' SECTION WILL BE BY LINEAR FOOT, PAY ITEM "0540 6XXX MTL W-BEAM GD FEN (NESTED) (TIM POST)" OR "540 6XXX MTL W-BEAM GD FEN (NESTED) (STEEL POST)" AS APPLICABLE FOR POST TYPE. SEE SHT.2 FOR ADDITIONAL INFORMATION.

**HIGH-SPEED TRANSITION**

**SHEET 1 OF 2**

Texas Department of Transportation — Design Division Standard

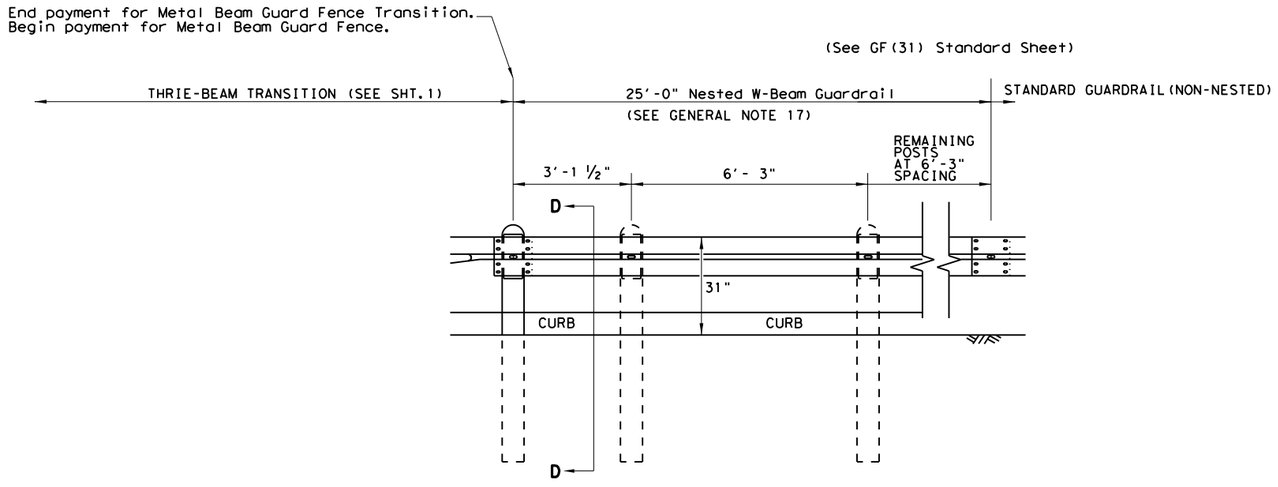
# METAL BEAM GUARD FENCE THRIE-BEAM TRANSITION TL-3 MASH COMPLIANT

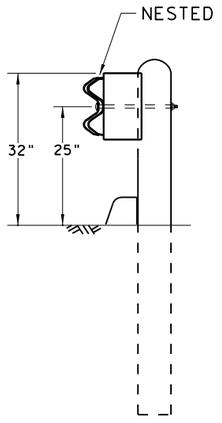
# GF(31)TR TL3-19

| FILE: gf31trt1319.dgn | DN: TxDOT | CK: KM | DW: VP | CK: CGL/AG |
|---|---|---|---|---|
| ©TxDOT: NOVEMBER 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 46 |

DATE:
FILE:

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




SECTION D-D

**HIGH-SPEED TRANSITION**

**SHEET 2 OF 2**

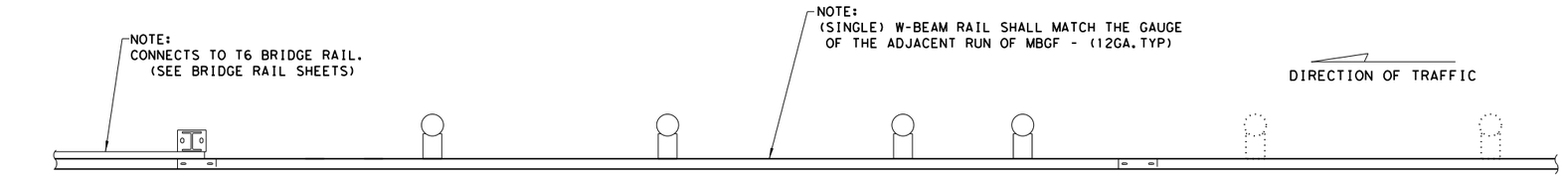
Texas Department of Transportation | Design Division Standard

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

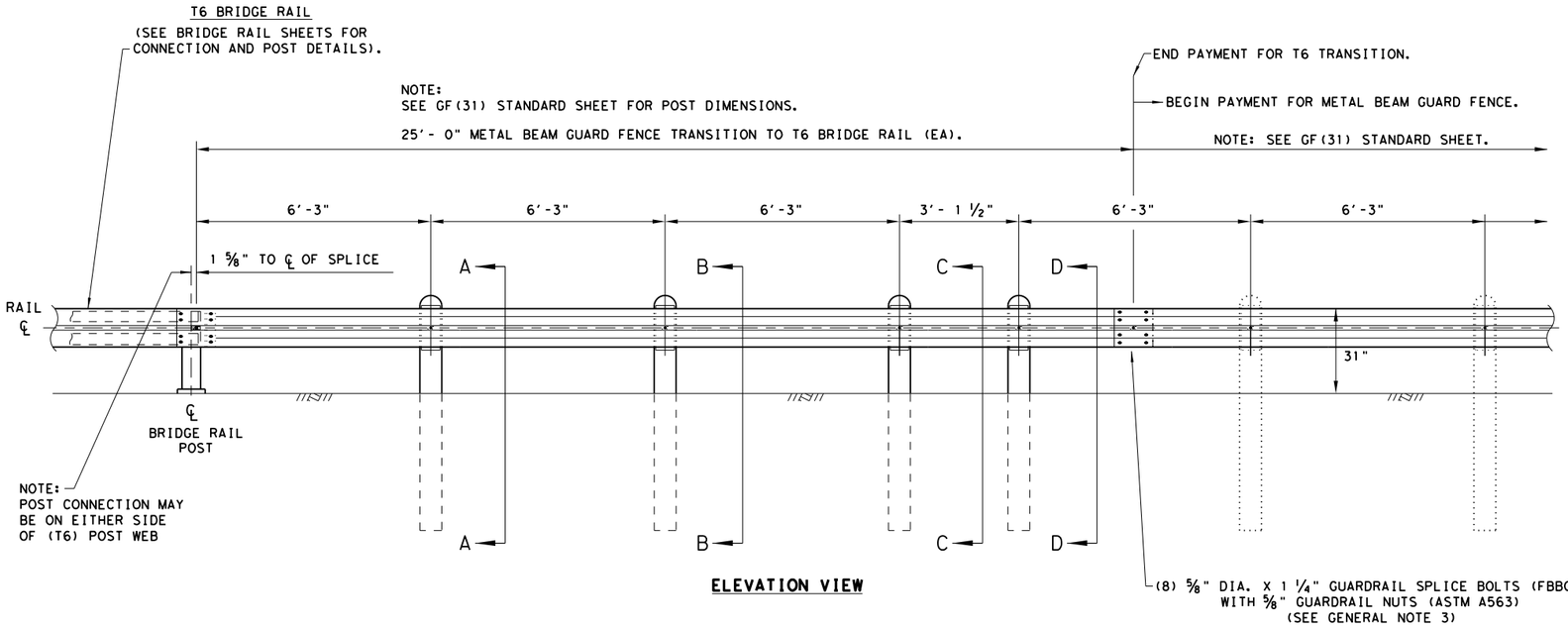
## GF(31)TR TL3-19

| | | | | | | |
|---|---|---|---|---|---|---|
| FILE: gf31trt1319.dgn | DN: TxDOT | | CK: KM | DW: KM | CK: CGL/AG | |
| ©TxDOT: NOVEMBER 2019 | CONT | SECT | JOB | | HIGHWAY | |
| REVISIONS | 6367 | 43 | 001 | | IH-20 | |
| | DIST | COUNTY | | | SHEET NO. | |
| | 10 | SMITH, ETC. | | | 47 | |

DATE:
FILE:

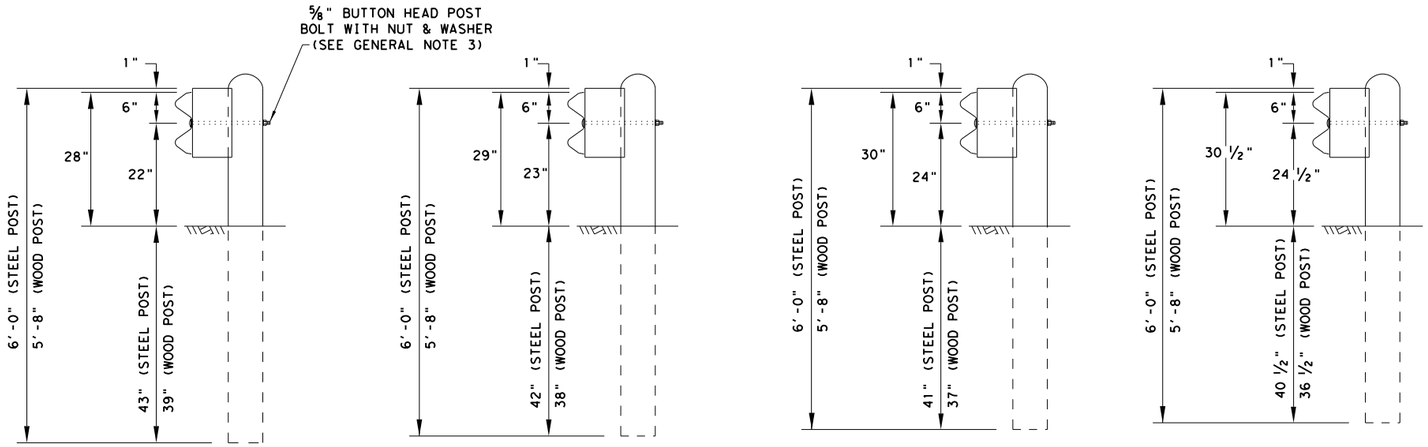



**PLAN VIEW**




**ELEVATION VIEW**

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




**SECTION A-A** **SECTION B-B** **SECTION C-C** **SECTION D-D**

## 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.

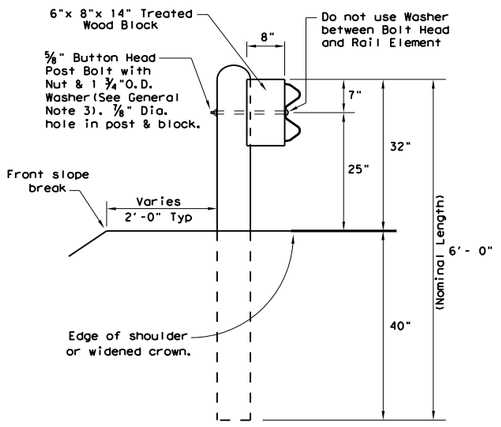
Texas Department of Transportation — Design Division Standard

# METAL BEAM GUARD FENCE TRANSITION (T6)

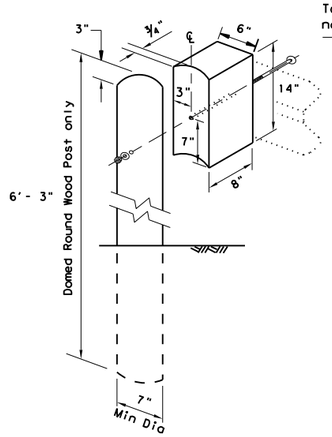
# GF(31)T6-19

| | | | | | |
|---|---|---|---|---|---|
| FILE: gf31t619.dgn | DN: TxDOT | CK: KM | DW: VP | CK: CGL/AG | |
| ©TxDOT: NOVEMBER 2019 | CONT | SECT | JOB | HIGHWAY | |
| REVISIONS | 6367 | 43 | 001 | IH-20 | |
| | DIST | COUNTY | | SHEET NO. | |
| | 10 | SMITH, ETC. | | 48 | |

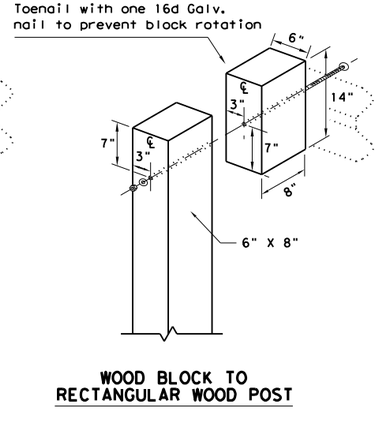
DATE:
FILE:



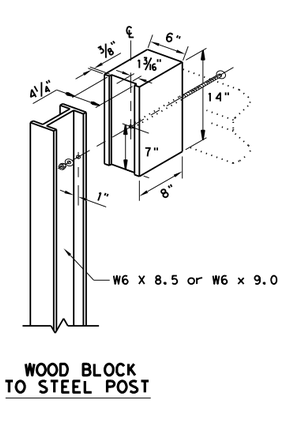

## TYPICAL POST




## WOOD BLOCK TO ROUND WOOD POST



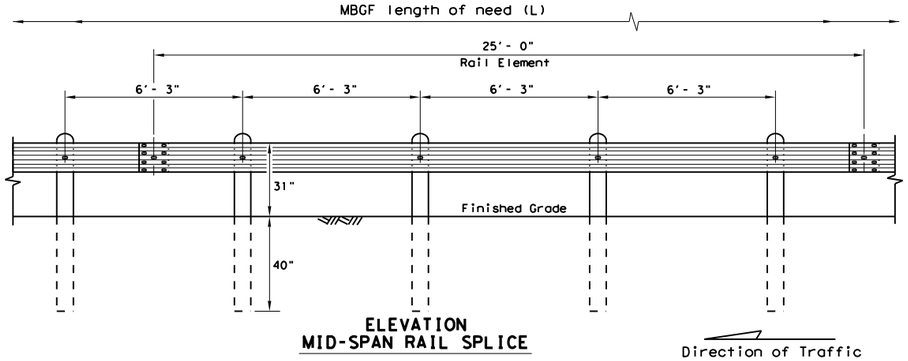

## WOOD BLOCK TO RECTANGULAR WOOD POST




## WOOD BLOCK TO STEEL POST

## GENERAL NOTES

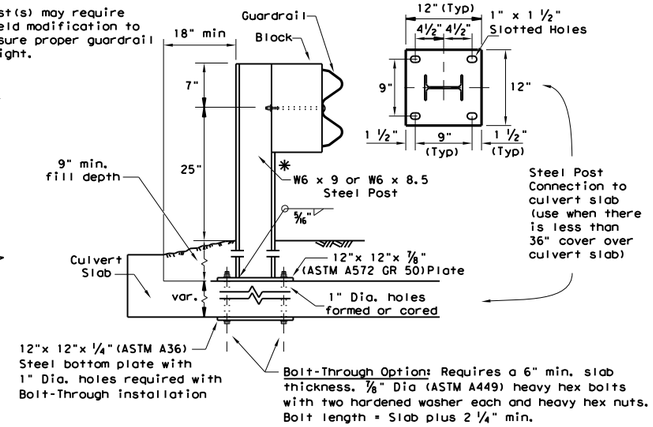
1. The type of post (round wood post, rectangular wood post, or steel post) will be as shown in the plans. The exact position of MBGF shall be shown in the plans or as directed by the Engineer. Steel posts to be galvanized in accordance with Item 445, "Galvanizing."
2. Rail element shall meet the requirements 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'-1½" 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 (ASTM A307) shall be of sufficient length to extend through the full thickness of the nut (ASTM A563) and Type A (1 ¾" O.D.)washer and not more than 1" beyond it. Button head "splice" bolts (ASTM A307) are ⅝" x 1 ¼" (or 2" long at triple rail splices) with a ⅝" double recessed nut (ASTM A563). Thrie beam "connection" ⅞" dia. (ASTM A325) hex bolts shall be of sufficient length to extend through the full thickness of the rail, washers, and nuts.
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. If solid rock is encountered within 0 to 18" of the finished grade, drill a 22" dia. hole, 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 maybe less. Any excess post length, after meeting these depths, may be field cut to ensure proper guardrail mounting height. Backfill with a cohesionless material.
10. Posts shall not be set in concrete, of any depth.
11. Special fabrication will be required at installations having a curvature of less than 150 ft. radius.
12. 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 may furnish composite material posts and/or blocks.
13. For posts located partially or wholly between precast box culvert units, the use of a cast-in-place concrete closure between boxes is required. See Detail "A" on Bridge Standard SCP-MD.




## ELEVATION MID-SPAN RAIL SPLICE

Showing a 25'- 0" section of W-Beam rail, 12'- 6" rail sections may also be supplied (See General Note 2)

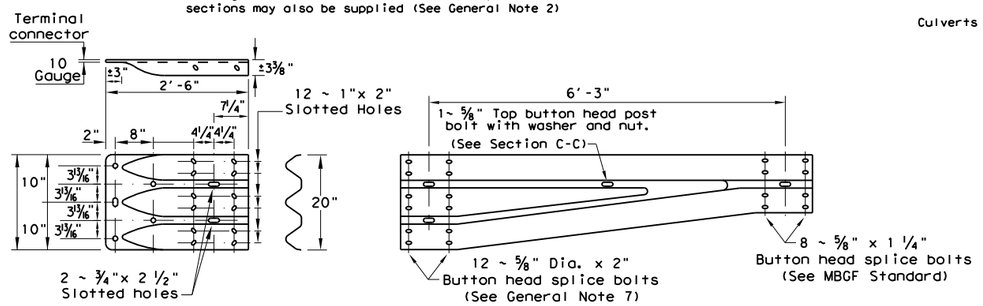
Direction of Traffic




## LOW FILL CULVERT POST

Culverts of 25 ft. or less, see GF(31)LS standard for "Long Span" option.

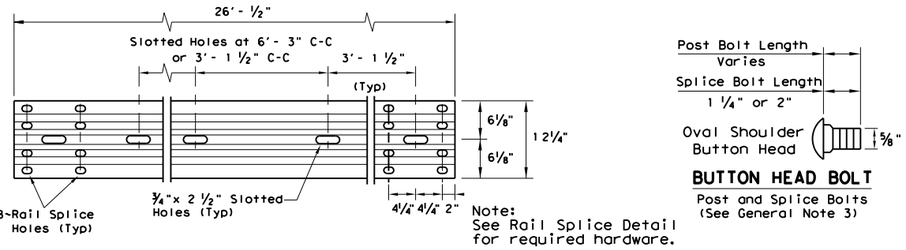
Epoxy Note:
Epoxy Anchor Option: This option may only be used if the culvert slab is 8" min. thick. Threaded anchor rods must be ⅞" Dia. ASTM A449 or A193 Grade B7 with heavy hex nut, and one hardened washer each. Embed anchor rods 6" with Hilti HIT RE 500 epoxy adhesive. Other Type III Class C epoxy adhesives meeting the requirements of DMS-6100, "Epoxies and Adhesives", may be used if it can be demonstrated that they meet or exceed the strength of Hilti HIT RE 500 with the same embedment depth and threaded rod dia. Follow the manufacturer's requirements for installing epoxied threaded rods. Extend rods ¼" min. beyond nut.




## THRIE-BEAM TERMINAL CONNECTION

(SEE GENERAL NOTES 6 & 7 FOR REQUIRED HARDWARE)

## NON-SYMMETRICAL TRANSITION TO W-BEAM (10 Gauge)



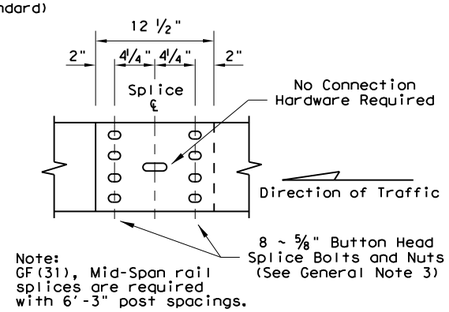

## ELEVATION 25'- 0" (NOM.) W-BEAM SECTION

12'- 6" RAIL SECTIONS MAY ALSO BE SUPPLIED (SEE GENERAL NOTE 2)

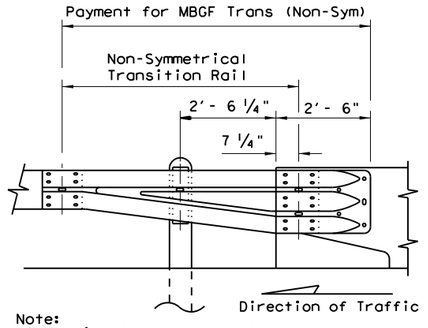



## BUTTON HEAD BOLT

Post and Splice Bolts (See General Note 3)




## MID-SPAN RAIL SPLICE DETAIL




## DOWNSTREAM RAIL ATTACHMENT

Texas Department of Transportation

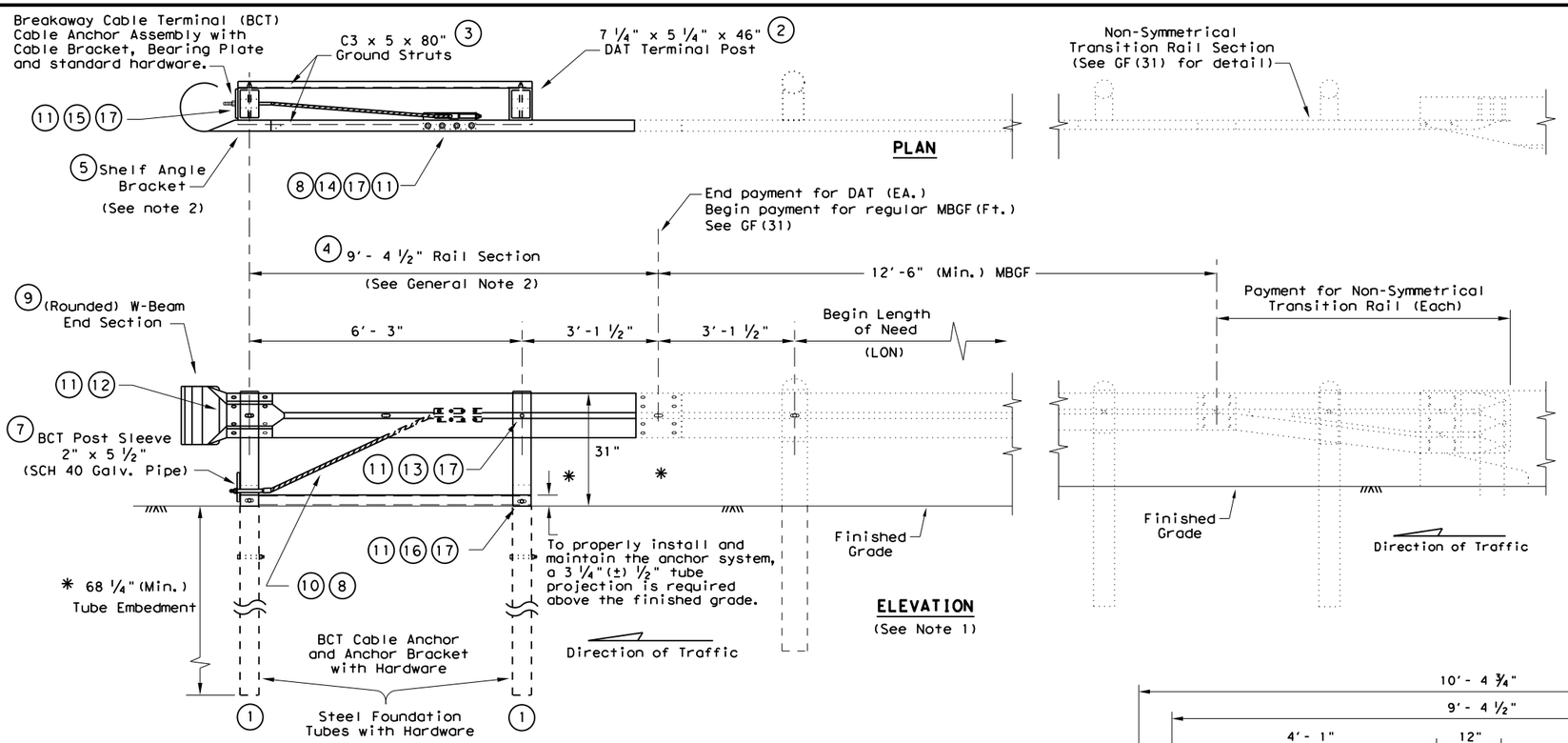
Design Division Standard

# METAL BEAM GUARD FENCE

# GF(31)-14

| | | | | | |
|---|---|---|---|---|---|
| FILE: gf3114.dgn | DN: TxDOT | CK: AM | DW: VP | CK: CGL | |
| ©TxDOT: December 2011 | CONT | SECT | JOB | HIGHWAY | |
| REVISIONS | 6367 | 43 | 001 | IH-20 | |
| | DIST | COUNTY | | SHEET NO. | |
| | 10 | SMITH, ETC. | | 49 | |

DATE:
FILE:




## DOWNSTREAM ANCHOR TERMINAL (DAT)

Only for downstream use, when located outside the horizontal clearance area of opposing traffic.

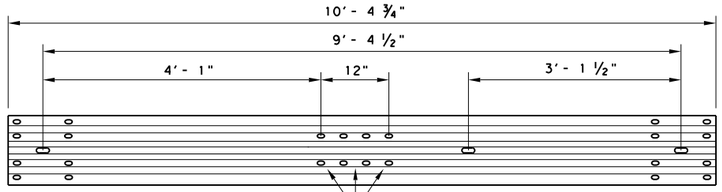
## GENERAL NOTES

1. The detail shown is the minimum Length of Need (LON) for a DAT connected to a concrete rail.
2. The rail section at the end post is supported by the Shelf Angle Bracket. The rail element is not attached to the end post.
3. The foundation tubes shall not project more than 3 3/4" above the finished grade.
4. All hardware for DAT shall be ASTM A307 unless otherwise shown.
5. Refer to GF(31) sheet for terminal connection details.

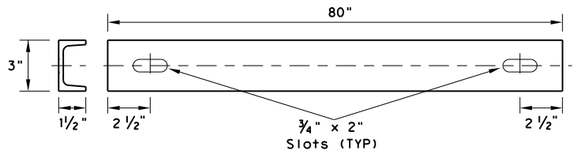
### MOW STRIP INSTALLATION

If a mow strip is required with the DAT installation the leave-out area around the steel foundation tubes and the two channel struts may be omitted. This will require a full pour at the foundation tubes.

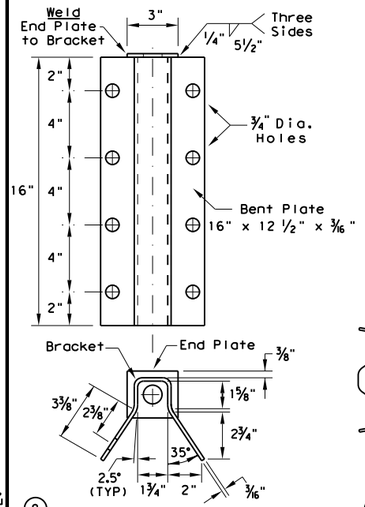
| # | (DAT) PARTS LIST | QTY |
|---|---|---|
| (1) | Steel Foundation Tube | 2 |
| (2) | DAT Terminal Post | 2 |
| (3) | Channel Strut | 2 |
| (4) | Terminal Rail Element | 1 |
| (5) | Shelf Angle Bracket | 1 |
| (6) | BCT Bearing Plate | 1 |
| (7) | BCT Post Sleeve | 1 |
| (8) | Guardrail Anchor Bracket | 1 |
| (9) | (Rounded) W-Beam End Section | 1 |
| (10) | BCT Cable Anchor | 1 |
| (11) | Recessed Nut, Guardrail | 20 |
| (12) | 1 1/4" Button Head Bolt | 4 |
| (13) | 10" Button Head Bolt | 2 |
| (14) | 5/8" x 2" Hex Head Bolt | 8 |
| (15) | 5/8" x 8" Hex Head Bolt | 4 |
| (16) | 5/8" x 10" Hex Head Bolt | 2 |
| (17) | 5/8" Flat Washer | 18 |



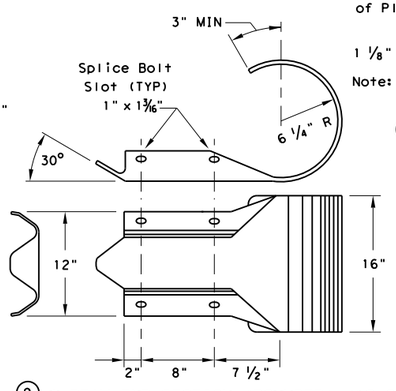

(4) TERMINAL RAIL ELEMENT FOR DAT



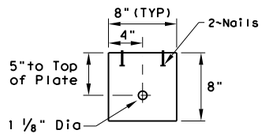

(3) CHANNEL STRUT
C3 x 5 x 80", Grade A36




(8) GUARDRAIL ANCHOR BRACKET

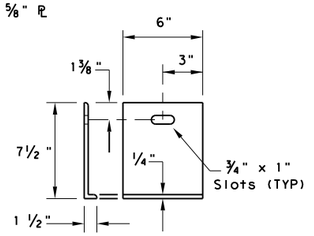



(9) W-BEAM END SECTION (ROUNDED) (12 GA.)

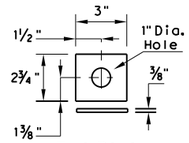



Note: Drive nails and bend over to prevent plate rotation

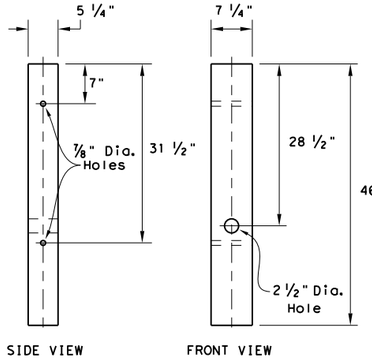
(6) BEARING PLATE
8"x 8"x 5/8" PL



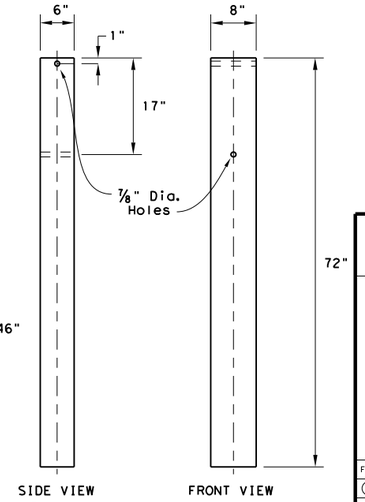

(5) SHELF ANGLE BRACKET




End Plate




(2) TERMINAL POST
7 1/4"x 5 1/4"x 46" Wood Post




(1) STEEL FOUNDATION TUBE
6"x 8"x 1/8" x 72" Steel Tube

Texas Department of Transportation

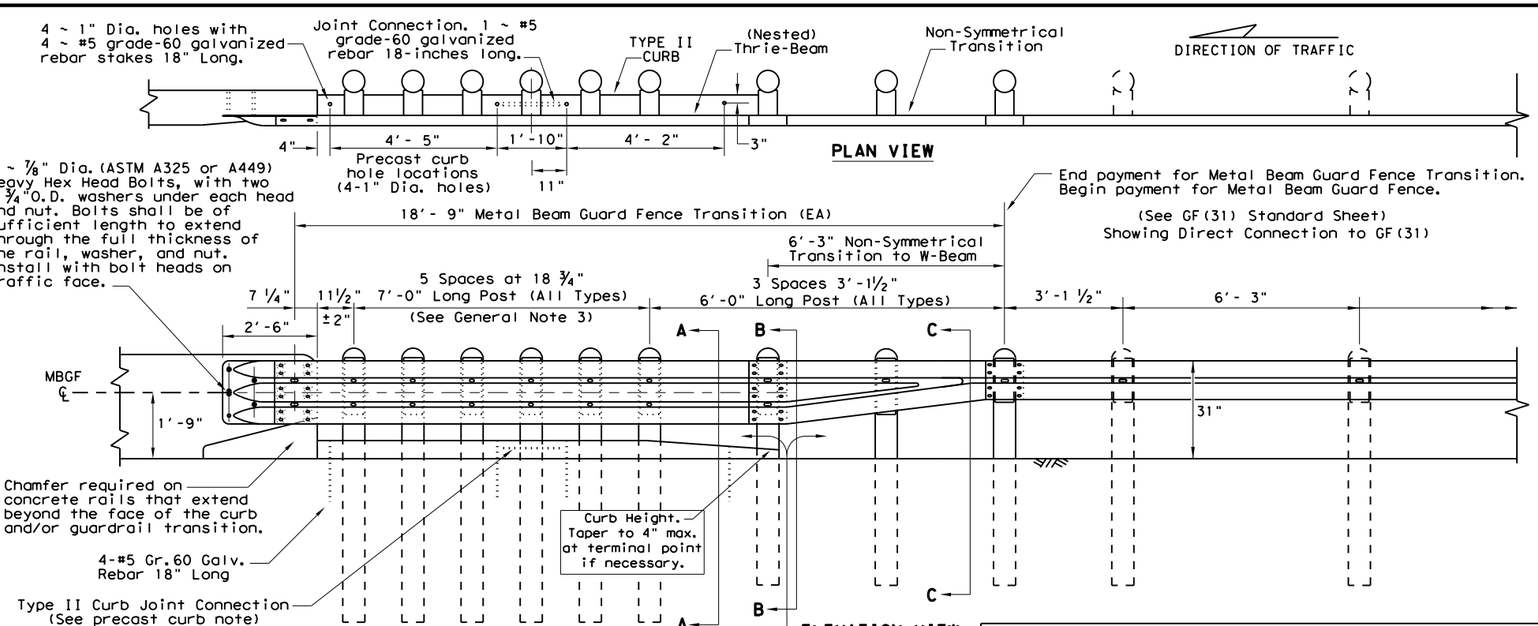
Design Division Standard

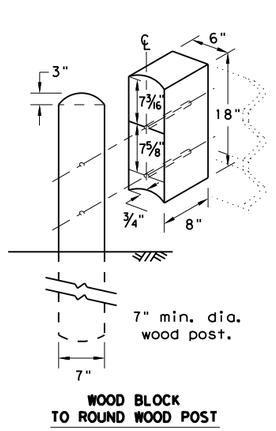
# METAL BEAM GUARD FENCE
## (Downstream Anchor Terminal)

## GF(31)DAT-14

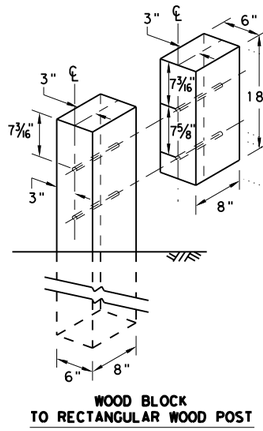
| FILE: gf31dat14.dgn | DN: TxDOT | CK: AM | DW: VP | CK: CGL |
|---|---|---|---|---|
| ©TxDOT: December 2011 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 50 |

DATE:
FILE:

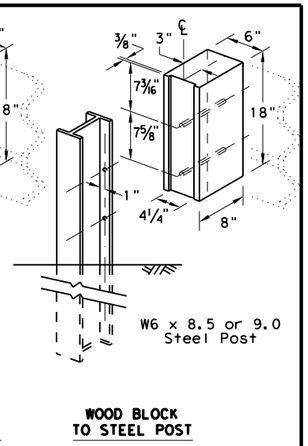



WOOD BLOCK TO ROUND WOOD POST




WOOD BLOCK TO RECTANGULAR WOOD POST




WOOD BLOCK TO STEEL POST

## GENERAL NOTES

1. 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 CCCG 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 out options needed within the curb section of the transition.

2. The type of post (round wood post, rectangular wood post or steel post) will be as shown in the plans.

3. 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.

4. 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.

5. Unless otherwise shown in the plans, transitions shall be placed with the block face in front of or directly above the curb face.

6. Galvanized washers used with the 5/8" dia. post bolts shall be Type A 1-3/4" O.D. washers. The (12) plate washers (FWR03) required at the terminal connector splice.

7. Button head "post" bolts (ASTM A307) shall be of sufficient length to extend through the full thickness of the nut (ASTM A563) and washer and not more than 1" beyond it. Button head "splice" bolts (ASTM A307) 5/8" dia.x 2" (at triple rail splices) with 5/8" double recessed nuts.

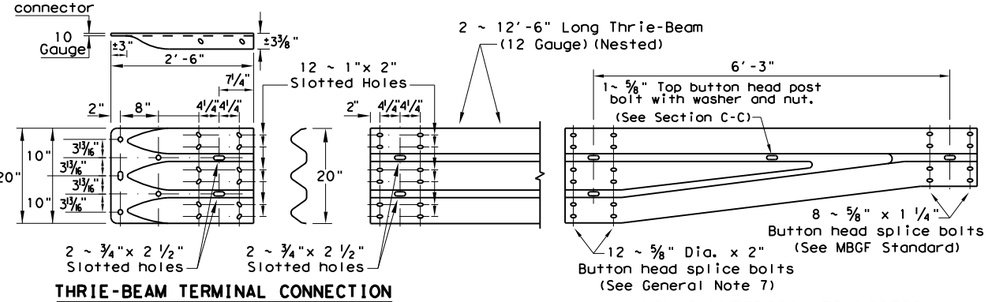
8. Fittings (bolts, nuts, and washers) shall be galvanized in accordance with Item 445, "Galvanizing". Fittings shall be subsidiary to the bid item.

9. Crown shall be widened to accommodate transitions.

10. If solid rock is encountered. See the MBGF standard sheet for the proper installation guidance.

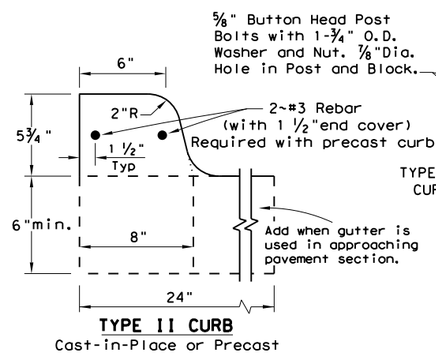
11. Posts shall not be set in concrete.

12. Unless otherwise shown in the plans, a composite material (post or block) that meets the requirements of DMS-7210, "Composite Material Posts and Blocks for Metal Beam Guard Fence" may be substituted for (post or block) of similar dimensions. TxDOT's Construction Division 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.

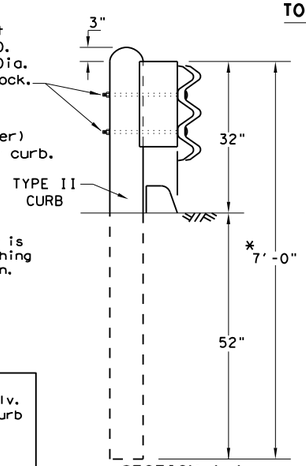



THRIE-BEAM TERMINAL CONNECTION
(See General Notes 6 & 7 for required hardware)

NON-SYMMETRICAL TRANSITION TO W-BEAM (10 Gauge)

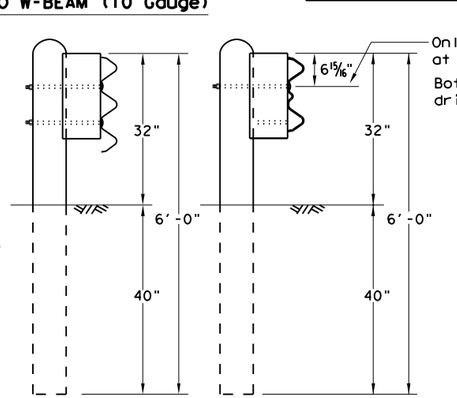



TYPE II CURB
Cast-in-Place or Precast




SECTION A-A

*Note: (All post types) (See General Note 3)

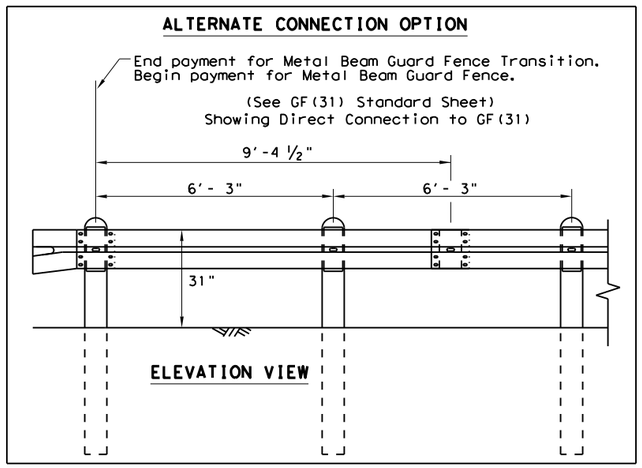



SECTION B-B SECTION C-C

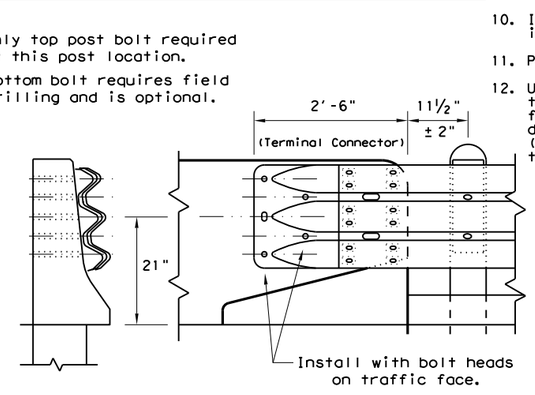
TRANSITION SECTIONS

PRECAST CURB:
Type II Precast Curb secured with 4~#5 Gr.60 Galv. Rebar stakes 18" long. The 12'- 2" section of curb may be cast in two sections.
Section ① 5'- 8" long
Section ② 6'- 6" long with the last 3'- 6" of curb tapered to a 4" height.
The Joint Connection is two 9" long 1" Dia. female ends connected with 1~#5 Gr.60 Galv.Rebar 18" long.

## ALTERNATE CONNECTION OPTION




ELEVATION VIEW




CONNECTION TO CONCRETE BRIDGE RAIL AND TRAFFIC BARRIERS

(12) Galvanized rectangular washers (FWR03) are required under the recessed nut at the terminal connector splice to nested thrie-beam. (See General Notes 6 & 7).

DIRECTION OF TRAFFIC

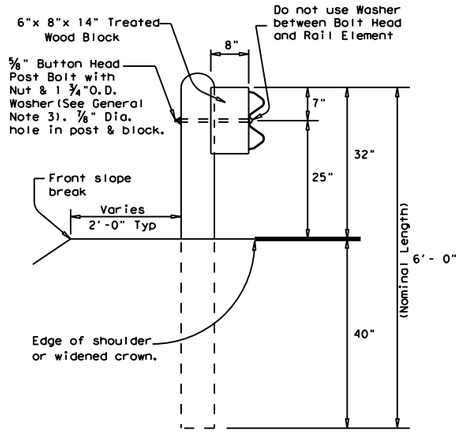
Texas Department of Transportation

Design Division Standard

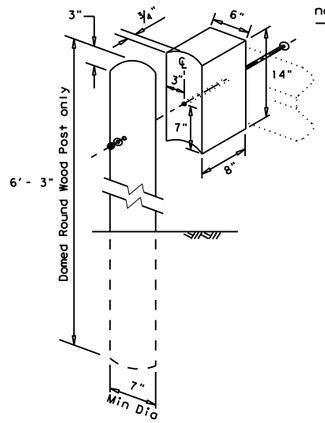
# METAL BEAM GUARD FENCE TRANSITION
## (Thrie-Beam Transition)
## GF(31)TR-14

| FILE: gf31tr14.dgn | DN: TxDOT | CK: AM | DW: VP | CK: CGL |
|---|---|---|---|---|
| ©TxDOT: December 2011 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 51 |

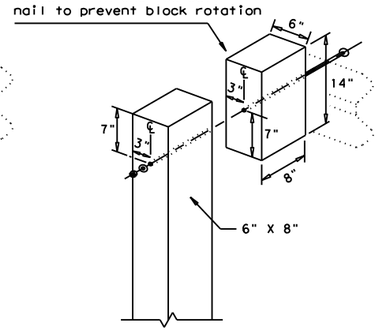
DATE:
FILE:



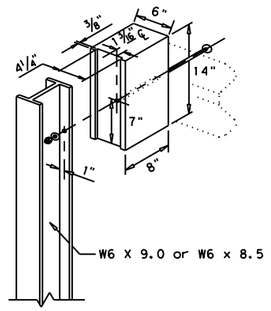

## TYPICAL POST



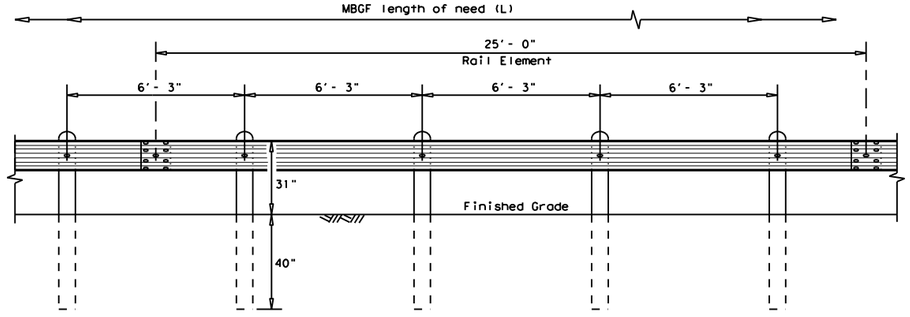

## WOOD BLOCK TO ROUND WOOD POST




## WOOD BLOCK TO RECTANGULAR WOOD POST

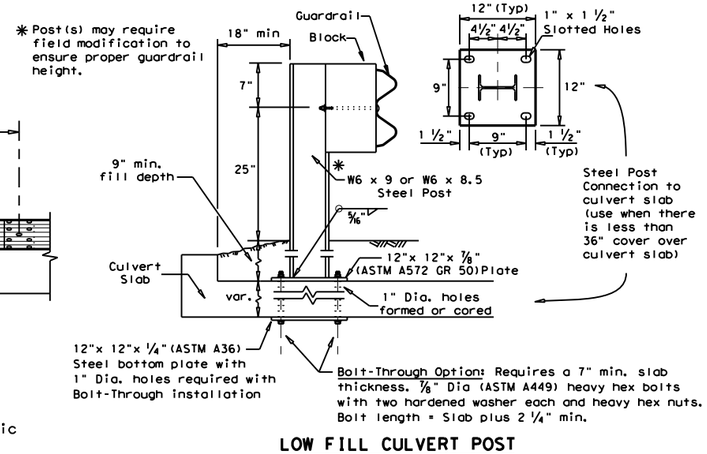



## WOOD BLOCK TO STEEL POST




## ELEVATION MID-SPAN RAIL SPLICE

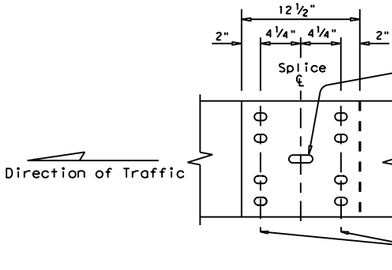
Showing a 25'- 0" section of W-Beam rail, 12'- 6" rail sections may also be supplied (See General Note 2)




## LOW FILL CULVERT POST

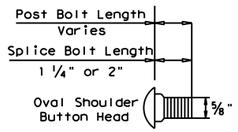
For use on culverts up to 50 ft. in length. Culverts of 25 ft. or less, See GF(31)LS standard for "Long Span" option.

Epoxy Note:
Epoxy Anchor Option: This option may only be used if the culvert slab is 8" min. thick. Threaded anchor rods must be ⅞" Dia. ASTM A449 or A193 Grade B7 with heavy hex nut, and one hardened washer each. Embed anchor rods 6" with Hilti HIT RE 500 epoxy adhesive. Other Type III Class C epoxy adhesives meeting the requirements of DMS-6100, "Epoxies and Adhesives", may be used if it can be demonstrated that they meet or exceed the strength of Hilti HIT RE 500 with the same embedment depth and threaded rod dia. Follow the manufacturer's requirements for installing epoxied threaded rods. Extend rods ¼" min. beyond nut.



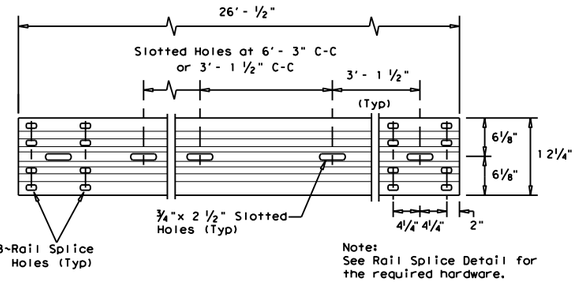

## MID-SPAN RAIL SPLICE DETAIL

GF(31), Mid-Span rail splices are required with 6'-3" post spacings.



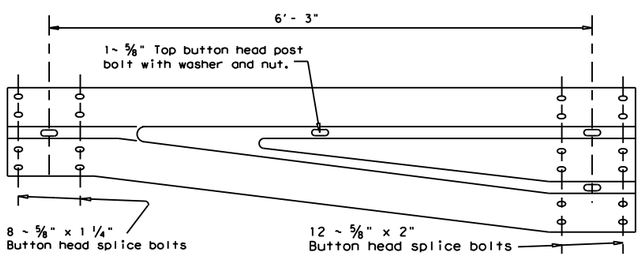

## BUTTON HEAD BOLT

Post and Splice Bolts (See General Note 3)



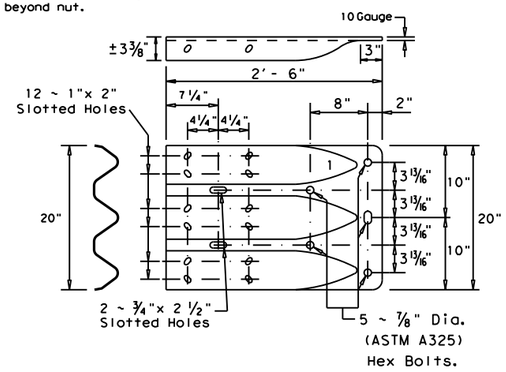

## ELEVATION 25'- 0"(NOM.) W-BEAM SECTION

12'- 6" rail sections may also be supplied (See General Note 2)




## NON-SYMMETRICAL TRANSITION FROM W-BEAM TO CONCRETE RAIL (10 GA.)

(See GF(31)DAT for Downstream Connection to Concrete Rail)




## THRIE-BEAM TERMINAL CONNECTION (10 GA.)

(See General Note 3 for required hardware)

## 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'-1½" 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 (ASTM A307) shall be of sufficient length to extend through the full thickness of the nut (ASTM A563) and Type A (1 ¾" O.D.) washer and not more than 1" beyond it. Button head "splice" bolts (ASTM A307) are ⅝" x 1 ¼" (or 2" long at triple rail splices) with a ⅝" double recessed nut (ASTM A563). Thrie beam "connection" ⅞" dia. (ASTM A325) hex bolts shall be of sufficient length to extend through the full thickness of the rail, washers, and nuts.
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. If solid rock is encountered within 0 to 18" of the finished grade, drill a 22" dia. hole, 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 maybe less. Any excess post length, after meeting these depths, may be field cut to ensure proper guardrail mounting height. Backfill with a cohesionless material.
10. Posts shall not be set in concrete, of any depth.
11. Special fabrication will be required at installations having a curvature of less than 150 ft. radius.
12. 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 may furnish composite material posts and/or blocks.
13. For posts located partially or wholly between precast box culvert units, the use of a cast-in-place concrete closure between boxes is required. See Detail "A" on Bridge Standard SCP-MD.

Texas Department of Transportation

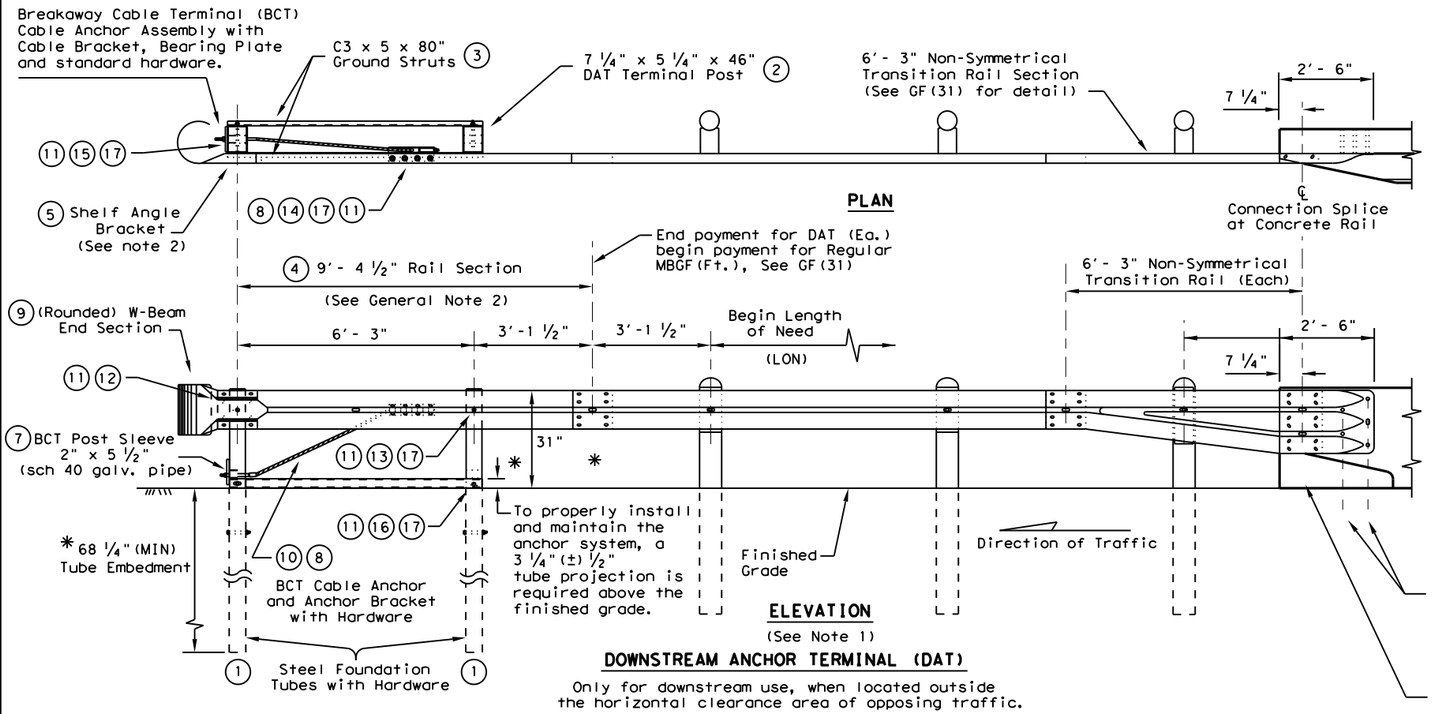
Design Division Standard

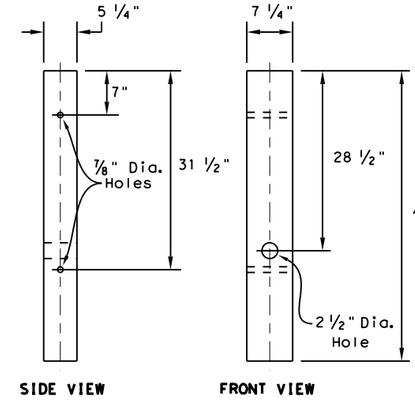
# METAL BEAM GUARD FENCE

# GF(31)-11

| FILE: gf3111.dgn | DN: TxDOT | CK: AM | DW: VP | CK: |
|---|---|---|---|---|
| ©TxDOT December 2011 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 52 |

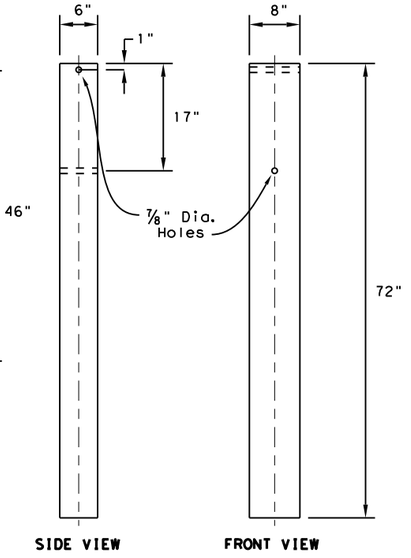
DATE:
FILE:




**TERMINAL POST**

(2) 7 1/4" x 5 1/4" x 46" Wood Post



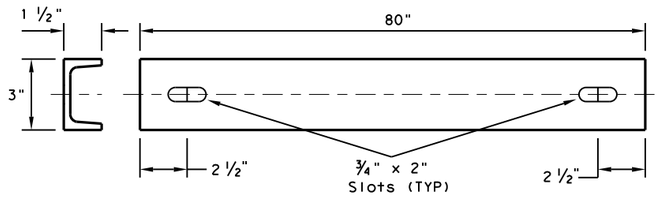

**STEEL FOUNDATION TUBE**

(1) 6" x 8" x 7/8" x 72" Steel Tube

| # | (DAT) PARTS LIST | QTY. |
|---|---|---|
| (1) | Steel Foundation Tube | 2 |
| (2) | DAT Terminal Post | 2 |
| (3) | Channel Strut | 2 |
| (4) | Terminal Rail Element | 1 |
| (5) | Shelf Angle Bracket | 1 |
| (6) | BCT Bearing Plate | 1 |
| (7) | BCT Post Sleeve | 1 |
| (8) | Guardrail Anchor Bracket | 1 |
| (9) | (Rounded) W-Beam End Section | 1 |
| (10) | BCT Cable Anchor | 1 |
| (11) | Recessed Nut, Guardrail | 20 |
| (12) | 1 1/4" Button Head Bolt | 4 |
| (13) | 10" Button Head Bolt | 2 |
| (14) | 5/8" x 2" Hex Head Bolt | 8 |
| (15) | 5/8" x 8" Hex Head Bolt | 4 |
| (16) | 5/8" x 10" Hex Head Bolt | 2 |
| (17) | 5/8" Flat Washer | 18 |

**Terminal Connection Note**

To ensure a stable connection. (12) Rectangular Washers (FWR03) are required under the recessed nuts at the Terminal Connection splice.




(3) **CHANNEL STRUT**

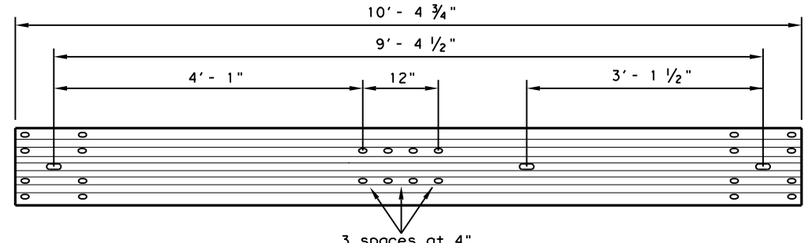
C3 x 5 x 80", Grade A36

## GENERAL NOTES

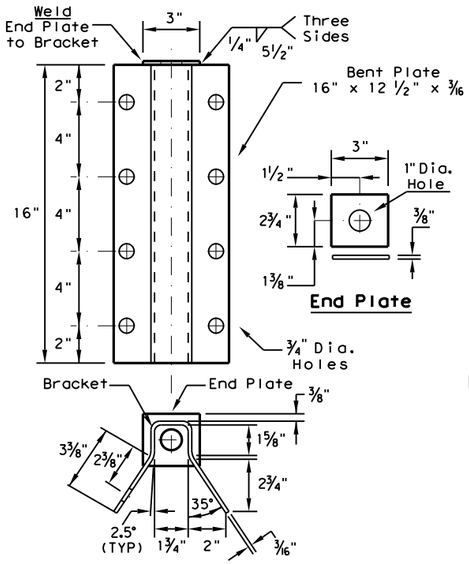
1. The DAT detail shown is the minimum Length of Need (LON) for a DAT connected to a concrete rail.
2. The rail section at the end post is supported by the Shelf Angle Bracket. The rail element is not attached to the end post.
3. The foundation tubes shall not project more than 3 3/4" above the finished grade.
4. All hardware for DAT shall be ASTM A307 unless otherwise shown.
5. Refer to GF(31) sheet for terminal connection details.

**MOW STRIP INSTALLATION**

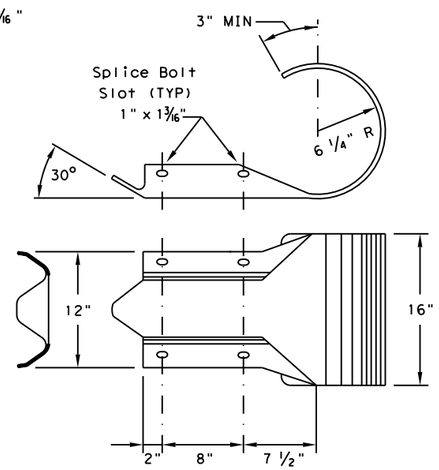
If a mow strip is required with the DAT installation the leave-out area around the steel foundation tubes and the two channel struts may be omitted. This will require a full pour at the foundation tubes.



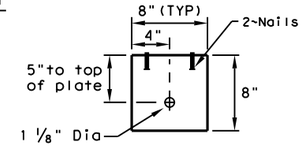

(4) **TERMINAL RAIL ELEMENT FOR DAT**




(8) **GUARDRAIL ANCHOR BRACKET**



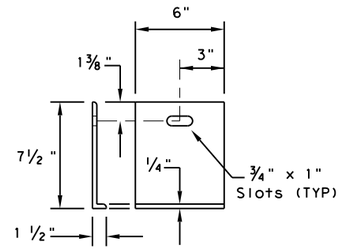

(9) **W-BEAM END SECTION (ROUNDED) (12 GA.)**




Note: Drive nails and bend over to prevent plate rotation

(6) **BEARING PLATE**

8" x 8" x 5/8" PL




(5) **SHELF ANGLE BRACKET**

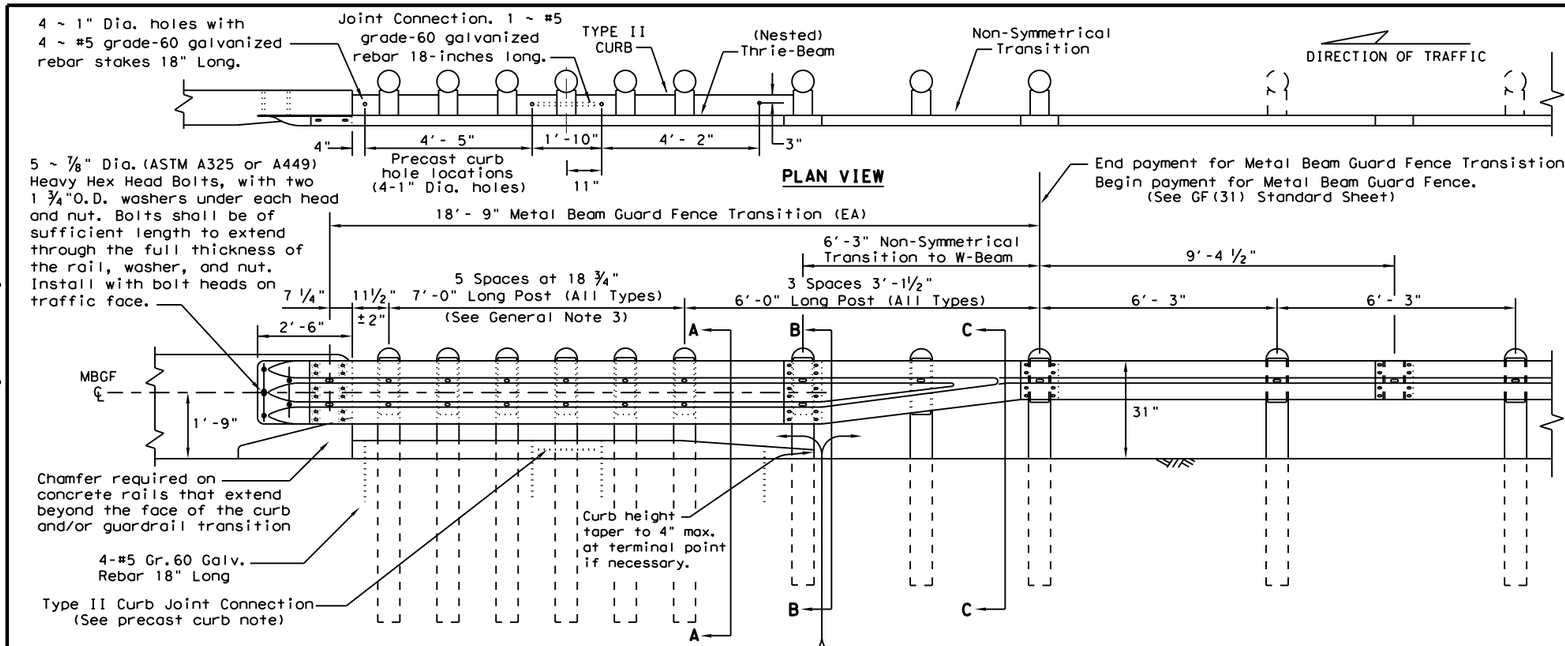
Texas Department of Transportation

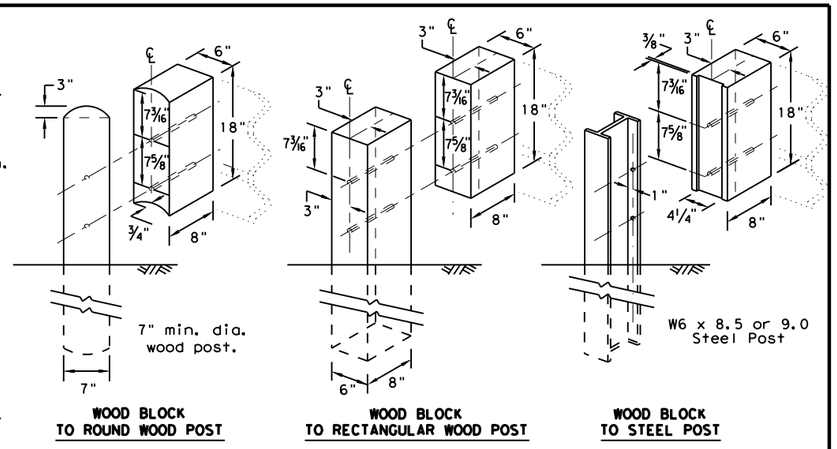
Design Division Standard

# METAL BEAM GUARD FENCE
## (Downstream Anchor Terminal)
## GF(31)DAT-11

| FILE: gf31da11.dgn | DN: TxDOT | CK: AM | DW: VP | CK: |
|---|---|---|---|---|
| ©TxDOT December 2011 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 53 |

DATE:
FILE:




## GENERAL NOTES

1. 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 CCCG 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.

2. The type of post (round wood post, rectangular wood post or steel post) will be as shown in the plans.

3. 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.

4. 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.

5. Unless otherwise shown in the plans, transitions shall be placed with the block face in front of or directly above the curb face.

6. Galvanized washers used with the 5/8" dia. post bolts shall be Type A 1 3/4" O.D. washers. The (12) plate washers (FWR03) required at the terminal connector splice.

7. Button head "post" bolts (ASTM A307) shall be of sufficient length to extend through the full thickness of the nut (ASTM A563) and washer and not more than 1" beyond it. Button head "splice" bolts (ASTM A307) 5/8" Dia. x 2" (at triple rail splices) with 5/8" double recessed nuts.

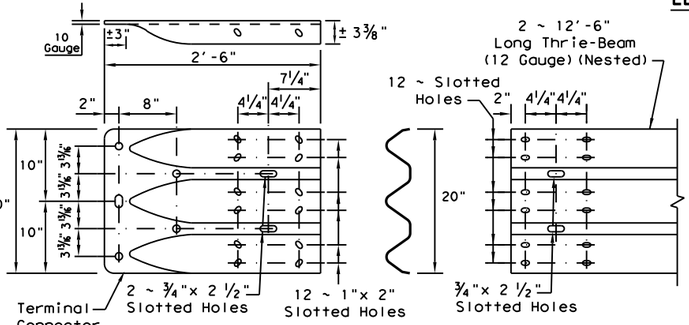
8. Fittings (bolts, nuts, and washers) shall be galvanized in accordance with Item 445, "Galvanizing". Fittings shall be subsidiary to the bid item.

9. Crown shall be widened to accommodate transitions.

10. If solid rock is encountered. See the MBGF standard sheet for the proper installation guidance.

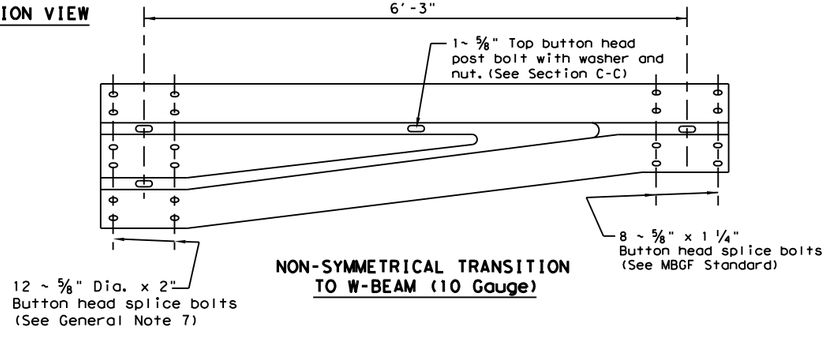
11. Posts shall not be set in concrete.

12. 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.

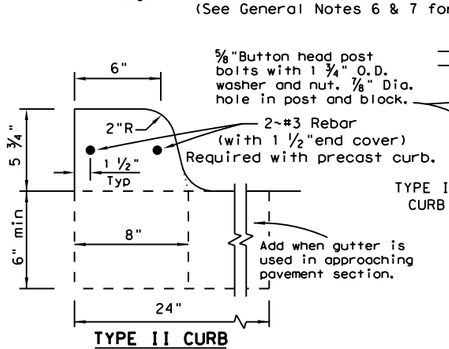



THRIE-BEAM TERMINAL CONNECTION
(See General Notes 6 & 7 for required hardware)

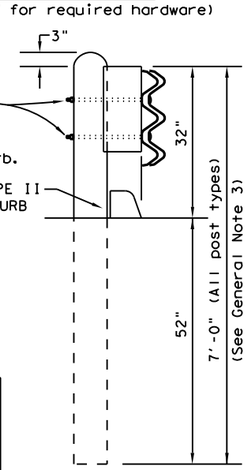


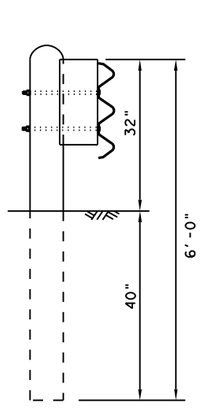

NON-SYMMETRICAL TRANSITION TO W-BEAM (10 Gauge)



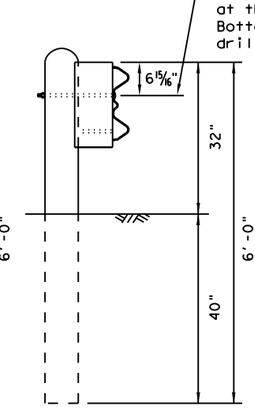

TYPE II CURB
Cast-in-Place or Precast




SECTION A-A

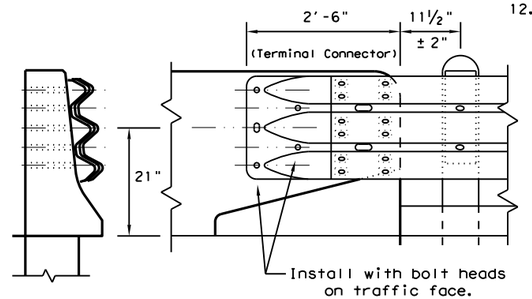



SECTION B-B




SECTION C-C

TRANSITION SECTIONS




CONNECTION TO CONCRETE BRIDGE RAIL AND TRAFFIC BARRIERS

(12) Galvanized rectangular washers (FWR03) are required under the recessed nut at the terminal connector splice to nested thrie-beam. (See General Notes 6 & 7).

DIRECTION OF TRAFFIC

PRECAST CURB:
Type II Precast Curb secured with 4~#5 Gr.60 Galv. Rebar stakes 18" long. The 12'- 2" section of curb may be cast in two sections.
Section (1) 5'- 8" long
Section (2) 6'- 6" long with the last 3'- 6" of curb tapered to a 4" height.
The Joint Connection is two 9" long 1" Dia. female ends connected with 1~#5 Gr.60 Galv.Rebar 18" long.

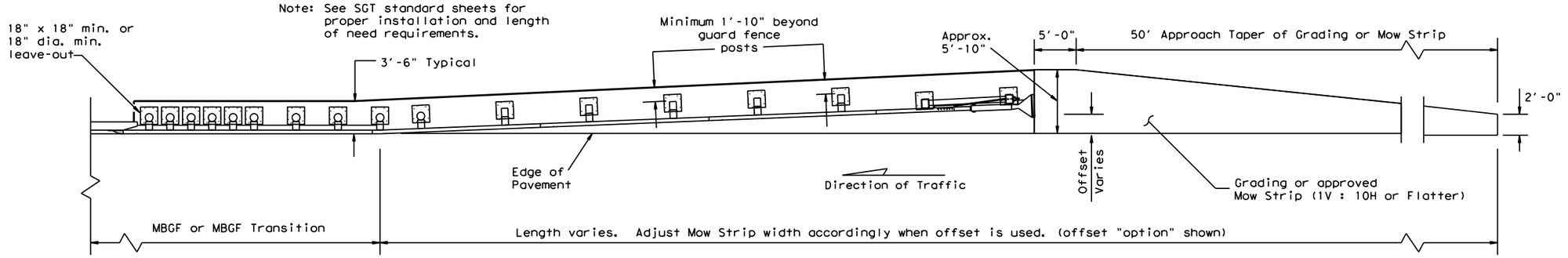
Texas Department of Transportation

Design Division Standard

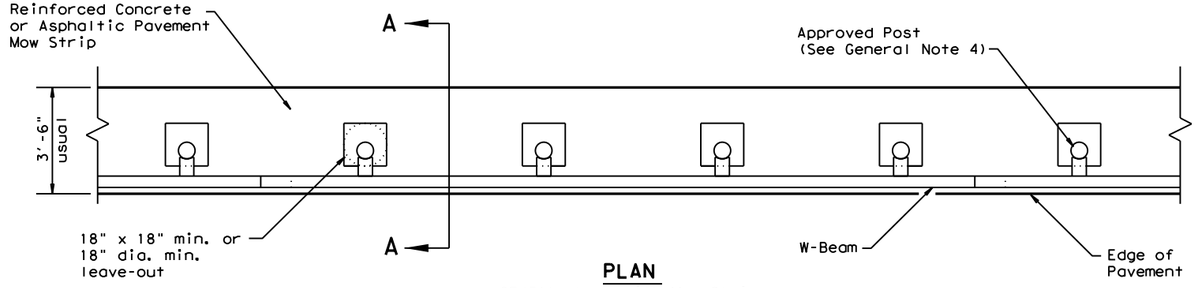
# METAL BEAM GUARD FENCE TRANSITION
## (Thrie-Beam Transition)
## GF(31)TR-13

| FILE: gf31tr13.dgn | DN: TxDOT | CK: AM | DW: VP | CK: |
|---|---|---|---|---|
| ©TxDOT December 2011 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 54 |

DATE:
FILE:

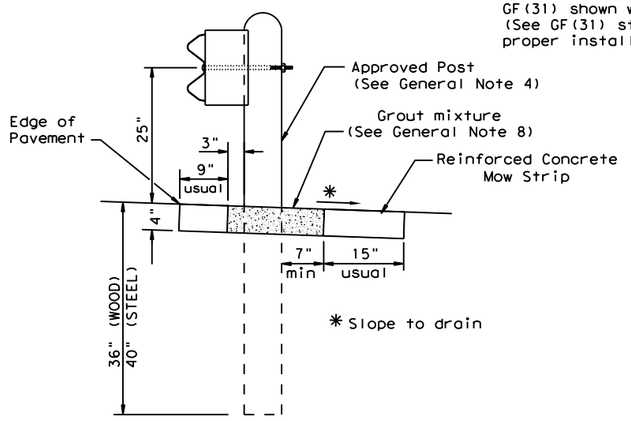



## GRADING AND MOW STRIP AT GUARDRAIL END TREATMENTS



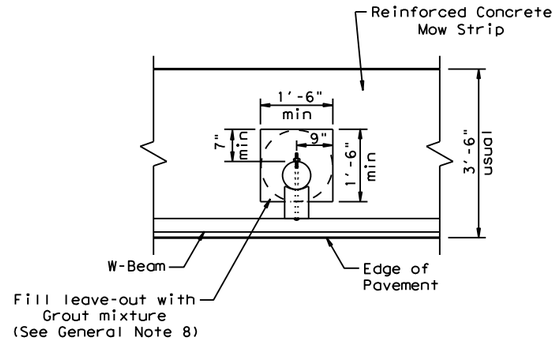

### PLAN

GF(31) shown with Mow Strip
(See GF(31) standard sheet for proper installation)



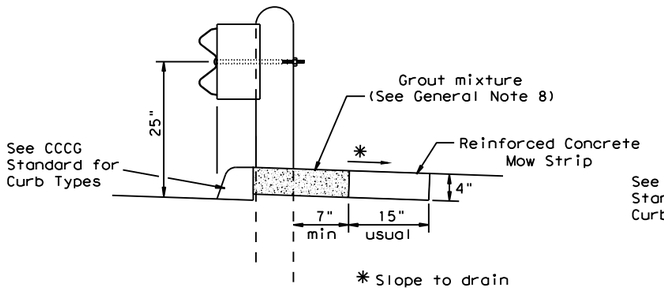

### SECTION A-A

Typical



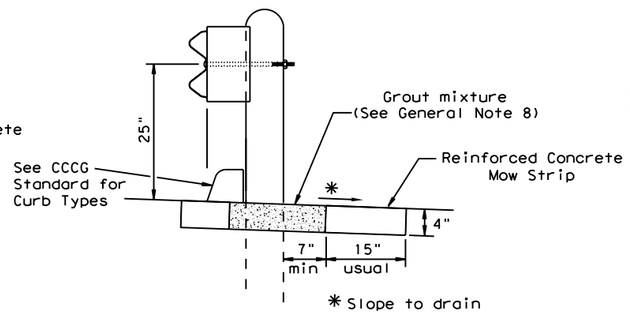

### MOW STRIP DETAIL

Reinforced Concrete Mow Strip with 18" x 18" Square or 18" Dia. minimum leave-out.



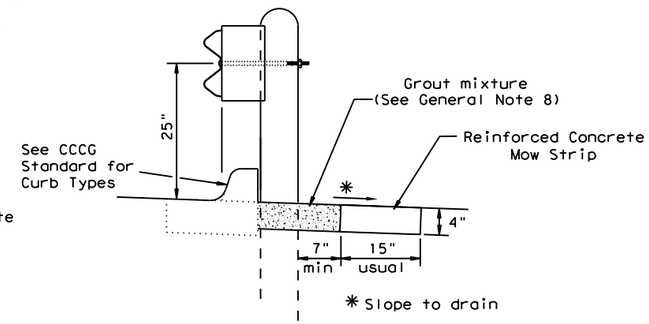

### CURB OPTION (1)

This option will increase the post embedment throughout the system.




### CURB OPTION (2)

Curb shown on top of mow strip




### CURB OPTION (3)

Note: Site Condition(s)

Site conditions may exist where grading is required for the proper installation of metal guard fence and end treatments.

Approach grading or mow strip may be decreased or eliminated, as directed by the Engineer.

## GENERAL NOTES

1. This mow strip design is for use with metal beam guard fence, guard fence transitions, and guard fence end treatments. See applicable GF(31) MBGF or GF(31) Transition Standard sheet for additional information.
2. Mow strips shall be reinforced concrete with (wire mesh or synthetic fiber), as shown on the plans and will be paid for under the pertinent bid item. Reinforced concrete shall be placed in accordance with Item 432, "Riprap." The use of the synthetic fiber in lieu of steel reinforcing is acceptable, provided the fiber producer is on the Department Material Producer List (MPL), maintained by TxDOT, Construction Division.
3. The leave-out behind the post shall be a minimum of 7".
4. Only steel (W6 x 8.5 or W6 x 9.0), or 7 ½" Dia. round wood posts are acceptable for use in the mow strip. See GF(31) Standard for additional details.
5. Other curb placement options may be used. Curbs are not considered part of the mow strip and will be paid for under other pertinent bid item.
6. Thickness of the mow strip will be 4".
7. The limits of payment for reinforced concrete will include leave-outs for the posts.
8. The leave-outs shall be filled with a Grout mixture consisting of: 2719 pounds sand, 188 pounds Type 1 or II cement, and 550 pounds of water per cubic yard, with a 28-day compressive strength of approximately 230 psi or less. Provide grout with a consistency that will flow into and completely fill all voids. Due to auger size, larger leave-out dimensions are acceptable from both an impact performance and maintenance repair standpoint (Suggested Maximum leave-out of 20"). Payment for furnishing and placing the grout mixture will be subsidiary to the pay item of riprap mow strip.

Texas Department of Transportation

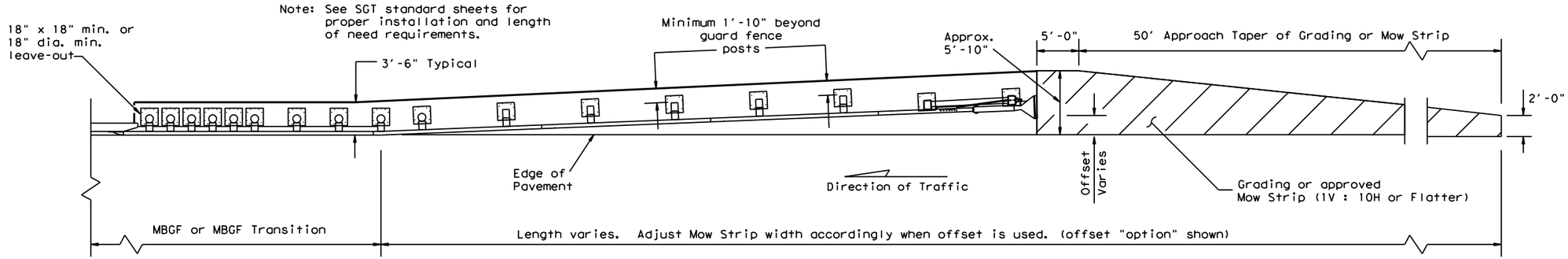
Design Division Standard

# METAL BEAM GUARD FENCE (MOW STRIP) TL-3 MASH COMPLIANT

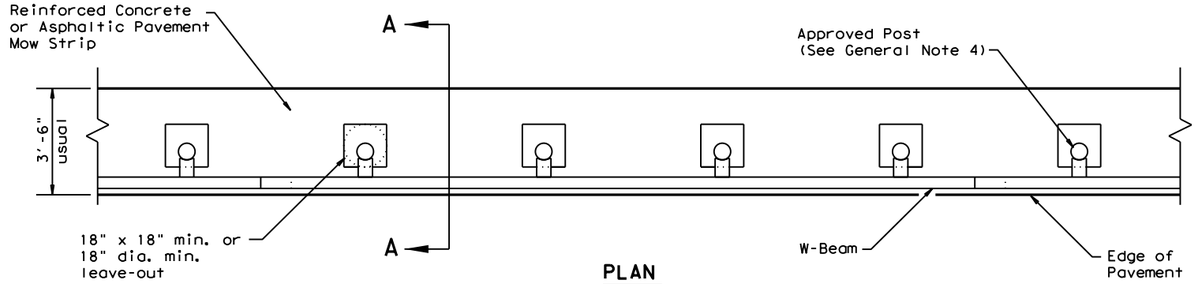
# GF(31)MS-19

| FILE: gf31ms19.dgn | DN: TxDOT | CK: KM | DW: VP | CK: CGL/AG |
|---|---|---|---|---|
| ©TxDOT: NOVEMBER 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH 20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 55 |

DATE:
FILE:

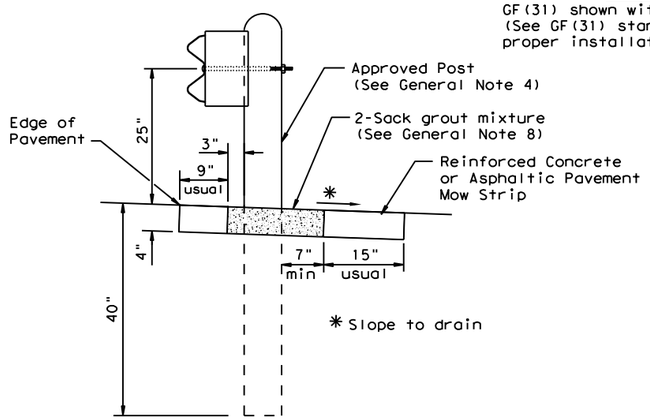



## GRADING AND MOW STRIP AT GUARDRAIL END TREATMENTS



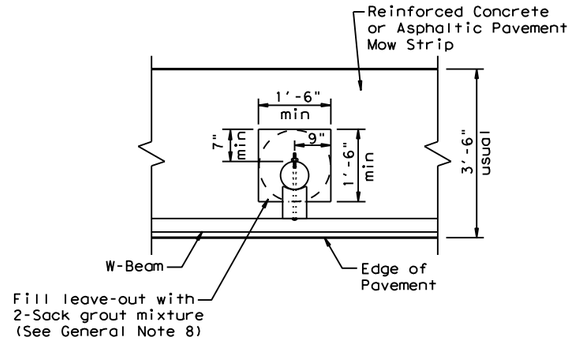

### PLAN

GF(31) shown with Mow Strip
(See GF(31) standard sheet for proper installation)



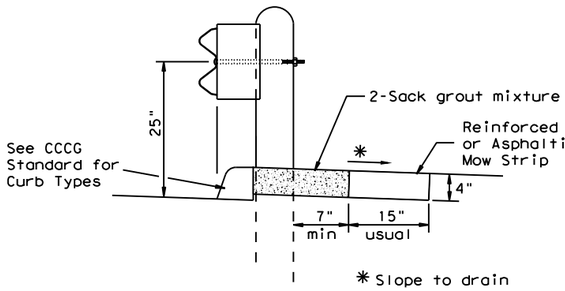

### SECTION A-A

Typical



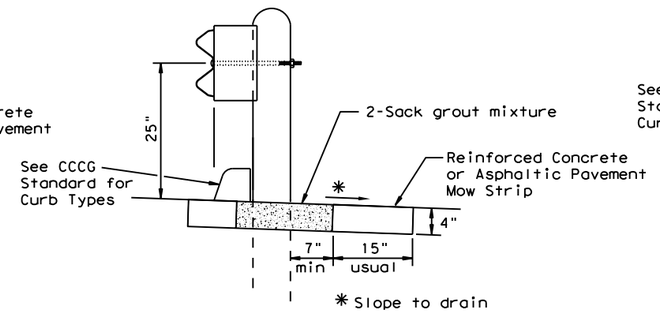

### MOW STRIP DETAIL

Reinforced Concrete or Asphaltic Pavement Mow Strip with 18" x 18" or 18" dia. minimum leave-out.



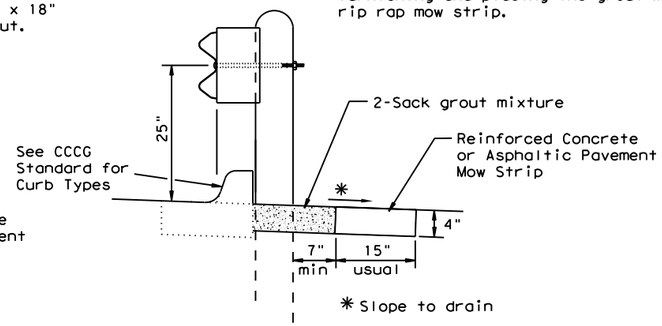

### CURB OPTION (1)

This option will increase the post embedment through out the system.




### CURB OPTION (2)

Curb shown on top of mow strip




### CURB OPTION (3)

Note: Site Condition(s)

Site conditions may exist where grading is required for the proper installation of metal guard fence and end treatments.

Approach grading or mow strip may be decreased or eliminated, as directed by the Engineer.

## GENERAL NOTES

1. This mow strip design is for use with metal beam guard fence, guard fence transitions, and guard fence end treatments (See SGT standards for proper SGT installation).
2. Mow strips shall be asphaltic pavement or reinforced concrete (wire mesh or synthetic fiber), as shown on the plans and will be paid for under the pertinent bid item. Asphaltic pavement shall meet the requirements of the item, and be placed in accordance with the pertinent bid item as shown in the plans. 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. The type of approved post will be as shown in the plans. See the applicable standard sheets for additional details and information.
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 asphaltic pavement or reinforced concrete will include leave-outs for the posts.
8. The leave-outs shall be filled with no more than a 2-sack grout mixture (1 part cement, 5 parts water, and 14 parts sand by volume) with a 28-day compressive strength of approximately 120 psi or less. Provide grout of a consistency that will flow into and completly 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 rip rap mow strip.

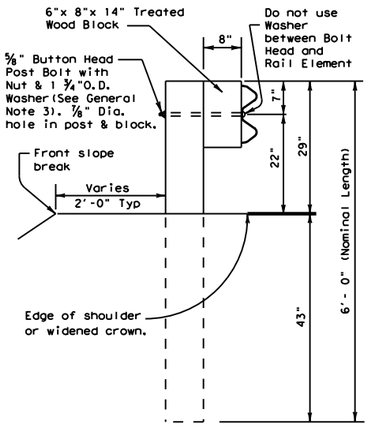
Texas Department of Transportation

Design Division Standard

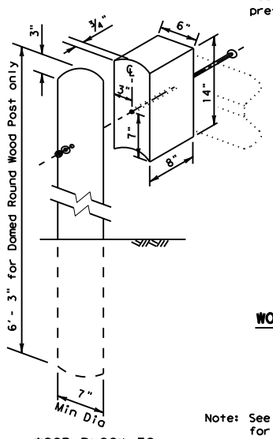
# METAL BEAM GUARD FENCE
## (MOW STRIP)
## GF(31)MS-17

| FILE: gf31ms17.dgn | DN: TxDOT | CK: KM | DW: TXDOT | CK: CL |
|---|---|---|---|---|
| © TxDOT December 2011 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| Revised 12, 2017 KM | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 56 |

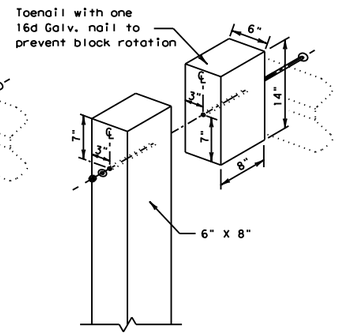
DATE:
FILE:



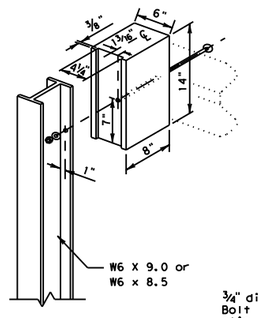

**TYPICAL POST**



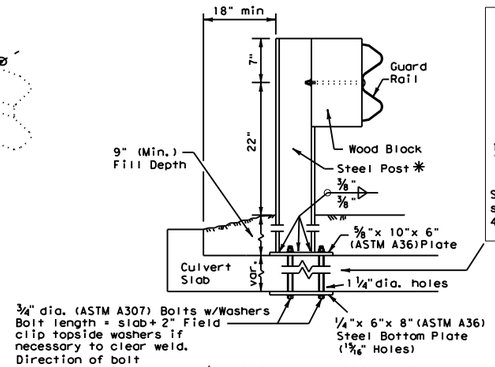

**WOOD BLOCK TO ROUND WOOD POST**




**WOOD BLOCK TO RECTANGULAR WOOD POST**

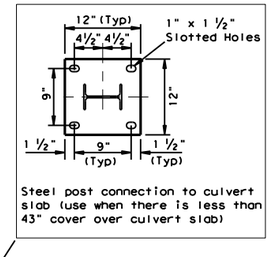



**WOOD BLOCK TO STEEL POST**

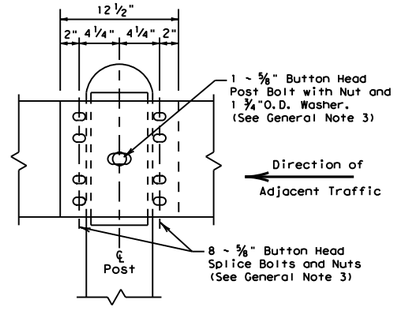



*** LOW FILL CULVERT POST**

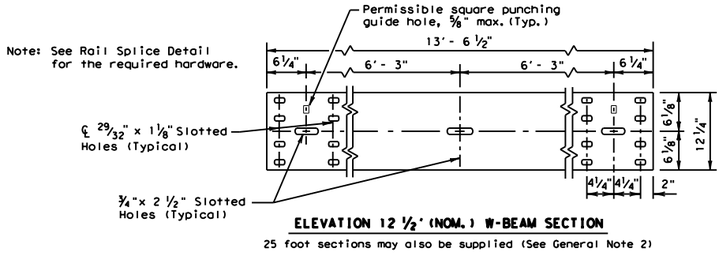
**FOR USE ON NON-BRIDGE CLASS CULVERTS ONLY**




* Post(s) may require field modifications to ensure proper guardrail height.




**RAIL SPLICE DETAIL**

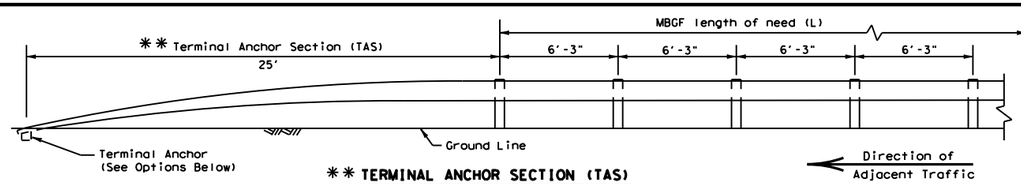



**ELEVATION 12 1/2' (NOM.) W-BEAM SECTION**

25 foot sections may also be supplied (See General Note 2)

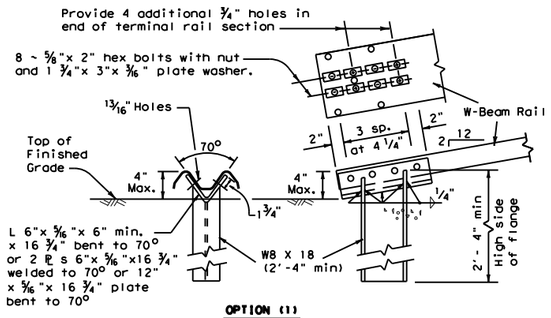
## GENERAL NOTES

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 MBGF shall be shown elsewhere 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 on the plans. The Contractor may furnish rail elements of 12 1/2 or 25 foot nominal lengths.
3. Button head "post" bolts (ASTM A307) shall be of sufficient length to extend through the full thickness of the nut (ASTM A563) and Type A (1 3/4" O.D.) washer and not more than 1" beyond it. Button head "splice" bolts (ASTM A307) are 5/8" x 1 1/4" (or 2" long at triple rail splices) with a 5/8" double recessed nut (ASTM A563).
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 slope rate of not more than 1V:10H.
7. 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.
8. 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.
9. Posts shall not be set in concrete, of any depth.
10. Special fabrication will be required at installations having a curvature of less than 150 ft. radius.
11. 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."
12. 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.



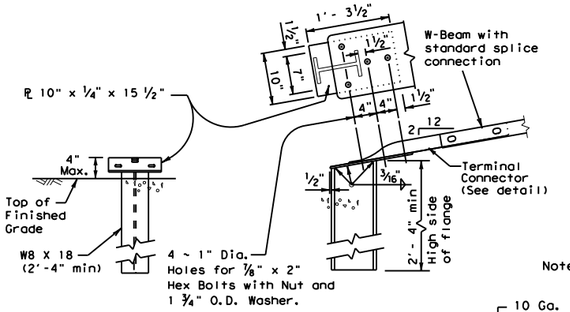

**** TERMINAL ANCHOR SECTION (TAS)**

**Terminal anchor sections are only for downstream use, when located outside the horizontal clearance area of opposing traffic.**




**OPTION (1)**

Note: This anchor post requires four additional 3/4" holes (shop or field) in the rail member with eight 5/8" hex bolts with nut and plate washer.

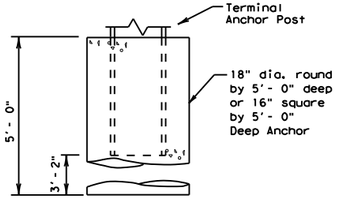



**OPTION (2)**

Note: This anchor post requires the use of the 10 ga. terminal connector with four 7/8" hex bolts with nut and washer.

**TERMINAL ANCHOR POST OPTIONS**

(See General Note 11)



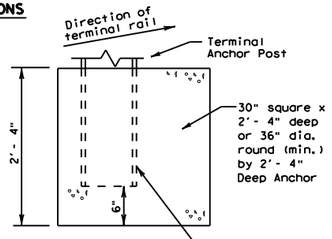

Notes:

Either concrete anchor may be used with either post option above.

No construction joint is allowed in the concrete anchor.

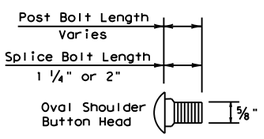
Terminal rail may be bolted to post and in twist position prior to placing concrete anchor.

If concrete anchor is precast, the area should be compacted as directed by the Engineer, when placed in the field.




**TERMINAL CONCRETE ANCHOR OPTIONS**

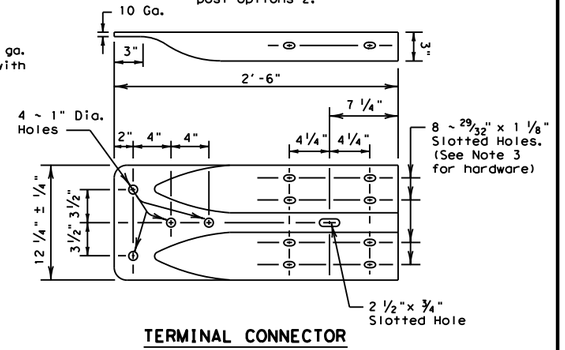
(See General Note 11)




**BUTTON HEAD BOLT**

Post and Splice Bolts (See General Note 3)

Note: Terminal Connector to be used with terminal anchor post options 2.




**TERMINAL CONNECTOR**

For connection hardware to concrete rails, see the MBGF transition standards.

**ONLY FOR USE IN MAINTENANCE REPAIRS OR HIGHLY CONSTRAINED SITE CONDITIONS.**

Texas Department of Transportation

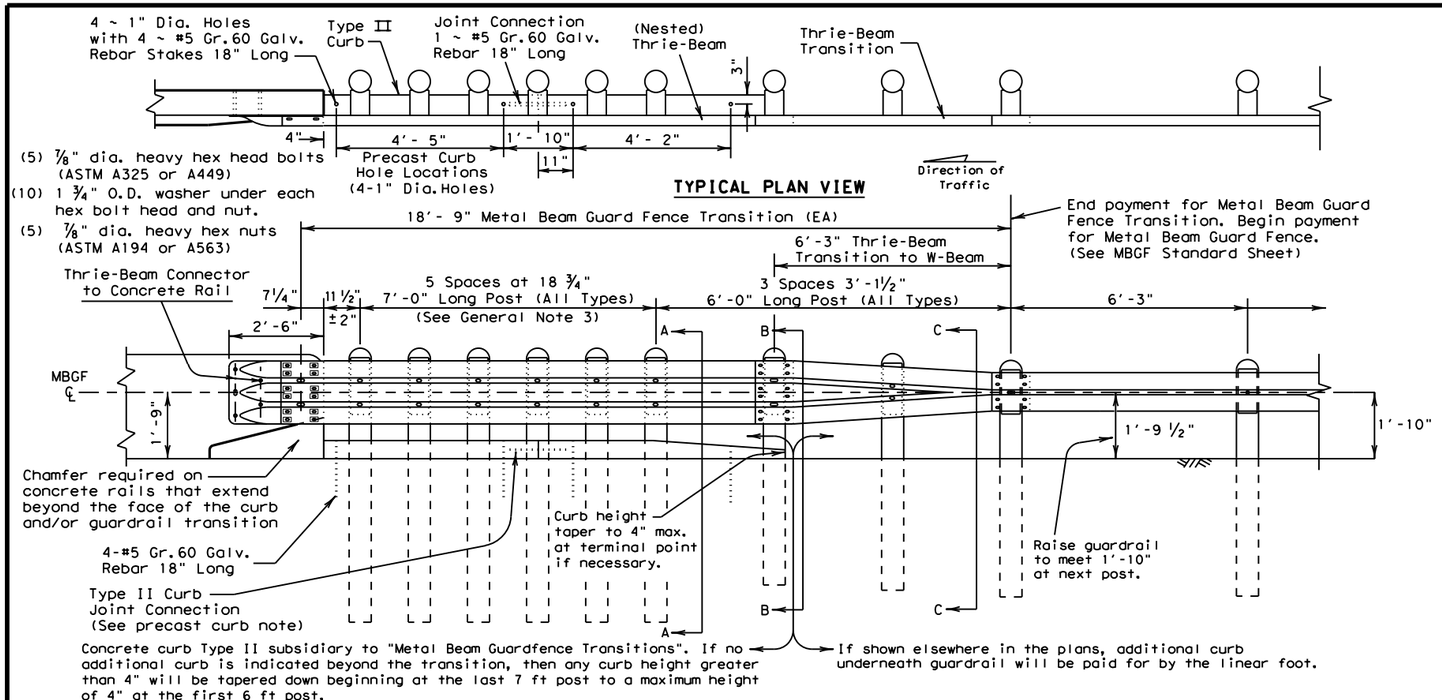
*Design Division Standard*

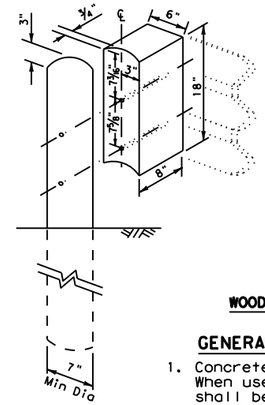
# METAL BEAM GUARD FENCE

# MBGF - 19

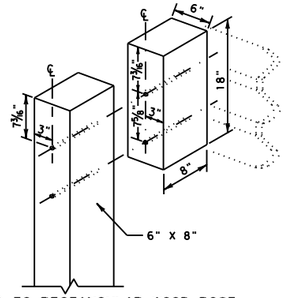
| FILE: mbgf19.dgn | DN: TxDOT | CK: KM | DW: BD | CK: VP |
|---|---|---|---|---|
| ©TxDOT NOVEMBER 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 57 |

DATE:
FILE:

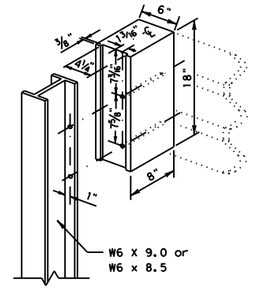



WOOD BLOCK TO ROUND WOOD POST




WOOD BLOCK TO RECTANGULAR WOOD POST




WOOD BLOCK TO STEEL POST

## GENERAL NOTES

1. 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 CCCG 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.

2. The type of post (round wood, rectangular wood or steel) will be shown elsewhere in the plans.

3. 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.

4. 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.

5. Unless otherwise shown in the plans, transitions shall be placed with the block face in front of or directly above the curb face.

6. Install terminal connector with (12) rectangular guardrail plate washers: (FWR03) and (12) 5/8" X 2" button head splice bolts with recessed nuts.

7. 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.

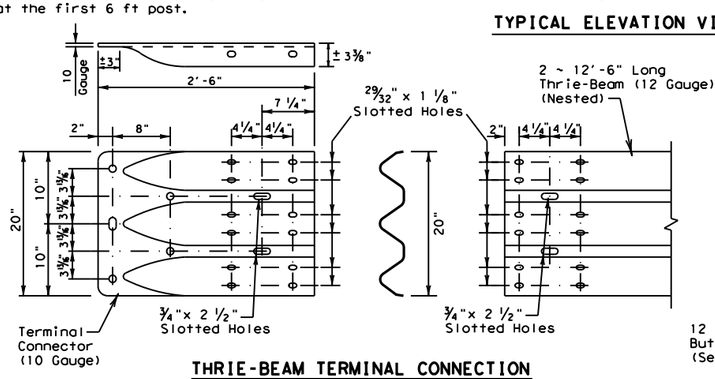
8. Fittings (bolts, nuts, and washers) shall be galvanized in accordance with Item 445, "Galvanizing". Fittings shall be subsidiary to the bid item.

9. Crown shall be widened to accommodate transitions.

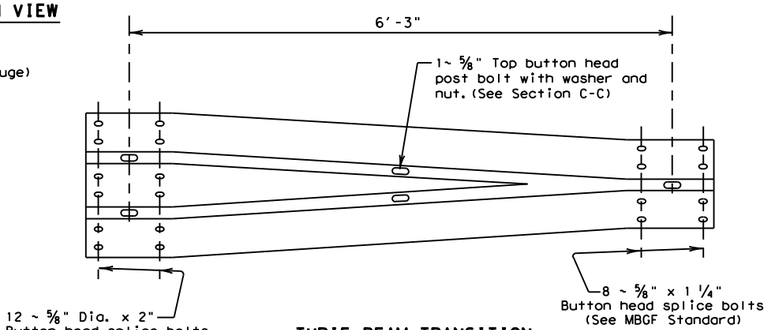
10. If solid rock is encountered. See the MBGF standard sheet for the proper installation guidance.

11. Posts shall not be set in concrete.

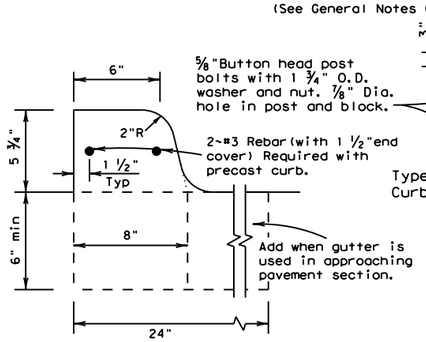
12. Unless otherwise shown in the plans, a composite material post and/or block that meets the requirements of DMS-7210, "Composite Material Posts and Blocks for Metal Beam Guard Fence" may be substituted for posts and/or blocks of similar dimensions. The Construction Division, TxDOT, maintains a Material Producer List (MPL) for producers of materials conforming to DMS-7210. Only producers on the MPL can furnish composite material posts and/or blocks.




THRIE-BEAM TERMINAL CONNECTION
(See General Notes 6 & 7 for required hardware)

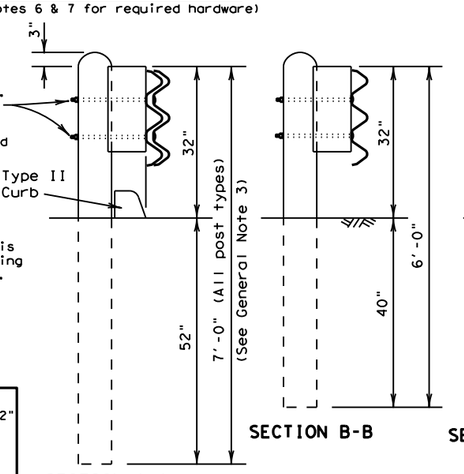



THRIE-BEAM TRANSITION TO W-BEAM (10 Gauge)




TYPE II CURB
Cast-in-Place or Precast

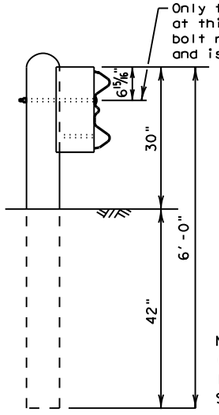
PRECAST CURB: Type II Precast Curb secured with 4~#5 Gr.60 Galv. Rebar stakes 18" long. The 12'- 2" section of curb may be cast in two sections.
Section ① 5'- 8" long
Section ② 6'- 6" long with the last 3'- 6" of curb tapered to a 4" height.
The Joint Connection is two 9" long 1" dia female ends connected with 1~#5 Gr.60 Galv. Rebar 18" long.




SECTION A-A

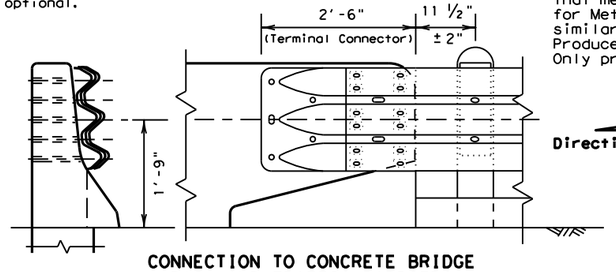



SECTION B-B




SECTION C-C

TRANSITION SECTIONS




CONNECTION TO CONCRETE BRIDGE RAIL AND TRAFFIC BARRIERS

NOTES:
(5) 7/8" dia. heavy hex bolts, length will vary depending on width of concrete rail, leave 1" of bolt length past the 5/8" hex nut. Trim as required.
See General Notes: 6 & 7 for additional connection details.

PLATE WASHER INSTRUCTIONS

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

**ONLY FOR USE IN MAINTENANCE REPAIRS.**

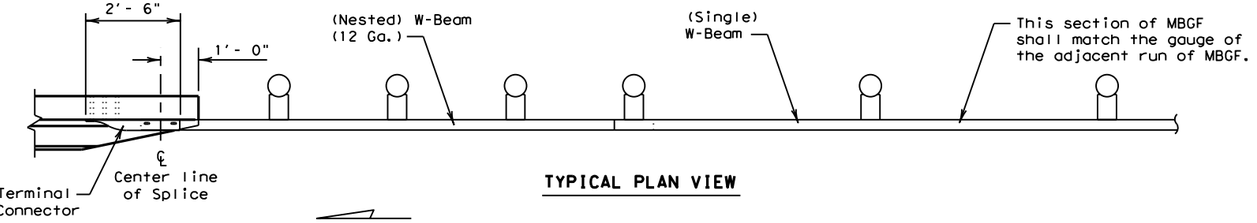
Texas Department of Transportation

Design Division Standard

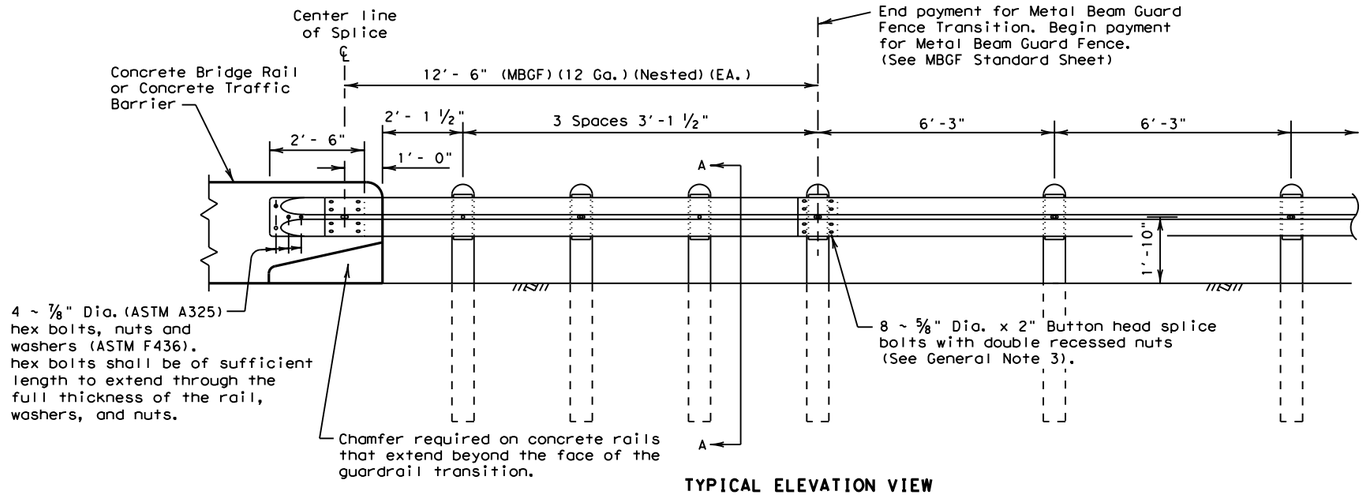
# METAL BEAM GUARD FENCE TRANSITION (THRIE-BEAM TRANSITION) MBGF(TR)-19

| FILE: mbgftr19.dgn | DN: TxDOT | CK: KM | DW: BD | CK: VP |
|---|---|---|---|---|
| © TxDOT NOVEMBER 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 58 |

DATE:
FILE:



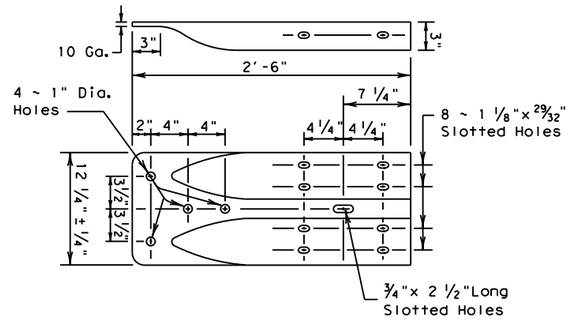

TYPICAL PLAN VIEW




TYPICAL ELEVATION VIEW

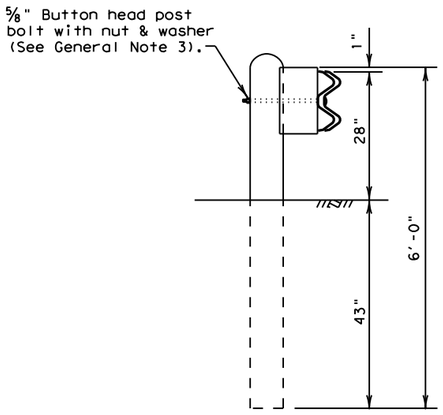
## GENERAL NOTES

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 and Type A 1 ¾" O.D. washer and not more than 1" beyond it. Button head "splice" bolts (ASTM A307) are ⅝" x 2" (at triple rail splices) with ⅝" 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 the 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.
9. Refer to MBGF standard sheet for additional details.

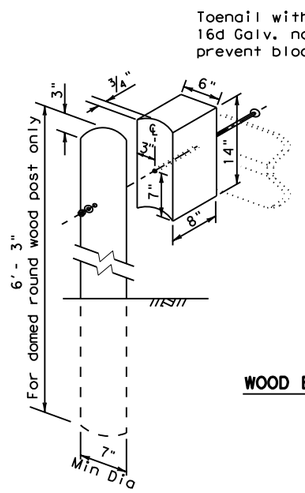



TERMINAL CONNECTOR

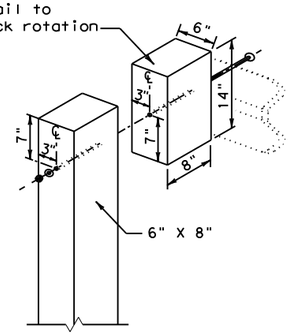
FOR USE WITH MBGF CONNECTIONS TO CONCRETE BRIDGE RAILS AND TRAFFIC BARRIERS



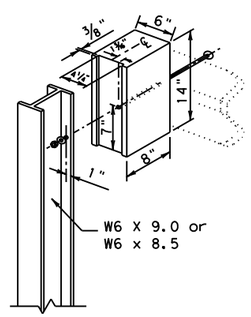

SECTION A-A




WOOD BLOCK TO ROUND WOOD POST




WOOD BLOCK TO RECTANGULAR WOOD POST




WOOD BLOCK TO STEEL POST

**ONLY FOR USE IN MAINTENANCE REPAIRS.**

Texas Department of Transportation

Design Division Standard

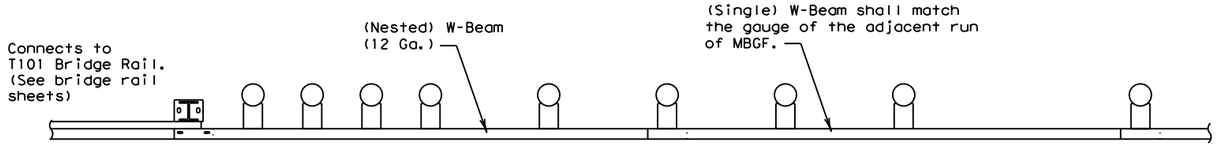
# METAL BEAM GUARD FENCE TRANSITION (TL2)

## (Low Speed Transition)

## MBGF (TL2) - 19

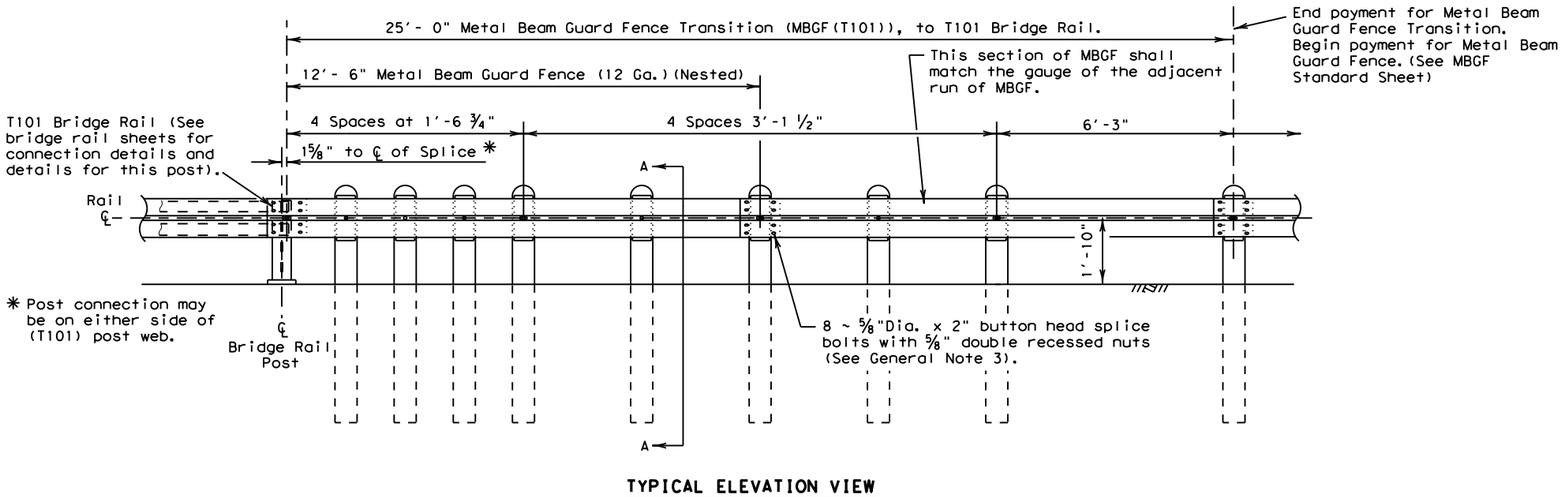
| FILE: mbgft1219.dgn | DN: TxDOT | CK: KM | DW: BD | CK: VP |
|---|---|---|---|---|
| © TxDOT NOVEMBER 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 59 |

DATE:
FILE:

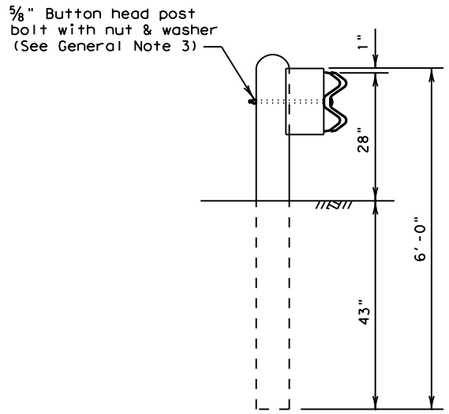



TYPICAL PLAN VIEW

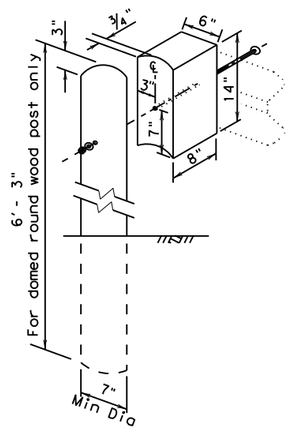
Direction of Traffic



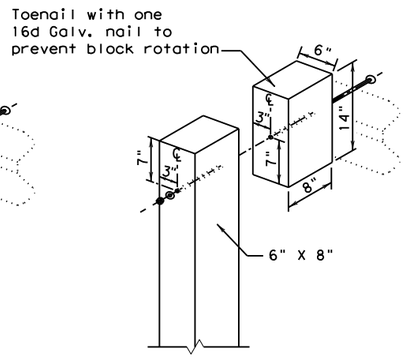

TYPICAL ELEVATION VIEW



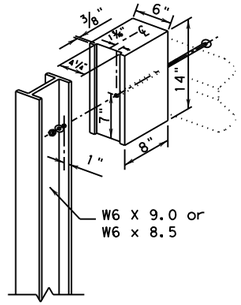

SECTION A-A




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.**

Texas Department of Transportation

Design Division Standard

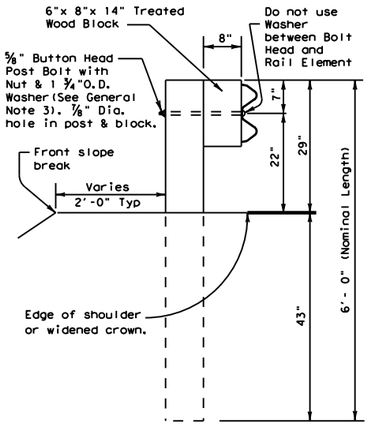
# METAL BEAM GUARD FENCE TRANSITION (T101)

## (T101 BRIDGE RAIL)

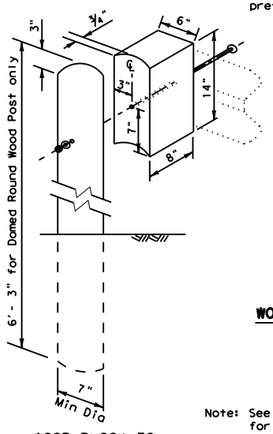
## MBGF(T101)-19

| | | | | | | |
|---|---|---|---|---|---|---|
| FILE: mbgft10119.dgn | DN: TxDOT | | CK: KM | DW: BD | | CK: VP |
|  | CONT | SECT | JOB | | HIGHWAY | |
| REVISIONS | 6367 | 43 | 001 | | IH-20 | |
| | DIST | COUNTY | | | | SHEET NO. |
| | 10 | SMITH, ETC. | | | | 60 |

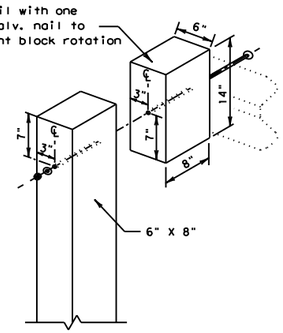
DATE:
FILE:



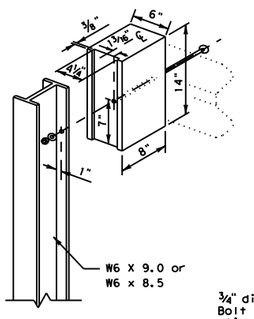

**TYPICAL POST**



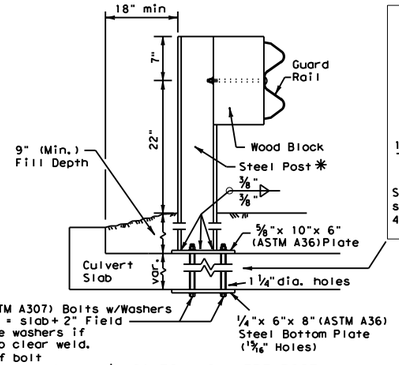

**WOOD BLOCK TO ROUND WOOD POST**




**WOOD BLOCK TO RECTANGULAR WOOD POST**

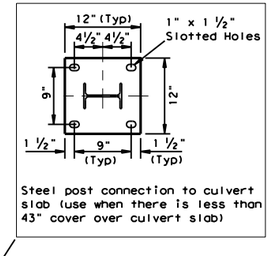



**WOOD BLOCK TO STEEL POST**

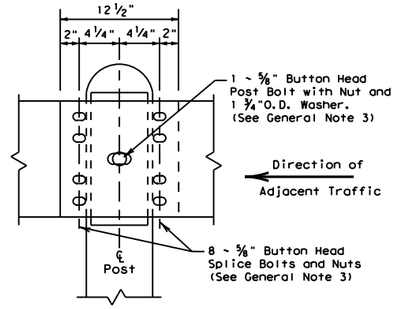



*** LOW FILL CULVERT POST**

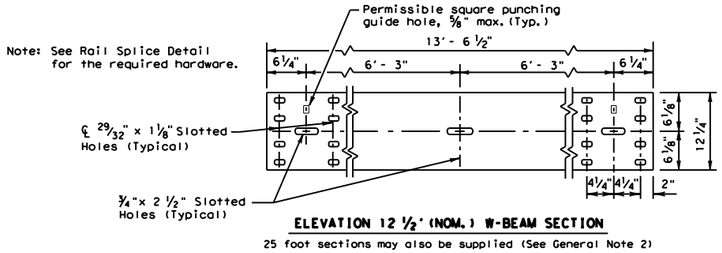
**FOR USE ON NON-BRIDGE CLASS CULVERTS ONLY**




* Post(s) may require field modifications to ensure proper guardrail height.

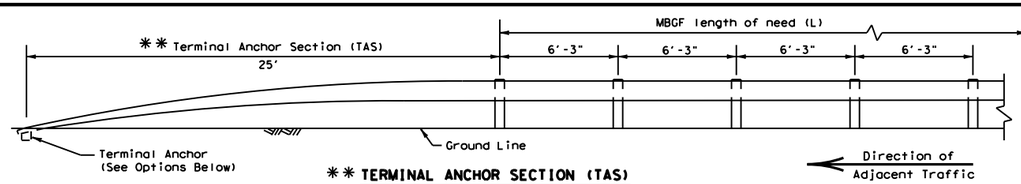



**RAIL SPLICE DETAIL**



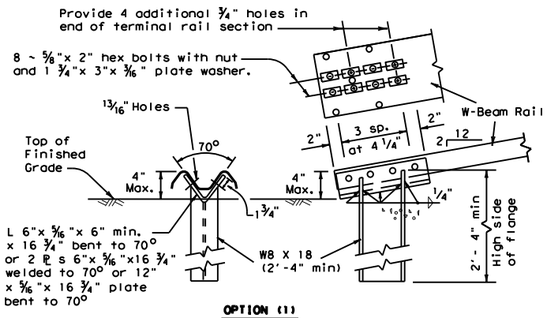

**ELEVATION 12 ½' (NOM.) W-BEAM SECTION**

25 foot sections may also be supplied (See General Note 2)



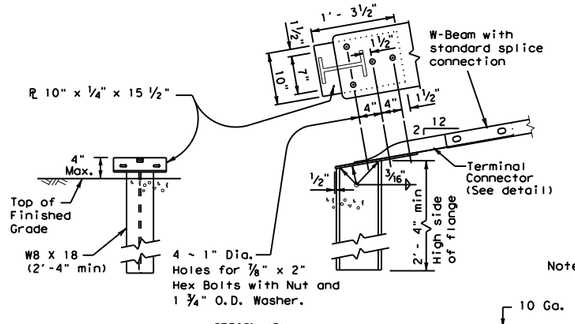

**** TERMINAL ANCHOR SECTION (TAS)**

**Terminal anchor sections are only for downstream use, when located outside the horizontal clearance area of opposing traffic.**




**OPTION (1)**

Note: This anchor post requires four additional ¾" holes (shop or field) in the rail member with eight ⅝" hex bolts with nut and plate washer.

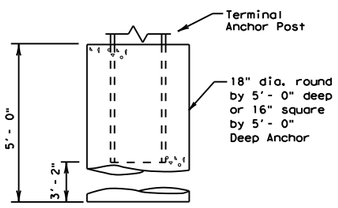



**OPTION (2)**

Note: This anchor post requires the use of the 10 ga. terminal connector with four ⅞" hex bolts with nut and washer.

**TERMINAL ANCHOR POST OPTIONS**

(See General Note 11)



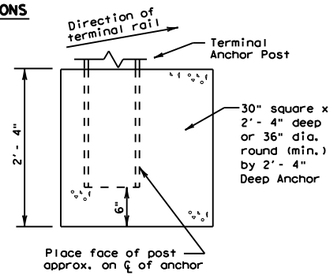

Notes:

Either concrete anchor may be used with either post option above.

No construction joint is allowed in the concrete anchor.

Terminal rail may be bolted to post and in twist position prior to placing concrete anchor.

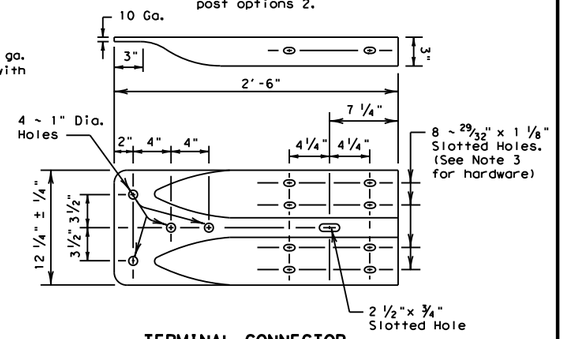
If concrete anchor is precast, the area should be compacted as directed by the Engineer, when placed in the field.




**TERMINAL CONCRETE ANCHOR OPTIONS**

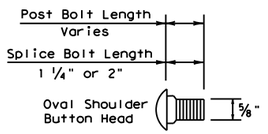
(See General Note 11)

Note: Terminal Connector to be used with terminal anchor post options 2.




**TERMINAL CONNECTOR**

For connection hardware to concrete rails, see the MBGF transition standards.




**BUTTON HEAD BOLT**

Post and Splice Bolts (See General Note 3)

## 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 MBGF shall be shown elsewhere 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 on the plans. The Contractor may furnish rail elements of 12 ½ or 25 foot nominal lengths.
3. 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 ¾" O.D.)washer and not more than 1" beyond it. Button head "splice" bolts (ASTM A307) are ⅝" x 1 ¼" (or 2" long at triple rail splices) with a ⅝" double recessed nut (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.
5. Crown shall be widened to accommodate the Metal Beam Guard Fence.
6. The lateral approach to the guard fence, shall have a slope rate of not more than 1V:10H.
7. 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.
8. 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.
9. Posts shall not be set in concrete, of any depth.
10. Special fabrication will be required at installations having a curvature of less than 150 ft. radius.
11. 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."
12. 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.

