THE STATE OF TEXAS §
§
COUNTY OF HIDALGO §

SERVICE CONTRACT
C-18-082-04-24

THIS CONTRACT is made and entered into this 24th day of April 2018 by and between the **County of Hidalgo, Texas** ("County"), and TIBH Industries, Inc. ("Company") acting by and through **CRP, RGR Industries, Inc.,** ("Provider"); and

WHEREAS, the Texas Human Resources Code, Section 122.017, authorizes the State to Purchase services and products produced by persons with disabilities under the provisions of Chapter 122 Tex. Human Res. Code and establishes procedures for such purchases (hereinafter referred to as the State Use Program); and

WHEREAS, the Texas Workforce Commission has promulgated rules for the State Use Program at Title 40, Texas Administrative Code, Chapter 806; and

WHEREAS, Hidalgo County desires to ***"Purchase Guardrail Materials and/or Turnkey Solutions",*** as more particularly described in the attached Exhibit "A" (the "Services"); and

WHEREAS, TIBH and the Texas Workforce Commission acting through Provider shall provide services in accordance with the specifications attached as Exhibits "A" and "B" ("CRP Pricing") respectively, and incorporated herein for all purposes; and

WHEREAS, in recognition of and in consideration of Company and Provider's agreement to perform the Services in accordance with specifications, the Commissioners Court of County awarded the project to Company.

NOW, THEREFORE, in mutual consideration of the foregoing and the further consideration of the following, the parties hereto agree as follows:

1. County, Company and Provider hereby agree that this Contract is entered into in

order to provide the Services to **Hidalgo County**. This Contract does not extend to any third parties any duties or benefits conferred in any manner hereunder or otherwise.

2. Company and Provider hereby promise and agree to render and provide, during the term of this Contract, and shall be obligated to render and provide the Services in accordance with the RFB Packet within **Hidalgo County** following a request for Services by the **County** or its designated agent. Company and Provider agree in performing the Services that it will use proper professional standards, comply with any and all appropriate laws and regulations in providing the Services, and devote such time as is necessary to safely and efficiently provide the Services.

3. This Contract shall be for a period of One (1) year, **(on an as needed basis),** commencing on _____, 2018, and expiring on _____,2019, and may be extended at the sole discretion of the County for an additional two (2) one (1) year term under the same rates, terms and conditions. Hidalgo County also reserves the right to continue this sealed bid for an additional sixty (60) day grace period at the end of the contract term for unforeseen delay of award for the next term and contingent upon cost remaining unchanged.

4. As a condition of this Contract, Company and Provider shall hold and maintain throughout the term of this Contract all licenses and permits required, or which may be required by any authority during the term hereof to provide the Services. If such license or permit is suspended or revoked, this Agreement shall automatically be terminated and Company and Provider shall immediately notify the County.

5. All trucks or vehicles operated by the Company/Provider to perform the Services shall contain all equipment required by any authority to operate on streets and roads and all persons in the employ of Company/Provider who operate such trucks or vehicles shall have the required licenses, qualifications, skill and expertise to perform such Services and shall comply with all laws, rules and regulations prescribed by any agency or authority having jurisdiction with regard to the operation of such trucks or vehicles in providing the Services.

6. As consideration for rendering the Services provided for in this Contract, the County agrees to pay Company the amounts specified in Exhibit "B" attached hereto payable against written invoice submitted by Company in accordance with the Texas Prompt Payment Act, Tex. Govt. Code Ch. 2251.

7. Company/Provider shall provide insurance in force on all its vehicles and all persons connected with providing services under this Contract naming County as an additional insured (with the coverages and in the amounts described in Exhibit "C" attached hereto and incorporated herein at this point for all purposes), and shall furnish to County certificates of such insurance coverage.

8. Company/Provider shall provide a sufficient number of trucks, vehicles, personnel, and equipment available to safely and efficiently provide the Services.

9. Company/Provider **shall indemnify and hold harmless County, its elected officials, employees and agents from any and all claims, damages, losses, and expenses including attorney's fees for the defense of any action against County arising out of, resulting from, or connected with the provision of the Service by Company**/Provider **under this Contract. Said indemnity shall cover any act or failure to act by the Company**/Provider**, its agents or employees.**

10. This Contract shall not be assignable in whole or in part by either party without the prior written consent of the other party.

11. It is expressly agreed that this Contract and the performance by the parties hereunder does not create any agency relationship or master-servant relationship that County has no supervision of the performance of the Services provided by Company/Provider, and that Company/Provider is an independent contractor under this Contract.

12. Any notice required or permitted to be given hereunder shall be in writing and shall be delivered personally or sent by certified mail, postage prepaid, as set forth below:

If to County: **The County of Hidalgo**
Attn: County Judge
100 E. Cano
Edinburg, Texas 78539

If to Company: TIBH INDUSTRIES, INC.
Attn: Rosa M. Valdez
1011 E 53 ½ Street
Austin, TX 78751

13. In case any one or more of the provisions contained in this Agreement shall for any reason be held to be invalid, illegal or unenforceable in any respect, such invalidity, illegality, or unenforceability shall not affect any other provision thereof and this Agreement shall be construed as if such invalid, illegal, or unenforceable provision had never been contained herein.

14. This Agreement may be terminated by County without cause upon thirty (30) days written notice.

15. This Agreement shall be binding upon and inure to the benefit of and be enforceable by the parties hereto and their respective heirs, executors, administrators, legal representatives, successors, and assigns where permitted by this Agreement.

16. This Agreement shall be governed by and construed in accordance with the laws of the State of Texas and shall be performable in Hidalgo County.

17. In the event that, during any term hereof, the Commissioners Court does not appropriate sufficient funds to meet the obligations of County under this Agreement, County may terminate this Agreement upon ninety (90) days written notice to Provider and Company. County agrees, however, to use reasonable efforts to secure funds necessary for the continued performance of this Agreement. The parties intend this provision to be a continuing right to terminate this Agreement at the expiration of each budget period of County.

18. This Agreement contains the entire contract between the parties hereto, and each party acknowledges that neither has made (either directly or through any agent or representative) any representation or agreement in connection with this Agreement not specifically set forth herein. This Agreement may be modified or amended only by an agreement in writing executed by the parties hereto, and not otherwise.

19. Nothing in this Agreement is intended to and County does not hereby waive, release or relinquish any right to assert any of the defenses County enjoys by virtue of the state or federal constitution, laws, rules or regulations, and any sovereign, official or qualified immunity available to County as to any claim or action of any person, entity, or individual against County.

20. Company/Provider, including subcontractors, assignees and successors in interest, ensures that no person shall on the grounds of race, religion, color, national origin, sex, age, disability, or any other protected class under law, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination or retaliation under any federally or non-federally funded program or activity when providing any services described herein under this contract/agreement.

21. The parties hereto covenant and agree that they will execute each such other and further instruments and documents as are or may become necessary or convenient to effectuate and carry out the terms of this contract/agreement.

EXECUTED and effective as of the day and year first written above.

COUNTY OF HIDALGO

_____

Ramon Garcia, County Judge

ATTEST:

_____

Arturo Guajardo Jr., County Clerk

Company: TIBH Industries,Inc.

By: _____

Printed Name: Rosa M. Valdez /

Title: Regional Marketing Manager /CEO

Provider: RGR Industries, Inc.

By: _____

Printed Name: _____

Title: _____

Note: Need signature for the Provider as well.

Approved By Commissioners Court On: _____

APPROVED AS TO FORM:
Hidalgo County Office of District Attorney
Ricardo Rodriguez, Jr.

By: _____

Victor M. Garza
Assistant District Attorney

EXHIBIT "A"

REQUEST FOR BID (RFB) PROCUREMENT PACKET

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ATTACHMENT A
SCOPE OF WORK

HARDWARE:
Perform "Metal Beam Guard Fence and Elements Repair".

GENERAL
Prior to beginning operations, a conference between representatives of the County and the Community Rehabilitation Program (CRP) will be arranged. In this meeting, the CRP will outline the proposed method of accomplishing this work.

The CRP is to visit the site to make its own examination of the work areas. The CRP will carefully examine these specifications and secure from the Department any additional information that may be essential for a clear and full understanding of the work.

Scheduled work that falls on a National Holiday will be performed on the following work day. National Holidays as defined in the "Texas Standard Specification 2014" are January 1, the last Monday in May, July 4, the first Monday in September, the fourth Thursday in November, December 24 and December 25.

The CRP is responsible for damage to County equipment, plants, shrubs, and County employee vehicles caused by its maintenance activities.

All lost and found items will be turned over to the County Representative.

The CRP is responsible for its employees reporting daily any needed repairs. This information will be reported to the County's representative.

All personal protective equipment (PPE) will be provided by the CRP.

Clear and remove from all work sites, surplus and waste materials and leave the site in a neat and aesthetically pleasing condition.

Work is on an as-needed basis and as directed by the County.

Perform work Monday through Friday during daylight hours unless otherwise approved. Close no more than one (1) lane at a time

If closing a lane is necessary, closure time will be Monday through Thursday, 9:00 A.M. to 3:00 P.M. and Friday, 9:00 A.M. to 12:00 P.M. (noon).

The CRP keeps all unusable salvaged material. Material that is deemed usable by the County shall be returned to Hidalgo County.

EQUIPMENT AND LABOR
The CRP will not be allowed to begin work until all equipment has been inspected, and found to be in good working condition, and deemed safe by the County.

BARRICADES, SIGNS, AND TRAFFIC HANDLING
The CRP will furnish and install all signs, barricades and other incidentals necessary for proper traffic control, in accordance with the 2011 "Texas Manual on Uniform Traffic Control Devices and as directed. All warning signs will be factory made and in satisfactory condition.

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ITEM 502 BARRICADES, SIGNS, AND TRAFFIC HANDLING

The CRP shall provide to the Engineer a letter certifying that all truck-mounted attenuators (TMA) used on the contract that were purchased on or after October 1, 1998, have been found to be crashworthy using the criteria outlined in the National Cooperative Highway Research Program (NCHRP) Report 350. If the TMA was purchased prior to October 1, 1998, a letter certifying crashworthiness using the criteria outlined in either (NCHRP) reports 230 or 350 shall be provided to the Engineer.

Provide flagmen properly attired in a white hard hat, approved safety vest and stop/slow paddle. Provide two-way radios in areas where flagmen do not have visual contact with one another or cannot communicate with one another.

Provide shadow vehicles equipped with Truck Mounted Attenuators (TMA) when performing work on the expressway as shown on Traffic Control Plan (TCP) standards (2 series).

Limit lane closures to a maximum of three (3) miles. If more than one (1) lane closure location is desired, provide a minimum of a 2 mile passing zone between locations. Provide a separate sign set up for each location.

Ensure equipment and materials are a minimum of 30 feet from the edge of the travel lane during non-working hours.

Erect signs in locations not obstructing the traveling public's view of the normal roadway signing or necessary sight distance at intersections and curves.

All signs will conform to the Roadside Traffic Control Plan (RS-TCP-05) (see attached).

ITEM 544 "Guardrail End Treatments"

Label "end treatment type" on backside of unit at time of installation.

ITEM 545 CRASH CUSHION ATTENUATORS

Damaged crash cushion attenuators beyond repair will be replaced with the same attenuator model or similar. Exemptions to the similar model replacements will be determined by the Engineer to satisfy crash test levels (TL-2 for roadways 45 mph or less and TL-3 for roadways greater than 50 mph).

Crash cushions needing to be moved and reset will be paid under Item 545-6003 regardless of attenuator model. Foundations, materials, incidentals, etc. is subsidiary to this item. Crash cushions needing to be removed will be paid under Item 545-6005 regardless of attenuator model. Removing, materials, hauling, incidentals, etc. is subsidiary to this item.

The CRP will have 24 hours to respond via e-mail, phone, fax, etc. confirming the request by the County to repair damaged facility. The CRP will have 24 hours to contact and advise Hidalgo County of timeline or schedule for work to be completed/performed This includes delivery of materials.

The CRP is to return any used materials to the County. Any material deemed salvageable by the State will also be returned.

The CRP is to avoid damaging utilities during guard fence operations by contacting utility companies and locating all underground lines in the vicinity of the work.

The CRP will furnish crew(s) and equipment capable of maintaining work in a continuous manner for the completion of the work on schedule, as approved.

The CRP will use care to avoid disturbing pavement surfaces. Any damaged caused by the normal operation outside the work area will be paid by the CRP.

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Furnish and place topsoil to repair areas disturbed by construction operations, as approved. The topsoil and placement will not be paid for directly, but will be considered subsidiary to the various bid items. (?)

ITEM 7650 CLEAN TRAFIC ATTENAUATORS

Remove debris at locations shown on the plans, or as directed by the Engineer. Dispose of debris off the right of way. (?)

MEASUREMENT

The unit of measurement for "Purchase Guardrail Materials and/or Turnkey Solutions" will be based upon the various Items of work as specified on Attachment B.

PAYMENT

Work performed as prescribed by this specification, measured as provided under "Measurement" will be paid for at the contract unit price, which will be full compensation for furnishing all labor, equipment, materials and incidentals necessary to complete the work. Payment will be made once each month after satisfactory completion of work.

POINT OF CONTACT (?)

	Contact	Telephone №
H. C. Precinct 1		
H. C. Precinct 2		
H. C. Precinct 3		
H. C. Precinct 4		

Item 540
Metal Beam Guard Fence

1. DESCRIPTION

Furnish, install, replace, or adjust metal beam guard fence consisting of metal beam rail elements, hardware, blocks, and support posts.

2. MATERIALS

Provide samples of metal beam rail elements, terminal sections, bolts, and nuts for compliance testing according to Tex- 708-I and Tex-713-I to verify physical and chemical properties meet AASHTO M 180 when directed.

Obtain materials at the locations shown on the plans when the plans designate that the Department will furnish materials.

2.1. Metal Beam Rail Elements. Furnish new metal beam rail elements, transitions, anchor sections, and terminals that meet the requirements of Table 1 and are from a manufacturer on the Department's MPL of rail element manufacturers.

Type I or II is required, unless otherwise shown on the plans. Base metal for metal beam rail elements must not contain more than 0.04% phosphorous or more than 0.05% sulfur.

Warped or deformed rail elements will be rejected.

Table 1
Rail Element Requirements

Specification	AASHTO M 180
Class	A— Base metal nominal thickness 0.105 in. B— Base metal nominal thickness 0.135 in.
Type	I— Zinc-coated 1.80 oz. per square foot minimum single-spot. II— Zinc-coated 3.60 oz. per square foot minimum single-spot. IV— Weathering Steel (required when shown on the plans).
Shape	W-Beam Thrie Beam W-Beam to Thrie Beam Transition
Markings	Permanently mark each metal beam rail element with the information required in AASHTO M 180. In addition, permanently mark all curved sections of metal beam rail element with the radius of the curved section in the format "R=XX ft." Markings must be on the back of the metal beam rail section away from traffic and visible after erection.

2.2. Posts. Furnish new round timber, rectangular timber, or rolled steel section posts in accordance with details shown on the plans and the following requirements:

2.2.1. Timber Posts. Meet the requirements of DMS-7200, "Timber Posts and Blocks for Metal Beam Guard Fence." Purchase from a manufacturer or supplier on the Department's MPL of timber treating plants and suppliers.

2.2.2. Steel Posts. Provide rolled sections conforming to the material requirements of ASTM A36. Drill or punch posts for standard rail attachment as shown on the plans. Galvanize according to Item 445, "Galvanizing." Low-fill culvert posts may be fabricated as galvanized "blanks" with the rail hole and the final height field fabricated. Treat all exposed post surfaces caused by the field fabrication in accordance with Section 445.3.5., "Repairs."

2.3. Blocks. Furnish new rectangular timber or composite blocks in accordance with details shown on the plans and the following requirements:

2.3.1. Timber. Meet the requirements of DMS-7200 "Timber Posts and Blocks for Metal Beam Guard Fence." Purchase from a manufacturer or supplier on the Department's MPL of timber treating plants and suppliers.

2.3.2. Composite. Meet the requirements of DMS-7210 "Composite Material Posts and Blocks for Metal Beam Guard Fence." Purchase from a manufacturer on the Department's MPL of composite material blocks and posts.

2.4. Fittings. Furnish new fittings (bolts, nuts, and washers) according to the details shown on the plans and galvanized according to Item 445, "Galvanizing."

2.5. Terminal Connectors. Furnish new terminal connectors, where required, meeting the material and galvanizing requirements specified for metal beam rail elements.

2.6. Concrete. Furnish concrete for terminal anchor posts meeting the requirements for Class A concrete as required in Item 421, "Hydraulic Cement Concrete."

2.7. Curb. If indicated in the details, furnish the curb shown with metal beam guard fence transition as required by Item 529, "Concrete Curb, Gutter, and Combined Curb and Gutter."

2.8. Terminal Anchor Posts. Furnish new terminal anchor posts from steel conforming to the material requirements of ASTM A36. Fabricate posts according to Item 441, "Steel Structures." Galvanize terminal anchor posts after fabrication according to Item 445, "Galvanizing."

2.9. Driveway Terminal Anchor Posts. Furnish new terminal anchor posts from steel conforming to the material requirements of ASTM A36. Fabricate posts according to Item 441, "Steel Structures." Galvanize terminal anchor posts after fabrication according to Item 445, "Galvanizing."

2.10. Downstream Anchor Posts. Furnish new terminal anchor posts consisting of new rectangular timber and new steel foundation tubes according to details shown on the plans.

2.11. Downstream Anchor Hardware. Furnish new hardware (brackets, plates, struts, cable, etc.) according to the details shown on the plans and galvanized according to Item 445, "Galvanizing."

2.12. Controlled Released Terminal (CRT) Posts. Furnish new CRT posts according to the details shown on the plans and conforming to the requirements of DMS-7200, "Timber Posts and Blocks for Metal Beam Guard Fence." Purchase from a manufacturer or supplier on the Department's MPL of timber treating plants and suppliers.

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3. CONSTRUCTION

Install posts and rail elements according to details shown on the plans.

3.1. Posts. Install posts by either drilling or driving.

3.1.1. Drilling. Drill holes and set posts plumb and firm to the line and grade shown. Backfill posts by thoroughly compacting material to the density of adjacent undisturbed material.

3.1.2. Driving. Drive posts plumb with approved power hammers (steam, compressed air, vibratory, or diesel) or gravity hammers to the line and grade shown while preventing damage to the post. Use pilot holes when required and approved. Determine the size and depth of pilot holes based on results of the first few posts

driven. Thoroughly tamp loosened soil around the post, fill voids with suitable material, and thoroughly compact to the density of adjacent undisturbed material.

3.2. Rail Elements. Erect metal beam rail elements to produce a smooth, continuous rail paralleling the line and grade of the roadway surface or as shown on the plans. Bolt rail elements end-to-end and lap splices in the direction of traffic. Field-drill or punch holes in rail elements for special details, only when approved.

3.3. Short Radius. Special rail fabrication with a required radius must be as shown on the plans.

3.4. Terminal Anchor Posts. Embed terminal anchor posts in concrete, unless otherwise shown on the plans.

3.5. Galvanizing Repair. Repair all parts of galvanized steel posts, washers, bolts, and rail elements after erection where galvanizing has become scratched, chipped, or otherwise damaged. Repair in accordance with Section 445.3.5., "Repairs."

3.6. Guardrail Adjustment. Work includes vertical adjustment, horizontal shift, and overlap of the rail element to meet the detail shown on the plans.

3.7. Curb. If indicated in the details, construct the curb shown with metal beam guard fence transition as required by Item 529, "Concrete Curb, Gutter, and Combined Curb and Gutter."

3.8. Driveway Terminal Anchor Posts. Embed terminal anchor posts in concrete, unless otherwise shown on the plans.

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4. MEASUREMENT

4.1. Guard Fence. Measurement will be by the foot of fence. Fence will be measured on the face of the rail in place, from center-to-center of end splice locations.

4.2. Terminal Anchor Sections. Measurement will be by each section, complete in place, consisting of a terminal anchor post and one 25-ft. section of rail element.

4.3. Transitions. Transitions for rail connection will be measured by each transition.

4.4. Short Radius. Measurement will be by the foot to the nearest whole foot along the face of the rail in place, from beginning of radius (first CRT post) to the end of radius.

4.5. Driveway Terminal Anchor Section. Measurement will be by each section, complete in place, consisting of a driveway terminal anchor post and one 6-ft. section of rail element.

4.6. Downstream Anchor Terminal. Measurement will be by each section, complete in place, consisting of one W-Beam end section, 2 downstream anchor posts, and one rail section.

4.7. Long Span System. Measurement will be by the foot of fence. Fence will be measured on the face of the rail, in place, between the first CRT and last CRT posts in the system.

5. PAYMENT

The work performed and material furnished in accordance with this Item and measured as provided under "Measurement" will be paid at the unit price bid for "Metal W-Beam Guard Fence" of the post type specified; "Metal Thrie Beam Guard Fence" of the post type specified; "Terminal Anchor Section"; "Metal Beam Guard Fence Transition" of the type specified; "Metal W-Beam Guard Fence Adjustment"; "Metal Thrie Beam Guard Fence Adjustment"; "Terminal Anchor Section Adjustment"; "Transition Adjustment"; "Short Radius"; "Driveway Terminal Anchor Section; "Downstream Anchor Terminal"; or "Metal Beam Guard Fence (Long Span System)." When weathering steel is required, Type IV will be specified.

Samples furnished to the Department for testing purposes, special backfill materials, and concrete curbs will not be paid directly but are subsidiary to this Item.

5.1. Guard Fence. The price bid for "Metal W-Beam Guard Fence" or "Metal Thrie Beam Guard Fence" is full compensation for materials, hauling, erection, setting posts in concrete, blocks, driving posts, excavating, backfilling, equipment, labor, tools, and incidentals.

5.2. Terminal Anchor Section. When a separate bid item is specified, the price bid for "Terminal Anchor Section" is full compensation for furnishing the rail element, anchor assembly, terminal anchor post, and foundations; installing the rail element anchor assembly and the terminal anchor post and foundations; excavation and backfilling; and equipment, labor, tools, and incidentals.

5.3. Transition. The price bid for "Metal Beam Guard Fence Transition" is full compensation for furnishing nested sections of Thrie Beam; nested sections of W-Beam; Thrie Beam to W-Beam transitional rail piece, posts, concrete, curb, and connections to W-Beam guard fence and bridge rails; Thrie Beam terminal connectors; excavation and backfilling; and equipment, labor, tools, and incidentals.

5.4. Guardrail Adjustment. The price bid for "Metal W-Beam Guard Fence Adjustment," "Metal Thrie Beam Guard Fence Adjustment," "Terminal Anchor Section Adjustment," and "Transition Adjustment" is full compensation for furnishing materials not supplied by the Department, drilling holes in posts, hauling, erection, blocks, excavation, backfill, cleaning, salvaging materials, setting rail element anchor assembly and terminal anchor post, removal of rail element, concrete, curb, equipment, labor, tools, and incidentals.

5.5. Short Radius. The price bid for "Short Radius" is full compensation for furnishing special rail fabricated metal beam guard fence, CRT posts, steel posts, sand barrels, end terminal, cable anchor, materials, hauling, erection, blocks, driving posts, excavating, backfilling, equipment, labor, tools, and incidentals.

5.6. Driveway Terminal Anchor Section. The price bid for "Driveway Terminal Anchor Section" is full compensation for furnishing the rail element, driveway anchor assembly, driveway terminal anchor post, and foundations; installing the rail element anchor assembly and the driveway terminal anchor post and foundations; excavation and backfilling; and equipment, labor, tools, and incidentals.

5.7. Downstream Anchor Terminal. The price bid for "Downstream Anchor Terminal" is full compensation for furnishing the rail element, W-Beam end section, guardrail anchor bracket, shelf angle bracket, channel strut, downstream anchor posts, breakaway cable terminal (BCT) cable anchor assembly, and foundations; installing the BCT cable anchor assembly and the downstream anchor post and foundations; excavation and backfilling; and equipment, labor, tools, and incidentals.

5.8. Long Span System. The price bid for "Metal Beam Guard Fence (Long Span System)" is full compensation for furnishing the rail element, CRT posts, materials, hauling, erection, blocks, driving posts, excavating, backfilling, equipment, labor, tools, and incidentals.

Item 542
Removing Metal Beam Guard Fence

1. DESCRIPTION

Remove existing metal beam guard fence and store at locations shown on the plans or as directed.

2. CONSTRUCTION

Remove rail elements in original lengths. Remove fittings from the posts and the metal rail and then pull the posts. Do not mar or damage salvageable materials during removal.

Completely remove posts and any concrete surrounding the posts. Furnish backfill material and backfill the hole with material equal in composition and density to the surrounding soil unless otherwise directed.

Cut off or bend down deadman eyebolts to an elevation at least 1 ft. below the new subgrade elevation and leave in place along with the deadman.

Neatly stack salvaged materials to be retained by the Department at designated sites shown on the plans. Properly dispose of unsalvageable materials in accordance with federal, state, and local regulations. Repair or replace Contractor-damaged salvageable material at the Contractor's expense.

3. MEASUREMENT

This Item will be measured by the foot for "Remove Metal Beam Guard Fence" in its original position. Measurement will be made along the face of the rail, in place, including metal beam guard fence transitions, from center-to-center of end posts and from terminal points shown on the plans.

When "Remove Terminal Anchor Section" is specified as a separate bid item, measurement will be made for each removed section. A terminal anchor section consists of one post, one 25-ft. rail element, and associated hardware.

When "Remove Downstream Anchor Terminal" is specified as a separate bid item, measurement will be made for each removed section. Downstream anchor terminal consists of 2 posts, 1 section, and associated hardware.

4. PAYMENT

The work performed and measured as provided under "Measurement" will be paid at the unit price bid for "Remove Metal Beam Guard Fence," "Remove Terminal Anchor Section," and "Remove Downstream Anchor Terminal." This price will be full compensation for removing materials; loading, hauling, unloading, and storing or disposal; furnishing backfill material; backfilling postholes; and equipment, labor, tools, and incidentals.

Removal of curb associated with the metal beam guard fence transitions will not be paid directly but will be subsidiary to this Item.

Item 543
Cable Barrier System

1. DESCRIPTION

Furnish and install a cable barrier system and cable barrier terminal sections at the locations shown on the plans.

2. MATERIALS

Furnish a new cable barrier system and cable barrier terminal sections in accordance with the details shown on the plans and on the manufacturer's shop drawings, or equal as approved. Cable barrier systems approved for use have passed NCHRP Report 350 or MASH of the test level specified (TL-3, TL-4, etc.) with a maximum deflection of 8 ft.

Furnish pre-stretched cable.

Furnish Class A concrete in accordance with Item 421, "Hydraulic Cement Concrete."

Furnish delineators as shown on the plans and in accordance with Item 658, "Delineator and Object Marker Assemblies."

3. CONSTRUCTION

Install cable barrier system in accordance with the details, dimensions, and requirements shown on the plans and manufacturer's recommendations. Install cable barrier terminal sections in accordance with the details shown on the plans and manufacturer's recommendations.

Place posts into steel sleeves in a concrete foundation unless otherwise shown on the plans. Locate terminal sections at locations as shown on the plans. Repair or replace damaged parts immediately. Provide an installation and repair manual specific to the cable barrier system and cable barrier terminal sections.

Locate barrier delineators at a maximum spacing of 100 ft. and according to TMUTCD or as shown on the plans. Install barrier delineators in accordance with manufacturer's recommendations.

3.1. Training. Provide training as specified by the Department.

4. MEASUREMENT

This Item will be measured by the foot of cable barrier system and by each cable barrier terminal section installed.

5. PAYMENT

The work performed and the materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Cable Barrier System" of the test level specified (TL-3, TL-4, etc.), "Cable Barrier System" of the test level specified (TL-3, TL-4, etc.) and post spacing specified, and "Cable Barrier Terminal Section" of the test level specified (TL-3, TL-4, etc.). This price is full compensation for furnishing cable barrier system, cable barrier terminal section, concrete, delineators, equipment, labor, tools, and incidentals.

Delineators will not be measured or paid for directly but will be considered subsidiary to this Item

Item 544
Guardrail End Treatments

1. DESCRIPTION

Furnish and install, move, or remove guardrail end treatments.

2. MATERIALS

Furnish new materials from the Department's MPL of rail element manufacturers. Obtain materials at the location shown on the plans when furnished by the Department.

3. CONSTRUCTION

Install guardrail end treatments in accordance with manufacturer's assembly and installation requirements and the details shown on the plans. Provide the Engineer with manufacturer's installation and repair manuals specific to the guardrail end treatment.

Move or remove guardrail end treatments in accordance with the plans and as directed. Deliver salvageable materials in accordance with the plans or as directed. Dispose of unsalvageable materials in accordance with federal, state, and local regulations.

4. MEASUREMENT

This Item will be measured by each guardrail end treatment.

5. PAYMENT

The work performed and the materials furnished in accordance with this Item and measured as provided for under "Measurement" will be paid for at the unit price bid for "Guardrail End Treatment (Install)" of the post and type specified where applicable, "Guardrail End Treatment (Move and Reset)," or "Guardrail End Treatment (Remove)." This price is full compensation for foundations, materials, stockpiling, disposal of unsalvageable materials, equipment, labor, tools, and incidentals.

Payment for "Guardrail End Treatment (Move and Reset)" will include each guardrail end treatment removed from a stockpile or from an existing location and reset in a new location as detailed on the plans or as directed.

Payment for "Guardrail End Treatment (Remove)" will include each guardrail end treatment removed from an existing location and stockpiled at the location designated on the plans, disposed, or as otherwise directed.

Item 545
Crash Cushion Attenuators

1. DESCRIPTION

Furnish and install, move and reset, or remove crash cushion attenuators.

2. MATERIALS

2.1. Crash Cushion Attenuators. Furnish new crash cushion attenuators in accordance with the details shown on the plans and on the manufacturer's shop drawings. Obtain crash cushion attenuators at the location shown on the plans when furnished by the Department.

2.2. Concrete. Furnish Class S concrete for pads that meets Item 421, "Hydraulic Cement Concrete."

3. CONSTRUCTION

Perform the following as shown on the plans:

3.1. Installation. Assemble and install crash cushion attenuators in accordance with the details shown on the plans and manufacturer recommendations. Obtain assembly and installation information for the crash cushion attenuators from the manufacturer and provide the Engineer with an installation and repair manual specific to the crash cushion attenuators.

3.2. Moving and Resetting. Remove crash cushion attenuators from a stockpile or from an existing location and reset in a new location as shown on the plans or as directed. Install crash cushion attenuators in accordance with pertinent standards and manufacturer recommendations. Provide additional materials to complete the installation as needed. Dispose of unsalvageable materials in accordance with federal, state, and local regulations.

3.3. Removal. Remove crash cushion attenuators from an existing location and stockpile in the area designated on the plans, as directed, or dispose. Clean and repair salvageable units before inspection and return them to the Department. Dispose of unsalvageable materials in accordance with federal, state, and local regulations.

4. MEASUREMENT

This Item will be measured by each crash cushion attenuator.

5. PAYMENT

The work performed and the materials furnished in accordance with this Item and measured as provided for under "Measurement" will be paid for at the unit price bid for "Crash Cushion Attenuator (Furnish and Install, Designated Source, Move and Reset, Stockpile, or Remove)" of the category, width (N or W), and test level. This price is full compensation for foundations; materials, stockpiling, moving and removing, hauling, installing and resetting, disposal of unsalvageable materials, equipment, labor, tools, and incidentals.

5.1. Furnish and Install. This price is full compensation for furnishing and installing crash cushion attenuator.

5.2. Designated Source. This price is full compensation for delivering and installing Department-furnished crash cushion attenuator from a designated source.

5.3. Move and Reset. This price is full compensation for moving crash cushion attenuator installations on the project from one location to another (including disassembly and reassembly costs), moving crash cushion attenuator from an installation on the project to a temporary storage area (including disassembly costs), and moving crash cushion attenuator from a temporary storage area to an installation site on the project (including assembly costs).

5.4. Stockpile. This price is full compensation for removing crash cushion attenuator from the project and delivering to the Department stockpile area shown on the plans or as directed.

5.5. Remove. This price is full compensation for removing crash cushion attenuator from the project and retained by the Contractor.

Item 550
Chain Link Fence

1. DESCRIPTION

Furnish, install, remove, repair, or replace chain link fence and gates.

2. MATERIALS

Furnish certification from the chain link fence materials manufacturer stating that all fencing materials comply with the requirements of this Item before installation of the fence. Use only new materials.

2.1. General. Furnish materials in accordance with the following:

- Item 421, "Hydraulic Cement Concrete," Class B
- Item 445, "Galvanizing"

2.2. Wire Fabric. Provide wire fabric with:

- 9 gauge (0.148 in. diameter) steel wire with a minimum breaking strength of 1,290 lb. meeting ASTM A392 Class I or ASTM A491;
- mesh size of 2 in. ±1/8 in. between parallel wires with at least 7 meshes in a vertical dimension of 23 in. along the diagonals of the openings; and
- knuckled selvages at the top and bottom edge of the fabric, unless otherwise shown on the plans.

2.3. Posts. Provide posts of the size and weight shown on the plans. Do not provide rerolled or open-seam posts. Use material for all posts meeting ASTM F1043 Group 1A Regular Grade or Group 1C High Strength.

2.4. Post Caps. Provide malleable iron post caps designed to exclude all moisture. Furnish barbed wire support arms integral with the post caps if barbed wire is shown on the plans. Furnish post caps with an opening for the top rail if top rail is shown on the plans. Post caps must have a 2-in. skirt.

2.5. Gates. Provide gates fabricated from round sections of pipe of the size and weight shown on the plans. Use material for all gate pipes meeting ASTM F1043 Group 1A Regular Grade or Group 1C High Strength. For each gate, include:

- corner and tee fittings of malleable iron or pressed steel with means for attaching diagonal bracing members;
- hinges of malleable iron allowing a full 180° swing, easily operated by one person;
- ball-and-socket-type bottom hinges that do not twist or turn from the action of the gate and prevent the closed gate from being lifted off the hinges;
- a positive stop that prevents any portion of the gate from swinging over an adjacent traffic lane;
- malleable iron pulley systems for roll type gate (only when required);
- diagonal braces consisting of 3/8-in. diameter cable with turnbuckles, 2 to each gate frame, and, for vehicle gates, a vertical pipe brace of the size and weight shown on the plans at the center of each gate leaf;
- latches of malleable iron or steel for single gates with a single-fork latch and padlock eye that will keep the gate closed;
- 2 fork latches mounted on a center plunger rod with a padlock eye for double-leaf gates;
- holdbacks for each leaf of vehicular gates, with a semi-automatic holdback catch anchored at least 12 in. into a 12-in. diameter by 24-in. deep concrete footing; and

- a malleable iron center rest, designed to receive the plunger rod anchored as shown on the plans for all double-leaf gates.

2.6. Top Rail. Use material meeting ASTM F1043 Group 1A or 1C for all top rail pipes. Provide 1.660 in. OD top rail manufactured from Group 1A standard weight (Schedule 40) steel pipe weighing 2.27 lb. per foot or from Group 1C high-strength pipe weighing 1.84 lb. per foot when shown on the plans. Provide pipe in sections at least 18 ft. long joined with outside steel sleeve couplings at least 6 in. long with a minimum wall thickness of 0.70 in. Use couplings designed to allow for expansion of the top rail.

2.7. Tension Wire. Use 7 gauge (0.177-in.) carbon steel wire with a minimum breaking strength of 1,950 lb. for the bottom edge of all fence fabric, and for the top edge of fence fabric when a top rail is not specified.

2.8. Truss Bracing. Provide truss bracing as shown on the plans.

2.9. Cables. Provide 7-wire strand cables manufactured of galvanized annealed steel at least 3/8 in. in diameter.

2.10. Barbed Wire. Provide 3 strands of twisted 12.5 gauge barbed wire with 2-point, 14 gauge barbs spaced approximately 5 in. apart conforming to ASTM A121 or ASTM A585 when specified on the plans.

2.11. Barbed Wire Support Arms. Provide support arms at an angle of 45° from vertical, with clips for attaching 3 strands of barbed wire to each support arm and sufficient strength to support a 200-lb. weight applied at the outer strand when barbed wire is specified on the plans.

2.12. Stretcher Bars. Provide stretcher bars made of flat steel at least 3/16 × 3/4 in. and not more than 2 in. shorter than the fabric height. Provide one stretcher bar for each gate and end post and 2 stretcher bars for each corner and pull post.

2.13. Grounds. Provide copper-clad steel rods 8 ft. long with a minimum diameter of 5/8 in., or other UL-listed ground rods.

2.14. Miscellaneous Fittings and Fasteners. Furnish enough fittings and fasteners to erect all fencing materials in a proper manner. Furnish fittings for posts from pressed or rolled steel, forged steel, malleable iron or wrought iron of good commercial quality spaced as shown on the plans.

2.15. Coatings. Hot-dip galvanize all materials unless specified otherwise in this Item or on the plans. Fabric, tension wire, and barbed wire may be aluminum-coated or alloy-coated if approved. Additionally coat all material except bolts, nuts, washers, and pipe material with thermally fused polyvinyl chloride (PVC) in accordance with ASTM F668, Class 2b, meeting the specified color when shown on the plans.

2.15.1. Fabric.

2.15.1.1. Galvanizing. Hot-dip galvanize in accordance with ASTM A392, Class I.

2.15.1.2. Aluminum Coating. Aluminum-coat in accordance with ASTM A491.

2.15.1.3. Alloy Coating. Coat with zinc-5% aluminum-mischmetal alloy (Zn-5A1-MM) in accordance with ASTM F1345, Class I.

2.15.2. Posts, Braces, and Gates.

2.15.2.1. Standard Weight (Schedule 40) Pipe. Hot-dip galvanize inside and outside according to ASTM F1043 (1.8 oz./sq. ft. galvanized zinc weight).

2.15.2.2. High Strength Pipe. Hot-dip galvanize before or after forming pipe according to ASTM F1043 Group 1C and as follows:

- Outside—minimum 0.9 oz./sq. ft. galvanized zinc weight with a verifiable polymer overcoat.

- Inside—minimum 0.9 oz./sq. ft. galvanized zinc weight before forming, or minimum 0.3 mils zinc-based coating after forming containing a minimum 90% zinc dust, by weight.

2.15.2.3. Optional Additional Coating. Additionally coat all pipe material with 10 mils minimum thermally fused PVC according to ASTM F1043, meeting the specified color when shown on the plans.

2.15.3. Fittings, Bolts, and Other Miscellaneous Hardware. Galvanize all fittings, bolts, and miscellaneous hardware in conformance with Item 445, "Galvanizing."

2.15.4. Tension Wire. Zinc-coat tension wire with a minimum coating of 0.80 oz./sq. ft. or aluminum-coat with a minimum coating of 0.30 oz./sq. ft.

2.15.5. Barbed Wire. Zinc-coat barbed wire in accordance with ASTM A121 (0.80 oz./sq. ft.) or aluminum-coat in accordance with ASTM A585 (0.30 oz./sq. ft.).

2.15.6. Pull Cable. Zinc-coat pull cable with a minimum coating of 0.80 oz./sq. ft. of individual-wire surface when tested in conformance with ASTM A116.

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3. CONSTRUCTION

Erect the chain link fence to the lines and grades established on the plans. Overall height of the fence when erected is the height above the grade shown.

Repair or replace damaged fence or gates. Remove and replace the post and foundation if posts cannot be repaired by straightening. Return all salvageable material to the location shown on the plans when a fence installation is to be removed in its entirety and not replaced. Backfill all postholes with suitable material. Return the salvaged fence fabric in secured rolls not more than 50 ft. long. Dispose of unsalvageable material.

3.1. Clearing and Grading. Clear all brush, rocks, and debris necessary for the installation of this fencing.

Stake the locations for corner posts and terminal posts unless otherwise shown on the plans. Follow the finished ground elevations for fencing panels between corner and terminal posts. Level off minor irregularities in the path of the fencing.

3.2. Erection of Posts. Install posts as shown on the plans. Plumb and permanently position posts with anchorages firmly set before fabric is placed. Brace corner and pull posts as shown on the plans.

3.2.1. Post Spacing. Space posts as shown in Table 1.

Table 1
Post Spacing and Placement

Post Type	Required Spacing or Placement
Line posts	no more than 10 ft. apart
Pull posts	no more than 500 ft. apart and at each change in direction exceeding 20° vertically
Corner posts	at each horizontal angle point

Install cables on all terminal posts and extend to adjacent posts. Install cables on each side of corner and pull posts with a 3/8-in. drop-forged eye-and-eye or eye-and-clevis turnbuckle unless otherwise shown on the plans.

3.2.2. Postholes. Drill holes for concrete footings for all posts to provide footings of the dimensions shown on the plans.

Penetrate solid rock by at least 12 in. (18 in. for end, corner, gate, and pull posts) or to plan depth where the rock is encountered before reaching plan depth. Drill holes in the solid rock with a diameter at least 1 in. greater than the outside diameter of the post.

Fill the hole in the solid rock with grout consisting of 1 part hydraulic cement and 3 parts clean, well-graded sand after the posts are set and plumbed. If desired, other grouting materials may be used only if approved. Thoroughly work the grout into the hole, leaving no voids. Construct concrete footings from the solid rock to the top of the ground.

3.2.3. Gate Posts. Align the tops of all gate frames with the fencing top tension wire or top rail. Provide vehicular gates that are greater in overall height than the adjacent fencing by the height necessary to extend to within 2 in. of the pavement between the curbs if curbs are shown on the plans.

3.2.4. Concrete Footings. Center posts in their footings. Place concrete and compact by tamping or other approved methods. Machine mix all batches of concrete over 1/2 cu. yd. Hand mixing concrete is allowed on batches under 1/2 cu. yd.

Use forms for footings where the ground cannot be satisfactorily excavated to neat lines. Crown the concrete or grout (for solid rock) to carry water from the post. Keep the forms in place for at least 24 hr. Backfill the footing with moistened material as soon as each form is removed, and thoroughly tamp. Cover concrete with at least 4 in. of loose moist material, free of clods and gravel, immediately after placing concrete. No other curing is required.

Spread all excess excavated and loose material used for curing neatly and uniformly. Remove excess concrete and other construction debris from the site.

3.3. Erection of Fabric. Place the fabric with the cables drawn taut with the turnbuckles after all posts have been permanently positioned and anchorages firmly set. Secure one end and apply enough tension to the other end to remove all slack before making attachments. Cut the fabric and independently attach each span at all corner posts and pull posts unless otherwise shown on the plans.

Follow the finished contour of the site with the bottom edge of fabric located approximately 2 in. above the grade. Grade uneven areas so the maximum distance between the bottom of fabric and ground is 6 in. or less.

Fasten fabric at 12 in. intervals to the top and bottom tension wires between posts. Fasten the fabric in the same manner when top rail is shown on the plans. Fasten the fabric on gate frames to the top and bottom of the frame at 12 in. intervals. Use steel wire fabric ties of 9 gauge steel or larger. Fasten fabric to terminal posts by steel stretcher bars and stretcher bar bands fitted with carriage bolts and nuts of the size and spacing shown on the plans. Use stretcher bars to fasten end posts, pull posts, corner posts, and gateposts with stretcher bar bands at intervals of no more than 15 in. Attach stretcher bars to terminal posts with 1 × 1/8 in. flat steel bands with 3/8-in. carriage bolts at intervals up to 15 in.

3.4. Electrical Grounds. Provide at least one electrical ground for each 1,000 ft. of fence, located near the center of the run. Provide additional grounds directly under the point where power lines pass over the fence.

Vertically drive or drill in the grounding rod until the top of the rod is approximately 6 in. below the top of the ground. Connect a No. 6 solid copper conductor to the rod and to the fence by a UL-listed method so that each element of the fence is grounded.

3.5. Repair of Coatings. Repair damaged zinc coating in accordance with Section 445.3.5., “Repairs.”

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4. MEASUREMENT

Chain link fence will be measured by the foot of fence installed, repaired, replaced, or removed, measured at the bottom of the fabric along the centerline of the fence from center to center of posts, excluding gates.

Gates will be measured as each gate installed, repaired, replaced, or removed.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Chain Link Fence (Install)" or "Chain Link Fence (Repair)" of the height specified or "Chain Link Fence (Remove)" and "Gate (Install)" or "Gate (Repair)" of the type, height, and width of opening specified or "Gate (Remove)." Clearing and grading for fencing and gates will not be paid for directly but is subsidiary to this Item.

5.1. Chain Link Fence (Install). This price is full compensation for furnishing and installing fencing, except gates; cleaning, grading, and backfilling; removing and disposing of surplus material; and equipment, labor, tools, and incidentals.

5.2. Chain Link Fence (Repair). This price is full compensation for furnishing materials; repairing or replacing fencing, except gates; cleaning, grading, and backfilling; removing and disposing of surplus or damaged material; and equipment, labor, tools, and incidentals.

5.3. Chain Link Fence (Remove). This price is full compensation for removing all fencing, except gates; cleaning, grading, and backfilling; removing and disposing of surplus material; and equipment, labor, tools, and incidentals.

5.4. Gate (Install). This price is full compensation for installing gate and for providing materials, center anchorages, equipment, labor, tools, and incidentals.

5.5. Gate (Repair). This price is full compensation for repairing or replacing gate and for furnishing materials; removing and disposing of damaged materials; and equipment, labor, tools, and incidentals.

5.6. Gate (Remove). This price is full compensation for removing gate and for materials, equipment, labor, tools, and incidentals.

Item 770
Guard Fence Repair

1. DESCRIPTION

Repair guard fence elements, posts, terminal anchor sections, single guard fence terminals, and other appurtenances.

2. MATERIALS

Furnish the following materials, unless otherwise shown on the plans:

- rail elements, posts, blockouts, fittings, and anchor concrete meeting Item 540, "Metal Beam Guard Fence";
- single guardrail terminal (SGT), in accordance with Item 544, "Guardrail End Treatments";
- steel posts with base plates or terminal anchor posts to match original design, meeting ASTM A36 or better;
- paint as required;
- concrete for structural repair, in accordance with Item 429, "Concrete Structure Repair";
- grout meeting the requirements of Item 421, "Hydraulic Cement Concrete"; and
- backfill material as approved.

Pick up materials furnished by the Department at the locations shown on the plans. Load and deliver furnished material to the project location. Pick up Department-furnished materials during normal business hours.

3. WORK METHODS

Replace guard fence, including thrie beam, curb, and transitions, in accordance with Item 540, "Metal Beam Guard Fence," and as shown on the plans or as directed. Work requests are made on a callout basis. Begin physical work within 72 hr. of notification, unless otherwise shown on the plans. Replace end treatments in accordance with Item 544, "Guardrail End Treatments," and as shown on the plans or as directed. Weld in accordance with Item 448, "Structural Field Welding." Repair concrete in accordance with Item 429, "Concrete Structure Repair." Remove guard fence in accordance with Item 542, "Removing Metal Beam Guard Fence." Replace rail and posts removed during the same workday, unless otherwise approved.