Texas Department of Transportation

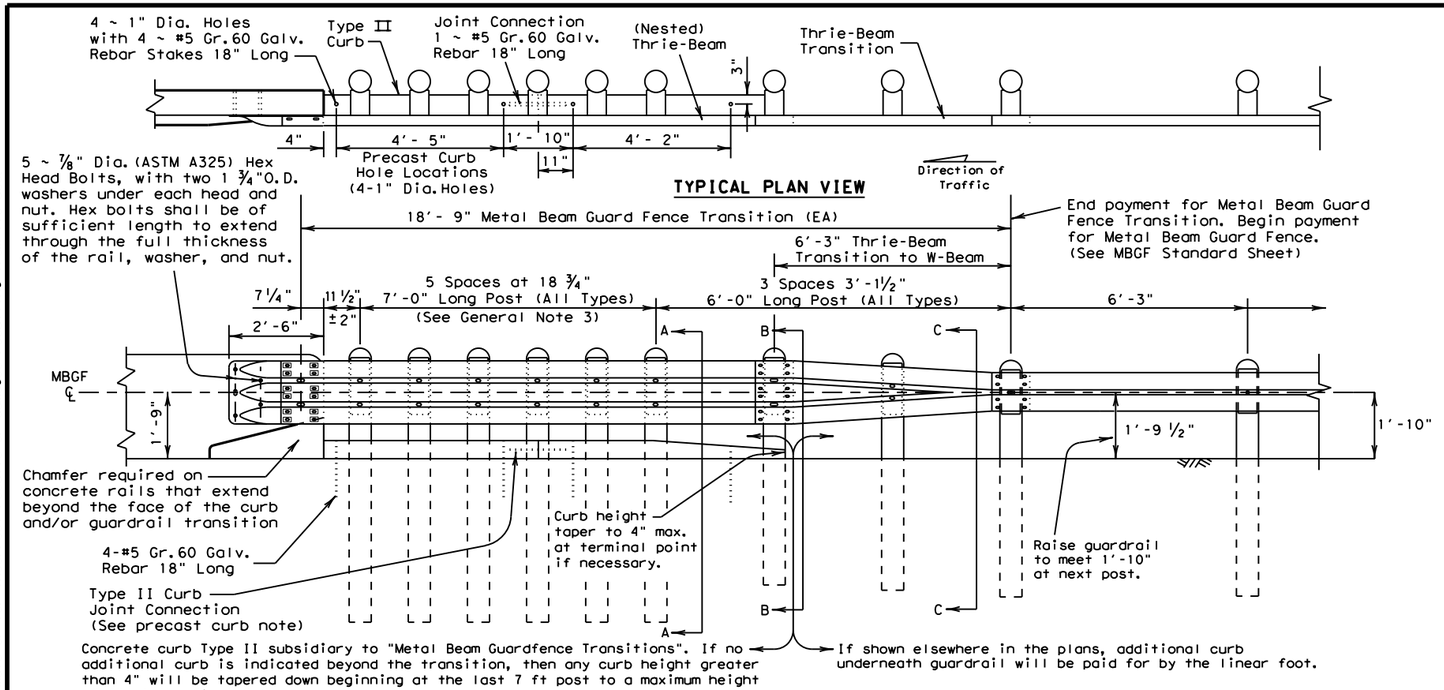
Design Division Standard

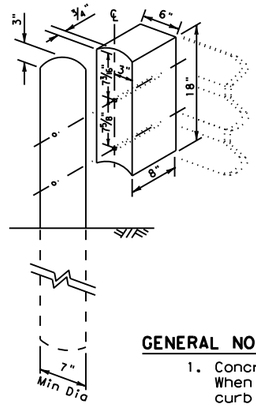
# METAL BEAM GUARD FENCE

# MBGF-11

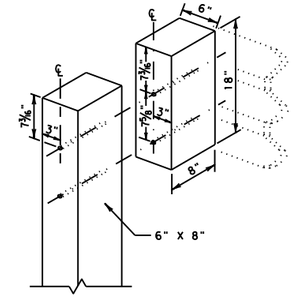
| FILE: mbgf11.dgn | DN: TxDOT | CK: AM | DW: BD | CK: VP |
|---|---|---|---|---|
| ©TxDOT July 1994 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS 12-2011 | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 61 |

DATE:
FILE:

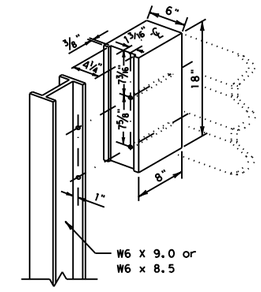



WOOD BLOCK TO ROUND WOOD POST




WOOD BLOCK TO RECTANGULAR WOOD POST




WOOD BLOCK TO STEEL POST

## GENERAL NOTES

1. 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 CCCG 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.

2. The type of post (round wood, rectangular wood or steel) will be shown elsewhere in the plans.

3. 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.

4. 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.

5. Unless otherwise shown in the plans, transitions shall be placed with the block face in front of or directly above the curb face.

6. Galvanized washers used with the 5/8" dia. post bolts shall be Type A 1 3/4" O.D. washers. The (24) plate washers required at the terminal connector splice are 1 3/4"x 3"x 3/16" plate washers with a 1/16"x 1" hole.

7. Button head "post" bolts (ASTM A307) shall be of sufficient length to extend through the full thickness of the nut (ASTM A563) and washer and not more than 1" beyond it. Button head "splice" bolts (ASTM A307) 5/8" Dia.x 2" (at triple rail splices) with 5/8" double recessed nuts.

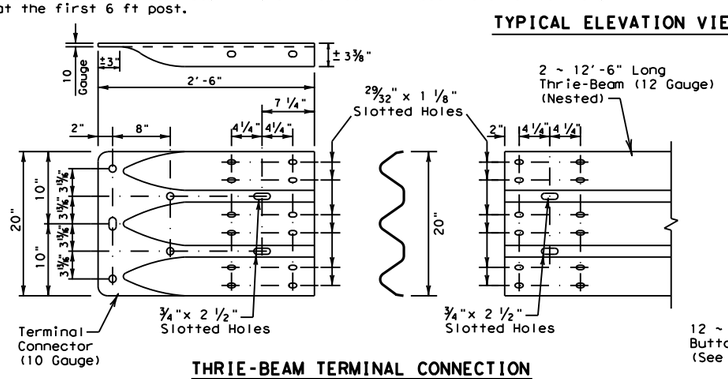
8. Fittings (bolts, nuts, and washers) shall be galvanized in accordance with Item 445,"Galvanizing".Fittings shall be subsidiary to the bid item.

9. Crown shall be widened to accommodate transitions.

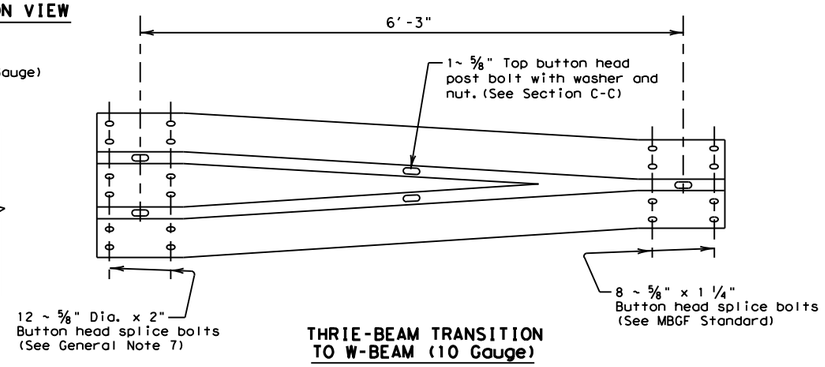
10. If solid rock is encountered. See the MBGF standard sheet for the proper installation guidance.

11. Posts shall not be set in concrete.

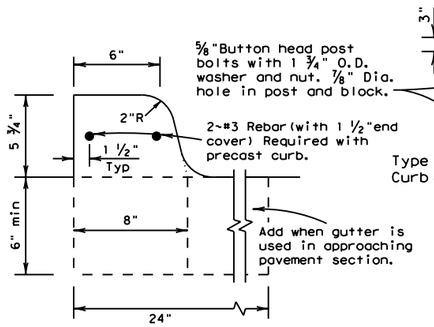
12. Unless otherwise shown in the plans, a composite material post and/or block that meets the requirements of DMS-7210,"Composite Material Posts and Blocks for Metal Beam Guard Fence" may be substituted for posts and/or blocks of similar dimensions. The Construction Division, TxDOT, maintains a Material Producer List (MPL) for producers of materials conforming to DMS-7210. Only producers on the MPL can furnish composite material posts and/or blocks.




THRIE-BEAM TERMINAL CONNECTION
(See General Notes 6 & 7 for required hardware)

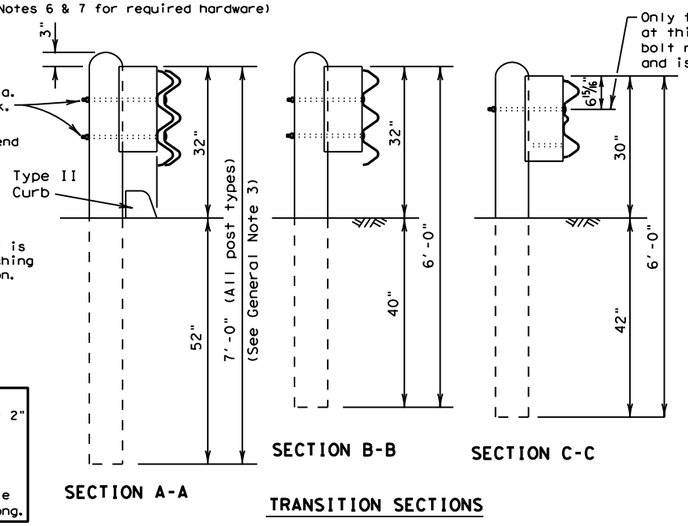



THRIE-BEAM TRANSITION TO W-BEAM (10 Gauge)

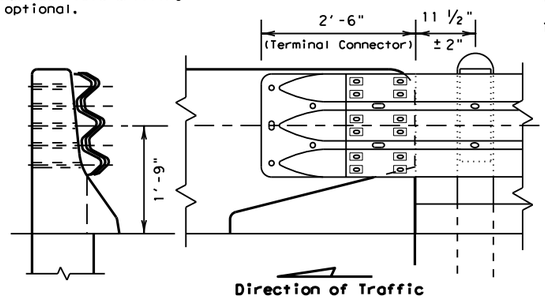



TYPE II CURB
Cast-in-Place or Precast

PRECAST CURB:Type II Precast Curb secured with 4~#5 Gr.60 Galv. Rebar stakes 18" long. The 12'- 2" section of curb may be cast in two sections.
Section ① 5'- 8" long
Section ② 6'- 6" long with the last 3'- 6" of curb tapered to a 4" height.
The Joint Connection is two 9" long 1" dia female ends connected with 1~#5 Gr.60 Galv.Rebar 18" long.




TRANSITION SECTIONS




CONNECTION TO CONCRETE BRIDGE RAIL AND TRAFFIC BARRIERS

Galvanized plate washers are required under the button head and nut at the terminal connector splice to nested thrie-beam. (See General Notes 6 & 7).
The 5 ~ 7/8" Dia.(ASTM A325) hex bolts shall be of sufficient length to extend through the full thickness of the rail, washers, and nuts.

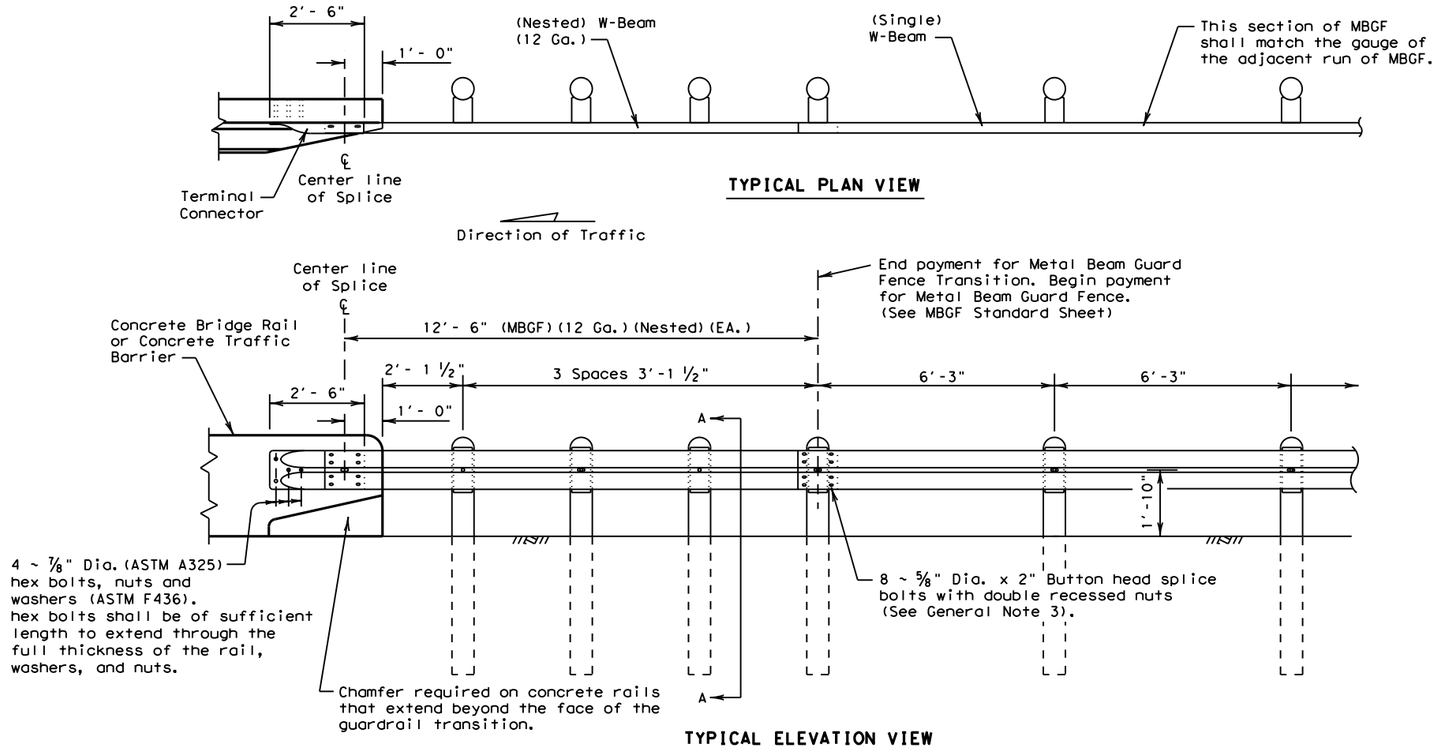
Texas Department of Transportation

Design Division Standard

# METAL BEAM GUARD FENCE TRANSITION
## (Thrie-Beam Transition)
## MBGF(TR)-11

| FILE: mbgftr11.dgn | DN: TxDOT | CK: AM | DW: BD | CK: VP |
|---|---|---|---|---|
| ©TxDOT December 2001 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 12-2011 | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 62 |

DATE:
FILE:

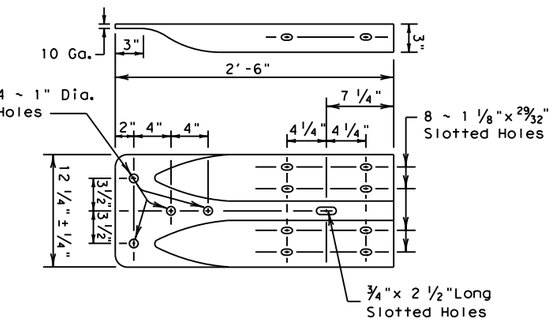



TYPICAL PLAN VIEW

TYPICAL ELEVATION VIEW

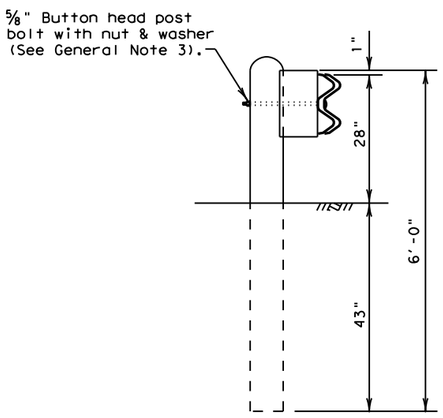
## GENERAL NOTES

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 and Type A 1 ¾" O.D. washer and not more than 1" beyond it. Button head "splice" bolts (ASTM A307) are ⅝" x 2" (at triple rail splices) with ⅝" 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 the 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.
9. Refer to MBGF standard sheet for additional details.

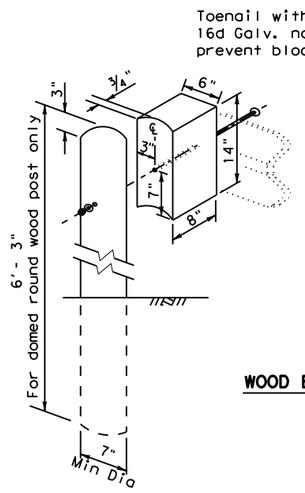



TERMINAL CONNECTOR

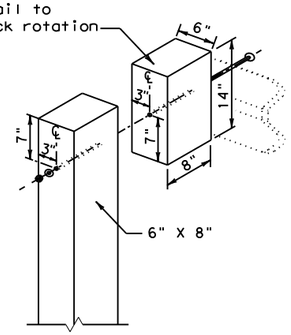
FOR USE WITH MBGF CONNECTIONS TO CONCRETE BRIDGE RAILS AND TRAFFIC BARRIERS



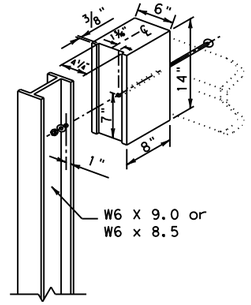

SECTION A-A




WOOD BLOCK TO ROUND WOOD POST




WOOD BLOCK TO RECTANGULAR WOOD POST




WOOD BLOCK TO STEEL POST

Texas Department of Transportation

Design Division Standard

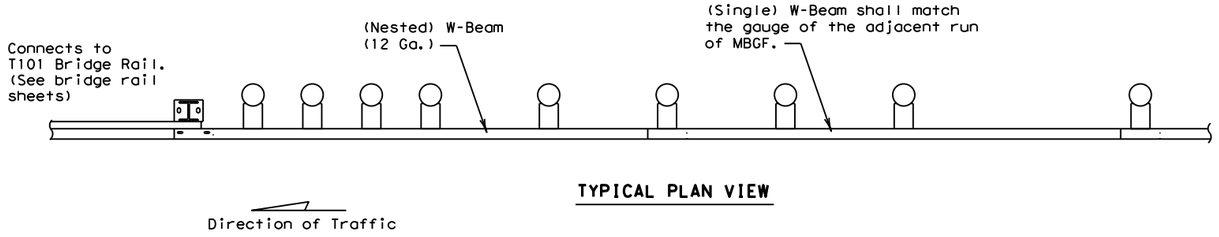
# METAL BEAM GUARD FENCE TRANSITION (TL2)

## (Low Speed Transition)

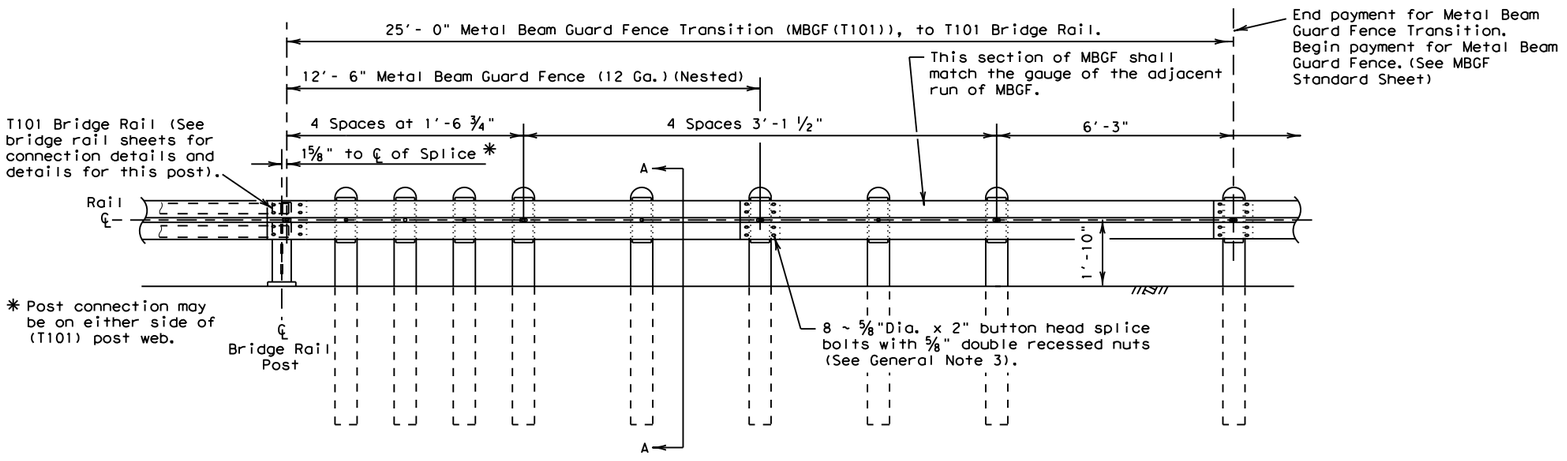
## MBGF (TL2) - 11

| FILE: mbgt1211.dgn | DN: TxDOT | CK: AM | DW: BD | CK: VP |
|---|---|---|---|---|
| ©TxDOT April 2003 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 12-2011 | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 63 |

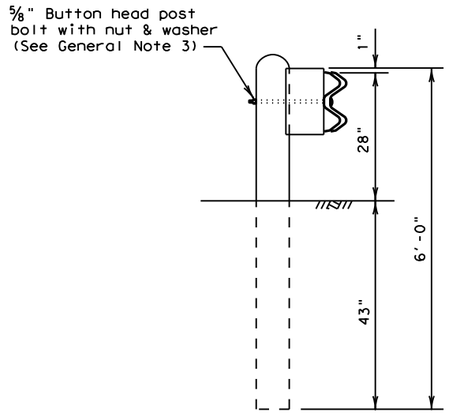
DATE:
FILE:



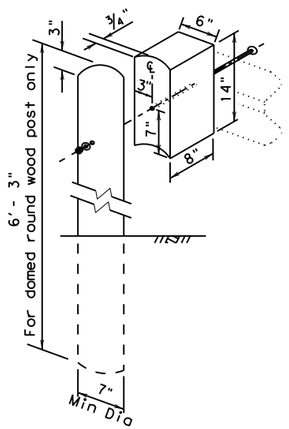

TYPICAL PLAN VIEW



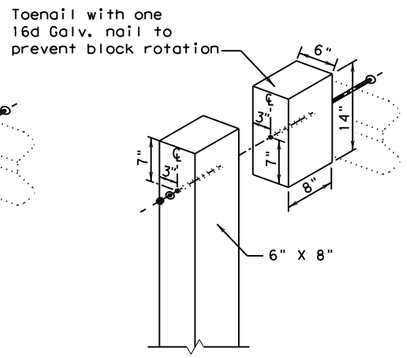

TYPICAL ELEVATION VIEW



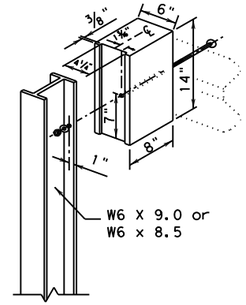

SECTION A-A




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.

Texas Department of Transportation

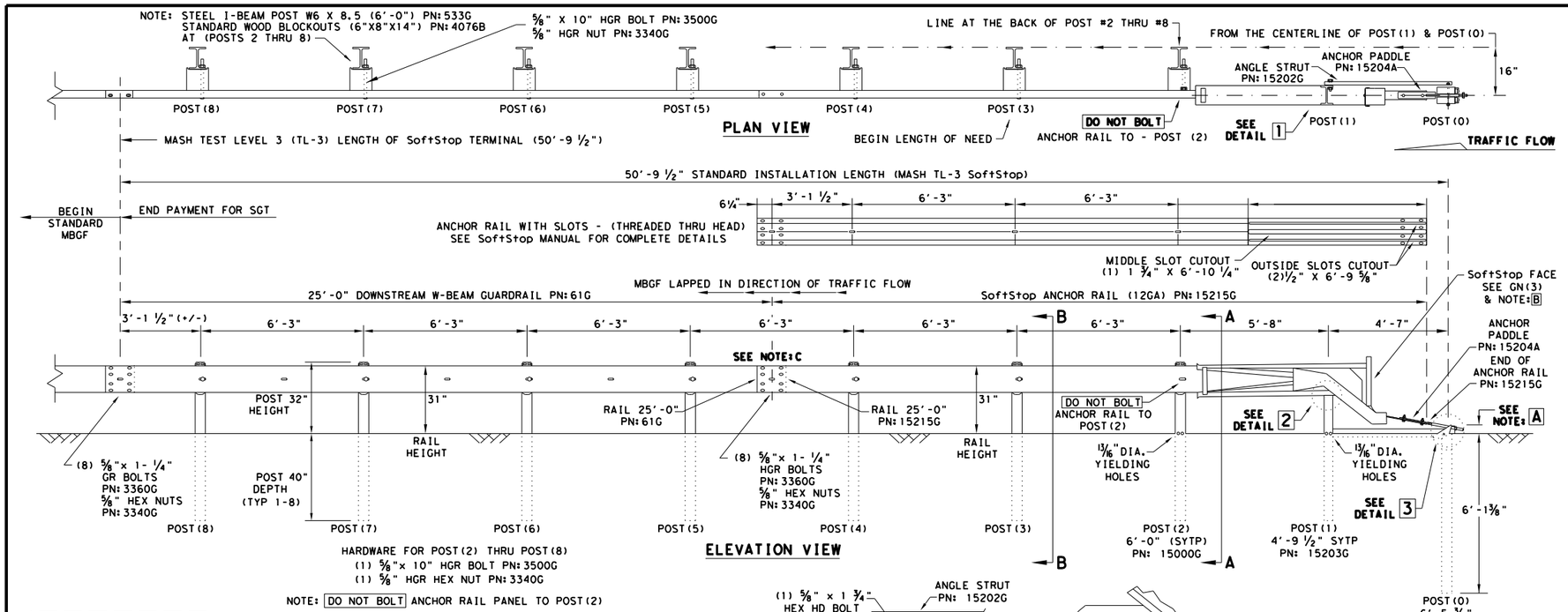
Design Division Standard

# METAL BEAM GUARD FENCE TRANSITION (T101)

## (T101 Bridge Rail)

## MBGF(T101)-11

| | | | | | | |
|---|---|---|---|---|---|---|
| FILE: mbgft111.dgn | DN: TxDOT | | CK: AM | DW: BD | | CK: VP |
|  | CONT | SECT | JOB | | HIGHWAY | |
| REVISIONS 12-2011 | 6367 | 43 | 001 | | IH-20 | |
| | DIST | COUNTY | | | | SHEET NO. |
| | 10 | SMITH, ETC. | | | | 64 |




## GENERAL NOTES

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

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

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

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

Texas Department of Transportation

Design Division Standard

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

| | | | | | |
|---|---|---|---|---|---|
| FILE: sgt10s3116 | DN: TxDOT | CK: KM | DW: VP | CK: MB/VP | |
| ©TxDOT: JULY 2016 | CONT | SECT | JOB | HIGHWAY | |
| REVISIONS | 6367 | 43 | 001 | IH-20 | |
| | DIST | COUNTY | | SHEET NO. | |
| | 10 | SMITH, ETC. | | 65 | |

DATE:
FILE:

DATE:
FILE:

(SEE GN NOTE 15)
STANDARD 31" MBGF

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

FIELD-SIDE
(RAIL 3)

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

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

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

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

ITEM (10)
CABLE ASSEMBLY

ITEM (2)
GROUNDSTRUT

NO BLOCKOUT
AT (POST 1)

RAIL 4 RAIL 3 RAIL 2 RAIL 1

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

**PLAN VIEW**

CABLES

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

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

INSTALL GUARD FENCE RECESSED
HEX NUTS ON TRAFFIC-SIDE

MBGF
RAIL 2

MBGF
RAIL 1

**DETAIL (C)**

TRAFFIC FLOW

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

END PAYMENT (SGT) BY EACH

DO NOT BOLT
RAIL TO POST 6

BEGIN LENGTH OF NEED

INSTALLATION LENGTH 55'- ½"

49'-8 ⅝"

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

RAIL HEIGHT 31"

ARROWS

RAIL HEIGHT 31"

HEAD HEIGHT

**DETAIL (B)**

32-¼"

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

**DETAIL (D)**

FINISHED GRADE

CABLES

FINISHED GRADE

ITEM (10)
CABLE ASSEMBLY

ITEM (2)
GROUNDSTRUT

68-⅛"

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

POST 1
ITEM (4)
I-BEAM
W6 X 9

NO BLOCKOUT
AT (POST 1)

SOIL
ANCHOR POST
ITEM (1)

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

**ELEVATION VIEW**

TSS PANEL
GALVANIZED
ITEM (5)

RSS PLATE
GALVANIZED
ITEM (8)

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

TSS PANEL AND RSS PLATE
**DETAIL (D)**

HEAD HEIGHT 32-¼"

TOP OF POST

31-⅞"

FINISHED GRADE

40-⅛"

68-⅛"
ANCHOR POST
DEPTH

ITEM (1)
ANCHOR

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

**SOIL ANCHOR, POST 1**
**& LINE POST 2 THRU 9**

**SECTION VIEW A-A**

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

7 ⅝"

2 ⅛"

UPPER CABLE
(BACK SIDE)

LOWER CABLE
(TRAFFIC SIDE)

**DETAIL (B)**

CABLE
FRICTION PLATE
HEAD UNIT
ITEM (9)

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

ITEM (24)

ITEM (21)

ITEM (20)
8X

ITEM (17)
8X

ITEM (23)
6X
3 SCREWS
EACH SIDE

(RAIL 1)

ITEM (22)
BRACKET
SHIPPED FLAT

ITEM (3)

ITEM (16)
4X

* ITEM (25)
HIGH INTENSITY
REFLECTIVE SHEETING

NOTE: DELINEATION MARKER IN
ACCORDANCE WITH TEXAS MUTCD.

SPLICE FOR IMPACT-HEAD
TO GUARD FENCE (RAIL1)

**DETAIL (A)**

APPROX 5'-10"

5'-0"

50' APPROACH GRADING

STANDARD
MBGF

2'-0"

EDGE OF PAVEMENT

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

2'-0" MAX.
RAIL OFFSET

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

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

**APPROACH GRADING AT GUARDRAIL END TREATMENTS**

TRAFFIC FLOW

## GENERAL NOTES

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

| ITEM # | PART NUMBER | DESCRIPTION | QTY |
|---|---|---|---|
| 1 | BSI-1610060-00 | SOIL ANCHOR - GALVANIZED | 1 |
| 2 | BSI-1610061-00 | GROUND STRUT - GALVANIZED | 1 |
| 3 | BSI-1610062-00 | MAX-TENSION IMPACT HEAD | 1 |
| 4 | BSI-1610063-00 | W6x9 I-BEAM POST 6FT.-GALVANIZED | 1 |
| 5 | BSI-1610064-00 | TSS PANEL - TRAFFIC SIDE SLIDER | 1 |
| 6 | BSI-1610065-00 | ISS PANEL - INNER SIDE SLIDER | 1 |
| 7 | BSI-1610066-00 | TOOTH - GEOMET | 1 |
| 8 | BSI-1610067-00 | RSS PLATE - REAR SIDE SLIDER | 1 |
| 9 | B061058 | CABLE FRICTION PLATE - HEAD UNIT | 1 |
| 10 | BSI-1610069-00 | CABLE ASSEMBLY - MASH X-TENSION | 2 |
| 11 | BSI-1012078-00 | X-LITE LINE POST-GALVANIZED | 8 |
| 12 | B090534 | 8" W-BEAM COMPOSITE-BLOCKOUT XT110 | 8 |
| 13 | BSI-4004386 | 12'-6" W-BEAM GUARD FENCE PANELS 12GA. | 4 |
| 14 | BSI-1102027-00 | X-LITE SQUARE WASHER | 1 |
| 15 | BSI-2001886 | ⅝" X 7" THREAD BOLT HH (GR.5)GEOMET | 1 |
| 16 | BSI-2001885 | ¾" X 3" ALL-THREAD BOLT HH (GR.5)GEOMET | 4 |
| 17 | 4001115 | ⅝" X 1 ¼" GUARD FENCE BOLTS (GR.2)MGAL | 48 |
| 18 | 2001840 | ⅝" X 10" GUARD FENCE BOLTS MGAL | 8 |
| 19 | 2001636 | ⅝" WASHER F436 STRUCTURAL MGAL | 2 |
| 20 | 4001116 | ⅝" RECESSED GUARD FENCE NUT (GR.2)MGAL | 59 |
| 21 | BSI-2001888 | ⅝" X 2" ALL THREAD BOLT (GR.5)GEOMET | 1 |
| 22 | BSI-1701063-00 | DELINEATION MOUNTING (BRACKET) | 1 |
| 23 | BSI-2001887 | ¼" X ¾" SCREW SD HH 410SS | 7 |
| 24 | 4002051 | GUARDRAIL WASHER RECT AASHTO FWR03 | 1 |
| * 25 | SEE NOTE BELOW | HIGH INTENSITY REFLECTIVE SHEETING | 1 |
| ** 26 | 4002337 | 8" W-BEAM TIMBER-BLOCKOUT, PDB01B | 8 |
| ** 27 | BSI-4004431 | 25' W-BEAM GUARDRAIL PANEL,8-SPACE,12GA. | 2 |
| 28 | MANMAX Rev-(D) | MAX-TENSION INSTALLATION INSTRUCTIONS | 1 |

* TO BE PROVIDED BY DISTRIBUTOR OR CONTRACTOR.

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

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

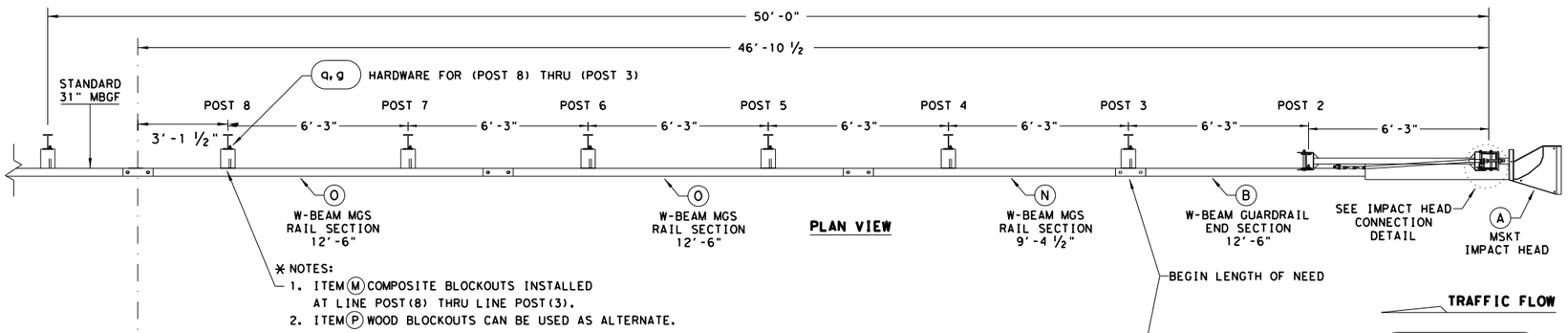
Texas Department of Transportation

Design Division Standard

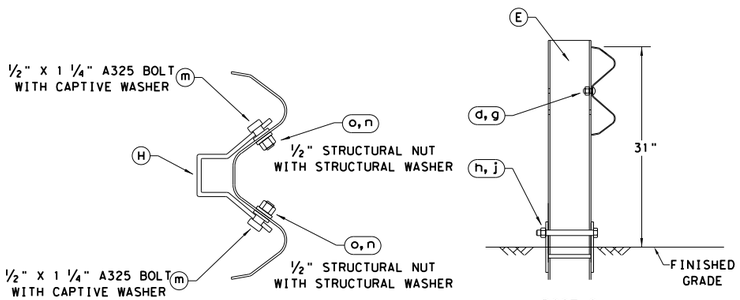
# MAX-TENSION END TERMINAL
# MASH - TL-3
# SGT(11S)31-18

| FILE: sgt11s3118.dgn | DN: TxDOT | CK: KM | DW: TxDOT | CK: CL |
|---|---|---|---|---|
| © TxDOT: FEBRUARY 2018 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 66 |

DATE:
FILE:

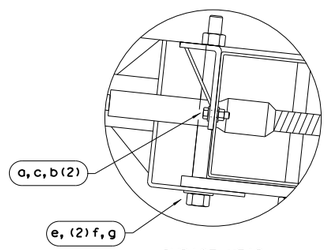


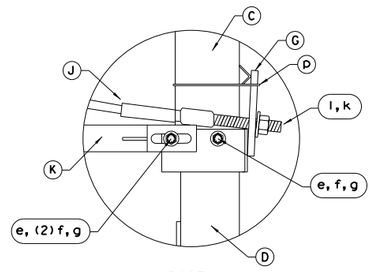

NOTE: SEE (GENERAL NOTE 14) FOR DRIVING CAP INFORMATION.





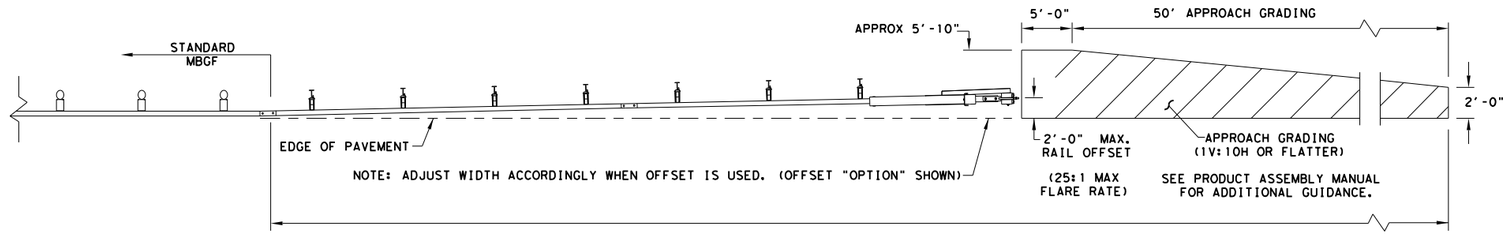





SEE NOTES: *

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




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

APPROACH GRADING AT GUARDRAIL END TREATMENTS

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.

## GENERAL NOTES

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

| ITEM | QTY | MAIN SYSTEM COMPONENTS | ITEM NUMBERS |
|---|---|---|---|
| A | 1 | MSKT IMPACT HEAD | MS3000 |
| B | 1 | W-BEAM GUARDRAIL END SECTION, 12 Ga. | SF1303 |
| C | 1 | POST 1 - TOP (6" X 6" X ⅛" TUBE) | MTPHP1A |
| D | 1 | POST 1 - BOTTOM (6' W6X15) | MTPHP1B |
| E | 1 | POST 2 - ASSEMBLY TOP | UHP2A |
| F | 1 | POST 2 - ASSEMBLY BOTTOM (6' W6X9) | HP2B |
| G | 1 | BEARING PLATE | E750 |
| H | 1 | CABLE ANCHOR BOX | S760 |
| J | 1 | BCT CABLE ANCHOR ASSEMBLY | E770 |
| K | 1 | GROUND STRUT | MS785 |
| L | 6 | W6x9 OR W6x8.5 STEEL POST | P621 |
| M | 6 | COMPOSITE BLOCKOUTS | CBSP-14 |
| N | 1 | W-BEAM MGS RAIL SECTION (9'-4 ½") | G12025 |
| O | 2 | W-BEAM MGS RAIL SECTION (12'-6") | G1203A |
| P | 6 | WOOD BLOCKOUT 6" X 8" X 14" | P675 |
| Q | 1 | W-BEAM MGS RAIL SECTION (25'-0") | G1209 |
| | | **SMALL HARDWARE** | |
| a | 2 | ⅝" x 1" HEX BOLT (GRD 5) | B5160104A |
| b | 4 | ⅝" WASHER | W0516 |
| c | 2 | ⅝" HEX NUT | N0516 |
| d | 25 | ⅝" Dia. x 1 ¼" SPLICE BOLT (POST 2) | B580122 |
| e | 2 | ⅝" Dia. x 9" HEX BOLT (GRD A449) | B580904A |
| f | 3 | ⅝" WASHER | W050 |
| g | 33 | ⅝" Dia. H.G.R NUT | N050 |
| h | 1 | ¾" Dia. x 8 ½" HEX BOLT (GRD A449) | B340854A |
| j | 1 | ¾" Dia. HEX NUT | N030 |
| k | 2 | 1 ANCHOR CABLE HEX NUT | N100 |
| l | 2 | 1 ANCHOR CABLE WASHER | W100 |
| m | 8 | ½" x 1 ¼" A325 BOLT WITH CAPTIVE WASHER | SB12A |
| n | 8 | ½" STRUCTURAL NUTS | N012A |
| o | 8 | 1 1/16" O.D. x ⅜" I.D. STRUCTURAL WASHERS | W012A |
| p | 1 | BEARING PLATE RETAINER TIE | CT-100ST |
| q | 6 | ⅝" x 10" H.G.R. BOLT | B581002 |
| r | 1 | OBJECT MARKER 18" X 18" | E3151 |

Texas Department of Transportation

Design Division Standard

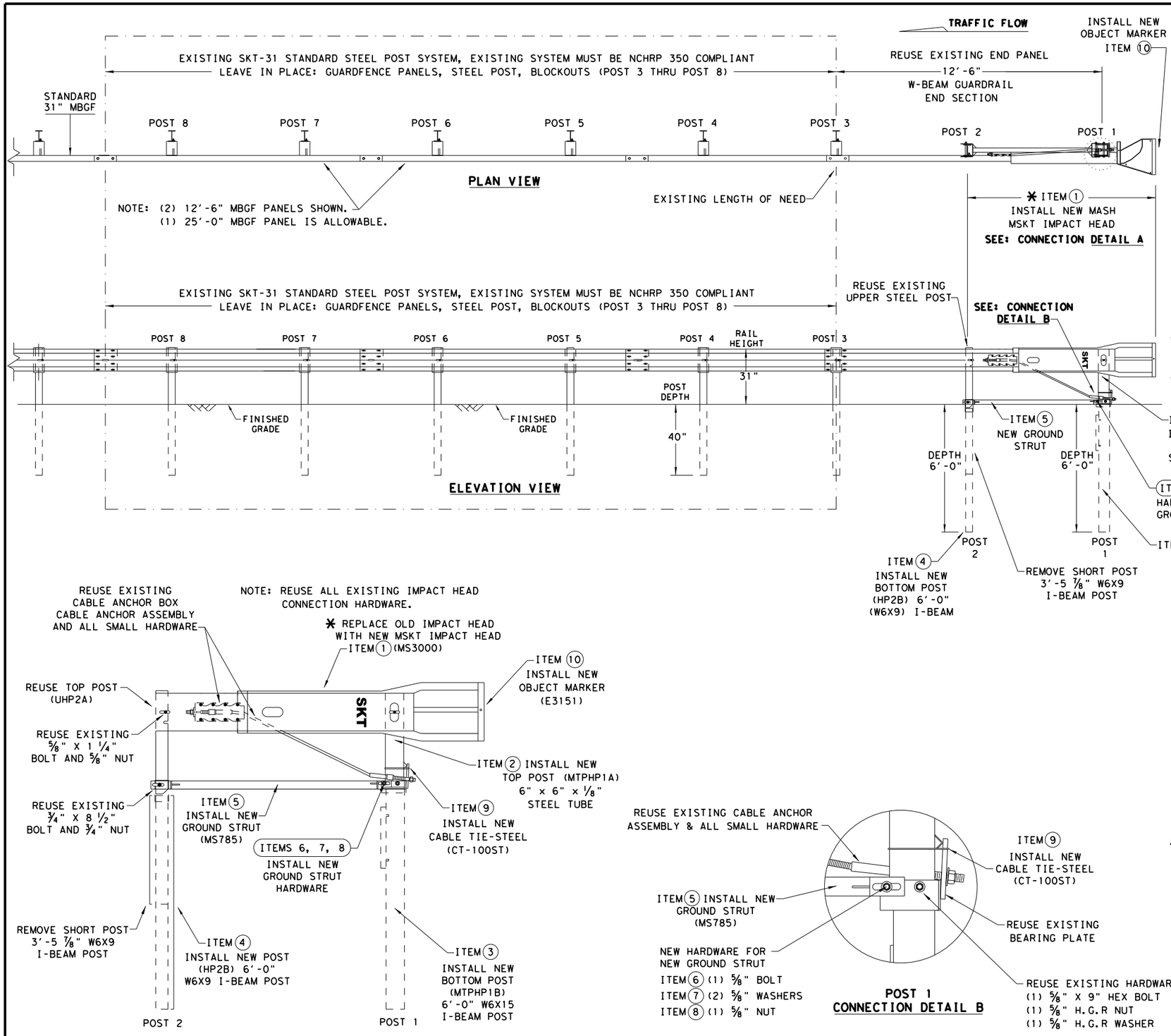
# SINGLE GUARDRAIL TERMINAL

## MSKT-MASH-TL-3

## SGT(12S)31-18

| FILE: sgt12s3118.dgn | DN: TxDOT | CK: KM | DW: VP | CK: CL |
|---|---|---|---|---|
| © TxDOT: APRIL 2018 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 67 |

DATE:
FILE:




## GENERAL NOTES

1. FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: ROAD SYSTEMS, INC. (432)263-2435. 3616 OLD HOWARD COUNTY AIRPORT, BIG SPRING, TX 79720
2. FOR INSTALLATION, REPAIR AND MAINTENANCE REFER TO; MSKT END TERMINAL, PRODUCT DESCRIPTION ASSEMBLY MANUAL (PUBLICATION~062717).
3. APPLY HIGH INTENSITY REFLECTIVE SHEETING, "OBJECT MARKER" ON THE FRONT FACE OF THE DEVICE PER MANUFACTURER'S RECOMMENDATIONS. OBJECT MARKER SHALL CONFORM TO THE STANDARDS REQUIRED IN TEXAS MUTCD.
4. FOR POST (LEAVE-OUT) INSTALLATION AND GUIDANCE SEE TXDOT'S LATEST ROADWAY MOW STRIP STANDARD.
5. HARDWARE (BOLTS, NUTS, & WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING". FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
6. IF SOLID ROCK IS ENCOUNTERED IN THE AREA OF (POST 1) AND / OR (POST 2) CONTACT THE MANUFACTURER, AND REFER TO THE LATEST ROADWAY MBGF STANDARD FOR INSTALLATION GUIDANCE.
7. POSTS SHALL NOT BE SET IN CONCRETE.
8. THE EXISTING SKT 31" STANDARD STEEL POST SYSTEM MUST BE THOROUGHLY INSPECTED, AND DETERMINED TO BE INTACT, AND FREE OF ANY DAMAGE OR DEFECTS BEFORE RETROFITTING. THIS INSPECTION INCLUDES COMPLETING THE MSKT RETROFIT INSPECTION CHECKLIST FOR THE EXISTING SKT 31" STEEL POST NCHRP 350 SYSTEM. ALL EXISTING, AND REUSABLE PARTS MUST BE FREE OF ANY DAMAGE FOR A MASH COMPLIANT RETROFIT.
9. UNDER NO CIRCUMSTANCES SHALL THE GUARDRAIL WITHIN THE MSKT SYSTEM BE CURVED.
10. A FLARE RATE OF UP TO 25:1 MAY BE USED TO PREVENT THE TERMINAL HEAD FROM ENCROACHING ON THE SHOULDER. THE FLARE MAY BE DECREASED OR ELIMINATED FOR SPECIFIC INSTALLATIONS, IF DIRECTED BY THE ENGINEER.
11. SPECIAL DRIVING CAP TO BE USED WHEN DRIVING (LOWER POSTS 1 & 2) TO PREVENT DAMAGE TO THE WELDED PLATES.




**CONNECTION DETAIL A**
**IMPACT HEAD (POST 1 & POST 2)**




**POST 1**
**CONNECTION DETAIL B**

| ITEMS | QTY | MAIN SYSTEM COMPONENTS | PART NUMBERS |
|---|---|---|---|
| * 1 | 1 | MSKT IMPACT HEAD | MS3000 |
| 2 | 1 | POST 1 - TOP (6" X 6" X 1/8" TUBE) | MTPHP1A |
| 3 | 1 | POST 1 - BOTTOM (6' W6X15) | MTPHP1B |
| 4 | 1 | POST 2 - ASSEMBLY BOTTOM (6' W6X9) | HP2B |
| 5 | 1 | GROUND STRUT | MS785 |
| 6 | 1 | 5/8" X 9" HEX BOLT (GRD A449) | B580904A |
| 7 | 2 | 5/8" WASHERS | W050 |
| 8 | 1 | 5/8" H.G.R NUT | N050 |
| 9 | 1 | CABLE TIE-STEEL | CT-100ST |
| * 10 | 1 | OBJECT MARKER 18" X 18" | E3151 |

**COMPONENTS REQUIRED TO RETROFIT: EXISTING 31" STEEL POST (NCHRP 350 SKT) GUARDRAIL TERMINAL WITH THE NEW 31" (MASH COMPLIANT MSKT IMPACT HEAD).**

*** IF THE EXISTING NCHRP 350 (31" STEEL POST SKT) ALREADY HAS THE MSKT IMPACT HEAD THERE IS NO NEED TO REPLACE THE IMPACT HEAD OR OBJECT MARKER AS LONG AS IT IS NOT DAMAGED.**

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

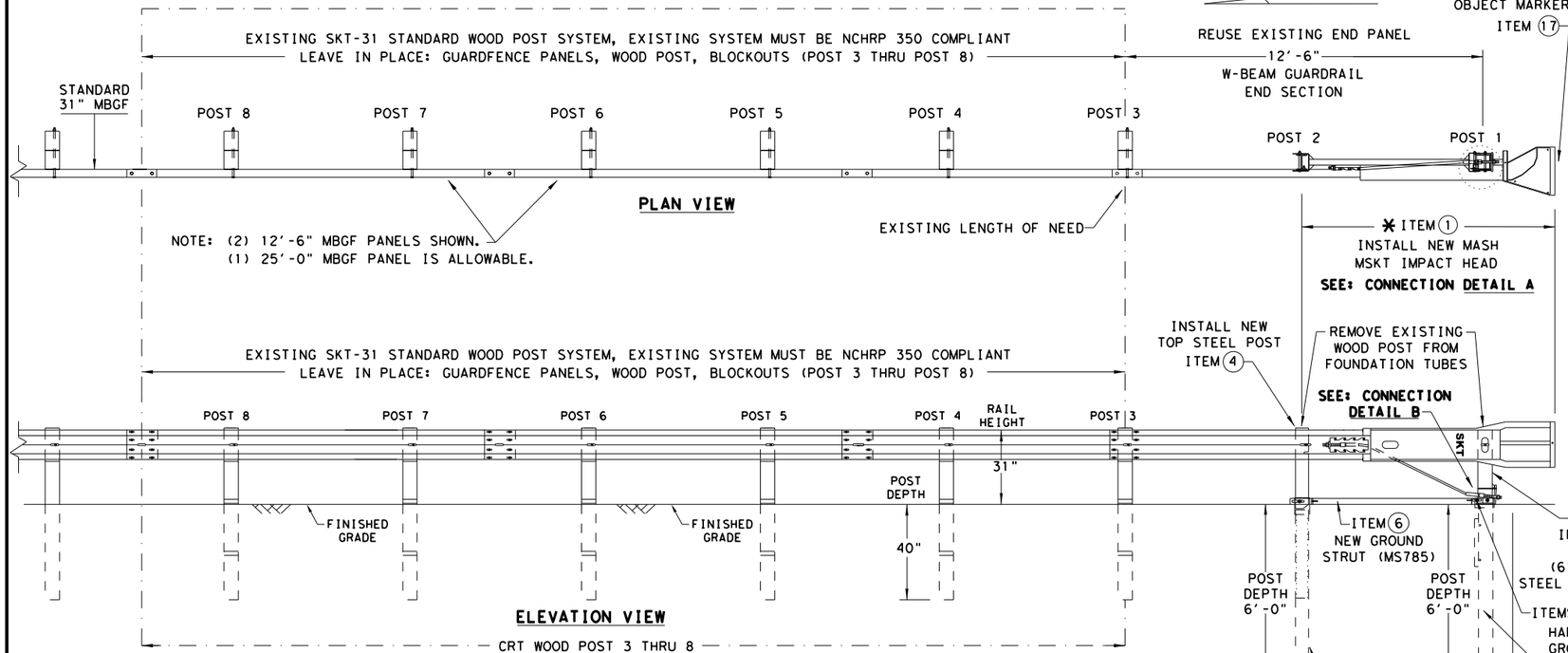
Texas Department of Transportation — Design Division Standard

# RETROFIT STANDARD SKT 31" STEEL POST SYSTEM TO MASH MSKT

# SGT(13S)31-18

| | | | | |
|---|---|---|---|---|
| FILE: sgt13s3118.dgn | DN: TxDOT | CK: KM | DW: VP | CK: CL |
| © TxDOT: APRIL 2018 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 68 |

DATE:
FILE:




** NOTE: EXTRA SOIL COMPACTION WILL BE NEEDED AROUND NEW (POSTS 1 & 2) DUE TO THE REMOVAL OF THE STEEL FOUNDATION TUBES.

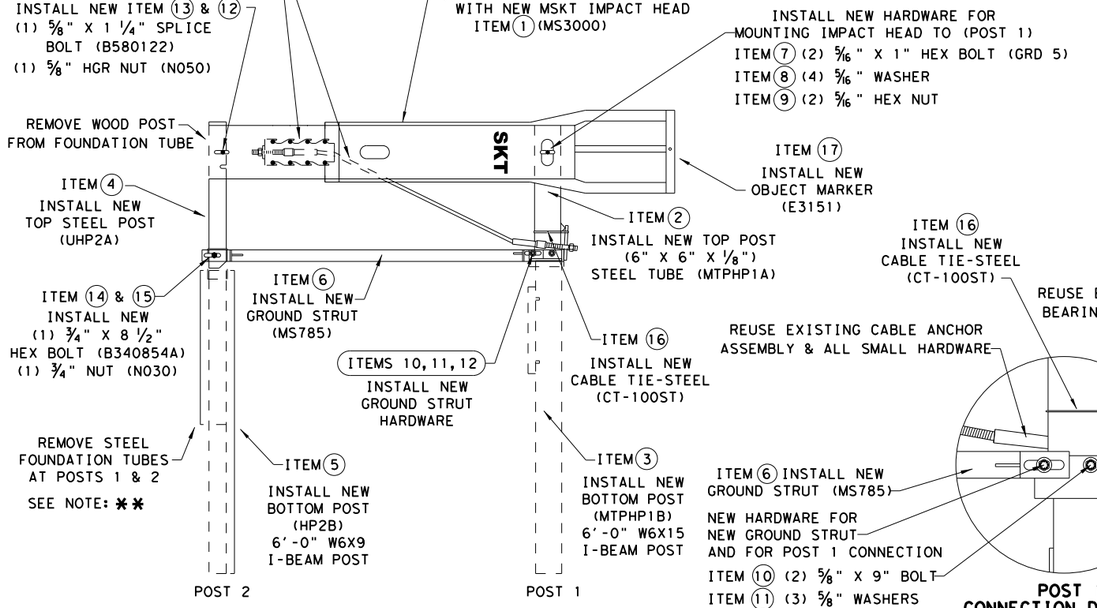
## GENERAL NOTES

1. FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: ROAD SYSTEMS, INC. (432)263-2435. 3616 OLD HOWARD COUNTY AIRPORT, BIG SPRING, TX 79720
2. FOR INSTALLATION, REPAIR AND MAINTENANCE REFER TO; MSKT END TERMINAL, PRODUCT DESCRIPTION ASSEMBLY MANUAL (PUBLICATION~062717).
3. APPLY HIGH INTENSITY REFLECTIVE SHEETING, "OBJECT MARKER" ON THE FRONT FACE OF THE DEVICE PER MANUFACTURER'S RECOMMENDATIONS. OBJECT MARKER SHALL CONFORM TO THE STANDARDS REQUIRED IN TEXAS MUTCD.
4. FOR POST (LEAVE-OUT) INSTALLATION AND GUIDANCE SEE TXDOT'S LATEST ROADWAY MOW STRIP STANDARD.
5. HARDWARE (BOLTS, NUTS, & WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING". FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
6. IF SOLID ROCK IS ENCOUNTERED IN THE AREA OF (POST 1) AND / OR (POST 2) CONTACT THE MANUFACTURER, AND REFER TO THE LATEST ROADWAY MBGF STANDARD FOR INSTALLATION GUIDANCE.
7. POSTS SHALL NOT BE SET IN CONCRETE.
8. THE EXISTING SKT 31" STANDARD WOOD POST SYSTEM MUST BE THOROUGHLY INSPECTED, AND DETERMINED TO BE INTACT, AND FREE OF ANY DAMAGE OR DEFECTS BEFORE RETROFITTING. THIS INSPECTION INCLUDES COMPLETING THE MSKT RETROFIT INSPECTION CHECKLIST FOR THE EXISTING SKT 31" WOOD POST NCHRP 350 SYSTEM. ALL EXISTING, AND REUSABLE PARTS MUST BE FREE OF ANY DAMAGE FOR A MASH COMPLIANT RETROFIT.
9. UNDER NO CIRCUMSTANCES SHALL THE GUARDRAIL WITHIN THE MSKT SYSTEM BE CURVED.
10. A FLARE RATE OF UP TO 25:1 MAY BE USED TO PREVENT THE TERMINAL HEAD FROM ENCROACHING ON THE SHOULDER. THE FLARE MAY BE DECREASED OR ELIMINATED FOR SPECIFIC INSTALLATIONS, IF DIRECTED BY THE ENGINEER.
11. SPECIAL DRIVING CAP TO BE USED WHEN DRIVING (LOWER POSTS 1 & 2) TO PREVENT DAMAGE TO THE WELDED PLATES.

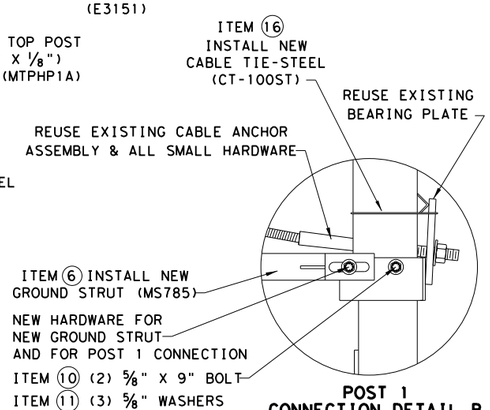
| ITEMS | QTY | MAIN SYSTEM COMPONENTS | PART NUMBERS |
|---|---|---|---|
| 1 | 1 | MSKT IMPACT HEAD | MS3000 |
| 2 | 1 | POST 1 - TOP (6" X 6" X 1/8" TUBE) | MTPHP1A |
| 3 | 1 | POST 1 - BOTTOM (6' W6X15) | MTPHP1B |
| 4 | 1 | POST 2 - ASSEMBLY TOP | UHP2A |
| 5 | 1 | POST 2 - ASSEMBLY BOTTOM (6' W6X9) | HP2B |
| 6 | 1 | GROUND STRUT | MS785 |
| 7 | 2 | 5/16" X 1" HEX BOLT (GRD 5) | B516014A |
| 8 | 4 | 5/16" WASHERS | W0516 |
| 9 | 2 | 5/16" HEX NUT | N0516 |
| 10 | 2 | 5/8" X 9" HEX BOLT (GRD A449) | B580904A |
| 11 | 3 | 5/8" WASHERS | W050 |
| 12 | 3 | 5/8" H.G.R NUT | N050 |
| 13 | 1 | 5/8" X 1 1/4" SPLICE BOLT | B580122 |
| 14 | 1 | 3/4" X 8 1/2" HEX BOLT (GRD 5) | B340854A |
| 15 | 1 | 3/4" HEX NUT | N030 |
| 16 | 1 | CABLE TIE-STEEL | CT-100ST |
| * 17 | 1 | OBJECT MARKER 18" X 18" | E3151 |

**COMPONENTS REQUIRED TO RETROFIT: EXISTING 31" WOOD POST (NCHRP 350 SKT) GUARDRAIL TERMINAL WITH THE NEW 31" (MASH COMPLIANT MSKT IMPACT HEAD).**

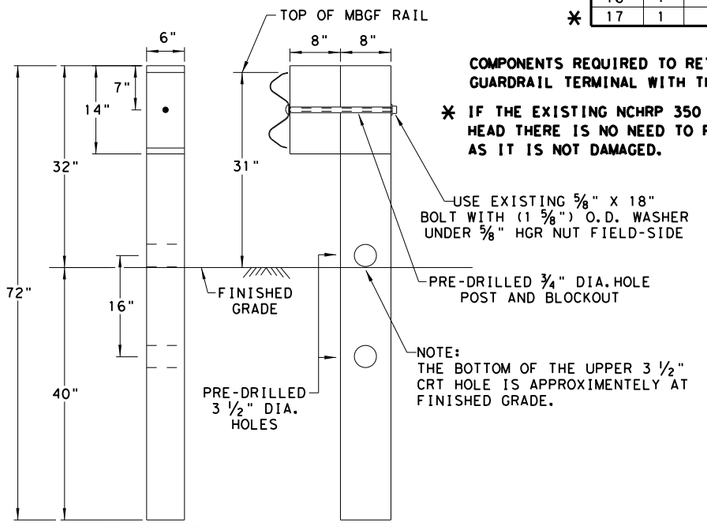
*** IF THE EXISTING NCHRP 350 (31" WOOD POST SKT) ALREADY HAS THE MSKT IMPACT HEAD THERE IS NO NEED TO REPLACE THE IMPACT HEAD OR OBJECT MARKER AS LONG AS IT IS NOT DAMAGED.**




**CONNECTION DETAIL A**
**IMPACT HEAD (POST 1 & POST 2)**




**POST 1**
**CONNECTION DETAIL B**




**FRONT VIEW** **SIDE VIEW**
**EXISTING WOOD POSTS 3-8**
**CONTROLLED RELEASE TERMINAL (CRT)**

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

Texas Department of Transportation

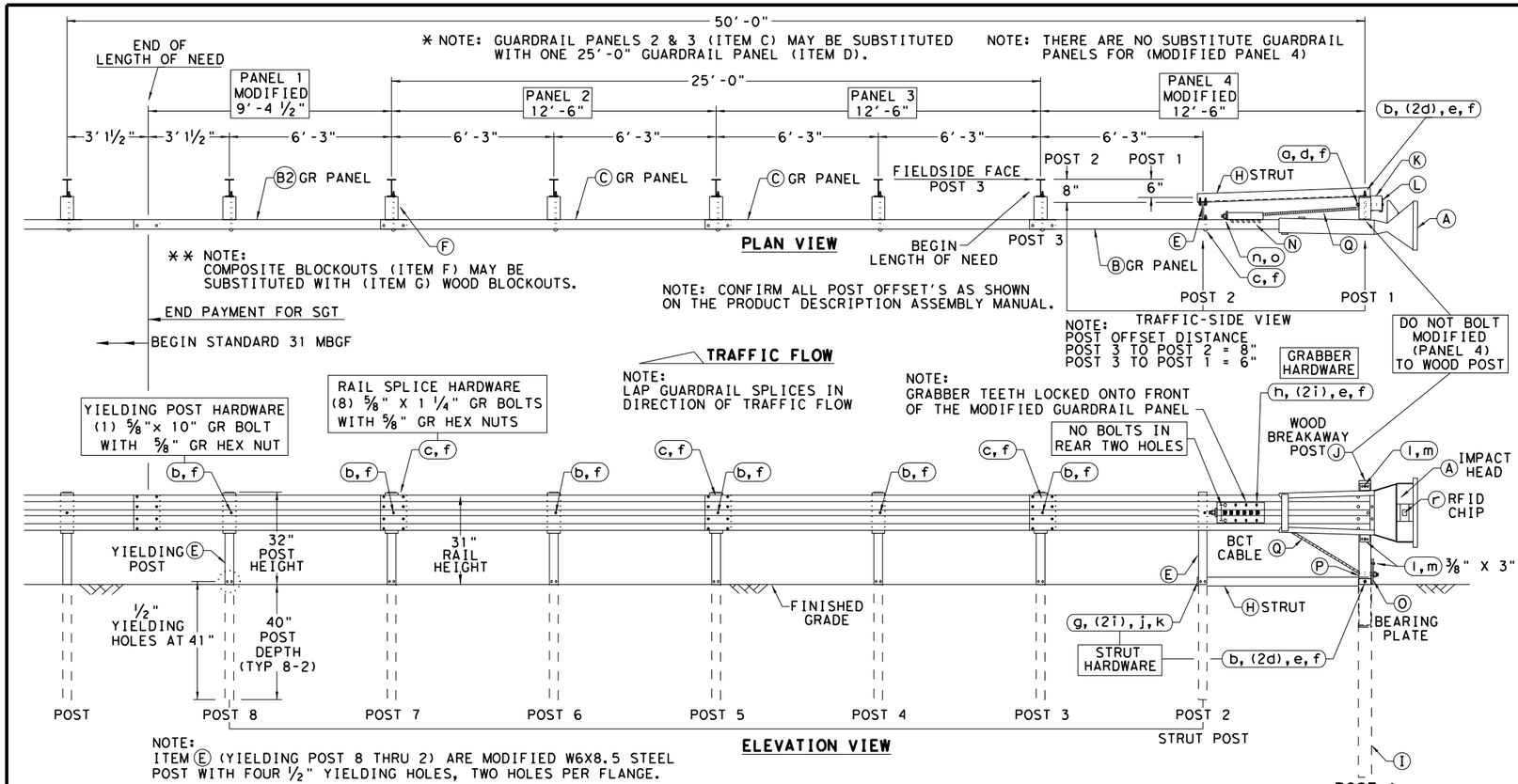
Design Division Standard

# RETROFIT STANDARD SKT 31" WOOD POST SYSTEM TO MASH MSKT

# SGT(14W)31-18

| FILE: sgt14w3118.dgn | DN: TxDOT | CK: KM | DW: VP | CK: CL |
|---|---|---|---|---|
| ©TxDOT: APRIL 2018 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 69 |

DATE:
FILE:

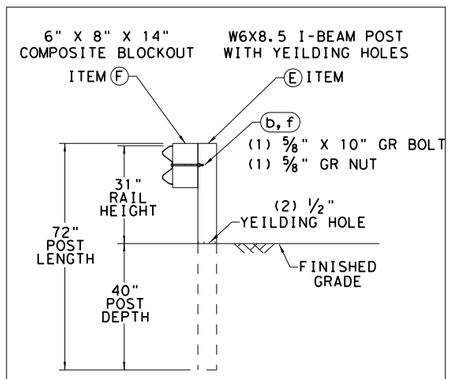



## GENERAL NOTES

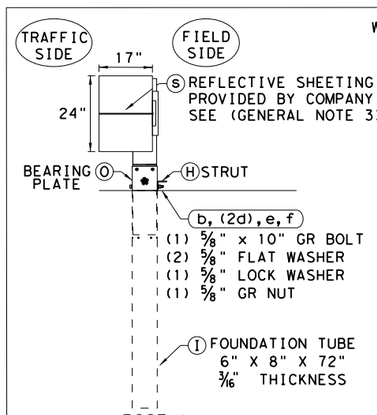
1. FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: SPIG INDUSTRY, INC. AT 1(267) 644-9510. 14675 INDUSTRIAL PARK RD; BRISTOL, VA 24202
2. FOR INSTALLATION, REPAIR AND MAINTENANCE REFER TO THE MANUFACTURER'S; SGET END TERMINAL, PRODUCT DESCRIPTION ASSEMBLY MANUAL.
3. 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.
4. THE NOMINAL HEIGHT OF THE GUARDRAIL BEAM IS 31 INCHES WITH A TOLERANCE OF +/- ONE INCH.
5. FOR POST (LEAVE-OUT) INSTALLATION AND GUIDANCE SEE TXDOT'S LATEST ROADWAY MOW STRIP STANDARD.
6. (POST 2 THROUGH POST 8) ARE MODIFIED STEEL-YIELDING POSTS WITH YIELDING HOLES AT GROUND LEVEL. THERE ARE NO SUBSTITUTE POSTS.
7. POSTS SHALL NOT BE SET IN CONCRETE.
8. IF SOLID ROCK IS ENCOUNTERED FOR ANY OF THE POSTS IN THE SYSTEM, CONTACT THE MANUFACTURER FOR SPECIFIC INSTALLATION GUIDANCE.
9. HARDWARE (BOLTS, NUTS, & WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445,"GALVANIZING". FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
10. 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.
11. 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 3/16" | FNDT6 |
| J | 1 | WOOD BREAKAWAY POST 5 1/2" x 7 1/2" x 50" | WBRK50 |
| K | 1 | WOOD STRIKE BLOCK | WSBLK14 |
| 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 |
| | | **SMALL HARDWARE** | |
| 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 |

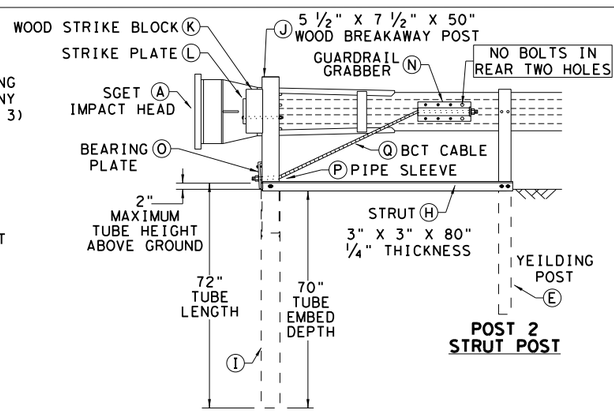
ALTERNATIVE ITEMS
* D
** G
NOTE: SEE PLAN VIEW



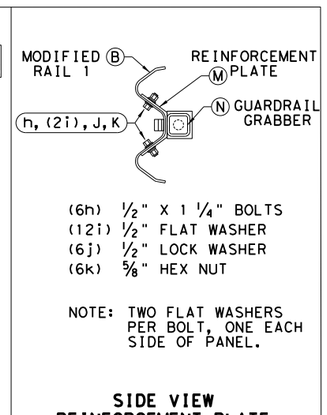

SIDE VIEW
POST 8 - POST 3 (TYP)



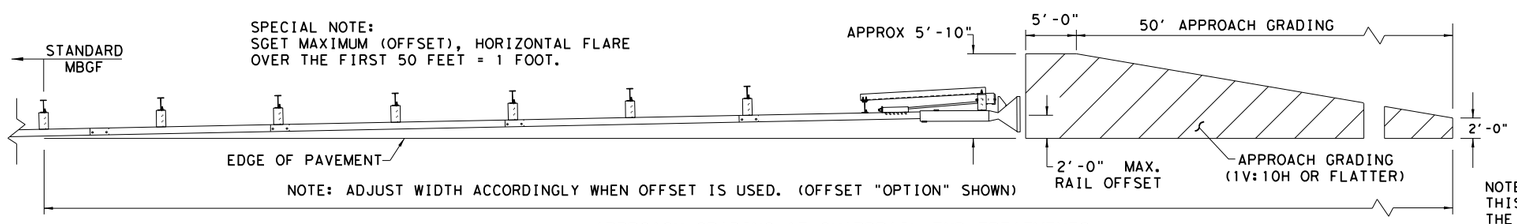

POST 1
FRONT END VIEW




POST 1
FIELD SIDE VIEW
POST 2
STRUT POST




SIDE VIEW
REINFORCEMENT PLATE
WITH GUARDRAIL GRABBER




APPROACH GRADING AT GUARDRAIL END TREATMENTS

NOTE:
THIS STANDARD IS A BASIC REPRESENTATION OF THE SGET TERMINAL SYSTEM AND IS NOT INTENDED TO REPLACE THE MANUFACTURER'S ASSEMBLY MANUAL.

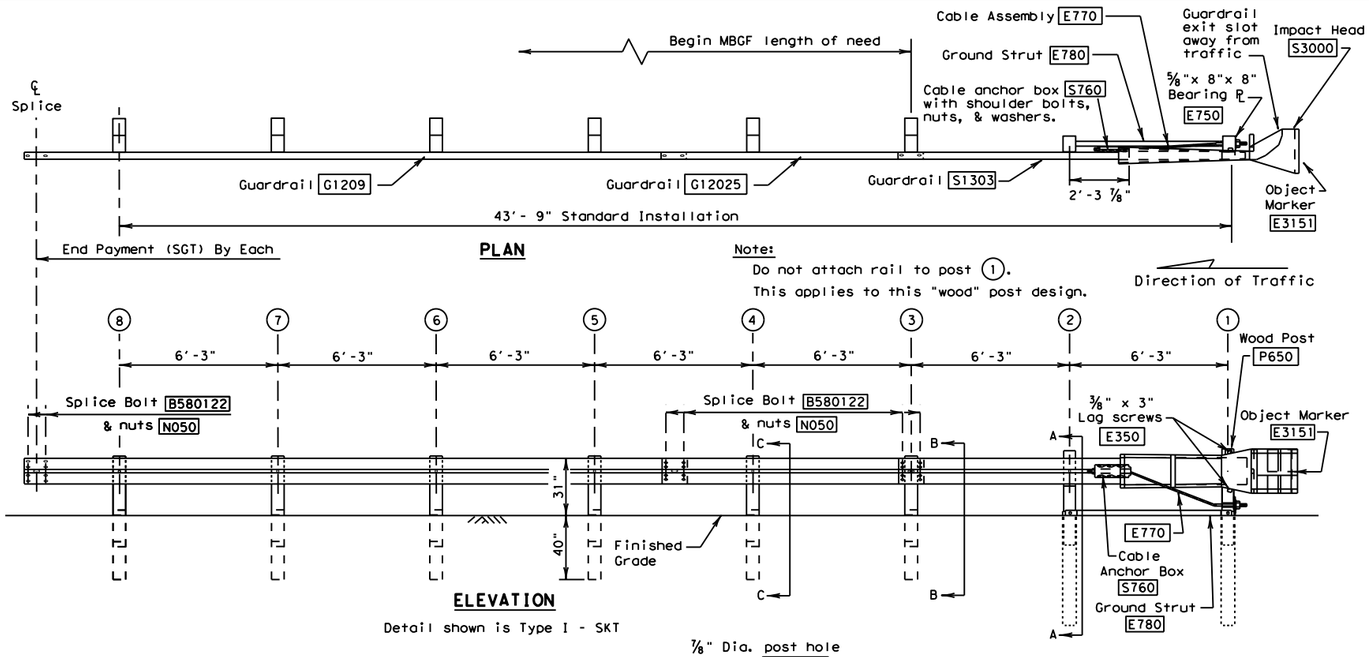
Texas Department of Transportation

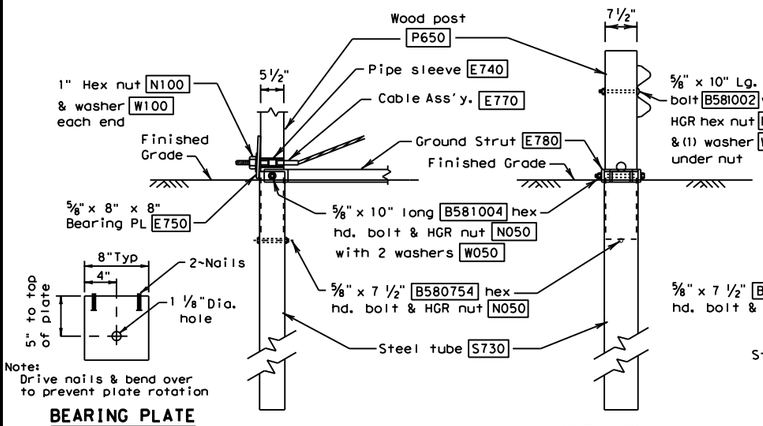
Design Division Standard

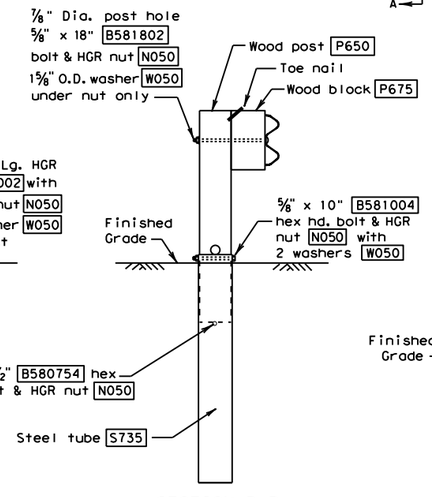
# SPIG INDUSTRY, LLC
# SINGLE GUARDRAIL TERMINAL
# SGET - TL-3 - MASH
# SGT(15)31-20

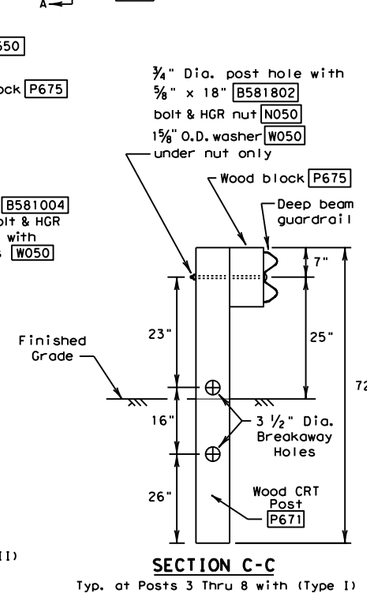
| FILE: sgt153120.dgn | DN: TxDOT | CK: KM | DW: VP | CK: VP |
|---|---|---|---|---|
| © TxDOT: APRIL 2020 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 70 |

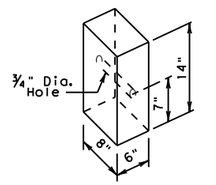
DATE:
FILE:

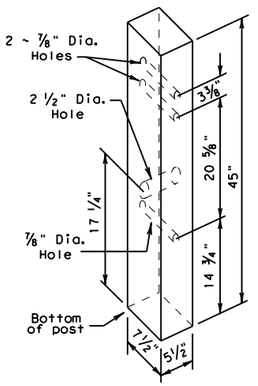


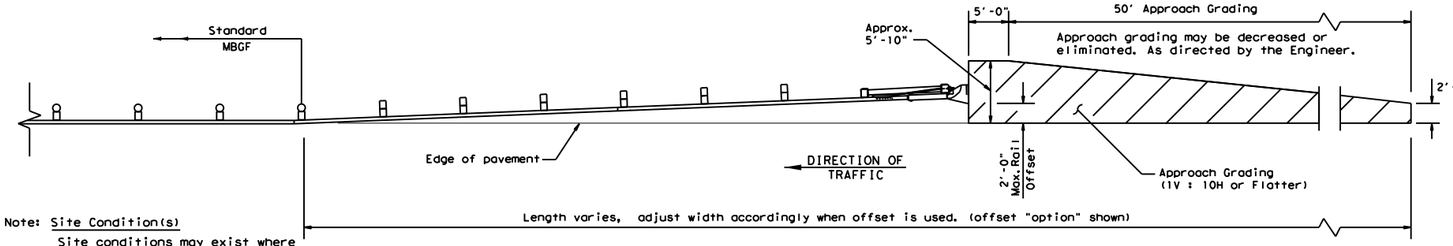




## GENERAL NOTES

1. For additional information contact: Interstate Steel Inc. (432) 263-3725
2. The Type of SGT unit will be specified elsewhere in the plans. The numbers in the circles indicate post position. The Type of SGT unit chosen is a maintenance consideration and does not affect the systems performance.

| | Post & Tube Options | Post Only |
|---|---|---|
| Type I | Posts ① thru ② | Posts ③ thru ⑧ |
| Type II | Posts ① thru ④ | Posts ⑤ thru ⑧ |
| Type III | Posts ① thru ⑧ | None |

3. SGT's placed within the "minimum" 150 ft. radius, shall be installed straight. Standard rail elements may be installed within the radius, without special fabrication.
4. All bolts, nuts cable assemblies, cable anchors, steel tubes & bearing plates shall be galvanized.
5. A flare rate of 25:1 may be used over the first 50 ft. of the system to prevent the terminal head from encroaching the shoulder. The flare may be decreased or eliminated for specific installations, if directed by the Engineer.
6. The steel tubes shall not protrude more than 4 inches above ground. Site grading may be necessary to meet this requirement.
7. The steel tubes may be driven with an approved driving head. They shall not be driven with the wood post in the tube. If the steel tubes are placed in drilled holes, the backfill material must be satisfactorily compacted to prevent tube settlement.
8. If solid rock is encountered. See the Manufacturer's installation manual for the proper installation guidance.
9. The breakaway cable assembly must be taut. A locking device, (vice grips or channel lock pliers) should be used to prevent the cable from twisting when tightening the nuts.
10. The wood blocks shall be "toe nailed" to the rectangular wood posts to prevent them from turning when the wood shrinks. The bearing plate on the front post shall also be "toe nailed" to prevent rotation.
11. For curb installations, the soil tubes and posts shall be installed at the proper ground elevation behind the curb. The posts will then require field drilling new holes to accommodate the rail to post connection bolt to maintain the proper height of the rail above the gutter pan. The excess post length above the rail will be removed if directed by the Engineer.
12. An object marker shall be installed on the front of the impact head as detailed on D&OM(VIA).

## BILL OF MATERIAL

| Item # | POST & TUBE OPTIONS Type I | Type II | Type III | DESCRIPTION |
|---|---|---|---|---|
| S1303 | 1 | 1 | 1 | Guardrail (12 Ga.) 12'- 6" SKT |
| G12025 | 1 | 1 | 1 | Guardrail (12 Ga.) 9'- 4 ½" |
| G1209 | 1 | 1 | 1 | Guardrail (12 Ga.) 25'- 0" |
| S730 | 2 | 2 | 2 | Steel Tube - 6" x 8" x 72" x ⅛" min. or ⅜" |
| S735 | 0 | 2 | 6 | Steel Tube - 6" x 8" x 54" x ⅛" min. or ⅜" |
| P650 | 2 | 4 | 8 | Wood Posts - 5 ½" x 7 ½" x 45" |
| P671 | 6 | 4 | 0 | Wood CRT Posts - 6" x 8" x 72" |
| P675 | 6 | 6 | 6 | Wood Block - 6" x 8" x 14" |
| E740 | 1 | 1 | 1 | Pipe Sleeve - 2" Std. Pipe x 5 ½" |
| E750 | 1 | 1 | 1 | Bearing Plate - ⅝" x 8" x 8" |
| S760 | 1 | 1 | 1 | Cable Anchor Box |
| E770 | 1 | 1 | 1 | Cable Assembly |
| E780 | 1 | 1 | 1 | Ground Strut |
| S3000 | 1 | 1 | 1 | Impact Head |
| | | | | HARDWARE |
| B580754 | 2 | 4 | 8 | ⅝" x 7 ½" Hex Hd. Bolt |
| B581004 | 2 | 4 | 8 | ⅝" x 10" Hex Hd. Bolt (Top of Tubes) |
| W050 | 11 | 15 | 23 | ⅝" Washers |
| B581002 | 1 | 1 | 1 | ⅝" x 10" HGR Post Bolt (Post 2) |
| B580122 | 16 | 16 | 16 | ⅝" x 1 ¼" HGR Splice Bolt |
| B581802 | 6 | 6 | 6 | ⅝" x 18" HGR Post Bolt (Posts ③ thru ⑧ ) |
| N050 | 35 | 39 | 47 | ⅝" HGR Nut (24-Spl, Varies-Posts, 2-Strut) |
| E350 | 2 | 2 | 2 | ⅜" x 3" Lag Screw |
| N100 | 2 | 2 | 2 | 1" Hex Nut (Anchor Cable) |
| W100 | 2 | 2 | 2 | 1" Washer (Anchor Cable) |
| SB12A | 8 | 8 | 8 | Cable Anchor Box Shoulder Bolts |
| N012A | 8 | 8 | 8 | ½" Structural Nut |
| W012A | 8 | 8 | 8 | ½" Structural Washer |
| E3151 | 1 | 1 | 1 | Object Marker - (18" x 18") |

| POST & TUBE OPTIONS | |
|---|---|
| Type I | post ① thru ② |
| Type II | post ① thru ④ |
| Type III | post ① thru ⑧ |

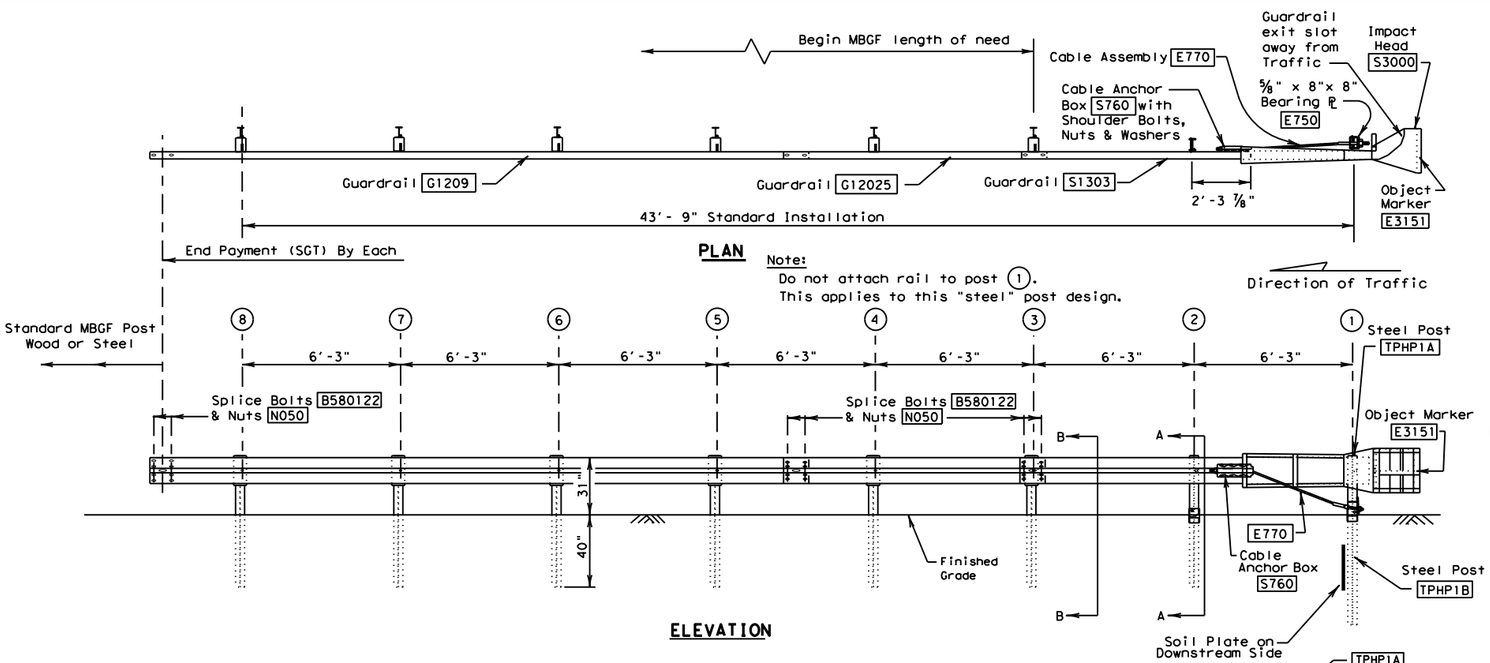
Texas Department of Transportation — Design Division Standard

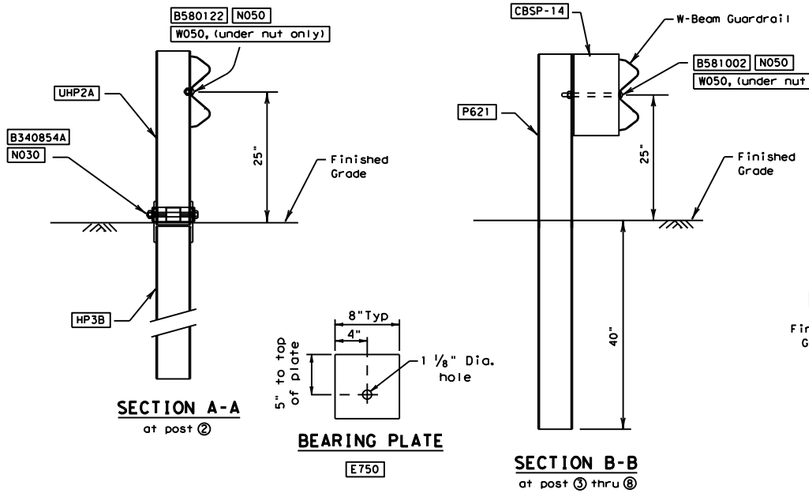
# SINGLE GUARDRAIL TERMINAL (SKT-31) (WOOD POST)

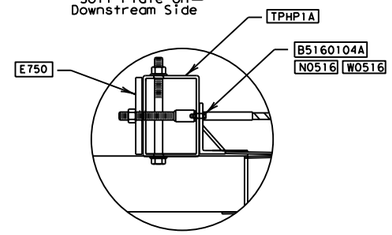
# SGT(8)31-14

| FILE: sgt83114.dgn | DN: TxDOT | CK: AM | DW: BD/VP | CK: VP |
|---|---|---|---|---|
| ©TxDOT December 2011 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 71 |

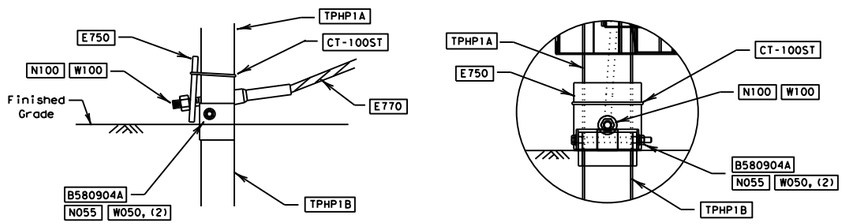
DATE:
FILE:



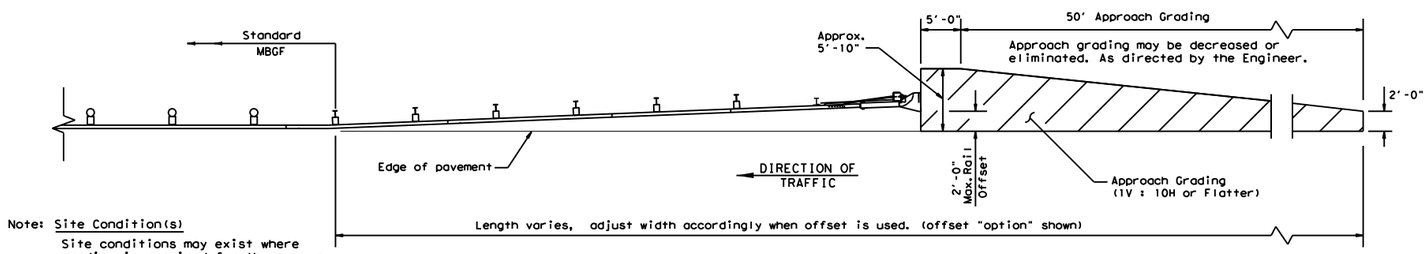




IMPACT HEAD CONNECTION DETAIL




POST #1 CONNECTION DETAILS




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 AT GUARDRAIL END TREATMENTS

## GENERAL NOTES

1. For additional information contact: Interstate Steel Inc., (432) 263-3725.
2. All bolts, nuts cable assemblies, cable anchors, steel posts & bearing plates shall be galvanized.
3. SGT's placed within the "minimum" 150 ft. radius, shall be installed straight. Standard rail elements may be installed within the radius without special fabrication.
4. A flare rate of 25:1 may be used to prevent the terminal head from encroaching on the shoulder. The flare may be decreased or eliminated for specific installations, if directed by the Engineer.
5. The lower sections of the post shall not protrude more than 4 inches above finished ground. Site grading may be necessary to meet this requirement.
6. The lower section of the steel posts should not be driven with the upper post attached. If the post is placed in a drilled hole, the backfill material must be satisfactorily compacted to prevent settlement.
7. If solid rock is encountered. See manufacturer's installation manual for the proper installation guidance.
8. The breakaway cable assembly must be taut. A locking device, (vice grips or channel lock pliers) should be used to prevent the cable from twisting when tightening the nuts.
9. Hinge bolts shall not be set below finished grade. At curb locations the posts shall be installed at the proper grade elevation behind the curb. The posts will then require field drilling new holes to accommodate the rail to post connection bolt to maintain the proper height of the rail above the gutter pan. The excess post length above the rail will be removed as directed by the Engineer.
10. An object marker shall be installed on the front of the impact head as detailed on D&OM(VIA).

| ITEM NO. | QTY | BILL OF MATERIALS |
|---|---|---|
| S1303 | 1 | GUARDRAIL (12 GA) 12'- 6" SKT Panel |
| G12025 | 1 | GUARDRAIL (12 GA) 9' - 4 ½" |
| G1209 | 1 | GUARDRAIL (12 GA) 25'- 0" |
| TPHP1A | 1 | FIRST POST ASSEMBLY TOP, TUBE |
| TPHP1B | 1 | FIRST POST ASSEMBLY BOTTOM, 6'- 0" |
| UHP2A | 1 | SECOND POST ASSEMBLY TOP |
| HP3B | 1 | SECOND POST ASSEMBLY BOTTOM, 3'- 5⅜" |
| P621 | 6 | STANDARD STEEL LINE POST 6'- 0" (POST 3 THRU 8) |
| E750 | 1 | BEARING PLATE |
| S760 | 1 | CABLE ANCHOR BOX |
| E770 | 1 | BCT CABLE ANCHOR ASSEMBLY |
| CT-100ST | 1 | CABLE TIE - STEEL |
| CBSP-14 | 6 | ROUTED BLOCK |
| S3000 | 1 | IMPACT HEAD |
| HARDWARE | | |
| B580122 | 25 | ⅝" Dia. x 1 ¼" SPLICE BOLT |
| B580904A | 1 | ⅝" Dia. x 9" HEX BOLT GR. 5 |
| B340854A | 1 | ¾" Dia. x 8 ½" HEX BOLT GR. 5 |
| B581002 | 6 | ⅝" Dia. x 10" H.G.R. BOLT (Post 3 thru 8) |
| N055 | 1 | ⅝" Dia. HEX NUT (Post 1 only) |
| N050 | 31 | ⅝" Dia. H.G.R. NUT (at splices & at Post 2 thru 8) |
| W050 | 9 | H.G.R. WASHER (At Post 1(2) & 2 thru 8) |
| N100 | 2 | 1" ANCHOR CABLE HEX NUT |
| W100 | 2 | 1" ANCHOR CABLE WASHER |
| B5160104A | 2 | ⅝" x 1" HEX BOLT, GR. 5 |
| N0516 | 2 | ⅝" HEX NUT |
| W0516 | 4 | ⅝" WASHER |
| SB12A | 8 | CABLE ANCHOR BOX SHOULDER BOLT |
| N030 | 1 | ¾" HEX NUT |
| N012A | 8 | ½" STR. NUT |
| W012A | 8 | ½" STR. WASHER |
| E3151 | 1 | OBJECT MARKER (18" x 18") |

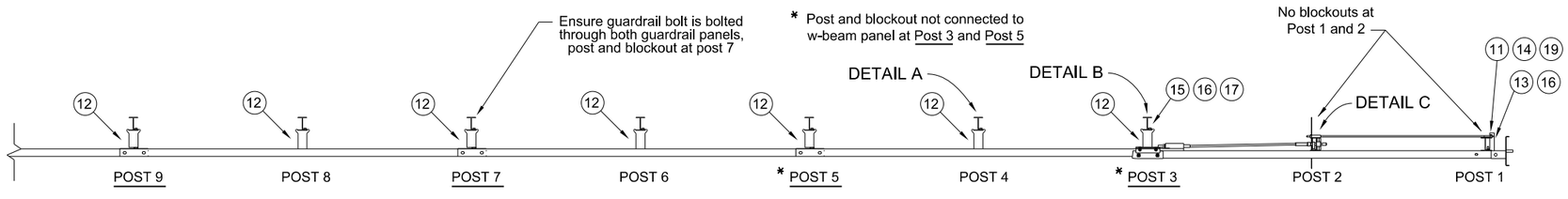
Texas Department of Transportation

Design Division Standard

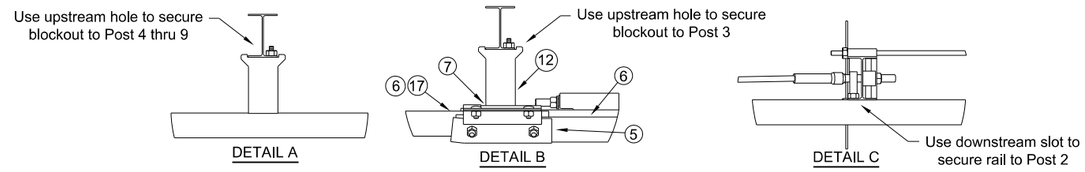
# SINGLE GUARDRAIL TERMINAL (SKT-31) (STEEL POST) SGT(8S)31-14

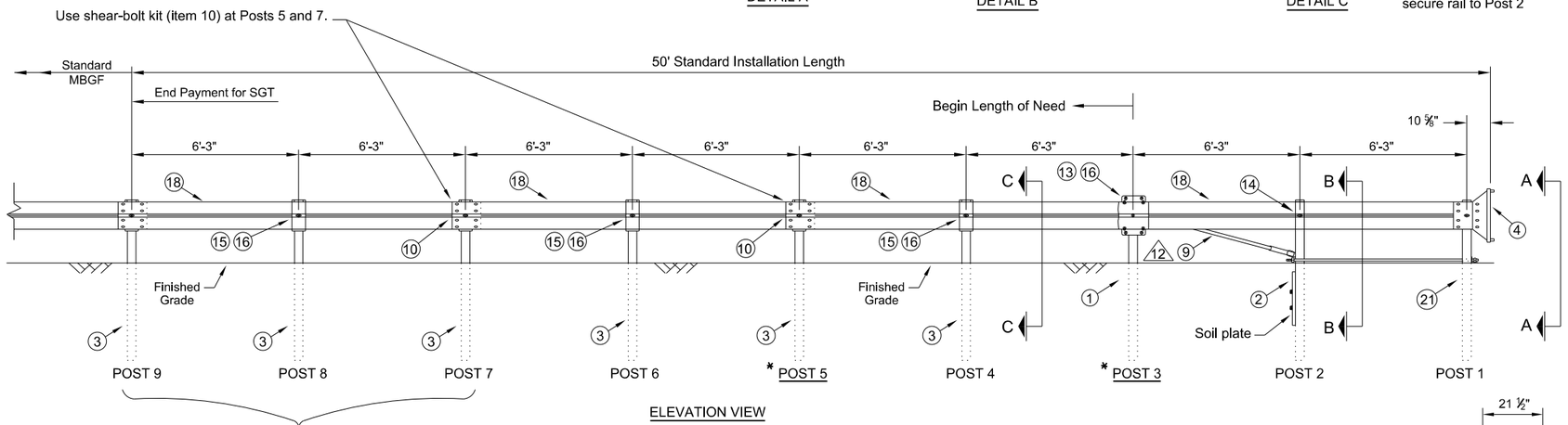
| FILE: sgt8s314.dgn | DN: TxDOT | CK: AM | DW: BD/VP | CK: VP |
|---|---|---|---|---|
| ©TxDOT December 2011 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 72 |

DATE:
FILE:

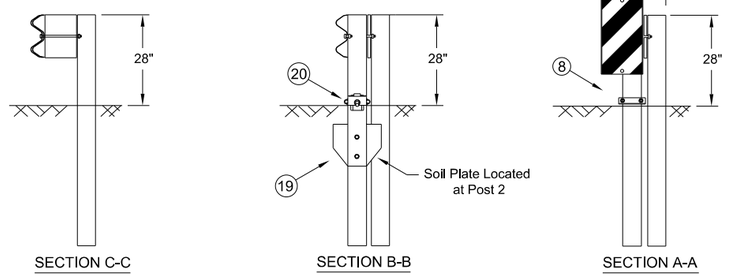



PLAN VIEW

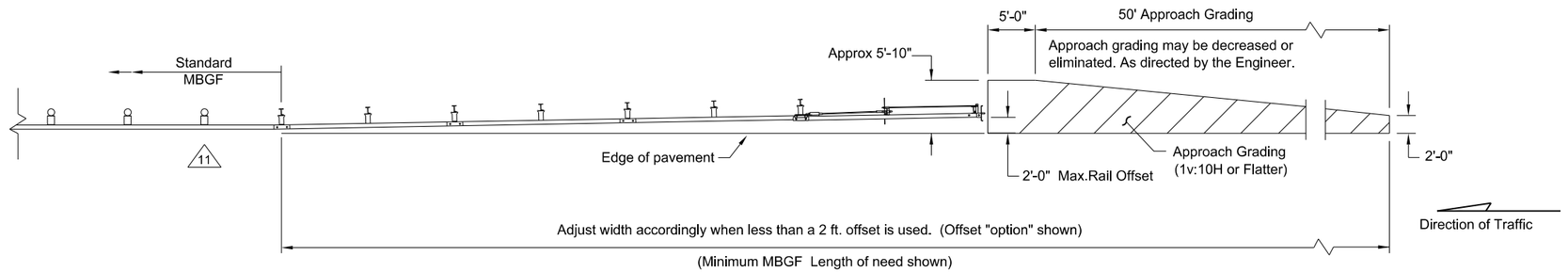



ELEVATION VIEW




SECTION C-C SECTION B-B SECTION A-A




APPROACH GRADING AT GUARDRAIL END TREATMENTS

## GENERAL NOTES

1. For additional information contact: Lindsay Transportation Solutions - Barrier Systems, 180 River Road, Rio Vista, CA 94571, (707) 374-6800
2. All dimensions are shown in inches except as otherwise indicated.
3. All cable assemblies, cable anchor, ground struts, slider pieces, impact heads, nuts, bolts and all steel components shall be galvanized unless otherwise is noted.
4. X-LITE placed within the minimum 150 ft. radius shall be installed straight. Standard rail elements may be installed within the radius without special fabrication.
5. A flare rate of 37.5:1 may be used over the first 50 ft. of the system to prevent the terminal head from encroaching on the shoulder the flare may be decreased or eliminated for specific installations, or as directed by the engineer.
6. At curbed locations the post shall be installed at the proper grade of elevation behind the curb. The post will then require field drilling new holes to accommodate the rail to post connection bolt to maintain the proper height of the rail above the gutter pan. The excess post length above the rail will be removed as directed by the engineer.
7. If rock excavation is encountered, the soil plate maybe modified if approved by the project engineer.
8. When site conditions permit, post may be driven. If posts are placed in a drilled hole, the backfill material must be satisfactorily compacted to prevent settlement.
9. An object marker shall be installed on the impact head as detailed on D&OM(VIA)
10. The X-LITE is a steel post SGT that is suitable for locations calling for wood post or steel post MBGF systems. When used with wood post guardrail system, post 7 thru 9 may be replaced with CRT posts.

△11 Minimum length of MBGF shown. See current guard fence Standards for further information.

△12 The breakaway cable assembly must be taut. A locking device (vice-grips or channel lock-pliers) should be used to prevent the cable from twisting when tightening the nut.

| ITEM | PART NO. | DESCRIPTION | QTY |
|---|---|---|---|
| 1 | BSI-1310027-00 | X-LITE, CRIMPED POST HOLES, GALV | 1 |
| 2 | BSI-1012086-00 | POST II, X-LITE, GALV | 1 |
| 3 | BSI-1012078-00 | LINE POST, X-LITE, GALV | 6 |
| 4 | BSI-1012103-00 | IMPACT HEAD, X-LITE, GALV | 1 |
| 5 | BSI-1012093-00 | SLIDER PANEL, FRONT, X-LITE, GALV | 1 |
| 6 | BSI-1012090-00 | SLIDER BRACKET, X-LITE | 1 |
| 7 | BSI-1012096-00 | BACK SLIDER PANEL, X-LITE, GALV | 1 |
| 8 | BSI-1102001-KT | GROUND STRUT KIT, X-LITE | 1 |
| 9 | BSI-1012104-00 | CABLE ANCHOR ASSEMBLY, X-LITE | 1 |
| 10 | K080123 | KIT, X-TENSION SHEAR BOLT, | 2 |
| 11 | BSI-1102027-00 | WASHER, SQUARE, X-LITE, GALV | 1 |
| 12 | B090534 | W-BEAM COMPOSITE BLOCKOUT 8 IN, | 7 |
| 13 | 4001115 | GUARDRAIL BOLT 5/8"-11X1 1/4" | 24 |
| 14 | 2000302 | BOLT CH 5/8"-11X2 | 2 |
| 15 | 2001635 | BOLT CH 5/8"-11X10" GRADE 5 MGAL | 7 |
| 16 | 4001116 | GUARDRAIL NUT RECESSED 5/8"-11 | 33 |
| 17 | 2001580 | WASHER 1 F436 FLAT RD STRUCT | 1 |
| 18 | 4000443 | W-BEAM GUARDRAIL RWM02a | 4 |
| 19 | BSI-1106016-KT | X-LITE, SOIL PLATE KIT | 1 |
| 20 | BSI-1303005-00 | BRACKET, X-LITE CABLE RETENTION | 1 |
| 21 | BSI-1310024-00 | X-LITE, CRIMPED POST SLOTS, GALV | 1 |
| 22 | MANXLT | X-LITE TANGENT INSTALLATION MANUAL | 1 |

Texas Department of Transportation

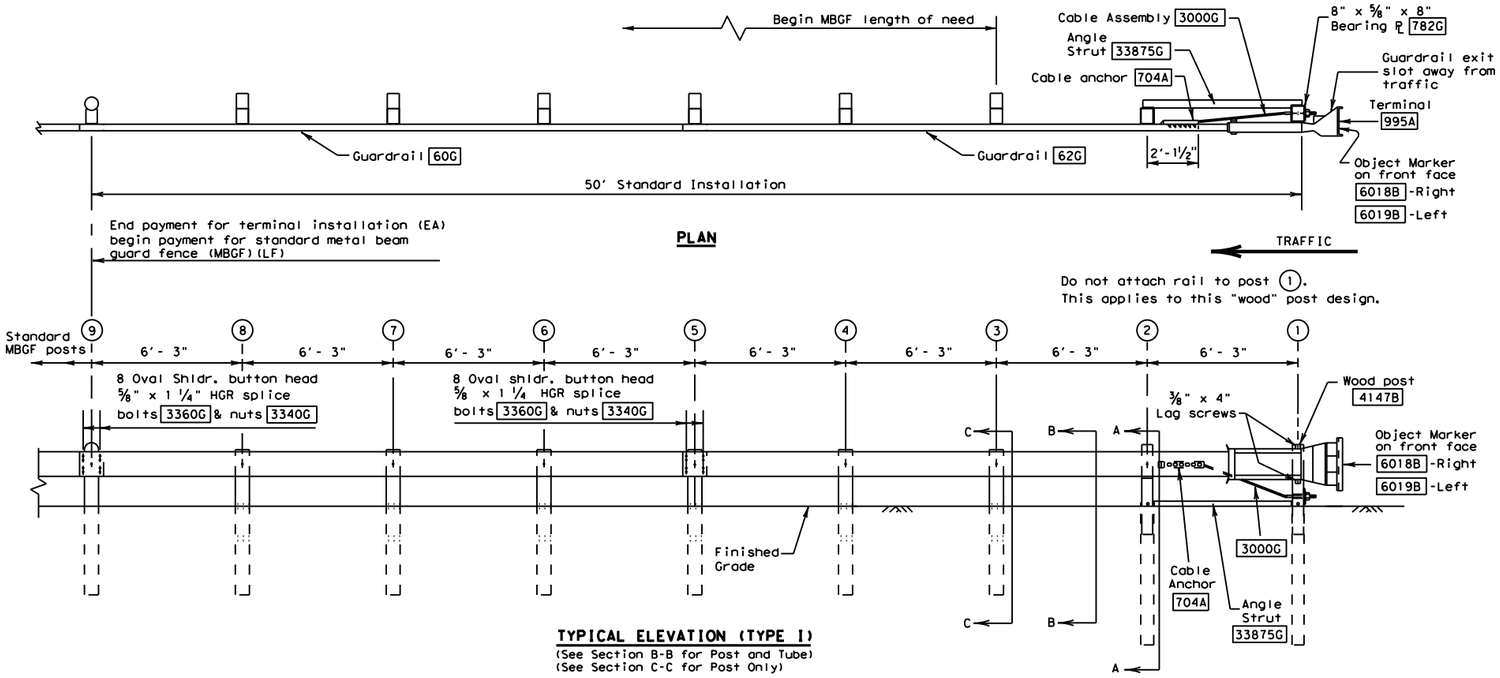
Design Division Standard

# SINGLE GUARDRAIL TERMINAL (X-LITE) STEEL POST

# SGT(9S)28-14

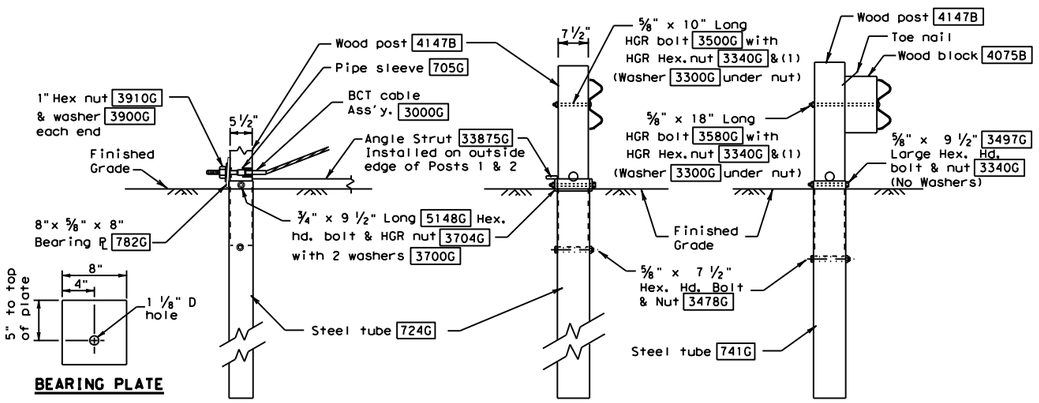
| FILE: sgt9s2814.dgn | DN: TxDOT | CK: RM | DW: VP | CK: CGL |
|---|---|---|---|---|
| ©TxDOT: JULY 2014 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 73 |

DATE:
FILE:




**PLAN**

**TYPICAL ELEVATION (TYPE I)**
(See Section B-B for Post and Tube)
(See Section C-C for Post Only)

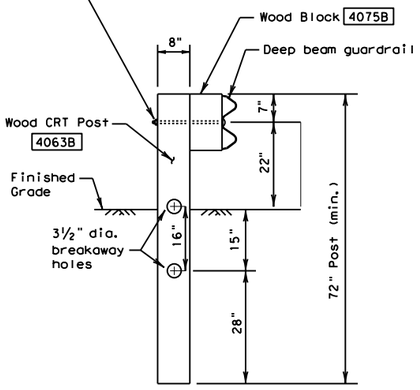



**BEARING PLATE**

**PARTIAL VIEW AT POST #1**

**SECTION A-A**
(at post 2)

**SECTION B-B**
(Typ. at Posts 3 thru 8, Type II & III)




**SECTION C-C**
(Typ. at post only positions)




**WOOD BLOCK**
4075B




All measurements should be taken from bottom of posts.

**WOOD POST**
4147B

| POST & TUBE OPTIONS | | | |
|---|---|---|---|
| Type I | Posts | (1) thru | (2) |
| Type II | Posts | (1) thru | (4) |
| Type III | Posts | (1) thru | (8) |




**DETAIL A**
Placement at curbed locations
(See General Note 4)

Note: Site Condition(s)

Site conditions may exist where grading is required for the proper installation of metal guard fence and end treatments.




## GRADING AT GUARDRAIL END TREATMENTS

## GENERAL NOTES

1. The Type of SGT unit will be specified elsewhere in the plans. Numbers in circles indicate post position. The Type of SGT unit chosen is a maintenance consideration and does not affect the systems performance.

| Post & Tube Options | | Post Only |
|---|---|---|
| Type I | Posts (1) thru (2) | Posts (3) thru (8) |
| Type II | Posts (1) thru (4) | Posts (5) thru (8) |
| Type III | Posts (1) thru (8) | None |

2. SGT's placed within the "minimum" 150 ft. radius, shall be installed straight. Standard rail elements may be installed within the radius, without special fabrication.
3. All bolts, nuts, cable assemblies, cable anchors, steel tubes & bearing plates shall be galvanized.
4. At non-curbed locations, a flare rate of 25:1 may be used over the first 50 ft. of the system to prevent the terminal head from encroaching on the shoulder. The flare may be decreased or eliminated for specific installations, if directed by the Engineer.
   At curbed locations, a flare rate of 25:1 shall be used beginning at post number 5 and ending at post number 1.
5. The steel tubes shall not protrude more than 4 inches above ground. Site grading may be necessary to meet this requirement.
6. The steel tubes may be driven with an approved driving head. They shall not be driven with the wood post in the tube. If the steel tubes are placed in drilled holes, the backfill material must be satisfactorily compacted to prevent tube settlement.
7. If solid rock is encountered. See the manufacturer's installation manual for the proper installation guidance.
8. The breakaway cable assembly must be taut. A locking device, (vice grips or channel lock pliers) should be used to prevent the cable from twisting when tightening the nuts.
9. The wood blocks shall be "toe nailed" to the rectangular wood posts to prevent them from turning when the wood shrinks.
10. For curb installations, the soil tubes and posts shall be installed at the proper ground elevation behind the curb. The posts will then require field drilling new holes to accommodate the rail to post connection bolt to maintain the proper height of the rail above the gutter pan. The excess post length above the rail will be removed if directed by the Engineer.
11. An object marker shall be installed on the front of the impact head as detailed on D&OM(VIA).
12. A special site evaluation should be considered, prior to using this end treatment where there is less than 25 feet between the extrusion side of the end treatment and any adjacent driving lane.

## BILL OF MATERIAL

| Code # | POST & TUBE OPTIONS Type I Qty. | Type II Qty. | Type III Qty. | DESCRIPTION |
|---|---|---|---|---|
| 62G | 1 | 1 | 1 | #1 Deep Beam Guardrail (12 Ga) at 25' |
| 60G | 1 | 1 | 1 | #2 Deep Beam Guardrail (12 Ga) at 25' |
| 724G | 2 | 2 | 2 | Steel Tube - 6"x 8"x 72"x 1/8" min |
| 741G | 0 | 2 | 6 | Steel Tube - 6" x 8" x 54" x 1/8" min |
| 4147B | 2 | 4 | 8 | Wood Posts - 5 1/2" x 7 1/2" x 45" |
| 4063B | 6 | 4 | 0 | Wood CRT Posts - 6"x 8"x 72" |
| 4075B | 6 | 6 | 6 | Wood Block - 6"x 8"x 14" |
| 705G | 1 | 1 | 1 | Pipe Sleeve - 2" std. pipe x 5 1/2" |
| 782G | 1 | 1 | 1 | Bearing Plate - 8"x 8"x 5/8" |
| 704A | 1 | 1 | 1 | Cable Anchor |
| 3000G | 1 | 1 | 1 | Cable Assembly (3/4" x 78") |
| 33875G | 1 | 1 | 1 | Angle Strut |
| 995A | 1 | 1 | 1 | ET-2000 Plus Guardrail Terminal |
| | | | | |
| | | | | HARDWARE |
| 5148G | 2 | 2 | 2 | 3/4" x 9 1/2" Hex Hd (Top of tubes 1&2) A325 |
| 3300G | 7 | 7 | 7 | 5/8" Washers |
| 3478G | 2 | 4 | 8 | 5/8" x 7 1/2" Hex Bolt |
| 3500G | 1 | 1 | 1 | 5/8" x 10" Post Bolt (Post 2 of LET) |
| 3580G | 6 | 6 | 6 | 5/8" x 18" HGR Post Bolt (posts (3) thru (8)) |
| 3360G | 16 | 16 | 16 | 5/8" x 1 1/4" HGR Splice Bolt |
| 3340G | 25 | 27 | 31 | 5/8" HGR Nut (16-spl, 7-posts) |
| 4228G | 2 | 2 | 2 | 5/8" x 4" Lag Screw |
| 3910G | 2 | 2 | 2 | 1" Hex Nut (Anchor Cable) |
| 3900G | 2 | 2 | 2 | 1" Washer (Anchor Cable) |
| 6018B | 1 | 1 | 1 | Right - Object Marker |
| 6019B | 1 | 1 | 1 | Left - Object Marker |
| 3700G | 4 | 4 | 4 | 3/4" Washer |
| 3704G | 2 | 2 | 2 | 3/4" Heavy Hex Nut |
| 3497G | 0 | 2 | 6 | 5/8" x 9 1/2" Hex Hd (Top of Tubes 3-8) A307 |

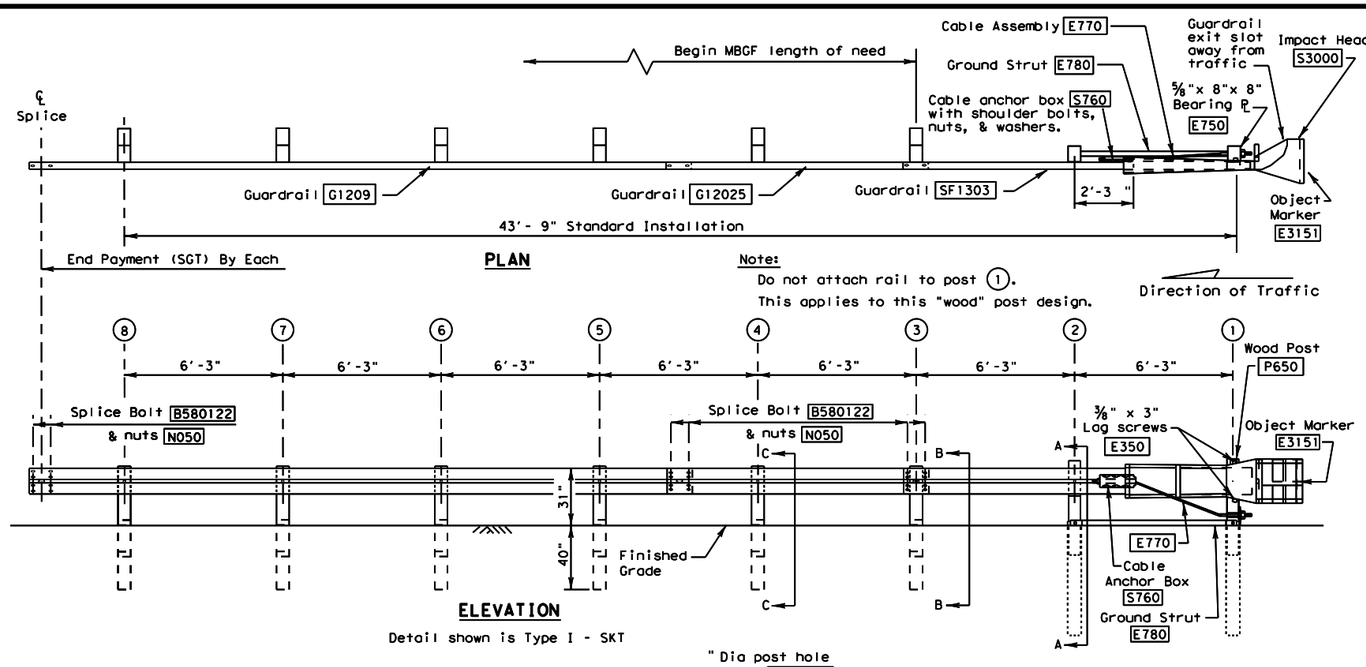
Texas Department of Transportation

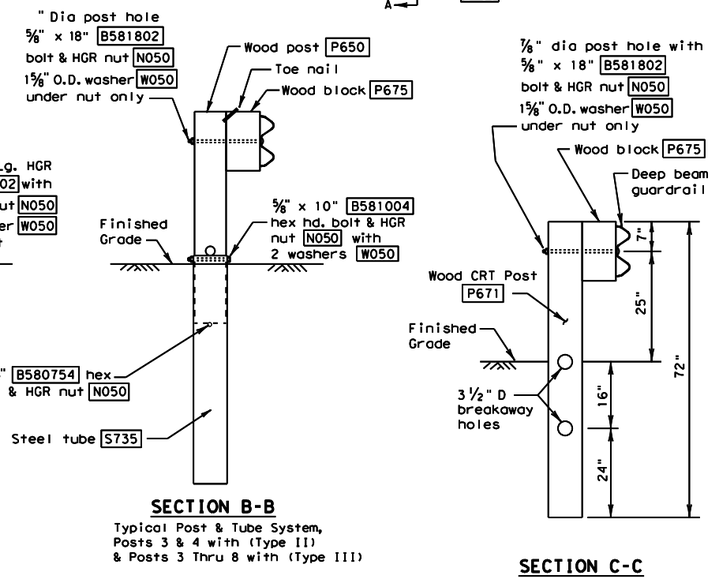
Design Division Standard

# SINGLE GUARDRAIL TERMINAL (ET-2000 PLUS) (WOOD POST)

# SGT(7)-11

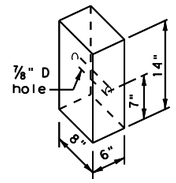
| FILE: sgt712.dgn | DN: TxDOT | CK: AM | DW: BD | CK: VP |
|---|---|---|---|---|
| © TxDOT April 1997 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS 12-2011 | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 74 |

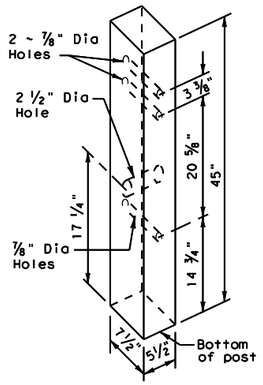


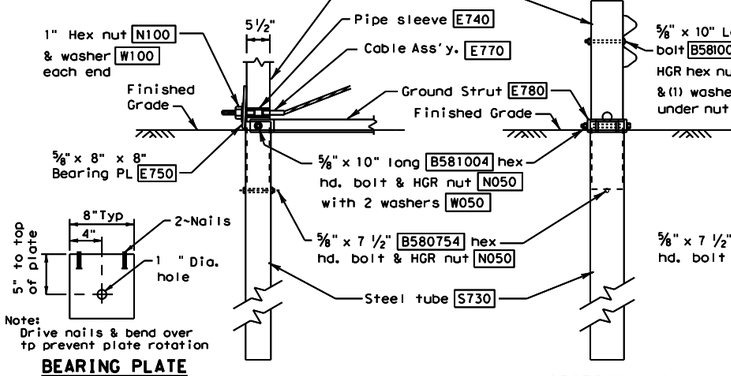





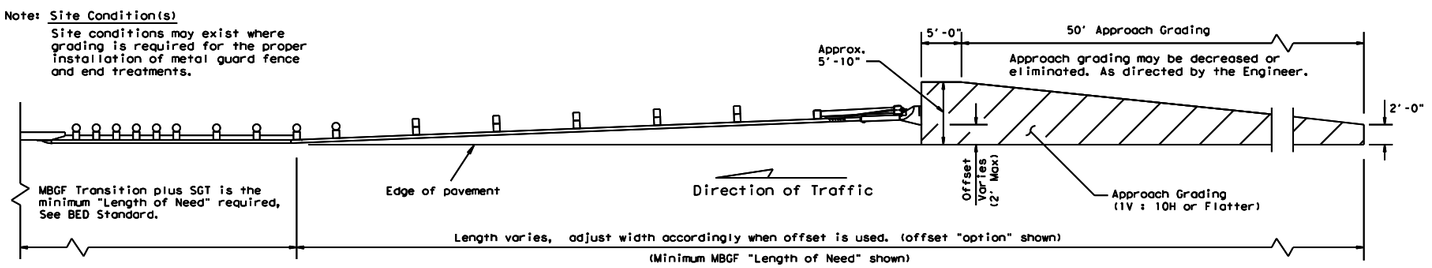





Note: Site Condition(s)
Site conditions may exist where grading is required for the proper installation of metal guard fence and end treatments.




GRADING AT GUARDRAIL END TREATMENTS

## GENERAL NOTES

1. For additional information contact: Interstate Steel Inc., (432) 263-3725.
2. The Type of SGT unit will be specified elsewhere in the plans. Numbers in circles indicate post position. The Type of SGT unit chosen is a maintenance consideration and does not affect the systems performance.

| | Post & Tube Options | Post Only |
|---|---|---|
| Type I | Posts (1) thru (2) | Posts (3) thru (8) |
| Type II | Posts (1) thru (4) | Posts (5) thru (8) |
| Type III | Posts (1) thru (8) | |

3. SGT's placed within the "minimum" 150 ft. radius, shall be installed straight. Standard rail elements may be installed within the radius, without special fabrication.
4. All bolts, nuts cable assemblies, cable anchors, steel tubes & bearing plates shall be galvanized.
5. A flare rate of 25:1 may be used to prevent the terminal head from encroaching on the shoulder. The flare may be decreased or eliminated for specific installations, if directed by the Engineer.
6. The steel tubes shall not protrude more than 4 inches above ground. Site grading may be necessary to meet this requirement.
7. The steel tubes may be driven with an approved driving head. They shall not be driven with the wood post in the tube. If the steel tubes are placed in drilled holes, the backfill material must be satisfactorily compacted to prevent tube settlement.
8. If solid rock is encountered. See the Manufacturer's installation manual for the proper installation guidance.
9. The breakaway cable assembly must be taut. A locking device, (vice grips or channel lock pliers) should be used to prevent the cable from twisting when tightening the nuts.
10. The wood blocks shall be "toe nailed" to the rectangular wood posts to prevent them from turning when the wood shrinks. The bearing plate on the front post shall also be "toe nailed" to prevent rotation.
11. For curb installations, the soil tubes and posts shall be installed at the proper ground elevation behind the curb. The posts will then require field drilling new holes to accommodate the rail to post connection bolt to maintain the proper height of the rail above the gutter pan. The excess post length above the rail will be removed as directed by the Engineer.
12. An object marker shall be installed on the front of the impact head as detailed on D&OM(VIA).
13. A special site evaluation should be considered, prior to using this end treatment where there is less than 25 feet between the outlet side of the end treatment and any adjacent driving lane.