- Protect traffic from exposure to unattached rail elements left overnight, as approved.
- Cover or fill postholes at the end of each day.
- Place rail to a smooth line and grade, with posts plumb to the correct height, in accordance with the plans.
- Remove salvageable rail elements in original lengths. Remove fittings from posts and rail elements. Deliver salvageable materials to a designated stockpile site and neatly stack as directed. Reuse salvageable materials in the repair as approved.
- Dispose of debris and damaged components in accordance with all federal, state, and local regulations.

3.1. Repair of Rail Element. Remove and replace rail elements as directed. Bolt rail elements end to end and lap in the direction of traffic in the lane adjacent to the guard fence. Provide prefabricated curved rail when needed. Field-drill,

punch, or use other approved methods to create holes for special details. Tighten nuts. Replace bridge end connection when required, in accordance with Item 540, "Metal Beam Guard Fence."

3.2. Removal and Replacement of Timber or Steel Post. Replace posts as directed. Dispose of any concrete removed. Drill new post holes as needed. Clean postholes free of loose dirt and debris, and thoroughly compact bottom of hole to the correct elevation for placement of post. Place post to the correct alignment, elevation, and plumb. Backfill with select material by thoroughly compacting material to the density of adjacent undisturbed material. Replace concrete foundations only as directed. Use grout to fill space between riprap and posts when replacing posts.

3.3. Realignment of Posts. Realign existing posts to a smooth line and grade.

3.4. Repair of Terminal Anchor Post. Repair the steel anchor post by straightening or welding to the existing post above the concrete foundation.

3.5. Replacing Terminal Anchor Posts. Remove and replace damaged anchor posts with foundation or install new anchor posts with foundation. Remove anchor and clean existing holes or drill new holes, as approved.

3.6. Removal of Guardrail End Treatment and Replacement with SGT. Remove damaged guard fence end treatment and replace with complete new SGT.

3.7. Repair of SGT. Remove damaged SGT components and replace with new components. Salvage and reuse components as approved.

3.8. Repair of Steel Post with Base Plate. Replace damaged steel posts with base plates. Drill anchor holes and install new bolts or weld new anchor bolts to existing bolts as directed. Field-weld in accordance with Item 448, "Structural Field Welding," or shop-weld in accordance with Item 441, "Steel Structures." Repair damaged galvanized coating in accordance with Section 445.3.5., "Repairs."

3.9. Raise Rail Element. Raise rail as shown on the plans.

3.10. Repair of Blockouts. Remove and replace damaged or deteriorated blockouts with new blockouts when shown on the plans or as directed.

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4. MEASUREMENT

This Item will be measured as follows:

4.1. Repair of Rail Element (W-Beam, Thrie-Beam, or Thrie-Beam Transition to W-Beam). By the foot along the face of the rail from center to center of the slotted hole at each end of the rail elements repaired, including the terminal anchor section and the rail with any bolt hole spacing, but excluding the first 2 rail elements of the SGT section.

4.2. Removal and Replacement of Timber or Steel Posts without Concrete Foundation. By each post replaced.

4.3. Removal and Replacement of Timber or Steel Posts with Concrete Foundation. By each post replaced.

4.4. Realignment of Posts. By each post realigned.

4.5. Repair of Terminal Anchor Post. By each post repaired.

4.6. Replacement of Terminal Anchor Posts. By each post replaced.

4.7. Removal of Guardrail End Treatment and Replacement with SGT. By each SGT.

4.8. Replacement of SGT Impact Head. By each head.

4.9. Replacement of SGT Rail. By the foot from center to center of posts, 2 rails.

4.10. Replacement of SGT Post. By each post replaced, includes metal sleeves.

4.11. Remove and Replace Blockouts. By each blockout replaced.

4.12. Repair of Steel Post with Base Plate. By each post repaired. Includes top or side mount posts.

4.13. Remove and Reset SGT Impact Head. By each head reset.

4.14. Replace SGT Object Marker. By each marker replaced, as directed, including the removal and disposal of the existing rubber bumpers.

4.15. Replace SGT Cable Anchor. By each cable anchor replaced.

4.16. Replace SGT Cable Assembly. By each cable assembly replaced.

4.17. Replace SGT Strut. By each strut replaced.

4.18. Raise Rail. By the foot along the face of the rail from center to center of the slotted hole at each end of the rail element raised.

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5. PAYMENT

The work performed and the materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid at the unit price bid for: "Repair Rail Element of the type specified," "Raise Rail of the type specified," "Remove Post of the type specified," "Replace Post of the type specified," "Repair Post of the type specified," "Realign Posts of the type specified," "Remove Guardrail End Treatment and Replace with SGT," "Replace SGT Impact Head," "Remove and Reset SGT Impact Head," "Remove and Replace Blockouts," "Replace SGT Object Marker," "Replace SGT Cable Anchor," "Replace SGT Cable Assembly," and "Replace SGT Strut."

This price is full compensation for repairing rail and furnishing equipment, materials, labor, tools, and incidentals. Realignment of existing rail without removing will not be paid for directly but considered subsidiary to realigning posts. Replacement of concrete riprap around posts, removal and replacement of curbs, and bridge end connection will not be paid for directly but considered subsidiary to the various bid items. Replacement of SGT components not mentioned above will not be paid for directly but considered subsidiary to the various bid items. Concrete repair will be paid for in accordance with pertinent Items. Payment for repair of steel posts with base plate includes work performed above the concrete foundation. Any rail removed and replaced to remove/replace posts will not be paid for directly but considered subsidiary to various bid items.

Coring new holes and furnishing new bolts and epoxy for the repair or replacement of posts with base plate will be considered subsidiary to various bid items.

Item772
Post and Cable Fence

1. DESCRIPTION

Install, repair, or remove post and cable fence.

2. MATERIALS

Furnish materials as follows, unless otherwise shown on the plans.

2.1. Posts. Furnish timber posts meeting DMS-7200, "Timber Posts and Blocks for Metal Beam Guard Fence."

2.2. Cable. Furnish wire cable meeting ASTM A475 and the following requirements:

- 3/8 in. nominal strand diameter,
- 7-wire strand, common grade,
- minimum breaking strength of 4,000 lb., and
- 0.30 oz. per square foot minimum weight of zinc coating.

2.3. Fittings and Anchors. Furnish fittings and anchors galvanized in accordance with ASTM A153.

2.4. Concrete. Furnish concrete meeting Item 421, "Hydraulic Cement Concrete," of the class shown on the plans.

2.5. Reflectors. Furnish reflectors as shown on the plans.

2.6. Backfill. Furnish backfill material as approved.

2.7. Gate. Furnish gates as shown on the plans.

3. WORK METHODS

Install, repair, or remove post and cable fence, including reflectors and related items as shown on the plans.

3.1. Removal. Remove concrete anchors, posts, and cable. Backfill and thoroughly compact post and anchor holes. Accept ownership of removed materials, unless otherwise shown on the plans. Dispose of removed materials in accordance with federal, state, and local regulations.

3.2. Installation. Place new anchors, posts, and cable as shown on the plans. Set posts on firm foundation and plumb to the required lines and grades. Thoroughly compact backfill in 4-in. layers. Space pull posts as shown on the plans. Lengthen or shorten one pull post space per continuous section if necessary to accommodate site conditions. Cover or fill open holes at the end of each workday.

Maintain current pull post spacing of existing installations if approved. Straighten undamaged posts that are more than 1 in. out of plumb. Stretch cable to remove sag between posts. One cable splice will be allowed between posts, adjacent to the post, but no more than 2 splices in any 100 ft. of cable. Painting is not required, unless otherwise shown on the plans.

3.3. Repair. Plumb and realign post in a vertical and horizontal position. Stretch cable to remove sag between posts. One cable splice will be allowed between posts, adjacent to the post, but no more than 2 splices in

any 100 ft. of cable. Removal and replacement of posts, anchors, or cable will be paid with the appropriate bid item.

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4. MEASUREMENT

This Item will be measured as follows:

4.1. Post and Cable Fence Removal. By the foot from center to center of pull posts.

4.2. Concrete Anchor Removal. By each anchor removed.

4.3. New Installation of Post and Cable Fence. By the foot of fence from center to center of pull posts for each continuous section installed.

4.4. New Concrete Anchor. By each anchor installed.

4.5. Removal and Replacement of Posts. By each post removed and replaced.

4.6. Removal and Replacement of Concrete Anchors. By each anchor removed and replaced.

4.7. Removal and Replacement of Cable. By the foot of cable removed and replaced.

4.8. New Installation of Post and Cable Fence (Gate). By each gate installed.

4.9. Repair. By the foot of fence from center to center of pull posts for each repair.

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5. PAYMENT

The work performed and the materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Post and Cable Fence (Removal)," "Post and Cable Fence (Remove Concrete Anchor)," "Post and Cable Fence (New Installation)," "Post and Cable Fence (New Concrete Anchor)," "Post and Cable Fence (Remove and Replace Posts)," "Post and Cable Fence (Remove and Replace Concrete Anchors)," or "Post and Cable Fence (Remove and Replace Cable)," "Post and Cable Fence (Gate) (New Installation)," or "Post and Cable Fence (Repair)." This price is full compensation for cable splices, straightening posts, realignments of posts, tightening cable, backfilling posts and anchor holes, installation of reflectors, bollards, foundations, backfilling, gate and hardware, paint, materials, equipment, labor, tools, and incidentals.

Item774
Attenuator Repair

1. DESCRIPTION

Repair or replace damaged attenuators or crash cushions.

2. MATERIALS

Furnish materials in accordance with details shown on the plans.

3. WORK METHODS

Repair or replace attenuators as approved. Begin physical repair for Contracts with callout work within 72 hr. of notification, unless otherwise shown on the plans. Repair damaged components, such as foundation, concrete, anchors, and pavement, as necessary to ensure the final installation functions as designed. Sweep and clean area around attenuator. Dispose of debris and damaged components in accordance with federal, state, and local regulations. Weld in accordance with Item 448, "Structural Field Welding," as directed or approved. Salvage materials as directed.

3.1. Removal and Replacement. Remove existing attenuator and replace with a system shown on the plans or as directed.

3.2. Repair. Remove and replace damaged elements of attenuators and repair to meet the installation requirements of the system shown on the plans and the specifications that pertain to that appropriate system.

4. MEASUREMENT

4.1. Removal and Replacement. When replacing a complete unit, measurement will be by each unit.

4.2. Repair. Repair will be measured by the each for the component specified or by the foot.

5. PAYMENT

The work performed and the materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Remove and Replace" or "Repair" of the type or component specified. This price is full compensation for repairing or replacing attenuators; furnishing materials; salvage and disposal; and equipment, labor, tools, and incidentals.

Item 776
Metal Rail Repair

1. DESCRIPTION

Repair metal traffic or pedestrian rail. Replace metal traffic or pedestrian rail if beyond repair as determined by the Engineer.

2. MATERIALS

Furnish materials in accordance with Item 450, "Railing," and details shown on the plans.

3. WORK METHODS

Remove damaged steel or aluminum rail and repair to match the original or details shown on the plans. Replace steel or aluminum rail to match the original or details shown on the plans if the damaged rail is beyond repair as determined by the Engineer. Begin physical repair for Contracts with callout work within 72 hr. of notification, unless otherwise shown on the plans. Repair damaged components, anchors, etc., as necessary to ensure the final installation functions as originally constructed. Drill anchor holes and install new bolts or weld new anchor bolts to existing bolts as directed. Weld in accordance with Item 441, "Steel Structures," or Item 448, "Structural Field Welding." Repair damaged galvanized coating in accordance with Section 445.3.5., "Repairs." Paint repaired areas of painted rail to match existing color, in accordance with Item 446, "Field Cleaning and Painting Steel." Repair railing removed for repair during the same workday unless otherwise approved. Deliver salvageable materials to a designated stockpile site and dispose of debris and damaged components in accordance with federal, state, and local regulations.

4. MEASUREMENT

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. Repairing metal post with base plate will be measured by each post repaired. Rail replacement will be measured by the foot between centers of the first undamaged post on each side of the replacement or to the end of the rail.

5. PAYMENT

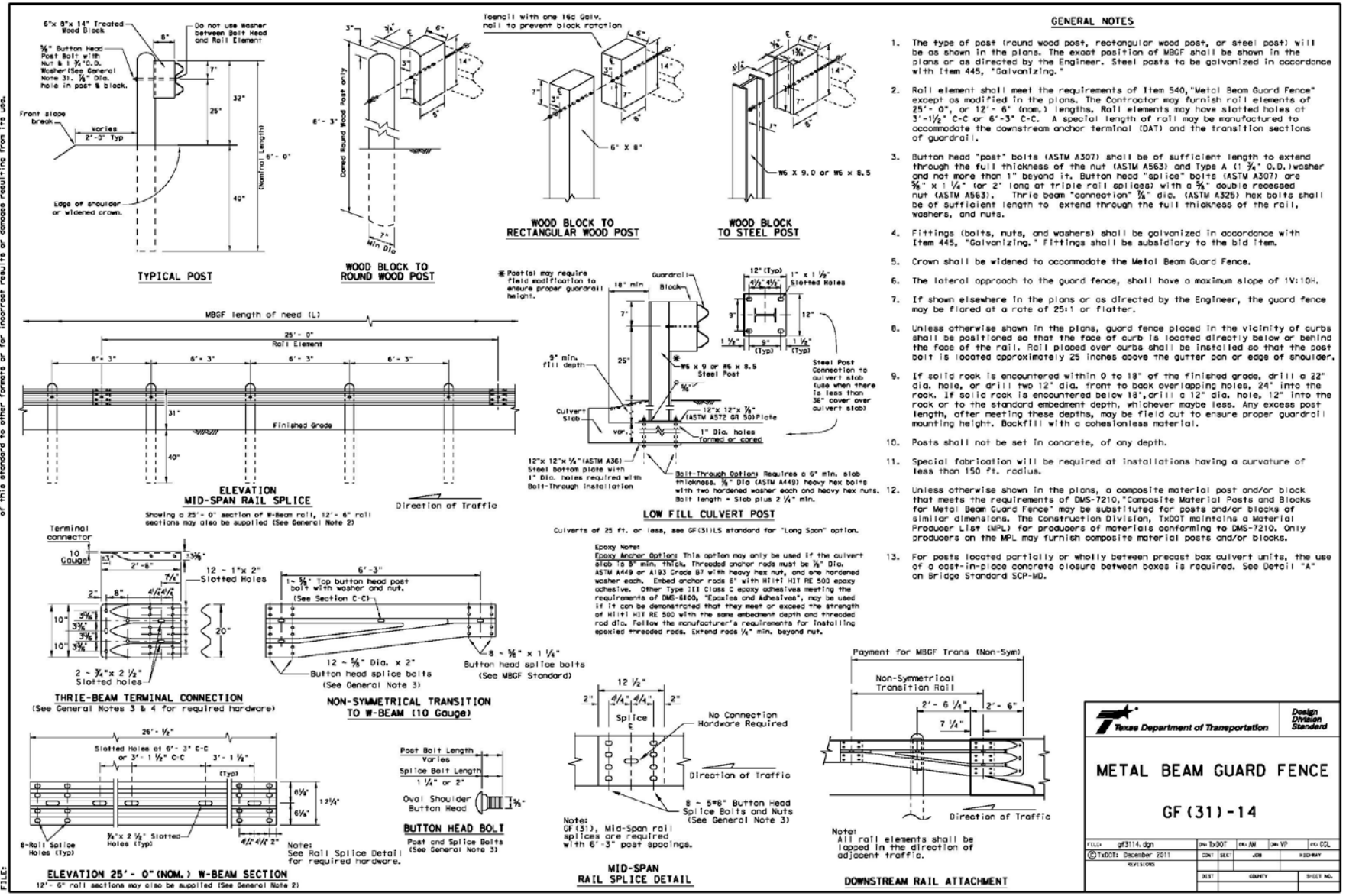
The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Repair" of the type specified, "Repair Metal Post with Base Plate" of the type specified, and "Replacement" of the type specified. This price is full compensation for removing and repairing rail; salvage and disposal; and materials, tools, equipment, labor, and incidentals. Concrete repair will be paid for in accordance with Item 429, "Concrete Structure Repair."

INDEX OF SHEETS

The Standard Sheets specifically identified above have been selected by me or under my responsible supervision as being applicable to this project.

_____ _____

Isaac Garza, P.E. Date
Transportation Engineer


TYPICAL POST
WOOD BLOCK TO ROUND WOOD POST
WOOD BLOCK TO RECTANGULAR WOOD POST
WOOD BLOCK TO STEEL POST
ELEVATION MID-SPAN RAIL SPLICE
LOW FILL CULVERT POST
THRIE-BEAM TERMINAL CONNECTION
NON-SYMMETRICAL TRANSITION TO W-BEAM (10 Gauge)
BUTTON HEAD BOLT
MID-SPAN RAIL SPLICE DETAIL
DOWNSTREAM RAIL ATTACHMENT
ELEVATION 25'-0" (NOM.) W-BEAM SECTION
GENERAL NOTES
METAL BEAM GUARD FENCE
GF(31)-14
Texas Department of Transportation
Design Division Standard

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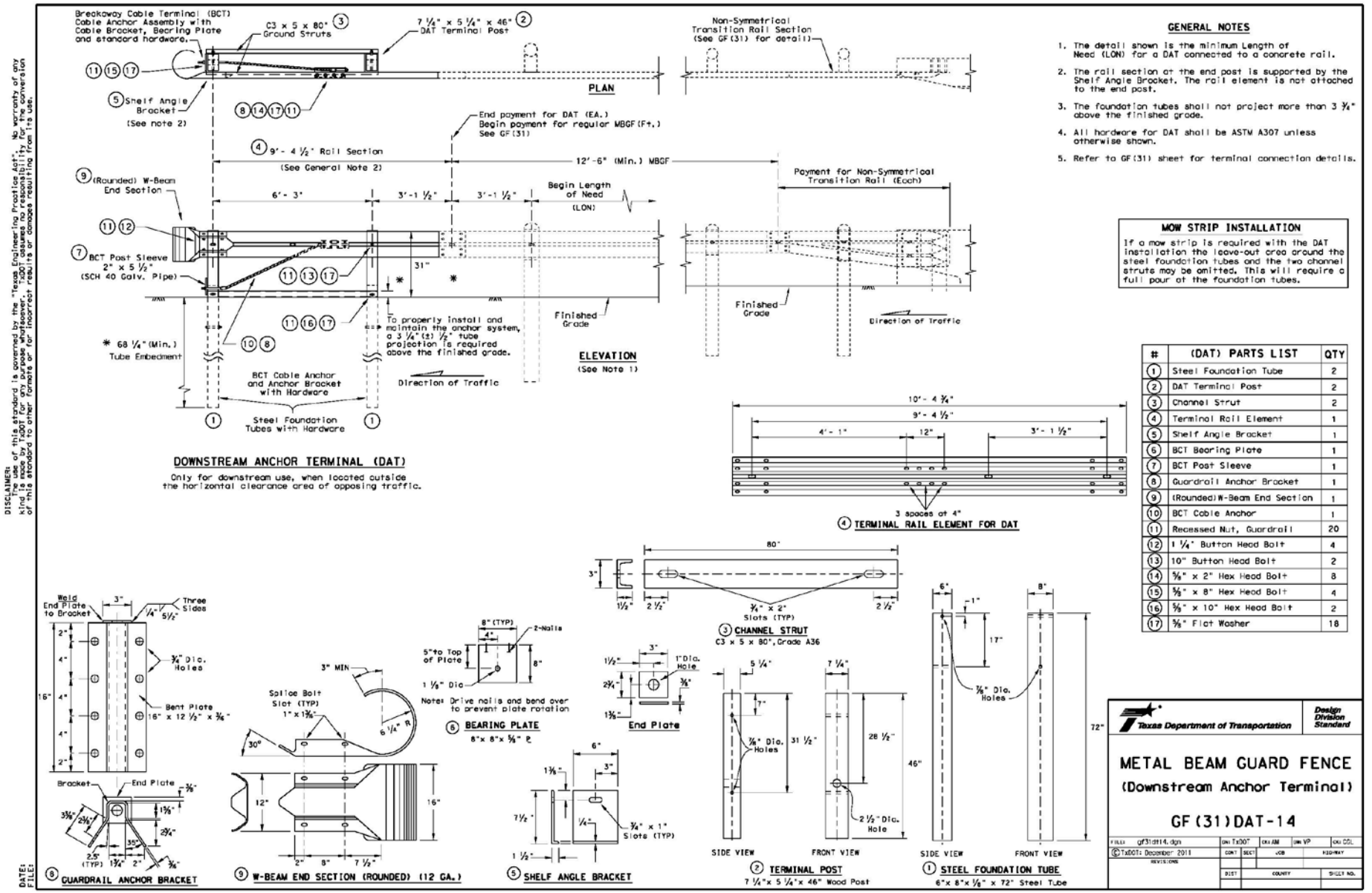

GENERAL NOTES

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

Texas Department of Transportation — Design Division Standard

METAL BEAM GUARD FENCE
(Downstream Anchor Terminal)

GF(31)DAT-14

FILE: gf31dt14.dgn | DN: TxDOT | CK: AM | DW: VP | CK: COL
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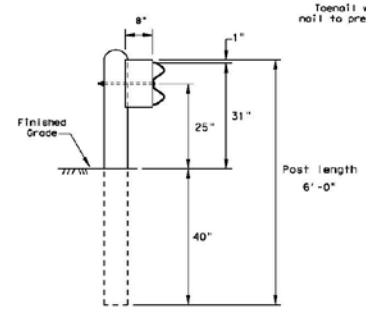
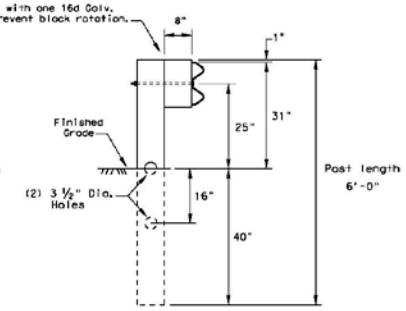
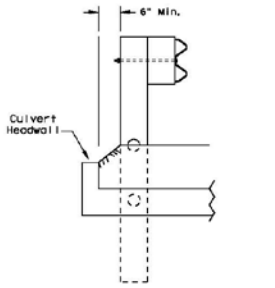


Standard Line Post Installation



Rectangular CRT Post (6"x 8" x 6' Long)

(6) CRT required.
See Elevation Detail for locations.

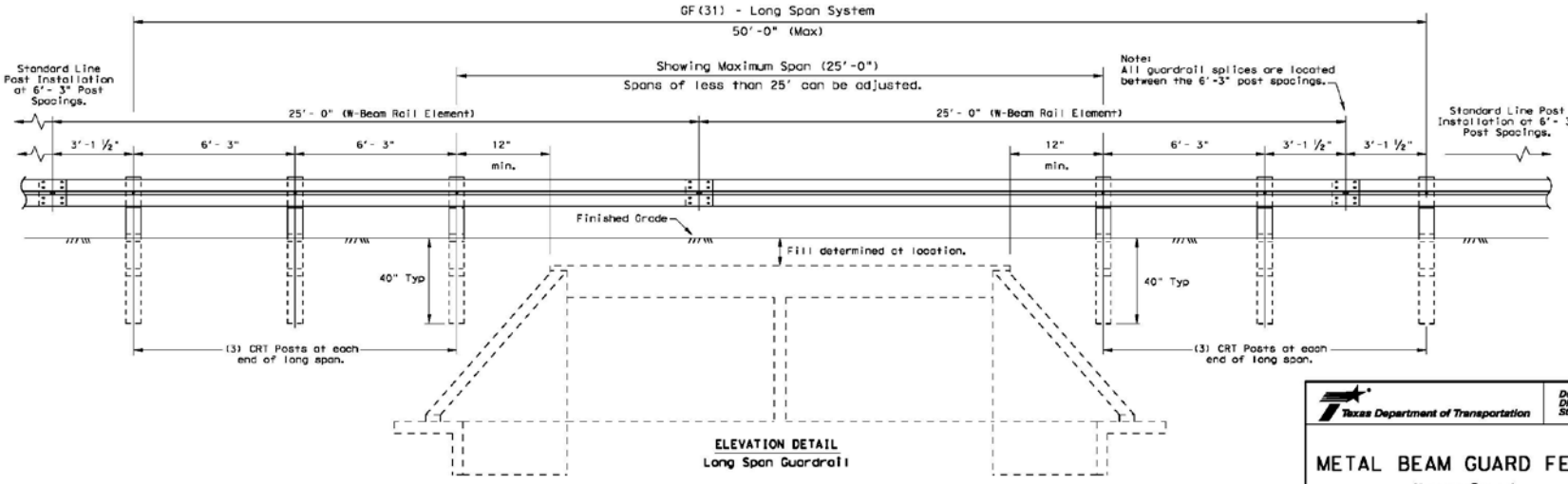


Lateral Offset Between the Guardrail and the Culvert Headwall

GENERAL NOTES

1. The type of line post (round wood post, rectangular wood post, or steel post) will be as shown in the plans. The exact position of the transitions shall be as 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 all 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. Rail post holes are offset 3'- 1 ½" from standard guardrail to accommodate the midspan splicing.
4. Button head post bolts (ASTM A307) shall be of sufficient length to extend through the full thickness of the nut (ASTM A563) and no more than ¼" beyond it. Button head splice bolts (ASTM A307) are ⅝" x 1 ¼" with a ⅜" double recessed nut (ASTM A563). Galvanized fittings (bolts, nuts, and washers) shall be in accordance with Item, "Metal For Structures". Fittings shall be subsidiary to the bid item requiring construction of transition.
5. Where solid rock is encountered or where shown on the plans, the diameter of the holes shall be approximantley 12 inches, the backfilling shall be with a cohesionless material, and embedment depth shall be 1' - 6" or more as directed by the Engineer.
6. Posts shall not be set in concrete, of any depth.
7. Refer to GF(31) Standard Sheet for additional details.

NOTE: Field drilled holes shall be repaired in accordance with Item 445, "Galvanizing". Flame cutting of holes in guardrail shall not be permitted.



ELEVATION DETAIL
Long Span Guardrail

Texas Department of Transportation | Design Division Standard

METAL BEAM GUARD FENCE
(Long Span)

GF(31)LS-14

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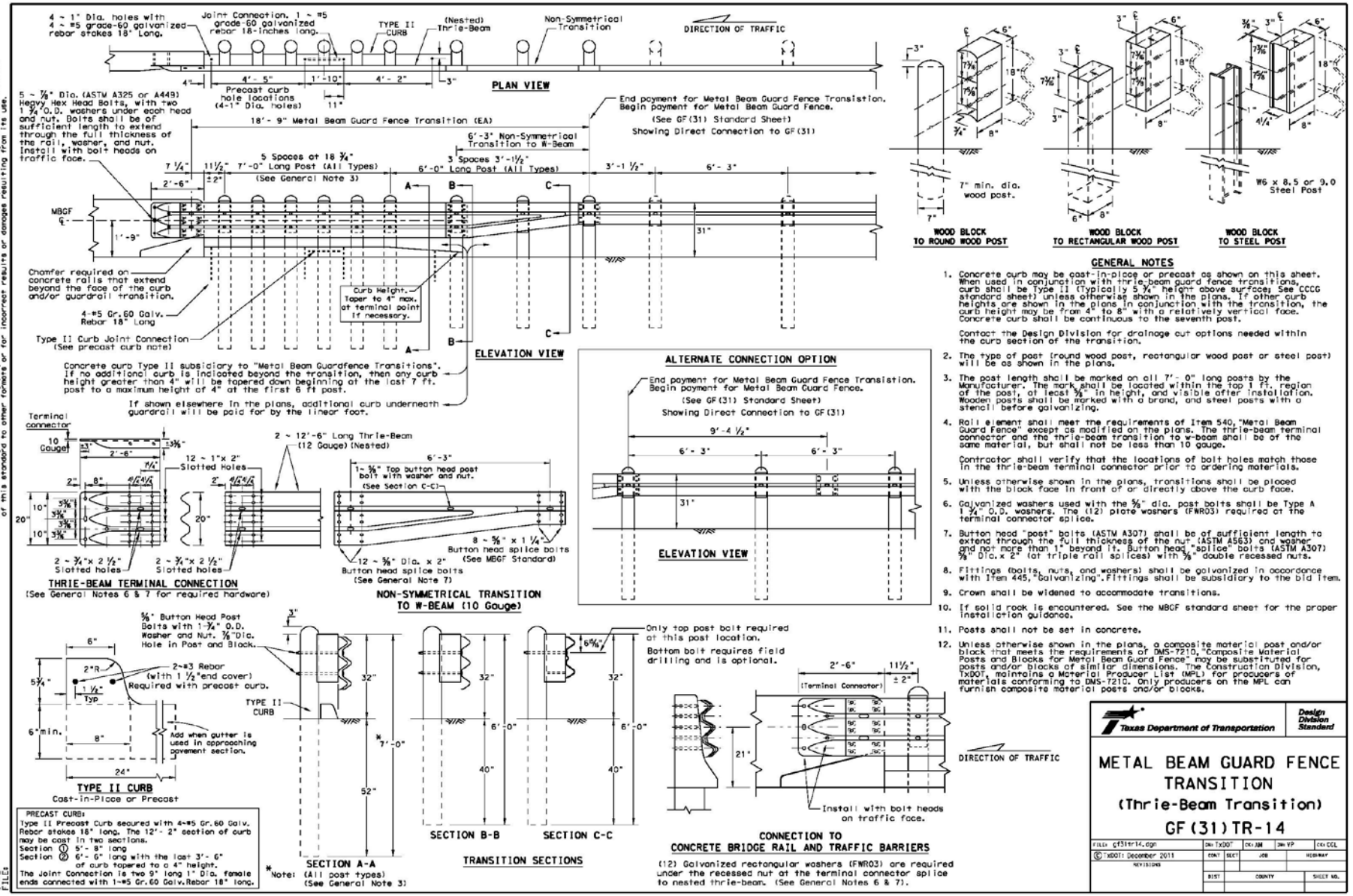

GENERAL NOTES

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 ⅞" 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 ⅜" 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 ⅝" dia. post bolts shall be Type A 1 ¾" 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) ⅝" Dia. x 2" (at triple rail splices) with ⅞" 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.

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.

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Texas Department of Transportation | Design Division Standard

METAL BEAM GUARD FENCE TRANSITION
(Thrie-Beam Transition)
GF(31)TR-14

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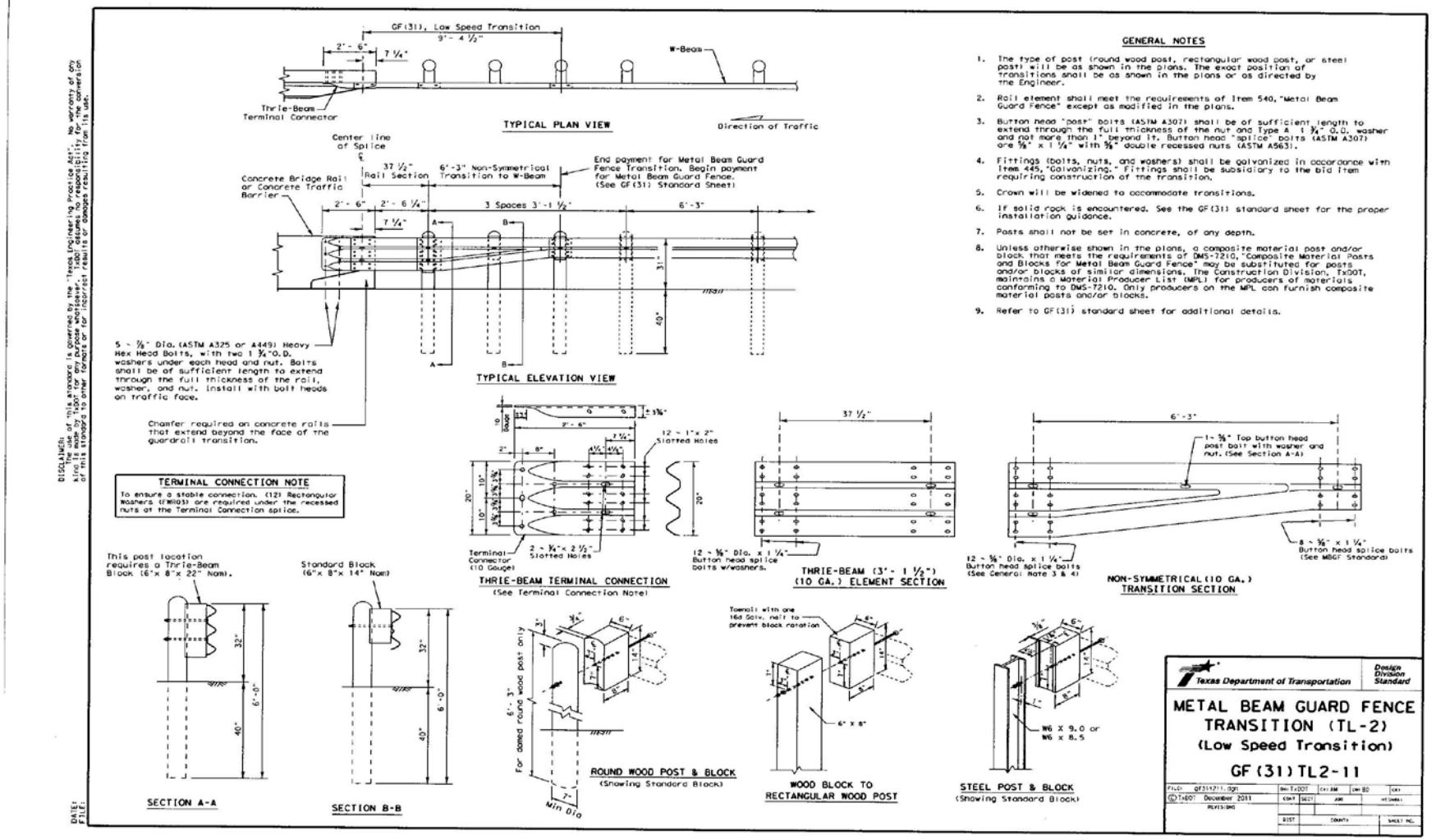
GF(31), Low Speed Transition
9'-4 1/2"
2'-6"
7 1/4"
W-Beam
Thrie-Beam Terminal Connector
TYPICAL PLAN VIEW
Direction of Traffic
Center line of Splice
37 1/2" Rail Section
6'-3" Non-Symmetrical Transition to W-Beam
End payment for Metal Beam Guard Fence Transition. Begin payment for Metal Beam Guard Fence. (See GF(31) Standard Sheet)
Concrete Bridge Rail or Concrete Traffic Barrier
2'-6 1/4"
3 Spaces 3'-1 1/2"
6'-3"
31"
40"
5 - 7/8" Dia. (ASTM A325 or A449) Heavy Hex Head Bolts, with two 1 3/4" O.D. washers under each head and nut. Bolts shall be of sufficient length to extend through the full thickness of the rail, washer, and nut. Install with bolt heads on traffic face.
Chamfer required on concrete rails that extend beyond the face of the guardrail transition.
TYPICAL 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.
2. Rail element shall meet the requirements of Item 540, "Metal Beam Guard Fence" except as modified in 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 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" with 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 GF(31) standard sheet for the proper installation guidance.
7. Posts shall not be set in concrete, of any depth.
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 GF(31) standard sheet for additional details.
TERMINAL CONNECTION NOTE
To ensure a stable connection, (12) Rectangular Washers (FW103) are required under the recessed nuts at the Terminal Connection splice.
12 - 1" x 2" Slotted Holes
2 - 3/4" x 2 1/2" Slotted Holes
Terminal Connector (10 Gauge)
THRIE-BEAM TERMINAL CONNECTION
(See Terminal Connection Note)
37 1/2"
12 - 5/8" Dia. x 1 1/4" Button head splice bolts w/washers.
THRIE-BEAM (3'-1 1/2") (10 GA.) ELEMENT SECTION
6'-3"
1 - 5/8" Top button head post bolt with washer and nut. (See Section A-A)
12 - 5/8" Dia. x 1 1/4" Button head splice bolts (See General Note 3 & 4)
8 - 5/8" x 1 1/4" Button head splice bolts (See MBGF Standards)
NON-SYMMETRICAL (10 GA.) TRANSITION SECTION
This post location requires a Thrie-Beam Block (6"x 8"x 22" Nom).
Standard Block (6"x 8"x 14" Nom)
32"
6'-0"
40"
SECTION A-A
SECTION B-B
6'-3" For dowel round wood post only
7" Min Dia
ROUND WOOD POST & BLOCK
(Showing Standard Block)
Toenail with one 16d Galv. nail to prevent block rotation
6" x 8"
WOOD BLOCK TO RECTANGULAR WOOD POST
W6 X 9.0 or W6 x 8.5
STEEL POST & BLOCK
(Showing Standard Block)
Texas Department of Transportation
Design Division Standard
METAL BEAM GUARD FENCE TRANSITION (TL-2)
(Low Speed Transition)
GF(31)TL2-11
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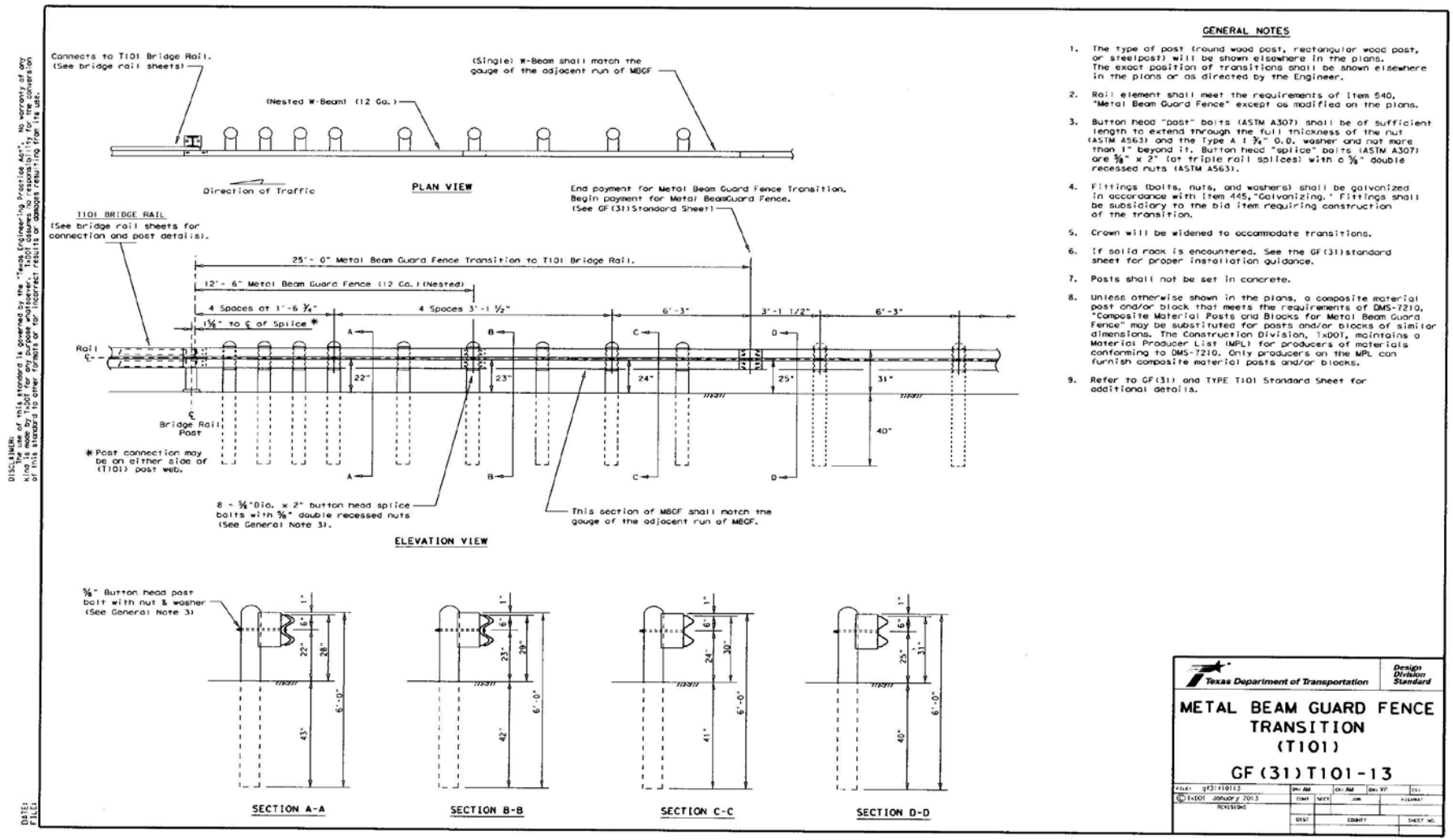

GENERAL NOTES

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 GF(31)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.
9. Refer to GF(31) and TYPE T101 Standard Sheet for additional details.