## BILL OF MATERIAL

| Code # | POST & TUBE OPTIONS Type I Qty. | Type II Qty. | Type III Qty. | DESCRIPTION |
|---|---|---|---|---|
| S1303 | 1 | 1 | 1 | Guardrail (12 Ga.) 12'- 6" SKT Panel |
| G12025 | 1 | 1 | 1 | Guardrail (12 Ga.) 9'- 4 ½" |
| G1209 | 1 | 1 | 1 | Guardrail (12 Ga.) 25'- 0" |
| S730 | 2 | 2 | 2 | Steel Tube - 6" x 8" x 72" x ⅛" |
| S735 | 0 | 2 | 6 | Steel Tube - 6" x 8" x 54" x ⅛" |
| P650 | 2 | 4 | 8 | Wood Post - 5 ½" x 7 ½" x 45" |
| P671 | 6 | 4 | 0 | Wood CRT Posts - 6" x 8" x 72" |
| P675 | 6 | 6 | 6 | Wood Block - 6" x 8" x 14" |
| E740 | 1 | 1 | 1 | Pipe Sleeve - 2" Std. Pipe x 5 ½" |
| E750 | 1 | 1 | 1 | Bearing Plate - ⅝" x 8" x 8" |
| S760 | 1 | 1 | 1 | Cable Anchor Box |
| E770 | 1 | 1 | 1 | Cable Assembly |
| E780 | 1 | 1 | 1 | Ground Strut |
| S3000 | 1 | 1 | 1 | Impact Head |
| | | | | |
| B580754 | 2 | 4 | 8 | ⅝" x 7 ½" Hex Hd. Bolt |
| B581004 | 2 | 4 | 8 | ⅝" x 10" Hex Hd. Bolt (Top of Tubes) |
| W050 | 11 | 15 | 21 | ⅝" Washers |
| B581002 | 1 | 1 | 1 | ⅝" x 10" HGR Post Bolt (Post 2) |
| B580122 | 24 | 24 | 24 | ⅝" x 1 ¼" HGR Splice Bolt |
| B581802 | 6 | 6 | 6 | ⅝" x 18" HGR Post Bolt (Posts (3) thru (8)) |
| N050 | 33 | 37 | 45 | ⅝" HGR Nut (16-Spl, 7-Posts, 2-Strut) |
| E350 | 2 | 2 | 2 | ⅜" x 3" Lag Screw |
| N100 | 2 | 2 | 2 | 1" Hex Nut (Anchor Cable) |
| W100 | 2 | 2 | 2 | 1" Washer (Anchor Cable) |
| SB58A | 8 | 8 | 8 | Cable Anchor Box Shoulder Bolts |
| N055A | 8 | 8 | 8 | ½" A325 Structural Nut |
| W050A | 16 | 16 | 16 | ½" A325 Structural Washer |
| E3151 | 1 | 1 | 1 | Object Marker - (18" x 18") |

| POST & TUBE OPTIONS | |
|---|---|
| Type I | post (1) thru (2) |
| Type II | post (1) thru (4) |
| Type III | post (1) thru (8) |

Texas Department of Transportation

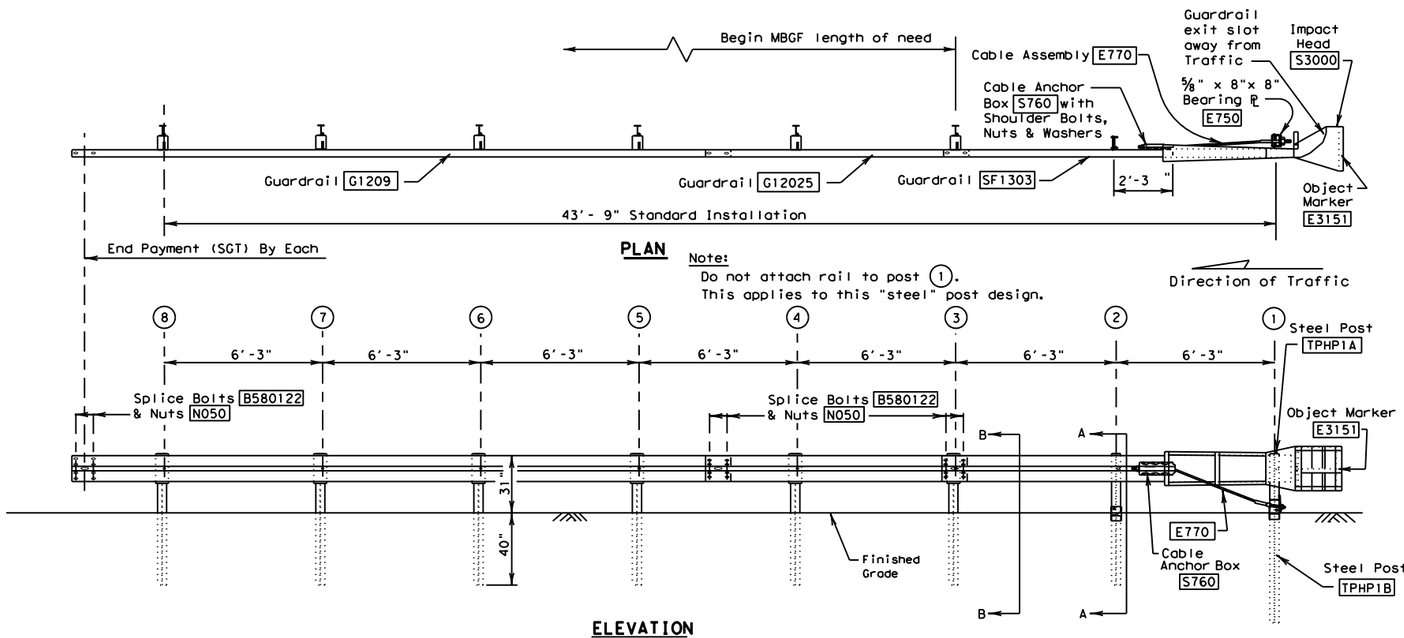
Design Division Standard

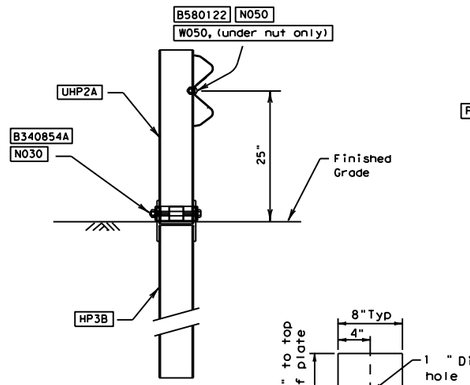
# SINGLE GUARDRAIL TERMINAL (SKT-31) (WOOD POST) SGT(8)31-11

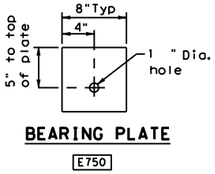
| FILE: sgt83111.dgn | DN: TxDOT | CK: AM | DW: BD | CK: |
|---|---|---|---|---|
| ©TxDOT December 2011 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 75 |

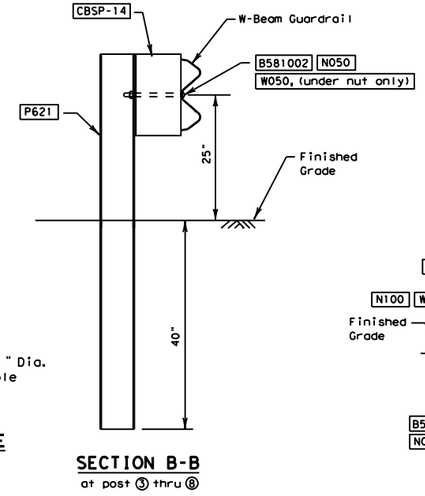
DATE:
FILE:

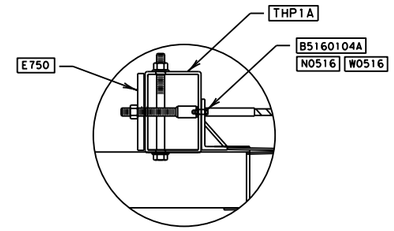
DATE:
FILE:

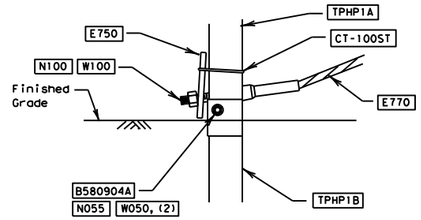


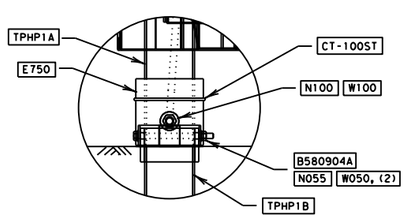




POST #1 CONNECTION DETAILS

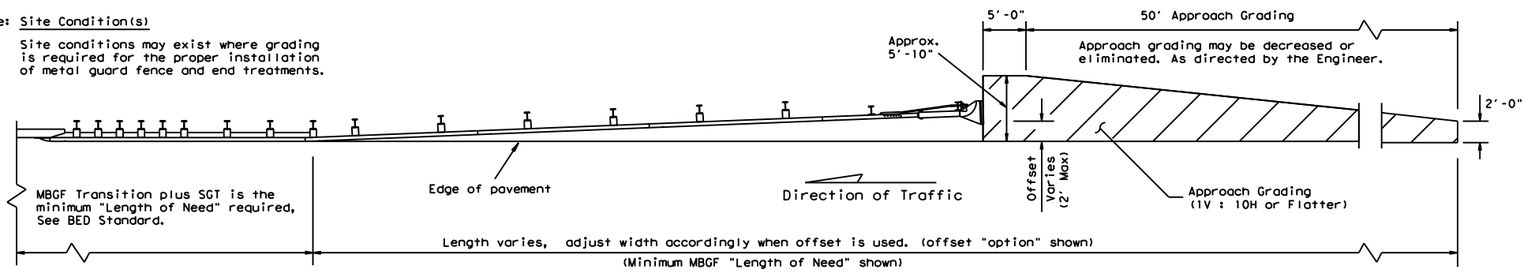
## GENERAL NOTES

1. For additional information contact: Interstate Steel Inc., (432) 263-3725.
2. All bolts, nuts cable assemblies, cable anchors, steel posts & bearing plates shall be galvanized.
3. SGT's placed within the "minimum" 150 ft. radius, shall be installed straight. Standard rail elements may be installed within the radius without special fabrication.
4. A flare rate of 25:1 may be used to prevent the terminal head from encroaching on the shoulder. The flare may be decreased or eliminated for specific installations, if directed by the Engineer.
5. The lower sections of the post shall not protrude more than 4 inches above finished ground. Site grading may be necessary to meet this requirement.
6. The lower section of the steel posts should not be driven with the upper post attached. If the post is placed in a drilled hole, the backfill material must be satisfactorily compacted to prevent settlement.
7. If solid rock is encountered. See manufacturer's installation manual for the proper installation guidance.
8. The breakaway cable assembly must be taut. A locking device, (vice grips or channel lock pliers) should be used to prevent the cable from twisting when tightening the nuts.
9. Hinge bolts shall not be set below finished grade. At curb locations the posts shall be installed at the proper grade elevation behind the curb. The posts will then require field drilling new holes to accommodate the rail to post connection bolt to maintain the proper height of the rail above the gutter pan. The excess post length above the rail will be removed as directed by the Engineer.
10. An object marker shall be installed on the front of the impact head as detailed on D&OM(VIA).
11. A special site evaluation should be considered, prior to using this end treatment where there is less than 25 feet between the outlet side of the end treatment and any adjacent driving lane.

| ITEM NO. | QTY | BILL OF MATERIALS |
|---|---|---|
| S1303 | 1 | GUARDRAIL (12 GA) 12'- 6" SKT Panel |
| G12025 | 1 | GUARDRAIL (12 GA) 9' - 4 ½" |
| G1209 | 1 | GUARDRAIL (12 GA) 25'- 0" |
| TPHP1A | 1 | FIRST POST ASSEMBLY TOP, TUBE |
| TPHP1B | 1 | FIRST POST ASSEMBLY BOTTOM, 6'- 0" |
| UHP2A | 1 | SECOND POST ASSEMBLY TOP |
| HP3B | 1 | SECOND POST ASSEMBLY BOTTOM, 6'- 0" |
| P621 | 6 | STANDARD STEEL LINE POST 6'- 0" (POST 3 THRU 8) |
| E750 | 1 | BEARING PLATE |
| S760 | 1 | CABLE ANCHOR BOX |
| E770 | 1 | BCT CABLE ANCHOR ASSEMBLY |
| CT-100ST | 1 | CABLE TIE - STEEL |
| CBSP-14 | 6 | ROUTED BLOCK |
| S3000 | 1 | IMPACT HEAD |
| B580122 | 25 | ⅝" Dia. x 1 ¼" SPLICE BOLT |
| B580904A | 1 | ⅝" Dia. x 9" HEX BOLT GR. 5 |
| B340854A | 1 | ¾" Dia. x 8 ½" HEX BOLT GR. 5 |
| B581002 | 6 | ⅝" Dia. x 10" H.G.R. BOLT (Post 3 thru 8) |
| N055 | 1 | ⅝" Dia. HEX NUT (Post 1 only) |
| N050 | 31 | ⅝" Dia. H.G.R. NUT (at splices & at Post 1 thru 8) |
| W050 | 9 | H.G.R. WASHER (At Post 2 thru 8) |
| N100 | 2 | 1" ANCHOR CABLE HEX NUT |
| W100 | 2 | 1" ANCHOR CABLE WASHER |
| B5160104A | 2 | ⅝" x 1" HEX BOLT, GR. 5 |
| N0516 | 2 | ⅝" HEX NUT |
| W0516 | 4 | ⅝" WASHER |
| SB58A | 8 | CABLE ANCHOR BOX SHOULDER BOLT |
| N030 | 1 | ¾" HEX NUT |
| N055A | 8 | ½" A325 STR. NUT |
| W050A | 16 | 1 1/16" OD x ⅜" ID A325 STR. WASHER |
| E3151 | 1 | OBJECT MARKER (18" x 18") |

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 AT GUARDRAIL END TREATMENTS

Texas Department of Transportation

Design Division Standard

# SINGLE GUARDRAIL TERMINAL (SKT-31) (STEEL POST)

# SGT(8S)31-11

| FILE: sgt8s311.dgn | DN: TxDOT | CK: AM | DW: BD | CK: |
|---|---|---|---|---|
| ©TxDOT December 2011 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 76 |

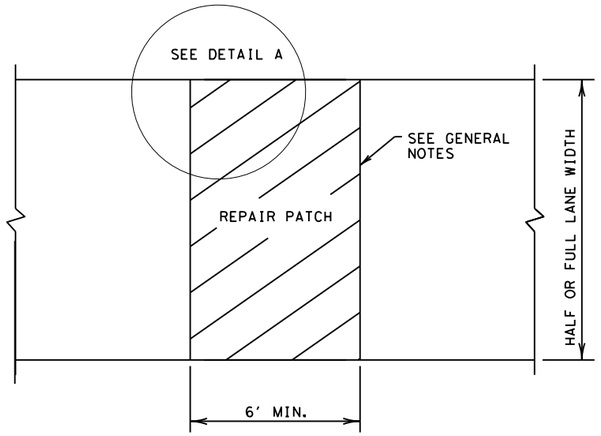
DATE:
FILE:

| TABLE NO.1 STEEL BAR SIZE AND SPACING | | | | | | |
|---|---|---|---|---|---|---|
| TYPE PAVEMENT | SLAB THICKNESS AND BAR SIZE | | LONGITUDINAL* | | TRANSVERSE* | |
| | | | REGULAR BARS | TIEBARS | BARS | TIEBARS |
| | T (IN.) | BAR SIZE | 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 |

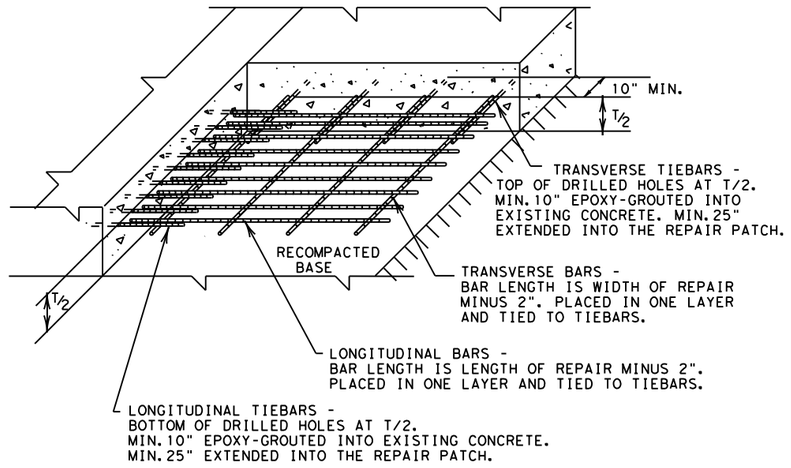
* USE 12" SPACING AS FIRST AND LAST SPACING AT END OR SIDE FOR ALL BARS.

## GENERAL NOTES

1. ITEM 361, "REPAIR OF CONCRETE PAVEMENT" SHALL GOVERN FOR THIS WORK.
2. MULTIPLE PIECE TIEBARS SHALL BE USED WHEN THE REPAIR AREA MUST BE PLACED IN TWO STAGES DUE TO SEQUENCE OF CONSTRUCTION.
3. 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.
4. AT LEAST ONE LONGITUDINAL FULL DEPTH SAW CUT SHALL BE AT AN EXISTING LONGITUDINAL JOINT.
5. 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.
6. THE SAW CUTS WHICH EXTEND OUTSIDE THE AREA OF THE REPAIR WILL BE CLEANED AND FILLED WITH A CEMENTITIOUS GROUT APPROVED BY THE ENGINEER.
7. 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

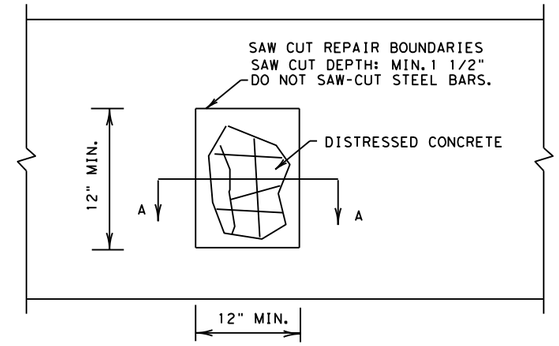



DETAIL A
GROUTED TIEBARS & REINFORCEMENT

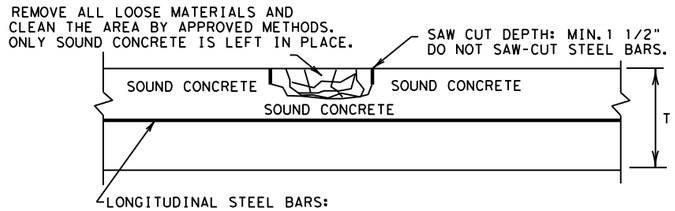
## FULL-DEPTH REPAIR OF CRCP, JRCP, AND CPCD

## GENERAL NOTES

1. ITEM 361, "REPAIR OF CONCRETE PAVEMENT" SHALL GOVERN FOR THIS WORK.
2. THE SAW CUTS WHICH EXTEND OUTSIDE THE AREA OF THE REPAIR WILL BE CLEANED AND FILLED WITH A CEMENTITIOUS GROUT APPROVED BY THE ENGINEER.
3. 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



Texas Department of Transportation

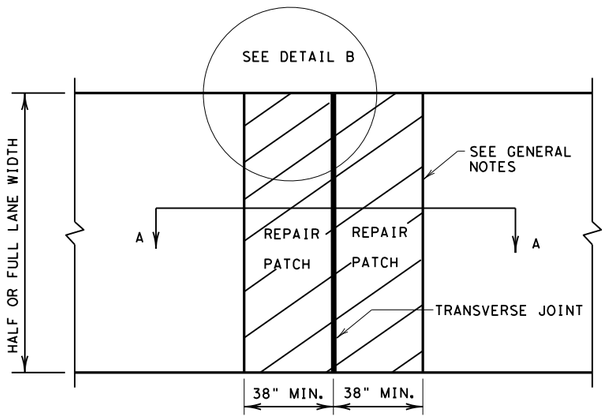
Design Division Standard

# REPAIR OF CONCRETE PAVEMENT

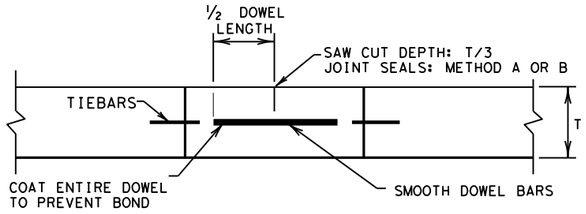
# REPCP-14

| FILE: repcp14.dgn | DN: TxDOT | DN: HC | DW: HC | CK: AN |
|---|---|---|---|---|
| © TxDOT: DECEMBER 2014 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 77 |

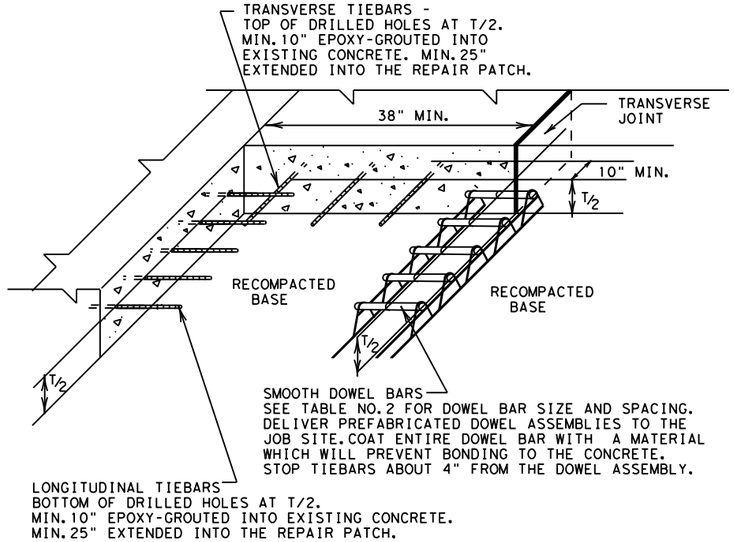
DATE:
FILE:




PLAN VIEW




SECTION A-A




DETAIL B
GROUTED TIEBARS & DOWELS

## GENERAL NOTES

1. ITEM 361, "REPAIR OF CONCRETE PAVEMENT" SHALL GOVERN FOR THIS WORK.
2. MULTIPLE PIECE TIEBARS SHALL BE USED WHEN THE REPAIR AREA MUST BE PLACED IN TWO STAGES DUE TO SEQUENCE OF CONSTRUCTION.
3. 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.
4. AT LEAST ONE LONGITUDINAL FULL DEPTH SAW CUT SHALL BE AT AN EXISTING LONGITUDINAL JOINT.
5. 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.
6. THE SAW CUTS WHICH EXTEND OUTSIDE THE AREA OF THE REPAIR WILL BE CLEANED AND FILLED WITH A CEMENTITIOUS GROUT APPROVED BY THE ENGINEER.
7. EXISTING LONGITUDINAL AND TRANSVERSE JOINTS REMOVED DUE TO REPAIR OPERATION SHOULD BE RESTORED IN ACCORDANCE WITH STANDARD SHEET "CONCRETE PAVING DETAILS, JOINT SEALS."
8. 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.

TABLE NO. 2 DOWELS (SMOOTH BARS)

| PAVEMENT THICKNESS (INCHES) | SIZE AND DIA. | LENGTH (IN.) | SPACING (IN.) |
|---|---|---|---|
| <10 | #8 (1 IN.) | 18.0 | 12.0 |
| ≥10 | #10 (1 1/4 IN.) | | |

# REPAIR OF TRANSVERSE JOINT OF CPCD



Texas Department of Transportation

Design Division Standard

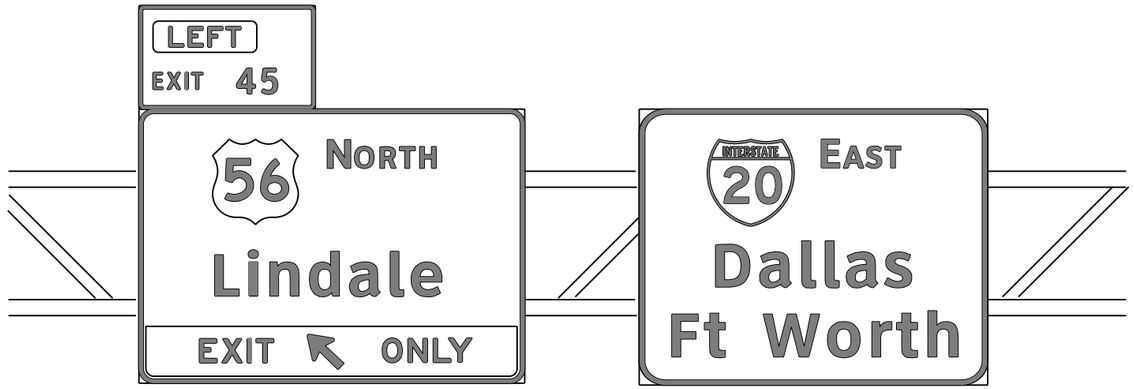
## REPAIR OF CONCRETE PAVEMENT

## REPCP-14

| | | | | | |
|---|---|---|---|---|---|
| FILE: repcp14.dgn | DN: TxDOT | DN: HC | DW: HC | CK: AN | |
| © TxDOT: DECEMBER 2014 | CONT | SECT | JOB | HIGHWAY | |
| REVISIONS | 6367 | 43 | 001 | IH-20 | |
| | DIST | COUNTY | | SHEET NO. | |
| | 10 | SMITH, ETC. | | 78 | |

# REQUIREMENTS FOR OVERHEAD AND LARGE GROUND-MOUNTED SIGNS

TYPICAL EXAMPLES








## GENERAL NOTES

1. Signs to be furnished shall be as detailed elsewhere in the plans and/or as shown on sign summary sheet. Standard sign designs and arrow dimensions can be found in the "Standard Highway Sign Designs for Texas" (SHSD).
2. Black legend shall use the Federal Highway Administration (FHWA) Standard Highway Alphabets (B, C, D, E, Emod, or F).
   White legend shall use the Clearview Alphabet.
   The following Clearview fonts shall be used to replace the existing white FHWA lettering, when not specified in the SHSD or in the plans.

| | |
|---|---|
| B | CV-1W |
| C | CV-2W |
| D | CV-3W |
| E | CV-4W |
| Emod | CV-5WR |
| F | CV-6W |

3. Lateral spacing between letters and numerals shall conform with the SHSD, and any approved changes thereto. Lateral spacing of legend shall provide a balanced appearance when spacing is not shown.
4. Black legend shall be applied by screening process or cut-out acrylic non-reflective black film to background sheeting, or combination thereof.
5. White legend and borders shall be cut-out white sheeting applied to colored background sheeting.
6. Information regarding borders and radii for signs is found in the "Standard Highway Sign Designs for Texas". Dimensions shown and described for borders and corner radii on parent sign are nominal. Borders may vary in width as much as 1/2 inch. Corner radii above 3 inches may vary in width as much as 1 inch. Borders and corner radii within a parent sign must be of matching widths. The sign area outside the corner radius need not be trimmed or rounded if fabricated from an extruded material.
7. Sign substrate for ground-mounted signs shall be any material that meets the Departmental Material Specification requirements of DMS-7110 or approved alternative. Sign substrate for overhead signs shall be any material that meets DMS-7110. Exit Number Panels attached above the parent sign shall be made with the same substrate and sheeting as the parent sign.
8. Mounting details of attachments to parent sign face are shown on Standard Plan Sheet TSR(5). Mounting details of exit number panels above parent sign are shown in the "SMD series" Standard Plan Sheets.
9. Background sheeting shall be applied to the substrate per sheeting manufacturer's recommendations. Sheeting will not be allowed to bridge the horizontal gap between panels.
10. Cut all legend, symbols, borders, and direct applied sign attachments at panel joints.

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

The Standard Highway Sign Designs for Texas (SHSD) can be found at the following website.

http://www.txdot.gov/

| SHEETING REQUIREMENTS | | |
|---|---|---|
| USAGE | COLOR | SIGN FACE MATERIAL |
| BACKGROUND | WHITE | TYPE B OR C SHEETING |
| BACKGROUND | ALL OTHERS | TYPE B OR C SHEETING |
| LEGEND & BORDERS | WHITE | TYPE D SHEETING |
| LEGEND & BORDERS | BLACK | ACRYLIC NON-REFLECTIVE FILM |

Texas Department of Transportation

Traffic Operations Division Standard

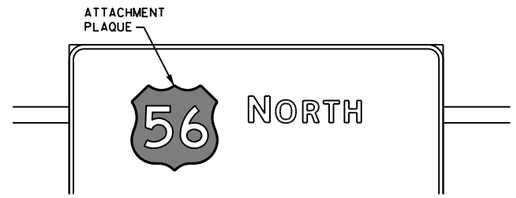
# TYPICAL SIGN REQUIREMENTS

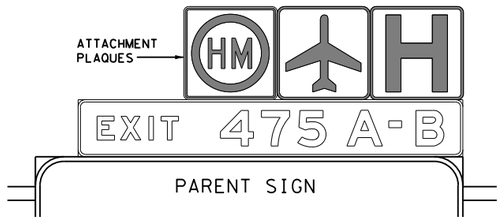
# TSR(1)-13

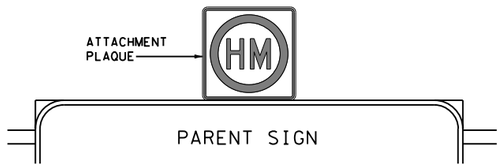
| FILE: tsr1-13.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT October 2003 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 12-03 7-13 | DIST | COUNTY | | SHEET NO. |
| 9-08 | 10 | SMITH, ETC. | | 79 |

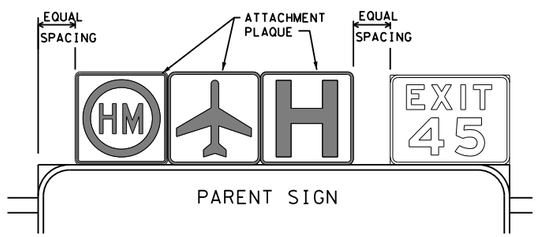
DATE:
FILE:

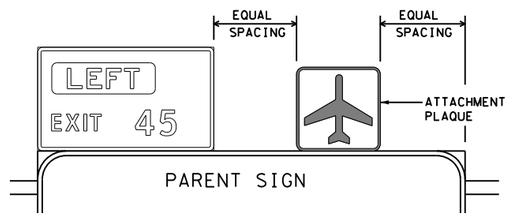
# REQUIREMENTS FOR ATTACHMENTS TO OVERHEAD AND LARGE GROUND MOUNTED SIGNS




TYPICAL EXAMPLES

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

| SHEETING REQUIREMENTS | | |
|---|---|---|
| USAGE | COLOR | SIGN FACE MATERIAL |
| BACKGROUND | ALL | TYPE B OR C SHEETING |
| LEGEND & BORDERS | BLACK | ACRYLIC NON-REFLECTIVE FILM |
| LEGEND & BORDERS | ALL OTHERS | TYPE B OR C SHEETING |

## GENERAL NOTES

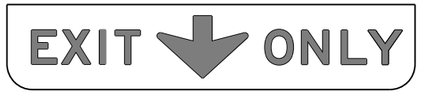
1. Signs to be furnished shall be as detailed elsewhere in the plans and/or as shown on sign tabulation sheet. Standard sign designs and arrow dimensions can be found in the "Standard Highway Sign Designs for Texas" (SHSD).
2. Route Marker legends (ie. IH, US, SH and FM shields) shall use the Federal Highway Administration (FHWA) Standard Highway Alphabets (B, C, D, E, Emod, or F).
3. Lateral spacing between letters and numerals shall conform with the SHSD, and any approved changes thereto. Lateral spacing of legend shall provide a balanced appearance when spacing is not shown.
4. Black legend and borders shall be applied by screening process or cut-out acrylic non-reflective black film to background sheeting, or combination thereof.
5. White legend and borders shall be applied by screening process with transparent colored ink, transparent colored overlay film to white background sheeting or cut-out white sheeting to colored background sheeting, or combination thereof.
6. Colored legend and borders shall be applied by screening process with transparent colored ink, transparent colored overlay film or colored sheeting to white background sheeting, or combination thereof.
7. Route markers and other attachments within the parent sign face shall be direct applied unless otherwise specified in the plans. Attachments not direct applied shall use 0.063 inch thick one piece sheet aluminum signs (Type A).
8. General Service Plaques shall be 0.080 inch thick and Routing Plaques shall be 0.100 inch thick.
9. The priority for Routing Plaques shall be (left to right) Hazardous Material, Airport then Hospital. See examples for mounting location.
10. Mounting details of attachments to parent signs face are shown on Standard Plan Sheet TSR(5). Mounting details of sign plaque attachments above and below parent sign are shown in the "SMD series" Standard Plan Sheets.
11. Plaques shall be horizontally centered at the top of the parent sign. If an exit number panel exists, the plaque shall be centered between the edge of the parent sign and the edge of the exit number panel. The plaque may be placed above the exit number panel when there is insufficient space.


TYPICAL EXAMPLES

# REQUIREMENTS FOR EXIT ONLY AND LEFT EXIT PANELS

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

| SHEETING REQUIREMENTS FOR OVERHEAD EXIT PANELS | | |
|---|---|---|
| USAGE | COLOR | SIGN FACE MATERIAL |
| BACKGROUND | FLUORESCENT YELLOW | TYPE $B_{FL}$ OR $C_{FL}$ SHEETING |
| LEGEND | BLACK | ACRYLIC NON-REFLECTIVE FILM |






TYPICAL EXAMPLES

## GENERAL NOTES

1. Signs to be furnished shall be as detailed elsewhere in the plans and/or as shown on sign tabulation sheet. Standard sign designs and arrow dimensions can be found in the "Standard Highway Sign Designs for Texas" (SHSD). Individual panel sizes shown in the plans may be adjusted to fit actual parent sign sizes if necessary.
2. Exit Panel legend shall use the Federal Highway Administration (FHWA)Standard Highway Alphabets E Series.
3. Lateral spacing between letters and numerals shall conform with the SHSD, and any approved changes thereto. Lateral spacing of legend shall provide a balanced appearance when spacing is not shown.
4. Black legend shall be applied by screening process or cut-out acrylic non-reflective black film to yellow background sheeting, or combination thereof.
5. Exit Only and Left Exit panels within the parent sign face shall be direct applied unless otherwise specified in the plans. Panels not direct applied shall use 0.063 inch thick one piece sheet aluminum signs (Type A).
6. Mounting details of Exit Only and Left Exit panel attachments to parent signs face are shown on Standard Plan Sheet TSR(5).

The Standard Highway Sign Designs for Texas (SHSD) can be found at the following website.

http://www.txdot.gov/

Texas Department of Transportation

Traffic Operations Division Standard

# TYPICAL SIGN REQUIREMENTS

## TSR(2)-13

| FILE: tsr2-13.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT October 2003 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 12-03 7-13 | DIST | COUNTY | | SHEET NO. |
| 9-08 | 10 | SMITH, ETC. | | 80 |

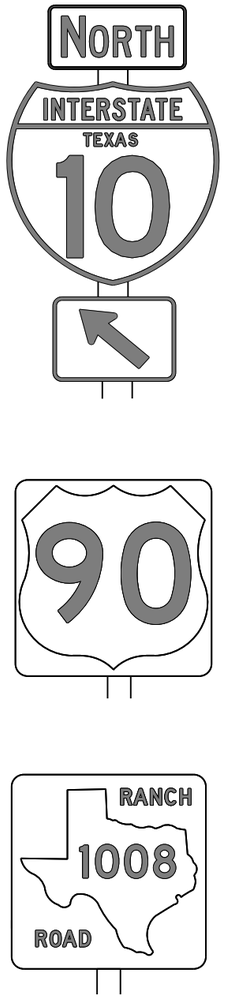
DATE:
FILE:

2

DATE:
FILE:

## REQUIREMENTS FOR INDEPENDENT MOUNTED ROUTE SIGNS

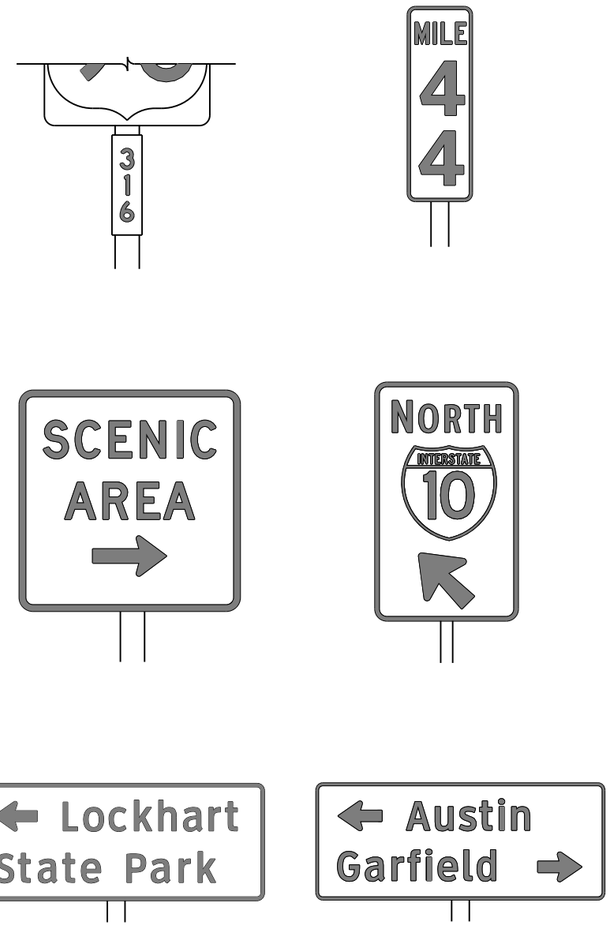
| SHEETING REQUIREMENTS | | |
|---|---|---|
| USAGE | COLOR | SIGN FACE MATERIAL |
| BACKGROUND | WHITE | TYPE A SHEETING |
| BACKGROUND | ALL OTHERS | TYPE B OR C SHEETING |
| LEGEND & BORDERS | WHITE | TYPE A SHEETING |
| LEGEND & BORDERS | BLACK | ACRYLIC NON-REFLECTIVE FILM |
| LEGEND & BORDERS | ALL OTHERS | TYPE B or C SHEETING |




TYPICAL EXAMPLES

## REQUIREMENTS FOR BLUE, BROWN & GREEN D AND I SERIES GUIDE SIGNS

| SHEETING REQUIREMENTS | | |
|---|---|---|
| USAGE | COLOR | SIGN FACE MATERIAL |
| BACKGROUND | ALL | TYPE B OR C SHEETING |
| LEGEND & BORDERS | WHITE | TYPE D SHEETING |
| LEGEND, SYMBOLS & BORDERS | ALL OTHERS | TYPE B OR C SHEETING |




TYPICAL EXAMPLES

## GENERAL NOTES

1. Signs to be furnished shall be as detailed elsewhere in the plans and/or as shown on sign tabulation sheet. Standard sign designs and arrow dimensions can be found in the "Standard Highway Sign Designs for Texas" (SHSD).

2. White legend shall use the Clearview Alphabet. The following Clearview fonts shall be used to replace the existing white Federal Highway Administration (FHWA) Standard Highway Alphabets, when not specified in the SHSD, or in the plans.

| | |
|---|---|
| B | CV-1W |
| C | CV-2W |
| D | CV-3W |
| E | CV-4W |
| Emod | CV-5WR |
| F | CV-6W |

3. Route sign legend (ie. IH, US, SH and FM shields) shall use the Federal Highway Administration (FHWA) Standard Highway Alphabets B, C, D, E, Emod or F).

4. Lateral spacing between letters and numerals shall conform with the SHSD, and any approved changes thereto. Lateral spacing of legend shall provide a balanced appearance when spacing is not shown.

5. Independent mounted route sign with white or colored legend and borders shall be applied by screening process with transparent color ink, transparent colored overlay film to white background sheeting or cut-out white sheeting to colored background sheeting, or combination thereof. White legend, symbols and borders on all other signs shall be cut-out white sheeting applied to colored background sheeting.

6. Information regarding borders and radii for signs is found in the "Standard Highway Sign Designs for Texas". Dimensions shown and described for borders and corner radii on parent sign are nominal. Borders may vary in width as much as 1/2 inch. Corner radii above 3 inches may vary in width as much as 1 inch. Borders and corner radii within a parent sign must be of matching widths. The sign area outside the corner radius should be trimmed or rounded.

7. Sign substrate shall be any material that meets the Departmental Material Specification requirements of DMS-7110 or approved alternative.

8. Mounting details of roadside signs are shown in the "SMD series" Standard Plan Sheets.

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

| ALUMINUM SIGN BLANKS THICKNESS | |
|---|---|
| Square Feet | Minimum Thickness |
| Less than 7.5 | 0.080 |
| 7.5 to 15 | 0.100 |
| Greater than 15 | 0.125 |

The Standard Highway Sign Designs for Texas (SHSD) can be found at the following website.

http://www.txdot.gov/

Texas Department of Transportation

Traffic Operations Division Standard

# TYPICAL SIGN REQUIREMENTS

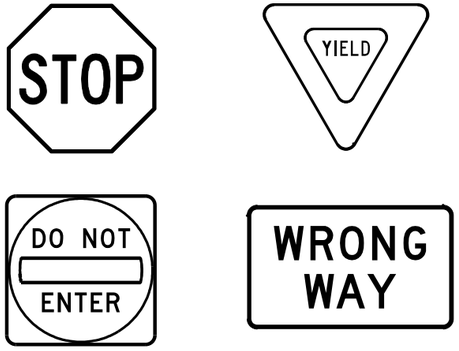
## TSR(3)-13

| FILE: tsr3-13.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT October 2003 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 12-03 7-13 | DIST | COUNTY | | SHEET NO. |
| 9-08 | 10 | SMITH, ETC. | | 81 |

DATE:
FILE:

## REQUIREMENTS FOR RED BACKGROUND REGULATORY SIGNS

**(STOP, YIELD, DO NOT ENTER AND WRONG WAY SIGNS)**




REQUIREMENTS FOR FOUR SPECIFIC SIGNS ONLY

| SHEETING REQUIREMENTS | | |
|---|---|---|
| USAGE | COLOR | SIGN FACE MATERIAL |
| BACKGROUND | RED | TYPE B OR C SHEETING |
| BACKGROUND | WHITE | TYPE B OR C SHEETING |
| LEGEND & BORDERS | WHITE | TYPE B OR C SHEETING |
| LEGEND | RED | TYPE B OR C SHEETING |

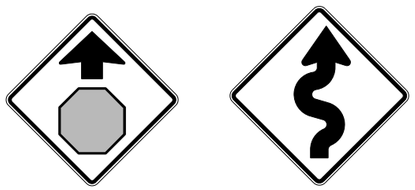
## REQUIREMENTS FOR WHITE BACKGROUND REGULATORY SIGNS

**(EXCLUDING STOP, YIELD, DO NOT ENTER AND WRONG WAY SIGNS)**


TYPICAL EXAMPLES

| SHEETING REQUIREMENTS | | |
|---|---|---|
| USAGE | COLOR | SIGN FACE MATERIAL |
| BACKGROUND | WHITE | TYPE A SHEETING |
| BACKGROUND | ALL OTHERS | TYPE B OR C SHEETING |
| LEGEND, BORDERS AND SYMBOLS | BLACK | ACRYLIC NON-REFLECTIVE FILM |
| LEGEND, BORDERS AND SYMBOLS | ALL OTHER | TYPE B OR C SHEETING |

## REQUIREMENTS FOR WARNING SIGNS



TYPICAL EXAMPLES

| SHEETING REQUIREMENTS | | |
|---|---|---|
| USAGE | COLOR | SIGN FACE MATERIAL |
| BACKGROUND | FLOURESCENT YELLOW | TYPE $B_{FL}$ OR $C_{FL}$ SHEETING |
| LEGEND & BORDERS | BLACK | ACRYLIC NON-REFLECTIVE FILM |
| LEGEND & SYMBOLS | ALL OTHER | TYPE B OR C SHEETING |

## REQUIREMENTS FOR SCHOOL SIGNS


TYPICAL EXAMPLES

| SHEETING REQUIREMENTS | | |
|---|---|---|
| USAGE | COLOR | SIGN FACE MATERIAL |
| BACKGROUND | WHITE | TYPE A SHEETING |
| BACKGROUND | FLOURESCENT YELLOW GREEN | TYPE $B_{FL}$ OR $C_{FL}$ SHEETING |
| LEGEND, BORDERS AND SYMBOLS | BLACK | ACRYLIC NON-REFLECTIVE FILM |
| SYMBOLS | RED | TYPE B OR C SHEETING |

## GENERAL NOTES

1. Signs to be furnished shall be as detailed elsewhere in the plans and/or as shown on sign tabulation sheet. Standard sign designs and arrow dimensions can be found in the "Standard Highway Sign Designs for Texas" (SHSD).
2. Sign legend shall use the Federal Highway Administration (FHWA) Standard Highway Alphabets (B, C, D, E, Emod or F).
3. Lateral spacing between letters and numerals shall conform with the SHSD, and any approved changes thereto. Lateral spacing of legend shall provide a balanced appearance when spacing is not shown.
4. Black legend and borders shall be applied by screening process or cut-out acrylic non-reflective black film to background sheeting, or combination thereof.
5. White legend and borders shall be applied by screening process with transparent colored ink, transparent colored overlay film to white background sheeting or cut-out white sheeting to colored background sheeting, or combination thereof.
6. Colored legend shall be applied by screening process with transparent colored ink, transparent colored overlay film or colored sheeting to background sheeting, or combination thereof.
7. Sign substrate shall be any material that meets the Departmental Material Specification requirements of DMS-7110 or approved alternative.
8. Mounting details for roadside mounted signs are shown in the "SMD series" Standard Plan Sheets.

| ALUMINUM SIGN BLANKS THICKNESS | |
|---|---|
| Square Feet | Minimum Thickness |
| Less than 7.5 | 0.080 |
| 7.5 to 15 | 0.100 |
| Greater than 15 | 0.125 |

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

The Standard Highway Sign Designs for Texas (SHSD) can be found at the following website.

http://www.txdot.gov/

Texas Department of Transportation

*Traffic Operations Division Standard*

# TYPICAL SIGN REQUIREMENTS

# TSR(4)-13

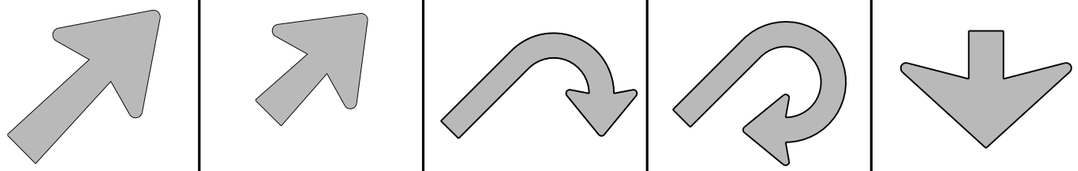
| FILE: tsr4-13.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| © TxDOT October 2003 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 12-03 7-13 | DIST | COUNTY | | SHEET NO. |
| 9-08 | 10 | SMITH, ETC. | | 82 |

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:
FILE:

# ARROW DETAILS

for Large Ground-Mounted and Overhead Guide Signs




| TYPE | LETTER SIZE | USE |
|---|---|---|
| A-1 | 10.67" U/L and 10" Caps | Single Lane Exits |
| A-2 | 13.33" U/L and 12" Caps | |
| A-3 | 16" & 20" U/L | |
| B-1 | 10.67" U/L and 10" Caps | Multiple Lane Exits |
| B-2 | 13.33" U/L and 12" Caps | |
| B-3 | 16" & 20" U/L | |

| CODE | USED ON SIGN NO. |
|---|---|
| E-3 | E5-1aT |
| E-4 | E5-1bT |

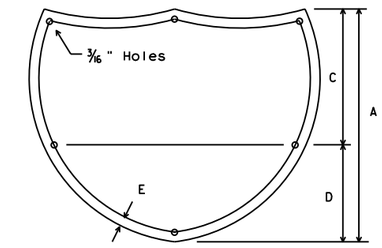
**NOTE**

Arrow dimensions are shown in the "Standard Highway Sign Designs for Texas" manual.

The Standard Highway Sign Designs for Texas (SHSD) can be found at the following website.

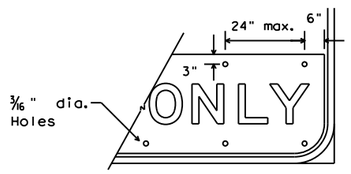
http://www.txdot.gov/

# SIGN BLANK PUNCHING DETAILS FOR ATTACHMENTS WHEN SPECIFIED TO BE TYPE A ALUMINUM SIGNS (FOR MOUNTING TO GUIDE SIGN FACE)

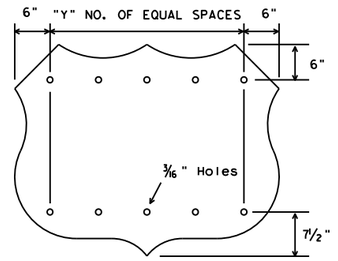



INTERSTATE ROUTE MARKERS

| A | C | D | E |
|---|---|---|---|
| 36 | 21 | 15 | 1 1/2 |
| 48 | 28 | 20 | 1 3/4 |

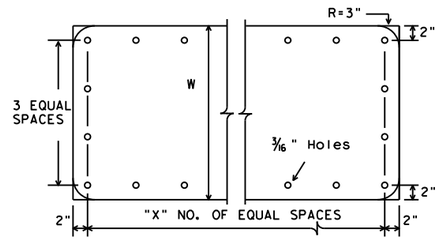



EXIT ONLY PANEL




U.S. ROUTE MARKERS

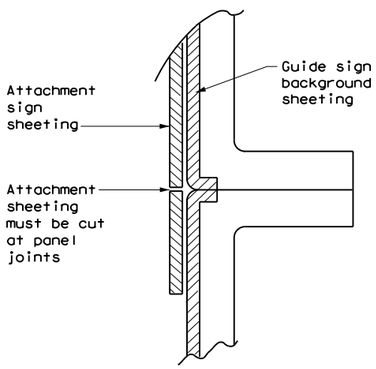
| Sign Size | "Y" |
|---|---|
| 24x24 | 2 |
| 30x24 | 3 |
| 36x36 | 3 |
| 45x36 | 4 |
| 48x48 | 4 |
| 60x48 | 5 |




STATE ROUTE MARKERS

| No. of Digits | W | X |
|---|---|---|
| 4 | 24 | 4 |
| 4 | 36 | 5 |
| 4 | 48 | 6 |
| 3 | 24 | 3 |
| 3 | 36 | 4 |
| 3 | 48 | 5 |

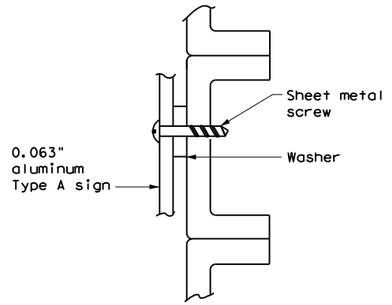
# MOUNTING DETAILS OF ATTACHMENTS TO GUIDE SIGN FACE ("EXIT ONLY" AND "LEFT EXIT" PANELS, ROUTE MARKERS AND OTHER ATTACHMENTS)



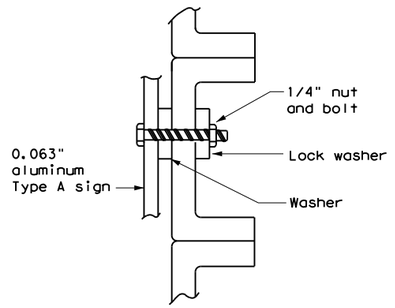

DIRECT APPLIED ATTACHMENT

**NOTE:**

1. Sheeting for legend, symbols, and borders must be cut at panel joints.
2. Direct applied attachment signs will be subsidiary to "Aluminum Signs" or "Fiberglass Signs".




SCREW ATTACHMENT



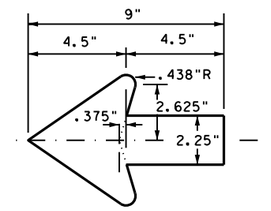

NUT/BOLT ATTACHMENT

**NOTE:**

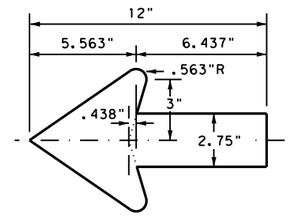
Furnish Type A aluminum sign attachments only when specified in the plans. These signs will be paid for under "Aluminum Signs".

# ARROW DETAILS

for Destination Signs (Type D)




Standard arrow to be used with 6 inch letters.




Standard arrow to be used with 8 inch letters.

Texas Department of Transportation

*Traffic Operations Division Standard*

# TYPICAL SIGN REQUIREMENTS

## TSR(5)-13

| FILE: tsr5-13.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT October 2003 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 12-03 7-13 | DIST | COUNTY | | SHEET NO. |
| 9-08 | 10 | SMITH, ETC. | | 83 |

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

# SIGN SUPPORT DESCRIPTIVE CODES

(Descriptive Codes correspond to project estimate and quantities sheets)

SM RD SGN ASSM TY XXXXX(X)XX(X-XXXX)

**Post Type**

FRP = Fiberglass Reinforced Plastic Pipe (see SMD(FRP))
TWT = Thin-Walled Tubing (see SMD(TWT))
10BWG = 10 BWG Tubing (see SMD(SLIP-1) to (SLIP-3))
S80 = Schedule 80 Pipe (see SMD(SLIP-1) to (SLIP-3))

**Number of Posts (1 or 2)**

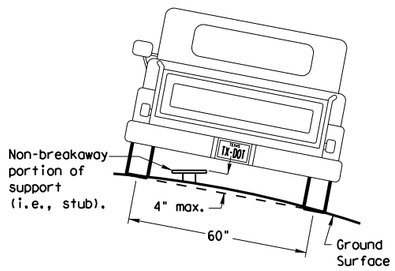
**Anchor Type**

UA = Universal Anchor - Concreted (see SMD(FRP) and (TWT))
UB = Universal Anchor - Bolted down (see SMD(FRP) and (TWT))
WS = Wedge Anchor Steel - (see SMD(TWT))
WP = Wedge Anchor Plastic (see SMD(TWT))
SA = Slipbase - Concreted (see SMD(SLIP-1) to (SLIP-3))
SB = Slipbase - Bolted Down (see SMD(SLIP-1) to (SLIP-3))

**Sign Mounting Designation**

P = Prefab. "Plain" (see SMD(SLIP-1) to (SLIP-3), (TWT), (FRP))
T = Prefab. "T" (see SMD(SLIP-1) to (SLIP-3), (TWT))
U = Prefab. "U" (see SMD(SLIP-1) to (SLIP-3))
IF REQUIRED
1EXT or 2EXT = Number of Extensions (see SMD(SLIP-1) to (SLIP-3), (TWT))
BM = Extruded Wind Beam (see SMD(SLIP-1) to (SLIP-3))
WC = 1.12 #/ft Wing Channel (see SMD(SLIP-1) to (SLIP-3))
EXAL = Extruded Aluminum Sign Panels (see SMD(SLIP-1) to (SLIP-3))

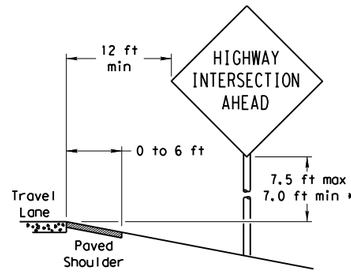
# REQUIRED CLEARANCE FOR BREAKAWAY SUPPORT




To avoid vehicle undercarriage snagging, any substantial remains of a breakaway support, when it is broken away, should not project more than 4 inches above a 60-inch chord (i.e., typical space between wheel paths).

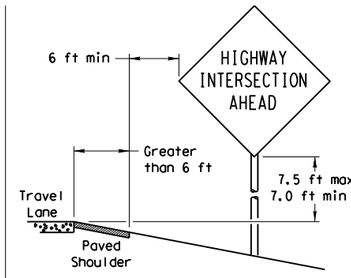
# SIGN LOCATION

## PAVED SHOULDERS




**LESS THAN 6 FT. WIDE**

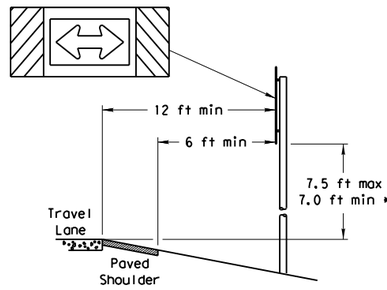
When the shoulder is 6 ft. or less in width, the sign must be placed at least 12 ft. from the edge of the travel lane.



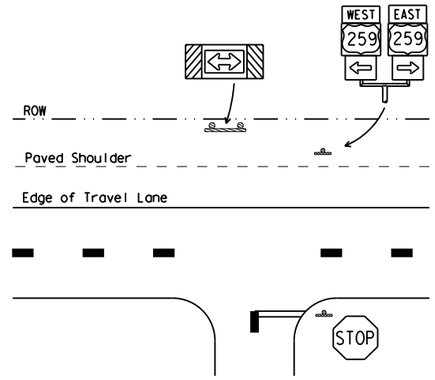

**GREATER THAN 6 FT. WIDE**

When the shoulder is greater than 6 ft in width, the sign must be placed at least 6 ft. from the edge of the shoulder.

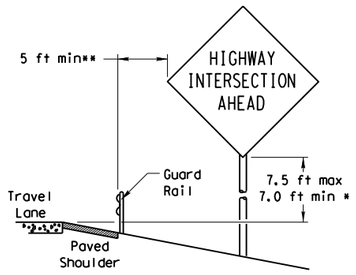
## T-INTERSECTION



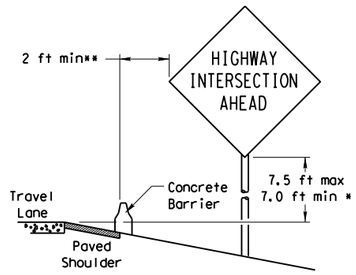

When this sign is needed at the end of a two-lane, two way roadway, the right edge of the sign should be in line with the centerline of the roadway. Place as close to ROW as practical.




## BEHIND BARRIER



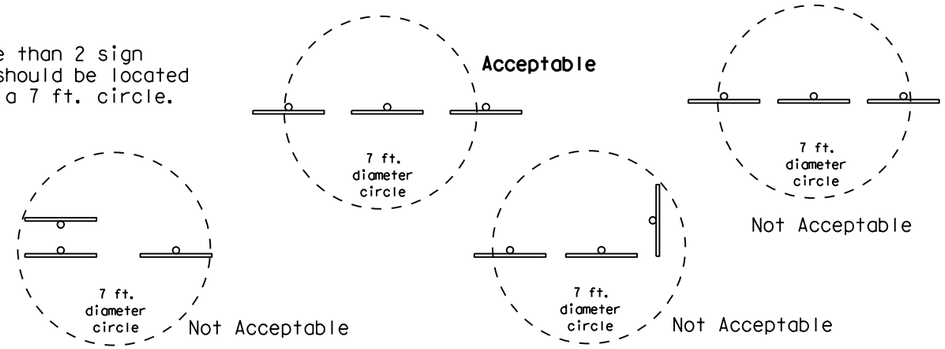

**BEHIND GUARDRAIL**




**BEHIND CONCRETE BARRIER**

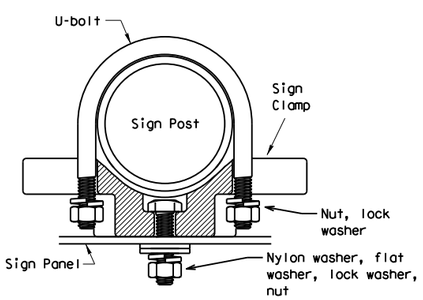
**Sign clearance based on distance required for proper guard rail or concrete barrier performance.

No more than 2 sign posts should be located within a 7 ft. circle.




# TYPICAL SIGN ATTACHMENT DETAIL

## Single Signs

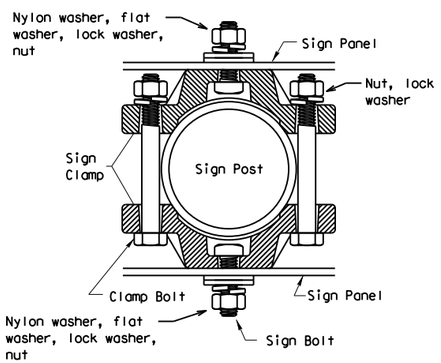



Bolts used to mount sign panels to the clamp are 5/16-18 UNC galvanized square head with nut, nylon washer, flat washer and lock washer. The bolt length is 1 inch for aluminum.

When two sign clamps are used to mount signs back-to-back, use a 5/16-18 UNC galvanized hex head per ASTM A307 with nut and helical-spring lock washer. The approximate bolt lengths for various post sizes and sign clamp types are given in the table at right. The bolt length may need to be adjusted depending upon field conditions.

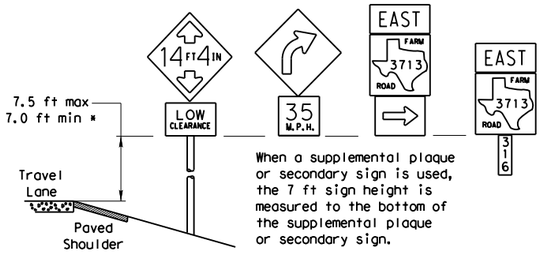
Sign clamps may be either the specific size clamp or the universal clamp.

## Back-to-Back Signs



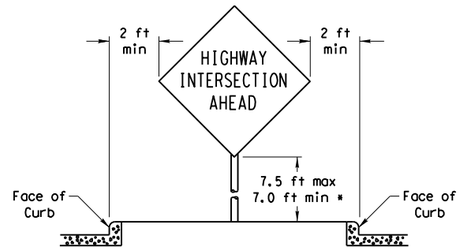

| Pipe Diameter | Approximate Bolt Length | |
|---|---|---|
| | Specific Clamp | Universal Clamp |
| 2" nominal | 3" | 3 or 3 1/2" |
| 2 1/2" nominal | 3 or 3 1/2" | 3 1/2 or 4" |
| 3" nominal | 3 1/2 or 4" | 4 1/2" |

## SIGNS WITH PLAQUES



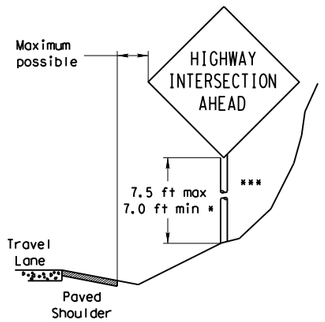

When a supplemental plaque or secondary sign is used, the 7 ft sign height is measured to the bottom of the supplemental plaque or secondary sign.

## CURB & GUTTER OR RAISED ISLAND




## RESTRICTED RIGHT-OF-WAY

**(When 6 ft min. is not possible.)**




Right-of-way restrictions may be created by rocks, water, vegetation, forest, buildings, a narrow island, or other factors.

In situations where a lateral restriction prevents the minimum horizontal clearance from the edge of the travel lane, signs should be placed as far from the travel lane as practical.

*** Post may be shorter if protected by guardrail or if Engineer determines the post could not be hit due to extreme slope.

* 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

Texas Department of Transportation
Traffic Operations Division

# SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS GENERAL NOTES & DETAILS

## SMD(GEN)-08



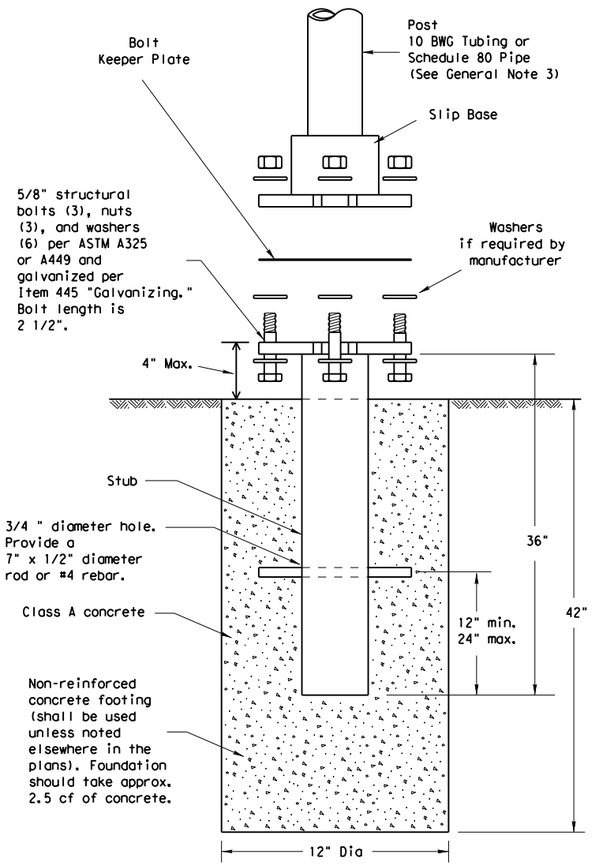
REVISIONS
9-08

| DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|

| CONT | SECT | JOB | HIGHWAY |
|---|---|---|---|
| 6367 | 43 | 001 | IH-20 |
| DIST | COUNTY | | SHEET NO. |
| 10 | SMITH, ETC. | | 84 |

DATE:
FILE:

# TRIANGULAR SLIPBASE INSTALLATION GENERAL REQUIREMENTS




SM RD SGN ASSM TY XXXXX(X)SA(X-XXXX)

**NOTE**

**There are various devices approved for the Triangular Slipbase System. Please reference the Material Producer List for approved slip base systems. http://www.txdot.gov/business/producer_list.htm The devices shall be installed per manufacturers' recommendations. Installation procedures shall be provided to the Engineer by Contractor.**

GENERAL NOTES:

1. Slip base shall be permanently marked to indicate manufacturer. Method, design, and location of marking are subject to approval of the TxDOT Traffic Standards Engineer.
2. Material used as post with this system shall conform to the following specifications:
   10 BWG Tubing (2.875" outside diameter)
   - 0.134" nominal wall thickness
   - Seamless or electric-resistance welded steel tubing or pipe
   - Steel shall be HSLAS Gr 55 per ASTM A1011 or ASTM A1008
   - Other steels may be used if they meet the following:
     - 55,000 PSI minimum yield strength
     - 70,000 PSI minimum tensile strength
     - 20% minimum elongation in 2"
   - Wall thickness (uncoated) shall be within the range of 0.122" to 0.138"
   - Outside diameter (uncoated) shall be within the range of 2.867" to 2.883"
   - Galvanization per ASTM A123 or ASTM A653 G210. For precoated steel tubing (ASTM A653), recoat tube outside diameter weld seam by metallizing with zinc wire per ASTM B833.

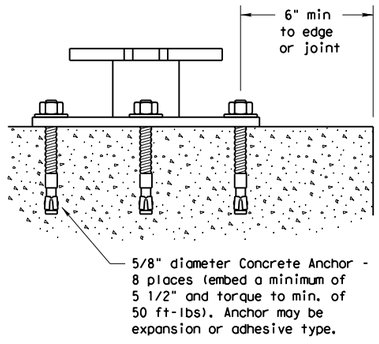
   Schedule 80 Pipe (2.875" outside diameter)
   - 0.276" nominal wall thickness
   - Steel tubing per ASTM A500 Gr C
   - Other seamless or electric-resistance welded steel tubing or pipe with equivalent outside diameter and wall thickness may be used if they meet the following:
     - 46,000 PSI minimum yield strength
     - 62,000 PSI minimum tensile strength
     - 21% minimum elongation in 2"
   - Wall thickness (uncoated) shall be within the range of 0.248" to 0.304"
   - Outside diameter (uncoated) shall be within the range of 2.855" to 2.895"
   - Galvanization per ASTM A123
3. See the Traffic Operations Division website for detailed drawings of sign clamps and Texas Universal Triangular Slipbase System components. The website address is: http://www.txdot.gov/publications/traffic.htm
4. Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.

ASSEMBLY PROCEDURE

Foundation
1. Prepare 12-inch diameter by 42-inch deep hole. If solid rock is encountered, the depth of the foundation may be reduced such that it is embedded a minimum of 18 inches into the solid rock.
2. The Engineer may permit batches of concrete less than 2 cubic yards to be mixed with a portable, motor-driven concrete mixer. For small placements less than 0.5 cubic yards, hand mixing in a suitable container may be allowed by Engineer. Concrete shall be Class A.
3. Push the pipe end of the slip base stub into the center of the concrete. Rotate the stub back and forth while pushing it down into the concrete to assure good contact between the concrete and stub. Continue to work the stub into the concrete until it is between 2 to 4 inches above the ground.
4. Plumb the stub. Allow a minimum of 4 days to set, unless otherwise directed by the Engineer.
5. The triangular slipbase system is multidirectional and is designed to release when struck from any direction.

Support
1. Cut support so that the bottom of the sign will be 7 to 7.5 feet above the edge of the travelway (i.e., edge of the closest lane) when slip plate is below the edge of pavement or 7 to 7.5 feet above slip plate when the slip plate is above the edge of the travelway. The cut shall be plumb and straight.
2. Attach sign to support using connections shown. When multiple signs are installed on the same support, ensure the minimum clearance between each sign is maintained. See SMD(SLIP-2) for clearances based on sign types.

## CONCRETE ANCHOR




SM RD SGN ASSM TY XXXXX(X)SB(X-XXXX)

Concrete anchor consists of 5/8" diameter stud bolt with UNC series bolt threads on the upper end. Heavy hex nut per ASTM A563, and hardened washer per ASTM F436. The stud bolt shall have a minimum yield and ultimate tensile strength of 50 and 75 KSI, respectively. Nuts, bolts and washers shall be galvanized per Item 445, "Galvanizing." Adhesive type anchors shall have stud bolts installed with Type III epoxy per DMS-6100, "Epoxies and Adhesives." Adhesive anchors may be loaded after adequate epoxy cure time per the manufacturer's recommendations. Top of bolt shall extend at least flush with top of the nut when installed. The anchor, when installed in 4000 psi normal-weight concrete with a 5 1/2" minimum embedment, shall have a minimum allowable tension and shear of 3900 and 3100 psi, respectively.

Texas Department of Transportation
*Traffic Operations Division*

# SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS TRIANGULAR SLIPBASE SYSTEM

## SMD(SLIP-1)-08



| DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|

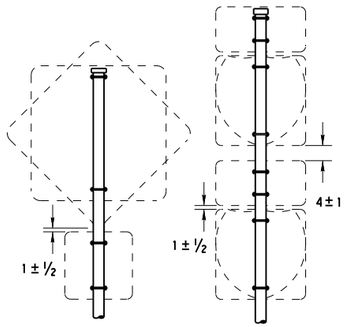
REVISIONS
9-08

| CONT | SECT | JOB | HIGHWAY |
|---|---|---|---|
| 6367 | 43 | 001 | IH-20 |

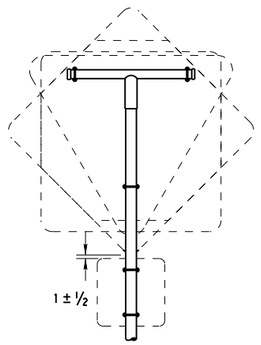
| DIST | COUNTY | SHEET NO. |
|---|---|---|
| 10 | SMITH, ETC. | 85 |

DATE:
FILE:

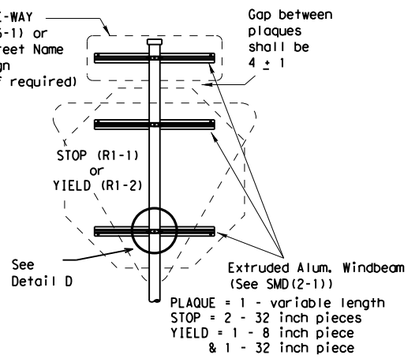
DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.



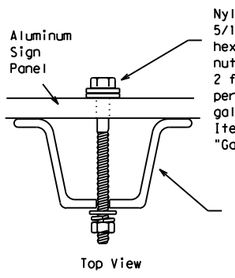

SM RD SGN ASSM TY XXXXX(1)XX(P)



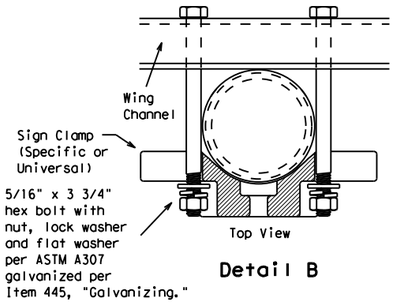

SM RD SGN ASSM TY XXXXX(1)XX(T)



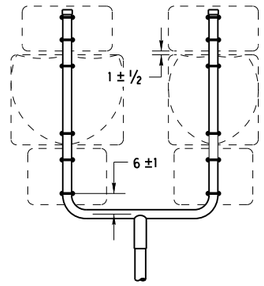

SM RD SGN ASSM TY XXXXX(1)XX(P-BM)



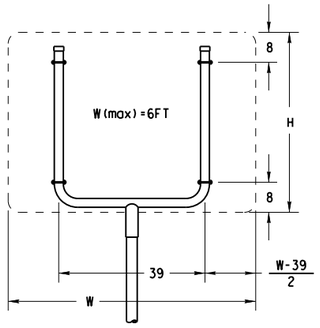

**Detail A**



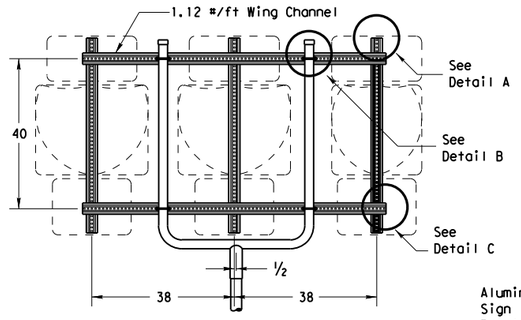

**Detail B**



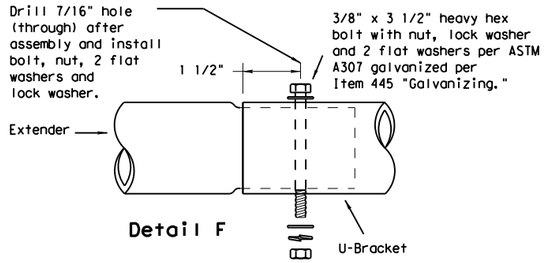

SM RD SGN ASSM TY XXXXX(1)XX(U)




SM RD SGN ASSM TY XXXXX(1)XX(U)

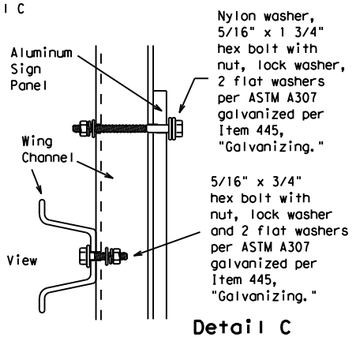



SM RD SGN ASSM TY XXXXX(1)XX(U-WC)
(See Note 11)

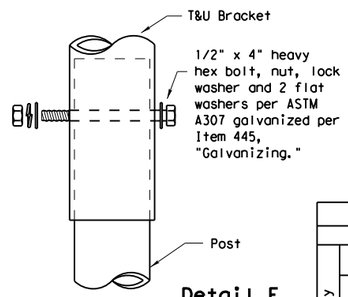



**Detail F**

Splices shall only be allowed behind the sign substrate.




**Detail C**



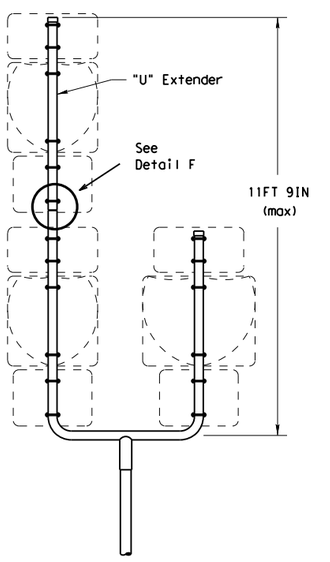

**Detail E**

**GENERAL NOTES:**

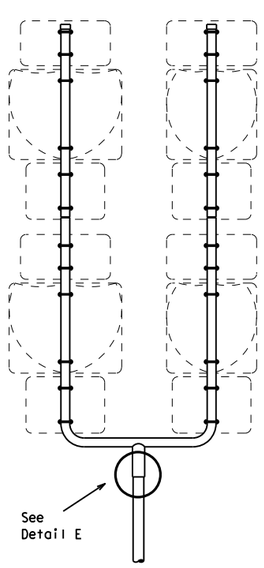
1.

| SIGN SUPPORT | # OF POSTS | MAX. SIGN AREA |
|---|---|---|
| 10 BWG | 1 | 16 SF |
| 10 BWG | 2 | 32 SF |
| Sch 80 | 1 | 32 SF |
| Sch 80 | 2 | 64 SF |

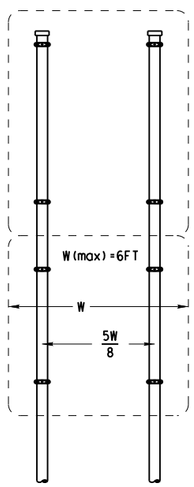
2. The Engineer may require that a Schedule 80 post be used in place of a 10 BWG where a sign height is abnormally high due to a fill slope.
3. Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.
4. Aluminum sign blanks shall conform to Departmental Material Specifications DMS-7110 and shall have the following minimum thicknesses: 0.080 for signs less than 7.5 sq. ft., 0.100 for signs 7.5 to 15 sq. ft., and 0.125 for signs greater than 15 sq. ft.
5. Signs that require specific supports due to reasons in addition to windloading are indicated on the "REQUIRED SUPPORT" table on this sheet.
6. For horizontal rectangular signs fabricated from flat aluminum, T-brackets are used for signs 24 inches or less in height. U-brackets are used for signs of greater height.
7. When two triangular slipbase supports are used to support a single sign, they shall not be "rigidly" connected to each other except through the sign panel. This will allow each support to act independently when impacted by an errant vehicle.
8. Wing channel shall meet ASTM A 1011 SS Gr 50 and be galvanized per ASTM A 123.
9. Excess pipe, wing channel, or windbeam shall be cut off so that it does not extend beyond the sign panel (i.e., excess support shall not be visible when the sign is viewed from the front.) Repair galvanized coating at cut support ends per Item 445, "Galvanizing."
10. Additional route markers may be added vertically, provided the total sign area does not exceed the maximum allowable amount per Note 1.
11. Additional sign clamp required on the "T-bracket" post for 24 inch height signs. Place the clamp 3 inches above bottom of sign when possible.
12. Post open ends shall be fitted with Friction Caps.
13. Sign blanks shall be the sizes and shapes shown on the plans.



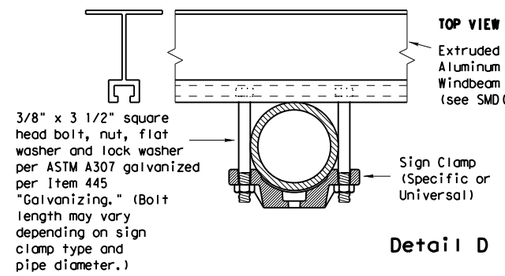

SM RD SGN ASSM TY S80(1)XX(U-1EXT)



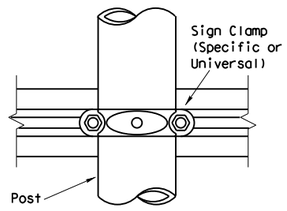

SM RD SGN ASSM TY S80(1)XX(U-2EXT)



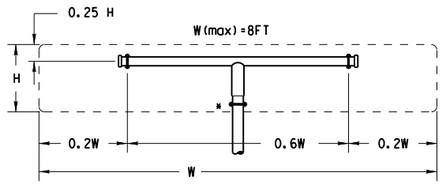

SM RD SGN ASSYM TY XXXXX(2)XX(P)




**Detail D**



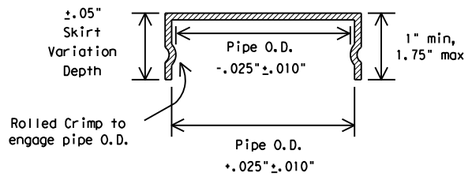

| REQUIRED SUPPORT | | |
|---|---|---|
| | SIGN DESCRIPTION | SUPPORT |
| Regulatory | 48-inch STOP sign (R1-1) | TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM) |
| | 60-inch YIELD sign (R1-2) | TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM) |
| | 48x16-inch ONE-WAY sign (R6-1) | TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM) |
| | 36x48, 48x36, and 48x48-inch signs | TY 10BWG(1)XX(T) |
| | 48x60-inch signs | TY S80(1)XX(T) |
| Warning | 48x48-inch signs (diamond or square) | TY 10BWG(1)XX(T) |
| | 48x60-inch signs | TY S80(1)XX(T) |
| | 48-inch Advance School X-ing sign (S1-1) | TY 10BWG(1)XX(T) |
| | 48-inch School X-ing sign (S2-1) | TY 10BWG(1)XX(T) |
| | Large Arrow sign (W1-6 & W1-7) | TY 10BWG(1)XX(T) |




All dimensions are in english unless detailed otherwise.

SM RD SGN ASSM TY XXXXX(1)XX(T)
(* - See Note 12)

## FRICTION CAP DETAIL




Friction caps may be manufactured from hot rolled or cold rolled steel sheets. The minimum sheet metal thickness shall be 24 gauge for all cap sizes.

The rim edges shall be reasonably straight and smooth. Caps shall be sized and formed in such a manner as to produce a drive-on friction fit and have no tendency to rock when seated on the pipe. The depth shall be sufficient to give positive protection against entrance of rainwater. They shall be free of sharp creases or indentations and show no evidence of metal fracture.

Caps shall have an electrodeposited coating of zinc in accordance with the requirements of ASTM B633 Class FE/ZN 8.

Texas Department of Transportation
Traffic Operations Division

# SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS TRIANGULAR SLIPBASE SYSTEM

## SMD(SLIP-2)-08



| DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|

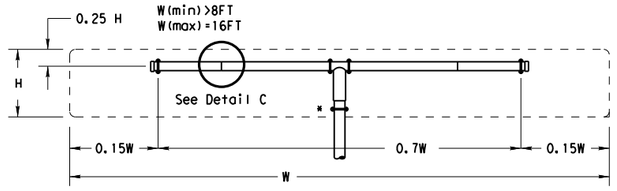
9-08 REVISIONS

| CONT | SECT | JOB | HIGHWAY |
|---|---|---|---|
| 6367 | 43 | 001 | IH-20 |

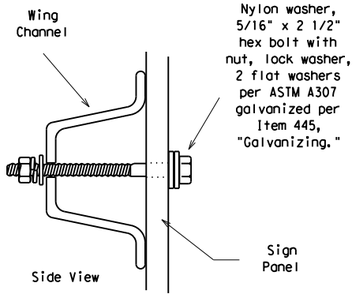
| DIST | COUNTY | SHEET NO. |
|---|---|---|
| 10 | SMITH, ETC. | 86 |

DATE:
FILE:

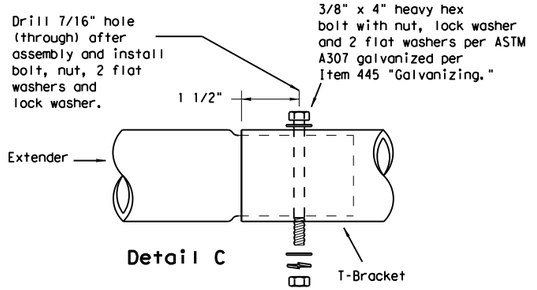
DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.




SM RD SGN ASSM TY XXXXX(1)XX(T-2EXT)
(* - See Note 12)




**Detail B**



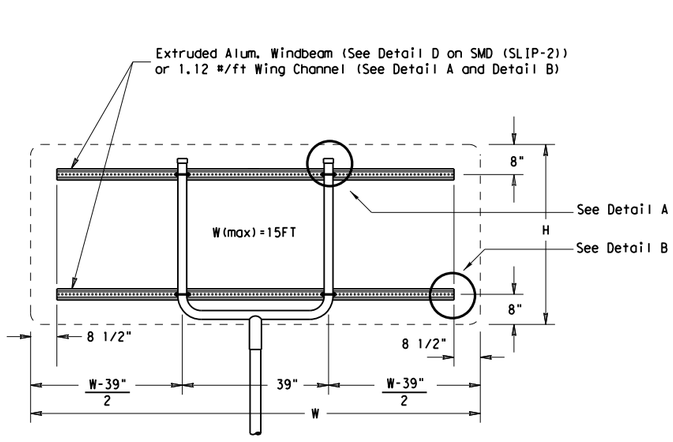

**Detail C**

Splices shall only be allowed behind the sign substrate.

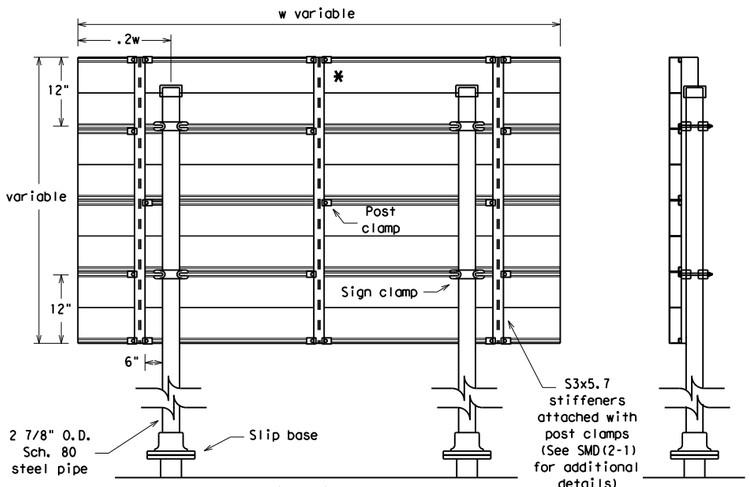
**GENERAL NOTES:**

| SIGN SUPPORT | # OF POSTS | MAX. SIGN AREA |
|---|---|---|
| 10 BWG | 1 | 16 SF |
| 10 BWG | 2 | 32 SF |
| Sch 80 | 1 | 32 SF |
| Sch 80 | 2 | 64 SF |

1. The Engineer may require that a Schedule 80 post be used in place of a 10 BWG where a sign height is abnormally high due to a fill slope.
2. Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.
3. Aluminum sign blanks shall conform to Departmental Material Specifications DMS-7110 and shall have the following minimum thicknesses: 0.080 for signs less than 7.5 sq. ft., 0.100 for signs 7.5 to 15 sq. ft., and 0.125 for signs greater than 15 sq. ft.
4. Signs that require specific supports due to reasons in addition to windloading are indicated on the "REQUIRED SUPPORT" table on this sheet.
5. For horizontal rectangular signs fabricated from flat aluminum, T-brackets are used for signs 24 inches or less in height. U-brackets are used for signs of greater height.
6. When two triangular slipbase supports are used to support a single sign, they shall not be "rigidly" connected to each other except through the sign panel. This will allow each support to act independently when impacted by an errant vehicle.
7. Wing channel shall meet ASTM A 1011 SS Gr 50 and be galvanized per ASTM A 123.
8. Excess pipe, wing channel, or windbeam shall be cut off so that it does not extend beyond the sign panel (i.e., excess support shall not be visible when the sign is viewed from the front.) Repair galvanized coating at cut support ends per Item 445, "Galvanizing."
9. Sign blanks shall be the sizes and shapes shown on the plans.
10. Additional sign clamp required on the "T-bracket" post for 24 inch high signs. Place the clamp 3 inches above bottom of sign when possible.
11. Post open ends shall be fitted with Friction Caps.




SM RD SGN ASSM TY XXXXX(1)XX(U-XX)



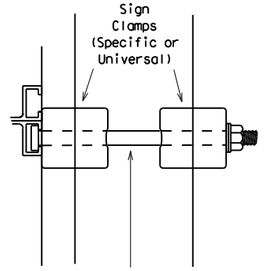

**Typical Sign Mount**

SM RD SGN ASSM TY S80(2)XX(P-EXAL)

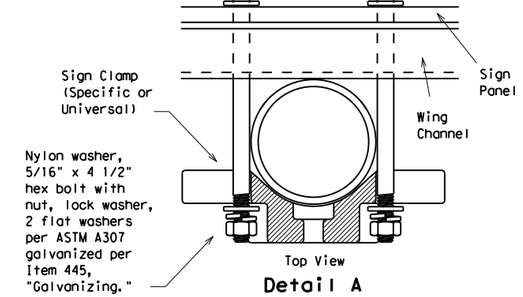
* Additional stiffener placed at approximate center of signs when sign width is greater than 10'.



See Detail E
for clamp installation

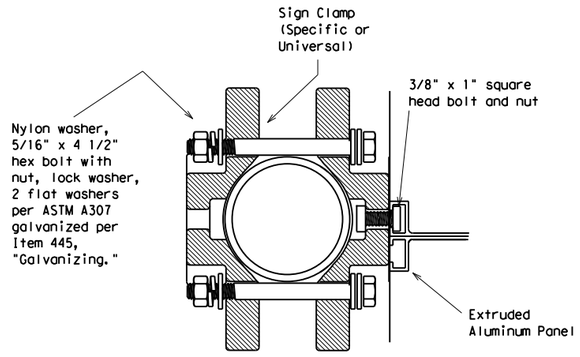



**Detail E**

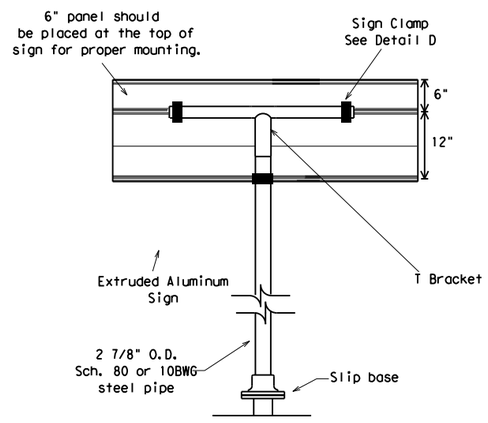



Top View

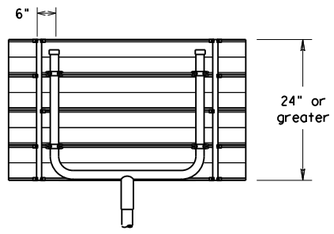
**Detail A**




**Detail D**
**EXTRUDED ALUMINUM SIGN WITH T BRACKET**




Extruded Aluminum Sign
With T Bracket




Use Extruded Alum. Windbeam as stiffeners
See SMD (2-1) for additional details

See Detail E
for clamp installation

| REQUIRED SUPPORT | | |
|---|---|---|
| | SIGN DESCRIPTION | SUPPORT |
| Regulatory | 48-inch STOP sign (R1-1) | TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM) |
| | 60-inch YIELD sign (R1-2) | TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM) |
| | 48x16-inch ONE-WAY sign (R6-1) | TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM) |
| | 36x48, 48x36, and 48x48-inch signs | TY 10BWG(1)XX(T) |
| | 48x60-inch signs | TY S80(1)XX(T) |
| Warning | 48x48-inch signs (diamond or square) | TY 10BWG(1)XX(T) |
| | 48x60-inch signs | TY S80(1)XX(T) |
| | 48-inch Advance School X-ing sign (S1-1) | TY 10BWG(1)XX(T) |
| | 48-inch School X-ing sign (S2-1) | TY 10BWG(1)XX(T) |
| | Large Arrow sign (W1-6 & W1-7) | TY 10BWG(1)XX(T) |

Texas Department of Transportation
Traffic Operations Division

# SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS TRIANGULAR SLIPBASE SYSTEM

## SMD(SLIP-3)-08



REVISIONS
9-08

| DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|

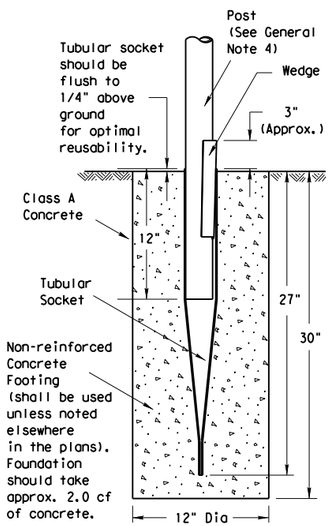
| CONT | SECT | JOB | HIGHWAY |
|---|---|---|---|
| 6367 | 43 | 001 | IH-20 |

| DIST | COUNTY | SHEET NO. |
|---|---|---|
| 10 | SMITH, ETC. | 87 |

DATE:
FILE:

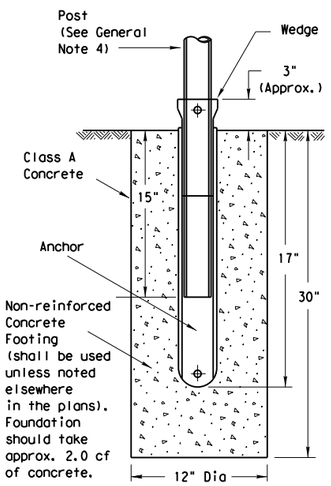
DATE:
FILE:

# Wedge Anchor Steel System



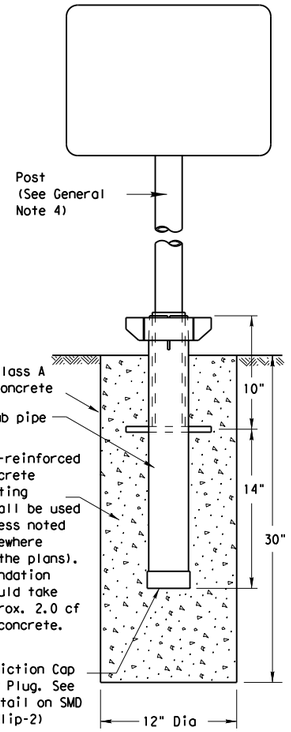

SM RD SGN ASSM TY TWT(X)WS(X)

# Wedge Anchor High Density Polyethylene (HDPE) System

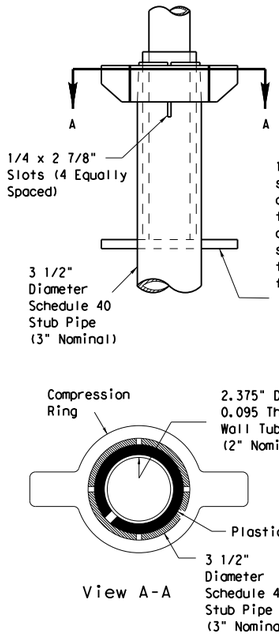



SMD RD SGN ASSM TY TWT(X)WP(X)

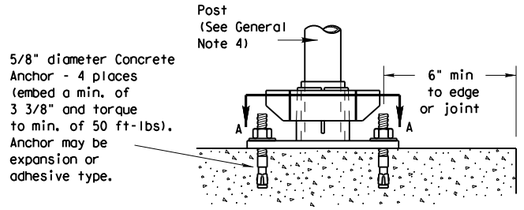
# Universal Anchor System with Thin-Walled Tubing Post



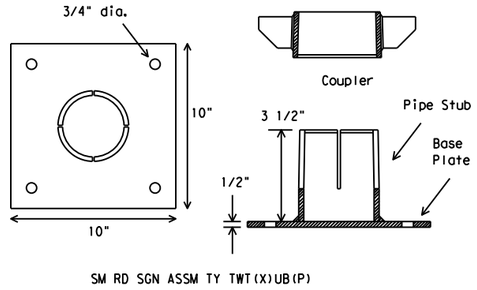

SM RD SGN ASSM TY TWT(X)UA(P)




Plastic insert must be used when using the TWT with either the Universal Anchor System or the Bolt Down Universal Anchor System. The insert should be approx. 10" long and cover the tubing from just above the top of the stub pipe to the bottom of the sign post when using the Universal Anchor System. The insert should be cut to approx. 4 1/2" when used with the Bolt Down Universal Anchor System.

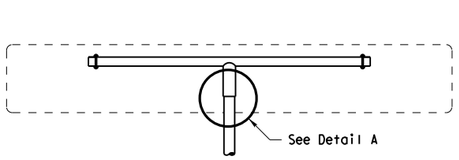


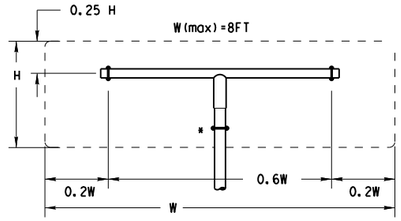

Concrete anchor consists of 5/8" diameter stud bolt with UNC series bolt threads on the upper end. A heavy hex nut per ASTM A563 and hardened washer per ASTM F436. The stud bolt shall have minimum yield and ultimate tensile strengths of 50 and 75 ksi, respectively. Nuts, bolts and washers shall be galvanized per Item 445, "Galvanizing." Top of bolt shall extend at least flush with top of nut when installed. The anchor, when installed in 4000 psi normal-weight concrete with a 3 3/8" minimum embedment, shall have a minimum allowable tension and shear of 2450 and 1525 psi, respectively. Adhesive type anchors shall have stud bolts installed with Type III epoxy per DMS-6100, "Epoxies and Adhesives." Adhesive anchors may be loaded after adequate epoxy cure time per the manufacturer's recommendations.



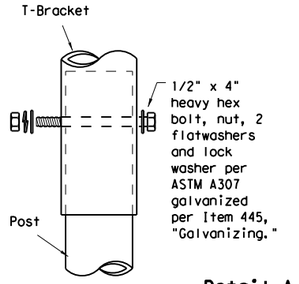

SM RD SGN ASSM TY TWT(X)UB(P)

## Sign Installation Using a Prefabricated T-Bracket for Thin-Wall Tubing Post




SM RD SGN ASSM TY TWT(X)XX(T)
(* - See General Note 6)




**Detail A**

9/16" hole may need to be drilled through post to accommodate bolt.

NOTE

The devices shall be installed per manufacturer's recommendations.
Installation procedures shall be provided to the Engineer by Contractor.

GENERAL NOTES:

1. 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.
2. 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.
3. 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
4. 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 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
   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.
5. Sign blanks shall be the sizes and shapes shown on the plans.
6. Additional sign clamp required on the "T-bracket" post for 24" high signs. Place clamp at least 3" above bottom of sign when possible.
7. Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.
8. 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

1. Dig foundation hole. Where solid rock is encountered at ground level, the foundation shall be a minimum depth of 18". When solid rock is encountered below ground level, the foundation shall extend in the solid rock a minimum depth of 18" or provide a minimum foundation depth of 30". If solid rock is encountered, the socket/stub may be reduced in length as required to a minimum length of 18". Any material removed from the socket/stub shall be from the bottom and the clearance requirements given on SMD(GEN) must be followed. The inner surfaces of the socket/stub must remain free of concrete or other debris.
2. The Engineer may permit batches of concrete less than 2 cubic yards to be mixed with a portable, motor driven concrete mixer. For small placements less than 0.5 cubic yards, hand mixing in a suitable container may be allowed by Engineer. Place concrete into hole until it is approximately flush with the ground. Concrete shall be Class A.
3. Insert tubular socket into concrete until top of socket is approximaely 1/4 " above the concrete footing.
4. Plumb the socket. Allow a minimum 4 days for concrete to set, unless otherwise directed by Engineer..
5. Attach the sign to the sign post.
6. Insert the sign post into socket and align sign face with roadway.
7. Drive the wedge into the socket to secure post. This will leave approximately 3 inches of the wedge exposed.

UNIVERSAL ANCHOR SYSTEM INSTALLATION PROCEDURE

1. Dig foundation hole. Where solid rock is encountered at ground level, the foundation shall be a minimum depth of 18". When solid rock is encountered below ground level, the foundation shall extend in the solid rock a minimum depth of 18" or provide a minimum foundation depth of 30". If solid rock is encountered, the socket/stub may be reduced in length as required to a minimum length of 18". Any material removed from the socket/stub shall be from the bottom and the clearance requirements given on SMD(GEN) must be followed. The inner surfaces of the socket/stub must remain free of concrete or other debris.
2. Insert base post in hole to depths shown and backfill hole with concrete.
3. 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.
4. Attach the sign to the sign post.
5. Install plastic insert around bottom of post.
6. Insert sign post into base post. Lower until the post comes to rest on steel rod.
7. Seat compression ring using a hammer. Typically, the top of compression ring will be approximately level with top of stub post when optimally installed.
8. 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



| DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|

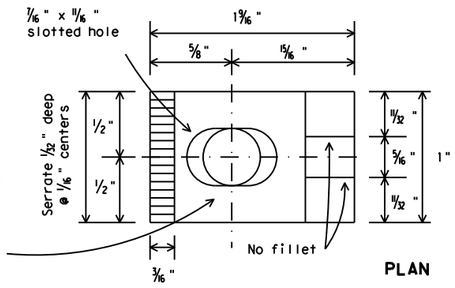
9-08 REVISIONS

| CONT | SECT | JOB | HIGHWAY |
|---|---|---|---|
| 6367 | 43 | 001 | IH-20 |

| DIST | COUNTY | SHEET NO. |
|---|---|---|
| 10 | SMITH, ETC. | 88 |

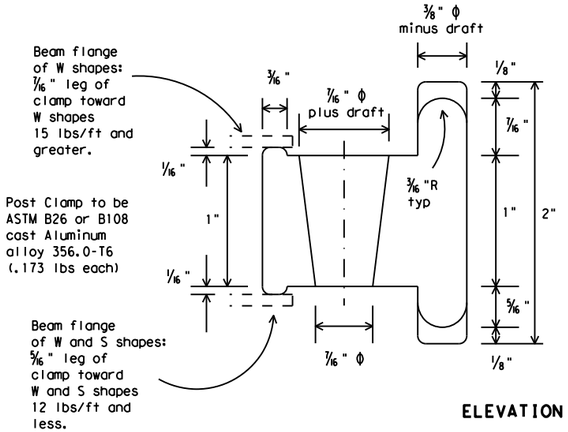
26E

DATE:
FILE:



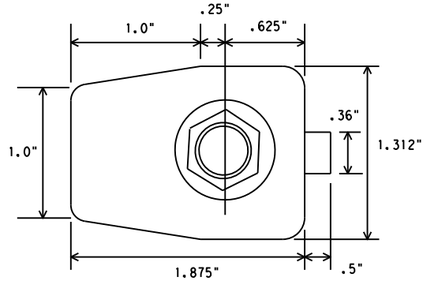

NOTE: centerline of hole for 3/8" diameter squarehead bolt x 2 1/4" long with a flat washer and self-locking nut, or lock washer and hex. nut. Bolt head dimensions shall be in accordance with ANSI B 18.2.1 as referred to in the AISC Manual of steel construction. Bolt assembly shall be galvanized.

PLAN

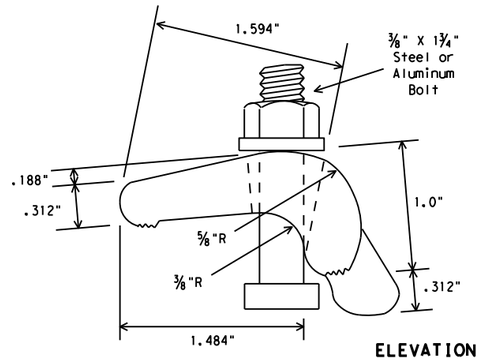



ELEVATION

## POST CLAMP DETAIL

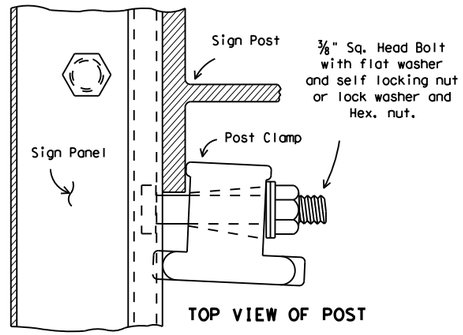



PLAN

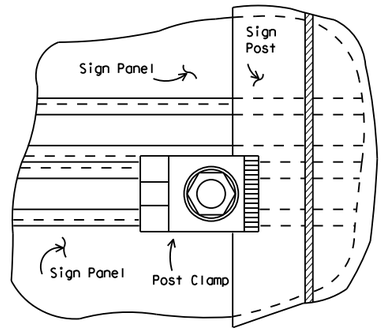



ELEVATION

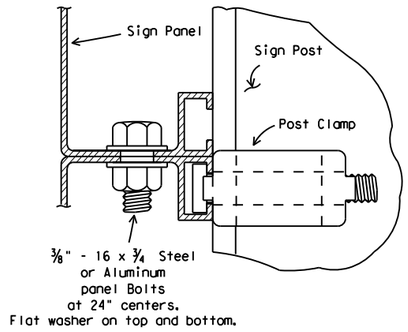
## ALTERNATE POST CLAMP DETAIL




TOP VIEW OF POST

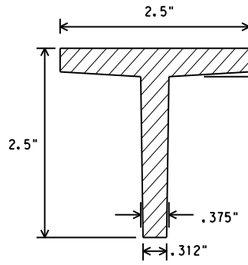



TOP VIEW OF CLAMP




SIDE VIEW OF PANELS

## CONNECTION DETAILS

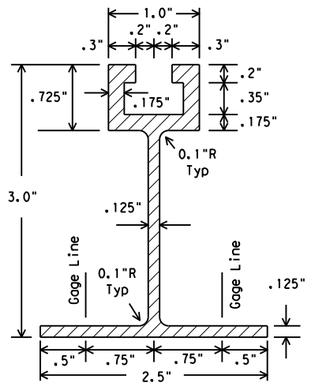


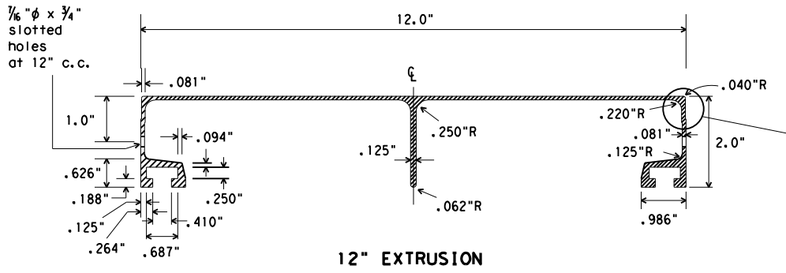

1.912 lbs/ft

## ALUMINUM T SECTION OR APPROVED ALTERNATIVE

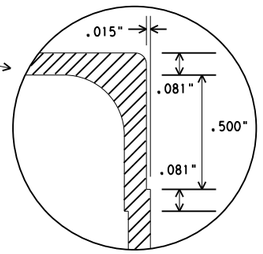
## WINDBEAM CROSS SECTION

Windbeam to be extruded aluminum (1.175 lbs/ft) or approved alternative

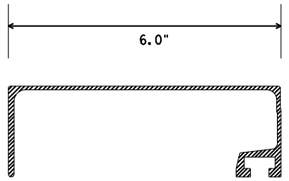


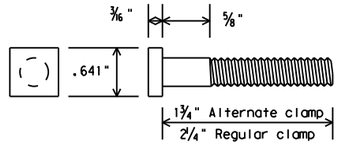

12" EXTRUSION




## ALUMINUM SIGN PANEL EXTRUSION DETAILS




6" EXTRUSION




## POST CLAMP BOLT DETAIL

DEPARTMENTAL MATERIAL SPECIFICATIONS

| SIGN HARDWARE | DMS-7120 |
|---|---|

GENERAL NOTES:

1. Design conforms with AASHTO Specifications for the design and construction of structural supports for highway signs.
2. Materials and fabrication shall conform to the requirements of the Department material specifications.
3. Structural steel shall be "low-alloy steel" for non-bridge structures per Item 442, "Metal For Structures."
4. For fiberglass substrate connection details, see manufacturer's recommendations.

Texas Department of Transportation
Traffic Operations Division

# SIGN MOUNTING DETAILS- EXTRUDED ALUMINUM SIGN PANELS & HARDWARE

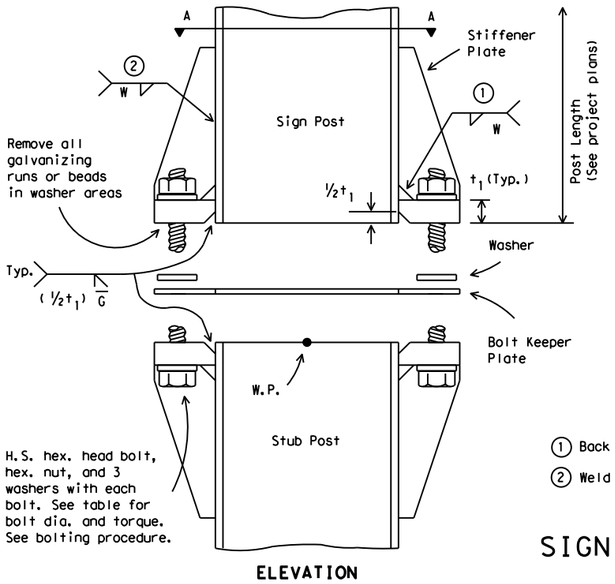
SMD(2-1)-08



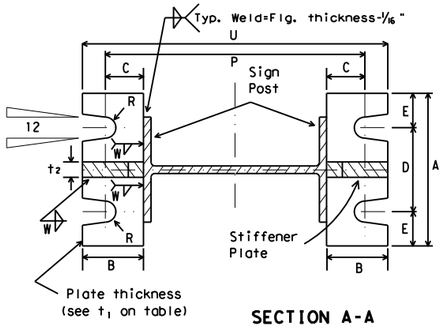
| DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|

| REVISIONS | CONT | SECT | JOB | HIGHWAY |
|---|---|---|---|---|
| 9-08 | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 89 |

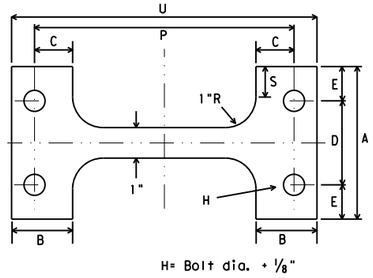
DATE:
FILE:




ELEVATION

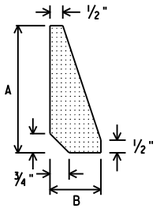



SECTION A-A




H= Bolt dia. + ⅛"

BOLT KEEPER PLATE
30 Ga galv. sheet steel

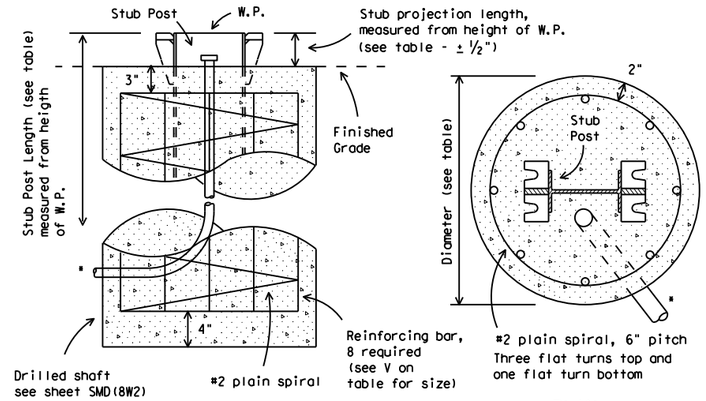



① Back up weld to be made before installing stiffener plate

② Weld W may be continued across clips to seal joint

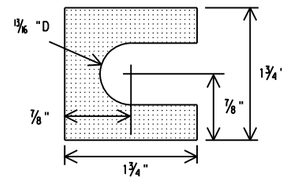
## SIGN POST AND STUB POST
(For W Shapes)

## STIFFENER PLATE DETAIL
Steel Plate (thickness = $t_2$)
(See table for dimensions)




ELEVATION PLAN

## FOUNDATION DETAIL
*Note: For signs with electrical apparatus, see ED(10) for conduit required in founation.




## SHIM DETAIL
Furnish two .012"± thick and two .032"± thick shims per post. Shims shall be fabricated from brass shim stock or strip conforming to ASTM B36.

BOLTING PROCEDURE FOR ASSEMBLY OF BASE CONNECTION:
1. Assemble sign post, BOLT KEEPER PLATE and stub post with bolts and three flat washers per bolt as shown.
2. Shim as required to plumb post.
3. Tighten all bolts the maximum possible with a 12 to 15 inch wrench to clean bolt threads and to bed washers and shims.
4. Loosen each bolt in sequence and retighten bolts in a systematic order to the prescribed torque. Do not overtighten.
5. To prevent nut loosening, burr threads of bolt at junction with nut using a center punch.

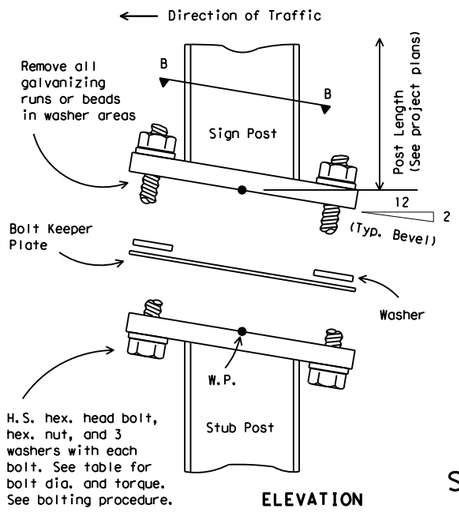
| Dimensions / Post Size | Base Connection Data Table: Bolt Size & Torque | A | B | C | D | E | $t_1$ | $t_2$ | W | R |
|---|---|---|---|---|---|---|---|---|---|---|
| W6x9 | ⅝"ϕ x 2¾" 440-450 inch pounds 36-38 foot pounds | 5" | 2" | 1¼" | 2¾" | 1⅛" | ¾" | ½" | ¼" | 11/32" |
| W6x12 | | | | | | | | | | |
| W6x15 | | | | | | | | | | |
| W8x18 | | | | | | | | | | |
| W8x21 | ¾"ϕ x 3½" 740-750 inch pounds 62-63 foot pounds | 6" | 2¼" | 1⅜" | 3½" | 1¼" | 1" | ¾" | 5/16" | 13/32" |
| W10x22 | | | | | | | | | | |
| W10x26 | | | | | | | | | | |
| W12x26 | | | | | | | | | | |
| S3x5.7 | ½"ϕ x 2½" 440-450 inch pounds 36-38 foot pounds | See Detail Below | | | | | | | | |
| S4x7.7 | | | | | | | | | | |

| Perforated Fuse Plate Data Table | | | | | | | | | | | | Bolt Keeper Data | | | Foundation Data | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F | G | J | K | M | $d_1$ | $d_2$ | $t_3$ | Bolt Dia. | Wt. (ea.) (lbs.) | Bolt length | P | S | U | Stub length | Stub projection | Dr. Shaft diameter | Bar V Size |
| 4¼" | 2" | 4" | 2¼" | 1" | 9/16" | ¾" | ¼" | ½" | 1.01 | 1½" | 8⅜" | 1" | 9⅞" | 2'-0" | 3" | 24" | #5 |
| | | | | | | | | | | | 8½" | | 10" | 2'-0" | 3" | | #5 |
| 5" | 2½" | 6" | 3½" | 1½" | 11/16" | 1¼" | ⅜" | ⅝" | 2.51 | 2¼" | 8½" | | 10" | 2'-6" | 3" | | #6 |
| 5" | 2½" | 5¼" | 2¾" | 1¼" | 11/16" | 1 1/16" | ⅜" | ⅝" | 2.26 | 2¼" | 10⅝" | | 12⅛" | 2'-6" | 3" | | #7 |
| 5½" | 2½" | 5¼" | 2¾" | 1¼" | 13/16" | 1" | ½" | ¾" | 3.35 | 2¼" | 11" | 1½" | 12¾" | 3'-0" | 2½" | | #8 |
| 6" | 3" | 5¾" | 2¾" | 1⅜" | 13/16" | 1⅛" | ½" | ¾" | 4.03 | 2¼" | 12⅞" | | 14⅝" | 3'-0" | 2½" | | #9 |
| | | | | | | | | | | | 13⅛" | | 14⅞" | 3'-0" | 2½" | | #10 |
| 6" | 3" | 6½" | 3½" | 1⅝" | 13/16" | 1 5/16" | ½" | ¾" | 4.47 | 2¼" | 15" | | 16¾" | 3'-0" | 2½" | | #11 |
| 3¾" | 1½" | 2⅝" | 1½" | ⅝" | 9/16" | ⅜" | ¼" | ½" | 0.60 | 1½" | See Detail Below | | | 3'-3½" | 3½" | 12" | Non-reinforced ③ |

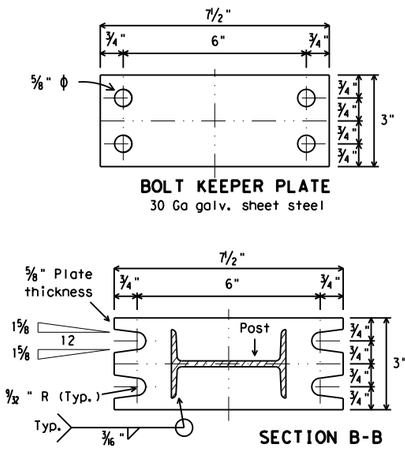
③ Foundation design shall be Type G Mount, see SMD (TY G).



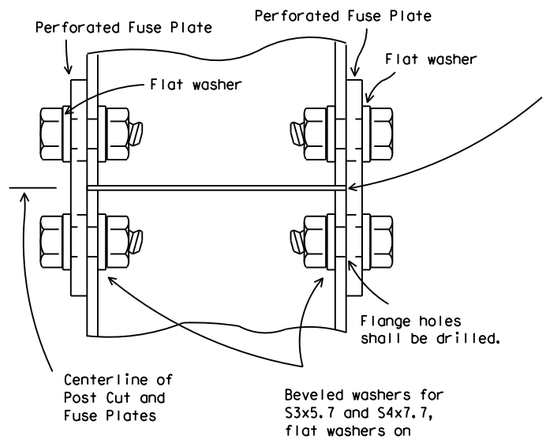

## PERFORATED FUSE PLATE DETAIL
Use H.S. hex head bolts, hex head nut and bevel or flat washer (where req'd) under nut. All holes shall be drilled, sub-punched and reamed. All plate cuts shall preferably be saw cuts. However, flame cutting will be permitted provided all edges are ground. Metal projecting beyond the plane of the plate face will not be permitted. Steel fuse plates shall conform to the requirements of ASTM A36. ASTM A572 Grade 50 or ASTM A588 may be substituted for A36 at the option of the fabricator. Mill test reports shall be submitted for Fuse Plates. Steel used shall have an ultimate tensile strength not to exceed 80 KSI. For alternative Fuse Plate contact Traffic Operations Division.




ELEVATION




## SIGN POST AND STUB POST
(For S4x7.7 and S3x5.7)




DETAIL "A"

Parts shall be saw cut either before galvanizing and the galvanized cut cleaned of zinc build-up, or saw cut after galvanizing and the cut surface repaired per Item 445, "Galvanizing."

Texas Department of Transportation
Traffic Operations Division

# SIGN MOUNTING DETAILS- LARGE ROADSIDE SIGNS FOUNDATION & STUB

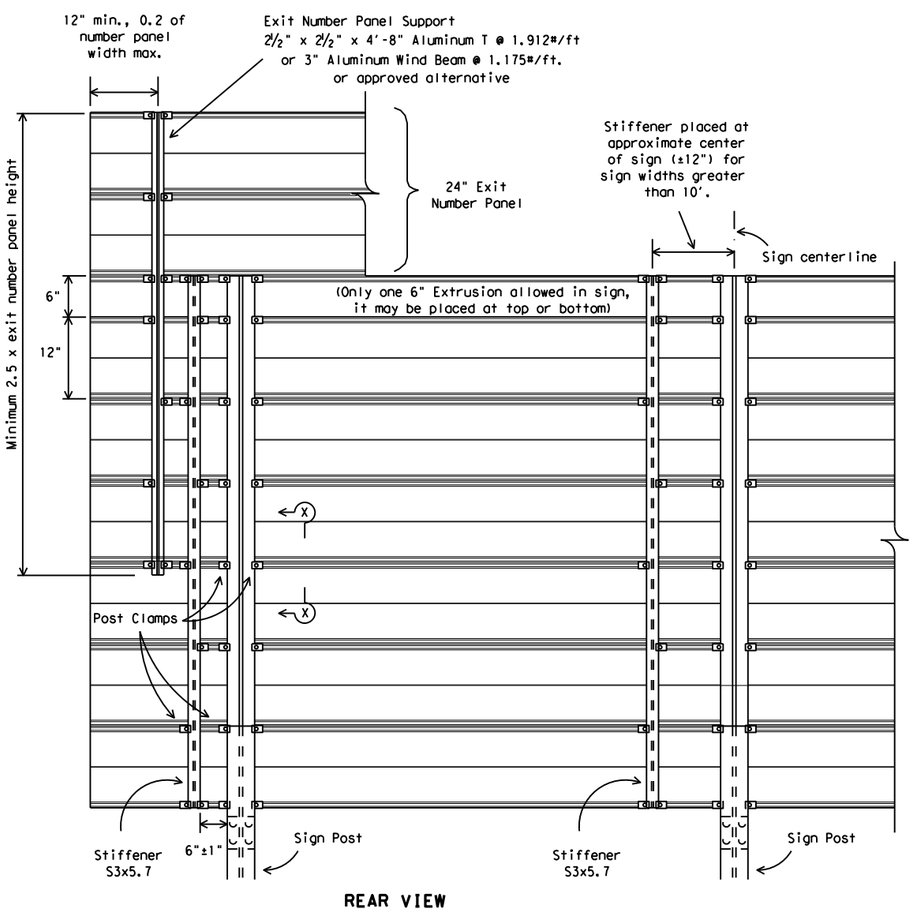
## SMD(2-2)-08

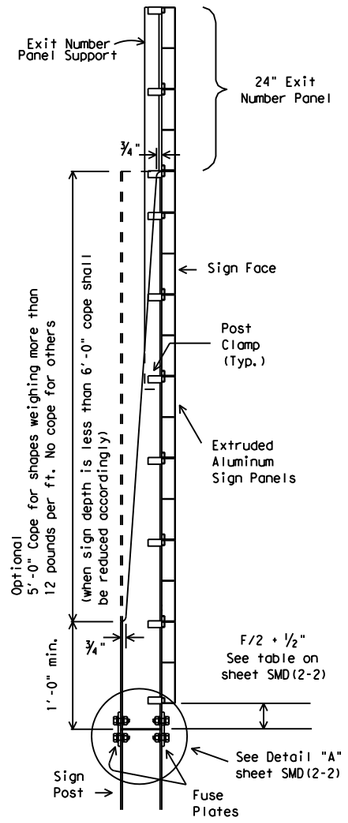


REVISIONS
4-98
9-08

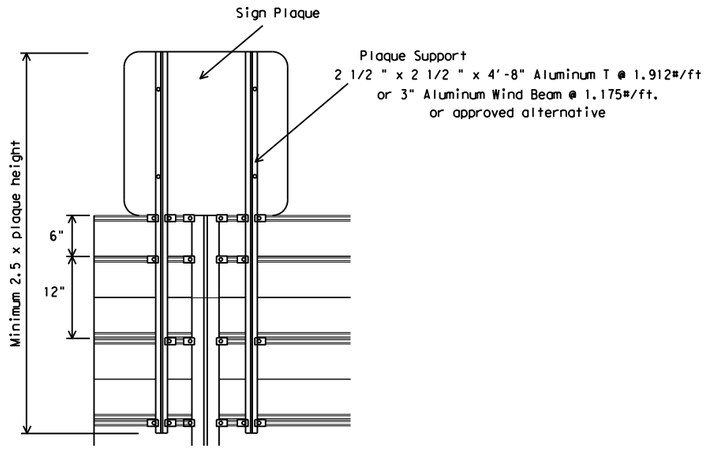
| DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|

| CONT | SECT | JOB | HIGHWAY |
|---|---|---|---|
| 6367 | 43 | 001 | IH-20 |
| DIST | COUNTY | | SHEET NO. |
| 10 | SMITH, ETC. | | 90 |



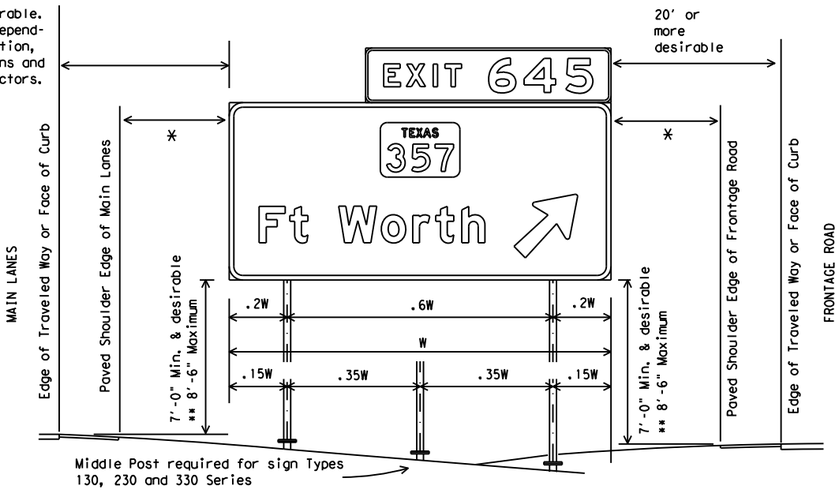




## ALUMINUM PARENT SIGN & EXIT NUMBER PANEL MOUNTING DETAILS




## SIGN PLAQUE MOUNTING DETAIL TO ALUMINUM PARENT SIGN

30' or more desirable. May be reduced depending on cross section, viewing conditions and other related factors.




## TYPICAL SIGN INSTALLATION AND LOCATION

LATERAL CLEARANCE NOTES:

Lateral clearances of signs mounted on median side of main lanes are the same as shown above where space will permit.

Where a sign is to be located behind guardrail, an allowable minimum clearance of five feet may be used, measured from the face of the guardrail to the near edge of sign.

⁎ - 6' minimum and desirable may be used only in areas of limited lateral clearance and when approved by the Engineer.

POST SPACING NOTES:

Post spacing on a two post sign may vary a maximum of plus or minus 10% of total sign width to fit field conditions.

Post spacing on a three post sign may vary a maximum of plus or minus 5% of total sign width to fit field conditions.

SIGN HEIGHT NOTES:

** The 8' 6" maximum may be exceeded when placing signs on extreme slopes. In these conditions, a 7' minimum from natural ground to bottom of sign must be maintained.

| DEPARTMENTAL MATERIAL SPECIFICATIONS | |
|---|---|
| ALUMINUM SIGN BLANKS | DMS-7110 |
| SIGN HARDWARE | DMS-7120 |

GENERAL NOTES:

1. Exit number panel shall be mounted to the right hand side of the parent sign for right exits and to the left hand side for left exits. The number panel shall be mounted with two uprights so its right edge is even with the right edge of the parent sign or vice-versa for left hand exits.
2. Exit number panel support shall be symmetrical about number panel centerline.
3. Exit number panel support shall be ASTM A36 structural steel galvanized after fabrication, or ASTM B221 aluminum alloy 6061-T6 or approved alternative.
4. All bolts, nuts and washers shall be galvanized per ASTM Designation: B695 Class 50, or A153 Class C or D.
5. Posts, parent sign panels, and exit number panels shall comply with notes on sheets SMD(2-1) and SMD(2-2).
6. Signs (such as exit number panels) attached above a parent sign shall be made of the same type material as the parent sign. General Service and Routing signs may be fabricated from flat sheet aluminum.
7. Exit number panel support and other connection hardware required to fasten exit number panel to parent sign shall be subsidiary to "Aluminum Signs" or "Fiberglass Signs."
8. For fiberglass sign installation details, see manufacturer's recommendations.

Texas Department of Transportation
Traffic Operations Division

# SIGN MOUNTING DETAILS-LARGE ROADSIDE SIGNS

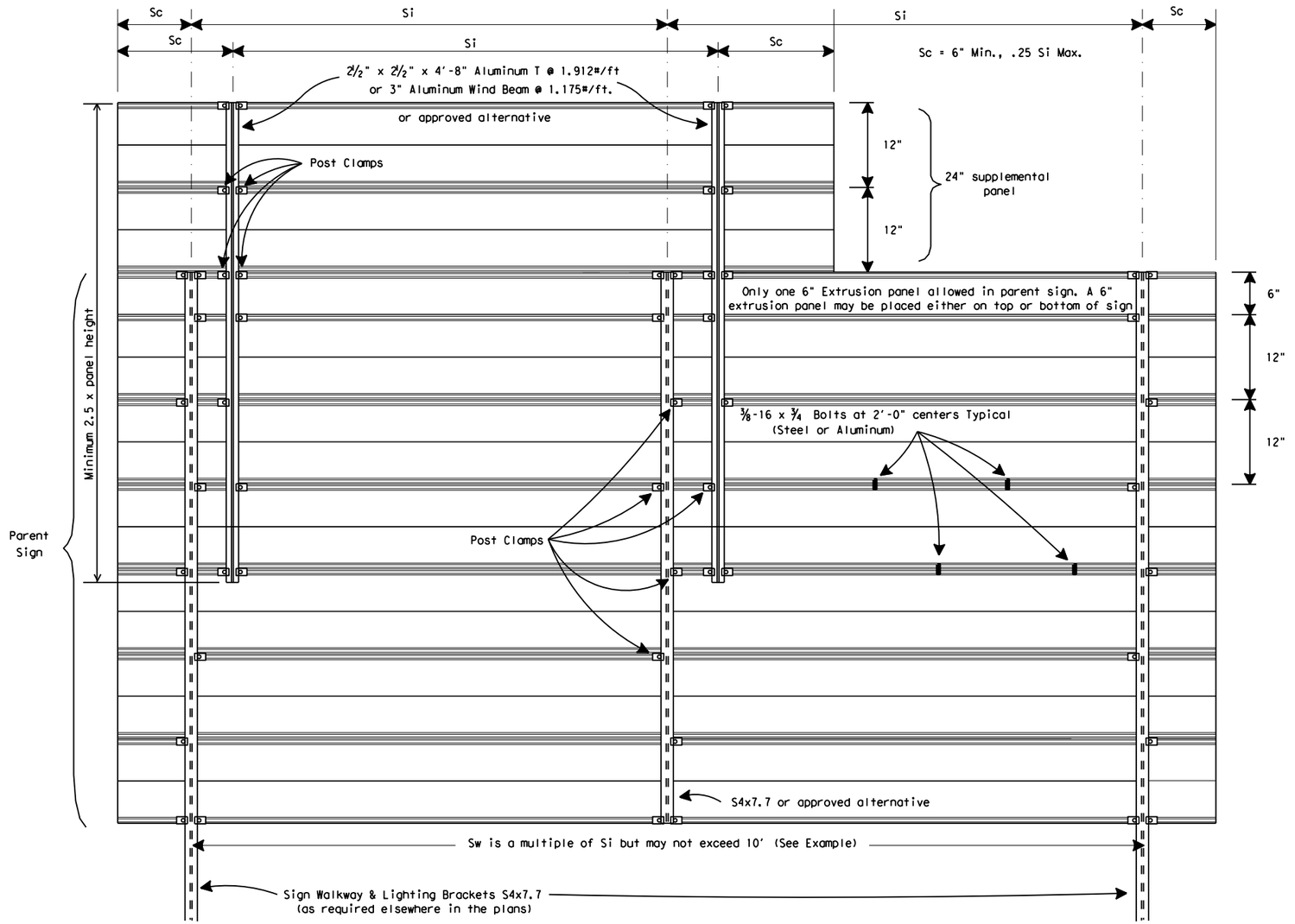
## SMD(2-3)-08



| REVISIONS | DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|---|
| 9-08 | CONT | SECT | JOB | HIGHWAY |
| | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 91 |

DATE:
FILE:

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

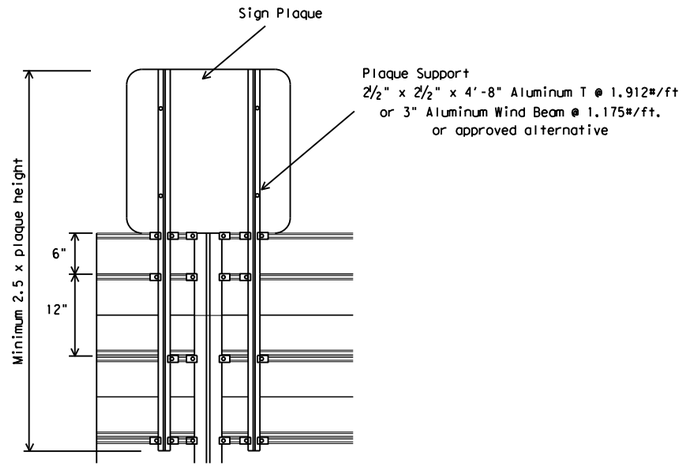



REAR VIEW

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

MAXIMUM SIGN SUPPORT SPACING "Si" (FEET)

| "d" Deepest Sign in Group (Ft.) | 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 | | | |
| | 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 | 10 |
| 13 | 7.5 | 9 | 10 | 10 | 7.5 | 9 | 10 | 10 | 9 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 12 | 8.5 | 10 | 10 | 10 | 8.5 | 10 | 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 | 10 |

For fiberglass sign installations, see manufacturer's recommendations.

Texas Department of Transportation
Traffic Operations Division

# SIGN MOUNTING DETAILS- OVERHEAD SIGNS EXTRUDED ALUMINUM

SMD(2-4)-08



| DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|

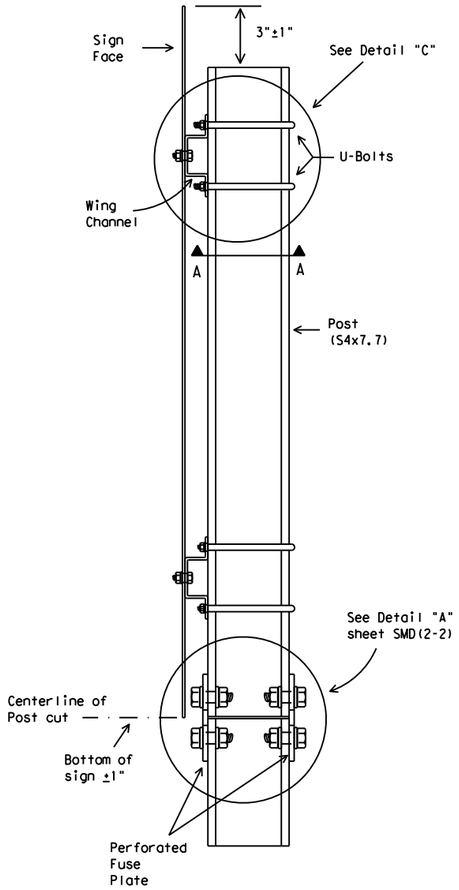
REVISIONS
9-08

| CONT | SECT | JOB | HIGHWAY |
|---|---|---|---|
| 6367 | 43 | 001 | IH-20 |

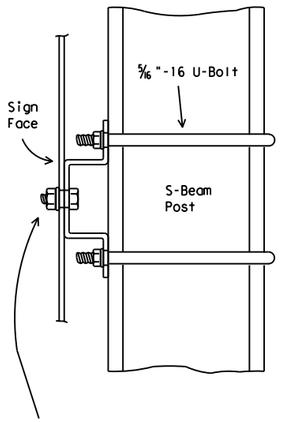
| DIST | COUNTY | SHEET NO. |
|---|---|---|
| 10 | SMITH, ETC. | 92 |

DATE:
FILE:

# WING CHANNEL CLAMP DETAIL FOR TYPE G MOUNT

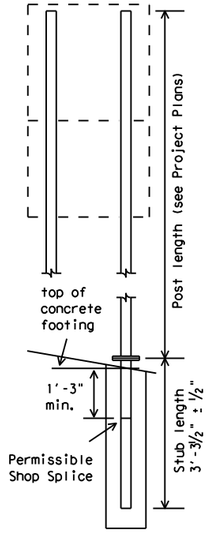



SIDE VIEW

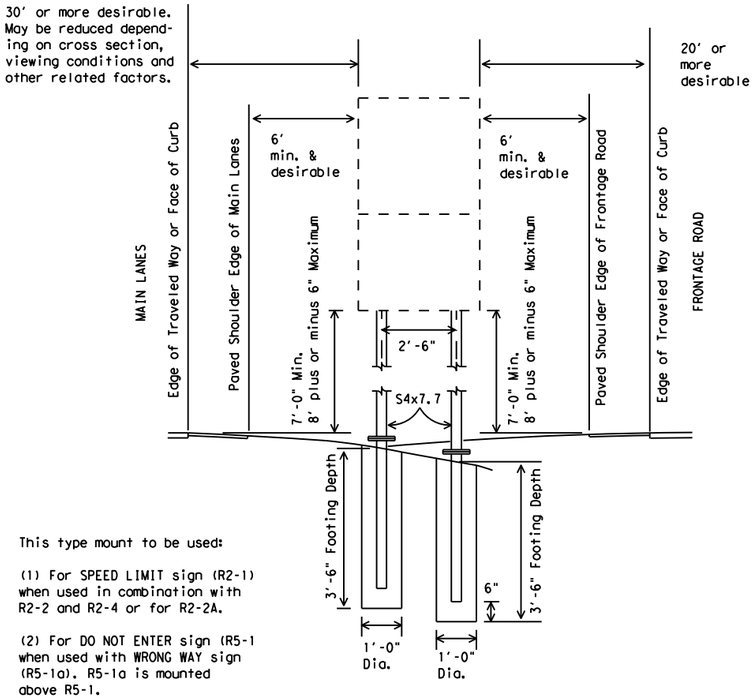



Galvanized steel or aluminum self-locking hex. head nut. 3/8 " - 16 x 3/4 " hex. head bolt for sheet metal. 3/8 " - 16 x 1 1/4 " hex. head bolt for plywood. 3/8 " galvanized medium washer.

**DETAIL "C"**



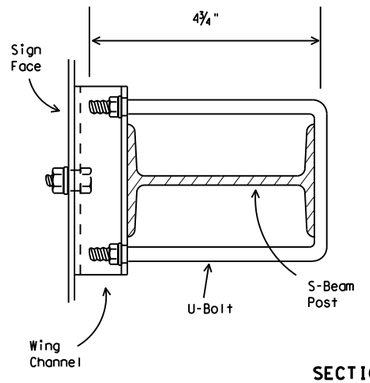

The weight of one S4x7.7 post is equal to 112.2 lbs. plus 7.7 lbs./ft x (post length in feet minus 10 ft). The weight of 112.2 lbs. includes 10 feet of post length, post foundation stub, related connection plates, friction fuse plate, and all high strength bolts, nuts and washers.



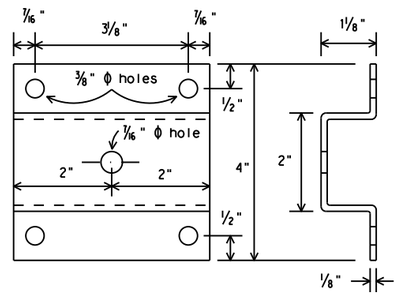

This type mount to be used:

(1) For SPEED LIMIT sign (R2-1) when used in combination with R2-2 and R2-4 or for R2-2A.

(2) For DO NOT ENTER sign (R5-1 when used with WRONG WAY sign (R5-1a). R5-1a is mounted above R5-1.




SECTION A-A




**WING CHANNEL**

Wing channel, 4" width x 1 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).

DEPARTMENTAL MATERIAL SPECIFICATIONS
SIGN HARDWARE DMS-7120

GENERAL NOTES:

1. Design conforms with AASHTO Specifications for the design and construction of structural supports for highway signs.
2. Materials and fabrication shall conform to the requirements of the Department material specifications.
3. Structural steel shall be "Low-Alloy Steel" for non-bridge structures per Item 442, "Metal For Structures."
4. Parts shall be saw cut either before galvanizing and the galvanized cut cleaned of zinc build-up, or saw cut after galvanizing and the cut surface repaired per Item 445, "Galvanizing." (Cut surface will not be treated until plate is installed and all bolts fully tightened.)

Texas Department of Transportation
Traffic Operations Division

# SIGN MOUNTING DETAILS, TYPE G SUPPORT

## SMD(TY G)-08



| DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|

REVISIONS
1-97
9-08

| CONT | SECT | JOB | HIGHWAY |
|---|---|---|---|
| 6367 | 43 | 001 | IH-20 |
| DIST | COUNTY | | SHEET NO. |
| 10 | SMITH, ETC. | | 93 |

DATE:
FILE:

DATE:
FILE:

## GENERAL NOTES FOR ALL ELECTRICAL WORK

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

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

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

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

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

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

## CONDUIT

A. MATERIALS

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

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

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

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

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

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

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

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

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

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

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

B. CONSTRUCTION METHODS

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

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

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

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

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

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

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

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

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

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

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

12. Place conduits entering ground boxes so that the conduit openings are between 3 in. and 6 in. from the bottom of the box. See the ground box detail on sheet ED(4).

13. Seal ends of all conduits with duct seal, expandable foam, or by other methods approved by the Engineer. Seal conduit immediately after completion of conductor installation and pull tests. Do not use duct tape as a permanent conduit sealant. Do not use silicone caulk as a conduit sealant.

14. File smooth the cut ends of all mounting strut and conduit. Before installing, paint the field cut ends of all mounting strut and RMC (threaded or non-threaded) with zinc rich paint (94% or more zinc content) to alleviate overspray. Use zinc rich paint to touch up galvanized material as allowed under Item 445 "Galvanizing." Do not paint non-galvanized material with a zinc rich paint as an alternative for materials required to be galvanized.

Texas Department of Transportation

Traffic Operations Division Standard

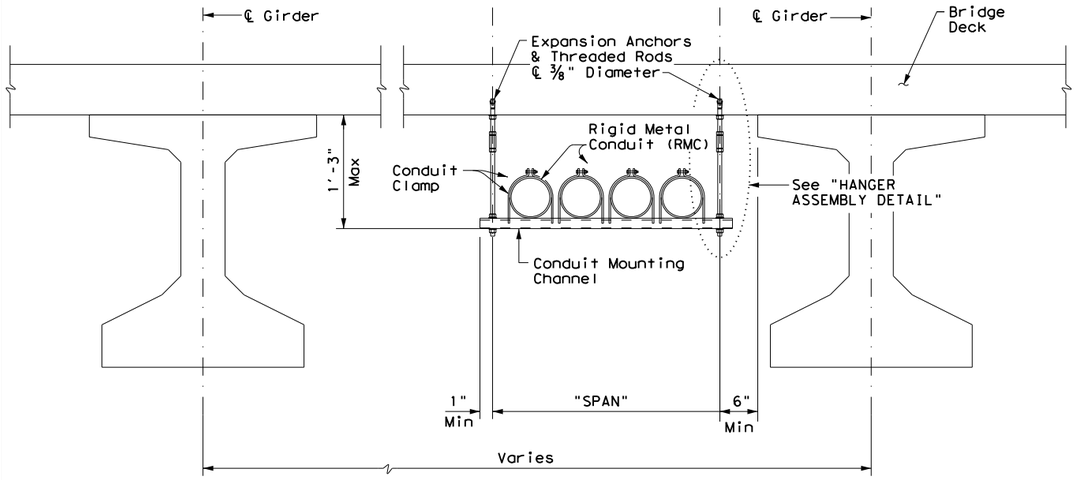
# ELECTRICAL DETAILS CONDUITS & NOTES

## ED(1)-14

| FILE: | ed1-14.dgn | DN: | CK: | DW: | CK: |
|---|---|---|---|---|---|
| © TxDOT | October 2014 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | | 6367 | 43 | 001 | IH-20 |
| | | DIST | COUNTY | | SHEET NO. |
| | | 10 | SMITH, ETC. | | 94 |

71A

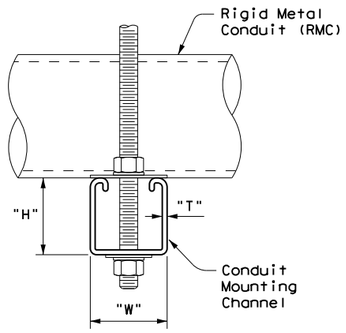
DATE:
FILE:

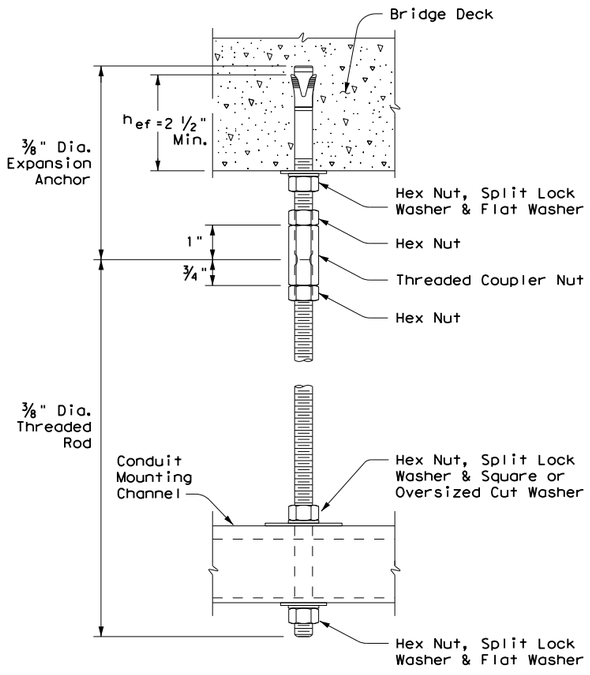



CONDUIT HANGING DETAIL

| CONDUIT MOUNTING CHANNEL | | |
|---|---|---|
| "SPAN" | "W" x "H" | "T" |
| less than 2' | 1 5/8" x 1 3/8" | 12 Ga. |
| 2'-0" to 2'-6" | 1 5/8" x 1 5/8" | 12 Ga. |
| >2'-6" to 3'-0" | 1 5/8" x 2 7/16" | 12 Ga. |

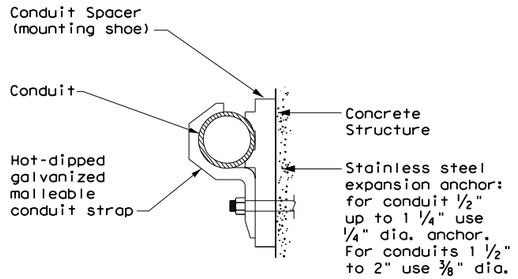
Channels with round or short slotted hole patterns are allowed, if the load carrying capacity is not reduced by more than 15%.

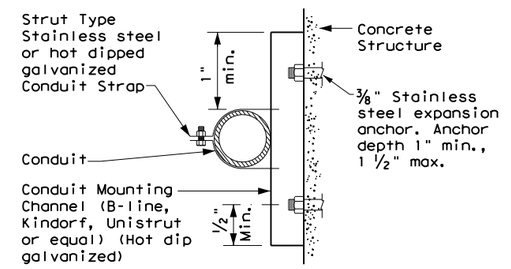



HANGER ASSEMBLY DETAIL

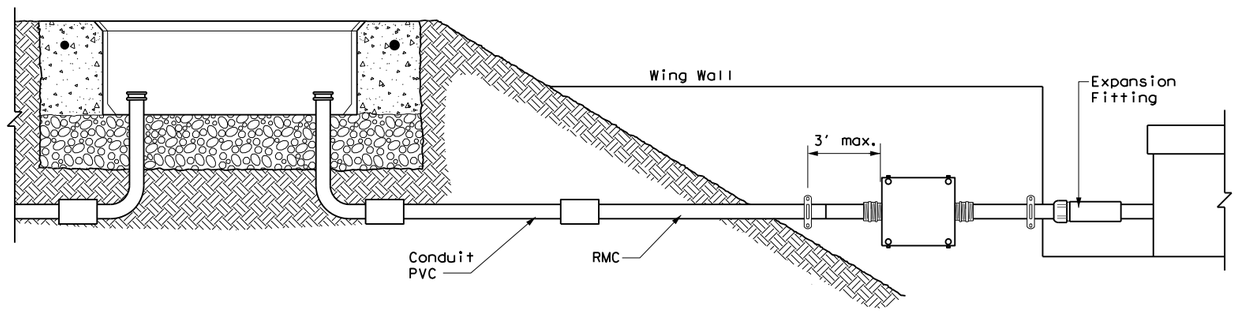
ELECTRIC CONDUIT TO BRIDGE DECK ATTACHMENT




## CONDUIT MOUNTING OPTIONS

Attachment to concrete surfaces
See ED(1)B.2




TYPICAL CONDUIT ENTRY TO BRIDGE STRUCTURE DETAIL

## EXPANSION ANCHOR NOTES FOR BRIDGE DECK ATTACHMENT

1. Use torque controlled mechanical expansion anchors that are approved for use in cracked concrete by the International Code Council, Evaluation Service (ICC-ES). The chosen anchor product shall have a designated ICC-ES Evaluation Report number, and its approval status shall be maintained on the ICC-ES website under Division 031600 for Concrete Anchors.

2. Unless otherwise approved by the Engineer: do not use adhesive anchors; do not use expansion anchors that are not included in the ICC-ES approval list; and do not use expansion anchors that are only approved for use in uncracked concrete.

3. Use anchors manufactured with stainless steel expansion wedges. Anchors manufactured with carbon steel expansion wedges are not allowed. Anchor bodies can be either zinc-plated carbon steel or stainless steel. For application in marine environment, both the anchor body and expansion wedge shall be stainless steel.

4. Install anchors as shown on the plans and in accordance with the anchor manufacturer's published installation instructions. Arrange a field demonstration test to evaluate the procedures and tools. The test shall be witnessed and approved by the Engineer prior to furnishing anchors on the structure.

5. Prior to hole drilling, use rebar locator to ensure clearing of existing deck strands or reinforcement. Install anchors to ensure a minimum effective embedment depth, ($h_{ef}$), as shown. Increase ($h_{ef}$)as needed to ensure sufficient thread length for proper torqueing and tightening of anchors.

6. Use anchors of minimum 1600 Lbs tensile capacity (minimum of steel, concrete breakout, and concrete pullout strengths as determined by ACI 318 Appendix D) at the required minimum embedment depth ($h_{ef}$). No lateral loads shall be introduced after conduit installation.

Texas Department of Transportation

Traffic Operations Division Standard

# ELECTRICAL DETAILS
# CONDUIT SUPPORTS

## ED(2)-14

| FILE: ed2-14.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT October 2014 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 95 |

71B

## ELECTRICAL CONDUCTORS

### A. MATERIAL INFORMATION

1. Provide Type XHHW insulated conductors in accordance with Departmental Material Specification (DMS)11040 "Conductors" and Item 620 "Electrical Conductors." Provide conductors as listed on the Material Producers List (MPL) on the Department web site under "Roadway Illumination and Electrical Supplies" Item 620. Color code insulated conductors in conformance with the NEC. Identify grounded (neutral) conductors with white insulation. Identify grounding conductors (ground wires) with green insulation or bare conductors. Identify ungrounded (hot) conductors with any color insulation except green, white, or gray. Keep color scheme consistent throughout the wiring system. Identify conductors 6 American Wire Gauge (AWG) and smaller by continuous color jacket. Identify electrical conductors 4 AWG and larger by continuous color jacket or by colored tape. When identifying conductors with colored tape, mark at least 6 in. of the conductor's insulation with half laps of tape.

2. Provide a solid copper 6 AWG grounding electrode conductor to bond the electrical service equipment to the concrete encased grounding electrode or the ground rod at the service location. Connect the grounding electrode conductor to the ground rod with a UL listed connector in accordance with DMS 11040. Connect the grounding electrode conductor to the concrete encased grounding electrode as shown in the plans.

3. Where two or more circuits are present in one conduit or enclosure, permanently identify the conductors of each branch circuit by attaching a non-metallic tag around both circuit conductors at each accessible location. Provide tags with two straps, large enough to indicate circuit number, letter, or other identification as shown in the plans. Print circuit identification on the tag with a permanent marker.

4. Use listed compression or screw type pressure connectors, terminal blocks, or split bolt connectors for splicing as specified in DMS 11040. Use hot melt adhesive tape to fill the gap and seal the ends of heat shrink tubing. Provide UL listed gel-filled insulating splice covers. Splicing materials, insulating materials, breakaway disconnects, splice covers, and fuse holders are subsidiary to various bid items.

### B. CONSTRUCTION METHODS

1. Use only a flat, high tensile strength polyester fiber pull tape for pulling conductors through the conduit system. After installing conductors in conduit, perform conductor pull test. If a conductor cannot be freely pulled, make any needed alterations or repairs at no additional cost to the department. Perform insulation resistance tests in accordance with Item 620. Coordinate with the Engineer to witness the tests.

2. Leave 2 ft. minimum, 3 ft. maximum length for each conductor up to the splice in ground boxes. Leave 3 ft. minimum, 4 ft. maximum length of conductor in ground boxes when pulled through with no splice. Leave 1 ft. minimum, 1.5 ft. maximum length of conductor at enclosures, weatherheads and pole bases.

3. Make splices only in junction boxes, ground boxes, pole bases, or electrical enclosures and use only listed compression or screw type pressure connectors, terminal blocks, or split bolt connectors. Insulate splices with heavy wall heat shrink tubing or gel-filled insulating splice covers to provide a watertight splice. Overlap conductor insulation with heat shrink tubing a minimum of 2 in. past both sides of the splice. Where heat shrink tubing may not shrink sufficiently to provide a watertight seal around the individual conductors, prior to heating the tubing, increase the diameter of the conductor insulation using hot melt adhesive tape to provide a watertight seal between the individual conductors and the heat shrink tubing. Ensure the tape extends past the heat shrink tubing. Use hot melt adhesive tape to fill the gap and seal the ends of heat shrink tubing. Heat shrink tubing that appears to have been burned, or overheated, is considered defective and must be replaced.

4. Size and install gel-filled insulating splice covers according to manufacturer's specifications when used in place of heat shrink tubing.

5. Wire nuts with factory applied waterproof sealant may be used for 8 AWG or smaller conductors in above ground junction boxes, but not in pole bases or ground boxes. Install wire nuts in an upright position to prevent the accumulation of water.

6. Support conductors in illumination poles with a J-hook at the top of the pole.

7. When terminating conductors, remove the insulation and jacketing material without nicking the individual strands of the conductor. Conductors with nicked individual conductor strands or removed strands will be considered damaged.

8. Replace conductors and cables that are damaged beyond repair or that fail an insulation resistance test at no additional cost to the department.

9. Do not repair damaged conductors with duct tape, electrical tape, or wire nuts. Use only approved splicing methods.

10. Do not terminate more than one conductor under a single connector, unless the connector is rated for multiple conductors. Do not exceed the pressure connector's listing for maximum number and size of conductors allowed.

11. Install breakaway connectors on conductors bid under Item 620 whenever those conductors pass through a breakaway support device. Follow manufacturer's instructions when terminating conductors to breakaway connectors. Properly torque threaded connections. Proper terminations are critical to the safe operation of breakaway devices. Trim waterproofing boots on breakaway connectors to fit snugly around the conductor to ensure waterproof connection. Only one conductor may enter a single opening in a boot. Provide waterproof boots with the correct number of openings. Leave unused openings factory sealed. Use prequalified breakaway connectors as shown on the MPL.

12. Provide and install a separate stranded equipment grounding conductor (EGC) in all conduits that contain circuit wiring of 50 volts or more. Unless shown elsewhere, size the EGC to be the same size as the largest current carrying conductor contained in the conduit. Ensure all EGCs are bonded together at every accessible location. For traffic signal installations, provide a minimum size 8 AWG EGC. The EGC is paid for under Item 620.

### C. TEMPORARY WIRING

1. Install temporary conductors and electrical equipment in accordance with the NEC article "Temporary Installations" and Department standard sheets.

2. Provide a ground fault circuit interrupter (GFCI) for power outlets for portable electrical equipment, power tools, ice machines, ice storage bins and refrigerators located outdoors at grade. GFCI may be any one of the following: molded cord and plug set, receptacle, or circuit breaker type.

3. Use listed wire nuts with factory applied sealant for temporary wiring where approved.

4. Enclose conductor splices within a listed enclosure or ground box, or ensure the splices are more than 10 ft. above grade vertically and more than 5 ft. horizontally from any metal structure. Where installing temporary conductors in areas subject to vehicle traffic or mobile construction equipment, ensure the vertical clearance to ground is at least 18 ft. when measured at the lowest point. Ground messenger wires that support power conductors in conformance with the NEC.

5. Protect and when necessary repair any existing electrical conduits uncovered during the construction process in a timely manner and in conformance with the NEC.

## GROUND RODS & GROUNDING ELECTRODES

### A. MATERIAL INFORMATION

1. Provide and install a grounding electrode at electrical services. Provide ground rods according to DMS 11040 and the plans. Larger diameter or longer length rods may be called for in some specific locations, see the individual plans sheets. Concrete encased grounding electrodes may be called for in specific locations including electrical service, see individual plan sheets.

### B. CONSTRUCTION METHODS

1. Furnish auxiliary ground rods for lightning protection and install in soil, concrete, or both, as called for in the plans. For ground rods installed in concrete, ensure the connection of the conductor to the ground rod is readily accessible for inspection or repairs. For ground rods installed in soil, ensure that the upper end is between 2 to 4 in. below finished grade.

2. Do not place ground rods in the same drilled hole as a timber pole.

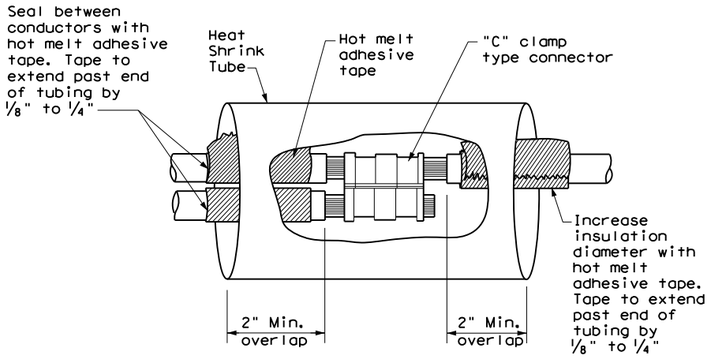
3. Install ground rods so the imprinted part number is at the upper end of the rod.

4. Remove all non-conductive coatings such as concrete splatter from the rod at the clamp location.

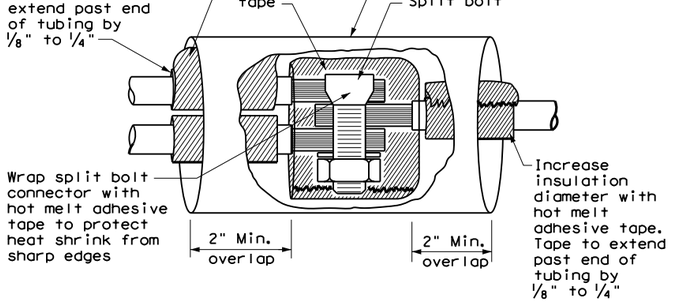
5. Route all conductors as short and straight as possible for connection to lightning protection ground rods. When a bend is required, ensure a minimum radius bend of four inches for these conductors.

6. Unless otherwise called for in the plans, protect grounding electrode conductors with non-metallic conduit. When protecting grounding electrode conductors with metal conduit, provide and install a grounding type bushing and properly sized bonding jumper on each end of the metal conduit.

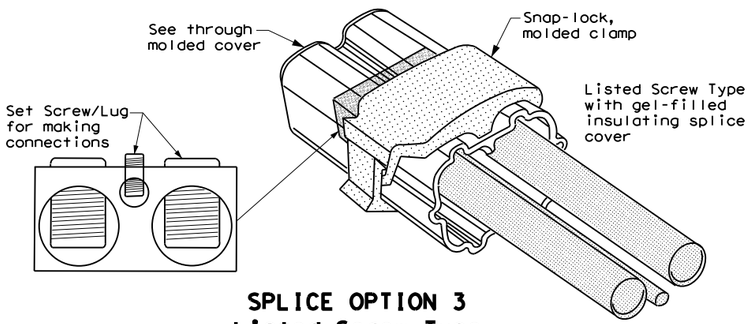
7. Written authorization is required before installing a ground rod in a horizontal trench for rocky soil or a solid rock bottom.




**SPLICE OPTION 1**
**Compression Type**




**SPLICE OPTION 2**
**Split Bolt Type**




**SPLICE OPTION 3**
**Listed Screw Type**

Texas Department of Transportation

Traffic Operations Division Standard

# ELECTRICAL DETAILS CONDUCTORS

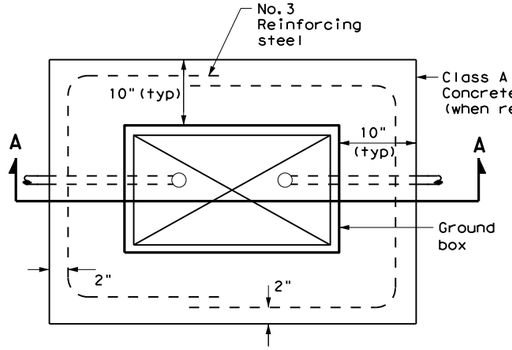
# ED(3)-14

| FILE: | ed3-14.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|---|
| © TxDOT | October 2014 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | | 6367 | 43 | 001 | IH-20 |
| | | DIST | COUNTY | | SHEET NO. |
| | | 10 | SMITH, ETC. | | 96 |

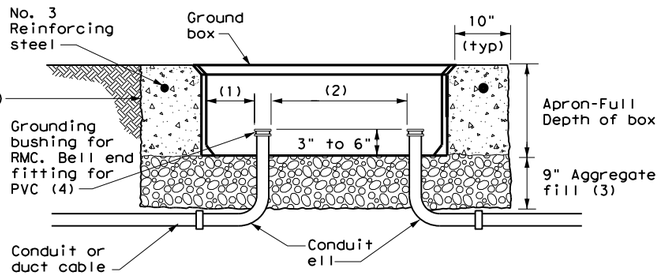
DATE:
FILE:

71C

DATE:
FILE:




PLAN VIEW




SECTION A - A

## APRON FOR GROUND BOX

(1) Uniformly space ends of conduits within the ground box. Position ends of conduits so that ground box walls do not interfere with the installation of grounding bushings or bell end fittings.

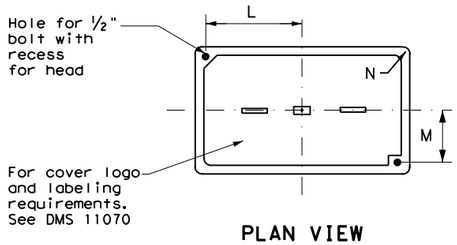
(2) Maintain sufficient space between conduits to allow for proper installation of bushing.

(3) Place aggregate under the box, not in the box. Aggregate should not encroach on the interior volume of the box.

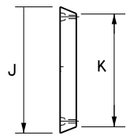
(4) Install a grounding bushing on the upper end of all RMC terminating in a ground box. Ground RMC elbows when any part of the elbow is less than 18 in. below the bottom of the ground box. Install a PVC bushing or bell end fitting on the upper end of all PVC conduits terminating in a ground box.

| GROUND BOX DIMENSIONS | |
|---|---|
| TYPE | OUTSIDE DIMENSIONS (INCHES) (Width x Length X Depth) |
| A | 12 X 23 X 11 |
| B | 12 X 23 X 22 |
| C | 16 X 29 X 11 |
| D | 16 X 29 X 22 |
| E | 12 X 23 X 17 |

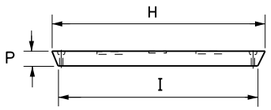
| GROUND BOX COVER DIMENSIONS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| TYPE | DIMENSIONS (INCHES) | | | | | | | |
| | H | I | J | K | L | M | N | P |
| A, B & E | 23 1/4 | 23 | 13 3/4 | 13 1/2 | 9 7/8 | 5 1/8 | 1 3/8 | 2 |
| C & D | 30 1/2 | 30 1/4 | 17 1/2 | 17 1/4 | 13 1/4 | 6 3/4 | 1 3/8 | 2 |




PLAN VIEW




END




SIDE

## GROUND BOX COVER

## GROUND BOXES

A. MATERIALS

1. Provide polymer concrete ground boxes measuring 16x30x24 in. (WxLxD) or smaller in accordance with Departmental Material Specification (DMS) 11070 "Ground Boxes" and Item 624 "Ground Boxes."

2. Provide Type A, B, C, D, and E ground boxes as shown in the plans, and as listed on the Material Producers List (MPL) on the Department web site under "Roadway Illumination and Electrical Supplies," Item 624.

3. Ensure ground box cover is correctly labeled in accordance with DMS 11070.

4. Provide larger ground boxes in accordance with Item 624 and as shown in the plans.

B. CONSTRUCTION METHODS

1. Remove all gravel and dirt from conduit. Cap all conduits prior to placing aggregate and setting ground box. Provide Grade 3 or 4 coarse aggregate as shown on Table 2 of Item 302 "Aggregates for Surface Treatments." Ensure aggregate bed is in place and at least 9 inches deep, prior to setting the ground box. Install ground box on top of aggregate.

2. Cast ground box aprons in place. Reinforcing steel may be field bent. Ensure the depth of concrete for the apron extends from finished grade to the top of the aggregate bed under the box. Ground box aprons, including concrete and reinforcing steel, are subsidiary to ground boxes when called for by descriptive code.

3. Keep bolt holes in the box clear of dirt. Bolt covers down when not working in ground boxes.

4. Install all conduits and ells in a neat and workmanlike manner. Uniformly space conduits so grounding bushings and bell end fittings can easily be installed.

5. Temporarily seal all conduits in the ground box until conductors are installed.

6. Permanently seal conduits immediately after the completion of conductor installation and pull tests. Permanently seal the ends of all conduits with duct seal, expandable foam, or other method as approved. Do not use duct tape as a permanent conduit sealant. Do not use silicone caulk as a sealant.

7. When a ground rod is present in a ground box, bond all equipment grounding conductors together and to the ground rod with listed connectors.

8. When a type B or D ground box is stacked to meet volume requirements, it is allowable to cut an appropriately sized hole for conduit entry in the side wall at least 18 inches below grade.

9. If an existing ground box in the contract has a metal cover, bond the cover to the equipment grounding conductor with a 3 ft. long stranded bonding jumper the same size as the grounding conductor. The bonding jumper is subsidiary to various bid items. Verify existing ground boxes with metal covers are shown on the plans, with notes fully describing the work required.

10. If other ground boxes with metal covers are within the project limits but are not part of the contract, the Engineer may direct the Contractor to bond the metal covers, identifying the specific boxes in writing. This work will be paid for separately.

11. Bond metal ground box covers to the grounding conductor with a tank ground type lug.

Texas Department of Transportation

Traffic Operations Division Standard

# ELECTRICAL DETAILS
# GROUND BOXES

## ED(4)-14

| FILE: ed4-14.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| © TxDOT October 2014 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 97 |

71D

DATE:
FILE:

## ELECTRICAL SERVICES NOTES

1. Provide new materials. Ensure installation and materials comply with the applicable provisions of the National Electrical Code (NEC) and National Electrical Manufacturers Association (NEMA) standards. Ensure material is Underwriters Laboratories (UL) listed. Provide and install electrical service conduits, conductors, disconnects, contactors, circuit breaker panels, and branch circuit breakers as shown on the Electrical Service Data chart in the plans. Faulty fabrication or poor workmanship in material, equipment, or installation is justification for rejection. Where manufacturers provide warranties and guarantees as a customary trade practice, furnish these to the State.

2. Provide electrical services in accordance with Electrical Details standard sheets, Departmental Material Specification (DMS) 11080 "Electrical Services,"DMS 11081 "Electrical Services-Type A," DMS 11082 "Electrical Services-Type C," DMS 11083 "Electrical Services-Type D," DMS 11084 "Electrical Services-Type T," DMS 11085 "Electrical Services-Pedestal (PS)", and Item 628 "Electrical Services" of the Standard Specifications. Provide electrical service types A, C, and D, as listed on the Material Producers List (MPL) on the Department web site under "Roadway Illumination and Electrical Supplies," Item 628. Provide other service types as detailed on the plans.

3. Provide all work, materials, services, and any incidentals needed to install a complete electrical service as specified in the plans.

4. Coordinate with the Engineer and the utility provider for metering and compliance with utility requirements. Primary line extensions, connection charges, meter charges, and other charges by the utility company to provide power to the location are paid for in accordance with Item 628. Get approval for the costs associated with these charges prior to engaging the utility company to do the work. Consult with the utility provider to determine costs and requirements, and coordinate the work as approved.

5. The enclosure manufacturer will provide Master Lock Type 2 with brass tumblers keyed #2195 for all custom electrical enclosures. Installing Contractor is to provide Master Lock #2195 Type 2 with brass tumblers for "off the shelf" enclosures. Master Lock #2195 keys and locks become property of the State. Unless otherwise approved, do not energize electrical service equipment until locks are installed.

6. Enclosures with external disconnects that de-energize all equipment inside the enclosure do not need a dead front trim. Protect incoming line terminations from incidental contact as required by the NEC.

7. When galvanized is specified for nuts, screws, bolts or miscellaneous hardware, stainless steel may be used.

8. Provide wiring and electrical components rated for 75°C. Provide red, black, and white colored XHHW service entrance conductors of minimum size 6 American Wire Gauge (AWG). Identify size 6 AWG conductors by continuous color jacket. Identify electrical conductors sized 4 AWG and larger by continuous color jacket or by colored tape. Mark at least 6 inches of the conductor's insulation with half laps of colored tape, when identifying conductors. Ensure each service entrance conductor exits through a separately bushed non-metallic opening in the weatherhead. The lengths of the conductors outside the weatherhead are to be 12 inches minimum, 18 inches maximum, or as required by utility.

9. All electrical service conduit and conductors attached to the electrical service including the riser or the elbow below ground are subsidiary to the electrical service. For an underground utility feed, all service conduit and conductors after the elbow, including service conduit and conductors for the utility pole riser when furnished by the Contractor, will be paid for separately.

10. Provide rigid metal conduit (RMC) for all conduits on service, except for the ½ in. PVC conduit containing the electrical service grounding electrode conductor. Size the service entrance conduit as shown in the plans. Ensure conduit for branch circuit entry to enclosure is the same size as that shown on the layout sheets for branch circuit conduit. Extend all rigid metal conduits a minimum of 6 inches underground and then couple to the type and schedule of the conduit shown on the layout for that particular branch circuit. Install a grounding bushing on the RMC where it terminates in the service enclosure.

11. Use of liquidtight flexible metal conduit (LFMC) is allowed between the meter and service enclosure when they are mounted 90 to 180 degrees to each other. Size the LFMC the same size as service entrance conduit. LFMC must not exceed 3 feet in length. Strap LFMC within 1 foot of each end. LFMC less than 12 inches in length need not be strapped. Each end of LFMC must have a grounding bushing or be terminated with a grounding fitting. The LFMC must contain a grounded (neutral) conductor. Ensure any bend in LFMC never exceeds 180 degrees. A pull test is required on all installed conductors, with at least six inches of free conductor movement demonstrated to the satisfaction of the Engineer.

12. Ensure all mounting hardware and installation details of services conform to utility company specifications.

13. For all electrical service enclosures listed under Item 628 on the MPL, the UL 508 enclosure manufacturers will prepare and submit a schematic drawing unique to each service. Before shipment to the job site, place the applicable laminated schematic drawings and the laminated plan sheet showing the electrical service data chart used to build the enclosure in the enclosure's data pocket. The installing contractor will copy and laminate the actual project plan sheets detailing all equipment and branch circuits supplied by that service. The laminated plan sheets are to be placed in the service enclosure's document pocket. Reduce 11 in. x 17 in. plan sheets to 8 ½ in. x 11 in. before laminating. If the installation differs from the plan sheets, the installing contractor is to redline plan sheets before laminating.

14. When providing an "Off The Shelf" Type D or Type T service, provide laminated plan sheets detailing equipment and branch circuits supplied by that service. Reduce 11 in. x 17 in. plan sheets to 8 ½ in. x 11 in before laminating. Deliver these drawings before completion of the work to the Engineer, instead of placing in enclosure that has no door pocket.

15. Do not install conduit in the back wall of a service enclosure where it would penetrate the equipment mounting panel inside the enclosure. Provide grounding bushings on all metal conduits, and terminate bonding jumpers to grounding bus. Grounding bushings are not required when the end of the metal conduit is fitted with a conduit sealing hub or threaded boss, such as a meter base hub.

## SERVICE ASSEMBLY ENCLOSURE

1. Provide threaded hub for all conduit entries into the top of enclosure.

2. Type galvanized steel (GS) enclosures may be used for Type C panelboards and for Type D and T services that do not use an enclosure mounted photocell or lighting contactor. Provide GS enclosures in accordance with DMS 11080, 11082, 11083, and 11084.

3. Provide aluminum (AL) and stainless steel (SS) enclosures for Types A, C, and D in accordance with DMS 11080, 11081, 11082, 11083, and 11084. Do not paint stainless steel.

4. Provide pedestal service (PS) enclosures in accordance with ED(9) and DMS 11080 and 11085. Do not provide GS pedestal services. If GS is shown in the PS descriptive code, provide an AL enclosure.

## MAIN DISCONNECT & BRANCH CIRCUIT BREAKERS

1. Field drill flange-mounted remote operator handle if needed, to ensure handle is lockable in both the "On" and "Off" positions.

2. When the utility company provides a transformer larger than 50 KVA, verify that the available fault current is less than the circuit breaker's ampere interrupting capacity (AIC) rating and provide documentation from the electric utility provider to the Engineer.

## PHOTOELECTRIC CONTROL

1. Provide photocell as listed on the MPL. Move, adjust, or shield the photocell from stray or ambient night time light to ensure proper operation. Mount photocell facing north when practical. Mount top of pole photocells as shown on Top Mounted Photocell Detail.

## *ELECTRICAL SERVICE DATA

| Elec. Service ID | Plan Sheet Number | Electrical Service Description | Service Conduit **Size | Service Conductors No./Size | Safety Switch Amps | Main Ckt. Bkr. Pole/Amps | Two-Pole Contractor Amps | Panelbd/ Loadcenter Amp Rating | Branch Circuit ID | Branch Ckt. Bkr. Pole/Amps | Branch Circuit Amps | KVA Load |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SB 183 | 289 | ELC SRV TY A 240/480 100(SS)AL(E)SF(U) | 2" | 3/#2 | 100 | 2P/100 | 100 | N/A | Lighting NB | 2P/40 | 26 | 28.1 |
| | | | | | | | | | Lighting SB | 2P/40 | 25 | |
| | | | | | | | | | Underpass | 1P/20 | 15 | |
| | | | | | | | | | | | | |
| NB Access | 30 | ELC SRV TY D 120/240 060(NS)SS(E)TS(O) | 1 ¼" | 3/#6 | N/A | 2P/60 | | 100 | Sig. Controller | 1P/30 | 23 | 5.3 |
| | | | | | | | 30 | | Luminaires | 2P/20 | 9 | |
| | | | | | | | | | CCTV | 1P/20 | 3 | |
| | | | | | | | | | | | | |
| 2nd & Main | 58 | ELC SRV TY T 120/240 000(NS)GS(N)SP(O) | 1 ¼" | 3/#6 | N/A | N/A | N/A | 70 | Flashing Beacon 1 | 1P/20 | 4 | 1.0 |
| | | | | | | | | | Flashing Beacon 2 | 1P/20 | 4 | |

* Example only, not for construction. All new electrical services must have electrical service data chart specific to that service as shown in the plans.

** Verify service conduit size with utility. Size may change due to utility meter requirements. Ensure conduit size meets the National ELectrical Code.

## EXPLANATION OF ELECTRICAL SERVICE DESCRIPTIVE CODE

ELEC SERV TY X XXX/XXX XXX (XX) XX (X) XX (X)

Schematic Type

Service Voltage V / V

Disconnect Amp Rating
000 indicates main lug only/
Typically Type T

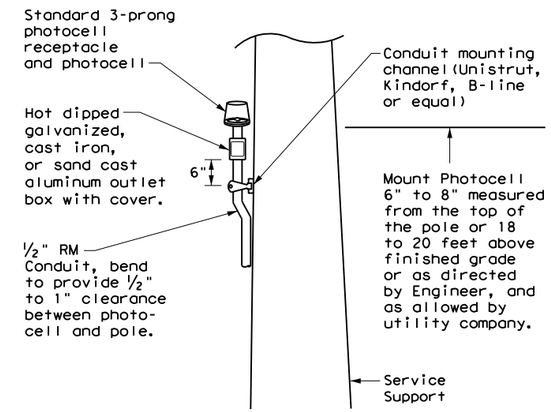
(SS)= Safety Switch Ahead of Meter-Check with Utility
(NS)= No safety Switch Ahead of Meter-Check with Utility

Enclosure Type
GS= Galvanized steel("off the shelf")
SS= Stainless steel(Custom Enclosure)See MPL
AL= Aluminum (Custom Enclosure)See MPL

Photocell Mounting Location
(E)= Inside Service/Enclosure Mounted
(T)= Top of pole
(L)= Luminaire mounted
(N)= None/No Photocell or Lighting Contactor Required

Service Support Type
GC= Granite concrete
OC= Other concrete
TP= Timber pole
SP= Steel pole
SF= Steel frame
OT= Pole by others or paid for separately
EX= Existing pole
TS= Service on traffic signal pole
PS= Pedestal Service

O= Overhead Service Feed from Utility
U= Underground Service Feed from Utility




## TOP MOUNTED PHOTOCELL

Install conduit strap maximum 3 feet from box. 5 foot maximum spacing between straps supporting conduit.

Texas Department of Transportation

Traffic Operations Division Standard

# ELECTRICAL DETAILS SERVICE NOTES & DATA

## ED(5)-14

| FILE: ed5-14.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| © TxDOT October 2014 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 98 |

DATE:
FILE:

# ROADWAY ILLUMINATION ASSEMBLY NOTES

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," 4th Edition (2001) (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

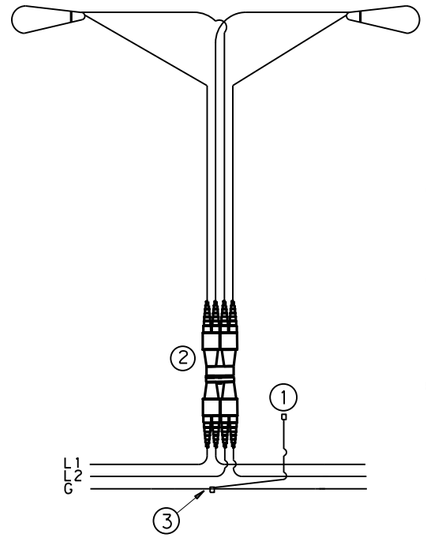
      i. Ensure pole is plumb and mast arm is perpendicular to the roadway according to plans to within 5 degrees.

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.




L1,L2 = Hot Conductors
G = Grounding Conductor

## TYPICAL WIRING DIAGRAM

LUMINAIRES SERVED AT 480V ON 240/480 VOLT SERVICE OR LUMINAIRES SERVED AT 240V FOR 120/240 VOLT SERVICE.

## 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.

Texas Department of Transportation

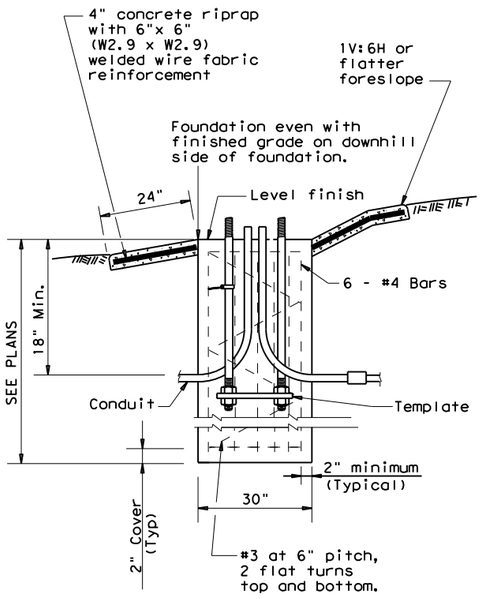
Traffic Operations Division Standard

# ROADWAY ILLUMINATION DETAILS

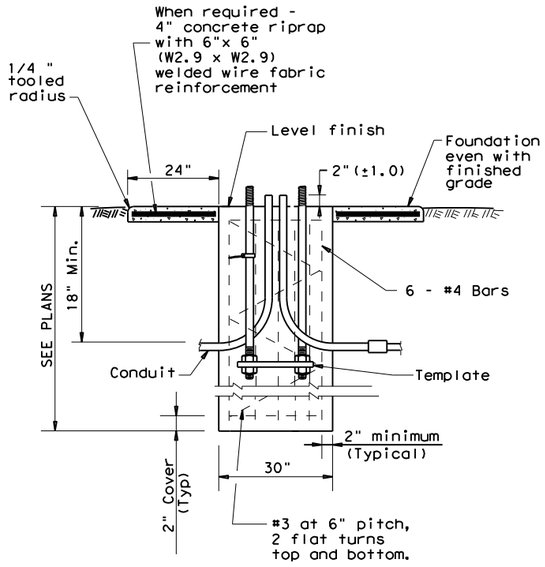
# RID(1)-17

| FILE: rid1-17.dgn | DN: | CK: | DW: | CK: |
|---|---|---|---|---|
| ©TxDOT January 2007 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 7-17 | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 99 |

72A




**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. | 1in.x 30in. |
| 40-50 ft. | 15 in. | 17 ¼in. | 1 ¼in. x 30in. |

**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:

1. "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.
2. 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.
3. 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.
4. 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.
5. Place riprap around the foundation when called for elsewhere in the plans. Riprap will be paid for under Item 432.
6. 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.
7. Use 4 hold down and 4 connecting washers on transformer base poles as recommended by the manufacturer and supplied with base.
8. 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.
9. Conduit location in foundations is critical for breakaway devices. Place conduits 2 in. apart on centerline as shown.
10. 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.
11. Use riprap on T-base foundations that are located on sloped grades.

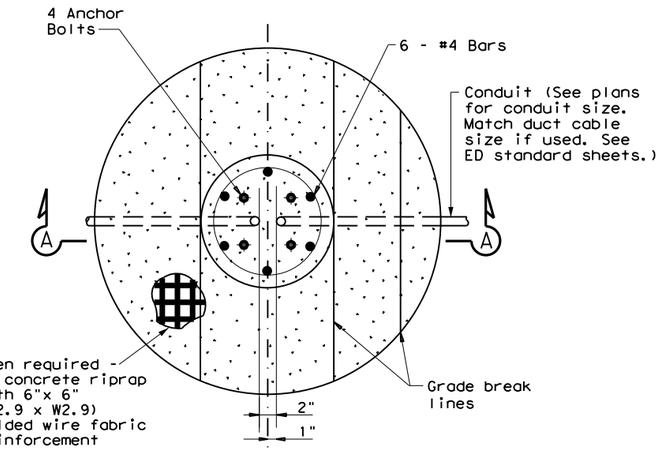
**TABLE 4**

**BREAKAWAY POLE PLACEMENT (See note 6)**

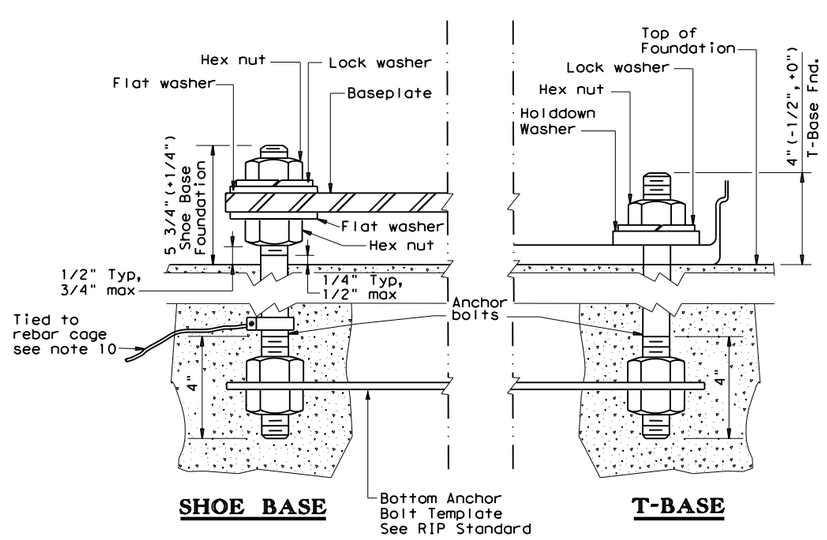
| ROADWAY FUNCTIONAL CLASSIFICATION | ** POLE OFFSET (DISTANCE TO FACE OF TRANSFORMER BASE) |
|---|---|
| Freeway Mainlanes (roadway with full control of access) | 15 ft. (minimum and typical) from lane edge |
| All curbed, 45 mph or less design speed | 2.5 ft. minimum (15 ft. desirable) from curb face |
| 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.




**FOUNDATION DETAIL**




**ANCHOR BOLT DETAIL**

Texas Department of Transportation

*Traffic Operations Division Standard*

# ROADWAY ILLUMINATION DETAILS
## (RDWY ILLUM FOUNDATIONS)

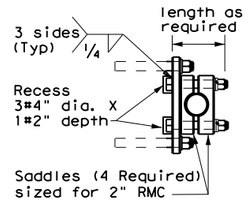
# RID(2)-17

| FILE: rid2-17.dgn | DN: | CK: | DW: | CK: |
|---|---|---|---|---|
| © TxDOT January 2007 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS 1-11 7-17 | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 100 |

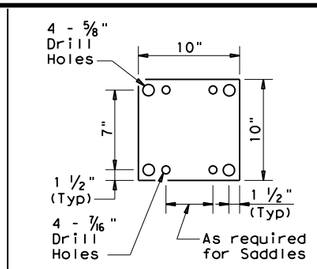
72B

DATE:
FILE:

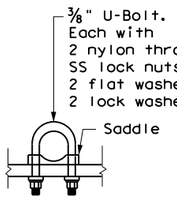
DATE:
FILE:



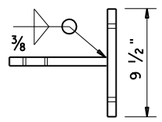

SECTION A-A



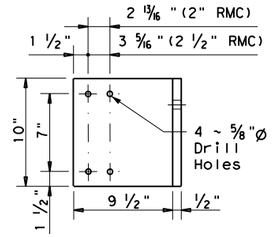

MOUNTING PLATE
(ASTM A-36 or better)



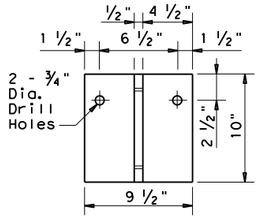

CLAMP DETAIL
(2 Req'd)




PLAN VIEW

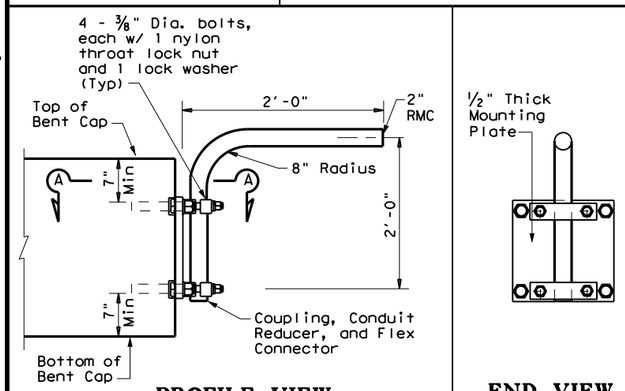



FRONT




SIDE

## BRACKET DETAIL
Make from 1/2" plate (ASTM A-36 or better)

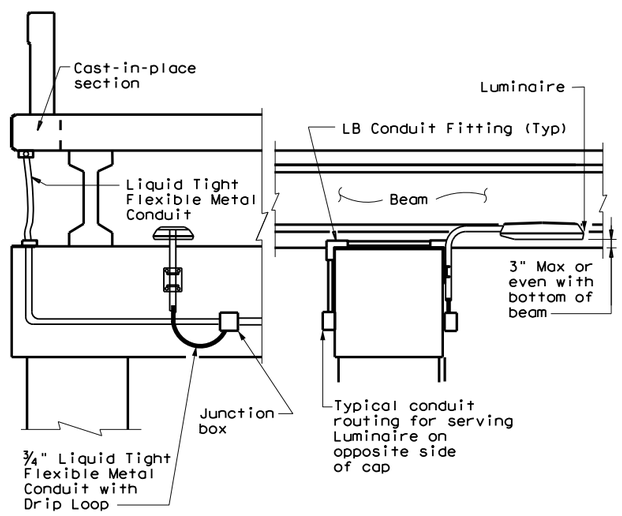



PROFILE VIEW
Or as Required
(See Note A.3)



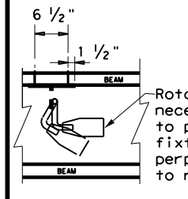

END VIEW

## UNDERPASS LIGHTING ARM



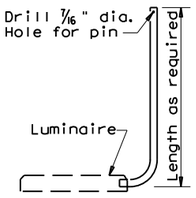

**IN RD IL AM (U/P)(TY 1)**
If bridge has pre-cast panels under deck, run circuit under deck edge.

## UNDERPASS LIGHTING TYPE 1

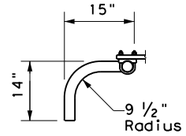



PLAN VIEW

## FIXTURE ORIENTATION

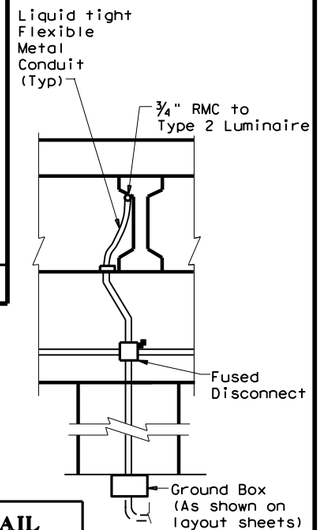



SIDE



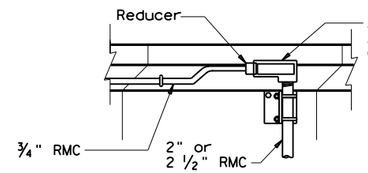

PLAN VIEW

## ARM DETAIL

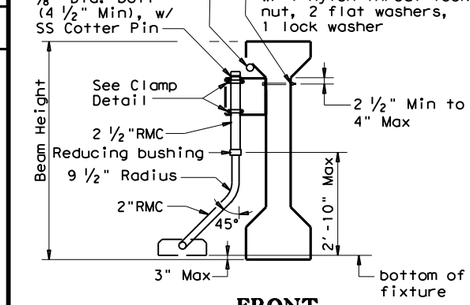



3 - No. 12 XHHW in 3/4" RMC for Branch Circuit runs from fused disconnect to underpass Luminaires

## CONDUIT DETAIL



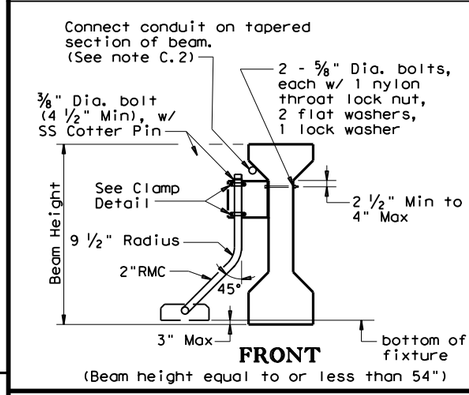

## CONDUIT CONNECTION PROFILE




FRONT
(Beam height greater than 54")

**IN RD IL AM (U/P)(TY 2)**

## UNDERPASS LIGHTING TYPE 2




FRONT
(Beam height equal to or less than 54")

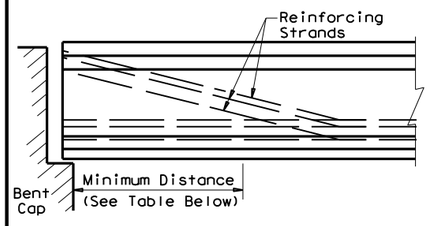



**TABLE 5**
**LOCATION OF UNDERPASS LIGHT MOUNTING BRACKET TABLE**

| SPAN LENGTH | MINIMUM DISTANCE |
|---|---|
| ≤ 50' | 10'-0" |
| 50' - 70' | 15'-0" |
| 70' - 90' | 20'-0" |
| > 90' | 25'-0" |

**LOCATION OF UNDERPASS LIGHT MOUNTING BRACKET**

## GENERAL NOTES:

A. ALL 150 watt HPS and 150 watt equivalent LED Luminaires

1. Luminaire locations, conduit and conductor sizes and routing are typical and diagrammatic only. See project layout sheets for specific details.
2. 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.
3. 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)
4. Except as noted, galvanize all structural steel and exposed bolts, nuts, and washers in accordance with Item 445 "Galvanizing".
5. Fabrication of brackets and support arms will not be paid for directly but is subsidiary to Item 610, "Roadway Illumination Assemblies."
6. 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.
7. 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

1. Provide 2 in. rigid metal conduit (2.375" O.D., 0.146" wall) for Type 1 arm shaft.
2. 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.
3. Attach conduit to plate with 4 saddles, four - 3/8 in. diameter bolts, nylon throat lock nuts, and lock washers.

### C. TYPE 2

1. 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.
2. 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.
3. 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.

Texas Department of Transportation

Traffic Operations Division Standard

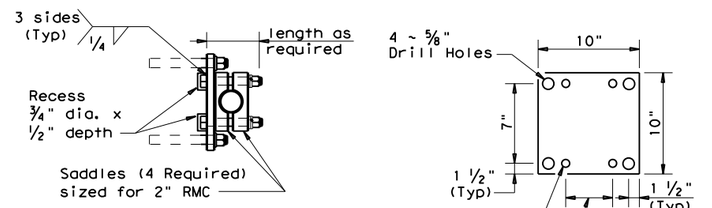
# ROADWAY ILLUMINATION DETAILS
(UNDERPASS LIGHT FIXTURES)

# RID(3)-17

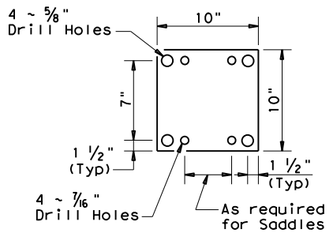
| FILE: | rid3-17.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|---|
| © TxDOT | May 2013 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | | 6367 | 43 | 001 | IH-20 |
| 2-14 | | DIST | COUNTY | | SHEET NO. |
| 7-17 | | 10 | SMITH, ETC. | | 101 |

72C

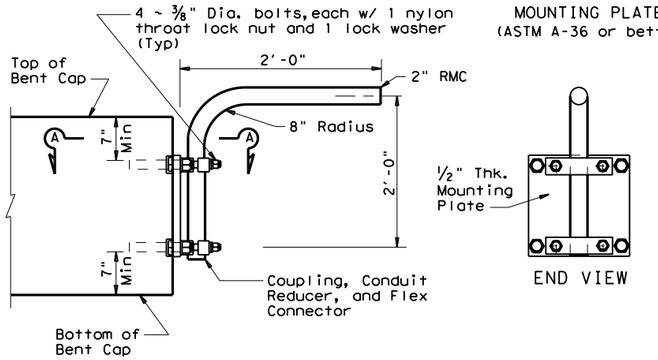
DATE:
FILE:




SECTION A-A




MOUNTING PLATE
(ASTM A-36 or better)




PROFILE VIEW
Or as Required
(See Note A.4)




END VIEW

## UNDERPASS LIGHTING ARM TYPE 1

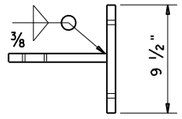
**NOTES:**

A. ALL 150 watt H.P.S. LUMINAIRES
1. Luminaire locations, conduit and conductor sizes and routing are typical and diagrammatic only. See project layout sheets for specific details.
2. Conduit will be paid for under Item 618, "Conduit" and conductors will be paid for under Item 620, "Electrical Conductor," unless otherwise shown on the plans. See lighting layout sheets.
3. Install a ground rod and attach to the equipment grounding conductor in all ground boxes containing conduit that extends above grade 6 in. or more. Install grounding bushings and properly bond RMC in these boxes.
4. Adjust conduit in saddles to place fixture height and orientation as required. See fixture orientation detail and layout sheet. Where practicable, place luminaires so the bottom of luminaire is above the bottom of the beam, maximum of 3 in. (See detail UNDER PASS LIGHTING ARM TYPE 2)
5. Except as noted, all structural steel and exposed bolts, nuts, washers shall be galvanized in accordance with Item 445 "Galvanizing".
6. Fabrication of brackets and support arms will not be paid for directly but is subsidiary to Item 610, "Roadway Illumination Assemblies."
7. 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.

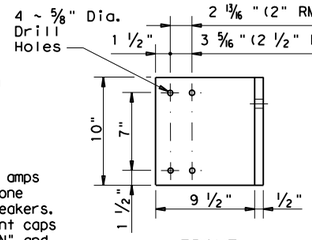
B. TYPE 1
1. Provide 2 in. rigid metal conduit (2.375" O.D., 0.146" wall) for Type 1 arm shaft.
2. Use ⅜ in. stainless steel bolt or stud non-epoxy type expansion anchors for concrete for Type 1 mounting. Except as noted, provide an allowable 2650 lbs minimum pull-out force (after consideration of adjustment factors for edge distance and bolt spacing) for each anchor. Install each anchor to the embedment depth recommended by the manufacturer.
3. Attach conduit to plate with 4 saddles, four - ⅜ in. diameter bolts, nylon throat lock nuts and lock washers.

C. TYPE 2
1. Provide 2 in. rigid metal conduit (2.375" O.D., 0.146" wall) or provide a combination of 2 ½ 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.
2. 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.
3. 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.

NOTE: 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.

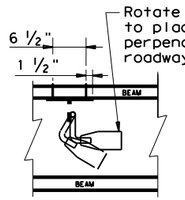



PLAN VIEW



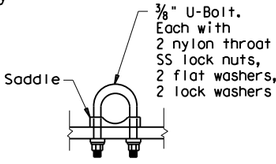

## BRACKET DETAIL

Make from ½" plate
(ASTM A-36 or better)

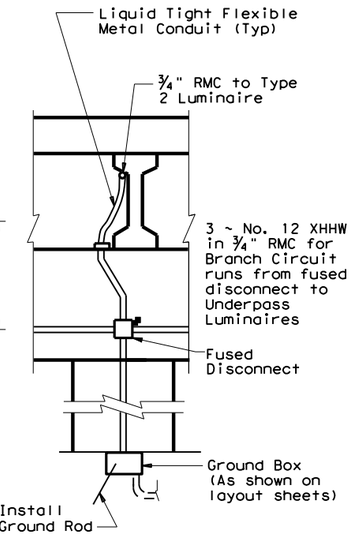



## FIXTURE ORIENTATION

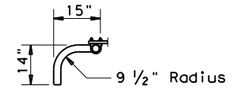
Plan View



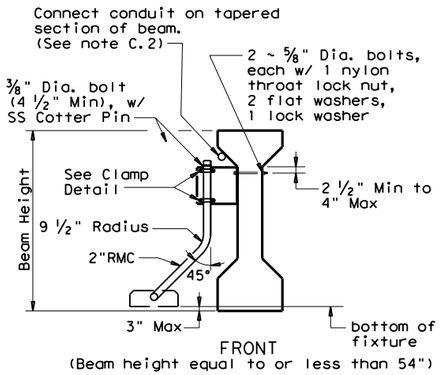

CLAMP DETAIL
(2 Req'd)

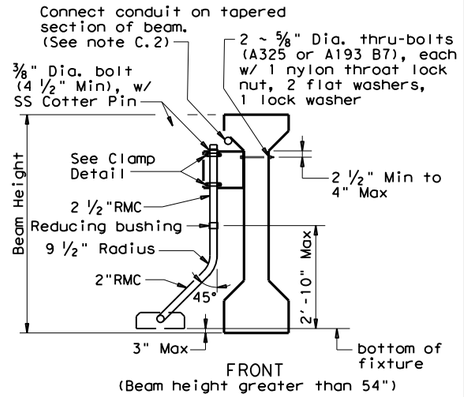



## INS RD IL AM (U/P) (TY 2) (.15 KW)

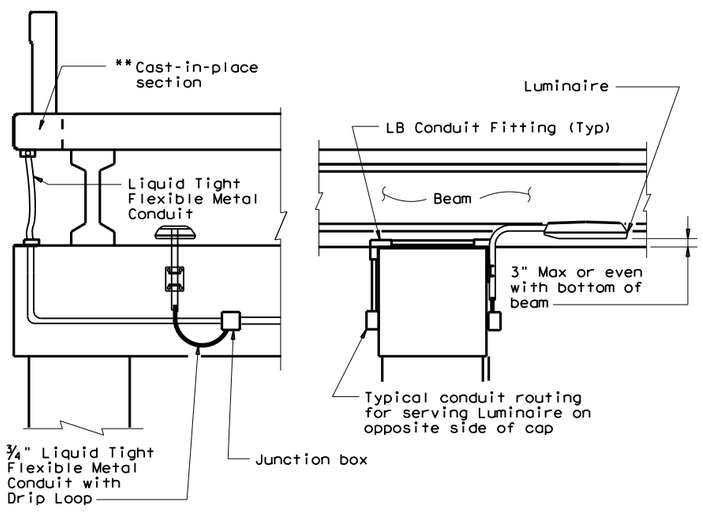


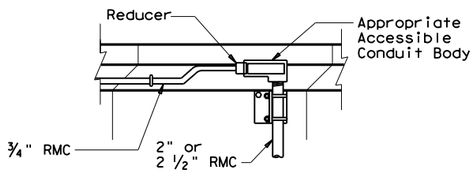

PLAN VIEW



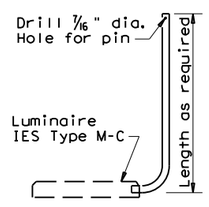




## UNDERPASS LIGHTING ARM TYPE 2



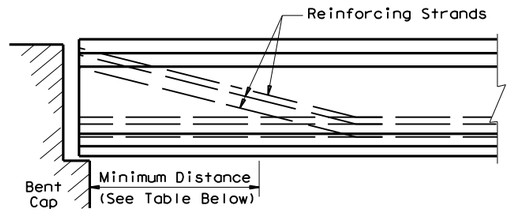

## CONDUIT CONNECTION PROFILE




SIDE

## INS RD IL AM (U/P) (TY 1) (.15 KW)

If bridge has pre-cast panels under deck, run circuit under deck edge.




## LOCATION OF UNDERPASS LIGHT MOUNTING BRACKET

**LOCATION OF UNDERPASS LIGHT MOUNTING BRACKET TABLE**

| SPAN LENGTH | MINIMUM DISTANCE |
|---|---|
| ≤ 50' | 10'-0" |
| 50' - 70' | 15'-0" |
| 70' - 90' | 20'-0" |
| > 90' | 25'-0" |

Texas Department of Transportation

Traffic Operations Division Standard

# ROADWAY ILLUMINATION DETAILS

## (UNDERPASS LIGHT FIXTURES)

# RID(UP)-14

| FILE: ridup14.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| © TxDOT May 2013 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 2-14 | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 102 |

72D

DATE:
FILE:

## GENERAL NOTES:

Scope:
Details apply to Induction Fluorescent type Roadway Illumination Assemblies, bid under Item 610, "Roadway Illumination Assemblies". Associated hardware, mounting assemblies, parts, junction boxes, lamps, lenses, brackets, disconnect, tools, and labor required to install the underpass lighting assembly will not be paid for directly but are subsidiary to Item 610. Conduit and conductors supplying the fixtures are paid for separately. Mounting channel for conduit supports are not paid for directly but are subsidiary to the various bid items of the contract.

Fixture Housing:

A. Provide fixture with a maximum of 28 in. square housing and 13 in. maximum overall depth (mounting mechanism and junction box may extend outside the 28 in. square). Meet ANSI 136.31 3.0 G vibration requirements.
B. Provide cutoff fixture with flat glass. Provide polished aluminum reflector with a min. of 95% efficiency in reflecting light. Do not block light emitting from the fixture with lens retainer (i.e. lens retainer protruding over the reflecting surface).
C. Provide housing made of aluminum sheeting (0.10 in. min.), stainless steel (14 ga. min.), or low copper content die-cast aluminum (1/8 in. min. wall thickness). Ensure fixture housing is constructed of good workmanship. Provide external mounting mechanism on fixture without any penetrations into fixture housing. Protect and seal penetrations from junction box to ballast compartment to ensure the integrity of conductor insulation and to assure required International Protection (IP) rating. Seal openings or construction joints in housing. Construct seams with continuous welds. Grind flush any seams on frame and housing.
D. Provide a heat tempered C73 flat glass lens a minimum of 5/32 in. thick, or flat clear tempered glass lens with a minimum of 3/16 in. thick. Seal lens frame with a seamless or vulcanized seam, closed cell silicone gasket, or provide a gasket material as approved by the Engineer.
E. Secure lens frame to the housing with a minimum of eight #10 stainless steel screws. Ensure a minimum of IP65 rating will be maintained inside fixture housing, even after any maintenance is performed on the fixture.
F. Provide and mount junction box on the fixture housing to provide wire connection to fixture. Provide junction box with a minimum of 3/16 in. thick aluminum housing or hot dipped galvanized cast iron walls. Provide threaded knockout for a 3/4 in. conduit entry at junction box. Thread, seal, weld or use other department approved means to attach junction box to the fixture housing.
G. Provide fixtures painted completely inside and outside with gray thermal TGIC, consistent in color to "cobra head" luminaire. Use other colors as approved by the Engineer.

Ballast and Lamp:

A. Provide ballast that operates universally between 120 and 277 VAC(+-10%) and meets ANSI 62.41 category"A" transient protection.
B. Provide Induction Fluorescent lamp system with a minimum rated output of 150 watts.
C. Provide lamp system with a minimum Color Rating Index (CRI) of 80 and color temperature of 4100K.
D. Support "Icetron" lamps at each end of the lamp.
E. Provide lamp that passes the Toxicity Characteristics Leachate Procedure (TCLP) test.

Performance:

A. Provide fixture that operates at 11,000 minimum initial rated lumens. Provide fixture that emits minimum light levels as shown below (when mounted at 15 ft. above the midpoint of a circular area);
   1. 0.2 foot-candles in a 35 ft. radius,
   2. 1.0 foot-candle in a 22 ft. radius,
   3. 2.0 foot-candles in a 16 ft. radius,
   4. No point in a 35 ft. radius will exceed 27.0 foot-candles,
   5. Max. to min. ratio of 30 to 1.
B. Provide photometric data that complies with required TxDOT photometrics.

Manufacturer Warranty:

A. Provide warranty from lamp manufacturer certifying the fixture being capable of sufficient heat dissipation. Provide fixture listed to operate in ambient temperatures of 55 degrees C. Submit certification of approval with fixture submittal.
B. Provide a written 60,000-hour life replacement warranty from lamp and fixture manufacturers for the ballast/lamp combination for underpass installation conditions. Provide a 10-year fixture warranty from the date of installation. Provide full replacement of failed fixture for the first five-years delivered to project location. Provide replacement parts after 5-years up through 10-years of lifetime of fixture.
C. Lamp or fixture light-output dropping below 60% of initial rated lumens will be considered failed.
D. Present warranty for approval with the fixture submittal.

Mounting:

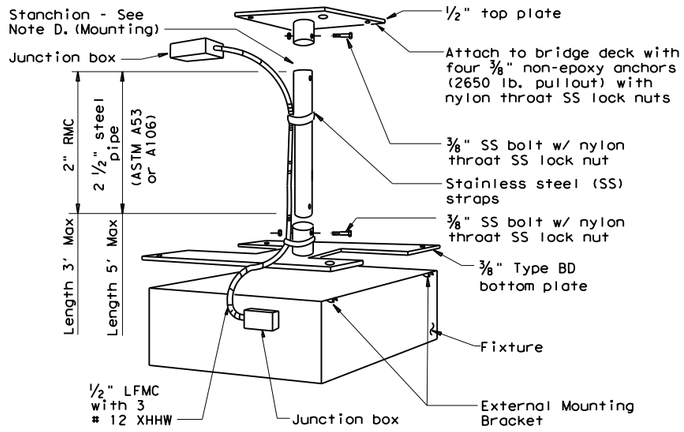
A. See RID(UP) for general routing of conduits under bridge structures. Embed conduit in concrete of bent caps and columns.
B. Install a heavy duty NEMA 3R fused disconnect or breaker enclosure rated at 30 amps and 480 volts to switch underpass luminaires as shown on plans, with at least one per bridge 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.
C. Do not randomly drill into pre-cast concrete beams. Drill only as specifically shown or as approved by the Engineer.
D. Position fixture lens flush with bottom of beam and adjust stanchion to seat fully into the 2 1/2 in. (or 3 in.) steel pipe. Field drill pipe and pin with bolt as shown. Do not oversize hole for pin. Repair galvanized cut ends and drilled holes with three coats of zinc rich paint (dry completely between coats).
E. Use 3/8 in. stainless steel bolt or stud non-epoxy type expansion anchors for concrete for Type BD and UB 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.
F. Except as noted, all structural steel and exposed bolts, nuts and washers shall be galvanized in accordance with Item 445 "Galvanizing."
G. For Type "UB" bracket, adjust vertical stanchion with fixture and align fixture lens flush with bottom of beam.
H. Adjust bracket dimensions as necessary to accommodate fixtures being supplied. Use Type "BD" for double T-beam mounting. Use other mounting arrangements as approved by the Engineer.
I. Provide a minimum clearance of 16.5 ft. from the roadway to the fixture, when mounting fixtures on box beams using "BB" type brackets. See Engineer for alternative underpass light mounting, if the 16.5 ft. clearance is not obtainable.
J. Submit other mounting arrangements designed according to the latest edition of the American Association of State Highway Transportation Officials (AASHTO) "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals", and approved by the Engineer.

Pre-qualification:

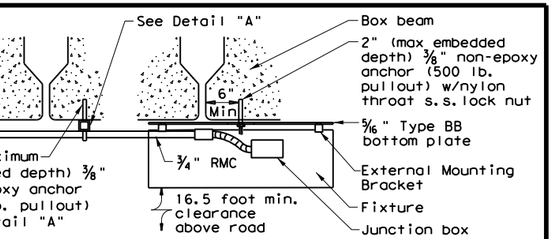
A. Provide fixtures and brackets with approved product codes as listed on the Department's Material Producer List (MPL), under Item 610 in the file Roadway Illumination and Electrical Supplies. The MPL can be found on the Department website.
B. Use of pre-qualified material does not relieve the contractor of the responsibility to ensure that the material meets specifications. All materials may be tested at any time and may be rejected if not in compliance with the specifications. Do not change material or manufacturing methods of approved fixtures without prior approval by the Department. Unapproved changes may result in removal of the manufacturer from the prequalified list for 1 yr.
C. All materials, including those shown on the MPL, may be inspected and tested at any time and may be rejected if not in compliance with the specifications.

Storage:

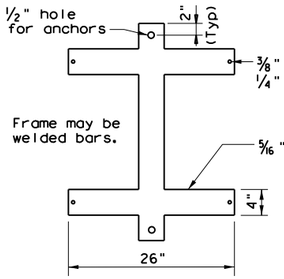
A. Store all fixtures in a safe dry environment. Fixtures that arrive damaged or weathered at the testing facility will be rejected and replaced at the contractors expense.



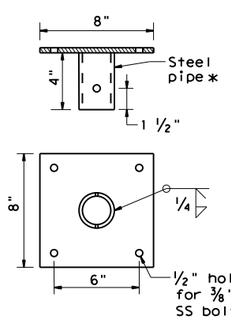

PERSPECTIVE TYPE BD
(BRIDGE DECK)



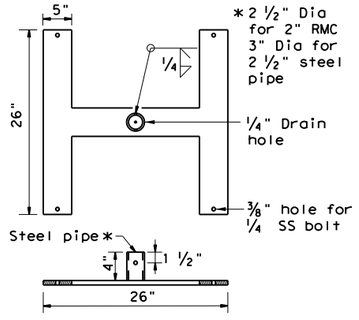

PERSPECTIVE TYPE BB
(BOX BEAM)



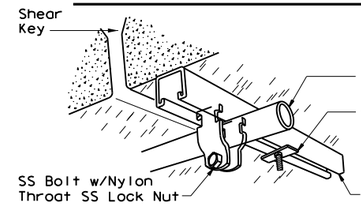

BOTTOM PLATE - TYPE BB




TOP PLATE - TYPE BD

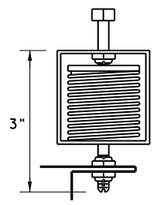



BOTTOM PLATE - TYPE BD



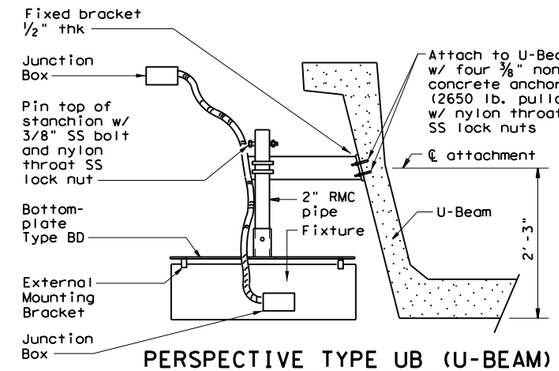

DETAIL "A"

Conduit Attachment to Box Beam
(shown longer than necessary for clarity)

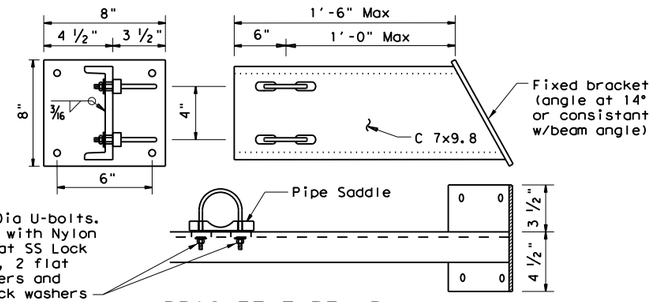



Install Spring clip with three nylon throat s.s. lock nuts.

DETAIL "B"
SHOCK ABSORBER SPRING CLIP
(When required by Manufacturer)




PERSPECTIVE TYPE UB (U-BEAM)




BRACKET TYPE UB

Texas Department of Transportation

Traffic Operations Division Standard

# ROADWAY ILLUMINATION DETAILS
(IF UNDERPASS LIGHT FIXTURES)

# RID(IF)-14

| FILE: ridif14.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT May 2013 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS 2-14 | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 103 |

72E

DATE:
FILE:

## SHIPPING PARTS LIST - POLES AND LUMINAIRE ARMS

| Nominal Mounting Ht. (ft) | Shoe Base Designation | | | | Quantity | T-Base Designation | | | | Quantity | CSB/SSCB Mounted Designation | | | | Quantity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pole | A1 | A2 | Luminaire | | Pole | A1 | A2 | Luminaire | | Pole | A1 | A2 | Luminaire | |
| 20 | (Type SA 20 S - 4) | | | (150W EQ) LED | | (Type SA 20 T - 4) | | | (150W EQ) LED | | | | | | |
| | (Type SA 20 S - 4 - 4) | | | (150W EQ) LED | | (Type SA 20 T - 4 - 4) | | | (150W EQ) LED | | | | | | |
| 30 | (Type SA 30 S - 4) | | | (250W EQ) LED | | (Type SA 30 T - 4) | | | (250W EQ) LED | | (Type SP 28 S - 4) | | | (250W EQ) LED | |
| | (Type SA 30 S - 4 - 4) | | | (250W EQ) LED | | (Type SA 30 T - 4 - 4) | | | (250W EQ) LED | | (Type SP 28 S - 4 - 4) | | | (250W EQ) LED | |
| | (Type SA 30 S - 8) | | | (250W EQ) LED | | (Type SA 30 T - 8) | | | (250W EQ) LED | | (Type SP 28 S - 8) | | | (250W EQ) LED | |
| | (Type SA 30 S - 8 - 8) | | | (250W EQ) LED | | (Type SA 30 T - 8 - 8) | | | (250W EQ) LED | | (Type SP 28 S - 8 - 8) | | | (250W EQ) LED | |
| 40 | (Type SA 40 S - 4) | | | (250W EQ) LED | | (Type SA 40 T - 4) | | | (250W EQ) LED | | (Type SP 38 S - 4) | | | (250W EQ) LED | |
| | (Type SA 40 S - 4 - 4) | | | (250W EQ) LED | | (Type SA 40 T - 4 - 4) | | | (250W EQ) LED | | (Type SP 38 S - 4 - 4) | | | (250W EQ) LED | |
| | (Type SA 40 S - 8) | | | (250W EQ) LED | | (Type SA 40 T - 8) | | | (250W EQ) LED | | (Type SP 38 S - 8) | | | (250W EQ) LED | |
| | (Type SA 40 S - 8 - 8) | | | (250W EQ) LED | | (Type SA 40 T - 8 - 8) | | | (250W EQ) LED | | (Type SP 38 S - 8 - 8) | | | (250W EQ) LED | |
| | (Type SA 40 S - 10) | | | (250W EQ) LED | | (Type SA 40 T - 10) | | | (250W EQ) LED | | (Type SP 38 S - 10) | | | (250W EQ) LED | |
| | (Type SA 40 S - 10 - 10) | | | (250W EQ) LED | | (Type SA 40 T - 10 - 10) | | | (250W EQ) LED | | (Type SP 38 S - 10 - 10) | | | (250W EQ) LED | |
| | (Type SA 40 S - 12) | | | (250W EQ) LED | | (Type SA 40 T - 12) | | | (250W EQ) LED | | (Type SP 38 S - 12) | | | (250W EQ) LED | |
| | (Type SA 40 S - 12 - 12) | | | (250W EQ) LED | | (Type SA 40 T - 12 - 12) | | | (250W EQ) LED | | (Type SP 38 S - 12 - 12) | | | (250W EQ) LED | |
| 50 | (Type SA 50 S - 4) | | | (400W EQ) LED | | (Type SA 50 T - 4) | | | (400W EQ) LED | | (Type SP 48 S - 4) | | | (400W EQ) LED | |
| | (Type SA 50 S - 4 - 4) | | | (400W EQ) LED | | (Type SA 50 T - 4 - 4) | | | (400W EQ) LED | | (Type SP 48 S - 4 - 4) | | | (400W EQ) LED | |
| | (Type SA 50 S - 8) | | | (400W EQ) LED | | (Type SA 50 T - 8) | | | (400W EQ) LED | | (Type SP 48 S - 8) | | | (400W EQ) LED | |
| | (Type SA 50 S - 8 - 8) | | | (400W EQ) LED | | (Type SA 50 T - 8 - 8) | | | (400W EQ) LED | | (Type SP 48 S - 8 - 8) | | | (400W EQ) LED | |
| | (Type SA 50 S - 10) | | | (400W EQ) LED | | (Type SA 50 T - 10) | | | (400W EQ) LED | | (Type SP 48 S - 10) | | | (400W EQ) LED | |
| | (Type SA 50 S - 10 - 10) | | | (400W EQ) LED | | (Type SA 50 T - 10 - 10) | | | (400W EQ) LED | | (Type SP 48 S - 10 - 10) | | | (400W EQ) LED | |
| | (Type SA 50 S - 12) | | | (400W EQ) LED | | (Type SA 50 T - 12) | | | (400W EQ) LED | | (Type SP 48 S - 12) | | | (400W EQ) LED | |
| | (Type SA 50 S - 12 - 12) | | | (400W EQ) LED | | (Type SA 50 T - 12 - 12) | | | (400W EQ) LED | | (Type SP 48 S - 12 - 12) | | | (400W EQ) LED | |

| OTHER Designation | | | | Quantity |
|---|---|---|---|---|
| Pole | A1 | A2 | Luminaire | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

## GENERAL NOTES:

1. All work, materials and services not shown on the plans which may be necessary for complete and proper construction shall be performed, furnished and installed by the Contractor. Faulty fabrication or poor workmanship in any material, equipment or installation will be considered justification for rejection. Where manufacturers provide warranties or guarantees as a customary trade practice, furnish to the Department such warranties or guarantees.

2. The location of poles and fixtures are diagrammatic only and 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. Standard Steel Pole Designs. Steel poles fabricated in accordance with the details and dimensions shown herein, shall be considered standard designs. Submission of shop drawings and design calculations for standard designs is not required.

4. Optional Steel Pole Designs. Multi-sided steel poles may be allowed as optional designs, if steel poles are permitted or required, pending approval by the Department as outlined below.

   a. Shop Drawings. Optional designs require submission of shop drawings and design calculations bearing the seal of an engineer licensed in the State of Texas, in accordance with Item 441, "Steel Structures." The Department may elect to pre-approve some shop drawings for optionally designed poles. Submission of shop drawings and design calculations is not required for structures fabricated in accordance with the details of shop drawings on the pre-approved list maintained by the TxDOT Traffic Operations Division. Any deviation from the pre-approved shop drawings will require submission of shop drawings of the complete assembly and design calculations as described above.
   b. Structural Support Design for Luminaires. Lighting support structures shall be designed for a 25 year design life in accordance with the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, 6th Edition (2013) and Interim Revisions thereto. All poles shall be designed for 110 mph 3-second gust wind speeds. The Gust Factor, G, and Wind Importance Factor, Ir, shall be applied as per the AASHTO Specifications assuming a 25-year design life. The design wind pressure for hurricane wind velocities greater than 100 mph shall not be less than the design wind pressure using 100 mph with the non-hurricane Wind Importance Factor, Ir, value. For transformer base poles, fabricator shall include transformer base and connecting hardware in design calculations and shop drawing submittals. All transformer bases shall have been structurally tested to resist the theoretical plastic moment capacity of the pole. Certification of the plastic moment load test and FHWA breakaway requirement test of the model of base being furnished shall be submitted with the shop drawings. Shop drawings shall show breakaway base model number, and manufacturer's name and logo. Manufacturer's shop drawings shall include the ASTM designations for all materials to be used.
   c. Mast Arm Attachments. All poles and attachments shall be structurally designed to support two 12-foot mast arms and luminaires. Poles shall be supplied with mast arm combinations as shown in the plans. All mast arms shall be designed for a 60-pound luminaire having an effective projected area of 1.6 square feet.
   d. Anchor Bolt Assembly. Anchor bolt assemblies for optionally designed poles shall be the same as those shown herein.

5. Aluminum Pole Designs. Aluminum pole designs may be allowed, if aluminum poles are permitted or required, pending approval by the Department as outlined below.

   a. Meet all of the requirements stated above for optional steel pole designs and the following:
      1. Aluminum poles shall be fabricated in accordance with "Structural Welding Code-Aluminum" AWS D1.2.
      2. Aluminum pole designs shall use the same anchor bolt assembly and be subject to the same geometric restraints and other requirements for steel poles specified herein.
      3. Aluminum poles shall be equipped with vibration mitigation devices, as approved by the engineer.
      4. Pole components shall be constructed using the following material:
         Shaft: ASTM B221 or B241 Alloy 6063-T6, ASTM B209 Alloy 5086-H34, ASTM B221 Alloy 6005-T5.
         Base Flange: ASTM B26 Alloy 356.0-T6 or ASTM B108 Alloy 356.0-T6 (Yield strength test required).
         Mast Arm Fitting: ASTM B209 Alloy 6061-T6 or ASTM B221 Alloy 6005-T5.
         Mast Arms: ASTM B241 Alloy 6061-T6 or Alloy 6063-T6.
         Pole Cap: ASTM B209 Alloy 5086-H32 or ASTM B108 or B26 Alloy 356.0-T6.
         Bolts: Stainless Steel AISI 300 series. Bolts threading into aluminum threads shall be treated with anti-seize compound, Never-Seez Compound, Permatex 133K or equal.

6. Special Designs. Poles with architectural treatments shall meet the requirements shown elsewhere in the plans.

7. Luminaire Mounting Height. Actual luminaire mounting height shall be the nominal mounting height given on RIP(2) for all pole-arm combinations except for poles with 4 ft. luminaire arms, which shall be 3'-0" lower than the nominal height, unless otherwise shown or directed.

## EXPLANATION OF ROADWAY ILLUMINATION ASSEMBLY DESIGNATIONS

(TYPE SA 50 T - X - X) (400W EQ) LED

- SA: Pole and mast arm may be steel or aluminum.
- ST: Pole and mast arm must be steel.
- AL: Pole and mast arm must be aluminum.
- SP: Special (ovalized) steel or aluminum pole for installing on CSB or SSCB. See standard sheet CSB (4), or SSCB (4).

Two numerical digits denote nominal mounting height in feet.

Next letter denotes type of base, (S-Shoe Base, T-Transformer Base, or B-Bridge/Ret.Wall Mount)

First number denotes length of mast arm in feet.

Use of second mast arm is indicated by second dashed number which denotes length in feet.

Luminaire rating in watts (i.e. 400W). Equivalent wattage LED fixtures will include EQ (i.e. 400W EQ)

Last letters indicate light source (S - High Pressure Sodium; LED - LED luminaire)

SHEET 1 OF 4

Texas Department of Transportation

Traffic Safety Division Standard

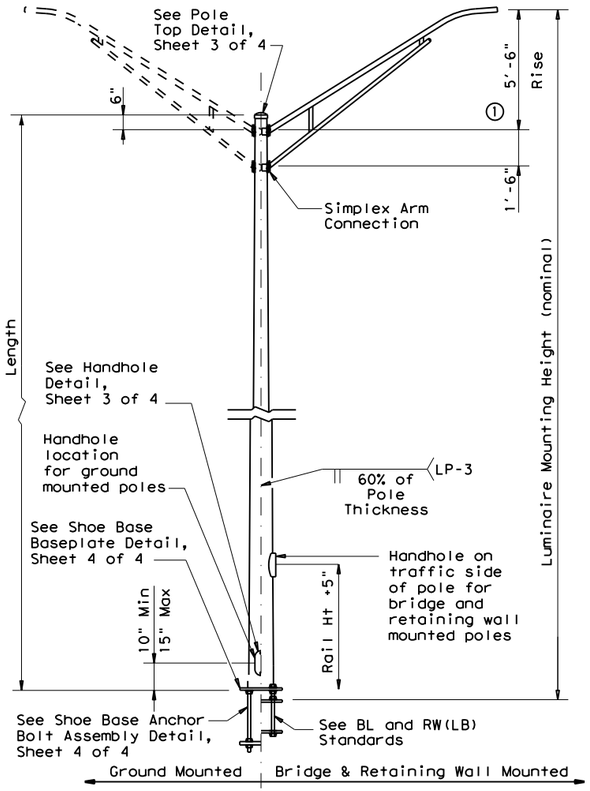
# ROADWAY ILLUMINATION POLES

# RIP(1)-19

| FILE: rip-19.dgn | DN: | CK: | DW: | CK: |
|---|---|---|---|---|
| © TxDOT January 2007 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS 7-17 12-19 | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 104 |

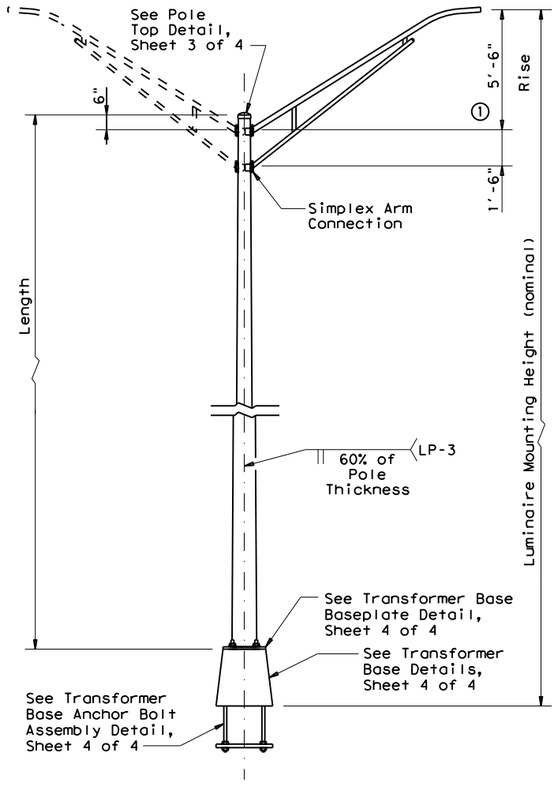
73A

DATE:
FILE:



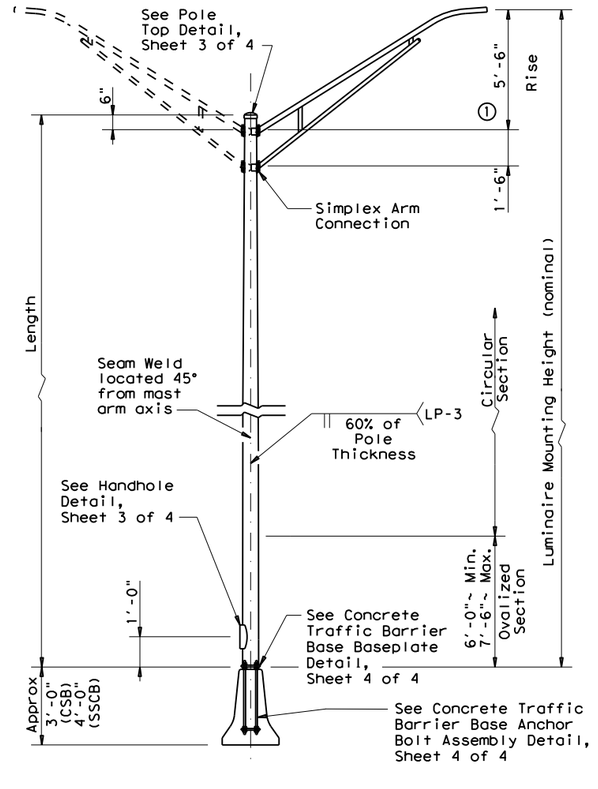

## SHOE BASE POLE

| 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

| 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 ② Diameter (in) | Top Diameter (in) | Length (ft) | Pole Thickness (in) | Design Moment (K-ft) | |
| | | | | | About ℄ 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 |

| 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:

① 2'-6" rise for 4 ft. luminaire arms.

② Before ovalized as shown on Concrete Traffic Barrier Base Baseplate details, Sheet 4 of 4.

③ 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" |

## GENERAL NOTES:

1. 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.
2. 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.
3. 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.
4. For mounting heights between values shown in the tables, use base diameter and thickness values for the larger height.
5. Unless otherwise noted, all steel parts shall be galvanized in accordance with Item 445, "Galvanizing."
6. 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.
7. 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.
8. Alternate material equal to or better than material specified may be substituted with the approval of the Engineer.
9. Lubricate and tighten anchor bolts, when erecting shoe base poles and concrete traffic barrier base poles, in accordance with Item 449, "Anchor Bolts."
10. 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.
11. 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."
12. 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.
13. Erect transformer base poles in accordance with sheet RID(1).



Texas Department of Transportation

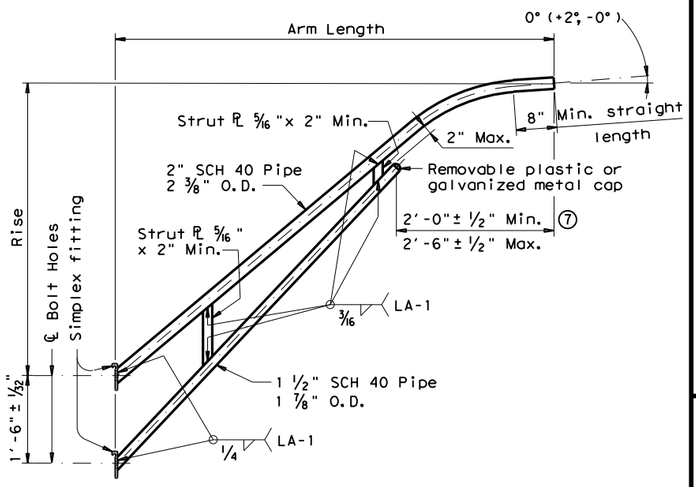
Traffic Safety Division Standard

# ROADWAY ILLUMINATION POLES

# RIP(2)-19

| FILE: rip-19.dgn | DN: | CK: | DW: | CK: |
|---|---|---|---|---|
| ©TxDOT January 2007 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS 7-17 12-19 | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 105 |

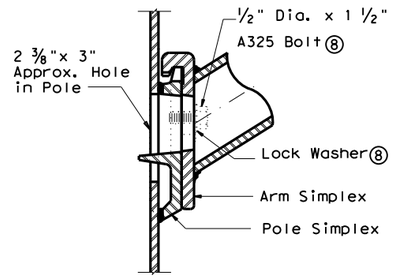
DATE:
FILE:



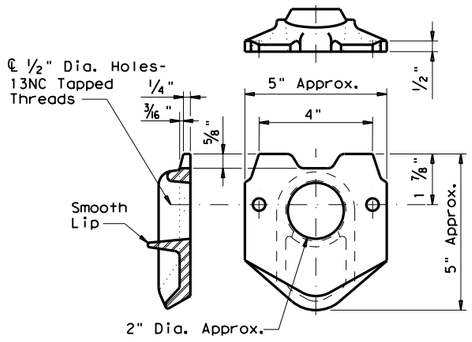

## LUMINAIRE ARM

| 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" |

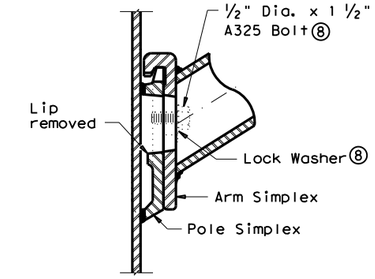
| ARM ASSEMBLY FABRICATION TOLERANCES TABLE | |
|---|---|
| DIMENSION | TOLERANCE |
| Arm Length | ±1" |
| Arm Rise | ±1" |
| Deviation from flat | 1/8" in 12" |
| Spacing between holes | ±1/32" |




## UPPER SIMPLEX FITTING
(Gusset not shown for clarity)

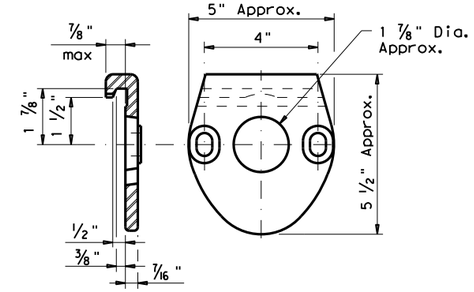



## POLE SIMPLEX DETAIL ⑨




## LOWER SIMPLEX FITTING
(Gusset not shown for clarity)

## SECTION B-B




## ARM SIMPLEX DETAIL ⑨

## NOTES:

④ Any of the materials listed for plates may be used where the drawings do not specify a particular ASTM designation.

⑤ 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.

⑥ A572, A1008 HSLAS-F, and A1011 HSLAS-F materials may have higher yield strengths but shall not have less elongation than the grade indicated.

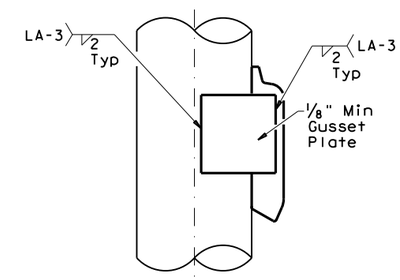
⑦ Dimensional limits are given to show acceptable variation in design. All of a Fabricator's production of a particular arm length shall have the same dimensions within specified tolerances.

⑧ 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.

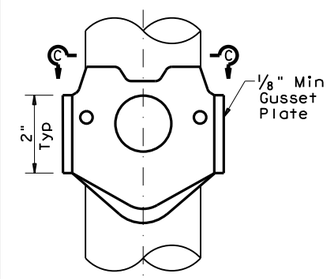
⑨ Proposed deviations in arm simplex dimensions or materials must be submitted to the Department for approval.

⑩ A welded handhole frame is permissible. Maximum of two (2) CJP weld splices is allowed.

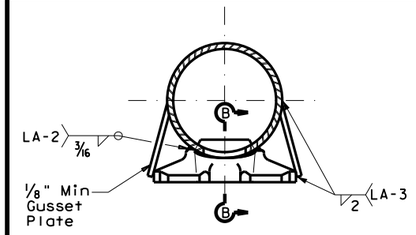
| MATERIALS | |
|---|---|
| Pole or Arm Simplex | ASTM A27 Gr 65-35 or Gr 70-36, A148 Gr 80-50, A576 Gr 1021 ⑤, or A36 (Arm only) |
| Arm Pipes | ASTM A53 Gr A or B, A500 Gr B, A501, A 1008 HSLAS-F Gr 50 ⑥, or A1011 HSLAS-F Gr 50 ⑥ |
| Arm Struts and Gusset Plates ④ | ASTM A36, A572 Gr 50 ⑥, or A588 |
| Misc. | ASTM designations as noted |




## SIDE

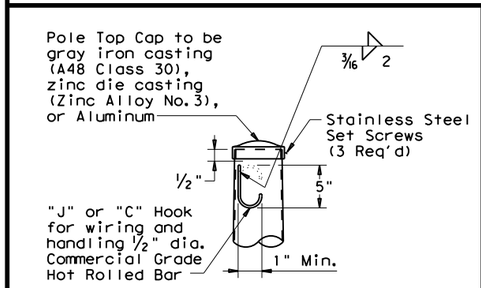



## ELEVATION

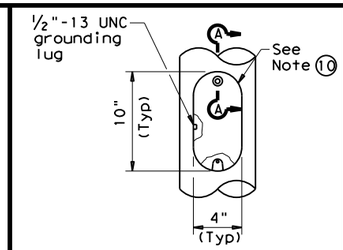



## SECTION C-C

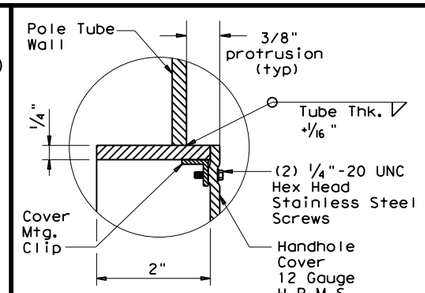
## SIMPLEX ATTACHMENT DETAIL




## POLE TOP




## ELEVATION




## SECTION A-A

## HANDHOLE

SHEET 3 OF 4

Texas Department of Transportation

Traffic Safety Division Standard

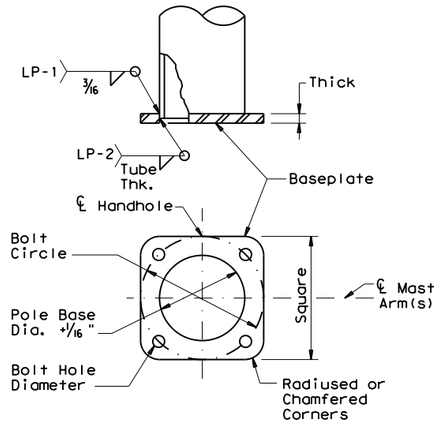
# ROADWAY ILLUMINATION POLES

# RIP(3)-19

| FILE: rip-19.dgn | DN: | CK: | DW: | CK: |
|---|---|---|---|---|
| ©TxDOT January 2007 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 7-17 | DIST | COUNTY | | SHEET NO. |
| 12-19 | 10 | SMITH, ETC. | | 106 |

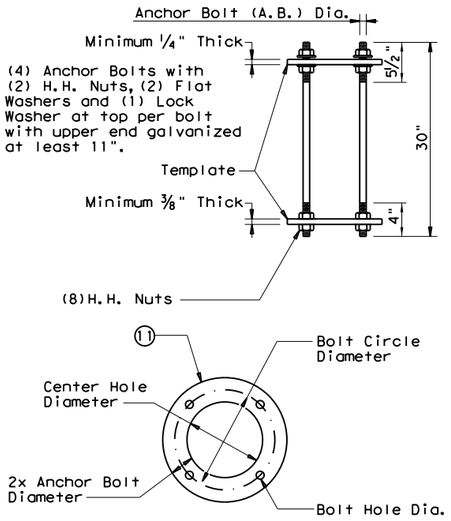
73C

DATE:
FILE:



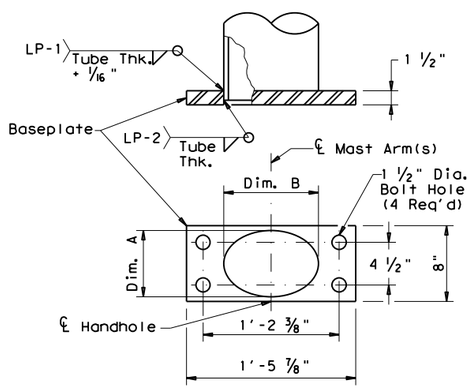

## SHOE BASE BASEPLATE

| 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" |



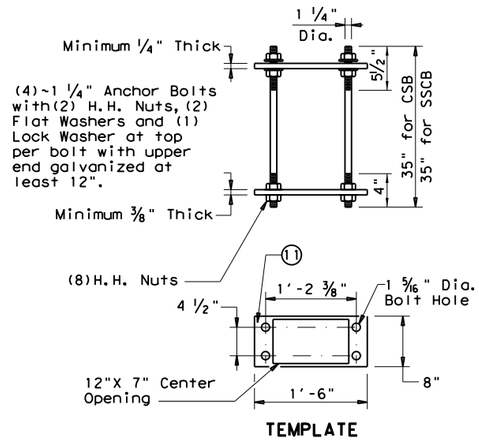

## SHOE BASE ANCHOR BOLT ASSEMBLY

| 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 BASEPLATE

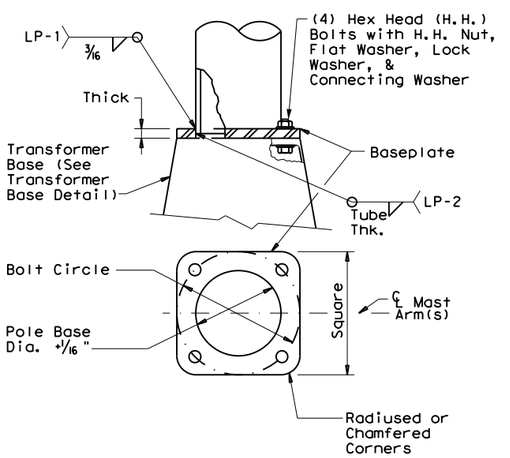
| CONCRETE TRAFFIC BARRIER BASE BASEPLATE TABLE | | | |
|---|---|---|---|
| MOUNTING HEIGHTS (nominal) | POLE DIA.(12) | DIM. A | DIM. B |
| 28' - 38' | 9" | 7" ± 1/4" | 10" ± 1/4" |
| 48' | 10 1/2" | 7" ± 1/4" | 13" ± 1/4" |




TEMPLATE

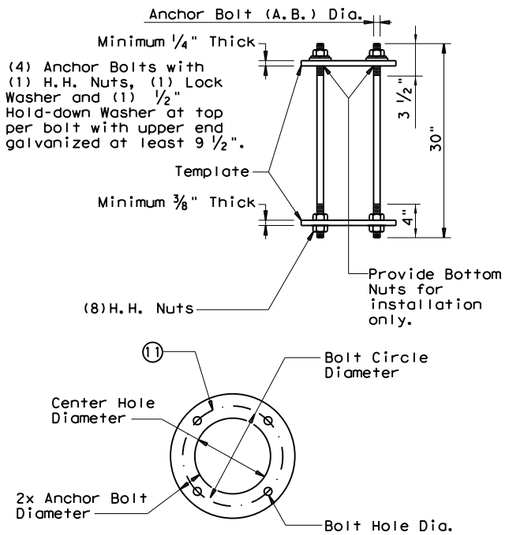
## CONCRETE TRAFFIC BARRIER BASE ANCHOR BOLT ASSEMBLY

| TRANSFORMER 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" |



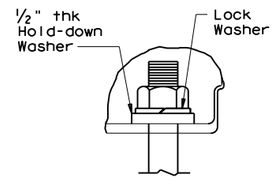

## TRANSFORMER BASE BASEPLATE

| TRANSFORMER BASE BASEPLATE TABLE | | | | | | |
|---|---|---|---|---|---|---|
| MOUNTING HEIGHTS (nominal) | BOLT CIRCLE | SQUARE | THICK | CONNECTING BOLT DIA. | BOLT HOLE DIAMETER | TRANSFOMER 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 |

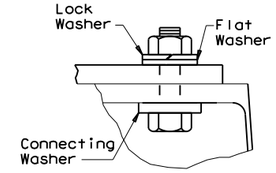



## TRANSFORMER BASE ANCHOR BOLT ASSEMBLY

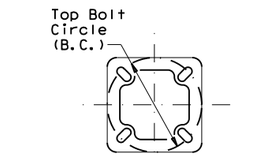
| TRANSFORMER BASE TABLE | | |
|---|---|---|
| TYPE | TOP B.C. | BTM. B.C. |
| A | 13" | 14" |
| B | 15" | 17 1/4" |



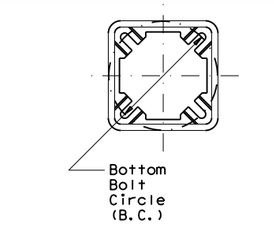

DETAIL A



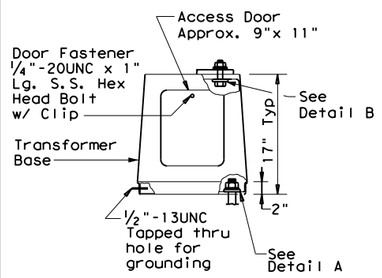

DETAIL B




TOP PLAN




BOTTOM PLAN




ELEVATION

## TRANSFORMER BASE DETAILS

## GENERAL NOTES:

1. For mounting heights between those shown in the table, use the values in the table for the larger mounting height.
2. 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.
3. 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.
4. 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.
5. 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:

(11) Anchor Bolt Templates do not need to be galvanized.

(12) Pole diameter before ovalized.

| ANCHOR BOLT FABRICATION TOLERANCES TABLE | |
|---|---|
| DIMENSION | TOLERANCE |
| Length | ± 1/2" |
| Threaded length | ± 1/2" |
| Galvanized length (if required) | - 1/4" |



Texas Department of Transportation

Traffic Safety Division Standard

# ROADWAY ILLUMINATION POLES

# RIP(4)-19

| FILE: rip-19.dgn | DN: | CK: | DW: | CK: |
|---|---|---|---|---|
| ©TxDOT January 2007 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS 7-17 12-19 | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 107 |

DATE:
FILE:

## SHIPPING PARTS LIST - POLES AND LUMINAIRE ARMS

| Nominal Mounting Ht. (ft) | Shoe Base Designation | | | | Quantity | T-Base Designation | | | | Quantity | CSB/SSCB Mounted Designation | | | | Quantity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pole | A1 | A2 | Luminaire | | Pole | A1 | A2 | Luminaire | | Pole | A1 | A2 | Luminaire | |
| 20 | (Type SA 20 S - 4) | | | (150W EQ) LED | | (Type SA 20 T - 4) | | | (150W EQ) LED | | | | | | |
| | (Type SA 20 S - 4 - 4) | | | (150W EQ) LED | | (Type SA 20 T - 4 - 4) | | | (150W EQ) LED | | | | | | |
| 30 | (Type SA 30 S - 4) | | | (250W EQ) LED | | (Type SA 30 T - 4) | | | (250W EQ) LED | | (Type SP 28 S - 4) | | | (250W EQ) LED | |
| | (Type SA 30 S - 4 - 4) | | | (250W EQ) LED | | (Type SA 30 T - 4 - 4) | | | (250W EQ) LED | | (Type SP 28 S - 4 - 4) | | | (250W EQ) LED | |
| | (Type SA 30 S - 8) | | | (250W EQ) LED | | (Type SA 30 T - 8) | | | (250W EQ) LED | | (Type SP 28 S - 8) | | | (250W EQ) LED | |
| | (Type SA 30 S - 8 - 8) | | | (250W EQ) LED | | (Type SA 30 T - 8 - 8) | | | (250W EQ) LED | | (Type SP 28 S - 8 - 8) | | | (250W EQ) LED | |
| 40 | (Type SA 40 S - 4) | | | (250W EQ) LED | | (Type SA 40 T - 4) | | | (250W EQ) LED | | (Type SP 38 S - 4) | | | (250W EQ) LED | |
| | (Type SA 40 S - 4 - 4) | | | (250W EQ) LED | | (Type SA 40 T - 4 - 4) | | | (250W EQ) LED | | (Type SP 38 S - 4 - 4) | | | (250W EQ) LED | |
| | (Type SA 40 S - 8) | | | (250W EQ) LED | | (Type SA 40 T - 8) | | | (250W EQ) LED | | (Type SP 38 S - 8) | | | (250W EQ) LED | |
| | (Type SA 40 S - 8 - 8) | | | (250W EQ) LED | | (Type SA 40 T - 8 - 8) | | | (250W EQ) LED | | (Type SP 38 S - 8 - 8) | | | (250W EQ) LED | |
| | (Type SA 40 S - 10) | | | (250W EQ) LED | | (Type SA 40 T - 10) | | | (250W EQ) LED | | (Type SP 38 S - 10) | | | (250W EQ) LED | |
| | (Type SA 40 S - 10 - 10) | | | (250W EQ) LED | | (Type SA 40 T - 10 - 10) | | | (250W EQ) LED | | (Type SP 38 S - 10 - 10) | | | (250W EQ) LED | |
| | (Type SA 40 S - 12) | | | (250W EQ) LED | | (Type SA 40 T - 12) | | | (250W EQ) LED | | (Type SP 38 S - 12) | | | (250W EQ) LED | |
| | (Type SA 40 S - 12 - 12) | | | (250W EQ) LED | | (Type SA 40 T - 12 - 12) | | | (250W EQ) LED | | (Type SP 38 S - 12 - 12) | | | (250W EQ) LED | |
| 50 | (Type SA 50 S - 4) | | | (400W EQ) LED | | (Type SA 50 T - 4) | | | (400W EQ) LED | | (Type SP 48 S - 4) | | | (400W EQ) LED | |
| | (Type SA 50 S - 4 - 4) | | | (400W EQ) LED | | (Type SA 50 T - 4 - 4) | | | (400W EQ) LED | | (Type SP 48 S - 4 - 4) | | | (400W EQ) LED | |
| | (Type SA 50 S - 8) | | | (400W EQ) LED | | (Type SA 50 T - 8) | | | (400W EQ) LED | | (Type SP 48 S - 8) | | | (400W EQ) LED | |
| | (Type SA 50 S - 8 - 8) | | | (400W EQ) LED | | (Type SA 50 T - 8 - 8) | | | (400W EQ) LED | | (Type SP 48 S - 8 - 8) | | | (400W EQ) LED | |
| | (Type SA 50 S - 10) | | | (400W EQ) LED | | (Type SA 50 T - 10) | | | (400W EQ) LED | | (Type SP 48 S - 10) | | | (400W EQ) LED | |
| | (Type SA 50 S - 10 - 10) | | | (400W EQ) LED | | (Type SA 50 T - 10 - 10) | | | (400W EQ) LED | | (Type SP 48 S - 10 - 10) | | | (400W EQ) LED | |
| | (Type SA 50 S - 12) | | | (400W EQ) LED | | (Type SA 50 T - 12) | | | (400W EQ) LED | | (Type SP 48 S - 12) | | | (400W EQ) LED | |
| | (Type SA 50 S - 12 - 12) | | | (400W EQ) LED | | (Type SA 50 T - 12 - 12) | | | (400W EQ) LED | | (Type SP 48 S - 12 - 12) | | | (400W EQ) LED | |

| OTHER Designation | | | | Quantity |
|---|---|---|---|---|
| Pole | A1 | A2 | Luminaire | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

## GENERAL NOTES:

1. All work, materials and services not shown on the plans which may be necessary for complete and proper construction shall be performed, furnished and installed by the Contractor. Faulty fabrication or poor workmanship in any material, equipment or installation will be considered justification for rejection. Where manufacturers provide warranties or guarantees as a customary trade practice, furnish to the Department such warranties or guarantees.

2. The location of poles and fixtures are diagrammatic only and 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. Standard Steel Pole Designs. Steel poles fabricated in accordance with the details and dimensions shown herein, shall be considered standard designs. Submission of shop drawings and design calculations for standard designs is not required.

4. Optional Steel Pole Designs. Multi-sided steel poles may be allowed as optional designs, if steel poles are permitted or required, pending approval by the Department as outlined below.

   a. Shop Drawings. Optional designs require submission of shop drawings and design calculations bearing the seal of an engineer licensed in the State of Texas, in accordance with Item 441, "Steel Structures." The Department may elect to pre-approve some shop drawings for optionally designed poles. Submission of shop drawings and design calculations is not required for structures fabricated in accordance with the details of shop drawings on the pre-approved list maintained by the TxDOT Traffic Operations Division. Any deviation from the pre-approved shop drawings will require submission of shop drawings of the complete assembly and design calculations as described above.
   b. Structural Support Design for Luminaires. Lighting support structures shall be designed for a 25 year design life in accordance with the 2001 Edition of the AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals." All poles shall be designed for 110 mph 3-second gust wind speeds. An additional 1.14 gust factor shall be applied to the wind loads. For transformer base poles, fabricator shall include transformer base and connecting hardware in design calculations and shop drawing submittals. All transformer bases shall have been structurally tested to resist the theoretical plastic moment capacity of the pole. Certification of the plastic moment load test and FHWA breakaway requirement test of the model of base being furnished shall be submitted with the shop drawings. Shop drawings shall show breakaway base model number, and manufacturer's name and logo. Manufacturer's shop drawings shall include the ASTM designations for all materials to be used.

   c. Mast Arm Attachments. All poles and attachments shall be structurally designed to support two 12-foot mast arms and luminaires. Poles shall be supplied with mast arm combinations as shown in the plans. All mast arms shall be designed for a 60-pound luminaire having an effective projected area of 1.6 square feet.

   d. Anchor Bolt Assembly. Anchor bolt assemblies for optionally designed poles shall be the same as those shown herein.

5. Aluminum Pole Designs. Aluminum pole designs may be allowed, if aluminum poles are permitted or required, pending approval by the Department as outlined below.

   a. Meet all of the requirements stated above for optional steel pole designs and the following:
      1. Aluminum poles shall be fabricated in accordance with "Structural Welding Code-Aluminum" AWS D1.2.
      2. Aluminum pole designs shall use the same anchor bolt assembly and be subject to the same geometric restraints and other requirements for steel poles specified herein.
      3. Aluminum poles shall be equipped with vibration mitigation devices, as approved by the engineer.
      4. Pole components shall be constructed using the following material:
         Shaft: ASTM B221 or B241 Alloy 6063-T6, ASTM B209 Alloy 5086-H34, ASTM B221 Alloy 6005-T5.
         Base Flange: ASTM B26 Alloy 356.0-T6 or ASTM B108 Alloy 356.0-T6 (Yield strength test required).
         Mast Arm Fitting: ASTM B209 Alloy 6061-T6 or ASTM B221 Alloy 6005-T5.
         Mast Arms: ASTM B241 Alloy 6061-T6 or Alloy 6063-T6.
         Pole Cap: ASTM B209 Alloy 5086-H32 or ASTM B108 or B26 Alloy 356.0-T6.
         Bolts: Stainless Steel AISI 300 series. Bolts threading into aluminum threads shall be treated with anti-seize compound, Never-Seez Compound, Permatex 133K or equal.

6. Special Designs. Poles with architectural treatments shall meet the requirements shown elsewhere in the plans.

7. Luminaire Mounting Height. Actual luminaire mounting height shall be the nominal mounting height given on RIP(2) for all pole-arm combinations except for poles with 4 ft. luminaire arms, which shall be 3'-0" lower than the nominal height, unless otherwise shown or directed.

## EXPLANATION OF ROADWAY ILLUMINATION ASSEMBLY DESIGNATIONS

(TYPE SA 50 T - X - X) (400W EQ) LED

SA: Pole and mast arm may be steel or aluminum.
ST: Pole and mast arm must be steel.
AL: Pole and mast arm must be aluminum.
SP: Special (ovalized) steel or aluminum pole for installing on CSB or SSCB. See standard sheet CSB (4), or SSCB (4).

Two numerical digits denote nominal mounting height in feet.

Next letter denotes type of base, (S-Shoe Base, T-Transformer Base, or B-Shoe Base Bridge Mount)

First number denotes length of mast arm in feet.

Use of second mast arm is indicated by second dashed number which denotes length in feet.

Luminaire rating in watts (i.e. 400W). Equivalent wattage LED fixtures will include EQ (i.e. 400W EQ)

Last letters indicate light source (S - High Pressure Sodium; LED - LED luminaire)

SHEET 1 OF 4

Texas Department of Transportation

Traffic Operations Division Standard

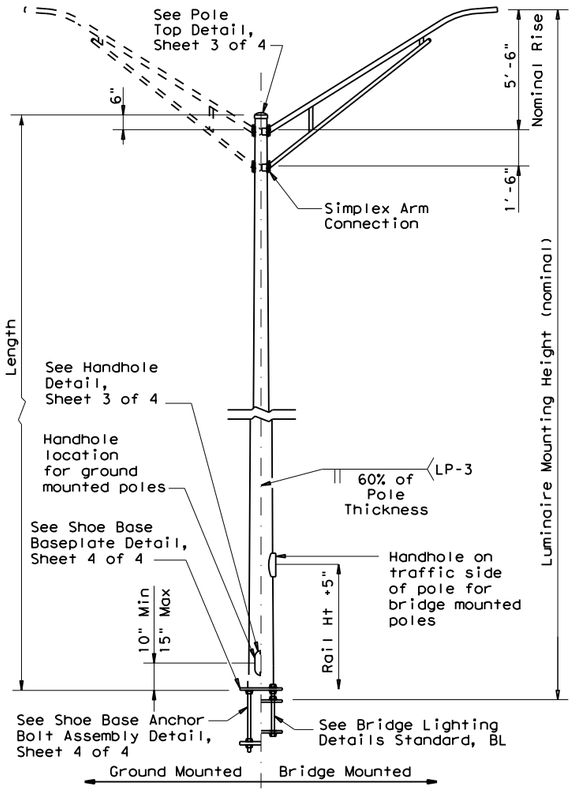
# ROADWAY ILLUMINATION POLES

# RIP(1)-17

| FILE: rip-17.dgn | DN: | CK: | DW: | CK: |
|---|---|---|---|---|
| © TxDOT January 2007 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS 7-17 | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 108 |

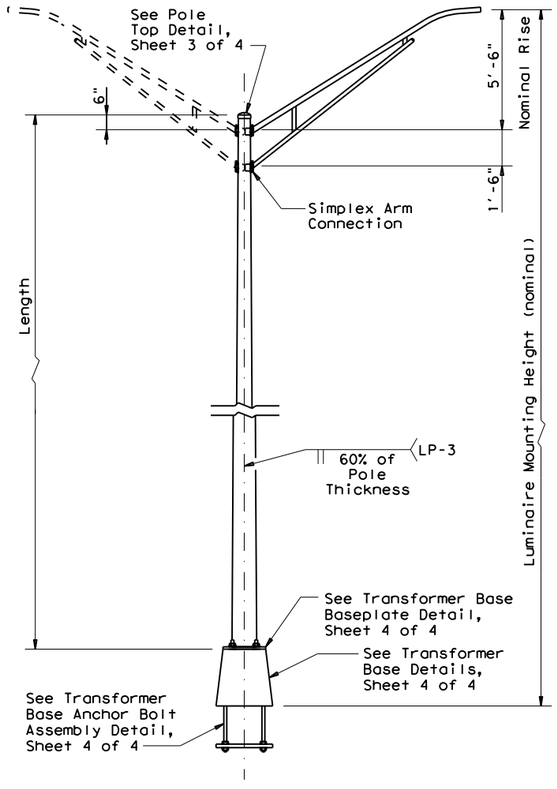
73A

DATE:
FILE:



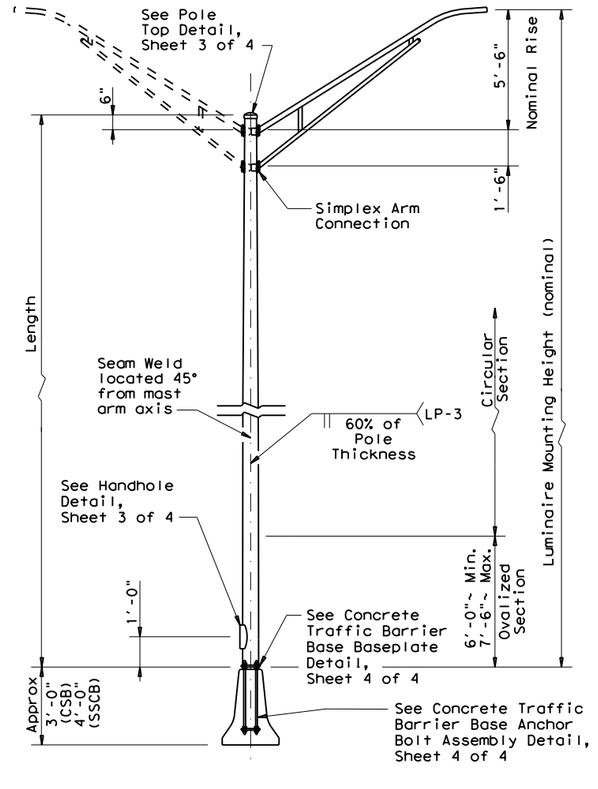

## SHOE BASE POLE

| 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

| 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 | 3.41 | 43.50 | 0.1196 | 30.3 |




## CONCRETE TRAFFIC BARRIER BASE POLE

| CONCRETE TRAFFIC BARRIER BASE POLE (CSB/SSCB) | | | | | | |
|---|---|---|---|---|---|---|
| Luminaire Mounting Height (Nominal) (ft) | Base ② Diameter (in) | Top Diameter (in) | Length (ft) | Pole Thickness (in) | Design Moment (K-ft) | |
| | | | | | About ℄ 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 |

| 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 | A325 ① | 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:

① Lubricate in the field if necessary instead of the requirements in ASTM A325.

② Before ovalized as shown on Concrete Traffic Barrier Base Baseplate details, Sheet 4 of 4.

③ 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 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" |

### GENERAL NOTES:

1. Designs conform to 2001 AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals and Interim Specifications. Design 3-Second Gust Wind Speed equal 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 less than 25' above natural ground level.
2. Design structures to support two 12' luminaire mast arms and luminaires. Design mast arms for a 60-pound luminaire having an effective projected area of 1.6 square feet.
3. 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.
4. For mounting heights between values shown in the tables, use base diameter and thickness values for the larger pole.
5. Unless otherwise noted, all steel parts shall be galvanized in accordance with Item 445, "Galvanizing."
6. 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 the ANSI/AWS Structural Welding Code D1.1.
7. 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.
8. Alternate material equal to or better than material specified may be substituted with the approval of the Engineer.
9. Lubricate and tighten anchor bolts, when erecting shoe base poles and concrete traffic barrier base poles, in accordance with Item 449, "Anchor Bolts."
10. All poles, except Transformer Base Poles, shall have hand holes with reinforcing frames and covers. Except for poles mounted on a concrete traffic barrier or bridge bracket, 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 bracket, hand hole shall be on traffic side of the pole, at a height that will clear the barrier.
11. 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."
12. 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.