Texas Department of Transportation — Design Division Standard

METAL BEAM GUARD FENCE TRANSITION (T101)

GF(31)T101-13

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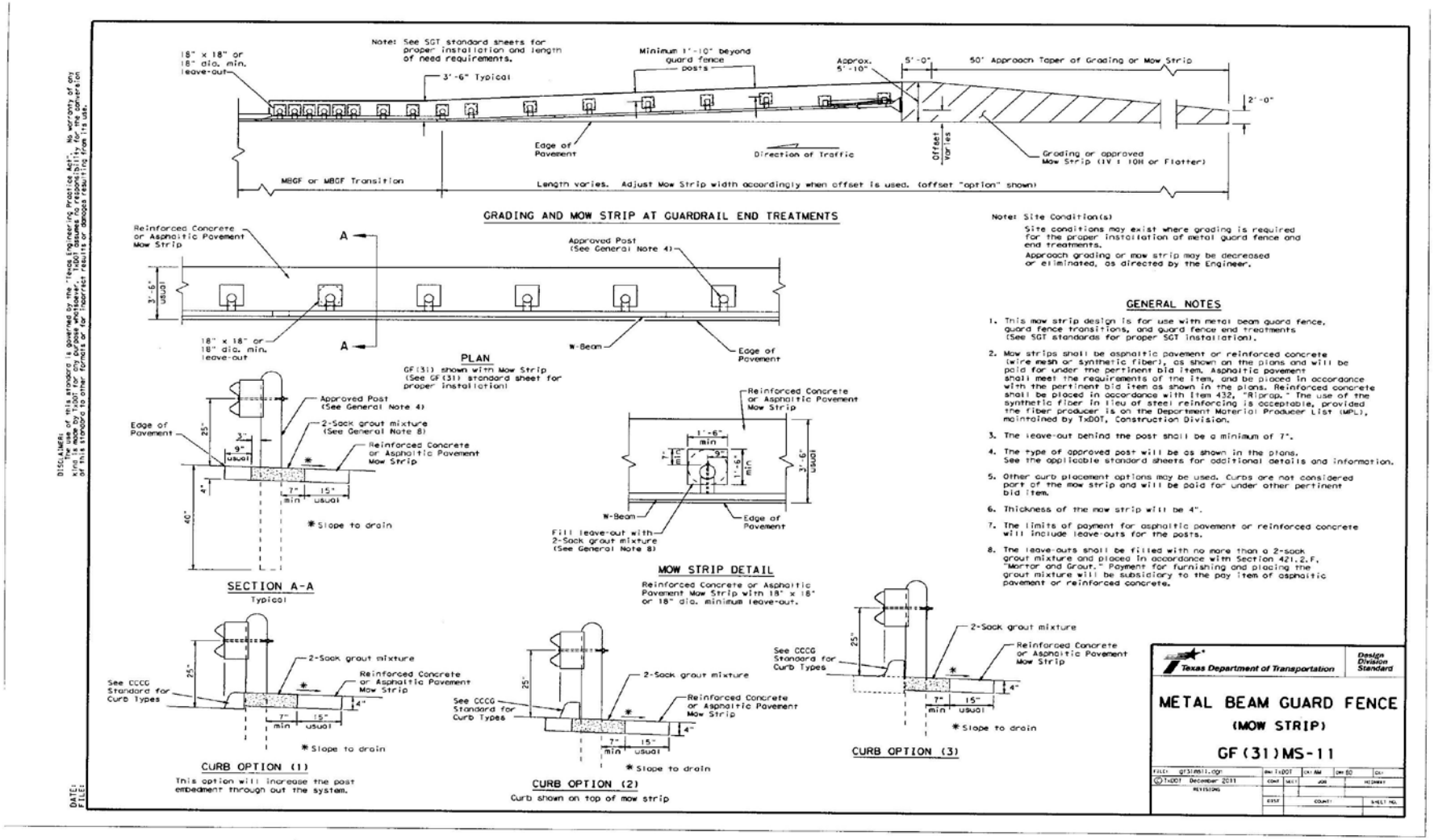
18" x 18" or 18" dia. min. leave-out
Note: See SGT standard sheets for proper installation and length of need requirements.
3'-6" Typical
Minimum 1'-10" beyond guard fence posts
Approx. 5'-10"
5'-0"
50' Approach Taper of Grading or Mow Strip
2'-0"
Edge of Pavement
Direction of Traffic
Offset Varies
Grading or approved Mow Strip (1V : 10H or Flatter)
MBGF or MBGF Transition
Length varies. Adjust Mow Strip width accordingly when offset is used. (offset "option" shown)
GRADING AND MOW STRIP AT GUARDRAIL END TREATMENTS
Reinforced Concrete or Asphaltic Pavement Mow Strip
Approved Post (See General Note 4)
3'-6" usual
W-Beam
PLAN
GF(31) shown with Mow Strip (See GF(31) standard sheet for proper installation)
Approved Post (See General Note 4)
2-Sack grout mixture (See General Note 8)
Reinforced Concrete or Asphaltic Pavement Mow Strip
Slope to drain
SECTION A-A
Typical
Fill leave-out with 2-Sack grout mixture (See General Note 8)
MOW STRIP DETAIL
Reinforced Concrete or Asphaltic Pavement Mow Strip with 18" x 18" or 18" dia. minimum leave-out.
See CCCG Standard for Curb Types
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 and placed in accordance with Section 421.2.F, "Mortar and Grout." Payment for furnishing and placing the grout mixture will be subsidiary to the pay item of asphaltic pavement or reinforced concrete.
Texas Department of Transportation
Design Division Standard
METAL BEAM GUARD FENCE
(MOW STRIP)
GF(31)MS-11
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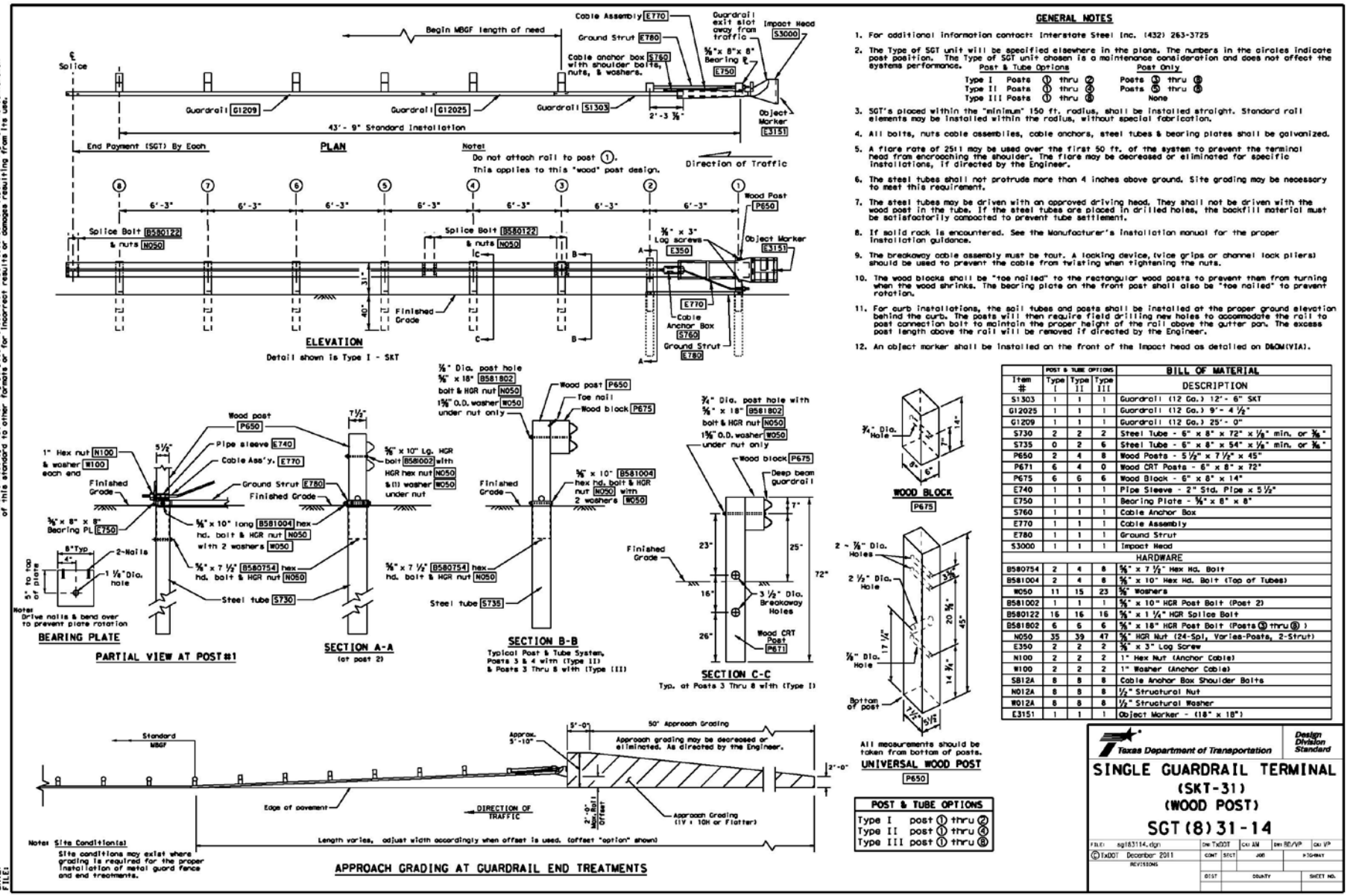

GENERAL NOTES

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 1/2"
G1209	1	1	1	Guardrail (12 Ga.) 25'- 0"
S730	2	2	2	Steel Tube - 6" x 8" x 72" x 1/8" min. or 3/16"
S735	0	2	6	Steel Tube - 6" x 8" x 54" x 1/8" min. or 3/16"
P650	2	4	8	Wood Posts - 5 1/2" x 7 1/2" 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 1/2"
E750	1	1	1	Bearing Plate - 3/8" 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	3/4" x 7 1/2" Hex Hd. Bolt
B581004	2	4	8	3/4" x 10" Hex Hd. Bolt (Top of Tubes)
W050	11	15	23	3/4" Washers
B581002	1	1	1	5/8" x 10" HGR Post Bolt (Post 2)
B580122	16	16	16	3/8" x 1 1/4" HGR Splice Bolt
B581802	6	6	6	5/8" x 18" HGR Post Bolt (Posts ③ thru ⑧)
N050	35	39	47	3/4" HGR Nut (24-Spl, Varies-Posts, 2-Strut)
E350	2	2	2	3/8" 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	1/2" Structural Nut
W012A	8	8	8	1/2" 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

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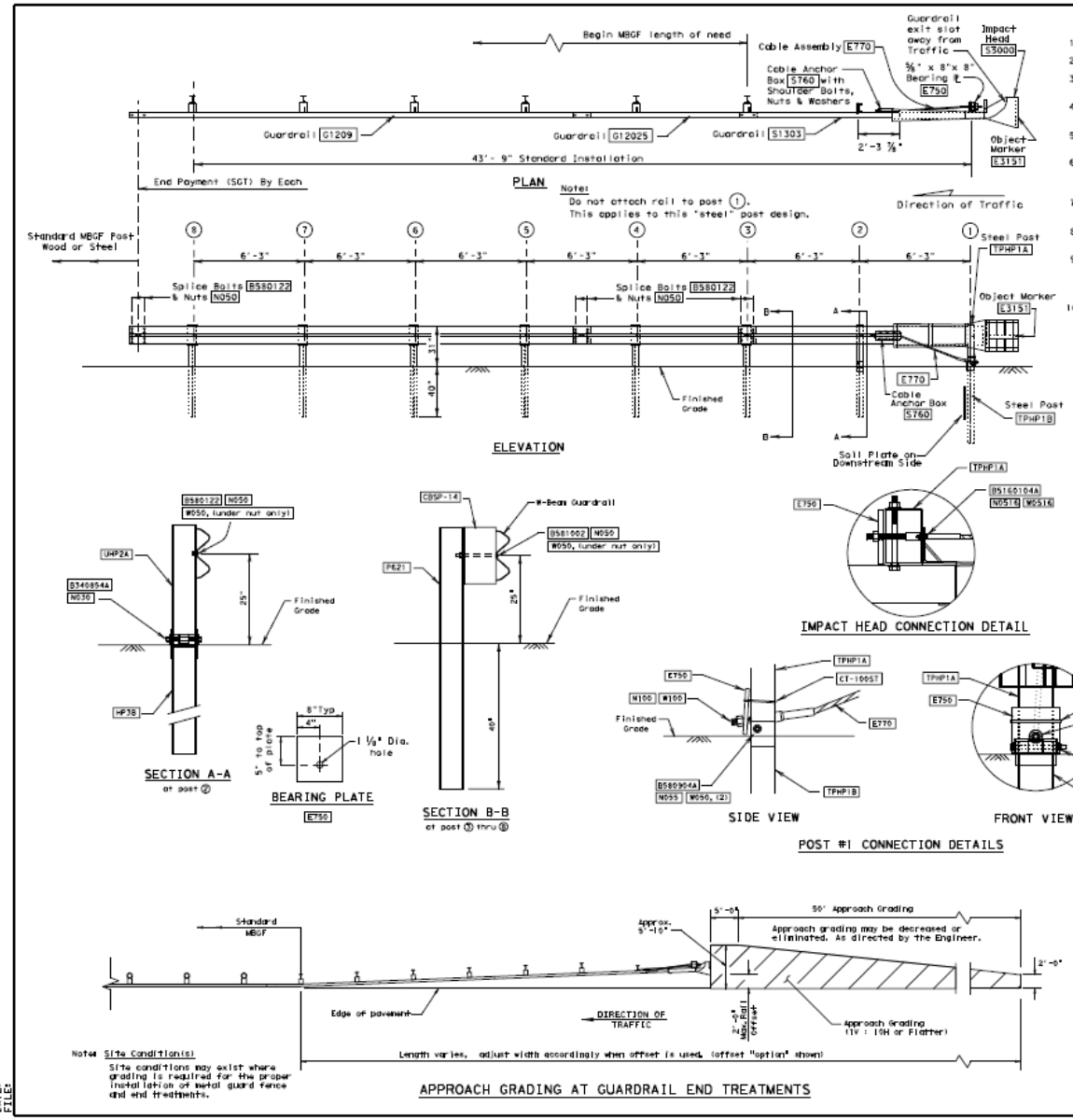

GENERAL NOTES

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&M(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
HP38	1	SECOND POST ASSEMBLY BOTTOM, 3'- 5⅛"
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
N051G	2	⅝" HEX NUT
W051G	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")

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)31-14

FILE: sgt8s314.dgn	DW: TxDOT	CK: AM	DW: BD/VP	CK: VP
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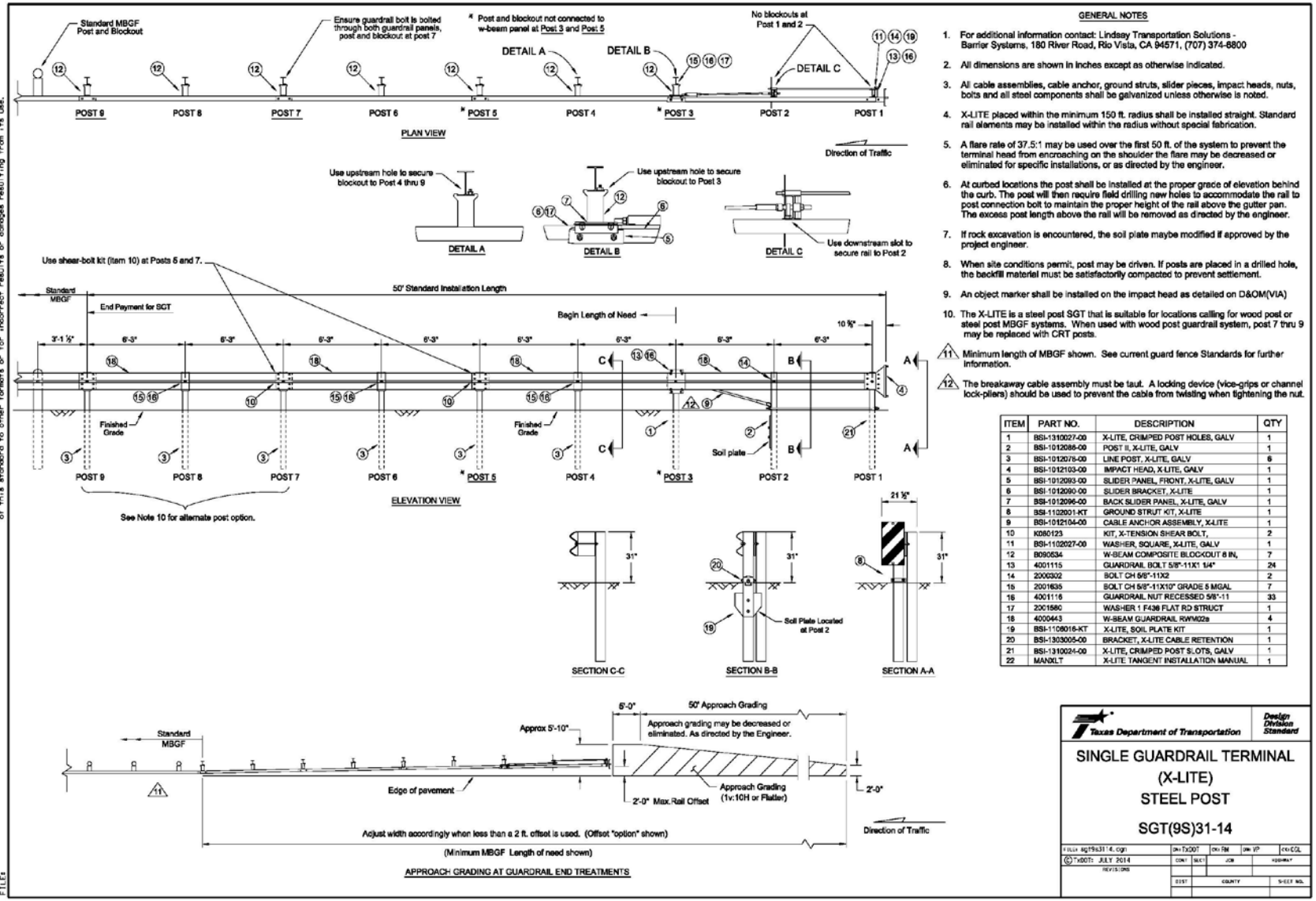
	DIST	COUNTY		SHEET NO.



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	B080534	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-1108016-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)31-14

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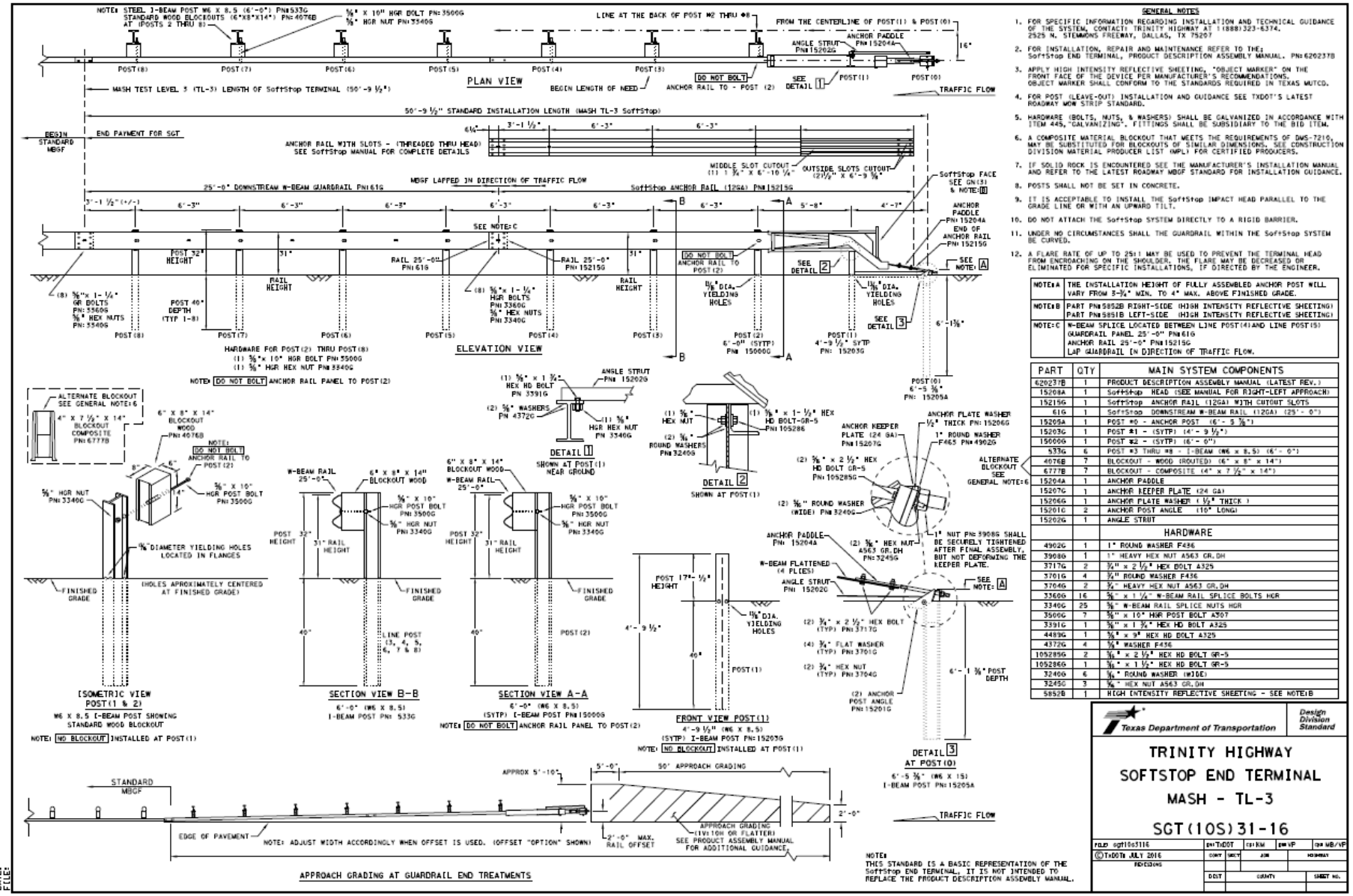

GENERAL NOTES

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

NOTE:A	THE INSTALLATION HEIGHT OF FULLY ASSEMBLED ANCHOR POST WILL VARY FROM 31-1/2" MIN. TO 4" MAX. ABOVE FINISHED GRADE.
NOTE:B	PART PN:5852B RIGHT-SIDE (HIGH INTENSITY REFLECTIVE SHEETING) PART PN:5851B LEFT-SIDE (HIGH INTENSITY REFLECTIVE SHEETING)
NOTE:C	W-BEAM SPLICE LOCATED BETWEEN LINE POST(4) AND LINE POST(5) GUARDRAIL PANEL 25'-0" PN:61G ANCHOR RAIL 25'-0" PN:15215G LAP GUARDRAIL IN DIRECTION OF TRAFFIC FLOW.

PART	QTY	MAIN SYSTEM COMPONENTS
620237B	1	PRODUCT DESCRIPTION ASSEMBLY MANUAL (LATEST REV.)
15208A	1	SoftStop HEAD (SEE MANUAL FOR RIGHT-LEFT APPROACH)
15215G	1	SoftStop ANCHOR RAIL (12GA) WITH CUTOUT SLOTS
61G	1	SoftStop DOWNSTREAM W-BEAM RAIL (12GA) (25'-0")
15205A	1	POST #0 - ANCHOR POST (6'-5 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
105289G	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:WB/VP
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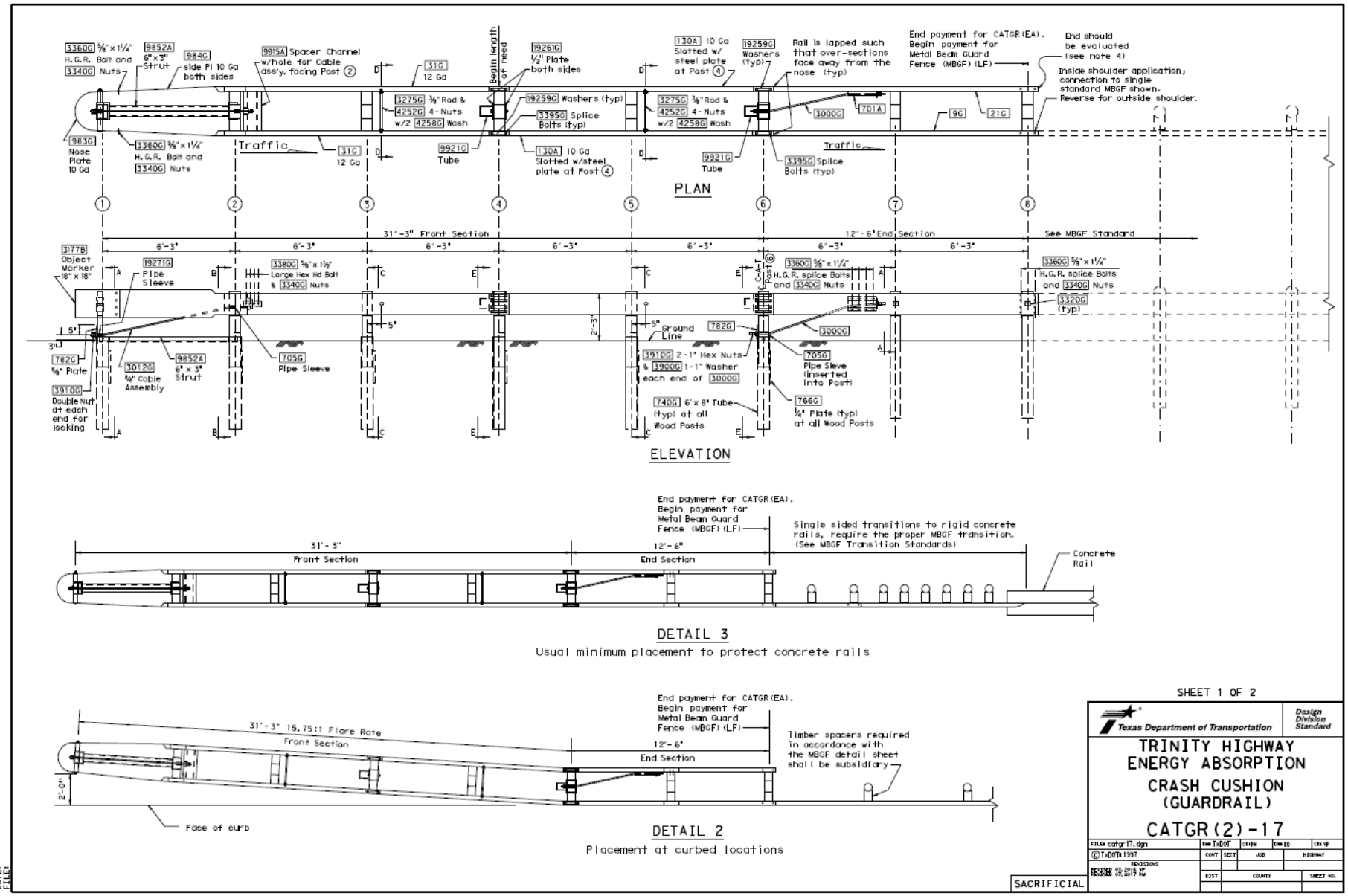

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SHEET 1 OF 2

Texas Department of Transportation — Design Division Standard

TRINITY HIGHWAY ENERGY ABSORPTION CRASH CUSHION (GUARDRAIL)

CATGR(2)-17

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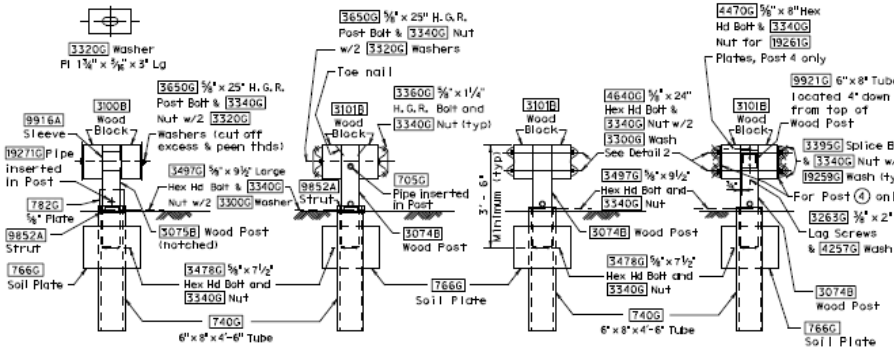
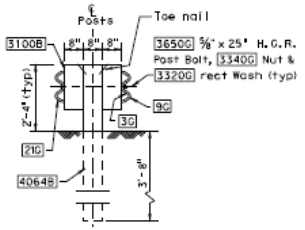
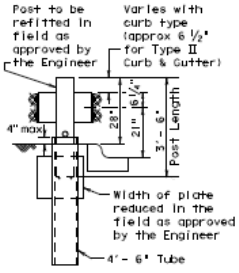


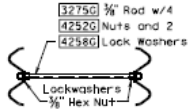
Note:
There are no Rail to Post attachments for Posts (3), (5), & (6)



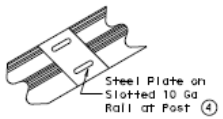
POSTS (7) & (8)



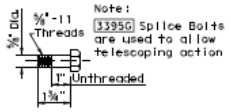
TYPICAL CURB PLACEMENT
(See CATGR(1) Detail 2)



SECTION D-D



DETAIL 1



3395G SPLICE BOLT

CATGR GUARDRAIL TERMINAL
(POSTS 1-6) BILL OF MATERIALS

Mfr Code #	QTY	DESCRIPTION
983G	1	Nose Plate x 10 GA
984G	2	Side Plate x 10 GA
31G	2	"W" Beam 12 GA x 13'-6 ½"
130A	2	"W" Beam 10 GA x 13'-6 ½"
9852A	1	Channel Strut x 6'-6"
740G	6	Steel Foundation Tube
766G	6	Soil Plate 18" x 24"
3075B	1	Wood Post 5½" x 7½" (Notched) (Post 1)
3074B	5	Wood Post 5½" x 7½" (Post 2 - 6)
3100B	2	Wood Block 5½" x 7½" (Post 1)
3101B	10	Wood Block 5½" x 7½" (Post 2 - 6)
9916A	1	Sleeve (Post 1)
9915A	1	Spacer Channel (Post 2)
9921G	2	Steel Tube (Post 4 & 6)
19271G	1	Pipe Sleeve (Post 1)
705G	1	Pipe Sleeve (Post 2)
19261G	2	Post Plate (Post 4)
782G	1	Bearing Plate (Post 1)
3012G	1	Cable Assembly (From Post 1 to 2)
3275G	2	⅜" Restraint Rod (Post 3 & 5)
19259G	32	Plate Washer (Post 4 & 6)

HARDWARE		
3263G	4	⅜" x 2" Lg Lag Screw
4252G	8	⅜" Hex Nut
4258G	4	⅜" Lock Washer
4257G	4	⅜" Flat Washer
3320G	4	Rectangular Washer
3395G	32	⅝" x 1 ¾" H.H. Splice Bolt
3650G	2	⅝" x 25" Lg H.G.R. Bolt
4640G	8	⅝" x 24" Lg H.H. Bolt
3478G	13	⅝" x 7½" Lg H.H. Bolt
3380G	8	⅝" x 1 ½" Lg H.H. Bolt
3360G	16	⅝" x 1 ¼" Lg H.G.R. Bolt
3340G	85	⅝" H.G.R. Nut
3300G	8	⅝" Flat Washer
3497G	6	⅝" x 9½" Lg H.H. Bolt
3910G	4	1" Hex Nut
3900G	2	1" Flat Washer

DELINEATOR		
3177B	1	Object Marker (18" x 18") (Cut to fit)

CATGR GUARDRAIL TERMINAL
(POSTS 7-8) BILL OF MATERIALS

Mfr Code #	QTY	DESCRIPTION
4064B	2	Wood Post 5 ½" x 7 ½" x 6'
3101B	4	Wood Block 5 ½" x 7 ½"
21G	1	"W" Beam Guard Rail (12 Ga)
9G	1	"W" Beam Guard Rail (12 Ga)
701A	1	Bracket
782G	1	Bearing Plate (Post 6)
705G	1	Pipe Sleve (Post 6)
3000G	1	Cable Assembly (from Post 6 to Rail)
3320G	2	Rectangular Washer

HARDWARE		
3360G	24	⅝" x 1¼" H.G.R. Splice Bolt
3400G	4	⅝" x 25" H.G.R. Post Bolt
3380G	8	⅝" x 1½" Hex Hd Bolt
3340G	28	⅝" H.G.R. Nut
3300G	8	⅝" Washer
3910G	4	1" Hex Nut
3900G	2	1" Washer

GENERAL NOTES

1. For specific information regarding installation and technical guidance of the system, contact: Trinity Highway at 1(888)323-6374. 70 W. Madison St. Suite 2350. Chicago, IL 60602
2. Crown will be widened to accommodate the CAT system. The crown should extend at least 3 feet beyond the inside face of rail. The ground line at posts should be an extension of the roadway surface crown.
3. All bolts, nuts, washers, cable assemblies, cable anchors, post tubes, backup plates, and soil plates shall be galvanized.
4. The exposed end segment of an "End Section" should be evaluated as a potential obstacle in the determination of the need of MBGF for the opposing direction of traffic.
5. If a "single sided" transition is required, (as shown in Detail 3) the proper MBGF transition standards are required.
6. For placement at curb sections, the height from gutter pan to post bolt will be 21", and the front section shall be flared (See Detail 2).
7. The wood blockouts shall be "toe nailed" to the rectangular wood posts to prevent them from turning when the wood shrinks.
8. Either 6" x 8" or 5 ½" x 7 ½" wood blocks may be used at posts 1 through 8 as supplied by the manufacturer.
9. An object marker shall be installed on the front of the terminal as detailed on the D&OM(VIA).

SHEET 2 OF 2

Texas Department of Transportation — Design Division Standard

TRINITY HIGHWAY ENERGY ABSORPTION CRASH CUSHION (GUARDRAIL)

CATGR(2)-17

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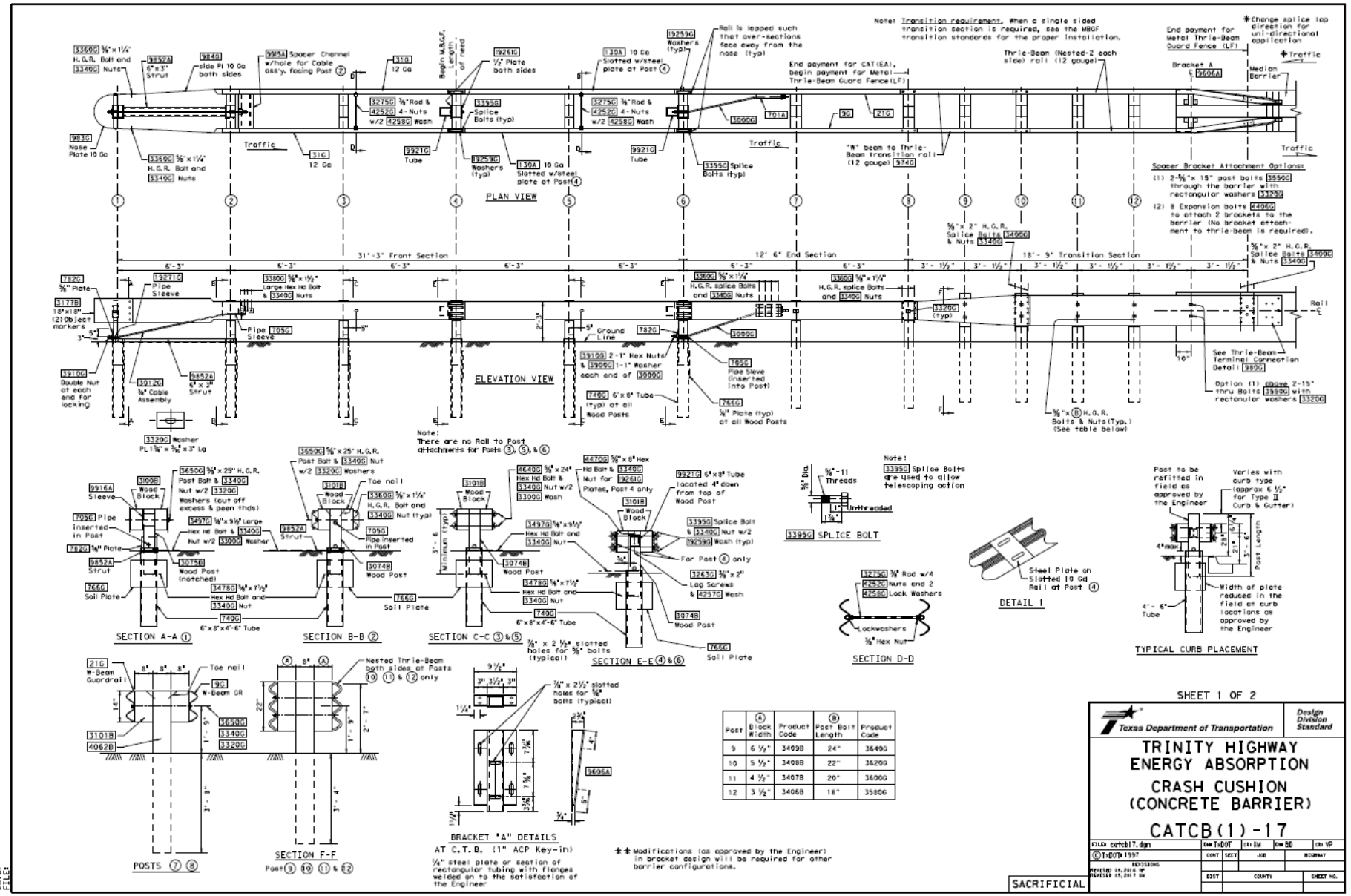

Post	Ⓐ Block Width	Product Code	Ⓑ Post Bolt Length	Product Code
9	6 ½"	3409B	24"	3640G
10	5 ½"	3408B	22"	3620G
11	4 ½"	3407B	20"	3600G
12	3 ½"	3406B	18"	3580G

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CATCB FRONT SECTION (POSTS 1 THRU 6)

BILL OF MATERIAL

Mfr Code #	QTY	DESCRIPTION
983G	1	Nose Plate (10 Ga)
984G	2	Side Plate (10 Ga)
31G	2	"W" Beam 12 Ga x 13'-6 1/2"
130A	2	"W" Beam 10 Ga x 13'-6 1/2"
9852A	1	Channel Strut x 6'-6"
740G	6	Steel Foundation Tube
766G	6	Soil Plate 18"x 24"
3075B	1	Wood Post 5 1/2"x 7 1/2" (Notched) (Post 1)
3074B	5	Wood Post 5 1/2"x 7 1/2"(Post 2-6)
3100B	2	Wood Block 5 1/2"x 7 1/2"(Post 1)
3101B	10	Wood Block 5 1/2"x 7 1/2"(Post 2-6)
9916A	1	Sleeve (Post 1)
9915A	1	Spacer Channel (Post 2)
9921G	2	Steel Tube (Posts 4 & 6)
19271G	1	Pipe Sleeve (Post 1)
705G	1	Pipe Sleeve (Post 2)
19261G	2	Post Plate (Post 4)
782G	1	Bearing Plate (Post 1)
3012G	1	Cable Assembly(Posts 1 to 2)
3275G	2	3/4" Restraint Rod(Post 3 & 5)
19259G	32	Plate Washer (Posts 4 & 6)

HARDWARE

3263G	4	3/4" x 2" Lg Lag Screw
4252G	8	3/4" Hex Nut
4258G	4	3/4" Lock Washer
4257G	4	3/4" Flat Washer
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3650G	2	5/8" x 25" Lg H.G.R. Bolt
4640G	8	5/8" x 24" Lg H.H. Bolt
3478G	13	5/8" x 7 1/2" Lg H.H. Bolt
3380G	8	5/8" x 1 1/2" Lg H.H. Bolt
3360G	16	5/8" x 1 1/4" Lg H.G.R. Bolt
3340G	85	5/8" H.G.R. Nut
3300G	8	5/8" Flat Washer
3497G	6	5/8" x 9 1/2" Lg H.H. Bolt
3910G	4	1" Hex Nut
3900G	2	1" Flat Washer

CATCB GUARDRAIL TERMINAL END SECTION (POSTS 7 & 8)

BILL OF MATERIAL

Mfr Code #	QTY	DESCRIPTION
4064B	2	Wood Post 5 1/2" x 7 1/2" x 6'
3101B	4	Wood Block 5 1/2" x 7 1/2"
21G	1	"W" Beam Guard Rail (12 Ga)
9G	1	"W" Beam Guard Rail (12 Ga)
701A	1	Bracket
782G	1	Bearing Plate
705G	1	Pipe Sleve
3000G	1	Cable Assembly
3320G	2	Rectangular Washer

HARDWARE

3360G	24	5/8" x 1 1/4" H.G.R. Splice Bolt
3400G	4	5/8" x 25" H.G.R. Post Bolt
3380G	8	5/8" x 1 1/2" Hex Hd Bolt
3340G	28	5/8" H.G.R. Nut
3300G	8	5/8" Washer
3910G	4	1" Hex Nut
3900G	2	1" Washer

CATCB TRANSITION SECTION (POST 9 THRU END SHOE)

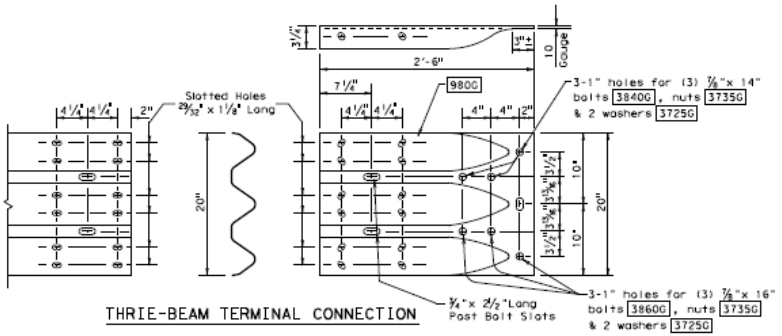
BILL OF MATERIAL

Mfr Code #	QTY	DESCRIPTION
211G	4	Thrie beam 12'-6"(12 Ga)
974G	2	Trans panel 6'-3"(12 Ga)
980G	2	Special Thrie beam end shoe
3078B	3	Wood Post 6"x 8"x 6', (Posts11&12)
3320G	20	Rectangular Washer
3340G	62	5/8" H.G.R. Nut
3400G	52	5/8" x 2" Splice Bolt
3406B	2	22 1/2" Block 6"x 3 1/2" (Post 12)
3407B	2	22 1/2" Block 6"x 4 1/2" (Post 11)
3408B	2	22 1/2" Block 6"x 5 1/2" (Post 10)
3409B	2	22 1/2" Block 6"x 6 1/2" (Post 9)
3412B	1	Wood Post 6"x 8"x 6', (Posts 9)
3560G	2	5/8" x 16" Bolt
* 4406G	8	5/8" x 3 3/4" Expansion Bolts w/Nuts
* 3580G	2	5/8" x 18"Post Bolt (Post 12)
3600G	2	5/8" x 20"Post Bolt (Post 11)
3620G	2	5/8" x 22"Post Bolt (Post 10)
3640G	2	5/8" x 24"Post Bolt (Post 9)
3725G	12	7/8" Washer (End Shoe Bolts)
3735G	6	7/8" Hex Nuts (End Shoe Bolts)
3840G	3	7/8" x 14" Hex Bolt (End Shoe)
3860G	3	7/8" x 16" Hex Bolt (End Shoe)
9606A	2	Spacer Bracket
		Delineation
3177B	2	Object Marker 18"x 18" (Cut to fit)
		Optional Hardware for Single Slope Barrier-42"
3640G	2	5/8" x 24" Bolt
4896G	6	7/8" x 24" Hex Bolt (End Shoe)

* Expansion or through bolts may be used with optional bracket installation.

GENERAL NOTES

1. For specific information regarding installation and technical guidance of the system, contact: Trinity Highway at 1(888)323-6374. 70 W. Madison St. Suite 2350. Chicago, IL 60602
2. Crown will be widened to accommodate the CAT system. The crown should extend at least 3 feet beyond the inside face of rail. The ground line at posts should be an extension of the roadway surface crown.
3. All bolts, nuts, washers, cable assemblies, cable anchors, post tubes, backup plates, and soil plates shall be galvanized.
4. The exposed end segment of an "End Section" should be evaluated as a potential obstacle in the determination of the need of MBGF for the opposing direction of traffic.
5. For placement at curb sections, the height from gutter pan to post bolt will be 21", and the front section shall be flared (See Detail 2).
6. The wood blockouts shall be "toe nailed" to the rectangular wood posts to prevent them from turning when the wood shrinks.
7. Either 6"- 8" or 5 1/2"x 7 1/2" wood blocks may be used at posts 1 thru 8 as supplied by the manufacturer.
8. If a "single sided" transition section is required for the attachment to a rigid concrete rail, see the MBGF transition standards for the proper installation.
9. Object markers shall be installed on the front of the terminal as detailed on the D&OM(VIA).



THRIE-BEAM TERMINAL CONNECTION

SACRIFICIAL

SHEET 2 OF 2

Texas Department of Transportation — Design Division Standard

TRINITY HIGHWAY ENERGY ABSORPTION CRASH CUSHION (CONCRETE BARRIER)

CATCB(1)-17

FILE: catcb17.dgn	DN: TxDOT	CK: KM	DW: BD	CK: VP
©TxDOT: 1997	CONT	SECT	JOB	HIGHWAY
REVISIONS: REVISED 05.2016 VP; REVISED 05.2017 KM	DIST	COUNTY		SHEET NO.

DATE:
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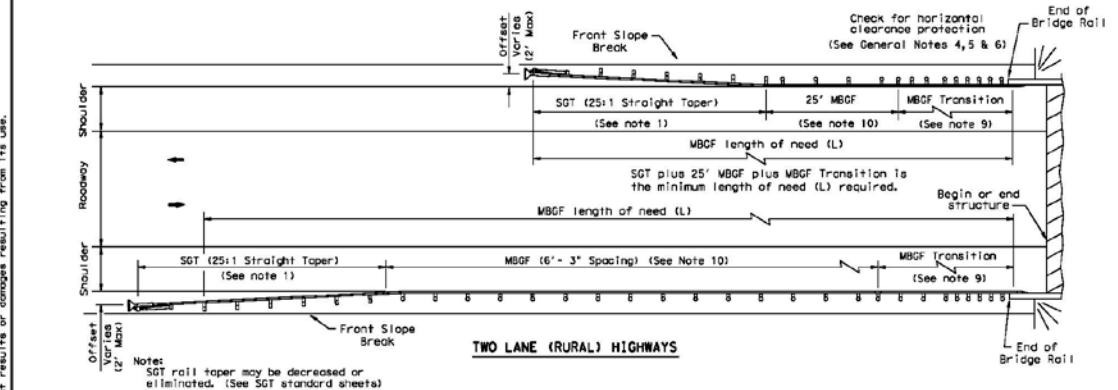
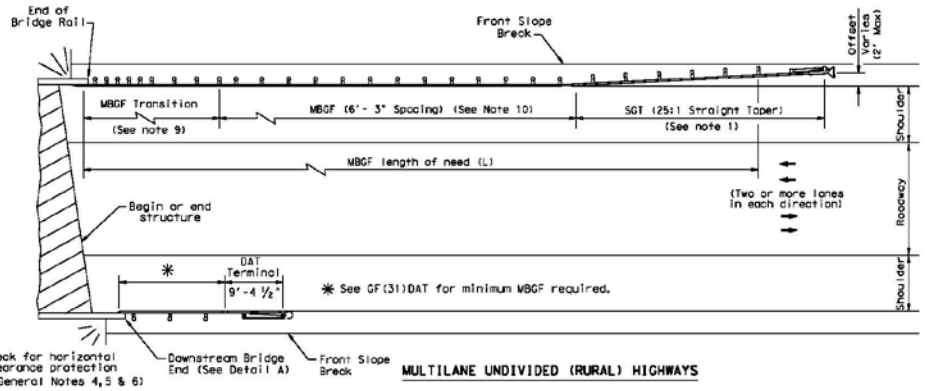
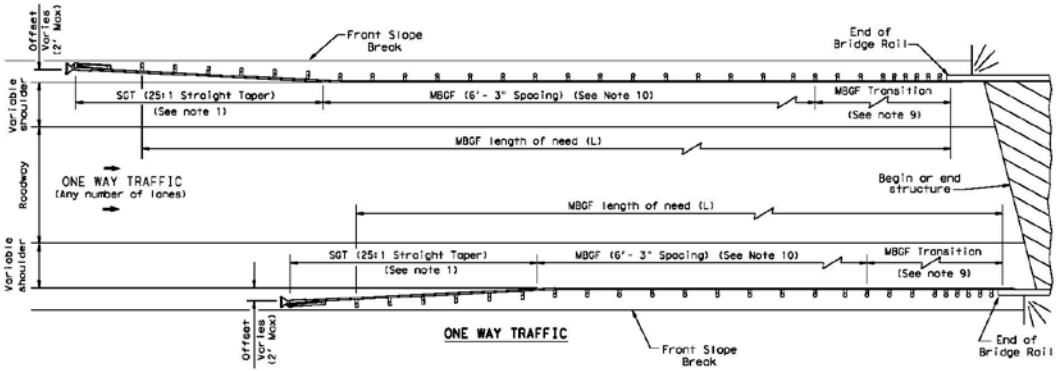


TWO LANE (RURAL) HIGHWAYS

Note:
SGT rail taper may be decreased or eliminated. (See SGT standard sheets)



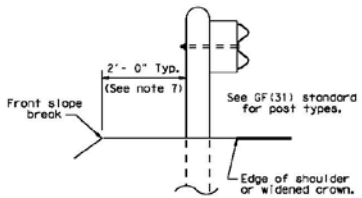
MULTILANE UNDIVIDED (RURAL) HIGHWAYS



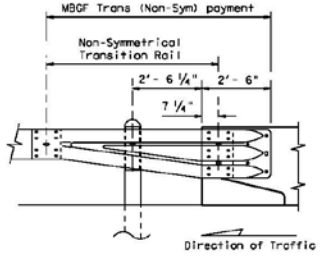
ONE WAY TRAFFIC

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)

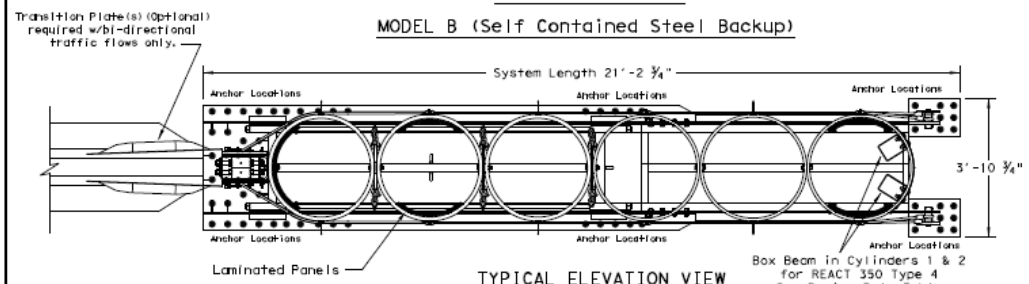
BED-14

FILE: bed14.dgn	DN: TxDOT	CK: AM	DW: BD/VP	CK: CGL
©TxDOT: December 2011	CONT	SECT	JOB	HIGHWAY
REVISIONS				
	DIST	COUNTY		SHEET NO.