Texas Department of Transportation

Traffic Operations Division Standard

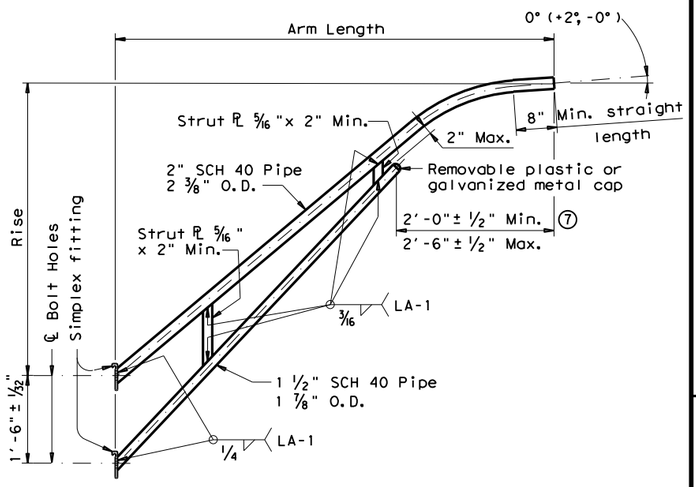
# ROADWAY ILLUMINATION POLES

# RIP(2)-17

| FILE: rip-17.dgn | DN: | CK: | DW: | CK: |
|---|---|---|---|---|
| ©TxDOT January 2007 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 7-17 | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 109 |

73B

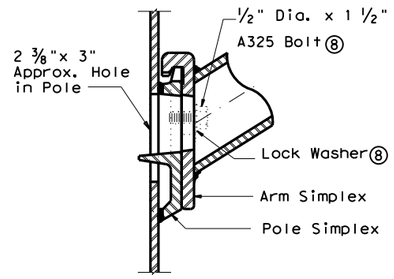
DATE:
FILE:



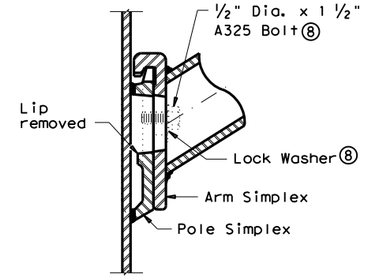

## LUMINAIRE ARM

| LUMINAIRE ARM DIMENSIONS | | |
|---|---|---|
| Nominal Arm Length | Arm Length | Rise |
| 4'-0" | 3'-6" | 2'-6" ⑩ |
| 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 | ±3" |
| Arm Rise | +1 3/4" in 10 ft |
| Arm Diameter | +3/16" |
| Overall length or width | +1/4" |
| Thickness | +1/4", -1/16" |
| Deviation from flat | 1/8" in 12" |
| Spacing between holes | +3/32" |
| Bolt hole size | ±1/16" |
| Strut location in truss arms | ±1 1/2" |

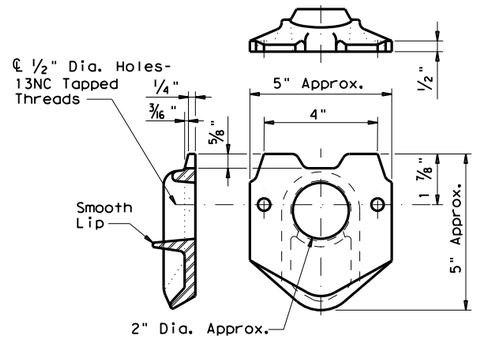



## UPPER SIMPLEX FITTING
(Gusset not shown for clarity)

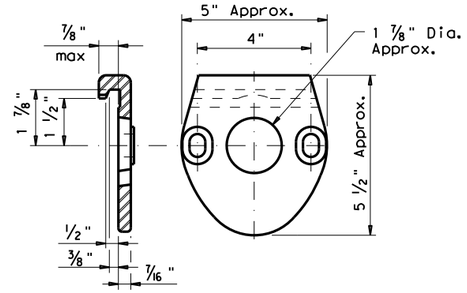



## LOWER SIMPLEX FITTING
(Gusset not shown for clarity)

## SECTION B-B




## POLE SIMPLEX DETAIL ⑨




## ARM SIMPLEX DETAIL ⑨

## NOTES:

④ Any of the materials listed for plates may be used where the drawings do not specify a particular ASTM designation.

⑤ 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.

⑥ A572, A1008 HSLAS-F, and A1011 HSLAS-F materials may have higher yield strengths but shall not have less elongation than the grade indicated.

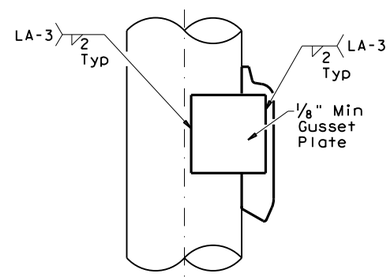
⑦ Dimensional limits are given to show acceptable variation in design. All of a Fabricator's production of a particular arm length shall have the same dimensions within specified tolerances.

⑧ 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.

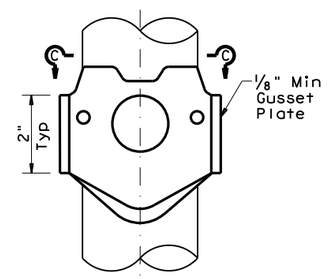
⑨ Proposed deviations in arm simplex dimensions or materials must be submitted to the Department for approval.

⑩ Luminaire mounting heights are based on assumed 5'-6" luminaire arm rise.

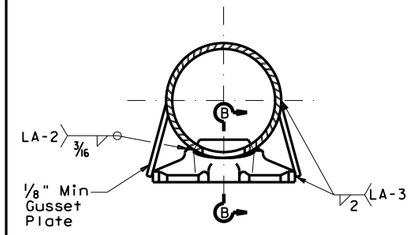
| MATERIALS | |
|---|---|
| Pole or Arm Simplex | ASTM A27 Gr 65-35, A148 Gr 80-50, A576 Gr 1021 ⑤, or A36 (Arm only) |
| Arm Pipes | ASTM A53 Gr A or B, A500 Gr B, A501, A 1008 HSLAS-F Gr 50 ⑥, or A1011 HSLAS-F Gr 50 ⑥ |
| Arm Struts and Gusset Plates ④ | ASTM A36, A572 Gr 50 ⑥, or A588 |
| Misc. | ASTM designations as noted |




## SIDE

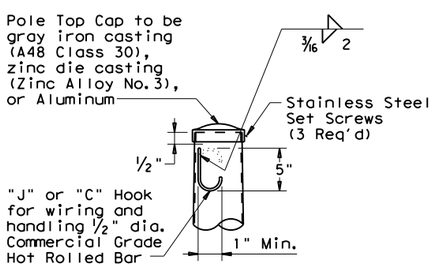



## ELEVATION

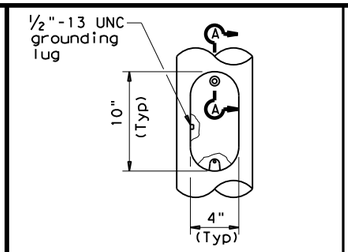



## SECTION C-C

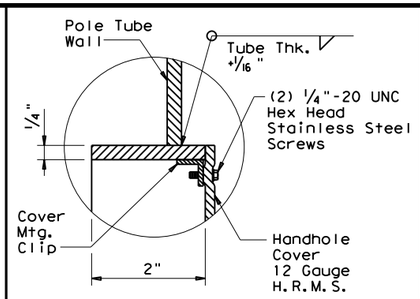
## SIMPLEX ATTACHMENT DETAIL




## POLE TOP




## ELEVATION




## SECTION A-A

## HANDHOLE



Texas Department of Transportation

Traffic Operations Division Standard

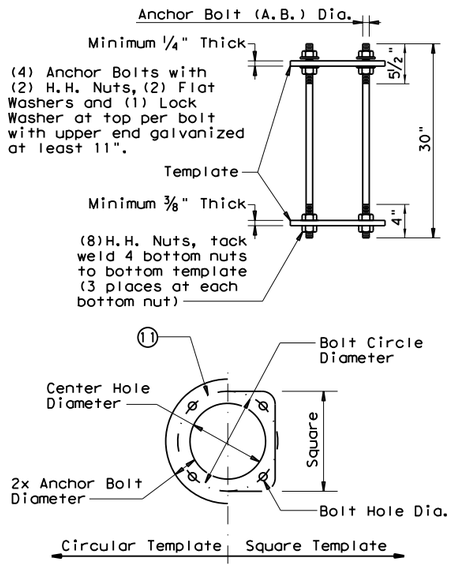
# ROADWAY ILLUMINATION POLES

# RIP(3)-17

| FILE: rip-17.dgn | DN: | CK: | DW: | CK: |
|---|---|---|---|---|
| ©TxDOT January 2007 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 7-17 | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 110 |

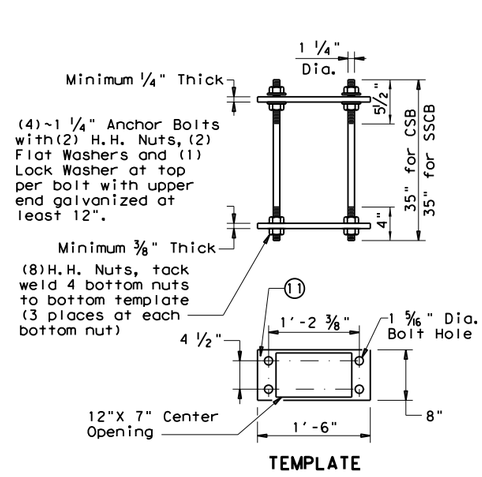
73C

DATE:
FILE:

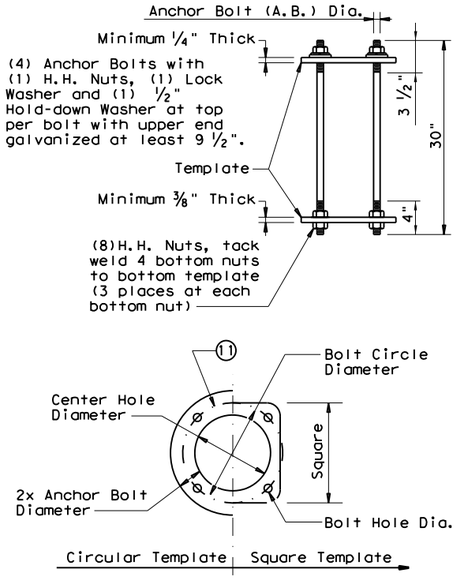



## SHOE BASE ANCHOR BOLT ASSEMBLY

| SHOE BASE ANCHOR BOLT ASSEMBLY TABLE | | | | | |
|---|---|---|---|---|---|
| MOUNTING HEIGHTS (nominal) | A.B. Dia. | BOLT CIRCLE DIAMETER | SQUARE | CTR. HOLE DIAMETER | BOLT HOLE DIAMETER |
| 20'-39' | 1" | 13" | 13" | 11" | 1 1/16" |
| 40'-50' | 1 1/4" | 15" | 14 1/2" | 12 1/2" | 1 5/16" |



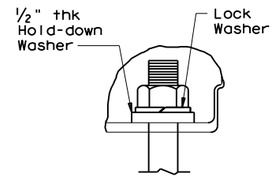

## CONCRETE TRAFFIC BARRIER BASE ANCHOR BOLT ASSEMBLY



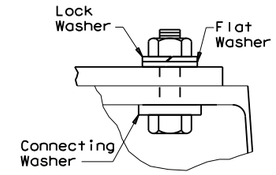

## TRANSFORMER BASE ANCHOR BOLT ASSEMBLY

| TRANSFORMER BASE ANCHOR BOLT ASSEMBLY TABLE | | | | | |
|---|---|---|---|---|---|
| MOUNTING HEIGHTS (nominal) | A.B. Dia. | BOLT CIRCLE DIAMETER | SQUARE | CTR. HOLE DIAMETER | BOLT HOLE DIAMETER |
| 20'- 39' | 1" | 14" | 14" | 12" | 1 1/16" |
| 40'- 50' | 1 1/4" | 17 1/4" | 16 3/4" | 14 3/4" | 1 5/16" |

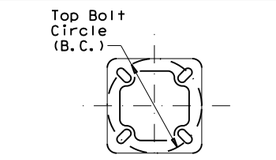
| TRANSFORMER BASE TABLE | | |
|---|---|---|
| TYPE | TOP B.C. | BTM. B.C. |
| A | 13" | 14" |
| B | 15" | 17 1/4" |



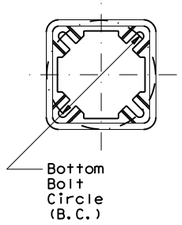

### DETAIL A




### DETAIL B




### TOP PLAN




### BOTTOM PLAN

## GENERAL NOTES:

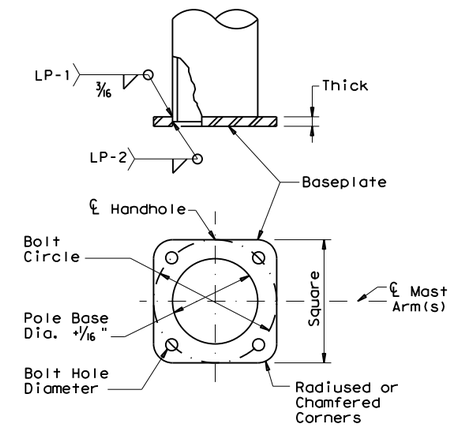
1. For mounting heights between those shown in the table, use the values in he table for the larger mounting height.
2. All breakaway bases shall meet the breakaway requirements of the 2001 Edition of the AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals," and shall have been tested by FHWA-approved methods. All bases shall have been structurally tested to resist 150% of the design moment.
3. 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.
4. 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.
5. 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:

(11) Anchor Bolt Templates do not need to be galvanized.

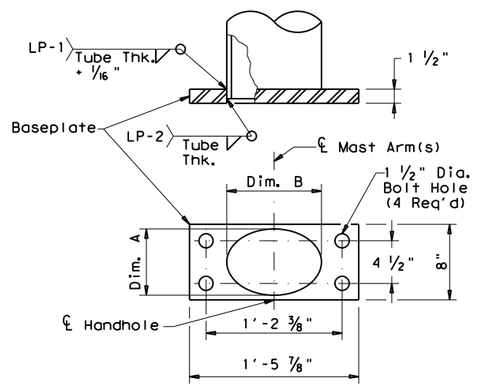
(12) Pole diameter before ovalized.

| ANCHOR BOLT FABRICATION TOLERANCES TABLE | |
|---|---|
| DIMENSION | TOLERANCE |
| Length | ± 1/2" |
| Threaded length | ± 1/2" |
| Galvanized length (if required) | - 1/4" |



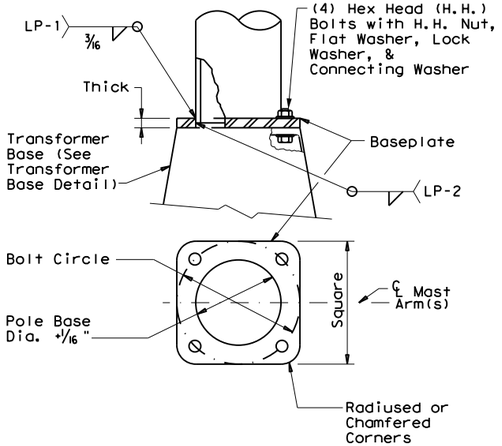

## SHOE BASE BASEPLATE

| 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" |



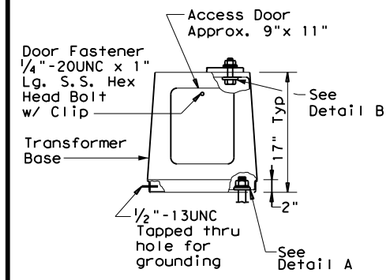

## CONCRETE TRAFFIC BARRIER BASE BASEPLATE

| 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 | TRANSFOMER 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 |




### ELEVATION

## TRANSFORMER BASE DETAILS

SHEET 4 OF 4

Texas Department of Transportation

Traffic Operations Division Standard

# ROADWAY ILLUMINATION POLES

# RIP(4)-17

| FILE: rip-17.dgn | DN: | CK: | DW: | CK: |
|---|---|---|---|---|
| ©TxDOT January 2007 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS 7-17 | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 111 |

73D

## SHIPPING PARTS LIST ~ POLES AND LUMINAIRE ARMS

| Nominal Mounting Ht. (ft) | Shoe Base Designation | | | | Quantity | T-Base Designation | | | | Quantity | CSB/SSCB Mounted Designation | | | | Quantity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pole | A1 | A2 | Luminaire | | Pole | A1 | A2 | Luminaire | | Pole | A1 | A2 | Luminaire | |
| 20 | (Type SA 20 S - 4) | | | (.15kW) S | | (Type SA 20 T - 4) | | | (.15kW) S | | | | | | |
| | (Type SA 20 S - 4 - 4) | | | (.15kW) S | | (Type SA 20 T - 4 - 4) | | | (.15kW) S | | | | | | |
| 30 | (Type SA 30 S - 4) | | | (.25kW) S | | (Type SA 30 T - 4) | | | (.25kW) S | | (Type SP 28 S - 4) | | | (.25kW) S | |
| | (Type SA 30 S - 4 - 4) | | | (.25kW) S | | (Type SA 30 T - 4 - 4) | | | (.25kW) S | | (Type SP 28 S - 4 - 4) | | | (.25kW) S | |
| | (Type SA 30 S - 8) | | | (.25kW) S | | (Type SA 30 T - 8) | | | (.25kW) S | | (Type SP 28 S - 8) | | | (.25kW) S | |
| | (Type SA 30 S - 8 - 8) | | | (.25kW) S | | (Type SA 30 T - 8 - 8) | | | (.25kW) S | | (Type SP 28 S - 8 - 8) | | | (.25kW) S | |
| 40 | (Type SA 40 S - 4) | | | (.25kW) S | | (Type SA 40 T - 4) | | | (.25kW) S | | (Type SP 38 S - 4) | | | (.25kW) S | |
| | (Type SA 40 S - 4 - 4) | | | (.25kW) S | | (Type SA 40 T - 4 - 4) | | | (.25kW) S | | (Type SP 38 S - 4 - 4) | | | (.25kW) S | |
| | (Type SA 40 S - 8) | | | (.25kW) S | | (Type SA 40 T - 8) | | | (.25kW) S | | (Type SP 38 S - 8) | | | (.25kW) S | |
| | (Type SA 40 S - 8 - 8) | | | (.25kW) S | | (Type SA 40 T - 8 - 8) | | | (.25kW) S | | (Type SP 38 S - 8 - 8) | | | (.25kW) S | |
| | (Type SA 40 S - 10) | | | (.25kW) S | | (Type SA 40 T - 10) | | | (.25kW) S | | (Type SP 38 S - 10) | | | (.25kW) S | |
| | (Type SA 40 S - 10 - 10) | | | (.25kW) S | | (Type SA 40 T - 10 - 10) | | | (.25kW) S | | (Type SP 38 S - 10 - 10) | | | (.25kW) S | |
| | (Type SA 40 S - 12) | | | (.25kW) S | | (Type SA 40 T - 12) | | | (.25kW) S | | (Type SP 38 S - 12) | | | (.25kW) S | |
| | (Type SA 40 S - 12 - 12) | | | (.25kW) S | | (Type SA 40 T - 12 - 12) | | | (.25kW) S | | (Type SP 38 S - 12 - 12) | | | (.25kW) S | |
| 50 | (Type SA 50 S - 4) | | | (.4kW) S | | (Type SA 50 T - 4) | | | (.4kW) S | | (Type SP 48 S - 4) | | | (.4kW) S | |
| | (Type SA 50 S - 4 - 4) | | | (.4kW) S | | (Type SA 50 T - 4 - 4) | | | (.4kW) S | | (Type SP 48 S - 4 - 4) | | | (.4kW) S | |
| | (Type SA 50 S - 8) | | | (.4kW) S | | (Type SA 50 T - 8) | | | (.4kW) S | | (Type SP 48 S - 8) | | | (.4kW) S | |
| | (Type SA 50 S - 8 - 8) | | | (.4kW) S | | (Type SA 50 T - 8 - 8) | | | (.4kW) S | | (Type SP 48 S - 8 - 8) | | | (.4kW) S | |
| | (Type SA 50 S - 10) | | | (.4kW) S | | (Type SA 50 T - 10) | | | (.4kW) S | | (Type SP 48 S - 10) | | | (.4kW) S | |
| | (Type SA 50 S - 10 - 10) | | | (.4kW) S | | (Type SA 50 T - 10 - 10) | | | (.4kW) S | | (Type SP 48 S - 10 - 10) | | | (.4kW) S | |
| | (Type SA 50 S - 12) | | | (.4kW) S | | (Type SA 50 T - 12) | | | (.4kW) S | | (Type SP 48 S - 12) | | | (.4kW) S | |
| | (Type SA 50 S - 12 - 12) | | | (.4kW) S | | (Type SA 50 T - 12 - 12) | | | (.4kW) S | | (Type SP 48 S - 12 - 12) | | | (.4kW) S | |

| OTHER Designation | | | | |
|---|---|---|---|---|
| Pole | A1 | A2 | Luminaire | Quantity |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

GENERAL NOTES:

All work, materials and services not shown on the plans which may be necessary for complete and proper construction shall be performed, furnished and installed by the Contractor. Faulty fabrication or poor workmanship in any material, equipment or installation will be considered justification for rejection. Where manufacturers provide warranties or guarantees as a customary trade practice, Contractor shall furnish to the Department such warranties or guarantees.

The location of poles and fixtures are diagrammatic only and may be shifted by the Engineer to accommodate local conditions. Erection and/or removal of poles and luminaires located near overhead electrical lines shall be accomplished using established industry and utility safety practices and in accordance with laws governing such work. The Contractor shall consult with the appropriate utility company prior to beginning such work.

A. Standard Steel Pole Designs. Steel poles fabricated in accordance with the details and dimensions shown herein, shall be considered standard designs. Submission of shop drawings and design calculations for standard designs is not required.

B. Optional Steel Pole Designs. Multi-sided steel poles may be allowed as optional designs, if steel poles are permitted or required, pending approval by the Department as outlined below.
1. Shop Drawings. Optional designs require submission of shop drawings and design calculations bearing the seal of an engineer registered in the State of Texas, in accordance with Item 441, "Steel Structures." The Department may elect to pre-approve some shop drawings for optionally designed poles. Submission of shop drawings and design calculations is not required for structures fabricated in accordance with the details of shop drawings on the pre-approved list maintained by the TxDOT Traffic Operations Division. Any deviation from the pre-approved shop drawings will require submission of shop drawings of the complete assembly and design calculations as described above.
2. Structural Support Design for Luminaires. Lighting support structures shall be designed for a 25 year design life in accordance with the 2001 Edition of the AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals." All poles shall be designed for 110 mph 3-second gust wind speeds. An additional 1.14 gust factor shall be applied to the wind loads. For transformer base poles, fabricator shall include transformer base and connecting hardware in design calculations and shop drawing submittals. All transformer bases shall have been structurally tested to resist the theoretical plastic moment capacity of the pole. Certification of the plastic moment load test and FHWA breakaway requirement test of the model of base being furnished shall be submitted with the shop drawings. Shop drawings shall show breakaway base model number, and manufacturer's name and logo. Manufacturer's shop drawings shall include the ASTM designations for all materials to be used.
3. Mast Arm Attachments. All poles and attachments shall be structurally designed to support two 12-foot mast arms and luminaires. Poles shall be supplied with mast arm combinations as shown in the plans. All mast arms shall be designed for a 60-pound luminaire having an effective projected area of 1.6 square feet.
4. Anchor Bolt Assembly. Anchor bolt assemblies for optionally designed poles shall be the same as those shown herein.

C. Aluminum Pole Designs. Aluminum pole designs may be allowed, if aluminum poles are permitted or required, pending approval by the Department as outlined below.
1. Meet all of the requirements stated above for optional steel pole designs and the following:
   a. Aluminum poles shall be fabricated in accordance with "Structural Welding Code-Aluminum" AWS D1.2.
   b. Aluminum pole designs shall use the same anchor bolt assembly and be subject to the same geometric restraints and other requirements for steel poles specified herein.
   C. Aluminum poles shall be equipped with vibration mitigation devices, as approved by the engineer.
   d. Pole components shall be constructed using the following material:
   Shaft: ASTM B221 or B241 Alloy 6063-T6, ASTM B209 Alloy 5086-H34, ASTM B221 Alloy 6005-T5.
   Base Flange: ASTM B26 Alloy 356.0-T6 or ASTM B108 Alloy 356.0-T6 (Yield strength test required).
   Mast Arm Fitting: ASTM B209 Alloy 6061-T6 or ASTM B221 Alloy 6005-T5.
   Mast Arms: ASTM B241 Alloy 6061-T6 or Alloy 6063-T6.
   Pole Cap: ASTM B209 Alloy 5086-H32 or ASTM B108 or B26 Alloy 356.0-T6.
   Bolts: Stainless Steel AISI 300 series. Bolts threading into aluminum threads shall be treated with anti-seize compound, Never-Seez Compound, Permatex 133K or equal.

D. Special Designs. Poles with architectural treatments shall meet the requirements shown elsewhere in the plans.

## EXPLANATION OF ROADWAY ILLUMINAION ASSEMBLY DESIGNATIONS

(TYPE SA 50 T - X - X) (.4KW) S

SA: Pole and mast arm may be steel or aluminum.
ST: Pole and mast arm must be steel.
AL: Pole and mast arm must be aluminum.
SP: Squashed (ovalized) steel or aluminum pole for installing on CSB or SSCB. See standard sheet CSB (5), or SSCB (4).

Two numerical digits denote mounting height in feet.

Next letter denotes type of base, (S-Shoe Base, T-Transformer Base, or B-Shoe Base Bridge Mount)

First number denotes length of mast arm in feet.

Use of second mast arm is indicated by second dashed number which denotes length in feet.

Next three figures indicate luminaire rating (1 kW= 1000 watts, .4 kW= 400 watts, etc.) Fixtures for U/P (SPL-CO) (.15KW)S(TYPE 1) and (TYPE 2) as shown on RID(UP) shall be "cobra head" style fixtures that meet the specifications shown on RID(LUM) sheets 1 and 2. Fixtures bid under the descriptive code RDWY ILL ASSEM U/P TYPE IF shall meet the specifications shown on RID(IF). All other fixtures bid under Item 610 shall meet specifications shown elsewhere in the plans.

Last letter indicates the type of lamp (M- Metal Halide, S- High Pressure Sodium, L- Low Pressure Sodium).

SHEET 1 of 4

Texas Department of Transportation
Traffic Operations Division

# ROADWAY ILLUMINATION POLES

RIP(1)-11



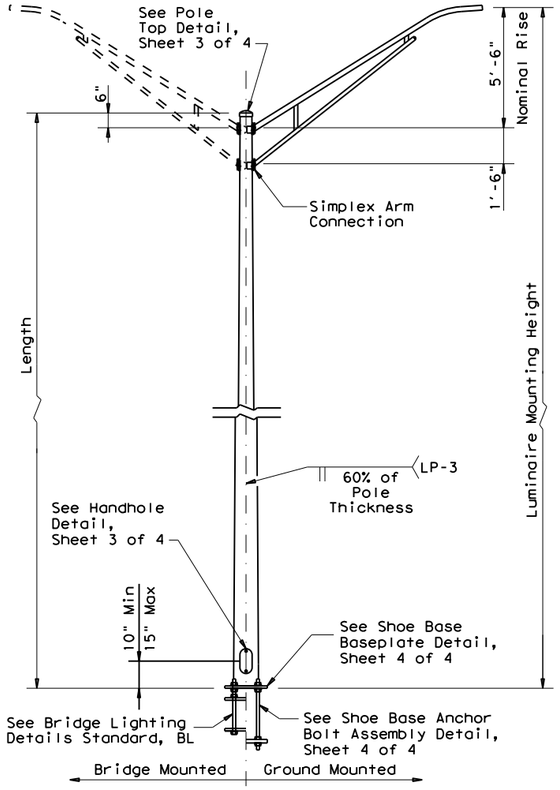
| DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|

REVISIONS

| CONT | SECT | JOB | HIGHWAY |
|---|---|---|---|
| 6367 | 43 | 001 | IH-20 |

| DIST | COUNTY | SHEET NO. |
|---|---|---|
| 10 | SMITH, ETC. | 112 |

DATE:
FILE:



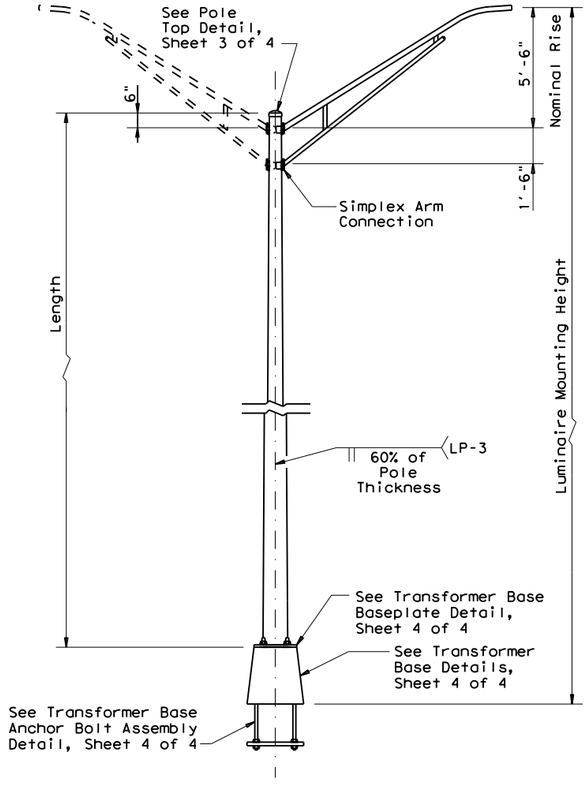

## SHOE BASE POLE

| SHOE BASE POLE | | | | | |
|---|---|---|---|---|---|
| Luminaire Mounting Height (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 |

Designs conform to 2001 AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals and Interim Specifications. Design 3-Second Gust Wind Speed equal 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 less than 25' above natural ground level.

Design structures to support two 12' luminaire mast arms and luminaires. Design mast arms for 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.




## TRANSFORMER BASE POLE

| TRANSFORMER BASE POLE | | | | | |
|---|---|---|---|---|---|
| Luminaire Mounting Height (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 | 3.41 | 43.50 | 0.1196 | 30.3 |

For mounting heights between values shown in the tables, use base diameter and thickness values for the larger pole.

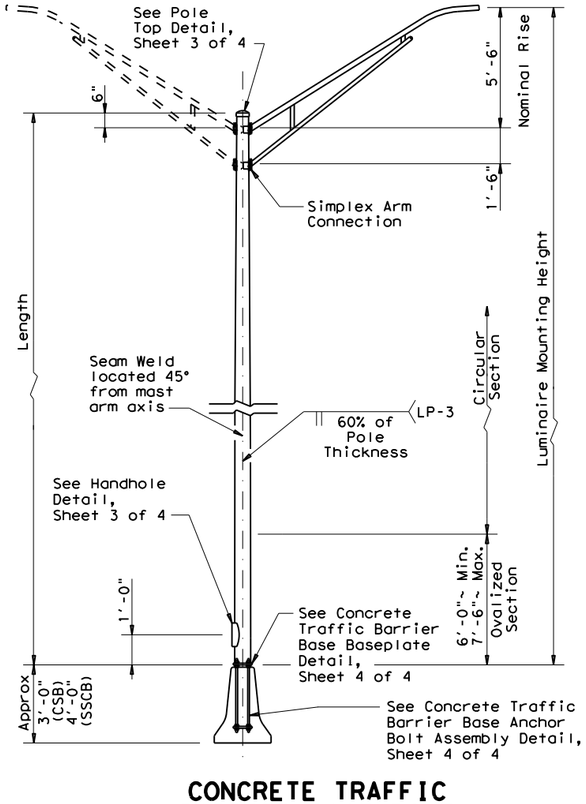
Unless otherwise noted, all steel parts shall be galvanized in accordance with Item 445, "Galvanizing."

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 the ANSI/AWS Structural Welding Code D1.1.

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."




## CONCRETE TRAFFIC BARRIER BASE POLE

| CONCRETE TRAFFIC BARRIER BASE POLE (CSB/SSCB) | | | | | | |
|---|---|---|---|---|---|---|
| Luminaire Mounting Height (ft) | Base ② Diameter (in) | Top Diameter (in) | Length (ft) | Pole Thickness (in) | Design Moment (K-ft) | |
| | | | | | About ℄ 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 |

All poles, except Transformer Base Poles, shall have hand holes with reinforcing frames and covers. Except for poles mounted on a concrete traffic barrier, 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.

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."

| 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 | A325 ① | 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 | |

① Lubricate in the field if necessary in lieu of the requirements in ASTM A325.

② Before ovalized as shown on Concrete Traffic Barrier Base Baseplate details, Sheet 4 of 4.

③ A1011 SS Gr 50 may be used in lieu 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 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" |



Texas Department of Transportation
Traffic Operations Division

# ROADWAY ILLUMINATION POLES

RIP(2)-11



| DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|

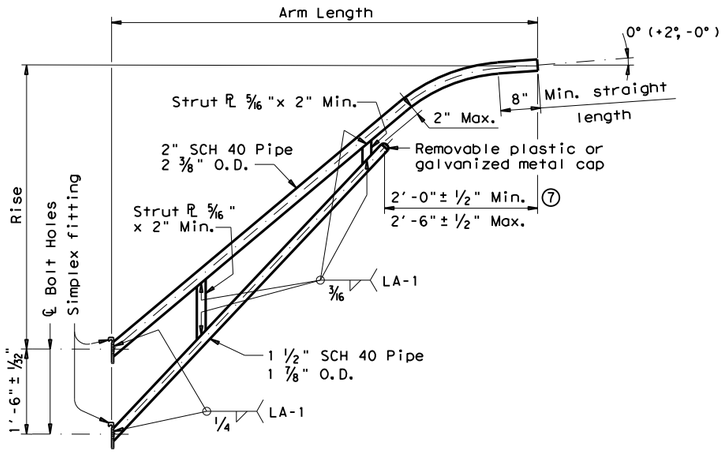
REVISIONS
MOD 1/11 JSY/TGG Added Aditional M.H. in table and revised Anchor Bolt Assembly

| CONT | SECT | JOB | HIGHWAY |
|---|---|---|---|
| 6367 | 43 | 001 | IH-20 |
| DIST | COUNTY | | SHEET NO. |
| 10 | SMITH, ETC. | | 113 |

73B

DATE:
FILE:

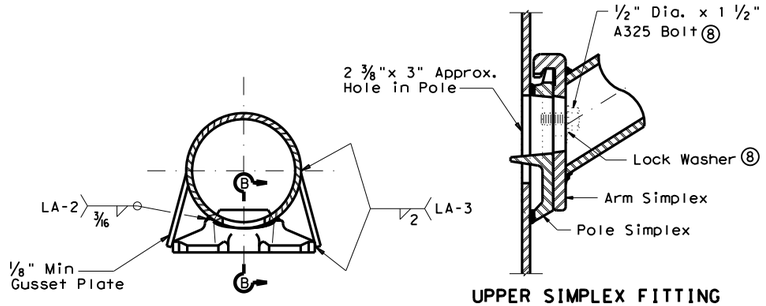
DISCLAIMER:
The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.




## LUMINAIRE ARM

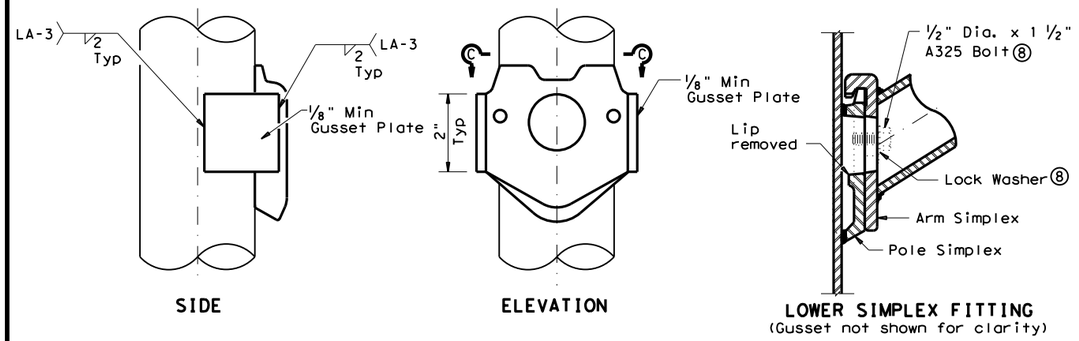
| LUMINAIRE ARM DIMENSIONS | | |
|---|---|---|
| Nominal Arm Length | Arm Length | Rise |
| 4'-0" | 3'-6" | 2'-6" ⑩ |
| 6'-0" | 5'-6" | 5'-6" |
| 8'-0" | 7'-6" | 5'-6" |
| 10'-0" | 9'-6" | 5'-6" |
| 12'-0" | 11'-6" | 5'-6" |

| MATERIALS | |
|---|---|
| Pole or Arm Simplex | ASTM A27 Gr 65-35, A148 Gr 80-50, A576 Gr 1021 ⑤, or A36 (Arm only) |
| Arm Pipes | ASTM A53 Gr A or B, A500 Gr B, A501, A 1008 HSLAS-F Gr 50 ⑥, or A1011 HSLAS-F Gr 50 ⑥ |
| Arm Struts and Gusset Plates ④ | ASTM A36, A572 Gr 50 ⑥, or A588 |
| Misc. | ASTM designations as noted |




SECTION C-C

UPPER SIMPLEX FITTING
(Gusset not shown for clarity)



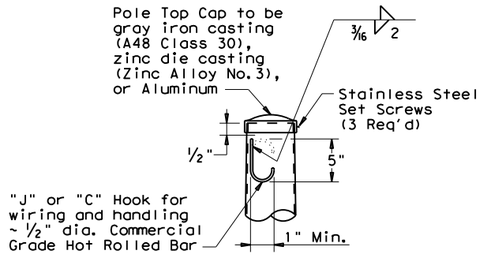

SIDE

ELEVATION

LOWER SIMPLEX FITTING
(Gusset not shown for clarity)

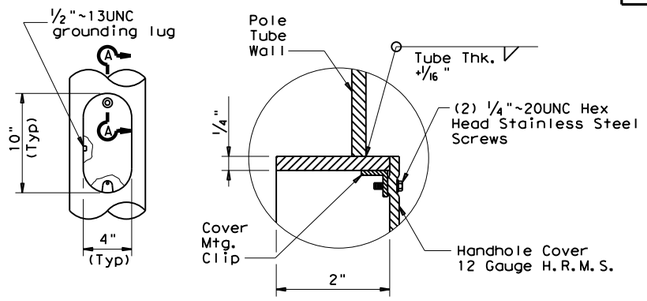
## SIMPLEX ATTACHMENT DETAIL

## SECTION B-B




## POLE TOP

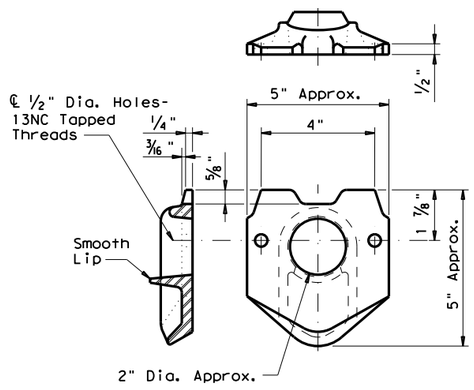
| ARM ASSEMBLY FABRICATION TOLERANCES TABLE | |
|---|---|
| DIMENSION | TOLERANCE |
| Arm Length | ±3" |
| Arm Rise | +1 3/4" in 10 ft |
| Arm Diameter | +3/16" |
| Overall length or width | +1/4" |
| Thickness | +1/4", -1/16" |
| Deviation from flat | 1/8" in 12" |
| Spacing between holes | +3/32" |
| Bolt hole size | ±1/16" |
| Strut location in truss arms | ±1 1/2" |



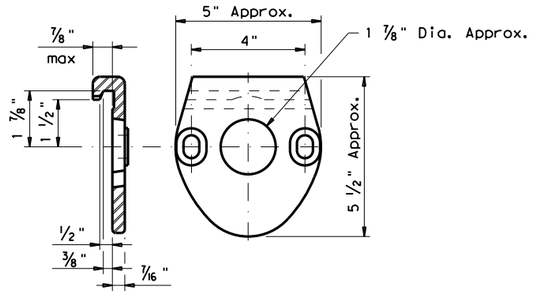

ELEVATION

SECTION A-A

## HANDHOLE




## POLE SIMPLEX DETAIL ⑨




## ARM SIMPLEX DETAIL ⑨

④ Any of the materials listed for plates may be used where the drawings do not specify a particular ASTM designation.

⑤ 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.

⑥ A572, A1008 HSLAS-F, and A1011 HSLAS-F materials may have higher yield strengths but shall not have less elongation than the grade indicated.

⑦ 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.

⑧ 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.

⑨ Proposed deviations in arm simplex dimensions or materials must be submitted to the Department for approval.

⑩ Luminaire mounting heights are based on assumed 5'-6" luminaire arm rise.



Texas Department of Transportation
Traffic Operations Division

# ROADWAY ILLUMINATION POLES

RIP(3)-11


REVISIONS

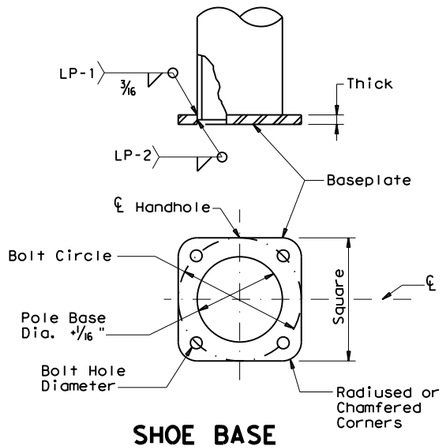
| DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|

| CONT | SECT | JOB | HIGHWAY |
|---|---|---|---|
| 6367 | 43 | 001 | IH-20 |

| DIST | COUNTY | SHEET NO. |
|---|---|---|
| 10 | SMITH, ETC. | 114 |

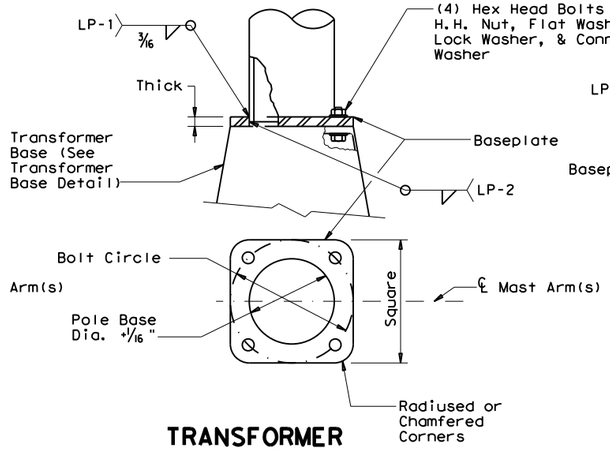
DATE:
FILE:

DATE:
FILE:



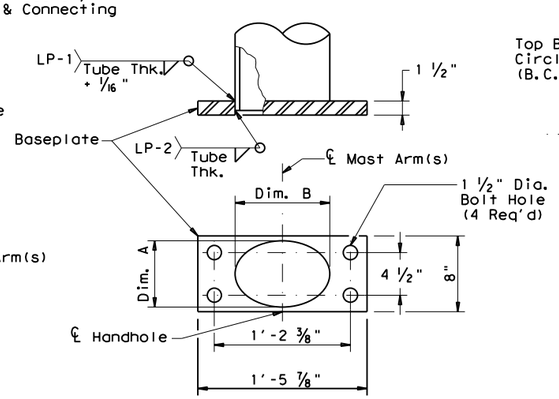

## SHOE BASE BASEPLATE

| SHOE BASE BASEPLATE TABLE | | | | |
|---|---|---|---|---|
| MOUNTING HEIGHTS | 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" |



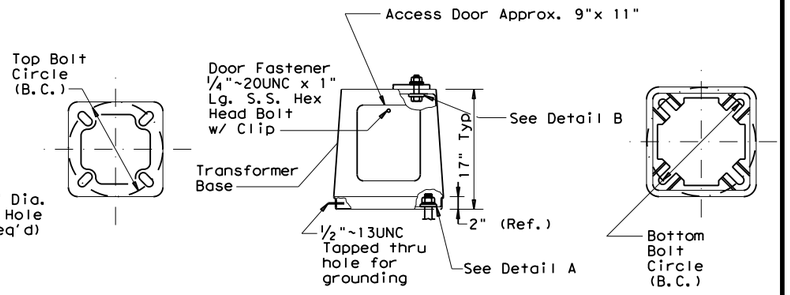

## TRANSFORMER BASE BASEPLATE

| TRANSFORMER BASE BASEPLATE TABLE | | | | | | |
|---|---|---|---|---|---|---|
| MOUNTING HEIGHTS | BOLT CIRCLE | SQUARE | THICK | CONNECTING BOLT DIA. | BOLT HOLE DIAMETER | TRANSFOMER 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 |

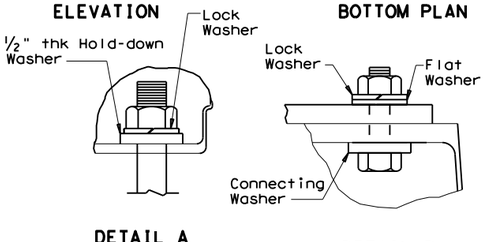



## CONCRETE TRAFFIC BARRIER BASE BASEPLATE

| CONCRETE TRAFFIC BARRIER BASE BASEPLATE TABLE | | | |
|---|---|---|---|
| MOUNTING HEIGHTS | POLE DIA.② | 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 TABLE | | |
|---|---|---|
| TYPE | TOP B.C. | BTM. B.C. |
| A | 13" | 14" |
| B | 15" | 17 1/4" |




## TRANSFORMER BASE DETAILS

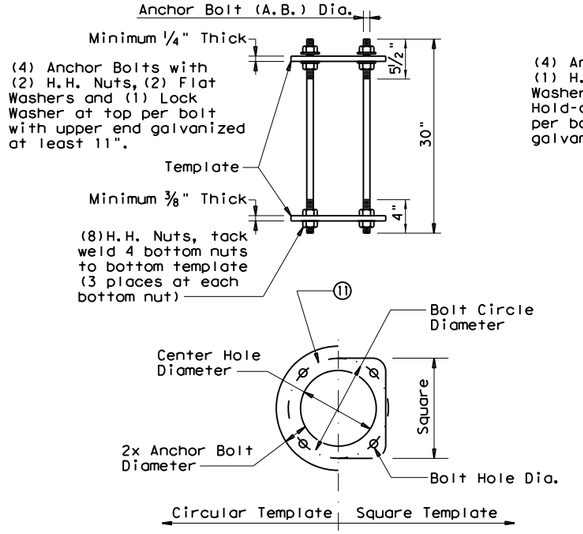
For mounting heights between those shown in the table, use the values in the table for the larger mounting height.

All breakaway bases shall meet the breakaway requirements of the 2001 Edition of the AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals," 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 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.

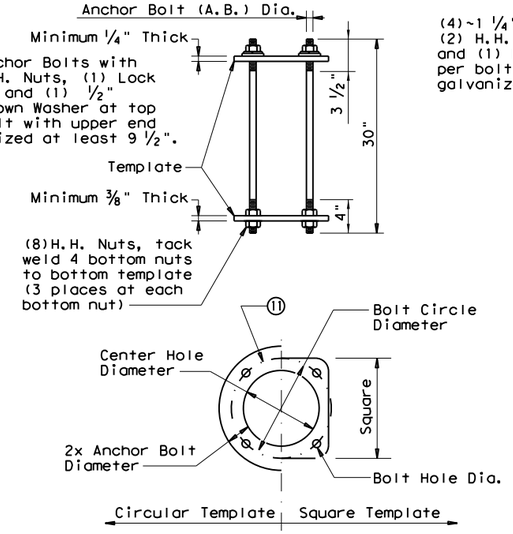
Bases shall be stamped, incised or by other approved permanent means, marked to show fabricator's name or logo, and model number. Such information shall be placed in a readily seen location, inside or outside the base, but shall not be placed on the door.

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.



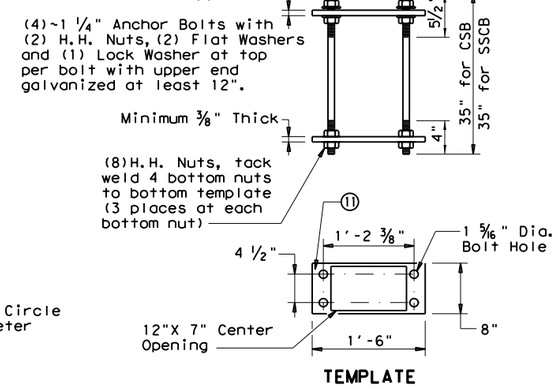

## SHOE BASE ANCHOR BOLT ASSEMBLY

| SHOE BASE ANCHOR BOLT ASSEMBLY TABLE | | | | | |
|---|---|---|---|---|---|
| MOUNTING HEIGHTS | A.B. Dia. | BOLT CIRCLE DIAMETER | SQUARE | CTR. HOLE DIAMETER | BOLT HOLE DIAMETER |
| 20′ - 39′ | 1" | 13" | 13" | 11" | 1 1/16" |
| 40′ - 50′ | 1 1/4" | 15" | 14 1/2" | 12 1/2" | 1 5/16" |




## TRANSFORMER BASE ANCHOR BOLT ASSEMBLY

| TRANSFORMER BASE ANCHOR BOLT ASSEMBLY TABLE | | | | | |
|---|---|---|---|---|---|
| MOUNTING HEIGHTS | A.B. Dia. | BOLT CIRCLE DIAMETER | SQUARE | CTR. HOLE DIAMETER | BOLT HOLE DIAMETER |
| 20′ - 39′ | 1" | 14" | 14" | 12" | 1 1/16" |
| 40′ - 50′ | 1 1/4" | 17 1/4" | 16 3/4" | 14 3/4" | 1 5/16" |




TEMPLATE

## CONCRETE TRAFFIC BARRIER BASE ANCHOR BOLT ASSEMBLY

⑪ Anchor Bolt Templates need not be galvanized.

| ANCHOR BOLT FABRICATION TOLERANCES TABLE | |
|---|---|
| DIMENSION | TOLERANCE |
| Length | ± 1/2" |
| Threaded length | ± 1/2" |
| Galvanized length (if required) | - 1/4" |

SHEET 4 of 4

Texas Department of Transportation
Traffic Operations Division

# ROADWAY ILLUMINATION POLES

# RIP(4)-11



| DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|

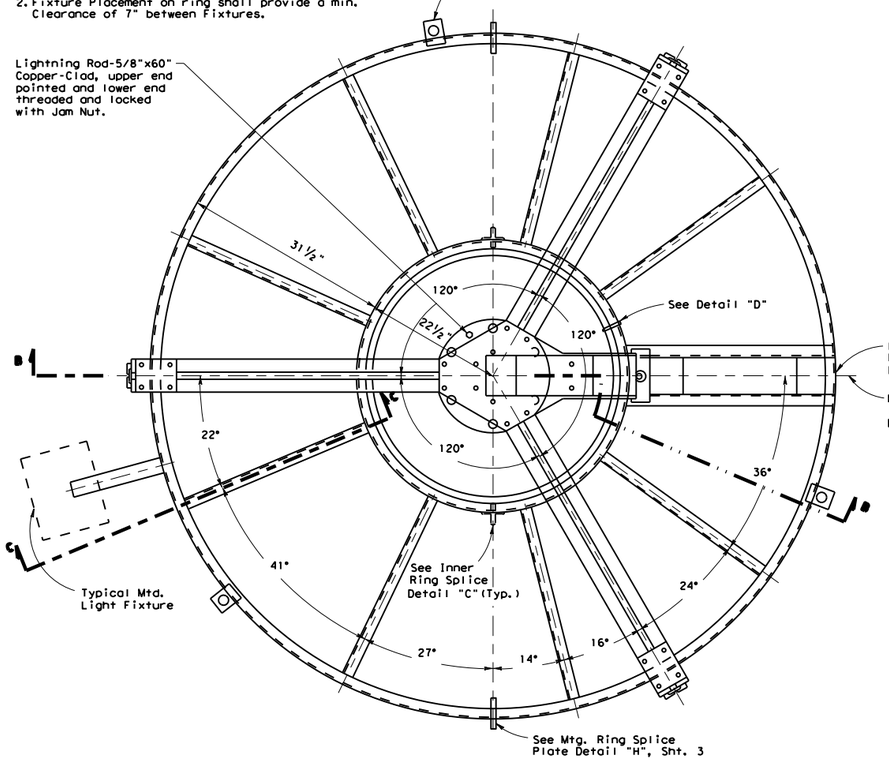
REVISIONS
MOD 1/11 JSY/TGG Revised Anchor Bolt Assemblies

| CONT | SECT | JOB | HIGHWAY |
|---|---|---|---|
| 6367 | 43 | 001 | IH-20 |
| DIST | COUNTY | | SHEET NO. |
| 10 | SMITH, ETC. | | 115 |

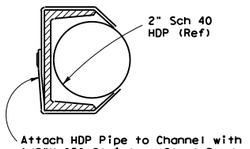
DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

## NOTES:

1. Pole, Ring, and Ring Support shall be assembled and erected so that Reference Line is parallel to center line of roadway or as shown on "Lighting Layouts" sheets.
2. Fixture Placement on ring shall provide a min. Clearance of 7" between Fixtures.

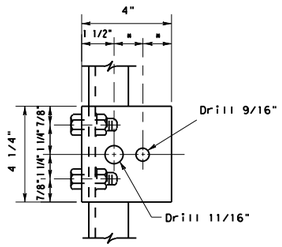


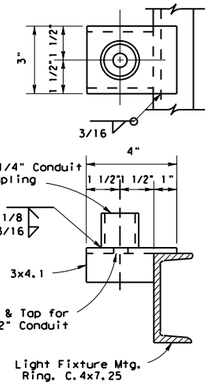

## LIGHT MOUNTING RING & SUPPORT ASSEMBLY



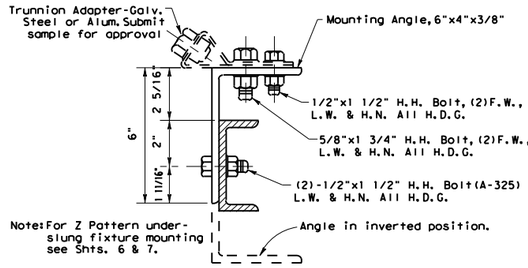

## DETAIL "D"
BUMPER RING ATTACHMENT

* As required by Trunnion Adapter supplied.



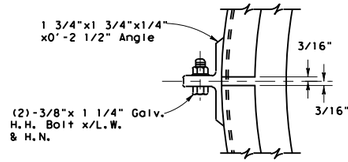

## DETAIL "E"
(CONDUIT ATTACHMENT FOR OBSTRUCTION LIGHTS, TYPICAL (3) PLACES)



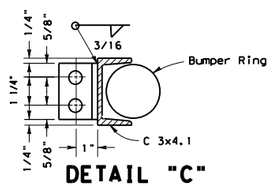

Note: Aiming capabilities may be by method shown or by Steel Mounting-Aiming Device as approved by the Engineer. Mark position of fixture with center punch or drill after fixture has been aligned to the right position on the roadway, as directed by the Engineer.

## SECTION C-C
(FOR TRUNNION MOUNT)

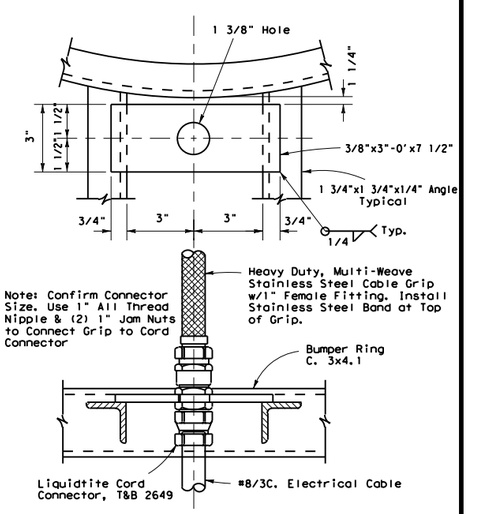
NOTE: Provide S.S. or galv. cable safety lanyard for Light Fixture when Trunnion Mount is used.




PLAN

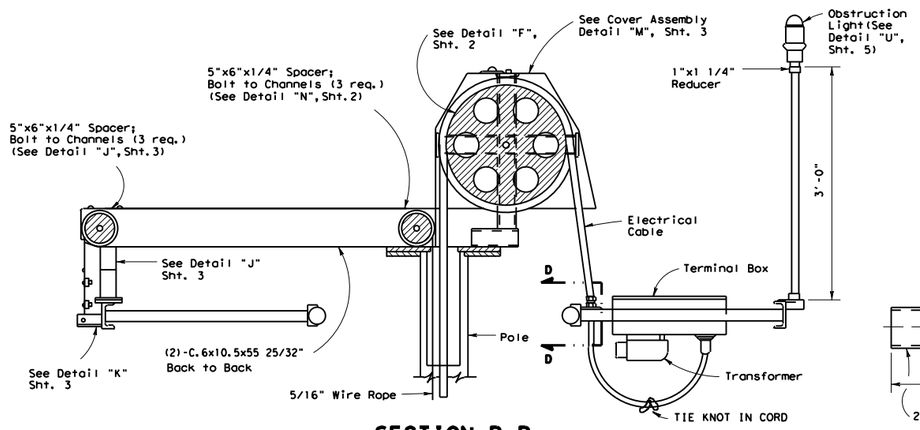



## DETAIL "C"
INNER RING SPLICE

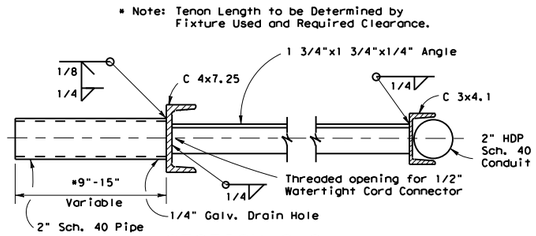



## SECTION D-D

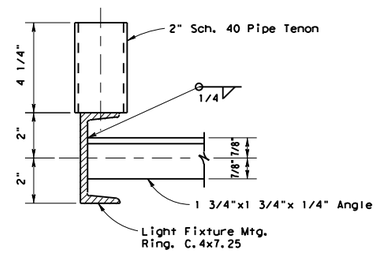
NOTE: COVER CORD WITH HEAT SHRINK TUBING FROM CABLE GRIP TO WITHIN ONE INCH OF GRIP TO CONNECTOR TRANSITION PRIOR TO INSTALLING CABLE GRIP.



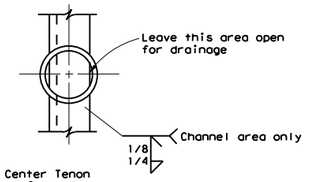

## SECTION B-B




## SECTION C-C
(FOR AREA LIGHTS)




## SECTION C-C
(FOR FLOODLIGHTS)




Note: Center Tenon on Channel

Texas Department of Transportation
Traffic Operations Division

# HIGH MAST ILLUMINATION DETAILS

HMID(1)-03



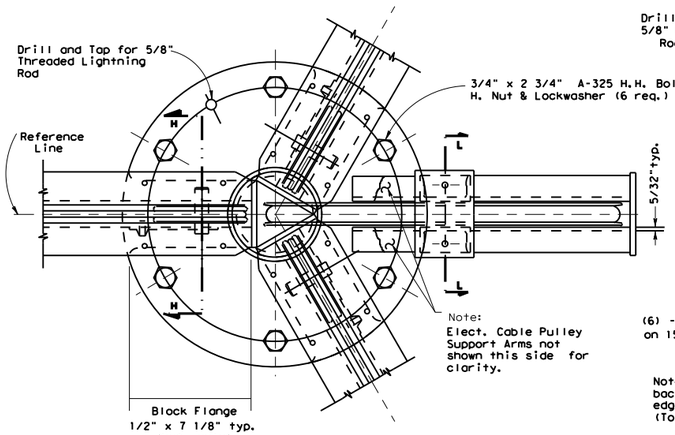
| DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|

REVISIONS
5-86
4-87 10-14-87
5-87 4-96
10-1-87

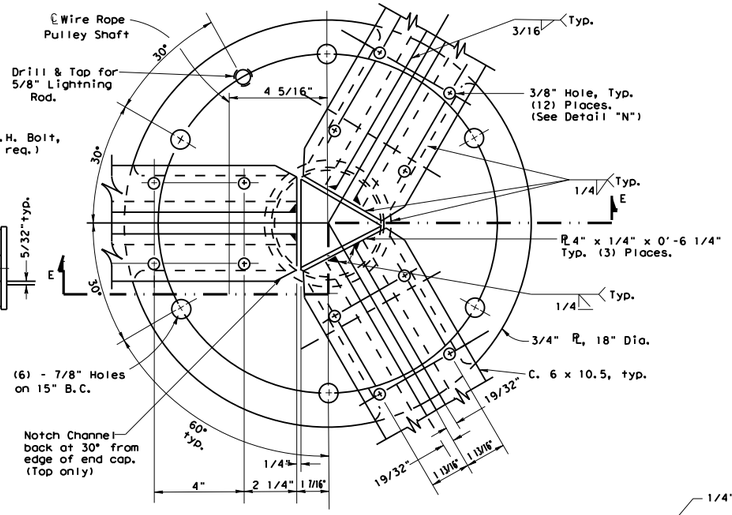
| CONT | SECT | JOB | HIGHWAY |
|---|---|---|---|
| 6367 | 43 | 001 | IH-20 |
| DIST | COUNTY | | SHEET NO. |
| 10 | SMITH, ETC. | | 116 |

DATE:
FILE:

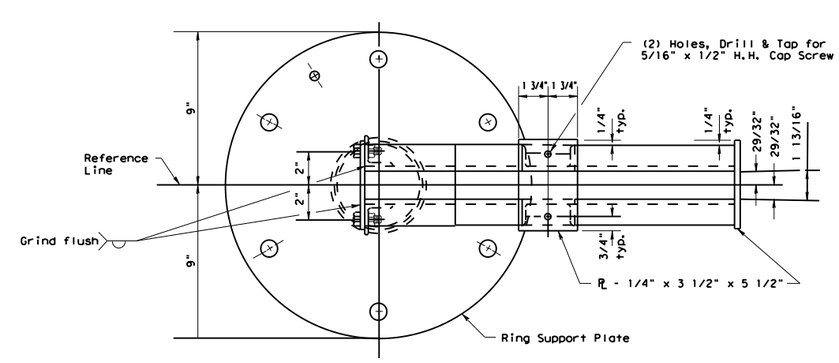
DATE:
FILE:



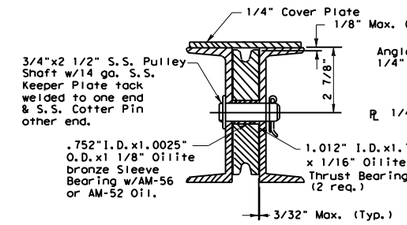

**PLAN VIEW**



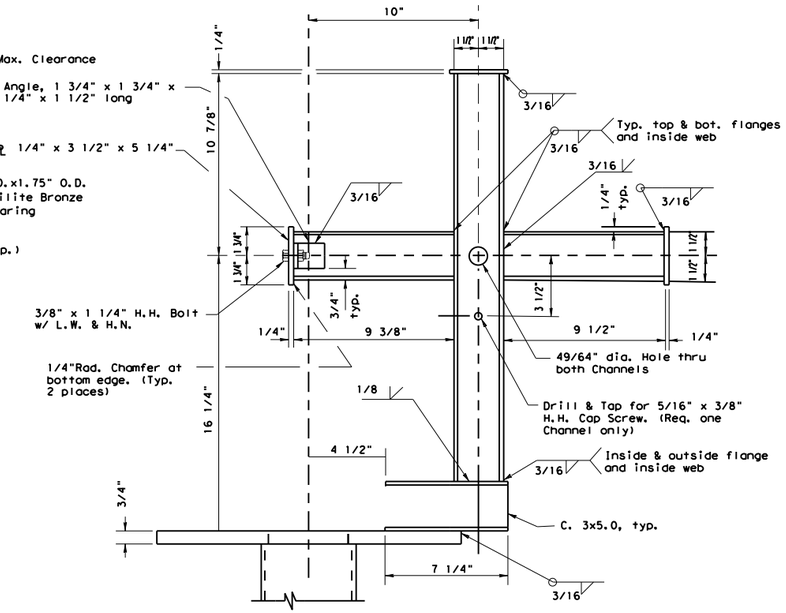

## DETAIL "G"
### TOP PLATE CONNECTION
(LESS ELECT. CABLE PULLEY SUPPORT)
(SEE DETAIL "L")



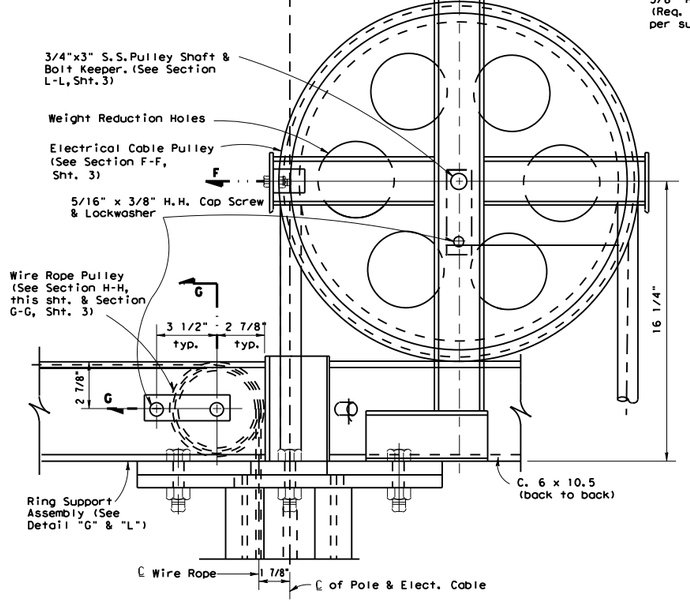

**PLAN VIEW**



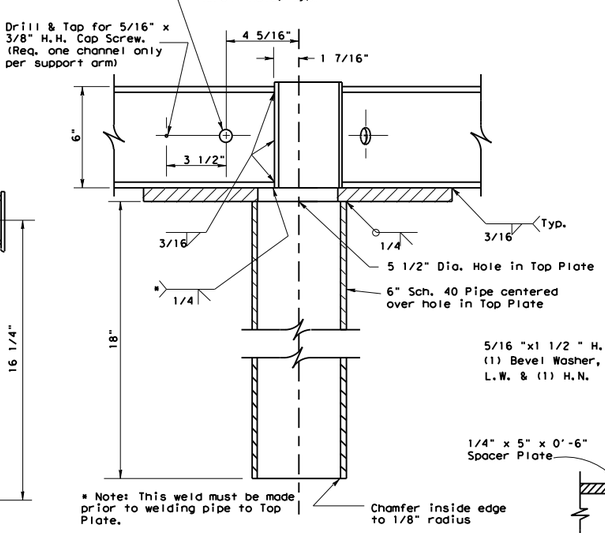

## SECTION "H-H"
### PULLEY MOUNTING FOR RING SUPPORT ARMS



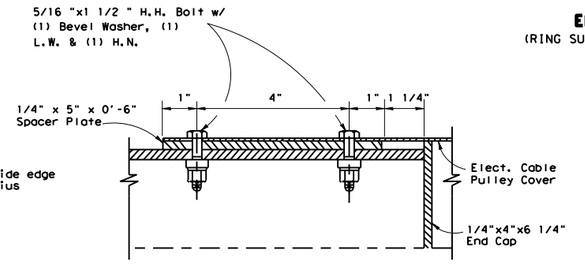

## DETAIL "L"
### ELECT. CABLE PULLEY SUPPORT
(RING SUPPORT ARMS NOT SHOWN FOR CLARITY)




## DETAIL "F"
### RING SUPPORT ASSEMBLY
(NEAR SIDE SUPPORT ARM & ELECT. CABLE PULLEY COVER NOT SHOWN FOR CLARITY)




## SECTION "E - E"




## DETAIL "N"

*Texas Department of Transportation*
*Traffic Operations Division*

# HIGH MAST ILLUMINATION DETAILS

## HMID(2)-03



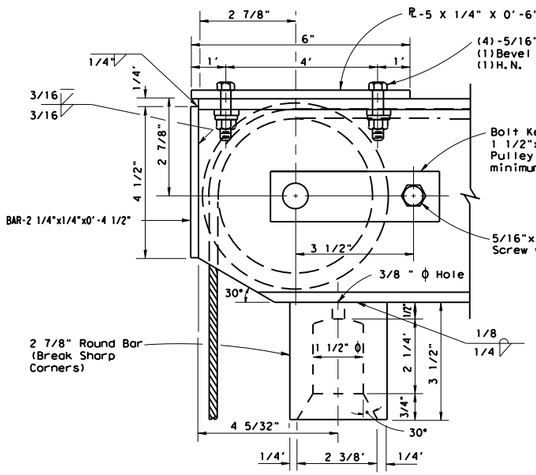
| DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|

REVISIONS
4-86
5-86
5-87
12-87
4-96

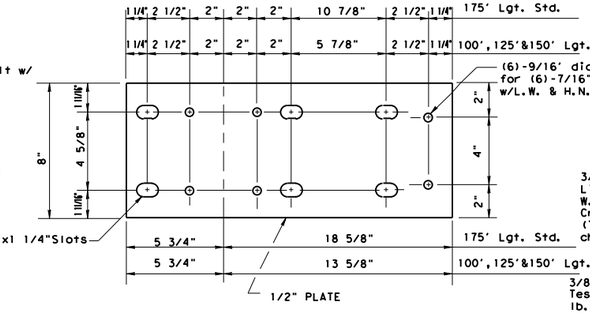
| CONT | SECT | JOB | HIGHWAY |
|---|---|---|---|
| 6367 | 43 | 001 | IH-20 |
| DIST | COUNTY | | SHEET NO. |
| 10 | SMITH, ETC. | | 117 |

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:
FILE:



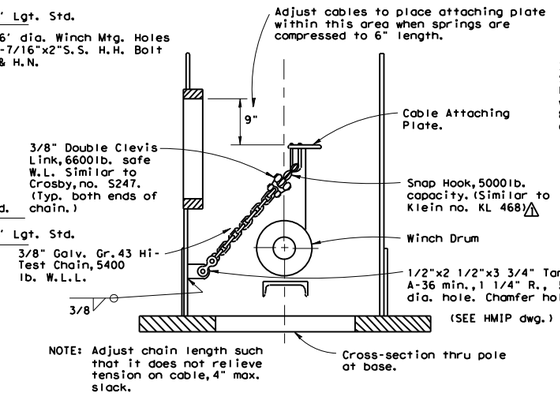

## DETAIL "J"




## DETAIL "V"

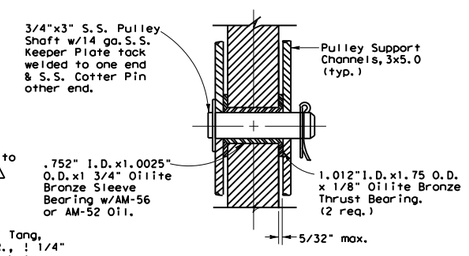
**WINCH MOUNTING PLATE**

NOTE: Dimensions may vary-Verify with winch manufacturer.



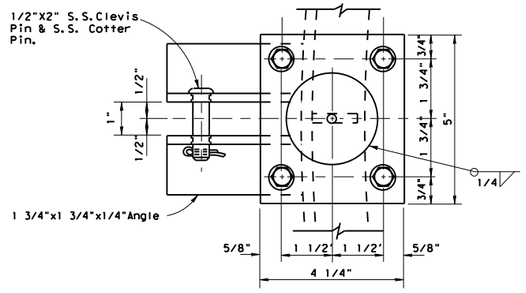

NOTE: Adjust chain length such that it does not relieve tension on cable, 4" max. slack.

## SAFETY LANYARD DETAIL

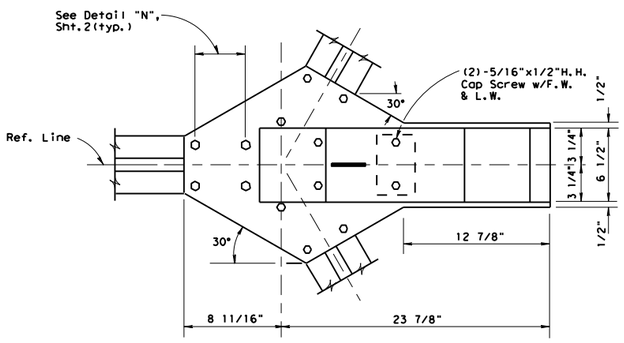



## SECTION L-L

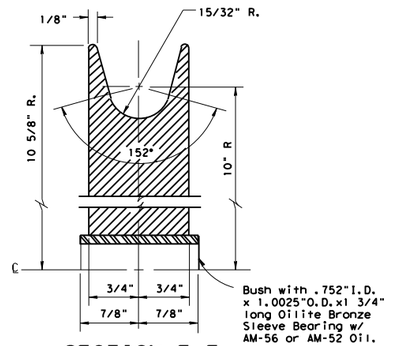
**ELECTRICAL CABLE PULLEY MOUNTING**




PLAN



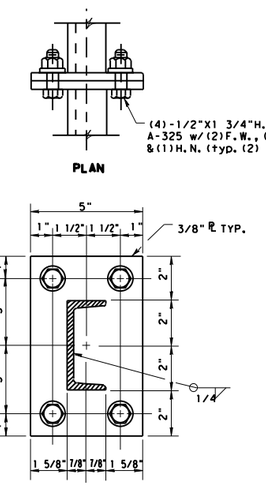

PLAN




## SECTION F-F

**ELECTRICAL CABLE PULLEY**

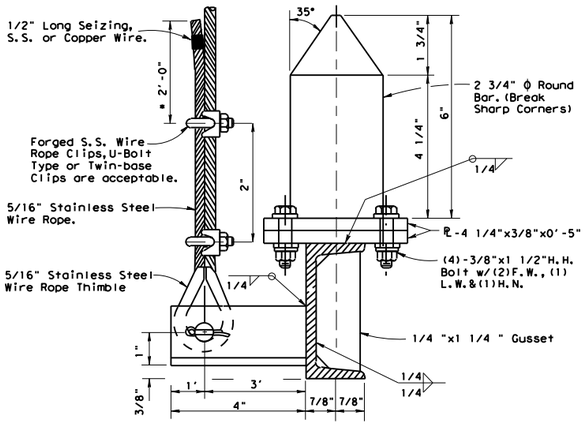
(Pulley material to be aluminum alloy, Type 356-T6 or equal)




PLAN

## DETAIL "H"

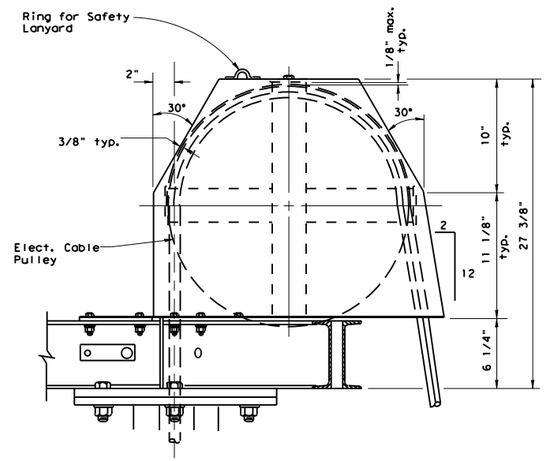
**MOUNTING RING SPLICE PLATE**




## DETAIL "K"

**MOUNTING RING CONNECTION & STABILIZER**

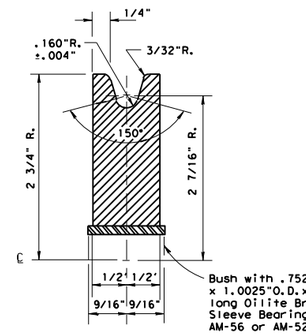
* EXTRA 2'-0" of wire cable to be attached to ring with SS Bands as directed by Engineer.




## DETAIL "M"

**COVER CAP ASSEMBLY**

NOTE: Cover to be 14 ga. galv. sht. metal or 0.10" anodized aluminum sheet.




## SECTION G-G

**WIRE ROPE PULLEY**

(Pulley material to be plated steel or Stainless Steel)

Texas Department of Transportation
*Traffic Operations Division*

# HIGH MAST ILLUMINATION DETAILS

## HMID(3)-03



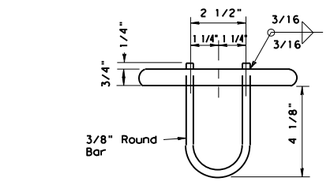
| DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|

REVISIONS
5-5-86
5-10-86 4-96
10-87
10-88

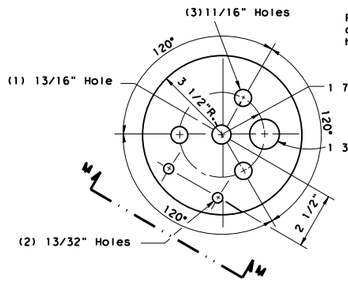
| CONT | SECT | JOB | HIGHWAY |
|---|---|---|---|
| 6367 | 43 | 001 | IH-20 |

| DIST | COUNTY | SHEET NO. |
|---|---|---|
| 10 | SMITH, ETC. | 118 |

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.

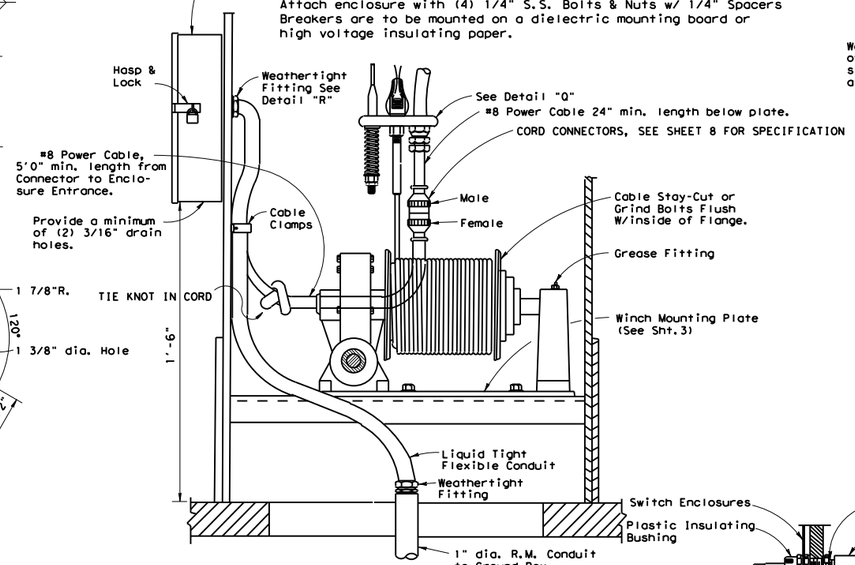



VIEW "M-M"

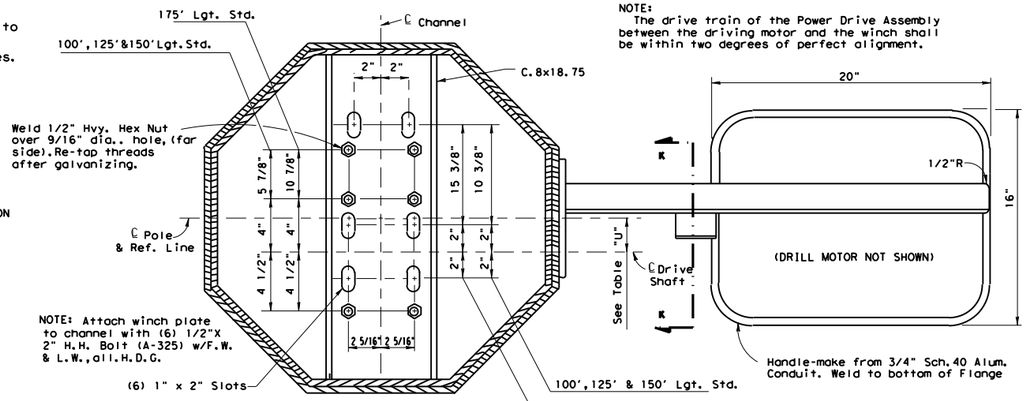



PLAN VIEW

50 A 480V. Circuit Breaker, NEMA 4 for total lamp watts exceeding 9000, 30A, 480V. Circuit Breaker, NEMA 4 for 9000 or less total lamp watts. Enclosure shall be stainless steel, 14 ga., weatherproof with full length vertical door hinge, welded hasp, lock and two sets of keys. Hinge pin shall be tack-welded to prevent removal. Lock(Master# 2195) and keys shall be furnished by the contractor and shall be the same type as used for the service enclosures. Enclosure dimensions shall be approx. 20" high x 9" wide x 5" deep. Attach enclosure with (4) 1/4" S.S. Bolts & Nuts w/ 1/4" Spacers Breakers are to be mounted on a dielectric mounting board or high voltage insulating paper.



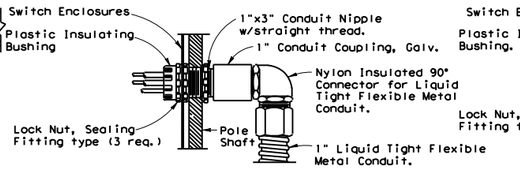

SECTION J-J
(WINCH ASSEMBLY)



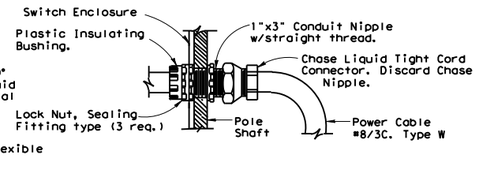

DETAIL "P"
(WINCH MOUNTING CHANNEL)
Dimensions may vary-Verify with winch manufacturer.

TABLE OF "U" DIMENSIONS

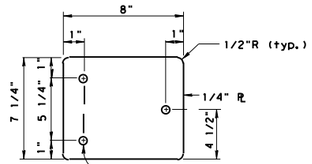
| Pole Ht. Ft. | 8 Sided 80 MPH | 8 Sided 100 MPH | 12 Sided 80 MPH | 12 Sided 100 MPH |
|---|---|---|---|---|
| 100 | 3 1/2" | 3 1/2" | 2 1/2" | 2 1/2" |
| 125 | 3 1/2" | 3 1/2" | 2 1/2" | 2 1/2" |
| 150 | 3 1/2" | 3 1/2" | 2 1/2" | 2 1/2" |
| 175 | 4 1/2" | 4 1/2" | 3 1/2" | 3 1/2" |



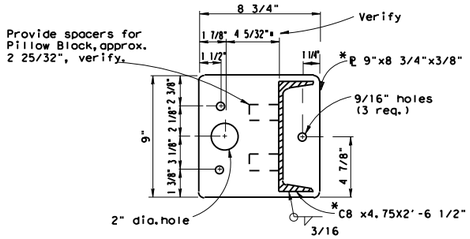

(POWER FEED FROM GROUND BOX)



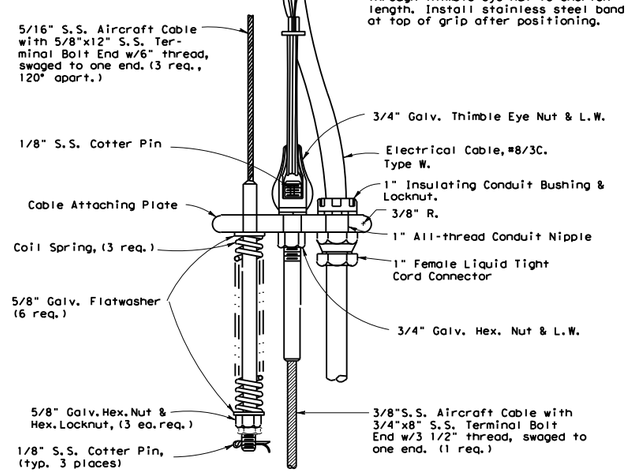

(POWER OUT TO LIGHT RING)




DETAIL "S"
(WINCH DRIVE ACCESS COVER)

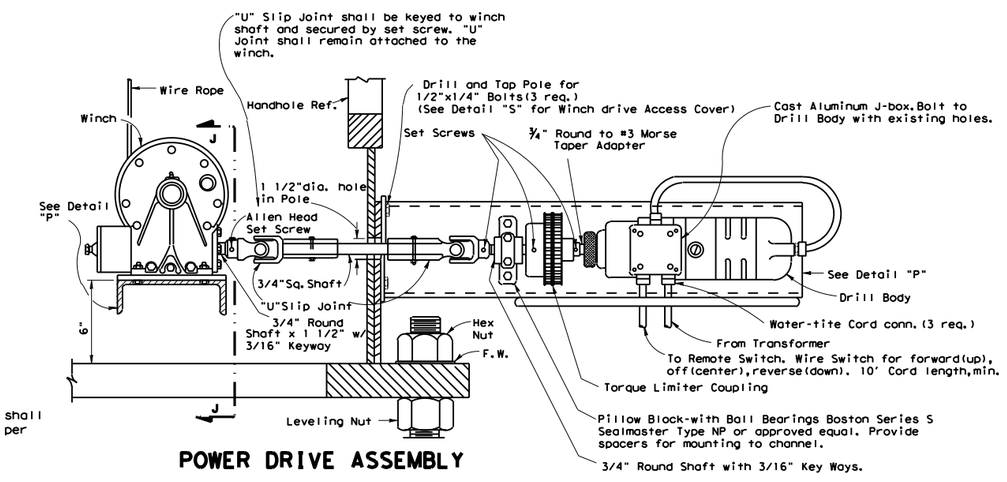



SECTION K-K
(DRILL MOTOR MOUNTING PLATE)
* Make from 6061-T6 Aluminum




DETAIL "Q"
(CABLE ATTACHING PLATE)

NOTE: 3/8"Cable for this Project shall be 19x7 Rotation Resistant per Sheet 9.




POWER DRIVE ASSEMBLY

Texas Department of Transportation
Traffic Operations Division

# HIGH MAST ILLUMINATION DETAILS

HMID(4)-03



| DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|

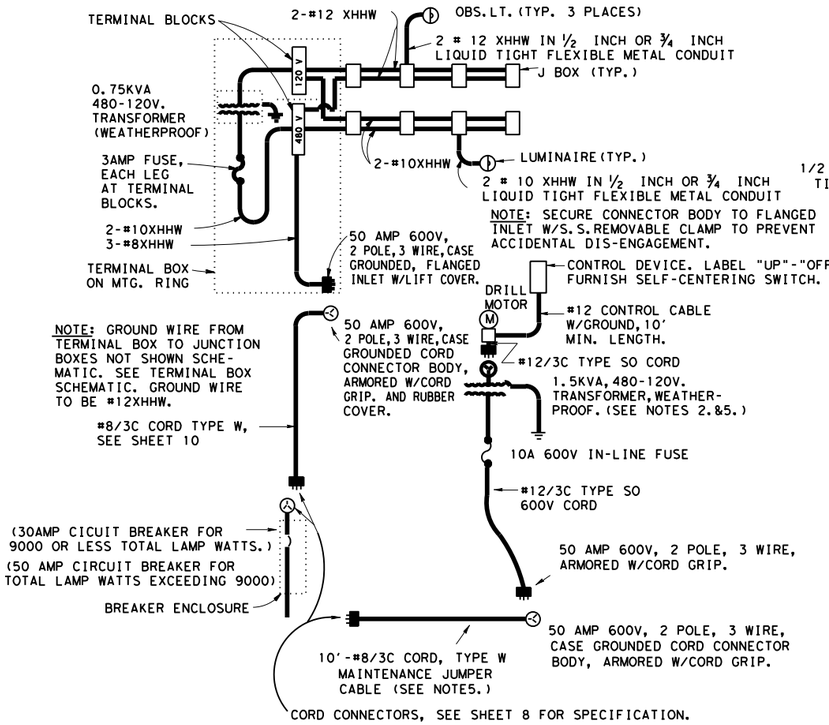
REVISIONS
4-86
5-86 12-87 4-96
12-3-86 4-89
12-8-86 10-93

| CONT | SECT | JOB | HIGHWAY |
|---|---|---|---|
| 6367 | 43 | 001 | IH-20 |

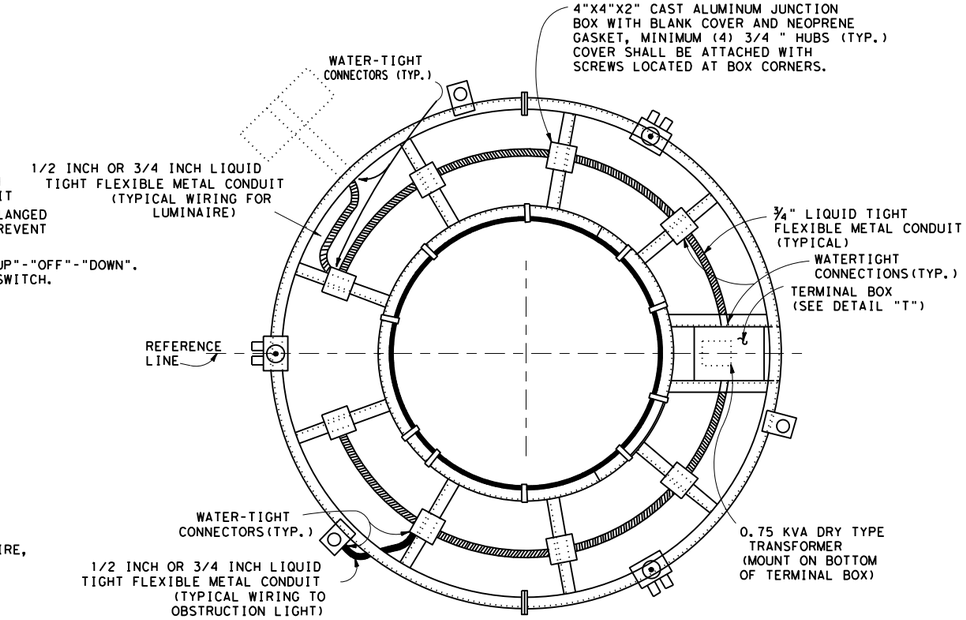
| DIST | COUNTY | SHEET NO. |
|---|---|---|
| 10 | SMITH, ETC. | 119 |

DATE:
FILE:

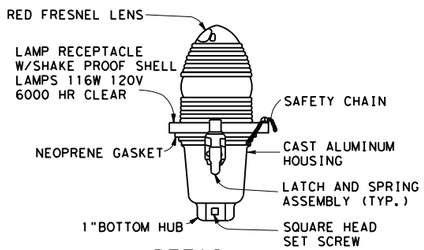
76D



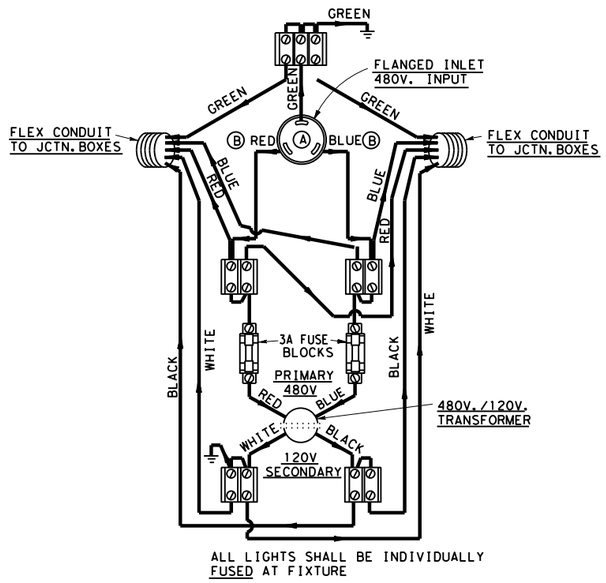

## ONE-LINE SCHEMATIC




## LIGHT MOUNTING RING

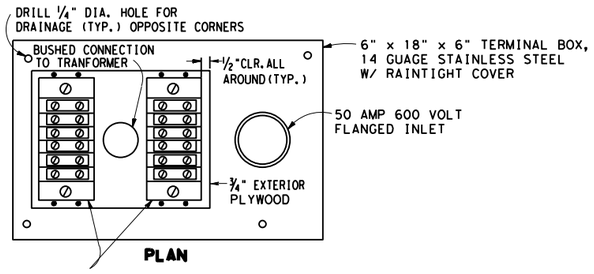



## DETAIL "U"
**(OBSTRUCTION LIGHT)**

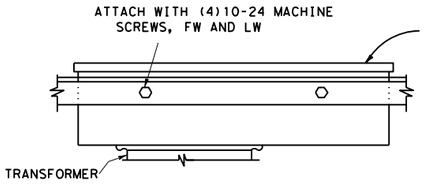



## TERMINAL BOX SCHEMATIC

NOTES:
1. OBSTRUCTION LIGHTS COLOR CODE: FROM SECONDARY SIDE OF TRANSFORMER THROUGH-OUT-CIRCUIT TO SOCKET, WHITE-NEUTRAL, BLACK-LOAD.
2. POWER SUPPLY CORD TO FLANGED INLET: GREEN-GROUND, WHITE LINE, BLACK LINE. FROM FLANGED INLET Ⓐ TO TERMINAL BLOCKS: GREEN-GROUND, RED LINE, BLUE-LINE. FROM THERE ON ALL 480V. CIRCUIT WIRES TO BE RED AND BLUE TO JUNCTION BOXES.
3. WIRE SIZE FROM POWER SUPPLY TO TERMINAL BLOCKS SHALL BE #8 AWG-SEE Ⓑ.
4. WIRE SIZE FROM TERMINAL BLOCKS TO JUNCTION BOXES SHALL BE #12 AWG.
5. MOUNT TERMINAL BLOCKS ON ¾" EXTERIOR GRADE PLYWOOD.
6. FOR 2-WIRE, 480V. SERVICE, OMIT FUSE IN GROUNDED CONDUCTOR IN LEADS TO TRANSFORMER.




## PLAN
600 VOLT TERMINAL BLOCKS




## DETAIL "T"
**(TERMINAL BOX)**

NOTES:

1. PLUGS, CONNECTOR BODIES AND FLANGED INLETS AT CORD TO RING CONNECTION SHALL BE "TWIST LOCK" TYPE, 3-PRONG, RATED 50 AMPS AT 600V, AND 20 AMPS FOR 120 V. 50 AMP CONNECTORS SHALL BE 3 WIRE CASE GROUNDED, ARMORED, WITH CORD GRIP, 20 AMP CONNECTOR SHALL BE 3 WIRE GROUNDING WITH CORD GRIP, NEMA TYPE L5-20.
2. PROVIDE HANDLE ON 1.5KVA TRANSFORMER FOR PORTABILITY. (SEE ONE-LINE SCHEMATIC)
3. CIRCUIT BREAKERS SHALL BE ITE #E43B030 OR #E43B050, SQUARE "D" #FAL24030 S/N OR #FAL24050 S/N, OR EQUAL.
4. CONDUIT ENTRIES INTO TERMINAL BOX SHALL BE INTO THE SIDE OF THE BOX.
5. A MINIMUM OF ONE (1) MAINTENANCE JUMPER CABLE SHALL BE SUPPLIED FOR EACH PROJECT. SUPPLY ONE (1) PORTABLE TRANS-FORMER FOR EACH POWER DRIVE UNIT REQUIRED FOR PROJECT.

Texas Department of Transportation
Traffic Operations Division

# HIGH MAST ILLUMINATION DETAILS

## HMID(5)-03

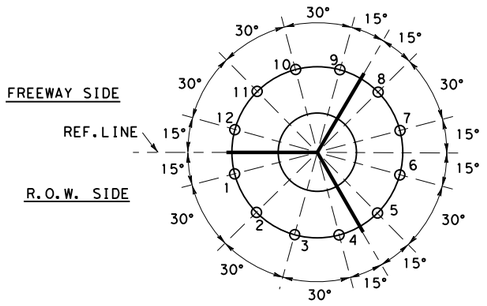


| DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|

REVISIONS
6-87
11-87
10-88
10-93
4-96

| CONT | SECT | JOB | HIGHWAY |
|---|---|---|---|
| 6367 | 43 | 001 | IH-20 |
| DIST | COUNTY | | SHEET NO. |
| 10 | SMITH, ETC. | | 120 |

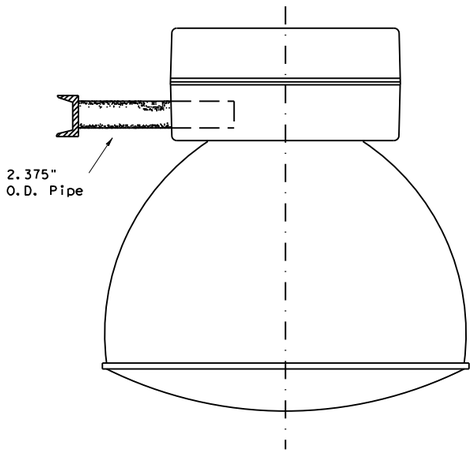
DATE:
FILE:




## 12-LIGHT SETTING

## LUMINAIRE LOCATIONS

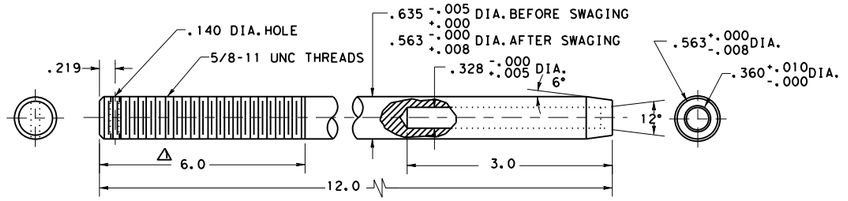
NOTE: AIRCRAFT OBSTRUCTION LIGHT LOCATIONS NOT SHOWN. THREE ARE REQUIRED LOCATED APPROX. 120° APART. LOCATIONS WILL VARY DEPENDENT ON THE LIGHT SETTING USED.




## AREALIGHT MOUNTING ASSEMBLY
(SYMMETRIC AND ASYMMETRIC)

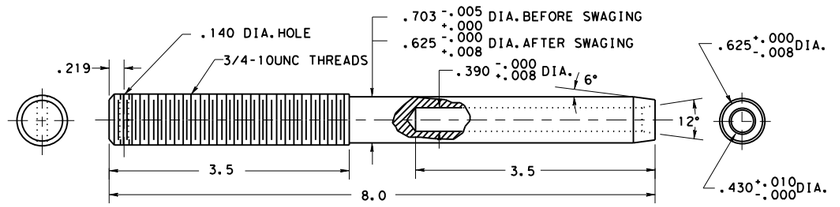
NOTES: IF ASYMMETRIC FIXTURES ARE USED, THE REFRACTORS SHALL BE ORIENTED TO PROPERLY ILLUMINATE THE ADJACENT ROADWAYS. ORIENTION SHALL BE AS SHOWN IN PLANS.

NOTE: MIN. SWAGE LENGTH = 2.06
MAX. SWAGE LENGTH = 2.94




TERMINAL FOR 5/16 "WIRE ROPE
MATERIAL: STAINLESS STEEL, TYPE 303SE OR 304
WITH 115,000 P.S.I. MAX. ULTIMATE TENSILE STRENGH.

NOTE: MIN. SWAGE LENGTH = 3.12
MAX. SWAGE LENGTH = 3.44




TERMINAL FOR 3/8 "WIRE ROPE
MATERIAL: STAINLESS STEEL, TYPE 303SE OR 304
WITH 115,000 P.S.I. MAX. ULTIMATE TENSILE STRENGH.

GENERAL NOTES:

1. AFTER FINAL AIMING HAS BEEN COMPLETED AND APPROVED BY THE ENGINEER, FIXTURES MUST BE LOCKED IN POSITION. CONTRACTOR MUST SUBMIT PROPOSED LOCKING SCHEME WITH THE FIXTURE SUBMITTAL. (FLOODLIGHTS ONLY).

⚠1 3/03 Revision
Removed obsolete diagrams and updated drawings.

Texas Department of Transportation
Traffic Operations Division

# HIGH MAST ILLUMINATION DETAILS

HMID(6)-03



| DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|

REVISIONS
10-93
10-95
4-96
3-03

| CONT | SECT | JOB | HIGHWAY |
|---|---|---|---|
| 6367 | 43 | 001 | IH-20 |

| DIST | COUNTY | SHEET NO. |
|---|---|---|
| 10 | SMITH, ETC. | 121 |

DATE:
FILE:

76F

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:
FILE:

1. AREA LIGHTING (Bid under Item 614, "High Mast Illumination Assemblies")

A. Area lighting shall be symmetric or asymmetric, as shown on the descriptive code. The number and wattage of the fixtures on each pole shall be as shown on the lighting layouts. The lighting pattern for symmetric fixtures shall be IES Type V; for asymmetric fixtures, it shall be IES Type II, III, or IV.

B. All luminaires shall be pre-qualified before installation. A sample of each type of luminaire to be considered for pre-qualification shall be submitted to TXDOT's Traffic Operations Division - Traffic Engineering Section (TRF-TE).

Traffic Operations Division - TE
Texas Department of Transportation
125 East 11th Street
Austin, TX 78701-2483

Sample luminaires are non-returnable. A list of pre-qualified luminaires may be obtained by contacting TRF-TE. In addition, luminaires will be sampled and tested in accordance with Item 614. Luminaires that inconsistently pass testing or that are inconsistent with published photometric information will be removed from the pre-qualified list at the discretion of the Engineer. Once a fixture has been approved, no changes shall be made in any material or manufacturing methods without prior approval of the Department. Unapproved changes will result in rejection of all fixtures.

C. Symmetric and Asymmetric fixtures shall meet the following requirements unless otherwise approved by the Engineer:

1. Luminaire Construction

a) The luminaire housing shall be formed, cast or drawn from low copper aluminum and shall be free of cracks and excessive porosity. Formed aluminum shall have a minimum thickness of 0.090, and shall have all seams welded. The minimum thickness of cast parts shall be as approved by the Engineer. Nuts, screws, and washers shall be made of Type 316 stainless steel. The housing shall be marked with minimum 2" letters to indicate the photometric type as being either A, B, C, or S as specified. Marking shall be permanent and shall be by stencil or stick on labels similar to "wattage" label on cobra heads. Wattage label will not be required on high mast fixtures. The fixture housing shall be constructed separate from the fixture reflector.

b) Fixtures shall be natural aluminum in color or shall be painted gray.

c) The slipfitter shall securely attach the luminaire to the tenon on the ring assembly with a minimum of 2 bolts and clamp. A positive means of vertical adjustment shall be provided.

d) For optical assemblies with lenses, reflectors shall be polished aluminum with Alzak or equal coating and shall not be painted. The optic assembly shall be sealed. The lens shall be tempered glass or prismatic glass, either flat or sag. The optic assembly shall be provided with a resilient seamless or sonically welded silicone rubber gasket, and constructed so that a positive seal against weather and other contaminants will be maintained. The latches shall be stainless steel, spring loaded, and hand operated (2 latches minimum, 3 attachment points),and shall provide a positive means of maintaining closure of the luminaire.

e) For optical assemblies without lenses, optical assembly shall consist of an open ventilated borosilicate glass reflector. The reflecting prisms shall be protected from dirt depreciation by a spun on hermetically sealed aluminum cover. There shall be no glass lens/refractor on this optical assembly.

f) Asymmetric fixtures shall have field rotatable optics with accurate degree of rotation markings. Reflector shall have "house side" and "street side" markings.

g) The socket shell shall be nickel plated and shall be rigidly attached to a high grade porcelain mogul base, which shall extend and enclose the metal shell. A locking means shall be incorporated in the shell of the socket to positively resist the removal of the lamp. This locking means shall be a spring loaded center tip. Lamp socket shall be non-adjustable and shall be riveted, welded, or otherwise permanently installed. Lamps shall be held securely in the proper position with a lamp support.

h) The terminal block shall use nickel plated brass connectors.

i) Fixture weight including ballast shall not exceed 80 pounds, and effective projected area (EPA) shall not exceed 2.62 square feet.

j) The Contractor may be responsible for fixture testing costs. See TXDOT's "Manual of Testing Procedures," Chapter 11 - "Traffic Systems and Illumination," TEX-1110-T - "Sampling Lighting Assemblies," at http://manuals.dot.state.tx.us/dynaweb/.

2. Photometrics

a) The Contractor shall submit a computer generated light level array of the area to be lighted by high mast poles. All computer generated arrays shall have 400 watt fixtures derated to 40,000 lumens per lamp.

b) The Type "A" 400 watt asymmetric fixture shall be IES cutoff. The Department will use the measured photometric data of sampled fixtures to run the following tests on a computer simulation:

(1) When mounted in the level position, 50 ft. above the midpoint and 20 ft outside of either long side of a rectangular area measuring 340 ft. by 50 ft., the fixture shall pass the following tests:

(a) The fixture shall provide a measured minimum intensity of 0.15 horizontal foot-candles at any point on the surface of this area.

(b) The fixture shall provide a measured maximum to minimum light ratio, based on horizontal foot-candles, of less than 25.

(c) The fixture shall provide an average measured intensity of 0.6 horizontal foot-candles on the surface area.

(2) When mounted in the level position, 50 ft. above the midpoint and 20 ft outside of either long side of a rectangular area measuring 260 ft. by 30 ft., the fixture shall provide a measured minimum intensity of 0.30 horizontal foot-candles at any point on the surface of this area.

c) The Type "B" 400 watt asymmetric fixture shall be IES cutoff. The Department will use the measured photometric data of sampled fixtures to run the following tests on a computer simulation:

(1) When mounted in the level position, 50 ft. above the midpoint and 20 ft outside of either long side of a rectangular area measuring 260 ft. by 65 ft., the fixture shall pass the following tests:

(a) The fixture shall provide a measured minimum intensity of 0.15 horizontal foot-candles at any point on the surface of this area.

(b) The fixture shall provide a measured maximum to minimum light ratio, based on horizontal foot-candles, of less than 25.

(c) The fixture shall provide an average measured intensity of 0.6 horizontal foot-candles on the surface area.

(2) When mounted in the level position, 50 ft. above the midpoint and 20 ft outside of either long side of a rectangular area measuring 200 ft. by 40 ft., the fixture shall provide a measured minimum intensity of 0.30 horizontal foot-candles at any point on the surface of this area.

d) The Type "C" 400 watt asymmetric fixture shall be IES cutoff. The Department will use the measured photometric data of sampled fixtures to run the following tests on a computer simulation:

(1) When mounted in the level position, 50 ft. above the midpoint and 20 ft. outside of either long side of a rectangular area measuring 220 ft. by 80 ft., the fixture shall pass the following tests:

(a) The fixture shall provide a measured minimum intensity of 0.15 horizontal foot-candles at any point on the surface of this area.

(b) The fixture shall provide a measured maximum to minimum light ratio, based on horizontal foot-candles, of less than 25.

(c) The fixture shall provide an average measured intensity of 0.6 horizontal foot-candles on the surface area.

(2) When mounted in the level position, 50 ft. above the midpoint and 20 ft. outside of either long side of a rectangular area measuring 160 ft. by 50 ft., the fixture shall provide a measured minimum intensity of 0.30 horizontal foot-candles at any point on the surface of this area.

e) The Type "S" 400 watt Symmetric fixture shall be IES cutoff. The Department will use the measured photometric data of sampled fixtures to run the following tests on a computer simulation:

(1) When mounted in the level position at 50 foot mounting height, the fixture shall provide the minimum light levels as shown below:

(a) 0.15 horizontal foot-candles within a 130 foot radius.

(b) 0.30 horizontal foot-candles within a 100 foot radius.

(c) 0.50 horizontal foot-candles within a 60 foot radius.

3. Ballasts

a) All ballasts shall be isolated-winding lag-type magnetic regulators designed to operate 400 watt high pressure sodium lamps rated 480 volts. Ballasts shall be capable of starting lamps at an ambient temperature of -20 degrees F. Ballast wiring shall include a grounding terminal bonded to metal housing. Ballasts shall be fused with a 5 amp time-delay fuse in an insulated fuse holder. Fuse holders shall be internal to the housing. Ballast wiring to the terminal board shall be through a quick-disconnect plug. Windings shall be made from copper wire.

b) When the circuit voltage indicated on the plans is applied, the ballast input wattage during fluctuations of the test voltage of +10% and -10% shall not exceed 552 watts for a 400 watt HPS lamp.

3/03 Revision

⚠1 Revised Area Lighting Requirements

Texas Department of Transportation
Traffic Operations Division

# HIGH MAST ILLUMINATION DETAILS

## HMID(7)-03



| DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|

REVISIONS
9-91
10-93
4-96
3-03

| CONT | SECT | JOB | HIGHWAY |
|---|---|---|---|
| 6367 | 43 | 001 | IH-20 |

| DIST | COUNTY | SHEET NO. |
|---|---|---|
| 10 | SMITH, ETC. | 122 |

76G

DATE:
FILE:

c) During fluctuation of the line voltage of +10% or -10%, the lamp wattage fluctuation shall not exceed a total of 20%. Ballast shall maintain lamp wattage between 280 and 475 watts for a 400 watt HPS lamp.

d) The power factor of any ballast when tested at the circuit voltage indicated in the plans shall not be less than 90% at any point in life. Ballast factor shall be between .95 and 1.0.

e) The electronic starting aid shall provide a starting pulse with an amplitude of 2500 volts minimum, 4000 volts maximum. The pulse width shall be a minimum of 0.8 microseconds at 2250 volts. The pulse shall occur when the open-circuit voltage is equal to or greater than 90 percent of peak open-circuit voltage. Pulse repetition rate shall be a minimum of one per cycle and pulse current shall be a minimum of 0.18 amperes. Electronic starting aids shall be replaceable without the use of tools. The starting aid shall discontinue to pulse when the lamp starts. Starter shall sense an inoperative or missing HPS lamp and automatically shut down luminaire to protect ballast after 10 minutes.

f) Ballasts shall permanently and clearly indicate the following: lamp type, catalog number, voltage rating, connection diagram, and manufacturer. Capacitors in all luminaires shall be non-PCB type.

4. Lamps

a) All lamps shall be new and of recent manufacture.

b) Lamps shall be high pressure sodium and shall meet ANSI C78 requirements. Lamps shall be the type that extinguish at the end of usable lamp life and remain extinguished without cycling. 400 watt lamps shall contain less than 4.0 mg of mercury. Lamps shall be lead free and shall pass the Federal Toxic Characteristic Leachate Procedure (TCLP). Lamp shall be Osram-Sylvania LU400/Eco Plus. No alternatives will be approved.

c) 400 watt high pressure sodium lamps shall have average initial lumens of 50000 and average rated life of 24000 hours.

⚠1 2. GENERAL

A. All material shall be in accordance with the applicable sections of the NEC. All conduit and conductors shall be in accordance with the materials and construction methods requirements of Items 618 and 620. Heat shrink tubing for use with cable grips and cable splicing shall meet the requirements of Item 620.

B. Where stainless steel bands are called for on the HMID sheets, stainless steel hose clamps may be provided. Stainless steel bands and stainless steel hose clamps shall be provided with stainless steel clips or stainless steel screws.

C. Obstruction Lights

1. When obstruction lights are required by layout sheets, summary sheets or general notes, the entire high mast assembly shall be controlled by an FAA approved photocell mounted inside the service enclosure. Ring mounted luminaires shall be controlled by up to 4 additional ring mounted photocells, with each photocell controlling up to 3 fixtures. Photocells shall meet the following requirements:

a) All photocells shall consist of a photoelectric cell, an internal lightning arrestor, and a relay or bimetallic switch mounted inside a weather proof enclosure with standard 3-prong twist lock photocell plug and receptacle. The enclosure shall be made of poly-acrylic with clear acrylic window. Enclosure chassis shall be molded thermosetting plastic. The photocell shall have an arrestor rated 2.0kV sparkover with 5000 amps follow-through. Relay or switch shall be time delay type with normally closed contacts. Photocell shall be rated a minimum of 1800 VA.

b) Service enclosure mounted photocell (FAA photocell) shall turn on at light levels below 35 foot-candles and off at levels above 58 foot-candles, in accordance with FAA requirements. This photocell shall be rated for operation at 240 volts. A permanent placard shall be installed on the inside of the service enclosure door to indicate that an FAA approved photocell is required.

c) High mast assembly ring mounted photocells (one foot-candle photocells) shall turn on at light levels below 1.0 (plus or minus 0.5) foot-candle, and shall turn off at 2 foot-candles higher than this level. These photocells shall be rated for operation at 480 volts. Photocells shall be mounted upright on the terminal box or on various junction boxes around the ring as approved by the Engineer. Conduit entries shall not be made into the top of the terminal box or junction boxes. The Contractor shall submit mounting details to the Engineer for approval.

2. When obstruction lights are not required, eliminate the 3 obstruction light fixtures, 3 mounting posts, 480/120 volt transformer, 120 volt wiring, and 3 mounting post support connections shown on detail "E", sheet 1.

D. The male cord connector on the lower end of the Type W cord running up the pole, the female cord connector for the Type W cord running to the circuit breaker enclosure and the male connector on the maintenance jumper shall meet the following or approved equal specifications:

1. Arrow Hart pin and sleeve watertight connectors UL listed, catalog numbers AH330C7W and AH330P6W.

2. Bryant watertight pin and sleeve connectors UL listed, catalog numbers 330C6W and 330P6W.

3. Hubble pin and sleeve connectors UL listed, catalog numbers HBL330C7W and HBL 330P7W.

4. The male connector for use with the Type W maintenance jumper shall be a pin and sleeve connector of one of the above types. The Contractor shall attach a 50 amp twist lock receptacle to the opposite end of the maintenance jumper to match the flange mounted plug on the ring and the portable transformer.

5. The Contractor shall make a brochure submittal on the cord connectors.

E. When shown on the plans, spill light shall be restricted to less than 0.15 horizontal footcandles.

F. The Contractor shall provide shop drawings for high mast illumination assemblies in accordance with this Item and Item 441. An Engineer licensed in the State of Texas shall seal the shop drawings.

3. TESTING

A. Fixtures, lamps and ballasts will be sampled and tested in accordance with the Department "Manual of Testing Procedures" except as noted in these specifications.

B. Ballasts and fixtures will be tested using a reference lamp.

C. The Department will bear the cost of all testing of equipment that complies with the specification requirements. However, the source of supply of fixtures and ballasts must be approved as required in Article 6.1 of the Standard Specifications. Such approval will be contingent on the supplier agreeing to bear the cost of testing any equipment that fails to comply with the specification requirements listed in this specification.

D. All other equipment will be tested in accordance with Item 614 of the Standard Specifications and Materials and Test Division Test Standards.

E. After High Mast Assembly has been completely assembled, the Engineer may require Contractor to fully lower and raise each high mast ring one time to demonstrate proper operation of the lowering mechanism, or may require the ring to be lowered for ring or fixture inspection. If any malfunction occurs, the problem shall be corrected at the Contractor's expense and the lowering test will be repeated.

4. MOUNTING RING AND SUPPORT ASSEMBLY

A. Ring and support assembly shall be fabricated from steel having a minimum yield strength of 36 KSI.

B. Cover assemblies, fittings and miscellaneous parts shall be as outlined on the plans.

C. All hardware shall be hot-dipped galvanized per ASTM A153 or shall be stainless steel, unless noted otherwise on the plans.

5. WINCH

A. Housing shall be high tensile strength die-cast silicon aluminum. Cable drum shall be fabricated from seamless steel tubing with stamped steel flanges and shall be hot-dipped galvanized. Drum shall have a minimum diameter of 4.5 inches. Drum shall be keyed to drum shaft. Drum and flanges shall be sized so that, when the fixture mounting ring is in the raised position, the cable including one full layer will fill the drum to no more than two-thirds of full capacity. Drum shaft shall be ground from stainless steel and mounted on lubricated bronze bearings with seals. Wormgear shall be made of nickel-bronze and worm shaft shall be high-strength stress-proofed steel, ground and polished and supported by tapered roller bearings.

B. Gear ratio shall be 36:1 with safe hoisting capacity of not less than 4000 pounds.

C. Winch shall incorporate adjustable automatic brake to assure positive load suspension. Brake shall be multiple disc with friction plates running in oil bath and one-direction clutch which operates only when load is suspended or lowered. Winch shall not have throw-out clutch.

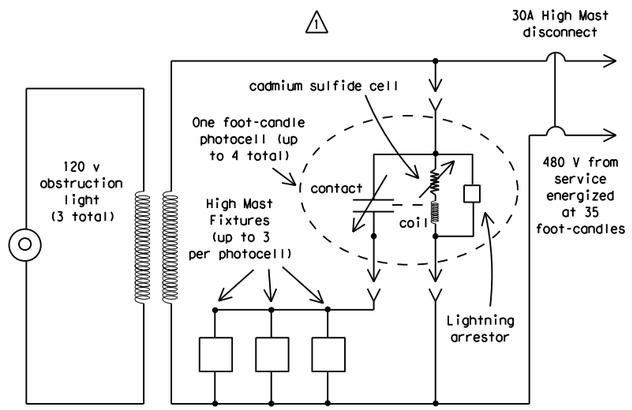
D. Any winch that is operated without oil shall be considered damaged and shall be replace by the contractor at the contractor's expense.

⚠2 6. WIRE ROPE AND TERMINALS

A. 5/16 and 3/8 wire rope shall be 19x7 Rotation Resistant IWRC stainless steel. 19x7 rotation resistant wire rope shall meet the construction requirements of Fed. Spec. RR-W-410D, Type IV, class 2, modified for stainless steel with a nominal breaking strength of 11,100 lbs. All wire rope shall be pre-formed and factory lubricated. Wire rope shall meet the requirements of the applicable specification except where modified by this specification. Quality Assurance testing shall be the responsibility of the manufacturer and shall meet recognized wire rope industry standards. No special tensile or torsion testing will be required. Mill Test Reports shall be furnished.

B. Winch cable shall be of sufficient length to leave a minimum of one full layer of cable on the drum when the fixture mounting ring is in the full down position.

C. Wire rope terminals shall be stainless steel, solid stud type as shown on Sheet 7. All terminals shall be drilled for cotter pin. Material to be 303 SE or 304 stainless steel with a maximum tensile strength of 115,000 p.s.i. Mill Test Reports shall be furnished.




One foot-candle photocell keeps High Mast fixtures
off when FAA photocell energizes
circuit at 35 foot-candles. Fixtures
come on when sun goes down at 1 foot-candle.

## One Foot-candle Photocell Schematic

Use on ring when obstruction lights are installed
and FAA photocell is installed in electrical service.

3/03 Revision

⚠1 Revised General requirements; add diagram

⚠2 Revised Wire Rope and Terminals

Texas Department of Transportation
Traffic Operations Division

# HIGH MAST ILLUMINATION DETAILS

## HMID(8)-03



| DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|

REVISIONS
4-89
10-93
4-96
3-03

| CONT | SECT | JOB | HIGHWAY |
|---|---|---|---|
| 6367 | 43 | 001 | IH-20 |

| DIST | COUNTY | SHEET NO. |
|---|---|---|
| 10 | SMITH, ETC. | 123 |

76H

D. All terminals shall be proof-tested by the manufacturer to 40% of rated strength of the wire rope. Each terminal shall be identified by manufacturer's logo permanently incised on terminal. Manufacturer shall furnish certification of tests. Contractor shall also furnish one sample of each size of terminal with 5 ft. of wire rope for load tests by the State. Samples tested must withstand test load not less than 100% of rated breaking strength of wire rope. If sample fails test, all terminals of same size will be rejected.

E. Wire rope shall be delivered from the manufacturer on a reel.

7. SPRINGS

A. Provide three steel springs as shown on plans.

B. Springs shall have an uncompressed length of approximately 8 inches and shall compress 3 inches under 700-pound load.

C. Springs shall contain approximately 19 total coils with ID of 0.875 and OD of 1.375 inches. Ends shall be closed and ground. Springs shall be zinc-plated.

D. Springs shall be made from 1/4" diameter oil-tempered MB Steel treated for overstress. Springs shall not develop permanent set from 3-inch compression.

8. ELECTRICAL POWER CABLE

A. Power cable shall be No. 8 AWG three-conductor round Type W, rated 90 degrees C, 600 volt or 2000 volt. Each conductor shall be tinned copper and shall consist of 133 strands. Insulation shall be ethylene propylene rubber. Jacket shall be chlorosulfonated polyethylene (CSPE), with glass fiber or nylon reinforcing mesh between two layers of CSPE. Nominal diameter shall be 0.91". Filler shall be rubber compound or other approved non-hygroscopic compound. Jacket shall be Hypalon Power Flex 90, with no substitutions allowed.

9. POWER DRIVE ASSEMBLY (ONE ONLY THIS CONTRACT UNLESS OTHERWISE SHOWN ELSEWHERE ON THE PLANS)

A. Drive Motor

1. Drive motor shall be 1-1/4" heavy-duty reversible portable electric drill modified as shown on plans.

2. Shall have a minimum of 6 radial ball bearings, one thrust bearing, and one needle bearing.

3. Shall have No. 3 Morse Taper socket.

4. Shall be designed for 115 volt 60 Hertz single phase operation 250 RPM at no load.

5. Shall be designed for continuous rated duty of 160 RPM and 15 amperes at 115 volts with delivery of 33-pound-feet of torque. Drill motor to be operated only at low speed range. (i.e. 150 to 160 RPM)

6. Shall develop 240 pound-feet of torque at stalled rotor condition.

B. Torque Limiter Coupling

1. Torque limiter coupling shall consist of standard torque limiter with Type A sprocket center member coupled to a Type B sprocket by an ASA double strand roller chain. Type A sprocket shall be chrome-plated.

2. Coupling shall have torque capacity minimum of 15 pound-feet and a maximum of 55 pound-feet.

3. Limiter section of coupling shall consist of integral hub and pressure plate, two friction facings, sintered iron bushing, pilot plate, disk spring, lock washer and hex adjustment nut. All major components except spring and friction facings shall be cadmium-plated with dichromate treatment.

4. Type A center sprocket shall have ground face (63 micro-inch) and shall be run-in for 4 minutes at approximately 60 RPM at a torque setting 70% to 80% of spring rating. Contractor shall provide written certification that run-in has been accomplished.

5. The torque limiter coupling shall, after run-in, be set to a torque limit of 35 pound-feet or as directed by the Engineer. The proper setting of the coupling shall be demonstrated to the Engineer.

C. Universal Joints

1. Shall be slip-type with 4-inch barrel. A grease fitting shall be so located in the spider that all caps and needle bearings may be adequately serviced. The assembly shall be disassembled and zinc-plated, then reassembled and properly lubricated.

2. Shall have a minimum torque rating of 1270 inch-pounds at 200 RPM.

3. Shall have set screw and keyed coupling as shown on plans.

⚠1

10. CONSTRUCTION METHODS

A. Fabrication

1. Fabrication and welding shall be in accordance with Item 441, "Steel Structures".

2. All holes supporting pulley shafts shall be drilled (not punched) prior to galvanizing.

3. All component parts shall be galvanized where galvanizing is applicable, after fabrication.

4. Galvanizing on all parts which have become scratched, chipped or otherwise damaged shall be thoroughly cleaned and the cleaned area painted with two coats of zinc dust-zinc oxide paint conforming to the requirements of repair compounds meeting Federal Specification TT-P-641 b.

5. Mounting rings and ring support assemblies shall be fabricated with the use of jigs that have been inspected and approved by Material and Test Division personnel prior to their usage.

6. The fabricator shall submit his proposed welding procedures in accordance with Item 441, "Steel Structures".

B. Installing Wire Rope

1. Extreme care shall be used to prevent wire rope from kinking, nicking, or from sustaining other damage during installation. Rope shall not be installed by pulling from flat coil, but shall be carefully unrolled its full length or placed on a horizontal axis and unreeled according to wire rope industry standards.

2. For right lay rope, the rope shall be attached to the drum on the end opposite the winch gear train, and wound on drum so that the free end of the rope comes off the backside of the drum during normal operation of the winch. Rope must be unreeled carefully as stated above. Care must be taken to insure that all layers lay full and tight on drum.

3. Installation of all wire rope shall be accomplished only under direct supervision of the Engineer or his authorized representative. Contractor shall not remove wire rope from manufacturer's reel until authorized by the Engineer. Installation of wire rope on winch shall be in accordance with the above and accepted industry practice. Installation of the three hoist cables shall be made from the top end of the pole and as directed by the Engineer or his representative.

C. Installing Wire Rope Clips

1. Turn back approx. 2' 3" of rope, measured from the top of thimble. Apply seizing to pigtail end of wire rope prior to cutting to length. See detail "K", Sheet 3. Apply first clip approx. 3" from the dead end of the wire rope with U-bolt over dead end and live end in clip saddle. Tighten nuts evenly to 30 pound-feet of torque, or as recommended by manufacturer.

2. Install second clip as near loop as possible, take out slack and torque nuts evenly to 30 pound-feet or as recommended by manufacturer.

3. After final erection and assembly of the pole and high mast assembly, retighten nuts to required torque.

D. Installing Light Ring and Luminaires

1. Prior to mounting luminaires to the light ring, Contractor shall ensure the ring is level. Luminaires shall be mounted level on the light ring. Luminaires shall be oriented as shown on plans.

3/03 Revision

⚠1 Revised Construction Methods.

Texas Department of Transportation
Traffic Operations Division

# HIGH MAST ILLUMINATION DETAILS

## HMID(9)-03



| DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|

REVISIONS
10-93
10-95
4-96
3-03

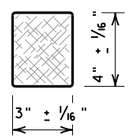
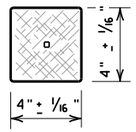
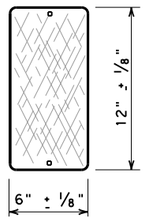
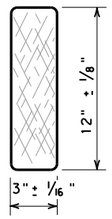
| CONT | SECT | JOB | HIGHWAY |
|---|---|---|---|
| 6367 | 43 | 001 | IH-20 |

| DIST | COUNTY | SHEET NO. |
|---|---|---|
| 10 | SMITH, ETC. | 124 |

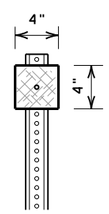
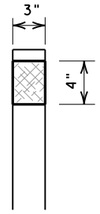
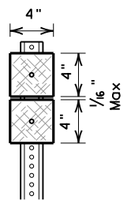
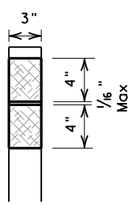
761

DATE:
FILE:

## REFLECTOR UNIT SIZES FOR DELINEATORS AND OBJECT MARKERS

| | SIZE 1 | SIZE 2 | SIZE 3 | SIZE 4 |
|---|---|---|---|---|
| DEVICE |   |   |   |   |
| SHEETING | Yellow, White or Red Type B or C reflective sheeting | | | |
| NOTE | 1. Size 1 and 4 - Direct applied reflective sheeting for use on flexible post (flx).<br>2. Size 2 and 3 - For use on wing channel (wc) post only. Use approved metal, plastic or fiberglass backplate with 17/64" mounting holes. | | | |

## DELINEATORS

| | SINGLE | | DOUBLE | |
|---|---|---|---|---|
| DEVICE |   |   |   |   |
| | 1-Size 2 reflector unit | 1-Size 1 reflector unit | 2-Size 2 reflector units | 2-Size 1 reflector units |
| SHEETING | Yellow, White or Red Type B or C Reflective Sheeting | | | |
| POST TYPE | WC | YFLX, WFLX | WC | YFLX, WFLX |
| MOUNT TYPE | GND | GND, SRF | GND | GND, SRF |

## D & OM DESCRIPTIVE CODES

INSTL DEL ASSM (D-XX)SZ X (XXXX)XXX(XX)

**NUMBER OF REFLECTORS**
S = Single
D = Double

**COLOR OF REFLECTORS**
W = White
Y = Yellow
R = Red

**REFLECTOR UNIT SIZE**
1 or 2

**TYPE OF POST OR DELINEATOR**
WC = Wing Channel Post
YFLX = Yellow Flexible Post
WFLX = White Flexible Post
BRF = Barrier Reflector

**TYPE OF MOUNT**
GND = Embedded (drivable or set in concrete)
CTB = Concrete Barrier Mount
GF1 or GF2 = Guard Fence Attachment
SRF = Surface Mount

**DIRECTION**
If Required
BI = Bi-Directional
BR = Bi-Directional with red on back

INSTL OM ASSM (OM-XX) (XXXX)XXX(XX)

**TYPE OF OBJECT MARKER**
1, 2, 3, or 4

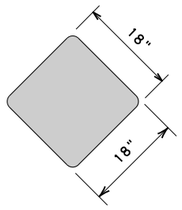
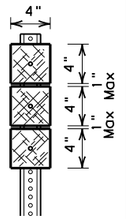
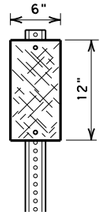
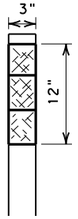
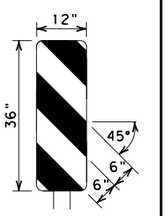
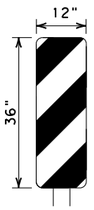
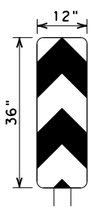
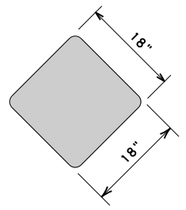
**NUMBER OF REFLECTORS OR DIRECTION**
X = 3-Size 2 reflector units (Type 2 only)
Y = 1-Size 3 reflector unit (Type 2 only)
Z = 3-Size 1 or 1-Size 4 reflector unit(s)(Type 2 only)
L = Left Side (Type 3 Object Marker only)
R = Right Side (Type 3 Object Marker only)
C = Center (Type 3 Object Marker only)

**TYPE OF POST**
WC = Wing Channel Post
WFLX = White Flexible Post
TWT = Thin Walled Tubing

**TYPE OF MOUNT**
GND = Embedded (drivable)
SRF = Surface Mount
WAS = Wedge Anchor Steel
WAP = Wedge Anchor Plastic

**DIRECTION**
If Required
BI = Bi-Directional

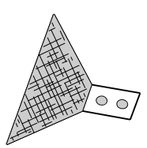
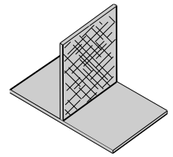
## OBJECT MARKERS

| | Type 1 (OM-1) | Type 2 (OM-2) | | | Type 3 (OM-3) | | | Type 4 (OM-4) |
|---|---|---|---|---|---|---|---|---|
| | OM-1 | OM-2X | OM-2Y | OM-2Z | OM-3L | OM-3R | OM-3C | OM-4 |
| DEVICE |   |   |   |   |   |   |   |   |
| | | 3-Size 2 reflector units | 1-Size 3 reflector unit | 3-Size 1 reflector units or 1-Size 4 reflector unit | | | | |
| SHEETING | Yellow-Type $B_{FL}$ or $C_{FL}$ Sheeting | Yellow - Type B or C Sheeting | | | Alternating acrylic black and retroflective yellow - Type $B_{FL}$ or $C_{FL}$ Sheeting | | | Red -Type $B_{FL}$ or $C_{FL}$ Sheeting |
| POST TYPE | TWT | WC | WC | WFLX | TWT | | | TWT |
| MOUNT TYPE | WAS, WAP | GND | GND | GND, SRF | WAS, WAP | | | WAS, WAP |

## DEPARTMENTAL MATERIAL SPECIFICATIONS

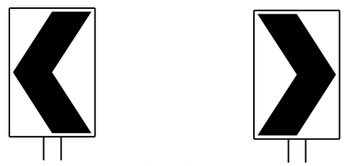
| | |
|---|---|
| FLEXIBLE DELINEATOR & OBJECT MARKER POSTS (EMBEDDED & SURFACE MOUNT TYPES) | DMS-4400 |
| SIGN FACE MATERIALS | DMS-8300 |
| DELINEATORS, OBJECT MARKERS AND BARRIER REFLECTORS | DMS-8600 |

## BARRIER REFLECTORS (BRF)

| | GF1 | GF2 | CTB |
|---|---|---|---|
| DEVICE |  |  |  |
| | 1. Barrier reflectors shall meet the requirements of DMS 8600.<br>2. Approved Barrier Reflectors are listed on the "Barrier Reflectors" Material Producer List at: www.txdot.gov. | | |
| SHEETING | Yellow, White, Red | | |
| NOTE | 1. Reflective sheeting shall have a minimum dimension of 3 inches and minimum surface area of 9 square inches. | | |

## CHEVRONS

DEVICE



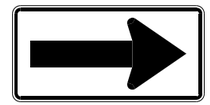
W1-8

| SIZE (W x L) | 18"x 24" (Conventional) | 24"x 30" (Conventional Oversize) | 30"x 36" (Expressway) | 36" x 48" (Freeway) |
|---|---|---|---|---|
| MOUNTING HEIGHT | 4'-0" or 7'-0" | | 7'-0" Only | |

NOTE
1. CHEVRON (W1-8) signs and ONE DIRECTION LARGE ARROW (W1-6) Signs shall be installed per Sign Mounting Details (SMD) Standard Sheets and paid under Item 644 (Small Roadside Sign Assemblies).
2. When there is a need to increase conspicuity, the Texas version of the ONE DIRECTION LARGE ARROW sign (W1-9T) may be used instead of the ONE DIRECTION LARGE ARROW (W1-6).

## ONE DIRECTION LARGE ARROW

DEVICE



W1-6

| SIZE (W x L) | 48" x 24" (Conventional) | 60" x 30" (Expressway & Freeway) |
|---|---|---|
| MOUNTING HEIGHT | 7'-0" | |

## NOTE:

Delineator and object marker substrates and sign substrates shall be 0.080" Aluminum sign blank to conform to ASTM B-209 Alloy 6061-T6 or approved alternative.

Texas Department of Transportation

Traffic Safety Division Standard

# DELINEATOR & OBJECT MARKER MATERIAL DESCRIPTION

# D & OM(1)-20

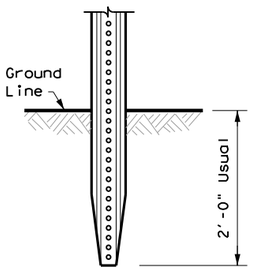
| FILE: dom1-20.dgn | DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|---|
| ©TxDOT August 2004 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 10-09 3-15 | DIST | COUNTY | | SHEET NO. |
| 4-10 7-20 | 10 | SMITH, ETC. | | 125 |

DATE:
FILE:

# POST TYPE AND SUPPORT FOUNDATION DETAILS

## WING CHANNEL (WC)

### GND

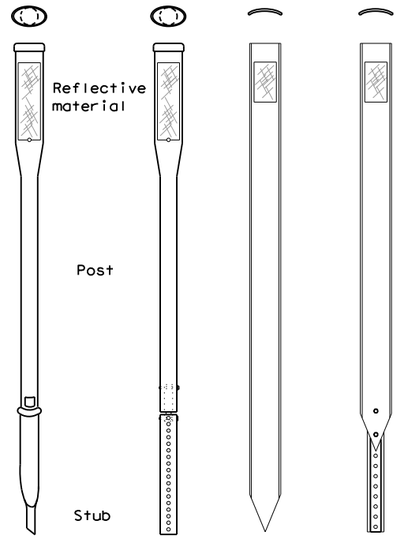



**NOTES**

1. Embedded Wing Channel (WC) post option may be used for Type 2 Object Markers and Delineators only.
2. 1.12 lbs/ft steel per ASTM A 1011 SS Gr. 50, or ASTM A499.

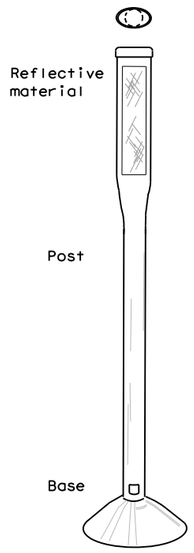
## FLEXIBLE POSTS (YFLX, WFLX)

### GND




EMBEDDED

### SRF



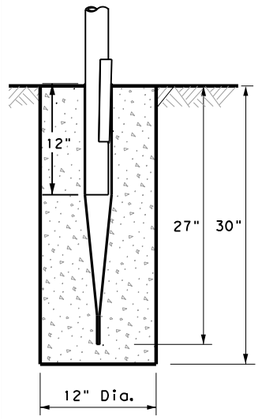

SURFACE MOUNT

**NOTES**

1. See "Flexible Delineator and Object Marker Posts" Material Producer List for approved devices.
2. Install per manufacturer's recommendations.
3. Post length may vary to meet field conditions.
4. When using yellow delineators with flexible posts to separate opposing direction of travel, such as centerline or median use, the flexible posts shall be yellow.

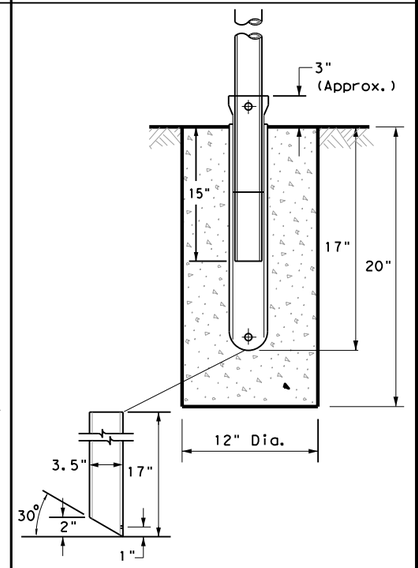
## WEDGE ANCHOR SYSTEMS

### WAS




STEEL

### WAP




PLASTIC

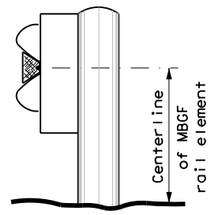
**NOTE**

1. Install per manufacturer's recommendations.

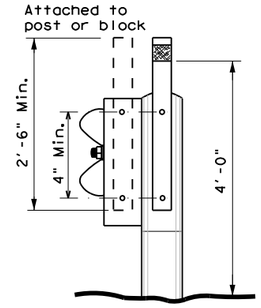
# TYPE OF BARRIER MOUNTS

## GUARD FENCE ATTACHMENT

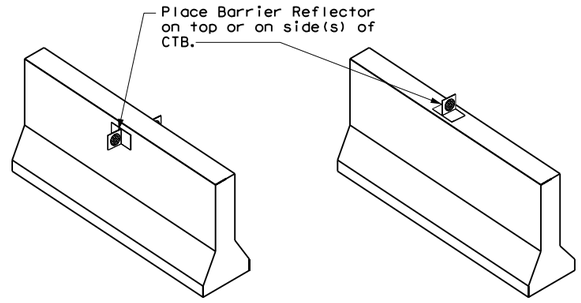
### GF1




### GF2



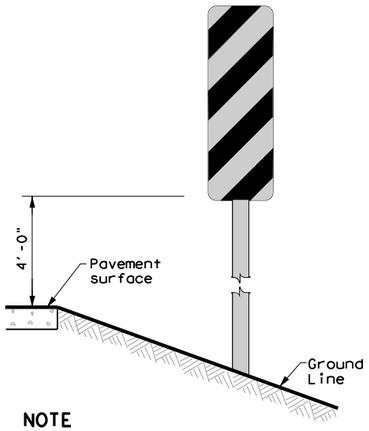

## CONCRETE TRAFFIC BARRIER (CTB)




**GENERAL NOTES**

1. Place delineators on a section of roadway at a consistent distance from the edge of pavement.
2. Where a restriction prevents consistent placement from the pavement edge, place the affected object markers in line with the innermost edge of the obstruction.
3. When Type 2 object markers and delineators are more than 8'-0" from the edge of the pavement, it may not be possible to maintain a height of approximately 4'-0". If this is the case, place the object marker or delineator as close to the desired height as possible.
4. Install all delineators, object markers and barrier reflectors in accordance with the manufacturer's recommendation.
5. Barrier reflectors should be installed a minimum of 18 inches above the edge of the pavement surface.
6. Diagonal stripes on Type 3 object markers shall slope down toward the intended travel lane.

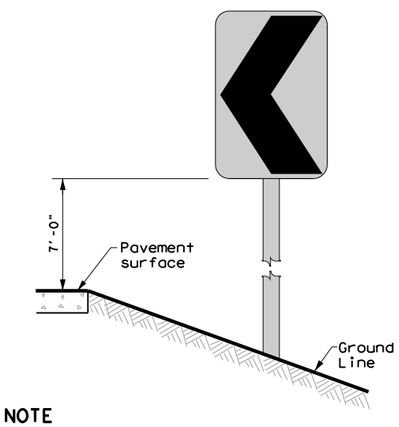
## TYPES 1, 3, AND 4 OBJECT MARKERS AND CHEVRONS




**NOTE**

Mounting at 4 feet to the bottom of the chevron is permitted for chevrons that will not exceed a height of 6'-6" to the top of the chevron (sizes 24" x 30" and smaller)

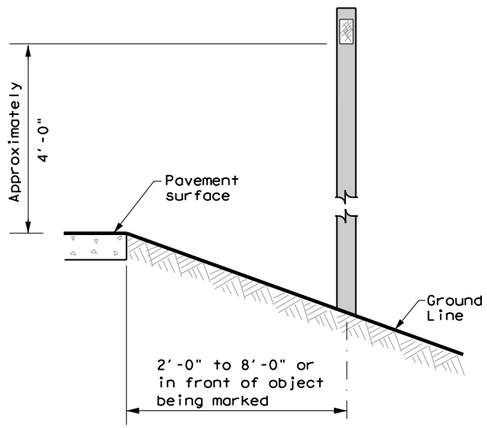
## CHEVRONS AND ONE DIRECTION LARGE ARROW SIGN




**NOTE**

Chevrons 30" x 36" and larger shall be mounted at a height of 7' to the bottom of the chevron. Chevron sign and ONE DIRECTION LARGE ARROW sign (W1-9T) shall be installed per SMD standard sheets and paid under item 644.

## DELINEATORS AND TYPE 2 OBJECT MARKERS




See general notes 1, 2 and 3.

Texas Department of Transportation

Traffic Safety Division Standard

# DELINEATOR & OBJECT MARKER INSTALLATION

# D & OM(2)-20

| FILE: dom2-20.dgn | DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|---|
| © TxDOT August 2004 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 10-09 3-15 | DIST | COUNTY | | SHEET NO. |
| 4-10 7-20 | 10 | SMITH, ETC. | | 126 |

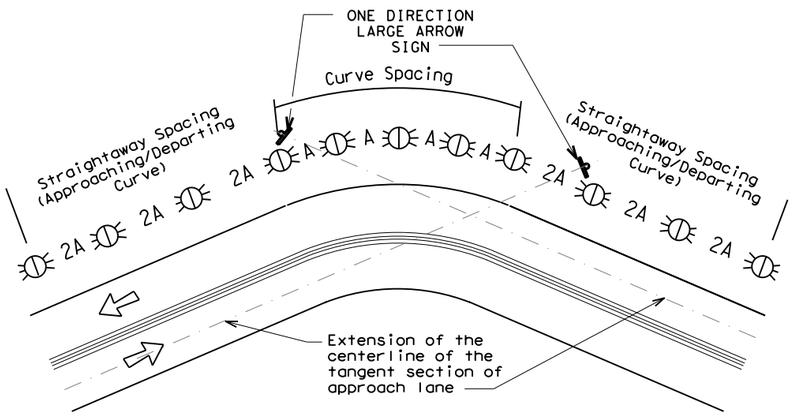
20B

DATE:
FILE:

## MINIMUM WARNING DEVICES AT CURVES WITH ADVISORY SPEEDS

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

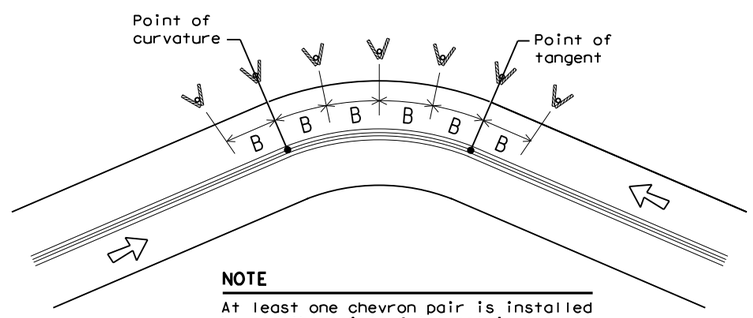
## SUGGESTED SPACING FOR DELINEATORS ON HORIZONTAL CURVES




**NOTE**

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

## SUGGESTED SPACING FOR CHEVRONS ON HORIZONTAL CURVES




**NOTE**

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

## DELINEATOR AND CHEVRON SPACING

WHEN DEGREE OF CURVE OR RADIUS IS KNOWN

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

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

## DELINEATOR AND CHEVRON SPACING

WHEN DEGREE OF CURVE OR RADIUS IS NOT KNOWN

| Advisory Speed (MPH) | Spacing in Curve | Spacing in Straightaway | Chevron Spacing in Curve |
|---|---|---|---|
| | A | 2xA | B |
| 65 | 130 | 260 | 200 |
| 60 | 110 | 220 | 160 |
| 55 | 100 | 200 | 160 |
| 50 | 85 | 170 | 160 |
| 45 | 75 | 150 | 120 |
| 40 | 70 | 140 | 120 |
| 35 | 60 | 120 | 120 |
| 30 | 55 | 110 | 80 |
| 25 | 50 | 100 | 80 |
| 20 | 40 | 80 | 80 |
| 15 | 35 | 70 | 40 |

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

## DELINEATOR AND OBJECT MARKER APPLICATION AND SPACING

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

### NOTES

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

### LEGEND

| | |
|---|---|
| | Bi-directional Delineator |
| | Delineator |
| | Sign |

Texas Department of Transportation — Traffic Safety Division Standard

# DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

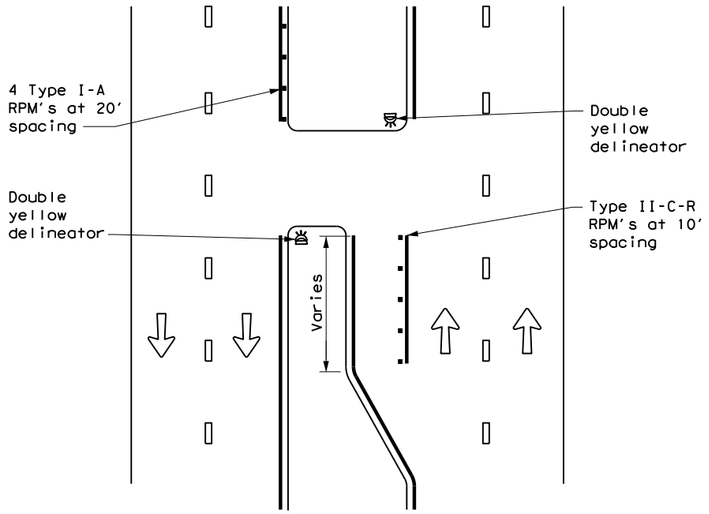
# D & OM(3)-20

| FILE: dom3-20.dgn | DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|---|
| © TxDOT August 2004 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 3-15 8-15 | DIST | COUNTY | | SHEET NO. |
| 8-15 7-20 | 10 | SMITH, ETC. | | 127 |

20C

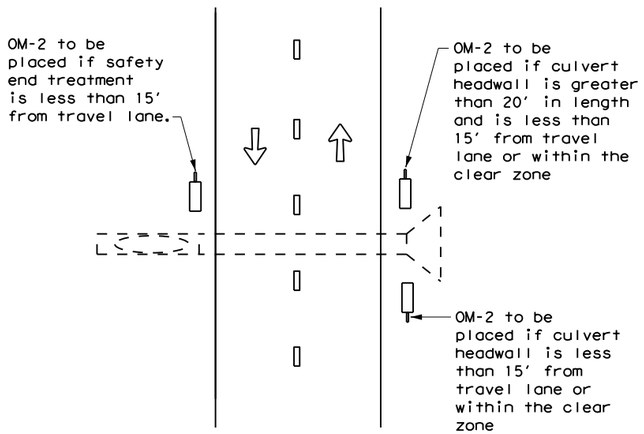
DATE:
FILE:

## CROSSOVERS



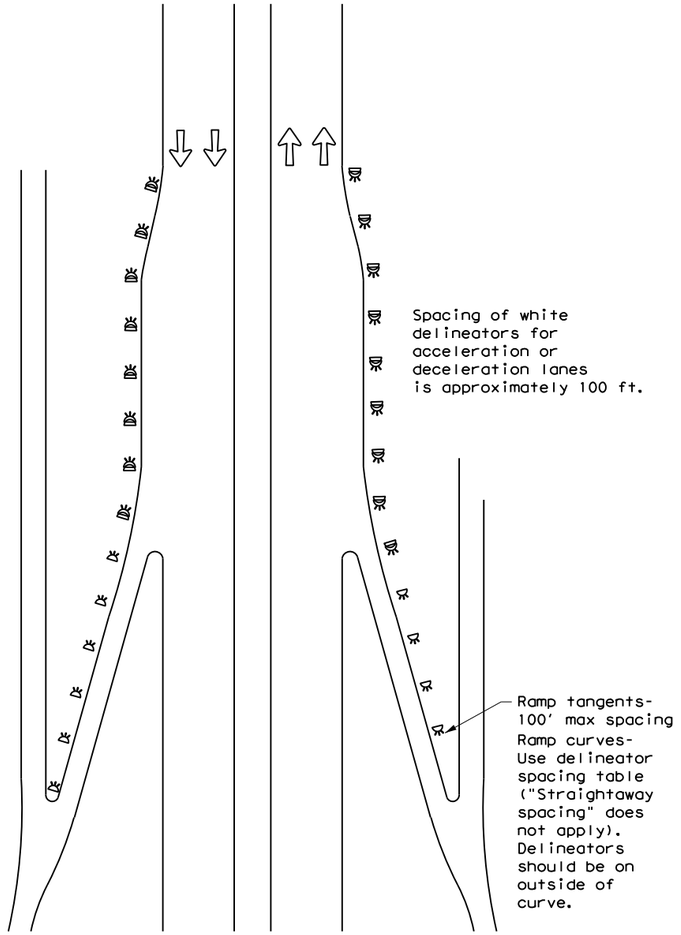

DETAIL 1

## FOR CULVERTS WITHOUT MBGF



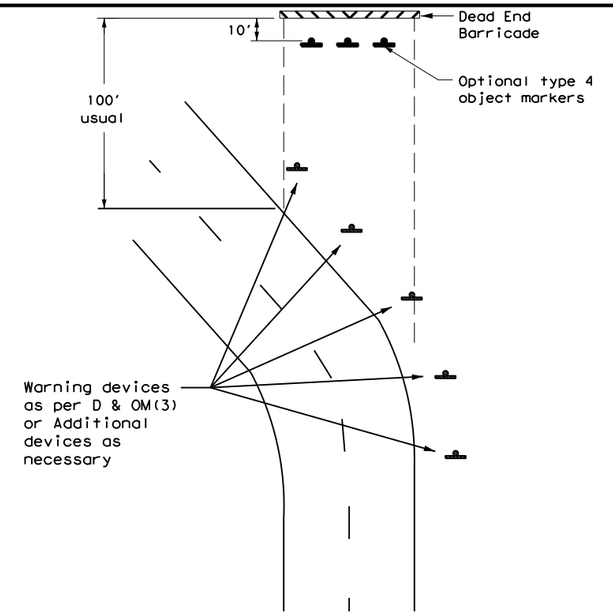

DETAIL 2

## FREEWAY DELINEATION FOR RAMPS AND ACCELERATION/DECELERATION LANES



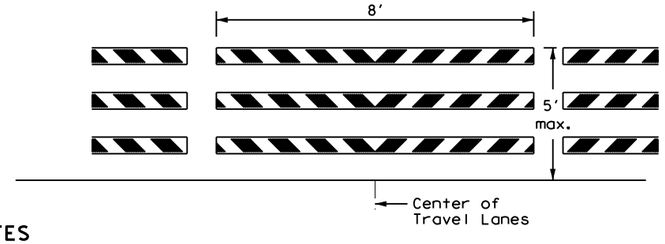

DETAIL 3

## TYPICAL APPLICATION OF DEAD END BARRICADE




DETAIL 4

## TYPICAL DEAD END BARRICADE INSTALLATION




NOTES

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

DETAIL 5

## LEGEND

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

Texas Department of Transportation

Traffic Safety Division Standard

# DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

# D & OM(4)-20

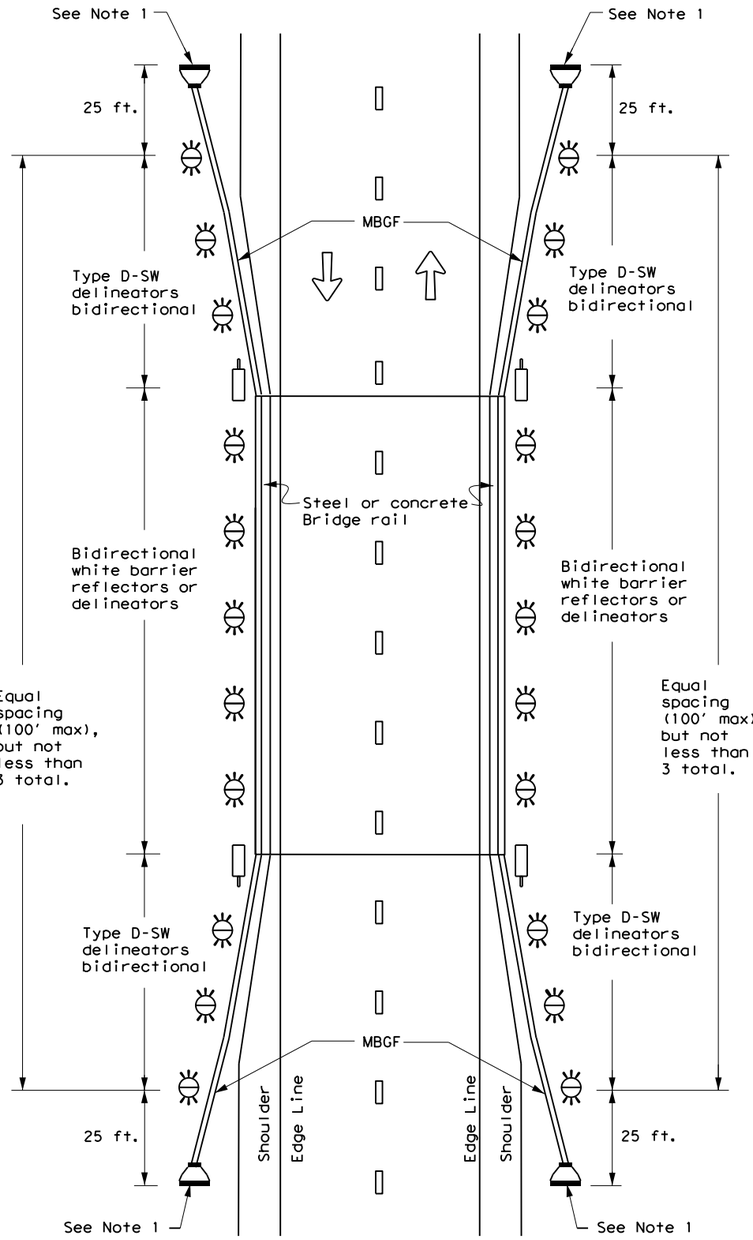
| FILE: dom4-20.dgn | DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|---|
| ©TxDOT August 2004 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 3-15 | DIST | COUNTY | | SHEET NO. |
| 7-20 | 10 | SMITH, ETC. | | 128 |

DATE:
FILE:

20D

DATE:
FILE:

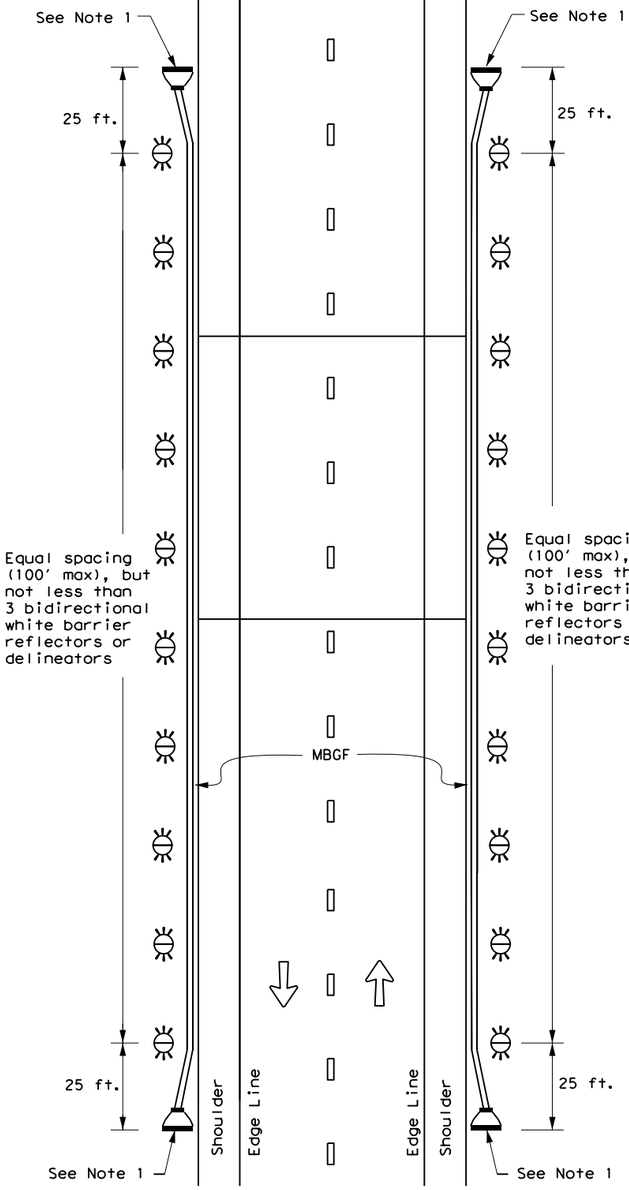
## TWO-WAY, TWO LANE ROADWAY WITH REDUCED WIDTH APPROACH RAIL




**NOTE:**

1. Terminal ends require reflective sheeting provided by manufacturer per D & OM (VIA) or a Type 3 Object Marker (OM-3) in front of the terminal end.

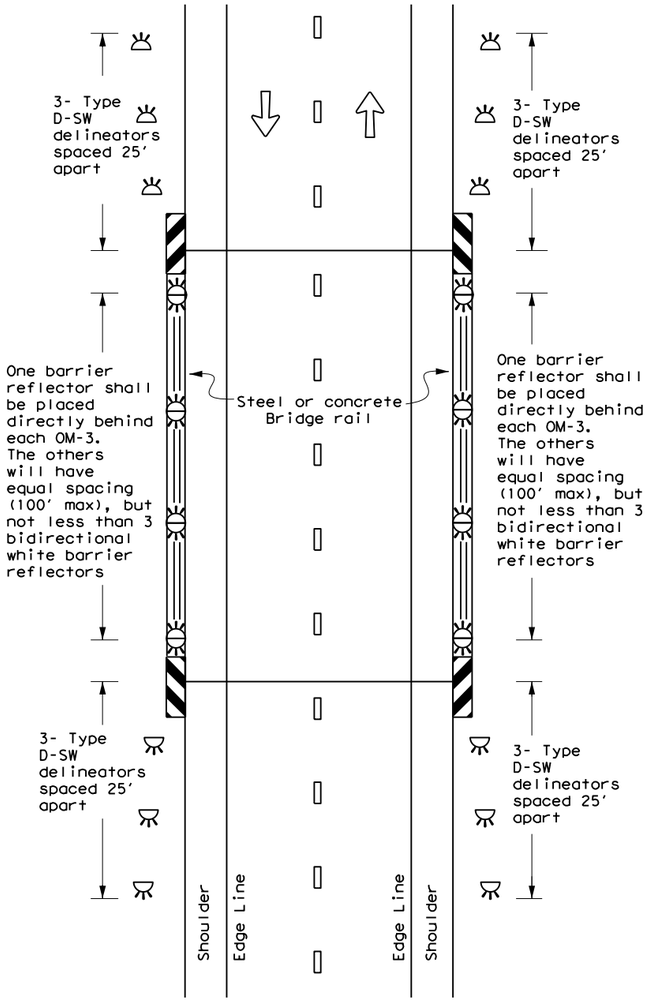
## TWO-WAY, TWO LANE ROADWAY WITH METAL BEAM GUARD FENCE (MBGF)




**NOTE:**

1. Terminal ends require reflective sheeting provided by manufacturer per D & OM (VIA) or a Type 3 Object Marker (OM-3) in front of the terminal end.

## TWO-WAY, TWO LANE ROADWAY BRIDGE WITH NO APPROACH RAIL




## LEGEND

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

Texas Department of Transportation

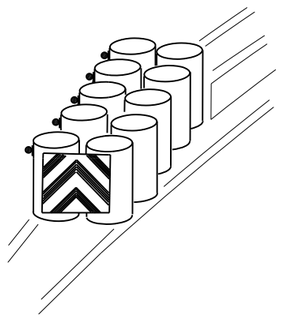
Traffic Safety Division Standard

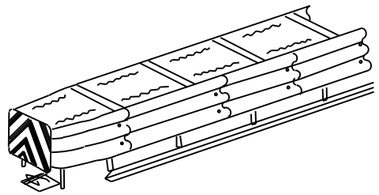
# DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

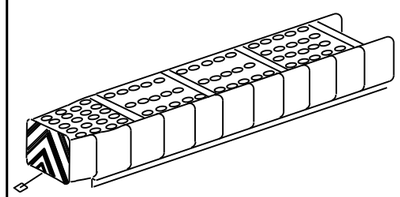
# D & OM(5)-20

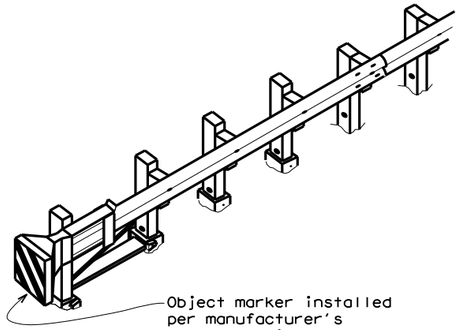
| FILE: dom5-20.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| © TxDOT August 2015 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 7-20 | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 129 |

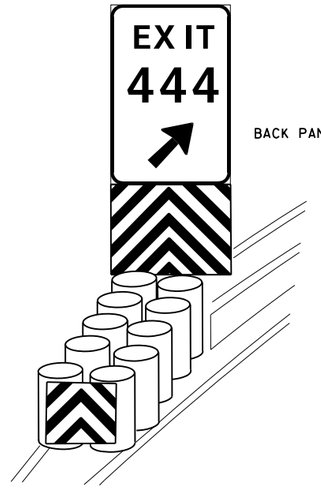
20E

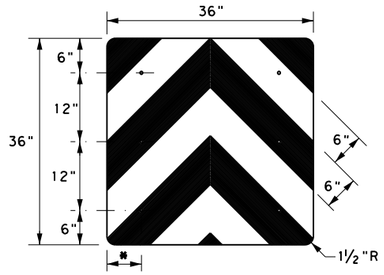


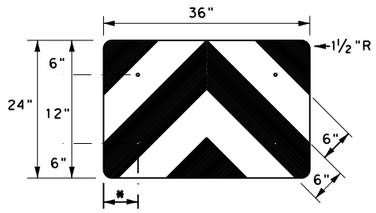




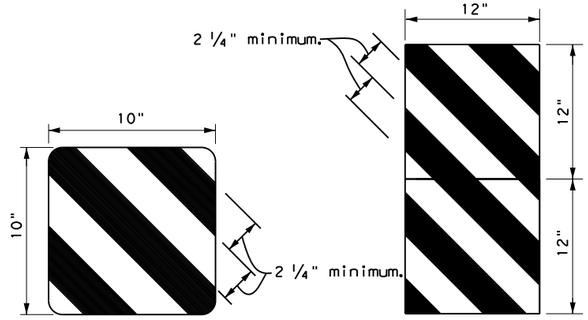


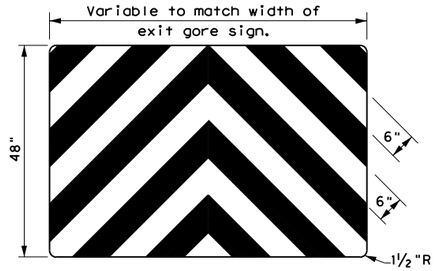



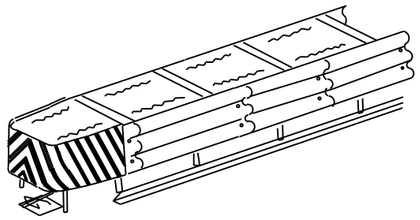



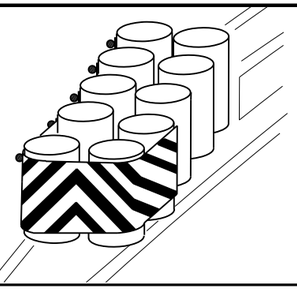

* Adjust to fit attenuator per manufacturer's recommendation, or as directed by the Engineer

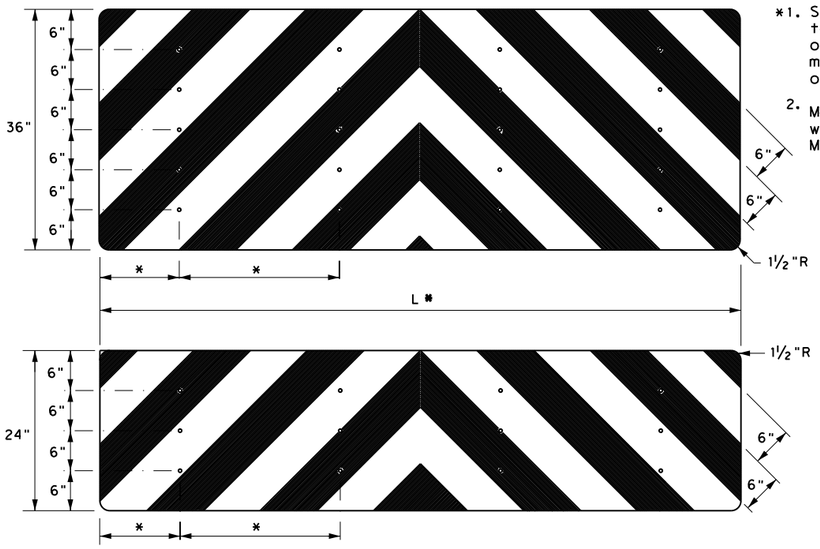



OBJECT MARKERS SMALLER THAN 3 FT$^2$








## NOTES

*1. Spacing should be adjusted to attach through centerline of drum, per attenuator manufacturers recommendation, or as directed by the Engineer.

2. Mounting should be flush with top of attenuator. Minimum size 96" x 24".

## NOTES

1. Object Markers shall conform to the Texas MUTCD and meet the color and reflectivity requirement of Department Material Specification DMS 8300. Background shall be yellow reflective sheeting (Type B or C) and Chevron shall be black.

2. Object Markers may be fabricated from adhesive backed reflective sheeting applied directly to guardrail end treatment, or applied directly to an "end cap" as per the manufacturer's recommendation. Direct applied sheeting shall provide a smooth surface and have no wrinkles, air bubbles, cuts or tears. A radius at the corners is not required for direct applied sheeting.

3. Object Marker size may be reduced to fit smaller devices. Width of alternating black and yellow stripes are typically 6". Object Markers smaller than 3ft may have reduced width stripes of a minimum of 2 ¼".

4. Pop rivets, screws, or nuts and bolts may be used to attach object markers and reflectors. Holes, slots or other openings may be cut or drilled through object markers to allow cable or other attachments.

5. Object Marker at nose of attenuator is subsidiary to the attenuator.

6. See D & OM (1-4) for required barrier reflectors.

Texas Department of Transportation

Traffic Safety Division Standard

# DELINEATOR & OBJECT MARKER FOR VEHICLE IMPACT ATTENUATORS

# D & OM(VIA)-20

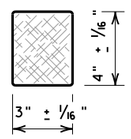
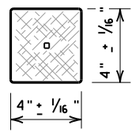
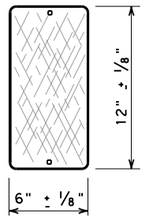
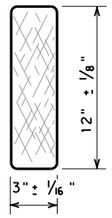
| FILE: domvia20.dgn | DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|---|
| © TxDOT December 1989 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 4-92 8-04 | DIST | COUNTY | | SHEET NO. |
| 8-95 3-15 | 10 | SMITH, ETC. | | 130 |
| 4-98 7-20 | | | | |

20G

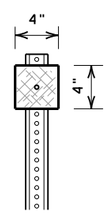
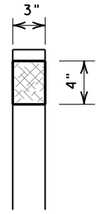
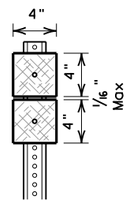
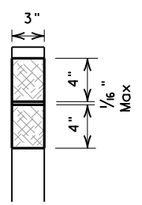
DATE:
FILE:

DATE:
FILE:

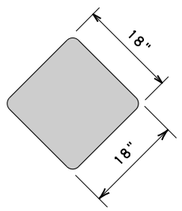
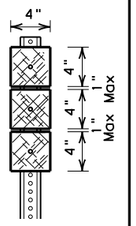
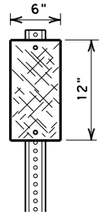
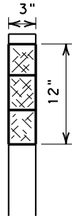
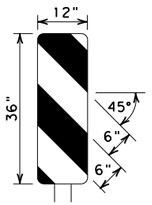
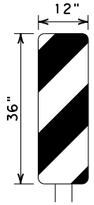
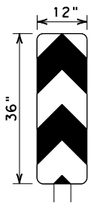
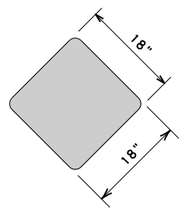
## REFLECTOR UNIT SIZES FOR DELINEATORS AND OBJECT MARKERS

| | SIZE 1 | SIZE 2 | SIZE 3 | SIZE 4 |
|---|---|---|---|---|
| DEVICE |   |   |   |   |
| SHEETING | Yellow, White or Red Type B or C reflective sheeting | | | |
| NOTE | 1. Size 1 and 4 - Direct applied reflective sheeting for use on flexible post (flx).<br>2. Size 2 and 3 - For use on wing channel (wc) post only. Use approved metal, plastic or fiberglass backplate with 17/64" mounting holes. | | | |

## DELINEATORS

| | SINGLE | | DOUBLE | |
|---|---|---|---|---|
| DEVICE |   |   |   |   |
| | 1-Size 2 reflector unit | 1-Size 1 reflector unit | 2-Size 2 reflector units | 2-Size 1 reflector units |
| SHEETING | Yellow, White or Red Type B or C Reflective Sheeting | | | |
| POST TYPE | WC | FLX | WC | FLX |
| MOUNT TYPE | GND | GND, SRF | GND | GND, SRF |

## OBJECT MARKERS

| | Type 1 (OM-1) | Type 2 (OM-2) | | | Type 3 (OM-3) | | | Type 4 (OM-4) |
|---|---|---|---|---|---|---|---|---|
| | OM-1 | OM-2X | OM-2Y | OM-2Z | OM-3L | OM-3R | OM-3C | OM-4 |
| DEVICE |   |   |   |   |   |   |   |   |
| | | 3-Size 2 reflector units | 1-Size 3 reflector unit | 3-Size 1 reflector units or 1-Size 4 reflector unit | | | | |
| SHEETING | Yellow-Type $B_{FL}$ or $C_{FL}$ Sheeting | Yellow - Type B or C Sheeting | | | Alternating acrylic black and retroflective yellow - Type $B_{FL}$ or $C_{FL}$ Sheeting | | | Red -Type $B_{FL}$ or $C_{FL}$ Sheeting |
| POST TYPE | TWT | WC | WC | FLX | TWT | | | TWT |
| MOUNT TYPE | WAS, WAP | GND | GND | GND, SRF | WAS, WAP | | | WAS, WAP |

## D & OM DESCRIPTIVE CODES

INSTL DEL ASSM (D-XX) SZ X (XXX) 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
FLX = 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) (XXX) 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
FLX = Flexible Post
TWT = Thin Walled Tubing

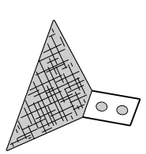
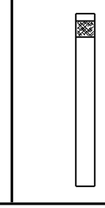
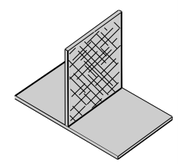
**TYPE OF MOUNT**
GND = Embedded (drivable)
SRF = Surface Mount
WAS = Wedge Anchor Steel
WAP = Wedge Anchor Plastic

**DIRECTION**
If Required
BI = Bi-Directional

### DEPARTMENTAL MATERIAL SPECIFICATIONS

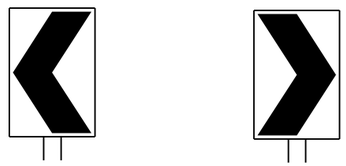
| | |
|---|---|
| FLEXIBLE DELINEATOR & OBJECT MARKER POSTS (EMBEDDED & SURFACE MOUNT TYPES) | DMS-4400 |
| SIGN FACE MATERIALS | DMS-8300 |
| DELINEATORS, OBJECT MARKERS AND BARRIER REFLECTORS | DMS-8600 |

## BARRIER REFLECTORS (BRF)

| | GF1 | GF2 | CTB |
|---|---|---|---|
| DEVICE |  |  |  |
| | 1. Barrier reflectors shall meet the requirements of DMS 8600.<br>2. Approved Barrier Reflectors are listed on the "Barrier Reflectors" Material Producer List at: www.txdot.gov. | | |
| SHEETING | Yellow, White, Red | | |
| NOTE | 1. Minimum 9 square inches of reflective sheeting surface area. | | |

## CHEVRONS

DEVICE



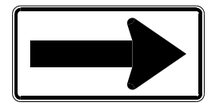
W1-8

| SIZE (W x L) | 18"x 24" (Conventional) | 24"x 30" (Conventional Oversize) | 30"x 36" (Expressway) | 36" x 48" (Freeway) |
|---|---|---|---|---|
| MOUNTING HEIGHT | 4'-0" or 7'-0" | | 7'-0" Only | |

NOTE
1. CHEVRON (W1-8) signs and ONE DIRECTION LARGE ARROW (W1-6) Signs shall be installed per Sign Mounting Details (SMD) Standard Sheets and paid under Item 644 (Small Roadside Sign Assemblies).
2. The Texas version of the ONE DIRECTION LARGE ARROW sign (W1-9T) may be used instead of the ONE DIRECTIONAL LARGE ARROW (W1-6).

## ONE DIRECTION LARGE ARROW

DEVICE



W1-6

| SIZE (W x L) | 48" x 24" (Conventional) | 60" x 30" (Expressway & Freeway) |
|---|---|---|
| MOUNTING HEIGHT | 7'-0" | |

**NOTE:**
Delineator and object marker backplates and sign substrates shall be 0.080" Aluminum sign blank to conform to ASTM B-209 Alloy 6061-T6 or approved alternative.

Texas Department of Transportation

Traffic Operations Division Standard

# DELINEATOR & OBJECT MARKER MATERIAL DESCRIPTION

# D & OM(1)-15

| FILE: dom1-15.dgn | DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|---|
| ©TxDOT August 2004 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 10-09 3-15 | DIST | COUNTY | | SHEET NO. |
| 4-10 | 10 | SMITH, ETC. | | 131 |

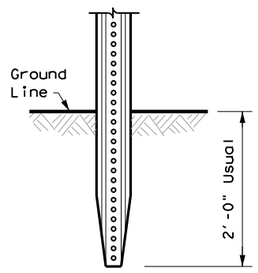
DISCLAIMER:
The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

DATE:
FILE:

# POST TYPE AND SUPPORT FOUNDATION DETAILS

## WING CHANNEL (WC)

### GND

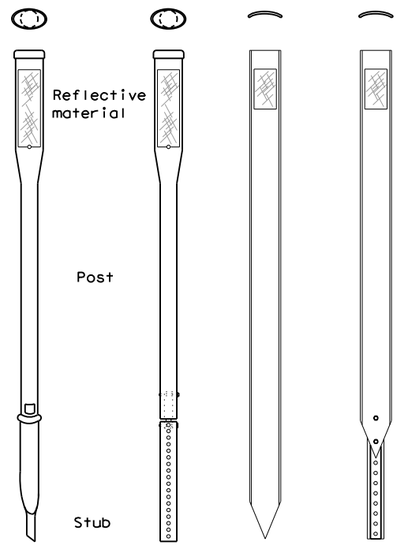



**NOTES**

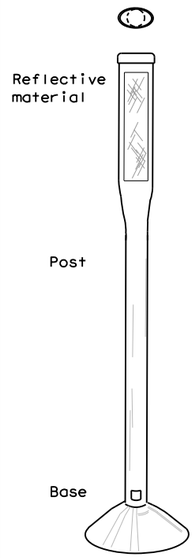
1. Embedded Wing Channel (WC) post option may be used for Type 2 Object Markers and Delineators only.
2. 1.12 lbs/ft steel per ASTM A 1011 SS Gr. 50, or ASTM A499.

## FLEXIBLE POSTS (FLX)

### GND




### SRF




EMBEDDED

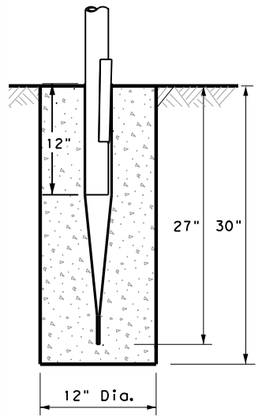
SURFACE MOUNT

**NOTES**

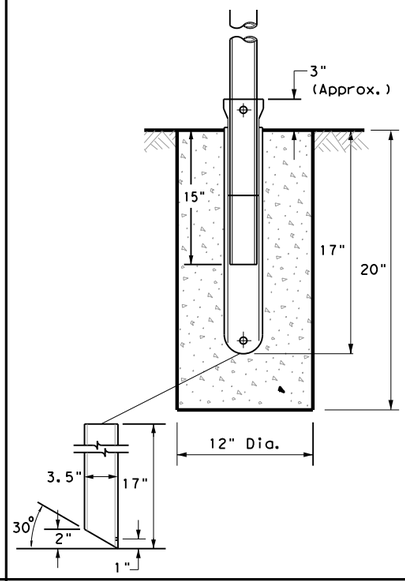
1. See "Flexible Delineator and Object Marker Posts" Material Producer List for approved devices.
2. Install per manufacturer's recommendations.
3. Post length may vary to meet field conditions.

## WEDGE ANCHOR SYSTEMS

### WAS




### WAP




STEEL

PLASTIC

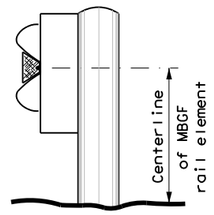
**NOTE**

1. Install per manufacturer's recommendations.

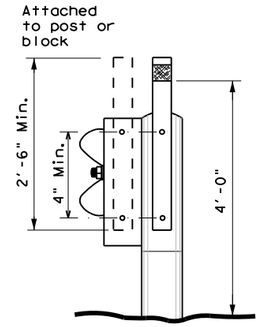
# TYPE OF BARRIER MOUNTS

## GUARD FENCE ATTACHMENT

### GF1

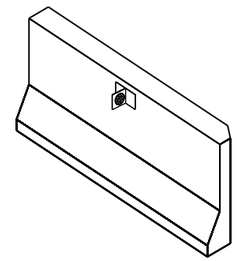



### GF2




## CONCRETE BARRIER / BRIDGE RAIL

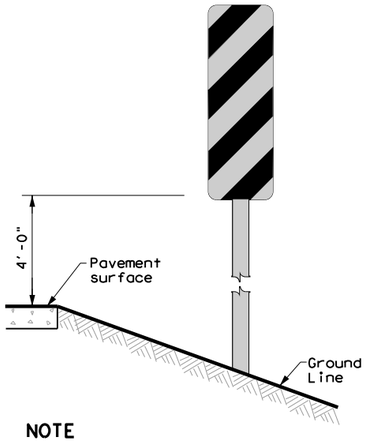
### CTB



**GENERAL NOTES**

1. Place delineators on a section of roadway at a consistent distance from the edge of pavement.
2. Where a restriction prevents consistent placement from the pavement edge, place the affected object markers in line with the innermost edge of the obstruction.
3. When Type 2 object markers and delineators are more than 8'-0" from the edge of the pavement, it may not be possible to maintain a height of approximately 4'-0". If this is the case, place the object marker or delineator as close to the desired height as possible.
4. Install all delineators, object markers and barrier reflectors in accordance with the manufacturer's recommendation.
5. Barrier reflectors should be installed a minimum of 18 inches above the edge of the pavement surface.

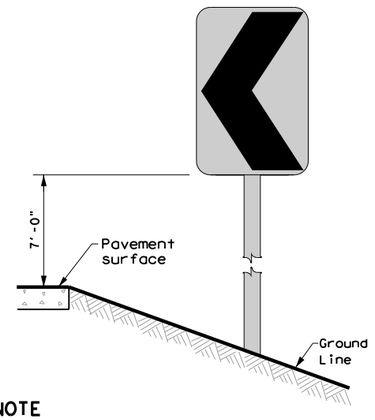
# TYPES 1, 3, AND 4 OBJECT MARKERS AND CHEVRONS




**NOTE**

Mounting at 4 feet to the bottom of the chevron is permitted for chevrons that will not exceed a height of 6'-6" to the top of the chevron (sizes 24" x 30" and smaller)

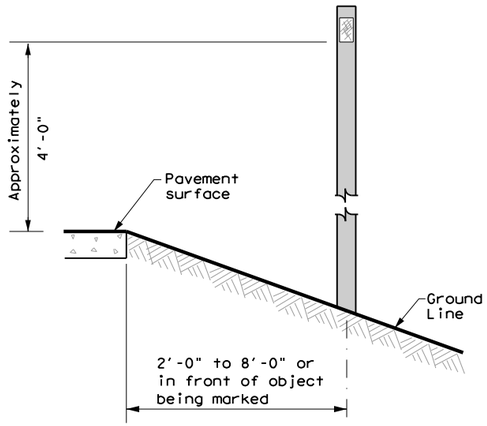
# CHEVRONS AND ONE DIRECTION LARGE ARROW SIGN




**NOTE**

Chevrons 30" x 36" and larger shall be mounted at a height of 7' to the bottom of the chevron. Chevron sign and ONE DIRECTIONAL LARGE ARROW sign (W1-9T) shall be installed per SMD standard sheets and paid under item 644.

# DELINEATORS AND TYPE 2 OBJECT MARKERS




See general notes 1, 2 and 3.

Texas Department of Transportation

Traffic Operations Division Standard

# DELINEATOR & OBJECT MARKER INSTALLATION

# D & OM(2)-15

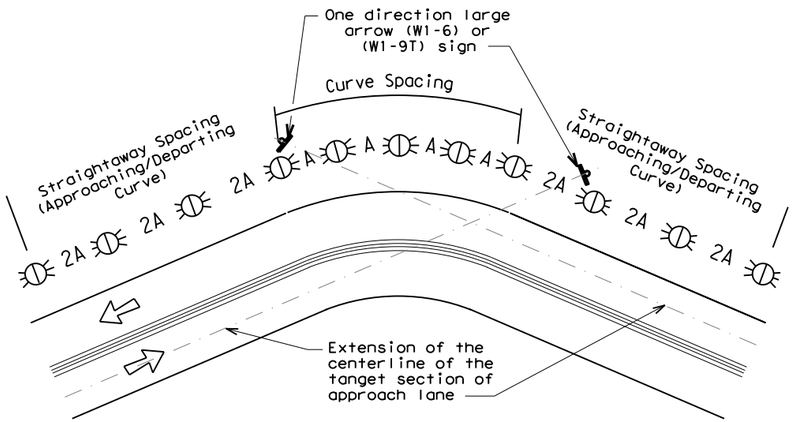
| FILE: dom2-15.dgn | DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|---|
| © TxDOT August 2004 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 10-09 3-15 | DIST | COUNTY | | SHEET NO. |
| 4-10 | 10 | SMITH, ETC. | | 132 |

20B

## USE OF WARNING DEVICES AT CURVES WITH ADVISORY SPEED LIMITS

| Amount by which Advisory Speed Is less than Posted Speed | Warning Devices Needed |
|---|---|
| 5 MPH & 10 MPH | RPMs |
| 15 MPH & 20 MPH | RPMs, and Delineators or RPMs and ONE DIRECTION LARGE ARROW (W1-6) or (W1-9T) sign |
| 25 MPH & Greater | RPMs and Chevrons |

## SUGGESTED SPACING FOR DELINEATORS ON HORIZONTAL CURVES

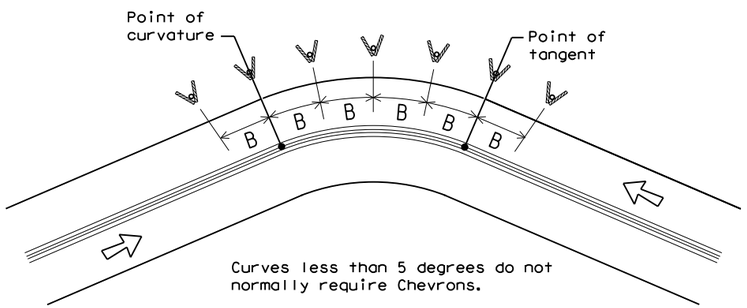



Curves less than 1 degree do not normally require delineators.

**NOTE**

ONE DIRECTIONAL LARGE ARROW (W1-6) or(W1-9T) sign should be located at approximately and perpendicular to the extension of the centerline of the tangent section of approach lane.

## SUGGESTED SPACING FOR CHEVRONS ON HORIZONTAL CURVES




Curves less than 5 degrees do not normally require Chevrons.

## DELINEATOR AND CHEVRON SPACING

WHEN DEGREE OF CURVE OR RADIUS IS KNOWN

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

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

## DELINEATOR AND CHEVRON SPACING

WHEN DEGREE OF CURVE OR RADIUS IS NOT KNOWN

| Advisory Speed (MPH) | Spacing in Curve | Spacing in Straightaway | Chevron Spacing in Curve |
|---|---|---|---|
| | A | 2xA | B |
| 65 | 130 | 260 | 200 |
| 60 | 110 | 220 | 160 |
| 55 | 100 | 200 | 160 |
| 50 | 85 | 170 | 160 |
| 45 | 75 | 150 | 120 |
| 40 | 70 | 140 | 120 |
| 35 | 60 | 120 | 120 |
| 30 | 55 | 110 | 80 |
| 25 | 50 | 100 | 80 |
| 20 | 40 | 80 | 80 |
| 15 | 35 | 70 | 40 |

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

## DELINEATOR AND OBJECT MARKER APPLICATION AND SPACING

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

### NOTES

1. Delineators not required in urban areas with continuous illumination.
2. Unless indicated otherwise, the delineator or barrier reflector color shall conform to the color of the pavement edge line on the side of the road where the delineators or barrier reflectors are placed.
3. Barrier reflectors may be used to replace required delineators.
4. Single red delineators may be mounted on the back side of delineator posts for wrong way driver applications

### LEGEND

| | |
|---|---|
| | Bi-directional Delineator |
| | Delineator |
| | Sign |

Texas Department of Transportation

Traffic Operations Division Standard

# DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

# D & OM(3)-15B

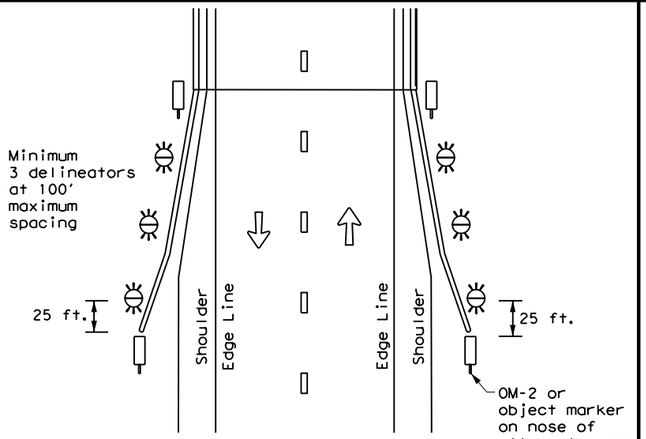
| FILE: dom3-15b.dgn | DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|---|
| © TxDOT August 2004 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 3-15 | DIST | COUNTY | | SHEET NO. |
| 8-15 | 10 | SMITH, ETC. | | 133 |

DATE:
FILE:

20C

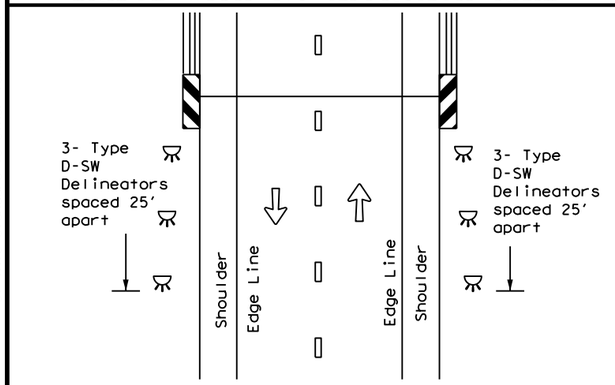
DATE:
FILE:

## TWO-WAY, TWO LANE ROADWAY WITH REDUCED WIDTH APPROACH



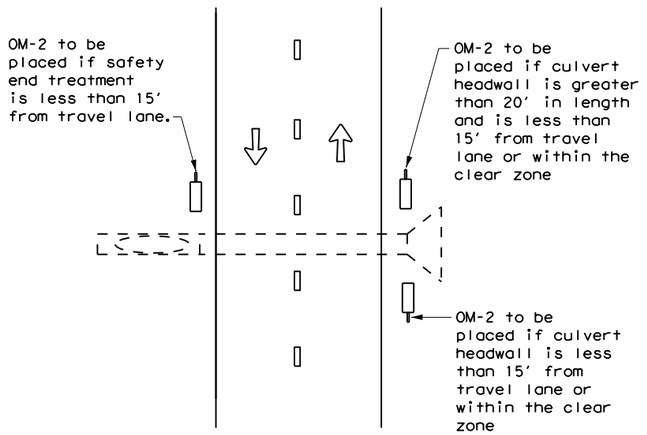

DETAIL 1

## TWO-WAY, TWO LANE ROADWAY BRIDGE WITH NO APPROACH RAIL



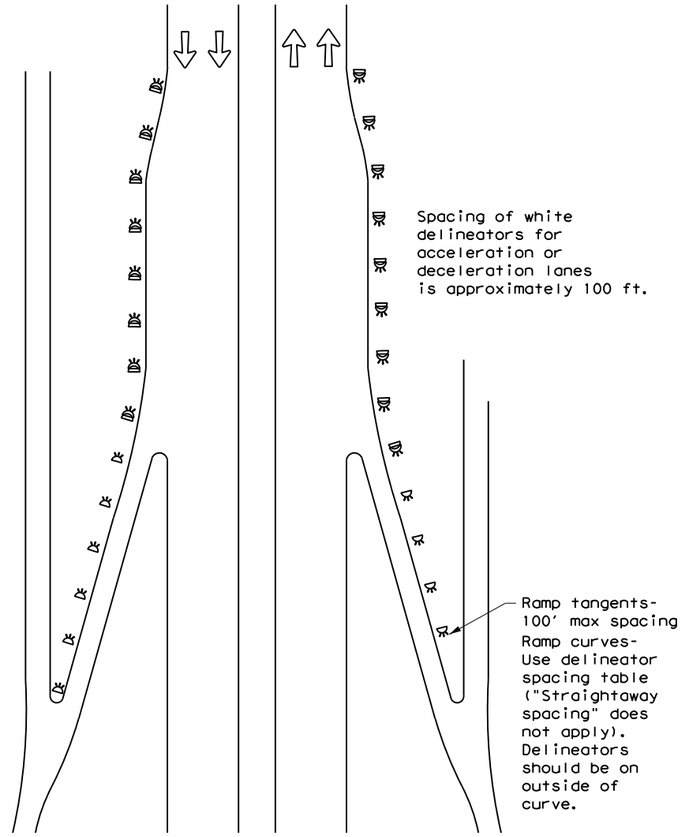

DETAIL 2

## FOR CULVERTS WITHOUT MBGF



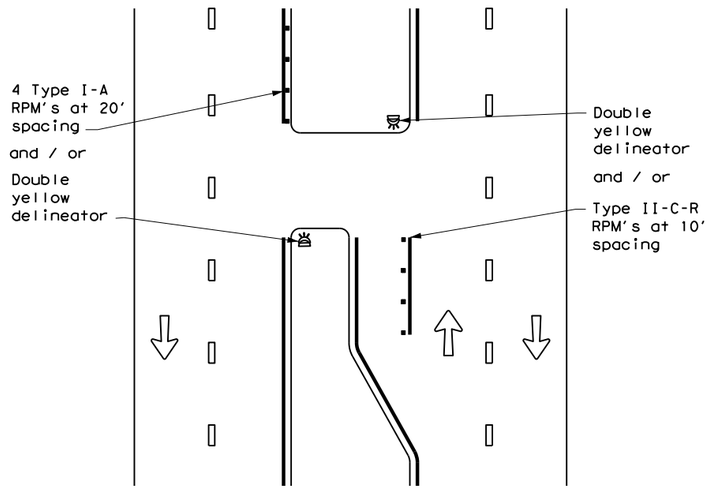

DETAIL 3

## FREEWAY DELINEATION FOR RAMPS AND ACCELERATION/DECELERATION LANES



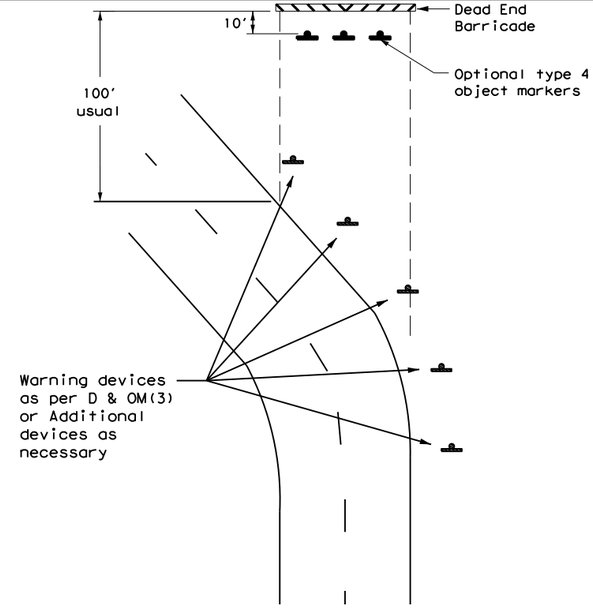

DETAIL 4

## CROSSOVERS



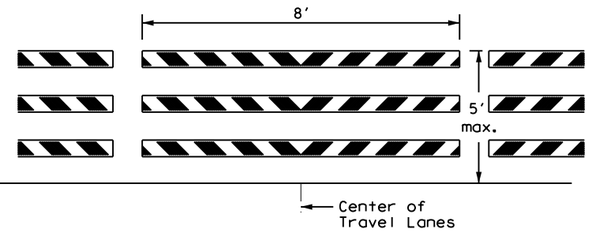

DETAIL 5

## TYPICAL APPLICATION OF DEAD END BARRICADE




DETAIL 6

## TYPICAL DEAD END BARRICADE INSTALLATION




### NOTES

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

DETAIL 7

### LEGEND

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

Texas Department of Transportation

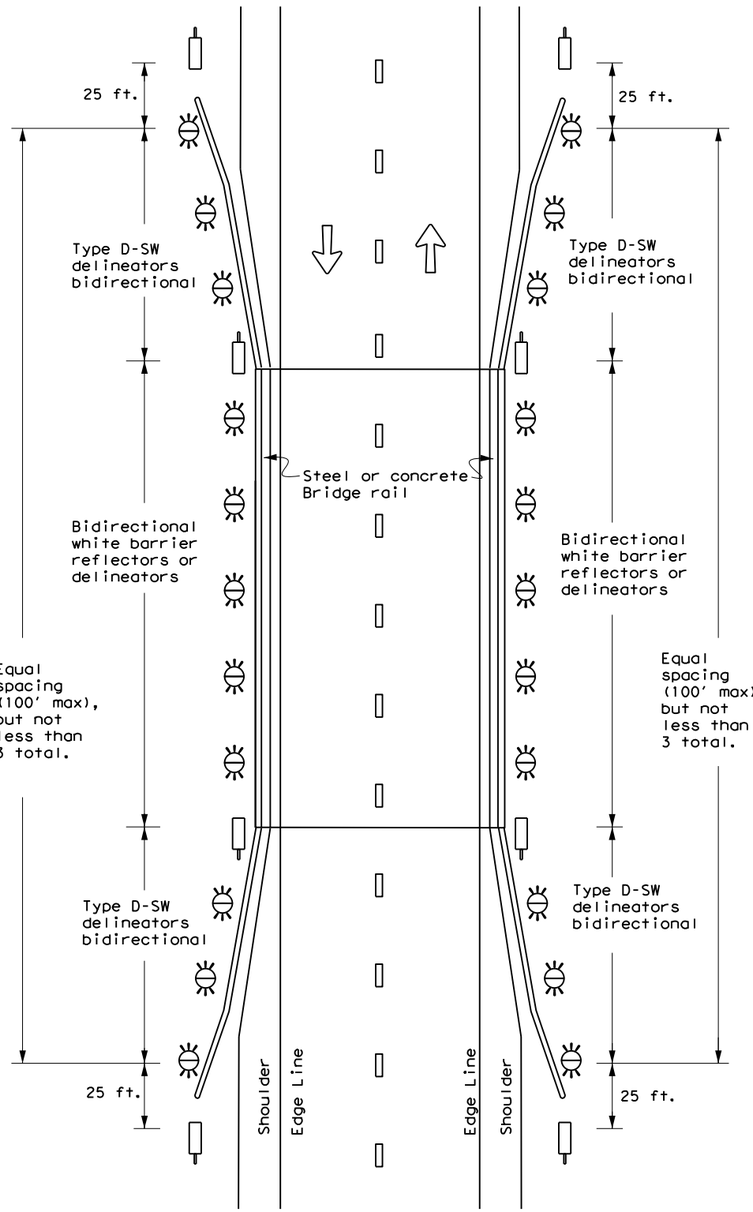
Traffic Operations Division Standard

# DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

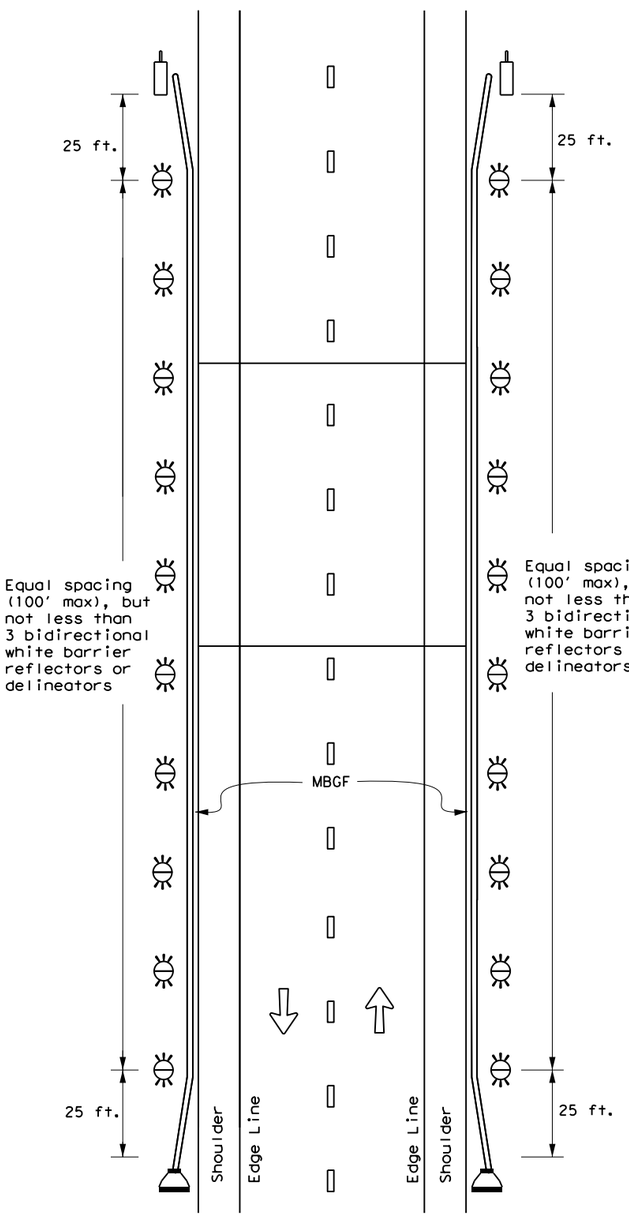
# D & OM(4)-15

| FILE: dom4-15.dgn | DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|---|
| ©TxDOT August 2004 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 3-15 | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 134 |

## TWO-WAY, TWO LANE ROADWAY WITH REDUCED WIDTH APPROACH RAIL



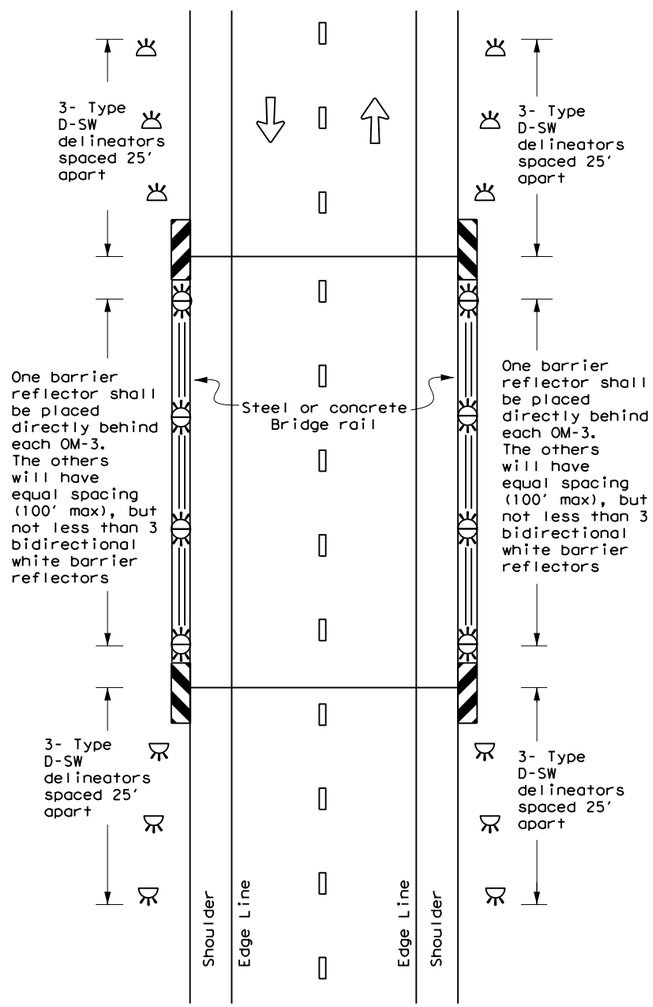

## TWO-WAY, TWO LANE ROADWAY WITH METAL BEAM GUARD FENCE (MBGF)




**NOTE:**

If terminal ends include an object marker, there is no need to install an OM-2 in front of terminal.

## TWO-WAY, TWO LANE ROADWAY BRIDGE WITH NO APPROACH RAIL




## LEGEND

| | |
|---|---|
| | Bidirectional Delineator |
| | Delineator |
| | OM-3 |
| | OM-2 |
| | Terminal End |
| | TRAFFIC FLOW |

Texas Department of Transportation

Traffic Operations Division Standard

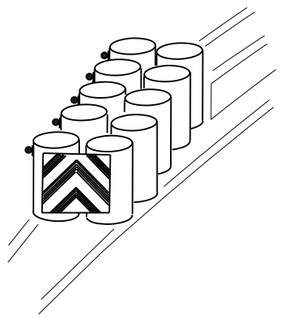
# DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

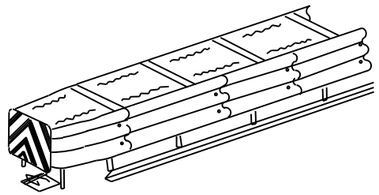
# D & OM(5)-15

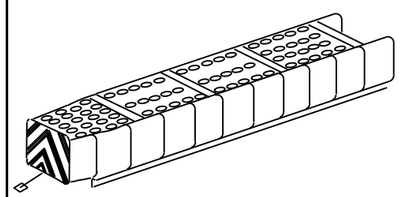
| FILE: dom5-15.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| © TxDOT August 2015 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 135 |

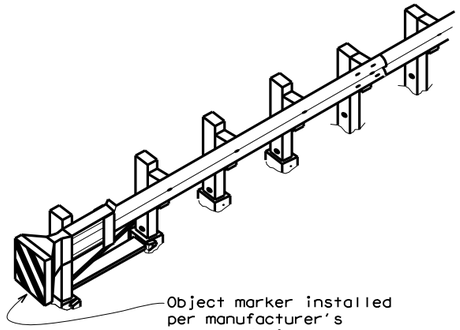
DATE:
FILE:

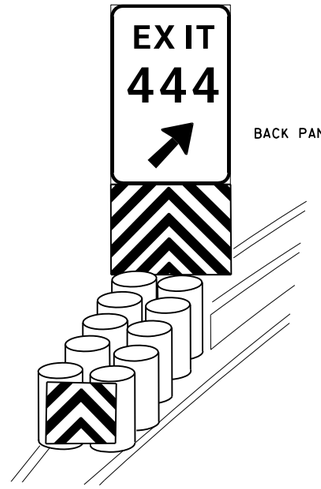
20E

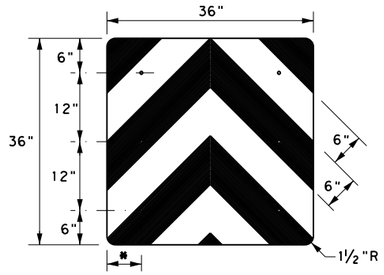


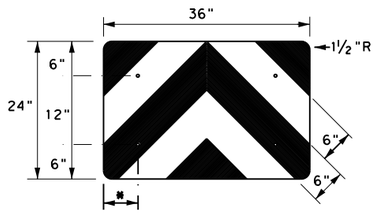




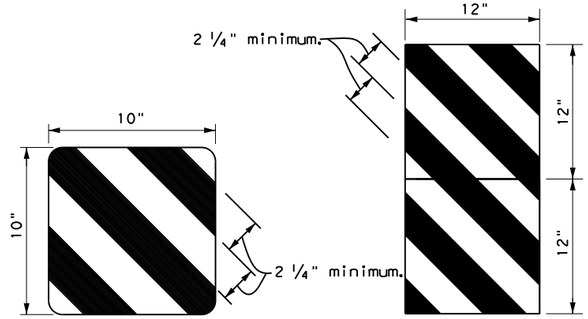


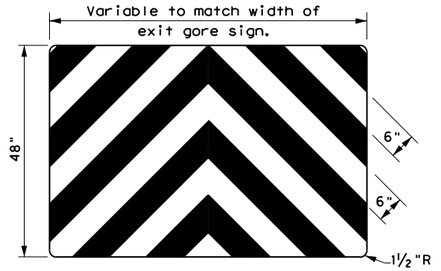



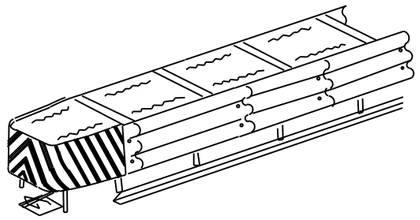



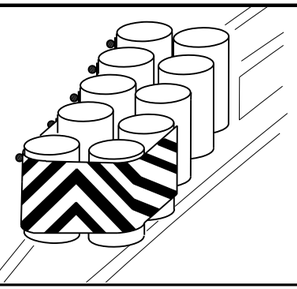

* Adjust to fit attenuator per manufacturer's recommendation, or as directed by the Engineer

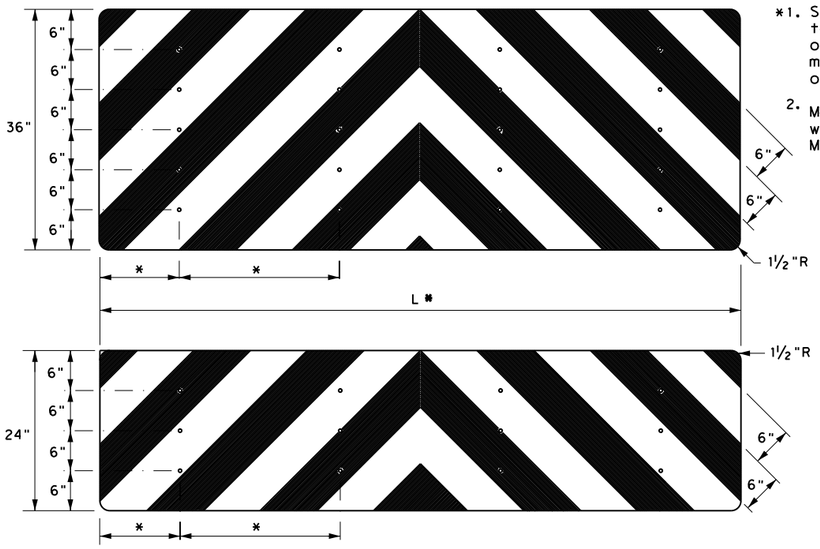



OBJECT MARKERS SMALLER THAN 3 FT$^2$








## NOTES

*1. Spacing should be adjusted to attach through centerline of drum, per attenuator manufacturers recommendation, or as directed by the Engineer.

2. Mounting should be flush with top of attenuator. Minimum size 96" x 24".

## NOTES

1. Object Markers shall conform to the Texas MUTCD and meet the color and reflectivity requirement of Department Material Specification DMS 8300. Background shall be yellow reflective sheeting (Type B or C) and Chevron shall be black.

2. Object Markers may be fabricated from adhesive backed reflective sheeting applied directly to guardrail end treatment, or applied directly to an "end cap" as per the manufacturer's recommendation. Direct applied sheeting shall provide a smooth surface and have no wrinkles, air bubbles, cuts or tears. A radius at the corners is not required for direct applied sheeting.

3. Object Marker size may be reduced to fit smaller devices. Width of alternating black and yellow stripes are typically 6". Object Markers smaller than 3ft may have reduced width stripes of a minimum of 2 ¼".

4. Pop rivets, screws, or nuts and bolts may be used to attach object markers and reflectors. Holes, slots or other openings may be cut or drilled through object markers to allow cable or other attachments.

5. Object Marker at nose of attenuator is subsidiary to the attenuator.

6. See D & OM (1-4) for required barrier reflectors.

Texas Department of Transportation

Traffic Operations Division Standard

# DELINEATOR & OBJECT MARKER FOR VEHICLE IMPACT ATTENUATORS

# D & OM(VIA)-15

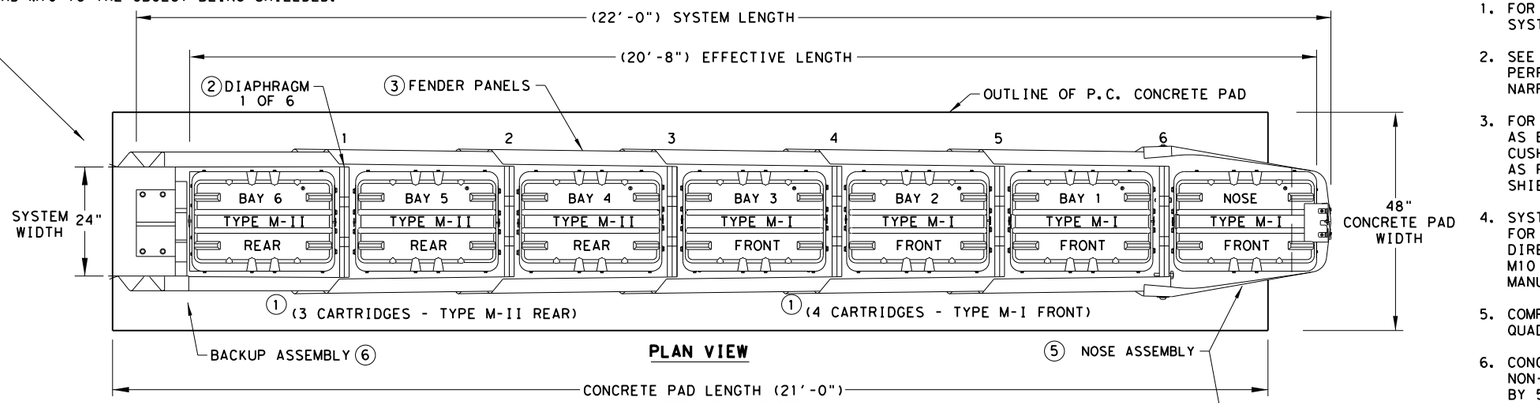
| FILE: domvia15.dgn | DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|---|
| ©TxDOT December 1989 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 4-92 8-04 | DIST | COUNTY | | SHEET NO. |
| 8-95 3-15 | 10 | SMITH, ETC. | | 136 |
| 4-98 | | | | |
| 20G | | | | |

DATE:
FILE:

DATE:
FILE:

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

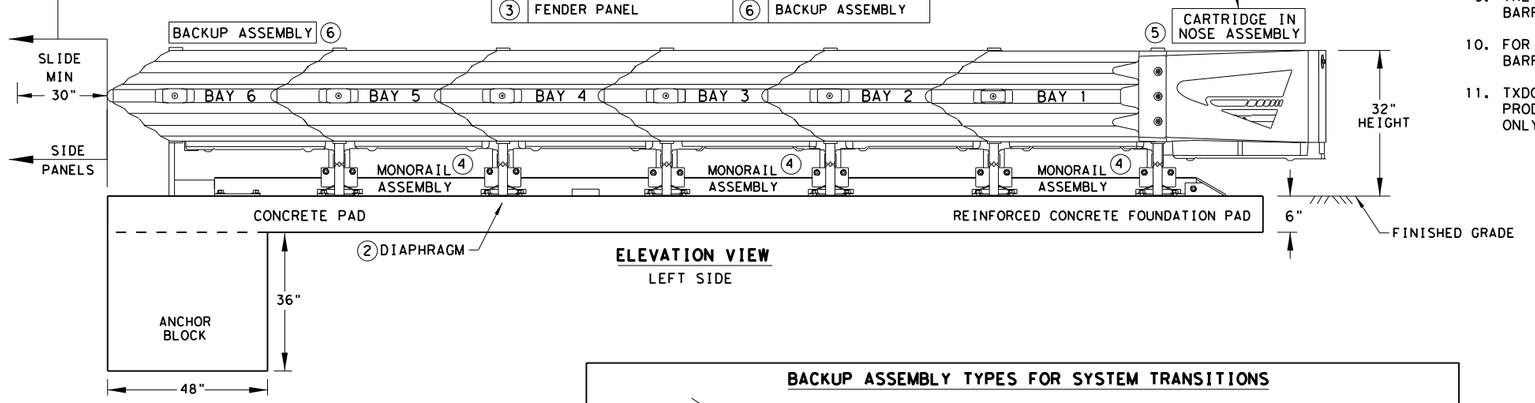
## QUADGUARD M10 24" WIDE 6-BAY SYSTEM




PLAN VIEW

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

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




ELEVATION VIEW
LEFT SIDE

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

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

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

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

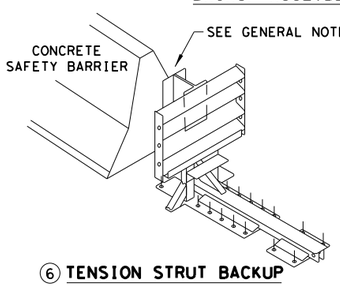
CONCRETE PAD AND ANCHOR BLOCK COMBINATIONS SHALL BE CONFIRMED WITH THE MANUFACTURER BASED UPON SITE SPECIFIC DATA (SSD).

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

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

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

## BACKUP ASSEMBLY TYPES FOR SYSTEM TRANSITIONS




(6) TENSION STRUT BACKUP

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

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

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

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

## GENERAL NOTES

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

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

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

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

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

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

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

REUSABLE

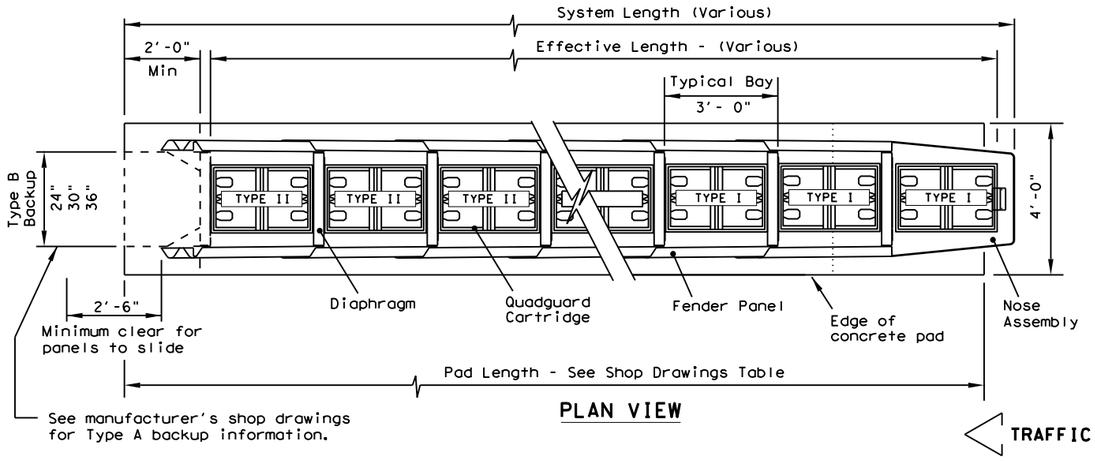
Texas Department of Transportation — Design Division Standard

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

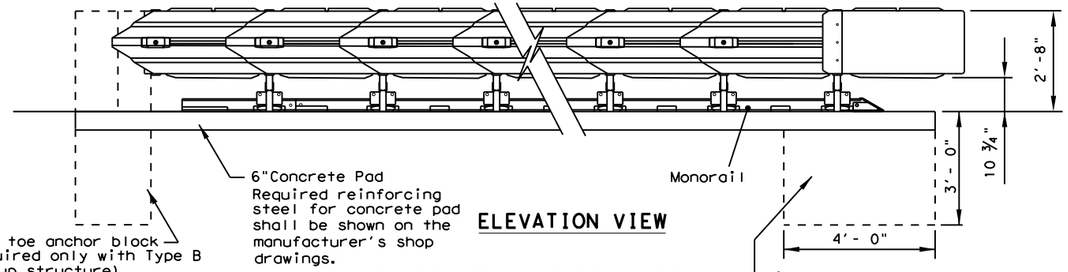
## QGUARD(M10)(N)-20

| FILE: qguardm10n20.dgn | DN: TxDOT | CK: KM | DW: VP | CK: AG |
|---|---|---|---|---|
| ©TxDOT: NOVEMBER 2020 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 137 |

DATE:
FILE:



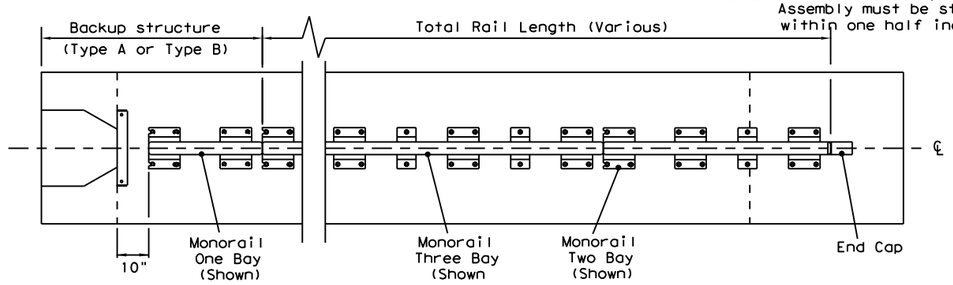

PLAN VIEW



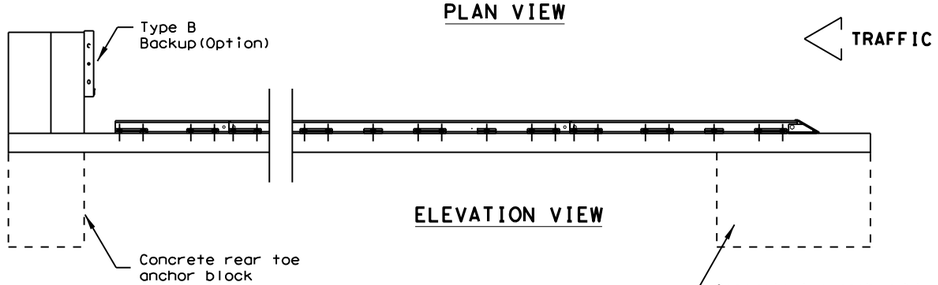

ELEVATION VIEW

## QUADGUARD II SYSTEM DETAIL

Note: Monorail & Backup Assembly must be straight within one half inch.




PLAN VIEW




ELEVATION VIEW

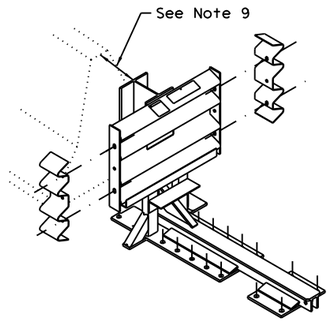
## MONORAIL ASSEMBLY DETAIL

(See the manufacturer's shop drawings for monorail hardware installation.)

| QUADGUARD II (NARROW) SYSTEM | | | | |
|---|---|---|---|---|
| Test Level | NO. OF BAYS | UNIT EFFECTIVE LENGTH | PAD LENGTH TYPE A | PAD LENGTH TYPE B |
| TL-2 | 2 | 8'- 8" | 9'- 0" | 8'- 6" |
| TL-3 | 5 | 17'- 8" | 18'- 0" | 17'- 6" |
| | | | | |

Additional bays may be added if special considerations warrant and site conditions will accommodate additional length.

QUAD II (N) units are available in 24", 30", or 36" widths from 2 to 8 bays. Unit width, number of bays, and backup type shall be specified elsewhere in the plans.




### TYPE A
### TENSION STRUT BACKUP

TENSION STRUT: Consists of diagonal struts, connections, and accessories, as detailed by the Manufacturer, located at the rear of the QUAD unit. Typical application is for QUAD units attached to double-face guardrail. When used, a 4'-0"x 4'-0"x 3'-0" concrete toe anchor block shall be provided beneath the front portion of the concrete pad, except where the QUAD unit is to be placed on continuously reinforced concrete pavement or bridge deck (7" minimum, 4,000 p.s.i.) or non-reinforced concrete pavement (8" minimum, 4,000 p.s.i.)

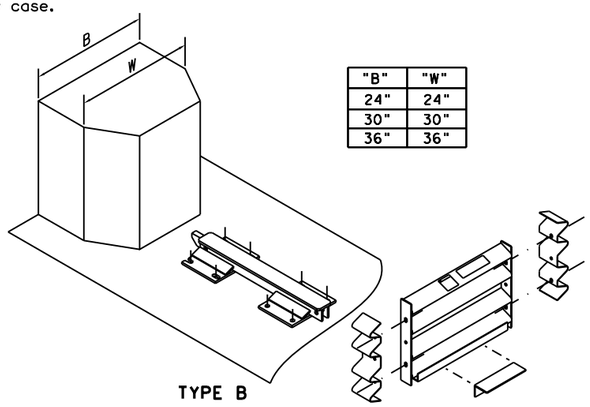
Anchorage requirements are as follows:

| WITH FOUNDATION TYPE: | ANCHOR WITH: |
|---|---|
| Minimum six inch portland cement concrete pad | Epoxy anchoring system with 7" studs, 5.5" embedment |
| Minimum three inch asphaltic concrete over minimum three inch portland cement concrete | Epoxy anchoring system with 18" studs, 16.5" embedment |
| Minimum six inch asphaltic concrete over minimum six inch compacted base | Epoxy anchoring system with 18" studs, 16.5" embedment |
| Minimum eight inch asphaltic concrete | Epoxy anchoring system with 18" studs, 16.5" embedment |

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. A zero clearance between the backup and barrier wall is recommended in no case should this distance exceed 7 inches.

## 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. For bi-directional traffic, appropriate transition panels will be required.
3. Details of components for the QUAD and backups and reinforcing details will be shown on the manufacturer's shop drawings furnished to the Engineer.
4. Concrete shall be class "S" with a minimum compressive strength of 4,000 p.s.i.
5. If the cross-slope varies more than 2% over the length of the system, the concrete pad will require levelling. Maximum permissible cross-slope is 8%.
6. The installation area should be free from curbs, elevated objects, or depressions.
7. The QUAD system should be approximately parallel with the barrier or ℄ of merging barriers.
8. Unit width selected should be adequate to protect an errant vehicle travelling at 15 degrees to the roadway from the face or corner of the fixed object.
9. For the permanent steel backup, (Type A) the distance between the back of backup and the barrier wall should not exceed 7 inches in any case.




| "B" | "W" |
|---|---|
| 24" | 24" |
| 30" | 30" |
| 36" | 36" |

### TYPE B
### CONCRETE BACKUP

CAST-IN-PLACE CONCRETE WALL BACKUP: If cast-in-place structures such as bridge parapets, columns, or special walls are used as backup structures, then intermediate walls shall be provided between the structures and the QUAD unit. Intermediate walls shall be equal in height and width to the QUAD unit and reinforced with a steel cage. A cast-in-place transition section from concrete barrier may be used. Reinforcing steel should transition from the standard barrier section to the standard backup section. Details for the intermediate walls, cast-in-place transition sections, or other modifications will be shown elsewhere in the plans. Concrete wall backups may be used on continuously reinforced concrete pavement pavement or bridge deck (7" minimum, 4,000 p.s.i)or non-reinforced concrete pavement (8" minimum, 4,000 p.s.i.) In those cases, all vertical steel will be doweled (5 inch minimum) into existing decks or located and placed prior to pouring proposed decks as approved by the Engineer.

REUSABLE

Texas Department of Transportation

Design Division Standard

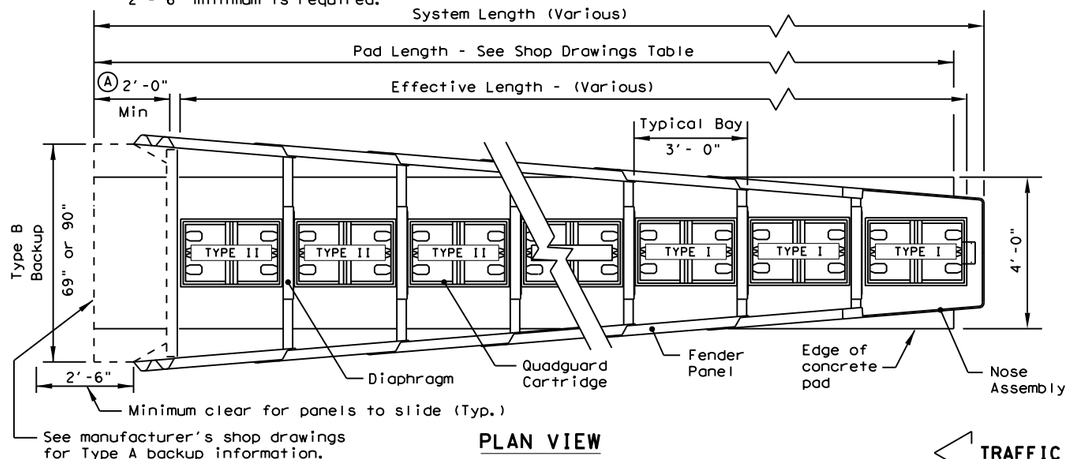
# TRINITY HIGHWAY ENERGY ABSORPTION (QUADGUARD II) (NARROW)

# QUAD(N)-17

| FILE: quadn17.dgn | DN: TxDOT | CK: KM | DW: VP | CK: KM |
|---|---|---|---|---|
| ©TxDOT: FEBRUARY 1998 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH 20 |
| REVISED 06,2013 VP<br>REVISED 03,2016 VP<br>REVISED 03,2017 KM | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 138 |

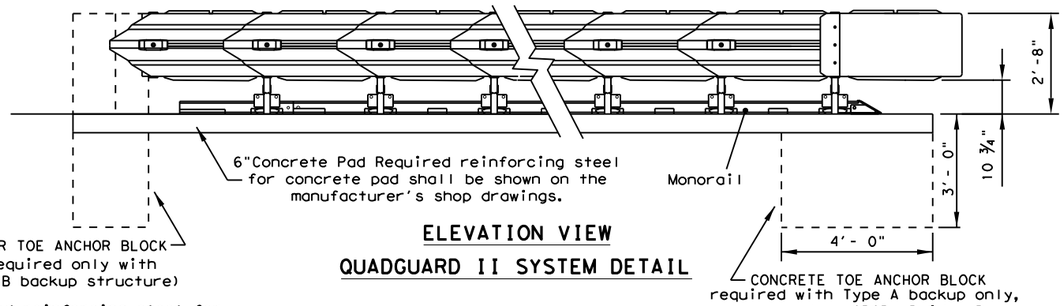
DATE:
FILE:

Ⓐ If Quad endshoes are used, then 2'- 6" minimum is required.




PLAN VIEW

TRAFFIC

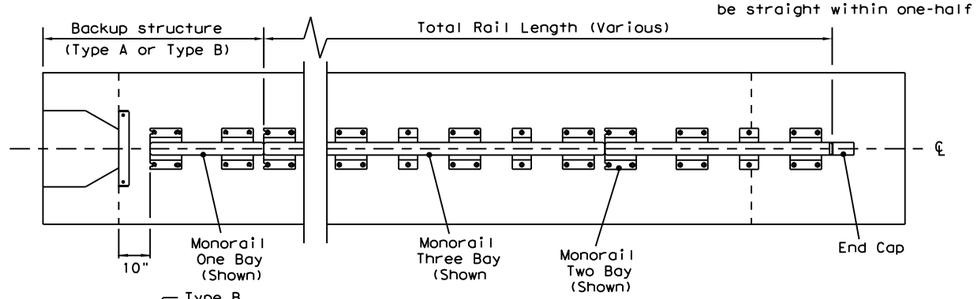



ELEVATION VIEW

QUADGUARD II SYSTEM DETAIL

Required reinforcing steel for concrete anchor shall be shown on the manufacturer's shop drawings.

Note: Monorail and Backup Assembly must be straight within one-half inch.




PLAN VIEW

TRAFFIC

ELEVATION VIEW

MONORAIL ASSEMBLY DETAIL

(See the manufacturer's shop drawings for monorail hardware installation.)

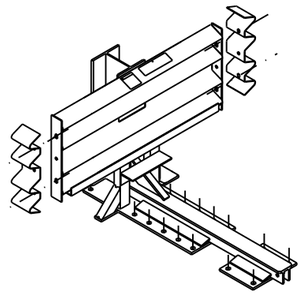
Concrete rear toe anchor block

Concrete toe anchor block (see additional information in System Detail.)

| QUADGUARD II (WIDE) SYSTEM | | | | |
|---|---|---|---|---|
| Test Level | NO. OF BAYS | UNIT EFFECTIVE LENGTH | PAD LENGTH TYPE A | PAD LENGTH TYPE B |
| TL-2 | 3 | 11'- 8" | 12'- 0" | 11'- 6" |
| TL-3 | 5 | 17'- 8" | 18'- 0" | 17'- 6" |
| | | | | |

Additional bays may be added if special considerations warrant and site conditions will accommodate additional length.

QUAD II (W) units are available in 69" and 90" widths from 3 to 8 bays.
Unit width, number of bays, and backup type shall be specified elsewhere in the plans.



TYPE A
TENSION STRUT BACKUP

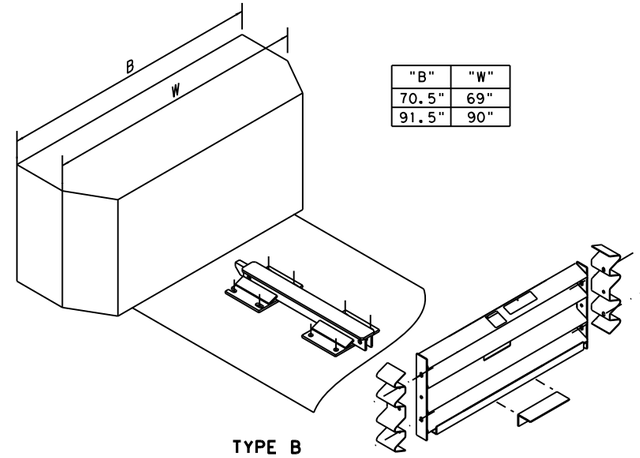
TENSION STRUT: Consists of diagonal struts, connections, and accessories, as detailed by the Manufacturer, located at the rear of the QUAD unit. Typical application is for QUAD units attached to double-face guardrail. When used, a 4'-0"x 4'-0"x 3'-0" concrete toe anchor block shall be provided beneath the front portion of the concrete pad, except where the QUAD unit is to be placed on continuously reinforced concrete pavement or bridge deck (7" minimum, 4,000 p.s.i.) or non-reinforced concrete pavement (8" minimum, 4,000 p.s.i.)

Anchorage requirements are as follows:

| WITH FOUNDATION TYPE: | ANCHOR WITH: |
|---|---|
| Minimum six inch portland cement concrete pad | Epoxy anchoring system with 7" studs, 5.5" embedment |

## 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. For bi-directional traffic, appropriate transition panels will be required.
3. Details of components for the QUAD and backups and reinforcing details will be shown on the manufacturer's shop drawings furnished to the Engineer.
4. Concrete shall be class "S" with a minimum compressive strength of 4,000 p.s.i.
5. If the cross-slope varies more than 2% over the length of the system, the concrete pad will require levelling. Maximum permissible cross-slope is 8%.
6. The installation area should be free from curbs, elevated objects, or depressions.
7. The QUAD system should be approximately parallel with the barrier or ℄ of merging barriers.
8. Unit width selected should be adequate to protect an errant vehicle travelling at 15 degrees to the roadway from the face or corner of the fixed object.




| "B" | "W" |
|---|---|
| 70.5" | 69" |
| 91.5" | 90" |

TYPE B
CONCRETE BACKUP

CAST-IN-PLACE CONCRETE WALL BACKUP: If cast-in-place structures such as bridge parapets, columns, or special walls are used as backup structures, then intermediate walls shall be provided between the structures and the QUAD unit. Intermediate walls shall be equal in height and width to the QUAD unit and reinforced with a steel cage. A cast-in-place transition section from concrete barrier may be used. Reinforcing steel should transition from the standard barrier section to the standard backup section. Details for the intermediate walls, cast-in-place transition sections, or other modifications will be shown elsewhere in the plans. Concrete wall backups may be used on continuously reinforced concrete pavement pavement or bridge deck (7" minimum, 4,000 p.s.i)or non-reinforced concrete pavement (8" minimum, 4,000 p.s.i.) In those cases, all vertical steel will be doweled (5 inch minimum) into existing decks or located and placed prior to pouring proposed decks as approved by the Engineer.

Texas Department of Transportation

Design Division Standard

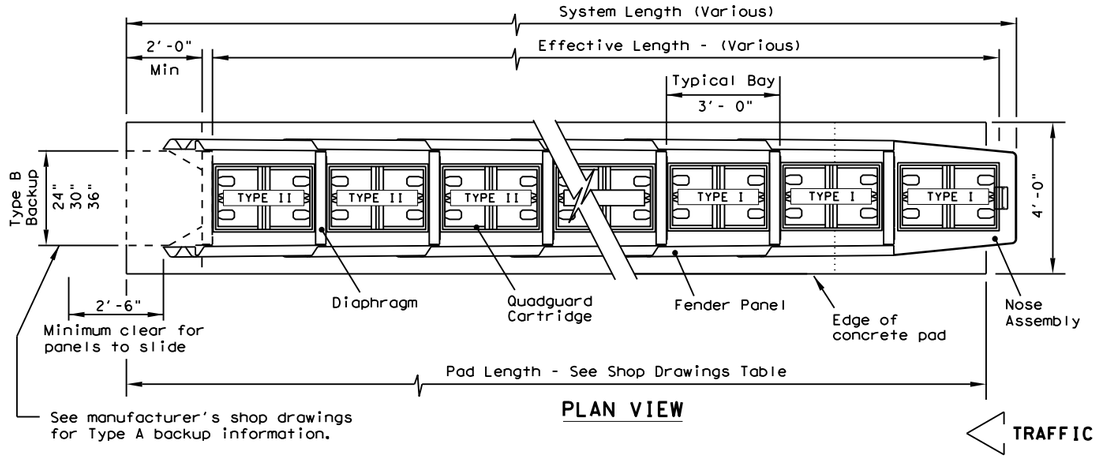
# TRINITY HIGHWAY ENERGY ABSORPTION (QUADGUARD II) (WIDE)

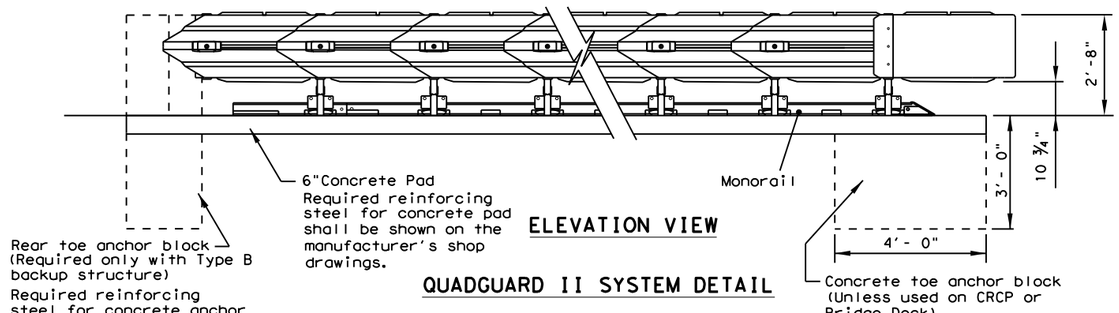
# QUAD(W)-17

| FILE: quadw17.dgn | DN: TxDOT | CK: KM | DW: VP | CK: KM |
|---|---|---|---|---|
| ©TxDOT: FEBRUARY 1998 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS REVISED 06,2013 VP REVISED 03,2016 VP REVISED 03,2017 KM | 6367 | 43 | 001 | IH 20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 139 |

REUSABLE

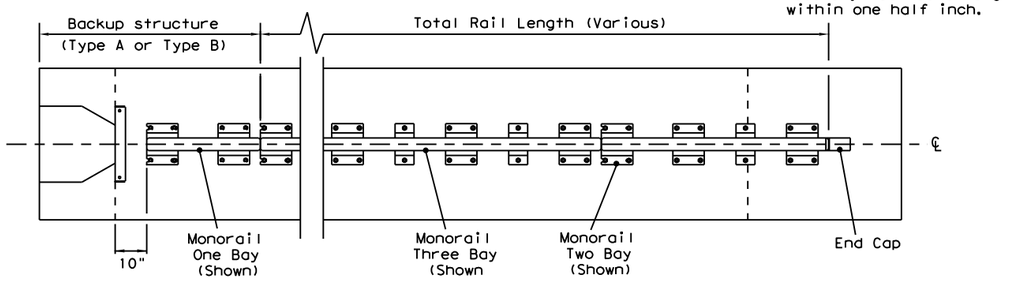
DATE:
FILE:




## QUADGUARD II SYSTEM DETAIL

Note: Monorail & Backup Assembly must be straight within one half inch.



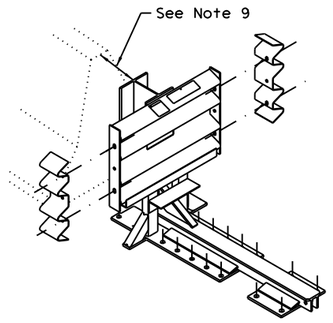

## MONORAIL ASSEMBLY DETAIL

(See the manufacturer's shop drawings for monorail hardware installation.)

| QUADGUARD II (NARROW) SYSTEM | | | | |
|---|---|---|---|---|
| Test Level | NO. OF BAYS | UNIT EFFECTIVE LENGTH | PAD LENGTH TYPE A | PAD LENGTH TYPE B |
| TL-2 | 2 | 8'- 8" | 9'- 0" | 8'- 6" |
| TL-3 | 5 | 17'- 8" | 18'- 0" | 17'- 6" |
| 70 | 8 | 26'- 8" | 27'- 0" | 26'- 6" |

Additional bays may be added if special considerations warrant and site conditions will accommodate additional length.

QUAD II (N) units are available in 24", 30", or 36" widths from 2 to 8 bays. Unit width, number of bays, and backup type shall be specified elsewhere in the plans.




### TYPE A TENSION STRUT BACKUP

TENSION STRUT: Consists of diagonal struts, connections, and accessories, as detailed by the Manufacturer, located at the rear of the QUAD unit. Typical application is for QUAD units attached to double-face guardrail. When used, a 4'-0"x 4'-0"x 3'-0" concrete toe anchor block shall be provided beneath the front portion of the concrete pad, except where the QUAD unit is to be placed on continuously reinforced concrete pavement or bridge deck (7" minimum, 4,000 p.s.i.) or non-reinforced concrete pavement (8" minimum, 4,000 p.s.i.)

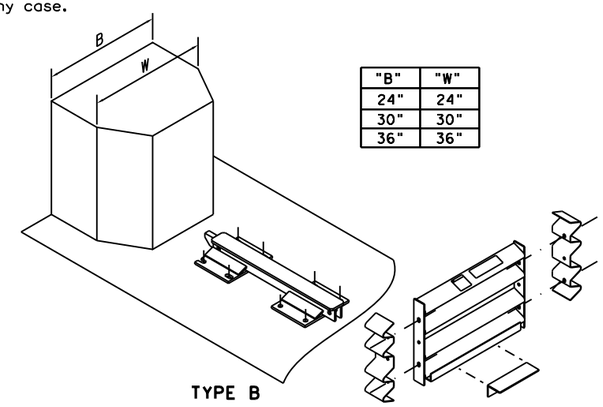
Anchorage requirements are as follows:

| WITH FOUNDATION TYPE: | ANCHOR WITH: |
|---|---|
| Minimum six inch portland cement concrete pad | MP-3 polyester anchoring system with 7" studs, 5.5" embedment |
| Minimum three inch asphaltic concrete over minimum three inch portland cement concrete | MP-3 polyester anchoring system with 18" studs, 16.5" embedment |
| Minimum six inch asphaltic concrete over minimum six inch compacted base | MP-3 polyester anchoring system with 18" studs, 16.5" embedment |
| Minimum eight inch asphaltic concrete | MP-3 polyester anchoring system with 18" studs, 16.5" embedment |

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. A zero clearance between the backup and barrier wall is recommended in no case should this distance exceed 7 inches.

## 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. For bi-directional traffic, appropriate transition panels will be required.
3. Details of components for the QUAD and backups and reinforcing details will be shown on the manufacturer's shop drawings furnished to the Engineer.
4. Concrete shall be class "S" with a minimum compressive strength of 4,000 p.s.i.
5. If the cross-slope varies more than 2% over the length of the system, the concrete pad will require levelling. Maximum permissible cross-slope is 8%.
6. The installation area should be free from curbs, elevated objects, or depressions.
7. The QUAD system should be approximately parallel with the barrier or ℄ of merging barriers.
8. Unit width selected should be adequate to protect an errant vehicle travelling at 15 degrees to the roadway from the face or corner of the fixed object.
9. For the permanent steel backup, (Type A) the distance between the back of backup and the barrier wall should not exceed 7 inches in any case.




| "B" | "W" |
|---|---|
| 24" | 24" |
| 30" | 30" |
| 36" | 36" |

### TYPE B CONCRETE BACKUP

CAST-IN-PLACE CONCRETE WALL BACKUP: If cast-in-place structures such as bridge parapets, columns, or special walls are used as backup structures, then intermediate walls shall be provided between the structures and the QUAD unit. Intermediate walls shall be equal in height and width to the QUAD unit and reinforced with a steel cage. A cast-in-place transition section from concrete barrier may be used. Reinforcing steel should transition from the standard barrier section to the standard backup section. Details for the intermediate walls, cast-in-place transition sections, or other modifications will be shown elsewhere in the plans. Concrete wall backups may be used on continuously reinforced concrete pavement pavement or bridge deck (7" minimum, 4,000 p.s.i)or non-reinforced concrete pavement (8" minimum, 4,000 p.s.i.) In those cases, all vertical steel will be doweled (5 inch minimum) into existing decks or located and placed prior to pouring proposed decks as approved by the Engineer.

REUSABLE

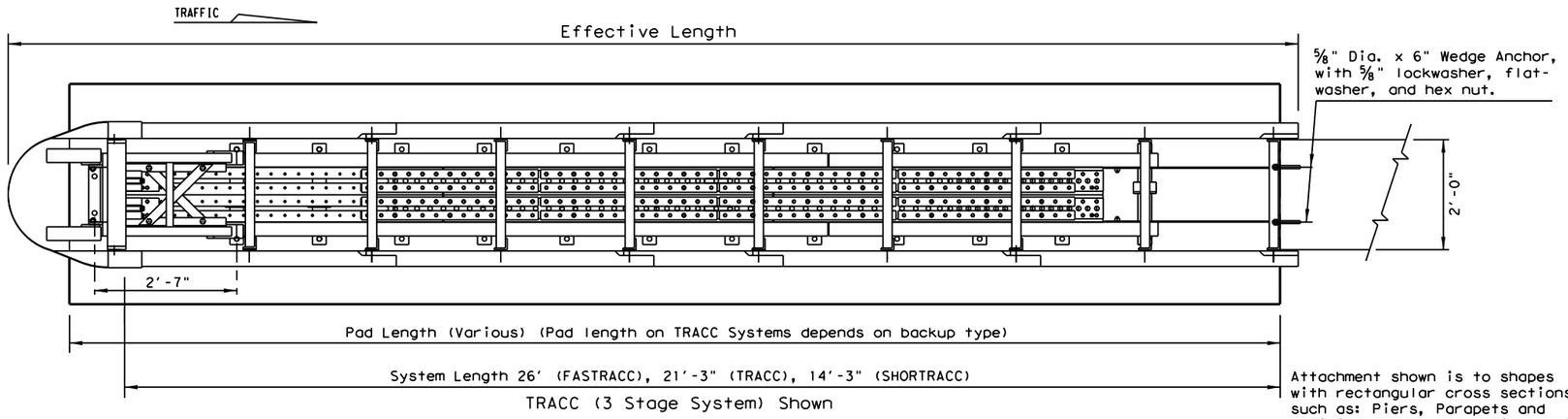
Texas Department of Transportation — Design Division Standard

# TRINITY HIGHWAY ENERGY ABSORPTION (QUADGUARD II) (NARROW)

# QUAD(N)-16

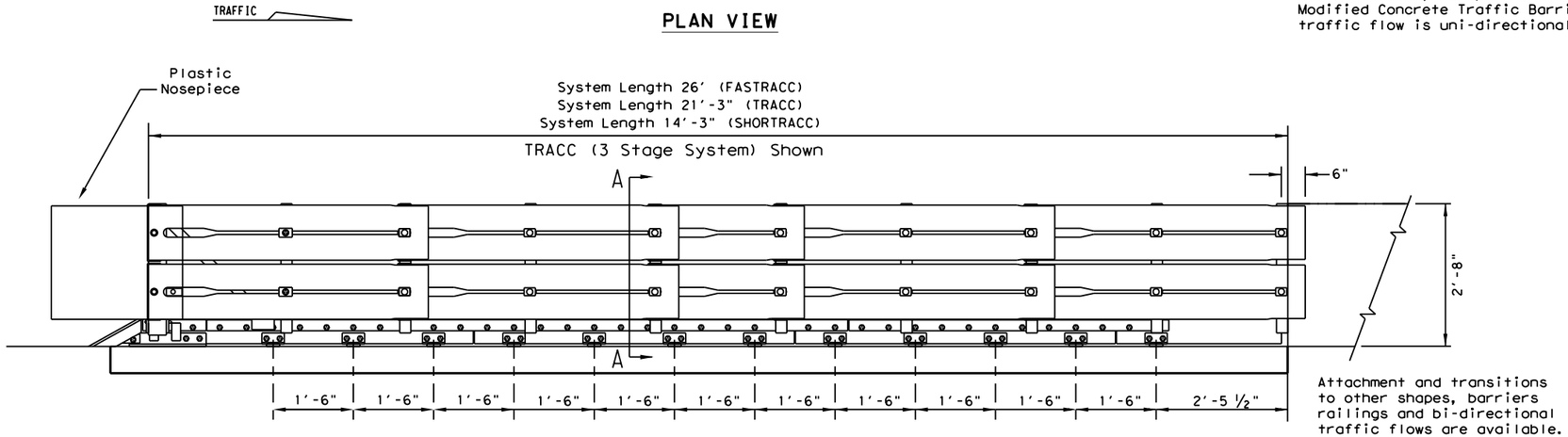
| FILE: quadn16.dgn | DN: TxDOT | CK: KM | DW: VP | CK: VP |
|---|---|---|---|---|
| ©TxDOT: February 1998 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| REVISED 06,2013 (VP) | DIST | COUNTY | | SHEET NO. |
| REVISED 03,2016 (VP) | 10 | SMITH, ETC. | | 140 |

DATE:
FILE:



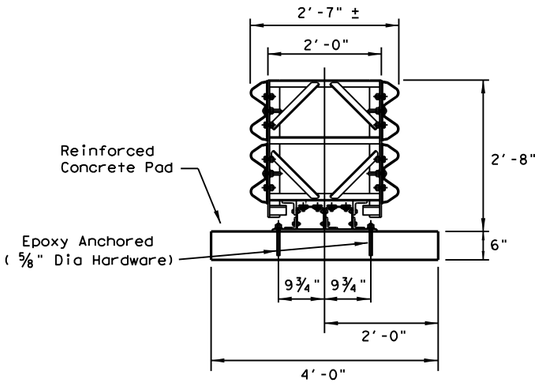

PLAN VIEW

Attachment shown is to shapes with rectangular cross sections such as: Piers, Parapets and Modified Concrete Traffic Barriers, traffic flow is uni-directional.




ELEVATION VIEW

Attachment and transitions to other shapes, barriers railings and bi-directional traffic flows are available. (See manufacturer's product manual)




SECTION A-A

| 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).

| TYPE (NARROW) | TEST LEVEL | SYSTEM LENGTH | EFFECTIVE LENGTH | PAD LENGTHS |
|---|---|---|---|---|
| **FASTRACC** (4 Stage System) | 70 | 26' | 27'- 9" | 26'- 8" |
| **TRACC** (3 Stage System) | TL-3 | 21'- 3" | 23'- 0" | 22'- 0"<br>23'- 0"<br>24'- 0" |
| **SHORTRACC** (2 Stage System) | TL-2 | 14'- 3" | 16'- 0" | 15'- 0"<br>16'- 0"<br>17'- 0" |

The Stage System refers to number of replaceable sled sections that could be replaced independently.

Concrete pad length on TRACC & SHORTRACC depends on backup type.

| 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

1. For specific information regarding installation and technical guidance of the system, contact: Trinity Highway at 1(888)323-6374. 2525 N. Stemmons Freeway - Dallas, TX 75207
2. For bi-directional traffic, appropriate transition panels will be required.
3. Details of components for the TRACC and backups and reinforcing details will be shown on the manufacturer's shop drawings furnished to the Engineer.
4. Concrete shall be class "S" with a minimum compressive strength of 4,000 p.s.i.
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 TRACC system should be approximately parallel with the barrier or ℄ of merging barriers.

## BILL OF MATERIAL

| PART # | FAST TRACC QTY | TRACC QTY | SHORT TRACC QTY | DESCRIPTION |
|---|---|---|---|---|
| 25936A | 1 | | | FASTRACC Unit Assembly |
| 25980A | | 1 | | TRACC Unit Assembly |
| 25997A | | | 1 | SHORTRACC Unit Assembly |
| 3310G | 4 | 4 | 4 | 5/8" Lockwasher |
| 4451G | 4 | 4 | 4 | 5/8" Dia x 6" Wedge Exp. Anchor |
| | | | | |
| 6531B | 1 | 1 | 1 | Plastic Nosepiece |
| 6668B | 4 | 4 | 4 | Reflective Sheeting |
| | | | | |
| ✳ ANCHOR HARDWARE (CONCRETE BASE) | | | | |
| 5204G | 32 | 26 | 18 | 5/8"Dia x 7 1/2" All Thd. Rod |
| 3310G | 32 | 26 | 18 | 5/8" Lockwasher |
| 3361G | 32 | 26 | 18 | 5/8" Hex Nut |
| 3300G | 32 | 26 | 18 | 5/8" Flat Washer |
| 5206B | 3 | 3 | 2 | TRACC Adhesive HIT HY150 Kit |
| | | | | |
| ✳ ANCHOR HARDWARE (ASPHALT BASE) | | | | |
| 6380G | 32 | 26 | 18 | 5/8" Dia x 18" All Thd. Rod |
| 3310G | 32 | 26 | 18 | 5/8" Lockwasher |
| 3361G | 32 | 26 | 18 | 5/8" Hex Nut |
| 3300G | 32 | 26 | 18 | 5/8" Flat Washer |
| 5206B | 7 | 5 | 4 | TRACC Adhesive HIT HY150 Kit |

✳ See manufacturer's product manual

Texas Department of Transportation

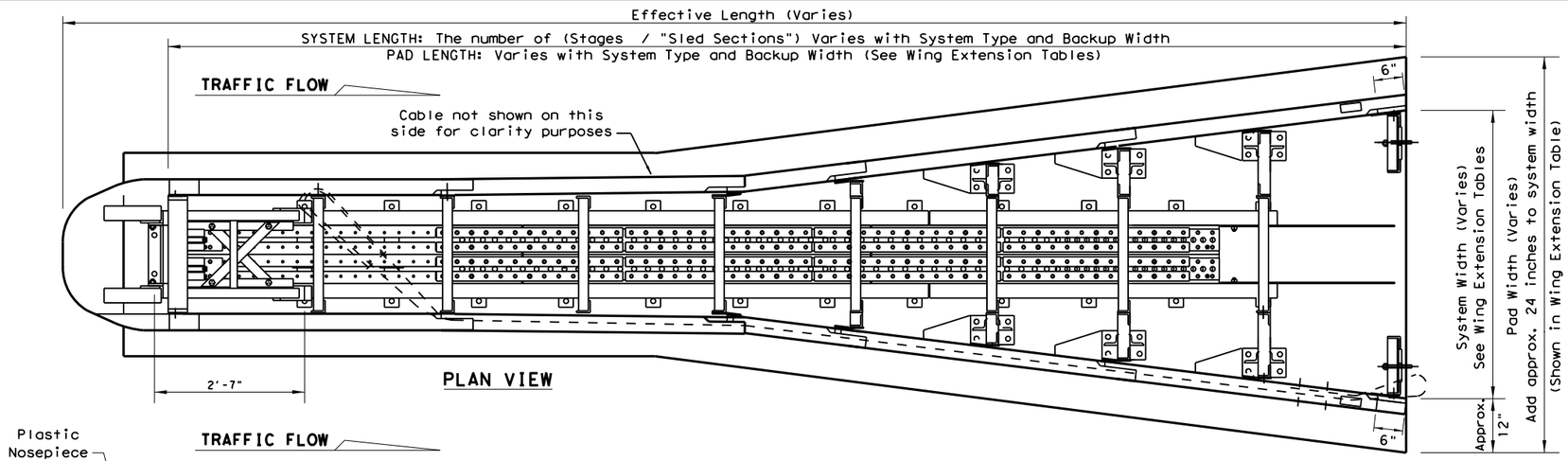
Design Division Standard

# TRINITY HIGHWAY
# CRASH CUSHION (NARROW)
# TRACC(N)-16

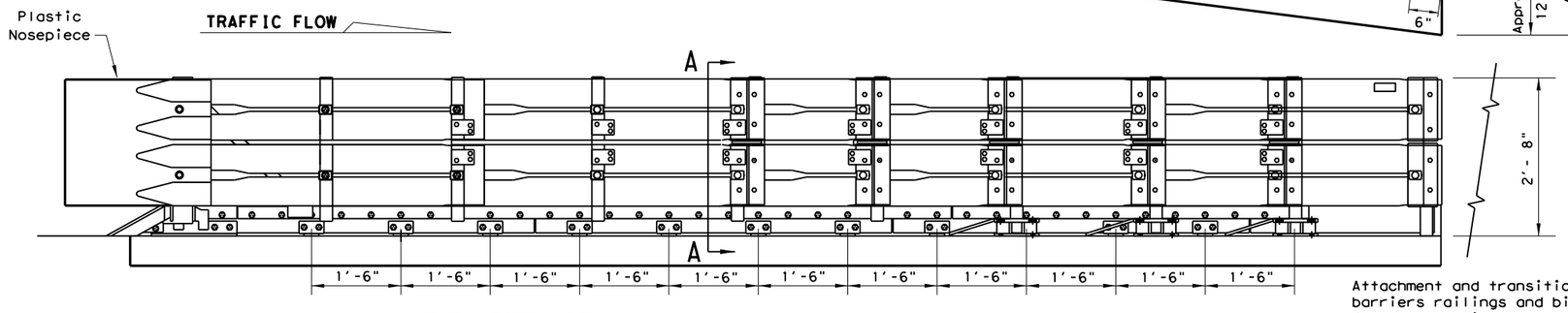
| FILE: traccn16.dgn | DN: TxDOT | CK: KM | DW: VP | CK: VP |
|---|---|---|---|---|
| ©TxDOT: February 2006 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS<br>REVISED 06, 2013 (VP)<br>REVISED 03, 2016 (VP) | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 141 |

REUSABLE

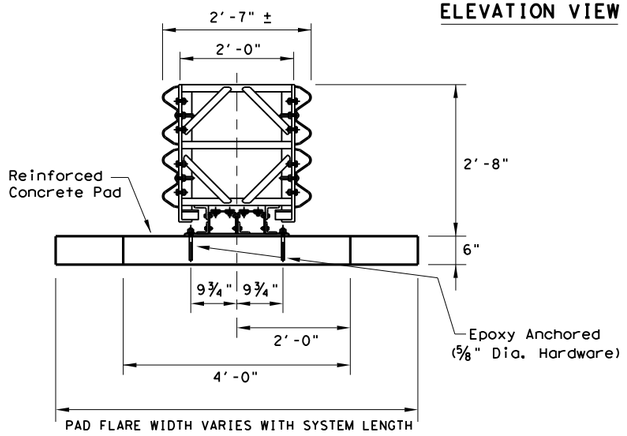
DATE:
FILE:




PLAN VIEW




ELEVATION VIEW




SECTION A-A

| TYPE (WIDE) | TEST LEVEL |
|---|---|
| FASTRACC (4 Stage System) | 70 |
| TRACC (3 Stage System) | TL-3 |
| SHORTRACC (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-SHORTRACC WING EXTENSIONS**

| NUMBER OF WING EXTENSIONS | WIDTH | SYSTEM LENGTH | EFFECTIVE LENGTH | Wide-SHORTRACC 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 |

## GENERAL NOTES

1. For specific information regarding installation and technical guidance of the system, contact: Trinity Highway at 1(888)323-6374. 2525 N. Stemmons Freeway - Dallas, TX 75207
2. Contact the company for: Custom widths from 31" up to 57" wide, and transition panels for bi-directional traffic applications.
3. Details of components for the WideTRACC, Backups and re-inforcing details will be shown on the manufacturer's shop drawings furnished to the Engineer.
4. Concrete shall be class "S" with a min. compressive strength 4,000 p.s.i.
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 8%.
6. The installation area should be free from curbs, elevated objects, or depressions.
7. The WideTRACC system should be approximately parallel with the barrier or ℄ of merging barriers.
8. The Unit shown is flared on both sides, but can be flared on a single side ether left or right. The flares will effect the length and width of the system. (See Wing Extension Tables)

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 MANUFACTORER'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).