DATE:
FILE:

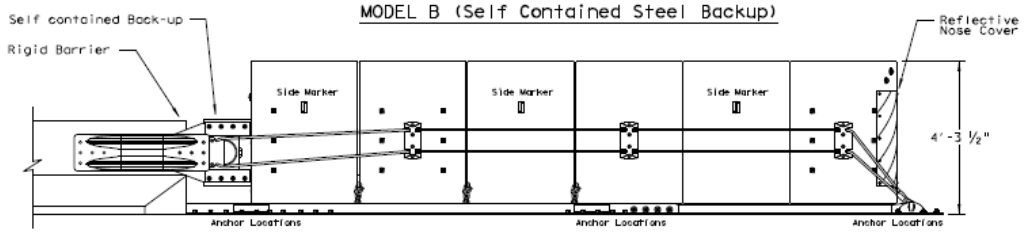
TYPICAL PLAN VIEW

MODEL B (Self Contained Steel Backup)



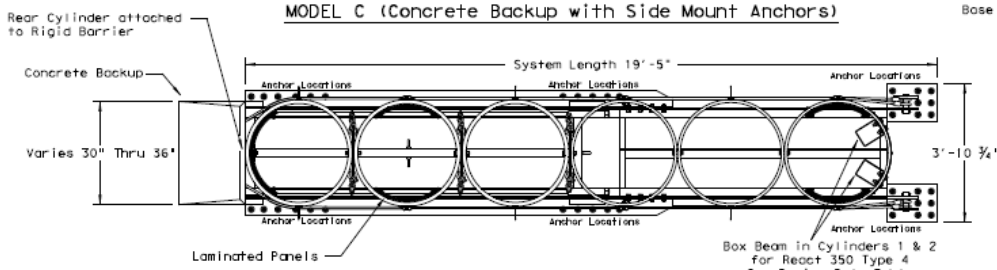
TYPICAL ELEVATION VIEW

MODEL B (Self Contained Steel Backup)



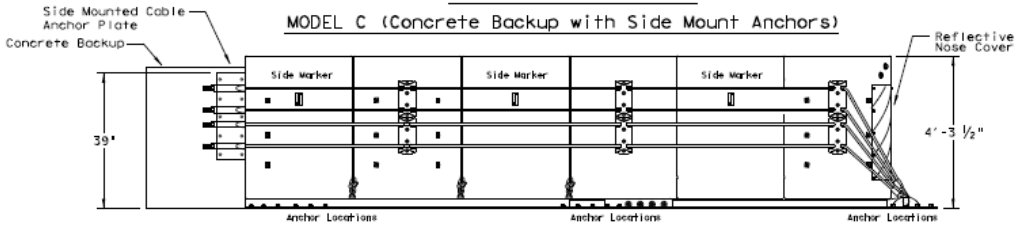
TYPICAL PLAN VIEW

MODEL C (Concrete Backup with Side Mount Anchors)



TYPICAL ELEVATION VIEW

MODEL C (Concrete Backup with Side Mount Anchors)



GENERAL NOTES

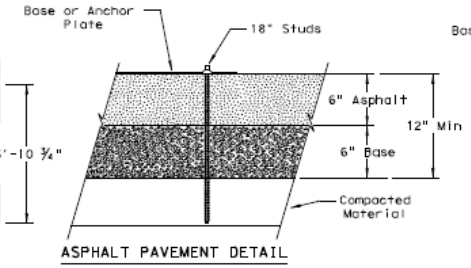
1. For specific information regarding installation and technical guidance of the system, contact: Trinity Highway - Energy Absorption at 1(888)323-6374. 70 W. Madison St. Suite 2350. Chicago, IL 60602
2. The nose of the REACT 350 shall be clad with a plastic wrap with standard delineation adhered to the wrap and shall have a series of side marker reflectors on both sides of the unit. See site plan views for marker and plastic wrap color orientation.
3. All steel components to be hot dipped galvanized except stakes, drive spikes, threaded bolts in backup unit, and wedge fittings on cables.
4. The installation area should be free from curbs, elevated objects, or depressions. If the REACT system is to span expansion joints contact the manufacturer.
5. The REACT system should be approximately parallel with the barrier or ℄ of merging barriers. The maximum permissible cross-slope is 8%.
6. REACT 350 II has laminated panels in cyliners 1, 5, & 6.

DESIGN DATA TABLE FOR REACT 350 AND REACT 350 II

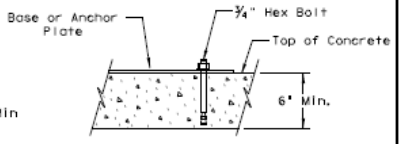
TYPE	REACT 350 4-B	REACT 350 4-C	REACT 350 II 6-B	REACT 350 II 6-C
Test Level	TL-2	TL-2	TL-3	TL-3
OVERALL LENGTH	15'-3"	13'-9"	21'-3"	19'-5"

FOUNDATION AND ANCHORAGE TABLE FOR REACT 350 AND REACT 350 II

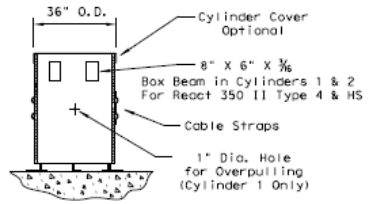
	FOUNDATION TYPE	MINIMUM THICKNESS	ANCHORAGE
A	CONCRETE PAD OR ROADWAY	6"	MP-3 WITH 7" STUDS (5.5" EMBEDMENT)
B	ASPHALT OVER CONCRETE PAVEMENT	6" CONCRETE PAVEMENT	ANCHOR LENGTH REQUIRED IS 7" STUD PLUS ASPHALT THICKNESS
C	ASPHALT OVER BASE	6" ACP + 6" BASE	MP-3 WITH 18" STUDS (16.5" EMBEDMENT)
D	ASPHALT ONLY	8"	MP-3 WITH 18" STUDS (16.5" EMBEDMENT)



ASPHALT PAVEMENT DETAIL



CONCRETE PAVEMENT DETAIL



TYPICAL CYLINDER

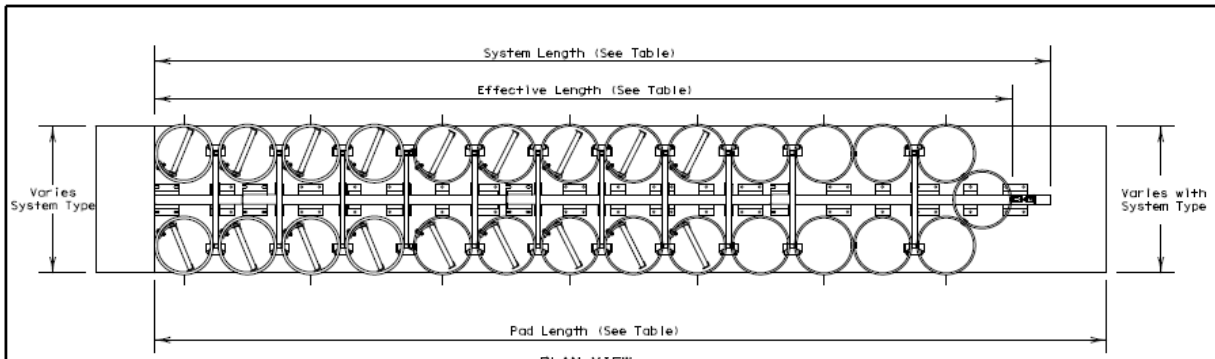
Texas Department of Transportation — Design Division Standard

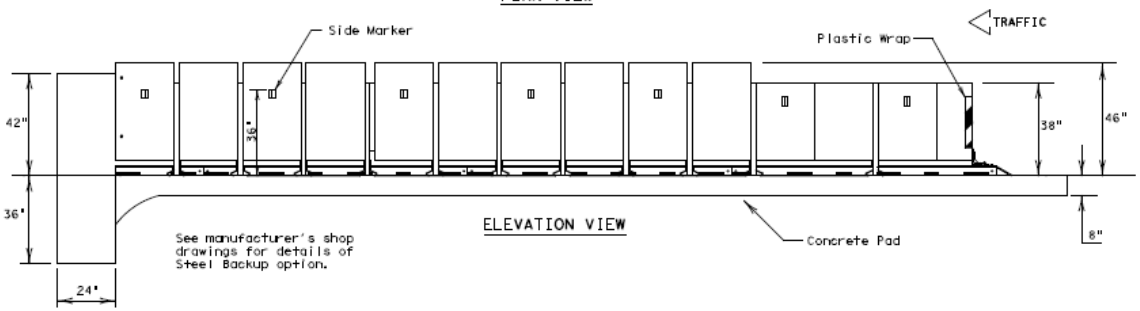
TRINITY HIGHWAY ENERGY ABSORPTION (REACT 350 NARROW) (REACT 350 II NARROW)

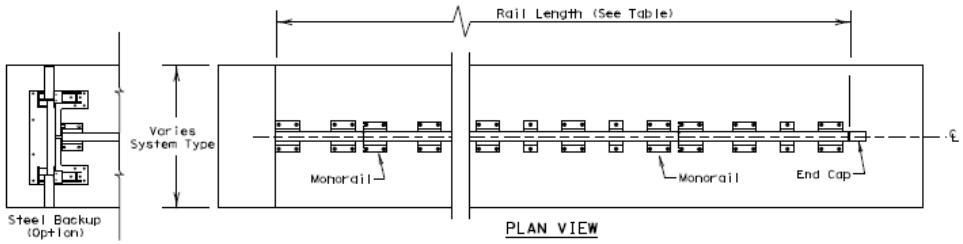
REACT(N)-16

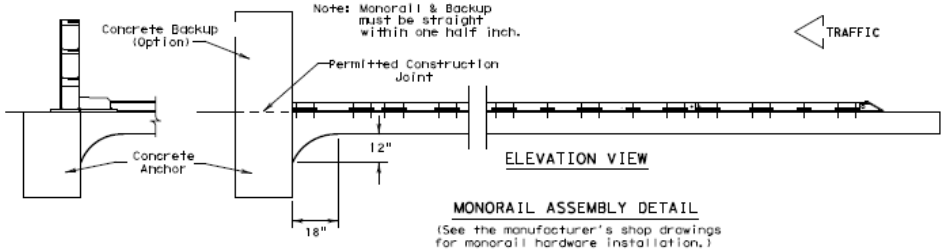
FILE: reactn16.dgn	DW: TxDOT	CK: KW	DW: VP	CK: VP
©TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS				
REVISED 06.2013 (VP)	DIST	COUNTY		SHEET NO.
REVISED 05.2016 (VP)				

LOW MAINTENANCE









MONORAIL ASSEMBLY DETAIL
(See the manufacturer's shop drawings for monorail hardware installation.)

GENERAL NOTES

1. For specific information regarding installation and technical guidance of the system, contact: Trinity Highway - Energy Absorption at 1(888)323-6374. 70 W. Madison St. Suite 2350. Chicago, IL 60602
2. The nose of the REACT 350 shall be clad with a plastic wrap with standard delineation adhered to the wrap and shall have a series of side marker reflectors on both sides of the unit. See site plan views for marker and plastic wrap color orientation.
3. For bi-directional traffic, appropriate transition details will be as shown on the manufacturer's shop drawings.
4. Details of components for the REACT(W) and backups and reinforcing details will be shown on the manufacturer's shop drawings furnished to the Engineer.
5. If the cross-slope varies more than 2% over the length of the system, the concrete pad will require leveling. Maximum permissible cross-slope is 8%.
6. The installation area should be free from curbs, elevated objects, or depressions.
7. The REACT(W) system should be approximately parallel with the barrier or ℄ of merging barriers.
8. All steel components to be hot dipped galvanized except stakes, drive spikes, threaded bolts in backup unit, and wedge fittings on cables.

WIDE REACT SYSTEMS

SYSTEM TYPE	BACKUP WIDTH	TEST LEVEL	SYSTEM LENGTH	EFFECTIVE LENGTH	PAD LENGTH
W60	60"	TL-2 TL-3	18'-10" 30'-10"	16'-3" 29'-3"	19'-6" 32'-6"
W96	96"	TL-2 TL-3	18'-10" 34'-9"	17'-6" 32'-10"	19'-7" 35'-6"
W120	120"	TL-3	33'-10"	32'-2"	35'-6"

(See the manufacturer's shop drawings for additional details.)

ANCHOR SYSTEM TYPE

MP-3® polyester anchoring system with 7.5" studs, 5.5" embedment

FOUNDATION TYPES

Minimum 8" Reinforced concrete pad (Required reinforcing steel for concrete pad shall be shown on the manufacturer's shop drawings.

Minimum 8" Non-reinforced concrete roadway (Measuring at least 12' wide by 50' long)

Minimum 7" Concrete deck structure, or Minimum 6" Reinforced concrete roadway

Texas Department of Transportation — Design Division Standard

TRINITY HIGHWAY ENERGY ABSORPTION CRASH CUSHION (REACT 350 WIDE)

REACT(W)-16

FILE: reactw16.dgn | Dw: TxDOT | Ck: KM | Dw: VP | Ck: VP
©TxDOT October 2001 | CONT | SECT | JOB | HIGHWAY
REVISIONS
REVISED 05,2016 (VP) | DIST | COUNTY | SHEET NO.

DATE:
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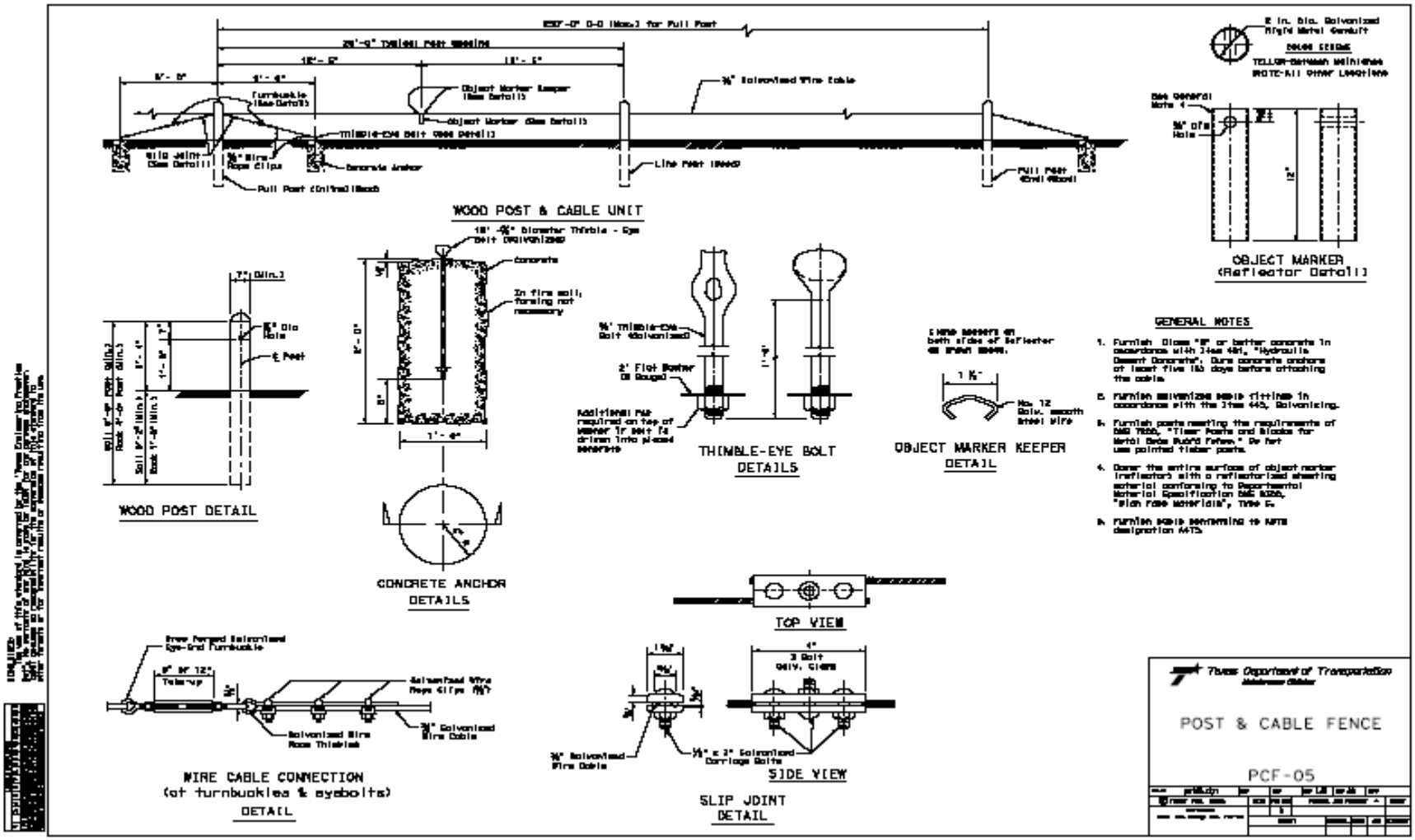
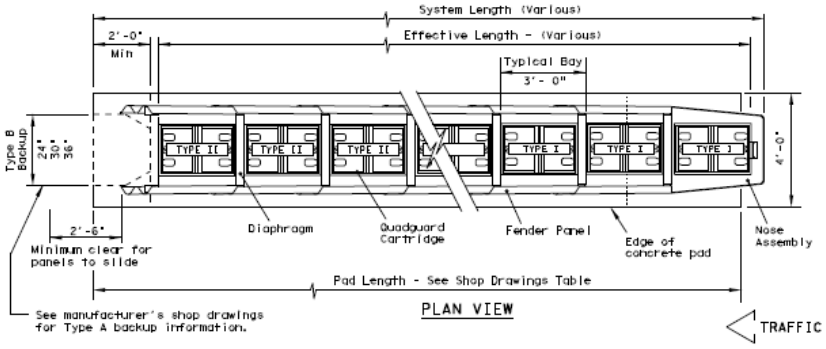
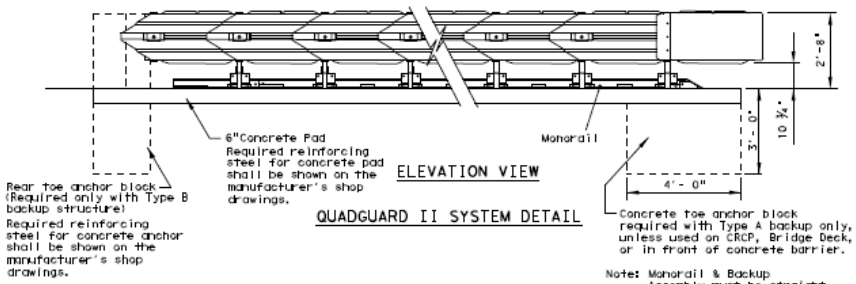
LOW MAINTENANCE


WOOD POST & CABLE UNIT
OBJECT MARKER
(Reflector Detail)
WOOD POST DETAIL
THIMBLE-EYE BOLT
DETAILS
OBJECT MARKER KEEPER
DETAIL
GENERAL NOTES
CONCRETE ANCHOR
DETAILS
TOP VIEW
SIDE VIEW
WIRE CABLE CONNECTION
(at turnbuckles & eyebolts)
DETAIL
SLIP JOINT
DETAIL
POST & CABLE FENCE
PCF-05

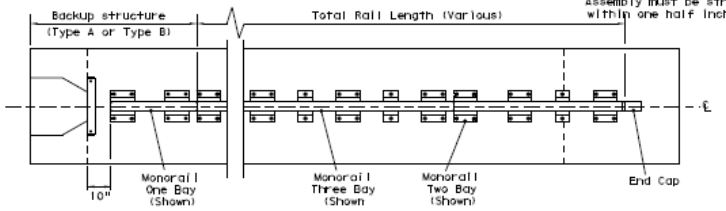
DATE:
FILE:

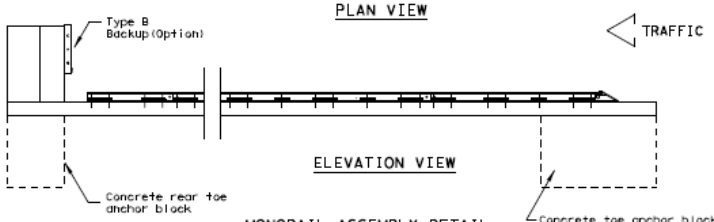




QUADGUARD II SYSTEM DETAIL

Note: Monorail & Backup Assembly must be straight within one half inch.



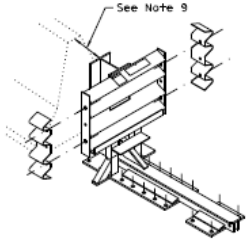


MONORAIL ASSEMBLY DETAIL
(See the manufacturer's shop drawings for monorail hardware installation.)

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"

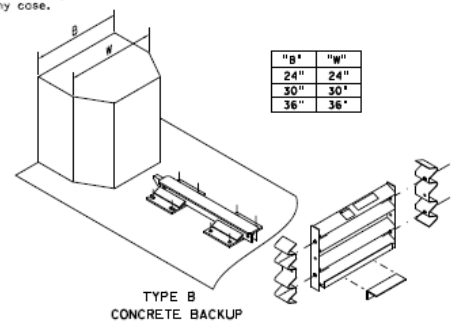
Additional bays may be added if special considerations warrant and site conditions will accommodate additional length.

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.)



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.

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.

REUSABLE

Texas Department of Transportation — Design Division Standard

TRINITY HIGHWAY ENERGY ABSORPTION (QUADGUARD II) (NARROW)

QUAD(N)-17

FILE: quadn17.dgn	DW: TxDOT	CK: BM	DW: VP	CK: BM
©TxDOT FEBRUARY 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS				
REVISED 06-2017 VP	DIST	COUNTY		SHEET NO.
REVISED 05-2016 VP				
REVISED 05-2017 BM				

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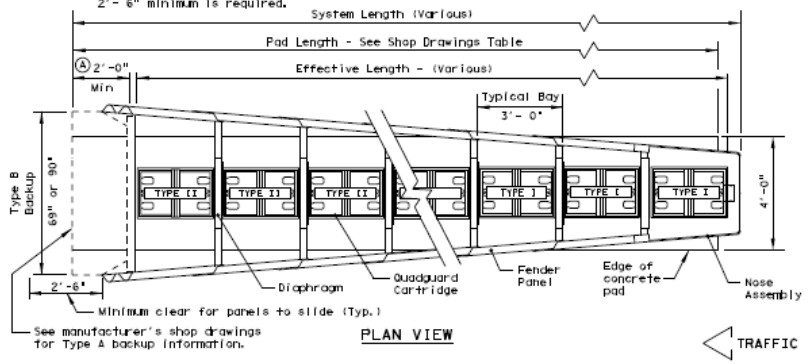
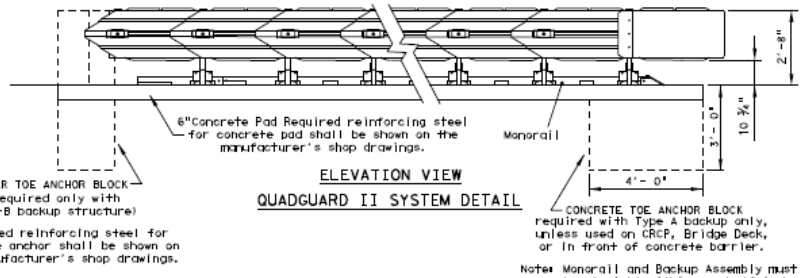
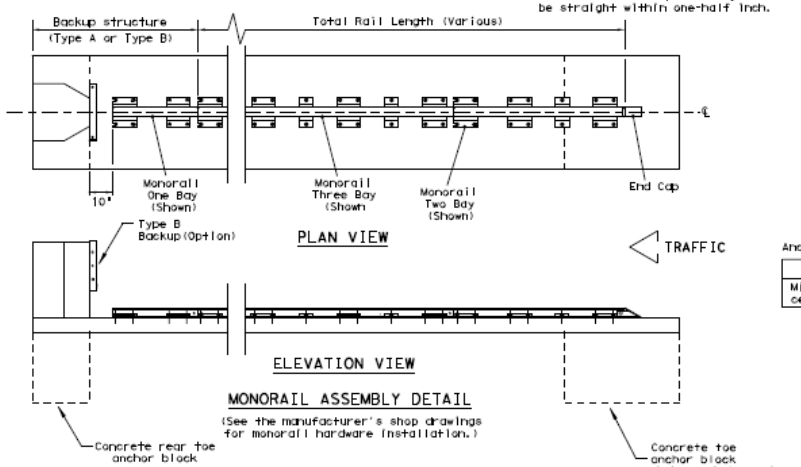
Ⓐ If Quad endshoes are used, then 2'-6" minimum is required.





ELEVATION VIEW
QUADGUARD II SYSTEM DETAIL

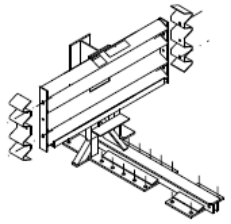
Note: Monorail and Backup Assembly must be straight within one-half inch.



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.

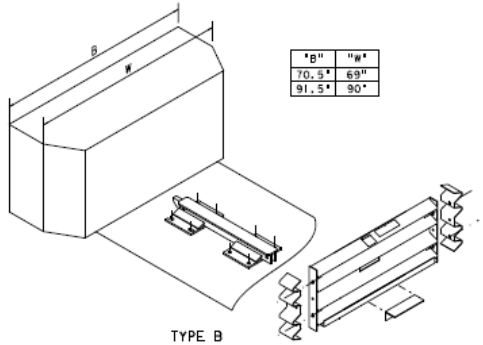


TYPE A
TENSION STRUT BACKUP

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.)

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.

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

Texas Department of Transportation — Design Division Standard

TRINITY HIGHWAY ENERGY ABSORPTION (QUADGUARD II) (WIDE)

QUAD(W)-17

FILE: quadw17.dgn	DW: TxDOT	CK: KM	DW: VP	CK: KM
©TxDOT FEBRUARY 1998	CONT	SECT	JOB	HIGHWAY
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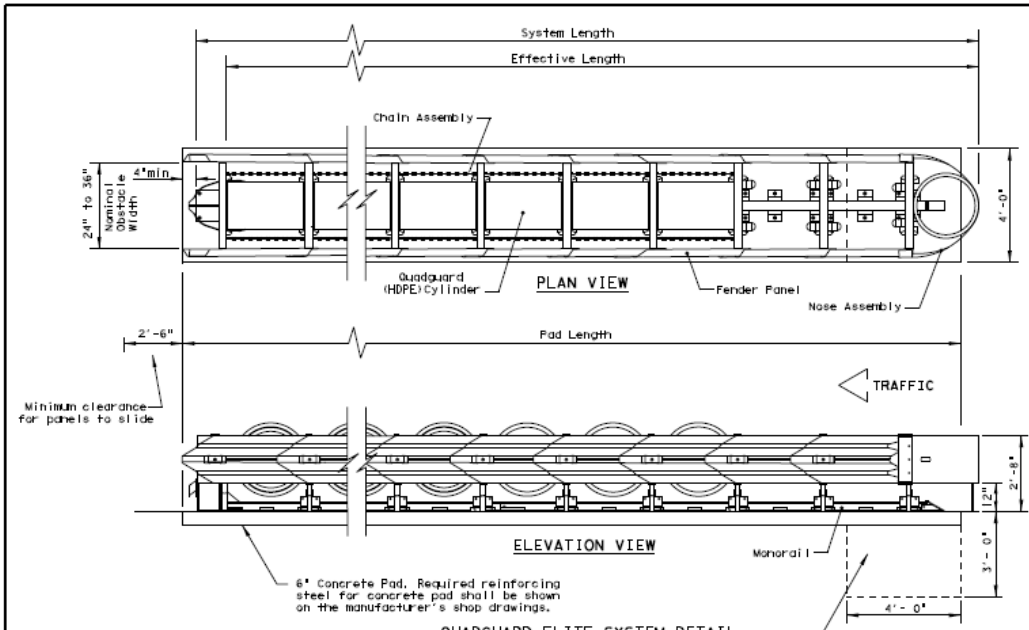
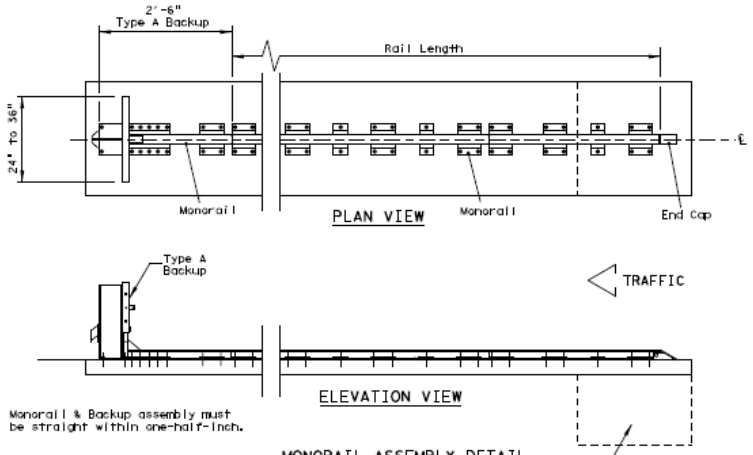
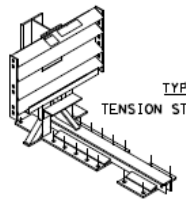




GENERAL NOTES

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. After each impact, measurements should be taken of the shortest outside diameter of the last cylinder (closest to the backup). When this diameter is reduced from its original 32" to 26" or less, all the HDPE cylinders will need to be replaced, including the nose cylinder.
3. For bi-directional traffic, appropriate transition panels will be required.
4. Details of components for the QG(ELITE) and backups and reinforcing details will be shown on the manufacturer's shop drawings furnished to the Engineer.
5. Concrete shall be class "S" with a minimum compressive strength of 4,000 p.s.i.
6. 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%.
7. The installation area should be free from curbs, elevated objects, or depressions.
8. The QG(ELITE) system should be approximately parallel with the barrier or ℄ of merging barriers.
9. 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.



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 QG(ELITE) unit.

Typical application:
QG(ELITE) units attached to [Double-Face Guard-Rail.] 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 QG(ELITE) unit is to be placed on continuously reinforced concrete pavement or bridge deck (7" minimum, 4,000 psi) or non-reinforced concrete pavement (8" minimum, 4,000 psi)

QUADGUARD ELITE (NARROW) SYSTEM						
Test Level	NO. OF BAYS	SYSTEM LENGTH	UNIT EFFECTIVE LENGTH	PAD LENGTH	RAIL LENGTH	OBSTACLE WIDTH
TL-2	5	17'- 11"	17'- 3"	18'- 0"	12'- 0"	24" to 36"
TL-3	8	26'- 7"	25'- 11"	27'- 1"	21'- 0"	

SEE MANUFACTURER'S SHOP DRAWINGS FOR TYPE A BACKUP INFORMATION.

ANCHORAGE REQUIREMENTS ARE AS FOLLOWS:

WITH FOUNDATION TYPE:	ANCHOR WITH:
Minimum 6" portland cement reinforced concrete pad or 8" non-reinforced concrete pad	Epoxy anchoring system with 7" studs and 5.5" embedment

LOW MAINTENANCE

Texas Department of Transportation — Design Division Standard

TRINITY HIGHWAY ENERGY ABSORPTION (QUADGUARD ELITE) (NARROW)

QGELITE(N)-17

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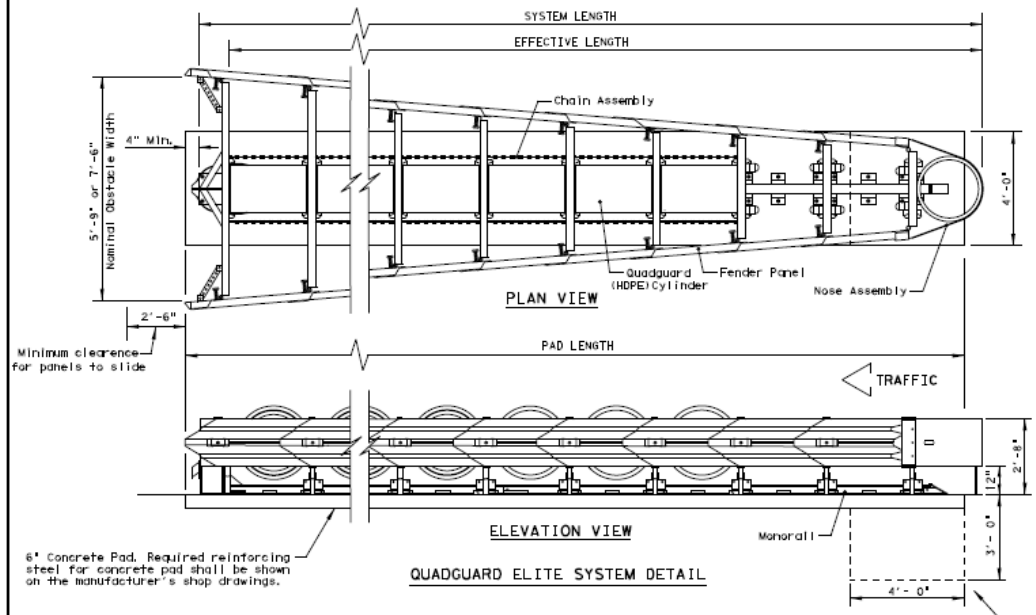
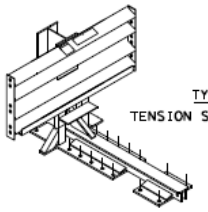


GENERAL NOTES

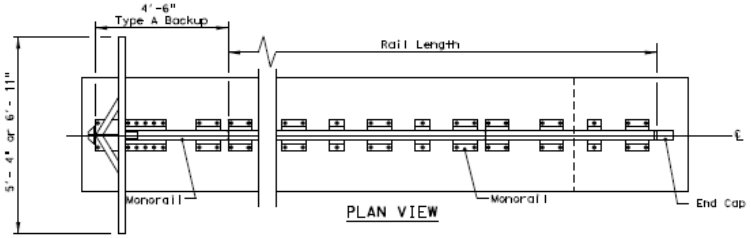
1. For specific information regarding installation and technical guidance of the system, contact: Trinity Highway - Energy Absorption at 1(888)323-6374. 70 W. Madison St. Suite 2350. Chicago, IL 60602
2. After each impact, measurements should be taken of the shortest outside diameter of the last cylinder (closest to the backup). When this diameter is reduced from its original 32" to 26" or less, all the HDPE cylinders will need to be replaced, including the nose cylinder.
3. For bi-directional traffic, appropriate transition panels will be required.
4. Details of components for the QG(ELITE) and backups and reinforcing details will be shown on the manufacturer's shop drawings furnished to the Engineer.
5. Concrete shall be class "S" with a minimum compressive strength of 4,000 p.s.i.
6. 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%.
7. The installation area should be free from curbs, elevated objects, or depressions.
8. The QG(ELITE) system should be approximately parallel with the barrier or ℄ of merging barriers.
9. 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.



TYPE A
TENSION STRUT BACKUP

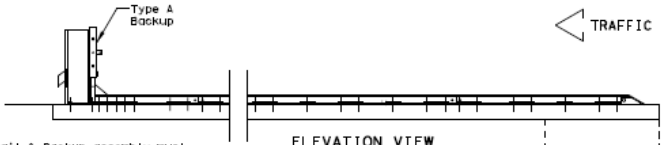
TENSION STRUT:
Consists of diagonal struts, connections, and accessories, as detailed by the manufacturer, located at the rear of the QG(ELITE) unit.

Typical applications:
QG(ELITE) units attached to [Double-Face Guard-Rail.] 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 QG(ELITE) unit is to be placed on continuously reinforced concrete pavement or bridge deck (7" minimum, 4,000 psi) or non-reinforced concrete pavement (8" minimum, 4,000 psi)



QUADGUARD ELITE (WIDE) SYSTEM						
Test Level	NO. OF BAYS	SYSTEM LENGTH	UNIT EFFECTIVE LENGTH	PAD LENGTH	RAIL LENGTH	OBSTACLE WIDTH
TL-2	7	17'-11"	17'- 3"	18'- 0"	12'- 0"	69" to 90"
TL-3	8	26'- 7"	25'- 11"	27'- 1"	21'- 0"	

SEE MANUFACTURER'S SHOP DRAWINGS FOR TYPE A BACKUP INFORMATION.



Note: Monorail & Backup assembly must be straight within one half inch.

MONORAIL ASSEMBLY DETAIL

(See the manufacturer's shop drawings for monorail hardware installation.)

Concrete toe anchor block required, unless used on CRCP, Bridge Deck, or in front of concrete barrier.

WITH FOUNDATION TYPE:	ANCHOR WITH:
Minimum 6" portland cement reinforced concrete pad or 8" non-reinforced concrete pad	Epoxy anchoring system with 7" studs and 5.5" embedment

ANCHORAGE REQUIREMENTS ARE AS FOLLOWS:

LOW MAINTENANCE

Texas Department of Transportation

Design Division Standard

TRINITY HIGHWAY ENERGY ABSORPTION (QUADGUARD ELITE) (WIDE)

QGELITE(W)-17

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©TxDOT OCTOBER 1999	CONT	SECT	JOB	HIGHWAY
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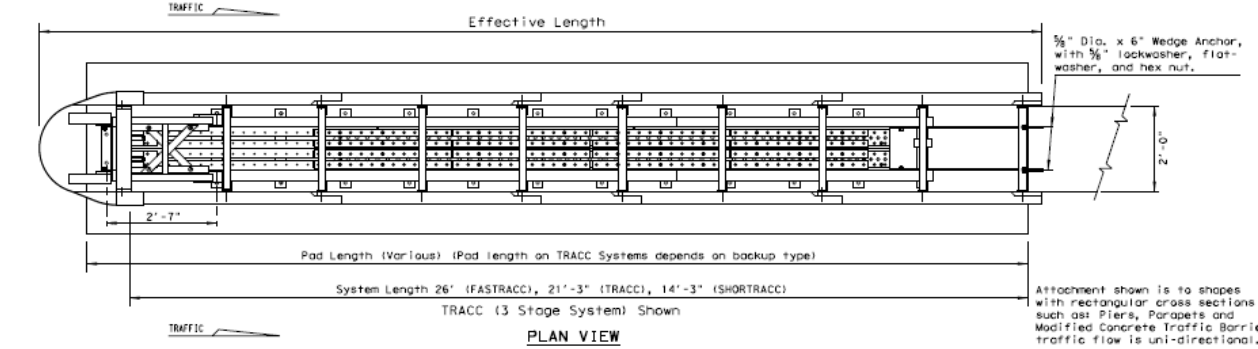
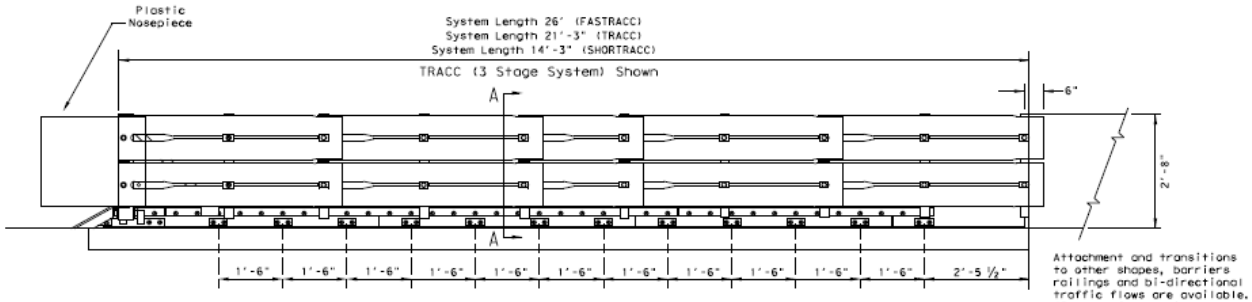
REVISED 06.2013 (VP)	DIST	COUNTY		SHEET NO.
REVISED 07.2015 (VP)				
REVISED 09.2017 (KW)				



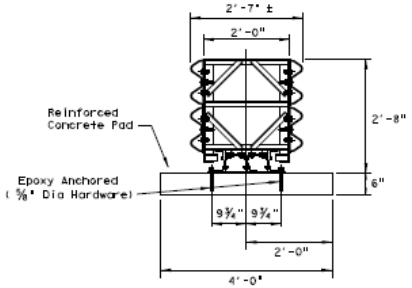
PLAN VIEW

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" 23'- 0" 24'- 0"
SHORTRACC (2 Stage System)	TL-2	14'- 3"	16'- 0"	15'- 0" 16'- 0" 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.

	FAST TRACC	TRACC	SHORT TRACC	BILL OF MATERIAL
PART #	QTY	QTY	QTY	DESCRIPTION
25936A	1			FASTRACC Unit Assembly
25980A		1		TRACC Unit Assembly
25997A			1	SHORTRACC Unit Assembly
3310G	4	4	4	⅝" Lockwasher
4451G	4	4	4	⅝" 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	⅝"Dia x 7 ½" All Thd. Rod
3310G	32	26	18	⅝" Lockwasher
3361G	32	26	18	⅝" Hex Nut
3300G	32	26	18	⅝" Flat Washer
5206B	3	3	2	TRACC Adhesive HIT HY150 Kit
✱ ANCHOR HARDWARE (ASPHALT BASE)				
6380G	32	26	18	⅝" Dia x 18" All Thd. Rod
3310G	32	26	18	⅝" Lockwasher
3361G	32	26	18	⅝" Hex Nut
3300G	32	26	18	⅝" 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

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©TxDOT: February 2006	CONT	SECT	JOB	HIGHWAY
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REVISED 05, 2014 (VP)	DIST	COUNTY		SHEET NO.

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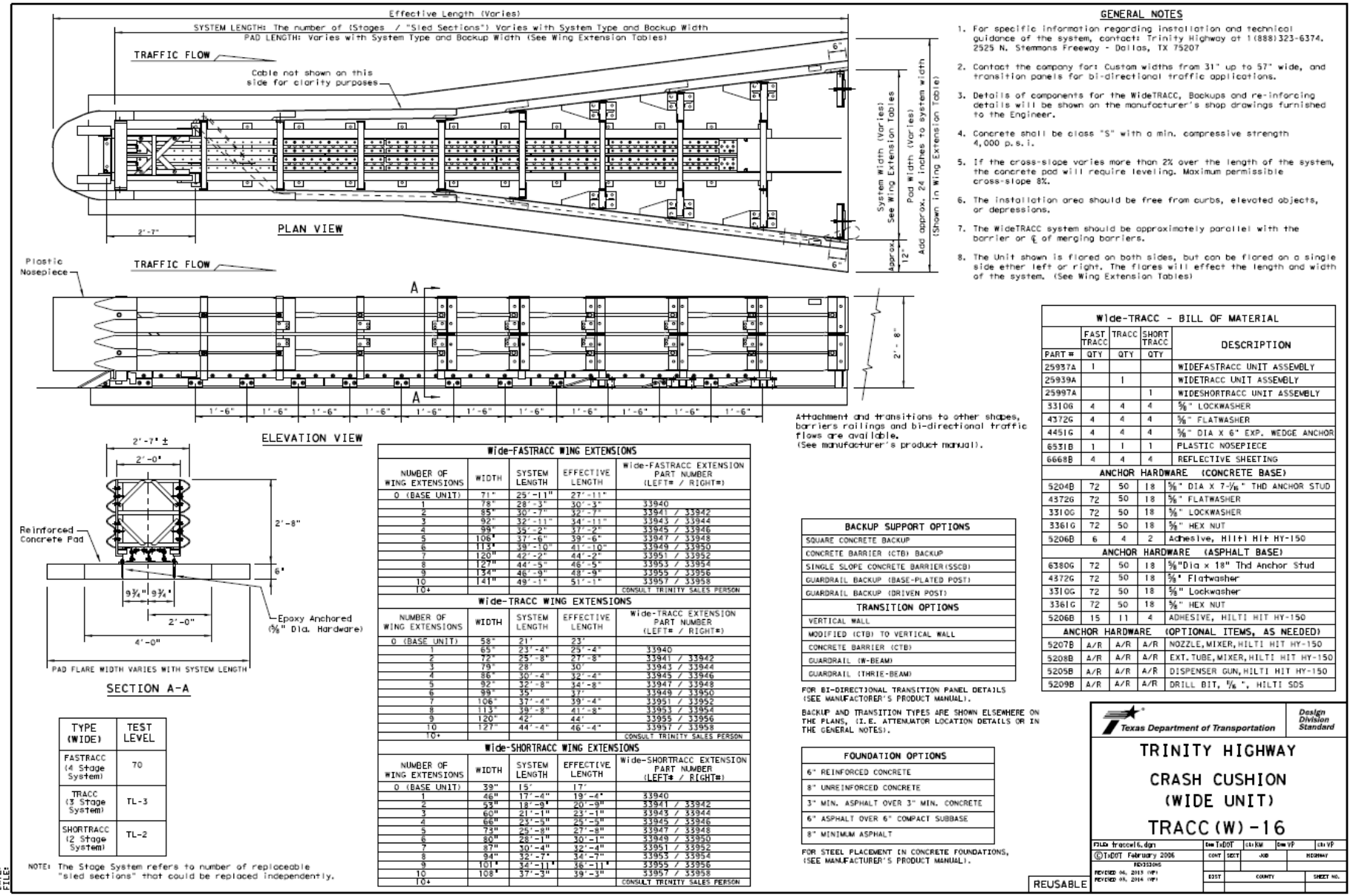

GENERAL NOTES

1. For specific information regarding installation and technical guidance of the system, contact: Trinity Highway at 1(888)323-6374, 2525 N. Stemmons Freeway - Dallas, TX 75207
2. 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 either 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).

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

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 7-⅛" 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, ⅞ ", HILTI SDS

REUSABLE

Texas Department of Transportation — Design Division Standard

TRINITY HIGHWAY
CRASH CUSHION (WIDE UNIT)
TRACC (W)-16

FILE: tracc(w)16.dgn	DN: TxDOT	CK: KM	DW: VP	CK: VP
©TxDOT February 2006	CONT	SECT	JOB	HIGHWAY
REVISIONS: REVISED 06, 2013 (VP) REVISED 08, 2014 (VP)	DIST	COUNTY		SHEET NO.

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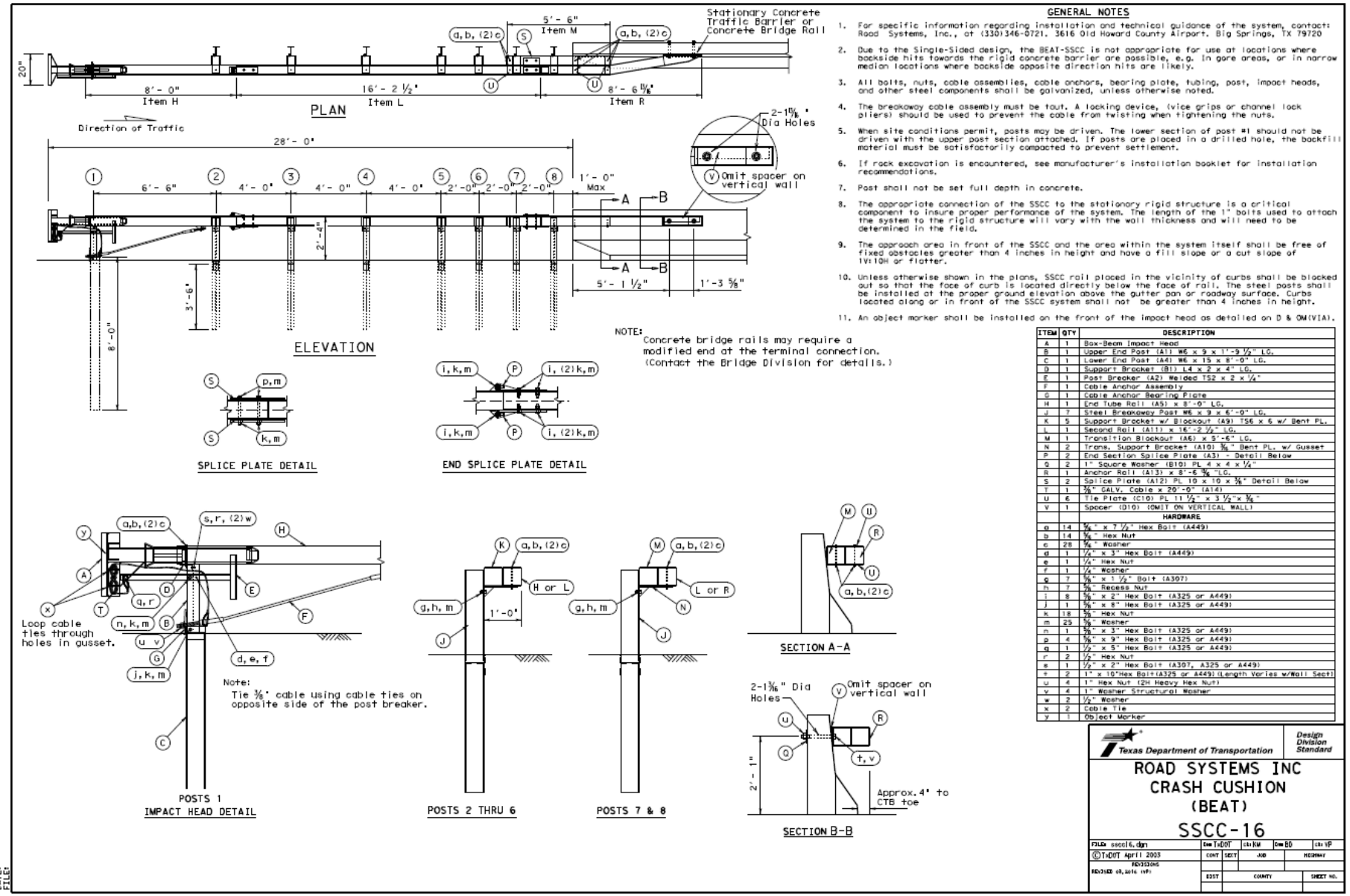

GENERAL NOTES

1. For specific information regarding installation and technical guidance of the system, contact: Road Systems, Inc., at (330)346-0721. 3616 Old Howard County Airport. Big Springs, TX 79720
2. Due to the Single-Sided design, the BEAT-SSCC is not appropriate for use at locations where backside hits towards the rigid concrete barrier are possible, e.g. in gore areas, or in narrow median locations where backside opposite direction hits are likely.
3. All bolts, nuts, cable assemblies, cable anchors, bearing plate, tubing, post, impact heads, and other steel components shall be galvanized, unless otherwise noted.
4. 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.
5. When site conditions permit, posts may be driven. The lower section of post #1 should not be driven with the upper post section attached. If posts are placed in a drilled hole, the backfill material must be satisfactorily compacted to prevent settlement.
6. If rock excavation is encountered, see manufacturer's installation booklet for installation recommendations.
7. Post shall not be set full depth in concrete.
8. The appropriate connection of the SSCC to the stationary rigid structure is a critical component to insure proper performance of the system. The length of the 1" bolts used to attach the system to the rigid structure will vary with the wall thickness and will need to be determined in the field.
9. The approach area in front of the SSCC and the area within the system itself shall be free of fixed obstacles greater than 4 inches in height and have a fill slope or a cut slope of 1V:10H or flatter.
10. Unless otherwise shown in the plans, SSCC rail placed in the vicinity of curbs shall be blocked out so that the face of curb is located directly below the face of rail. The steel posts shall be installed at the proper ground elevation above the gutter pan or roadway surface. Curbs located along or in front of the SSCC system shall not be greater than 4 inches in height.
11. An object marker shall be installed on the front of the impact head as detailed on D & OM(VIA).

NOTE: Concrete bridge rails may require a modified end at the terminal connection. (Contact the Bridge Division for details.)

ITEM	QTY	DESCRIPTION
A	1	Box-Beam Impact Head
B	1	Upper End Post (A1) W6 x 9 x 1'-9 ½" LG.
C	1	Lower End Post (A4) W6 x 15 x 8'-0" LG.
D	1	Support Bracket (B1) L4 x 2 x 4" LG.
E	1	Post Breaker (A2) Welded TS2 x 2 x ¼"
F	1	Cable Anchor Assembly
G	1	Cable Anchor Bearing Plate
H	1	End Tube Rail (A5) x 8'-0" LG.
J	7	Steel Breakaway Post W6 x 9 x 6'-0" LG.
K	5	Support Bracket w/ Blockout (A9) TS6 x 6 w/ Bent PL.
L	1	Second Rail (A11) x 16'-2 ½" LG.
M	1	Transition Blockout (A6) x 5'-6" LG.
N	2	Trans. Support Bracket (A10) ⅜" Bent PL. w/ Gusset
P	2	End Section Splice Plate (A3) - Detail Below
Q	2	1" Square Washer (B10) PL 4 x 4 x ¼"
R	1	Anchor Rail (A13) x 8'-6 ⅜" LG.
S	2	Splice Plate (A12) PL 10 x 10 x ⅜" Detail Below
T	1	⅜" GALV. Cable x 20'-0" (A14)
U	6	Tie Plate (C10) PL 11 ½" x 3 ½" x ⅜"
V	1	Spacer (D10) (OMIT ON VERTICAL WALL)
		HARDWARE
a	14	⅝" x 7 ½" Hex Bolt (A449)
b	14	⅝" Hex Nut
c	28	⅝" Washer
d	1	¼" x 3" Hex Bolt (A449)
e	1	¼" Hex Nut
f	1	¼" Washer
g	7	⅝" x 1 ½" Bolt (A307)
h	7	⅝" Recess Nut
i	8	⅝" x 2" Hex Bolt (A325 or A449)
j	1	⅝" x 8" Hex Bolt (A325 or A449)
k	18	⅝" Hex Nut
m	25	⅝" Washer
n	1	⅝" x 3" Hex Bolt (A325 or A449)
p	4	⅝" x 9" Hex Bolt (A325 or A449)
q	1	½" x 5" Hex Bolt (A325 or A449)
r	2	½" Hex Nut
s	1	½" x 2" Hex Bolt (A307, A325 or A449)
t	2	1" x 10"Hex Bolt(A325 or A449) (Length Varies w/Wall Sect)
u	4	1" Hex Nut (2H Heavy Hex Nut)
v	4	1" Washer Structural Washer
w	2	½" Washer
x	2	Cable Tie
y	1	Object Marker

Texas Department of Transportation — Design Division Standard

ROAD SYSTEMS INC CRASH CUSHION (BEAT)

SSCC-16

FILE: sscc16.dgn	DW: TxDOT	CK: KM	DW: BD	CK: VP
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REVISIONS				
REVISED 08, 2016 (VP)	DIST	COUNTY		SHEET NO.

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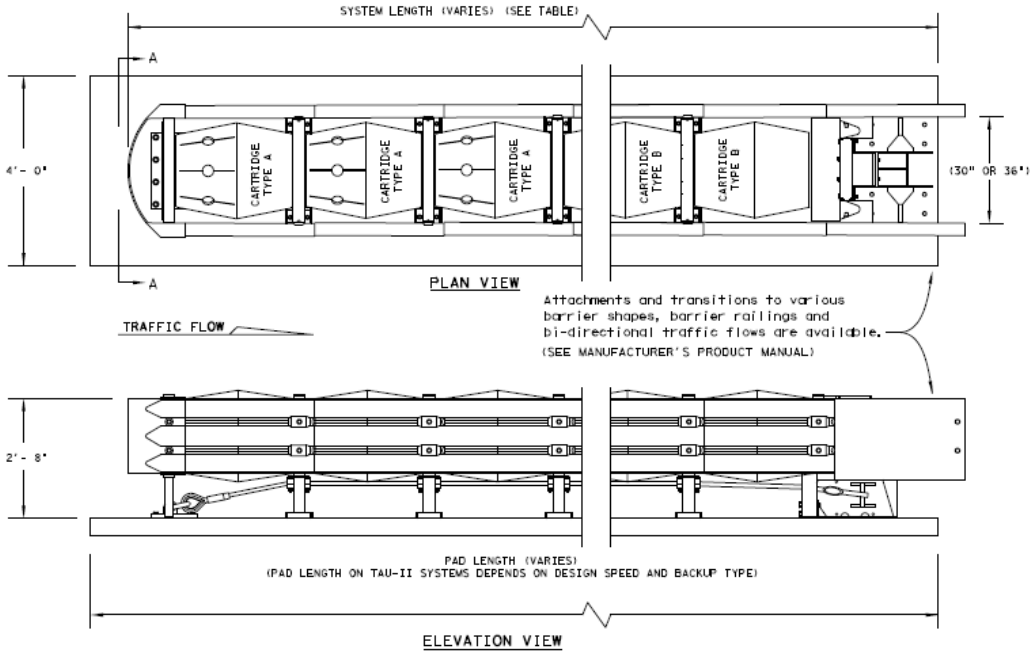

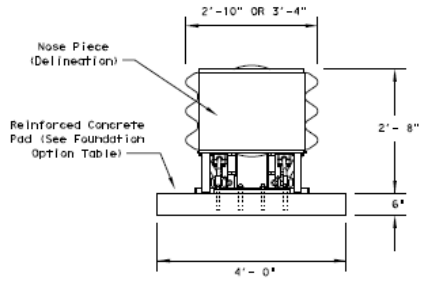

SECTION A-A

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

GENERAL NOTES

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

BILL OF MATERIAL

PRODUCT CODE	QTY	DESCRIPTION
B030704	1	Front Support
B030703	TBD	Middle Support Diaphragm
TBD	1	Backup Support Option (See Table)
B010802	TBD	Energy Absorbing Cartridge, Type A
B010722	TBD	Energy Absorbing Cartridge, Type B
TBD	1	Anchor Package
K001005	1	Front Support Leg Kit
K001004	1	Cable Guide Assembly Kit
B010202	TBD	Sliding Panel
K001003	TBD	Slider Assembly Kit
B010659	2	End Panel
B010651	4	Pipe Panel Mount
TBD	1	Front Cable Anchor
TBD	1	Nose Piece
TBD	2	Cable
K001013	1	Nose Mounting Hardware

(TBD) = To Be Determined, depending on Backup Type and System Length. (See manufacturer's product manual)

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

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

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

BACKUP SUPPORT OPTIONS
COMPACT (STAND ALONE)
FLUSH MOUNT
PCB (CONCRETE BARRIER)

TAU-II (NARROW) SYSTEM LENGTHS			
BACKSTOP	TL-2	TL-3	70 mph
PCB	12'-7"	26'-10"	29'-7"
FLUSH MOUNT	13'-0"	27'-3"	30'-0"
COMPACT	14'-3"	28'-6"	31'-3"

NOTE: SYSTEM LENGTHS ARE ±2"

FOUNDATION OPTIONS
6" REINFORCED CONCRETE
8" UNREINFORCED CONCRETE
ASPHALT OVER CONCRETE WITH MINIMUM 6" EMBEDMENT IN CONCRETE
6" ASPHALT OVER 6" COMPACT SUBBASE
8" MINIMUM ASPHALT

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

Texas Department of Transportation — Design Division Standard

LTS-BARRIER SYSTEMS CRASH CUSHION (NARROW UNIT)

TAU-II(N)-16

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REVISED 06.2013 (VP)	DIST	COUNTY		SHEET NO.
REVISED 05.2016 (VP)				

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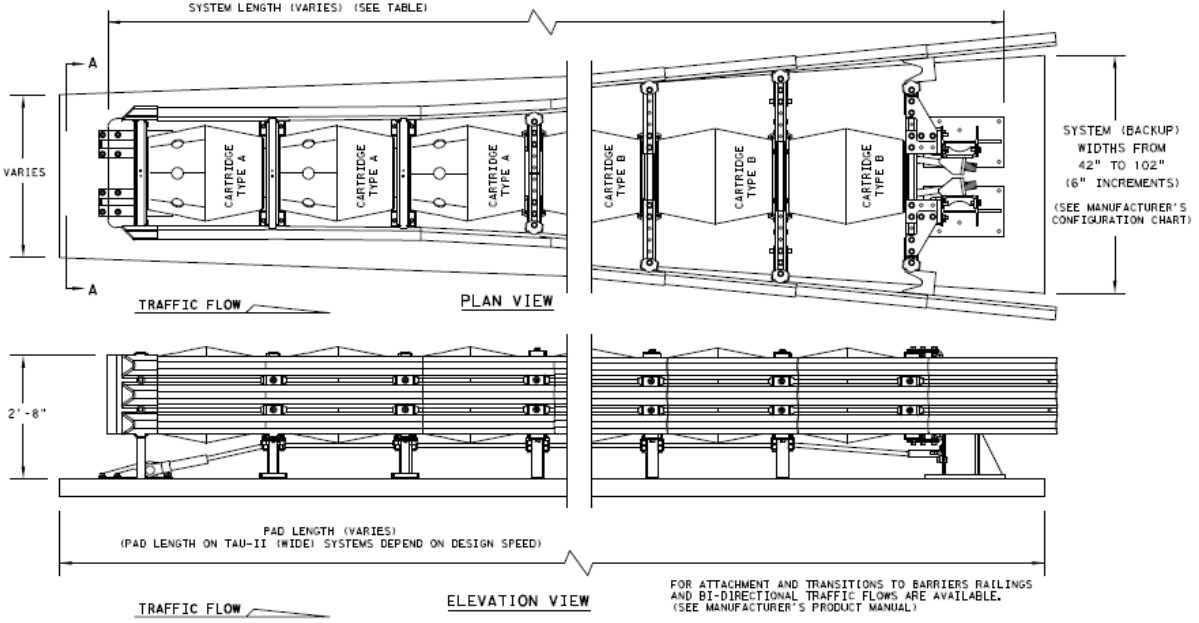

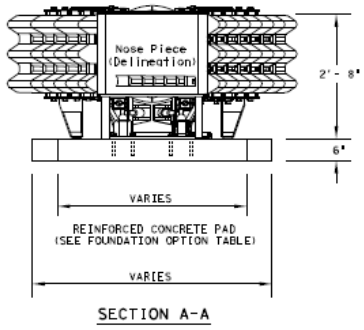

SECTION A-A

NOTE: NOSE PIECE DELINEATION ORIENTATION, IS SHOWN ELSEWHERE ON THE PLANS.

FOUNDATION OPTIONS
6" REINFORCED CONCRETE
8" UNREINFORCED CONCRETE
ASPHALT OVER CONCRETE WITH MINIMUM 6" EMBEDMENT IN CONCRETE

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

TAU-II (WIDE) SYSTEM LENGTHS			
SYSTEM WIDTH	TL-2	TL-3	70 MPH
42"	14'-4"	28'-5"	31'-3"
48"	14'-4"	28'-5"	31'-3"
54"	14'-4"	28'-5"	31'-3"
60"	11'-5"	28'-5"	31'-3"
66"	11'-5"	25'-7"	28'-5"
72"	11'-5"	25'-7"	25'-7"
78"	11'-5"	25'-7"	25'-7"
84"	11'-5"	25'-7"	25'-7"
90"	11'-5"	25'-7"	25'-7"
96"	11'-5"	25'-7"	25'-7"
102"			25'-7"

NOTE: SYSTEM LENGTHS ARE +/-2"

BACKUP SUPPORT
WIDE FLANGE BACKUP (STAND ALONE)

TRANSITION OPTIONS
VERTICAL WALL
CONCRETE TRAFFIC BARRIER
W-BEAM GUARDRAIL
THRIE BEAM GUARDRAIL

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

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

GENERAL NOTES

1. For specific information regarding installation and technical guidance of the system, contact: Lindsay Transportation Solutions - Barrier Systems, Inc. at (707) 374-6800. 180 River Road, Rio Vista, CA 94571
2. Refer to installation manual and configuration chart for specific system assembly and element orientation.
3. For unusual locations see the manufacturer's configuration chart. If the configuration chart does not offer a system suitable for the location a special design, or design details made be required, contact the manufacturer for further information.
4. For bi-directional traffic, appropriate transition panels will be required.
5. Additional details for the backup support options, transition options and foundation options will be shown on the manufacturer's shop drawings furnished to the Engineer.
6. Concrete shall be class "S" with a minimum compressive strength of 4,000 p.s.i.
7. Maximum permissible cross-slope is 8%.
8. The installation area should be free from curbs, elevated objects, or depressions.
9. The TAU-II system should be approximately parallel with the barrier or ℄ of merging barriers.

BILL OF MATERIAL

PRODUCT CODE	QTY	DESCRIPTION
B030704	1	FRONT SUPPORT
B030703	TBD	MIDDLE SUPPORT
TBD	TBD	XL BULKHEAD
TBD	TBD	XXL BULKHEAD
TBD	TBD	XXXL BULKHEAD
TBD	TBD	XXXXL BULKHEAD
TBD	1	BACKUP SUPPORT
TBD	1	FRONT CABLE ANCHOR
TBD	1	NOSE
B010202	TBD	SLIDING PANEL
B010659	1	END PANEL
K001003	TBD	SLIDER ASSEMBLY KIT
B010802	TBD	ENERGY ABSORBING CARTRIDGE, TYPE A
B010722	TBD	ENERGY ABSORBING CARTRIDGE, TYPE B
TBD	2	CABLE
K001031	TBD	LATERAL SUPPORT KIT
K001004	TBD	CABLE GUIDE KIT
K001005	2	FRONT SUPPORT LEG KIT
TBD	1	ANCHORING PACKAGE
K001013	1	NOSE ATTACHING HARDWARE

(TBD) = To Be Determined, depending on Backup Width, Backup Type and System Length. (See manufacturer's product manual)

Texas Department of Transportation — Design Division Standard

LTS-BARRIER SYSTEMS CRASH CUSHION (WIDE UNIT)

TAU-II(W)-16

FILE:	tauiiw16.dgn	DN: TxDOT	CK: KM	DW: VP	CK: DSL
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REVISIONS					
REVISED 06.2018 INFO		DIST	COUNTY		SHEET NO.
REVISED 09.2016 INFO					

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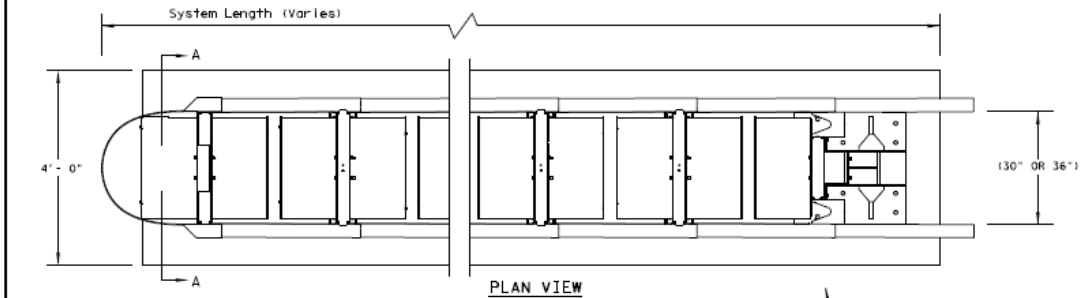
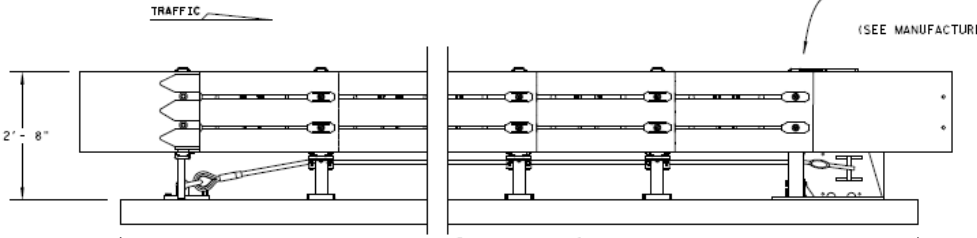


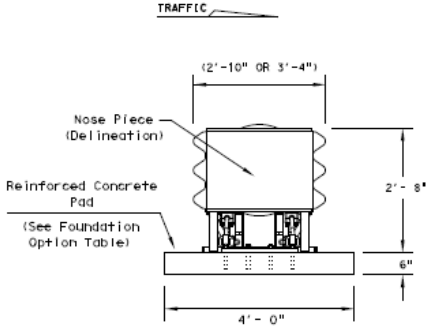
PLAN VIEW

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

(SEE MANUFACTURER'S PRODUCT MANUAL)

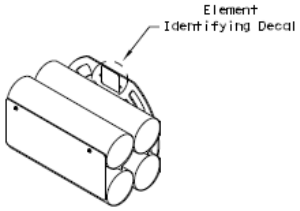


ELEVATION VIEW



SECTION A-A

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



ENERGY ABSORBING ELEMENTS (EAE)

GENERAL NOTES

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

BILL OF MATERIAL

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

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

(See manufacturer's product manual for details)

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

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

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

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

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

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

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

Note: System lengths are ± 2'

LOW MAINTENANCE

Texas Department of Transportation — Design Division Standard

LTS-BARRIER SYSTEMS CRASH CUSHION (R-NARROW)

TAU-II-R(N)-16

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REVISED 06.2017 (VP)
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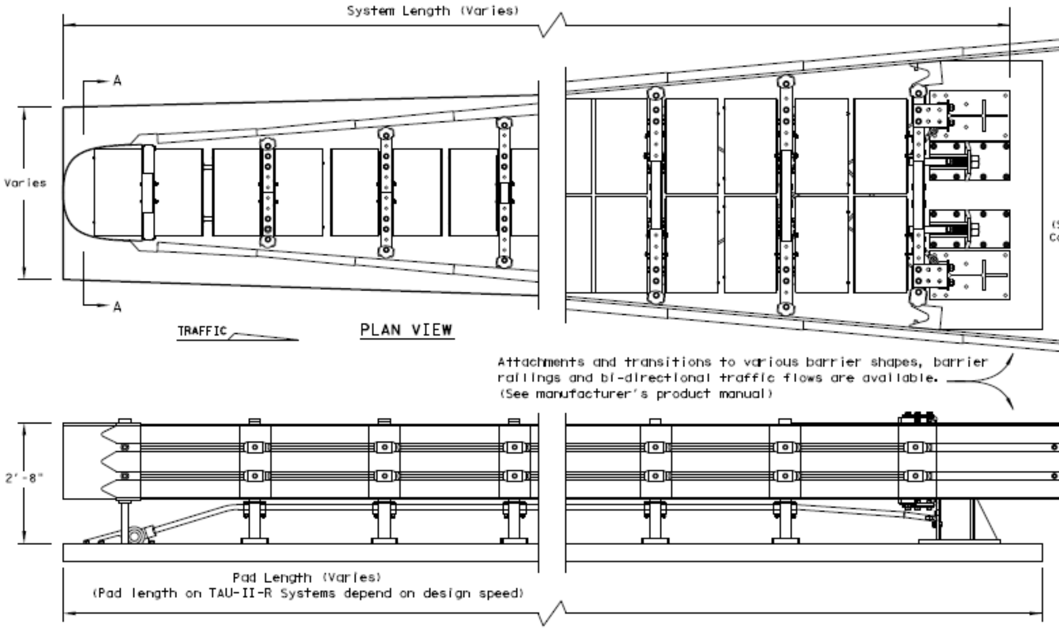
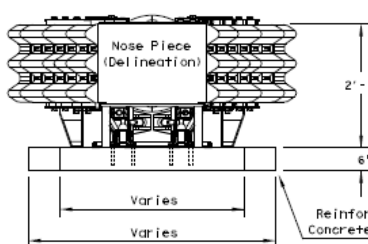


GENERAL NOTES

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

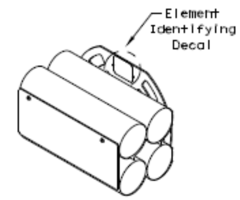


SECTION A-A

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

TAU-II-R (WIDE) SYSTEM LENGTHS			
SYSTEM WIDTH	TL-2	TL-3	70 mph
42"	15'-4"	29'-5"	32'-3"
48"	15'-4"	29'-5"	32'-3"
54"	15'-4"	29'-5"	32'-3"
60"	12'-5"	29'-5"	32'-3"
66"	12'-5"	26'-7"	29'-5"
72"	12'-5"	26'-7"	26'-7"
78"	12'-5"	26'-7"	26'-7"
84"	12'-5"	26'-7"	26'-7"
90"	12'-5"	26'-7"	26'-7"
96"	12'-5"	26'-7"	26'-7"
102"			26'-7"

Note: System Lengths are +/-2"



ENERGY ABSORBING ELEMENTS (EAE)

BILL OF MATERIAL		
PRODUCT CODE	QTY	DESCRIPTION
B030704	1	Front Support
B030703	TBD	Mid Support
TBD	TBD	XL Bulkhead
TBD	TBD	XXL Bulkhead
TBD	TBD	XXXL Bulkhead
TBD	1	Backstop Assembly (See Table)
TBD	2	Front Cable Anchor
TBD	1	Nose Assembly
B010202	TBD	Sliding Panel
B010659	2	End Panel
K001003	1	Slider Assembly Kit
BSI-1202006-KT	TBD	TAU-II-R Slider Kit
BSI-1107131-KT	TBD	TAU-II-R EAE Mounting Hw Kit
BSI-1012069-00	TBD	Energy Absorbing Element, Type 1
BSI-1012070-00	TBD	Energy Absorbing Element, Type 2
BSI-1012071-00	TBD	Energy Absorbing Element, Type 3
BSI-1109042-00	TBD	Energy Absorbing Element, Type 1S
BSI-1107116-00	TBD	Energy Absorbing Element, Type 2S
BSI-1110009-00	TBD	Energy Absorbing Element, Type 3N
TBD	TBD	Cable Assembly
K001031	TBD	Lateral Support Kit
K001004	TBD	Cable Guide Kit
K001005	2	Front Support Leg Kit
TBD	1	Anchoring Package

(TBD) = To Be Determined, depending on Backup Type and System Length.
(See manufacturer's product manual for details)

BACKUP SUPPORT OPTIONS
Wide Flange (Stand alone)

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

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

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

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

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

LOW MAINTENANCE

Texas Department of Transportation — Design Division Standard

LTS-BARRIER SYSTEMS CRASH CUSHION (R-WIDE)

TAU-II-R(W)-16

FILE: tauiirw16.dgn | DN: TxDOT | CK: KM | DW: VP | CK: CGL
©TxDOT January 2013 | CONT | SECT | JOB | HIGHWAY
REVISIONS: REVISED 06, 2015 (VP); REVISED 02, 2016 (VP) | DIST | COUNTY | SHEET NO.

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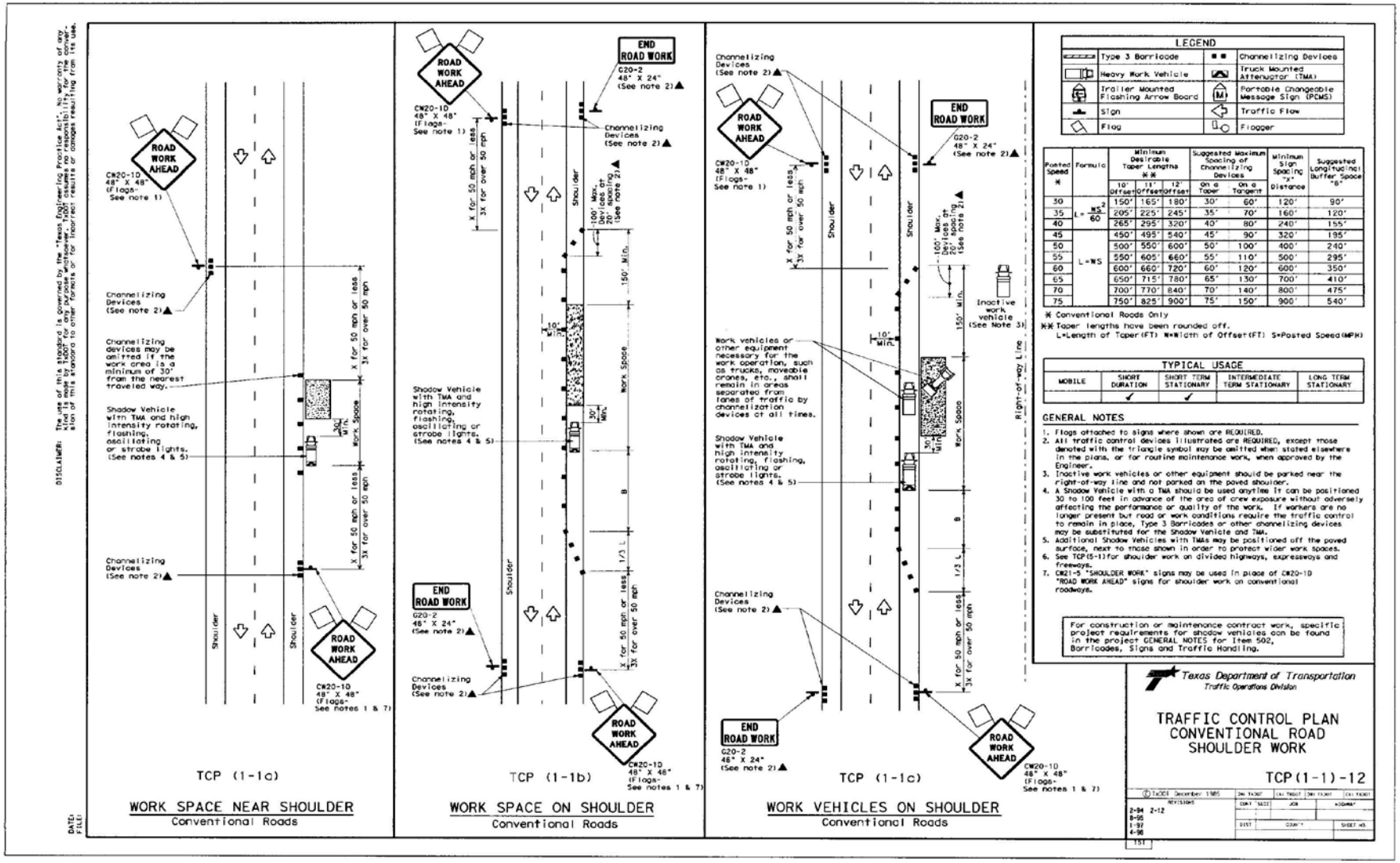
DISCLAIMER:
The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the completeness of this standard or for damages resulting from its use.
DATE:
FILE:
ROAD WORK AHEAD
CW20-1D 48" X 48" (Flags- See note 1)
Channelizing Devices (See note 2)
Channelizing devices may be omitted if the work area is a minimum of 30' from the nearest traveled way.
Shadow Vehicle with TMA and high intensity rotating, flashing, oscillating or strobe lights. (See notes 4 & 5)
X for 50 mph or less 3X for over 50 mph
30' Min.
Work Space
Shoulder
CW20-1D 48" X 48" (Flags- See notes 1 & 7)
TCP (1-1a)
WORK SPACE NEAR SHOULDER
Conventional Roads
END ROAD WORK
G20-2 48" X 24" (See note 2)
100' Max. Devices at 20' spacing (See note 2)
150' Min.
10' Min.
B
1/3 L
TCP (1-1b)
WORK SPACE ON SHOULDER
Conventional Roads
Work vehicles or other equipment necessary for the work operation, such as trucks, moveable cranes, etc., shall remain in areas separated from lanes of traffic by channelization devices at all times.
Inactive work vehicle (See Note 3)
Right-of-way Line
TCP (1-1c)
WORK VEHICLES ON SHOULDER
Conventional Roads
LEGEND
Type 3 Barricade
Channelizing Devices
Heavy Work Vehicle
Truck Mounted Attenuator (TMA)
Trailer Mounted Flashing Arrow Board
Portable Changeable Message Sign (PCMS)
Sign
Traffic Flow
Flag
Flagger
Posted Speed *
Formula
Minimum Desirable Taper Lengths **
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"
30 150' 165' 180' 30' 60' 120' 90'
35 205' 225' 245' 35' 70' 160' 120'
40 265' 295' 320' 40' 80' 240' 155'
45 450' 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'
L=WS
* 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.
For construction or maintenance contract work, specific project requirements for shadow vehicles can be found in the project GENERAL NOTES for Item 502, Barricades, Signs and Traffic Handling.
Texas Department of Transportation
Traffic Operations Division
TRAFFIC CONTROL PLAN
CONVENTIONAL ROAD
SHOULDER WORK
TCP(1-1)-12
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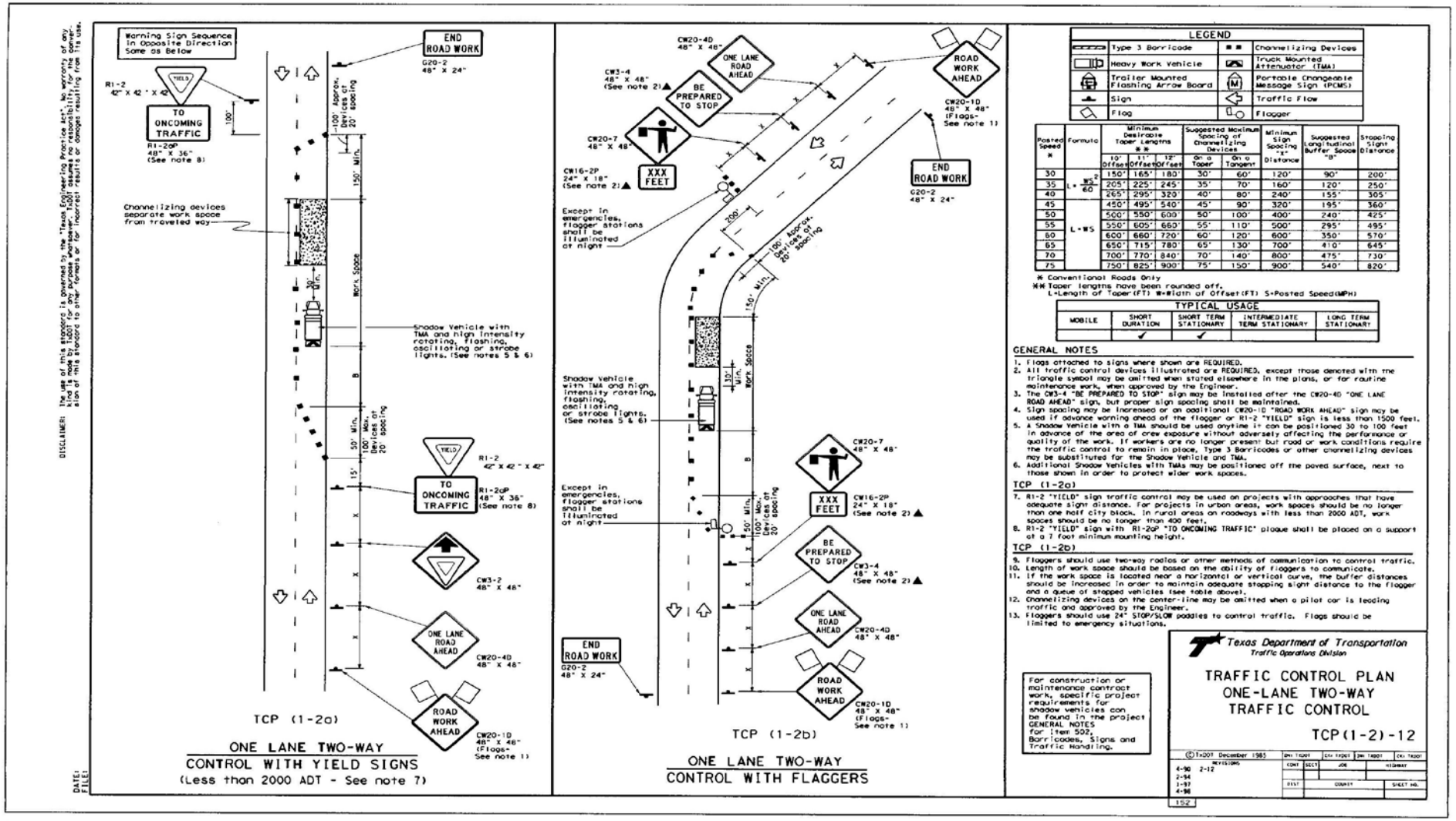
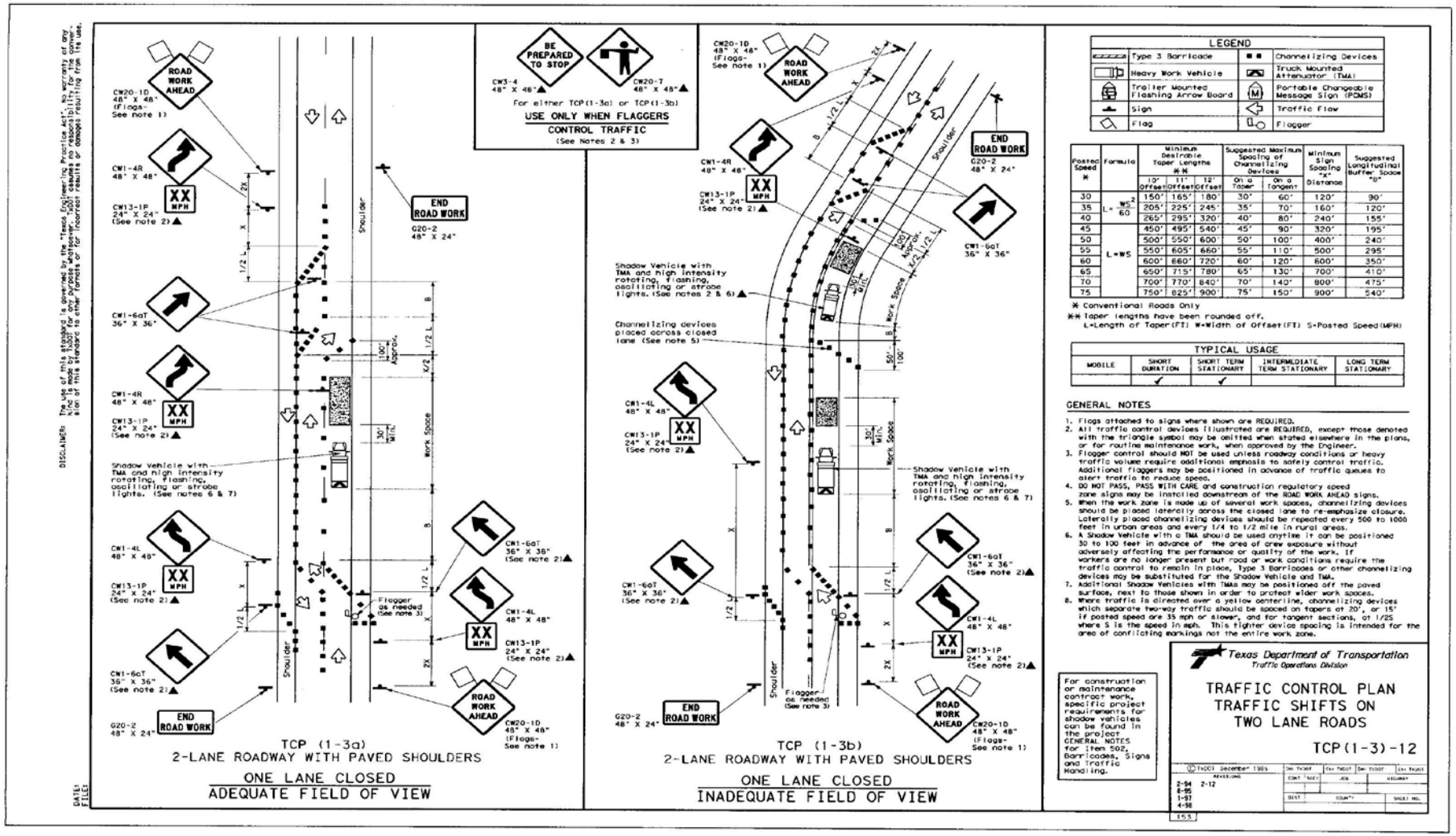
REVISIONS
2-94 2-12
8-95
1-97
4-98
DIST
COUNTY
SHEET NO.



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)


BE PREPARED TO STOP
CW3-4 48" X 48"
CW20-7 48" X 48"
For either TCP(1-3a) or TCP(1-3b)
USE ONLY WHEN FLAGGERS CONTROL TRAFFIC
(See Notes 2 & 3)
ROAD WORK AHEAD
CW20-1D 48" X 48" (Flags-See note 1)
CW1-4R 48" X 48"
CW13-1P 24" X 24" (See note 2)
CW1-6aT 36" X 36"
CW1-4L 48" X 48"
END ROAD WORK
G20-2 48" X 24"
Shadow Vehicle with TMA and high intensity rotating, flashing, oscillating or strobe lights. (See notes 6 & 7)
Channelizing devices placed across closed lane (See note 5)
Flagger as needed (See note 3)
Shoulder
Work Space
TCP (1-3a)
2-LANE ROADWAY WITH PAVED SHOULDERS
ONE LANE CLOSED
ADEQUATE FIELD OF VIEW
TCP (1-3b)
2-LANE ROADWAY WITH PAVED SHOULDERS
ONE LANE CLOSED
INADEQUATE FIELD OF VIEW
LEGEND
Type 3 Barricade
Channelizing Devices
Heavy Work Vehicle
Truck Mounted Attenuator (TMA)
Trailer Mounted Flashing Arrow Board
Portable Changeable Message Sign (PCMS)
Sign
Traffic Flow
Flag
Flagger
Posted Speed *
Formula
Minimum Desirable Taper Lengths **
Suggested Maximum Spacing of Channelizing Devices
Minimum Sign Spacing "X" Distance
Suggested Longitudinal Buffer Space "B"
10' Offset
11' Offset
12' Offset
On a Taper
On a Tangent
30 150' 165' 180' 30' 60' 120' 90'
35 205' 225' 245' 35' 70' 160' 120'
40 265' 295' 320' 40' 80' 240' 155'
45 450' 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'
L=WS²/60
L=WS
* 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.
For construction or maintenance contract work, specific project requirements for shadow vehicles can be found in the project GENERAL NOTES for Item 502, Barricades, Signs and Traffic Handling.
Texas Department of Transportation
Traffic Operations Division
TRAFFIC CONTROL PLAN
TRAFFIC SHIFTS ON
TWO LANE ROADS
TCP(1-3)-12
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REVISIONS
2-94 2-12
8-95
1-97
4-98
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COUNTY
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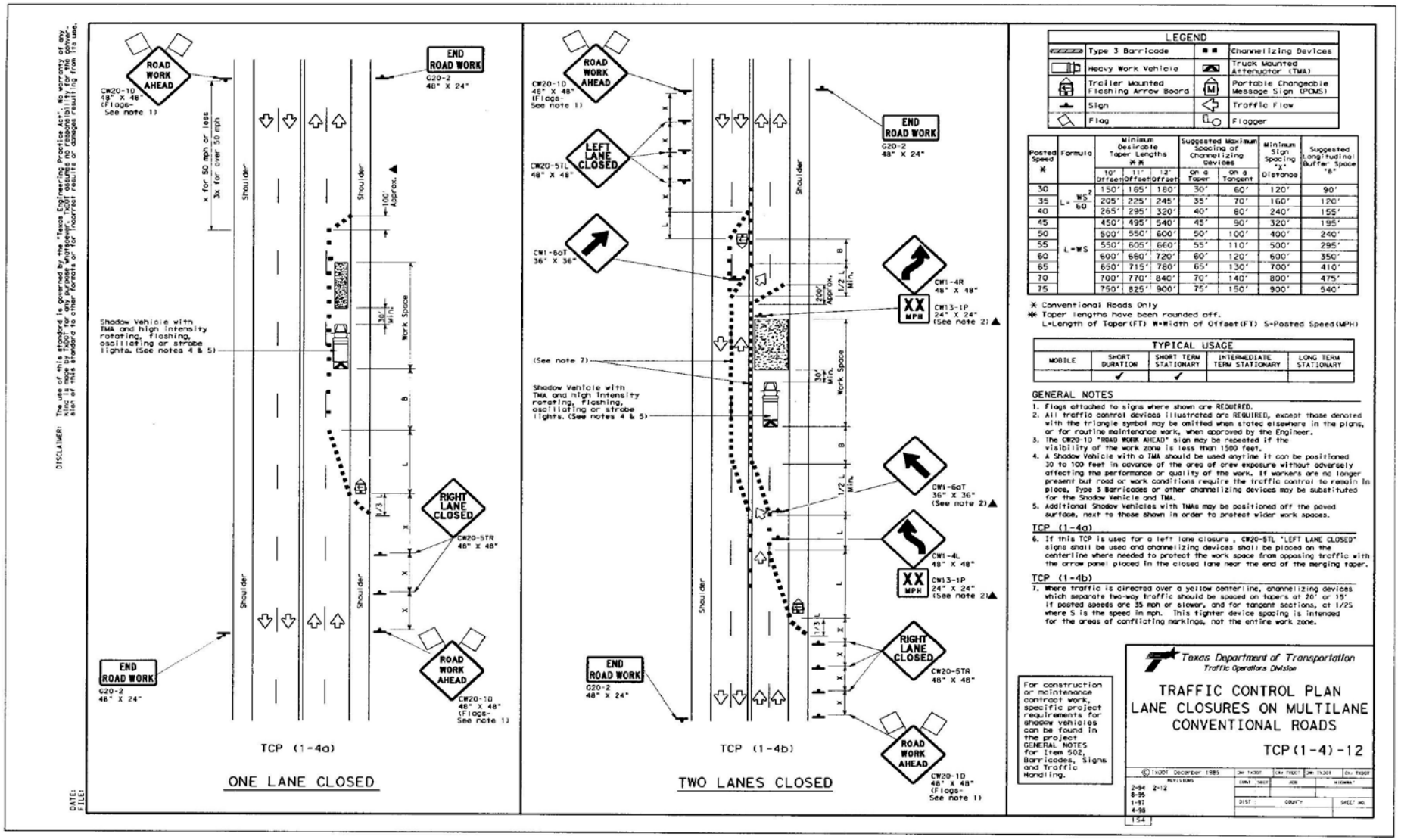

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FILE:

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.

For construction or maintenance contract work, specific project requirements for shadow vehicles can be found in the project GENERAL NOTES for Item 502, Barricades, Signs and Traffic Handling.