**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 | WIDESHORTRACC UNIT ASSEMBLY |
| 3310G | 4 | 4 | 4 | ⅝" LOCKWASHER |
| 4372G | 4 | 4 | 4 | ⅝" FLATWASHER |
| 4451G | 4 | 4 | 4 | ⅝" 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 | ⅝" DIA X 7-1/16" THD ANCHOR STUD |
| 4372G | 72 | 50 | 18 | ⅝" FLATWASHER |
| 3310G | 72 | 50 | 18 | ⅝" LOCKWASHER |
| 3361G | 72 | 50 | 18 | ⅝" HEX NUT |
| 5206B | 6 | 4 | 2 | Adhesive, Hilti Hit HY-150 |
| **ANCHOR HARDWARE (ASPHALT BASE)** | | | | |
| 6380G | 72 | 50 | 18 | ⅝"Dia x 18" Thd Anchor Stud |
| 4372G | 72 | 50 | 18 | ⅝" Flatwasher |
| 3310G | 72 | 50 | 18 | ⅝" Lockwasher |
| 3361G | 72 | 50 | 18 | ⅝" 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, 11/16", HILTI SDS |

Texas Department of Transportation

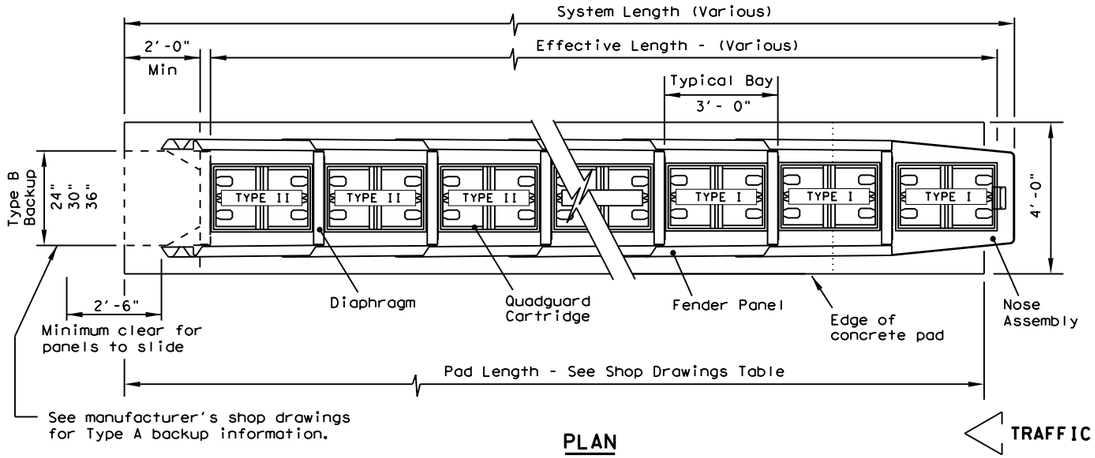
Design Division Standard

# TRINITY HIGHWAY
# CRASH CUSHION (WIDE UNIT)
# TRACC(W)-16

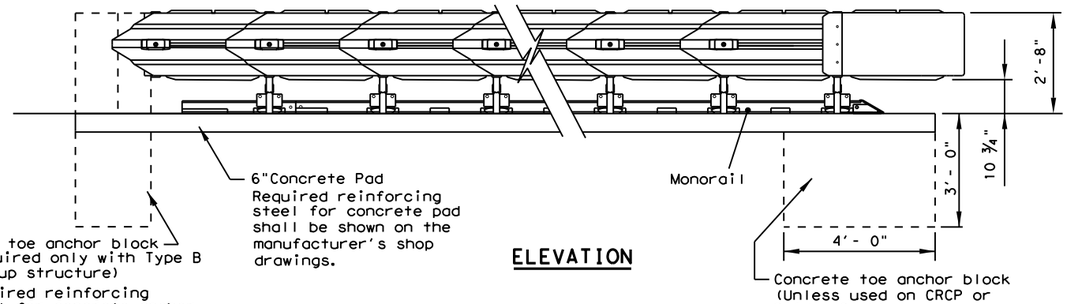
| FILE: traccw16.dgn | DN: TxDOT | CK: KM | DW: VP | CK: VP |
|---|---|---|---|---|
| © TxDOT February 2006 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| REVISED 06, 2013 (VP) | DIST | COUNTY | | SHEET NO. |
| REVISED 03, 2016 (VP) | 10 | SMITH, ETC. | | 142 |

REUSABLE

DATE:
FILE:



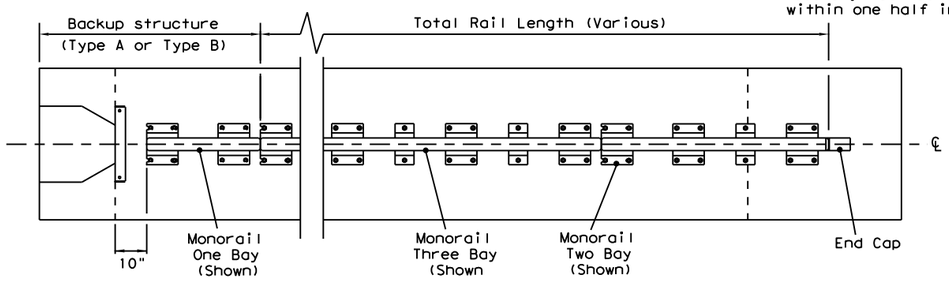

PLAN



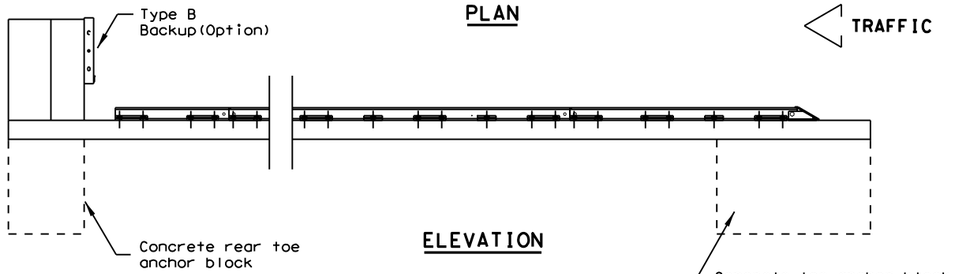

ELEVATION

## QUADGUARD II SYSTEM DETAIL

Note: Monorail & Backup Assembly must be straight within one half inch.




PLAN




ELEVATION

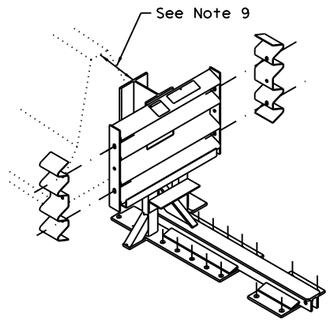
## MONORAIL ASSEMBLY DETAIL

(See the manufacturer's shop drawings for monorail hardware installation.)

| QUADGUARD II (NARROW) SYSTEM | | | | |
|---|---|---|---|---|
| Test Level | NO. OF BAYS | UNIT EFFECTIVE LENGTH | PAD LENGTH TYPE A | PAD LENGTH TYPE B |
| TL-2 | 2 | 8'- 8" | 9'- 0" | 8'- 6" |
| TL-3 | 5 | 17'- 8" | 18'- 0" | 17'- 6" |
| 70 | 8 | 26'- 8" | 27'- 0" | 26'- 6" |

Additional bays may be added if special considerations warrant and site conditions will accommodate additional length.

QUAD II (N) units are available in 24", 30", or 36" widths from 2 to 8 bays. Unit width, number of bays, and backup type shall be specified elsewhere in the plans.




### TYPE A
### TENSION STRUT BACKUP

TENSION STRUT: Consists of diagonal struts, connections, and accessories, as detailed by the Manufacturer, located at the rear of the QUAD unit. Typical application is for QUAD units attached to double-face quardrail. When used, a 4'-0"x 4'-0"x 3'-0" concrete toe anchor block shall be provided beneath the front portion of the concrete pad, except where the QUAD unit is to be placed on continuously reinforced concrete pavement or bridge deck (7" minimum, 4,000 p.s.i.) or non-reinforced concrete pavement (8" minimum, 4,000 p.s.i.)

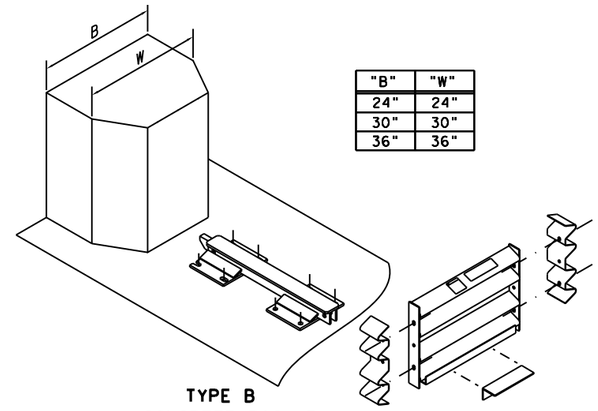
Anchorage requirements are as follows:

| WITH FOUNDATION TYPE: | ANCHOR WITH: |
|---|---|
| Minimum six inch portland cement concrete pad | MP-3 polyester anchoring system with 7" studs, 5.5" embedment |
| Minimum three inch asphaltic concrete over minimum three inch portland cement concrete | MP-3 polyester anchoring system with 18" studs, 16.5" embedment |
| Minimum six inch asphaltic concrete over minimum six inch compacted base | MP-3 polyester anchoring system with 18" studs, 16.5" embedment |
| Minimum eight inch asphaltic concrete | MP-3 polyester anchoring system with 18" studs, 16.5" embedment |

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. A zero clearance between the backup and barrier wall is recommended in no case should this distance exceed 7 inches.

## GENERAL NOTES

1. For additional information contact Energy Absorption Systems Inc. at (888)323-6374.
2. For bi-directional traffic, appropriate transition panels will be required.
3. Details of components for the QUAD and backups and reinforcing details will be shown on the manufacturer's shop drawings furnished to the Engineer.
4. Concrete shall be class "S" with a minimum compressive strength of 4,000 p.s.i.
5. If the cross-slope varies more than 2% over the length of the system, the concrete pad will require levelling. Maximum permissible cross-slope is 8%.
6. The installation area should be free from curbs, elevated objects, or depressions.
7. The QUAD system should be approximately parallel with the barrier or ℄ of merging barriers.
8. Unit width selected should be adequate to protect an errant vehicle travelling at 15 degrees to the roadway from the face or corner of the fixed object.
9. For the permanent steel backup, (Type A) the distance between the back of backup and the barrier wall should not exceed 7 inches in any case.




| "B" | "W" |
|---|---|
| 24" | 24" |
| 30" | 30" |
| 36" | 36" |

### TYPE B
### CONCRETE BACKUP

CAST-IN-PLACE CONCRETE WALL BACKUP: If cast-in-place structures such as bridge parapets, columns, or special walls are used as backup structures, then intermediate walls shall be provided between the structures and the QUAD unit. Intermediate walls shall be equal in height and width to the QUAD unit and reinforced with a steel cage. A cast-in-place transition section from concrete barrier may be used. Reinforcing steel should transition from the standard barrier section to the standard backup section. Details for the intermediate walls, cast-in-place transition sections, or other modifications will be shown elsewhere in the plans. Concrete wall backups may be used on continuously reinforced concrete pavement pavement or bridge deck (7" minimum, 4,000 p.s.i)or non-reinforced concrete pavement (8" minimum, 4,000 p.s.i.) In those cases, all vertical steel will be doweled (5 inch minimum) into existing decks or located and placed prior to pouring proposed decks as approved by the Engineer.

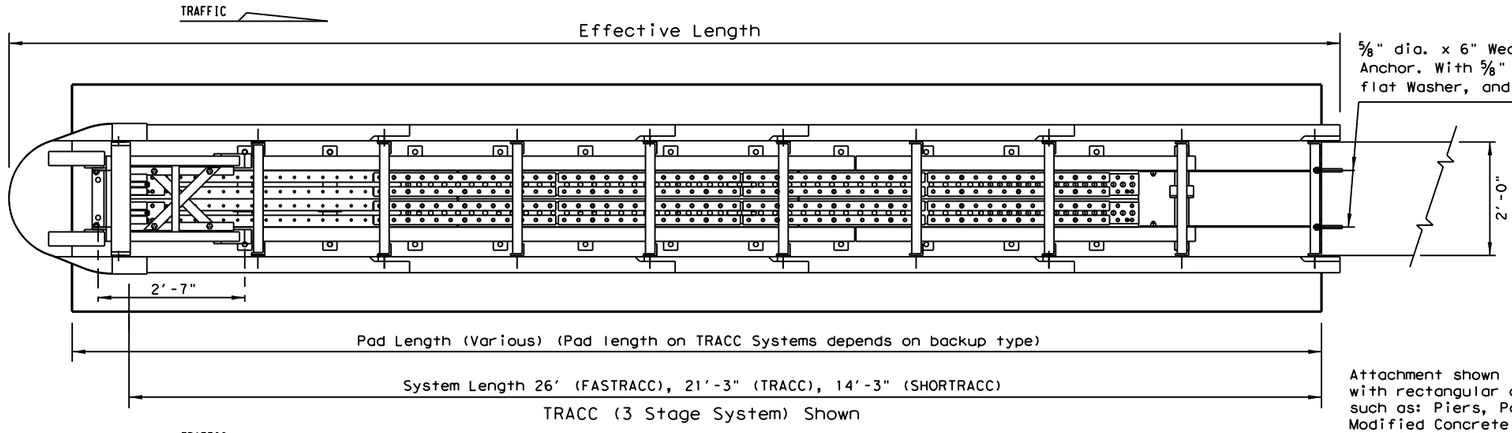
Texas Department of Transportation — Design Division Standard

# QUADGUARD II SYSTEM (NARROW)

# QUAD(N)-13

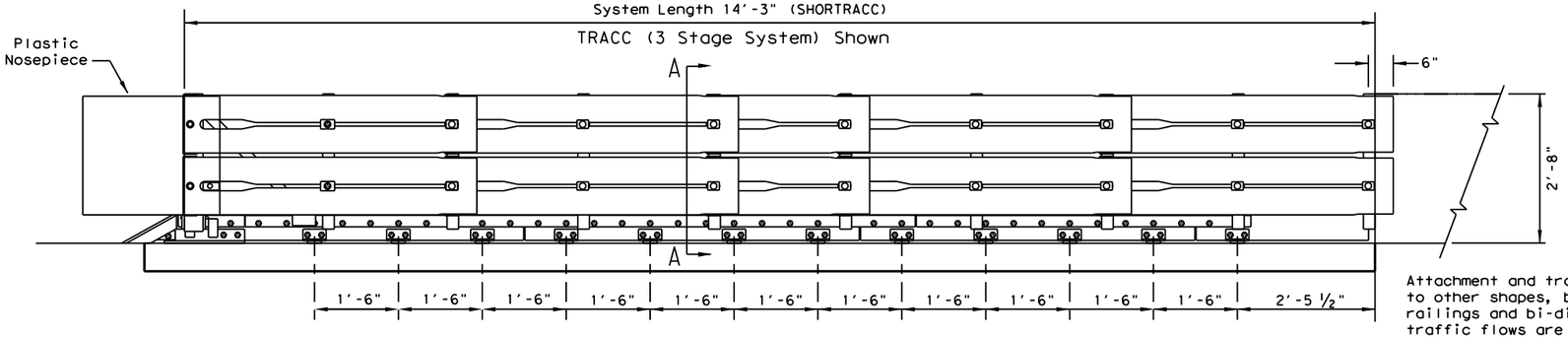
| FILE: quadn13.dgn | DN: TxDOT | CK: AM | DW: VP | CK: |
|---|---|---|---|---|
| ©TxDOT February 1998 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS REVISED JUNE, 2013 (VP) | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 143 |

DATE:
FILE:



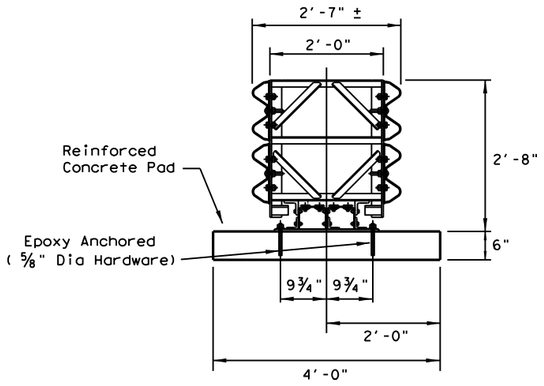

PLAN

Attachment shown is to shapes with rectangular cross sections such as: Piers, Parapets and Modified Concrete Traffic Barriers, traffic flow is uni-directional.




ELEVATION

Attachment and transitions to other shapes, barriers railings and bi-directional traffic flows are available. (See manufacturer's product manual)




SECTION A-A

| 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).

| TYPE (NARROW) | TEST LEVEL | SYSTEM LENGTH | EFFECTIVE LENGTH | PAD LENGTHS |
|---|---|---|---|---|
| **FASTRACC** (4 Stage System) | 70 | 26' | 27'- 9" | 26'- 8" |
| **TRACC** (3 Stage System) | TL-3 | 21'- 3" | 23'- 0" | 22'- 0"<br>23'- 0"<br>24'- 0" |
| **SHORTRACC** (2 Stage System) | TL-2 | 14'- 3" | 16'- 0" | 15'- 0"<br>16'- 0"<br>17'- 0" |

The Stage System refers to number of replaceable sled sections that could be replaced independently.

Concrete pad length on TRACC & SHORTRACC depends on backup type.

| 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

1. For additional information contact, Trinity Highway Products at 1(800)527-6050.
2. For bi-directional traffic, appropriate transition panels will be required.
3. Details of components for the TRACC and backups and reinforcing details will be shown on the manufacturer's shop drawings furnished to the Engineer.
4. Concrete shall be class "S" with a minimum compressive strength of 4,000 p.s.i.
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 TRACC system should be approximately parallel with the barrier or ℄ of merging barriers.

## BILL OF MATERIAL

| PART # | FAST TRACC QTY | TRACC QTY | SHORT TRACC QTY | DESCRIPTION |
|---|---|---|---|---|
| 25936A | 1 | | | FASTRACC Unit Assembly |
| 25980A | | 1 | | TRACC Unit Assembly |
| 25997A | | | 1 | SHORTRACC Unit Assembly |
| 3310G | 4 | 4 | 4 | 5/8" Lockwasher |
| 4451G | 4 | 4 | 4 | 5/8" Dia x 6" Wedge Exp. Anchor |
| | | | | |
| 6531B | 1 | 1 | 1 | Plastic Nosepiece |
| 6668B | 4 | 4 | 4 | Reflective Sheeting |
| | | | | |
| ✳ ANCHOR HARDWARE (CONCRETE BASE) | | | | |
| 5204G | 32 | 26 | 18 | 5/8"Dia x 7 1/2" All Thd. Rod |
| 3310G | 32 | 26 | 18 | 5/8" Lockwasher |
| 3361G | 32 | 26 | 18 | 5/8" Hex Nut |
| 3300G | 32 | 26 | 18 | 5/8" Flat Washer |
| 5206B | 3 | 3 | 2 | TRACC Adhesive HIT HY150 Kit |
| | | | | |
| ✳ ANCHOR HARDWARE (ASPHALT BASE) | | | | |
| 6380G | 32 | 26 | 18 | 5/8" Dia x 18" All Thd. Rod |
| 3310G | 32 | 26 | 18 | 5/8" Lockwasher |
| 3361G | 32 | 26 | 18 | 5/8" Hex Nut |
| 3300G | 32 | 26 | 18 | 5/8" Flat Washer |
| 5206B | 7 | 5 | 4 | TRACC Adhesive HIT HY150 Kit |

✳ See manufacturer's product manual

Texas Department of Transportation

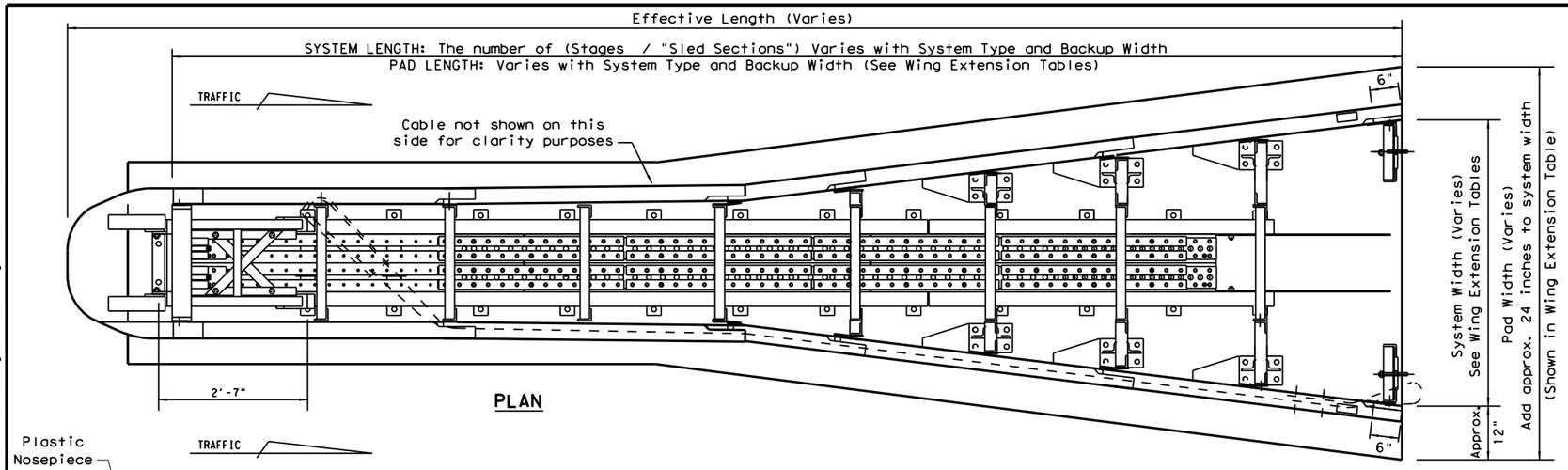
Design Division Standard

# TRINITY ATTENUATING CRASH CUSHION

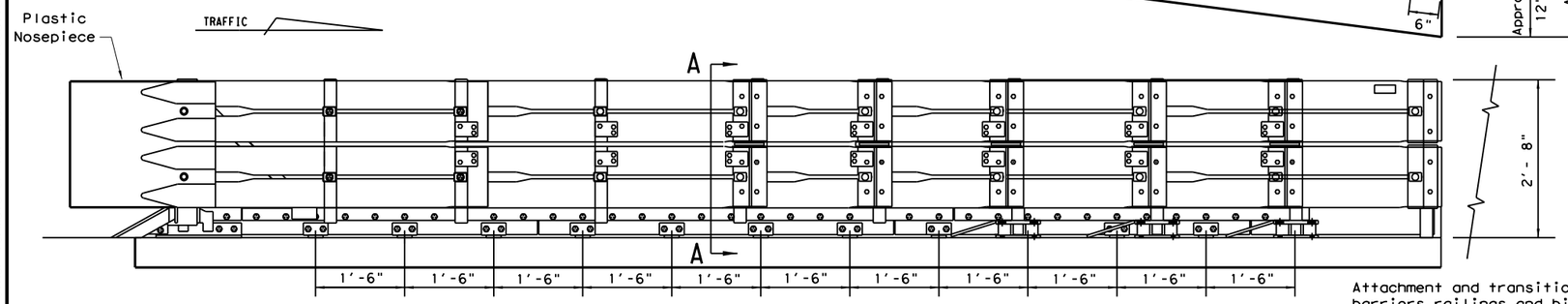
# TRACC(N)-13

| FILE: traccn13.dgn | DN: TxDOT | CK: AM | DW: VP | CK: |
|---|---|---|---|---|
|  | CONT | SECT | JOB | HIGHWAY |
| REVISIONS<br>REVISED JUNE, 2013 (VP) | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 144 |

DATE:
FILE:

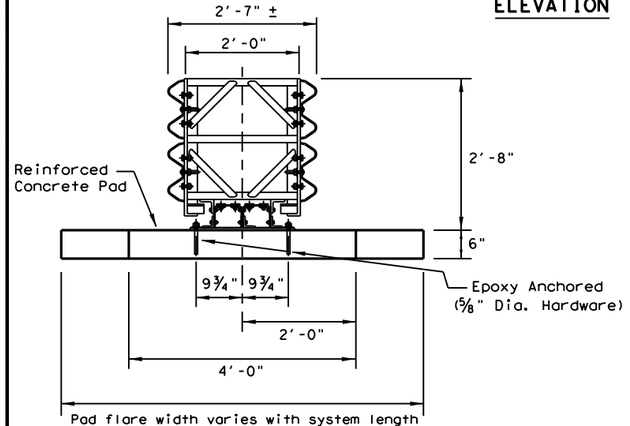



PLAN




ELEVATION

Attachment and transitions to other shapes, barriers railings and bi-directional traffic flows are available.
(See manufacturer's product manual).




SECTION A-A

| TYPE (WIDE) | TEST LEVEL |
|---|---|
| FASTRACC (4 Stage System) | 70 |
| TRACC (3 Stage System) | TL-3 |
| SHORTRACC (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-SHORTRACC WING EXTENSIONS**

| NUMBER OF WING EXTENSIONS | WIDTH | SYSTEM LENGTH | EFFECTIVE LENGTH | Wide-SHORTRACC 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 |

## GENERAL NOTES

1. For custom widths, 31 inches to 57 inches wide. Contact Trinity Highway Products at 1(800)527-6050.
2. For bi-directional traffic, appropriate transition panels will be required.
3. Details of components for the WideTRACC and backups and re-inforcing details will be shown on the manufacturer's shop drawings furnished to the Engineer.
4. Concrete shall be class "S" with a minimum compressive strength of 4,000 p.s.i.
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 WideTRACC system should be approximately parallel with the barrier or ℄ of merging barriers.
8. The Unit shown is flared on both sides, but can be flared on a single side ether 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 | WideSHORTRACC Unit Assembly |
| 3310G | 4 | 4 | 4 | ⅝" Lockwasher |
| 4372G | 4 | 4 | 4 | ⅝" Flatwasher |
| 4451G | 4 | 4 | 4 | ⅝" 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 | ⅝"Dia x 7 1/16 "Thd Anchor Stud |
| 4372G | 72 | 50 | 18 | ⅝" Flatwasher |
| 3310G | 72 | 50 | 18 | ⅝" Lockwasher |
| 3361G | 72 | 50 | 18 | ⅝" Hex Nut |
| 5206B | 6 | 4 | 2 | Adhesive, Hilti Hit HY-150 |
| **ANCHOR HARDWARE (ASPHALT BASE)** | | | | |
| 6380G | 72 | 50 | 18 | ⅝"Dia x 18" Thd Anchor Stud |
| 4372G | 72 | 50 | 18 | ⅝" Flatwasher |
| 3310G | 72 | 50 | 18 | ⅝" Lockwasher |
| 3361G | 72 | 50 | 18 | ⅝" 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, 11/16 ", Hilti SDS |

| 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 manufactorer'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).

Texas Department of Transportation

Design Division Standard

# TRINITY ATTENUATING CRASH CUSHION

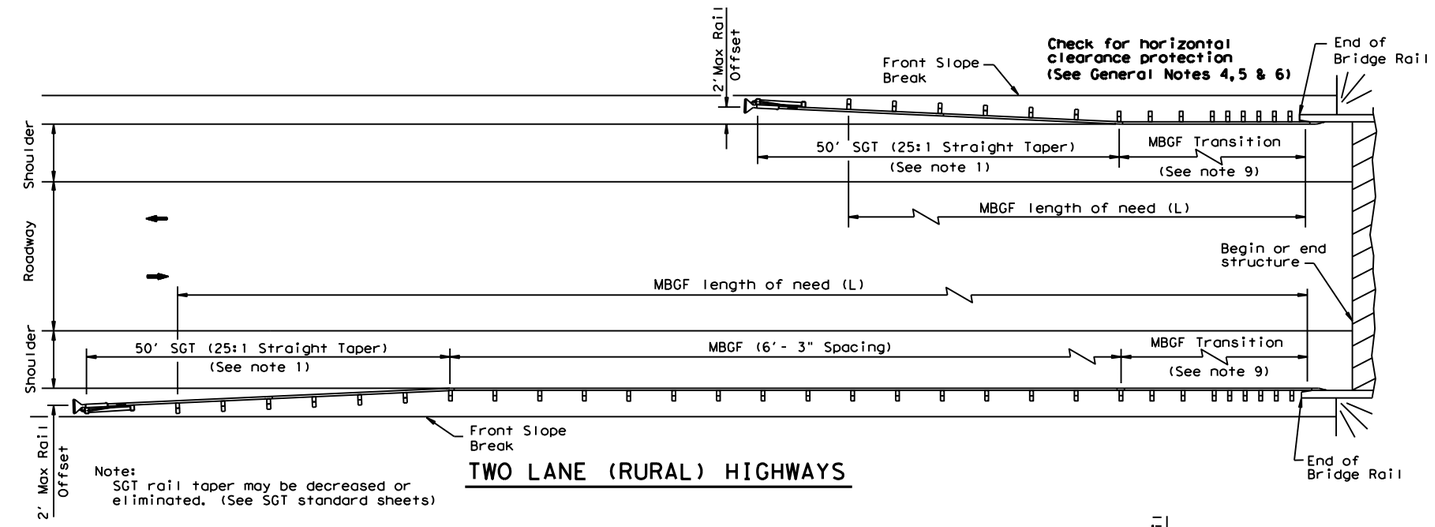
## (WIDE TRACC Systems)

## (FASTRACC, TRACC, SHORTRACC)

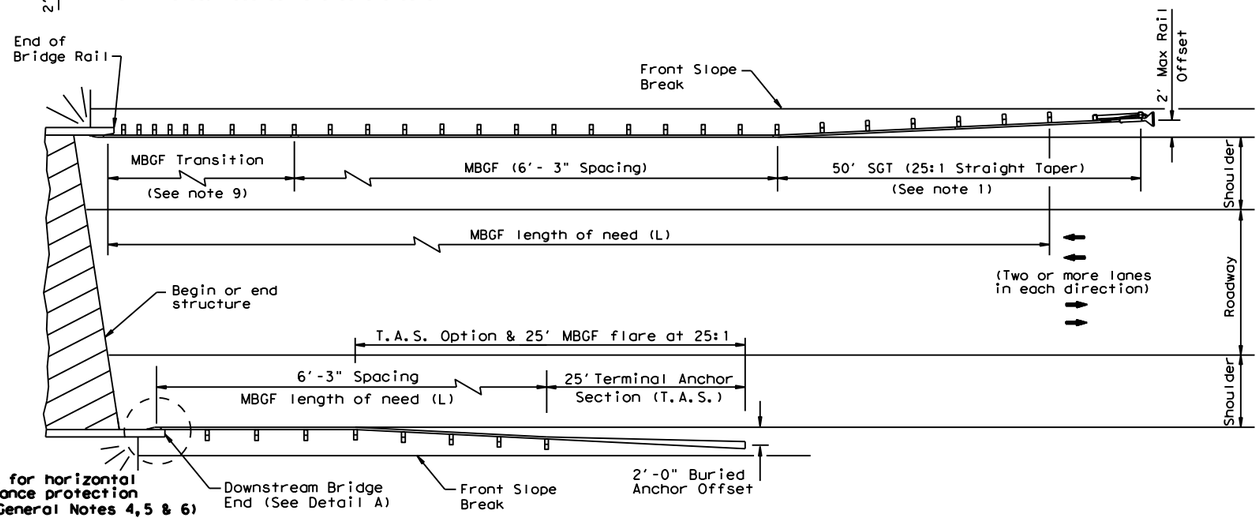
## TRACC(W)-13

| FILE: traccw13.dgn | DN: TxDOT | CK: AM | DW: VP | CK: |
|---|---|---|---|---|
| ©TxDOT February 2003 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS REVISED JUNE, 2013 (VP) | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 145 |

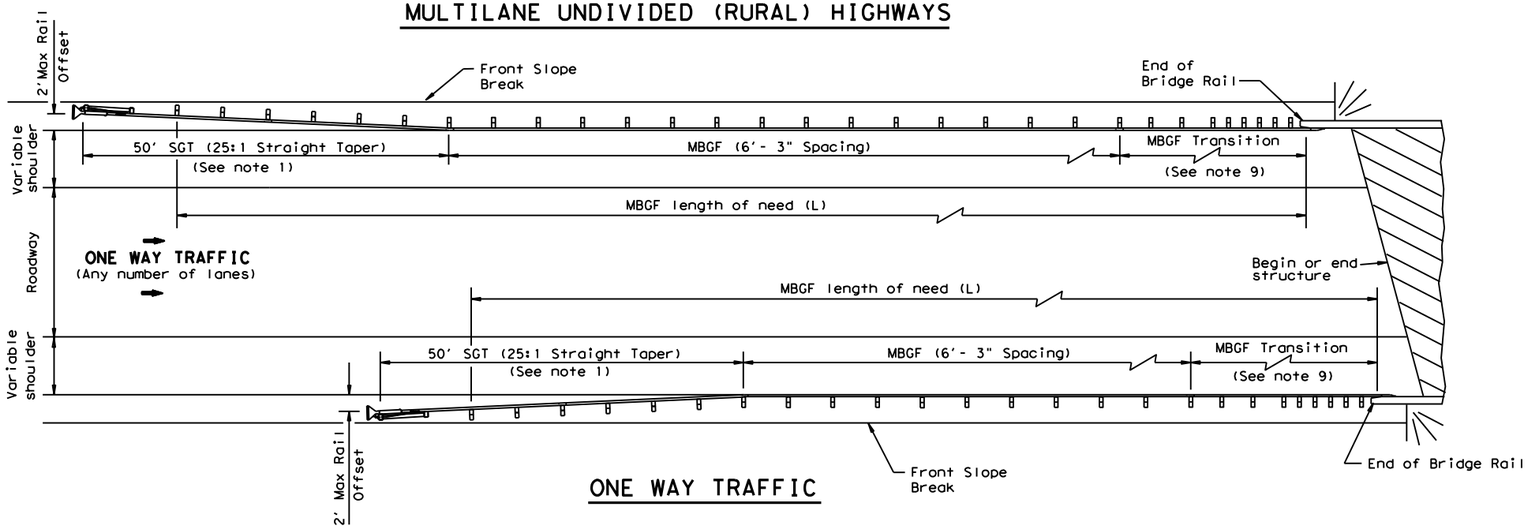
DATE:
FILE:




## TWO LANE (RURAL) HIGHWAYS



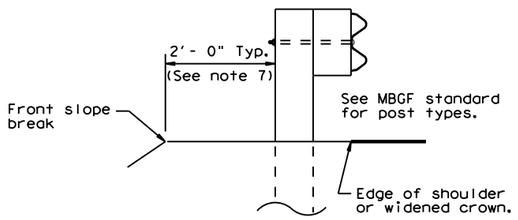

## MULTILANE UNDIVIDED (RURAL) HIGHWAYS



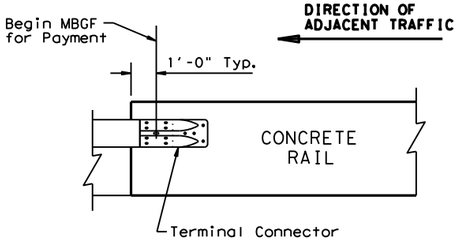

## ONE WAY TRAFFIC

## GENERAL NOTES

1. For more detail: See MBGF, SGT, and MBGF Transition standard sheets.
2. Quantities of metal beam guard fence (MBGF) at individual bridge ends are shown elsewhere in plans.
3. Use average daily traffic (ADT) for the current year to determine MBGF length of need in accordance with the Roadway Design Manual unless otherwise specified. Where significant traffic volume growth is anticipated on low volume (0-750 ADT) highways, use length determinations for the higher volume category.
4. MBGF may not be required to shield departure end of bridge unless other obstacles within the horizontal clearance limits or opposing traffic indicate a MBGF consideration.
5. Terminal anchor sections (TAS) are only for downstream end anchorage use, outside the horizontal clearance area of opposing traffic.
6. Direct connection of MBGF (at 6'-3" post spacing without transition) to concrete rail are only for downstream rail connections outside the horizontal clearance area of opposing traffic. (See Detail A)
7. The crown shall be widened to accommodate MBGF. Typically the "front slope" break should be 2'- 0" from the back of the MBGF post. This applies to new construction on new alignment or where existing roadway cross section is to be widened to increase roadway width. This does not apply to rehabilitation work where existing roadway crown width is to be retained (See Typical Cross Section at MBGF).
8. For restrictive bridge widths: The MBGF should be properly transitioned from the existing bridge rail to the adjoining MBGF (See MBGF Transition Standards). Metal beam guard fence at these bridge location(s) shall be flared at the rate of 25:1 or flatter, and be of the length necessary to locate the terminal end at the 2 ft."maximum" offset from the shoulder edge.
9. Transition length and post spacing will vary depending on the transition type. Transition type will be shown elsewhere in the plans.




## TYPICAL CROSS SECTION AT MBGF




## DETAIL A

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

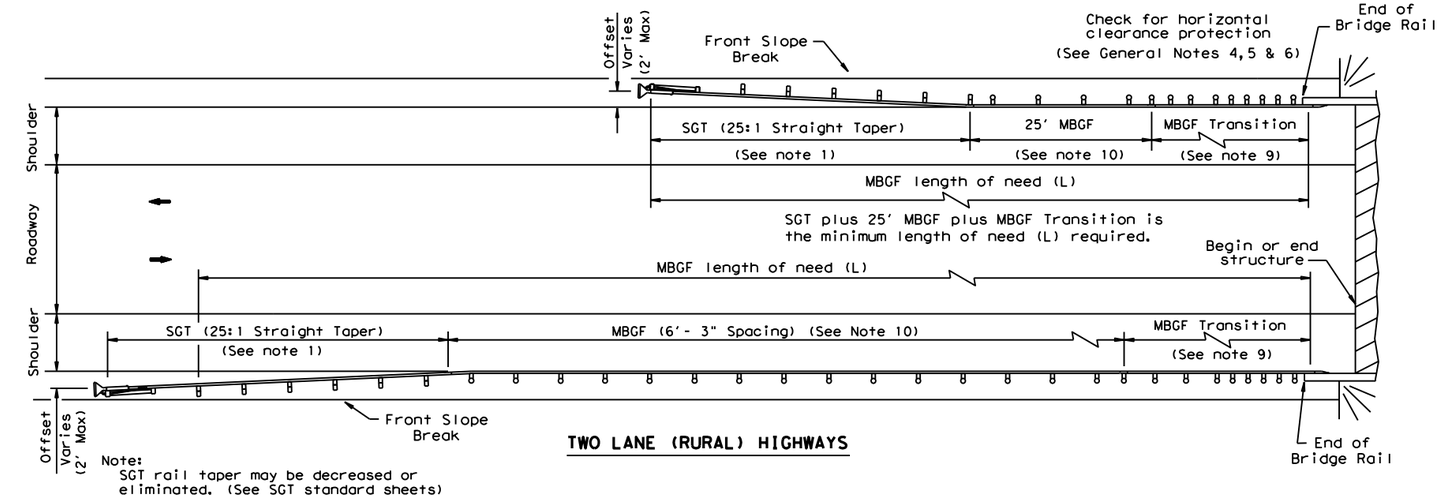
**ONLY FOR USE IN MAINTENANCE REPAIRS.**

Texas Department of Transportation

Design Division Standard

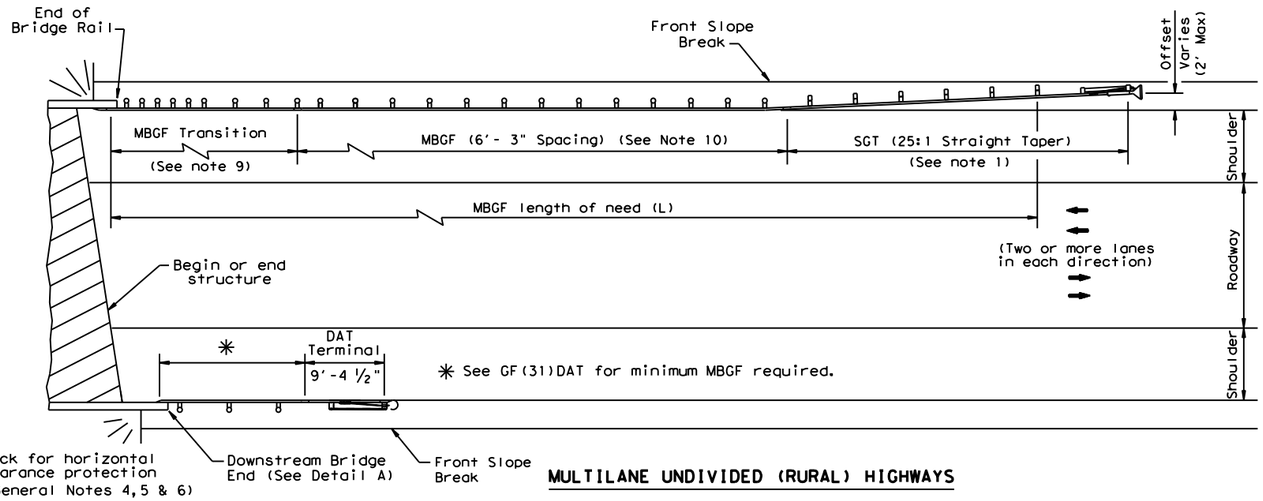
# BRIDGE END DETAILS
## (28" METAL BEAM GUARD FENCE APPLICATIONS TO RIGID RAILS)
# BED(28)-19

| FILE: bed2819.dgn | DN: TxDOT | CK: KM | DW: BD | CK: VP |
|---|---|---|---|---|
| © TxDOT NOVEMBER 2019 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH 20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 146 |

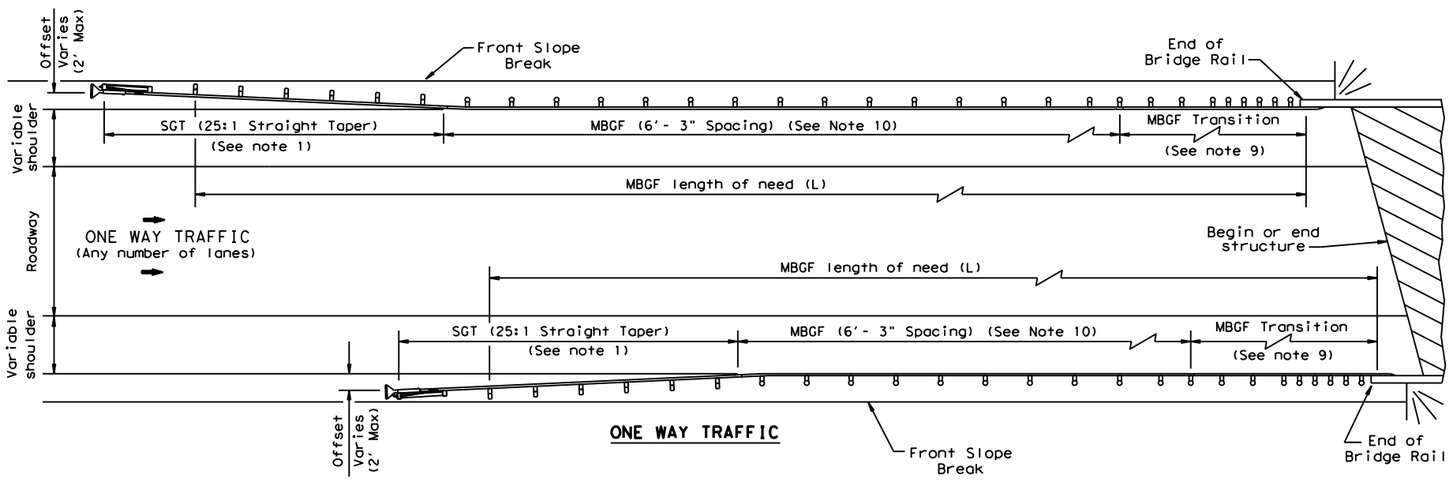



Note:
SGT rail taper may be decreased or eliminated. (See SGT standard sheets)

**TWO LANE (RURAL) HIGHWAYS**



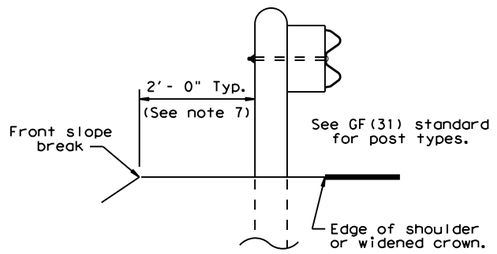

**MULTILANE UNDIVIDED (RURAL) HIGHWAYS**



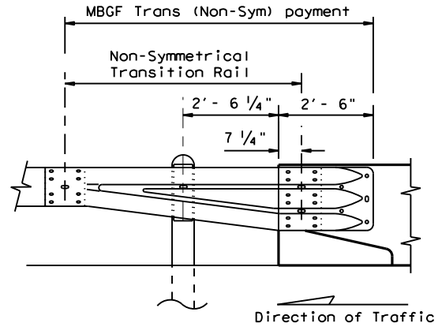

**ONE WAY TRAFFIC**

## GENERAL NOTES

1. For more detail: See GF(31), SGT( )31, GF(31)TR, and GF(31)TL2 standard sheets.
2. Quantities of metal beam guard fence (MBGF) at individual bridge ends are as shown in the 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. Downstream anchor terminals (DAT) are only for downstream end anchorage use, outside the horizontal clearance area of opposing traffic.
6. Direct connection of MBGF to concrete rails are only for downstream rail connections outside the horizontal clearance area of opposing traffic. (This requires a minimum of three standard line posts plus the DAT terminal, See Detail A)
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 in the approach direction.
9. Transition length and post spacing will vary depending on the transition type. Transition type will be shown elsewhere in the plans.
10. A minimum 25' length of MBGF will be required.




**TYPICAL CROSS SECTION AT MBGF**




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

**DETAIL A**

Showing Downstream Rail Attachment

Texas Department of Transportation

Design Division Standard

# BRIDGE END DETAILS

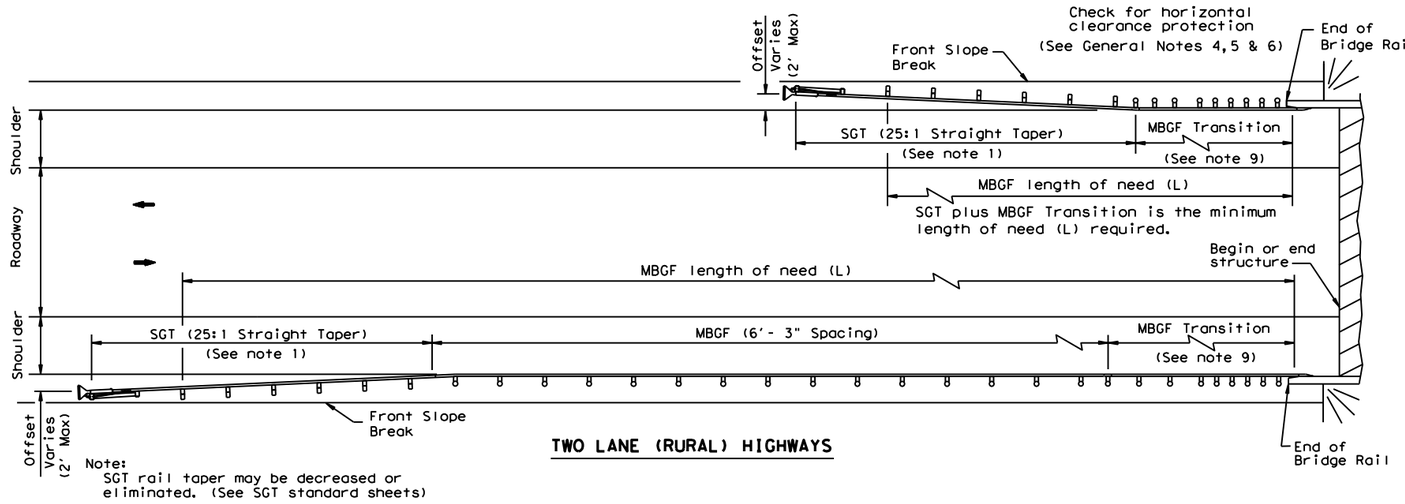
## (METAL BEAM GUARD FENCE APPLICATIONS TO RIGID RAILS)

# BED-14

| FILE: bed14.dgn | DN: TxDOT | CK: AM | DW: BD/VP | CK: CGL |
|---|---|---|---|---|
| © TxDOT: December 2011 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 147 |

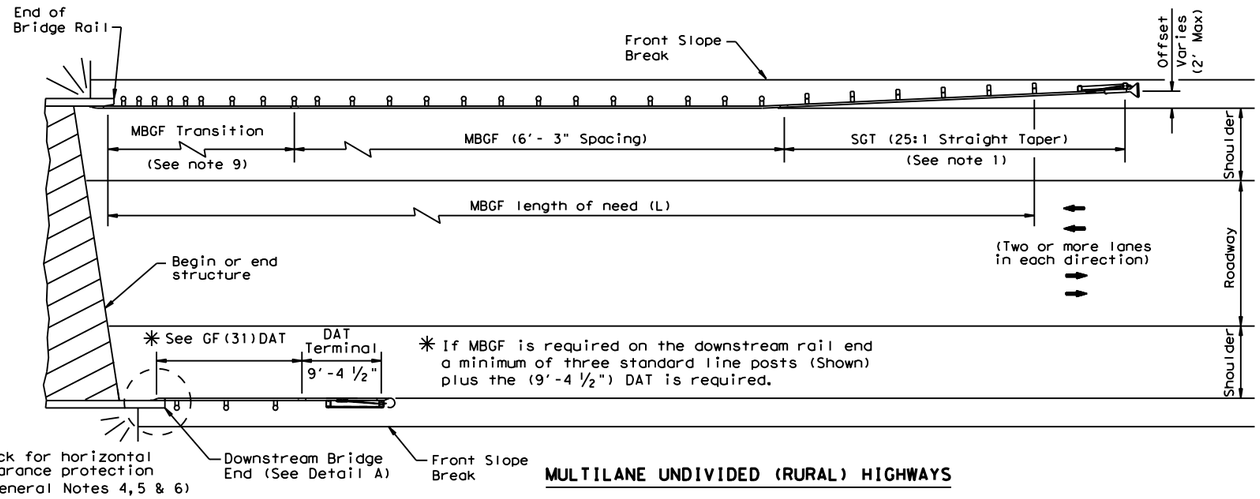
DATE:
FILE:

DATE:
FILE:

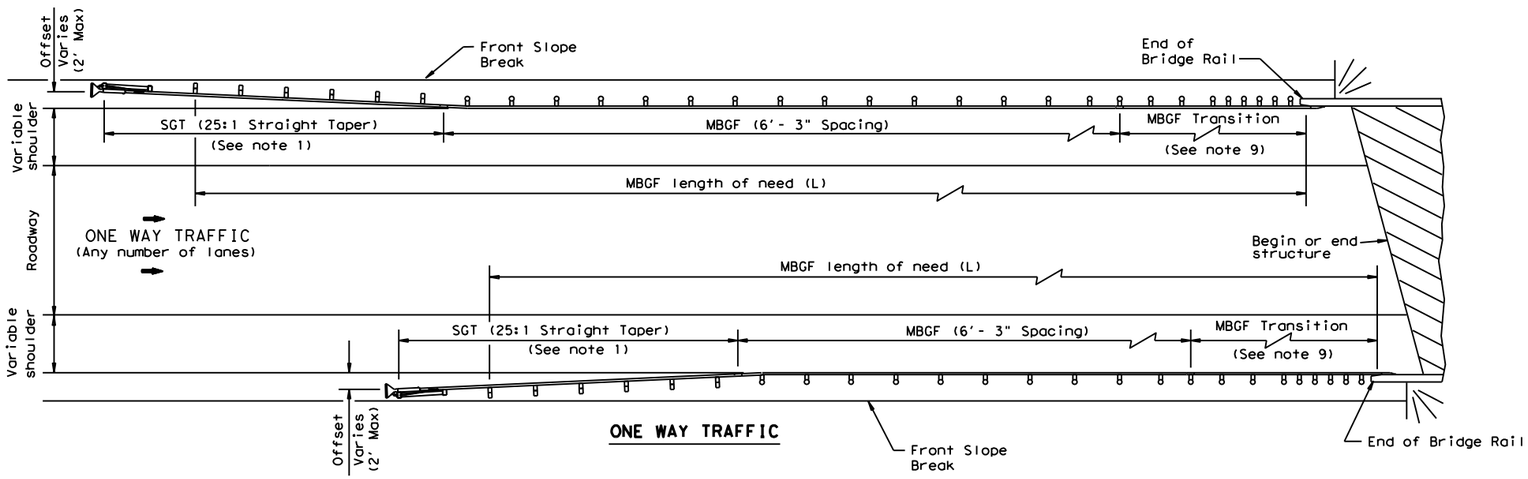



Note:
SGT rail taper may be decreased or eliminated. (See SGT standard sheets)

## TWO LANE (RURAL) HIGHWAYS



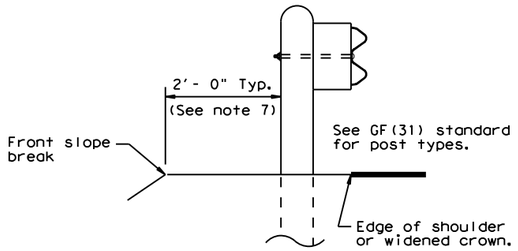

## MULTILANE UNDIVIDED (RURAL) HIGHWAYS



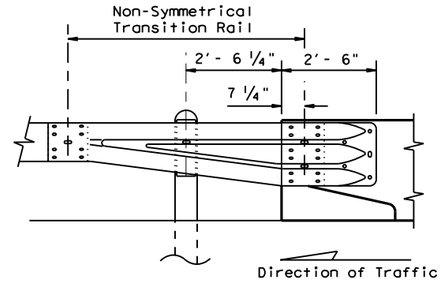

## ONE WAY TRAFFIC

## GENERAL NOTES

1. For more detail: See GF(31), SGT( )31, GF(31)TR, and GF(31)TL2 standard sheets.
2. Quantities of metal beam guard fence (MBGF) at individual bridge ends are as shown in the 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. Downstream anchor terminals (DAT) are only for downstream end anchorage use, outside the horizontal clearance area of opposing traffic.
6. Direct connection of MBGF to concrete rails are only for downstream rail connections outside the horizontal clearance area of opposing traffic. (This requires a minimum of three standard line posts plus the DAT terminal, See Detail A)
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. <u>For restrictive bridge widths:</u> The MBGF should be properly transitioned from the existing bridge rail to the adjoining MBGF (See MBGF Transition Standards). Metal beam guard fence at these bridge location(s) shall be flared at the rate of 25:1 or flatter, and be of the length necessary to locate the terminal end at the 2 ft. "maximum" offset from the shoulder edge in the approach direction.
9. Transition length and post spacing will vary depending on the transition type. Transition type will be shown elsewhere in the plans.




## TYPICAL CROSS SECTION AT MBGF




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

## DETAIL A

Showing Downstream Rail Attachment

Texas Department of Transportation

Design Division Standard

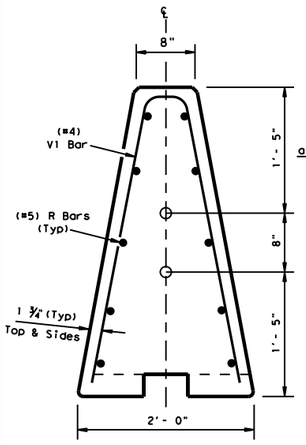
# BRIDGE END DETAILS

(Metal Beam Guard Fence Applications to Rigid Rails)

# BED-11

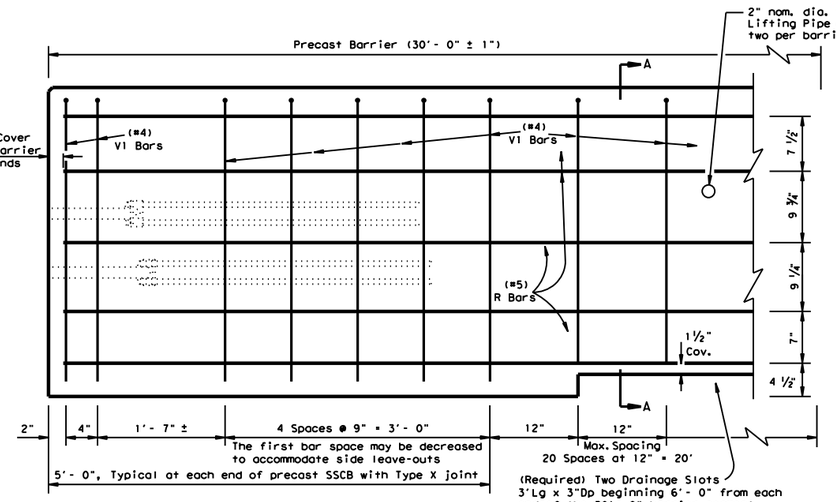
| FILE: bed11.dgn | DN: TxDOT | CK: AM | DW: BD | CK: |
|---|---|---|---|---|
| © TxDOT December 2011 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 148 |

DATE:
FILE:



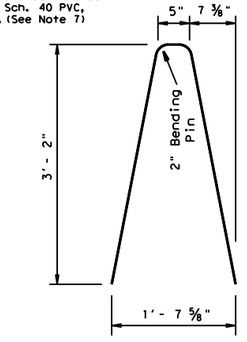

**End View**
**Precast Barrier**

Pipe locations for Joint Type X connection



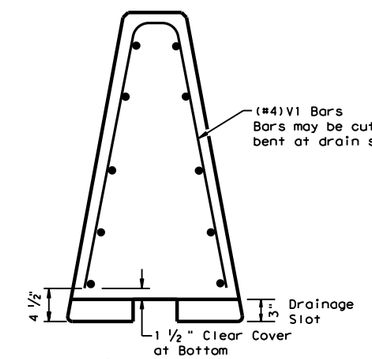

**Reinforcement for Precast (SSCB)**
**Single Slope Concrete Barrier (Type 1)**

Showing reinforcement for Joint Connection (Type X)

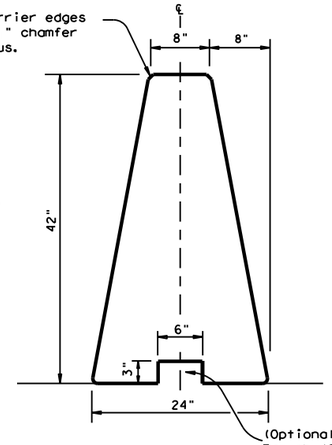



**V1 Bar**
#4 Rebar

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

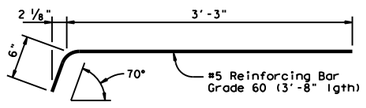



**Section A-A**
Steel Placement at (Required) Drainage Slots



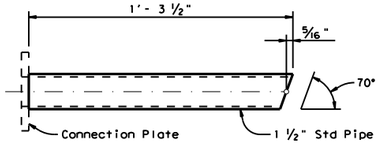

**Single Slope Concrete Traffic Barrier**

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



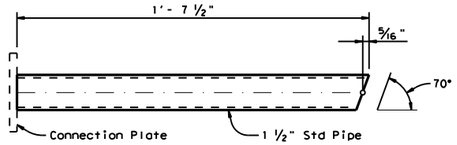

**DEFORMED BAR ANCHOR DETAILS**

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



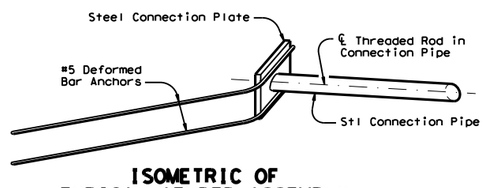

**UPPER CONNECTION PIPE DETAILS**

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




**LOWER CONNECTION PIPE DETAILS**

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

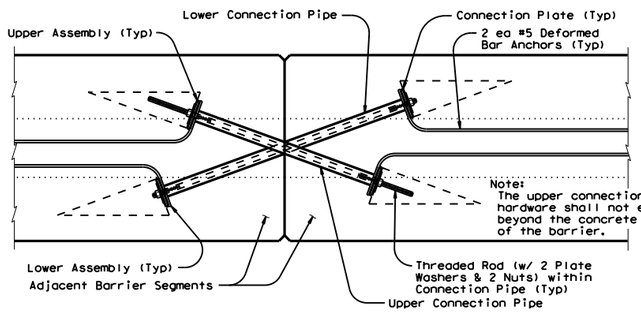



**ISOMETRIC OF TYPICAL WELDED ASSEMBLY**

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

## General Notes

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




**TYPE X JOINT INSTALLATION DETAIL**

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

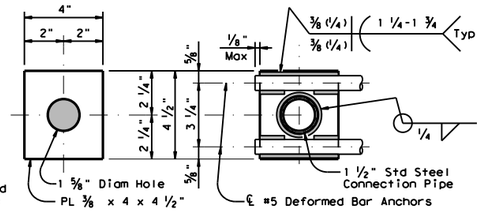
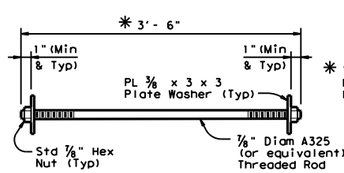



**PLATE DIMENSIONS** **WELDING DETAILS**

**CONNECTION PLATE DETAILS**

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

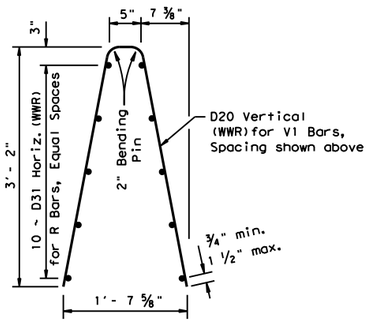



* The connection hardware shall not extend beyond the concrete face of the barrier. Hex head bolts may be provided. The proper length of all hardware should be verified.

**CONNECTION BOLT OR THREADED ROD DETAIL**

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

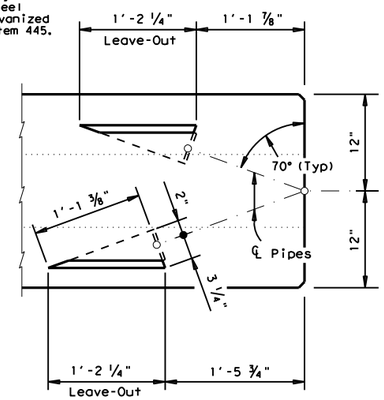
Weight of one precast 30 ft. (SSCB) segment = Approx. 10.5 Tons or 717 lbs per ft.




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

### (WWR) General Notes

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




**BARRIER PLAN AT JOINT**

SHEET 1 OF 2

Texas Department of Transportation | Design Division Standard

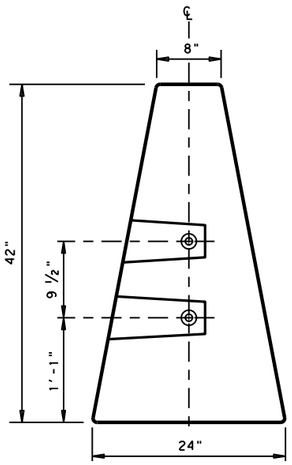
# SINGLE SLOPE CONCRETE BARRIER

## PRECAST BARRIER (TYPE 1)

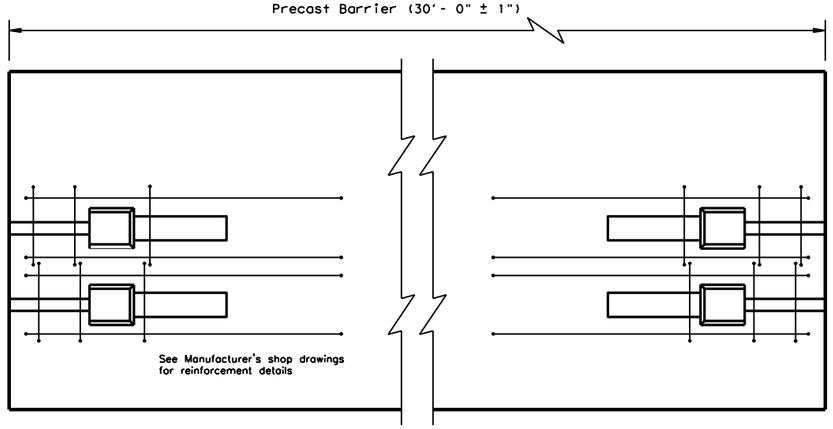
## SSCB(2)-10

| FILE: sscb210.dgn | DN: TxDOT | CK: AM | DW: BD | CK: |
|---|---|---|---|---|
| ©TxDOT December 2010 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 149 |

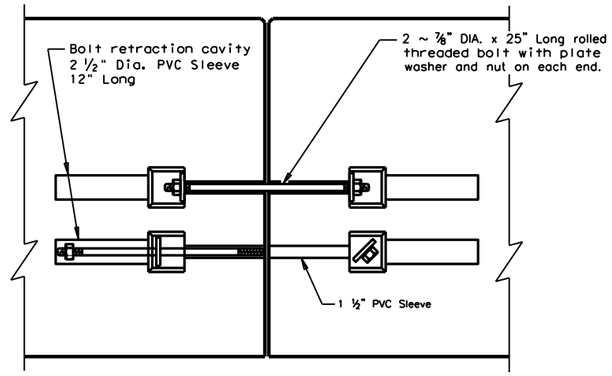
DATE:
FILE:




**END VIEW**
"QUICK-BOLT" POCKET LOCATIONS

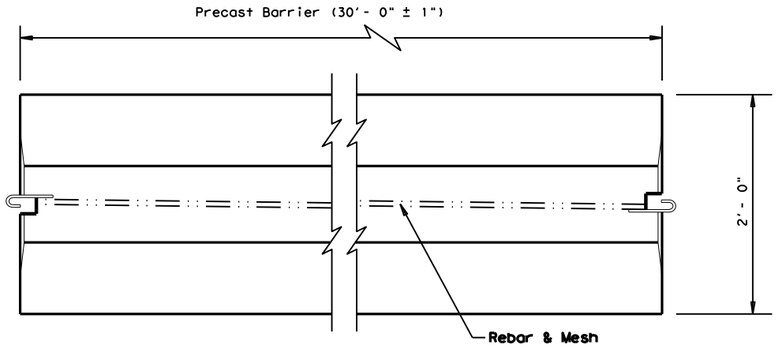



**ELEVATION VIEW**
**"QUICK-BOLT" (SSCB)**
See Manufacturer's shop drawing for additional details

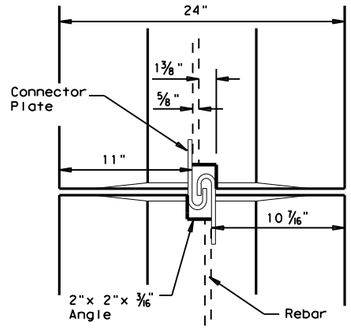



**ELEVATION VIEW SHOWING JOINT CONNECTION**
**"QUICK-BOLT"**

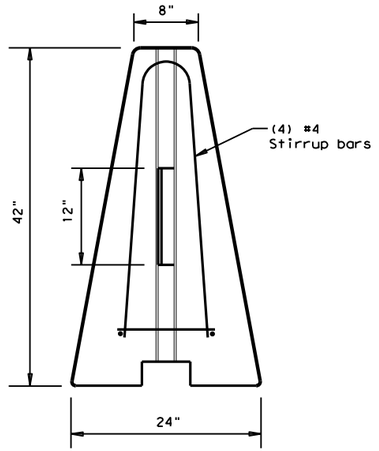
## Joint Connection (Type Q)




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




**VIEW FROM ABOVE**
**J-J HOOK CONNECTION**



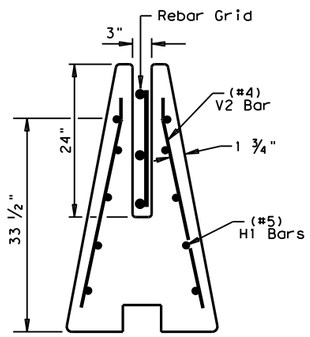

**END VIEW**

### Proprietary Joint Connections (SSCB)

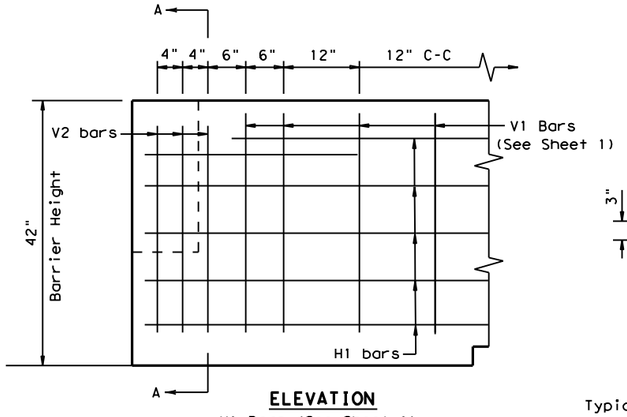
Two proprietary joint connections are acceptable as alternates to the (Type X) connection shown, here on. These joint connections types are:

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

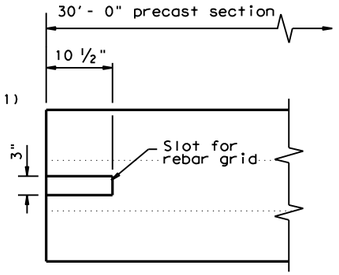
If one of these connection systems are exclusively specified in the plans, prior approval for sole source use must be obtained. Details of the connection components and barrier reinforcement for these systems, will be shown on the manufacturer's shop drawing(s) furnished to the Engineer.



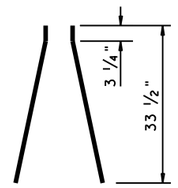

**SECTION A-A**
Showing (Type R) Rebar Grid



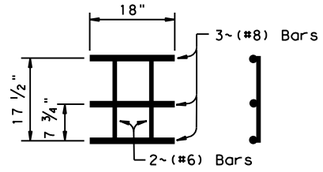

**ELEVATION**
V1 Bars (See Sheet 1)




**TOP VIEW**
**JOINT CONNECTION**
Typical at both ends of barrier segment




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




**WELDED REBAR GRID**

## Joint Connection (Type R)

SHEET 2 OF 2

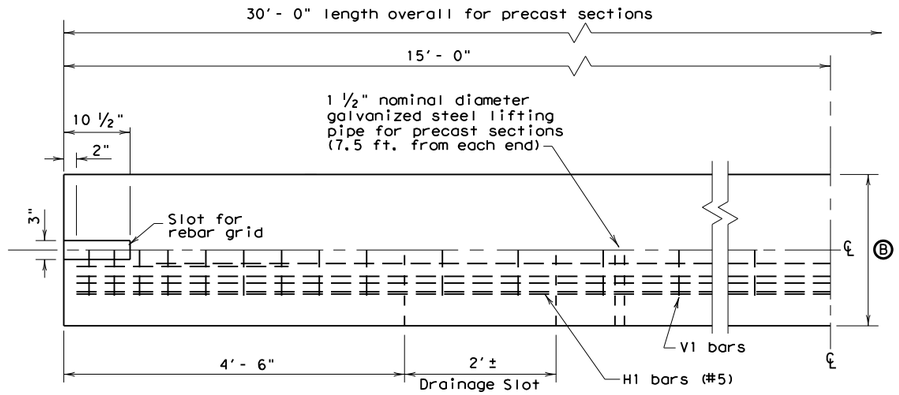
Texas Department of Transportation | Design Division Standard

# SINGLE SLOPE CONCRETE BARRIER

PRECAST BARRIER
(TYPE 1)

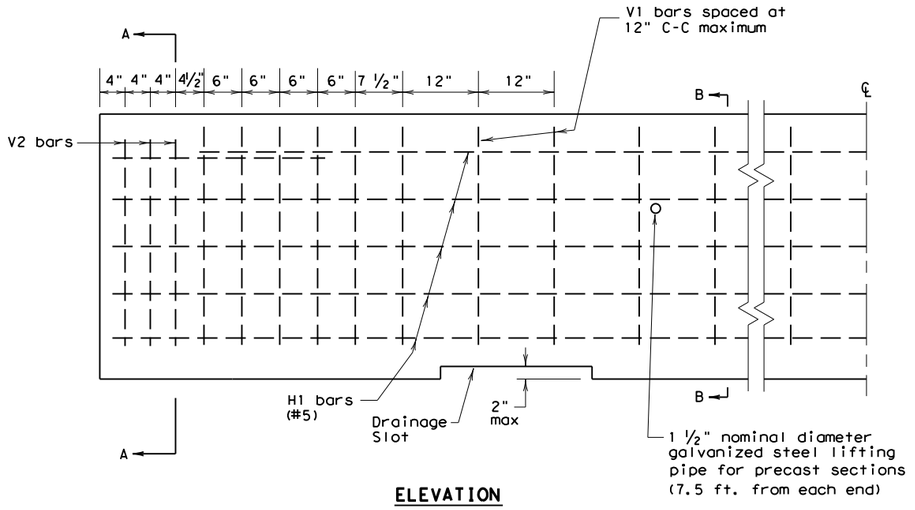
## SSCB(2)-10

| FILE: sscb210.dgn | DN: TxDOT | CK: AM | DW: VP | CK: |
|---|---|---|---|---|
| ©TxDOT December 2010 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 150 |



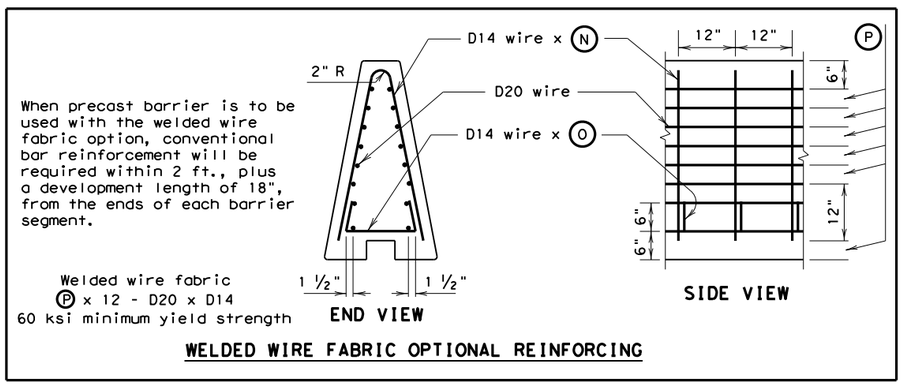

## PLAN VIEW

(SYMMETRICAL ABOUTCENTER LINE)




## ELEVATION

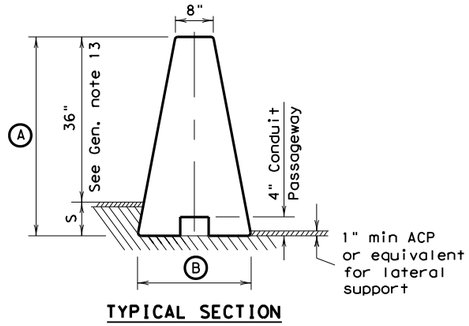
(SYMMETRICAL ABOUT CENTERLINE)



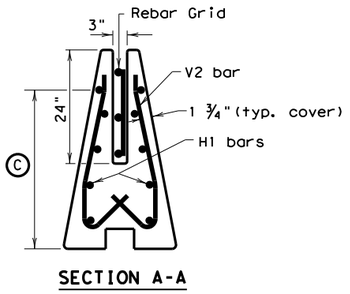

## WELDED WIRE FABRIC OPTIONAL REINFORCING

## GENERAL NOTES

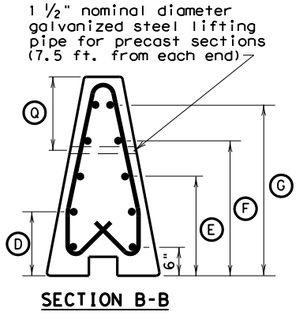
1. Precast barrier length shall be 30 feet (±1") unless otherwise specified in the plans. Cast-in-place or slip-formed barrier shall have an intermediate barrier joint at a maximum spacing of 100 feet unless otherwise directed by the Engineer. Refer to the intermediate barrier joint detail. Cast-in-place or slip-formed barrier will have the vertical V1 bars placed at 12" C-C maximum except near joints. The narrower vertical bar spacing at the ends of each barrier segment, as shown in the elevation view, will be required at the joints. The V2 bars shown in the elevation view will be replaced by V1 bars for cast-in-place or slip-form construction.
2. The usual temporary installation will require the placement of the rebar grid in the ungrouted slot. The usual permanent installation using precast barrier will connect the barrier segments with the rebar grid placed in the slot and grouted in place.
3. When installed in a permanent roadway location, the end connections of the precast barrier shall be grouted with a mixture of two parts sand and one part cement with enough water to make the mixture plastic. Grouting shall be done in a manner that will assure a smooth surface at the joint.
4. All concrete shall be class C or H, unless otherwise specified.
5. All reinforcing steel shall be Grade 60, unless otherwise specified.
6. Each precast barrier to be installed in a temporary location shall be delivered with a rebar grid.
7. Chamfer top and end edges ¾ inch.
8. Unless otherwise shown in the plans, the Contractor has the option of placing either precast or cast-in-place permanent concrete barrier. Cast-in-place barrier may be slip-formed. Additional reinforcement may be tack welded to the upper two-thirds of the reinforcing cage to provide bracing. Lifting pipe, rebar grid and slot shall be omitted for cast-in-place or slip-form construction.
9. Bar splices for roadway barrier shall be a minimum of 24 times the nominal diameter of the bar.
10. Welded wire fabric may be used as an option to conventional reinforcement for precast or cast-in-place barrier. Welded wire fabric shall be made in accordance with ASTM A 497.
11. Conduit will be provided only when called for elsewhere in the plans. The position of the conduit or conduit passageway may be adjusted to facilitate construction, subject to approval of the Engineer.
12. Transitions to barrier height, as needed, shall be determined by the Engineer. Changes in barrier height should not normally exceed 2 inches per 30 foot. Vertical steel shall be uniformly transitioned throughout the variation in barrier height as directed by the Engineer.
13. A 36 inch minimum height differential between top of barrier and top of ACP shall be required at placement in order to allow for up to 6 inches of future overlays while maintaining a 30 inch minimum future effective height of barrier. Total minimal barrier height for design is therefore dictated by allowance for future overlays plus existing stairstep dimension "S". Minimums typically rounded to 42", 48" or 54" to facilitate precasting.



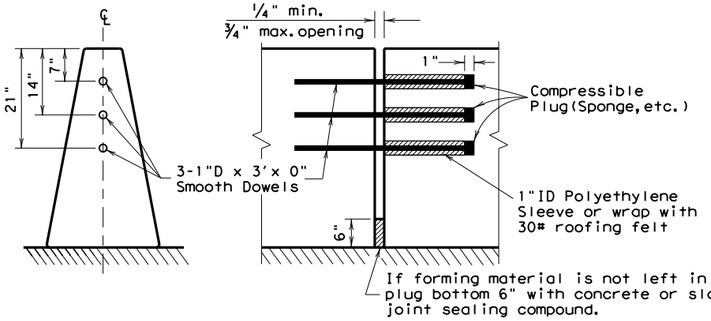

TYPICAL SECTION



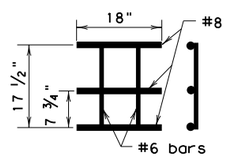

SECTION A-A



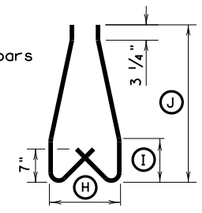

SECTION B-B



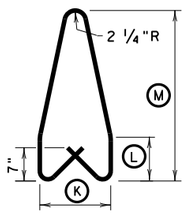

INTERMEDIATE BARRIER JOINT DETAIL (cast-in-place or slip-formed sections)




REBAR GRID




V2 BAR (#4)




V1 BAR (#4)

REINFORCING DETAILS

R = Radius
D = Diameter

| Barrier Height | DIMENSIONS (inches) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ⓐ | Ⓑ | Ⓒ | Ⓓ | Ⓔ | Ⓕ | Ⓖ | Ⓗ | Ⓘ | Ⓙ | Ⓚ | Ⓛ | Ⓜ | Ⓝ | Ⓞ | Ⓟ | Ⓠ |
| 42 | 24 | 33 ½ | 13 ½ | 21 | 28 ½ | 36 | 15 | 9 ¼ | 33 ¼ | 15 | 9 ¼ | 36 | 72 | 28 | 4 | 15 ½ |
| 48 | 26 9/32 | 39 ½ | 15 | 24 | 33 | 42 | 17 ¼ | 10 ¾ | 39 ¼ | 17 ¼ | 10 ¾ | 42 | 84 | 31 ½ | 5 | 17 |
| 54 | 28 9/16 | 45 ½ | 16 ½ | 27 | 37 ½ | 48 | 19 ½ | 12 ¼ | 45 ¼ | 19 ½ | 12 ¼ | 48 | 96 | 34 ¾ | 6 | 18 ½ |

Texas Department of Transportation
Design Division (Roadway)

# SINGLE SLOPE CONCRETE BARRIER TYPE 2

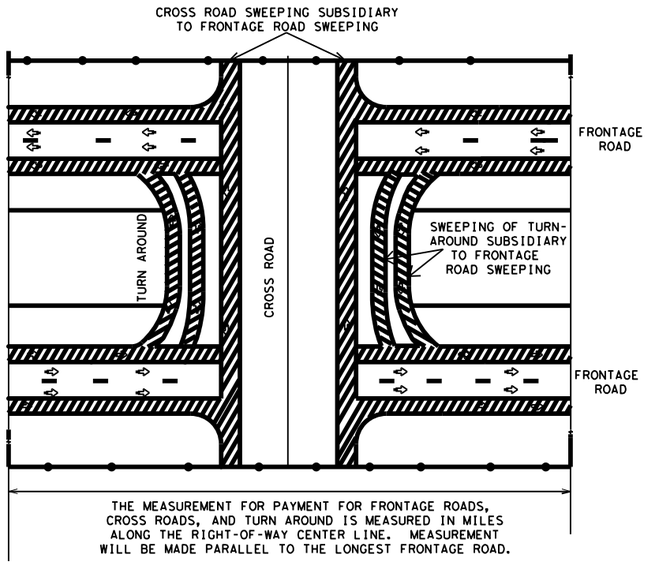
# SSCB(2)-00A

| FILE: sscb200a.dgn | DN: GTH | CK: GTH | DW: BGD | CK: TGM | |
|---|---|---|---|---|---|
| ©TxDOT MAY 1992 | DIST | PROJECT NO | | | SHEET |
| REVISIONS | 10 | RMC 6367-43-001 | | | 151 |
| | COUNTY | | CONTROL | SECT | JOB | HIGHWAY |
| | SMITH, ETC. | | 6367 | 43 | 001 | IH-20 |

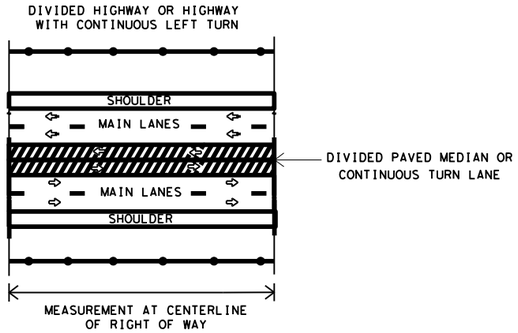


LEVELS DISPLAYED
1

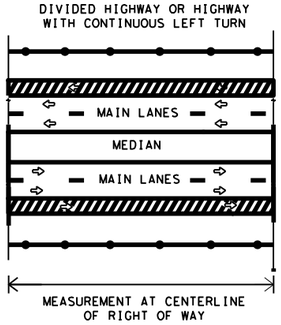
## FRONTAGE ROAD SWEEPING



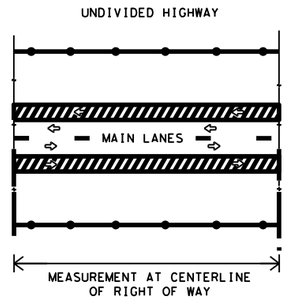

## CENTER MEDIAN SWEEPING

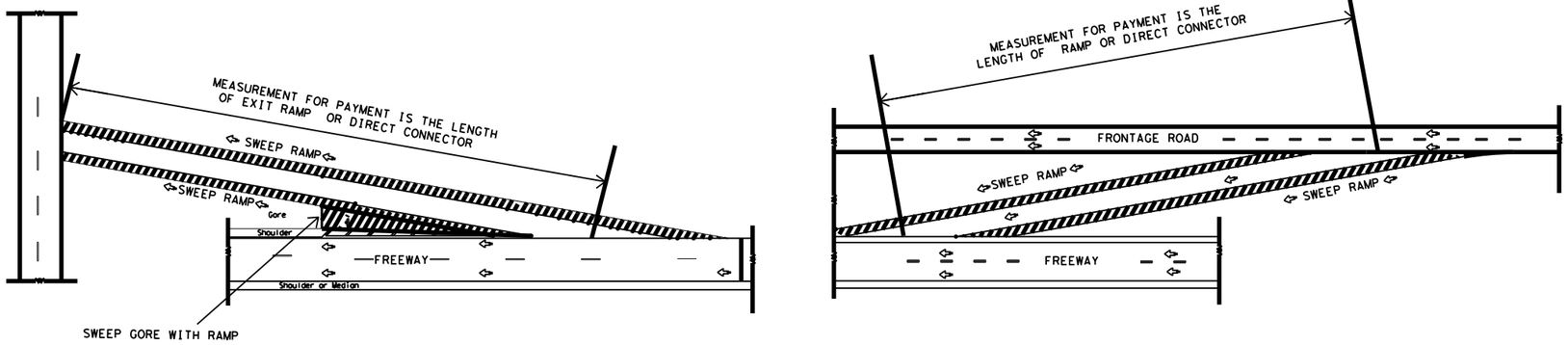



## OUTSIDE MAIN LANE SWEEPING




## OUTSIDE MAIN LANE SWEEPING




## RAMPS OR DIRECT CONNECTORS

| PAYMENT ITEM | NORMAL NUMBER OF PASSES OF THE SWEEPER | MEASUREMENT OF CENTER LINE MILES | OTHER AREAS SUBSIDARY 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 |

### KEY

- PATH OF SWEEPER
- DIRECTION OF TRAFFIC & SWEEPER
- LANE DIVIDER STRIPE
- RIGHT-OF-WAY LINE

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

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

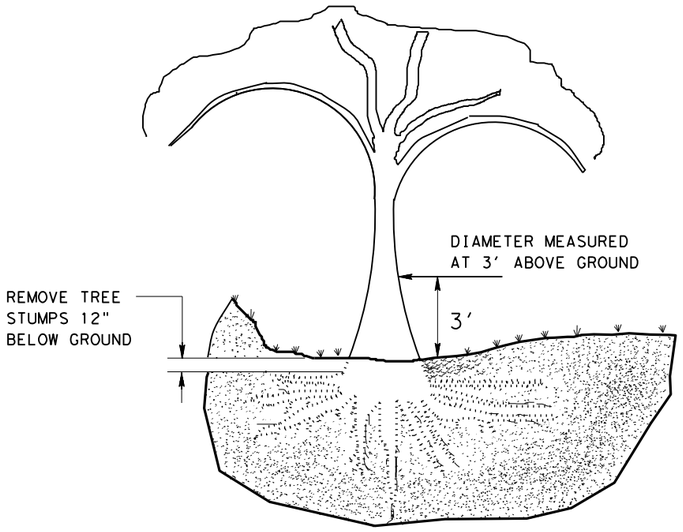
# SWEEPING HIGHWAYS

SHEET 1 OF 1

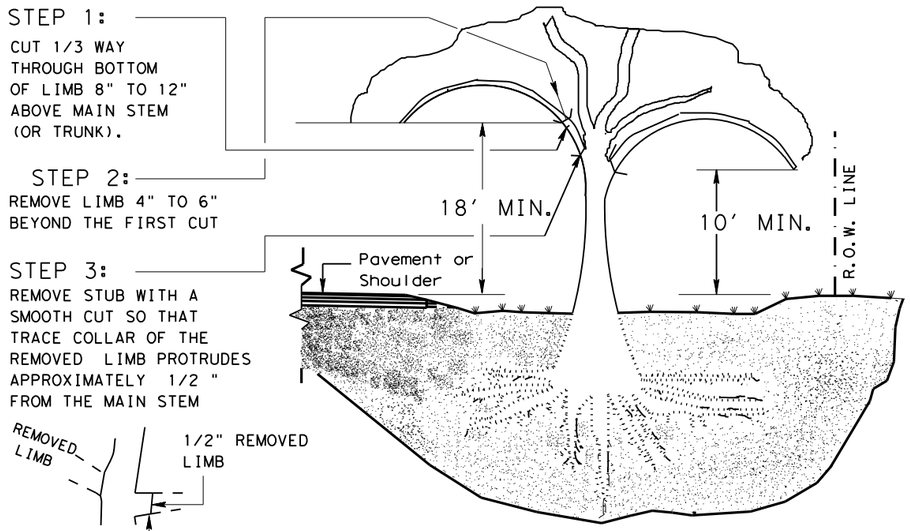
# SWEEP - 04

NOT TO SCALE

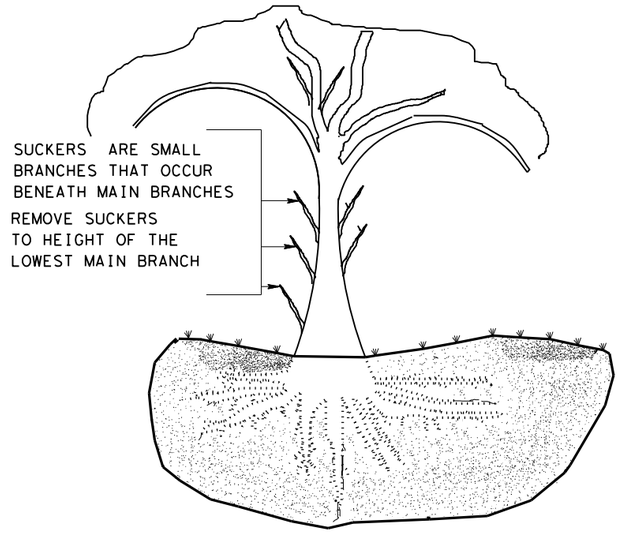
| FILE: SWEEP04.DGN | DN: LJB | CK: JG | DW: - | CK: - | NEG NO.: |
|---|---|---|---|---|---|
| ©TxDOT MAY 2004 | STATE DISTRICT | FEDERAL REGION | FEDERAL AID PROJECT | | SHEET |
| REVISED: | 10 | N/A | RMC 6367-43-001 | | 152 |
| REVISED: | COUNTY | | CONTROL | SECTION | JOB | HIGHWAY |
| REVISED: | SMITH, ETC. | | 6367 | 43 | 001 | IH-20 |



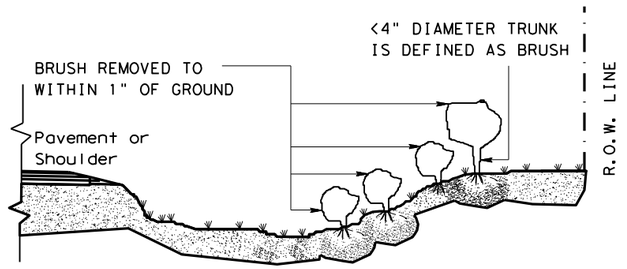

TREE REMOVAL



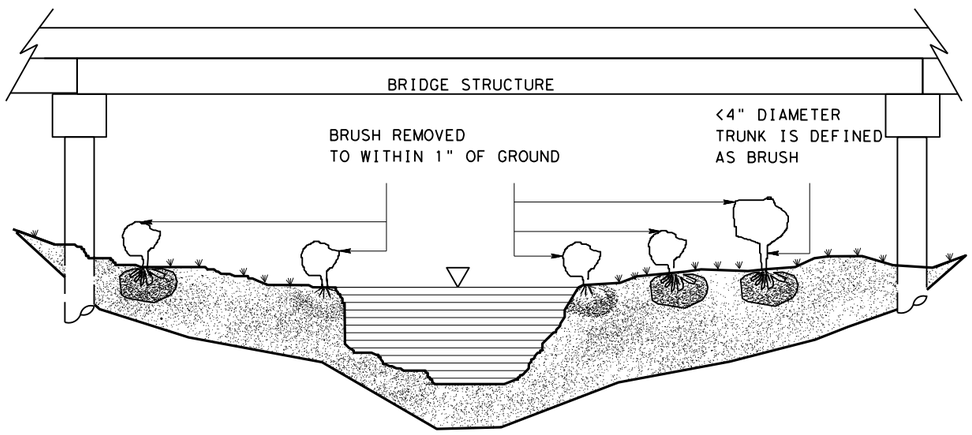

TREE TRIMMING




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




BRUSH REMOVAL




BRUSH REMOVAL UNDER BRIDGE AND IN CHANNEL

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.

**TABLE 1**
**TREE TRUNK SIZE FOR TREE REMOVAL PAYMENT**

| 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 |

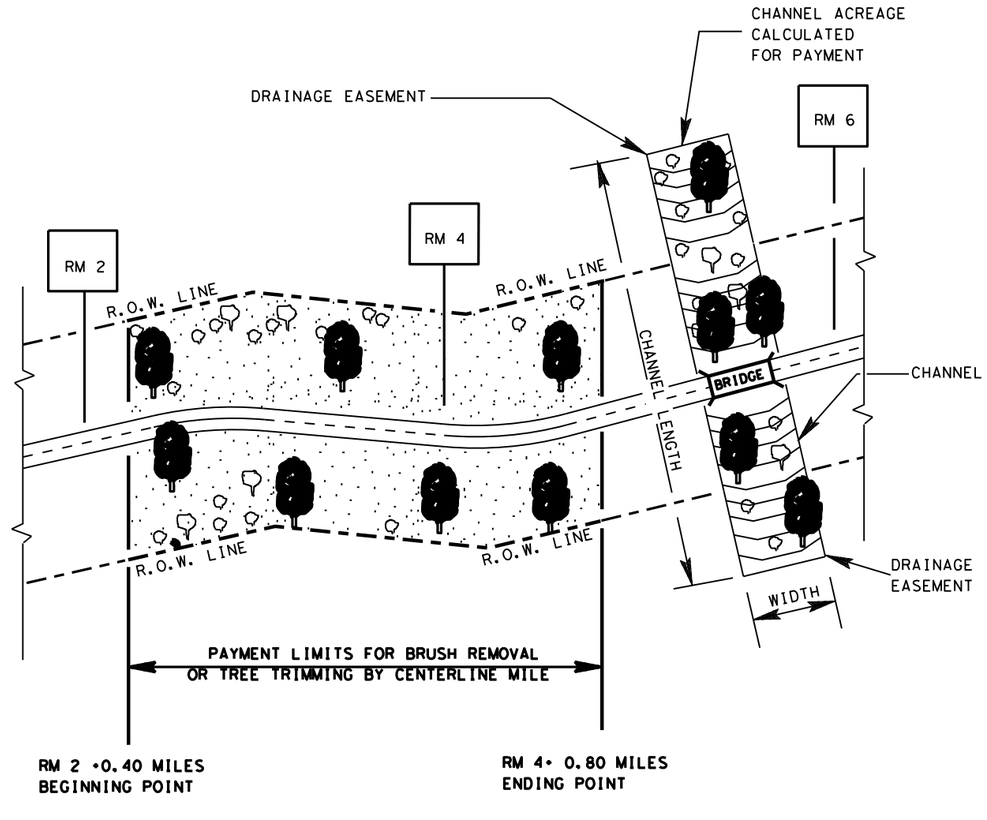
***SEE GENERAL NOTE *3.**

Texas Department of Transportation — Maintenance Division Standard

# TREE AND BRUSH REMOVAL

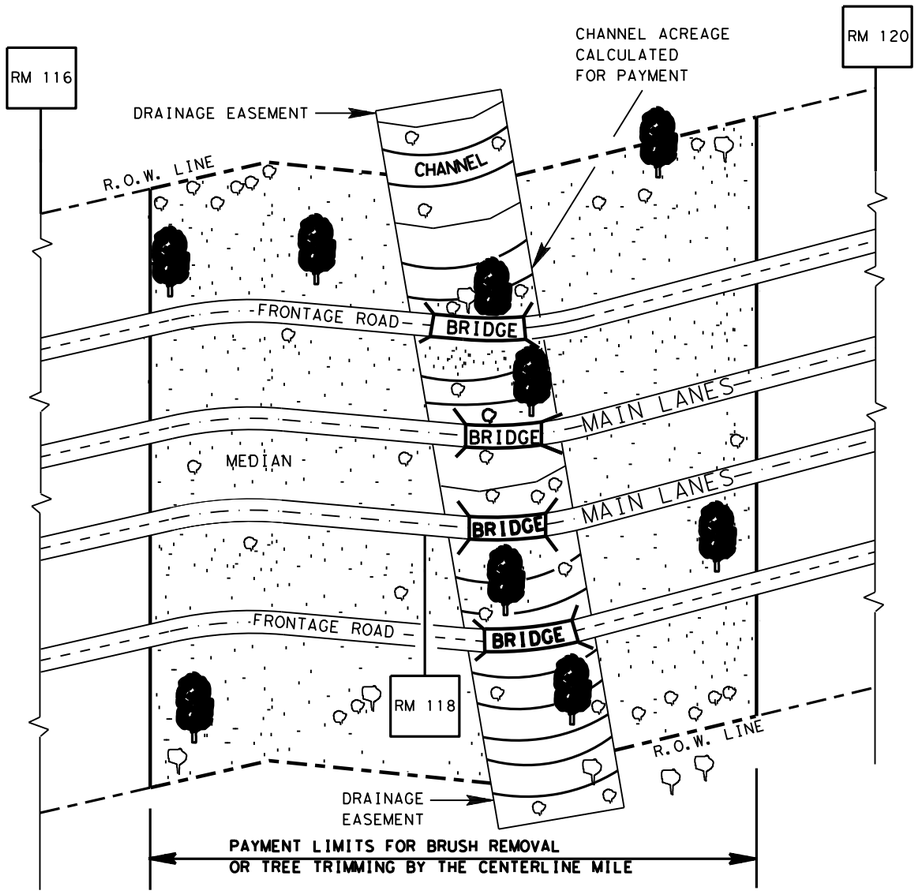
## TRB-15(1)

| FILE: | DN: JEO | CK: LJB | DW: JEO | CK: |
|---|---|---|---|---|
| © TxDOT MARCH 2015 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| Revised table 1 to 2014 Specification | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 153 |




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

LEVELS DISPLAYED
1

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

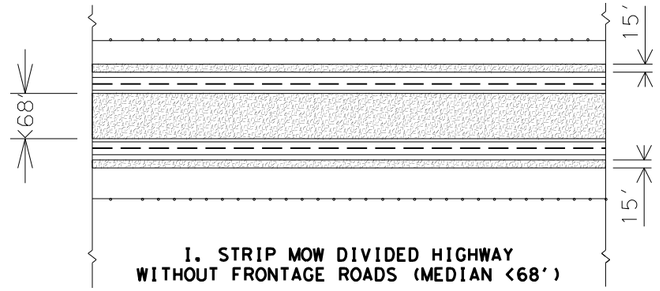
# TREE AND BRUSH REMOVAL

## TRB-15(2)

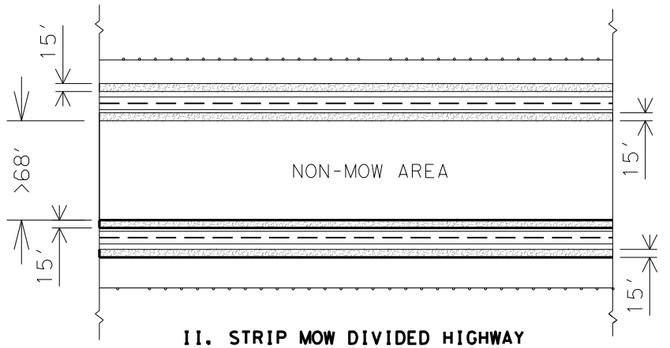
NOT TO SCALE — SHEET 2 OF 2

| FILE: TRB-15(2).DGN | DRAWN: JEO / MODIFIED: | CHECKED: DM; LJB | DW: - | CK: - | NEG NO.: |
|---|---|---|---|---|---|

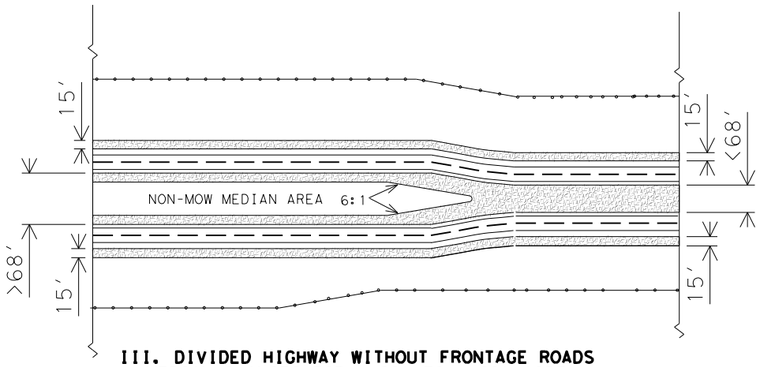
| © TxDOT APRIL 2015 | | STATE DISTRICT | FEDERAL REGION | ROUTINE MAINTENANCE PROJECT ⊕ | | | | SHEET |
|---|---|---|---|---|---|---|---|---|
| REVISED: 5/13/2004 | LJB | 10 | | RMC 6367-43-001 | | | | 154 |
| REVISED: 9/24/2004 | LJB | COUNTY | | | CONTROL | SECTION | JOB | HIGHWAY |
| REVISED: APRIL 2015 | JEO | SMITH, ETC. | | | 6367 | 43 | 001 | IH-20 |



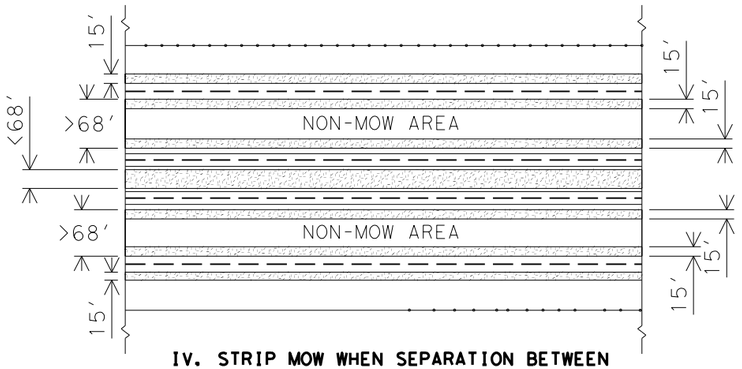

I. STRIP MOW DIVIDED HIGHWAY
WITHOUT FRONTAGE ROADS (MEDIAN <68')



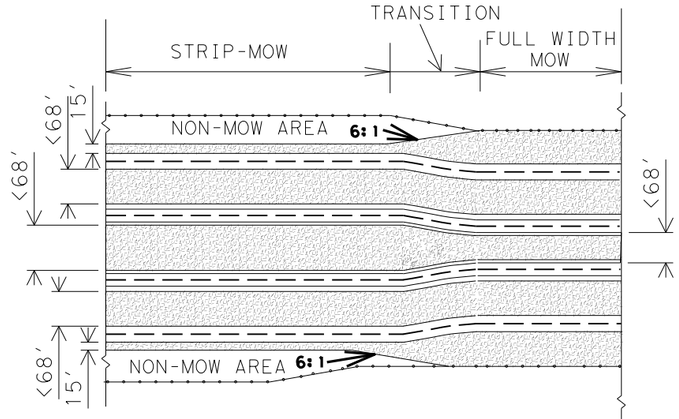

II. STRIP MOW DIVIDED HIGHWAY
WITHOUT FRONTAGE ROADS (MEDIAN >68')




III. DIVIDED HIGHWAY WITHOUT FRONTAGE ROADS
MEDIAN CHANGES FOR > 68' TO < 68' WIDE




IV. STRIP MOW WHEN SEPARATION BETWEEN
MAIN LANE AND FRONTAGE ROADS IS
WIDER THAN 68'




V. TRANSITION FROM FULL WIDTH TO STRIP
MOWING DIVIDED HIGHWAY WITH FRONTAGE ROADS
(MEDIAN <68' WIDE)

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

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 | |

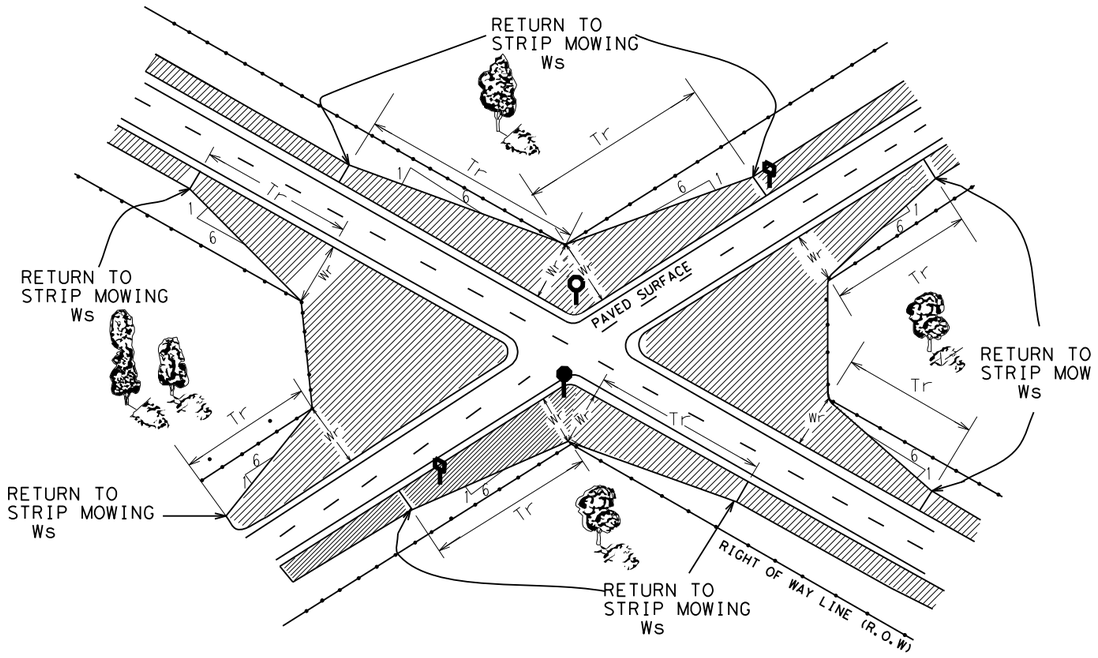
Texas Department of Transportation
Maintenance Division
Standard Plans

# STRIP MOWING (DIVIDED HIGHWAYS)

# STRIP-MOW-D-04

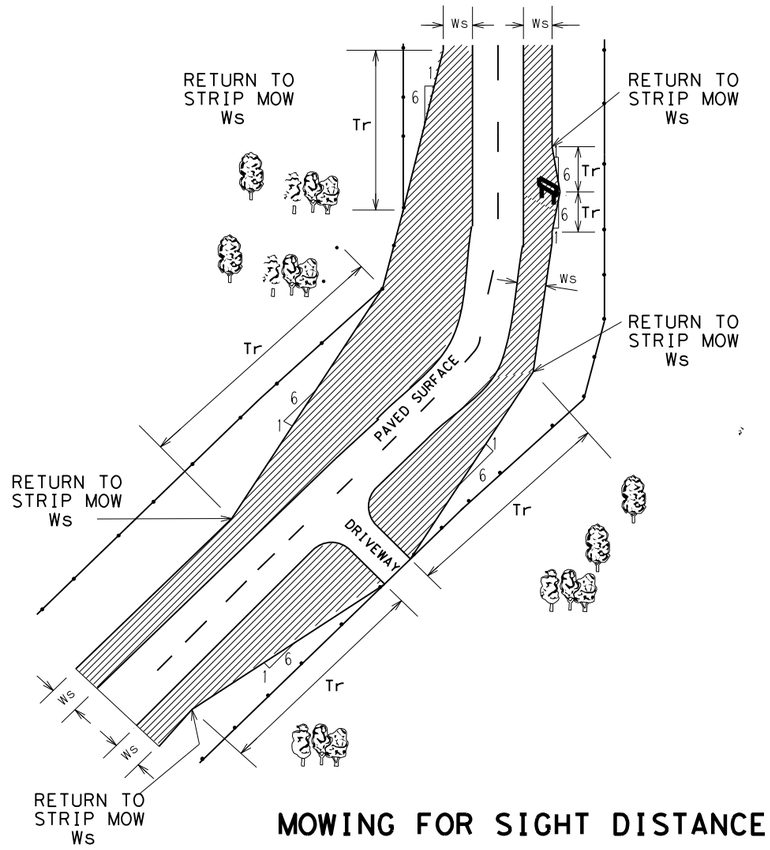
SHEET 1 OF 1 NOT TO SCALE

| FILE: SMOWD04.DGN | DN: LJB | CK: JG | DW: - | CK: - | NEG NO.: | |
|---|---|---|---|---|---|---|
|  | STATE DISTRICT | FEDERAL REGION | ROUTINE MAINTENANCE PROJECT | | | SHEET |
| REVISED: 6/03/2004 | 10 | N/A | RMC 6367-43-001 | | | 155 |
| REVISED: | COUNTY | | CONTROL | SECTION | JOB | HIGHWAY |
| REVISED: | SMITH, ETC. | | 6367 | 43 | 001 | IH-20 |




## 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

Wr - R.O.W. WIDTH (AT START OF TRANSITION)

Ws - STRIP MOWING WIDTH

Tr - TRANSITION

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 | |

*Texas Department of Transportation*

*Maintenance Division*
*Standard Plans*

# STRIP MOWING NON-DIVIDED HIGHWAYS

SHEET 1 OF 1

STRIP-MOW-ND-04

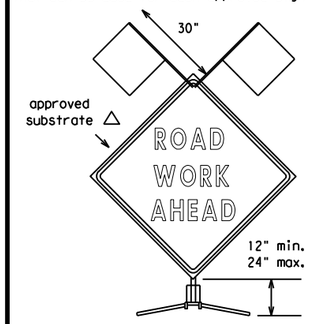
NOT TO SCALE

| | | | | | | |
|---|---|---|---|---|---|---|
| FILE: SMOWND04.DGN | DN: LJB | CK: JG | DW: - | CK: - | NEG NO.: | |
|  | STATE DISTRICT | FEDERAL REGION | ROUTINE MAINTENANCE PROJECT | | | SHEET |
| REVISED: 5/18/2004 LJB | 10 | N/A | RMC 6367-43-001 | | | 156 |
| REVISED: | COUNTY | | CONTROL | SECTION | JOB | HIGHWAY |
| REVISED: | SMITH, ETC. | | 6367 | 43 | 001 | IH-20 |

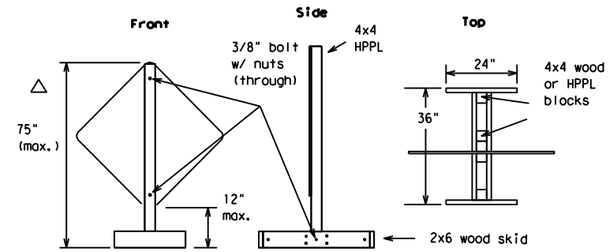
# EXAMPLES OF SIGN SUPPORTS

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

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




Flags as required by Engineer or as shown on plans




The upright SHALL be made of hollow-profile plastic lumber (HPPL). Wood or metal shall NOT be used.

1 Foot Mounting Height

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.**


48" X 48" | 48" X 48" | 48" X 48" | 48" X 48"

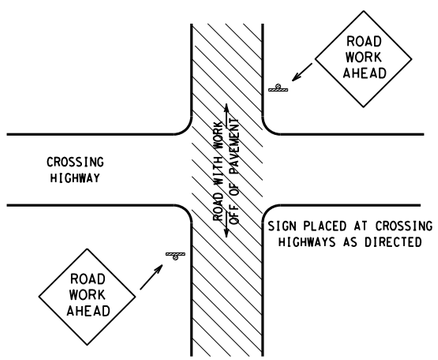
**SIGN IN ACCORDANCE WITH THE TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS**

**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

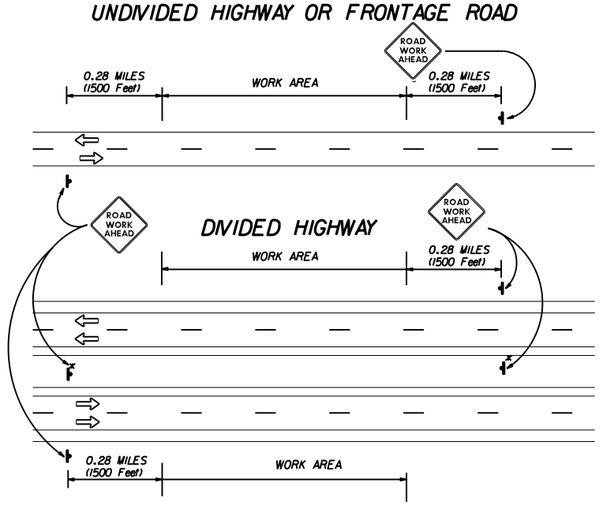
*WORK AREA IS A MAXIMUM OF 2.0 MILES UNLESS OTHERWISE DIRECTED. SIGNS MAY REMAIN IN PLACE ONLY DURING DAYLIGHT HOURS.*

*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.*

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 | | |

## GENERAL NOTES FOR WORK ZONE SIGNS

1. Contractor shall install and maintain signs in a straight and plumb condition and/or as directed by the Engineer.
2. Wooden sign posts shall be painted white.
3. Barricades shall NOT be used as sign supports.
4. Nails shall NOT be used to attach signs to any support.
5. All signs shall be installed in accordance with the plans or as directed by the Engineer. Signs shall be used to regulate, warn, and guide the traveling public safely through the work zone.
6. 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.
7. 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.
8. 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.
9. Identification markings may be shown only on the back of the sign substrate. The maximum height of letters and/or company logos used for identification shall be 1".
10. 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 VI)**

1. 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.
2. The Contractor shall furnish the sign sizes shown on this sheet or as directed by the Engineer.

## SIGN SUBSTRATES

1. 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.
2. "Mesh" type materials are NOT an approved sign substrate.
3. All wooden individual sign panels fabricated from 2 or more pieces shall have one or more plywood cleat, 1/2" thick by 6" wide, fastened to the back of the sign and extending fully across the sign. The cleat shall be attached to the back of the sign using wood screws that do not penetrate the face of the sign panel. The screws shall be placed on both sides of the splice and spaced at 6" centers. The Engineer may approve other methods of splicing the sign faces.

## REFLECTIVE SHEETING

1. 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
2. White sheeting, meeting the requirements of DMS-8300 Type C (High Specific Intensity), shall be used for signs with white background and channelizing devices.
3. Orange sheeting, meeting the requirements of DMS-8300 Type E (Fluorescent Prismatic), shall be used for signs with orange backgrounds.

## SIGN LETTERS

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

## REMOVING OR COVERING

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

## SIGN SUPPORT WEIGHTS

1. Where sign supports require the use of weights to keep from turning over, the use of sandbags with dry cohesionless sand is recommended.
2. The sandbags will be tied shut to keep the sand from spilling and to maintain a constant weight.
3. Rock, concrete, iron, steel or other solid objects will not be permitted for use as sign support weights.
4. Sandbags should weigh a minimum of 35 lbs and a maximum of 50 lbs.
5. Sandbags shall be made of a durable material that tears upon vehicular impact.
6. Rubber (such as tire inner tubes) shall NOT be used for sandbags.
7. Rubber ballasts (such as those used with cones or edgeline channelizers) shall NOT be used as sign support weights.
8. 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.
9. 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:**

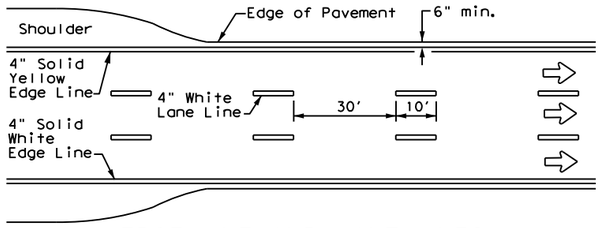
**Start at website - www.dot.state.tx.us**
**Click on "About TxDOT",**
**Click on "Organizational Chart",**
**Click on Traffic Operations Box,**
**Click on "Compliant Work Zone Traffic Control Devices",**
**Click on "View PDF".**
**This site is printable.**

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

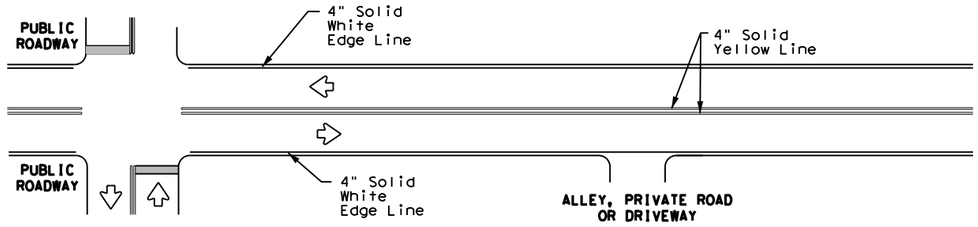
# ROADSIDE TRAFFIC CONTROL PLAN

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

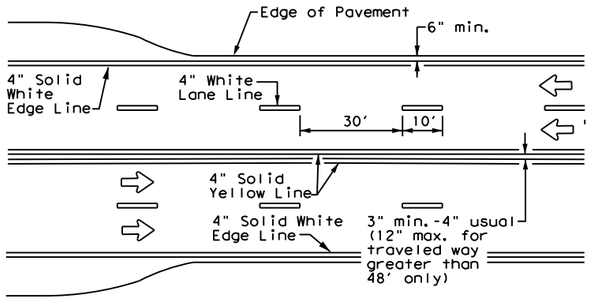
| FILE: RSTCP05.DGN | DN: LJB | CK: JG | DW: - | CK: - | MEG NO.: | |
|---|---|---|---|---|---|---|
| ©TxDOT FEBRUARY 2005 | STATE DISTRICT | FEDERAL REGION | FEDERAL AID PROJECT | | | SHEET |
| REVISED: September 17, 2004 | 10 | N/A | RMC 6367-43-001 | | | 157 |
| REVISED: FEBRUARY 2, 2005 Sign placement in TCP | COUNTY | | | CONTROL | SECTION | JOB | HIGHWAY |
| REVISED: | SMITH, ETC. | | | 6367 | 43 | 001 | IH-20 |



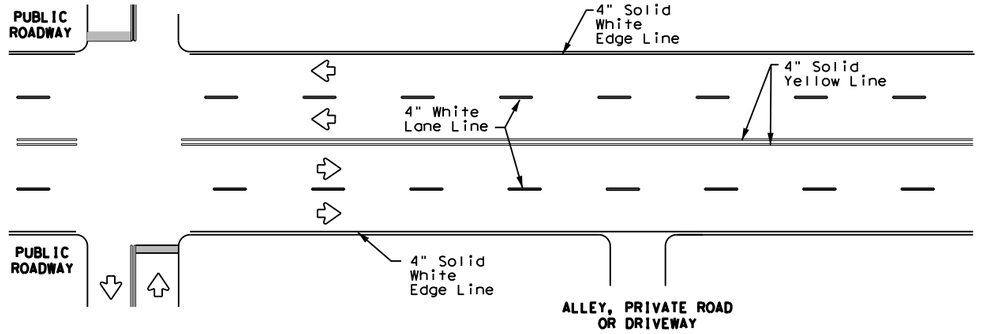

## EDGE LINE AND LANE LINES ONE-WAY ROADWAY WITH OR WITHOUT SHOULDERS



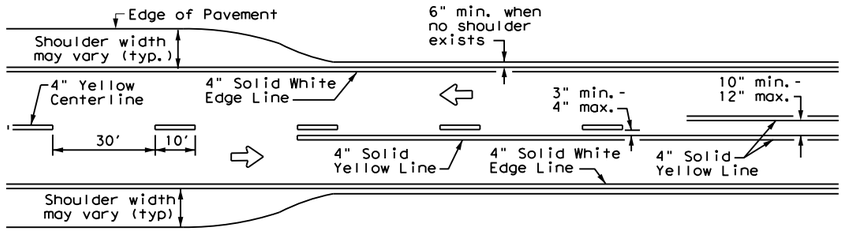

## TYPICAL TWO-LANE, TWO-WAY PAVEMENT MARKINGS THROUGH INTERSECTIONS



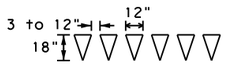

## CENTERLINE AND LANE LINES FOUR LANE TWO-WAY ROADWAY WITH OR WITHOUT SHOULDERS



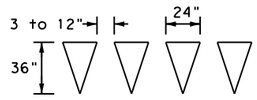

## TYPICAL MULTI-LANE, TWO-WAY PAVEMENT MARKINGS THROUGH INTERSECTIONS




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

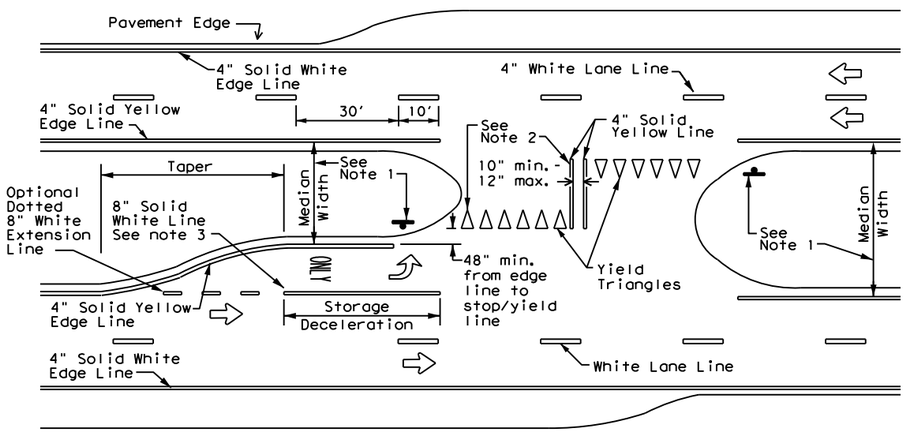



For posted speed on road being marked equal to or less than 40 MPH.




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

## YIELD LINES




## FOUR LANE DIVIDED ROADWAY CROSSOVERS

### NOTES

1. Where divided highways are separated by median widths at the median opening itself of 30 feet or more, median openings shall be signed as two separate intersections. Each median opening has two width measurements, with one measurement for each approach. The narrow median width will be the controlling width to determine if signs are required. Yield signs are the typical intersection control. Stop signs are optional as determined by the Engineer.

2. Install median striping (double yellow centerlines and stop bars/yield triangles) when a 50' or greater median centerline can be placed. Stop bars shall only be used with stop signs. Yield traingles shall only be used with yield signs.

3. Length of turn bays, including taper, deceleration, and storage lengths shall be as shown on the plans or as directed by the Engineer.

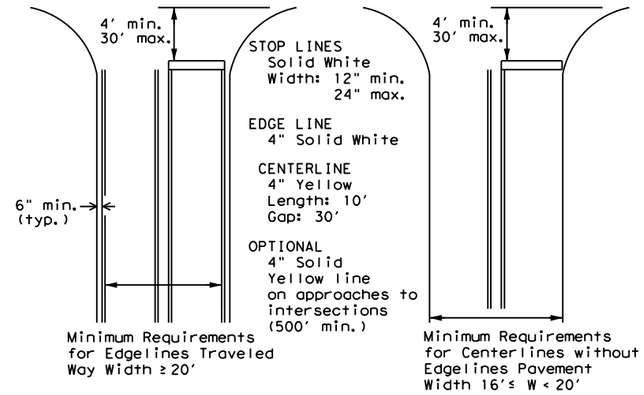
### GENERAL NOTES

1. Edgeline striping shall be as shown in the plans or as directed by the Engineer. The edgeline should not be placed less less than 6 inches from the edge of pavement. This distance may vary due to pavement raveling or other conditions. Edgelines are not required in curb and gutter sections of roadways.

2. The traveled way includes only that portion of the roadway used for vehicular travel. It does not include the parking lanes, sidewalks, berms and shoulders. The traveled ways shall be measured from the inside of edgeline to the inside of edgeline of a two lane roadway.

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

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




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

Based on Traveled Way and Pavement Widths for Undivided Highways

Texas Department of Transportation

Traffic Safety Division Standard

# TYPICAL STANDARD PAVEMENT MARKINGS

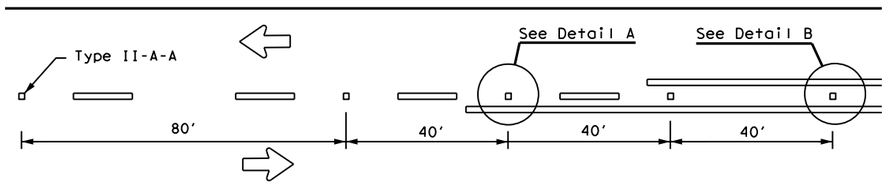
# PM(1)-20

| FILE: pm1-20.dgn | DN: | CK: | DW: | CK: |
|---|---|---|---|---|
| © TxDOT November 1978 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS 8-95 3-03 | 6367 | 43 | 001 | IH-20 |
| 5-00 2-12 | DIST | COUNTY | | SHEET NO. |
| 8-00 6-20 | 10 | SMITH, ETC. | | 158 |

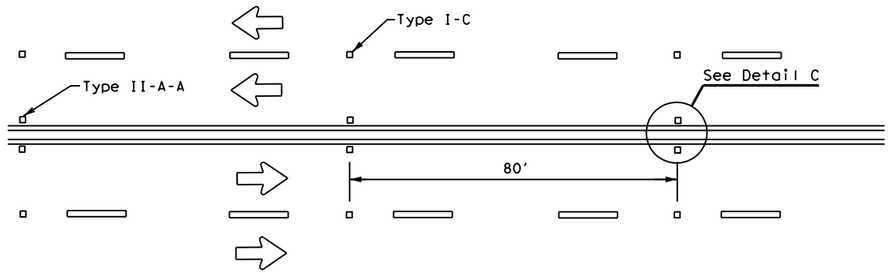
22A

DATE:
FILE:

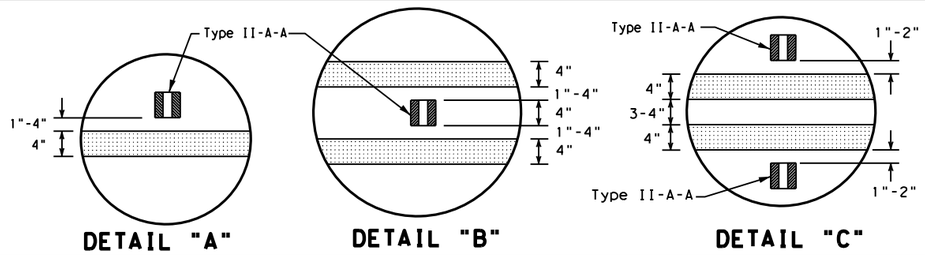
# REFLECTIVE RAISED PAVEMENT MARKERS FOR VEHICLE POSITIONING GUIDANCE



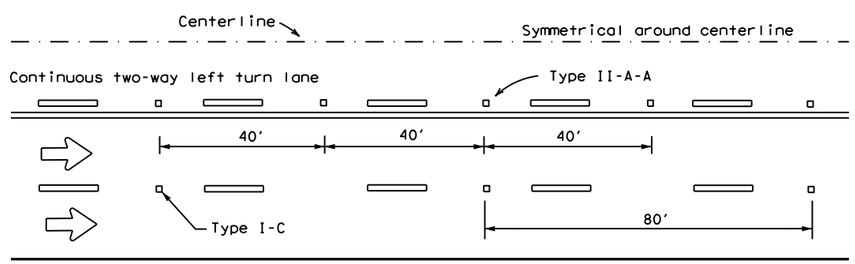

## CENTERLINE FOR ALL TWO LANE ROADWAYS



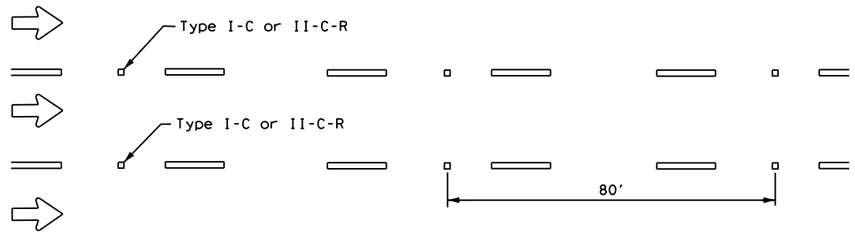

## CENTERLINE & LANE LINES FOR FOUR LANE TWO-WAY HIGHWAYS




**DETAIL "A"** **DETAIL "B"** **DETAIL "C"**

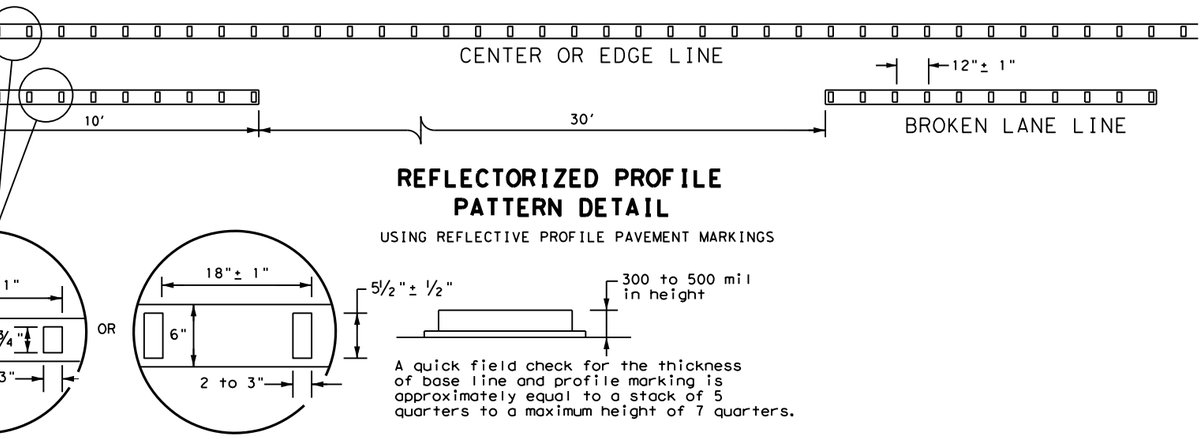



## CENTERLINE AND LANE LINES FOR TWO-WAY LEFT TURN LANE




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

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




**4" EDGE LINE, CENTER LINE OR LANE LINE**

**OPTIONAL 6" EDGE LINE, CENTER LINE OR LANE LINE**

## REFLECTORIZED PROFILE PATTERN DETAIL

USING REFLECTIVE PROFILE PAVEMENT MARKINGS

A quick field check for the thickness of base line and profile marking is approximately equal to a stack of 5 quarters to a maximum height of 7 quarters.

### NOTE

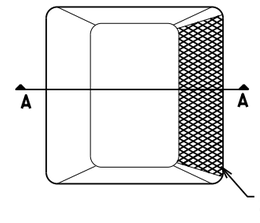
Profile markings shall not be placed on roadways with a posted speed limit of 45 MPH or less.

### GENERAL NOTES

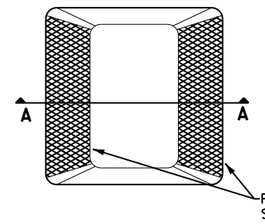
1. All raised pavement markers placed in broken lines shall be placed in line with and midway between the stripes.
2. On concrete pavements the raised pavement markers should be placed to one side of the longitudinal joints.

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

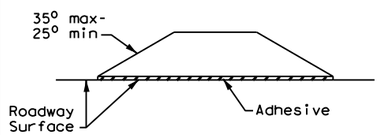
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.




**Type I (Top View)**




**Type II (Top View)**




**SECTION A**

## RAISED PAVEMENT MARKERS

Texas Department of Transportation

*Traffic Safety Division Standard*

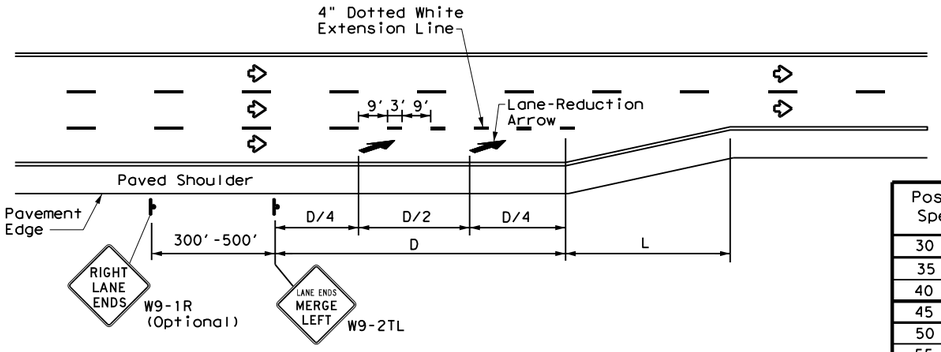
# POSITION GUIDANCE USING RAISED MARKERS RELECTORIZED PROFILE MARKINGS PM(2)-20

| FILE: pm2-20.dgn | DN: | CK: | DW: | CK: |
|---|---|---|---|---|
| ©TxDOT April 1977 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS 4-92 2-10 5-00 2-12 8-00 6-20 | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 159 |

22B



DATE:
FILE:

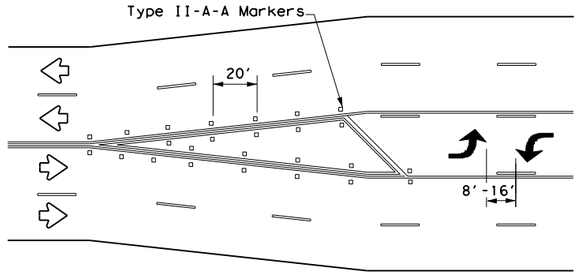



## LANE REDUCTION

| Posted Speed | D (ft) | L (ft) |
|---|---|---|
| 30 MPH | 460 | $L=\frac{WS^2}{60}$ |
| 35 MPH | 565 | |
| 40 MPH | 670 | |
| 45 MPH | 775 | L=WS |
| 50 MPH | 885 | |
| 55 MPH | 990 | |
| 60 MPH | 1,100 | |
| 65 MPH | 1,200 | |
| 70 MPH | 1,250 | |
| 75 MPH | 1,350 | |

## NOTES

1. Lane reduction pavement markings are used where the number of through lanes is reduced because of narrowing of the roadway or because of a section of on-street parking in what would otherwise be a through lane. For Texas Super 2 Passing Lanes, see TS2(PL) standard sheets.
2. On divided highways, an additional W9-1R "RIGHT LANE ENDS" sign may be installed in the median aligned with the W9-1R sign on the right side of the highway.
3. Lane reduction arrows are required for speeds of 45 mph or greater. An optional third lane reduction arrow may be added based on engineering judgement. If used, the optional third lane reduction arrow should be centered between the first and last lane reduction arrows.
4. For lane reductions on Freeways and Expressways, signing shall conform to the TxDOT Freeway Signing Handbook.




A two-way left-turn (TWLT) lane-use arrow pavement marking should be used at or just downstream from the beginning of a two-way left-turn lane within a corridor. Repeating the marking after each intersection or dedicated turn bay is not required unless stated elsewhere in the plans.

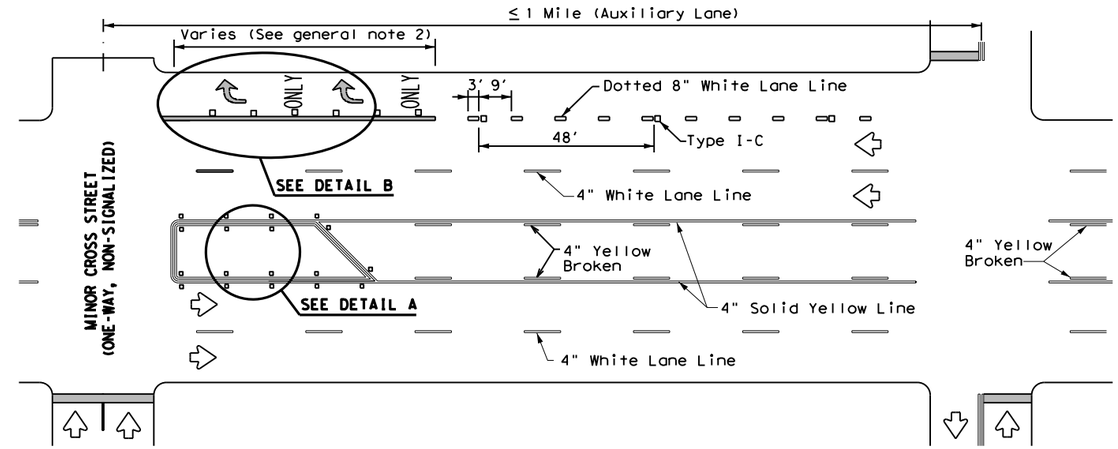
## TYPICAL TRANSITION FOR TWLTL AND DIVIDED HIGHWAY

## GENERAL NOTES

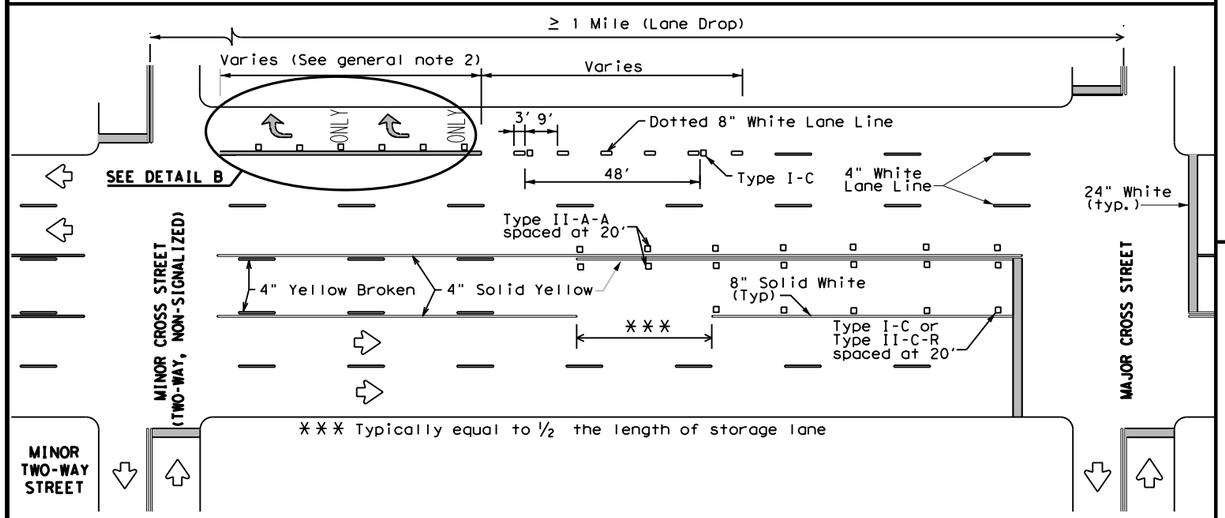
1. Lane use word and arrow markings shall be used where through lanes approaching an intersection become mandatory turn lanes. Lane use word and arrow markings should be used in auxiliary lanes of substantial length. Lane use arrow markings or word and arrow markings may be used in other lanes and turn bays for emphasis. Details for words and arrows are as shown in the Standard Highway Sign Designs for Texas.
2. When lane-use words and arrow markings are used, two sets of arrows should be used if the length of the bay is greater than 180 feet. When a single lane use arrow or word and arrow marking is used for a short turn lane, it should be located at or near the upstream end of the full-width turn lane.
3. Use raised pavement marker Type I-C with undivided highways, flush medians and two way left turn lanes. Use raised pavement marker Type II-C-R with divided highways and raised medians.
4. Length of turn bays, including taper, deceleration, and storage lengths shall be as shown on the plans or as directed by the Engineer.

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

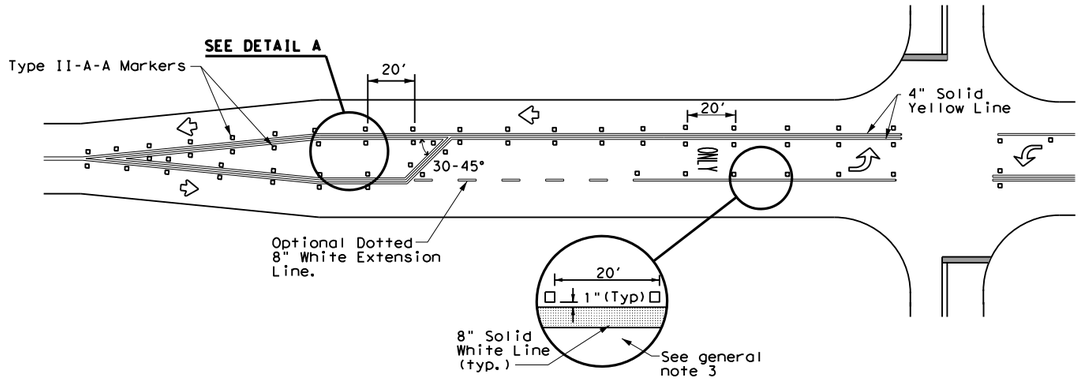
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



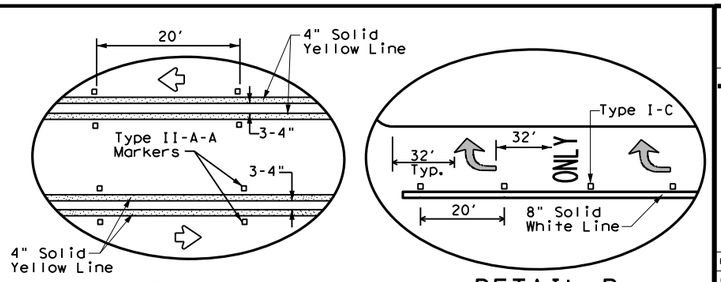

## TYPICAL TWLTL AT ONE-WAY STREET AND RIGHT TURN AUXILIARY LANE




## TYPICAL TWLTL AT TWO-WAY CROSS STREET AND RIGHT TURN LANE DROP




## TYPICAL TWO-LANE HIGHWAY INTERSECTION WITH LEFT TURN BAYS




Texas Department of Transportation

Traffic Safety Division Standard

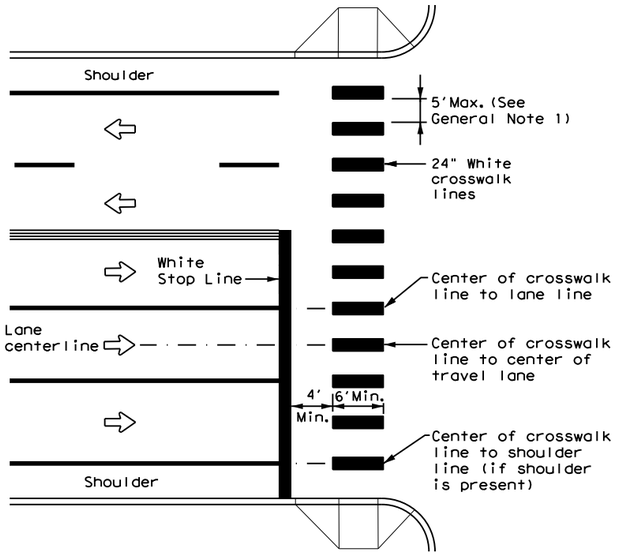
# TWO-WAY LEFT TURN LANES, RURAL LEFT TURN BAYS, AND LANE REDUCTION PAVEMENT MARKINGS PM(3)-20

| FILE: pm3-20.dgn | DN: | CK: | DW: | CK: |
|---|---|---|---|---|
| © TxDOT April 1998 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 5-00 2-10 | DIST | COUNTY | | SHEET NO. |
| 8-00 2-12 | 10 | SMITH, ETC. | | 160 |
| 3-03 6-20 | | | | |

220

DATE:
FILE:

DATE:
FILE:



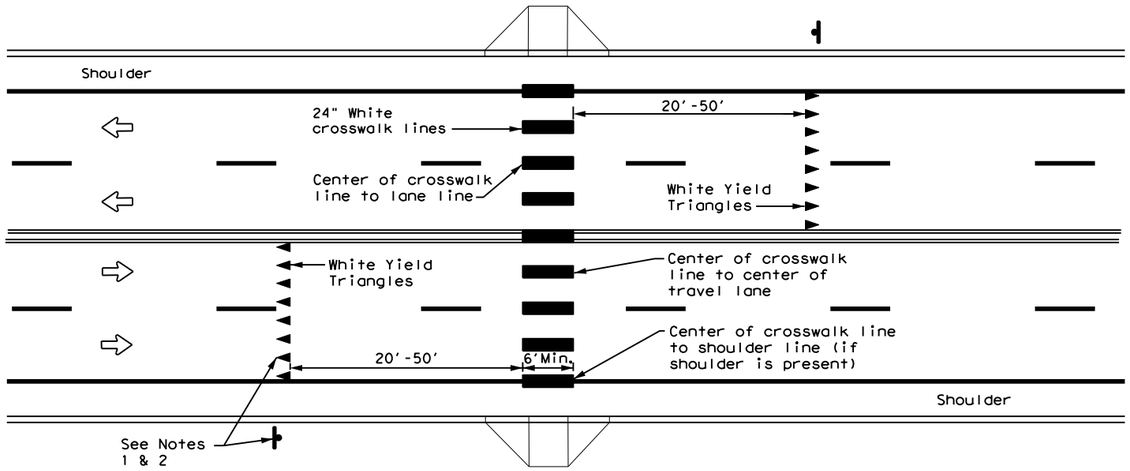

## HIGH-VISIBILITY LONGITUDINAL CROSSWALK AT CONTROLLED APPROACH

## 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/Yield Triangles 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 yield triangles with "Yield Here to 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.

Texas Department of Transportation

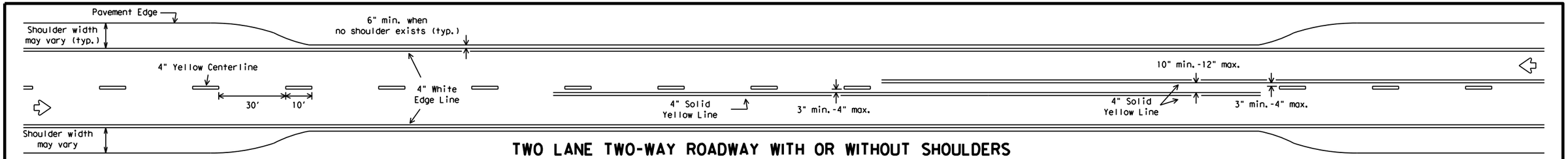
Traffic Safety Division Standard

# CROSSWALK PAVEMENT MARKINGS

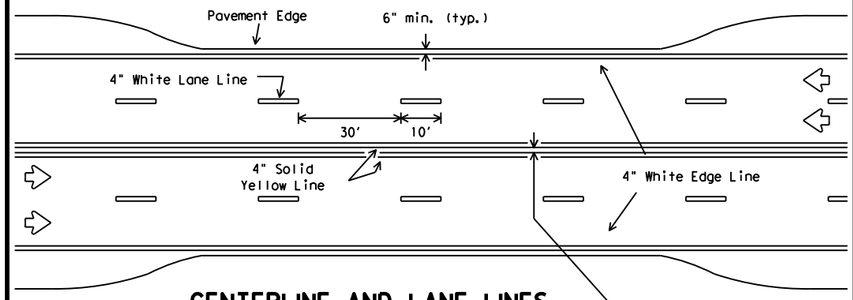
# PM(4)-20

| FILE: pm4-20.dgn | DN: | CK: | DW: | CK: |
|---|---|---|---|---|
| © TxDOT June 2020 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 161 |

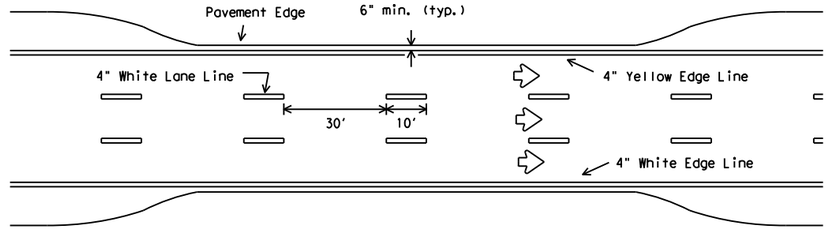
22D



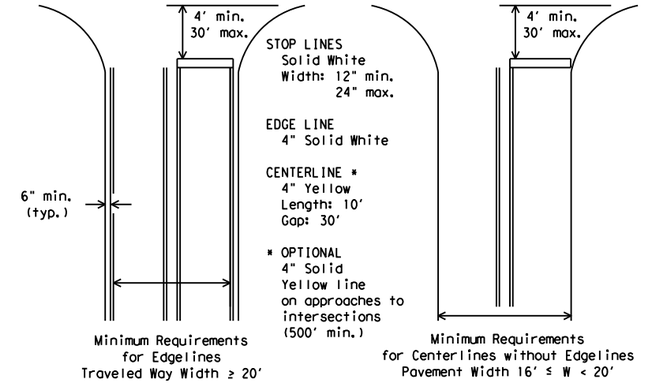

## TWO LANE TWO-WAY ROADWAY WITH OR WITHOUT SHOULDERS




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

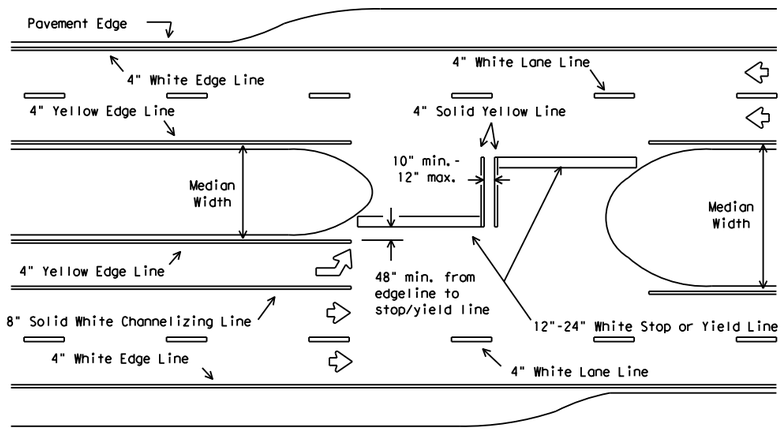



## EDGE LINE AND LANE LINES ONE-WAY ROADWAY WITH OR WITHOUT SHOULDERS



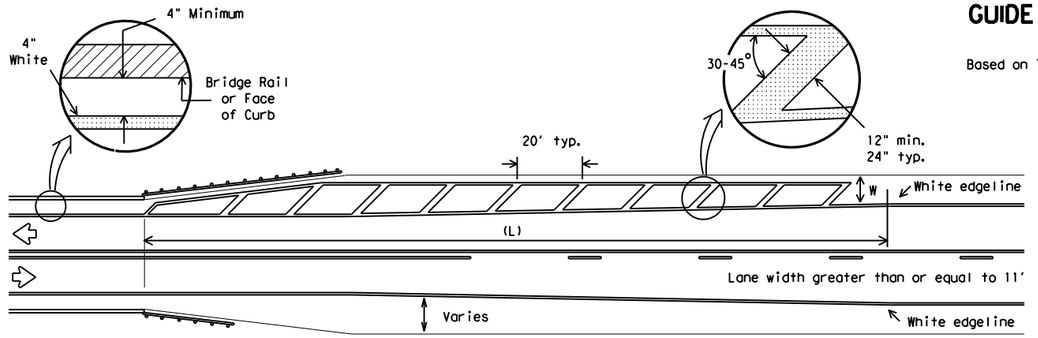

## GUIDE FOR PLACEMENT OF STOP LINES, EDGE LINE & CENTERLINE

Based on Traveled Way and Pavement Widths for Undivided Highways




All medians shall be field measured to determine the location of necessary striping. Stop/Yield bars and centerlines shall be placed when the median width is greater than 30 ft. The median width is defined as the area between two roadways of a divided highway measured from edge of traveled way to edge of traveled way. The median excludes turn lanes. The median width might be different between intersections, interchanges and of opposite approaches of the same intersection. The narrow median width will be the controlling width to determine if markings are required.

## FOUR LANE DIVIDED ROADWAY INTERSECTIONS




NOTES:

1. No-passing zone on bridge approach is optional but if used, it shall be a minimum 500 feet long.
2. For crosshatching length (L) see Table 1.
3. The width of the offset (W) and the required crosshatching width is the full shoulder width in advance of the bridge.
4. The crosshatching is not required if delineators or barrier reflectors are used along the structure.
5. For guard fence details, refer elsewhere in the plans.

## ROADWAYS WITH REDUCED SHOULDER WIDTHS ACROSS BRIDGE OR CULVERT

### TABLE 1 - TYPICAL LENGTH (L)

| Posted Speed * | Formula |
|---|---|
| ≤ 40 | $L = \frac{WS^2}{60}$ |
| ≥ 45 | L=WS |

* 85th Percentile Speed may be used on roads where traffic speeds normally exceed the posted speed limit. Crosshatching length should be rounded up to nearest 5 foot increment.

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

EXAMPLES:

An 8 foot shoulder in advance of a bridge reduces to 4 feet on a 70 MPH roadway. The length of the crosshatching should be:

$L = 8 \times 70 = 560$ ft.

A 4 foot shoulder in advance of a bridge reduces to 2 feet on a 40 MPH roadway. The length of the crosshatching should be:

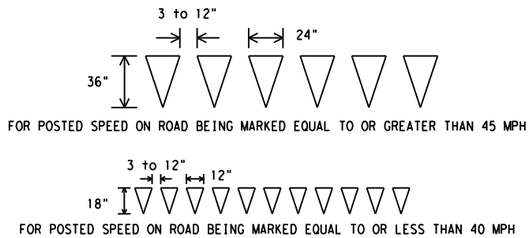
$L = 4(40)^2 / 60 = 106.67$ ft. rounded to 110 ft.

### GENERAL NOTES

1. Edgeline striping shall be as shown in the plans or as directed by the Engineer. The edgeline should typically be placed a minimum of 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 and not the parking lanes, sidewalks, berms and shoulders. The traveled ways shall be measured from the inside of edgeline to 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.




## YIELD LINES

Texas Department of Transportation
Traffic Operations Division

# TYPICAL STANDARD PAVEMENT MARKINGS

PM(1)-12



| DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|

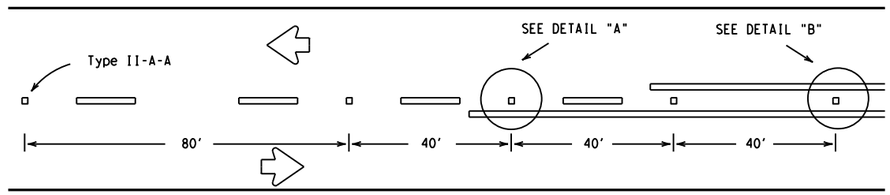
| REVISIONS | CONT | SECT | JOB | HIGHWAY |
|---|---|---|---|---|
| 8-95 2-12 | 6367 | 43 | 001 | IH-20 |
| 5-00 | | | | |
| 8-00 | DIST | COUNTY | | SHEET NO. |
| 3-03 | 10 | SMITH, ETC. | | 162 |

DATE:
FILE:

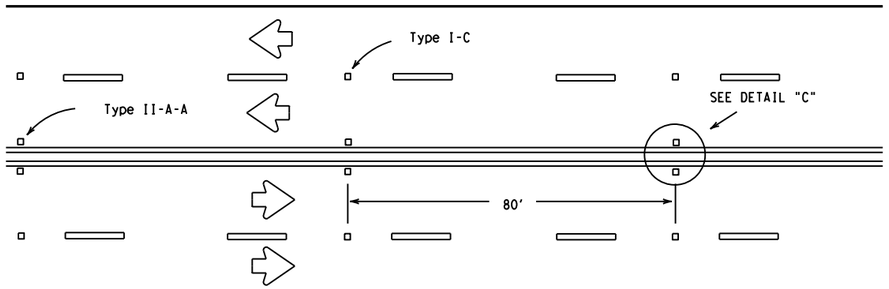
22A

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.

# REFLECTIVE RAISED PAVEMENT MARKERS FOR VEHICLE POSITIONING GUIDANCE




## CENTERLINE FOR ALL TWO LANE ROADWAYS

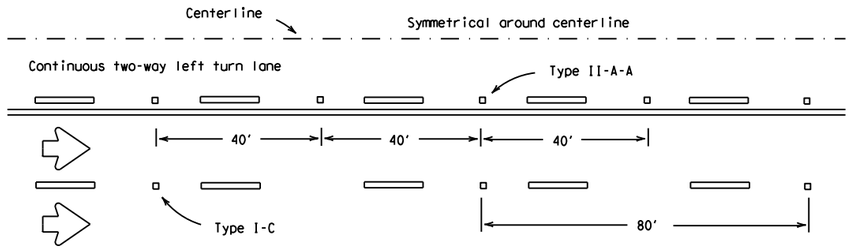



## CENTERLINE & LANE LINES FOR FOUR LANE TWO-WAY HIGHWAYS

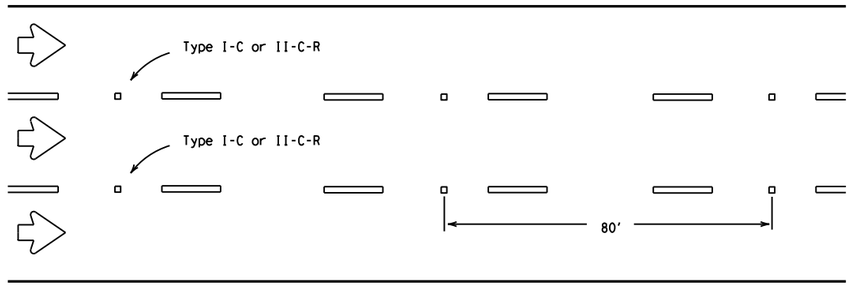
Raised pavement marker Type I-C, clear face toward normal traffic, shall be placed on 80-foot centers.




DETAIL "A" DETAIL "B" DETAIL "C"




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

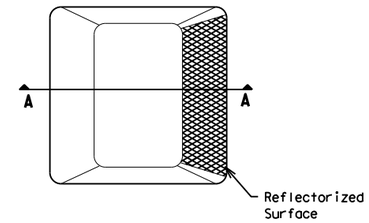



## LANE LINES FOR ONE-WAY ROADWAY (NON-FREEWAY FACILITIES)

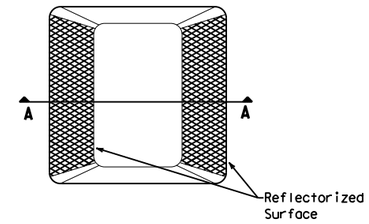
Raised pavement markers Type II-C-R shall have clear face toward normal traffic and red face toward wrong-way traffic.

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

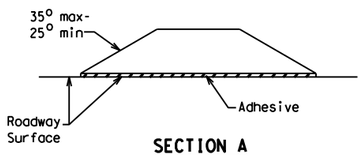
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.




Type I (Top View)

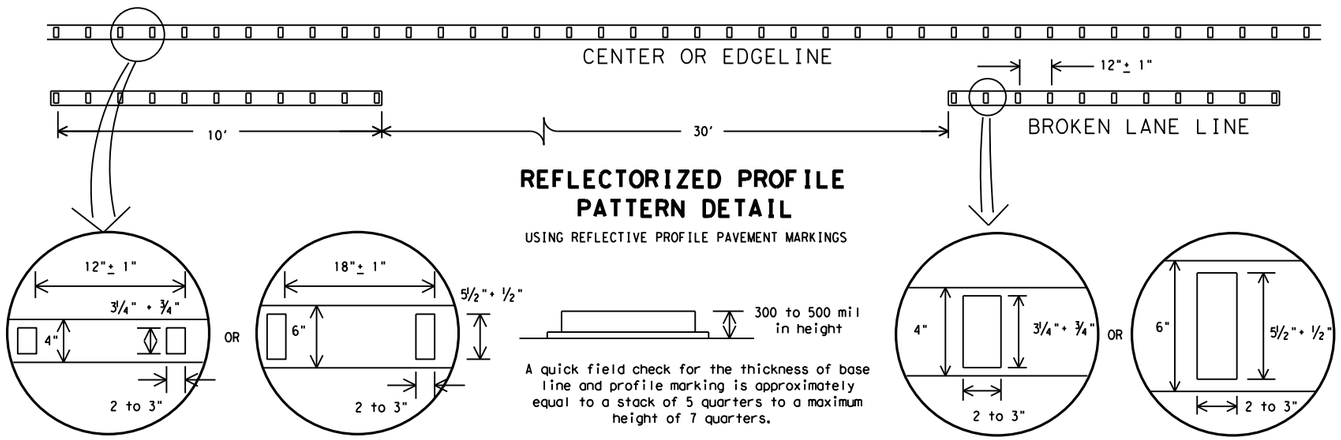



Type II (Top View)




SECTION A

## RAISED PAVEMENT MARKERS




## REFLECTORIZED PROFILE PATTERN DETAIL

USING REFLECTIVE PROFILE PAVEMENT MARKINGS

A quick field check for the thickness of base line and profile marking is approximately equal to a stack of 5 quarters to a maximum height of 7 quarters.

4" EDGE LINE OR CENTERLINE — OPTIONAL 6" EDGE LINE OR CENTERLINE — 4" LANE LINE — OPTIONAL 6" LANE LINE

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

### GENERAL NOTES

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

*Texas Department of Transportation*
*Traffic Operations Division*

## POSITION GUIDANCE USING RAISED MARKERS
## REFLECTORIZED PROFILE MARKINGS
## PM(2)-12

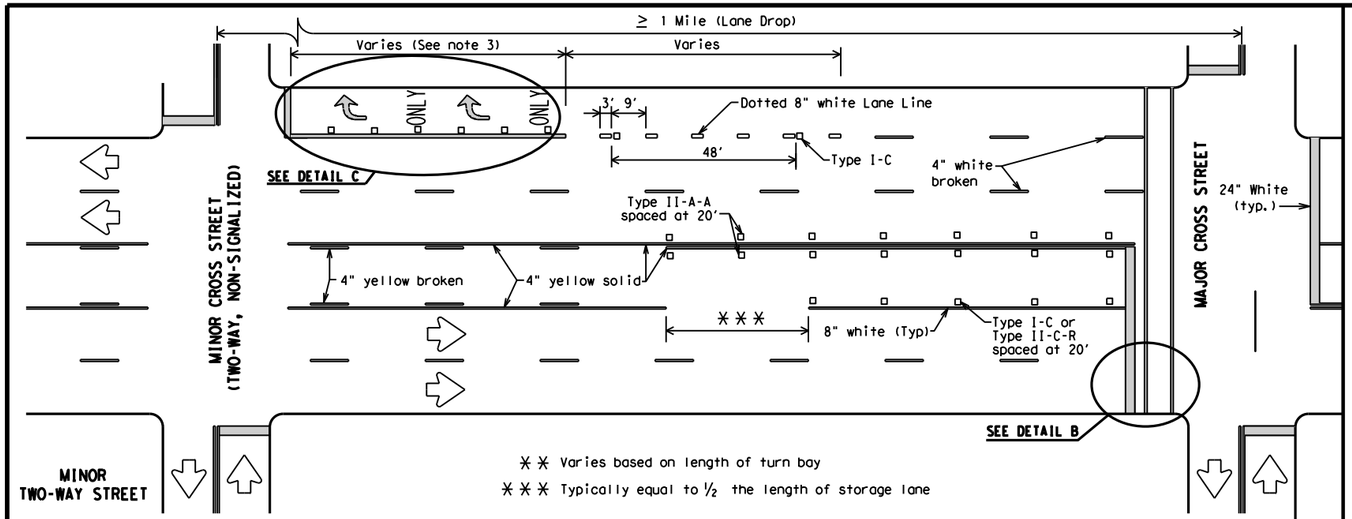


| DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|

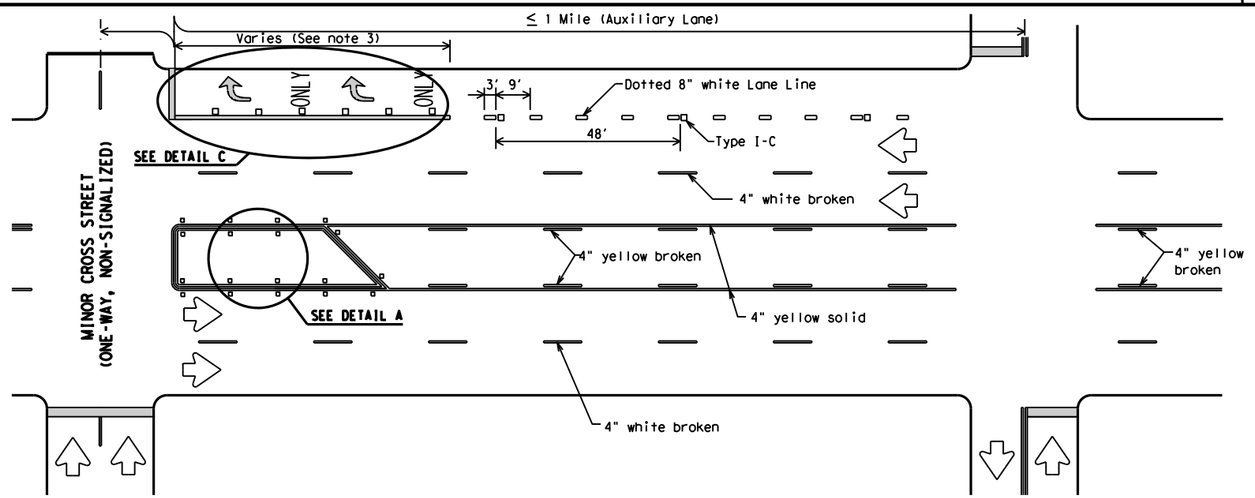
| REVISIONS | | CONT | SECT | JOB | HIGHWAY |
|---|---|---|---|---|---|
| 4-92 | 2-10 | 6367 | 43 | 001 | IH-20 |
| 5-00 | 2-12 | DIST | COUNTY | | SHEET NO. |
| 8-00 | | 10 | SMITH, ETC. | | 163 |
| 2-08 | | | | | |

DATE:
FILE:

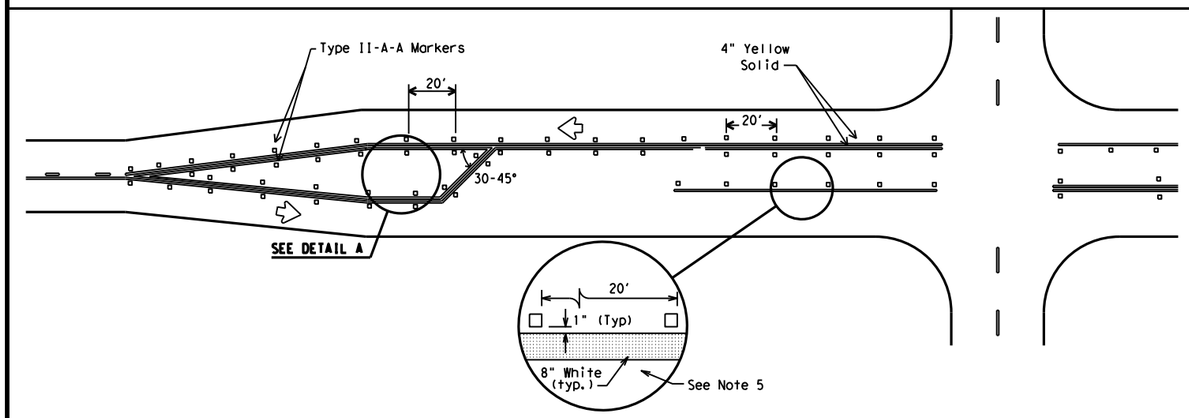
DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.



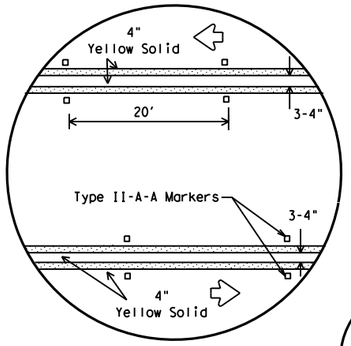

TYPICAL TWLTL AT TWO-WAY CROSS STREET AND RIGHT TURN LANE DROP



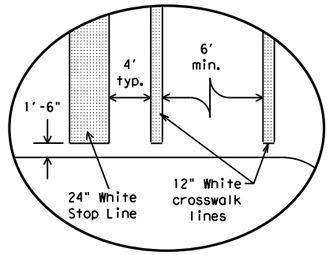

TYPICAL TWLTL AT ONE-WAY STREET AND RIGHT TURN AUXILIARY LANE




TYPICAL TWO-LANE HIGHWAY INTERSECTION WITH LEFT TURN BAYS

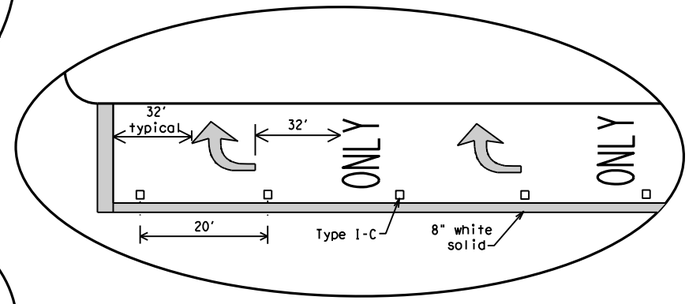



DETAIL A




Final placement of Stop Bar and Crosswalk shall be approved by the Engineer in the field.

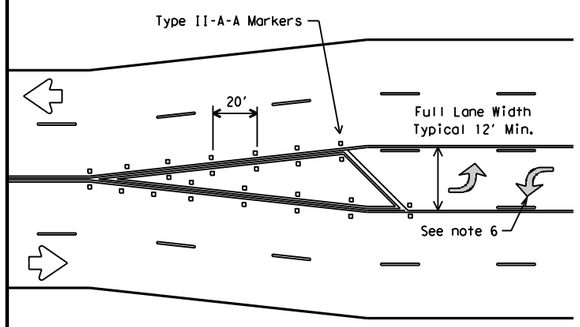
DETAIL B




DETAIL C

| 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 TRANSITION FOR TWLTL AND DIVIDED HIGHWAY

## GENERAL NOTES

1. Refer elsewhere in plans for additional RPM placement and details.
2. Lane use word and arrow markings shall be used where through lanes approaching an intersection become mandatory turn lanes. Lane use word and arrow markings should be used in auxiliary lanes of substantial length. Lane use arrow markings or word and arrow markings may be used in other lanes and turn bays for emphasis. Details for words and arrows as shown in the Standard Highway Sign Designs for Texas.
3. When lane used word and arrow markings are used, two sets of arrows should be used if the length of the bay is greater than 180 feet. When a single lane use arrow or word and arrow marking is used for a short turn lane, it should be located at or near the upstream end of the full-width turn lane.
4. Other crosswalk paterns as shown in the "Texas Manual on Uniform Traffic Control Devices" may be used.
5. Raised pavement marker Type I-C with undivided highways, flush medians and two way left turn lanes. Raised pavement marker Type II-C-R with divided highways and raised medians.
6. A two-way left-turn (TWLT) lane-use arrow pavement marking should be used at or just downstream from the beginning of a two-way left-turn lane within a corridor. Repeating the marking after each intersection or dedicated turn bay is not required unless stated elsewhere in the plans.

Texas Department of Transportation
Traffic Operations Division

# PAVEMENT MARKINGS FOR TWO-WAY LEFT TURN LANES DIVIDED HIGHWAYS AND RURAL LEFT TURN BAYS

PM(3)-12

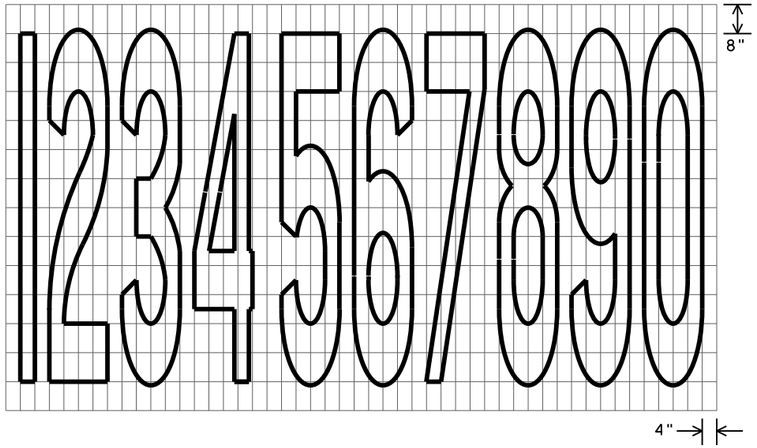


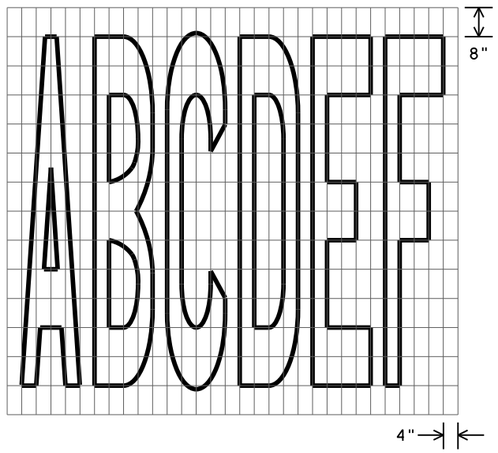
| REVISIONS | DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|---|
| 5-00 2-12 | CONT | SECT | JOB | HIGHWAY |
| 8-00 | 6367 | 43 | 001 | IH-20 |
| 3-03 | DIST | COUNTY | | SHEET NO. |
| 2-10 | 10 | SMITH, ETC. | | 164 |

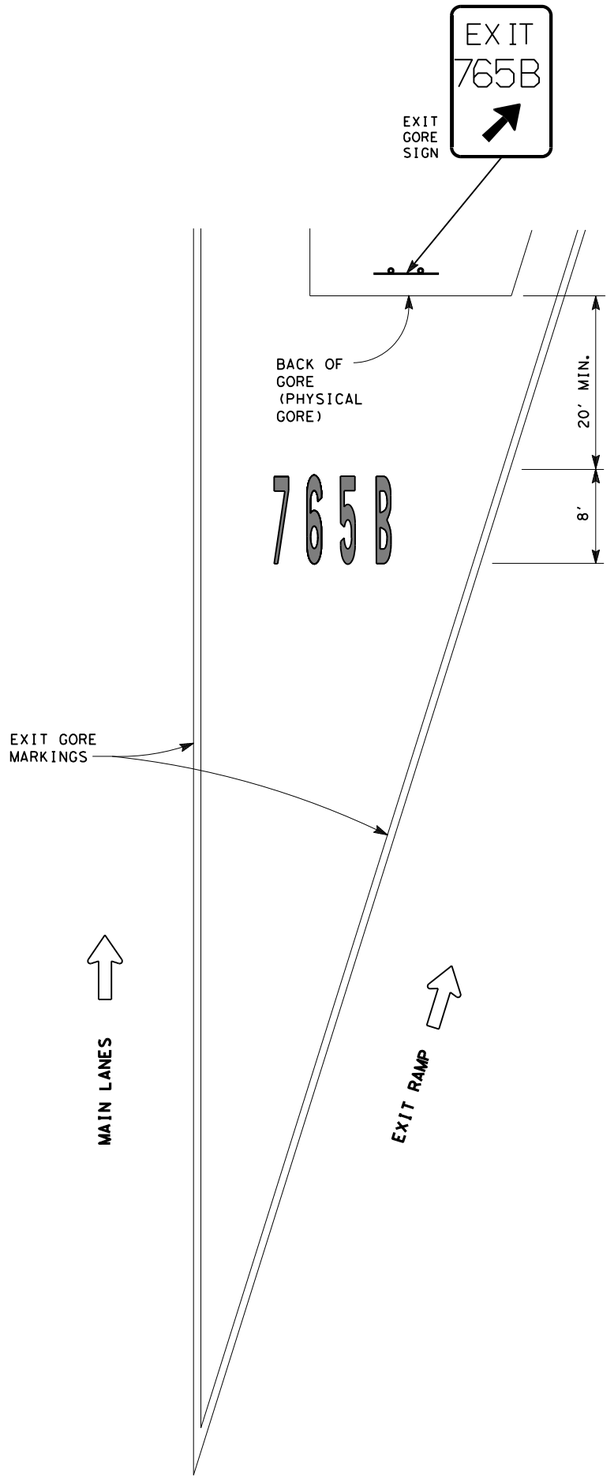
22C

DATE:
FILE:

DATE:
FILE:




## GENERAL 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.

Texas Department of Transportation
Traffic Operations Division

# EXIT NUMBER GORE MARKINGS FOR AERIAL VIEW DETAIL

PM(4)-12

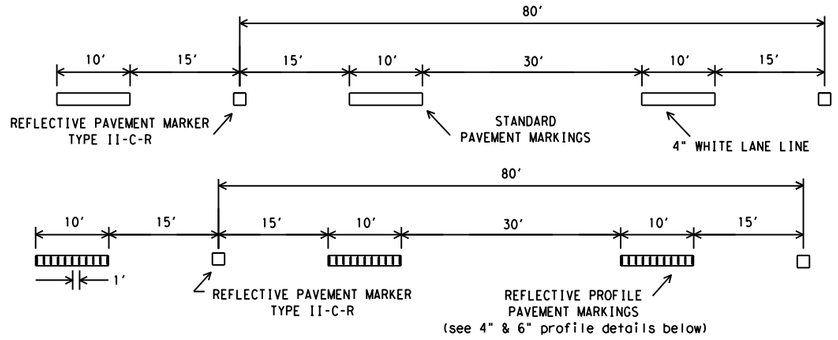


| DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|

REVISIONS
2-10
2-12

| CONT | SECT | JOB | HIGHWAY |
|---|---|---|---|
| 6367 | 43 | 001 | IH-20 |

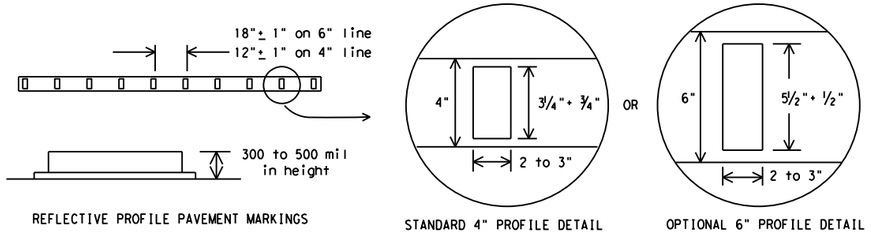
| DIST | COUNTY | SHEET NO. |
|---|---|---|
| 10 | SMITH, ETC. | 165 |



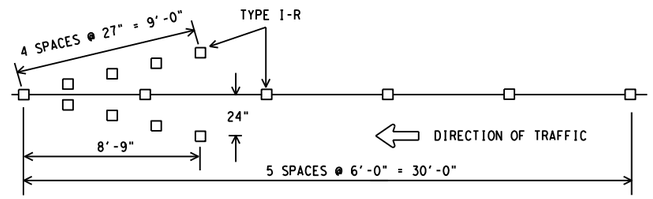

PAVEMENT MARKERS (REFL) TYPE II-C-R SHALL BE SPACED ON 80' CENTERS WITH THE CLEAR FACE TOWARD NORMAL TRAFFIC AND THE RED FACE TOWARD WRONG WAY TRAFFIC.

## TRAFFIC LANE LINES PAVEMENT MARKING DETAILS

EDGELINES SHOULD TYPICALLY BE 4" WIDE AND THE MATERIALS SHALL BE AS SPECIFIED IN THE PLANS.
IF RAISED PROFILE PAVEMENT MARKINGS ARE USED SEE DETAILS BELOW.



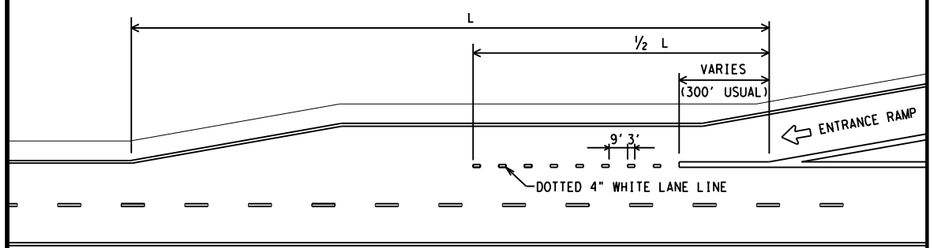

## EDGELINE PAVEMENT MARKINGS



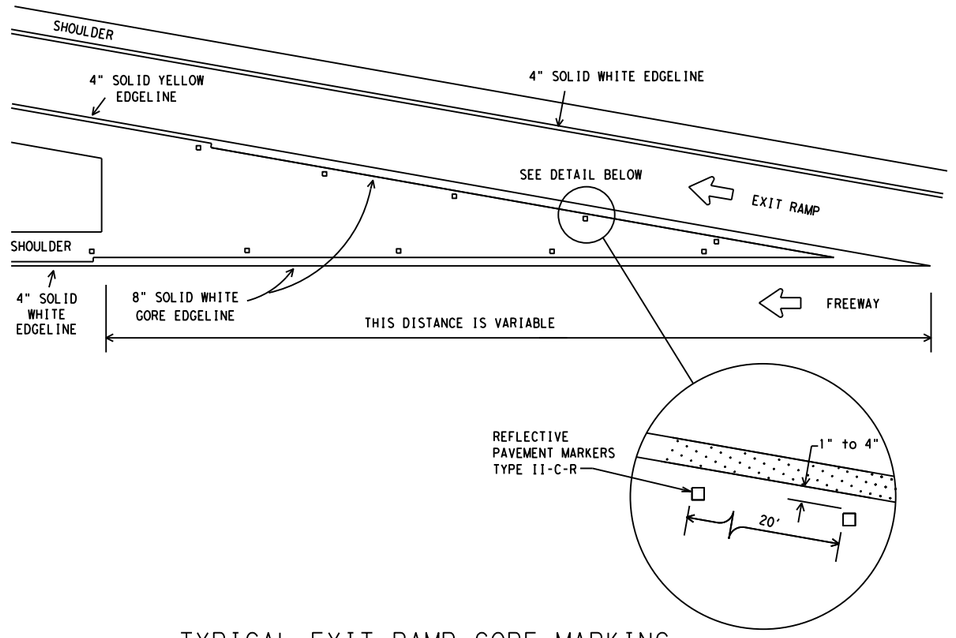

ALL RAISED MARKERS IN THE WRONG WAY ARROW SHALL BE TYPE I-R REFLECTORIZED PAVEMENT MARKERS WITH THE REFLECTORIZED SURFACE FACING THE WRONG WAY TRAFFIC. TYPE II-C-R SHALL NOT BE USED.

REFLECTORIZED WRONG WAY ARROWS, NOT TO EXCEED TWO, MAY BE PLACED ON EXIT RAMPS.
LOCATION OF THE ARROWS SHALL BE AS SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER.

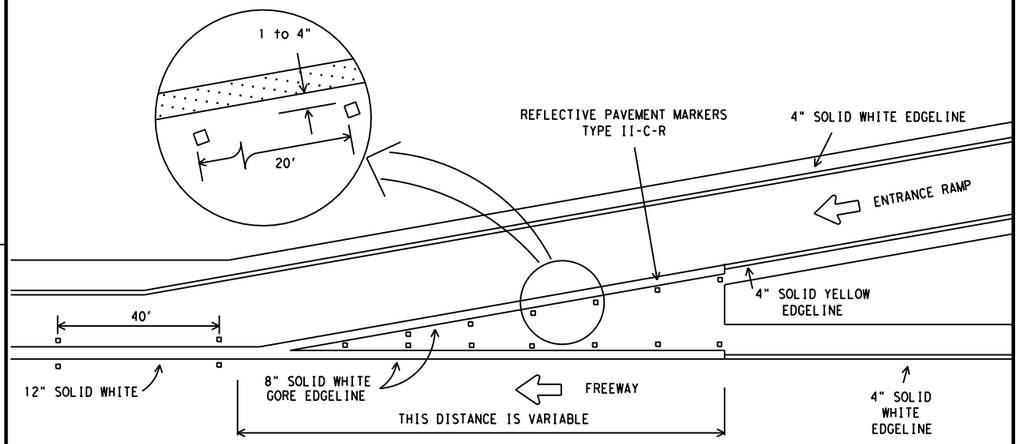
## WRONG WAY ARROW DETAIL




## PARALLEL ACCELERATION LANE

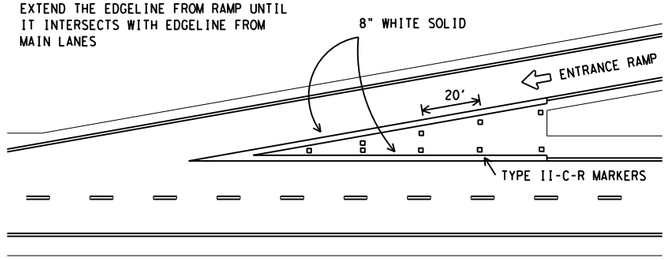



## TYPICAL EXIT RAMP GORE MARKING




## TYPICAL ENTRANCE RAMP GORE MARKING

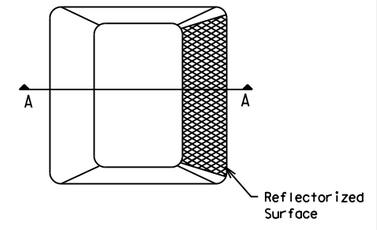
EXTEND THE EDGELINE FROM RAMP UNTIL IT INTERSECTS WITH EDGELINE FROM MAIN LANES




## 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.




## RAISED PAVEMENT MARKERS

Texas Department of Transportation
Traffic Operations Division

# TYPICAL STANDARD FREEWAY PAVEMENT MARKINGS WITH RAISED PAVEMENT MARKERS

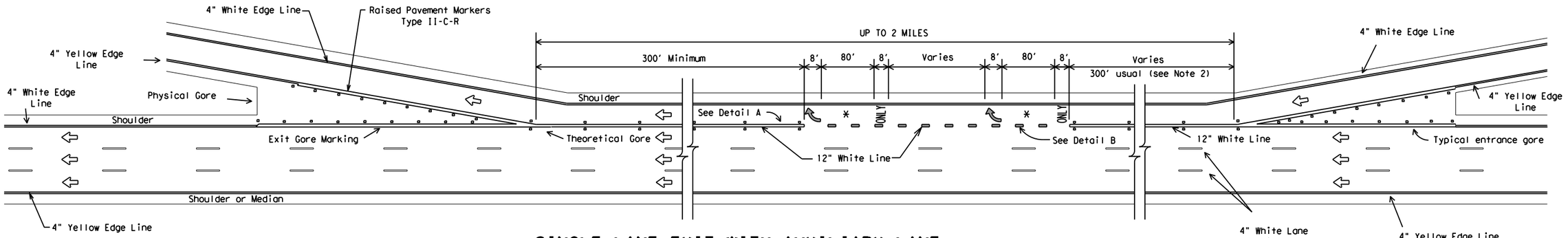
**FPM(1)-12**



| DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|

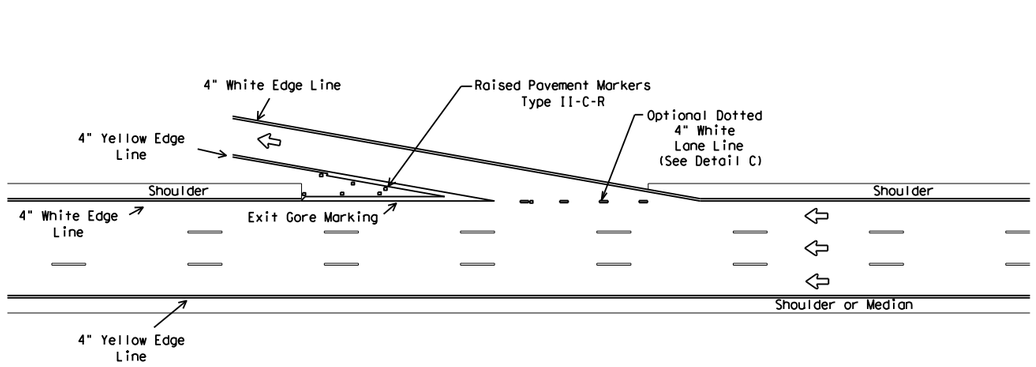
| REVISIONS | | CONT | SECT | JOB | HIGHWAY |
|---|---|---|---|---|---|
| 4-92 | 2-10 | 6367 | 43 | 001 | IH-20 |
| 5-00 | 2-12 | DIST | COUNTY | | SHEET NO. |
| 8-00 | | 10 | SMITH, ETC. | | 166 |
| 2-08 | | | | | |

DATE:
FILE:

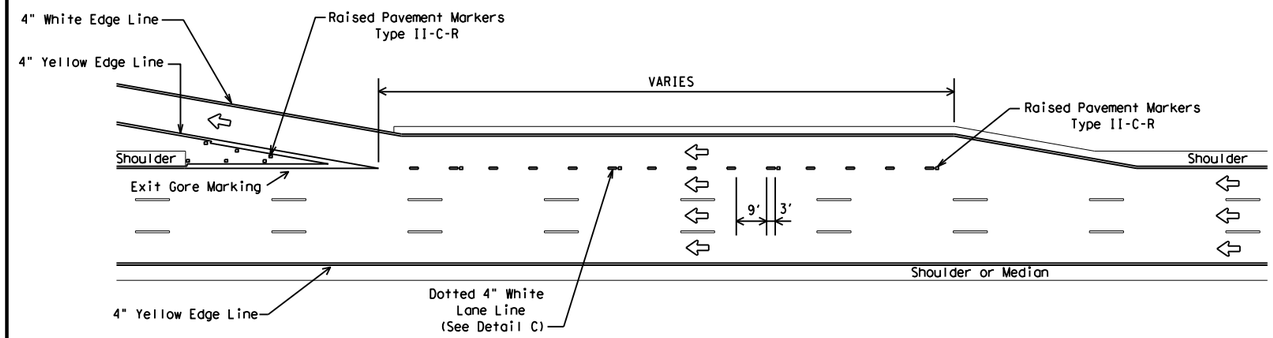



## SINGLE LANE EXIT WITH AUXILIARY LANE

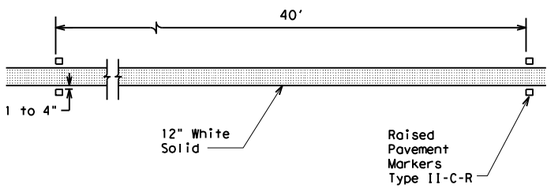
(See Note 2)



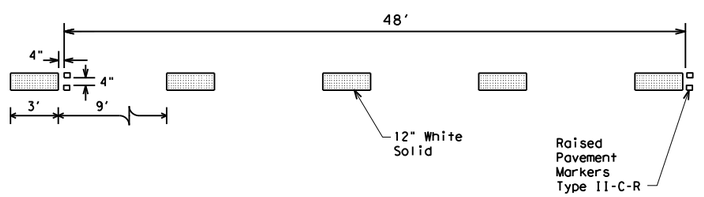

## TAPERED DECELERATION LANE




## PARALLEL DECELERATION LANE

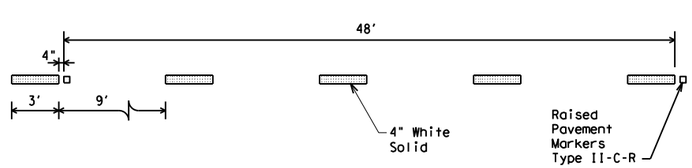



## DETAIL A




## DETAIL B

Wide (12") Dotted Lane Line (See Note 3)




## DETAIL C

Normal (4") Dotted Lane Line (See Note 4)

### GENERAL NOTES

1. Pavement markings shall be white except as otherwise noted.
2. Length of 12" white line may vary depending on location.
3. Wide (12") Dotted Lane Line (See Detail B) is used to separate a through lane from a lane drop at normal exit ramp and from an auxiliary lane between an entrance and exit ramp.
4. Normal (4") Dotted Lane Line (See Detail C) is used at parallel acceleration and deceleration lanes.

| LEGEND | |
|---|---|
| ⇦ | Denotes direction of traffic. |
| ↱ | Pavement marking arrows (white) |
| ✳ | Arrow markings are optional, however "ONLY" is required if arrow is used |

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

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

Texas Department of Transportation
Traffic Operations Division

# TYPICAL STANDARD FREEWAY PAVEMENT MARKINGS ENTRANCE AND EXIT RAMPS

# FPM(2)-12



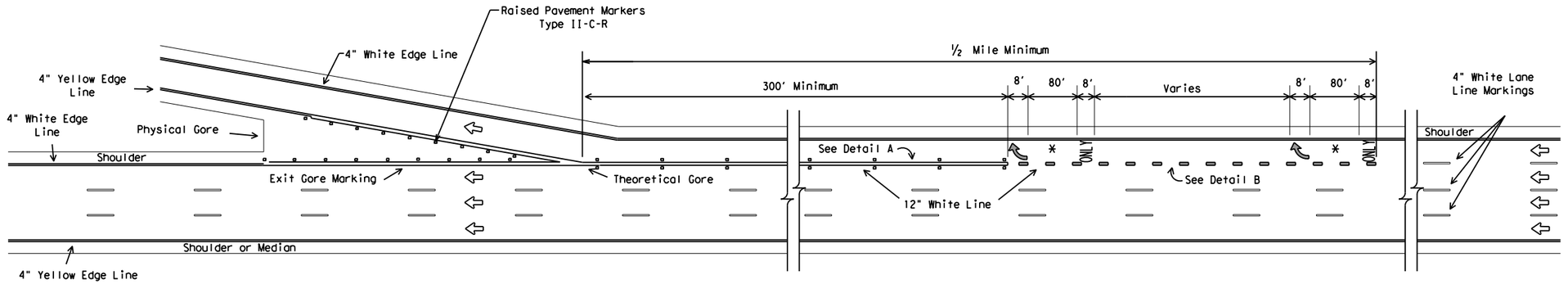
| DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|

REVISIONS
4-92 2-10
8-95 2-12
5-00
8-00

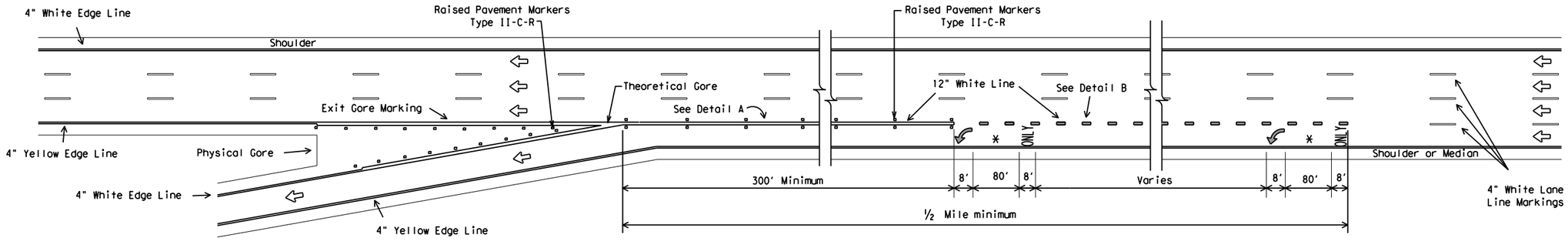
| CONT | SECT | JOB | HIGHWAY |
|---|---|---|---|
| 6367 | 43 | 001 | IH-20 |
| DIST | COUNTY | | SHEET NO. |
| 10 | SMITH, ETC. | | 167 |

DATE:
FILE:

DATE:
FILE:




## SINGLE LANE EXIT - LANE DROP OR EXIT ONLY

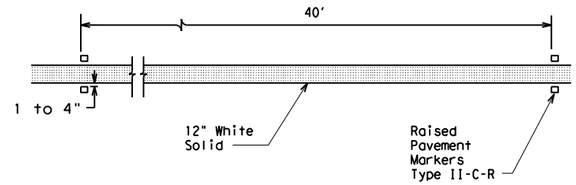



## SINGLE LANE EXIT - LANE DROP OR EXIT ONLY (LEFTHAND)

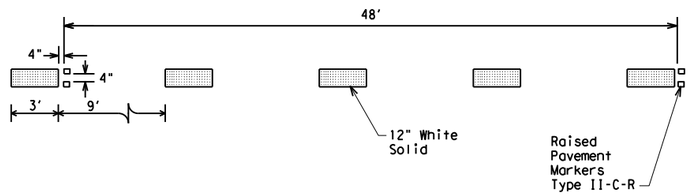
| LEGEND | |
|---|---|
| ⇦ | Denotes direction of traffic. |
| ↱ | Pavement marking arrows (white) |
| ✳ | Arrow markings are optional, however "ONLY" is required if arrow is used |

### 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.

*Texas Department of Transportation*
*Traffic Operations Division*

# TYPICAL STANDARD FREEWAY PAVEMENT MARKINGS LANE DROP (EXIT ONLY) EXIT RAMPS

## FPM(3)-12



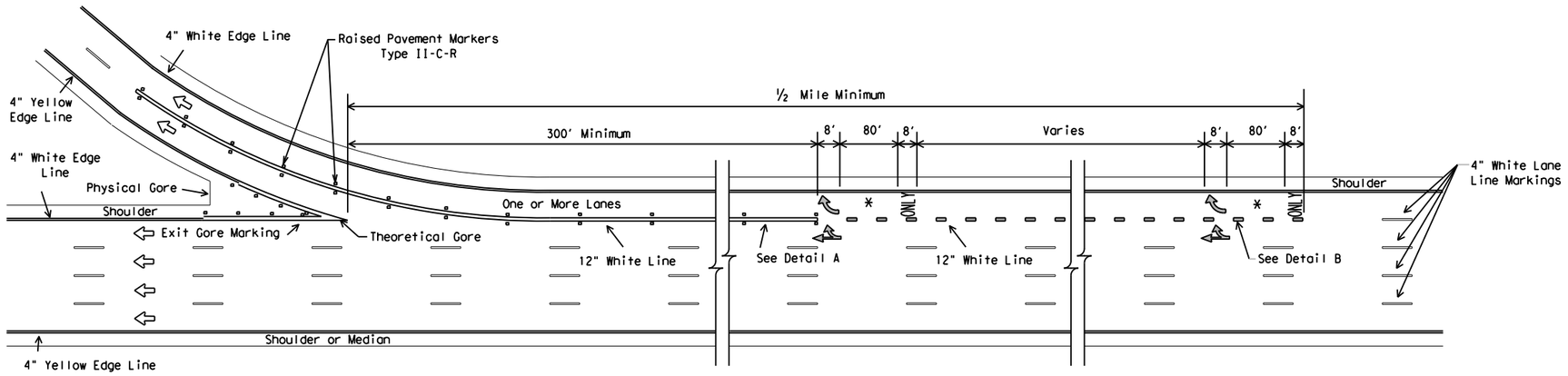
| DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|

REVISIONS
5-00
8-00
2-10
2-12

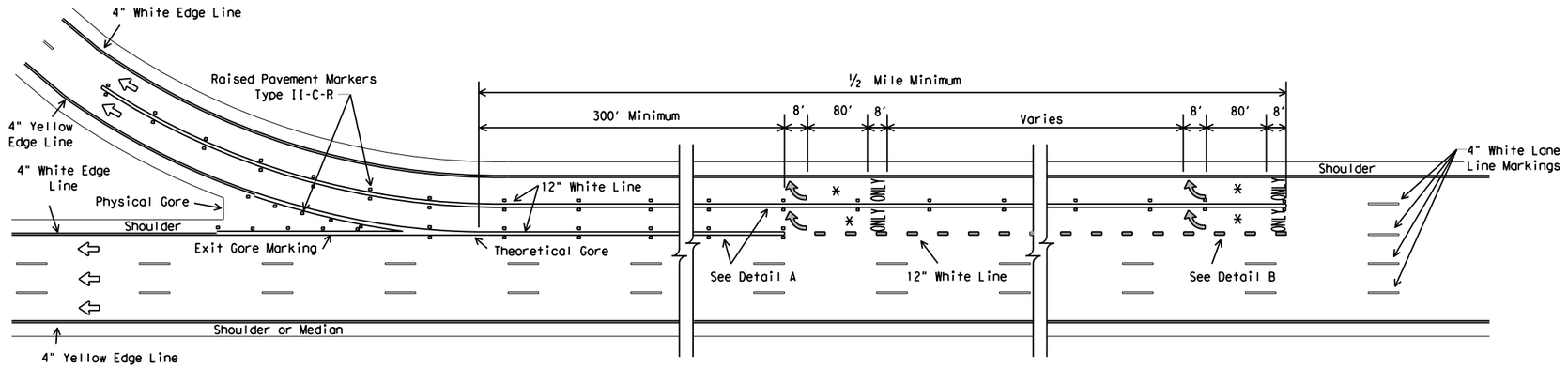
| CONT | SECT | JOB | HIGHWAY |
|---|---|---|---|
| 6367 | 43 | 001 | IH-20 |

| DIST | COUNTY | SHEET NO. |
|---|---|---|
| 10 | SMITH, ETC. | 168 |

23C




## MULTIPLE LANE EXIT - EXIT ONLY WITH OPTION LANE

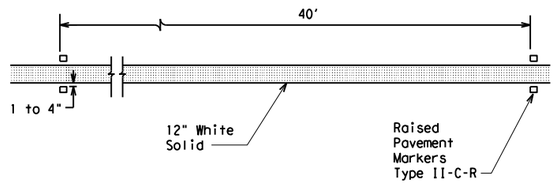



## MULTIPLE LANE EXIT ONLY

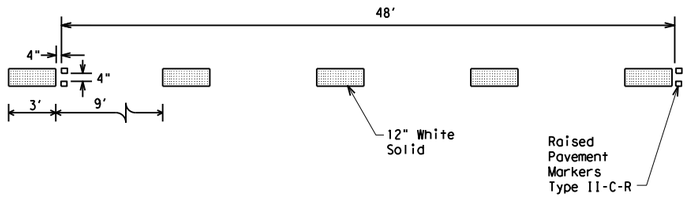
| LEGEND | |
|---|---|
| ⇦ | Denotes direction of traffic |
| | Pavement marking arrow (white) |
| | Optional Pavement Marking Arrows (white) |
| ✳ | Arrow markings are optional, however "ONLY" is required if arrow is used |

### 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.

*Texas Department of Transportation*
*Traffic Operations Division*

# TYPICAL STANDARD FREEWAY PAVEMENT MARKINGS LANE DROP (EXIT ONLY) DETAILS

FPM(4)-12

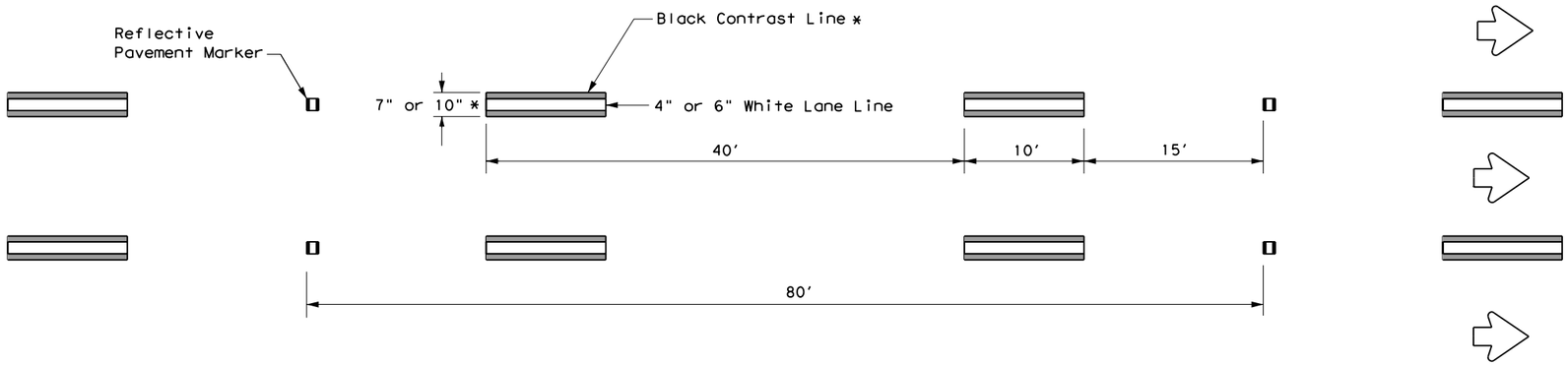


| DN: TXDOT | CK: TXDOT | DW: TXDOT | CK: TXDOT |
|---|---|---|---|

REVISIONS
5-00
8-00
2-10
2-12

| CONT | SECT | JOB | HIGHWAY |
|---|---|---|---|
| 6367 | 43 | 001 | IH-20 |
| DIST | COUNTY | | SHEET NO. |
| 10 | SMITH, ETC. | | 169 |

DATE:
FILE:



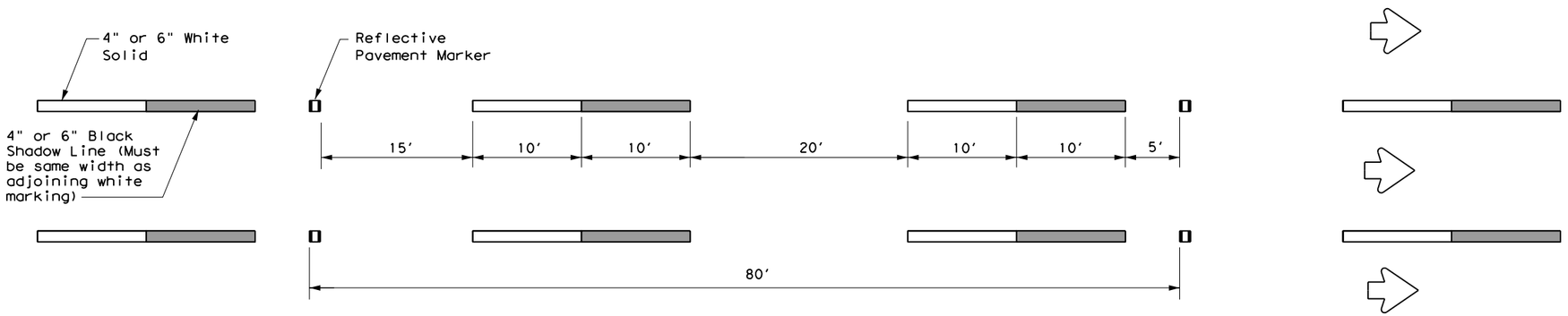

* See contrast line dimensions table for width of black line.

## CONTRAST LANE LINE DESIGN

| 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.

Texas Department of Transportation

Traffic Operations Division Standard

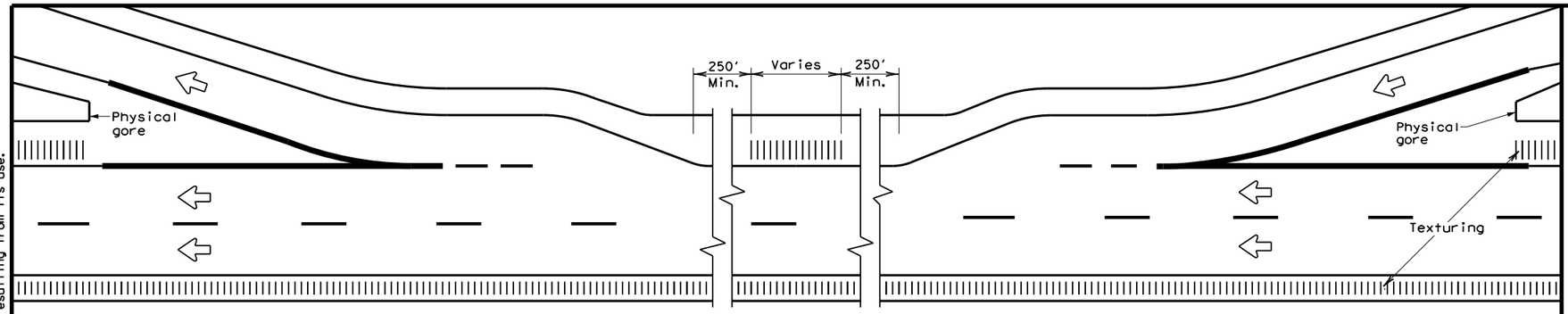
# CONTRAST AND SHADOW PAVEMENT MARKINGS

# CPM(1)-14

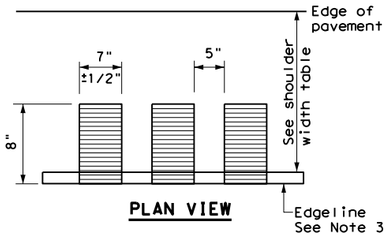
| FILE: CPM(1)14.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| © TxDOT May 2014 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 170 |

22N

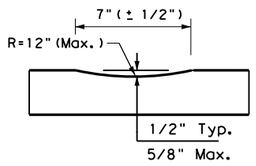
DATE:
FILE:




# TYPICAL RUMBLE STRIP PLACEMENT AT EXIT AND ENTRANCE RAMPS

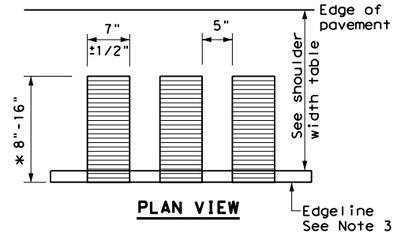



PLAN VIEW



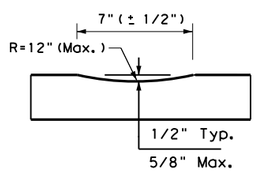

PROFILE VIEW
OPTION 1

CONTINUOUS MILLED DEPRESSIONS
(Rumble Stripes)



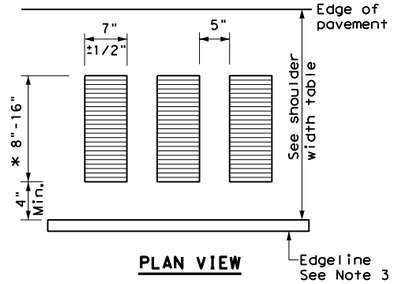

PLAN VIEW

* This distance may vary based on width of shoulder



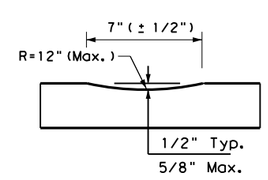

PROFILE VIEW
OPTION 2

CONTINUOUS MILLED DEPRESSIONS
(Rumble Stripes)



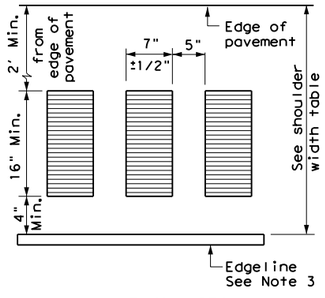

PLAN VIEW

* This distance may vary based on width of shoulder

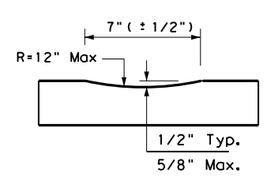



PROFILE VIEW
OPTION 3

CONTINUOUS MILLED DEPRESSIONS
(Rumble Strips)




PLAN VIEW




PROFILE VIEW
OPTION 4

CONTINUOUS MILLED DEPRESSIONS
(Rumble Strips)

## GENERAL NOTES

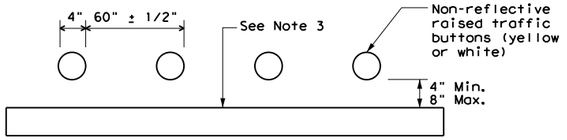
1. Rumble strips and profile markings shall not be placed on roadways with a posted speed limit of 45 MPH or less.
2. Milled rumble strips are preferred when adequate pavement depth is available. If pavement thickness is less than 2 inches, milled rumble strips shall not be used. Rumble strips shall not be milled or depressed into bridge decks.
3. Use Standard Sheet PM(2) for positioning, dimensioning, and spacing of all reflective raised pavement markers, pavement markings, and profile markings.
4. See the table below for determining what options may be used for edgeline rumble strips.

**WHEN INSTALLING MILLED DEPRESSION EDGELINE RUMBLE STRIPS:**

5. See dimensions for milled rumble strips. Other shapes and dimensions may be used if approved by the Traffic Operations Division.
6. Pavement markings can be applied over milled shoulder rumble strips to create an edgeline rumble stripe.
7. Breaks in edgeline rumble strips shall occur at least 50 feet and no more than 150 feet in advance of bridges, railroad crossings, intersections and driveways with high usage of large trucks when installed on conventional highways.
8. Rumble strips shall not be placed across exit or entrance ramps, acceleration and deceleration lanes, crossovers, gore areas or intersections with other roadways.
9. Consideration should be given to noise levels when edgeline rumble strips are installed near residential areas, schools, churches, etc. A minimum of 3/8 inches depth of milled rumble strip may be considered in these areas.
10. On roadways with high bicycle activity, consideration should be given before the installation of edgeline rumble strips. Things to consider include size of rumble strips, rumble strip material and location of rumble strips on the shoulder. If the designer determines that gaps are needed in the rumble strips due to bicycle use of the road, then follow the requirement shown in FHWA Technical Advisory T5040.39, or latest version. A detail of the spacing shall be included in the plans.

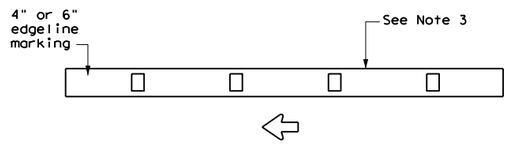
**WHEN INSTALLING RAISED OR PROFILE EDGELINE RUMBLE STRIPS:**

11. Raised rumble strips consisting of non-reflective raised traffic buttons may be used. Non-reflective raised traffic buttons can be affixed to asphalt or concrete with bitumen or adhesives, as per the manufacturer's recommendations.
12. Non-reflective traffic buttons shall be placed adjacent to the pavement marking delineating the edgeline when used as a rumble strip. The color of the button should match the color of the adjacent edgeline marking (white or yellow). The buttons will be paid for under Item 672, "Raised Pavement Markers." Non-reflective traffic buttons must meet the requirements of DMS-4300.
13. Non-reflective traffic buttons shall not be placed across exit or entrance ramps, acceleration and deceleration lanes, crossovers, gore areas or intersections with other roadways.
14. Breaks in edgeline rumble strips using raised traffic buttons shall occur at least 50 feet and no more than 150 feet in advance of bridges, railroad crossing, intersections and driveways with high usage of large trucks when installed on conventional highways.
15. The minimum distance between the edgeline and the buttons should be used if the shoulder is less than 8 feet in width.
16. Raised profile thermoplastic markings used as edgelines may substitute for buttons.




PLAN VIEW
OPTION 5

RAISED EDGELINE RUMBLE STRIPS




PLAN VIEW
OPTION 6

PROFILE EDGELINE MARKINGS

| SHOULDER WIDTH TABLE | | |
|---|---|---|
| EQUAL TO OR LESS THAN 2 FEET | GREATER THAN 2 FEET LESS THAN 4 FEET | EQUAL TO OR GREATER THAN 4 FEET |
| Option 1, 5 OR 6 | Option 1, 2, 3, 5 or 6 | Option 2, 4, 5 OR 6 |

Texas Department of Transportation

Traffic Operations Division Standard

# EDGELINE RUMBLE STRIPS ON FREEWAYS AND DIVIDED HIGHWAYS

# RS(1)-13

| FILE: rs(1)-13.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| ©TxDOT April 2006 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS 2-10 10-13 | 6367 | 43 | 001 | IH 20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 171 |

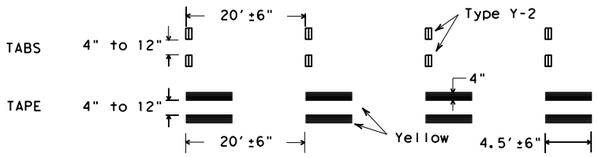
DATE:
FILE:

DATE:
FILE:

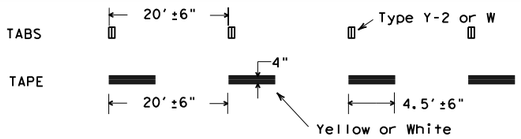
# WORK ZONE SHORT TERM PAVEMENT MARKINGS DETAILS

## SOLID LINES

DOUBLE NO-PASSING LINE

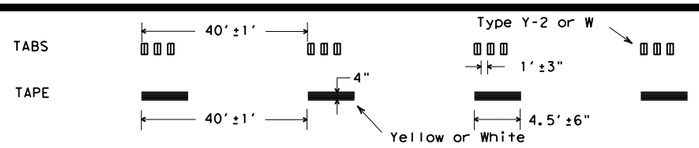



SINGLE NO-PASSING LINE or CHANNELIZATION LINE



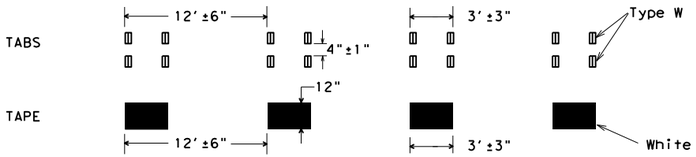

## BROKEN LINES

(FOR CENTER LINE OR LANE LINE)

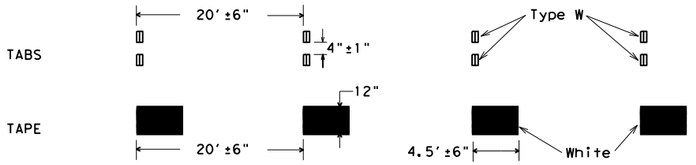



## WIDE DOTTED LINES

(FOR LANE DROP LINES)




## WIDE GORE MARKINGS



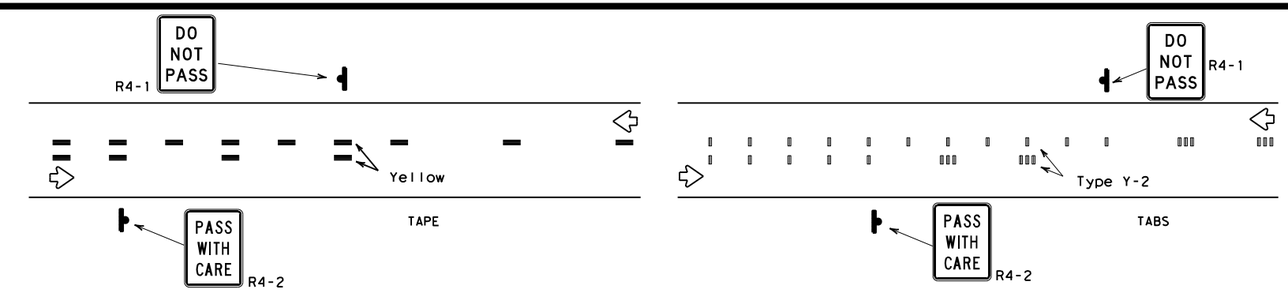

## NOTES:

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

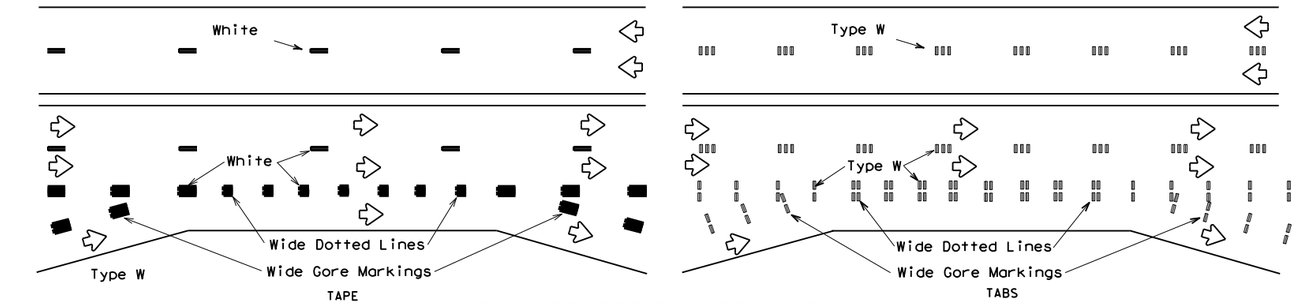
## TEMPORARY FLEXIBLE, REFLECTIVE ROADWAY MARKER TABS (TABS)

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

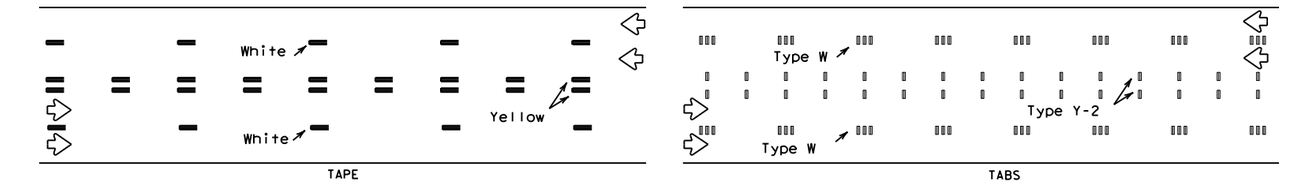
# WORK ZONE SHORT TERM PAVEMENT MARKINGS PATTERNS



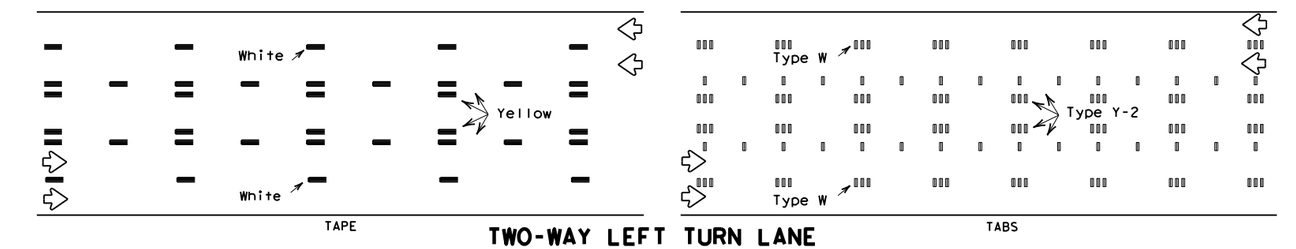

CENTER LINE & NO-PASSING ZONE BARRIER LINES FOR TWO LANE TWO-WAY HIGHWAYS



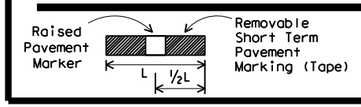

LANE LINES FOR DIVIDED HIGHWAY




LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS




TWO-WAY LEFT TURN LANE




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

## PREFABRICATED PAVEMENT MARKINGS

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

## RAISED PAVEMENT MARKERS

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

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

1. DMSs referenced above can be found along with embedded links to their respective MPLs at the following website:
   http://www.txdot.gov/business/contractors_consultants/material_specifications/default.htm

Texas Department of Transportation

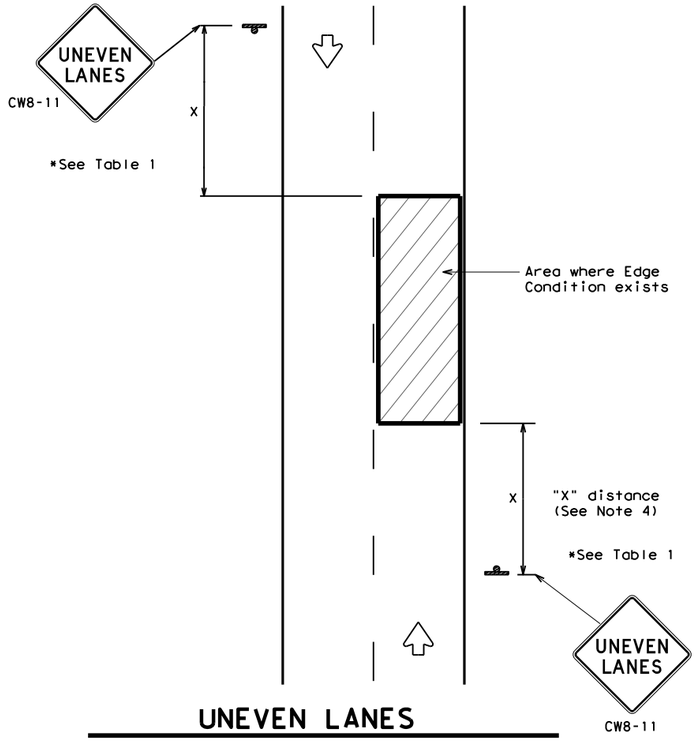
Traffic Operations Division Standard

# WORK ZONE SHORT TERM PAVEMENT MARKINGS

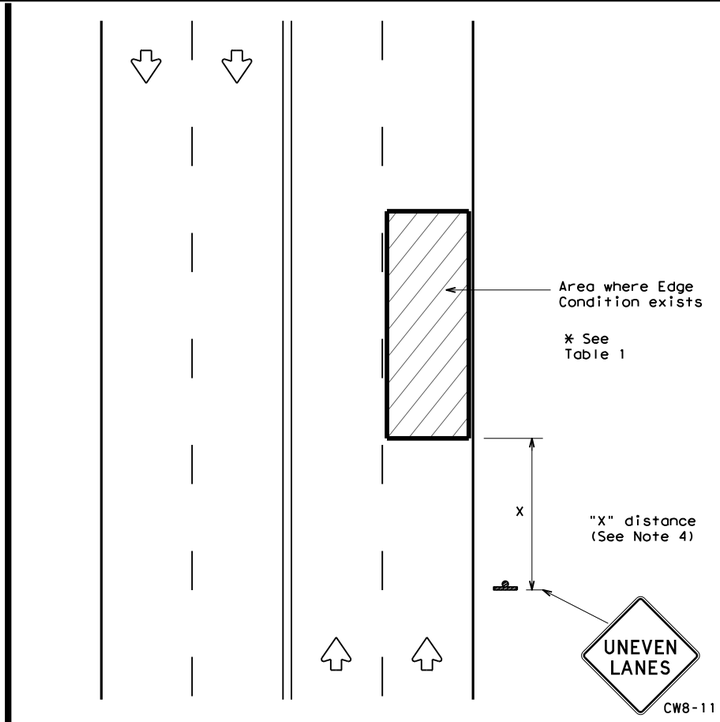
## WZ(STPM)-13

| FILE: | wzstpm-13.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|---|
| © TxDOT | April 1992 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | | 6367 | 43 | 001 | IH-20 |
| 1-97 | | DIST | COUNTY | | SHEET NO. |
| 3-03 | | 10 | SMITH, ETC. | | 172 |
| 7-13 | | | | | |

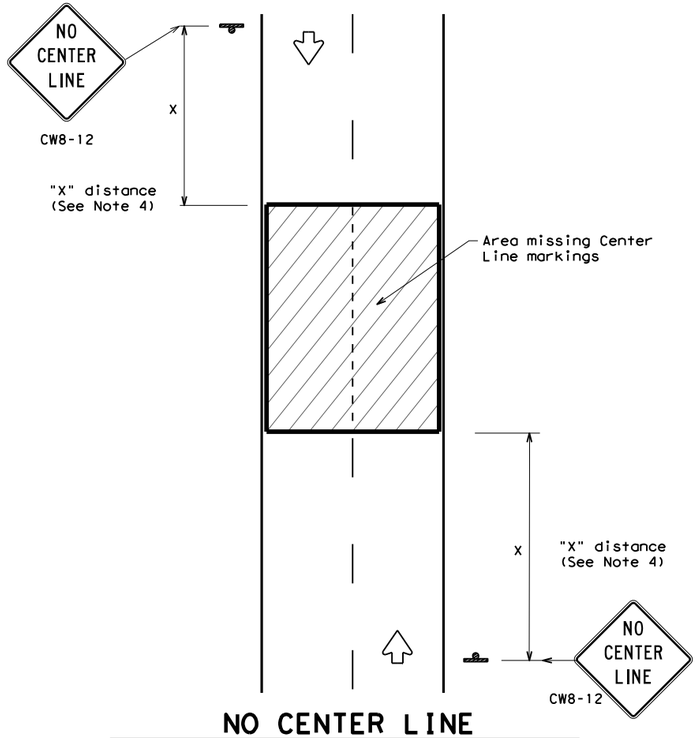
DATE:
FILE:



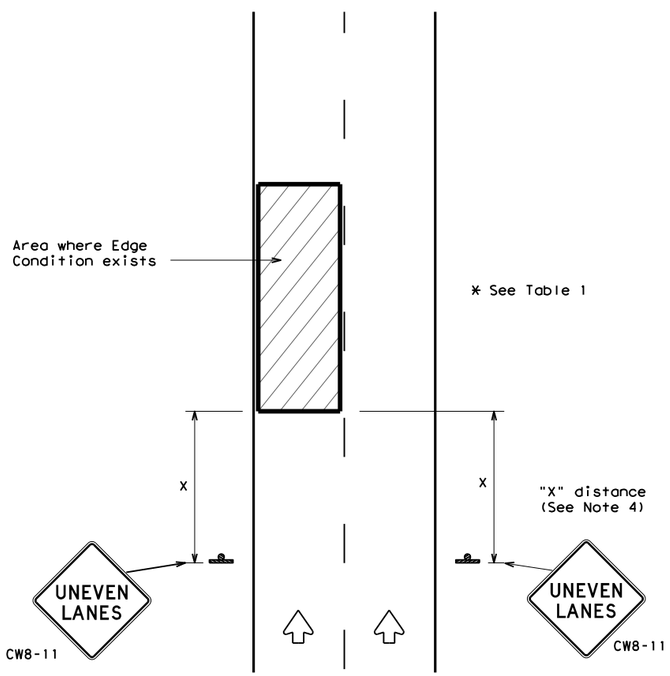

## UNEVEN LANES
## TWO LANE CONVENTIONAL ROAD




## UNEVEN LANES
## FOUR LANE CONVENTIONAL ROAD




## NO CENTER LINE
## TWO LANE CONVENTIONAL ROAD




## UNEVEN LANES
## DIVIDED ROADWAY

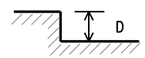
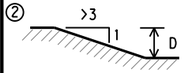
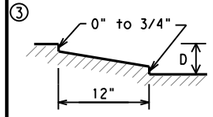
| DEPARTMENTAL MATERIAL SPECIFICATIONS | |
|---|---|
| PERMANENT PREFABRICATED PAVEMENT MARKINGS | DMS-8240 |
| TEMPORARY (REMOVABLE) PREFABRICATED PAVEMENT MARKINGS | DMS-8241 |
| SIGN FACE MATERIALS | DMS-8300 |

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

## GENERAL NOTES

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

**TABLE 1**

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

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

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

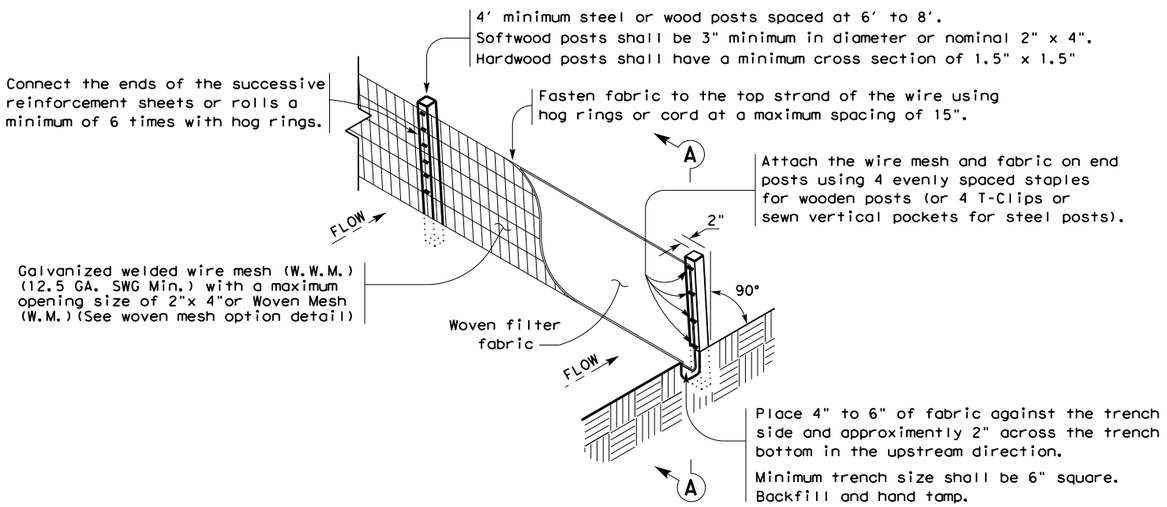
Texas Department of Transportation

*Traffic Operations Division Standard*

# SIGNING FOR UNEVEN LANES

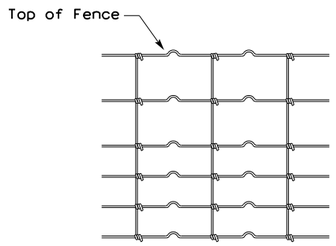
# WZ(UL)-13

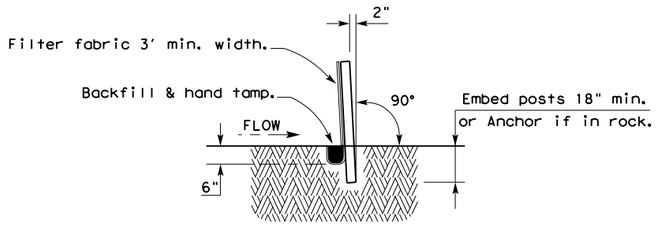
| FILE: wzul-13.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT |
|---|---|---|---|---|
| © TxDOT April 1992 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| 8-95 2-98 7-13 | DIST | COUNTY | | SHEET NO. |
| 1-97 3-03 | 10 | SMITH, ETC. | | 173 |




## TEMPORARY SEDIMENT CONTROL FENCE

SCF




## SECTION A-A

## HINGE JOINT KNOT WOVEN MESH (OPTION) DETAIL

Galvanized hinge joint knot woven mesh (12.5 GA.SWG Min.) requires a minimum of five horizontal wires spaced at a maximum of 12 inches apart and all vertical wires spaced at a maximum of 12 inches apart.

### SEDIMENT CONTROL FENCE USAGE GUIDELINES

A sediment control fence may be constructed near the downstream perimeter of a disturbed area along a contour to intercept sediment from overland runoff. A 2 year storm frequency may be used to calculate the flow rate to be filtered.

Sediment control fence should be sized to filter a maximum flow through rate of 100 GPM/FT$^2$. Sediment control fence is not recommended to control erosion from a drainage area larger than 2 acres.

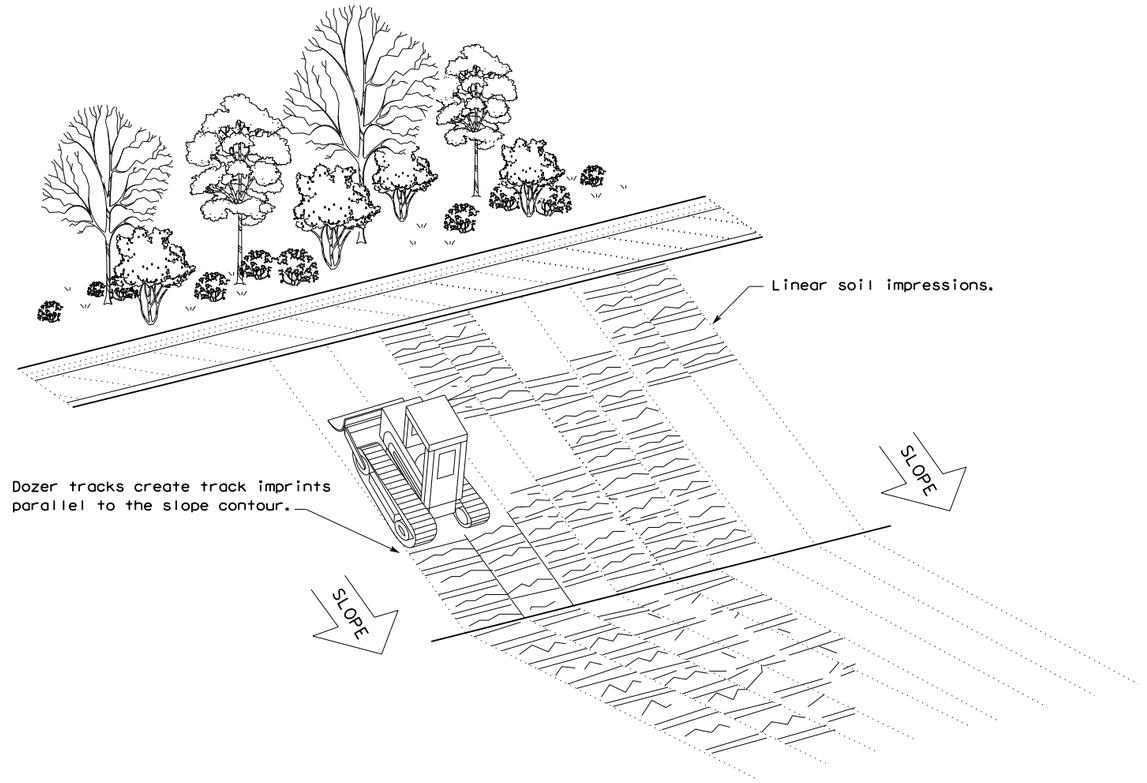
### LEGEND

Sediment Control Fence

SCF

## GENERAL NOTES

1. Vertical tracking is required on projects where soil distributing activities have occurred unless otherwise approved.
2. Perform vertical tracking on slopes to temporarily stabilize soil.
3. Provide equipment with a track undercarriage capable of producing linear soil impressions measuring a minimum of 12" in length by 2" to 4" in width by 1/2" to 2" in depth.
4. Do not exceed 12" between track impressions.
5. Install continous linear track impressions where the minimum 12" length impressions are perpendicular to the slope or direction of water flow.




## VERTICAL TRACKING

Texas Department of Transportation

Design Division Standard

# TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

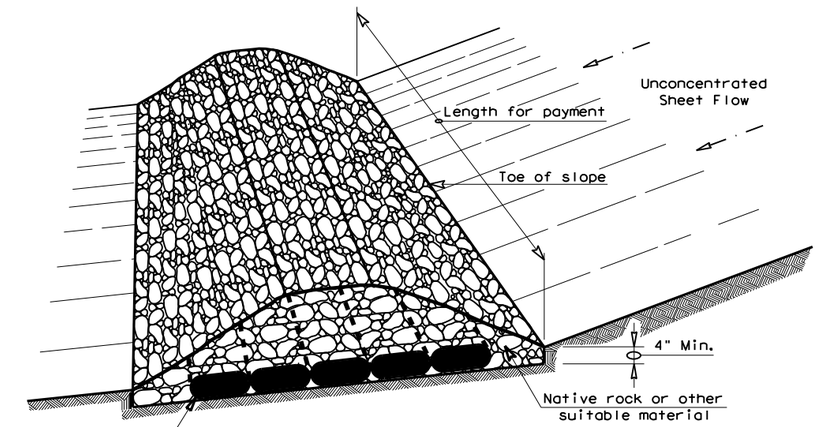
## FENCE & VERTICAL TRACKING

## EC(1)-16

| FILE: ec116 | DN: TxDOT | CK: KM | DW: VP | DN/CK: LS |
|---|---|---|---|---|
| © TxDOT: JULY 2016 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 174 |

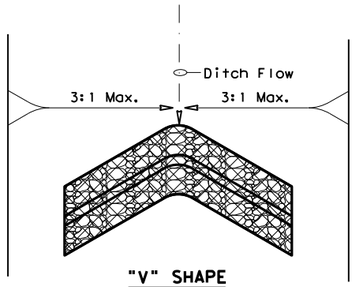
DATE
FILE

DATE:
FILE:

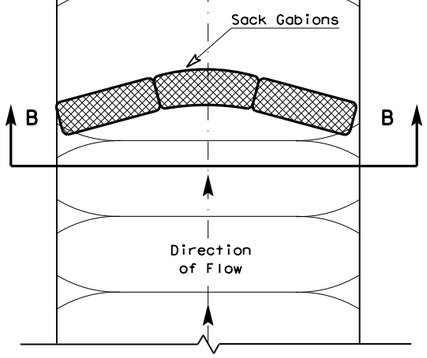



## FILTER DAM AT TOE OF SLOPE

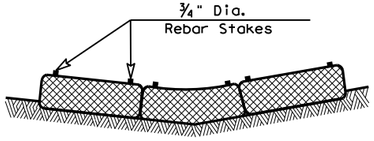
RFD1



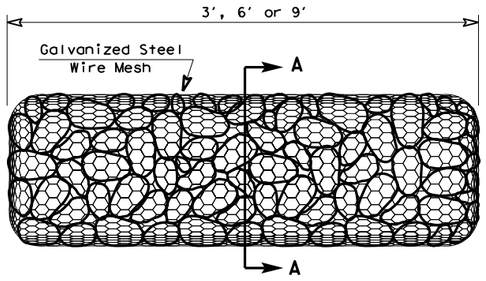

## "V" SHAPE PLAN VIEW




## PLAN VIEW

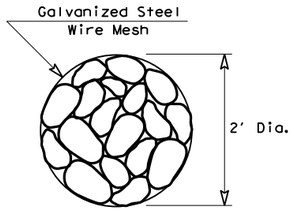



## SECTION B-B

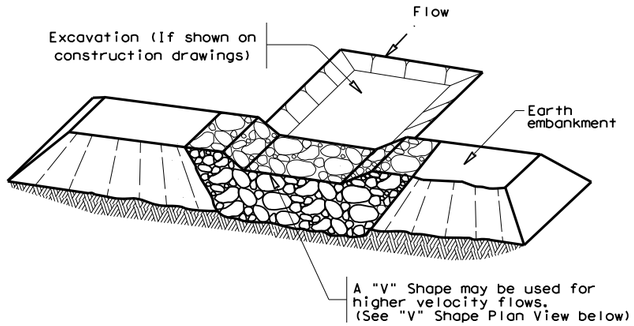



## TYPE 4 (SACK GABIONS)

RFD4

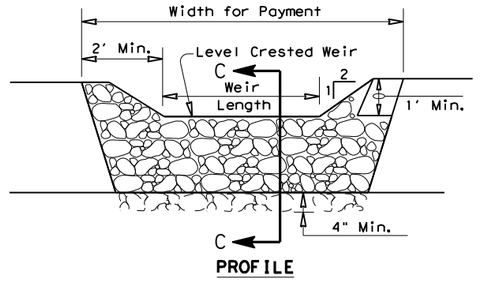



## SECTION A-A

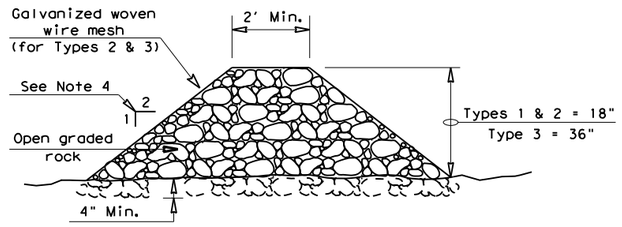



## FILTER DAM AT SEDIMENT TRAP

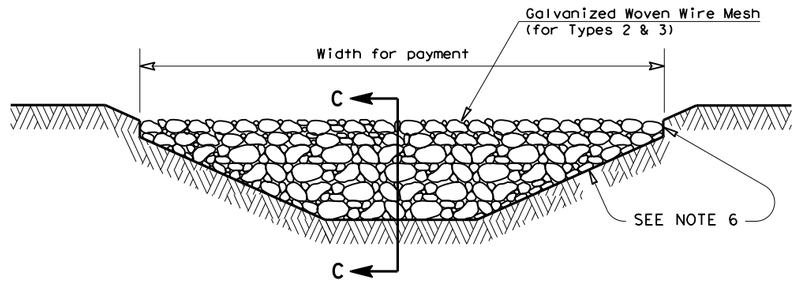
RFD1 — OR — RFD2




## PROFILE




## SECTION C-C




## FILTER DAM AT CHANNEL SECTIONS

RFD1 — OR — RFD2 — OR — RFD3

### ROCK FILTER DAM USAGE GUIDELINES

Rock Filter Dams should be constructed downstream from disturbed areas to intercept sediment from overland runoff and/or concentrated flow. The dams should be sized to filter a maximum flow through rate of 60 GPM/FT$^2$ of cross sectional area. A 2 year storm frequency may be used to calculate the flow rate.

Type 1 (18" high with no wire mesh) (3" to 6" aggregate): Type 1 may be used at the toe of slopes, around inlets, in small ditches, and at dike or swale outlets. This type of dam is recommended to control erosion from a drainage area of 5 acres or less. Type 1 may not be used in concentrated high velocity flows (approximently 8 Ft/Sec or more) in which aggregate wash out may occur. Sandbags may be used at the embedded foundation (4" deep min.) for better filtering efficiency of low flows if called for on the plans or directed by the Engineer.

Type 2 (18" high with wire mesh) (3" to 6" aggregate): Type 2 may be used in ditches and at dike or swale outlets.

Type 3 (36" high with wire mesh) (4" to 8" aggregate): Type 3 may be used in stream flow and should be secured to the stream bed.

Type 4 (Sack gabions) (3" to 6" aggregate): Type 4 May be used in ditches and smaller channels to form an erosion control dam.

Type 5: Provide rock filter dams as shown on plans.

### GENERAL NOTES

1. If shown on the plans or directed by the Engineer, filter dams should be placed near the toe of slopes where erosion is anticipated, upstream and/or downstream at drainage structures, and in roadway ditches and channels to collect sediment.
2. Materials (aggregate, wire mesh, sandbags, etc.) shall be as indicated by the specification for "Rock Filter Dams for Erosion and Sedimentation Control".
3. The rock filter dam dimensions shall be as indicated on the SW3P plans.
4. Side slopes should be 2:1 or flatter. Dams within the safety zone shall have sideslopes of 6:1 or flatter.
5. Maintain a minimum of 1' between top of rock filter dam weir and top of embankment for filter dams at sediment traps.
6. Filter dams should be embedded a minimum of 4" into existing ground.
7. The sediment trap for ponding of sediment laden runoff shall be of the dimensions shown on the plans.
8. Rock filter dam types 2 & 3 shall be secured with 20 gauge galvanized woven wire mesh with 1" diameter hexagonal openings. The aggregate shall be placed on the mesh to the height & slopes specified. The mesh shall be folded at the upstream side over the aggregate and tightly secured to itself on the downstream side using wire ties or hog rings. For in stream use, the mesh should be secured or staked to the stream bed prior to aggregate placement.
9. Sack Gabions should be staked down with ¾" dia. rebar stakes, and have a double-twisted hexagonal weave with a nominal mesh opening of 2 ½" x 3 ¼"
10. Flow outlet should be onto a stabilized area (vegetation, rock, etc.).
11. The guidelines shown hereon are suggestions only and may be modified by the Engineer.

### PLAN SHEET LEGEND

| | |
|---|---|
| Type 1 Rock Filter Dam | RFD1 |
| Type 2 Rock Filter Dam | RFD2 |
| Type 3 Rock Filter Dam | RFD3 |
| Type 4 Rock Filter Dam | RFD4 |

Texas Department of Transportation — Design Division Standard

# TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

## ROCK FILTER DAMS

## EC(2)-16

| FILE: ec216 | DN: TxDOT | CK: KM | DW: VP | DN/CK: LS |
|---|---|---|---|---|
| © TxDOT: JULY 2016 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 175 |

FILE: T:\TyIMaintenance\Contracts\Maintenance Contracts\TOTAL MTCE I-20\FY 21\Plans\SW3P-17.dgn
DATE: 1/27/2021 3:43:29 PM

## A. GENERAL SITE DATA

1. PROJECT LIMITS:
**SEE TITLE SHEET**

PROJECT LOCATION:
**SEE TITLE SHEET**

PROJECT COORDINATES:

2. PROJECT SITE MAPS:
* PROJECT LOCATION MAP: **TITLE SHEET**
* DRAINAGE PATTERNS: **N/A**
* SLOPES ANTICIPATED AFTER MAJOR GRADINGS OR AREAS OF SOIL DISTURBANCE: **N/A**
* LOCATION OF EROSION AND SEDIMENT CONTROLS: **N/A**
* SURFACE WATERS AND DISCHARGE LOCATIONS: **TITLE SHEET**
* PROJECT SPECIFIC LOCATIONS: TO BE SPECIFIED BY THE PROJECT FIELD OFFICE DURING CONSTRUCTION AND LOCATED IN THE PROJECT SW3P FILE. REFERENCE ITEM #10 BELOW

3. PROJECT DESCRIPTION: **PERFORM ROUTINE MAINTENANCE ACTIVITIES ON IH-20.**

4. MAJOR SOIL DISTURBING ACTIVITIES: **N/A**

5. EXISTING CONDITION OF SOIL & VEGETATIVE COVER AND % OF EXISTING VEGETATIVE COVER:

**THE EXISTING SOIL AROUND THE PAVEMENT IS SILT OR CLAY SAND. 85% EXISTING VEGETATIVE COVER**

6. TOTAL PROJECT AREA: **1,046 ACRES**

7. TOTAL AREA TO BE DISTURBED: **1,046 ACRES**

8. WEIGHTED RUNOFF COEFFICIENT
BEFORE CONSTRUCTION: **N/A**
AFTER CONSTRUCTION: **N/A**

9. NAME OF RECEIVING WATERS: (SEGMENT NUMBER OF RECEIVING WATERS)
**CONTRIBUTARIES OF THE TRINITY RIVER AND THE SABINE RIVER.**

10. PROJECT SW3P FILE: FOR PROJECTS DISTURBING ONE ACRE OR MORE, TXDOT WILL MAINTAIN AN SW3P FILE WITH ALL PERTINENT ENVIRONMENTAL DOCUMENTS, CORRESPONDENCE, ETC. AT THE PROJECT FIELD OFFICE. IF NO FIELD OFFICE IS AVAILABLE THEN THE SW3P FILE SHALL BE KEPT IN THE INSPECTOR'S TRUCK.

## B. EROSION AND SEDIMENT CONTROLS

1. SOIL STABILIZATION PRACTICES:

___ TEMPORARY SEEDING
___ PERMANENT PLANTING, SODDING, OR SEEDING
___ MULCHING
___ SOIL RETENTION BLANKET
___ BUFFER ZONES
_X_ PRESERVATION OF NATURAL RESOURCES

OTHER: **XXXXXXXXXXXXXXXXXXXX**

2. STRUCTURAL PRACTICES:

___ SILT FENCES
___ ROCK FILTER DAMS
___ DIVERSION, INTERCEPTOR, OR PERIMETER DIKES
___ DIVERSION, INTERCEPTOR, OR PERIMETER SWALES
___ DIVERSION DIKE AND SWALE COMBINATIONS
___ PIPE SLOPE DRAINS
___ PAVED FLUMES
___ ROCK BEDDING AT CONSTRUCTION EXIT
___ TIMBER MATTING AT CONSTRUCTION EXIT
___ CHANNEL LINERS
___ SEDIMENT TRAPS
___ SEDIMENT BASINS
___ STORM INLET SEDIMENT TRAP
___ STONE OUTLET STRUCTURES
___ CURBS AND GUTTERS
___ STORM SEWERS
___ VELOCITY CONTROL DEVICES

OTHER:

3. STORM WATER MANAGEMENT:

STORM WATER DRAINAGE WILL BE PROVIDED BY _____

THIS SYSTEM WILL CARRY THE DRAINAGE WITHIN THE RIGHT-OF-WAY TO

_____.

4. STORM WATER MANAGEMENT ACTIVITIES: (SEQUENCE OF CONSTRUCTION)

1.
2.
3.
4.
5.
6.

5. NON-STORM WATER DISCHARGES:
FILTER NON-STORM WATER DISCHARGES, OR HOLD RETENTION BASINS, BEFORE BEING ALLOWED TO MIX WITH STORM WATER. THESE DISCHARGES CONSIST OF NON-POLLUTED GROUND WATER, SPRING WATER, FOUNDATION AND/OR FOOTING DRAIN WATER; AND WATER USED FOR DUST CONTROL, PAVEMENT WASHING AND VEHICLE WASHWATER CONTAINING NO DETERGENTS.

## C. OTHER REQUIREMENTS & PRACTICES

1. MAINTENANCE:
MAINTENANCE WILL BE PERFORMED AS INDICATED ON FIELD INSPECTION AND MAINTENANCE REPORT FORM 2118.

2. INSPECTION:
INSPECTION WILL BE PERFORMED AS INDICATED ON FIELD INSPECTION AND MAINTENANCE REPORT FORM 2118.

3. WASTE MATERIALS:
ALL WASTE MATERIALS WILL BE COLLECTED, STORED AND DISPOSED OF IN A LEGAL AND PROPER MANNER. NO CONSTRUCTION WASTE MATERIAL WILL BE BURIED ON SITE.

4. HAZARDOUS WASTE (INCLUDING SPILL REPORTING):
AT A MINIMUM, ANY PRODUCTS IN THE FOLLOWING CATEGORIES ARE CONSIDERED TO BE HAZARDOUS. PAINTS, ACIDS FOR CLEANING MASONRY SURFACES, CLEANING SOLVENTS, ASPHALT PRODUCTS, CHEMICAL ADDITIVES FOR SOIL STABILIZATION, OR CONCRETE CURING COMPOUNDS AND ADDITIVES. IN THE EVENT OF A SPILL WHICH MAY BE HAZARDOUS, THE SPILL COORDINATOR MUST BE CONTACTED IMMEDIATELY.

5. SANITARY WASTE:
ALL SANITARY WASTE WILL BE COLLECTED FROM THE PORTABLE UNITS AS NECESSARY OR AS REQUIRED BY LOCAL REGULATION BY A LICENSED SANITARY WASTE MANAGEMENT CONTRACTOR.

OFFSITE VEHICLE TRACKING:

___ HAUL ROADS DAMPENED FOR DUST CONTROL
_X_ LOADED HAUL TRUCKS TO BE COVERED WITH TARPAULIN
_X_ EXCESS DIRT ON ROAD REMOVED DAILY
___ STABILIZED CONSTRUCTION ENTRANCE

OTHER:

REMARKS: DISPOSAL AREAS, STOCKPILES AND HAUL ROADS SHALL BE CONSTRUCTED IN A MANNER THAT WILL MINIMIZE AND CONTROL SEDIMENT FROM ENTERING RECEIVING WATERS. DISPOSAL AREAS SHALL NOT BE LOCATED IN ANY WATERBODY OR STREAMBED.

CONSTRUCTION STAGING AREAS AND VEHICLE MAINTENANCE AREAS SHALL BE CONSTRUCTED TO MINIMIZE THE RUNOFF OF POLLUTANTS.

# STORM WATER POLLUTION PREVENTION PLAN (SW3P)


Texas Department of Transportation

SHEET 1 OF 1

| CONT | SECT | JOB | HIGHWAY |
|---|---|---|---|
| 6367 | 43 | 001 | IH-20 |
| DIST | COUNTY | | SHEET NO. |
| 10 | SMITH, ETC. | | 176 |

DATE:
FILE:

## I. STORMWATER POLLUTION PREVENTION-CLEAN WATER ACT SECTION 402

TPDES TXR 150000: Stormwater Discharge Permit or Construction General Permit required for projects with 1 or more acres disturbed soil. Projects with any disturbed soil must protect for erosion and sedimentation in accordance with Item 506.

List MS4 Operator(s) that may receive discharges from this project. They may need to be notified prior to construction activities.

1.

2.

☐ No Action Required ☒ Required Action

Action No.

1. Prevent stormwater pollution by controlling erosion and sedimentation in accordance with TPDES Permit TXR 150000
2. Comply with the SW3P and revise when necessary to control pollution or required by the Engineer.
3. Post Construction Site Notice (CSN) with SW3P information on or near the site, accessible to the public and TCEQ, EPA or other inspectors.
4. When Contractor project specific locations (PSL's) increase disturbed soil area to 5 acres or more, submit NOI to TCEQ and the Engineer.

## II. WORK IN OR NEAR STREAMS, WATERBODIES AND WETLANDS CLEAN WATER ACT SECTIONS 401 AND 404

USACE Permit required for filling, dredging, excavating or other work in any water bodies, rivers, creeks, streams, wetlands or wet areas.

The Contractor must adhere to all of the terms and conditions associated with the following permit(s):

☐ No Permit Required

☒ Nationwide Permit 14 - PCN not Required (less than 1/10th acre waters or wetlands affected)

☐ Nationwide Permit 14 - PCN Required (1/10 to <1/2 acre, 1/3 in tidal waters)

☐ Individual 404 Permit Required

☐ Other Nationwide Permit Required: NWP# _____

Required Actions: List waters of the US permit applies to, location in project and check Best Management Practices planned to control erosion, sedimentation and post-project TSS.

1.

2.

3.

4.

The elevation of the ordinary high water marks of any areas requiring work to be performed in the waters of the US requiring the use of a nationwide permit can be found on the Bridge Layouts.

Best Management Practices:

| Erosion | Sedimentation | Post-Construction TSS |
|---|---|---|
| ☐ Temporary Vegetation | ☐ Silt Fence | ☐ Vegetative Filter Strips |
| ☐ Blankets/Matting | ☐ Rock Berm | ☐ Retention/Irrigation Systems |
| ☐ Mulch | ☐ Triangular Filter Dike | ☐ Extended Detention Basin |
| ☐ Sodding | ☐ Sand Bag Berm | ☐ Constructed Wetlands |
| ☐ Interceptor Swale | ☐ Straw Bale Dike | ☐ Wet Basin |
| ☐ Diversion Dike | ☐ Brush Berms | ☐ Erosion Control Compost |
| ☐ Erosion Control Compost | ☐ Erosion Control Compost | ☐ Mulch Filter Berm and Socks |
| ☐ Mulch Filter Berm and Socks | ☐ Mulch Filter Berm and Socks | ☐ Compost Filter Berm and Socks |
| ☐ Compost Filter Berm and Socks | ☐ Compost Filter Berm and Socks | ☒ Vegetation Lined Ditches |
| | ☐ Stone Outlet Sediment Traps | ☐ Sand Filter Systems |
| | ☐ Sediment Basins | ☐ Grassy Swales |

## III. CULTURAL RESOURCES

Refer to TxDOT Standard Specifications in the event historical issues or archeological artifacts are found during construction. Upon discovery of archeological artifacts (bones, burnt rock, flint, pottery, etc.) cease work in the immediate area and contact the Engineer immediately.

☐ No Action Required ☒ Required Action

Action No.

1. Contractor shall protect metal plaques on Alligator Creek Bridge and is responsible for any damages thereto.
2. Contractor shall minimize damage to the concrete rail while uninstalling existing metal guard beams on the Alligator Creek Bridge.
3. Contractor shall await instruction after notifing the Engineer and district environmental staff if the new metal guard beams cannot be installed to the last 3.0' of the existing concrete rail at all 4 corners of Alligator Creek Bridge.

## IV. VEGETATION RESOURCES

Preserve native vegetation to the extent practical.
Contractor must adhere to Construction Specification Requirements Specs 162, 164, 192, 193, 506, 730, 751, 752 in order to comply with requirements for invasive species, beneficial landscaping, and tree/brush removal commitments.

☒ No Action Required ☐ Required Action

Action No.

1.

2.

3.

4.

---

☐ No Action Required ☒ Required Action

Action No.

1. In accordance with the Migratory Bird Treat Act, TxDOT would take any reasonable and practicable measures to avoid impacts to migratory birds, ground nesting birds, their nests, or their young.

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

Does the project involve any bridge class structure rehabilitation or replacements (bridge class structures not including box culverts)?

☐ Yes ☒ No

If "No", then no further action is required.
If "Yes", then TxDOT is responsible for completing asbestos assessment/inspection.

Are the results of the asbestos inspection positive (is asbestos present)?

☐ Yes ☒ No

If "Yes", then TxDOT must retain a DSHS licensed asbestos consultant to assist with the notification, develop abatement/mitigation procedures, and perform management activities as necessary. The notification form to DSHS must be postmarked at least 15 working days prior to scheduled demolition.

If "No", then TxDOT is still required to notify DSHS 15 working days prior to any scheduled demolition.

In either case, the Contractor is responsible for providing the date(s) for abatement activities and/or demolition with careful coordination between the Engineer and asbestos consultant in order to minimize construction delays and subsequent claims.

Any other evidence indicating possible hazardous materials or contamination discovered on site. Hazardous Materials or Contamination Issues Specific to this Project:

☒ No Action Required ☐ Required Action

Action No.

1.

2.

3.

## VII. OTHER ENVIRONMENTAL ISSUES

(includes regional issues such as Edwards Aquifer District, etc.)

☒ No Action Required ☐ Required Action

Action No.

1.

2.

3.

Texas Department of Transportation

*Design Division Standard*

# ENVIRONMENTAL PERMITS, ISSUES AND COMMITMENTS

# EPIC

| FILE: epic.dgn | DN: TxDOT | CK: RG | DW: VP | CK: AR |
|---|---|---|---|---|
| ©TxDOT: February 2015 | CONT | SECT | JOB | HIGHWAY |
| REVISIONS<br>12-12-2011 (DS)<br>05-07-14 ADDED NOTE SECTION IV.<br>01-23-2015 SECTION I (CHANGED ITEM 1122 TO ITEM 506, ADDED GRASSY SWALES. | 6367 | 43 | 001 | IH-20 |
| | DIST | COUNTY | | SHEET NO. |
| | 10 | SMITH, ETC. | | 177 |