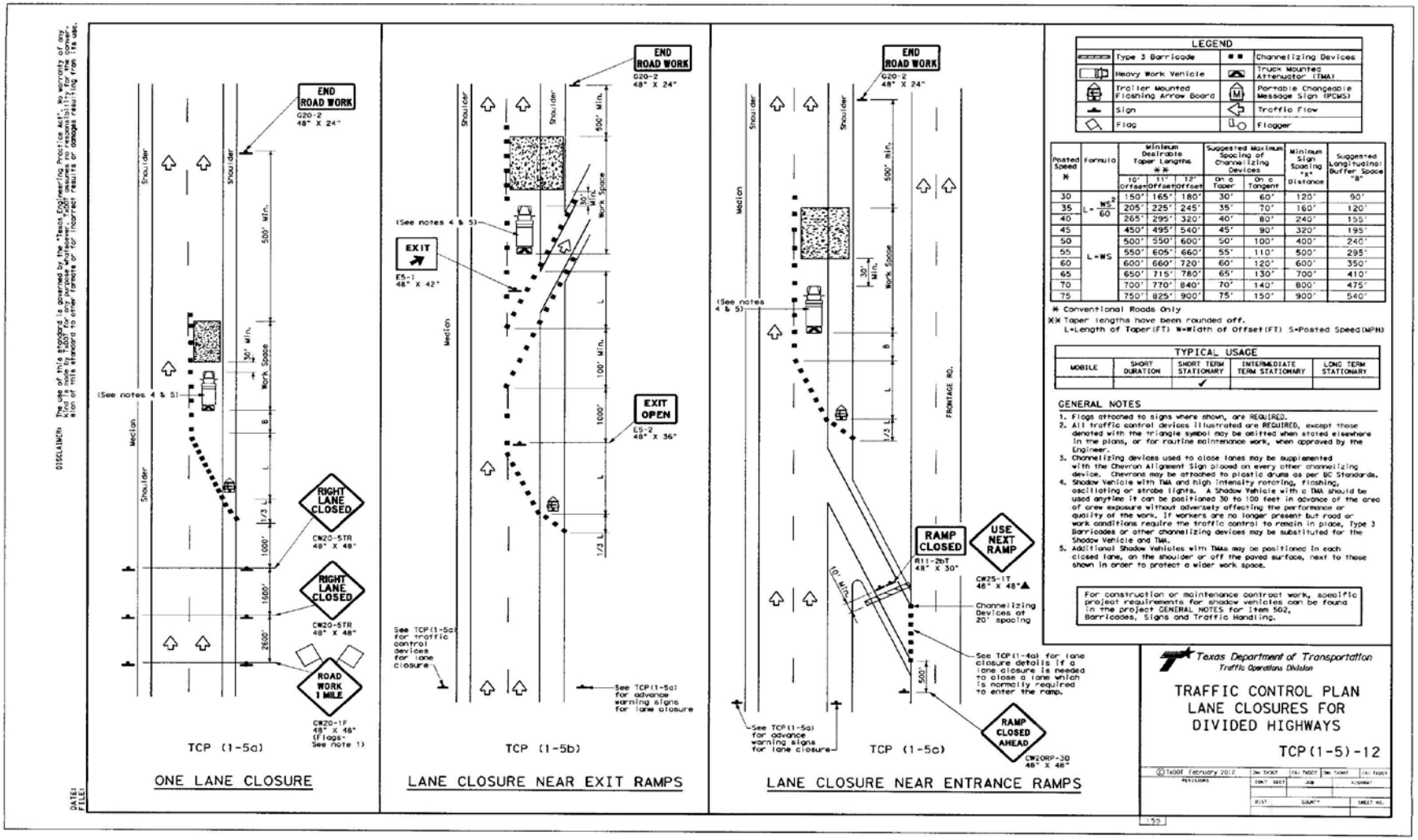
Texas Department of Transportation
Traffic Operations Division

TRAFFIC CONTROL PLAN
LANE CLOSURES ON MULTILANE CONVENTIONAL ROADS

TCP(1-4)-12

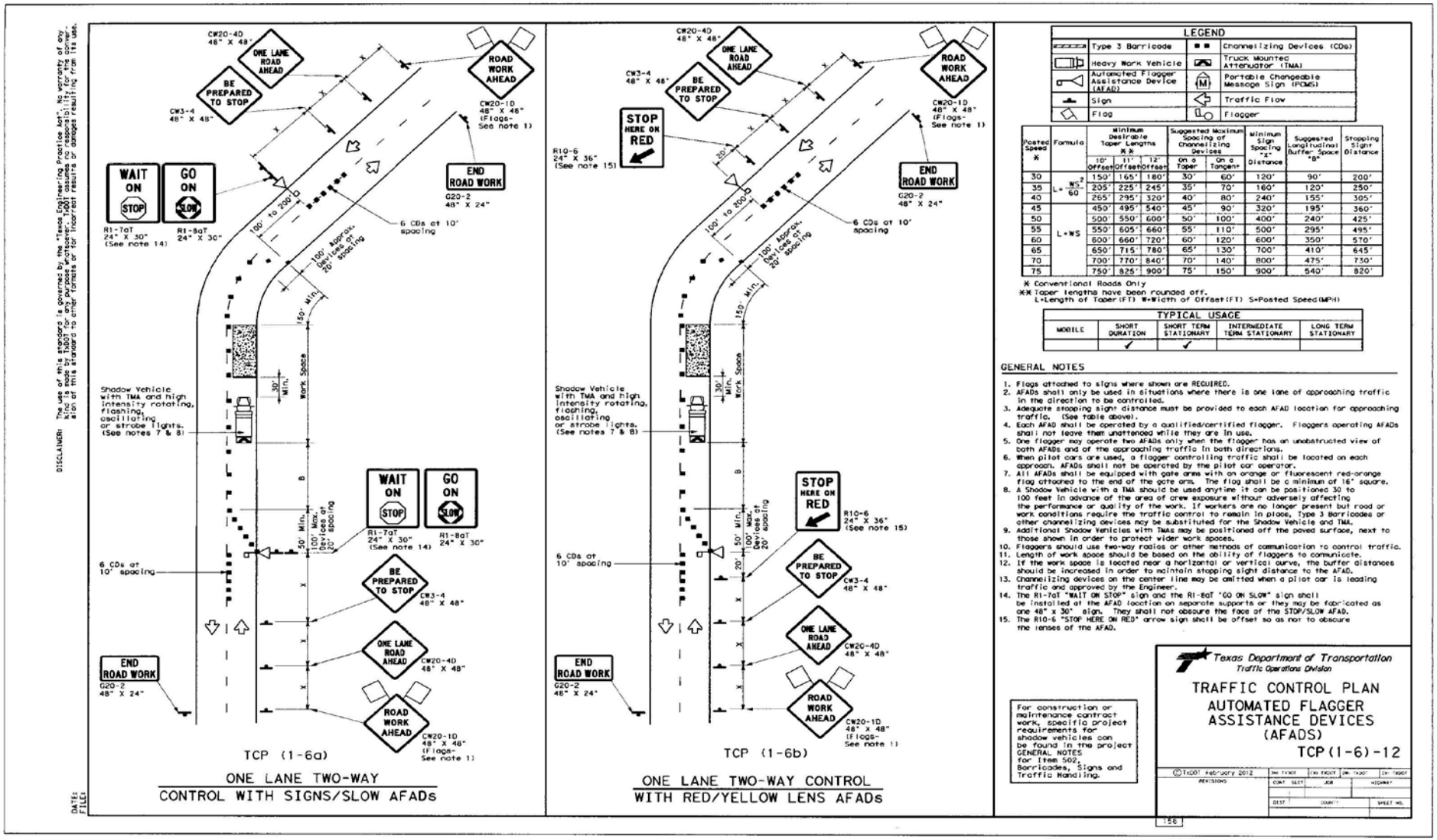
REVISIONS			
2-94	2-12		
8-95			
1-97			
4-98			

DIST | COUNTY | SHEET NO.
154



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)



LEGEND			
	Type 3 Barricade		Channelizing Devices (CDs)
	Heavy Work Vehicle		Truck Mounted Attenuator (TMA)
	Automated Flagger Assistance Device (AFAD)	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. AFADs shall only be used in situations where there is one lane of approaching traffic in the direction to be controlled.
3. Adequate stopping sight distance must be provided to each AFAD location for approaching traffic. (See table above).
4. Each AFAD shall be operated by a qualified/certified flagger. Flaggers operating AFADs shall not leave them unattended while they are in use.
5. One flagger may operate two AFADs only when the flagger has an unobstructed view of both AFADs and of the approaching traffic in both directions.
6. When pilot cars are used, a flagger controlling traffic shall be located on each approach. AFADs shall not be operated by the pilot car operator.
7. All AFADs shall be equipped with gate arms with an orange or fluorescent red-orange flag attached to the end of the gate arms. The flag shall be a minimum of 16" square.
8. 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.
9. Additional Shadow Vehicles with TMAs may be positioned off the paved surface, next to those shown in order to protect wider work spaces.
10. Flaggers should use two-way radios or other methods of communication to control traffic.
11. Length of work space should be based on the ability of flaggers to communicate.
12. If the work space is located near a horizontal or vertical curve, the buffer distances should be increased in order to maintain stopping sight distance to the AFAD.
13. Channelizing devices on the center line may be omitted when a pilot car is leading traffic and approved by the Engineer.
14. The R1-7aT "WAIT ON STOP" sign and the R1-8aT "GO ON SLOW" sign shall be installed at the AFAD location on separate supports or they may be fabricated as one 48" x 30" sign. They shall not obscure the face of the STOP/SLOW AFAD.
15. The R10-6 "STOP HERE ON RED" arrow sign shall be offset so as not to obscure the lenses of the AFAD.

For construction or maintenance contract work, specific project requirements for shadow vehicles can be found in the project GENERAL NOTES for Item 502, Barricades, Signs and Traffic Handling.

Texas Department of Transportation
Traffic Operations Division

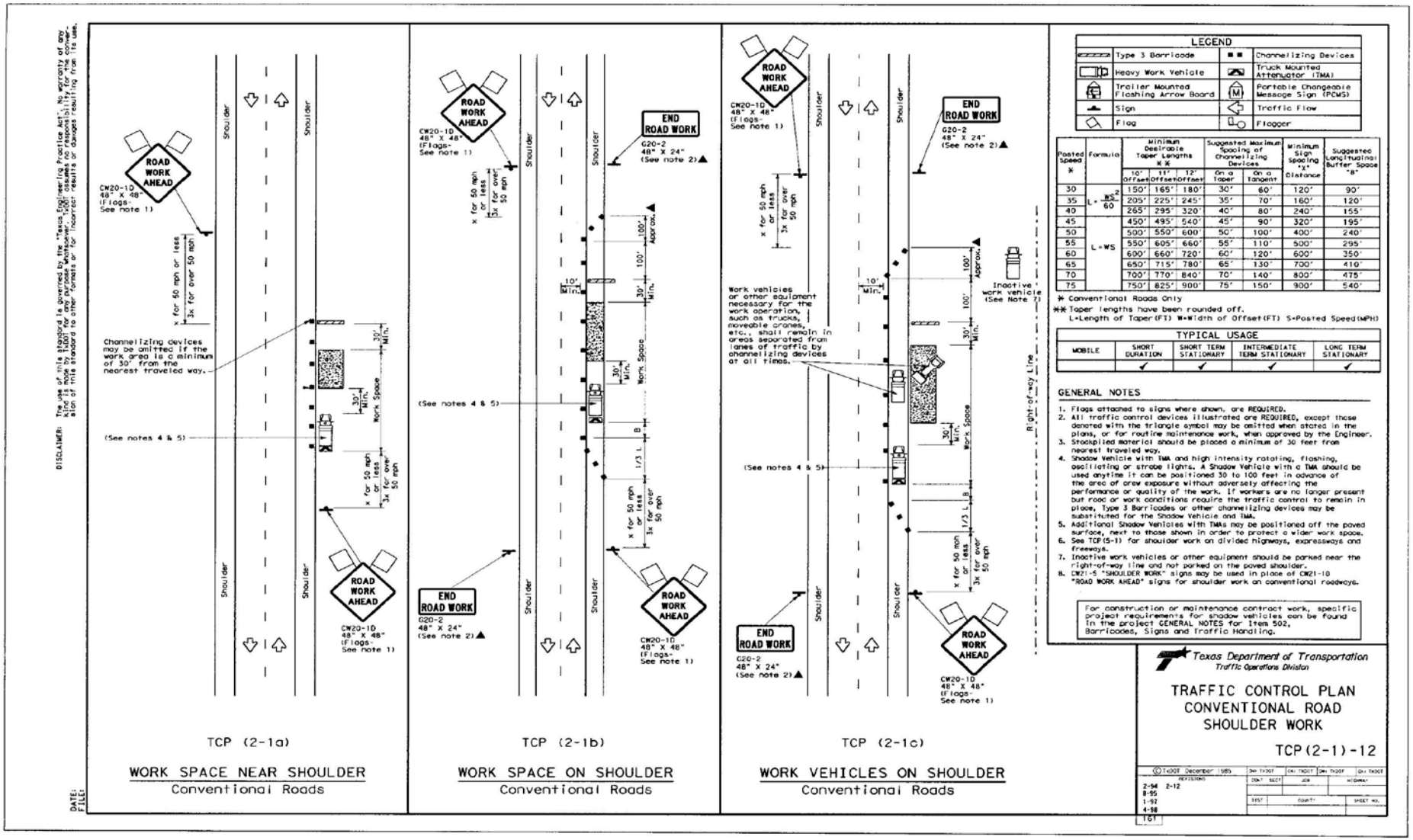
TRAFFIC CONTROL PLAN
AUTOMATED FLAGGER ASSISTANCE DEVICES (AFADS)
TCP(1-6)-12

DATE:
FILE:

REVISIONS

DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
CONT	SECT	JOB	HIGHWAY
DIST	COUNTY		SHEET NO.

156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DATE:
FILE:
ROAD WORK AHEAD
CW20-1D 48" X 48" (Flags- See note 1)
x for 50 mph or less
3x for over 50 mph
Channelizing devices may be omitted if the work area is a minimum of 30' from the nearest traveled way.
Shoulder
30' Min.
Work Space
(See notes 4 & 5)
END ROAD WORK
G20-2 48" X 24" (See note 2)
TCP (2-1a)
WORK SPACE NEAR SHOULDER
Conventional Roads
100' Approx.
10' Min.
B
1/3 L
TCP (2-1b)
WORK SPACE ON SHOULDER
Conventional Roads
Work vehicles or other equipment necessary for the work operation, such as trucks, moveable cranes, etc., shall remain in areas separated from lanes of traffic by channelizing devices at all times.
Inactive work vehicle (See Note 7)
Right-of-way Line
TCP (2-1c)
WORK VEHICLES ON SHOULDER
Conventional Roads
LEGEND
Type 3 Barricade
Channelizing Devices
Heavy Work Vehicle
Truck Mounted Attenuator (TMA)
Trailer Mounted Flashing Arrow Board
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"
30 150' 165' 180' 30' 60' 120' 90'
35 L=WS²/60 205' 225' 245' 35' 70' 160' 120'
40 265' 295' 320' 40' 80' 240' 155'
45 450' 495' 540' 45' 90' 320' 195'
50 500' 550' 600' 50' 100' 400' 240'
55 L=WS 550' 605' 660' 55' 110' 500' 295'
60 600' 660' 720' 60' 120' 600' 350'
65 650' 715' 780' 65' 130' 700' 410'
70 700' 770' 840' 70' 140' 800' 475'
75 750' 825' 900' 75' 150' 900' 540'
* Conventional Roads Only
** Taper lengths have been rounded off.
L=Length of Taper(FT) W=Width of Offset(FT) S=Posted Speed(MPH)
TYPICAL USAGE
MOBILE
SHORT DURATION
SHORT TERM STATIONARY
INTERMEDIATE TERM STATIONARY
LONG TERM STATIONARY
GENERAL NOTES
1. Flags attached to signs where shown, are REQUIRED.
2. All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated in the plans, or for routine maintenance work, when approved by the Engineer.
3. Stockpiled material should be placed a minimum of 30 feet from nearest traveled way.
4. Shadow Vehicle with TMA and high intensity rotating, flashing, oscillating or strobe lights. A Shadow Vehicle with a TMA should be used anytime it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the performance or quality of the work. If workers are no longer present but road or work conditions require the traffic control to remain in place, Type 3 Barricades or other channelizing devices may be substituted for the Shadow Vehicle and TMA.
5. Additional Shadow Vehicles with TMAs may be positioned off the paved surface, next to those shown in order to protect a wider work space.
6. See TCP(5-1) for shoulder work on divided highways, expressways and freeways.
7. Inactive work vehicles or other equipment should be parked near the right-of-way line and not parked on the paved shoulder.
8. CW21-5 "SHOULDER WORK" signs may be used in place of CW21-1D "ROAD WORK AHEAD" signs for shoulder work on conventional roadways.
For construction or maintenance contract work, specific project requirements for shadow vehicles can be found in the project GENERAL NOTES for Item 502, Barricades, Signs and Traffic Handling.
Texas Department of Transportation
Traffic Operations Division
TRAFFIC CONTROL PLAN
CONVENTIONAL ROAD
SHOULDER WORK
TCP(2-1)-12
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REVISIONS
2-94 2-12
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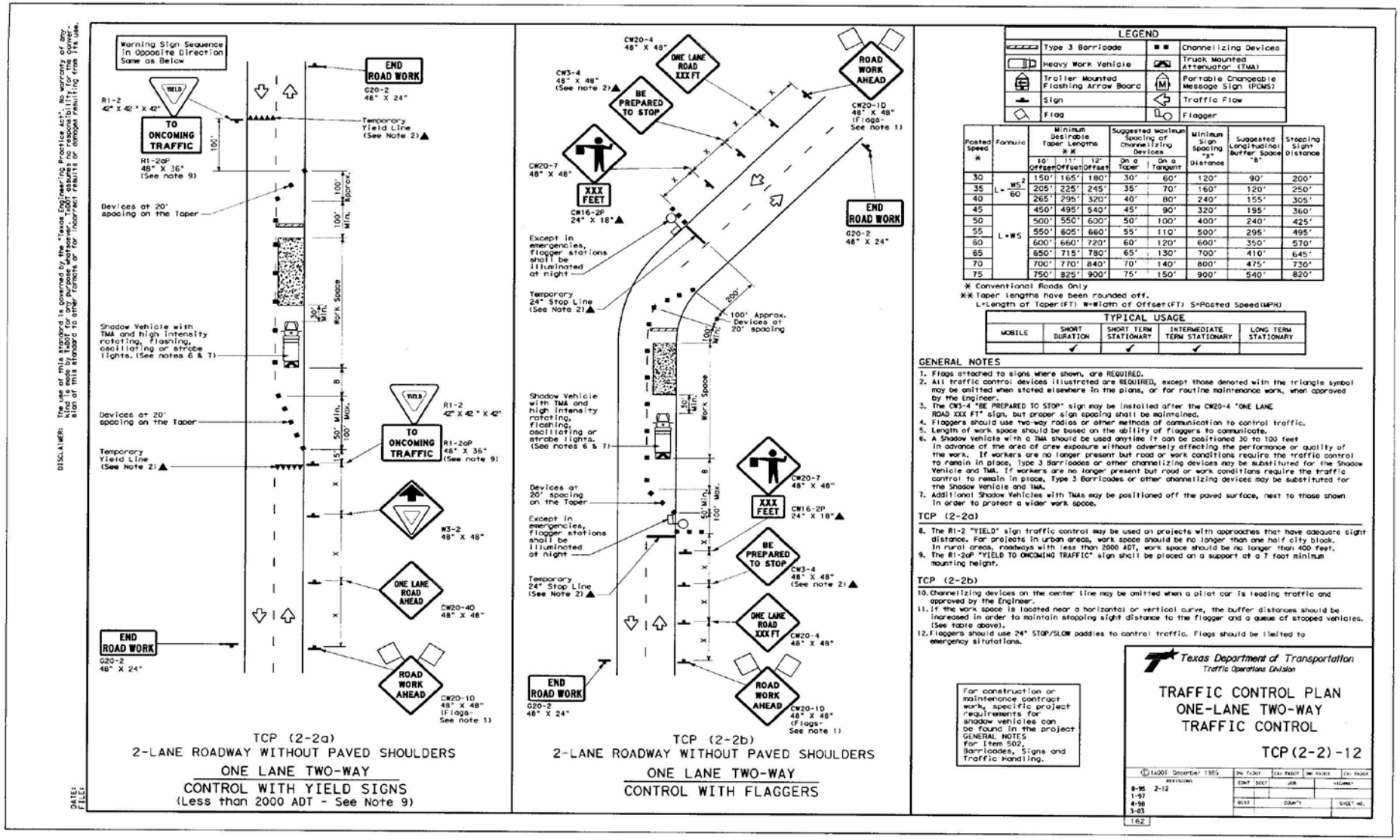


LEGEND

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

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

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

TYPICAL USAGE

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

GENERAL NOTES

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

TCP (2-2a)

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

TCP (2-2b)

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

For construction or maintenance contract work, specific project requirements for shadow vehicles can be found in the project GENERAL NOTES for Item 502, Barricades, Signs and Traffic Handling.

Texas Department of Transportation
Traffic Operations Division

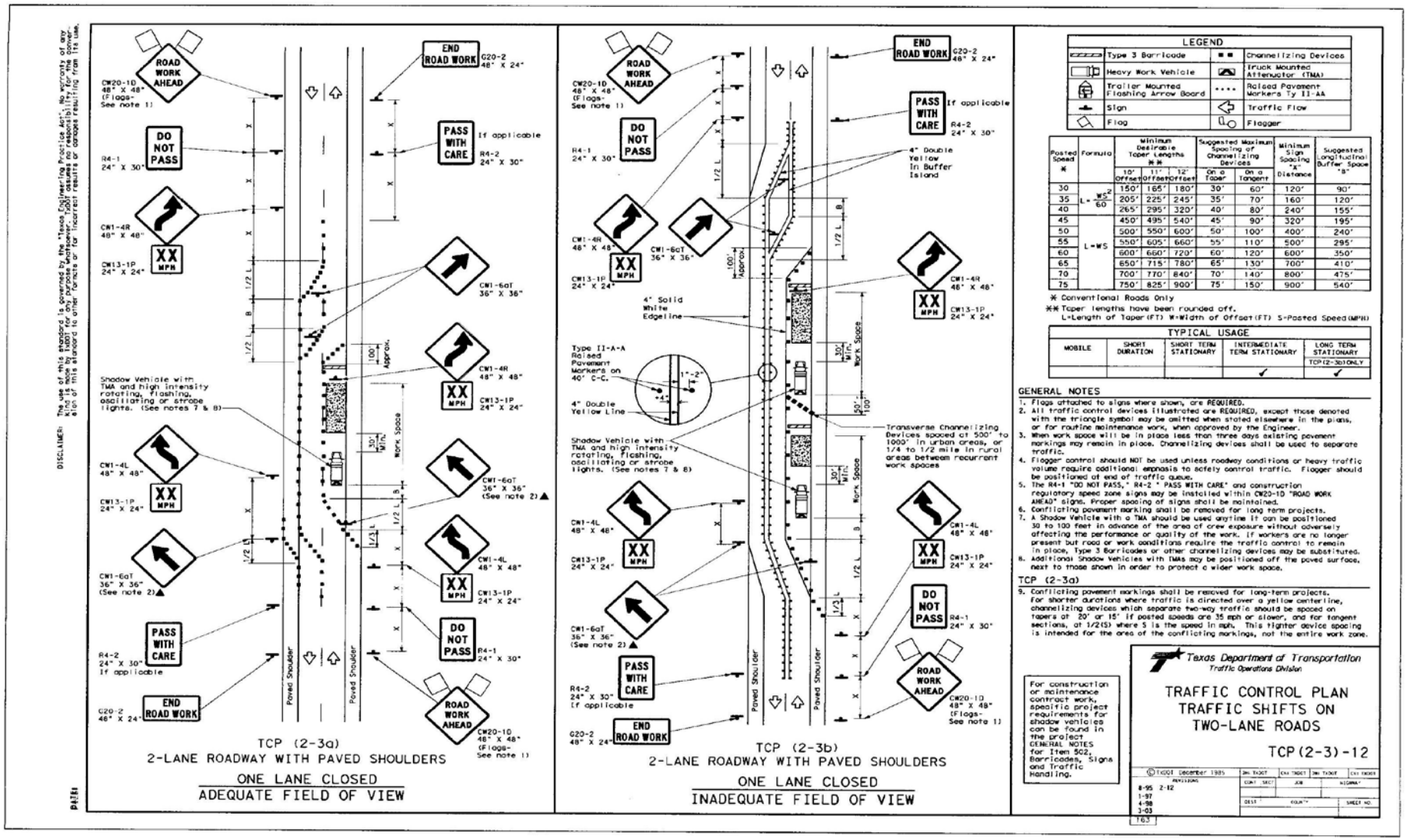
TRAFFIC CONTROL PLAN
ONE-LANE TWO-WAY
TRAFFIC CONTROL

TCP(2-2)-12

DATE:
FILE:

REVISIONS		DIV. TxDOT	CIV. TxDOT	DIV. TxDOT	CIV. TxDOT
8-95	2-12	CONT.	SECT.	JOB	HIGHWAY
1-97					
4-98		DIST.	COUNTY		SHEET NO.
3-03					

162


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.
ROAD WORK AHEAD
CW20-1D 48" X 48" (Flags- See note 1)
DO NOT PASS
R4-1 24" X 30"
CW1-4R 48" X 48"
XX MPH
CW13-1P 24" X 24"
END ROAD WORK
G20-2 48" X 24"
PASS WITH CARE
R4-2 24" X 30"
If applicable
CW1-6aT 36" X 36"
CW1-4L 48" X 48"
CW1-6aT 36" X 36" (See note 2)▲
Shadow Vehicle with TMA and high intensity rotating, flashing, oscillating or strobe lights. (See notes 7 & 8)
100' Approx.
30' Min.
Work Space
Paved Shoulder
TCP (2-3a)
2-LANE ROADWAY WITH PAVED SHOULDERS
ONE LANE CLOSED
ADEQUATE FIELD OF VIEW
4" Solid White Edgeline
Type II-A-A Raised Pavement Markers on 40' C-C.
4" Double Yellow Line
Transverse Channelizing Devices spaced at 500' to 1000' in urban areas, or 1/4 to 1/2 mile in rural areas between recurrent work spaces
TCP (2-3b)
2-LANE ROADWAY WITH PAVED SHOULDERS
ONE LANE CLOSED
INADEQUATE FIELD OF VIEW
LEGEND
Type 3 Barricade
Channelizing Devices
Heavy Work Vehicle
Truck Mounted Attenuator (TMA)
Trailer Mounted Flashing Arrow Board
Raised Pavement Markers Ty II-AA
Sign
Traffic Flow
Flag
Flagger
Posted Speed *
Formula
Minimum Desirable Taper Lengths **
Suggested Maximum Spacing of Channelizing Devices
Minimum Sign Spacing "X" Distance
Suggested Longitudinal Buffer Space "B"
10' Offset
11' Offset
12' Offset
On a Taper
On a Tangent
30 L=WS²/60 150' 165' 180' 30' 60' 120' 90'
35 205' 225' 245' 35' 70' 160' 120'
40 265' 295' 320' 40' 80' 240' 155'
45 L=WS 450' 495' 540' 45' 90' 320' 195'
50 500' 550' 600' 50' 100' 400' 240'
55 550' 605' 660' 55' 110' 500' 295'
60 600' 660' 720' 60' 120' 600' 350'
65 650' 715' 780' 65' 130' 700' 410'
70 700' 770' 840' 70' 140' 800' 475'
75 750' 825' 900' 75' 150' 900' 540'
* Conventional Roads Only
** Taper lengths have been rounded off.
L=Length of Taper(FT) W=Width of Offset(FT) S=Posted Speed(MPH)
TYPICAL USAGE
MOBILE
SHORT DURATION
SHORT TERM STATIONARY
INTERMEDIATE TERM STATIONARY
LONG TERM STATIONARY
TCP(2-3b)ONLY
GENERAL NOTES
1. Flags attached to signs where shown, are REQUIRED.
2. All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated elsewhere in the plans, or for routine maintenance work, when approved by the Engineer.
3. When work space will be in place less than three days existing pavement markings may remain in place. Channelizing devices shall be used to separate traffic.
4. Flagger control should NOT be used unless roadway conditions or heavy traffic volume require additional emphasis to safely control traffic. Flagger should be positioned at end of traffic queue.
5. The R4-1 "DO NOT PASS," R4-2 " PASS WITH CARE" and construction regulatory speed zone signs may be installed within CW20-1D "ROAD WORK AHEAD" signs. Proper spacing of signs shall be maintained.
6. Conflicting pavement marking shall be removed for long term projects.
7. A Shadow Vehicle with a TMA should be used anytime it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the performance or quality of the work. If workers are no longer present but road or work conditions require the traffic control to remain in place, Type 3 Barricades or other channelizing devices may be substituted.
8. Additional Shadow Vehicles with TMAs may be positioned off the paved surface, next to those shown in order to protect a wider work space.
TCP (2-3a)
9. Conflicting pavement markings shall be removed for long-term projects. For shorter durations where traffic is directed over a yellow centerline, channelizing devices which separate two-way traffic should be spaced on tapers at 20' or 15' if posted speeds are 35 mph or slower, and for tangent sections, at 1/2(S) where S is the speed in mph. This tighter device spacing is intended for the area of the conflicting markings, not the entire work zone.
For construction or maintenance contract work, specific project requirements for shadow vehicles can be found in the project GENERAL NOTES for Item 502, Barricades, Signs and Traffic Handling.
Texas Department of Transportation
Traffic Operations Division
TRAFFIC CONTROL PLAN
TRAFFIC SHIFTS ON
TWO-LANE ROADS
TCP(2-3)-12
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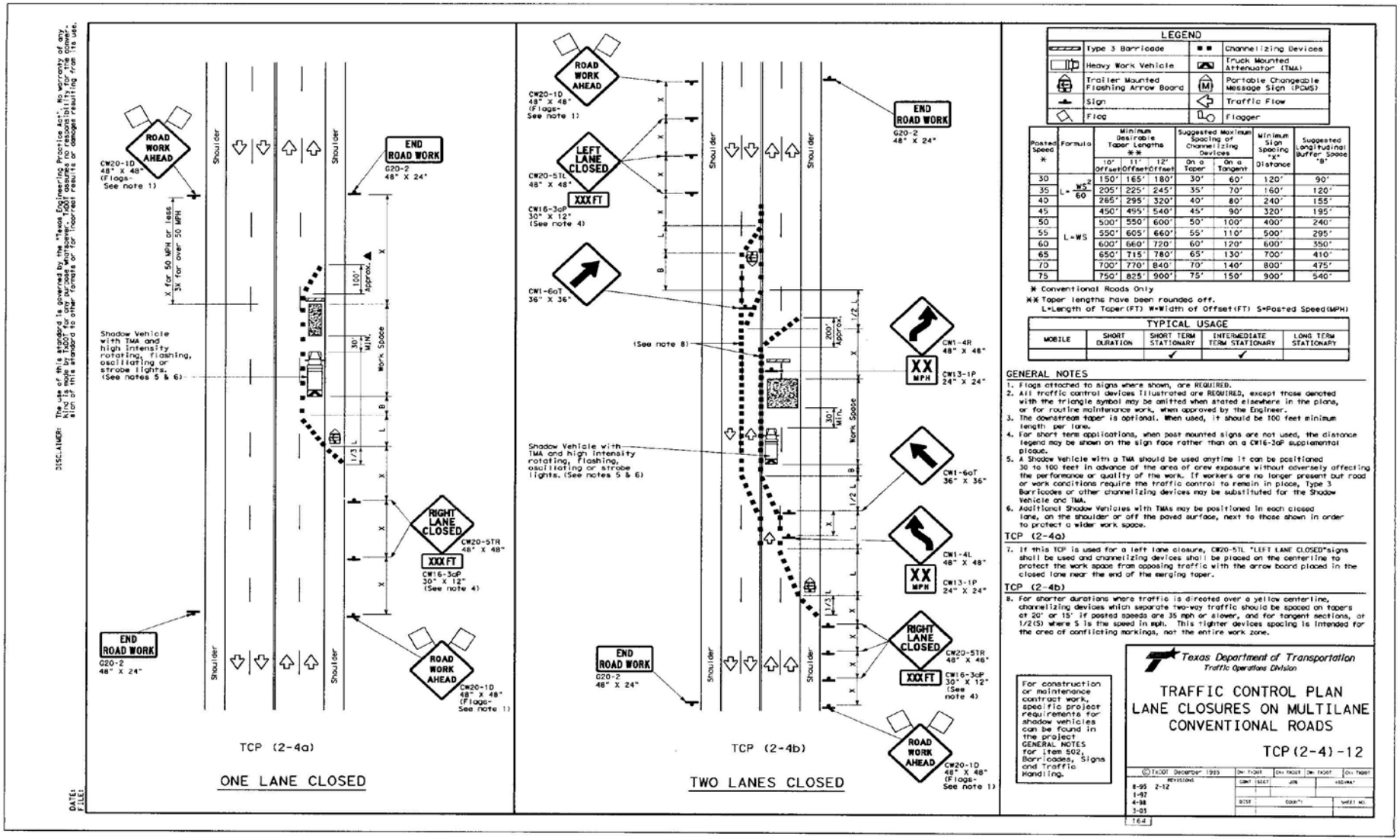
REVISIONS
8-95 2-12
1-97
4-98
3-03
163



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		450'	495'	540'	45'	90'	320'	195'
50	L=WS	500'	550'	600'	50'	100'	400'	240'
55		550'	605'	660'	55'	110'	500'	295'
60		600'	660'	720'	60'	120'	600'	350'
65		650'	715'	780'	65'	130'	700'	410'
70		700'	770'	840'	70'	140'	800'	475'
75		750'	825'	900'	75'	150'	900'	540'

* Conventional Roads Only

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

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

GENERAL NOTES

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

TCP (2-4a)

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

TCP (2-4b)

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

For construction or maintenance contract work, specific project requirements for shadow vehicles can be found in the project GENERAL NOTES for Item 502, Barricades, Signs and Traffic Handling.

Texas Department of Transportation
Traffic Operations Division

TRAFFIC CONTROL PLAN LANE CLOSURES ON MULTILANE CONVENTIONAL ROADS

TCP(2-4)-12

DATE:
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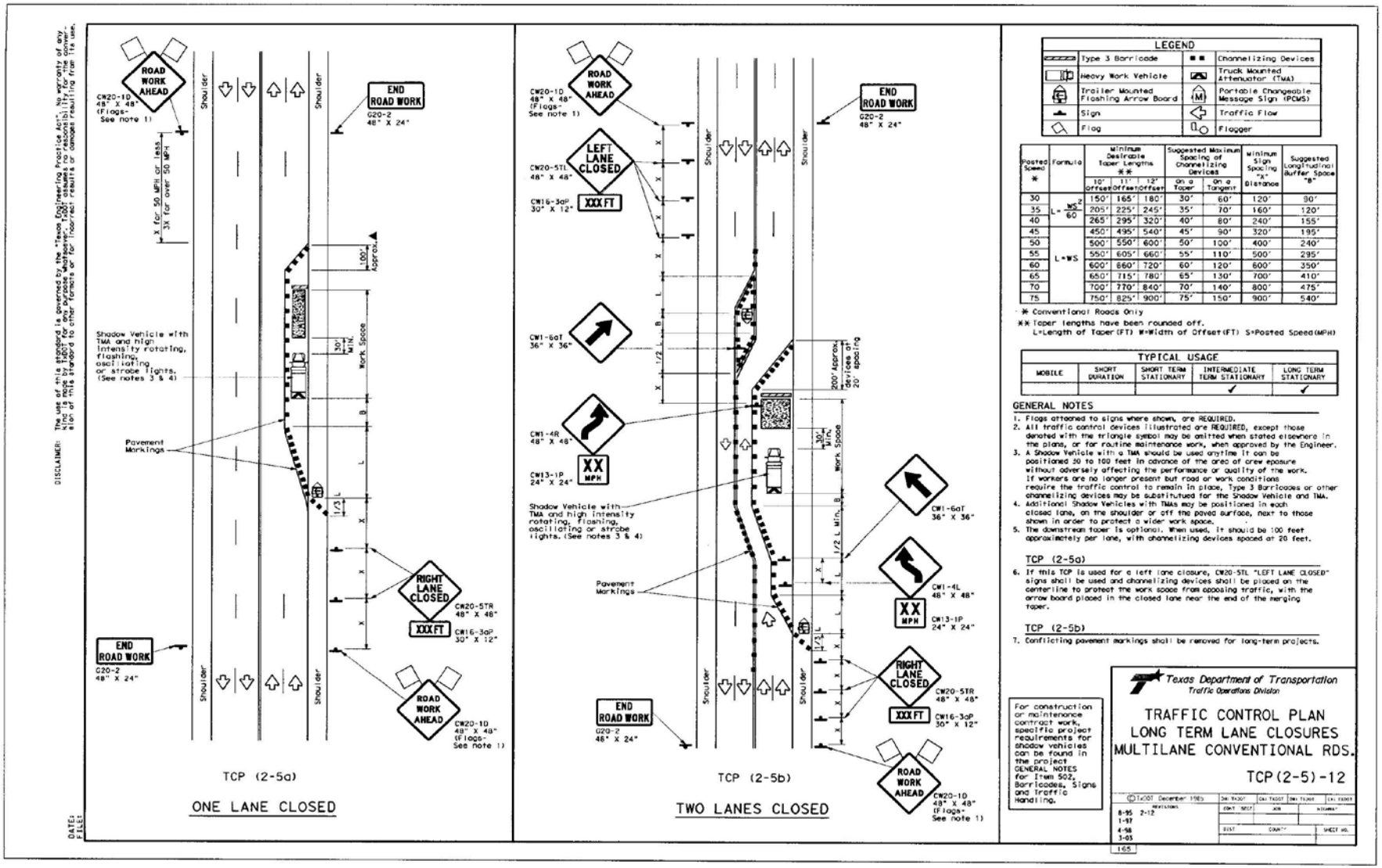
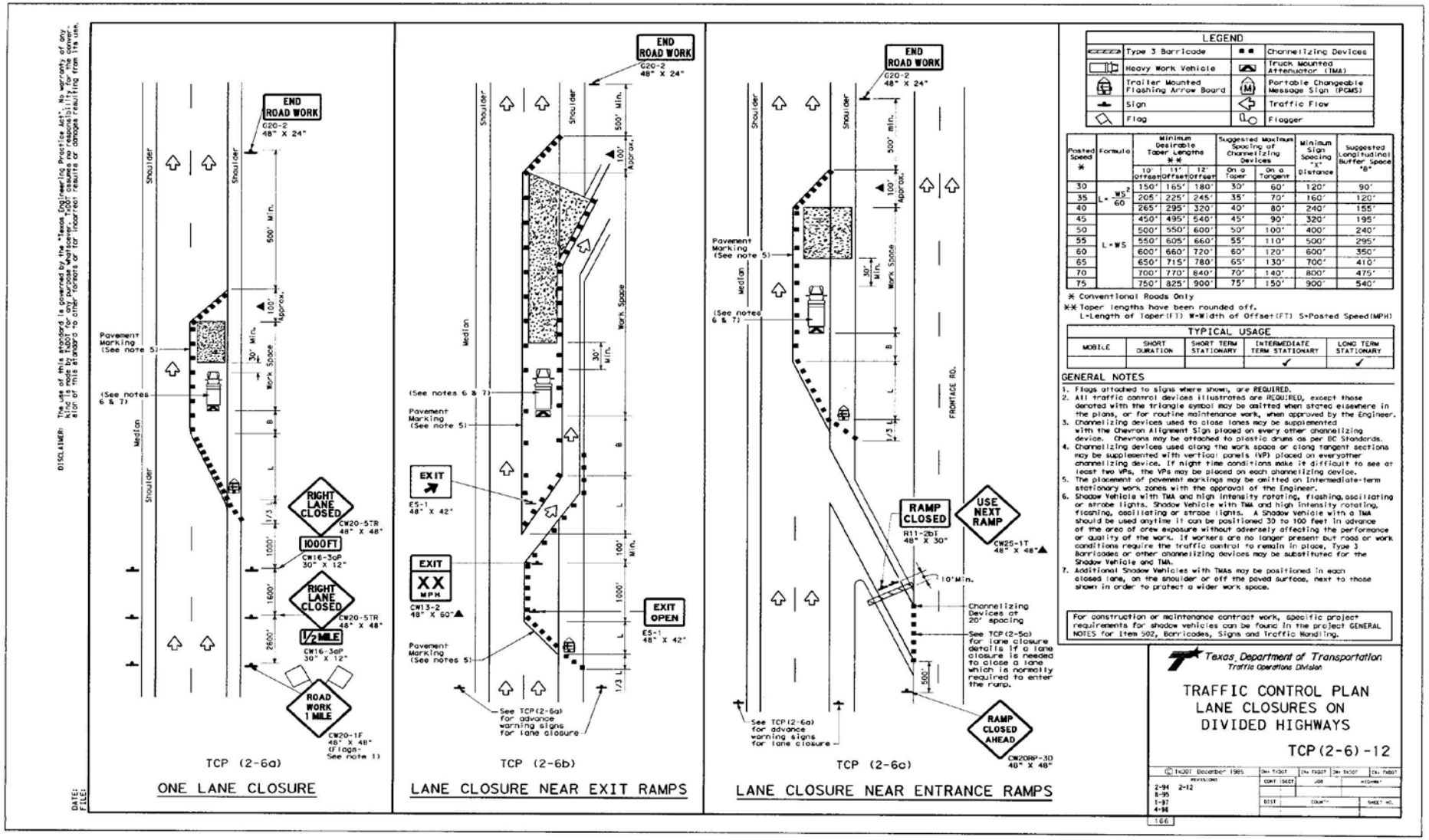
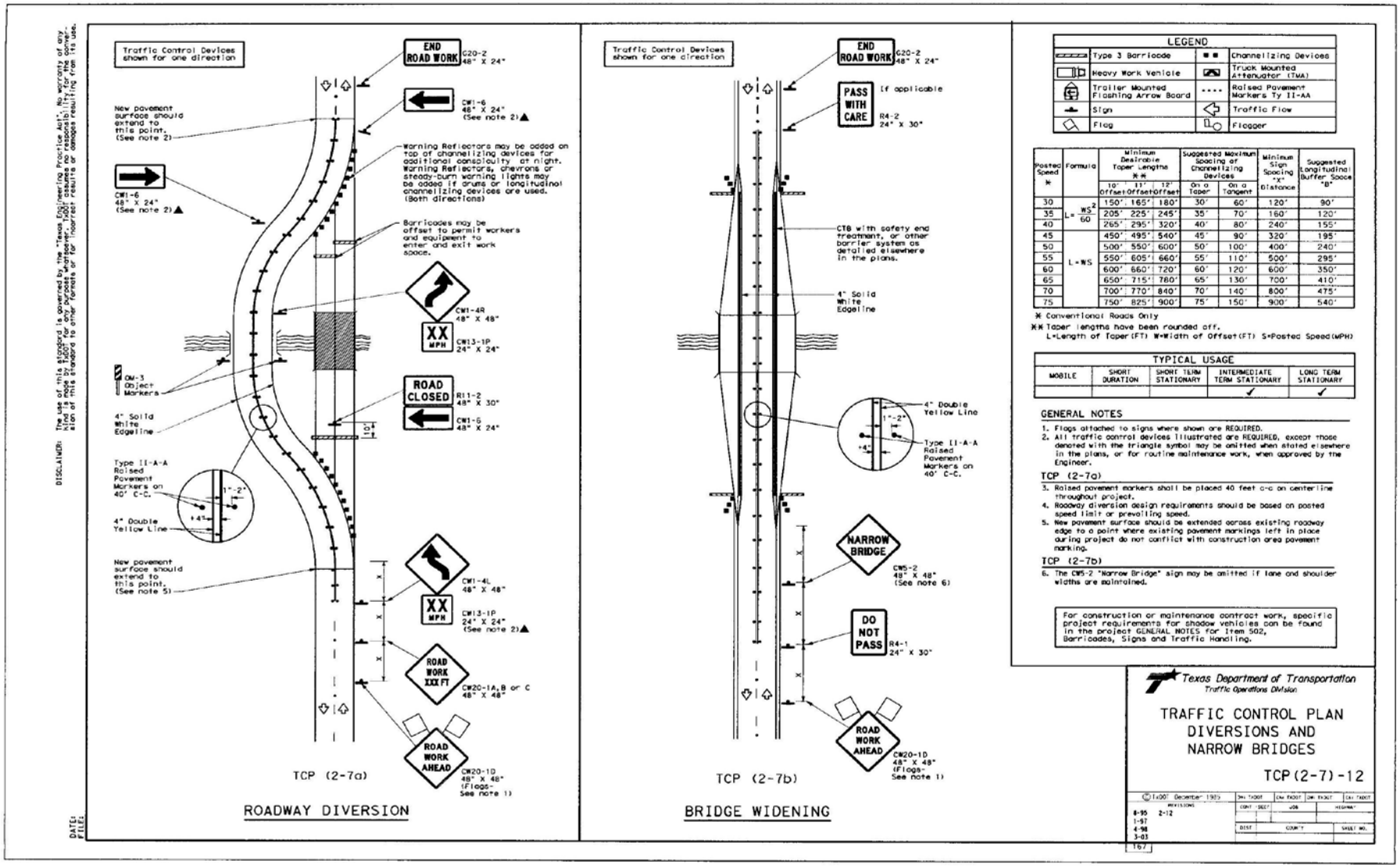


Posted Speed *	Formula	Minimum Desirable Taper Lengths ** 10' Offset	11' Offset	12' Offset	Suggested Maximum Spacing of Channelizing Devices On a Taper	On a Tangent	Minimum Sign Spacing "X" Distance	Suggested Longitudinal Buffer Space "B"
30	$L=\frac{WS^2}{60}$	150'	165'	180'	30'	60'	120'	90'
35		205'	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)


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.
END ROAD WORK
C20-2
48" X 24"
Shoulder
Median
Pavement Marking (See note 5)
(See notes 6 & 7)
500' Min.
100' Approx.
30' Min.
Work Space
RIGHT LANE CLOSED
CW20-5TR
48" X 48"
1000FT
CW16-3aP
30" X 12"
1600'
2600'
1/2 MILE
ROAD WORK 1 MILE
CW20-1F
48" X 48"
(Flags-See note 1)
TCP (2-6a)
ONE LANE CLOSURE
EXIT
E5-1
48" X 42"
XX MPH
CW13-2
48" X 60"
EXIT OPEN
See TCP(2-6a) for advance warning signs for lane closure
TCP (2-6b)
LANE CLOSURE NEAR EXIT RAMPS
RAMP CLOSED
R11-2DT
48" X 30"
USE NEXT RAMP
CW25-1T
48" X 48"
FRONTAGE RD.
10' Min.
Channelizing Devices at 20' spacing
See TCP(2-5a) for lane closure details if a lane closure is needed to close a lane which is normally required to enter the ramp.
500'
RAMP CLOSED AHEAD
CW20RP-3D
48" X 48"
TCP (2-6c)
LANE CLOSURE NEAR ENTRANCE RAMPS
LEGEND
Type 3 Barricade
Channelizing Devices
Heavy Work Vehicle
Truck Mounted Attenuator (TMA)
Trailer Mounted Flashing Arrow Board
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=WS²/60 150' 165' 180' 30' 60' 120' 90'
35 205' 225' 245' 35' 70' 160' 120'
40 265' 295' 320' 40' 80' 240' 155'
45 L=WS 450' 495' 540' 45' 90' 320' 195'
50 500' 550' 600' 50' 100' 400' 240'
55 550' 605' 660' 55' 110' 500' 295'
60 600' 660' 720' 60' 120' 600' 350'
65 650' 715' 780' 65' 130' 700' 410'
70 700' 770' 840' 70' 140' 800' 475'
75 750' 825' 900' 75' 150' 900' 540'
* Conventional Roads Only
** Taper lengths have been rounded off.
L=Length of Taper(FT) W=Width of Offset(FT) S=Posted Speed(MPH)
TYPICAL USAGE
MOBILE
SHORT DURATION
SHORT TERM STATIONARY
INTERMEDIATE TERM STATIONARY ✓
LONG TERM STATIONARY ✓
GENERAL NOTES
1. Flags attached to signs where shown, are REQUIRED.
2. All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated elsewhere in the plans, or for routine maintenance work, when approved by the Engineer.
3. Channelizing devices used to close lanes may be supplemented with the Chevron Alignment Sign placed on every other channelizing device. Chevrons may be attached to plastic drums as per BC Standards.
4. Channelizing devices used along the work space or along tangent sections may be supplemented with vertical panels (VP) placed on everyother channelizing device. If night time conditions make it difficult to see at least two VPs, the VPs may be placed on each channelizing device.
5. The placement of pavement markings may be omitted on Intermediate-term stationary work zones with the approval of the Engineer.
6. Shadow Vehicle with TMA and high intensity rotating, flashing, oscillating or strobe lights. Shadow Vehicle with TMA and high intensity rotating, flashing, oscillating or strobe lights. A Shadow Vehicle with a TMA should be used anytime it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the performance or quality of the work. If workers are no longer present but road or work conditions require the traffic control to remain in place, Type 3 Barricades or other channelizing devices may be substituted for the Shadow Vehicle and TMA.
7. Additional Shadow Vehicles with TMAs may be positioned in each closed lane, on the shoulder or off the paved surface, next to those shown in order to protect a wider work space.
For construction or maintenance contract work, specific project requirements for shadow vehicles can be found in the project GENERAL NOTES for Item 502, Barricades, Signs and Traffic Handling.
Texas Department of Transportation
Traffic Operations Division
TRAFFIC CONTROL PLAN
LANE CLOSURES ON
DIVIDED HIGHWAYS
TCP(2-6)-12
© TxDOT December 1985
DATE:
FILE:
2-94 2-12
8-95
1-97
4-98
166


Traffic Control Devices shown for one direction
END ROAD WORK G20-2 48" X 24"
CW1-6 48" X 24" (See note 2)▲
New pavement surface should extend to this point. (See note 2)
Warning Reflectors may be added on top of channelizing devices for additional conspicuity at night. Warning Reflectors, chevrons or steady-burn warning lights may be added if drums or longitudinal channelizing devices are used. (Both directions)
Barricades may be offset to permit workers and equipment to enter and exit work space.
CW1-4R 48" X 48"
XX MPH CW13-1P 24" X 24"
ROAD CLOSED R11-2 48" X 30"
CW1-6 48" X 24"
CW1-4L 48" X 48"
XX MPH CW13-1P 24" X 24" (See note 2)▲
ROAD WORK XXX FT CW20-1A,B or C 48" X 48"
ROAD WORK AHEAD CW20-1D 48" X 48" (Flags-See note 1)
CW1-6 48" X 24" (See note 2)▲
CM-3 Object Markers
4" Solid White Edgeline
Type II-A-A Raised Pavement Markers on 40' C-C.
4" Double Yellow Line
New pavement surface should extend to this point. (See note 5)
TCP (2-7a)
ROADWAY DIVERSION
Traffic Control Devices shown for one direction
END ROAD WORK G20-2 48" X 24"
PASS WITH CARE (If applicable) R4-2 24" X 30"
CT8 with safety end treatment, or other barrier system as detailed elsewhere in the plans.
4" Solid White Edgeline
4" Double Yellow Line
Type II-A-A Raised Pavement Markers on 40' C-C.
NARROW BRIDGE CW5-2 48" X 48" (See note 6)
DO NOT PASS R4-1 24" X 30"
ROAD WORK AHEAD CW20-1D 48" X 48" (Flags-See note 1)
TCP (2-7b)
BRIDGE WIDENING
LEGEND
Type 3 Barricade
Channelizing Devices
Heavy Work Vehicle
Truck Mounted Attenuator (TMA)
Trailer Mounted Flashing Arrow Board
Raised Pavement Markers Ty II-AA
Sign
Traffic Flow
Flag
Flagger
Posted Speed * | Formula | Minimum Desirable Taper Lengths ** 10' Offset | 11' Offset | 12' Offset | Suggested Maximum Spacing of Channelizing Devices On a Taper | On a Tangent | Minimum Sign Spacing "X" Distance | Suggested Longitudinal Buffer Space "B"
30 | L=WS²/60 | 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.
TCP (2-7a)
3. Raised pavement markers shall be placed 40 feet c-c on centerline throughout project.
4. Roadway diversion design requirements should be based on posted speed limit or prevailing speed.
5. New pavement surface should be extended across existing roadway edge to a point where existing pavement markings left in place during project do not conflict with construction area pavement marking.
TCP (2-7b)
6. The CW5-2 "Narrow Bridge" sign may be omitted if lane and shoulder widths are maintained.
For construction or maintenance contract work, specific project requirements for shadow vehicles can be found in the project GENERAL NOTES for Item 502, Barricades, Signs and Traffic Handling.
Texas Department of Transportation
Traffic Operations Division
TRAFFIC CONTROL PLAN
DIVERSIONS AND
NARROW BRIDGES
TCP(2-7)-12
©TxDOT December 1985
REVISIONS
8-95 2-12
1-97
4-98
3-03
DN: TxDOT CK: TxDOT DW: TxDOT CK: TxDOT
CONT SECT JOB HIGHWAY
DIST COUNTY SHEET NO.
167
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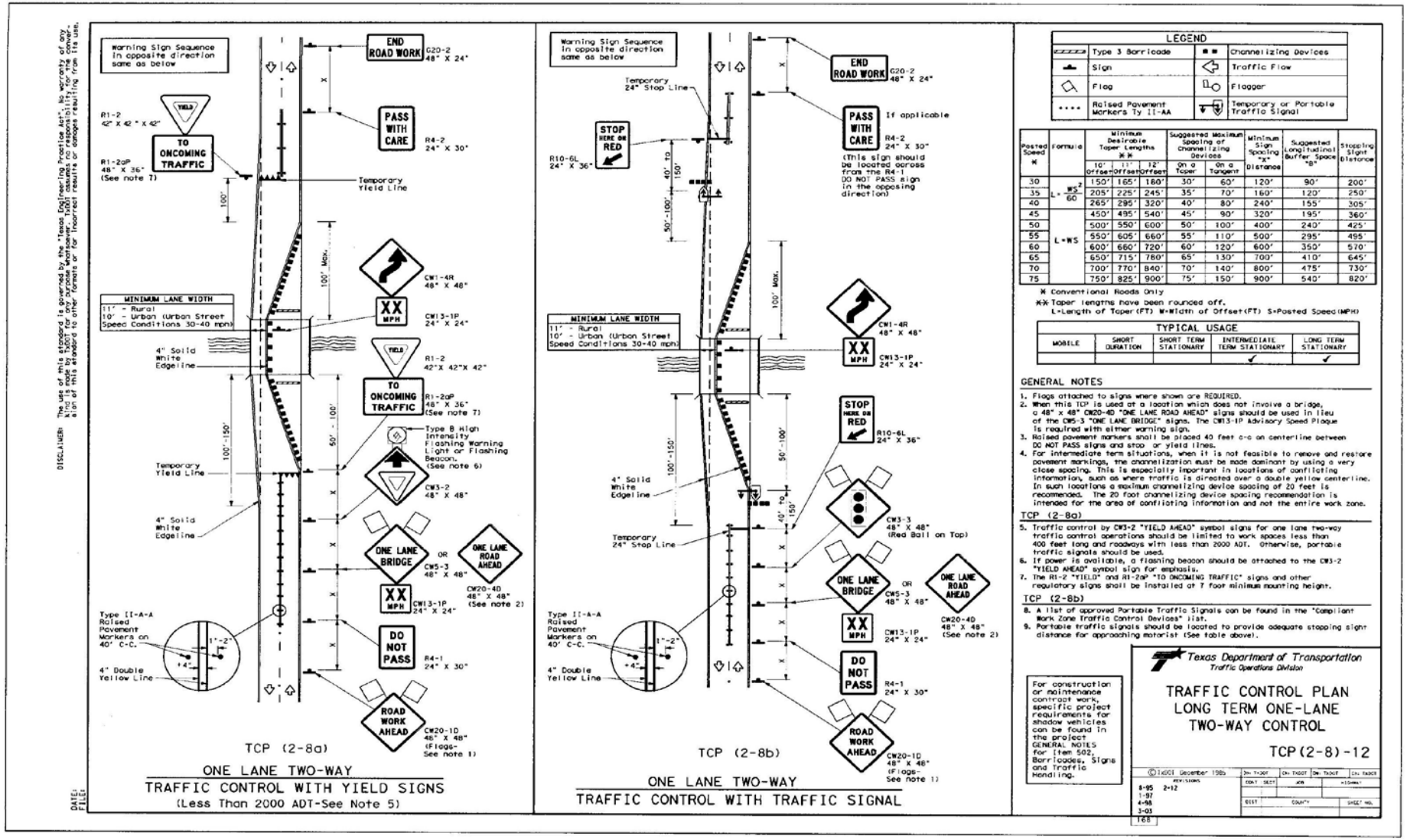
DATE:
FILE:


Warning Sign Sequence in opposite direction same as below
END ROAD WORK G20-2 48" X 24"
PASS WITH CARE R4-2 24" X 30"
R1-2 42" X 42" X 42"
TO ONCOMING TRAFFIC
R1-2aP 48" X 36" (See note 7)
Temporary Yield Line
100' Max.
CW1-4R 48" X 48"
XX MPH CW13-1P 24" X 24"
MINIMUM LANE WIDTH
11' - Rural
10' - Urban (Urban Street Speed Conditions 30-40 mph)
4" Solid White Edgeline
Type B High Intensity Flashing Warning Light or Flashing Beacon. (See note 6)
CW3-2 48" X 48"
100'-150'
50' - 100'
ONE LANE BRIDGE OR CW5-3 48" X 48"
ONE LANE ROAD AHEAD CW20-4D 48" X 48" (See note 2)
Type II-A-A Raised Pavement Markers on 40' C-C.
4" Double Yellow Line
DO NOT PASS R4-1 24" X 30"
ROAD WORK AHEAD CW20-1D 48" X 48" (Flags-See note 1)
TCP (2-8a)
ONE LANE TWO-WAY
TRAFFIC CONTROL WITH YIELD SIGNS
(Less Than 2000 ADT-See Note 5)
Temporary 24" Stop Line
STOP HERE ON RED R10-6L 24" X 36"
If applicable
(This sign should be located across from the R4-1 DO NOT PASS sign in the opposing direction)
40' to 150'
50'-100'
CW3-3 48" X 48" (Red Ball on Top)
TCP (2-8b)
ONE LANE TWO-WAY
TRAFFIC CONTROL WITH TRAFFIC SIGNAL
LEGEND
Type 3 Barricade
Channelizing Devices
Sign
Traffic Flow
Flag
Flagger
Raised Pavement Markers Ty II-AA
Temporary or Portable Traffic Signal
Posted Speed *
Formula
Minimum Desirable Taper Lengths **
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=WS²/60 150' 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. When this TCP is used at a location which does not involve a bridge, a 48" x 48" CW20-4D "ONE LANE ROAD AHEAD" signs should be used in lieu of the CW5-3 "ONE LANE BRIDGE" signs. The CW13-1P Advisory Speed Plaque is required with either warning sign.
3. Raised pavement markers shall be placed 40 feet c-c on centerline between DO NOT PASS signs and stop or yield lines.
4. For intermediate term situations, when it is not feasible to remove and restore pavement markings, the channelization must be made dominant by using a very close spacing. This is especially important in locations of conflicting information, such as where traffic is directed over a double yellow centerline. In such locations a maximum channelizing device spacing of 20 feet is recommended. The 20 foot channelizing device spacing recommendation is intended for the area of conflicting information and not the entire work zone.
TCP (2-8a)
5. Traffic control by CW3-2 "YIELD AHEAD" symbol signs for one lane two-way traffic control operations should be limited to work spaces less than 400 feet long and roadways with less than 2000 ADT. Otherwise, portable traffic signals should be used.
6. If power is available, a flashing beacon should be attached to the CW3-2 "YIELD AHEAD" symbol sign for emphasis.
7. The R1-2 "YIELD" and R1-2aP "TO ONCOMING TRAFFIC" signs and other regulatory signs shall be installed at 7 foot minimum mounting height.
TCP (2-8b)
8. A list of approved Portable Traffic Signals can be found in the "Compliant Work Zone Traffic Control Devices" list.
9. Portable traffic signals should be located to provide adequate stopping sight distance for approaching motorist (See table above).
For construction or maintenance contract work, specific project requirements for shadow vehicles can be found in the project GENERAL NOTES for Item 502, Barricades, Signs and Traffic Handling.
Texas Department of Transportation
Traffic Operations Division
TRAFFIC CONTROL PLAN
LONG TERM ONE-LANE
TWO-WAY CONTROL
TCP(2-8)-12
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REVISIONS
8-95 2-12
1-97
4-98
3-03
168
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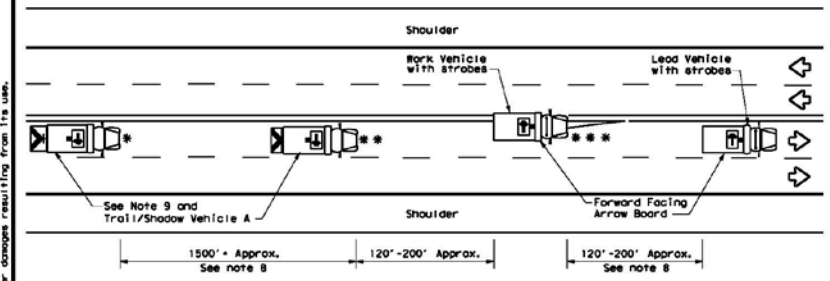
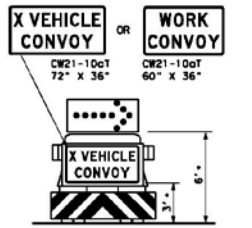


TCP (3-1a)

UNDIVIDED MULTILANE ROADWAY



TRAIL/SHADOW VEHICLE A

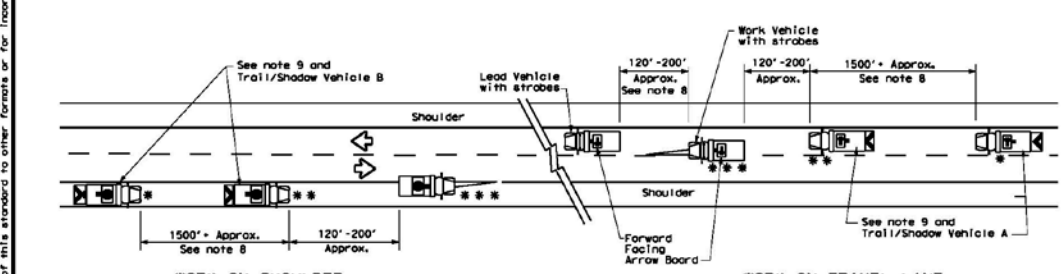
with RIGHT Directional display Flashing Arrow Board

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

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

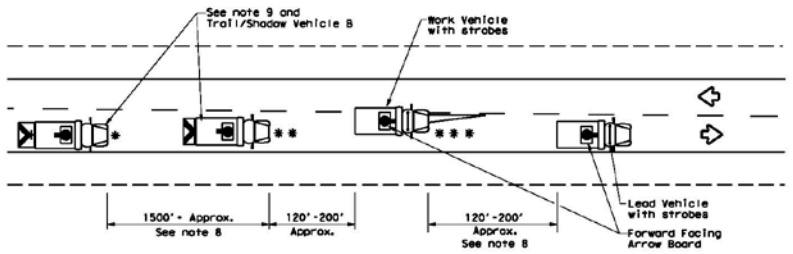
GENERAL NOTES

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" (CW21-10aT) or "WORK CONVOY" (CW21-10aT) signs shall be used on TRAIL VEHICLES and SHADOW VEHICLES as shown. As an option 48" X 48" diamond shaped "WORK CONVOY" (CW21-10T) or "X VEHICLE CONVOY" (CW21-10bT) signs may be used where adequate mounting space exists. When used, the X VEHICLE CONVOY sign shall have the number of the convoy vehicles displayed on the sign in the number designation "X" location. The "X VEHICLE CONVOY" sign shall not be used on the SHADOW VEHICLE if a TRAIL VEHICLE is used.
10. On two-lane two-way roadways, the work and protection vehicles should pull over periodically to allow motor vehicle traffic to pass. If motorists are not allowed to pass the work convoy, a "DO NOT PASS" (R4-1) sign should be placed on the back of the rearmost protection vehicle.



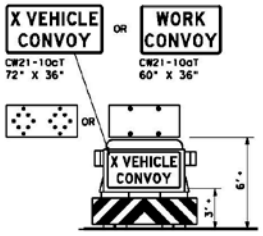
TCP (3-1b)

TWO-WAY ROADWAY WITH PAVED SHOULDERS



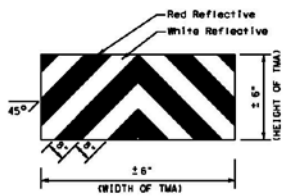
TCP (3-1c)

TWO-WAY ROADWAY WITHOUT PAVED SHOULDERS



TRAIL/SHADOW VEHICLE B

with Flashing Arrow Board in CAUTION display



STRIPING FOR TMA

Texas Department of Transportation — Traffic Operations Division Standard

TRAFFIC CONTROL PLAN MOBILE OPERATIONS UNDIVIDED HIGHWAYS

TCP(3-1)-13

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REVISIONS 2-94 4-98 8-95 7-13 1-97	DIST	COUNTY		SHEET NO.

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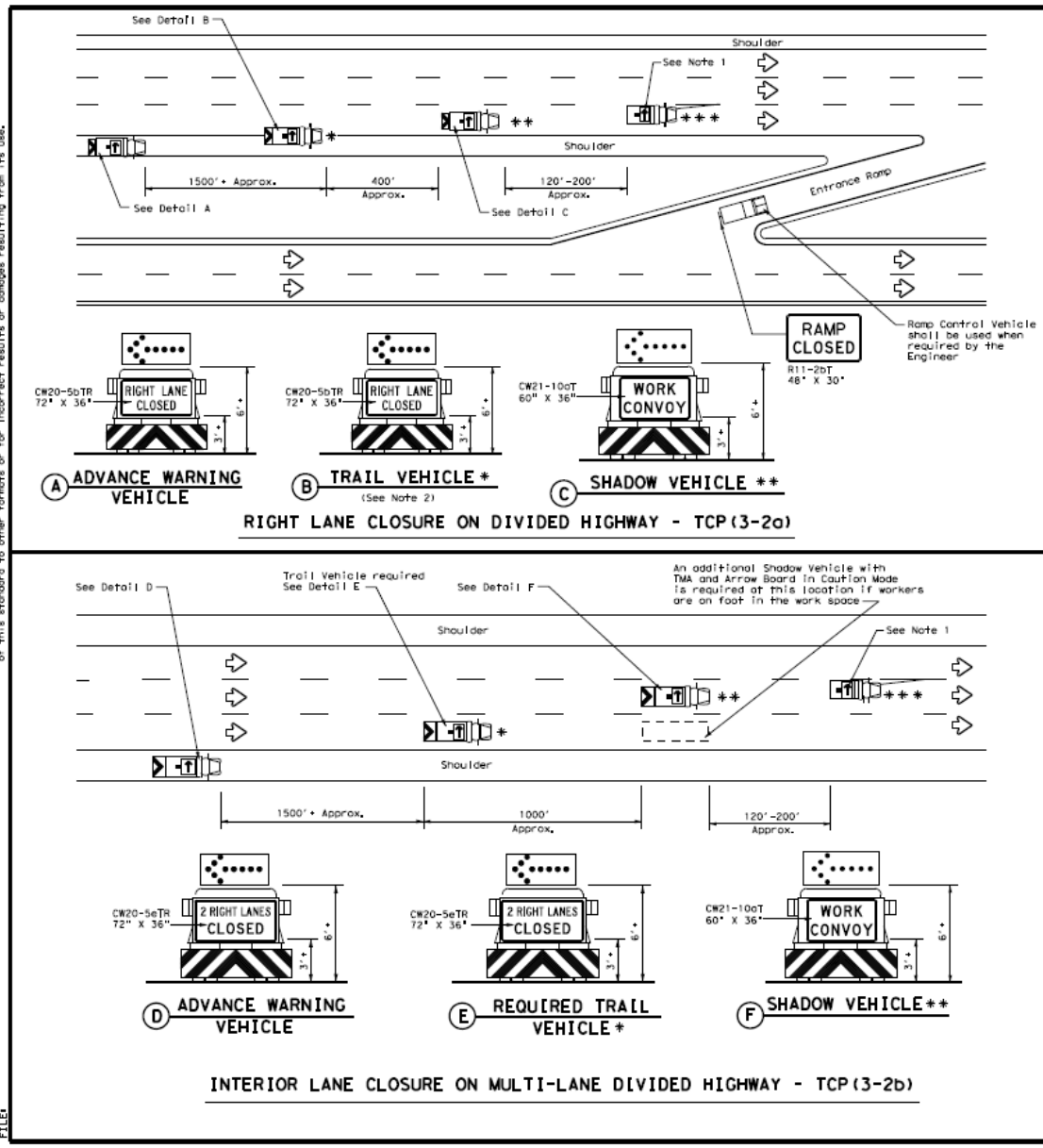
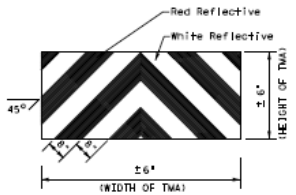


LEGEND			
*	Trail Vehicle	ARROW BOARD DISPLAY	
**	Shadow Vehicle		
***	Work Vehicle		RIGHT Directional
	Heavy Work Vehicle		LEFT Directional
	Truck Mounted Attenuator (TMA)		Double Arrow
	Traffic Flow		CAUTION (Alternating Diamond or 4 Corner Flash)

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

GENERAL NOTES

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

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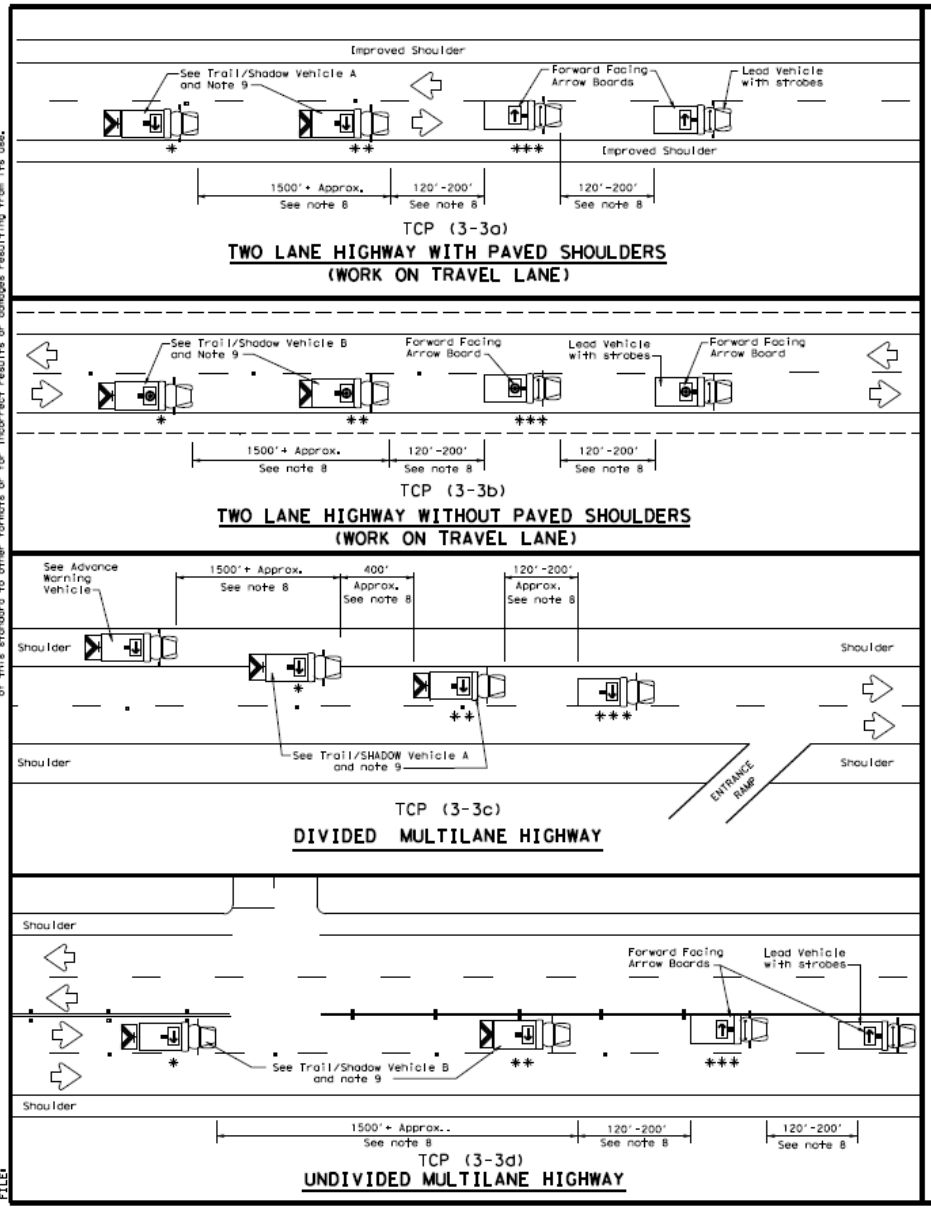
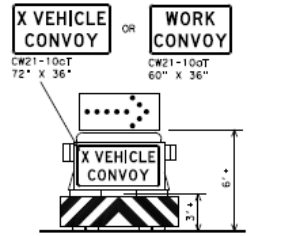
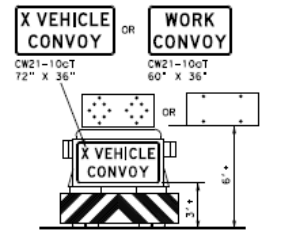




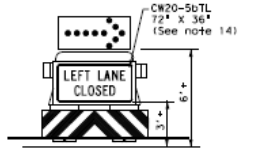
TRAIL/SHADOW VEHICLE A

with RIGHT Directional display
Flashing Arrow Board

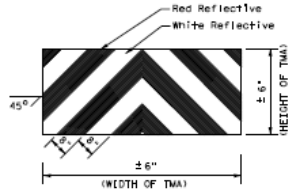


TRAIL/SHADOW VEHICLE B

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 (CW20-5cT) 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

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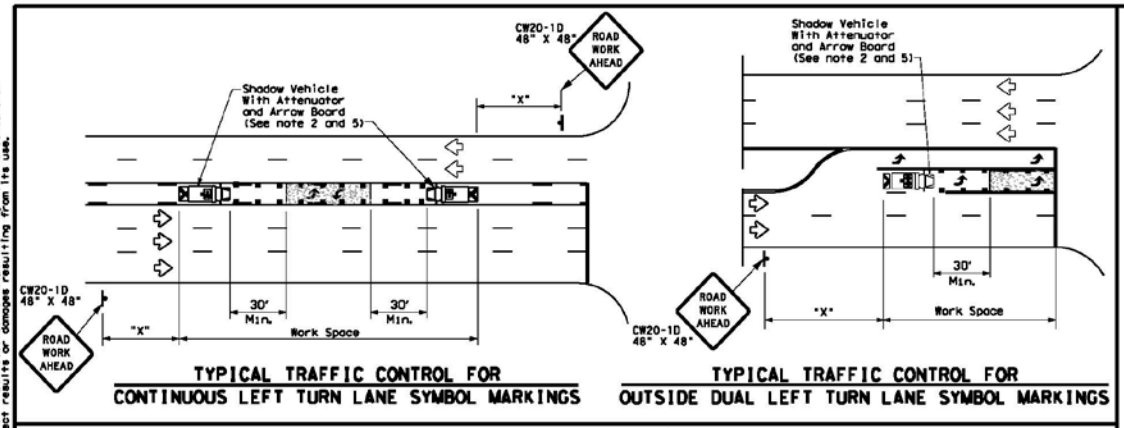
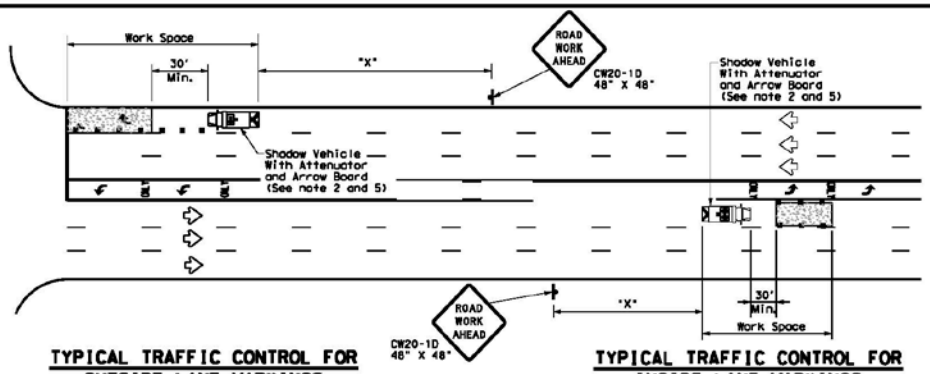


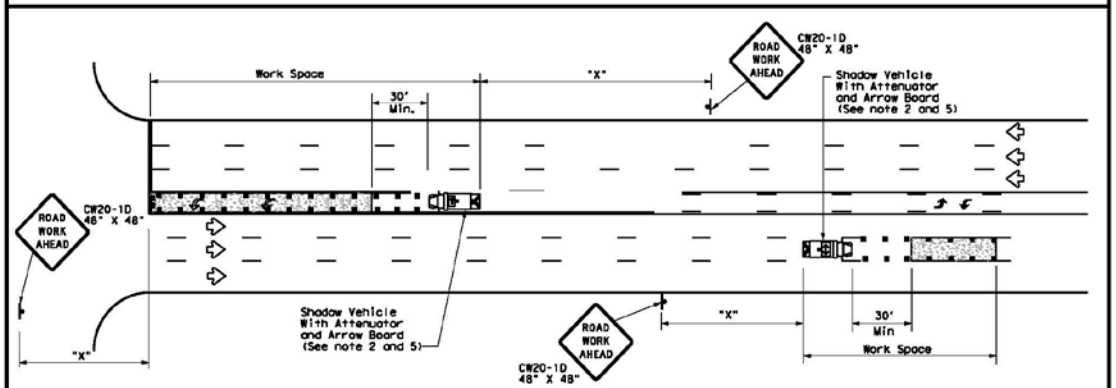
TYPICAL TRAFFIC CONTROL FOR
CONTINUOUS LEFT TURN LANE SYMBOL MARKINGS

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'

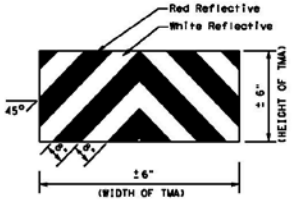
* Conventional Roads Only

** 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

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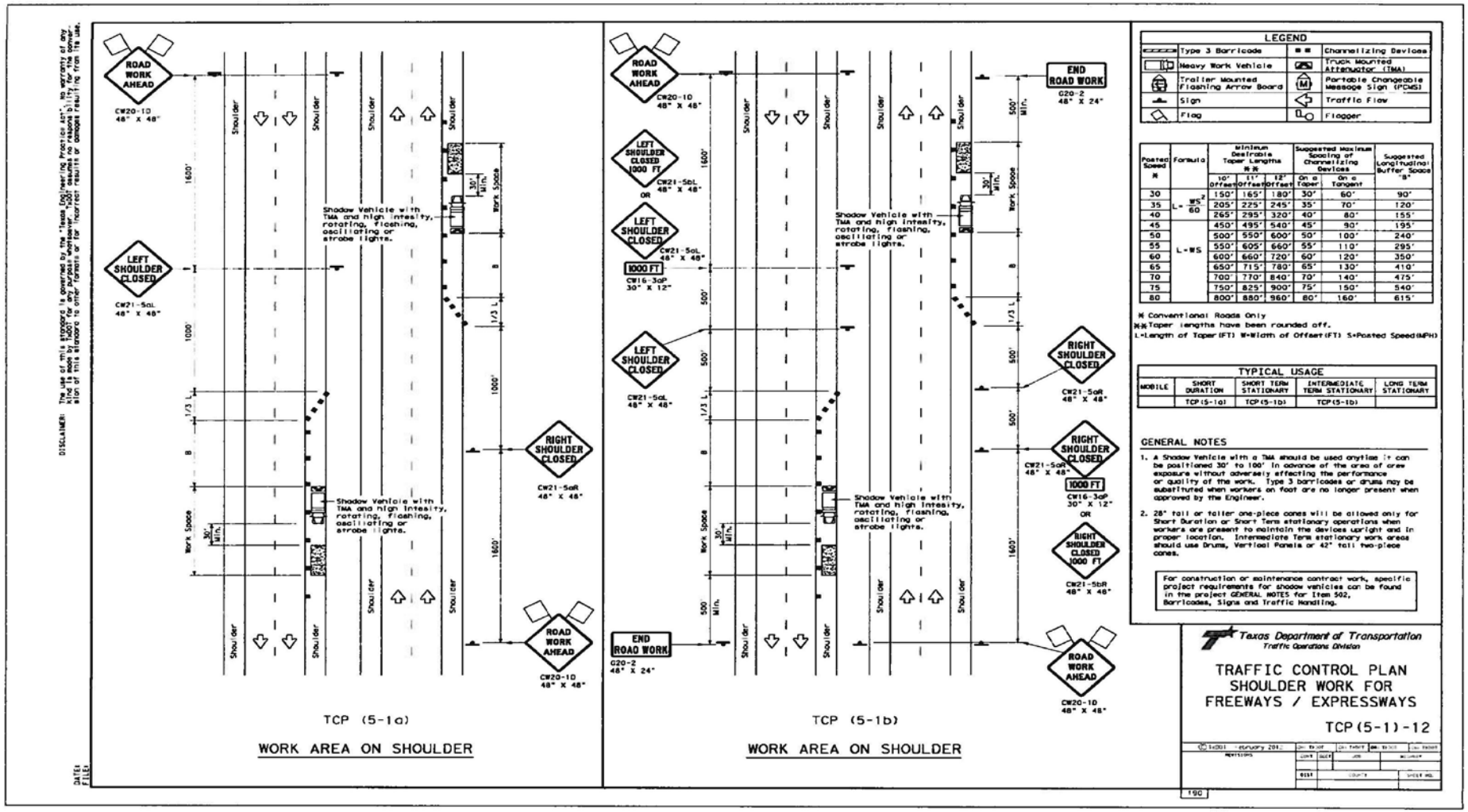


LEGEND			
	Type 3 Barricade	■ ■	Channelizing Devices
	Heavy Work Vehicle		Truck Mounted Attenuator (TMA)
	Trailer Mounted Flashing Arrow Board	M	Portable Changeable Message Sign (PCMS)
	Sign		Traffic Flow
	Flag		Flagger

Posted Speed MPH	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= WS²/60	150'	165'	180'	30'	60'	90'
35		205'	225'	245'	35'	70'	120'
40		265'	295'	320'	40'	80'	155'
45	L=WS	450'	495'	540'	45'	90'	195'
50		500'	550'	600'	50'	100'	240'
55		550'	605'	660'	55'	110'	295'
60		600'	660'	720'	60'	120'	350'
65		650'	715'	780'	65'	130'	410'
70		700'	770'	840'	70'	140'	475'
75		750'	825'	900'	75'	150'	540'
80		800'	880'	960'	80'	160'	615'

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

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

GENERAL NOTES

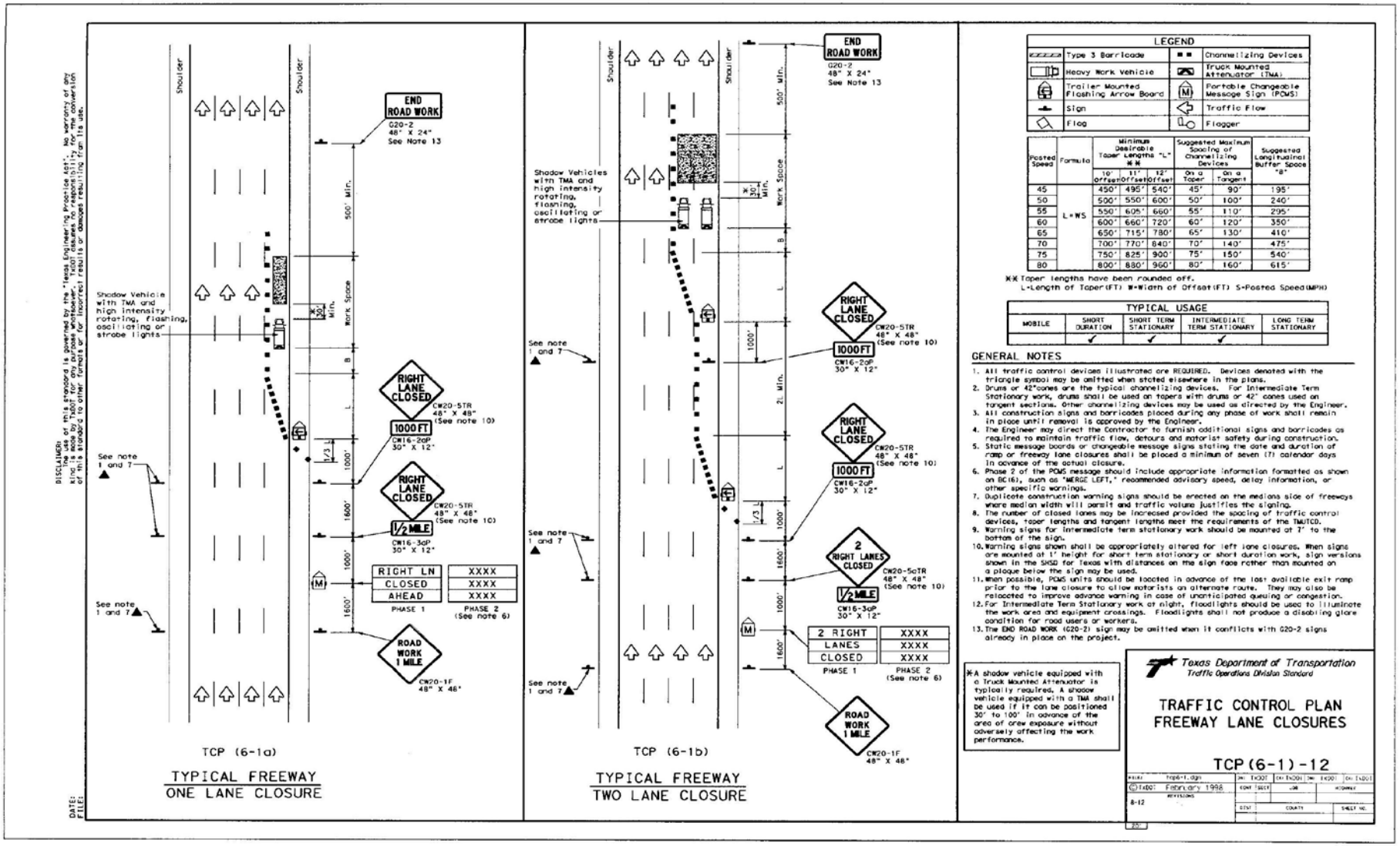
1. A Shadow Vehicle with a TMA should be used anytime it can be positioned 30' to 100' in advance of the area of crew exposure without adversely affecting the performance or quality of the work. Type 3 barricades or drums may be substituted when workers on foot are no longer present when approved by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

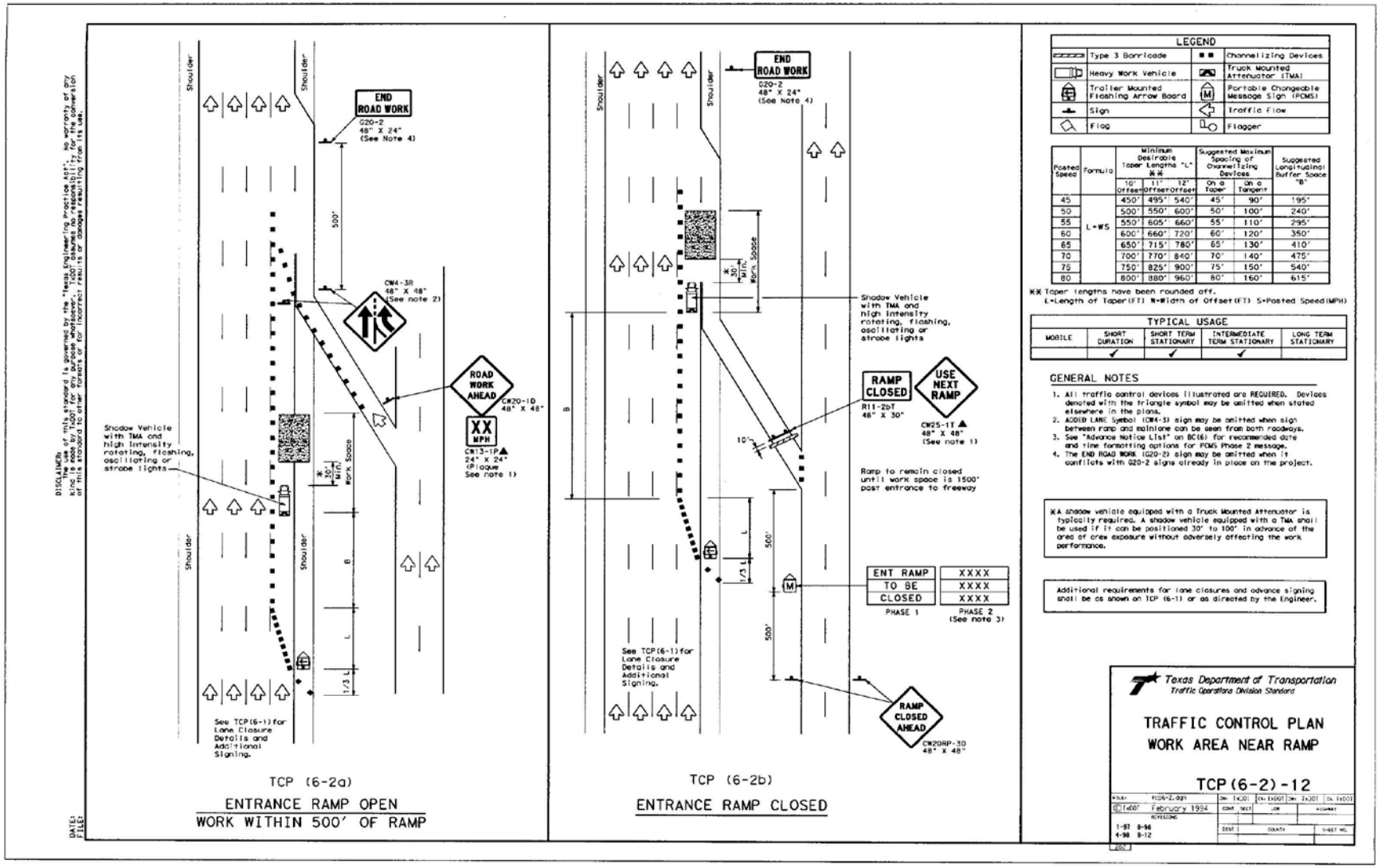
For construction or maintenance contract work, specific project requirements for shadow vehicles can be found in the project GENERAL NOTES for Item 502, Barricades, Signs and Traffic Handling.

Texas Department of Transportation
Traffic Operations Division

TRAFFIC CONTROL PLAN
SHOULDER WORK FOR
FREEWAYS / EXPRESSWAYS

TCP(5-1)-12


END ROAD WORK
G20-2
48" X 24"
See Note 13
Shoulder
Shadow Vehicle with TMA and high intensity rotating, flashing, oscillating or strobe lights
See note 1 and 7
RIGHT LANE CLOSED
CW20-5TR
48" X 48"
(See note 10)
1000 FT
CW16-2aP
30" X 12"
½ MILE
CW16-3aP
30" X 12"
RIGHT LN CLOSED AHEAD
XXXX
XXXX
XXXX
PHASE 1
PHASE 2
(See note 6)
ROAD WORK 1 MILE
CW20-1F
48" X 48"
500' Min.
Work Space
1000'
1600'
TCP (6-1a)
TYPICAL FREEWAY
ONE LANE CLOSURE
Shadow Vehicles with TMA and high intensity rotating, flashing, oscillating or strobe lights
2 RIGHT LANES CLOSED
CW20-5aTR
48" X 48"
2 RIGHT LANES CLOSED
XXXX
XXXX
XXXX
TCP (6-1b)
TYPICAL FREEWAY
TWO LANE CLOSURE
LEGEND
Type 3 Barricade
Channelizing Devices
Heavy Work Vehicle
Truck Mounted Attenuator (TMA)
Trailer Mounted Flashing Arrow Board
Portable Changeable Message Sign (PCMS)
Sign
Traffic Flow
Flag
Flagger
Posted Speed
Formula
Minimum Desirable Taper Lengths "L" ** W
10' Offset
11' Offset
12' Offset
Suggested Maximum Spacing of Channelizing Devices
On a Taper
On a Tangent
Suggested Longitudinal Buffer Space "B"
45 450' 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'
L=WS
** 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 11' 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
tcp6-1.dgn
©TxDOT February 1998
8-12
DATE:
FILE:


END ROAD WORK
G20-2
48" X 24"
(See Note 4)
500'
CW4-3R
48" X 48"
(See note 2)
ROAD WORK AHEAD
CW20-1D
48" X 48"
XX MPH
CW13-1P▲
24" X 24"
(Plaque
See note 1)
Shadow Vehicle with TMA and high intensity rotating, flashing, oscillating or strobe lights
*35' Min. Work Space
B
L
1/3 L
Shoulder
See TCP(6-1) for Lane Closure Details and Additional Signing.
TCP (6-2a)
ENTRANCE RAMP OPEN
WORK WITHIN 500' OF RAMP
Shadow Vehicle with TMA and high intensity rotating, flashing, oscillating or strobe lights
RAMP CLOSED
R11-2bT
48" X 30"
USE NEXT RAMP
CW25-1T▲
48" X 48"
(See note 1)
10'
Ramp to remain closed until work space is 1500' past entrance to freeway
ENT RAMP TO BE CLOSED
XXXX
XXXX
XXXX
PHASE 1
PHASE 2
(See note 3)
RAMP CLOSED AHEAD
CW20RP-3D
48" X 48"
TCP (6-2b)
ENTRANCE RAMP CLOSED
LEGEND
Type 3 Barricade
Channelizing Devices
Heavy Work Vehicle
Truck Mounted Attenuator (TMA)
Trailer Mounted Flashing Arrow Board
Portable Changeable Message Sign (PCMS)
Sign
Traffic Flow
Flag
Flagger
Posted Speed | Formula | Minimum Desirable Taper Lengths "L" ** 10' Offset | 11' Offset | 12' Offset | Suggested Maximum Spacing of Channelizing Devices On a Taper | On a Tangent | Suggested Longitudinal Buffer Space "B"
45 | L=WS | 450' | 495' | 540' | 45' | 90' | 195'
50 | | 500' | 550' | 600' | 50' | 100' | 240'
55 | | 550' | 605' | 660' | 55' | 110' | 295'
60 | | 600' | 660' | 720' | 60' | 120' | 350'
65 | | 650' | 715' | 780' | 65' | 130' | 410'
70 | | 700' | 770' | 840' | 70' | 140' | 475'
75 | | 750' | 825' | 900' | 75' | 150' | 540'
80 | | 800' | 880' | 960' | 80' | 160' | 615'
** Taper lengths have been rounded off.
L=Length of Taper(FT) W=Width of Offset(FT) S=Posted Speed(MPH)
TYPICAL USAGE
MOBILE | SHORT DURATION | SHORT TERM STATIONARY | INTERMEDIATE TERM STATIONARY | LONG TERM STATIONARY
✓ ✓ ✓
GENERAL NOTES
1. All traffic control devices illustrated are REQUIRED. Devices denoted with the triangle symbol may be omitted when stated elsewhere in the plans.
2. ADDED LANE Symbol (CW4-3) sign may be omitted when sign between ramp and mainlane can be seen from both roadways.
3. See "Advance Notice List" on BC(6) for recommended date and time formatting options for PCMS Phase 2 message.
4. The END ROAD WORK (G20-2) sign may be omitted when it conflicts with G20-2 signs already in place on the project.
*A shadow vehicle equipped with a Truck Mounted Attenuator is typically required. A shadow vehicle equipped with a TMA shall be used if it can be positioned 30' to 100' in advance of the area of crew exposure without adversely affecting the work performance.
Additional requirements for lane closures and advance signing shall be as shown on TCP (6-1) or as directed by the Engineer.
Texas Department of Transportation
Traffic Operations Division Standard
TRAFFIC CONTROL PLAN
WORK AREA NEAR RAMP
TCP(6-2)-12
DISCLAIMER:
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DATE:
FILE:
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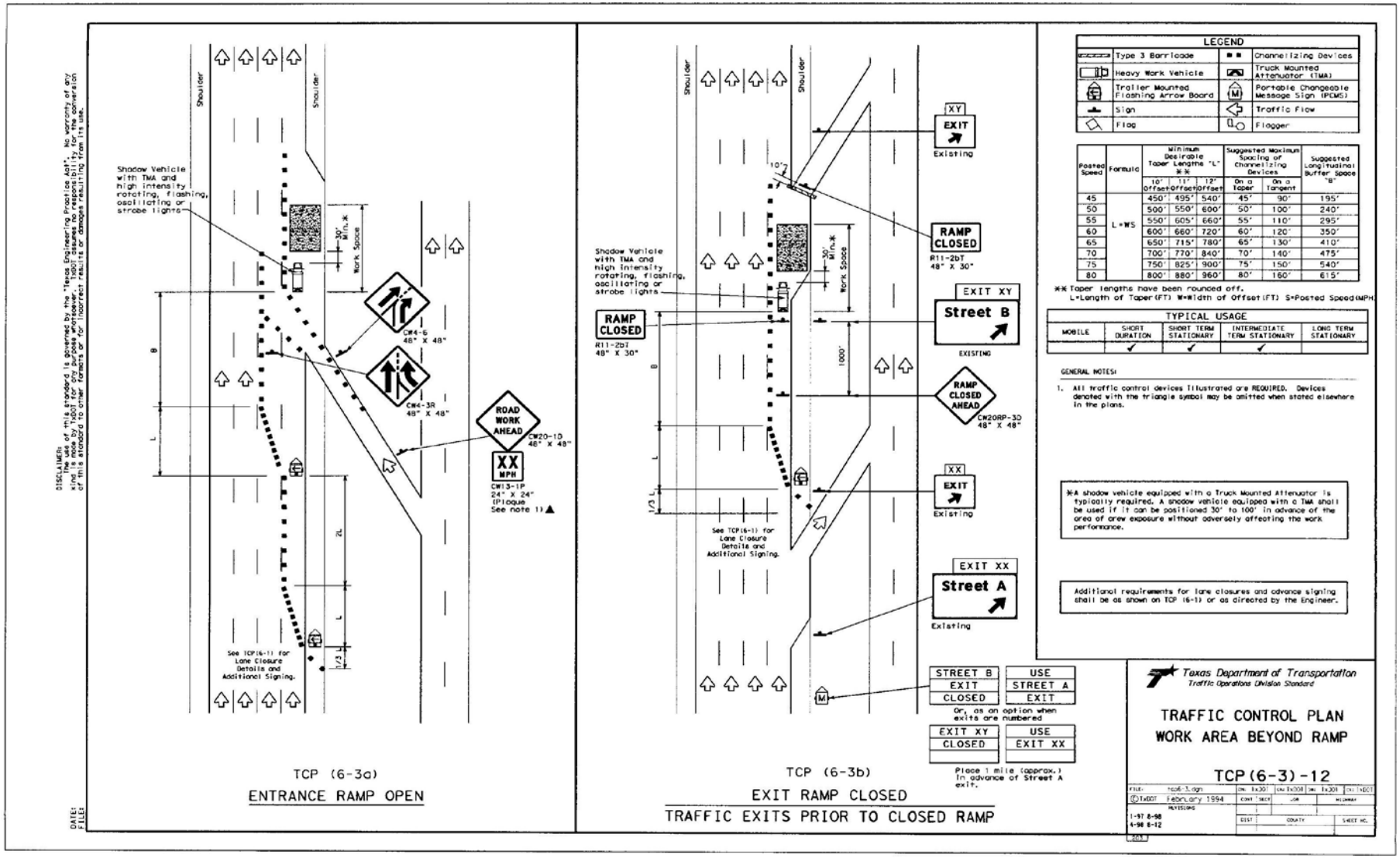
REVISIONS
1-97 8-96
4-98 8-12


DISCLAIMER:
The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by the Texas Department of Transportation for any purpose whatsoever. The Texas Department of Transportation shall not be responsible for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.
DATE:
FILE:
Shadow Vehicle with TMA and high intensity rotating, flashing, oscillating or strobe lights
Shoulder
Shoulder
30' Min.*
Work Space
CW4-6 48" X 48"
CW4-3R 48" X 48"
ROAD WORK AHEAD
CW20-1D 48" X 48"
XX MPH
CW13-1P 24" X 24" (Plaque See note 1)▲
B
L
2L
L
1/3 L
See TCP(6-1) for Lane Closure Details and Additional Signing.
TCP (6-3a)
ENTRANCE RAMP OPEN
Shadow Vehicle with TMA and high intensity rotating, flashing, oscillating or strobe lights
RAMP CLOSED
R11-2bT 48" X 30"
XY
EXIT
Existing
RAMP CLOSED
R11-2bT 48" X 30"
EXIT XY
Street B
EXISTING
RAMP CLOSED AHEAD
CW20RP-3D 48" X 48"
1000'
XX
EXIT
Existing
EXIT XX
Street A
Existing
See TCP(6-1) for Lane Closure Details and Additional Signing.
STREET B EXIT CLOSED
USE STREET A EXIT
Or, as an option when exits are numbered
EXIT XY CLOSED
USE EXIT XX
Place 1 mile (approx.) in advance of Street A exit.
TCP (6-3b)
EXIT RAMP CLOSED
TRAFFIC EXITS PRIOR TO CLOSED RAMP
LEGEND
Type 3 Barricade
Channelizing Devices
Heavy Work Vehicle
Truck Mounted Attenuator (TMA)
Trailer Mounted Flashing Arrow Board
Portable Changeable Message Sign (PCMS)
Sign
Traffic Flow
Flag
Flagger
Posted Speed | Formula | Minimum Desirable Taper Lengths "L" ** 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
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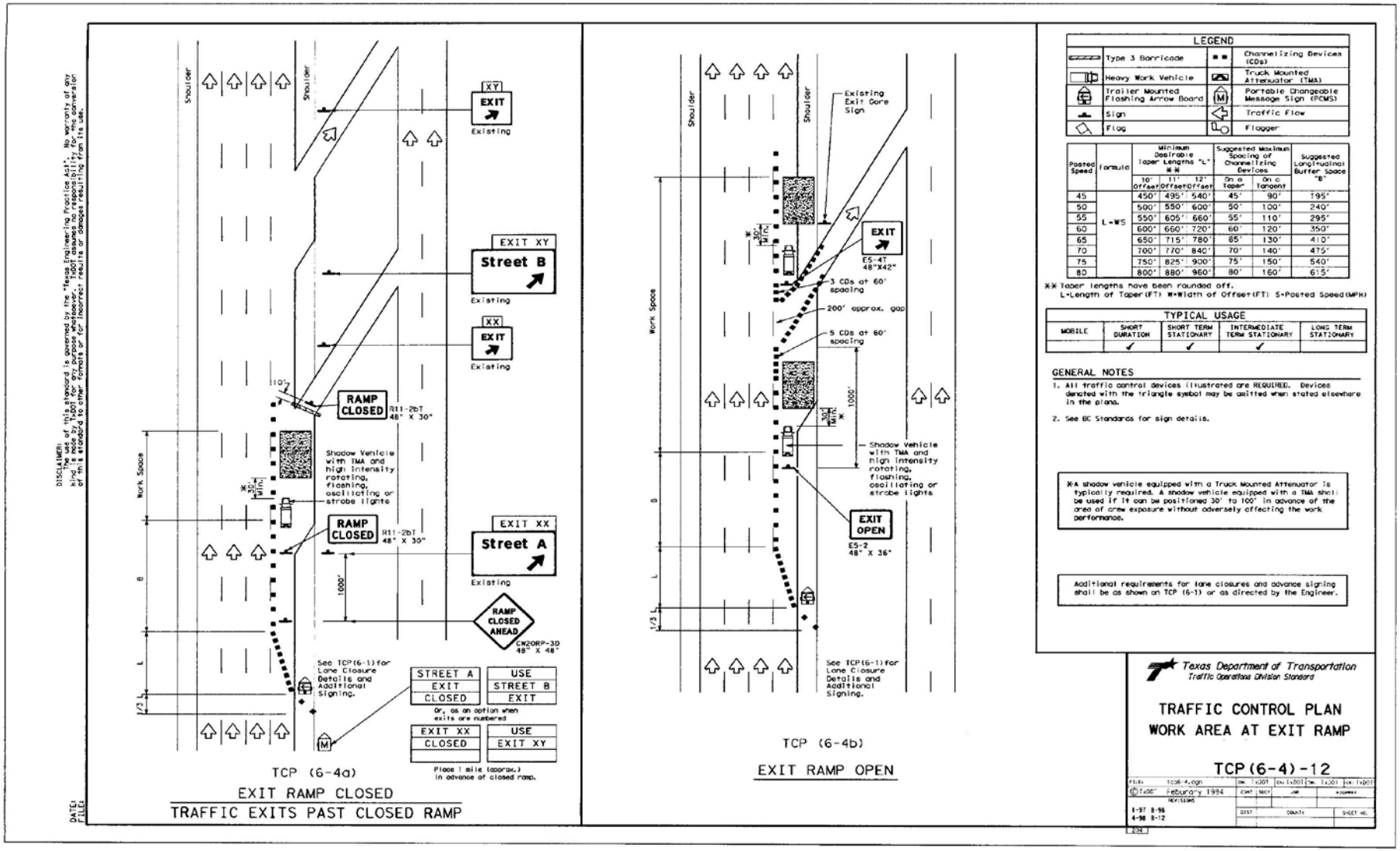
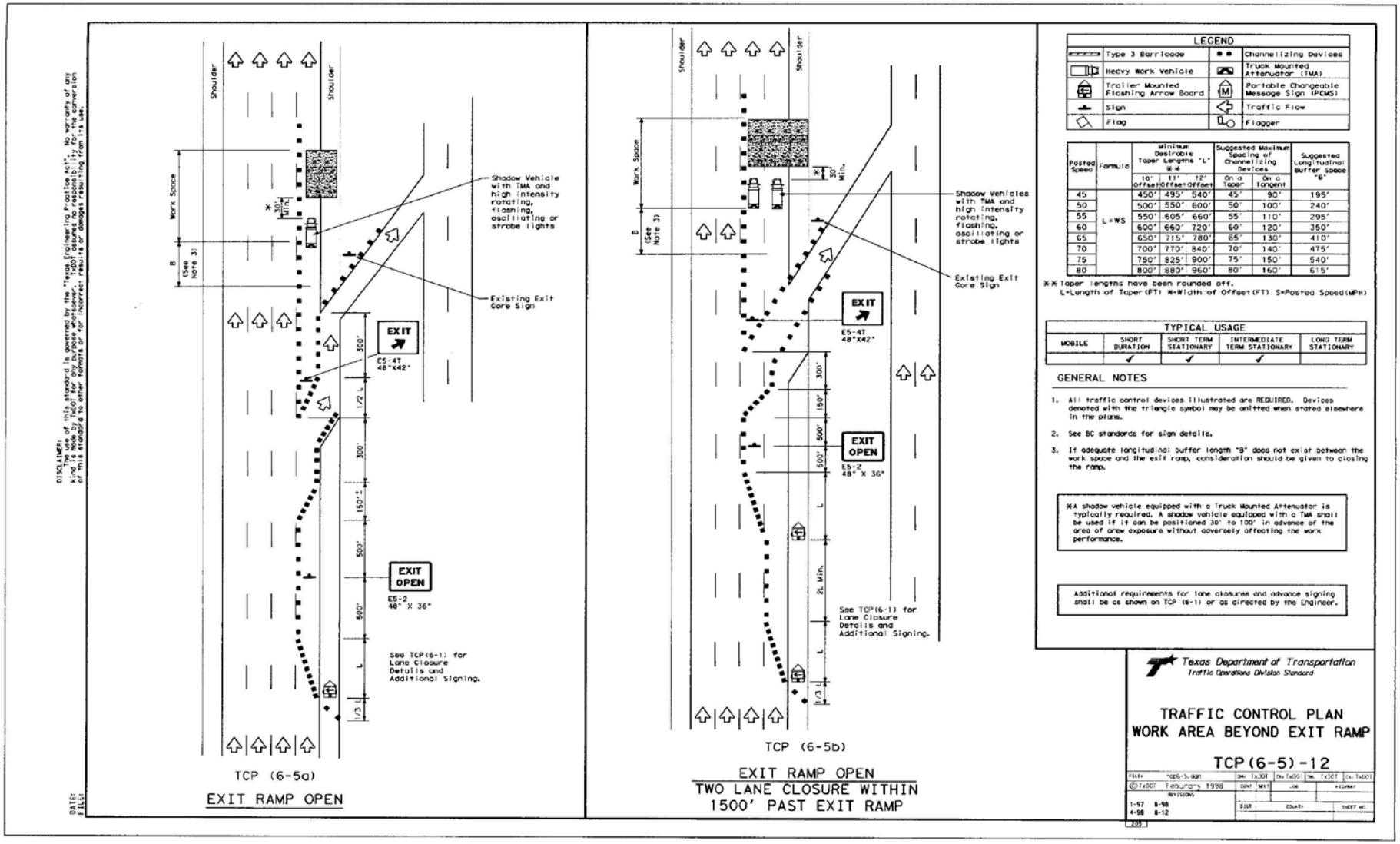
REVISIONS
1-97 8-98
4-98 8-12


DISCLAIMER:
The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by the Texas Department of Transportation for any purpose whatsoever. The Texas Department of Transportation assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.
DATE:
FILE:
Shoulder
Shoulder
XY
EXIT
Existing
EXIT XY
Street B
Existing
XX
EXIT
Existing
110'
RAMP CLOSED
R11-2bT
48" X 30"
Work Space
Shadow Vehicle with TMA and high intensity rotating, flashing, oscillating or strobe lights
30' Min.*
RAMP CLOSED
R11-2bT
48" X 30"
EXIT XX
Street A
Existing
1000'
RAMP CLOSED AHEAD
CW20RP-3D
48" X 48"
See TCP(6-1) for Lane Closure Details and Additional Signing.
STREET A EXIT CLOSED
USE STREET B EXIT
Or, as an option when exits are numbered
EXIT XX CLOSED
USE EXIT XY
Place 1 mile (approx.) in advance of closed ramp.
TCP (6-4a)
EXIT RAMP CLOSED
TRAFFIC EXITS PAST CLOSED RAMP
Shoulder
Shoulder
Existing Exit Gore Sign
Work Space
30' Min.*
EXIT
E5-4T
48"X42"
3 CDs at 60' spacing
200' approx. gap
5 CDs at 60' spacing
1000'
30' Min.*
Shadow Vehicle with TMA and high intensity rotating, flashing, oscillating or strobe lights
EXIT OPEN
E5-2
48" X 36"
See TCP(6-1) for Lane Closure Details and Additional Signing.
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
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
SHORT DURATION ✓ | SHORT TERM STATIONARY ✓ | INTERMEDIATE 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
tcp6-4.dgn
February 1994
REVISIONS
1-97 8-96
4-98 8-12
DIST
COUNTY
SHEET NO.



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.

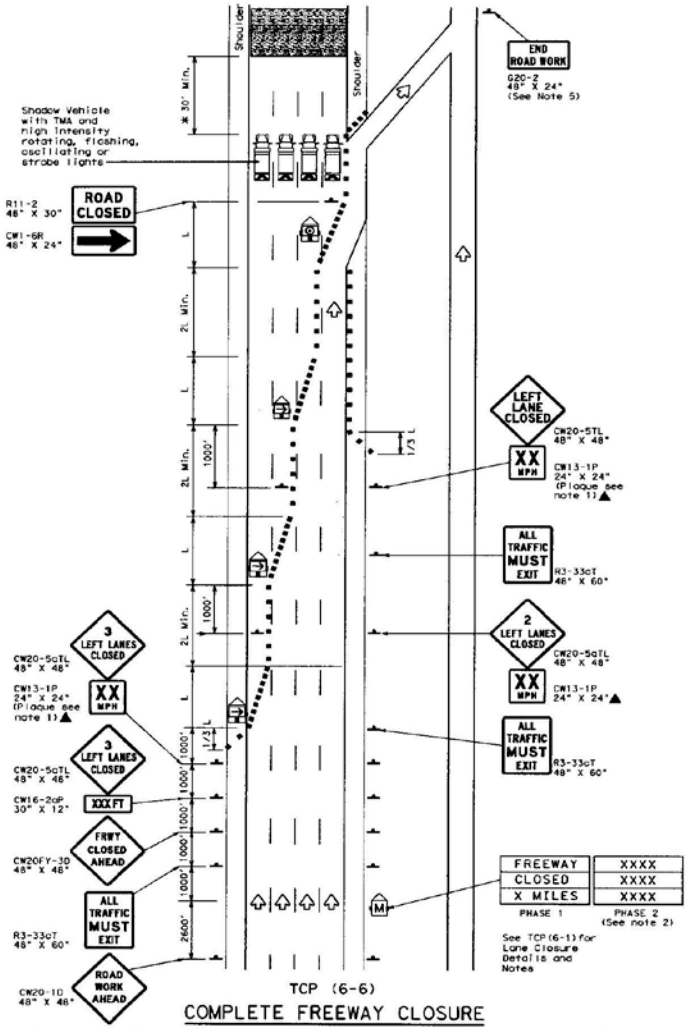
Additional requirements for lane closures and advance signing shall be as shown on TCP (6-1) or as directed by the Engineer.

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 February 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS				
1-97 8-98	DIST	COUNTY		SHEET NO.
4-98 8-12				
205				



TCP (6-6)
COMPLETE FREEWAY CLOSURE

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

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

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

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

GENERAL NOTES

1. All traffic control devices illustrated are REQUIRED. Devices denoted with the triangle symbol may be omitted when stated elsewhere in the plans.
2. Phase 2 of the PCMS message should include appropriate information formatted as shown on BC(6), such as "MERGE RIGHT," recommended speed, delay, exit information, or other specific warnings.
3. Where queuing is anticipated beyond signing shown, additional PCMS signs, other warning signs, devices or Law Enforcement Officers should be available to warn approaching high speed traffic of the end of the queue, as directed by the Engineer.
4. Entrance ramps located from the advance warning area to the exit ramp should be closed whenever possible.
5. 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
FREEWAY CLOSURE

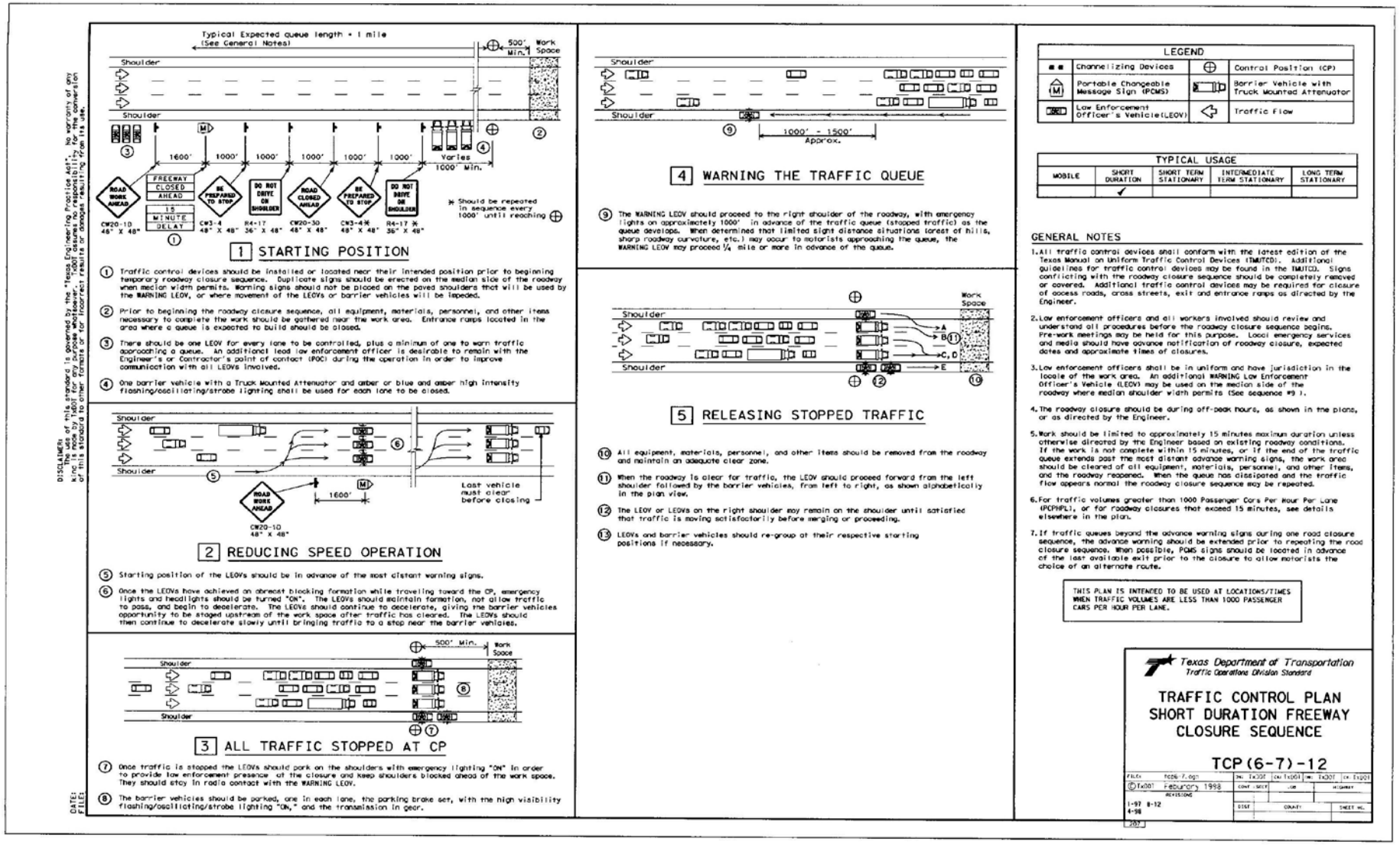
TCP(6-6)-12

FILE: tcp6-6.dgn | DN: TxDOT | CK: TxDOT | DW: TxDOT | CK: TxDOT

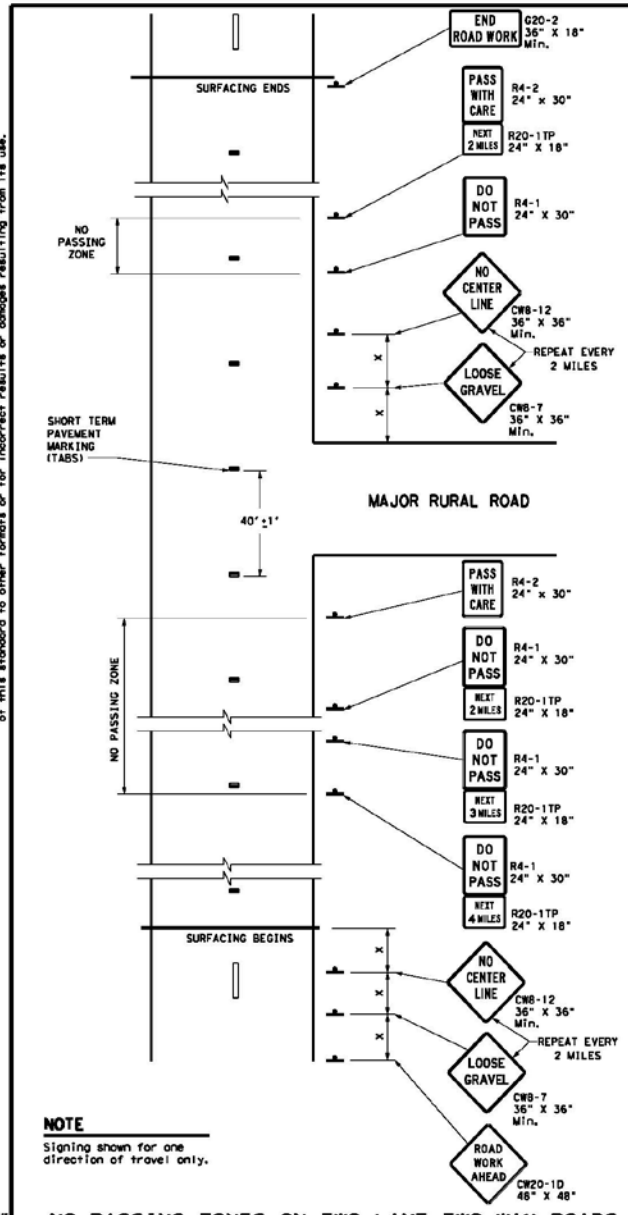
REVISIONS
1-97 8-98
4-98 8-12

CONT | SECT | JOB | HIGHWAY
DIST | COUNTY | SHEET NO.

DATE:
FILE:

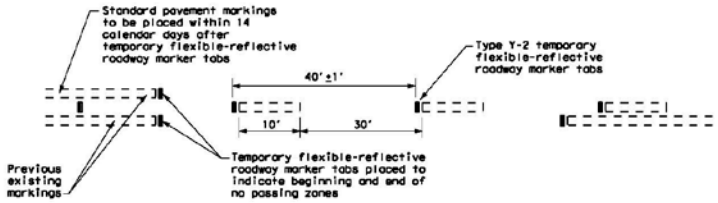

Typical Expected queue length = 1 mile
(See General Notes)
500' Min.
Work Space
Shoulder
1600'
1000'
Varies
1000' Min.
FREEWAY CLOSED AHEAD
15 MINUTE DELAY
ROAD WORK AHEAD
BE PREPARED TO STOP
DO NOT DRIVE ON SHOULDER
ROAD CLOSED AHEAD
CW20-10 48" X 48"
CW3-4 48" X 48"
R4-17 36" X 48"
CW20-3D 48" X 48"
CW3-4* 48" X 48"
R4-17* 36" X 48"
* Should be repeated in sequence every 1000' until reaching
1 STARTING POSITION
1 Traffic control devices should be installed or located near their intended position prior to beginning temporary roadway closure sequence. Duplicate signs should be erected on the median side of the roadway when median width permits. Warning signs should not be placed on the paved shoulders that will be used by the WARNING LEOV, or where movement of the LEOVs or barrier vehicles will be impeded.
2 Prior to beginning the roadway closure sequence, all equipment, materials, personnel, and other items necessary to complete the work should be gathered near the work area. Entrance ramps located in the area where a queue is expected to build should be closed.
3 There should be one LEOV for every lane to be controlled, plus a minimum of one to warn traffic approaching a queue. An additional lead law enforcement officer is desirable to remain with the Engineer's or Contractor's point of contact (POC) during the operation in order to improve communication with all LEOVs involved.
4 One barrier vehicle with a Truck Mounted Attenuator and amber or blue and amber high intensity flashing/oscillating/strobe lighting shall be used for each lane to be closed.
Shoulder
Last vehicle must clear before closing
2 REDUCING SPEED OPERATION
5 Starting position of the LEOVs should be in advance of the most distant warning signs.
6 Once the LEOVs have achieved an abreast blocking formation while traveling toward the CP, emergency lights and headlights should be turned "ON". The LEOVs should maintain formation, not allow traffic to pass, and begin to decelerate. The LEOVs should continue to decelerate, giving the barrier vehicles opportunity to be staged upstream of the work space after traffic has cleared. The LEOVs should then continue to decelerate slowly until bringing traffic to a stop near the barrier vehicles.
3 ALL TRAFFIC STOPPED AT CP
7 Once traffic is stopped the LEOVs should park on the shoulders with emergency lighting "ON" in order to provide law enforcement presence at the closure and keep shoulders blocked ahead of the work space. They should stay in radio contact with the WARNING LEOV.
8 The barrier vehicles should be parked, one in each lane, the parking brake set, with the high visibility flashing/oscillating/strobe lighting "ON," and the transmission in gear.
4 WARNING THE TRAFFIC QUEUE
1000' - 1500' Approx.
9 The WARNING LEOV should proceed to the right shoulder of the roadway, with emergency lights on approximately 1000' in advance of the traffic queue (stopped traffic) as the queue develops. When determined that limited sight distance situations (crest of hills, sharp roadway curvature, etc.) may occur to motorists approaching the queue, the WARNING LEOV may proceed ¼ mile or more in advance of the queue.
5 RELEASING STOPPED TRAFFIC
10 All equipment, materials, personnel, and other items should be removed from the roadway and maintain an adequate clear zone.
11 When the roadway is clear for traffic, the LEOV should proceed forward from the left shoulder followed by the barrier vehicles, from left to right, as shown alphabetically in the plan view.
12 The LEOV or LEOVs on the right shoulder may remain on the shoulder until satisfied that traffic is moving satisfactorily before merging or proceeding.
13 LEOVs and barrier vehicles should re-group at their respective starting positions if necessary.
LEGEND
Channelizing Devices
Control Position (CP)
Portable Changeable Message Sign (PCMS)
Barrier Vehicle with Truck Mounted Attenuator
Law Enforcement Officer's Vehicle(LEOV)
Traffic Flow
TYPICAL USAGE
MOBILE
SHORT DURATION
SHORT TERM STATIONARY
INTERMEDIATE TERM STATIONARY
LONG TERM STATIONARY
GENERAL NOTES
1. All traffic control devices shall conform with the latest edition of the Texas Manual on Uniform Traffic Control Devices (TMUTCD). Additional guidelines for traffic control devices may be found in the TMUTCD. Signs conflicting with the roadway closure sequence should be completely removed or covered. Additional traffic control devices may be required for closure of access roads, cross streets, exit and entrance ramps as directed by the Engineer.
2. Law enforcement officers and all workers involved should review and understand all procedures before the roadway closure sequence begins. Pre-work meetings may be held for this purpose. Local emergency services and media should have advance notification of roadway closure, expected dates and approximate times of closures.
3. Law enforcement officers shall be in uniform and have jurisdiction in the locale of the work area. An additional WARNING Law Enforcement Officer's Vehicle (LEOV) may be used on the median side of the roadway where median shoulder width permits (See sequence #9).
4. The roadway closure should be during off-peak hours, as shown in the plans, or as directed by the Engineer.
5. Work should be limited to approximately 15 minutes maximum duration unless otherwise directed by the Engineer based on existing roadway conditions. If the work is not complete within 15 minutes, or if the end of the traffic queue extends past the most distant advance warning signs, the work area should be cleared of all equipment, materials, personnel, and other items, and the roadway reopened. When the queue has dissipated and the traffic flow appears normal the roadway closure sequence may be repeated.
6. For traffic volumes greater than 1000 Passenger Cars Per Hour Per Lane (PCPHPL), or for roadway closures that exceed 15 minutes, see details elsewhere in the plan.
7. If traffic queues beyond the advance warning signs during one road closure sequence, the advance warning should be extended prior to repeating the road closure sequence. When possible, PCMS signs should be located in advance of the last available exit prior to the closure to allow motorists the choice of an alternate route.
THIS PLAN IS INTENDED TO BE USED AT LOCATIONS/TIMES WHEN TRAFFIC VOLUMES ARE LESS THAN 1000 PASSENGER CARS PER HOUR PER LANE.
Texas Department of Transportation
Traffic Operations Division Standard
TRAFFIC CONTROL PLAN
SHORT DURATION FREEWAY
CLOSURE SEQUENCE
TCP(6-7)-12
FILE: tcp6-7-00
DATE: February 1998
REVISIONS
1-97 8-12
4-98
DISTRICT
COUNTY
SHEET NO.
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:



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 M	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'

M 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

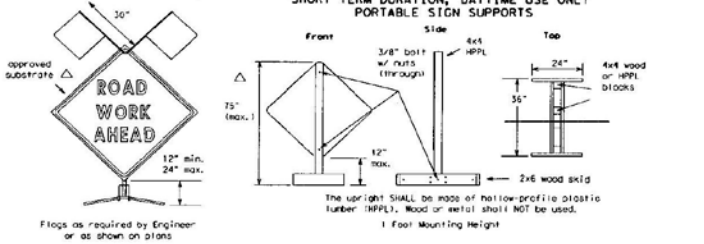
FILE: tcp7-1.dgn	DW: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT March 1991	CONT	SECT	JOB	HIGHWAY
REVISIONS 4-92 4-98 1-97 7-13	DIST	COUNTY		SHEET NO.

216

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

EXAMPLES OF SIGN SUPPORTS

SHORT TERM DURATION, DAYTIME USE ONLY PORTABLE SIGN SUPPORTS



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.

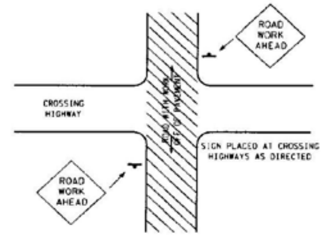
SIGN IN ACCORDANCE WITH THE TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS

MOWERS AHEAD SIGNS ARE USED FOR MOWING OPERATIONS.

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

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

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

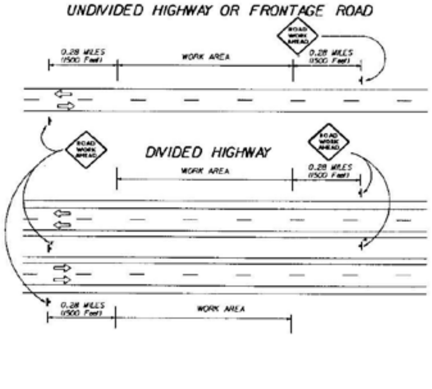


TYPICAL LOCATION OF SIGNS AT HIGHWAY CROSSING

WORK AREA IS A MAXIMUM OF 2.0 MILES UNLESS OTHERWISE DIRECTED.
SIGNS MAY REMAIN IN PLACE ONLY DURING DAYLIGHT HOURS.
SIGNS ARE TO BE PLACED 6' TO 12' OFF OF THE PAVED SURFACE UNLESS OTHERWISE DIRECTED.
ROAD WORK AHEAD SIGNS SHOWN AS EXAMPLES. ONE OF THE FOUR TYPE SIGNS WILL BE USED AS DIRECTED.

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

UNDIVIDED HIGHWAY OR FRONTAGE ROAD



TRAFFIC CONTROL PLAN FOR WORK OFF OF THE PAVED SURFACE.

GENERAL NOTES FOR WORK ZONE SIGNS

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 moving 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 moving.
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			FEDERAL AID PROJECT		SHEET
REVISED September 17, 2004	N/A	N/A	N/A		1
REVISED February 2, 2005 Sign placement in TCP	COUNTY		CONTROL	SECTION	JOB	HIGHWAY
REVISED	N/A		N/A	N/A	N/A	N/A

EXHIBIT "B"

BID PAGE

REQUEST FOR BID

State Use Negotiation Committee Meeting Preparation

Current CSJ: 6287-93,94,95-001

New CSJ: 6314-60,61,62-001

Contract Description: MBGFR

Provider: RGR

Item Number:	Description:	UOM	Current Price	Proposed Price	Counter offer
0450-6042	RAIL (TY PR1)	LF	$150.00	$150.00	approved
0496-6099	REMOVE RAIL (METALELEMENTS)	LF	$3.00	$3.00	approved
0540-6001	MTL W-BEAM GD FEN (TIM POST)	LF	$21.00	$21.00	approved
0540-6005	TERMINAL ANCHOR SECTION	EA	$350.00	$350.00	approved
0540-6010	MTL W-BEAM GD FEN ADJUSTMENT	LF	$10.00	$10.00	approved
0540-6006	MTL BEAM GD FEN TRANS (THRIE-BEAM)	EA	$1,250.00	$1,800.00	$1,500.00
0540-6016	DOWNSTREAM ANCHOR TERMINAL (DAT) SECTION	EA	$1,000.00	$1,200.00	approved
0540-6017	METAL BEAM GUARD FENCE (LONG SPAN SYSTEM)	LF	$0.00	$35.00	$30.00
0542-6001	REMOVING METAL BEAM GUARD FENCE	LF	$3.00	$3.00	approved
0542 6002	REMOVING TERMINAL ANCHOR SECTION	EA	$100.00	$100.00	approved
0542 6004	RM MTL BM GD FEN TRANS (THRIE BEAM)	EA	$75.00	$100.00	approved
0542 6005	RM MTL BM GD FEN TRANS (T101)	EA	$450.00	$450.00	approved
0544-6001	GUARD RAIL END TREATMENT (INSTALL)	EA	$2,300.00	$2,300.00	approved
0544-6003	GUARD RAIL END TREATMENT (REMOVE)	EA	$300.00	$300.00	approved
0545-6003	CRASH CUSHION ATTEN (MOVE & RESET)	EA	$1,800.00	$2,000.00	approved
0545-6005	CRASH CUSHION ATTEN (REMOVE)	EA	$1,000.00	$1,000.00	approved
0545-6024	CRASH CUSHION ATTEN (INSTALL) (TRACC)	EA	$16,000.00	$20,000.00	$16,000.00
0545-6025	CRASH CUSHION ATTEN (INSTALL) (REACT)(N)	EA	$23,000.00	$23,000.00	approved
0545-6026	CRASH CUSHION ATTEN (INSTALL) (QUAD)(N)	EA	$17,500.00	$20,000.00	approved
0545-6027	CRASH CUSHION ATTEN (INSTALL) (QUAD)(W)	EA	$26,000.00	$26,500.00	approved
0550-6001	CHAIN LINK FENCE (INSTALLATION)(6')	LF	$9.50	$10.00	approved
0550-6002	CHAIN LINK FENCE (REPAIR)(6')	LF	$5.00	$10.00	approved
0550-6007	CHAIN LINK FENCE (REPAIR)(4')	LF	$9.50	$10.00	approved
0770-6001	REPAIR RAIL ELEMENT (W - BEAM)	LF	$11.00	$12.00	approved
0770-6054	REPAIR RAIL ELEMENT (W - BEAM) (LABOR)	LF	$6.00	$6.00	approved
0770-6010	REM/REPL TIMBER/STL POST W/O CONC FND	EA	$40.00	$40.00	approved
0770-6011	REM/REPL TIMBER/STL POST W/ CONC FND	EA	$50.00	$80.00	$60.00
0770-6017	REALIGN POSTS	EA	$15.00	$15.00	approved
0770-6019	REMOVE AND REPLACE BLOCK OUT	EA		$20.00	approved
0770-6027	REMOVE GDRAIL END TRT/REPL WITH SGT	EA	$2,250.00	$2,500.00	approved
0770-6021	REPLACE SINGLE GDRAIL TERMINAL RAIL	LF	$15.00	$15.00	approved
0770-6028	REPL SINGLE GDRAIL TERM IMPACT HEAD	EA	$900.00	$900.00	approved
0770-6022	REPLACE SINGLE GDRAIL TERMINAL POST	EA	$42.00	$45.00	approved
0770-6030	REPLACE SGT CABLE ASSEMBLY	EA		$200.00	$75.00
0770-6031	REPLACE CABLE ANCHOR	EA		$100.00	$85.00
0770-6032	REPLACE SGT STRUT	EA		$60.00	approved
0770-6033	REPLACE SGT OBJECT MARKER	EA		$45.00	$25.00
0770-6052	REPAIR STEEL POST WITH BASE PLATE	EA	$200.00	$200.00	approved
0770-6046	REMOVE AND RESET SGT IMPACT HEAD (FURNISHED)	EA	$250.00	$250.00	approved
0772-6001	POST AND CABLE FENCE (REMOVAL)	LF	$3.00	$3.00	approved
0772-6003	POST AND CABLE FENCE (NEW INSTALLATION)	LF	$6.50	$10.00	approved
0772-6004	POST AND CABLE FENCE (NEW CONC ANCHOR)	EA	$50.00	$175.00	$100.00
0772-6005	POST AND CABLE FENCE (REMV/REPL POSTS)	EA	$50.00	$50.00	approved
0772-6006	POST AND CABLE FENCE (REMV/REPL CONC ANCHR)	EA	$100.00	$200.00	$125.00
0774-6006	REPAIR (TRACC)	EA	$2,600.00	$2,600.00	approved
0774-6008	REPAIR (WIDE TRACC)	EA	$2,600.00	$2,600.00	approved
0774-6018	REPAIR (CATGR-FRONT SECTION)	EA	$2,500.00	$7,000.00	$3,500.00
0774-6019	REPAIR (CATGR-END SECTION)	EA	$1,500.00	$2,500.00	approved
0774-6023	REPAIR REACT (N) (MISC HARDWARE)	EA		$2,500.00	$2,500.00
0774-6027	REPAIR REACT (N) (CYLINDERS)	EA		$3,500.00	$3,500.00
0774-6028	QUAD (N) (BAY) (REPAIR ONLY)	EA	$750.00	$1,600.00	$1,600.00
0774-6083	QUAD (N) (BAY) CARTRIDGE	EA	$1,200.00	$1,300.00	approved
0774-6084	QUAD (N) (BAY) NOSE ASSEMBLY	EA	$1,000.00	$1,000.00	approved
0774-6029	QUAD (W) (BAY) (REPAIR ONLY)	EA	$750.00	$1,600.00	approved
0774-6086	QUAD (W) (BAY) CARTRIDGE	EA	$1,200.00	$1,200.00	approved
0774-6087	QUAD (W) (BAY) NOSE ASSEMBLY	EA	$1,000.00	$1,200.00	$1,100.00
0774-6088	QUAD (w) (BAY) Diaphragm	EA	$1,000.00	$1,200.00	$1,100.00
0543-6017	CABLE BARRIER TERMINAL SECTION (TL-3)	EA	$2,700.00	$2,900.00	$2,800.00
0543-6022	REMOVE CABLE BARRIER TERMINAL SECTION	EA	$1.00		$500.00
0771-6001	REPLACE POSTS (TL 3)	EA	$110.00	$136.00	approved
0771-6005	REPAIR CONCRETE FOUNDATION (TL 3)	EA	$225.00	$2,500.00	$250.00
0771-6009	REPLACE CABLE (TL 3)	LF	$7.50	$5.00	approved
7053-6001	CLEAN TRAFFIC ATTENUATORS (TRACC) (N)	EA	$500.00	$500.00	approved
7053-6002	CLEAN TRAFFIC ATTENUATORS (QUAD) (N)	EA	$500.00	$500.00	approved
7053-6003	CLEAN TRAFFIC ATTENUATORS (QUAD) (W)	EA	$500.00	$500.00	approved
7053-6004	CLEAN TRAFFIC ATTENUATORS (REACT 350)	EA	$500.00	$500.00	approved
7053-6005	RIGHT OF WAY MARKERS (LABOR ONLY)	EA	$25.00	$30.00	approved
7053-6008	TMA	DAY	$400.00	$410.00	approved
New Item	QUAD FENDER PANEL	EA		$1,000.00	$750.00
New Item	REACT CABLE 350 (6 BAY)	EA		$1,500.00	$1,200.00
New Item	REACT DECAL	EA		$350.00	approved
New Item	REACT CABLE 350 (9 BAY)	EA		$1,500.00	$1,250.00
New Item	CABLE RELEASE POST	EA		$600.00	approved
New Item	ANCHOR POST	EA		$800.00	approved
New Item	REACT 350 CABLE HOLDERS	EA		$350.00	approved
New Item	FAST TRACK CENTER PANELS	EA		$1,200.00	approved

EXHIBIT "C"

CERTIFICATE OF INSURANCE